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History and experiences with customary tenure rights and Indigenous Peoples' tenure rights in fisheries

Abstract

The Global Conference on Tenure and User Rights in Fisheries 2018 took place in Yeosu, the Republic of Korea, 10-14 September 2018. Case studies were presented on a number of topics relating to tenure and user rights in global fisheries and their relation to the SDGs. Through the exploration of case studies in eight concurrent thematic sessions, the best practices, shortcomings, and challenges associated with rights-based approaches were discussed. The conference was a platform for the exchange of ideas about how to support the implementation of sustainable governance solutions to rights-based fisheries management.

This document presents case studies from Session 1 of the UserRights 2018 conference, "History and experiences with customary tenure rights and Indigenous Peoples' tenure rights in fisheries." All case studies are published as submitted, with minor changes for spelling and grammar. The case studies span across various geographical and socio-economic contexts. These include:

- the recognition of aboriginal rights to fish in Canada;
- the evolution of customary rights to fisheries in Guatemala to tenure;
- institutional management plans for benthic resources in Ecuador;
- designating protected territorial use rights for fishing in Indonesia;
- the formalization of community-based fisheries management in Indonesia;
- the customary rights and co-management approaches to governance in Indonesia;
- the regulation of indigenous communities' fishing rights in Argentina; and
- the transition from individual rights to community commons in Cambodia.

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Indigenous Peoples' Tenure Rights in Fisheries: A Canadian Case Study

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Abstract
This paper describes recent developments in recognition of aboriginal rights to fish in Canada, in particular, how First Nations have utilized the Canadian constitution and domestic law to achieve greater access to fisheries resources. Canada's constitution recognizes and affirms "existing aboriginal and treaty rights of aboriginal peoples…" The nature and scope of aboriginal fishing rights in Canada are evolving through the negotiation of modern treaties and through litigation. The fundamental objective of the modern law of aboriginal and treaty rights is the reconciliation of aboriginal and non-aboriginal peoples to their respective claims, interests and ambitions. In 1990, the Supreme Court of Canada found that a First Nation group on Canada's Pacific coast has an aboriginal right to fish for food, social and ceremonial purposes and that this right takes priority (after conservation) over other harvesters. The Government of Canada responded to this court decision by extending the aboriginal priority to fish for food, social and ceremonial purposes to all First Nations across Canada. In 2009, Canada's courts found that five First Nations on the Pacific coast hold aboriginal rights to fish within their territories, and to sell that fish. As a result, the five First Nations had their aboriginal fishing rights recognized, increased their access to fish for economic purposes and gained the flexibility of having small-scale local fisheries as an alternative to participating in the general commercial fishery. A second phase of the trial concluded in 2018. It provided a further interpretation of the rights with respect to a number of issues including fisheries management responsibilities, the appropriate level of fish allocation for some species and the priority of the First Nations' fishery relative to other harvesters.

1. INTRODUCTION

1.1 Description of the fishery

This paper provides an overview of a multi-species fishery off Canada's Pacific coast, where fishing is conducted by indigenous groups (First Nations). These groups carry court-recognized commercial fishing rights. Pre-contact, First Nations had a long history of fishing and exchanging fish with others in this area. Fish were an integral part of their distinctive economies and culture. Post-contact, when the modern fishery developed during the late 1800s, First Nations maintained a prominent role, using smaller, older vessels in local waters close to canneries. However, during the 1920s and 1930s, First Nations fishermen began to be displaced by the trend toward larger, costlier fishing vessels. This displacement continued during the mid-twentieth century with the consolidation of the salmon canning industry into fewer, larger operations.

First Nations' participation in the commercial fishery declined even further when the federal government began to introduce limited entry licensing in the late 1960s and subsequently through government-funded fleet reduction programs. Specifically, many First Nation vessel owners did not meet the initial landings qualifications required to obtain a limited entry licence. They were therefore no longer eligible to participate in the commercial fishery. Additionally, some individuals who did qualify for limited entry licences subsequently sold them in government-funded licence retirement programs – these programs were designed to improve the sustainability and financial viability of commercial fisheries.

The decline in First Nations' participation in commercial fisheries resulted in serious economic and social distress in their communities, many of which had limited alternative employment opportunities.

This situation prompted the federal government to adopt a series of measures, since the 1990s, to increase the participation of First Nations in commercial fisheries. One ongoing measure involves the federal government acquiring commercial fisheries access through a voluntary relinquishment process, where commercial vessel owners and licence holders are offered the opportunity to permanently relinquish licences and/or quota in exchange for a payment. The equivalent commercial fishing access is then re-issued to First Nations communities.

Some First Nations have disagreed with the government's approach to providing commercial fisheries access in the manner described above. In particular, First Nations maintain that the approach does not recognize an aboriginal right to fish: commercial communal fishing licences and quotas are usually issued to First Nations authorizing participation in the general commercial fishery, as opposed to in a separate aboriginal rights-based fishery. This means that commercial fishing under a communal commercial fishing licence is generally subject to the same terms and conditions as other commercial licences, except there is no associated licence fee.

In the early 2000s, a number of First Nations on the Pacific coast were dissatisfied with their access to commercial fisheries and decided to seek a judicial determination of their aboriginal fishing rights.[1] These First Nations sought a greater level of commercial fisheries access and the ability to use numerous small boats in their local area to conduct a multi-species fishery, rather than participating in the general commercial fishery with a limited number of larger boats that are generally licenced as a single species fishery. Following a lengthy trial, a 2009 court decision found that five First Nations collectively known as T'aaq-wiihak (meaning fishing with permission of the hereditary chiefs) each have an aboriginal right to fish and sell fish within their territories up to 9 miles offshore.[2] This ruling was based on evidence that the First Nations' ancestors had traded fisheries resources at a significant scale and that this trade was a practice integral to their society.

The T'aaq-wiihak First Nations' fishing rights are protected under Canada's constitution.[3] The 2009 judgment did not provide a precise definition of the T'aaq-wiihak First Nations' fishing rights – the rights were described as something less than an unrestricted commercial right on an industrial scale, but something more than exchanging fish for money or other goods. The Court nevertheless characterized the First Nations' preferred means of fishing rights as community-based, multi-species, localized fisheries involving wide community participation, using small low-cost boats. In the absence of a precise definition of the right, the Court directed the T'aaq-wiihak First Nations and the federal government to consult and negotiate the manner in which the aboriginal right to fish and sell fish can be accommodated and exercised without jeopardizing Canada's legislative objectives and societal interests in regulating the fishery.

After six years of negotiations, there was still no agreement between the T'aaq-wiihak First Nations and the government on allocations of fish and management of the fishery. Progress was hindered because the parties had divergent views about the nature and scale of the right. This impasse resulted in a second phase of the trial, which concluded in 2018. The 2018 judgment provided a further interpretation of the nature and scope of the rights, including fisheries management responsibilities, the appropriate level of fish allocation for some species, and the priority of the T'aaq-wiihak First Nations' fishery relative to other harvesters.

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[1] Eleven of the 14 Nuu-chah-nulth Nations started the action in 2003. During pre-trial procedures, the claims of three of those Nations were severed to be tried in a later phase due to conflicting claims with the other eight. Three more plaintiffs discontinued their claims during the trial in order to sign the Maa'nulth Treaty. In the end, five of the 14 Nuu-chah-nulth Nations – the Ahousaht, Ehattesaht, Hesquiaht, Mowachaht/Muchalaht and Tla-o-qui-aht – completed the case.

[2] Each of the five First Nations self-identified as an autonomous nation and the judgement concluded that each group is the rights holder for its own First Nation.

[3] Section 35(1) Canada's Constitution Act, recognizes and affirms the existing Aboriginal and treaty rights of the Aboriginal peoples in Canada; however, it does not specify the nature or content of the rights that are protected.

As a result of the court decisions described above, the T'aaq-wiihak First Nations had their aboriginal fishing rights recognized, increased their access to fish for commercial purposes and gained the flexibility to have small-scale local fisheries as an alternative to participating in the general commercial fishery. The rest of this paper focuses on a commercial salmon fishery that was initiated in 2012, as a result of the Court's recognition of the five T'aaq-wiihak First Nations' aboriginal fishing rights. The fishery continues to evolve through negotiations and ongoing litigation. The government refers to it as a "demonstration fishery," meaning alternative fisheries management features are being tested in an attempt to accommodate the T'aaq-wiihak First Nations' fishing rights, without jeopardizing Canada's legislative objectives and societal interests in regulating the fishery.

The T'aaq-wiihak First Nations do not consider the fishery to be an appropriate reflection of their aboriginal rights, as they continue to seek changes to the fisheries management regime imposed by the government. However, as an interim step, the T'aaq-wiihak First Nations have accepted aspects of the government's demonstration fishery, offered "in order to create opportunities, however, limited, for their fishers, while continuing with negotiations for true rights-based fisheries."[4] The T'aaq-wiihak First Nations' salmon fishery operates separately from the general commercial fishery. The fishing area includes coastal inlets and near-shore coastal waters, extending nine nautical miles seaward. Figure 1 illustrates the T'aaq-wiihak First Nations' fishing territories. The main target species in this fishery is Chinook salmon (*Oncorhynchus tshawytscha*), though smaller quantities of other salmon (e.g., coho and sockeye) and groundfish (e.g., halibut, lingcod and rockfish) are harvested too. All of the species harvested in the fishery are fully exploited and are subject to annual stock assessments.

Figure 1. Map identifying the location of the fishery.
Source: Fisheries and Oceans Canada, Pacific Region.

[4] T'aaq-wiihak Fishery Indicators, 2015. Page 3.

The fishing season covers the period of February to September; however, fishing is permitted only during authorized openings. Openings are scheduled to occur when there is an abundance of the species, and the by-catch of lesser abundant species can be minimized. In 2016, most of the total salmon harvest occurred in the first four openings (one in May, one in July and two in August). In 2017, most of the harvest occurred during three openings (13 February to 15 March, 19 April to 13 May and 24 July to 30 July).

After the 2009 decision, the T'aaq-wiihak reached an agreement that they would conduct their fishery using two main types of vessels – (i) commercial troll vessels ranging from 34 to 46 feet in length and (ii) 'mosquito' vessels ranging from 14 to 28 feet in length.[5] Both the troll and mosquito vessels fish with hook and line gear, but the troll vessels have significantly greater catching capacity. The troll vessels typically have internal fish holds with ice, allowing fishers to engage in multi-day fishing trips (usually two to four days). By contrast, the mosquito vessels are mostly small, open, aluminium skiffs or covered fibreglass hull cruisers. They use coolers on the deck of the vessels to store fish. Mosquito vessels generally engage in day-fishing trips due to storage limitation of their coolers.

The relative catching and storage capacity of the two vessel types is reflected in the distribution of landings. Since this fishery was established, in 2012, troll vessels have accounted for a minority of the total number of vessels but have landed a majority of the total catch (e.g. between 2014 and 2017, troll vessels accounted for 76 percent to 88 percent of the total Chinook landings). All of the fish sold from vessels participating in the fishery must be landed at a designated landing site and validated through a dockside-monitoring program. There are four designated landing sites located in the fishing area (Zeballos, Gold River, and two docks in Tofino). The distance between the most northern landing site (Zeballos) and the most southern (Tofino) is about 160 kilometres. No major conflicts have occurred on the fishing grounds. However, a number of concerns have been raised by those who participate in the T'aaq-wiihak First Nations fishery and by those potentially affected by it. For example, the T'aaq-wiihak First Nations have opposed some of the government restrictions imposed on their fishery. T'aaq-wiihak fishers also expressed frustration when trolling next to recreational fishers, which are not restricted to the same opening and area restrictions or fishery monitoring requirements. In addition, T'aaq-wiihak fishers expressed frustration that the general commercial fishery did not have the same area restrictions and had the potential to catch more salmon.

Participants in the general commercial fishery have expressed concerns about the impact of the T'aaq-wiihak First Nations fishery. They have also sought confirmation from the government that the allocations provided to the T'aaq-wiihak First Nations' fishery are fully mitigated (i.e. will not reduce the average catch per licence in the general commercial fishery). To prevent an escalation of tensions, considerable effort is dedicated to resolving issues through negotiations between the T'aaq-wiihak and the government, and through fisheries advisory meetings that include representatives of all harvest sectors.

1.2 Economic contribution and social implications of the fishing activity

The fishery is important economically and culturally to the T'aaq-wiihak First Nations. Before European settlement, fish were central to their local economies and inspired many of their ceremonies, culture, and art. During the court proceedings that resulted in the recognition of the T'aaq-wiihak First Nations' aboriginal right to fish and sell fish, there was evidence presented that the First Nations' ancestors had traded fisheries resources at a significant scale and that this trade was a practice integral to their society. This illustrates the historic importance of the fishery to the T'aaq-wiihak First Nations. In their efforts to increase access to the fishery and to have the Courts recognize their aboriginal right to fish for commercial purposes, the T'aaq-wiihak First Nations placed importance on the effort to "reinvigorate their coastal communities" through "participation in the commercial fishery" and

[5] 2017 Salmon Demonstration Fisheries Post Season Review, January 2018. Page 14.

through “restoring this fishing culture and economy.” These statements illustrate the overall importance of the fishery to the T’aaq-wiihak First Nations.

Since it was established in 2012, the T’aaq-wiihak First Nations fishery has been an important source of income and employment in their communities. From 2012 and 2017, there were 96 to 229 designated T’aaq-wiihak fishers, of which 42 to 89 were active in a given year. All of the participants come from the five territories shown in Figure 1. The total population of the five T’aaq-wiihak First Nations is just over 5 000, although not all members live on the reserves (e.g. in 2014 about 1,750 members lived on the reserves). Mosquito vessels usually fish 5 to 11 hours per day and catch between zero and 10 Chinook during that period. In 2017, 19 percent of the mosquito fleet fishing trips resulted in zero Chinook salmon being caught. The troll vessels fish 10 to 14 hours per day and catch about 200 Chinook salmon daily when fishing conditions are good.

In 2016, the estimated landed value of fishery was USD 727 000. Fish is landed in the local area at one of four designated landing sites. A small quantity of the salmon is sold locally in Tofino to the public, local restaurants and a retail fish store while the majority is sold to domestic buyers who transport the fish to an urban centre (Vancouver). Here, most are sold in fresh or frozen product form, either domestically or as an export to the U.S.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

The T’aaq-wiihak First Nations commercial fishery operates within a broad fisheries management regime that includes an international collaboration - between Canada and the U.S., and between a number of other Canadian fisheries. The Canada-U.S. Pacific Salmon Treaty contains harvest-sharing provisions between the two countries. The purpose of these provisions is to achieve conservation and harvest-sharing objectives by limiting the interception of salmon that migrate between the two countries. Canada’s catch limit for Chinook salmon on the west coast of Vancouver Island is established based on the harvest provisions of the treaty and a model that predicts Chinook salmon abundance. Canada plans its domestic fisheries to comply with the catch limits contained in the Pacific salmon treaty. Canada’s allowable harvest is allocated to a number of domestic fisheries - First Nations food, social and ceremonial fisheries, the T’aaq-wiihak First Nations commercial aboriginal rights-based fishery, recreational fisheries and the general commercial fishery.

Canada’s Department of Fisheries and Oceans has the overall authority for managing all of the salmon fisheries described above. The T’aaq-wiihak First Nations commercial fishery is licensed under the Aboriginal Communal Fishing Licences Regulations. Under this regime, the Minister of Fisheries and Oceans issues a licence to an aboriginal organization (in this case, one licence is issued to the five First Nations collectively), setting out conditions of the fishery. The licence generally describes the authorized elements of a fishery (open area, retention species, gear permitted, etc.). The T’aaq-wiihak First Nations are responsible for authorizing participation in their fishery. Each fisher is required to register annually to participate in the fishery, and vessels engaged in the fishery are required to be registered on an annual basis. The T’aaq-wiihak First Nations also have a Requirements and Responsibilities (R&R) Agreement between their fishers and the individual First Nations. The R&R Agreement specifies conditions that fishers must adhere to when participating in the fishery (or face registration being revoked based on non-compliance with the conditions).

The T’aaq-wiihak First Nations have an established limit on the number of Chinook salmon that a vessel can sell per trip or, in some instances, for an entire multi-day fishery opening. The vessel catch limit was introduced to control the total catch and thereby avoid exceeding the total allocation authorized for the fishery. Further, the T’aaq-wiihak First Nations have assumed a prominent role in the delivery of the dockside-monitoring and catch-reporting systems. With Canada’s Department of

Fisheries and Oceans, they have dedicated considerable effort to developing fishing plans that provide the appropriate fishing opportunity commensurate with their Aboriginal rights. A "Main Table" was established in 2010 as the primary venue for consultations and negotiations involving the T'aaq-wiihak First Nations and the government. Main Table meetings have addressed a broad range of topics from designing and funding the consultation and negotiation process, to fisheries access arrangements. A Joint Working Group was established in 2010 to share relevant fisheries management, stock assessment, and licensing information, as well as to review, analyze, and present recommendations for the Main Table. The Joint Working Group is not a negotiation forum and does not make decisions on whether proposals may be implemented. In addition, an Enforcement Sub-Committee was established to support the Main Table.

Beyond the bilateral consultations and negotiations described above, Canada's Department of Fisheries and Oceans has ongoing advisory processes, including the Integrated Salmon Harvest Planning Committee. This is comprised of First Nations and commercial and recreational harvesters, supporting environmental interests. The advisory committee provides formal advice and makes recommendations; on operational decisions related to salmon harvesting in British Columbia, and on the watersheds that contribute to these fisheries. First Nations participation is intended to co-ordinate the fishing plans of First Nations and other users of the resource.

2.2 Brief history of the former rights-based approaches used in the fishery

Before having their aboriginal rights to fish for commercial purposes recognized by the courts, the T'aaq-wiihak First Nations participated in two fisheries: the general commercial fishery, and the food, social and ceremonial (FSC) fishery. The general commercial fishery has been managed with input controls, including limited entry since 1969. Other features of the general commercial fishery include single gear licensing (seine, gillnet and troll), area licensing, and restricted fishing times.

By the late 1990s, the T'aaq-wiihak First Nations found that the general commercial fishery was managed in such a way that few community members could participate and those that were able to required commercial fishing vessels and gear to compete for a share of the harvest. Further, they found that increasingly, they did not have the mosquito boats to conduct their own FSC fishery. This made it impractical to achieve their objectives of having, on the first hand, a mosquito fleet comprised of many small-scale vessels, and on the second hand, broad community participation to conduct both commercial and FSC fishery. This was a major factor prompting the T'aaq-wiihak First Nations to seek legal recognition of their fishing rights in 2003.

2.3 Rights-based approach: allocation and characteristics

The T'aaq-wiihak fishery is based on the legal recognition of their aboriginal rights to fish (2009), and a second court decision (2018) that provides additional interpretation regarding the nature and scope of the right. The 2009 court decision established that each of the five T'aaq-wiihak First Nations have an aboriginal right to fish and sell fish within their court-defined fishing territories. In practice, the five First Nations have collectively chosen to receive a single allocation and the members of each of the five First Nations are able to fish in the entire court-defined area (i.e., the members of one First Nation are not confined to their particular area).

Since 2012, the government has used the following mechanism to allocate a specific quantity of Chinook salmon to the T'aaq-wiihak. First, the government has identified a number of commercial fishing licences to the T'aaq-wiihak First Nations that can be operated as part of the general commercial fishery or converted into an allocation that can be used in a separate T'aaq-wiihak fishery. The allocation is based on the average catch-per-licence in the general commercial fishery. For example, in 2017, the T'aaq-wiihak First Nations opted to use 14 licences in their own fishery. These 14 licences represented an 11.9 percent share of the ocean commercial troll fishery on the west coast

of Vancouver Island (14 of 118 commercial licences), resulting in a pre-season allocation of 6,688 Chinook salmon assigned to the T'aaq-wiihak First Nations fishery.

The 2018 judgment did not change the right, but the Court did provide a further interpretation of the aboriginal fishing rights. The 2018 judgment stated:

> "despite the lack of parameters in the [2009] declaration, … the declared right to fish for any species and to sell that fish is to be interpreted as a small-scale, artisanal, local, multi-species fishery, to be conducted in a nine-mile strip from shore, using small, low-cost boats with limited technology and restricted catching power, and aimed at wide community participation." (Paragraph 441)

The 2018 judgment also included some "basic interpretive principles as to the extent of the right" including:

- the right is restricted to a nine nautical mile area defined by the Court;
- the right provides for a community-based localized fishery with wide community participation;
- the right enables the T'aaq-wiihak First Nations to fish using their preferred means, that is, small, low-cost boats with restricted catching power, with wide community participation;
- the right is multi-species; therefore it is the totality of the fishery that is relevant, not one particular allocation of a species; and,
- the right is not exclusive and does not provide a guaranteed level of income, prosperity, or economic viability. (Paragraph 414)

The 2018 judgment provided specific guidance on the nature and scope of the right with respect to several issues that the T'aaq-wiihak First Nations and the government were not able to agree upon.

Fisheries Management Authorities and Responsibilities

The T'aaq-wiihak First Nations' rights are to fish and to sell fish; they do not include aboriginal rights to manage the fishery. In Canada, the federal government has legislative authority under s. 91(12) of the Constitution Act of 1867 to manage all fisheries. This authority includes the T'aaq-wiihak First Nations Aboriginal rights-based fisheries. However, the government does collaborate with the T'aaq-wiihak First Nations and with other First Nations, with respect to fisheries management issues.

Level of Allocations

The 2009 court decision did not specify how much fish should be allocated to accommodate the commercial fishing rights of T'aaq-wiihak First Nations. During the period of 2010 to 2016, there was a significant increase in the T'aaq-wiihak First Nations' access to a range of fisheries. The 2018 judgment stated that, in some instances, those levels of access are sufficient to satisfy the right. For example, with respect to access to the prawn fishery, the 2018 judgment stated that the present allocations "are appropriate accommodations of the right and are not an infringement of the plaintiffs' right to trade in prawn into the commercial marketplace." (Paragraph 1722) For some other species, the 2018 judgment was inconclusive with respect to whether or not the current allocations are appropriate to accommodate the right.

Allocation Priority

Canada's approach to allocating Chinook and Coho salmon among domestic fisheries has been based on an allocation policy that was established in 1999.[6] Under this policy, First Nations FSC fisheries are the first harvest priority after conservation needs. The policy specifies that the recreational fishery is the next harvest priority for Chinook and Coho salmon, followed by the commercial fishery. The 2018

[6] Fisheries and Oceans Canada, An Allocation Policy for Pacific Salmon. 1999.

court decision struck down the allocation policy that applies to Chinook and Coho salmon, as it does not properly recognize the aboriginal rights of the T'aaq-wiihak First Nations commercial fishery (i.e. the recreational fishery should not be afforded a higher priority than an aboriginal rights-based fishery). Specifically, the 2018 judgment states:

> "… the fact that the declared aboriginal right is to fish and sell fish into the commercial marketplace does not lessen the priority to be accorded to the aboriginal right -- it does not allow Canada to start out on the allocation process by treating the plaintiffs' fishery as simply another commercial fishery. To accord priority to the recreational fishery over the plaintiffs' aboriginal commercial fishery is not justified." (Paragraph 925)

The Court's 2018 interpretation of the T'aaq-wiihak First Nations' aboriginal fishing rights will help inform ongoing negotiations as the fishery continues to evolve. Further, the Court may provide an additional interpretation of the rights in the future, given that the 2018 court decision has been appealed by the T'aaq-wiihak First Nations and some aspects of the rights are yet to be clearly defined in court decisions to date.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

The T'aaq-wiihak First Nations' fishery continues to be managed by the government and subject to restrictions designed to achieve conservation and sustainable fisheries objectives. Many of the fisheries management features that apply to the general commercial fishery also apply to the T'aaq-wiihak First Nations' fishery (e.g., a total catch limit, gear restrictions, closed conservation areas, etc.). Accordingly, there has not been an observed change in the sustainable use of fishery resources resulting from the establishment of the T'aaq-wiihak First Nations' fishery in 2012.

Two factors may have an impact on resource sustainability in the future. First, the T'aaq-wiihak First Nations are now more actively engaged in fisheries management activities compared to their previous involvement in the general commercial fishery. This role includes determining who participates in the T'aaq-wiihak First Nations fishery, communicating with fishers to ensure that the rules of the fishery are understood and operating a dockside catch monitoring program. An R&R agreement between the fishers and the individual First Nations specifies conditions that fishers must adhere to when participating in the fishery, with penalties for non-compliance. The enhanced fishery management roles of scientists, managers and dockside monitors employed are expected to make a positive contribution to future resource sustainability.

Second, a number of fisheries management features related to resource sustainability remain unresolved in negotiations between T'aaq-wiihak First Nations and the government. For example, the government has applied restrictions to vessels over 25 feet participating in the T'aaq-wiihak fishery that is similar to those applied in the general commercial fishery (e.g. gear restrictions to limit the incidental harvest of coho salmon and catch reporting standards). The T'aaq-wiihak First Nations oppose these restrictions, noting that the recreational fishery is not subject to the same restrictions. Reaching a common understanding of the outstanding fishing restrictions would contribute to future resource sustainability.

3.2 Economic viability of the fishery

Under the previous rights-based approach, it was not practical for the smaller vessels (mosquito fleet) to participate in the commercial fishery. Under the newly established aboriginal-rights-based fishery, the T'aaq-wiihak First Nations are constrained by an overall allocation of fish, but there is no limit on the number of vessels under 25 feet that can participate in the fishery. The T'aaq-wiihak fishery continues to evolve, and its economic viability is closely tied to both the level of fish allocated to the

fishery by the government and the approach the First Nations take to managing access to the fishery. A brief discussion of each of these factors follows.

3.2.1 Allocation of Fish to the T'aaq-wiihak Fishery

The level of fish allocations to the T'aaq-wiihak fishery is a contentious issue in negotiations between the T'aaq-wiihak First Nations and the government. Specifically, the T'aaq-wiihak First Nations are seeking significantly higher allocations of Chinook salmon - currently the main target species - and a wide range of other fish that are included in their fishing rights. The government has not supported the allocations proposed by the T'aaq-wiihak First Nations, and the two sides remain far apart on this issue. For example, since 2012, the T'aaq-wiihak First Nations proposed allocations of Chinook salmon that have been between three and six times higher than the allocation provided by the government. The T'aaq-wiihak First Nations have identified allocations of fish as the primary factor affecting the economic viability of their fishery. In their post-season review of the 2017 fishery, the T'aaq-wiihak stated that the number of fishers registering and participating in the fishery likely demonstrates the recognition by fishers that the current allocations "are not viable or able to provide a reliable source of income."[7]

3.2.2 Number of Vessels Participating in the T'aaq-wiihak Fishery

Unlike the general commercial fishery, there is presently no limit on the number of vessels that participate in the T'aaq-wiihak fishery. The T'aaq-wiihak First Nations are responsible for designating eligible individuals and vessels and have been encouraging community members to participate in the fishery. In recent years, there has been a gradual increase in the number of troll vessels in the T'aaq-wiihak fishery. This is illustrated in the following statement:

> "In 2017, six new trollers joined the fleet bringing the total to 34 registered trollers this year. Four of these trollers were purchased by younger fishers, showing that fishing knowledge and skills are being passed down to younger generations and these younger fishers are showing the desire to participate in the fishing industry despite the low allocations currently provided …"[8]

The number of vessels participating in the fishery is an important factor affecting economic viability. That is, at a given level of allocation, as the number of vessels participating in the fishery increases, the average catch-per-vessel decreases. This means the decisions made by the T'aaq-wiihak First Nations on the number of vessels that participate in the fishery influence its economic viability.

3.2.3 Composition of the T'aaq-wiihak Fishing Fleet

The two vessel types presently participating in the T'aaq-wiihak fishery (mosquito and troll) are quite distinct with respect to vessel size (mosquito vessels are 14 to 28 feet in length and troll vessels are 34 to 46 feet), fishing capacity and fishing costs. The relative fishing capacity of the two vessel types is reflected in the catch rates in Table 1.

[7] 2017 Salmon Demonstration Fisheries Post Season Review, January 2018. p.12.
[8] Ibid., p.32.

Table 1. Catch Rates and Fishing Effort by Vessel Type.

Vessel Type	Average Chinook Catch per Day	Average Days per Trip	Average Hours Fishing per Day
Mosquito Vessel	8	1	9
Commercial Type Troll Vessel	214	2 to 3	12

Source: T'aaq-wiihak Fishery Indicators, 2015, p.7.

In 2016, 73 vessels participated in the fishery. This included 42 mosquito vessels (58 percent) and 31 troll vessels (42 percent). The estimated landed value of all species caught in the fishery that year was USD 713 000, with troll vessels accounting for 75 percent of the total landed value. With respect to the main target species, Chinook salmon, the troll vessels accounted for about 90 percent of the landed value.[9] The relative fishing costs of mosquito and troll vessels are shown in Table 2.

Table 2. Fishing Costs by Vessel Type.

Costs (USD)	Mosquito Fleet (day-trips)	Trollers (multi-day trips)
Average fuel costs per trip	113	656
Range of fuel costs per trip	40-150	500-900
Average vessel maintenance costs	1 006	4 134

Source: T'aaq-wiihak Fishery Indicators, 2015, p.9.

As noted above in connection with the total number of vessels participating in the fishery, decisions the T'aaq-wiihak First Nations make concerning access to the fishery (e.g., vessel trip or fishery opening limits) would be expected to affect the composition of the fishing fleet (mosquito and troll) and the economic viability of the fishery. If the distribution of catch between mosquito vessels and troll vessels is not controlled, the mosquito fleet may find it increasingly difficult to maintain its share of the total catch. The 2018 court decision cautioned that the focus of the right-based fishery is on small, low-cost boats and wide community participation. For example, the court decision stated:

> "How the use of trollers will be handled to ensure that wide community participation can be maintained for the mosquito fleet will necessitate appropriate management and monitoring of the right-based fishery, but the answer is not a continued increase in allocations to compensate for all the fish being caught by a large and growing fleet of small trollers." (Paragraph 455)

3.3 Social equality

All members of the T'aaq-wiihak First Nations are eligible to participate in the fishery. To date, only a small proportion of the population has opted to do so. A number of barriers to fishing were identified by individuals who registered but did not fish in 2015, including the following:

> "Not worth fishing due to the low DFO[10] allocation (not economical); T'aaq-wiihak openings were too short/poorly timed/ poor weather/ not enough notice; Fisher lives outside of territory – too far away from T'aaq-wiihak fishing area for fishing to be economical for quantity of fish available or duration of fishery; Fishing vessel is not adequate for ocean fisheries (e.g., too small to travel offshore); and, Fisher does not have a vessel/cannot afford one."[11]

[9] 2016 Salmon Demonstration Fisheries Post Season Review, p.27.
[10] DFO refers to Canada's Department of Fisheries and Oceans.
[11] T'aaq-wiihak Fishery Indicators, 2015, p.11.

In 2015, 24 percent of participating T'aaq-wiihak fishers did not own a boat but were able to participate in the fishery by borrowing or leasing a boat (and gear) from another T'aaq-wiihak fishery (generally family).[12]

While women are eligible to participate, men primarily conduct the fishing. In 2015, there were 229 individuals registered to fish, including 35 women. However, only two women *actually* participated in the fishery that year. The fishery has contributed to community sustainability by enabling fishing knowledge to be passed down within families. During the 2015 fishery, it was reported: "26 out of 28 T'aaq-wiihak mid-sized troll vessel operators were able to pass down fishing knowledge and skills to younger fishers by having them on-board as deckhands."[13]

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

Since the T'aaq-wiihak First Nations fishery was initiated in 2012, several challenges have emerged, including the following. First, the lack of a clear description of the T'aaq-wiihak First Nations' fishing rights from the Courts has resulted in various different interpretations and expectations regarding the actions required to accommodate the rights. For example, during extensive negotiations involving the T'aaq-wiihak First Nations and the government, the two parties were unable to agree on many of the fundamental issues associated with accommodating the rights, such as quantity of fish, type of fishing vessels, the priority of the fishery relative to other harvesters, and fisheries management responsibilities. This is an ongoing challenge since the most recent court decision (2018) left some key issues unresolved, and the 2018 Court decision has been appealed by the T'aaq-wiihak First Nations.

Second, negotiations involving the T'aaq-wiihak First Nations and government officials have taken place in the context of ongoing litigation. The adversarial nature of litigation has had a negative impact on the working relationship. This is reflected in the T'aaq-wiihak First Nations 2017 post-season report, which stated that the adversarial trial -that had occurred over the whole of the previous 2016 season "sat heavily with the Nations leadership, their fishers and their staff."[14]

The third challenge stems from having to manage both mosquito and troll vessels in a common fishery. This presents a number of difficulties in ensuring the focus of the rights-based fishery on small, low-cost boats and also on wide community participation. For example, there appears to be a trade-off emerging between the First Nations' objective of broad community participation in the fishery and the gradual increase in the number of troll vessels which account for the vast majority of the total harvest in the T'aaq-wiihak fishery. Some fisheries management features such as fishery monitoring and catch reporting are subject to cost-sharing in commercial fisheries. However, if the same provisions were applied to all vessels in the T'aaq-wiihak fishery, it would likely be unaffordable for the smaller mosquito vessels, further constraining broad community participation. At the same time, fisheries management features that are appropriate for small vessels may not provide sufficient fisheries management control for larger vessels.

4.2 Improving fishery sustainability in the future

Perhaps the greatest single factor that could improve the fishery's sustainability would be to gain greater clarity regarding the nature and scope of the T'aaq-wiihak First Nations' fishing rights. In particular, a clear definition of the rights would help the First Nations and the government develop a common understanding of the actions required to accommodate the rights, and it would provide a

[12] T'aaq-wiihak Fishery Indicators, 2015, p.14.
[13] T'aaq-wiihak Fishery Indicators, 2015, p.14.
[14] 2017 Salmon Demonstration Fisheries Post Season Review, January 2018, p.36.

more solid foundation for future negotiations. With this being said, the court process is exceedingly slow, and the litigation that interpreted the fishing rights in 2018 is now being appealed by the T'aaq-wiihak First Nations – it is expected to go on for many more years. In the meantime, several immediate actions have the potential to improve the current situation.

First, the Canadian government should respond to the 2018 Court judgment concerning the allocation priority of the T'aaq-wiihak fishery. It should update its domestic salmon allocation policy to ensure the aboriginal rights are appropriately accommodated. Second, the government should continue to advance proposals to expand the T'aaq-wiihak fishery (additional species and allocations) in a manner consistent with the First Nations' commercial fishing rights (i.e., for small, low-cost vessels.). Third, the T'aaq-wiihak should consider how they would like their fisheries access to develop in the future, in particular with respect to the relative priority of mosquito vessels versus troll vessels, recognizing that the focus of the fishing rights is on small, low-cost boats and wide-community participation. In doing so, the T'aaq-wiihak First Nations could learn from the experience of other commercial fisheries in Canada and worldwide. This will help inform decisions that will affect the economic viability and social equitability of their fishery.

Fourth, it would be beneficial for the Canadian government and the T'aaq-wiihak to further explore options for fisheries access beyond the strict interpretation of the court-defined fishing rights, particularly with respect to the use of larger, high-technology vessels. In 2014, the government proposed a 'hybrid approach' that would allow larger T'aaq-wiihak vessels to participate in the general commercial fishery, but this proposal was rejected. Future negotiations could explore approaches such as establishing a maximum share of the allowable harvest that can be taken by the larger vessels, and establishing fishery monitoring and catch reporting requirements based on vessel catching capacity. Requirements could be informed by testing different approaches for mosquito vessels and vessels with the same catching capacity as those participating in the general commercial fishery. Finally, recognizing that litigation is slow and costly, the T'aaq-wiihak First Nations and the government should continue to negotiate in the spirit of reconciliation.

Artisanal Fishing of the Kaqchikel and Tz'utujil Indigenous People in Lake Atitlán: An Approach to Tenure Rights for the Fishing Sector in San Juan la Laguna, Sololá

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Abstract
The first human settlements in Lake Atitlán date from pre-classical times. Although there are no records of fishing activities on the site, it is widely known that the inhabitants had a deep relationship with natural resources and therefore with the fish from Lake Atitlán. The Kaqchikeles and Tz'utujiles indigenous communities on the shores of the lake have developed fishing activities for hundreds or thousands of years. These activities have been important cultural pillars and sources of livelihoods and subsistence for inhabitants. The Mayan-Kaqchikel and Maya-Tz'utujil indigenous peoples of the shores of Lake Atitlán have customary/traditional rights in terms of access, utilization and exploitation of the area's fishing resources. With the arrival of the Spanish in the sixteenth century - which saw the imposition of Western organizational forms, new doctrines and the formation of the State of Guatemala in the nineteenth century - these customary/traditional rights are forced to evolve and adapt. Specifically, in the municipality of San Juan la Laguna, Mayan-Tz'utujil town, both characteristic elements of customary and legally recognized rights can be identified, thus demonstrating the combination of both cultures and forms of organization. The fishing activities, techniques and gear used in Lake Atitlán remained relatively unchanged until the last 50-60 years. Fish output has declined in recent years, caused mainly by anthropogenic effects (introduction of exotic invasive species and pollution) and natural disasters related to climate change (hurricanes and storms). The introduction of new fishing gears and new materials influenced the way fishermen carry out their activities; nevertheless, the fishermen of San Juan la Laguna still conserve traditional fishing methods, replicating the customs and traditions of their ancestors from generation to generation.

1. INTRODUCTION

1.1 Description of the fishery

Lake Atitlán is located in the department of Sololá, Guatemala (longitude West 91 ° 11, latitude North 14 ° 42). It covers approximately 125 km^2 and has 1 562 meters (m) above sea level. The maximum depth of the lake is approximately 318 m (PREPAC 2006). The activities of artisanal fishing are carried out at most shores of the lake (100-300 m from the coastline). The main fish species of commercial importance nowadays are: Mojarra (*Lepomis machrochirus*), White bass (*Micropterus dolomieu*), Black bass (*Micropterus salmoides*), Tilapia (*Oreochromis aureus*), Crappie (*Pomoxis nigromaculatus*) and Tigerfish or Carp (*Cyprinus carpio*); these are all exotic/introduced species (Barrientos and Quintana, 2012). Two different species of crab are also identified: Canchito (*Raddaus bocourti*) and Negrito (*Potamocarcinus magnus*) and some species of snails, both native organisms of the region.

The fishermen participating in this fishery come from 11 municipalities located on the shores of the lake: Panajachel, Santa Catarina Palopó, San Antonio Palopo, San Lucas Toliman, Santiago Atitlan, San Pedro la Laguna, San Juan la Laguna, San Pablo la Laguna, San Marcos la Laguna, Santa Cruz la Laguna and Sololá. According to Shook et al. (1979), one of the oldest sites of Lake Atitlán (Semetabaj) has occupational sequences that begin in the Middle Preclassic period (1200 - 400 BC). There is no bibliographic information regarding the first people who carried out fishing activities, although it is widely known that the inhabitants had a close relationship with the lake and its resources. Artisanal fishing is carried out by boats or from the shores of the lake. The boats, locally known as "cayucos," are made mostly in the municipality of Santiago Atitlán; they are a piece of the region’s millenarian

ancestral craftsmanship. Boats do not use engines and measure approximately 3-4 meters. The fishing gears currently used are trammel, net, hook and harpoon. The use of trammel nets is prohibited only in the municipality of San Juan la Laguna. In most cases, fishermen own their boats and the fishing gear.

Men, women, young people, children and the elderly develop artisanal fishing activities. At present, there are some women who are engaged in fishing, using cayucos and hook, specifically in the municipalities of Santiago Atitlán and San Juan la Laguna. Most women, children and the elderly carry out fishing activities from the shore and/or from the docks using hooks. Particularly in the municipality of San Juan la Laguna, most of the people who are commercial fishers perform activities every day, with an approximate duration of 4-6 hours per day (depending on the season and fishing gear). The quantity of fish landed has declined significantly during the years, making fishing almost uneconomical. Most of these declines were caused by environmental phenomena such as Hurricane Stan (2005), tropical storm Agatha (2010) and blooming cyanobacteria (*Limnoraphis robusta*) in 2009, events where the ecological processes of Lake Atitlán underwent significant changes.

1.2 Economic contribution and social implications of the fishing activity

The fishing activity developed by the communities of Lake Atitlán is a basic and essential way of life for hundreds of families that depend on this resource for income and food. Catches (all species of commercial importance) are for local consumption of the communities around the lake (fresh consumed product, little processing). Some species have great commercial importance in the domestic market, such as crab (*Raddaus bocourti*) and (*Potamocarcinus magnus*), which are sold to the capital city and the western region of the country.

There are approximately 30 fishermen who depend specifically on fishing activities as a means of livelihood in San Juan la Laguna. Currently, fishing activities are carried out partially and throughout the year (they dedicate at least 30 percent, but less than 90 percent, of their working time to participate in fisheries). Most fishermen mention that currently, fishing activities are not enough to support their families, so they are forced to develop other activities/jobs, like agriculture (mostly beans, coffee and corn), crafts, tourism, and holiday villa upkeep, amongst other things. The Association of artisanal fishermen "Chajil Ch'upup" has a fishing tour, an activity that supports the local economy of fishermen.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

The State of Guatemala has some institutions responsible for the management of the natural and fishery resources of Lake Atitlán. These include Dirección de Normatividad de la Pesca y Acuicultura (DIPESCA), the governmental institution in charge of the management and administration of the country's hydrobiological resources; Authority for the Sustainable Management of the Atitlán Lake Basin and Environment (AMSCLAE), a government institution to plan, coordinate and execute measures and actions to conserve the ecosystem of Lake Atitlán; and National Council of Protected Areas (CONAP), to guarantee the sustainable development and conservation of the country's natural resources. However, there is very little presence of these institutions, and there is a lack of support to the fishing sector. Thus, fisheries management is delegated to the communities and/or committees – the associations of fishermen of the municipalities.

Most of the municipalities do not have a management plan of the fishing resource. Some have fishermen's committees, but mostly without any regulation of fishing activities. The municipality of San Juan la Laguna is the only one that has some regulations regarding the governance of fisheries resources. The Association of Artisanal Fishermen, "Chajil Ch'upup," has developed some management measures, such as regulation of fishing gear allowed (trammel net ban) and regulation

of size and minimum catch maturity (catching female fish is forbidden when fishing with harpoons). The fishermen from the association have fishing licenses from DIPESCA with no tax or fee.

There are established formal limits in the lake where fishing with trammel nets are prohibited. These limits are given by the "monjones" (ancestral limits of the municipalities using geographical elements such as trees, rocks or wooden poles). In the specific case of San Juan la Laguna, the body responsible for monitoring to comply with the regulations is the Association of Artisanal Fishermen, Chajil Ch'upup. DIPESCA has provided logbooks for obtaining fishery records, where the species and the quantities in pounds obtained by species are recorded. Artisanal fishermen who are members of the association are aware of these regulations. There are fines and confiscations for prohibited gears, although the lack of presence of DIPESCA means that they are not implemented. The association of artisanal fishermen prefers to promote the dialogue between fishermen, to avoid major conflicts. Most of the times, fishermen have agreed not to continue with prohibited practices (use of trammel net and/or fish fishing female).

2.2 Rights-based approach: allocation and characteristics

The fishermen from the Mayan tribes Tz'utujil and Kaqchikel have customary and/or traditional rights to access the fishing resources of Lake Atitlán. Currently, all the municipalities with access to this resource belong to these two different tribes. They also maintain and preserve the right to use the fisheries resources. Most of the ancestral knowledge currently known - some regarding the management and use of natural resources - has been conserved through oral tradition. Previously, there was an intrinsic connection between the human being and nature, which was respected and used with a high degree of care; inhabitants considered all living beings to be sacred, and believed they should only be treated responsibly. The hierarchy and the division of political and social powers also existed. Some important figures that persist in the Mayan peoples are the Council of Elders and Ancestral Authorities, which have great political-social power in the indigenous communities still they make important decisions.

The ancestral organizational forms suffer a negative impact in the sixteenth century with the arrival of the Spanish to indigenous ancestral territories since they started to impose the western system of organization that resulted in a variety of conflicts and violations towards the forms ancestral organizations. At the beginning of the nineteenth century, the formation of the State of Guatemala began, with a centralized organization that did not represent the indigenous peoples. Up to now, new forms of Western organization have been imposed on indigenous territory, creating a great diversity of conflicts regarding tenure rights and the responsible governance of land, forests and fisheries.

The management and jurisdiction of the fishery in the Lake Atitlán is a combination of indigenous ancestral norms and western norms through the State of Guatemala. Regarding the legally recognized rights, only in the municipalities of Santiago Atitlán and San Juan la Laguna does DIPESCA issue fishing permits/licenses. Those permits were first given in 2008 in Santiago Atitlán and in 2012 in San Juan la Laguna. In the case of San Juan la Laguna, these permits were given directly to the members of the Chajil Ch'upup. The Chajil Ch'upup was the first association of artisanal fishermen of Lake Atitlán, founded in 2005. Most of the municipalities around the lake have committees of artisanal fishermen, and in the specific case of the municipalities of Santiago Atitlán and San Juan la Laguna there is a legally recognized association. Previously, the municipality of the people and the figure of 'mayor and judge of peace', which was assigned by the indigenous communities, was responsible for providing the permit/fishing license.

In the specific case of the municipality of San Juan La Laguna and the Chajil Ch'upup there are both customary/traditional and legally recognized fishing rights in the co-management of fishery resources. Previously, customary/traditional fishing rights were only provided to fishermen who use the harpoon and hook fishing gear and respect the reproductive stages and gender of the species (female fish catch

is prohibited). With the initiative of the Chajil Ch'upup, around 2012, the legal fishing right is assigned by DIPESCA. The traditional regulations were considered and a ministerial agreement is created, currently renewed (Ministerial Agreement 208-2018), which prohibits fishing with trammel net in an area of 1km^2 in San Juan la Laguna. The customary fishing rights are renewed every year through the fishermen's association. Legally, recognized rights are given for 3 years; in both cases, these rights are non-transferable. The cases of noncompliance have decreased significantly since both rights (traditional and legal) were granted. Fishermen have a legal basis to act if they discover any user in violation of the rules/law. Most breaches are related to the use of trammel nets. In cases where fishermen encounter this non-compliance, traditional forms of dialogue are used to resolve the conflict. Violence or legal bases have not been used to solve any breach of this nature.

Since rights-based approaches have been maintained for hundreds of years through customary tenure rights, the number of users and fishing effort in the municipality has remained stable. The possibility of new users obtaining the right to fish with trammel nets was never viable since this practice was controlled by local fishermen, even though there was no legal regulation (ministerial agreement).

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

Currently, the municipality of San Juan la Laguna and the Chajil Ch'upup represent the only organization with a system of regulations that allow for the responsible and sustainable use of resources. The regulations regarding the use of more specific fishing gear (hook-harpoon), the prohibition of non-selective fishing gear (trammel nets) and the regulation of sizes and gender (no female capture) are the only regulations present, applicable only to an area of 1 km^2 of the municipality. These practices were implemented thousands of years ago and have been transferred from generation to generation, by oral tradition and as part of the fishing culture of the Tz'utujil people of San Juan la Laguna.

Despite the regulations that exist in the area, fishermen have noticed a decrease in the abundance of native species of Lake Atitlán. This is more associated with the introduction of exotic species and their feeding on native species than with excessive fishing effort by local fishers. Most species of commercial importance and subsistence are exotic species, introduced into the body of water approximately 50 years ago. One of the native species that still shows presence and importance for artisanal fishing is the pepesca (*Astyanax aeneus*), although it is increasingly scarce in the capture. There are no assessments of the fish stocks of native and exotic species at Lake Atitlán, although some analyses were carried out regarding relative abundance, maximum sustainable yield and the level of catch-per-unitof effort, depending on the fishing gears used. However, changes in the average size of the species captured are evident.

In the case of the species with the most commercial and subsistence importance - mojarra (*Lepomis macrochirus*) - there has been a decrease in fish sizes and abundance. In the case of species such as bass (*M. dolomieu and salmoides*), tilapia (*Oreochromis aureus*) and crappie (*Pomoxis nigromaculatus*), size and abundance are growing or without significant changes. Carp (*Cyprinus carpio*) shows an increasing size. Fishermen mentioned that most carp exceed the size available for harpoon fishing since the point of the harpoon bend or break when making contact with the scales of the fish at the moment of catch. In addition, the species does not have a significant economic value in the local market since consumers do not like carp due to too many bones.

3.2 Economic viability of the fishery

In the municipality of San Juan la Laguna, the number of active fishermen has decreased over time. Most fishermen in the area believe this happened due to the considerable decrease in fishery resources. The Chajil Ch'upup is now composed of approximately 25 active members, while there were

30 to 35 members some ten years ago. The sector of women fishing activities was most affected by the introduction of exotic species, though. Still, in the late 1970s, fishing activities were carried out on the shores of the lake with the use of ancestral fishing gear such as seaweed fences and glass jars with corn dough. Currently, most active fishermen catch approximately 2-3 lbs of fish per day, while some years ago, the daily catch was 30lbs. The economic gains range between Q40 - Q90 (USD 5-12) per day depending on the species caught. For this reason, some of the fishermen have focused on alternative livelihoods such as agriculture, crafts, tourism, among others.

3.3 Social equality

The customary/traditional fishing rights of the indigenous peoples around the lake have taken into account the social equality and human rights of the population to achieve the food security and sovereignty, by ensuring access to fishery resources for men, women, children, young and elder people. There is equality and gender equality in terms of fishing activities. Cecilia Sumoza, an artisanal fisherwoman, explained that "Men respect me and we respect each other. I like to be the only fisherwoman in San Juan, although I would like a partner to fish." Gender equality has been respected, giving permission/fishing license to the only artisanal fisherwoman who currently uses a vessel to carry out fisheries activities. Fishing done by children, youth and the elderly is not legally recognized or registered in national statistics. The combination of both traditional and legal rights-based approaches ensures access and possibility for new generations to carry out fishing activities in the area by providing and supporting a system of regulations for the sustainable use of fishery resources.

Bernardino Ixtamer, an artisanal fisherman, explained that "We all need to eat and bring food home, so everyone can fish, as long as we respect the lake and do not damage it."

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

The indigenous communities around the lake have faced a variety of challenges in recent years, some caused by environmental disasters and others by the anthropogenic effect and pressure on natural resources. A series of storms/hurricanes in 2005 and 2010 had a significant impact on the ecological processes of the trophic webs, the fish fauna of Lake Atitlán and on some plant species that are fundamental to the reproduction and recruitment of hydrobiological species, such as the Typha, locally known as "Tul." Increased pressure on natural resources due to population growth, the use of intensive agrochemical systems, the lack of wastewater treatment, pollution by solid waste, and atmospheric deposition – among others - are some of the factors that have a negative effect on the lake's ecological processes. They, therefore, constitute a problem that directly affects the livelihoods of artisanal fishermen and users of the natural resources of Lake Atitlán.

The absence of fisheries management constitutes one of the most complex challenges in the area, even though most municipalities have an organizational figure (committees and/or associations). There is no control and surveillance system for fishing activities in the different communities by the state and DIPESCA. Most municipalities, with the exception of Santiago Atitlán and San Juan la Laguna, do not have a fishing permit/license and only San Juan la Laguna has some regulations regarding their fishing activities. The lack of human and monetary resources of government institutions, which are responsible for the administration and management of hydrobiological resources in the country, has had a devastating effect on the fishing communities. This is why in most of the rivers, lakes and lagoons of the country, there is no type of regulation and management.

The lack of presence of governmental institutions responsible for the sustainable management of natural and fishery resources have led to conflicts between users. Some of the most frequent include use of fishing gear not permitted (trammel nets) and/or mesh size less than allowed, fishing gear was stolen by fishermen from different municipalities, crossing municipal boundaries/areas of fishing, and

conflicts for fishing spaces between fishermen of the same municipality. Other points of conflict with fishing activities come from extensive agriculture and use of agrochemicals; tourism, population growth; lack of solid waste management and sewage treatment; and the water transport sector (which leads to the destruction of fishing gear, boats and pollution).

The allocation of rights (customary as legally recognized) in San Juan la Laguna has positively influenced the conflict resolution between the users of fisheries resources in the municipality. Most users say that the presence of users violating the regulations is minimal or nil due to the legally recognized permits and the creation of the ministerial agreement (2008-2018). This agreement was generated through the collaboration of the fishermen's association and DIPESCA.

4.2 Improving fishery sustainability in the future

The elaboration of diagnoses of fishing communities by municipality/community/village is essential to identify the key factors that can help to design a fisheries management plan, both at the local (municipality) and global (Department - Lake Atitlán) levels. Information that needs to be generated and/or updated includes: number of active fishers, fishing gear used, presence of committees and/or fishers' organizations, main needs of users, and type of conflicts related to the fishing sector. This type of diagnosis can be carried out through a series of methodologies such as participatory observation, work with decisive informants, interviews/structured and unstructured surveys, and various participatory approaches.

At the same time, in order to design any plan, it is necessary to ensure high participation and cooperation between government institutions and users of artisanal fisheries in each municipality (committees and associations). There must also be focused discussion on possible lines of action for the fishing ordering, and an awareness of the laws and norms of indigenous peoples, constituting knowledge that can be used as a basis for sector regulation. Throughout the government-fishery communication, transparency would help to build bonds of trust and respect. It is, moreover, essential to use an ecosystem approach for the evaluation and implementation of the fisheries management/ordinance plan. The approach must use previously generated knowledge regarding the management of fishery resources (especially inland), and then try to apply them in the context of the Lake Atitlán basin. Lastly, evaluating the best co-management strategy will enable both fishing institutions and users to ensure the fishery resource promotes the security and sovereignty of the following generations.

4.3 Lessons learned

The combination of western and traditional fishing rights works well when the fishers are organized into associations that acquire management rights from the national authorities and have sufficient enforcement capability. Clear formulated regulations reduce conflicts among fishers. The introduction of exotic species changes the environmental situation of a closed system entirely and leads to the disruption of traditional fishing methods. Thus, the introduction of exotic species into water bodies should be avoided. Limited human and financial resources result in the absence of the governmental agency in the Lake. This absence, in the case of Lake Atitlán, created the need among the fishers to take on the management function of the fishery resources.

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Rights-based Approaches in Ecuador's Fishery for Mangrove Cockles

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Abstract
The fishery for ark clams or mangrove cockles (*Anadara tuberculosa* and *A. similis*) has been culturally and economically important in communities that depend on mangrove forests throughout the Pacific coast of Latin America since pre-Columbian times. In Ecuador, more than 3 000 artisanal fishermen manually harvest bivalve molluscs of the genus Anadara. However, this fishery has been vulnerable to harvesting pressures and habitat destruction. For almost three decades, researchers and international organizations have increasingly recognized the value of Territorial Use Rights in Fisheries (TURFs) as a tool for achieving marine conservation and socially equitable outcomes in fisheries management. Since 2000, the Ecuadorian government began granting mangrove concessions to local fishing associations to promote mangrove conservation and sustainable use in fisheries. Many of those fishing associations designed management plans for benthic resources (such as cockles and crabs) similar to TURF arrangements in other parts of the world. This paper explores how these institutional arrangements contribute to the goals of sustainability with particular attention to challenges and tradeoffs. The mangrove concessions have created conditions that promote habitat health necessary for fishery productivity while strengthening resource rights, enabling communities to pursue sustainable fishing-based livelihoods for present and future generations. On the other hand, the creation of exclusive access rights for particular user groups has also exacerbated tensions among independent cockle gatherers that feel they are increasingly losing access to their customary fishing grounds. Moreover, fishing pressures and a lack of compliance with the minimum size regulations continue to threaten the sustainability of the fishery. Understanding tradeoffs in Ecuador's integrated approach to coastal management may provide valuable insights for the management of other small-scale benthic fisheries within multiple-use coastal zones. We recommend it is necessary to create opportunities for diversified livelihoods in locations where TURFs or similar forms of territorial use privileges are implemented.

Keywords: Mangroves; Artisanal fisheries; Concha prieta; sustainability; Ecuador

1. INTRODUCTION

1.1 Description of the fishery

Ark clams or mangrove cockles have been an important resource within coastal communities, dependent on mangrove forests in the intertidal swamps of Central and South America since pre-Colombian times. In Ecuador, mangrove cockles are gathered from the roots of mangrove trees during low tide periods by artisanal fishers throughout the coast (Figure 1). In the northern province of Esmeraldas, cockles are traditionally harvested by family groups, women and children; however, the lack of employment in recent years has driven more men to enter the fishery[15]. Throughout the rest of the country, the fishery has been primarily dominated by men who harvest cockles for commercial markets[16]. The cultural and economic value of mangrove cockles is particularly high in Ecuador and

[15] Source: Mera Orcés, 1999; Ocampo-Thomason, 2006.
[16] Source: Beitl, 2014a; Beitl, 2014b.

Colombia, which represent over half of the estimated fishers that harvest cockles throughout their range from wetlands from Mexico to Peru[17].

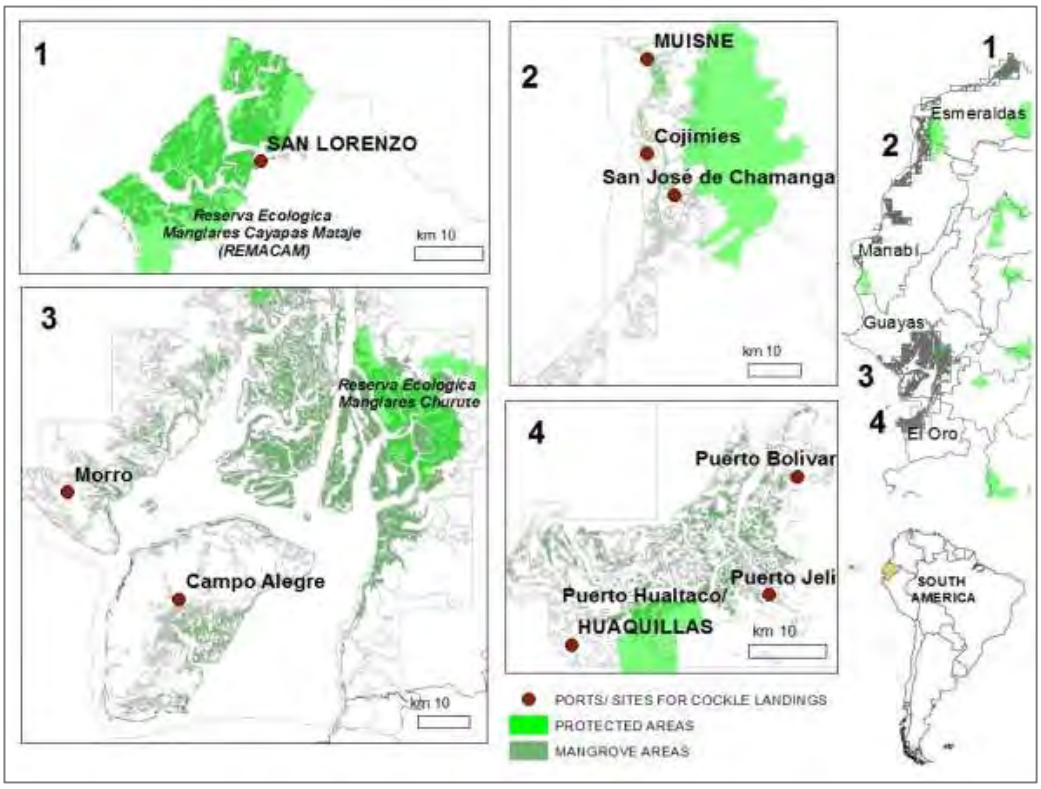

Figure 1. Mangrove habitat where cockles are harvested, protected areas, and major ports for landings throughout coastal Ecuador.

1) Ecological Reserve Cayapas Mataje (REMACAM) in the province of Esmeraldas;

2) Muisne-Cojimíes Estuary bordering the provinces of Esmeraldas and Manabí;

3) Puerto El Morro and Campo Alegre in Guayas Province;

4) Archipelago Jambelí in El Oro Province.

Sources: PMRC-CLIRSEN 2006; Larrea 2006; INP 2018.

Three species of mangrove cockles are harvested for commercial markets in Ecuador (*Anadara tuberculosa*, *A. similis*, and *A. grandis*). There have been no official stock assessments, meaning the current status of the fishery is poorly understood. However, since 1997, there have been a handful of studies conducted by non-government organizations (NGOs) and Ecuador's Instituto Nacional de Pesca (INP), which is a government research institution established in 1960. These studies suggest harvesting pressures have been increasing[18]. On the other hand, there is a great deal of spatio-temporal variability in fishery production. One study of the cockle fishery in the Archipelago Jambelí showed a 41 percent decline in catch rates between 2005 and 2009 and an increase of 4-10 percent since 2010[19]. The reasons for variability in harvesting pressures and catch rates are complex and unclear, but most likely attributed to habitat destruction associated with shrimp farming and

[17] Source: MacKenzie, 2001 ; MacKenzie & Buesa, 2006.
[18] Source: Flores & Mora, 2011; Mora & Moreno, 2009; Mora et al., 2009, Mora et al., 2011; Mora et al., 2010ª; Mora et al., 2010b; Moreno C N.D., Moreno Cáceres, 2005; Moreno Cáceres & Ortega González, 2003; Moreno Cáceres & Ortega, 2002; Moreno et al., n.d.
[19] Source: Zambrano et al., 2017.

urbanization since the 1970s. Livelihood strategies and management practices have responded to such economic and environmental uncertainty in recent decades[20].

Fishers participating in Ecuador's cockle fishery are often from communities located within mangrove forests and adjacent urban areas throughout the coast (Figure 1). Cockles are landed in 10 major ports: San Lorenzo, Muisne, San Felipe (not shown), Cojimies, San Jose de Chamanga, Morro, Campo Alegre, Puerto Bolivar, Puerto Jelí, and Puerto Hualtaco/ Huaquillas. Gathering grounds are within close proximity to ports (Figure 2). The ports of Bolivar, Jelí, and Hualtaco receive landings from 5 rural communities located throughout the Archipelago Jambelí, as well as a number of neighbourhoods in the cities of Huaquillas and Machala, whose residents have ancestral ties to the archipelago and other parts of the country. Muisne receives landings from 3-4 neighbourhoods and 5-6 rural communities from adjacent mangrove areas. On the northern border, San Lorenzo receives imports from Colombia, as well as several neighbourhoods throughout the city and rural communities located throughout the Cayapas Mataje Mangrove Reserve (REMACAM), Ecuador's largest mangrove reserve.

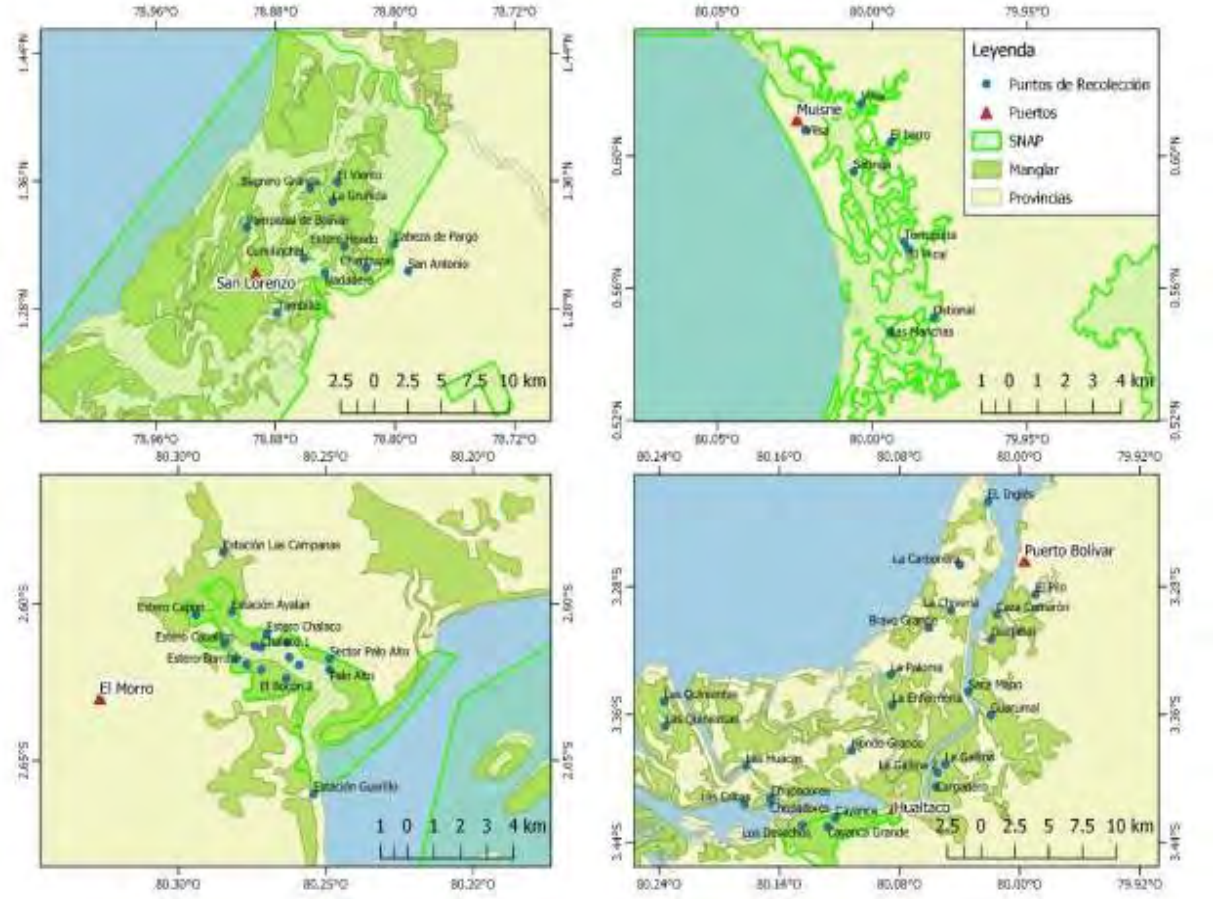

Figure 2. Cockle gathering grounds around ports with the highest landings.
Sources: PMRC-CLIRSEN 2006; Larrea 2006; INP 2018.

During low tide periods, artisanal fishers travel individually or in groups to gathering grounds in small boats, canoes, or on foot. Harvesting cockles for commercial consumption is generally an individualized activity, though some family groups (i.e. parents and their children) may pool their catch. Fishers identify productive fishing grounds through their own experience and customary use of preferred spots. Certain fishing associations and cooperatives may occasionally conduct collective

[20] Source: Beitl, 2014a; Beitl, 2014b; Elao & Guevara, 2006; Mera Orcés, 1999; Ocampo-Thomason, 2006

harvests to raise money for their organization. In areas where mangrove concessions are present, associations may coordinate group transportation to communal harvesting areas.

There are differences in the organization of fishing activity between urban areas and rural communities located within the mangrove forests. In rural communities, some individuals travel with the receding tide on foot or by paddle in their "bongo" (traditional wooden canoe). Those who have their own motorized canoes and boats leave later and may take passengers in exchange for a fee or a small portion of the catch. Some cockle fishers with boats and other types of fishing gear may travel to more remote areas and may combine different types of fishing activities during one long trip (i.e. cast net, gill net, or hook/ line during high tide; gathering cockles and/ or crabs during low tide). In urban areas, cockle fishers often pay USD 1-2 to a boat captain or wholesaler who transports individuals to their preferred sites. For example, in Puerto Hualtaco, motorized boats (12-15 m) carrying 12-30 passengers drop fishers off at their preferred sites, where they harvest cockles for three hours before being transported back to port. It is common in Muisne to rent paddle canoes carrying up to 4-5 people, which requires a great deal of travel time investment, particularly for more remote gathering grounds.

The spatiotemporal distribution of cockles corresponds to the conditions of mangrove habitat, changing economic conditions, and broader socio-political change. While Ecuador's baselines have been debated,[21] the conversion of mangrove wetlands to alternate uses such as shrimp aquaculture and urbanization has been as high as 75 percent in some estuaries, with an overall average loss of about 27 percent for the entire coast.[22] These landscape transformations have often resulted in the displacement of artisanal fishers and conflict in some areas. Moreover, the booming shrimp industry triggered demographic shifts and infrastructural developments (i.e. roads, bridges, public transportation, sewerage and sanitation, aquaculture facilities, processing and packing plants, etc.) throughout the 1980s and 1990s. Not only have these developments attracted migrants from other parts of the country, but they've contributed to problems of contamination in mangrove areas. Increased demand and proximity to markets may have further exacerbated fishing pressures.

At present, mangrove-dependent villages vary considerably in their economic activities and population dynamics. On the one hand, some cockle fishers are concerned that more people are entering the fishery. On the other hand, some villages have been characterized by high levels of outmigration. Some individuals have abandoned their fishing-based livelihoods to participate in temporary or seasonal wage labour (e.g. plantations, shrimp industry, construction, domestic service, industrial fisheries, etc.). These factors have affected fishing effort levels in complicated ways, but have not been systematically studied. To add to this uncertainty, several hazardous events have affected the fishery, including floods, storms, earthquakes, and pollution associated with urbanization and agricultural runoff. Events like ENSO and a 2016 earthquake in Muisne have caused a significant amount of damage to bridges, ports, jetties, docks, houses, schools, stores, utilities.

1.2 Economic contribution and social implications of the fishing activity

Mangrove cockles that are captured are primarily used for human consumption as ingredients for traditional coastal cuisines of Ecuador, Colombia and Peru. In Ecuador, cockles are in high demand during holiday seasons and in tourist areas to be served in ceviche, with coconut sauce and rice, or roasted. Most landings are destined for local and regional markets throughout the coast and highlands, though some are traded in international markets. In Hualtaco on the southern border, about half of the 14 merchants transport cockles to Peru. In San Lorenzo, cockles are imported from Colombia. Live cockles are transported in burlap or polypropylene sacks of three different sizes, the largest having a capacity of 5 000 shells. Small rural communities may have one or two merchants,

[21] López-Angarita et al., 2016.
[22] CLIRSEN-PMRC, 2007.

who serve as intermediaries to facilitate transport to larger port areas and landings sites. More remote areas like REMCAM have relied heavily on intermediaries[23].

Ecuador's INP estimates about 3 000 fishers participate in the fishery, a drop from the estimated 5 000 in previous studies[24]. Reliable estimates are difficult to determine since fishing effort may vary significantly over time and space; livelihood decision-making is dynamic, in the face of environmental variability and economic uncertainty.

The fishery represents a significant source of income for women in the northern province of Esmeraldas. For both male and female cockle gatherers in Ecuador, this fishing activity provides anywhere between 50-75 percent of total household income for those that full harvest time, i.e. 5-6 days per week. Some cockle harvesters are specialized, while others employ mixed livelihood strategies, i.e. fishing during high tide and gathering cockles and/ or crabs during low tide. Many cockle fishers alternate between part-time and full-time engagement depending on seasonality in other fisheries or availability of wage labour in other sectors. Residents of small rural communities may leave temporarily for work, the army, or educational opportunities.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

Since 2000, Ecuador's Ministry of Environment has allocated over 50 mangrove concessions (custodias del manglar) to community organizations and fishing associations throughout the coast, in order to promote mangrove conservation and sustainable fisheries. With the exception of some communities holding mangrove concessions, Ecuador's cockle fishery is open-access, with no limits on the number of new entrants. While the overall goal of custodias is to promote mangrove conservation, community management plans are tailored to meet locally identified needs in fisheries management, artisanal aquaculture, or tourism. Of the approximately 32 currently active custodias, 25 are estimated to include plans for managing the cockle fishery using a TURF model. Communities with mangrove concessions regulate access to fishing grounds, as stipulated by their management plans.

All of the communities with mangrove concessions and TURF arrangements restrict the harvest and commercialization of cockles with shell lengths less than 45 mm in compliance with national regulations. Some communities practice rotational closures and/or set aside reserve areas for spawning. Compliance with the rules is monitored locally by the community. Community patrols regulating access are based on obligations as members, or in some cases, associations pay their members a remuneration for their service on guard duty. In one case, reserve areas are monitored by each member of the association on a rotating basis, in order to prevent entry by outsiders, with sanctions for members who shirk this responsibility. However, noncompliance in that community is rare.

At landing sites, catch monitoring programs are currently conducted in six ports by INP. Since 2008, the Subsecretaria de Recursos Pesqueros (SRP) has designated fish inspectors in five of the major ports for cockle landings, to enforce minimum size requirements. Different communities with concessions have their own rules and conflict resolution mechanisms. In some cases, the incidence of social conflict among different user groups has increased where mangrove concessions are present. Overall, mangrove custodias have strengthened the ability of cockle harvesters and other artisanal fishers in Ecuador to denounce violations of the laws upholding the mangrove forest conservation, which was a significant challenge throughout the 1980s and 1990s[25]. It is increasingly clear that adequate

[23] Source: Ecobiotec, 2009
[24] Source: MacKenzie, 2001 ; MacKenzie & Buesa, 2006
[25] Source: Beitl, 2012; Beitl, 2017.

enforcement of mangrove conservation laws has played a critical role in the resolution of aquaculture-fishery conflicts.

2.2 Brief history of former rights-based approaches used in the fishery

At the national level, the SRP introduced the first measures for managing the cockle fishery through Ministerial Agreement No. 170 in October 2001, based on recommendations from the INP. These measures included 1) a closed season for the capture, transport, possession, processing, and commercialization of *A. tuberculosa* and *A. similis* between 15 February and 31 March of each year; and 2) the prohibition of the capture and commercialization of cockles with shell lengths less than 45 mm. The shell size regulation was made permanent in 2005 by way of a reform to Article 2 of the Ministerial Agreement 170. However, with respect to the closed season, these measures were considered ineffective for promoting the sustainability of the fishery.

There has been some scientific debate about spawning periods. One study from Colombia found that *A. tuberculosa* reproduces primarily during December, February, April, and August[26]. In light of these debates and given the difficulty in enforcing a closed season in Ecuador, this regulatory measure was lifted in 2006. The only national regulatory measures currently in place are the size limits and rights-based area management in locations where custodias are present.

Traditionally and within open-access areas of the fishery, communities practice a form of informal customary rights. Cockle fishers typically harvest from their preferred areas on a regular basis. Individual preferences emerge from cultural norms of avoidance and mutual respect similar to customary practices in other small-scale fisheries (SSFs)[27]. Harvesters, meanwhile, customarily leave undersized cockles in the mangroves to promote growth and spawning. In small communities where fishing effort is relatively low, a self-organized informal division of fishing space serves to maintain relatively reliable catch rates for individual harvesters. These versions of informal social organization have been vulnerable to demographic change and boom-bust economic conditions. Mangrove concessions have served to strengthen local resource rights, particularly in regard to conflicts with the shrimp aquaculture sector. On the other hand, consequently, some independent cockle harvesters feel they have been losing their customary gathering grounds, first to an encroaching shrimp industry, and now to mangrove custodias.

2.3 Rights-based approach: allocation and characteristics

With the presence of TURF arrangements in some custodias since 2000, Ecuador's cockle fishery is now characterized by a mixture of legally recognized fishing rights and informal customary rights. This mixed system is best illustrated by the case of one community's custodia, in which reserve areas are closed for periods of 30 days and then open for harvest during 10-day periods. During the 10-day period, the reserve areas are open for harvest, all of the association members leave their customary grounds to take advantage of the expected larger shell and catch sizes harvested from the reserve areas (managed as a TURF) and then return to their individualized customary preferences after the 10-day period is over. In open-access areas, decisions about where to fish and when to move on are generally made by individuals and small kin-based groups; while in areas managed as TURFs, decisions are based on collective choice agreements.

Mangrove custodias allocated to local associations explicitly stipulate the goal of sustainable use and are valid for 10-year periods, with the possibility of renewal[28]. To obtain a mangrove concession, communities must first organize into formal groups legally recognized by the state. Then, they should identify a partner organization to provide technical assistance for a two-year commitment period (i.e.

[26] Source: Lucero et al., 2012.
[27] Source: Cordell, 1992; McGoodwin, 1994; Quimby, 2015.
[28] See also Acuerdo Ministerial 172 published in Registro Oficial No. 365, January 20, 2000.

NGO, university, or business enterprise). Once accredited as a civic organization, they are eligible to submit a package to the Subsecretaria de Gestion de Recursos Costeros office within the Ministry of Environment containing a list of their members, the names of executive officers, maps of the area, and a management plan to meet basic needs. Local organizations often include women members who are active participants in the cockle fishery in the northern province of Esmeraldas.
In neither the formal rights-based system nor the informal customary system can fishing rights be sold, transferred or inherited. There are limitations to the rights that can be officially held by one community at a time. Community associations may only apply for one concession at a time. However, individuals may simultaneously hold customary rights and legally recognized communal rights granted to their fishing association.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

There is evidence to suggest that the rights-based approach practiced in some custodias may effectively improve cockle catch rates and shell sizes[29]. However, it should not be assumed that territorial fishing rights necessarily promote sustainable fishing behaviour by individuals. Compliance with minimum size regulations remains a significant challenge recognized by scientists, authorities, and fishers alike. Membership in associations and awareness of the problem may not be enough to address this challenge. For example, one study found most cockle fishers were concerned about the status of the fishery; yet there were no differences in fishing behaviour among members of associations compared with independent harvesters[30]. The same study suggested that characteristics of the fishing grounds were more likely to explain differences in harvesting behaviour than membership in an association. Therefore, management efforts should ensure healthy mangrove habitat as a necessary precondition for sustainable fishing. However, more research is needed to evaluate the impacts of mangrove restoration and TURF arrangements on mangrove cockle production.

3.2 Economic viability of the fishery

Without a systematic evaluation, the economic impacts of the rights-based approach can only be estimated. First, it remains unclear whether the distance travelled on average fishing trips has changed since the implementation of rights-based approaches. To our knowledge, there have been no changes in the types of fishing boats or in the concentration of boat ownership. On the other hand, association members attest that cockleshell sizes and catch rates are larger from the managed areas. Without systematic investigation, it is unknown whether the implementation of the rights-based approach has generated new employment or whether it has discouraged fishing, as many independent cockle gatherers in Puerto Hualtaco note they have been increasingly losing their access to customary gathering grounds.

3.3 Social equality

Prior to the implementation of the rights-based system, customary fishing rights were assumed by individual cockle harvesters. Since the implementation of rights-based approaches, only formally recognized associations qualify for territorial rights. This has implications for equity in the distribution of fishing resources. The initial allocation criteria aimed to achieve the three pillars of sustainability. Having access to gathering grounds allows individuals to meet their basic livelihood needs. However, some independent harvesters have been displaced from their customary gathering grounds, which has resulted in the unintended consequence of increasing harvesting pressures in remaining open access areas.[31] Moreover, many independent harvesters prefer to maintain their independence as

[29] Source: Beitl, 2011.
[30] Source: Beitl, 2014°.
[31] Source: Beitl, 2012.

they lack the time, trust, and money to commit their own resources to membership in local associations.

At the same time, mangrove custodias ensure the protection of mangrove forests, which is necessary to support sustainable livelihoods for future generations of fishers. It remains to be seen whether TURFs are adaptable to potentially shifting resource distributions that happen as a consequence of climate chance and environmental uncertainty.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

One mid-term evaluation of the custodias demonstrated a number of challenges such as irresponsible fishing practices, lack of respect for minimum size regulations, trespassing, and the use of machete in collecting cockles[32]. The report suggested that with a few exceptions, the majority of communities had difficulty enforcing territorial management due to a lack of social organization, control, and vigilance. The authors suggested that technical assistance and support from authorities were critical factors in successful management and conflict resolution. Despite these challenges, the report concluded that the benefits of the concessions outweighed any drawbacks.

Other challenges include fishing pressures and a lack of compliance with the minimum size limit. The underlying causes of these problems are complicated, i.e. habitat degradation, changing demographics in response to dynamic economic conditions and infrastructure development. Different communities with concessions have their own rules and conflict resolution mechanisms. In some cases, the incidence of social conflict among different user groups has increased where mangrove concessions are present.

In Esmeraldas where cockles are traditionally harvested by women and family groups, more men are entering the fishery, and there are rising concerns over unsustainable harvesting practices, such as the use of machetes to cut the roots of mangrove trees. There have also been recent reports of foreign fishers from Colombia and an increasing number of “occasional fishers” who do not respect regulations or customary norms.

RBAs have strengthened resource rights in locations where custodias are present, however many local groups still face organizational challenges. Overall, many fishing associations in the REMACAM communities have low levels of organization. They lack real representation and participation in defense of the interests of their members.

Many cockle harvesters do not belong to fishing associations or cooperatives. One study found that independent harvesters lack the time, money, and interest in joining a fishing association since participation in civic life requires a significant investment of time and commitment. Some independent cockle harvesters do not trust public or community institutions. Because of precarious situations like these, many independents are regarded with suspicion by members of fishing associations and the authorities as “occasional fishermen” that threaten to undermine the sustainability of the fishery, regardless of how many generations they have been working in the mangroves.

4.2 Improving fishery sustainability in the future

A more systematic study is needed to assess the social, economic, and ecological impacts of custodias. Understanding tradeoffs in Ecuador’s integrated approach to coastal management may provide valuable insights for the management of other small-scale benthic fisheries within multiple-use coastal zones.

[32] Source: Coello et al., 2008.

It is necessary to create opportunities for diversified livelihoods in locations where TURFs or similar forms of territorial use privileges are implemented. This recommendation is based on the reality that a number of independent cockle harvesters may be displaced by a growing system of territorial use rights, which reduces their access to their customary gathering grounds. While many cockle fishers prefer fishing based livelihoods and take pride in their livelihood, there are others who may have entered the fishery as a last resort during difficult economic times.

Support from the authorities and technical assistance are critical for the success and empowerment of communities with custodias, particularly in dealing with issues of conflict resolution and lack of compliance. The presence of the authorities within harvesting areas may further deter unsustainable harvesting techniques.

Information sharing sessions should be developed that would allow them to work with different stakeholders, to identify standardized management measures for more effective enforcement of minimum size regulations, closures, zone management, and the allocation of use rights to members. Such sessions for information exchange can be supported, attended, or facilitated by authorities to promote a public space for sharing ideas about resource governance.

5. LESSONS LEARNED

The case study suggests that mangrove custodias have strengthened the ability of cockle harvesters to contribute to the protection of mangrove forests, which was a significant challenge throughout the 1980s and 1990s. Such effective enforcement of mangrove conservation laws will continue to be a critical factor for the success of sustainable mangrove fisheries.

The problem with the exclusion of traditional cockle collectors from the TURF creates problems and conflicts. TURFs need to be as inclusive as possible, and in case of exclusion, create possibilities of other sources of income. However, some independent harvesters have been displaced from their customary gathering grounds, which has resulted in the unintended consequence of increasing harvesting pressures in remaining open access areas.

It remains to be seen whether TURFs can adapt to the potentially shifting resource distributions that result from climate change and environmental uncertainty.

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Rights-Based Management in Indonesia's Dampier Strait: Blending Customary Rights and MPAs to Create the World's Largest Comprehensive TURF+Reserve Network

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Abstract
Currently, small-scale fishing communities are at a pivotal moment for sustainably managing their fisheries and safeguarding the food security and livelihoods of the local people who depend on them. After historically maintaining open access in fisheries, Indonesia, through the national government's Ministry of Marine Affairs and Fisheries (MMAF), moved in July of 2016 to grant communities in and around Marine Protected Areas (MPAs) the responsibility to co-manage their coastal resources and implement MPAs alongside government partners. In the Dampier Strait, a body of water that passes through Raja Ampat in the West Papua province, 19 local fishing communities on the islands of Batanta and Salawati will take on the responsibility of co-managing their coastal fishing grounds with the provincial government's Technical Operating Unit. In July of 2018, under the leadership of the Maya Tribe Adat Council, 58 customary, religious and village leaders from the communities formally agreed to organize local waters into a network of 21 Territorial Use Rights in Fisheries (TURF)+Reserves, housing the network within the Dampier Strait Conservation Area, a vast MPA declared in 2014 in the Dampier Strait. The resulting network, officially designated a TURF+Reserve network at the national level, encompasses 211 000 hectares, making it the largest comprehensive TURF+Reserve network in the world. The newly declared network is the result of a yearlong collaborative effort among the Maya Tribe communities in the Dampier Strait and the government's Technical Operating Unit, with support from conservation organization Rare, the USAID SEA project, and partners. Through the adoption of the network, the Dampier villages will be able to link their customary (adat) rights system to the protections of the strait's large protected area. The network's co-management strategy aims to enable sustainable community fisheries management with respect for historic customary rights and traditional fishing grounds, and through the networking of TURFs, aims to bring about large-scale reform by catalyzing change in fishing behaviours across an entire region. Looking forward, the government's Technical Implementing Unit in Raja Ampat will support enforcement of the TURF+Reserves, and Rare will support the office and Dampier villages in building management capacity, adherence to new regulations, and local support for the TURFs.

1. INTRODUCTION

1.1 Description of the fishery

Fishing takes place in a small-scale, demersal fishery within the Dampier Strait MPA in West Papua, Indonesia, in coastal waters zero to 12 nautical miles from shore (Figure 1). Among the most important species targeted by local fishers in the Dampier Strait are rabbitfish (Siganus sp), grouper (Ephinephelus sp), snapper (Lutjanus sp), emperor (Lethrinus sp), and lobster (Nephropidae sp), all of which are currently fully exploited. Fishers in the Dampier Strait are generally from the same country and local communities. There are fishers harvesting in the fishery from more than ten local villages. Fishers from other communities outside of the strait in Indonesia and from other countries also access the fishery. Fishers do not usually go very far to fish, as confirmed by target species and boat sizes

used.[33] Landing sites are scattered in the area and are informal. More than ten local communities receive landings in the fishery, in addition to several landing sites in other countries. There is one larger, commercial port that receives landings near Dampier villages, in the neighbouring township of Sorong. Though local subsistence is the primary purpose of fishing, in several villages catch has been traded to neighbouring village to fulfill needs of fish protein, and to Sorong for distribution.

Fishers commonly use seine nets, traps, and hooks and lines to fish; no fish-aggregating devices are used in the fishery. Gleaning for sea cucumber and other invertebrates is also common. Small power winches or haulers powered by engine are used to deploy fishing gear in the fishery, as well as independently powered gear deployment and hauling methods. More than 100 fishing vessels that are used in the fishery make use of outboard and inboard motorization. On average, the vessels are less than 12 meters in length, with an average gross tonnage at less than ten gross tons. There is no cold storage for the catch on vessels. Vessel owners and operators are fishers that come from the local communities and are sometimes joined aboard vessels by family members. Women are allowed to own fishing gear and vessels.

Though fishery intrusion by outsiders has been a consistent issue for local communities in the Dampier Strait, no major conflicts have erupted over this or other issues between/ among the communities - both before and after the recent adoption of the TURF+Reserve network. Before its adoption, it was common for local people to describe seeing outsiders from other nearby districts and provinces. However, overfishing is not yet considered a rampant problem within the Dampier Strait. Fishers have perceived their local fisheries to be abundant, but they need to adopt sustainable practices to maintain this condition. The adoption of the TURF+Reserve network is seen more as a preventative measure against overfishing.

[1, 2, 3] Jakub, R., Yapen, M., & Kushardanto, H., & Campbell, S.J. (2017d). Activity Report: Fishery Assessment of Dampier Strait, Raja Ampat, West Papua. USAID-SEA Project, 19 pp.

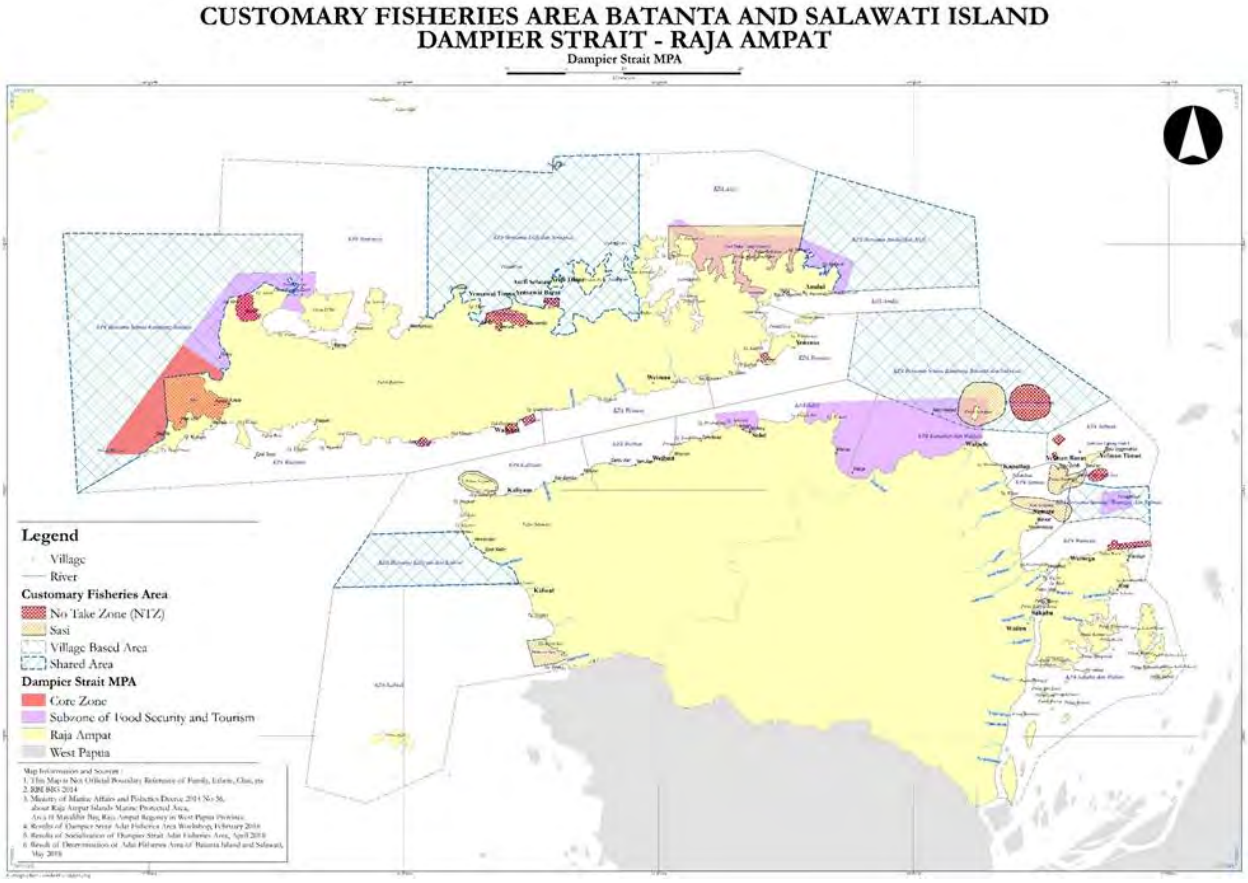

Figure 1. Map of the fishery within the Dampier Strait Marine Protected Area (MPA).
Source: KKP Raja Ampat, 2016; http://kkpr4.net/en/index.php?page=page&id=13.

1.2 Economic contribution and social implications of the fishing activity

Fisheries are a primary source of income and protein for all coastal villages of the Batanta and Salawati islands, complementing agricultural practices and production.[34] Among the local communities that make primary use of the fishery and its resources, the catch is utilized for direct human consumption. The catch is traded in markets for household consumption and/or bartering, local direct sale, and sale to domestic markets, for all of the key species caught (rabbitfish, grouper, snapper, etc.). Approximately 1 600 individual fishers within the Dampier Strait are involved in the fishery, with less than 25 percent being women. On average, fishers derive more than half of their income from their participation in the fishery.

Local fishers operate year-round but balance their fishing with seasonal farming activity. For several months of the year, they grow fruit and vegetables in individual gardens and focus extra effort on farming during periods in which the price for the gardens' products (like cassava and sweet potatoes) is higher. Fishers operating in the Dampier Strait are opportunistic, shifting their efforts based on market prices and income from their farming and fishing products.

[34] Jakub, R., Yapen, M., & Kushardanto, H., & Campbell, S.J. (2017d). Activity Report: Fishery Assessment of Dampier Strait, Raja Ampat, West Papua. USAID-SEA Project, 19 pp.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

With the formal adoption of the TURF+Reserve network in July 2018, the fishery is co-managed by local Maya communities on Batanta and Salawati and the provincial government. 21 TURF (Territorial Use Right for Fishing) areas have been created within the Dampier Strait MPA (which composes the "Reserve" portion of the network's TURF+Reserve formula). Rights to access and fish the TURF areas are held exclusively by local fishers from the villages, and rights allocation and management fall primarily under the control of the villages and their leaders. Ultimately, however, the provincial government must formally recognize the rights allocated by villages. The government also annually evaluates (starting in 2019) local compliance with regulations laid out in the TURF+Reserve network's management plan. A specific office carries out these responsibilities.

In Indonesia, the provincial government (working on behalf of 34 provinces) manages waters from 0 to 12 nautical miles. The Raja Ampat district, through which the strait's waters pass, is one of 11 coastal districts within the West Papua province. The provincial government in West Papua has an extension office in the Raja Ampat district: the Technical Operating Unit. This office formally recognizes rights to the TURF areas laid out for the newly adopted network, in addition to administering the regulations of the Dampier protected area. Because the villages control rights allocation, local fishers receive rights by proving they are from a Dampier village, using an ID card. Professional registration for fishers exists but does not dictate the ability of local fishers to access the villages' designated TURFs.

Per the co-management strategy of the TURF+Reserve network and as seen in its adoption, individual fishers and management authority staff alike weigh in on and make the rules for the fishery's management. NGOs like Rare have also been consulted for advice and opinions on management rules, particularly during the initial process of designing the network. In terms of enforcement of the rules, local government primarily holds responsibility. Despite this, the villages have agreed to carry out community-based surveillance. The provincial government plans to provide fuel to all 19 villages for surveillance (via patrol by boat) of the Dampier Strait.

The network's additional fishing regulations, made with community consensus, chiefly maintain catch by controlling fishing inputs (gears and time spent fishing) and the outputs (size and sex of catch). Restrictions to fishing also come with the no-take reserves of the Dampier Strait's protected area. The no-take areas surrounding the TURFs are meant to serve as "fish banks." Protecting critical reef and other marine ecosystems, the "fish banks" save and accumulate fish populations, allowing them to recover and potentially spill over into the TURFs inside the protected area. While the strait's protected area has existed since 2014, the new system outlines how fishers can work within it.

2.2 Brief history of the former rights-based approaches used in the fishery

Previously, the Maya Tribe villages of the Dampier Strait (now part of the new TURF+Reserve network) had long exercised customary rights collectively for their fishers and observed traditional fishing grounds. However, they had no legal basis to ask fishers from outside Dampier Strait communities to stop fishing in their waters. Fishers from outside Raja Ampat, wider West Papua, and from outside Indonesia had open access to fish their coastal waters. Unfettered access made it difficult for Dampier communities to take further steps in sustainably managing the use of their fishery or giving legal basis to the customary rights they had developed for local fishing.

The TURF+Reserve network was adopted to give local Maya communities the ability to manage access and prevent overfishing in their coastal waters. Now, access is prioritized for local villagers. Permission to make use of a local fisher's right to fish in the TURF areas of the Dampier Strait protected area must be requested by the fisher, and then granted through a temporary permit by the village and customary

leaders. The concept of folding TURFs into the protected area also turns local fishers into conservation stewards, incentivizing fishers to enforce marine protections to see area fish stocks increase. This enables Dampier communities to help maximize the functions of the protected area as well as TURFs.

2.3 Rights-based approach: allocation and characteristics

The 21 TURF areas created within the Dampier Strait protected area represent the division of much of the area's coastal waters into distinct fishing areas, to which each community's local fishers are granted access. To determine the boundaries of these areas, the village, customary and religious leaders of the 19 communities involved in the creation of the TURF+Reserve network participated in workshops with Rare and the provincial government. At these workshops, the communities drew up maps of the fishing grounds that they traditionally used - and which they considered theirs - based on historical information. The leaders then worked through the overlap of the mapped areas and conflicts over the boundaries to come up with a single, unified map of 21 access areas (effectively creating areas for each of the 19 villages, as well as several common fishing grounds to be shared by multiple villages). Under this system, each community's fishers have rights to clearly defined areas. Communities and their leaders manage rights allocation, as aforementioned, with formal recognition by the Technical Implementing Unit of the West Papua provincial government. The rights pertaining to fishing with traditional gear types and specifically for demersal and reef fish.

The customary rights on which the TURF+Reserve network is based were developed from historical information and with consensus among all communities. Maya fishers and non-fishers alike from the villages can hold rights, and rights are inclusive across community demographics, including ethnicity, gender, fisher generation/age, and economic status. The rights are valid indefinitely, pending users' compliance with the network management plan. People who hold rights can give outsiders from neighbouring villages or from within the district permission to fish in their TURF for a limited period, but the rights are not tradable. Those requesting permission can receive a temporary permit (and must request renewal if they seek to use it for longer) by filling out an application form, which must then be approved by village and customary leaders. Maya people outside of the Dampier Strait MPA who want to fish in the TURFs must also ask for permission from those with rights. Rights can be passed on to one's children, as they are part of a fisher's clan. If a fisher's children move and eventually return to the area desiring the rights, they must request permission from the village to get those rights back. Non-Maya fishers from outside the district are prohibited from fishing in the areas, and can only buy fish from local Maya fishers.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

The rights-based approach at the center of this case study was adopted in July 2018 and is in early stages of implementation. While new rules aim in part to change pre-existing fishing behaviour taking place within the fishery (e.g., who is fishing there; whether they follow the TURF requirements granting local fishers exclusive access), more time will be needed to observe the changes in resource use, as well as potential resultant changes in fish populations (growth in size, abundance, etc.), economic benefits, or social equity.

3.1 Sustainable use of the resources

There has been no noticeable change in the size of target species since the approach was adopted.

3.2 Economic viability of the fishery

Fishing effort characteristics like duration and distance of average fishing trips and use of fishing vessels have not changed. Other related changes have not yet been noted, again due to timing.

3.3 Social equity

The allocation of rights to members of the network's 19 Maya Tribe villages on the islands of Batanta and Salawati within the Dampier Strait MPA empowers the rights historically observed by these communities and, as aforementioned, applies to different genders, ethnicities, and more.

4. MAIN CHALLENGES AND WAY FORWARD

Before adopting the network, the primary challenge perceived by local fishers and their communities in the Dampier Strait was an intrusion into local fishing grounds by outsiders and migratory fishers, both small and large-scale. These fishers come from other communities, other areas of the country, and even other countries.[35] In the early stages of network implementation, intrusion into TURFs and violation of regulations (like gear, size and time restrictions) may present challenges.

Compliance with the fishery regulations presents another challenge. Changing behaviour from unsustainable fishing practices to sustainable ones will still need time to happen. Despite the fact that local fishers in Dampier have agreed to further control their catch size, fishing gears and season, they will need self-discipline and social pressure to lock in sustainable behaviour.

Raja Ampat's Technical Operating Unit and the 19 Dampier villages have expressed their commitment to the enforcement of the TURF+Reserves. Looking forward, conservation organization Rare will also support the office and Dampier villages in building management capacity, adherence to new regulations, and local support for the TURF+Reserves.

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[35] Refer to section 2.2 for more information about outside intrusion and overcapacity, as well as about how the TURF+Reserve network addresses these challenges.

Formalizing community-based fisheries management, challenges and opportunity: A case from Selayar, South Sulawesi, Indonesia

Dedi Adhuri

Please refer to the presentation of this case study available at:
http://www.fao.org/3/CA2263EN/ca2263en.pdf.

Moving from Customary Fishing Rights to Co-Management: Aceh

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Abstract
After the tsunami, traditional rights were wiped out in Aceh Province, Indonesia. As part of post-tsunami efforts during 2007-2010, FAO and the US Red Cross tried to recover the knowledge of traditional user rights. The program covered 160 villages along 300 kilometres (km) of the coastline of the west coast of the province. The key effort was to move the SSF from a custom-driven to a co-managed one through an elaborate participatory process. The initiative was a collaborative effort of the Food and Agriculture Organization of the United Nations (FAO) and the American Red Cross (ARC) – hereafter referred to as 'the Program'.

1. INTRODUCTION

This case study very briefly narrates one part of a development assistance program undertaken in Aceh Province, Indonesia, as part of the post-tsunami efforts during 2007-2010. The Program covered 160 villages along 300 km of coastline of the west coast of the Province. The key effort was to move the small-scale fishery (SSF) from a custom-driven to a co-managed one through an elaborate participatory process. This summary study describes the process, the outcomes and the evaluation of the initiative a few years after its completion.

1.1 Description of the fishery

Aceh Province, located at the northern tip of the island of Sumatra in Indonesia, grabbed world attention after Christmas Day of 2004. On the morning of 26 December 2004, a gigantic and unprecedented earthquake with a magnitude of 9.0 on the Modified Mercalli scale struck. It was followed shortly by one of the largest tsunamis recorded in human history. These events took human lives by the hundred thousand and severely damaged property as well as livelihoods, valued at several billions of US dollars. It has been estimated that in Aceh as a whole, between 15-20 percent of the total number of fishers died in the tsunami, meaning about 14 100 -18 800 individuals. Many fishing vessels were destroyed, and a major part of the fishery infrastructure was partially damaged and often beyond repair. What may be considered a 'gift of the tsunami' was the political autonomy that was given to Aceh Province by the central government through the Law on Governance of Aceh (LOGA). This newfound status was the result of a long and protracted political and armed struggle.

The fishery of Aceh was a beach-based, SSF before the tsunami and continued to remain so after. According to the Department of Ocean and Fishery, in 2001 there were 11 288 fishing boats. Of this total, 88 percent were small-scale – either non-motorised or fitted with an outboard motor. As of 2004, the year of the tsunami, the number of boats had increased to 15 576. However, by 2008 the number increased to 17 584, reflecting the largesse of the post-tsunami development assistance. The share of the larger-scale boats increased from 12 to 20 percent. However, by 2011 the number of boats in Aceh dropped back to 15 995 as a result of the 'mortality' and 'disuse' of the poor quality and inappropriate gift boats. No resource assessment has been carried out, but the increasing number of boats has led to overfishing, especially for the valuable demersal resources.

1.2 Economic contribution and social implications of the fishing activity

Fisheries is an extremely important source of livelihood in the coastal areas of the Aceh province. In many places, it is the only source of employment. Fish is also a major source of food in the province, and hence, there is a vibrant domestic market. Some products, such as lobsters, shrimp and tuna, are

going through Chinese traders to Singapore from where they find their way to other international markets. The eastern coastline of the province, being close to Malaysia (separated only by a narrow strait) also results in a vibrant trade of all varieties of fish between the two. Coastal communities are organized in distinct socio-ecological units called 'Ihok', of which there are 173 in the Province. These units form the basis for the fishery occupational and cultural pillars of the communities.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Brief history of the former rights-based approaches used in the fishery

The coastal commons of Aceh Province (the erstwhile 16th century Sultanate of Aceh) in Indonesia was governed by a customary institution called the Panglima Laot (Sea Commander). The Sultan of Aceh set up this four-century-old institution as a coastal naval protection force. Each Panglima had a socio-ecological territory, composed of land and sea space, usually including the delta of one of the numerous rivers flowing to the sea from the nearby hills. This territory is called an 'Ihok'. The Panglima commanded his coastal fleet, which was operated by the men of his territory, and he reported directly to the Sultan. It is worthy of mention that the wives of Panglima were also brave seafarers. One of them, Keu Malahayati, in the late 16th century even rose to the rank of Chief Admiral of the Sultan's navy! In time, when the naval priorities of the Panglima Laot (hereafter PL) ceased, they gradually became the leaders of the coastal communities of Aceh Province. The PL is always elected by the group of skippers of the village. Today, there are totally 173 PL in Aceh. Being a customary institution, there are no written rules; custom and norms are living law – referred to as 'Hukom Adat Laot' (Customary Law of the Sea) and passed down from one Panglima to the next.

The main realms of authority of the Panglima concern: the allocation of fishing space and fishing gear; care of the coastal zone resources such as corals, mangroves, beach grass, sand dunes, trees meant as wind-breakers; and most importantly, fishing-related conflict resolution. The institution has always functioned in an open and transparent manner and remained outside the influence of the secular and religious authorities. It is not well known to the world outside that Aceh was the "troubled province" of Indonesia. The Indonesian Army had, for over three decades since the 1970s, been engaging the Free Aceh Movement (also known as GAM) which was fighting for the control of the natural resources – oil, gas, forests, fisheries – and the independence of Aceh. The Province was often placed under military rule.

Several thousands of men, women and children were victims of this long and protracted, low-intensity war. Aceh was a no-go zone for foreigners. Finally, a Peace Agreement was on the anvil, mediated by Prime Minister Ahtisari of Finland. It was signed in Helsinki in October 2004 and it was a compromise deal. There was no independence; only autonomy, and the possibility to maintain the long-standing hukom adat (customary laws) in the governance of the Province. Two months later, the great earthquake and tsunami struck Aceh on that fateful morning of 26 December 2004. The whole western coast of the Province was devastated. Whole coastal townships and villages swallowed up by the ferocious waves. Many PL was spearheading the operations of getting people away from the coast and onto higher ground. Many fishers were at sea that morning. Their boats were buoyed up by the gigantic wave. But they remained oblivious of the devastation which is wrecked on to their villages on land. As many as 22 of the PL of the western coast of Aceh perished in the tsunami. Within a few weeks of the tsunami, in each coastal village, a new leadership was elected by the remaining population. However, they were in no position to replace the huge repository of unwritten customary knowledge that was suddenly lost forever.

The task of managing the post-tsunami coastal commons in the face of this big knowledge vacuum was a major challenge. This was particularly relevant in the realm of local conflict resolution. The ability to resolve local conflict without the intervention of other authorities – secular or religious – was an important way of asserting their collective rights to the resources over which the conflict was

resolved. This right had to be maintained at all costs. The option of writing down the rules and procedures of the conflict resolution process was out of the question. “Once custom is written, it ceases to be living law!” said a senior PL (personal communication). One of the big tragedies of the tsunami was the death of several of these customary leaders who were the repositories of this customary knowledge. Given the circumstances, many younger men, who were not full-time fishing skippers, were elected. At the same time, the coastal community’s immediate intention was to ensure the survival of this important social institution. Aceh had, pre-tsunami, been politically isolated from the Indonesian mainstream; customary context had given the SSF a sense of cohesion, identity and autonomy of practice. In the post-tsunami context, these were major factors in promoting collective action towards co-management.

2.2 Management of the fishery

One part of the Program during 2007-2010 was to negotiate the fishery towards being co-managed, rather than custom-driven. The process of negotiating co-management initially involved a three-fold strategy: (1) awareness creation, (2) capacity building and (3) field action. Those who participated as the key interest groups included young men and women from the coastal community, the members of the PL, and the representatives of the state (primarily staff of the fishery departments (DKP)). As many as 400 individuals from the aforementioned groups were directly involved in all the aspects of the strategy for over a period of three years (2007–2010). Some of the important details of the different awareness-raising, capacity building and field action programs initiated are summarily described below.

2.3 Awareness-raising

Awareness creation products were widely disseminated in the coastal areas to highlight the meaning and relevance of co-management. The products used idiomatic expressions found in Acehnese culture and Islamic teachings to sensitize people about the need to work together to ‘Sustain the Sea.’ The services of the PL network were ensured for the dissemination of these products. Following this awareness campaign, the key leaders of the village – customary, religious and official – were contacted with the idea of a training course for young men and women of the communities. The criteria for selection were mutually agreed upon, which ensured collective support for the selection process and a moral obligation for the youth to serve the community after the training.

2.4 Capacity building

Capacity building programs were undertaken for all three key interest groups. A three-week training course for youth on community organization and the technical and social aspects of fisheries co-management was organized. It was composed of knowledge inputs and a learning-by-doing process involving a participatory pedagogy. The course was titled ‘Youth for Responsible Fisheries.’ Seven rounds of training produced a cadre of 164 youth (33 women). They went back to their villages to play the role of ‘creative irritants’ in the formation of the new co-management organizational centres. As a group, they were named Motivator Masyarakat (Community Motivators) or MM for short. Capacity building of the fishers later took the form of meetings and workshops at the provincial and district levels. The PL had earlier taken an ‘adversarial’ position vis-à-vis the state during the three decades prior to the tsunami, and hence the idea of collaborating with the state was not readily acceptable to many of the individual PL. As custom provided the coastal community with an ‘identity’, it was important to continue fostering customary practices which helped to assert the rights of the coastal community over the fishery resources. Most important was the role of conflict resolution on matters relating to the fishery for which the PL authority was accepted by the police, navy and the civil administration.

Most of the fishery officials had no prior fishery education or training. Many of them were reluctant to visit the coastal areas, shy of exposing their ignorance to the community and the PL. A small group of key officers were selected for a study tour of neighbouring Malaysia to expose them to the fisheries

management approach of that country. The trip convinced them about the need for greater resource management and conservation in Acehnese fisheries and the significance of coastal community participation.

Short fisheries co-management courses - using the pedagogy of 'group discovery of realms of ignorance' - involved role play, case studies and games, making the process of overcoming one's ignorance and lack of knowledge an enjoyable endeavour. The training focused on the significance of SSFs and the four components of management, including conservation, regulation, allocation and rejuvenation. The role and challenges of multi-stakeholder fishery governance in the new Aceh political context was also debated. The training was intentionally devised to highlight that inter-district coordination is more important for managing a mobile and fugitive resource like fish than it is for land based activities. The personal rapport developed between the officers of the districts was a significant factor towards fostering future cooperation. In addition, the rapport that these officers developed with the Program staff greatly helped the latter when facilitating co-management initiatives.

2.5 Field Action

As the first step towards putting fisheries co-management into action, an informally constituted co-management forum was set-up in each district. The lead role in putting together this initiative was taken by the cadre of trained MMs in each district. The forum became a vehicle for getting the PL members, fishery staff and the authorities involved with general administration and governance of the district and villages. They discussed the finer details of putting co-management into action, with the main outcome being the initiation of five fishery co-management centres in different parts of Aceh's west coast. A legal framework for governance was also constituted as a decree of the Bupati (District Head). Although the decree had a very lowly position as a legal instrument, it served as authorization for exercising rights over a designated space.

2.6 Rights-based approach: allocation and characteristics

The five co-management centres commenced at different points in time between 2008 and 2010. Each centre had its specific 'spark of origin.' The first one, located in a district which was hugely battered by the tsunami, was created under the infectious enthusiasm of a few MMs who were able to rally the village head and key persons of the other interest groups (PL and fishery officials). The centre functioned to protect a large bay in which the coral eco-system had been destroyed by the tsunami, thereby causing a big loss of fishery livelihoods. A major initiative was undertaken to rejuvenate the corals, to quickly heal the eco-system and bring back the fish. This centre quickly became the 'model' and even attracted the attention of the Governor of the District, who gave full support. The women from the coastal community linked up with the centre to start a flourishing savings and credit scheme, too. The scheme provided funds to their fisher husbands to buy new, selective fishing gear and re-start their livelihoods in the healed eco-system.

A second centre, which was located near the capital city, was the result of the championing of a very respected, elderly PL. He rallied together with the MMs in his lhok along with some officers who visited Malaysia. Together they set out to promote safe, legal and responsible fishing practices, to link up with the tourism industry on the beach (this would protect the coastal zone resources on both land and sea), and to promote safe and responsible domestic tourism that would become a market for the fish caught by the local fishers. Local NGOs and the university also soon pitched in to support this center.

Yet another centre was formed by the initiative of a woman who was Head of the Fishery Department. This was a means of challenging the growing menace of the destructive mini-trawls which had taken root in her district in the post-tsunami phase. She called a meeting of the co-management forum to discuss the issue. The MMs in the district wholeheartedly supported her, and the PL of one village along with his group of fishers took on the challenge of organizing collective action to stop mini-

trawling. The small-scale fishers of the district joined hands, and the political elite of the district was compelled to ban mini-trawling. They offered fishers alternative fishing gear, in exchange for stopping the destructive activity of mini-trawling.

The formation of the other two centres was based on more formal circumstances in which the MMs and the PL took the lead, but with less support from the trained fishery officers.

The Program provided support to all the five centres by providing personnel who would oversee the coordination of activities, help establish organizational systems for the functioning of the new centres, and arrange for exchange visits across the centres. They also helped in documenting some of the actions in written and video formats that were then circulated widely in the Province.

3. CONTRIBUTION OF THE NEW RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

The traditional PL system of management was efficient in guaranteeing a sustainable use of the resource. However, with the death of the traditional leaders due to the tsunami and with the arrival of new and bigger boats through development assistance after the tsunami, the system was disrupted, and overfishing occurred prior to co-management. With co-management, resource exploitation became sustainable again.

3.2 Viability of the fishery

Fishers in Aceh sell their product at a very low price, in some cases at less than 10 percent of the final price of the product once it reaches the final consumer. The middlemen do not disclose the value of the fishery products in the national and international market. The creation of a price information system, implemented during the first years after the tsunami, helped the fishers to achieve a better understanding of the real economic value of their fisheries and better negotiation power with the middlemen and exporters. Unfortunately, the price information system was discontinued once the foreign assistance came to an end.

3.3 Social equality

The initiative of the Program and the resulting participatory creation of the new co-management centres had both social and political fallouts. The most important fallout was that the combination of awareness creation, capacity building and field action is undertaken for key interest groups in the fishery resulted in the formation of new alliances which sought to base their action on the strong customary base of the fishery (PL), but then to gradually bring in elements of a new approach to fisheries management in which the community and the state played equal roles. While this new arrangement did not alter the tenure rights in the coastal fishery, which resembled a form of TURF with regulated open access in each lhok, it significantly altered the governance of this erstwhile customary system. The social implication of the involvement of youth and women of the community in this process was a meaningful step towards empowerment and confidence. This resulted in greater openness to new organizational arrangements, alliances, technology and so forth. The participation of the state helped to demystify its role in natural resource management.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

There were also complications that come with any multi-interest group form of governance, such as the element of power, the overlapping identities, and the conflicting socio-cultural and political interests. Such influences did result in forces of corruption that altered the ‘neat theoretical arrangements’ of co-management. In the case of the five co-management centres, as many as three succumbed to these influences after 2012. The Program was closed in mid-2010. In 2013, an informal

review of the centres was undertaken by the International Collective in Support of Fishworkers (ICSF) as part of the preparatory initiatives for the drafting of the FAO Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines). Representatives from all the five co-management centres initiated at the time of the Program were invited to discuss. The main outcomes of this review are presented in section 4.2 below.

4.2 Improving fishery sustainability in the future

From the ICSF's review in 2013, the following discussion points emerged:

- There was a consensus that the centres provided a fresh set of institutional initiatives within the context of the post-disaster vulnerabilities, as well as the new emerging challenges of the socio-political situation in Aceh after the Province attained autonomy.
- There was agreement that collective action by communities and the state to rejuvenate resources and revive livelihoods gave coastal people confidence and revived hopes for a better and sustainable future. The outcomes from the conservation of coastal resources led to the community believing that protecting and rejuvenating nature was possible by collective efforts with the participation of different interest groups.
- There was an acceptance that collective action to create such endeavours is an important therapy for coastal communities recovering from the trauma of the disaster and/or conflict. These post-event scenarios also provide the possibilities for establishing new relationships between people and the resources of the sea.
- It was accepted that the functioning of the co-management centres was overtly and covertly influenced both by the form of decentralization policies of the central government and the dynamics of the new political processes within Aceh and Indonesia.
- Lastly, there was a consensus that between 2008 and 2012, the centres were 'facilitators' that created the enabling conditions for any member of the community, whether it be youth, women, and men, particularly fishers, to take actions that assisted them in pursuing livelihood options of their choice. Such actions could be individual or collective.

The centres had, in varying degrees, asserted their legal rights over space and resources and ensured that sustainable and responsible fisheries were undertaken. It was evident that their sustainable continuity depends, inter alia, on appropriate moral leadership and some degree of continuity in the state's political and executive arms.

As there was no formal assessment of the material changes that had been achieved because of the centres, it would be inappropriate to make any strong statements about the outcomes and impacts it had made on improving assets, incomes or food and nutrition security. Nevertheless, a consensus was reached on the fact that the sudden termination of the 'facilitation process' (due to the closure of the Program) was an important element in the faltering of some of the centres. Clearly then, exit policies of international assistance programs must envision and provide support for some minimal, follow-up, post-exit activities.

Another interesting issue that can be replicated in other regions and countries of the world is: how then, could these improved practices and user rights be communicated to the younger generations? On this question, several suggestions were on the anvil such as popular drama, song, puppet shows and traditional storytelling. But none of these was adequately appealing to the youth. Finally, the suggestion for a full-scale movie with the favourite Bollywood formula so appreciated in Aceh – comedy, love, and moral lesson – was embraced wholeheartedly.

The famous film comedian group of Aceh, Empang Breuh, agreed in principle to take up the challenge. The script for the film was discussed with academicians who were well-versed with the hukum adat

laot (customary sea law) and one among them with experience in film script writing offered to produce a draft. The focus of the script was to be on the role of the PL in conflict resolution, highlighting the mechanism of the adat court (customary court) in this regard. The idea was to assert the legal authority and autonomy of the PL in keeping with the new recognition given to customary institutions in the context of the post-Helsinki Law on Governance of Aceh and the Qanun on Customary Institutions promulgated by the Aceh Parliament in 2009.

There had to be an assurance that all the concerned participants would be fully committed to this novel means of reviving custom. To ensure this, the film was made fully participatory. An agreement was arrived at with the film's director that he would cast the whole PL team of elders in the film in their real role as adat court members. He was also encouraged to take on as many other people as possible from the youngsters in the coastal community, officers from the Fisheries Department, the Navy and Police after giving them the appropriate screen tests! The end result of this initiative was a great sense of ownership and pride in the film across the whole range of stakeholders in Aceh. The film was a great commercial success. Over 25 000 DVDs were sold in two months of its release. (Post-tsunami there were no movie theatres in Aceh) It was also selected for the International Fisheries Film Festival held in Lorient, France in March 2010. Independent assessments among the viewers in Aceh clearly indicated that it succeeded in its purpose of creating awareness about the customary adat law; the role of the PL as its guardians; the manner of conducting an adat court to resolve conflict; and the important measures to be taken to achieve responsible fisheries in Aceh.

The decision of the Program to go for a non-conventional organizational structure involving multi-interest groups was consciously taken, to test out the collective action possibilities for introducing co-management of a natural resource in a free and autonomous Aceh Province. The above brief review reveals both the prospects and the dilemmas, as well as the incomplete transition. They are some points of consideration for the way forward.

4.3 Two main lessons learned

1) Development assistance dealing with user rights has to be long term, embracing at least a 10-year life cycle, and it should have clearly defined exit policies. These exist policies must envision and provide support for some minimal, follow-up, post-exit activities.

2) Changes in user rights have to be communicated to the public and to the youth, and the use of popular film stars and film scripts is a good way to communicate the philosophy of improved management and sustainability of fisheries resources.

Sustainability of aboriginal fishing communities of the Bermejo River (Salta, Argentina): needs of improving the legal framework and governance conditions to retrieve and secure its ownership of fishing rights

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Abstract
The basin of the Bermejo (Argentina) has several artisanal fisheries where exclusively indigenous ethnic groups operate. For these groups, fishing represents a traditional ancestral practice that ensures food security. However, under current conditions, the management of fisheries does not allow fishers to obtain the necessary social and economic benefits, because the activity is considered only as a palliative - something to reduce the poverty that afflicts indigenous communities, rather than as a way of life that enables these communities to improve gradually their well-being. The regulations consider fishing by the indigenous communities only for subsistence and not as a commercial activity. This misunderstanding strongly limits the fishing quotas, prevents fishers from using motorized boats or more efficient gears, prohibits the sale of fish in legal form, and eliminates the opportunity to add value to the catch. In addition, closure of access roads that cross between farms creates serious impediments to access to fishing sites, preventing the passage of fishers who must travel long distances to get to the river. Given that these fisheries also have firmly centralised and top-down management that precludes the participation of non-State actors, it is critical to incorporate regulations that are oriented towards fisheries ecosystem management, looking at criteria and governance processes aimed at ensuring the legitimate rights of indigenous fishers, preserving tenure rights, and improving livelihoods in these communities.

Keywords: inland fisheries; indigenous population; local; capacity; government

1. INTRODUCTION

1.1 Description of the fishery

The Bermejo River is one of the main tributaries of the Paraguay River, which represents, at the same time, the largest tributary of the Paraná River in the Rio de la Plata basin. Fisheries of the Río Bermejo in the province of Salta occupy a corridor of approximately 150 kilometres (km), which encompasses the cities of Embaración and Morillo (Figure 1).

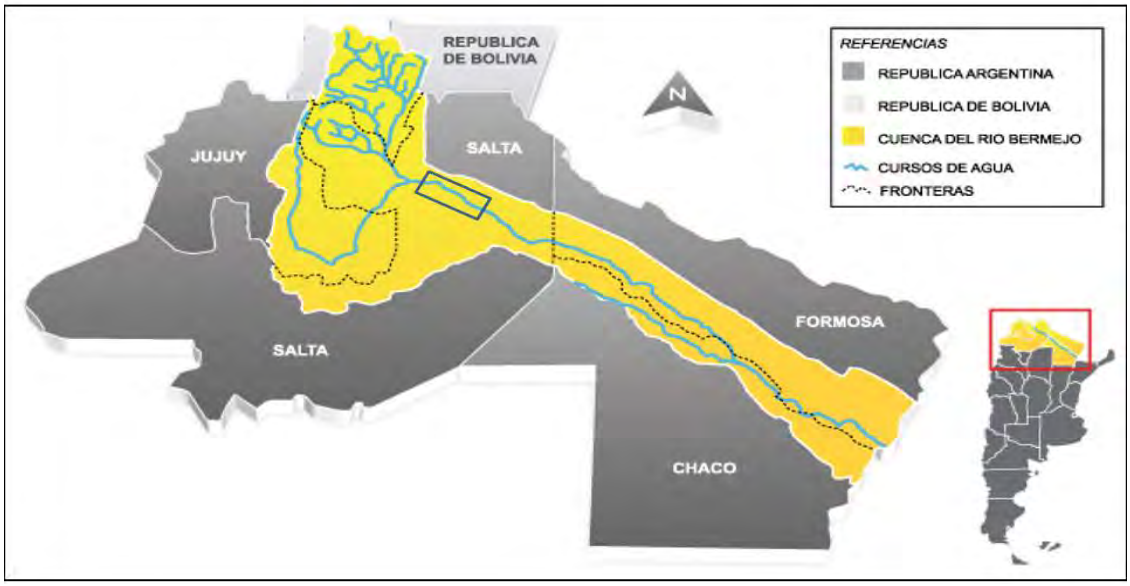

Figure 1. Map of Bermejo River. The black rectangle locates the study site.
Source: Map adapted from Fundación Nuestromar http://www.nuestromar.org/fundacion.

In this section, the river enters a plain forming meanders, side channels and extensive beaches whose configuration changes constantly. This generates numerous arms or secondary channels, too. The study area is inhabited by almost 28 indigenous communities of Wichi, Guarani and Toba ethnicities, of which 50 percent lives in the town of Embarcación and its nearby area, thus at some distance from the River (Figure 2). Four thousand five hundred families live in this corridor, and about 75 percent of indigenous fishers belong to the Wichi ethnic group, while 14 percent are Guarani.[36]

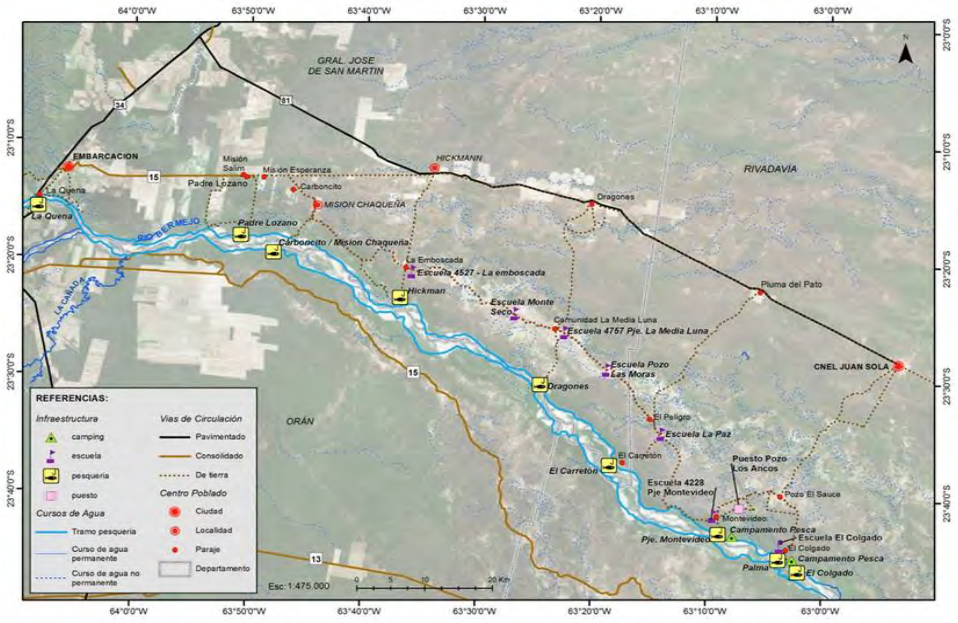

Figure 2. Location of indigenous communities.
Source: Adopted from Serman y Asociados, 2017.

[36] Source: Regidor et al. (2007)

The white catfish (*Pimelodus albicans*) is the preferred species (44%) for the indigenous communities, as it is easy to capture with hooks, and serves as meat without bones. The second preferred fish (28%) is the sábalo or streaked prochilod (*Prochilodus lineatus*), which has a higher market price.

1.2 Economic contribution and social implications of the fishing activity

The indigenous populations of the Chaco region have a subsistence economy associated with fishing, hunting, seasonal agricultural, forestry activity and the manufacture of handicrafts, supplementing income with government subsidies (pensions, family allowances, etc.). In some cases, they get temporary jobs to develop work on farms associated with the harvest of beans, bamboo, etc. for several months in other areas of the province. In the more urban communities, there are community members who are blacksmiths, carpenters, or construction workers. These communities, in particular, those located in rural areas, have a high degree of illiteracy that can vary between 10 and 30 percent, whilst also living in precarious conditions with poor access to essential services.

The indigenous communities engage in fishing between 30 percent and 90 percent of their time, influenced by the possibility of diversifying their livelihoods.[37] In some communities, fishing is practiced with unmotorized wooden boats about 5 - 7 meters (m) long, while in other cases where the community does not have access to boats, fishing is done on foot. The gear used includes harpoons, hooked lines, throw nets and encircling nets, depending on the species and time of year. The encircling nets are used only when there is a boat and are a maximum of 50 m in length and 5 m in height. There is a minimum aperture of 11 centimetres between knots. The fishing trips are made in groups, (usually of 3-4 fishers) and each fisher can make two trips per week. The activity develops throughout the year but is significantly reduced during the floods of the river that take place between January and March. Therefore, fishing takes place mostly in autumn, winter and spring. The duration of the fishing day may be several hours, though in many cases the fishers remain at fishing sites for several days, depending on the distance to their place of origin. Fishing in the river is conducted exclusively by men, whilst women work in the post-harvest.

Even though no studies on the consumption of fish by indigenous communities exist, it's estimated that fish contributes significantly to food security. On the other hand, and despite the fact that fishers do not have legal authorization to market the fish, when fishers do have a surplus of catch it becomes an object of barter; for sports fishers and in urban centres such as Embarcación alongside basic goods and non-perishable food. However, the fish also enters the commercial circuit through intermediaries who, in exchange for transporting fishermen to certain fishing sites, take the fish as part of the payment for these services and then resell it to fishmongers of Orán. Sábalo is mainly sold in the La Quena, alongside the Bermejo River, where there are several fish restaurants for tourists and drivers. The fishers are strongly dependent on these intermediaries due to the prohibition to sell the fish legally on their own. The fish caught and not delivered to sport fishers is gutted in the river without any processing (except some salting), before being taken to the communities of origin of the fishers.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

The management and administration of the provincial fisheries system are centralised and top-down, meaning fishers do not have organized participation in management or any legal mechanisms for conflict resolution. In case conflicts among users of the same resource do emerge, the enforcement authority resolves them unilaterally. The absence of regional delegations in the province limits interaction with fishers. In addition, the collection of statistical information on the fisheries is not done – either directly, or indirectly through dialogue with fishers. Current regulations that stipulate there

[37] Source: Alderman et al. (2007)

to be only two weekly trips per fisher also limit catch to 15 sábalo, ten catfish, three bogue, one dorado, and two surubíes per tour per fisher.

2.2 Brief history of former rights-based approaches used in the fishery

Unlike with sports fishing regulations, legal measures for fishing for indigenous communities depend on resolutions issued by the Secretary of Environment of Salta and may vary according to the criterion of the enforcement authority. These resolutions decide on fishing quotas, minimum sizes, number and size of nets and boats that can be used. Although the indigenous communities are the only ones authorized for non-sports fishing in the territory of the province, their customary rights to go fishing are not recognized. Fishing is only allowed as a means of improving their life conditions and contributing to food security.

2.3 Rights-based approach: allocation and characteristics

Fishers must inscribe themselves into a fishing register and then wait for the corresponding inspection and approval of fishing gear. User rights reflect an ancestral relationship with the river and fishing, with the failure to recognize these rights ignoring the culture of fishing of indigenous people. The government view, of fishing, being a means of subsistence only (and not as a commercial activity of small-scale nature), strongly limits the possibility of improving social and economic conditions for indigenous fishing communities.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

There is no statistical data available on catches by the indigenous communities, but given the current regulation that strongly limits fishing effort, it can be estimated that these fisheries do not exceed 40-50 tonnes per month. Management can be understood as precautionary, given the impossibility of more accurately knowing catches and the unfavourable opinions held by many sectors of society with regard to fishing that is not sports fishing. The scarce equipment of fishers, including the inability to maintain a proper cold chain, prevents any expansion of the fishery.

However, there are estimates that suggest that the Bermejo River can provide higher yields without approaching overfishing. It is clear that the capture of subsistence fishing is comparatively small and does not justify the severe restrictions that impact the lives of the indigenous communities.

3.2 Economic viability of the fishery

In any case, the State does not have the necessary tools and resources to provide concrete support to indigenous fishers, in order to improve economic situations, fishing gear facilities, poaching impact control, and to enable added-value amongst fisheries products, which would improve marketing and reduce the dependence of collectors.

3.3 Social equality

There is a marked social inequality between the indigenous fishers and the sports fishers in the Rio Bermejo. The fact that fishing effort is highly limited and controlled for the indigenous fishers and that they are not allowed to sell their catch puts them into a very unfair position in relation to the transporters and other middlemen, who can easily exploit this situation.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

The main area of recurrent conflicts relates to the restriction of access to the river because of road cuts made by landowners, forcing the fishermen to make a wide detour to get to the river. This also demands that some fishermen must remain on the shore for several days with the consequent

damage and deteriorating quality of the fish by the inability to maintain a proper cold chain. The solution for fishermen is selling fish at a very low price to collectors who carry fish to the neighbouring cities.

The uncontrolled development of sport fishing often generates territorial disputes as sport fishers often interfere with indigenous fishers in the use of the coastal area. There is a marked asymmetry in terms of controls, as subsistence fishing must have the approval to operate but there is no control over the arts and catches of sport fishers. In addition, while sports fishing is authorized to use motorized boats, the subsistence fishers can only un-motorized boats, creating an unjustified inequality. There is also a serious problem of poaching.

In any case, one of the most obvious problems is the lack of regulations and governance aimed at improving the conditions of fishing communities. The provincial government, regardless of the demands or needs of the communities, sets both quotas and arts unilaterally. Legislation requires that the fishers use only rudimentary fishing gear. These criteria initially envisioned to protect the resource from possible overfishing and entry into the fishery of unauthorized external fishers, strongly limit the possibilities of improving the socio-economic situation of the indigenous fishers.

It is detected that subsistence fishing governance processes are poorly developed, compounded by weak cohesion among the different groups of fishers. Although there is an Association of indigenous fishers of the River Bermejo in Embarcación, this does not reach all the indigenous fishers. The lack of common leaders accepted by all communities hinders the Organization‘s function as a counterpart to the enforcement authority.

The weak organization of these communities generates conflicts between its members. This conflict is mainly between the more urban and more rural indigenous communities over the availability of fishing equipment (nets, hooks, boats, freezers). The enforcement authority, on the other hand, exhibits problems of hierarchy that weaken the interaction with other fishery stakeholders and limit the leading role it should have in the management of fisheries in the province of Salta. The absence of regional offices leads to sporadic contacts with the communities, too, particularly those more rural located east of Embarcación.

Beyond these issues, the view that fishing communities should be only oriented toward subsistence fishery becomes a severe impediment to promote policies of social development and improvement in the economic conditions of communities. The State should encourage, for example, the value addition to fisheries products in order to improve the benefits of fishing. The fishing system, on the other hand, appears deficient since most fishers lack the ability to implement or maintain appropriate cold chain or sell fish respecting the necessary sanitary conditions that force them to rely on intermediaries.

On the other hand, the fisheries legislation of Salta, with its top-down approach, does not provide any legal mechanism that encourages participation and consultation with fisheries stakeholders in order to integrate their demands. Centralized management impedes the possibility to have greater interaction with the municipalities of the main fishing areas, so they implement mechanisms for bromatological and fiscal control of fishing, for the monitoring of the fishing activity and mainly to implement measures that promote tenure rights of fishing by indigenous fishers.

The main claims and needs of communities focus on achieving increased fishing quotas, gaining permission to market the fish, regaining free access to fishing sites and controlling poaching. It is required to move towards a broader view on the management of resources - by incorporating the human component and its interaction with the environment and implementing an ecosystem approach to fisheries.

4.2 Improving fishery sustainability in the future

The future of the fisheries for indigenous communities will depend on the degree to which its current governance and management can be modified. The indigenous fishing sector must be recognized as an artisanal fishery, where fishing functions not as a vehicle for self-consumption but also as a generator of income through legal and organized sale.

In this sense, the State should focus on the problem from a wider perspective, understanding not only the strict fisheries aspects but also the social and economic sustainability of the activity. On the other hand, and consistent with these policies, a thorough review and update of the legal framework governing these fisheries are required as a basis to implement measures of management. These policies need to replace the current conventional approach with an ecosystem approach to fisheries. The use of the ecosystem approach to fisheries has notable advantages, encouraging the participation of the fishing actors, optimizing the use of fishery products and reducing the impact of fishing. It will also promote the improvement of governance and equity, strengthening the livelihoods and welfare of fishermen.

Finally – and no less importantly - legal improvements should facilitate governance and facilitate the recognition of tenure rights of fishing as the main axis so that the fishing communities of the Bermejo River can develop sustainably and improve their quality of life.

4.3 Lessons learned

There are several lessons from this experience:

- The declaration of indigenous fisheries as pure subsistence fisheries leaves these fishers in the hand of intermediaries, who take advantage of the fishers.
- Management needs to be ecosystem-based and carried out in a dialogue with all stakeholders.
- Discrimination of indigenous fishers versus sport fishers has to be avoided by the government agencies.
- The inability to sell fish leads to huge post-harvest losses, as no value addition can the fish products can be achieved, including cold storage and the use of ice.
- The traditional rights of fishers to the access of rivers must be guaranteed by law, preventing land-owners from cutting off traditional access roads.

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From individual rights to community commons Cambodia's Community Fisheries Initiative

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Abstract
Defining tenurial boundaries and proving rights in an aquatic milieu is a daunting task. This is further confounded when dealing with a dynamic land-water interface marked by significant seasonal fluctuations. Yet, taking advantage of its overriding tenure over all such terrains, the state reserves the right of granting tenure with differential bundles of rights to individuals or riparian communities to access and manage such fuzzy interfaces. The current fishery rights system in Cambodia is the most extensive and well-developed system of community fisheries in the world. In Cambodia, the tenure rights were initially given to individuals. This system held for many centuries. But, in 2000, a bold initiative in Cambodia in South-East Asia became a trail-blazer when individual rights were replaced with community rights in this regard. The case study very briefly narrates this unique case of top-down creation of community fisheries in an inland fishery in Cambodia. It provides a brief evaluation of the current status and indicates the likely trajectory into the future.

1. INTRODUCTION

1.1 Description of the fishery

Cambodia's vast aquatic milieu is part of the larger Mekong River Basin and its fertile floodplains. At the heart of this area is the Tonle Sap Lake, the largest freshwater lake in South-East Asia and the most productive and bio-diverse freshwater zone in the world. The Tonle Sap River flows out from the Lake and joins the Mekong at Phnom Penh, the capital of Cambodia. During the peak flooding season from June to September, the seasonal monsoon causes the Mekong and its tributaries to spill out of their channels. The flooding is so heavy that the flow of Tonle Sap River is reversed back into the lake, inundating huge areas of forest and grassland across the country. When this happens, the Tonle Sap – now designated a UNESCO Biosphere Reserve – grows from about 2 500 km² to cover over 16 000 km² or roughly 7 percent of Cambodia's land area.

1.2 Economic contribution and social implications of the fishing activity

Tonle Sap teems with fish that nourish Cambodia's population, making them the world's largest consumers of inland fish. Fish is the major source of protein for the country's population, and it provides seasonal employment to over a million individuals directly; many more are indirectly employed.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Brief history of the former rights-based approaches used in the fishery

In 1873, the French Protectorate introduced tenure rights to the most productive parts of the Lake by auctioning licenses to individuals to erect fish enclosures called 'fishing lots' over vast areas of the lake. The Tonle Sap was also mute witness to the genocide of the Pol Pot regime in the 1970s. The populations around the Lake were uprooted and scattered far and wide to realise his dream of making a communist state, based exclusively on a rice-growing proletariat that subsists on state welfare. Many Vietnamese fishers and Khmer farmers who were educated and fishing lot owners were killed for fear that they would rise against the state. Fishing came to a standstill. The vicious regime of Pol Pot was defeated in 1978. Cambodia slowly returned to the democratic mainstream in 1993, but only after over a decade of 'socialist' rule. The fishing lots gradually reappeared, and their auctioning by the state

was revived as it did form sizeable – between USD 2 and 3 million per annum. Fishing lot owners became a rich and privileged group, and many former military men also got involved. They jealously protected the lots from ingress by the large displaced Khmer peasant population who settled around the Lake after Pol Pot. Conflict over access to fish became endemic. Many deaths were reported among riparian communities as a result.

This situation changed drastically in October 2000. Cambodia's Prime Minister made an unexpected announcement cancelling half of all fishing lot licenses of a few hundred powerful individuals. He turned over the rights of access to thousands of poor rural families to harvest the fishery resources for food and livelihood. This action led to important political rewards for the Prime Minister in the 2003 elections. It was a state-sponsored, aquarian reform backed with the highest level of legal protection, with the pronouncement of a Sub-Decree. The Fisheries Administration (FiA) was asked to start a Community Fisheries Development Office to assist the riparian communities set up new community fisheries institutions (CFi for short). Civil society organizations and international development partners were encouraged to help too.

Meanwhile, spurred by the new freedom to access the resources, many communities, sometimes with the help of NGOs, initiated the process of creating new CFi. They submit to the local Fisheries Administration a 'petition of interest' that is signed by interested members and enclose a hand-drawn map of the proposed area of their commons usually composed of a dynamic land-water terrain. The Administration investigates the claim, conducts a needs assessment with the petitioners, arranges for a rough check of the boundaries and then gives a tentative approval or rejection notice in 30 days. If approval is obtained, the Fisheries Administration sets out to disseminate the rights and responsibilities of the interested members, as spelt out in the Sub-Decree.

Noting the small but significant nutritional, economic and social benefits that widely accrued to the communities from his earlier policy pronouncements, the Prime Minister completed his reforms in 2012 by taking over the remaining half of the fishing lots. Some were converted into exclusive conservation zones in the Lake, in his words "to protect the lake's pressured wild fisheries on which tens of thousands of subsistence fishermen rely."

2.2 Management of the fishery

Fisheries management within the designated areas of the CFi in the Tonle Sap is trusted to the Cfi. The Fisheries Administration is responsible for the conservation zones within the Lake. Today (2018), there are over 550 CFi in Cambodia. The majority are around and within the riparian districts of the Tonle Sap Lake. In the country as a whole, the CFi area covers over 850 000 hectares spread across 19 of the 25 provinces of the country. There are 188 000 members of which more than 61 000 are women. Not all the CFi in Cambodia function as 'lively commons.' About a fifth of them remains 'empty shells,' for lack of leadership and timely support from civil society and development partners. The framework for a modern commons and the rich collaboration of thousands of commoners in the last 18 years has already created a huge corpus of social capital that can be tapped into with good facilitation and support.

2.3 Rights-based approach: allocation and characteristics

To obtain formal recognition of their CFi from the Ministry of Agriculture, Forest and Fisheries, the CFi must firstly form a general assembly. This assembly initiates a democratic process to decide on a name for their CFi, to frame there objectives, internal rules and regulations, and also to elect a managing CFi Committee from among the members. A list of name of all members and the Committee is then prepared. To produce an accredited map, the CFi area is physically mapped together with the Administration and neighbouring communities, to hedge against potential future boundary disputes. The local administration, competent NGOs and technical agencies often help with financial support and mapping skills. Additionoally, the use of orthophoto mapping technology – with assistance from

international development agencies – has been widely reported. Large cement boundary markers are placed at points which are perennially underwater.

Having attained formal recognition with the Ministry, a CFi has the exclusive use and management rights to the fishery domain within their mapped jurisdiction, for an officially recognized period of 3 years; this period is renewable. Fishing in the CFi is strictly meant for subsistence, and only very small-scale nets and traps (designated as 'family-scale' fishing gear) are legally permitted. Consequently, the risk of overfishing is minimal in this salubrious and highly productive eco-system.

Each CFi is required to prepare their own management plan to chart out how they will utilise and conserve their common domain and its resources. This plan includes a careful inventory of the different eco-systems in the area. It also lists the fish species diversity and seasonal patterns, the total fishing assets available with the members, and provides a rough assessment of the sustainable resource yields that can be harvested. All the commoners of the CFi are duty-bound to protect their commons from harm. Formal patrolling groups composed of members are active in all CFi.

3. CONTRIBUTION OF THE NEW RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

There have also been tangible improvements in the local ecosystem through the collective efforts of the CFi members to protect the flooded forests, plant mangroves, stop destructive fishing and pursue other conservation measures. The structured role of women in the CFi committees provided new avenues to bring in gradually more gender equality in the communities, too. Now some of the best functioning CFi are marked by a higher level of participation amongst women.

3.2 Economic viability of the fishery

An assessment made in 2012, of the 450 CFi established by then, demonstrated that the aquarian reforms resulted in a much wider spreading of the benefits gained from the huge teeming fishery resources of the Lake -- and also the other riverine and marine areas brought under the CFi regime.

Leading the list of benefits was the greater quantities of fish consumed by the rural population, in particular children. Secondly, the use of the small cash incomes from the sale of fish contributed to a range of family expenditures, including children's schoolbooks, minor health costs, small home repairs and rice in the lean season. For the rural communities, such as small but crucial expenses may carry significant differences in their lives. Knowing that all this comes from resources over which they have collective control is a great source of empowerment for the communities. This is an important factor that motivates them to conserve, regulate, allocate and rejuvenate their fishing areas and related eco-systems (flood plains, flooded forests, mangrove areas, etc.).

3.3 Social equality

The governance of their CFi has thrown up new leaders, reinforced the merits of collective action and made a significant dent in the 'trust deficit' that prevailed due to periods of conflict and war. Earlier, the benefits from the fishery were taken by a few hundred individuals. Today, they are widely distributed across many hundreds of thousands in the rural Cambodian hinterlands where poverty was very high.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

There are many challenges to overcome. These include the important bane of illegal fishing and the conflicts that arise from it. There are dispute settlement procedures and graded sanctions in place, but the will of the community often pales before the might of the powerful.

Another issue of concern is the 'restrictive' definition of the organization as a 'fishery' institution when the clear majority of the community only fish for consumption but depend on agriculture and other service sector activities for their main livelihood.

In the current reality, there are already threats to the eco-system, changes in food habits and new competing elements entering the cultural realm. The majority of these threats relate to the assault on the eco-system: the conversion of flood plains to agriculture; the damage to the flooded forests; the destruction of mangrove swamps and mudflats; the reduction of river flow due to erection of barriers and construction of dams; the use of illegal fishing gear, and destructive fishing methods. Much of this assault on nature is undertaken with the patronage of powerful economic interests, often with political backing.

4.2 Improving fishery sustainability in the future

Fish is an integral part of Cambodia's aquatic eco-system, an indispensable component of its people's food intake and an essential part of Khmer cultural identity. As long as this remains true, there will be a role for Community Fisheries in Cambodia where community-based collective action to sustain and manage aquatic eco-systems is the basis for equitable benefits to individual members. If Community Fisheries are to survive, though, they will have to take more affirmative collective action to guard their domain and the resources within it.

Community Fisheries were created in 2000 in a particular socio-political context. Both the riparian communities and those at the helm of political affairs who heralded the reforms into existence reaped the rewards from the reforms that created Community Fisheries. As long as this convergence of interests continues, Community Fisheries in Cambodia have a future.

However, empowering Community Fisheries to become vibrant democratic people's organizations, living up to the narrative of the SSF Guidelines and guaranteeing a bright future for the aquatic eco-systems, fishery resources and members of riparian communities will depend on many factors. Importantly, these include:

- A genuine commitment to democracy and concern for the livelihoods of the rural poor on the part of the political establishment;
- A strong belief in the viability of Community Fisheries on the part of the Fisheries Administration;
- Coordinated support of civil society organizations to promote self-reliance of the Community Fisheries; and
- An emergence of more committed leaders and enthusiastic young membership within the Community Fisheries.

The direction of events in Cambodia in the immediate future will reveal which way the dice are loaded for Community Fisheries and the riparian communities.

4.3 Lessons Learnt

One of the most important lessons from this case study is that political will, backed by supportive legislation and bottom-up community participation, is the bedrock for radical transitions of tenure from individual rights to community rights. Democratic participation and the role of women are important ingredients for sustaining community rights. The support of civil society is another element.

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Volume 2

History and experiences with open access fisheries

Abstract

The Global Conference on Tenure and User Rights in Fisheries 2018 took place in Yeosu, the Republic of Korea, 10-14 September 2018. Case studies were presented on a number of topics relating to tenure and user rights in global fisheries and their relation to the SDGs. Through the exploration of case studies in eight concurrent thematic sessions, the best practices, shortcomings, and challenges associated with rights-based approaches were discussed. The conference was a platform for the exchange of ideas about how to support the implementation of sustainable governance solutions to rights-based fisheries management.

This document presents case studies from Session 2 of the UserRights 2018 conference, "History and experiences with open access fisheries." All case studies are published as submitted, with minor changes for spelling and grammar. The case studies span across various geographical and socio-economic contexts. These include:

- recognition of tenure rights in Senegal;
- securing artisanal fishing rights in Guatemala;
- implementation of TURFs via MPAs in Sierra Leone;
- understanding community-based or co-management arrangements through estuarine resource use in Ghana;
- challenges associated with open access fishing in Lake Tanganyika (Burundi and Tanzania)
- developing a co-management system in Kenya;
- empowering artisanal fisheries in Equatorial Guinea;
- policy alignment to the Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa (PFRS), in Cote d'Ivoire and Senegal;
- institutional rearranging to benefit artisanal fisheries on the Kenyan coast; and
- multiple access regimes are governing the exclusive economic zones (EEZs) of Timor-Leste.

Contents

Recognition of the tenure rights for ensuring the sustainability of artisanal fisheries in Senegal in the context of food security and the eradication of poverty

Papa Gora Ndiaye

Please refer to the presentation of this case study available at:
http://www.fao.org/3/CA2335FR/ca2335fr.pdf

Artisanal fishing tenure rights in Sipacate, Escuintla, Guatemala

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Abstract
The marine artisanal fisheries of Sipacate, a coastal community in the department of Escuintla, Guatemala (13° 56'00 "N 91 ° 09'00" W), contain approximately 150 craft boats and 300 fishermen. Here, around 5 000 people benefit from small-scale fishing. Artisanal fishermen come into conflict with industrial and sport-fishing sectors since the sectors' different fishing areas are not delimited throughout the Pacific of Guatemala. Guatemala lacks a fisheries management plan that emphasizes production control, individual catch quotas and division by fishing sector. The total production of the fishing resource of the Sipacate artisanal sector is unknown and undocumented. Illegal fishing is neither declared nor regulated in the Pacific of Guatemala and aquaculture operations are inefficient. The labour exploitation of fishing communities continues to be important obstacles to achieving sustainability in fisheries and aquaculture. With these aspects mentioned, the coastal communities in Guatemala need to carry out fisheries management and governance. There is evidence that unregulated fisheries and the absence of a fishery management plan promote the depletion of resources. This study will set a precedent for governance and fisheries management, especially in the target species and short-term operational management processes, up to the elaboration and planning of long-term fisheries policies. This will contribute to the development of small-scale fisheries and aquaculture, and further improve the food security and nutrition of the coastal communities of the Pacific region of Guatemala.

1. INTRODUCTION

1.1 Description of the fishery

Sipacate is a municipality of the department of Escuintla in the Republic of Guatemala, with 43 kilometres (km) of coastline (13 ° 56'00 "N 91 ° 09'00" W). Five years ago, this fishery was characterized by having around 400 vessels; currently, there are around 200 vessels and 400 fishermen. Fishermen believe this decline is related to the reduction of fishery resources since many of them can no longer survive with the activity and must dedicate themselves to other livelihoods. Around 3 000 people depend on fishery resources in this area (OSPESCA, 2012; INFOPESCA, 2018).

The fishing area is in the coastal zone between three and five nautical miles (nm) from the coastline. The target species are Croaker (*Micropogonias sp*), Snapper (*Lutjanus guttatus*), Yellowfin snook (*Centropomus robalito*), Sea catfish, Dolphinfish (*Coryphaena hippurus*) and Shark (*Carcharhinus falciformis*). These species are fully exploited (INFOPESCA, 2018; Ixquiac, 2014; OSPESCA, 2012). Fishermen (ship owners, crew and skippers) who participate in this fishery are from the same country, but there are different fishing communities, ports and landing points. There are approximately four fishing communities/ports and landing points located less than 20 km from the fishing zone.

Fishermen who travel from different parts of the country have regular access to this fishery. Those who currently have the legally recognized right in this fishery are owners of vessels, family members of fishermen, and fishermen's organizations. The fishing gear often used in this fishery are: throw nets (esparaveles-Atarraya), gillnets, trammel nets and longlines. No equipment is used while placing fishing gear. There are 150 vessels, with an outboard engine of ≤150 horsepower and the average length of 12-20 meters (m), weighing 10-50 gigatonnes (GT). Ice containers are used on deck for fish storage. The crew is composed of three people, including one motorist. Fish aggregation devices are

not used for this fishery, and the owners of the vessels are individual(s) not involved in the fishing activity of the local community. The owner of the fishing gear is the owner of the boat. Women have the right to own boats and fishing gear. The distance travelled by the boats to access the fishing area is between 10 and 20 kilometres. Fishing trips last, on average, for one to four days.

Conflicts arise between the different interest groups that participate in this fishery. There a number of factors driving this, among which the allocation of fishing rights, differences between fishery managers and participating fishermen, and competition between fishing community and migrating fishermen are important. Conflict persists between different groups too: the small-scale sector and the national industrial level clash, as to fishing communities and sports fishers, while there is competition between different fishing gears for target species. These conflicts appear because the area allowed for the different sectors, respectively is not clarified through regulations.

Additionally, the fishery runs without a management plan. The volumes of fish production are unknown since there is no record of landings, creating a lack of product traceability. The agriculture sector is also in conflict. The fishing community confronts the sugarcane production farms as they pollute the estuary, filtering pesticides and agrochemicals and pouring them into tributaries, whilst putting the hydrobiological resources under risk. The burning of sugarcane causes atmospheric pollution, and the concentration of smoke and soot increases up to 6 times. Dangerous phenomena have affected the fishery since the implementation of tenure rights. These include floods, storms, hurricanes and pollution from agricultural activities and they have caused severe damage on the fishery, affecting vessels, fishing gear, and community infrastructure (houses, schools, stores and fish landing centres).

Figure 1. Fishing area map Sipacate, Escuintla-Guatemala, coordinates 13 ° 56 '0 "N, 91 ° 9' 0" W.
Source: Google Maps.

Figure 2. Fishing area map Sipacate, Escuintla-Guatemala, coordinates 13 ° 56 '0 "N, 91 ° 9' 0" W.
Source: United Nations Geospatial Information Section, 2019. Available at https://www.un.org/Depts/Cartographic/english/htmain.htm.

1.2 Economic contribution and social implications of the fishing activity

There are two different sectors in Sipacate to carry out fishing activities: marine (open sea - Pacific Ocean) and continental (Canal de Chiquimulilla). Both activities are mainly for commercial purposes, although officially most of the fishermen carry out subsistence fishing as an inland activity. These two fisheries involve around 5 000 people in secondary, fishing-related roles (restaurants, hotels, fish market stalls, ice factories and stores). The annual fish production estimated for Sipacate is around 11 846 tonnes/year (marine sector) and 574 tonnes/year (continental sector), totalling 12 420 tonnes/year.[38] There are approximately 300-400 marine fishermen and 100-200 continental fishermen on the site, operating an estimated 200 marine and 100-150 continental vessels respectively.

Catch for human consumption is sold through distribution channels – 70 percent to the sales centre, 20 percent to the intermediary and ten percent to local consumption. The sales centres sell 50 percent to the main market of the capital of Guatemala (Mercado La Terminal), 30 percent to the intermediary, 10 percent to the restaurant, and 10 percent to the consumer; the percentage of the catch going to non-human consumption (fishmeal, fertilizer for the agricultural industry) is 10 percent. The approximate percentage of fisherwomen participating in this fishery is 10 percent. Fishermen dedicate full time to this fishery throughout the year (at least 90% of their working time to fish). Alternative

[38] This is according to data provided by the fishing leaders.

livelihoods possible for fishermen are agriculture, livestock, construction works, street trade, saltpans, boat and fishing gear repair, and production.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

This fishery has the particularity that artisanal, industrial fishing and fishermen from other parts of the country have access to the same fishing resource due to the lack of regulations for each sector. In all Guatemalan territory, those who have the right to fish for commercial purposes must have a fisherman's license and registration of the vessel approved by the competent authorities.

2.1 Management of the fishery

The people of Guatemala have jurisdiction over this fishery in Sipacate, as the management of continental, coastal or waters within the exclusive economic zone falls on a single nation. The central government is responsible for the management of the fishing resource. The fisheries management system established for this fishery is government management (information management, non-participatory and top-down).

The institutions that elaborate the regulations governing fisheries management are The Directorate of Fisheries and Aquaculture (DIPESCA) of the Ministry of Agriculture, Livestock and Food (MAGA), the fishermen's association and non-governmental organizations (NGOs). Government authorities and fishermen organizations can provide their opinion and advice in the process of developing fishery regulations.

Management measures used in the fishery include regulation of the permitted characteristics of fishing gear (i.e. mesh size) and regulation of the characteristics of fishing vessels. There are no fishing areas with well-defined limits. DIPESCA and other government entities are responsible for monitoring and enforcing the regulations. Control and surveillance systems monitor the fishing activity both before the fishing activity (permits and fishing licenses) and during (patrol boats), although there is no control during the landing or post-landing. Failure to comply with regulations can result in economic sanctions and confiscation of fishing gear, although these measures are rarely applied.

Lastly, there are mechanisms for conflict resolution in the fishery through the legal system (courts of justice, other legal authorities) and government authority in fisheries management (DIPESCA). Again, these measurements are rarely effective.

2.2 Brief history of former rights-based approaches used in the fishery

Before the allocation of rights, there was no determined mesh size, fishing occurred with manual trawl gear, and boat sizes exceeded 20 m in length. There was also permission to fish with wooden boats in the open sea, whilst vessels were not required to carry safety equipment such as navigation lights, lifejackets or flares. Additionally, there were no determined target species.

2.3 Rights-based approach: allocation and characteristics

The fishery has legally recognized fishing rights that were born in 1975. Individual fishing licenses and territorial rights in fisheries were implemented in 2002, with DIPESCA being the current competent authority that regulates fishing activity in Guatemala.

Initially, the legally recognized fishing rights for this fishery were assigned to private fishermen, fishing boats, owners of fishing vessels, members of a fishing family, and members of fishermen's organizations (cooperatives). These rights were assigned based on historical fishing data and uniform allocation of rights to fishermen who had participated in the fishery. For the initial allocation of rights, the need to ensure basic subsistence rights among poor/vulnerable communities – as well as in indigenous communities and fishermen – was strongly considered.

Fishing rights were assigned in such a way that a species can be caught with specific gear. In general, once the fishing rights have been assigned, the validity time in this fishery is one year. Those who have the right to fish cannot sell or lease legally recognized fishing rights. The ones currently allowed to own the right to fish are private fishermen, fishing boats, boat owners, fishermen from other communities, fishermen's organizations (i.e. cooperatives), national and foreign private companies. There are no specific restrictions about who can own, receive or acquire fishing rights at the tenure level for women, fishermen of non-indigenous origin, ethnic groups, etc.

There are no limitations regarding the number of fishing rights that a person, company, community or foreign company can possess at one time. The rate of non-compliance with current regulations has increased since the rights-based approach was implemented, such as illegal fishing by unauthorized organizations and use of unauthorized fishing gear.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

This fishery is characterized by the interactions and conflicts between the small-scale artisanal fishery, large-scale industrial fishery sectors and the recreational fishery. Each type of fishery uses different fishing gear in the same area, sharing the same fishery resource. Particularly, the industrial sector uses trawler for the target species (shrimp) and is not selective. For this reason, artisanal fishers change the mesh from 5 meters to 15 meters in the water column and decrease the mesh size from 2.5 inches (6.35 centimetres) to 1 inch (2.54 cm). This measure affects the fishing stock, increases by-catch, and biological impacts the target species since it interrupts their reproduction and survival of juveniles.

This year (2018), non-governmental organizations (NGOs), the artisanal fishermen's association, the fishing community and government authorities started an initiative to design and implement selective fishing gear that is environment-friendly and economically favourable to the fishing community. Some changes in the size of the most important species captured were noted since the implementation of tenure rights. For example, Snapper, Robalo and Dorado have increased in size. No stock evaluations have bene carried out in this fishery for the last 18 years.

3.2 Economic viability of the fishery

This fishery is experiencing an economically unfavourable situation since distances in an average fishing trip in order to catch the target species have increased. There are higher expenses on fuel and inputs, too. Several changes in gear were established since the rights-based approach was implemented, with trammel, longline, and throwing nets. Fishing boats without engines have not suffered changes, but boats with outboard engines/equal to 150 HP have decreased in quantity.

No changes are noted regarding the fishing fleet characteristics since the implementation of rights. However, fishing vessels owned and operated by a remunerated crew have decreased, boats owned by individuals and leased to fishermen have increased, and boats owned by companies have increased. Aggregating devices are not used in this fishery. Fishermen believe the decline in fishermen (from 800 present five years ago, to 400 currently) is related to the reduction of the fishery resources since many of them can no longer survive fishing and had to participate in other activities (agriculture, salt pans, masonry and street trade).

3.3 Social equality

In this fishery, changes in fishing rights owned by individuals have increased. Fishing rights owned by fishing vessels have also increased, and fishing rights owned by companies declined, as well as fishing rights owned by foreign entities. The initial allocation of legally recognized fishing rights aims to ensure

basic subsistence rights of poor and vulnerable communities and focus on the economic viability of fishing activity.

Guatemala is a predominantly chauvinistic country with gender inequality in artisanal fishing. Women are very marginalized in this fishing activity. The allocation of fishing rights has helped to promote social equality and human rights, including the right to food security. The allocation of fishery resources has not respected the rights of indigenous communities, and new generations of fishermen are not ensured access to the resource. Conflicts in different fisheries have increased due to the lack of control and presence of government authorities.

The current rights-based system has helped to aid certain fishermen, but not to the entire fishing community. For example, if natural phenomena occur such as hurricanes, floods and tropical storms, it is possible to identify those who have an individual fishing right to receive aid (health, money transfer, replacement of equipment and infrastructure).

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

There are ways to navigate the challenges facing this fishery:

- **Limit areas for each fishing sector** (artisanal fishing, industrial fishing, recreational fishing). This action will avoid the conflict that artisanal fishermen have with industrial fisheries and recreational fisheries. As mentioned before, they share the same fishing area and target species.
- **Prevent free-access fishery**. This means that the artisanal fishermen with their registered boat are only allowed to fish in the place of origin and not in the whole national territory. That would avoid the conflict with vessels from other territories and neighbouring countries which catch in this fishery.
- **Encourage the creation of a cooperative.** Reactivate the association of artisanal fishermen in Sipacate (APASI). Reactivate the landing centre and include women in trade and processing of fishery products. These actions would strengthen the organization of the fishing community and provide a physical place. Seafood would keep good quality, be marketed at a favourable price and add value when processed. In addition, product diversification could be possible.
- **Have government authorities (DIPESCA and MARINA) present to control fishing gear and landings**. This action would contribute to combat illegal fishing, improve traceability and provide reliable data on production and type of fishery product.

4.2 Improving fishery sustainability in the future

The private, academic, government and community sectors should also be included in the dialogue tables to encourage the management of this fishery, in order to make the necessary changes and to achieve long-term sustainability of the fishery, adequate management of fishery resources, economic viability and social equity.

4.3 Lessons learned

Without close monitoring and control by the competent authorities, a rights-based system does not work.

Conflicts between different users of the same resource (small-scale fishers, industrial fisheries, recreational fisheries) need to be solved by clearly defining exclusive fishing zones for each category.

Territorial rights are key to sustainable development in the fishery; open access to the resource for all nationals and even foreign fishing boats overexploits the resource.

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On the Development of Territorial Use Rights in the Marine Small-Scale Fisheries of Sierra Leone

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Abstract
Sierra Leone would score highly on sensitivity to food fish insecurity scale, given the proportion (63.1%) of the population dependent on food fish as the main source of animal protein. Small-scale fisheries which could contribute up to 90 percent of the annual national catch are particularly well-placed for fish food security. However, there are existential threats that engender willingness in stakeholders to create a resource sustainability environment: overcapitalisation is facilitated by a *de facto* open access regime, illegal, destructive fishing takes place on sensitive grounds, and there are incursions by industrial fishing vessels into the Inshore Exclusion Zone (IEZ). With support from donor projects, Territorial Use Rights in Fisheries (TURFs) are being instituted via Marine Protected Areas (MPAs) for efficient resource allocation. We have chronicled the unique process of the progression towards TURFs via MPAs using scientific and local community knowledge within a co-management framework. The analysis revealed opportunities, challenges and lessons learned for other small-scale fisheries that seek to institute rights-based fisheries management.

Keywords: Small-Scale Fisheries, Marine Protected Areas, Territorial Use Rights in Fisheries, Co-management

1. INTRODUCTION

1.1 Description of the Small-Scale Fisheries of Sierra Leone

There is always the temptation to offer a definition of small-scale fisheries whenever one engages in discussions on the subsector. However, this is a temptation that should be resisted because, as Baio (2010) had insisted, there is no agreement on the characterisation of the term "small-scale or artisanal fisheries" as interchangeably used in Sierra Leone. The subsistence or locality arguments no-longer hold as catches are sold or even exported. Besides, such fisheries have differential locations and contexts; a singular definition accommodating all these variations is difficult to arrive at. The comparison to industrial fisheries with respect to the amount of capital, energy and size of vessel depiction may be too generic to fit specific situations. The small-scale fisheries of Sierra Leone have also been characterised in the language of exploitation. For example, the Fisheries and Aquaculture Bill (MFMR, 2016) explains that small-scale fisheries exploit the Inshore Exclusion Zone ("IEZ"), which consists of all waters seaward of the low-water line along the coast of Sierra Leone, to the line connecting the coordinates of latitude and longitude (Figure 1) – it covers a distance of 5-6 nautical miles (nm). This area is reserved for small-scale fishing vessels and recreational fishing, excluding semi-industrial and industrial fisheries operators. The suggestion is that the exclusive demarcation could also serve as another definition of small-scale fisheries in Sierra Leone with respect to an area of fishing operations. That is, all fishing units legally operating in the IEZ. Again, such a definition is limited because while the IEZ is reserved for the small-scale fisheries, that does not legally preclude them from fishing in waters beyond the IEZ. In fact, small-fishers operate in waters ranging from coastal areas less than 3nm, to offshore areas within national jurisdiction greater than 12 nm. The multiplicity of contradictory definitions gives credence to the notion that definitions of small-scale fisheries lack harmony. Consequently, we limit our definition as done elsewhere (e.g. Baio, 2010), to the operation

of the fishing units and gears (Table 1) designated as small-scale fisheries in Sierra Leone, gleaned from the 2009 frame survey (IMBO/MFMR, 2009).

Table 1. Distribution of Crafts and Gears in the Small-Scale Fisheries of Sierra Leone.

Diversity of Fishing Crafts in the Small-Scale Fisheries of Sierra Leone				
Craft Category	**Dimension (m) – L x B x D**	**Number**	**Crew Number**	**Mode of Construction/Propulsion**
Ghana Boat	21x2x1	219	> 10<30	Planked/Powered
Standard 5-10	18x2x1	705	5-10	Planked/Powered
Standard 3-5	13x1.5x1	1553	3-5	Planked/Powered/Sail / Paddle
Standard 1-3	7.9x0.85x0.62/6.5x0.45 x0.3	5673	1-3	Planked or Dug-Out/Sail/Paddle
Kru Canoe	5-6x0.6x0.08	1360	1	Dug-Out/Paddle
Total		**9,514**		

Diversity of Fishing Nets in the Small-Scale Fisheries of Sierra Leone	
Net Type	**Number**
Beach Seine	166
Ring net	1183
Bottom Driftnet	788
Surface Driftnet	3062
Bottom Set net	2555
Surface Set net	323
Cast net	689
Hand-line	2989
Long Line	1846
Others (Pots, Traps etc.)	544
Total	**14,145**

Source: IMBO/MFMR, 2009.

The small-scale fisheries of Sierra Leone exploit diverse ecosystems such as - coastal near shore, estuaries, intertidal zones, mangroves and the open sea. The exploit species such as *Sardinella species* (Herring), *Ethmalosa fimbriata* (Bonga Shad), *Decapturus rhonsus* (False Scad (Pollock)), *Chloroscombrus Chrysursus* (Atlantic Bumper (Kente)), *Pseudotolithus elongatus* (Bobo Croaker (Gwangwa)), *Galoides decadactylus* (Lesser African Threadfin (Shinenose)). As Baio and Sei (2017) indicated, these species are, in the above order, fully exploited, overexploited, underexploited, underexploited, fully exploited and fully exploited respectively. The small-scale fisheries of Sierra Leone accommodate fishers from multiple countries, especially Ghana and Senegal, in addition to local fisheries. The 2009 frame survey (IMBO/MFMR, 2009) indicates that 37 053 individual fishers land their catch at about 641 landing sites, by communities dotted along the coast within 20 km of fishing ground. Some 29 081 fishers are full-time operators, whereas 5,783 are part-time and there are 954 migrant fishers, along with 1 235 local migrant fishers. Even though women do not engage in the fishing operations involving the physical extraction of fish, they dominate in the post-harvest; 85.5 percent (1 300) of this segment of the value chain (cf. Thorpe *et al.*, 2014) are women. There is evidence that only 4.3 percent (361) of boat owners are women (IMBO/MFMR, 2009).

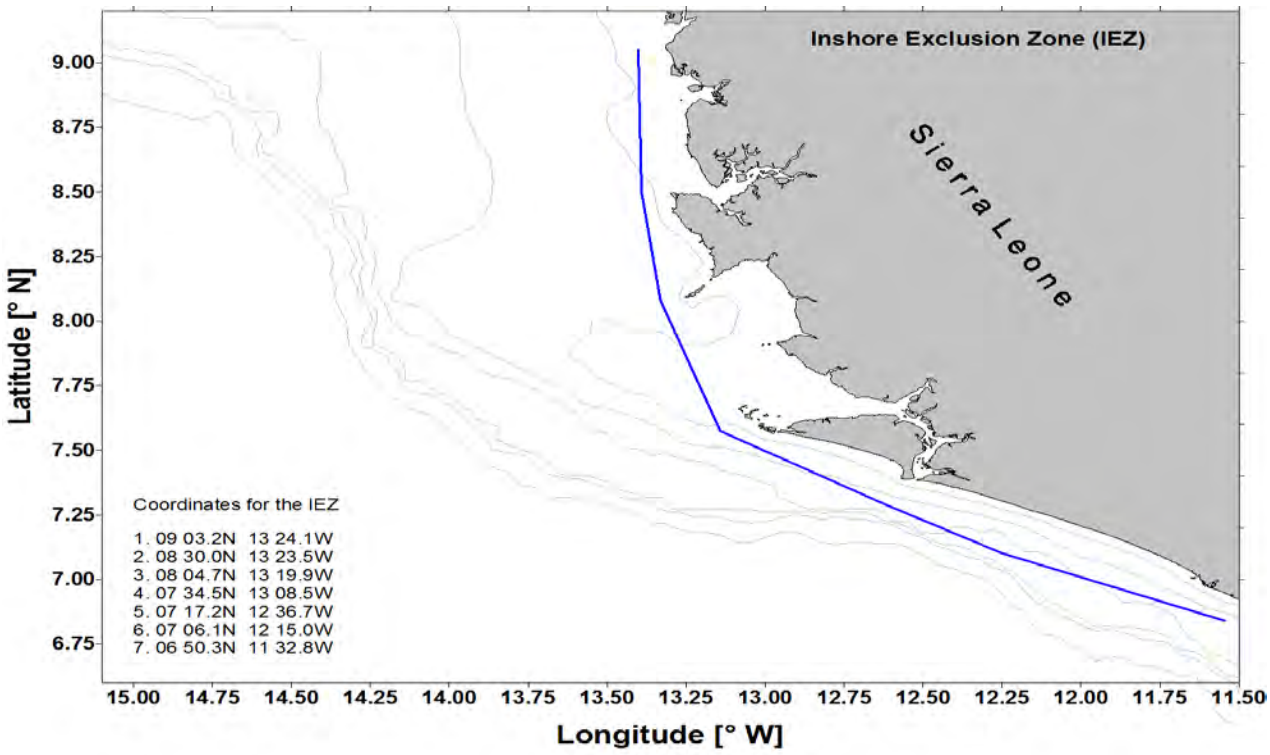

Figure 1. Inshore Exclusion Zone (IEZ) of Sierra Leone.
Source: MFMR, Fisheries and Aquaculture Bill, 2017.

Individual fishers or the fishing vessel owners may legally hold fishing rights. However, a wide range of actors (such as family members of fishers, women, communities, fisher organisations, national private organisation, processors/buys and even distant water vessels) may have access to fishing rights by teaming up with established fishers or vessel owners. Such access is influenced by ownership of fishing vessel and or fishing gears. This is the case because individual fishers do operate crafts and gears (outlined in Table 1) owned by a second party amongst the aforementioned actors. For example, the effective policing of the IEZ has seen foreign industrial fishing companies entering into joint ventures with small-scale fishers, to target species such as the Bobo Croaker (cf. Baio, 2016). In such arrangements, the companies support fishers; craft and gears are available in return for catch acquired at a reduced price. Although the averaged distance travelled to the fishing ground is between 100 m to 10 km lasting between 6-24 hrs, it is not unusual for fishers to traverse the coast in excess of 20 km on fishing trips, in order to access fishing grounds and stay for a duration in excess of one day. Light is used to attract fish as a fish aggregation mechanism.

Various conflicts occur in the small-scale fisheries of Sierra Leone. There is disagreement with management authorities, as well as the conflict between communities over resources, local communities and seasonal migrant fishers, local small-scale fisheries and national industrial fisheries, and national industrial fisheries versus illegal foreign industrial fleets. These conflicts usually involve two key externalities (e.g. Seijo et al., 1998). Firstly, technological externalities ensue when different technologies interact, and a party come out worse-off. For example, industrial fishery operators illegally fish in the IEZ and destroy gears of small-scale fishers. This breeds conflicts between local small-scale fisheries and industrial fisheries. Secondly, crowding externalities occur when many vessels converge on a fishing ground due to overcapitalisation or competition for desired species.

The conflict resolution mechanisms that are used include legal systems/the court of justice, government management authorities, and customary systems such as tribal councils. These

resolutions have been found to be moderately effective (cf. Thorpe et al., 2009; Baio, 2009) which could be addressed by effective management (e.g. Khan and Sei, 2015; Neiland et al., 2016).

Potential non-fisheries related conflicts include the following: mining, oil and natural gas exploitation; pollution from agriculture; spatial competition from tourism; coastal infrastructural development. Coastal erosion, domestic solid waste (from plastics and household material) and agriculture pollution are serious threats to the environmental sustainability of the small-scale fisheries ecosystems. Coastal erosion forces communities to leave, and agriculture pollution leads to stock mortality. The rights holders suffering from such impacts can be reached, in case of an emergency.

1.2 Economic contribution and social implications of the fishing activity

Although small-scale fisheries could account for up to 90 percent of the annual national catch (e.g. Baio, 2009), this has not been captured in the national accounts (because transactions are informal, taking place at isolated locations). Notwithstanding the failure to adequately account for the contribution of small-scale fisheries (SSFs), further indication of the subsector's contribution to economic development can be garnered from its importance in food security, income (source of both local and foreign revenue) and employment, and its direct or indirect relationship with the Sustainable Development Goals (SDGs).

As 52.9 percent of the population fall below the nationally established poverty line (UNDP, 2016) the food of fish has always been important in Sierra Leone. Some 63.1 percent of the population depends on fish for animal dietary protein (Thorpe, 2005). This renders the sector highly sensitive to the impact of external factors such as climate change (e.g. Allison et al., 2009). Food fish catch is disposed of in a number of ways, including consumption at the household level, in exchange for other goods and services, or sale - directly on the beach at the prevailing price, or at a domestic fish market. Smoked small-scale food fish catch is increasingly exported to African communities in Europe and North America; an important dimension of international fish trade worth further investigation.

As mentioned earlier, former industrial fishing operators have now been reconstituted into the processing outfit, which obtains their supply from small-scale fisheries to provide another marketing outlet. The products might then be consumed fresh (directly and with minimal processing), chilled for local/factory processing, cured, smoked, salted, or frozen for local/factory processing. Although market information is rare on catch destined for non-human consumption such as fishmeal, minimal proportions (1-25%) may be used for such purposes.

Most workers are employed in relatively low productivity jobs in agricultural self-employment (59.2%) and non-farm self-employment (31.3%) (cf. Statistics Sierra Leone et al., 2015). Small-scale fisheries as an employer of last resort (due to the safety-net role afforded by the open-access regime) are significant as a self-employer. The 2009 frame survey indicated that there are 37 053 fishers engaged in the extraction process in small-scale fisheries, estimating that fisheries employ about three percent of the total population of ten percent of the economically active population (Neiland et al., 2016). Of these portions for fisheries, industrial fisheries contribute about a tenth.

Small-scale fisheries employment of nine percent of the economically active population could be increased through the introduction of value-added facilities and other employment generating activities in the fish value chain. The majority of the full-time fishers (83.4%, 29 081) depend on fisheries for income for 90 percent of the time (IMBO/MFMR, 2009) only resorting to sand mining, mangrove woodcutting or use of a boat in travel/tourism during the lean period.

One of the challenges in the small-scale fisheries of Sierra Leone is mainstreaming the subsector into national accounts, and determining income therefore to inform planning and policy. The 17 SDGs propose desired states of human wellbeing on which a concerted global developmental effort is

focused (cf. UNDP, 2015). Fisheries' role in development could be bolstered because it has the potential to connect directly or indirectly with some SDGs. For example, fish and income from fish can help eradicate extreme poverty and hunger (SDG 1& 2), while increased consumption of fish would ensure healthly lives and promote wellbeing (SDG 3). Moreover, women dominate the post-capture process, thereby providing the opportunity to promote gender equality and empower women (SDG 5). The subsector is well-positioned to promote inclusive growth (SDG 8) and ensure sustainable consumption patterns (SDG 12). The marine EEZ of Sierra Leone is 155 700 km^2, which is more than double the land area of about 71 740 km^2. Thus, the sustainable use of the aquatic zone contributes to environmental sustainability (SDG 14). Fish is a migratory and straddling resource that happens to be one of the most traded commodities. This should promote global partnerships for sustainable development (SDG 17).

2. THE EVOLUTION OF SMALL-SCALE FISHERIES MANAGEMENT IN SIERRA LEONE ONTO RIGHTS-BASED APPROACH

2.1. Management of the Small-Scale Fisheries Before the Local Government Act (2004)

The management of the small-scale fisheries of Sierra Leone has evolved from a central static management arrangement to a more participatory paradigm over the past half-century. Before the Local Government Act of 2004, the small-scale fisheries management was characterised by static management strategies or tactics. These were designed at the central government department responsible for fisheries and implemented by their protégées, with little or no involvement of other stakeholders. Extension officers levied licences when possible, but access was more or less open to anybody who could acquire vessels or nets with no monitored limit on quantity to catch, where to fish or type of gear to use. Traditional leaders and Master Fishermen did what they could to settle conflicts with limited success; conflicts between small-scale fishers and their industrial counterparts before the Ministry of Fisheries and Marine Resources (MFMR) were rarely settled to the satisfaction of the former. The bulk of the catch was sold fresh to the vendor and other buyers on the beach, after crew and boat owner catch ration had been reserved. Catch information was collected across the landing sites by extension officers that provided a time series of the development of the small-scale fisheries catch.

2.2 Management of the Small-Scale Fisheries at the Promulgation of the Local Government Act (2004)

The fisheries resource stewardship paradigm shift involved the transfer of some responsibilities of small-scale fisheries management to local councils. It can be traced to the enactment of the Local Government Act (LGA) 2004 (GoSL, 2004). The Act authoritatively instructed the devolution of certain small-scale fisheries management functions to newly forged local government councils. But, as Baio (2006) argued, this created the scenario of managing nostalgia for relinquished power and led to unprepared controlling powers and the occupancy of the perfect stranger. These things occurred because LGA 2004 followed fast implementation schedules.

Concomitantly, the unheeded government fisheries ministry was displeased with the relinquishing of power and the local fisher communities were not prepared to assume power –they lacked basic needs. The local council - that lacked knowledge in fisheries management - was put in charge of small-scale fisheries. This resulted in a mismatched setup and was a recipe for chaos, as the LGA of 2004 immediately superseded the fisheries policy of 2003. This clearly incoherent policy breakdown weighed heavily on resource management in small-scale fisheries sector. It is therefore unsurprising that catch statistics on small-scale fisheries were not collected between 2010-2016. In a rent extraction drive, the LGA 2004 focused on the licensing of canoes and collecting fees, rather than on the more traditional management functions such as the generation of management information for evidence-based decision making.

The general and persisting weakness in the small-scale fisheries is the lack of stock assessment. Baseline assessment was abandoned in 2008 due to shallow inshore areas where the vessel could not trawl. Apart from the delegation of responsibilities mentioned in the LGA, functional management of the sector persisted as it was before the Act.

2.3. Rights-Based Approach: Allocation and Characteristics

The current, more devolved, participatory arrangement involves the broad range of interested parties in the decision-making process and establishes organised stakeholder groups with built capacities to assume such responsibilities. This system was initiated by the development of Marine Protected Areas (MPAs) under the auspices of the Institutional Support for Fisheries Management Project (ISFMP) – (2007-2010).

The proposal of introducing of Territorial Use Rights in Fisheries (TURFs) with the advent of the West African Regional Fisheries Programme in Sierra Leone (WARFP-SL) in 2010 accelerated substantive actions of the declaration of MPAs expected to evolve into TURFs. The process of forging MPAs and TURFs involved eliciting stakeholder views on MPA concepts. A more conceptualised mechanism that was also implemented based on a clear strategic framework. This framework was supported through the World Bank-funded West Africa Regional Fisheries Program in Sierra Leone (WARFP-SL/MFMR, 2013) based on a process approach (e.g. Kooiman, 2005). This approach involved putting local community stakeholders at the fore to work together with fisheries managers, in combining both traditional and scientific knowledge to identify vulnerable habitats within major river systems and to declare, establish and manage MPAs that will later evolve into TURFs.

The process entailed five key aspects: (1) Development of a Conceptual and Strategic Framework (2) Declaration and Organisation of Communities (3) Delineation of Boundaries and Territories (4) Registration and Institutionalisation of Community Management Associations (CMAs) (5) Incentives for Change. The strategic framework was developed through nationwide consultations. The framework conceived a system wherein firstly the central government legitimizes the existence of MPAs and assists in their operation. Secondly, fishing communities and other stakeholders are organised and actively participate in the management process. And finally, a wide range of stakeholders (MFMR, CMAs, Private Sector, Civil Society, Navy & Police, NGOs, Local Government and Local Community Leaders) participate in MPA management with defined roles.

During the consultations, stakeholders agreed on key steps such as a preparatory phase where MPAs were identified, and extension service staff trained. A pilot project phase involved identification and organisation of fishing communities, identification of alternative livelihoods, and legalisation and enforcement of by-laws. The expansion phase fully engaged the community stakeholders holding exchange meetings and harmonizing and management activities whereas; a declaration phase delineated MPA areas and boundaries, and MPAs declared by the Minister of Fisheries and Marine Resources as provided in the Fisheries Act.

However, as McPhail (2013) argued, the declaration of MPAs was rushed to qualify for the Millennium Challenge Cooperation (MCC) fund from the United States Government, followed by the formulation of Community Management Associations (CMAs). This may have created hiccups in the process as evidenced by continued training and organisation of stakeholders after the declaration of MPAs, with consequent delays in implementation. As part of the registration process, CMAs developed their own constitution as an input for the legal registration and institution of their organisation. This involved a name check screening by the Criminal Investigation Department of the Sierra Leone Police to issue a police clearance certificate. Registration with the Ministry of Social Welfare, Gender and Children's Affairs (MSWGCA) as an indigenous local voluntary organisation followed, after which a certificate of registration was issued. The final step was to register each CMA with the Local Governance authority. The MPA boundaries, including CMA territories in each chiefdom were delineated through a team that

combined the skills of geographical information system (GIS) practitioners, fisheries scientists and community stakeholders. The local stakeholders provided knowledge on the characterisation of communities to permit access by the scientific team. This aided the use of global positioning systems (GPS) to obtain detailed coordinates of MPAs, including chiefdom boundaries around CMA localities. In order to encourage stakeholder participation in the enforcement of MPA regulations at their various localities, an incentive for change measure was employed by the MFMR'. It was supported by Government and development partners including the World Bank-funded WARFP in Sierra Leone. Under this support, fishing nets and accessories were distributed free of cost in fishing communities that voluntarily surrendered illegal fishing nets, and other large quantities sold at 50 percent reduced costs in fishing communities.

Four MPAs were established between 2012-2015 in the Scarcies River Estuary, the Sierra Leone River Estuary, Yawri Bay and the Sherbro River Estuary. 30 CMA clusters were forged in order to manage the MPAs with a distribution of 5, 6, 10 and 9 CMA clusters respectively. Five elected executives run each CMA: Chairman, Secretary-General, Public Relation Officer, Financial Secretary and Treasurer. The fisheries fall under the local or national jurisdiction management of coastal fisheries. The central government, local government and local community-based organisations are responsible for management.

The fisheries management system is a co-management operation conducted through a partnership arrangement that engages government, local communities, NGOs, research organisations and fisher organisations. The key management measures applied include area closure, area restriction, gear restriction and engine power regulation. Fishing operations are subject to licenses, but they are not taxed like in commercial businesses. Government and local communities are responsible for Community Monitoring Control and Surveillance (MCS). Clearance is required before fishing, and patrol boats and beach patrols monitor fishing activity. Enforcement measures often used to ensure compliance include economic sanctions such as fines, confiscations of gears, and peer pressure exerted by a local community. The most frequent non-compliance is perpetrated by industrial fishers who flout gear restrictions and fish in off-limit zones such as IEZ.

The fisheries management system, planned to evolve from managing MPAs to TURFs, is characterised by both legally recognised rights and traditional rights. Environmentally friendly informal and customary rights practices are maintained in the institution of rights. Legally recognised rights were initially allocated to Local councils after the LAG (2004) who were responsible for licenses. However, these rights are now allocated to CMAs who then extend the rights to various actors or actor groups such as individual fishers, boat owners, fisher organisations etc.

Fishing access rights are restricted by community management associations (CMAs), based on the type of fishing gears used and areas fished. Industrial fishing vessels are excluded from fishing within the five to six nautical mile big Inshore Exclusion Zone (IEZ). Legally recognised rights are allocated to those who historically participated in the fisheries and to the communities represented by CMAs. The allocation was mindful of the economic viability of the fishing activity, the rights of the next generation of fishers, and sustainability of the stocks. Fishing rights are allocated for fishing with specific gears and areas; they are valid for one year, after which licenses must be renewed. Fishing rights that can be inherited are not sold but are transferable between fishers with no limit on catch. There are no limits on the number of rights that can be held. Customarily, measures used by Master Fishermen and traditional leaders who served as custodians of fishing grounds reserve the authority to resolve conflicts and levy sanctions are maintained to supplement the current right-based measures. Customary rights are allocated for all gears except monofilaments and the so-called 'channel net,' with small-sized meshes regarded as destructive. However, nowadays issues regarding allocation, duration

of rights, limits on the number of rights and questions about whether rights could be inherited or transferable follow from the decision of central government and CMAs.

One important lesson is that the processes involved in the institution of rights-based management take time and should not be rushed. This is especially true when strong traditional management systems are non-existent. A full assessment of the MPAs' impact under the current management system is to be undertaken in order to inform TURF implementation. This means specific observed changes could not be reported at this stage. Nevertheless, the process of instituting TURFs has consolidated stakeholders' organisation, capacity building, and confirmed the delineated areas and approved laws. Substantive applications of the by-laws in management had just begun and are yet to be evaluated. The number of fishers and their vessels (with or without engines) is expected to surge because of the suspicion by fishers and other stakeholders that the institution of TURFs will cap capacity (Stephen Cunningham, Personal Communication, 2016). Thus, both the size composition and the quantity of fish caught are not expected to increase. Both the duration and distance covered are unchanged, but monofilament and "channel nets" are no longer in use. Fish aggregation devices are not used, and the effectiveness of lights that fishers believe to aggregate fishes is not yet established. Changes in ownership of vessels since the establishment of MPAs are yet to be fully investigated.

Government authorities and local communities are responsible for monitoring rights. Documentation and vessel clearance are used before fishing, and patrol vessels and beach patrol during fishing; catch monitoring market sales monitoring are used during the landing and post-landing respectively. As mentioned earlier, enforcement measures often used include economic measures (e.g. fines), confiscation of catch or gears, and soft measures involving peer group pressure. With the incentive for change and the policing of the IEZ by patrols, we have witnessed a decrease in the major types of non-compliance. The use of destructive illegal nets, incursion in the IEZ, and the open-access nature of the fisheries are all less common.

Conflicts existing include disagreements between fishers and management authorities, between communities for resources, between communities and migrants, and between small-scale and industrial fishing operatives. Non-fishery sources of conflicts include agriculture, tourism, coastal infrastructure projects and oil exploration. Important threats come from pollution by oil palm production company (SUCFIN) in the southern estuary and lakes, pollution from iron ore mining activities in the North, and oil exploration in the South. The conflict resolution mechanisms are moderately effective – they include the legal system using the courts, government authorities, and customary systems such as tribal councils. Hazardous events affecting the fisheries include floods and coastal erosion, solid wastes (plastic and household materials), and agriculture pollution (pesticides, insecticides). Impacts on the rights holders (who are accessible in case of an emergency) include communities having to leave due to coastal erosion and stock mortality from agriculture pollution, reminiscent of the massive catfish mortality in the early 2000s.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable Use of the Resources

Although an evaluation of the rights-based system is yet to be carried out, a number of observations can be made:

- The incentive for change has ensured that legal gears are used.
- The effective protection of the IEZ means that stock rebuilding could be achieved, due to the protection of the inshore from industrial vessels.
- The vessels registration exercise, as part of the process of developing rights-based fisheries that demand documentation and vessel clearance, means that the fisheries are no longer open. With the protection of the IEZ, this measure should contribute to sustainable use of the resources.

- Empowerment of resource users has enabled the monitoring of remote landing sites where the peer group is applied to ensure sustainable management. For example, the landing of juvenile fish is not allowed at Tombo landing sites.

3.2 Economic Viability of the Fishery

As noted elsewhere (Baio, 2016), the unit cost of harvest decreases with an increase in stock size, which has a cost-saving effect. Large stock size can be maintained by effective effort and catch control in a healthy environment, which suggests limited entry from rights-based fisheries management. Reforms in the fisheries are therefore geared towards effort and catch controls to maintain a healthy stock level. The process of vessel registration with a unique number (including documentation of the gears and owners) is geared towards the monitoring of capped capacity going forward. Adjusting effort to the value of catch at the margins would sustain the economic viability of the small-scale fisheries of Sierra Leone. However, as argued earlier, the economic viability is contingent on the performance of the national economy.

3.3 Social equality

Notwithstanding the fisheries resource sustainability and economic viability threats exhibited by the pre-rights-based management, small-scale fisheries as an employer of last resort have always served as a social safety net catering for the poor and vulnerable. So, as Baio (2010) maintained, the challenge managers should face is providing livelihood security for resource-dependent communities whilst also sustaining resource health. As observed earlier in sub-section 1.2, fisheries connect with many SDGs that enhance social equity; for example, fish and income from fish can help eradicate extreme poverty and hunger (SDGs 1&2), while increased consumption of fish would ensure health lives and promote wellbeing (SDG 3). Moreover, women dominate the post-capture process, thereby providing the opportunity to promote gender equality and empower women (SDG 5). The subsector is well-positioned to promote inclusive growth (SDG 8) and ensure sustainable consumption patterns (SDG 12). The management system considers the stock sustainability and economic viability of the fishing activity, but also the needs of the poor and vulnerable, including women, and the rights of the next generation of fishers.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the Fishery

With more than half of the population living below the national poverty threshold, fisheries are a vital safety net. This has been a major challenge to the introduction of rights-based fisheries - which will involve the exclusion of some resource users - and options for fishers' engagement in non-fisheries livelihoods are underdeveloped. The issue of sustaining effective mechanisms to detect and curb threats to environmental sustainability (such as the use of destructive fishing methods like explosives, monofilament netting materials or the so-called 'channel fishing') is an important challenge. The absence of micro-credit schemes for CMAs facilitates a speedy involvement of the community to govern fishing tenure rights effectively.

The human capacity needs to manage fisheries resources following right-based paradigm is quite significant, and transaction costs are high, requiring direct financial support. A serious issue with fisheries sector reform is that once actions have been taken to conserve fish stocks, it may be years before the full benefits are felt and the results are evident in terms of increased catches. This makes it harder for governments to institute unpopular reforms, even though they may be in the best interests of the nation, fishing communities and individuals. Fishermen and their families are used to receiving an instant 'same-day return' on their catch; they are less willing and less able to wait for gradual improvements than stakeholders in other sectors. Traditional fishing practices are quite literally a way of life for many Sierra Leoneans, having been handed down from one generation to the next. These traditions are closely interlinked with cultural practices, and power and influence reside

in specific families with hereditary authority. In order to change attitudes and gain acceptance of new approaches to fishing, there is a need for major awareness-building and communications strategy targeting. Particular focus should be on the traditional leaders of the fishing communities. Without such a plan, it will be difficult to break down the internal resistance and inertia towards change.

4.2. Improving Fishery Sustainability in the Future

As the MPAs evolve in TURFs, a number of actions should be taken to improve the sustainability of the fisheries:

- More support is required to develop effective mechanisms to detect and curb threats to environmental sustainability (such as the use of destructive fishing methods like explosives, monofilament netting materials or the so-called 'channel fishing').
- Community Monitoring Control and Surveilance (MCS) programmes - designed with the full participation of resource users - will be effective because they empower stakeholders to defend their own interests and livelihoods.
- Curbing the illegal, unregulated and unreported (IUU) fishing in the IEZ represents an important step towards reducing poverty in the small-scale fisheries.
- Catch and effort data is fundamental in fisheries management and the lack of which during the institution of MPAs and TURFs was the single most challenge to the success of the nascent system.
- Co-management must be sustained because it establishes a clear line of communication between interested parties, so that the interaction process is both complementary and supplementary with respect to mapping out the desired state of affairs, formulating the rules of the game in pursuing such goals, and implementing management/governance strategies or tactics.
- MPA management demands high cooperation and collaboration/information-sharing between the interest groups. The CMAs should be empowered to participate in community surveillance and report fishing trawler incursions into the IEZ to the MFMR in order to scale up surveillance in those localities.
- Promoting and sustaining TURFs going forward will require the provision of micro-credit schemes that will pave the way for fishers and other community stakeholders to engage in alternative livelihood activities. This would enable them to effectively govern and enforce their tenure of fisheries in their communities.
- A management plan that take account of the current biological, social and economic status of the fisheries system must be developed because rights-based fisheries management introduces efficiency by specifying the quantity, type and size of fish to catch and when, where and how to catch them based on a predetermined management plan.
- In developing existing strategies and plans, it will be prudent to ensure that measures are in place to offer encouragement and practical assistance to fishers to convert to more sustainable practices, while at the same time introducing effective enforcement. The will to enforce management measures must be unwavering because, while the broad principles of tenure rights and rights-based fisheries are accepted, the majority of the fishing community simply do not believe that the new regulations will be enforced, because they have witnessed the failure of so many previous efforts to introduce firm management.
- Resource users have shown a keen interest in co-management ventures evident – this is evident from the successful process of establishing community management associations for the management of MPAs. Sustained human and material capacity development of stakeholders, including professional organisations, would put them in good stead for continued sound resource stewardship.
- The establishment of platforms for stronger participation and information sharing in the transition from resource users to stewards would enhance future sustainability.
- Sustained public reinvestment in fisheries would preserve resource sustainability gains.

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Towards securing community and individual user rights and tenure: the case of two estuarine resources in Ghana

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Abstract

Most major rivers in Ghana empty into the Atlantic Ocean through estuaries that harbour biodiversity ranging from mangroves, fish, clams and other wetland resources. These resources provide livelihoods for riparian communities around the estuaries. Estuarine resource use by closed communities in Ghana presents a great opportunity to understand traditional tenure and user rights in community-based management or co-management arrangements. Ghana has practised community-based natural resource management in many forms in the forestry and fisheries sectors. While the forestry sector has a policy on community resource management areas (CREMA), the fisheries sector is yet to adopt a new fisheries co-management policy. Such policies seek to fully involve resource users in the sustainable management of the resources, combining traditional management with management by government agencies. In the meantime, civil society groups under various funding support mechanisms are accelerating the development of strong co-management institutions in some important estuaries, to demonstrate how community-based management can best be implemented while securing the rights and tenure of the resource users. This paper describes implementation approaches in securing community and individual tenure and user rights in two estuaries (Ankobra and Volta estuaries) in Ghana.

1. INTRODUCTION

Ghana is one of the biggest fishing nations in Africa, with over ten percent of its population directly or indirectly depending on fishing for livelihoods. Ghana's fishery waters comprise marine and inland and brackish waters. The marine provided the bulk of the fishery and dominated by artisanal fishers who land about 70 percent of the marine catch. The inland waters comprising river, lakes, lagoons and estuaries also support the fisheries and play critical socio-economic roles. The estuarine ecosystems harbour a wide range of biodiversity that provides livelihood opportunities for riparian communities.

This paper focuses on the fisheries and other natural resources governance in two important river estuaries – Ankobra and Volta river estuaries. It examines customary tenure and user rights arrangements, multiple-use and users, social aspects of tenure and user rights, as well as issues of gender and youth. It discusses approaches to securing *community* (Ankobra) and *individual* (Volta) tenure and user rights. The resources of the Ankobra Estuary include mangroves and important fish species – Nile tilapia (*Oreochromis niloticus*), bagrid catfish (*Chrysichthys nigrodigitatus*) and cassava croaker (*Pseudotolithus elongates*), while the Volta estuary resource use revolves around the Volta clam (*Galatea paradoxa*).

1.1 Description of the Estuaries

Ankobra Estuary: The Ankobra river is within the coordinates 4°52'N/5°00'N and 2°10'W/ 2°16'W. It opens into the Atlantic Ocean west of Cape Three Points (Figure 1). The estuary is located within two local government jurisdictions (Ellembelle and Nzema East Districts), and the management area covers approximately 8 460 km^2. The estuary has rich biodiversity characterized by terrestrial forests, swamp,

bamboo and mangroves forests. The fauna composition includes species of global conservation interest including the West Africa Dwarf crocodile (*Osteolaemus tetraspis)* and the cassava croaker (*Pseudotholithus elongates*). Among the 27 estuarine fish species identified, the most important to the fishers are the cassava croaker, the Nile tilapia (*Oreochromis niloticus*) and the bagrid catfish (*Chrysichthys nigrodigitatus*). Together with mangroves, these resources support the food and livelihood security of riparian communities. The mangroves are harvested for fuelwood and for other domestic purposes such as building construction.

Fishing is done all year round in the estuary but peaks in the rainy season when fish is relatively abundant. Fish harvesting is done by men using small canoes with hook and line, traps and set nets. Besides fishing, food and cash crops are farmed, including rubber and oil palm.

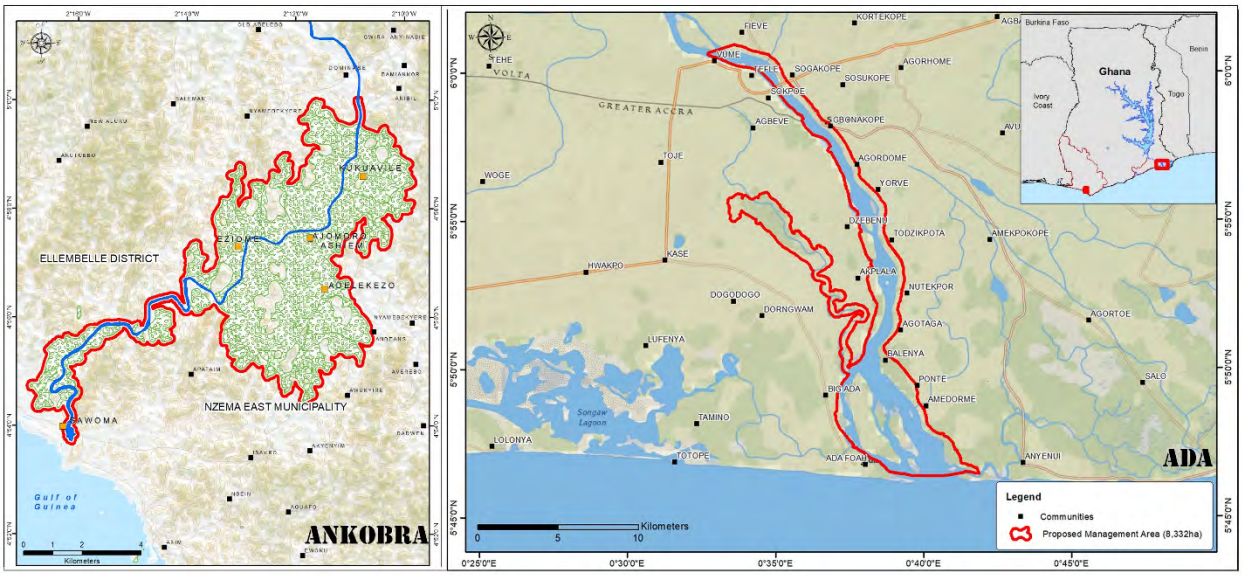

Figure 1. Map description of the Ankobra (left) and Volta estuaries (right) in Ghana.
Source: Hen Mpoano.

The Volta Estuary: The estuary lies between 0°35'E / 0°45'E and 5°45'N and 6°00'N. The estuary is linked to two important wetlands/lagoons; the Keta lagoon to the east and the Songhor lagoon to the west. These lagoons and wetlands are rich in biodiversity. Both lagoons are used for solar salt production. Upstream of the estuary are two multipurpose dams - the Akosombo and Kpong, primarily for generating hydropower though they are associated with a vibrant fishery and aquaculture. The creation of the dams has resulted in a constant discharge or flow regime of water to the estuary, leading to a very small salinity gradient as water discharges into the Atlantic Ocean. The brackish waters of the estuary support a vibrant clam fishery. The Volta estuary has many competing uses including navigation/transportation, recreation, tourism, real estates, fishing, tilapia aquaculture and clam mining/culture.

1.2 Economic contribution and social implications of the fishing activity

Ankobra Estuary: Several technical assessments have shown that the fishery has gone through significant changes over the past decades with regard to fishing effort, size of the catch, fuelwood for fish smoking and price of fish. In the last decade, fish has become less abundant, and fisher numbers have decreased. In some communities, the canoes are only used for harvesting and transporting mangroves or for the transport of farm produce. The decline in the catch is perceived to be a result of the illegal gold mining activities upstream and the use of undersize mesh nets in fishing. Historically, fish was only harvested for subsistence. Currently, fishermen sell the fish as there is increasing demand

for fish protein. The fish are either sold fresh or processed (smoked, fried, salted or sun-dried). Women dominate the post-harvest and fish is sold on the local markets.

Mangroves are also heavily harvested; they are used for domestic fuelwood, for fish processing, or sold commercially. This has led to a degradation of the mangrove forest, with observed implications for fish production. Three fishes, the Nile tilapia, bagrid catfish and cassava croaker are the priority fish for the riparian communities.

The Volta clam is a sedentary bivalve buried in the substratum of the river. Harvesting requires that clam miners dive three to five meters to pick them. Traditionally, a clam picker was allowed to pick one clam at a time and miners may not spend more than two minutes underwater. Currently, the miners have devised a system using air compressors, tubes and facemasks, to allow them to stay underwater longer and to pick as many clams as possible. They spend 15 to 30 minutes underwater before surfacing and delivering the clams into a boat. This system has the potential of over-harvesting. However, clams picked may be of various sizes and maturity and immature clams are returned to the water. To ensure clams returned to the water are not lost by the individual picker, clam miners started to own clam farms by cultivating the clams underwater. The boundaries of farms are marked with long bamboo poles that poke out of the water surface. The harvesters easily identify individual farms and pickers, by rule, are not allowed to access another person's farm. This practice presents a new dimension to underwater tenure and user rights that are yet to be adequately documented.

Both men and women dive for clams, but farming clams is a male-dominated business. The women dominate the downstream – processing and marketing of clam meat and shells. The clamshells have better market value than the meat.

Figure 2. The Volta Clam Galatea paradoxa (left) and processing of the meat by women (right).
Source: Hen Mpoano.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

A rights-based approach means that individuals and communities know their rights, are fully supported to participate in the development of practices that affect their lives and are able to claim their rights where necessary. This means that community or individual rights to the fisheries are assured and such communities or individuals are part of the rule set in the management of resources. This paper examines tenure and rights-based approaches in the two estuaries. While the Ankobra estuarine focuses on community rights, the Volta estuary clam fisheries consider individual rights to the resources.

2.1 Management of the Fishery

Ankobra Estuary: There are five riparian communities around the Ankobra estuary. Fishing is open access and is not restricted by boundaries. Nonetheless, each community has preferred fishing grounds. Each riparian community historically has restricted fishing activities to identifiable tributaries, and the communities are perceived to possess de-facto user rights to those fishing grounds. The fishing grounds may overlap in some cases, but conflicts are rare, and when they do occur, they are addressed through traditional norms or rules.

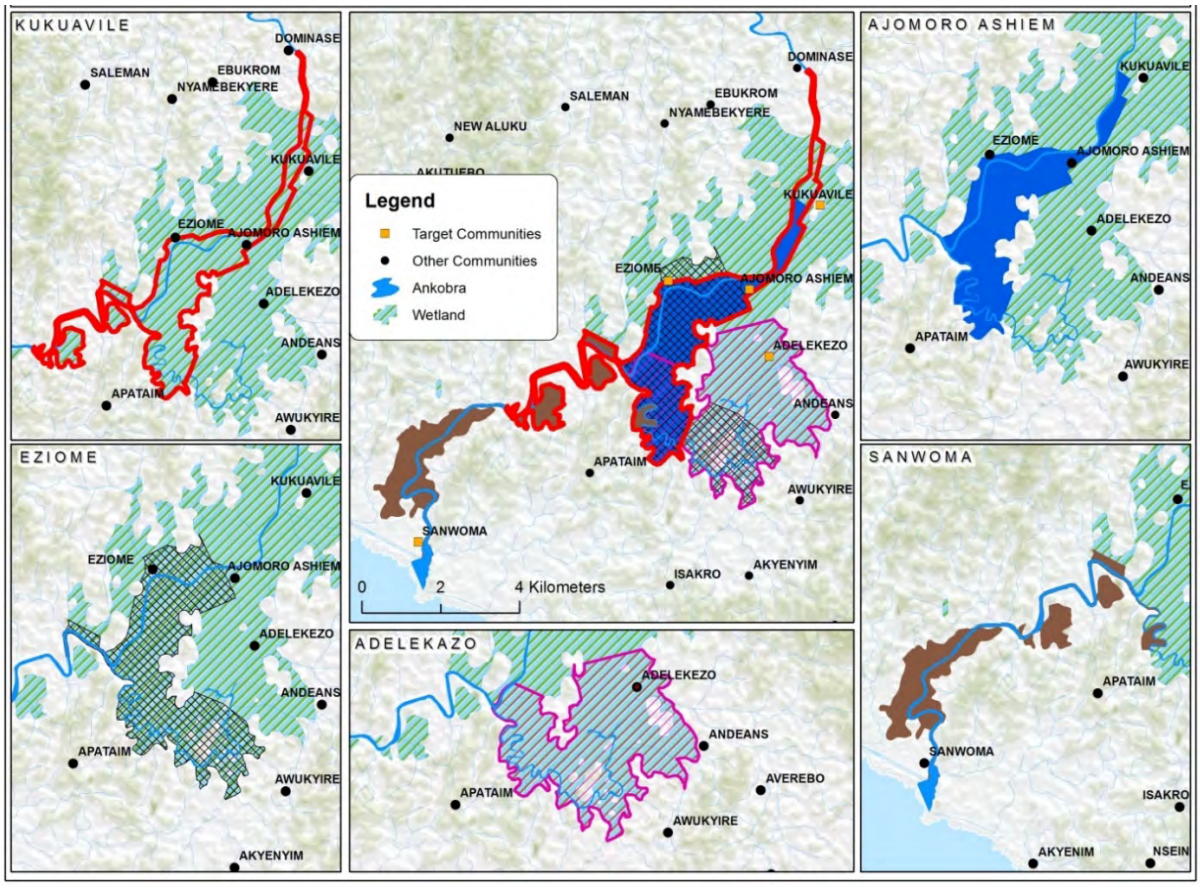

Figure 3. Fishing grounds of estuarine communities and combined overlay showing overlapping fishing areas and exclusive fishing areas.
Source: Hen Mpoano.

Although some government agencies have responsibility for wetland and fisheries resources, community chiefs who are custodians of the norms predominantly conduct traditional management. In recent times, the government agencies (Fisheries Commission, Wildlife Division and the District Assemblies) have shown interest in the management as a result of the involvement of civil society organizations working with the communities to establish co-management arrangements that involved the government agencies. The awareness raised also rekindled the management interest of the traditional authorities.

Volta Estuary: Clam mining or harvesting in the Volta estuary is a vibrant fishery supporting the livelihoods of many youths, older persons and women. The fishery is open access but self or group regulated and predicated on traditional religious taboos that are believed to be enforced by local deities. There is no active involvement of government institutions in resource management at the estuary, while the traditional authority occasionally steps in to resolve conflicts. There are competing uses of the estuarine resource. Resource users observe non-fishing days, closed seasons or seasonal

mining or harvesting of clams. Tuesdays are set aside by local tradition as no harvest days but can be used to tend cultured farms. No person is allowed to mine clams from another person's farm. A three-month closed season is observed from December to March when clams are reproducing. The rules in the clam fishery are self/user regulated.

Figure 4. Eighty-year-old woman dives for clams for her livelihood.
Source: Hen Mpoano.

Mining or harvesting clams is not restricted to the community members, as individuals from other areas can join in the harvesting in so far as they are able to dive. Matured clams are harvested by women processors while immature or undersized clams are replanted in individual clam farms in the substratum underwater, where they are tended until mature. Clam harvesters travel between 5-10 kilometres (km) to upstream areas to mine clams for sale or for culture. During periods of high salinity at the lower reaches of the estuary, some farmers move their clams to upstream farms with less salinity. The migration of the harvesters to farm in other 'community waters' is sometimes a source of conflict. During the closed season or non-fishing days, individuals can visit and tend their farms, but the sale of land clams is prohibited. Ownership of the underwater farm is conferred to individuals, but only recognized peers.

2.2 Brief history rights-based approaches used in the fishery

In the Ankobra estuary, community resource use patterns are very well known, e.g. community mangrove areas or fishing grounds. In the last decades, resource extraction has been indiscriminate and lacked regard for sustainability. This has led to the degradation of mangrove forests and dwindling fish catches, as well as the erosion of some traditional community rules that granted rights to users. This is partly because the rules are not codified and difficult to enforce - by either the traditional authority, the local government or law enforcement agencies.

The Volta estuary clam fisheries are self-regulated by norms and taboos that give rights to resource users. The rules are uncodified but largely obeyed, with occasional violations and situations of conflict. Violations and conflicts are reported either to law enforcement or to the traditional authority for

prosecution or mediation. Since the laws are only conventional or traditional, individual rights are not clearly defined or absolute, while conflict resolution or enforcement has not been satisfactory. The traditional activity of clam business is also challenged by the increasing tourism activities, including water sports and the need for more waterfront areas for real estate and hospitality facilities. Landing sites, which serve as market locations for the miners and women processors, are at risk of being lost to emerging developments.

2.3 Rights-based approach: allocation and characteristics

Civil society has engaged the Ankobra riparian communities in developing approaches towards securing user rights through the mapping of the community resources and identification of critical mangrove areas to be restored, as well as the setting aside of closed areas to aid the recovery of fish and other resources. Additionally, management groups have been formed that comprise representatives from all the riparian communities, to engage in discussions with the traditional authority and the government agencies on approaches that would lead to the devolution of authority and rights to communal resource use.

The communities have been assisted in forming recognized associations. They are registered with the local government authorities and have developed a management plan that sets the mechanisms for the management of the resource. There are also bylaws that provide for sanctions. The civil society-led intervention, supported by the traditional authorities, local and other government agencies have served as a blueprint for implementing a broader co-management framework to improve food security and livelihood benefits for the participating estuarine communities and to demonstrate how the granting of user rights could benefit natural resources management and sustainability of the resources.

Quick win actions that yielded short-term gains increased the commitment of resource users in implementing actions with long-term results. It was also proven that respecting existing rules and norms in traditional governance, codifying traditional norms into district bylaws, and developing a management plan were valuable in securing the user rights of community resource users.

As part of early actions, degraded mangrove areas were restored by the mangrove harvesters (men and women). While they are able to link mangrove forests to fish production, the fish and mangroves in certain tributaries and sheltered areas were protected by making such areas off-limits to the resource users. Violations attract sanctions by community leaders or traditional authority. The communities agreed closed season and closed areas within the estuary allow for the rejuvenation the fishery and the protection of the mangrove and other resources. When the management plans and bylaws are passed, a certificate of devolution granting exclusive user right to the resource users of the riparian communities will be issued to the association.

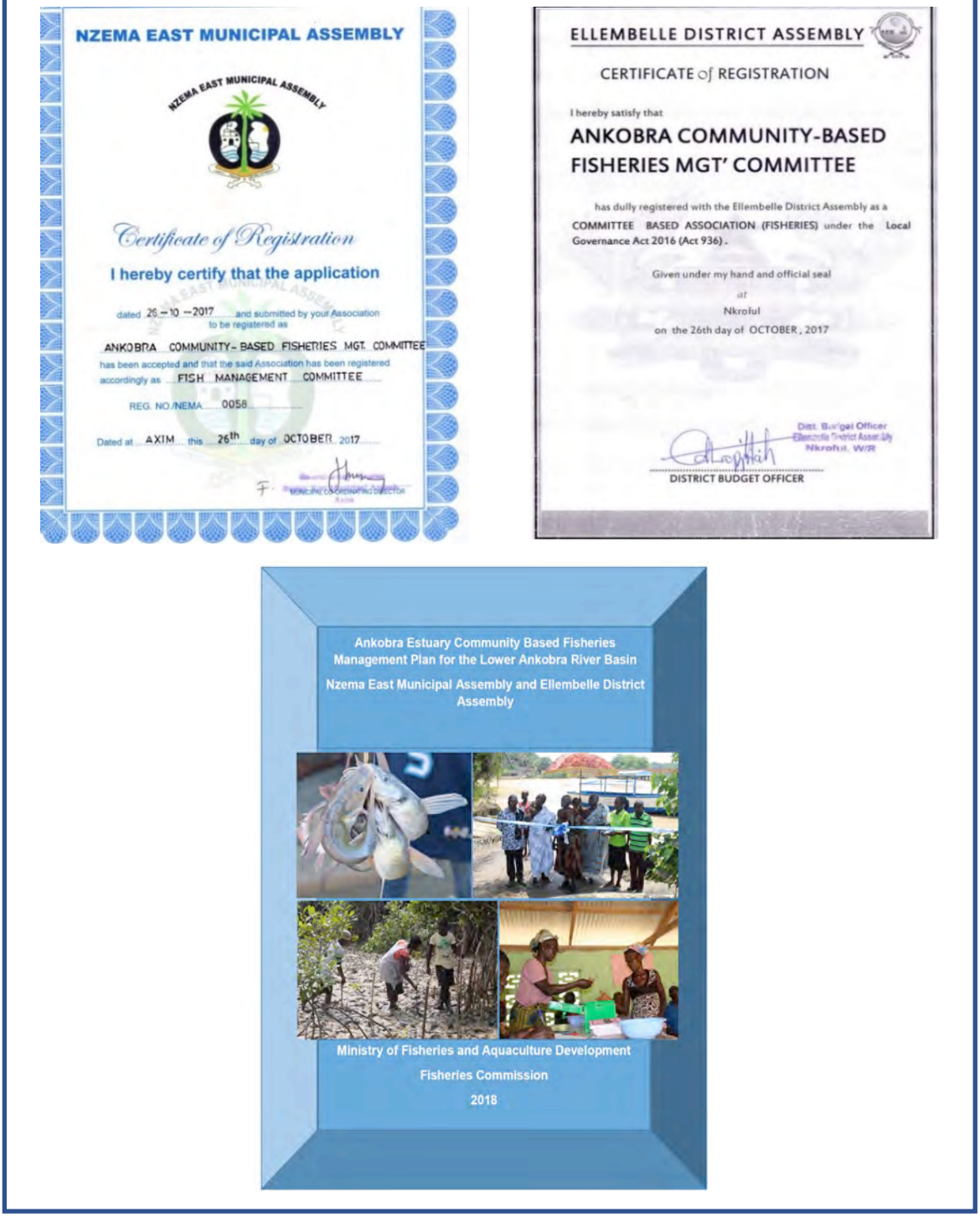

Figure 5. Certificates of incorporation of Ankobra river estuary resource users and their Management Plan.
Source: Hen Mpoano.

Volta Estuary: Underwater farming of clams presents an interesting situation for management, user and tenure rights. Since 2017, a European Union-funded collaboration between the Environmental Justice Foundation and Hen Mpoano has been working with the communities and clam harvesters at the Volta estuary to secure individual rights and tenure of clam miners/farmers. As an innovation, the project was supported to pilot the FAO Open Tenure tools for mapping underwater clam farms. A step-by-step approach was used to analyze current traditional tenure rights arrangements in the clam fishery, spatial mapping of main clam fishing areas, and development and distribution of maps showing competing uses. The process identified key stakeholders and potential for fisher associations to develop a co-management programme, with options for the administration of user rights, tenure needs and sustainability. Documentation and dissemination of best practices and lessons learned were discussed with the traditional authority and the local government, to inform the devolution for securing user rights.

The Open Tenure tool uses mobile application for Android and iOS devices and allows citizen and community recording of tenure rights. It also records claimant details, capture boundary information, and collects scanned documents and photos to support a claim. Although this has been used on land, the Volta estuary example is the first in mapping underwater farms. See Figures 6 and 7.

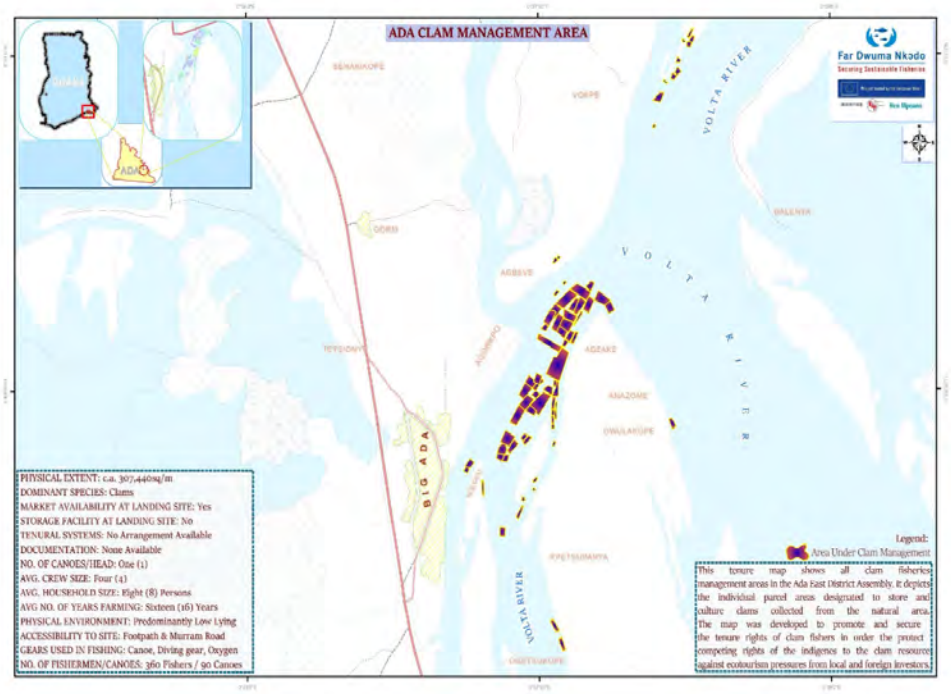

Figure 6. An aggregate of clam farms in a channel in the Volta delta.
Source: Hen Mpoano.

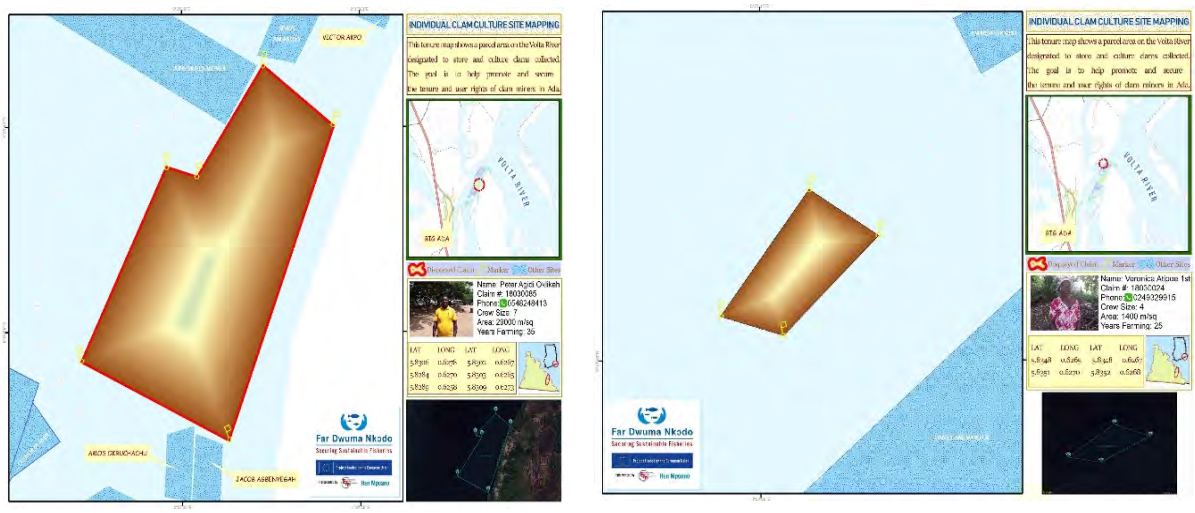

Figure 7. Individual farms with claimant attributes.
Source: Hen Mpoano.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

The two examples described demonstrating that community, as well as individual rights, can be secured when individuals and community resource users are involved in designing and discussing issues around their rights to resource use and management. Top-down approaches to resource management have not been effective. More often than not, they alienate resource users from decision making on issues that affect their livelihoods and draws a wedge between them and the authorities. Once they see the resources as their own and have the authority and rights to manage them, they see the resources as theirs and manage them for posterity.

3.1 Sustainable use of the resource

Community-based natural or common-pool resource management has previously been controlled by traditional rules, norms and sanctions that ensure the resources are well managed and protected. With central authority or government annexing those rights, resources users and their traditional authorities (custodians of the resources) have felt alienated by the consideration that these rights belong to the government. This has led to disinterest, sustainable management, and wanton exploitation. Realizing this, central government agencies are now beginning to devolve such authority back to communities for sustainable exploitation through policies such as Community Resource Management Areas (CREMA) or Community Fisheries Management (Co-management). These policies confer expanded rights to resource users. In the Ankobra estuary, for example. Mangrove harvesters have now become an association of mangrove restorers, while fishers have been able to set aside closed fishing areas and seasons to rebuild fish stocks without the involvement of government.

3.2 Economic viability

Good management of community natural resources ensures the optimal provision of economic opportunities for those whose livelihoods depend upon such resources. For example, the sale of large-sized fish or clams is more profitable than immature ones. In the Ankobra estuary, the communities have agreed on management rules such as minimum mesh size for fish harvest. This means only large-sized fish are harvested, while the closed areas and seasons ensure that fish are able to spawn for the recruitment of next cohorts. Meanwhile, mangrove harvesters have been trained in sustainable mangrove harvesting, which ensures that stumps are able to regenerate.

Within Volta, farming clams is a growing business. Small-size clams that are mined are planted in an individual's farm and may take two years or more to reach maturity. Based on local ecological knowledge, the closed season period allows matured clams to release their spats for continuous repopulation of the estuary. This also makes clam farming a source of continuous livelihood for the youth.

3.3 Social equality

Community associations formed around the resources are gendered, and representation is by self-selection by resource user groups. In the Ankobra, the men focus on the fisheries while women have shown greater interest in mangrove management, restoration and harvesting. The riparian communities now consider the resources as collective private properties and ensure that the rules and sanctions apply to all resource users. Within the Volta estuary, men lead in the harvesting of clams while women specialize in processing and trading.

Mobilizing the resource users to discuss the sustainable management of the resource has rekindled the interest of the traditional authority. For example, there is the risk of the traditional authority selling off the clam landing areas and marketing to real estate or hospitality industry developers. Mapping and securing these sites for the women through negotiation with the traditional authority is insurance for clam farmers and the women. Underwater rights for clam farmers also reinforce the traditional rule: no tampering with another person's farm. The use of technology to demarcate the underwater farms and the provision of titles to owners will ensure the rights and tenure of the clam farmers. It is also expected to boost clam culture in the estuary.

4. MAIN CHALLENGES AND WAY FORWARD

Collaborative management or co-management involving communities, individuals and authorities is the paradigm shift in fisheries and natural resources management. If effectively developed, it leads to a sense of ownership and responsibility towards natural resources by resource users. Government or any higher authority always hesitates or is afraid to cede such powers or rights to individuals in a community or communities or user associations in natural resources governance. Ostrom suggests that if some eight cardinal principles are followed in the management of common-pool resources, it is possible to secure sustainability.

4.1 Challenges for the fishery

However small the scale of the co-management, it involves time and financial commitment. Quick wins that yield short-term gains are important in attaining the commitment of resource users to implement actions with long-term gains. In order to implement community-based resource management effectively, it is important to respect the existing rules and norms of participating communities. For example, rules and sanctions may have to be built on top of an existing traditional natural resource governance system, incorporating local knowledge of resource users in resource management.

4.2 Improving fishery sustainability in the future

Securing user rights and tenure in fisheries and natural resource governance can be achieved by involving a wide range of stakeholders, governments, communities, user associations, individuals, private sector interests and traditional authorities. These actors should come together and understand the issues involved in the governance of natural resources. The process requires transparency, communication, information sharing, sound policies, science for decision-making and, above all, commitment and sustainable and innovative financing.

CONCLUSION

The two examples discussed have demonstrated that the understanding and involvement of resource users in decisions that affect their livelihoods provides an opportunity for sustainable management of natural resources. Tenure, user rights and devolution of authority to resource users in natural resource management (such as fisheries or forests) can be a useful approach in securing community or individual user rights. Technology can play an important role in the visualization of resource extent for management. Once ownership is conferred on them, resource users are able to manage common-pool resources better. They will see resources as belonging to them, while the community rules that have been endorsed by the government may be viewed as more legitimate, commanding more respect.

ACKNOWLEDGEMENTS

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Open access challenges in attaining Sustainable Development Goals in Lake Tanganyika: The Case Study of Kabonga in Burundi and Kagunga in Tanzania Landing Sites

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Abstract
Lake Tanganyika is located in the western branch of the East African Rift Valley and is shared by the Republic of Burundi (8%), the Democratic Republic of Congo (45%), Tanzania (41%) and Zambia (6%). About 12.5 million people live in the lake basin, of which more than one million depend entirely on its resources for a living. As a result, some species, particularly species of economic importance, have declined sharply and conflicts have increased due to uncontrolled changes and gear changes in the pursuit of more fish (TAFIRI 2016). For example, the 2011 joint survey of the entire lake revealed a significant increase in the number of active fishers, motorized fishing vessels and prohibited fishing gear since 1995 (LTA 2012b). Most recently, the emergence of modified gillnets of unlimited length has been reported. These are nicknamed by data collectors of this study as 'Abnormal Active gill net fremaya brush-kamatia chini' net (Locally known as Fremaya brush for Burundi and fremaya makila kamatia chini for Tanzania) and may impact the sustainability of food and rights of other fisheries in the area. Lake management and control efforts are hindered, alongside other factors, by the low rate of adoption of harmonized fisheries policies, processes and procedures between the riparian states of the lake. The case of closing seasons and the illegality of gillnets on the Burundian side of the lake is compared to legality of gillnets in the Tanzanian part of the free access fishery. Using the case study of the Kagunga Landing Site in Tanzania and its nearby Kabonga Landing Site in Burundi, this study explores bottlenecks arising from non-harmonized fisheries management laws, policies, and practices among fisheries in riparian states of Lake Tanganyika.

Keywords: Open Access, modified Gillnet, Overfishing, Fisherman, Harmonized Laws, Fisheries Management, Lake Tanganyika

1. INTRODUCTION

The current population of the Lake Basin is above 12.5 million but, in terms of fish consumption, considering only the population living near Lake Tanganyika shore is dangerously misleading. Population in Burundi alone is already 11 million and although only one million live on the lakeside, all households now eat fish from the lake rather than from the fish-farming sector, which is under-developed but growing. Kagunga is geographically located at 4° 29' 0" South, 29° 39' 0" East 18 and Kabonga at Latitude of 4.4072°, and Longitude of 29.6739°.

Figure 1. Map of Lake Tanganyika with country.
Source: Williun Apollinaire.

Since the year 2016, the collapse of the wild adult pelagic fish stocks was reported to Lake Tanganyika Authority from all over the lake, even at places that are not intensively fished. 2017 was reported as similar, and the reporters (Mlimbwa & Chubwa, for 2017 and 2018) described it as an even worse situation for the first six months of 2018. Although not yet fully proven but reasoned from the responses of indigenous knowledge sources, both study sites concurred that the initial collapse of the stocks (2016) could be caused by prevailing use of Active Abnormal gill nets. Nonetheless, in order to compensate for their economic losses due to the absence of high value, adult fish, a majority of fishers adopted irrational fishing practices, consisting mostly of the capture of their juveniles of low essential value. This hastened the deterioration of the fish resource, and overfishing explained the catastrophic landings by the offshore fisheries in 2018.

The Lake Tanganyika Authority Secretariat, since its origin, has coordinated and supervised some major actions at the regional level in partnership with member states, FAO, NGOs and donors to implement projects in fisheries management, to contribute to an increase of food security and to improve livelihood. More efforts and funds are yet needed to ensure sustainable fisheries management and utilization.

1.1 Description of the fishery

Lake Tanganyika provides the second-largest freshwater fisheries on the African continent with an annual fish production potential of the four countries bordering the lake estimated to vary in the range of 165 000 – 200 000 metric tonnes (mt). Recently, it was reported that annual yields fluctuate between 20 t (Burundi) and 184 000 t (Tanzania) (Philippe, 2013). The lake is shared between Burundi,

Democratic Republic of Congo, Tanzania and Zambia. Small and medium scale fishing predominates with two distinct but often overlapping fisheries: 1) offshore fisheries (pelagic zone), which mainly target two species of sardine-like clupeids and four species of perch; and 2) nearshore (littoral zone) fisheries, which target a wide diversity of species (LTA, 2016).

Table 1. Significant commercial species from Lake Tanganyika.

Offshore (pelagic species)	Maximum length (mm)*	Type of Gears (2018)	Abundance (2014)
1. Lates stappersii	450	Lt, RN, MAGN, AP	Abundant
2. Stolothrissa tanganicae	102	Lt, RN, MAGN, AP	Abundant
3. Limnothrissa miodon	170	Lt, RN, MAGN, AP	Frequent
4.Lates angustifrons	2000	Lt, RN, MAGN, AP,HL	Infrequent
5. Lates mariae	750	Lt, RN, MAGN, AP.HL	Infrequent
6. Lates microlepis	850	Lt, RN, MAGN, AP,HL	Frequent
7. Hydrocynus goliath	2500+	BS, MAGN, RN	Rare
Nearshore (littoral) and marshes species	**Maximum length (mm)***		**Abundance (2014)**
Boulengerochromis microlepis	800	BS, MAGN, RN,HL	Frequent
Limnotilapia spp	260	BS, MAGN, RN	Frequent
Tylochromis polylepis	435	BS, MAGN, RN	Frequent
Bathybathes fasciatus	397	BS, MAGN, RN	Frequent
Bathybathes ferox	362	BS, MAGN, RN	Frequent
Chrysichthys graueri (catfish)	360	BS, MAGN, RN	Frequent
Clarias gariepinus (catfish)	1700	BS, MAGN, RN,HL	Frequent
Limnothrissus cunningtoni (catfish)	[illegible]	BS, MAGN, RN.HL	Rare (frequent in DRC)

LT- Lift net, AP- Apppolo
RN- Ring net, MAGN- Modifies active abnormal gill net,
Bs-Beach seine HL- Hook line

Source: LTA, 2016.

All the pelagic fish species of Lake Tanganyika are commercially exploited. The artisanal fleet, using catamarans with lift-nets in most of the lake or ring-nets in the extreme south, operates further offshore and catches the pelagic species of commercial value; two Clupeids and four Centropomids. The main species are the sardine *Stolothrissa tanganicae* and the perch *Lates stappersii* (previously *Luciolates stappersii*) which represent 98 percent of the total landings of the offshore fishery (Philippe and Tom, 2015). They provide between 25 percent, and 40 percent of the animal protein consumed in the region and the annual estimated value of the fisheries is USD 700 million (Philip, 2013). The offshore fish production is characterized in normal times by two annual peaks of abundance for the two main species, leading to the quick and improper processing of the large surpluses and the temporary collapse of fish price.

However, the sustainability of fisheries resources and the attendant business are jeopardised by a number of factors. To name just a few: there is an increase of population in the lake basin; an increase of fishing capacity; an extraordinary increase of bad fishing practices such as illegal modified gill nets, locally known as “fremaya brush” for Burundi and “fremaya makila kamatia chini” for Tanzania; and the use of generator and solar-powered LED lighting systems which are overtaking the conventional kerosene-powered pressure lanterns (LTA, 2018; Sweke et al., 2013).

Recently, fisher communities, stakeholders and government have been experiencing unexpected massive catches of juveniles of *Luciolates spp* and *Stollothrissa tanganyicae* (LT sprat) fry, both of which are indigenous to Lake Tanganyika. In this study, the increase was reported to be an increase of bad fishing practices above. These gears are catching tremendous amounts of juvenile *Luciolates* species and sardine fry.

In realization of these threats to the sustainability of the lake, the LTA countries and different stakeholders of the lake established national and international management measures. The measures are diverse; they include conservation, fisheries frame surveys, scientific studies, policies, frameworks, laws, surveillance, and so forth (see Bunting, 2001). However, fish stock assessment has never been conducted in 20 years, and the implementation of management measures is still limited — some need to be reviewed so as to slow down the fishermen marathon toward immature catching behaviour.

LTA aims to implement its convention on the Sustainable Management of Lake resources for the livelihoods of riparian communities, using an FAO questionnaire on tenure and user rights in capture fisheries to collect information. This includes the case study of the transboundary landing sites of Kabonga of the Republic of Burundi (KB) and Kagunga of the United Republic of Tanzania (KT).

The study aimed to provide vivid evidence of how a lack of harmonized policy with an open access practice can lead to fisheries resource depletion, environmental degradation, socio-economic conflict and poverty among fisheries communities. The information was gathered from 54 fishers aged 19 to 46 years, among which 4 were women, 50 were men and the other 4 governmental officials. The 54 respondents consisted of fish operators, owners of different fishing gears and vessels, and boat builders.

Table 2. Information on fishing capacity and gears at Kabonga and Kagunga sites.

Gears type	No. of Engine	Measurements	Size of the Fish adult/juvenile/ both	Numbers of fishing Gears			Number of boats			No. of Fishermen employed		
				KB	KT	Total	KB	KT	Total	KB	KT	Total
Catamaran Lift net	86	length: 40m Depth: 25 -35m.	Both	06 40	11 86	126	20	140	160	280	516	796
Planked Ring net	12	length: 35- 40m Depth: 25 -50m.	Both	0	7	07	20	28	48	60	84	144
Planked Gill net abnormal	20	length: 1000 - 3000m Depth: 25 -30m	Both	0	20	20	0	40	40	0	60	60
Appolo Appolo lift net	75	length: 30-40m Depth: 25 -50m.	Both	70	0	70	34	0	34	490	0	490
Gill net normal-passive	NA	length: 80-100m Depth: 1-1.5	Larger	30	20	50	60		60	60	0	60
Hooks-Passive	NA	30 -50 hooks/fisher	Larger	100	15	15		13	13	200	30	30
Total	193			125	128	243	134	221	355	930	690	970

NA= Non-motorised gear; KB= Kabonga landing site in Burundi, KT=Kagunga Landing site in Tanzania

The statistics show that in this study, numbers of fishers have increased in both landing sites over these eight seven years (168 in 2011 to 930 fishers in 2018 for KB; 111 in 2011 to 690 fishers in 2018 for KT). Noncompliance was observed and reported by fishers involved in the study in both sites. The nonconformity includes immature fishing and illegal modification of gears, as well as prohibited measurements, mesh sizes, fishing times and areas. For instance, ring nets are illegal in shallow water in the Fisheries regulations of both countries. Their operation is only allowed in deep waters in both countries at night hours, but this stipulation is not adhered to. Operation is illegal when done in shallow or even breeding areas for pelagic species, where it collects fry and juveniles of *Luciolates* and sardine, which leads to the decline of fish stock. However, fishers in both Kabonga and Kagunga were reported and observed to be using such nets any time as long as there is fish to fish (personal communication, 2017).

1.2 Economic contribution and social implications of the fishing activity

The lake basin provides about 12.5 million people with food, drinking water, and a transportation corridor. Many more millions of people residing within the wider trading orbit of the Tanganyika basin benefit from its resources as consumers of fishery products. Fishing activities in the study area are benefiting more than 35 000 of the population, both directly and indirectly.

In the study area, there were more than 1 620 fishermen who are directly employed under fishery (Report from Fisheries Extension officers working in the study area). About 85 percent of 54 respondents are fishers who are earning about 26-50 percent of the earnings that is divided to the number of fishers, and the remaining is for owners, i.e. 15 percent. However, the sustainability of this lake, its resources and the attendant business are at the limit, due to the increases of illegal fishing and population in the basin.

Most fishers are occupied full-time, except when there is fish scarcity. Out of 54 fishermen, only eight were not full-time fishers. The activities are not done on a daily basis, and other livelihood activities performed by the respondents from May to July were transport and retail business. Only 12 and eight percent from Kabonga and Kagunga respectively mention participating in agriculture activities. They confirmed that it is not easy for fishermen to change to different activities. Those who can readily change are owners. In both sites, six species were mentioned to greatly contribute food and income to individuals, households and local governments, among which clupeids contributed about 80 percent of the catch followed by *Luciolates*. Other species consumed locally are Lake Tanganyika Sardine Tanganyika Lates, Giant cichlid and *Limnotilpia.* The findings are close to those of the study conducted in Kigoma, which is about 60km south of the study area under analysis. The work in Kigoma indicated that 70 percent and 25 percent of the catch was *Luciolates* and Luciolates (Kimerei, 2006). The catch, particularly sardine *Stollostrissa*, is traded within the sites and in nearby cities like Burumbura and Kigoma. They are also traded in Eastern D.R.Congo and other international markets such as Canada and Belgium (LTA, 2017). Other species such as *Lates*, Giant clupeid, and *Limnotilapia* are caught in littoral waters and are commonly sold at the local markets for household consumption.

<u>Conflict and conflict resolution in open access fishery</u>

The existence of conflicts was investigated using FAO questionnaires, but there was no conflict between fisheries and other livelihood sectors in the two sites. The only conflicts pointed out were due to resource competition at the fishing ground between fishers who operated different gears and targeted the same fishing ground/species. It was reported, however, that local fisheries institutions of Burundi and Tanzania respectively would resolve such antagonisms whenever they arise. It was reported that leaders of these institutions could solve almost 90 percent of the antipathy. If parties failed to settle their confrontation, they appeal to the higher governments authorities in their respective areas.

In the study area at KT, a misunderstanding of resource competition among fishers with different gears was mentioned. A good example was the relationship between fishers who are using lift nets, those who use modified gill nets, and those who use ring nets. It was reported that fishers that are modified gill net and lift net operators did not like each other because they fished the same species (*Luciolates* and Sardine *Stollostrissa*) at the same fishing ground (pelagic).

The gill net was reported to have four problems. First, it occupies a large volume of space (1 000-4 000 meters long, 25-30 meters deep) compared to a lift net, which has a circumference of 24 meters with a depth of 25 - 40 meters toward the cord end. Second, during fishing operation, gill nets drift toward the area where the lift net is set, provoking lift net owners. It was reported that proximity of nets during the hauling caused nets of different fleets to interweave, sparking blame games between the groups. The current modified gill net drifts dredging hauling toward the area where lift nets are

set for fishing. Sometimes unravelling of the tangled nets took lots of time, and pieces must be cut and then left in the water. This damages fishing gears wastes time and loses catch.

The third problem is that the modified gill net is suspected of collectingten fish that are intended to be hauled by the lift net fishers. Out of the 54 fishers interviewed in each site, those who have supported the occurrence of this antagonism rated at 87 percent at Kabonga and 93 percent at Kagunga. Fourthly, it was mentioned that modified active abnormal gill nets actually destroy fish; they have an unacceptable ply net that catches massive amounts of sardine fry of *Stollothrissa tanganincat,* as well as *Luciolates* juvenile and other species. Based on the misunderstandings, it was suggested that a timetable be made for different fishing operators by governmental officials.

It was learned that KB closes its fishing season for about ten days in each month during the full moon to comply with its national regulation of closing fishing season and landing site. At the same time, KT does not practice this measure. The disgust was that fishers in KB felt their reserves were being harvested by their neighbours. Additionally, there was a feeling among those implementing closure season felt their neighbours were getting more money as they starved during the closure. The ten days closure concerning growth parameters of the intended species might not bring positive results; therefore, a research profile might be helpful to suggest the period of closure in the future plan.

2. MANAGEMENT OF THE FISHERY AND OPEN ACCESS

2.1 Management of the fishery

Fishery in this study area is transboundary and multinational with a single unified convention on the Sustainable Management of Lake Tanganyika Article 2(a) and 7(1,2). This convention insists on the cooperation of the Contracting States in planning and managing activities that negatively affect a Contracting State and are under its jurisdiction. The states also shall promote broad participation in fisheries management and co-operate to promote sustainable fisheries management on Lake Tanganyika. They shall also take, as a matter of priority, appropriate measures to prevent and reduce as far as possible adverse impacts from fishing activities under their jurisdiction or control. It is through this that fishers are directly involved in fisheries management.

The case study illustrates how the ability of the fishing institutions to be proactive depends chiefly upon training and working facilities support from the government. In this case, KB was found to be more active than KT. It was mentioned that members of the fishing community who lack alternative livelihoods more easily violate fisheries regulatory measures toward resources. Therefore, the cross-collaboration in terms of capacity building, conduct research based on the prevailing needs, awareness-raising to change the defaulters' behaviour and support small economical intervention that they can deal with during closure seasons.

The responsibility for managing the fishery resources resides with government member states, fisher communities sharing the lake, and other stakeholders. The government recently agreed to promote community participation through fisher officials, registered groups and Fisheries federations in Tanzania and Burundi respectively. In Burundi, the fisheries federation is strong compared to other states, due to empowerment from the government. They conduct patrol in confiscating illegal gears, and thereafter they submit the gears to be destroyed by government officials. Government has empowered them to collect some fees from defaulters who used to fuel patrol boats, though these penalties are low and insufficient. Fishermen and other stakeholders in the study areas are organized and registered locally known as Fish Federation and Beach Management Unit for Burundi and Tanzania, respectively.

The management system used for fishery resources is a combination of government management and co-management. However, National fisheries policy and regulations of all riparian states emphasize

community involvement, but still, the top-down management exists. Nevertheless, the degree of involving fisher communities increased more than ten years ago to both sides (LTA, 2018). In these two landing sites, the effectiveness of community involvement and direct communication with the government is higher in KB than KT. Such an example is when fishermen advised government to burn the modified Active abnormal Gill net (fremay brush- kamatia chini') nets in KB. The government, in collaboration with fishermen, took action to burn the gear.

Input into management:
In this management system of these study areas, individual fishers, authorities staff, fisher associations, and NGOs who are stakeholders all propose opinions, which are finally embraced by the government and thereafter at regional level (LTA, 2012a). Therefore, national regulations on the study area provide a platform where all fisheries/stakeholders such as fishers, fisher groups, regional fisheries management organisations (RFMOs), and fisher communities are called by their government to get involved in rule setting that governed this resources. For example, the suggestion of burning modified active abnormal gillnets 'fremaya-brush kamatia chini' in Burundi.

Management measures:
Management measures are undertaken by individual country while waiting on the approval of the Frameworks Fisheries Management Plan. Regulations, implemented at a low level, were found to be means of collecting government revenue, rather than impactful management tools. These include restricting fishing gear (e.g. mesh size restrictions), closed areas (e.g. 50m from shoreline), lunar break observations, and licensing. Other measures, which have been mentioned, are closure season, control, surveillance and enforcement (e.g. burning illegal gears such as modified gillnets).

The rare application of the measures was seen to be caused by a combination of factors. These included open-access nature of the fisheries, a shortage of manpower, a lack of surveillance facilities due to financial constraints, logistical constraints, a lack of awareness by the fisheries communities, and an inadequacy in the dissemination of relevant information.

Monitoring and enforcement:
Generally, enforcement is engineered by government entities with the involvement of fisher local communities, such as the Fisheries Federation for Burundi and Beach Management Unit for Tanzania. Strong involvement of the local and central government authorities was mentioned to be a success; RFMO is playing a key role of harmonizing fisheries policy and regulations, disseminating proper information related and promoting proper fisheries management to rescue transboundary resources for sustainable regional livelihoods. It was found that on one site enforcement measures can be somewhat effective, but on another site, there were a number of challenges, including lack of patrol boats. One strength noticed in KB sites is that if there is a strong involvement of other sectors. At both sites, there were claims of inadequate and lack of surveillance facilities and funds.

Using the FAO questionnaire, the most hazardous events mentioned by respondents included storms and piracy. Both led to the bankruptcy of fishers, thereby removing them from fishing activities or forcing them to resort to cheaper illegal gears to survive. It was reported that piracy would occur at night, where their gears would be taken, and some of them would be drowned.

3. CONTRIBUTION OF THE OPEN ACCESS APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

Among other challenges, one is the undefined suitable mesh size to be used in the fishery, to minimize pressure on exploiting immature sardine and *Luciolates spp*. Using indigenous knowledge and other research findings, it was recognized that immature *Luciolates spp* was 160 mm in length. From this point of view, together with the occurrence of Stollothrssa juveniles (Kimerei, 2016), changes were

noticed. Additional change was observed and reported in catch composition during our study, whereby ten percent of sardine *Stollothrissa* against 90 percent of juveniles of *Luciolates* has increased from that which is reported. The abundance of Clupeids, which have a short-term breeding circle, has remained unchanged. Likewise, rest of species like Lake Tanganyika *Lates*, Giant Cichlid, *limnolitapia* spp have decreased in size and catch. This is probably due to bad fishing practices in onshore waters.

The modified and active abnormal gill net, which is illegal at shallow water, is greatly impacting fishery stock biologically, with its unacceptable length, mesh size and active fishing operation of cruising. This is because such nets have heavily caught immature fish, and they interrupt the growth of the fish. With lift nets, mesh size is also causing the same impact. Ring net operation at a shallow fishing ground as well as its mesh size both lead to biological impact and hence destroy fisheries' biodiversity by blocking fish recruitment systems; this may lead to the total collapse of the fishery. These effects are brought by countries' slow decision-making to harmonizing management frameworks, and also by a lack of alternative livelihoods. During the concluding meeting with interviewers at the study area, they reported not to be happy with the situation of ending up with immature fish and let the government harmonize the regulation regarding the destructive fishing practices (Mr Chubwa and Eliasa- BMU leaders of KB and KT).

3.2 Economic viability of the resource

Generally, fishing efforts have increased six-fold in Kabonga and Kagunga landing sites. There were 930 fishers in KB and 690 fishers in KT, compared to that of 2011, where there were 186 and 111 respectively. An increase of immature fish due to the increase of gears and fishers has reduced economic value within the fish chain. This also contributes to a weakening of food security in the area. The losses are demonstrated in the tables below:

Table 3. Value of one box of fresh immature Lates stappersii (Luciolates) compared to mature fish from the same box (BIF = Burundi Franc; Tsh = Tanzanian Shilling).

Species	No if individual fish/ per box	Value /portion/BF	Total value per box (Assume one box contains 50 portions
		BIF/Tsh	
Luciolates, immature	126 x 50 portions = 6300	1000/126 pieces	50 portions x 1000 = 50 000 BF
Luciolates, at maturity/adult	250 pcs/box 6300 =25 boxes	3000/7pieces	(25boxesx250)/7pcs
			=892x3000=2.6M
		Loss by selling immature	-2.55 BF millions

Table 4. Social loss of immature catch versus mature catch among Luciolates species.

Average fish consumption rate in LTA states is between 2 to 10 kg/prs/year			
Species	No if individual fish/ portion	Required pieces to attain 10/kg	No.People benefitting from one box
Luciolates - immature	126pcs –1kg	1260 piece of fish	5 people
Luciolates - at maturity/adult 1 box – 6300fish/ 7– 900kg	7pc = 1kg	70 piece of fish	90 people
		Social Loss by selling Immature	8 persons

Because of these realities, selling immature fish brought about poverty to the community and blocked increasing fish consumption rates. Furthermore, it reduces government revenue, as well as social services that could be supported by the government. Economically immature fishing at the open-access transboundary fish with unharmonised regulatory frameworks is not viable. It also runs contrary to the aim of promoting food security in the region.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

There are several important challenges to confront in the study areas:

- Unharmonized fishery regulatory measures and standards amongst member states.
- Low compliance rates with fisheries laws and regulations, and inadequate enforcement of these leads to a prevalence of immature fishing and marketing in the study areas.
- Ineffective involvement of all stakeholders in the fisheries management process.
- Conflict between fishers due to resource competition.
- Limited scientific findings, as well as other sources of knowledge to provide sound data that can be used for decision-making in the management plan. Among the reasons for this are a shortage of manpower, financial constraints, and lack of awareness by the fisheries.
- Changing gears consistently in order to catch pelagic fish leads to a loss of pelagic and littoral. fisheries resources, as well as a reduction of fish, and social/economy impacts.
- A loss of aquatic biodiversity and ecosystem services, and habitat degradation.
- Lack of alternative activities for fishers.
- Population increase.

4.2 Improving fishery sustainability in the future

Sustainable use of the fisheries resources depends much on evidence from well-collected data. This can inform proper decision-making on management measures, regulation amendment, and government/community commitment to enforcing regulations. This is especially important since every day fishers seek to deviate from the regulations.

In order to increase the fishery's sustainability, economic viability and social equitability, the following is therefore suggested:

- Harmonize regulatory frameworks (e.g. control immature fish, closures (both spatial and temporal), minimum mesh sizes and size limits) on minimum legal lengths that our collaborators LVFO are implementing.
- Immediate meetings involving fishermen, women fishmongers, youth and technical government fisheries officials are highly required to agree and propose administration and management rules, so as to rescue fishery stock as well as to improve the economic wellbeing and food security of the fishery community and the larger region.
- Conduct training and awareness campaigns against illegal practices and abolish immature fish marketing.
- FAO and other fisheries practitioners are invited to support LTA riparian states with interventions to support fishery attainment of SDGs:
    a) Conduct research on suitable mesh size of commercially exploited species in order to suggest the appropriate mesh size for use in the fishery (TAFIR, 2006).
    b) Urgently conduct a study on the economic loss from the immature fish, to show how many resources are wasted from individual perspectives, and the region/nation as a whole. This will show how negatively fish per capita consumption is reduced, which is currently is 2 kg and 9 kg/prs/year for Burundi and Tanzania.
    c) Approval of LTA aquaculture protocol that shall support the creation of alternative activities in fisheries during the closure system, through the promotion of environmentally friendly cage culture.
    d) Conduct a socio-economic study on the importance and contribution of the fishery resources of the lake to community livelihoods.

e) Establish legal slot size of the *Luciolates spp* so at to rescue its stock; currently, there is none and when people are caught some politician is using it as an excuse for people to continue to trade the immature fish.
f) Support fishmonger women with savings schemes and communal cage culture.
g) Research the months which fish-breeding and member states should institute closing seasons, as per researchers' advice.

- Diminish immature/juvenile fishing through developing sensitization programs for the population. These would illustrate the negative impact of buying immature fish on future economic viability in order to change behaviour.
- Develop an immediate intervention that restricts the sale of juvenile fish, like seizure and destruction of all juvenile pelagic fish landed or the prohibition of transportation and local or domestic sale.

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A review of lobster fishery management in Kenya: a case study on the development of the rights–based fisheries management system (co-management)

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Abstract
This review uses the lobster fishery in Kenya as a case study for the development of a rights-based fisheries management system. It discusses the fishery's characteristics, production trends, management systems, socio-economic dynamics, input and output controls, and challenges and opportunities. The paper highlights the achievements of co-management and recommends measures necessary to achieve effective management of the fishery. The lobster fishery is one of the most important resources in Kenya. The fishery is based on five spiny lobster species: *Panulirusornatus* (ornate spiny lobster)*, P. longipes (*long-legged spiny lobster)*, P. penicillatus (*pronghorn spiny lobster)*, P. versicolor (*painted spiny lobster)*, P. homarus (*scalloped spiny lobster)*.* Small-scale fishers harvest lobsters along the entire Kenyan coastline. Average annual landing in 2009-2013 was estimated at 84 metric tons (mt). In 2016, 389 mt was landed. Fishers employ different gears to catch lobsters. Communities have practised lobster fishing for centuries under traditional systems of lobster fishery management. Collaborative fisheries management was introduced in 2006 with the establishment of Beach Management Units (BMUs). BMUs have legitimate jurisdiction over their fisheries, access, user and management rights. The management of the fishery is by limitation on fishing gears, sizes (weight) landed, protection of breeding stock, and authorized entry. Market-based tools (Marine Stewardship Council certification) and spatial management (co-management areas) are being pursued. Harvest control rules and strategy have been proposed in the draft lobster management plan. A well-defined use, access, management and ownership rights system that is complemented by biological controls and technological interventions can help drive the fishery to sustainability, and improve socio-economic returns.

Keywords: Lobster, management, rights-based, Coast, Kenya

1. INTRODUCTION

1.1 Description of the fishery

Kenya has a coastline of over 640 kilometres (km) and 880 km including inlets and bays (Ministry of Agriculture, Livestock and Fisheries, 2016), extending from Somalia to the North and Tanzania to the South. The country has an expansive Exclusive Economic Zone (EEZ) of 200 nautical miles. Kenya has vast and diverse coastal and marine ecosystems, including estuarine, seagrass beds, coral reefs, nearshore and offshore waters. These ecosystems provide important habitats, breeding and feeding grounds for marine life, including fisheries resources (Government of Kenya, 2017).

Fishing is one of the most important economic activities for local communities on the Kenyan coast. Fisheries are important sources of local income, food and nutritional security. The lobster fishery is one of the most important crustacean fisheries resources in Kenya. The fishery is multi-species with harvesting activities confined within the coastal areas less than 3 nautical miles from shore. The spiny lobster is the most valuable one, although the lobster fishery in Kenya is based on five shallow water spiny lobster species, namely, *Panulirus ornatus, P. longipes, P. penicillatus, P. versicolor, P. homarus* (Mueni et al., 2016). Over 75 percent of the lobster landings in Kenya is comprised of two species, *P.*

ornatus and P. longipes. P. homarus is also abundant, especially on the North Coast. Other spiny lobsters include *P. versicolor, P. penicillatus*, though their catches are extremely low.

Lamu Archipelago, Kipini-Kiwaiyu Islands, and the Mambrui, Kilifi, Msambweni and Shimoni areas are highly productive lobster fishing grounds. Lamu-Manda-Pate Archipelago accounts for about 50 percent of all the lobster landings in Kenya (Mutagyera, 1978; Church & Obura, 2003). These high catches are attributed to the wide continental shelf with a large cover of shallow reefs. The harvesting of lobster is done throughout the year, and peak season is reported in the months of November to March. This coincides with the North-East Monsoon (NEM) winds (McClanahan, 1998).

Fishing for lobster in Kenya by the coastal communities has been a practice for centuries, with commercial exploitation reported only in the 1950s. The growth of the tourism industry in Kenya and the demand for lobster on the international market have been the key drivers behind the commercial exploitation of the lobster fishery. Lobster is one of the most pricey and highly valued seafood products, both on the domestic and export markets (Olendo & Weru, 2009). The catches for lobster, including the size, are declining. This can be attributed to increasing fishing efforts and changing environment and recruitment cycles (Church & Obura, 2003). The use of illegal fishing gears such as Beach seine ("juya") is also on the increase, consequently contributing to increased fishing pressure.

The number of artisanal fishers, including those targeting lobster, has gradually increased over the years. There are 13 426 artisanal fishers at the Kenyan coast, of which 98 percent are male, and only 2 percent are female (Ministry of Agriculture, Livestock and Fisheries, 2016). The Marine Frame Survey Report (2014) gives an estimate of 690 lobster fishers along the Kenyan Coastline. Lamu County has the highest number of lobster fishers with 511, which represents 74 percent of the total. Other counties are Kilifi (119, 17%), Kwale (29, 4%), Tana River (24, 4%) and Mombasa (7, 1%).

Most of the fishers are from the local coastal communities, and they have a right to access the fishery by paying for a fishing permit. This is obtained at the Kenya Fisheries Service for a modest fee. Individuals, owners of fishing boats, family members of fisherfolk, fish processors and/or fish buyers - as well as local fishing communities once granted permit - carry legally recognized rights to access the lobster fishery without any prejudice. There are 197 fish landing sites at the coast, of which 175 are served by the Kenya Fisheries Staff (Ministry of Agriculture, Livestock and Fisheries, 2016). Lobster fishers land their catch at designated landing sites in their respective Beach Management Units (BMU) sites.

Conflicts over fishing grounds by different players in the same space usually arise. Sometimes, artisanal fishers complain of their fishing gears being destroyed by semi-industrial (prawn trawlers) and deep-water fishers. Conservationists accuse fishers and tourists (that snorkel) of breaking and destroying coral reefs. Artisanal fishers, on the other hand, usually come into conflict with the marine park management authorities for illegal fishing in marine protected areas. Large-scale infrastructural development, such as the Lamu Port, is also a source of conflict. Recently, artisanal fishers sued the government of Kenya over compensation for the loss of their fishing grounds, which occurred due to the construction of the Lamu Port (Kenya Business Daily, 2 May 2018). Oils spills have also been reported, causing the death of mangroves and the degradation of fishing grounds.

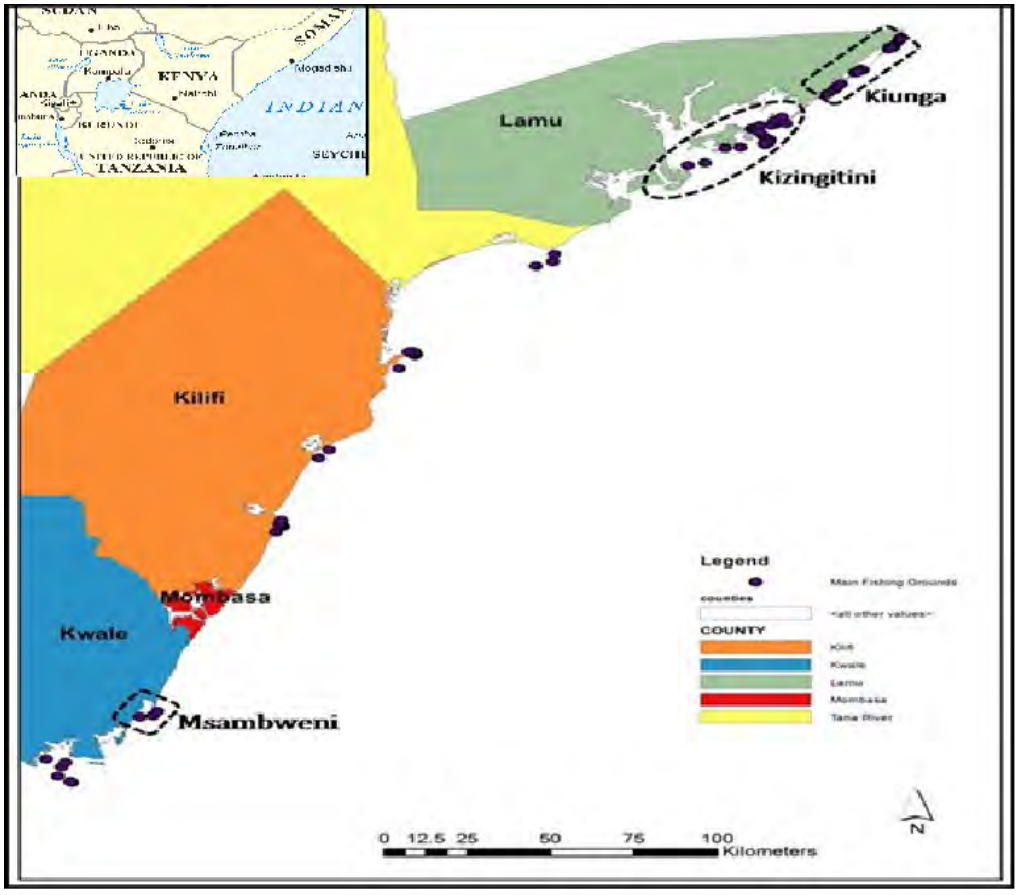

Figure 1. Lobster Fishing Grounds in Kenya.
Source: https://www.un.org/Depts/Cartographic/english/htmain.htm, Mueni et al., 2014. Stock assessment of Kenya commercial spiny lobster species (Panulirus spp., Palinuridae) Kenya. Technical Report NEPAD Project 2014.

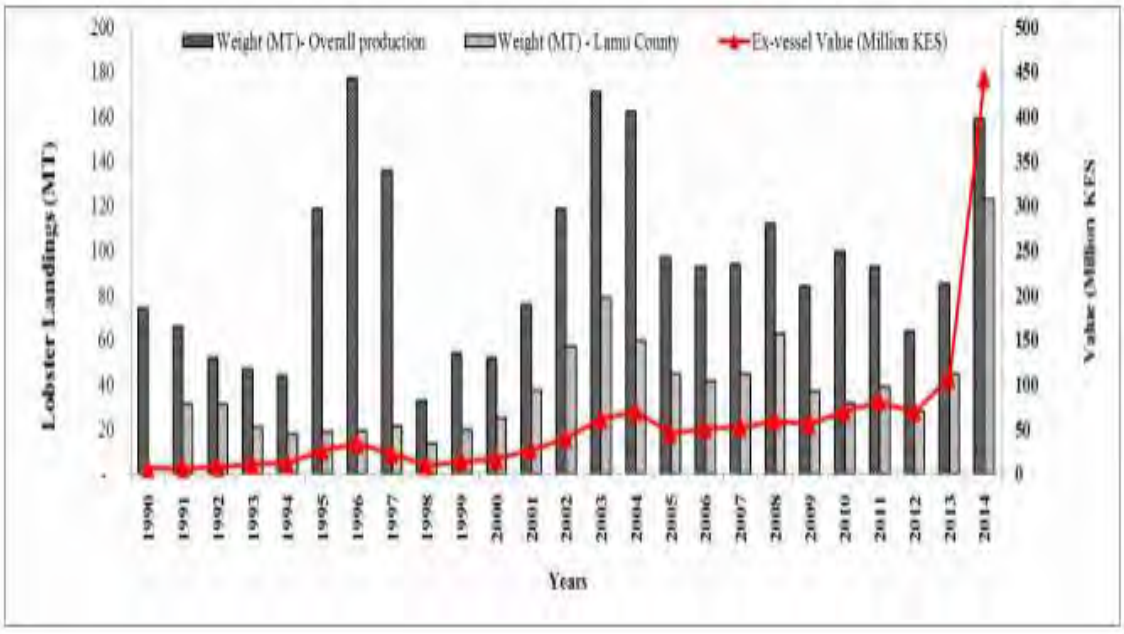

Figure 2. National and Lamu County Lobster fishery production trends and value between 1990 and 2014.
Source: Mueni et al., 2016.

1.2 Economic contribution and social implications of the fishing activity

The lobster fishery is an important source of livelihood and income for the local fishing communities, as well as a source of revenue and foreign exchange to the country. There are approximately 639 individual lobster fishers, all of whom are men (Frame Survey Report, 2014). Lobster fishing, on average, contributes to 26-50 percent of the fisher's total income. Lobster fishing is seasonal - depending on the monsoon season - with peak season ranging from November to March. During the low season, fishers engage themselves other non-fishing livelihoods such as transport, tourism, farming, forestry, and fishery-related services such as boat and net repairs.

Lobster fishery products in Kenya are sold as whole, live animals or frozen to domestic and export markets. Lobster catches are mainly sold through dealers who then transport to local hotels or the export market. The domestic market is becoming increasingly popular. Lobster is on the menu of high-end hotels in Nairobi and Mombasa, namely the Tamarind Group, Nyali Beach Hotel, and Hotel White Sands. The demand for lobster is high during the high tourist season. The average price offered by the hotels to the suppliers is 1 200 Kenyan shilling (Ksh.) per kilogram (kg) of lobster.

Most lobster from Kenya to the export market is in frozen form, though many dealers and processors are also involved in the export of live lobsters. There is a general decline in the amount of lobster exported, in particular, frozen lobster. The European Union is the main export market with 97 percent, with Italy, in particular, importing a lot. Ninty-five percent of the live lobsters are exported to China. There are three lobster processing and exporting companies in Kenya, all of which are based in Mombasa. Crustacean Processors is the leading exporter, accounting for 73 percent of the exports. The other two companies are Trans Africa and Sea Harvest.

The lobster price per kg varies depending on the size, season and the prevailing fluctuations in supply and demand. In some cases, the trader, who has financed the fishing operations, determines the price. In this situation, the traders are assured of a steady supply of lobster at a determined price. Prices for lobster are usually high during the low fishing and high tourist seasons. The price ranges from Ksh 500 to Ksh 1 500 per kg. Lobster exports increased from 38 mt valued at Ksh 33 Million in 2001. In 2004, some 208 Mt of lobster valued at Ksh 141 Million was exported. In 2016, an estimated 79 mt of lobster valued at Ksh 78 Million was exported (Ministry of Agriculture, Livestock and Fisheries, 2016).

Figure 3. Trends in Lobster Exports 2001-2015.

Source: Kenya Fisheries Annual Statistical Bulletin, 2016.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

The management of fisheries resources in Kenya is under the jurisdiction of the Kenya Fisheries Service (KeFS), as provided for in the Fisheries Management and Development Act 2016. The Kenya Marine and Fisheries Research Institute (KMFRI) established under the Science and Technology Act (CAP 250) has the mandate for fisheries research. In the marine reserves, including the Kiunga National Marine Reserve (KMNR), fishing is regulated by the Kenya Wildlife Services (KWS) in close collaboration with the Kenya Fisheries Service and the County Governments. The Kenya Wildlife Conservation and Management Act (2013) prohibits any form of fishing in the Marine Protected Areas (MPAs) while allowing controlled fishing in marine reserves with the active involvement of the local communities. The County Governments, the local fishing communities, Beach Management Units (BMUs), the industry, the Civil Society Organizations (CSOs), Universities and Non-Governmental Organizations (NGOs) are also involved in the formulation of rules and implementation of fisheries management measures.

The Fisheries Management and Development Act 2016 makes provisions for fisheries management measures, including prohibitions on the catching of berried females, fishing gear restrictions (use of beach seines, speargun, scuba gear), and minimum size and maturity restrictions (e.g. landing of lobster of less than 250 grams (gm) is outlawed). Trawling activities are restricted in the five nautical miles and beyond; this may as well apply to lobster fishing. The role and active involvement of local communities in the management of fisheries resources, including lobster, is provided for in the Act. Compliance is achieved voluntarily through the implementation of BMU internal rules (by-laws).

This is part of the co-management strategy, though its implementation is faced with a number of challenges, including inadequate enforcement mechanisms. Currently, there are over 80 BMUs established in the Coast Region. Fifteen co-management areas (CMAs) have been established, though at varying stages. Three joint co-management areas have been set up, too, namely the Pate Island in Lamu County, the Malindi–Ungwana Bay (covering part of Kilifi Tana-River and Lamu Counties) and the Shimoni-Vanga in Kwale County. The Kenya Fisheries Service licenses access to the fisheries resources. The BMUs and County Government are responsible for vetting those applying for a fishing license. Fishing without a license is illegal, and anyone found infringing on these provisions is reprimanded and charged in a court of law.

The Kenya Fisheries Service, in partnership with other key stakeholders, the industry and the local fishing communities, has developed a comprehensive lobster fishery management plan. The plan which is yet to be gazetted provides for the introduction of closed areas/seasons, harvest control rules and strategy, limiting of fishing effort through licensing of lobster fishers, and setting of Total Allowable Catch (TAC) and size restrictions (Caparace length (CL)). This is in addition to weight restrictions that are to be adjusted upwards from 250 to 300 grams. The Lobster management plan provides for prohibition of retention and landing of lobsters of the minimum carapace (MCL) of 70 millimetres (mm) CL for *P. ornatus*; 65 mm CL for *P. versicolor, P. homarus* and *P. penicilatus;* and 60 mm for *P. longipes*.

The Kenya Fisheries Service, in partnership with other agencies including KWS, county governments and local fishing communities, is responsible for the enforcement and monitoring of lobster fishing activities. However, there is limited capacity, especially on the part of the BMUs. As part of the Monitoring and enforcement of the fisheries law, a vessel has to be cleared by a relevant national entity before it is licensed for any fishing operations. There are also surveillance and patrol vessels, while the relevant government staff and BMUs undertake land-based beach patrols. The Kenya Navy and the recently created Kenya Coast Guard Service have pushed a notch higher towards enforcement of the fisheries law. There is catch monitoring at the different landing sites, although some fishers

have been reported to avoid the designated landing sites in order to perpetrate illegal activities elsewhere. Post landing monitoring focuses on market and sales, exports, and roadblocks on transport/ transit routes.

Failure to comply with the relevant provisions for lobster fishing usually result in the arrest of the offender, who is charged in a court of law. The fishing vessel and/or equipment are confiscated, criminal charges are preferred, and the offender is required to pay a fine and or serve a prison sentence. Resource use conflicts usually arise from time to time. This is because there are competing interests over the use of the same space by different maritime sector players. There are various conflict resolution mechanisms in place whenever they arise, namely the legal redress in a court of law, as well as local administration (Chiefs, Sub-chiefs and village elders) and the Beach Management Units (BMUs). Lead government agencies in the different sector including fisheries officers, park management authorities and the county governments would always intervene, whenever there is a conflict between the different players in the lobster fishing grounds. To some extent, these mechanisms have been moderately effective but more needs to be done to strengthen them. More powers, for instance, should be given to the BMU leadership to reprimand offenders and be actively involved in the prosecution. Customary mechanisms seem to work very well, and they need to be embraced and strengthened in order to complement the court and judicial process.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

Kenya is endowed with rich marine resources, including fisheries. Previous studies have estimated that the potential Kenya marine fisheries resources are in the range of 150 000 – 300 000 mt per year. There is limited knowledge about the status of stocks in Kenya marine waters, including lobster fisheries. The KeFS with the support of WWF and collaboration from other partners, including KMFRI, developed and initiated the lobster fishery improvement project (FIPs) as part of the Marine Stewardship Council (MSC) standards certification. The implementation of the lobster FIP, which has been ongoing since 2012, has seen the fishery moving towards sustainability. In June 2018, the application of the Marine Stewardship Council (MSC) Benchmarking and Tracking (BMT) tool gave a score of 0.89 out of the possible 1. This is a remarkable improvement to the fishery, compared to its 0.54 index in 2014. Plans are underway to subject the lobster fishery to full assessment.

The lobster stock assessment was undertaken in 2016 by KMFRI in collaboration with KeFS, WWF, Pwani University and other partners. The assessment was supported by the Kenya Coast Development Project (KCDP) with funding from the World Bank. The results from the current stock assessment indicate that the Kenya lobster fishery is not overexploited as previously thought (Mueni et al., 2016). In Lamu, for instance, *P. ornatus* was the most abundant species contributing 55% of the catch sampled. This was closely followed by P.longipes, which accounted for 26% of the catch composition. *P. homarus* contributed 13%, while *P. vesicolor* and *P. pencillatus* contributed 4% and 2% respectively. *P. ornatus and P. longipes* combined accounted for over 81% of the lobsters catches.

The legal size for the lobster to be landed is 250 gm and above. The study revealed that based on length at first capture and length at first maturity, most of the species attain maturity at sizes above the Minimum Legal Weight (MLW) of 250 gm. This implies that juveniles of *P. ornatus, P. penicillatus* and *P. homarus* are still being captured with the exception of *P. longipes,* which matures below the MLW. Further study is yet required.

The information and data generated by the lobster FIP and stock assessment have been used to inform the development of the lobster fishery management plan. The plan proposes the management of the lobster fishery based on limiting fishing effort by licensing fishers, introduces closed season, ‘no-take zones’ as well as total allowable catch (TAC). The plan though, is not yet gazetted. The co-management

areas have been established, at Pate Island (Lamu), Malindi-Ungwana Bay (Kilifi –Tana River) and the Shimoni-Vanga (Kwale). There are several co-management areas managed by the Beach Management Units (BMUs) where the no-take zones have been established. The zones are important breeding and foraging grounds for different marine life, including the lobster fishery.

3.2 Economic viability of the fishery

The number of artisanal fishers, including those targeting lobster, has gradually increased over the years. There are 13 426 artisanal fishers on the Kenyan coast (Ministry of Agriculture, Livestock and Fisheries, 2016). The Marine Frame Survey Report (2014) gives an estimate of 690 lobster fishers along the Kenyan Coastline. The lobster fishery is experiencing declining catches. Fishers targeting lobster must now venture further offshore. Hence the distance travelled has increased to reach fishing grounds. The duration for an average fishing trip for lobster has also increased. This has driven upward the cost of lobster over time.

The introduction of co-management in the artisanal fishery has resulted in changes in the type of gears used in the lobster fishery. The use of the speargun was outlawed, and the number of fishers using this gear illegally has reduced. The use of gillnets to catch lobster is on the increase, too. More fishers are now using vessels with outboard engines, however, the average length and gross tonnage of the fishing crafts have remained unchanged. Lobster fishers do not use Fish Aggregating Devices (FADs) in their fishing operations.

Vessels are owned by individuals who sometimes lease out to fishers. In many cases, artisanal fishing is a mutual partnership that brings together the owner of the boat, owner of fishing gear and the fishing crew. The proceeds from the fishing operations are shared based on the agreed proportions amongst these three individuals/ categories of the partnership after every fishing trip.

3.3 Social equality

Fishing rights are owned by individuals who have access by paying a fishing permit. The fishing permit is issued by the Kenya Fisheries Service to the individual fisher. The cost of the permit is Ksh 200 (equivalent to USD 2) per annum; once purchased, it is not transferable. Over the years, there haven't been changed in the legal requirements and cost of the fishing permit. However, the lobster fisheries management plan (once gazetted) will oversee the introduction of fishing permits specifically for fishers targeting lobster. The allocation of fishing rights for lobster and other artisanal marine fisheries via permit takes into consideration the ability of the poor and vulnerable communities to access their basic livelihoods needs, in particular food and nutritional security. The economic viability of the fishery, stock sustainability and the rights of the local communities are also important criteria for distributing fishing opportunities in the artisanal fishery.

In the event of an emergency such as a hazardous event, it is not possible to identify individual lobster fishers in order to deliver targeted support or reallocate fishing rights. As earlier mentioned in the previous section, there are no fishery-specific fishing permits.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

The lobster fishery in Kenya is faced with a number of challenges and constraints relating to governance, production, processing and marketing:

- Many of the lobster fishers do not have their own fishing equipment and capital to venture into lobster fishing. Some of the dealers and fish processing plants provide credit, nets and fishing gears to lobster fishers through their agents. Therefore, they play a big role in determining the prices at the landing sites and collections points. This erodes the power of

the individual lobster fishers to negotiate for their fair share, whilst also constraining their growth in the subsector.

- Most of the fish processors and lobster dealers complain of high transport and freight charges. Subsequently, this requires higher amounts of working capital. This has resulted in a shift where some lobster processing and exporting companies are now targeting the domestic market. They supply their products to hotels when supplies are low.

- The results of the Frame Survey Report (2008) show that there were some 12 077 marine artisanal fishers in 2008, up from 7 500 in 1990. The Frame Survey Report (2016) shows the number of artisanal fishers increased to over 13 000. Olendo and Weru (2009) reported that there were over 5 000 fishermen in Lamu, with approximately 50 percent of them fishing in the Kiunga Marine National Reserve. Consequently, this has put undue pressure on the lobster stock, which is now on the decline. The lobster fishers have to invest more in terms of fishing efforts and have to fish in more distant places, compared to previous years.

- Shrimp trawlers catch significant amounts of lobster as by-catch. The exact quantities of the lobster caught are not known due to non-submission of catch data by these vessels. The volume and value of the lobster supplied to the domestic market is not clearly defined. This is because there is no comprehensive data collection system targeting the local market, in particular, the hotels and restaurants.

- Artisanal fishers, as well as the key players in the domestic market, acknowledge that there is a great potential for marketing their catch to larger national and international markets. However, the high sanitary and phytosanitary (SPS) measures and strict standards imposed by the EU present challenges. There are also other marketing constraints, including inadequate cold storage facilities along the supply chain, poor road infrastructure, and seasonality of the lobster landings.

- The EU illegal, unregulated and unrecorded fishing (IUU) regulation came into effect on 1 January 2010 to prevent IUU products from being sold on the EU market. Compliance with the EU regulations has some cost implication to the government and to the fish processing and exporting establishments.

- The Kenya Fisheries Service (the then Fisheries Department), with the support of other partners including WWF, Cordio-East Africa, NEPAD, local fishing communities and the industry, initiated the process of formulating the lobster fishery management plan in 2009. The plan is yet to be gazetted by the Kenya Government.

4.2 Improving fishery sustainability in the future

The contribution of the lobster fishery to the national economy and livelihoods of the local fishing communities in Kenya must not be overemphasized. The challenges the fishery is facing, unless addressed, can drive the lobster stocks to depletion. This would eliminate socio-economic benefits to the country and the people that depend on lobster fishery for their livelihood.

In this paper, we propose a number of technical solutions, management measures and market-based approaches that would help improve the governance of the lobster fishery and move it towards sustainability. This would ensure long-term sustainable use of the lobster fishery, its economic viability and social equitability. We make the following recommendations:

- Strengthen enforcement and surveillance of the fishing operations to ensure compliance with policy and legal provisions for lobster harvesting. This would greatly reduce, among other things, the use of illegal fishing gears, unlicensed access to the fishery and landing of undersized individuals.

- Local communities play an important role in natural resources management. Efforts should be directed towards capacity-building in local fishing communities in participatory monitoring, management and development of the lobster fishery.

- Data on fish stocks is helpful to inform decision making and management of the fishery. The data and information on the biology of the lobster fishery in Kenya are limited. Further research on the lobster fishery in Kenya is desirable, in particular, the biological aspects including lobster migration and impacts of fishing operations on the ecosystem. In the event that data and information on the fishery are inadequate, a precautionary approach should be applied to help reduce the risks of the fishery from collapsing.

- Time and area closures have been reported elsewhere to contribute to sustainable use and management of the lobster, prawns, octopus and Sardine fisheries. These closures should be introduced by KeFS in consultations with the respective county governments, the private sector and local fishing communities.

- Currently, there are restrictions at the lobster fishery on the size of the lobster to be landed, prohibitions in the catching of berried females, and outlaws the use of beach seines, spear guns and scuba gear. Trawling is confined to the five nautical miles. Kenya Fisheries Service and the key stakeholders, including fishers, should, in addition to the weight restrictions, introduce carapace length restrictions. This will take into consideration mature individuals that weigh less than 250 gm.

- With the increasing demand for lobster on both the domestic and export markets, fishing pressure on the fishery will continue to increase. Efforts should be directed to introduce fishing effort control, total allowable catch (TAC) and a rights-based approach.

- Lobster is high-value seafood, and with increasing demand, dealers and fishers are likely to under-report and not record the sources of their lobsters. The government, the industry and fisherfolk should implement a transparent traceability system.

As these challenges persist, more consumers in the export market - particularly in Europe, USA and South Africa - are now demanding environmental credentials for the seafood products that access their markets. The local fishing communities, the Kenyan government, NGOs, development partners and the industry are implementing the lobster fishery improvement project (FIP) with the support of WWF and other partners. This is part of the lobster fishery certification and creates a market-based incentive to drive the fishery to sustainability, while at the same time ensuring market access and fair price of the products. The recent results of the Marine Stewardship Council (MSC) Benchmarking and Tracking Tool (BMT) has shown that the lobster fishery is moving towards sustainability with a BMT index of 89 percent (WWF, 2018).

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Empowering Artisanal Fisheries to manage communal grounds

Christian Barrientos
Please refer to the presentation of this case study available at:
http://www.fao.org/3/CA2342EN/ca2342en.pdf

User rights-based management in Cote d'Ivoire and Senegal: aligning national policies to the Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa (PFRS)

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Abstract
African Union has considerable concern for the status of the fisheries sector in Africa, particularly the small-scale fisheries as demonstrated in the Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa (PFRS). This blueprint for African fisheries management and aquaculture development highlighted the ''adaptive management'' to suit local circumstances, but strengthened environmental sustainability including co-management, rights-based approaches. As a result, the countries moved from open access to user rights-based fisheries. This is a key element to increasing social benefits from the sector, without destroying the resource and marine habitats. Along these lines, the member states of the African Union support the promotion of User Rights Fisheries through substantial awareness and capacity-building campaigns. These campaigns facilitate the understanding and implementation of the various approaches in rights-based fisheries management, including territorial use rights fisheries (TURFs) and rights to harvest a certain fraction of the allowable catch. Our paper is based on two case studies on the alignment of national policy to the PFRS, looking at the various user rights-based fisheries management in Cote d'Ivoire and Senegal, fish deficit and fish export countries respectively.

1. INTRODUCTION

The African Union has considerable concern for the status of the fisheries sector in Africa, particularly the small-scale fisheries as demonstrated in the PFRS (AUC-NEPAD, 2014). This blueprint for African fisheries management and aquaculture development highlighted the ''adaptive management'' to suit local circumstances while strengthening environmental sustainability, including co-management, rights-based approaches. This resulted in the countries' move from open access fisheries to user rights-based fisheries. This move is key to increasing social benefits from the sector without destroying the resource and marine habitats.

The member states of the African Union support the promotion of User Rights Fisheries through substantial awareness and capacity-building campaigns to facilitate the understanding and the implementation of the various approaches in rights-based fisheries management including territorial use rights fisheries (TURFs) and rights to harvest a certain fraction of the allowable catch.

In West Africa, there are different fisheries governance approaches, depending on fishing community involvement in decision-making. Cote d'Ivoire and Senegal are shifting from the dictator-like, top-down approach, to a more participative and inclusive way of performing fisheries governance.

A notable damaging of biomasses and loss of economic value due to the very high proportion of small size fish in the catch accompany overexploitation. This situation is made worse by illegal, unreported and unregulated fishing (IUU) that, besides the thinning of fish stocks, destroys marine habitats and weakens the inshore communities. The IUU fishing in particular costs West Africa more than USD 1 billion per year [. In 2006, Michael Fleishman already announced that deepwater fish stocks off the West African coast (at depths exceeding 400 meters) had decreased by half since 1970. Like sea fishing, continental fishing in Africa has seen the number of catches decrease. Lake Tanganyika (the

second biggest in the world) has, since 1946, witnessed a thinning of fish reserves (estimated at 38%) due to combined effects of overfishing and climate change (Fleishman, 2006).

Area-based fishing rights, commonly referred to as Territorial Use Rights for Fishing programs (TURFs), allocate secure, exclusive privileges to fish in a specified area to groups, or in rare cases individuals. Well-designed TURFs have appropriate controls on fishing mortality and hold fishermen accountable to comply with these controls. TURFs are usually allocated to and managed by an organized group of fishermen called a Cooperative.

Most TURF systems do not grant ownership of fishing areas. They allocate exclusive harvesting rights for one or more marine species in a specified area. TURFs are ideal for species like abalone that will not move beyond TURF boundaries, but they can be designed for species that are more mobile as well. TURFs may occur independently, or they may be part of a broader system of TURFs. Well-designed networks of TURFs can be used to manage more complex fisheries, including those with mobile species and multiple groups of fishermen.

1.1 The Policy Framework and reform strategy

The provisions of PFRS incorporate best practices for sustainable fisheries management and responsible aquaculture development, which have been identified as stakeholder priorities. The rational implementation of the PFRS entails identification of user-friendly, appropriate strategies that would facilitate alignment of national and regional fisheries and aquaculture policies to these PFRS provisions.

A complimentary document to the parent PFRS, to provide guidance for the PFRS implementation, has been developed through consultative processes. These processes involved key stakeholders: African Union Member States (AU MS), Regional Economic Communities (RECs), specialized regional institutions in fisheries and aquaculture, NSAs, members of the AFRM, development partners, individual experts and key institutions.

The guidance document describes the criteria/parameters for the alignment of national and regional policies with PFRS, the indicators to monitor the process of alignment, implementation, and the supporting mechanisms for implementation. The guide also includes indicators to measure the medium and long-term impact of the anticipated sector reforms that are engendered by this pan-African policy and other instruments.

Tools or measures in the form of criteria and indicators are suggested by the guide. Criteria for alignment ensure consistency and coherence between national and regional policies and strategies with the PFRS; they are the elements that are used to assess consistency or coherence. Indicators are pointers to measure the progress in the implementation of the PFRS and its provisions and thereof towards its outcomes. Together, these enable all actors charged with management and development of fisheries and aquaculture at national and regional levels to implement PFRS effectively. Mechanisms for implementing PFRS by engaging other stakeholders, including Non-State Actors and development actors, are also provided.

The PFRS is, therefore, the product of a broad and inclusive, participatory and transparent, interactive process that identified seven policy objectives as critical to Africa's fisheries development. We will focus on the first policy objective:

> "*enhancing conservation and sustainable use of fisheries resources through the establishment of national and sub-national governance and institutional arrangements. The fishery sector of most States that are members of the African Union consists of capture fisheries and aquaculture*" (AUC-NEPAD, 2014).

Box 1. PFRS on user rights-based systems, under section 4, "Conservation and Sustainable Resource Use."

Design and apply appropriate users rights-based systems

a. Moving from open access fisheries to user rights-based fisheries is a key element in increasing societal benefits from the sector while ensuring ecological sustainability of the resource. Member States are invited to define and design various suites of user rights-based fisheries management that take into account the geographical scope, socio-cultural context and nature of the fisheries, and minimize negative impacts to vulnerable groups and ecosystems.
b. Ensuring that sustainable fishing operations are maintained, through for example, implementing TAC-based system, and that fishing effort does not undermine the status of the fish stocks in question.
c. Designing and implementing Territorial Use Rights in Fisheries for small-scale fisheries and provide the necessary regulatory frameworks and institutional support.

Source: AUC-NEPAD (2014). The Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa

1.2 Description of the fishery

(a) Fisheries in Cote d'Ivoire
Fisheries and aquaculture represent 3.1 % of GDP and 0.74 % of the total GDP. The sector provides nearly 70 000 direct jobs and supports over 400 000 people. Fish is the main source of animal protein for the Ivorian consumer, i.e. 50%, and represents 15-16 kg/year of consumption per capita. The sector has a long experience in the processing industry. The country is one of the EU's top ten suppliers of canned tuna.

The Strategic Development Plan for Livestock, Fisheries and Aquaculture (PSDPA) for the period 2014-2020 has the objectives to renovate and develop production and processing infrastructure to facilitate the trade of value-added products.

Despite the adoption of the PSDPA, the sectoral fisheries policies have not changed much since the 1960s.

The sector provides an abundant protein diet to the populations, export revenue and diversified fishery resources if sustainably managed. The sector is limited by numerous shortcomings that impede the implementation of the policy and limit the performance of the sector. The obsolete legislation led to the following:

- Weak governance of fisheries and poor law enforcement to regulate fisheries
- IUU fishing and Poor statistical data to support fisheries planning and management
- The deficit in the trade balance of fishery products
- Poor working conditions fishermen of the SSF
- SSFs lack power and control; are still open access.

Cote d'Ivoire must make significant efforts in order to align the laws to the PFRS and to adopt user rights approach to the SSF.

(b) Fisheries in Senegal

The coastline is around 718 km, and the country is a well-stocked river system, comprising the following:

- Senegal River (340 000 km²)
- Saloum River (29 700 km²)
- Casamance River (16 300 km²)
- Gambia River (77 100 km²)
- Lake Guiers (350 km²).

Fishing is the first provider of export earnings; it contributes significantly to job creation and food intake. Already, several foreign investors are present in the area and are exporting their products to Europe, Asia and America. Fish and shrimp are the main products processed industrially. Each year Senegal harvests 30 000 tonnes of shrimp from Casamance Islands, Saloum, and St. Louis on an exploitable potential estimated at 450 000 tonnes/year. There are 600 000 direct and indirect jobs, two-thirds of which are provided by artisanal fisheries, mainly domestic marketing and small-scale processing. As for aquaculture, it is considered a priority. Preferred areas and conditions for its development were identified in the state report with the private sector.

Senegal fisheries subsector

Senegal's fisheries subsector has historically been one of the country's largest sources of foreign currency. Seafood represents close to a quarter of Senegal's exports. Industrial fishing consists of sardines, tuna, and trawler harvests (shrimp, mullet, sole, cuttlefish, and so on). Artisanal catches are mainly destined for the local market, with a large proportion purchased for processing by local factories. The fishing industry is also a key subsector for employment. At the local level, thousands of families depend on fish as a nutritional staple.

The European Union (EU) is the largest market for Senegal's seafood exports. Various agreements with the EU allow its fishing craft access to Senegalese waters, while setting export quotas and limits and requiring that part of the catch, especially tuna, is supplied to local processing industries (Ndiaye, 2006).

Senegal Artisanal Fisheries

The Senegalese fisheries are predominantly artisanal, i.e. they take place by the use of canoes operated by traditional fishing communities, some also fishing on foot without vessels. There is an important number of landing sites for the marine sector along the 700 km-long Atlantic coast, from Saint Louis in the north to Boudiédiéte in the south. Inland fisheries are mainly found in the deltas of the three main rivers; Senegal, Saloum and Casamance. About 82 000 fishers work in the artisanal sector, with an equal distribution between the marine and the inland sector. In addition, there are some 37 600 jobs in ancillary activities, mainly fish processing and marketing. This provides 119 600 jobs in the sector, among which 30 percent are women.

Numbers of fishermen, fishing boats and gear have risen, along with land-based facilities including fish processing plants and cold storage depots. Although fisheries production grew with an increase in fishing activities and the concurrent expansion of processing facilities, production more recently has begun to decline due to uncontrolled fishing, which has resulted in annual catches exceeding a sustainable level of output.

Fisheries' production in Senegal rose until the mid-1980s after which catches began to level off and landings in the country's fishing ports began to decline. Since then, SSF activities have expanded while the number of large fishing vessels has remained stable.

Rising world prices and demand for fish have encouraged the expansion of SSF in spite of the smaller catches being landed. In addition, Senegalese fishermen have ventured further up and down the coast of West Africa in search of fish, catching lower value species and fishing in neighbouring countries' territorial waters. One result of SSF expansion is that many of the highest value coastal demersal fish stocks are severely depleted and facing rapid decline unless effective fisheries management is introduced. According to the FAO, Senegal's total wild capture fish production in totalled 405 000 metric tons (mt). Foreign fishing vessels also are active in Senegal's waters with fishing boats from various EU countries normally taking about 10 000 mt per year, mostly of high-value crustaceans and tuna.

Government recognition of the fishery sector's importance resulted in the government naming sustainable fisheries development as a key driver in the country's first Poverty Reduction Strategy Paper, 2003-2005. Fisheries is named as one of five sectors in the national economy with high development potential in the current second Poverty Reduction Strategy paper 2006-2010.

Senegal's Ministry of Maritime Economy, Marine Transport, Fisheries and Community Protected Areas (MEM) is the main government agency involved in implementing the sustainable fisheries development programme. On a local level, the ministry works with Local Fishers Councils and Local Artisanal Fishers Councils to co-manage coastal resources in each particular area.

Studies have shown that around 70 percent of community members surveyed in participating communities are satisfied with project activities to rehabilitate coastal fish stocks, including the use of protected fisheries zones, the construction of artificial reefs and the use of eco-labelling for processed fisheries products.

Economic contribution and social implications of the fishing activity
The fisheries sector contributes 12 percent of the primary sector GDP and 2.5 percent of Gross Domestic Product (GDP). It represents 170 billion CFA equivalent currency and 30 percent of export earnings.

The subsector of artisanal fishing employs 60 000 fishermen (17% of the active population), of which 20 percent (12 000) are for small coastal pelagic fisheries. The continental fishing, according to the review of existing documents, reported 30 000-40 000 people involved in inland fisheries, which suggests the opportunity to use this subsector as a brake on the rural exodus.

Fish contribute to 70 percent of the nutritional intake of animal protein, offering a per capita consumption of 26 kg; this is double the African average and higher than the world average (20 kg). Employment in fisheries provides income for almost 20 percent of the labour force and around 10 percent of the rural population.

Women work mainly in the post-harvest subsector (40 000 processors). They earn their livelihoods through the processing and marketing of cured products. The importance of women's involvement in the sector is favourable when setting policies for poverty reduction. Through these activities, women contribute significantly to revenues for their family, thereby reducing poverty in fishing communities. In many cases, they completely provide only all cost households.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fisheries

The marine and inland fisheries sector suffers from a lack of control of the national artisanal and industrial fishing effort, and also a weakness of the means of control and surveillance of the fisheries, which are at the origin of non-responsible exploitation. Overexploitation and poor management

threaten wild fisheries in Senegal, too. They further constrain the growth of fisheries and reduce their resilience in the face of climate change. Improved management of fisheries at the national and regional levels is necessary to mitigate these threats and enhance their adaptive capacity.

Coastal demersal fish species usually account for around 25 percent of the annual fish catch and represent more than 50 percent of fishery export value. Consequently, problems facing coastal demersal fisheries in Senegal are of major concern. The report 'Western Africa is Missing Fish', published by the Overseas Development Institute, claims that Senegal lost USD 300 million or two percent of its GDP to IUU fishing in 2012 (Daniels et al., 2006). Senegal recently launched a campaign to emboss or place identification plates on 19 009 registered artisanal boats. Registration and embossment allow the monitoring of the overall capacity of the artisanal fleet; they are first steps toward better governance of the fisheries sector and serve as a welcome, protective mechanism against domestic and foreign IUU fishing.

With threats to the long-term sustainability of fish stocks accompanying increasing poverty, the government has made a diagnosis of the sector and responded appropriately to preserve its fisheries resources sustainably. The *Plan Sénégal Émergent* (*PSE*) and the Fisheries Ministry worked with all private sector actors to carry out an analysis of the value chains of the sector. The exercise highlighted the opportunities and weaknesses of the sector in line with the National Fishery Policy (Lettre de Politique Sectorielle).

2.2 Brief history of former rights-based

Traditionally, the coastal communities of Senegal defined their fishing territories and access was granted to all members of the community. Unfortunately, the open-access regime to artisanal fisheries has contributed to the depletion of marine resources and the increase of fish prices. The overexploited fish stocks have pushed the Senegalese to extend their navigation range, and therefore target fish further offshore, often in the neighbouring countries of Guinea-Bissau and Mauritania. This search for more productive fishing grounds add to the costs due to the additional fishing gear needed, the price of the fuel used for a wider fishing range, and the increased risk of accidents at sea. These increased costs of fishing have reduced fishermen's revenues significantly. In addition, the commercial SSF fleet went from 13 000 boats in 2009 to 19 000 in 2015. This increase in the number of boats without proper monitoring and control have continued to impact the country's already overexploited resources negatively.

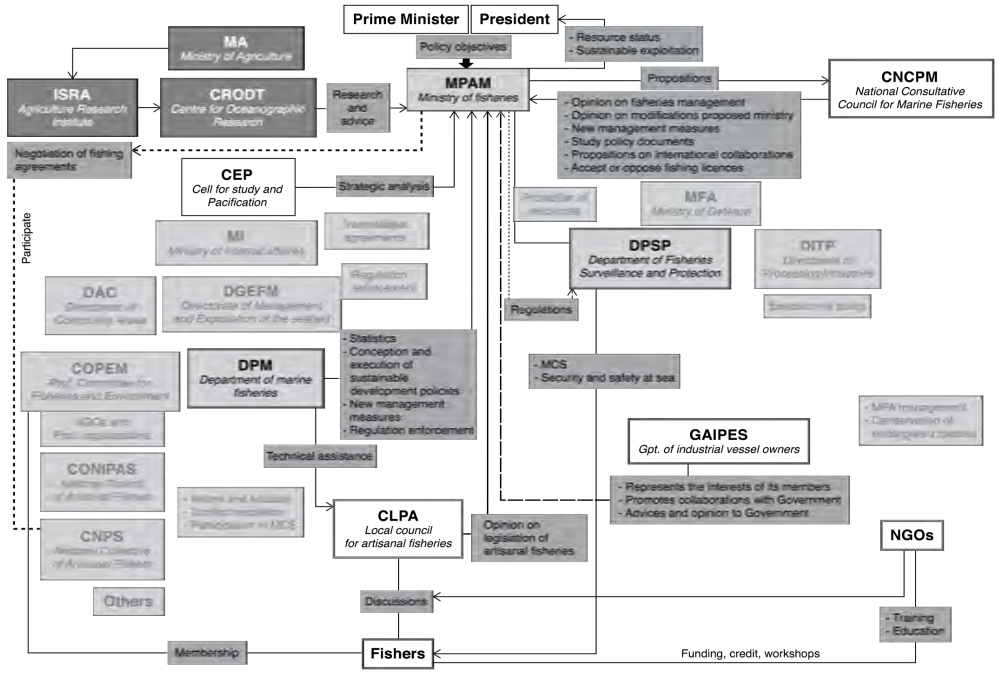
2.3 Rights-based approach

To change its approach from top-bottom to bottom-top, the government operated the boat identification mechanisms and made a first step in the acquisition of fishing permits with management features such as target species and zones. In the event of an accident at sea, identification mechanisms allow for rapid identification of a boat and its crew.

Senegal has had much success in the co-management of marine resources. In the coastline, fishmongers, boat owners and other stakeholders came together to implement a system aimed at ensuring balanced management of resources; the results were transformative. Key species that were hard to find have begun to return in the co-managed areas.

In the view of empowered communities, it is essential to decentralize through devolution of rights and responsibilities in order to better protect resources. These efforts are expected to bring better governance and eventually restore the fisheries resources, replenishing them both in terms of abundance and diversity.

Since the country adopted the bottom-top approach, the organogram (Figure 1) included the stakeholder's role in fishery management.



Note: Secondary institutions and their roles are shown in light grey.

Figure 1. Diagram of the main institutions governing the fisheries in Senegal.

Governance outcomes in Senegal:
The bottom-top approach led to the strengthening and enabling of conditions required to enhance fisheries governance in Senegal at all levels. The important outcomes achieved to address governance issues include:

- Strengthening of Local Artisanal Fishing Councils (Conseils Locaux de Pêche Artisanale, or CLPAs) and their steering committees (ICC);
- Promulgation and adaptation of Conventions Locales (CLs),
- Dramatic increases in the issuance of fishing licenses,
- Increases in boat registration,
- Increases in the issuance of seller cards.

Strengthening of the CLPAs and their ICCs:
The existing CLPAs and development of new CLPAs have been critical to the success of the program. Specific examples of achieving this outcome include:

- Revitalization of CLPAs, and assistance using a participatory and inclusive mechanism, to promulgate 'local conventions' to implement the policy framework and the adopted fishery management strategy (See promulgation of local conventions below)
- Capacity development of CLPAs and their ICCs on administrative and financial management, fundraising mechanisms, community organization and dynamics, resource management, collaborative surveillance, monitoring, and climate change adaptation
- Organizing CLPAs into relevant technical committees (Rufisque/Bargny and Yene/Dialaw)
- Establishing the new CLPA in Kafountine in the Casamance
- Facilitating the renovation and provision of equipment in CLPA offices in Rufisque/Bargny, Mbour, and Sindia Sud.

Promulgation and Adaptation of Conventions Locales (CLs):
In order to provide the legal underpinning for CLPAs to negotiate fisheries management rules in each area of intervention, convention locales (CLs) have been promulgated by the CLPAs and approved by the local central government representative (local authorities). The establishment and implementation of these CLs are also critical for stakeholders to participate actively in developing collaborative management plans. Specific examples of the outcomes achieved to support CLs include:

- Establishment of six CLs, for the CLPAs in Sindia, Mbour and Joal Fadiouth, and in Cayar, Rufisque/Bargny, and Yenne/Diallao
- Development of new CLs for the Ziguinchor, Kafountine, and Saint Louis CLPAs
- Conducting of surveys of fishery stakeholders and their equipment in Ziguinchor, Kafountine, and Saint Louis
- Disseminating of CLs via awareness meetings (in Yenne/Dialaw, Rufisque/Bargny and Cayar) and radio programs (in Joal Fadiouth, Mbour, Ndayane, Cayar and in Rufisque)
- Development of three fisheries management plans for three zones: (1) Petite Côte (CLPA Joal, Mbour, Sindia-North, Sindia- South and Palmarin); (2) Cape Verde (CLPA Yenn-Dialaw, Rufisque-Bargny, Pikine and Hann) and (3) Grande Côte (CLPA Cayar, Dakar Yoff West and Fass Boye).

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of resources

Establishing boat identification mechanisms was the first step in the acquisition of fishing permits with management features such as target species and zones. “This campaign is part of a greater effort toward sustainable fisheries in Senegal; the goal is to improve fisheries governance and management, help rebuild stocks for food security, and allow a sizeable increase in revenues from the wise use of marine resources. The activities include community-led fisheries management and artisanal fisheries that have traditionally been unmanaged.” (World Bank, 2016).

3.2 Economic viability of the fishery

To relieve the pressure on fishing resources while continuing to provide for the social and economic needs of the fishing communities, government through development partners financed alternative livelihoods and entrepreneurship among women, allowing the reconversion of fishermen.

In the region of Thies, fishermen, fishmongers, boat owners and other stakeholders came together to implement a system aimed at ensuring balanced management of resources. The results were transformative. Key species that were hard to find have begun to return in the co-managed areas. Lobsters’ weight has increased by 133 percent, allowing communities to enjoy larger returns. To sustain the results of community-led fisheries management, the government decided to further decentralize and to empower communities by giving them the rights and responsibilities needed to protect the resources better. These efforts are expected to bring better governance and eventually restore the fisheries resources, replenishing them both in terms of abundance and diversity.

3.3 Social equity

The bottom-top approach led to successful co-management. As a result, authors record an improvement of sustainable, high-quality protein for the nation and of quality of life among artisanal fishermen, who can maintain the productive capacity of marine and coastal ecosystems. These aspects support the government efforts to achieve reform in the marine fishery sector and to enhance the participation of the artisanal fishermen and women in the decision-making processes; this is in accordance with the Sectoral Letter for the Development of Fishery and Aquaculture of 2008 (revised in 2016).

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

(a) To strengthen institutional and stakeholder capacity at all levels to implement an ecosystem-based, co-management approach towards sustainable fisheries, taking into account climate change impacts in the fisheries sector.
(b) To identify and test governance strategies, policies and best practices.
(c) To build ecosystem resilience to threats to biodiversity conservation and climate risk.

4.2 Improving fishery sustainability in the future

(a) To enhance social and economic benefits to artisanal fishing communities.
(b) To provide incentives to a continued sustainable fisheries agenda.

Senegal did well in the alignment with the Policy Framework and Reform Strategy for the Fishery and Aquaculture sector.

4.3 Recommendation on the Turfs and user rights for the Region

Elaboration of policies and a regulatory framework consistent with international and regional conventions:

i. Develop coherent regional/national policies and laws to secure preferential use rights;
ii. Strengthen community-based marine tenure institutions;
iii. Improve capacity, effectiveness, and accountability of co-management arrangements to support community-based institutions.
iv. Entrench community-based management in an ecosystem approach to fisheries management.

Development of appropriate and multi-source investments and credit schemes easy to access to secure sustainable small-scale fisheries:

i. Design, on the basis of the SSF Guidelines, appropriate investments and credit schemes to support sustainable small-scale fisheries.
ii. Identify priority reforms and strategies that could eliminate harmful subsidies leading to overfishing.
iii. Develop strategies to support an inclusive coastal economy.

Designation of mechanisms to facilitate responsible governance of tenure in SSFs:

i. Develop mechanisms facilitating responsible governance systems including flexible and adaptable tenure, respecting the rights of small-scale fishers and fishing communities to resources that promote sustainable development, social and cultural well-being.
ii. Elaborate effective co-management arrangements, dispute resolution mechanisms, local participation, gender balance, youth work and empowerment; strengthen institutional capacity earmarked for responsible governance of marine tenure.
iii. Promote responsible governance of marine tenure through collaborative forms of learning.
iv. Enable governance and planning frameworks that recognize community-based marine tenure institutions including, rights, exclusion, withdrawal/access, management, enforcement, and alienation rights.
v. Identify and build the capacity of national and local tenure governance bodies to secure these rights.

Strengthen marine tenure governance institutions to protect tenure rights and effectively engage in co-management arrangements at multiple scales of governance:

i. Strengthen marine tenure governance institutions that support tenure arrangements through the creation and enforcement of associated rules.
ii. Elaborate co-management arrangements that support ecosystem-based management.

Develop a country-specific sourcebook of good practices and lessons building on a global community of practice:

i. Elaborate a toolbox on good practices on marine tenure systems for small-scale fisheries.
ii. Adopt iterative approaches to adaptive learning that can benefit from building a broader 'community of learning.'

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Dealing with the changing face of artisanal fisheries on the Kenyan coast: rationale for strengthening local institutions, challenges and way forward

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Abstract
Along the Kenyan coast, artisanal fisheries make a vital contribution to food security, livelihoods and cultural identities in coastal communities. However, these benefits are at risk because fish stocks are exploited well beyond their sustainable limits. Characterised by simple traditional gears and non-mechanized vessels, the fishing operations are restricted to the shallow coral reef lagoons and seagrass beds, not extending beyond 20 metres (m) in depth. Consequently, the overall catch landed primarily consists of demersal reef species (38% of the total marine catches), the output per fisher is low, and the catch is either sold locally or consumed at the household level. Historically, fisheries operate under an open-access regime with no direct control over entry or effort. However, the government - through the state department of fisheries - has attempted to regulate fishing operations, with input control measures such as licensing, restriction of destructive gears, and the protection of breeding areas.

Nevertheless, due to lack of enforcement and capacity within the government agencies, these measures have proved ineffective; a recent analysis of interventions indicated a consistent increase in fishers' numbers and use of illegal gears. Similarly, attempts to encourage co-management by involving all the major stakeholders at the fishery in the decision-making process through the Beach Management Units (BMUs) have had limited successes. This is due to weak local institutions and the failure of current institutions to address the core problem, poverty, which is intricately linked to unsustainable fishing practices and defiance of regulations. With the changing face of artisanal fisheries, where there are strong attempts to generate profit by investing in modern gears and motorised vessels, there are concerns that the local institutions may no longer exert significant influence over who fishes and where fishing occurs, given that these responsibilities are not explicitly defined in current regulations.

Keywords: artisanal; fisheries; enforcement; local; capacity; government.

1. INTRODUCTION

Marine fisheries play an important role along the Kenyan coast, making a vital contribution to livelihoods and food security, as well as the cultural identity of coastal communities. Fisheries are one of the few economic activities practised along the entire coast and are the lifeline of most of the coastal communities, taking into account the fishers, their families and dependants. However, the contribution to the gross domestic product (GDP) is low (<1%) and, as such, fishing receives low priority at the national level (Mangi et al., 2007b). To highlight the contribution of the marine fisheries to the livelihood of coastal communities in Kenya, Malleret King (2000) estimated that the sector contributed up to 80 percent of the total income to 70 percent of some coastal communities (Le Manach et al., 2015). However, these estimates are recognised as an underestimation. There is an apparent lack of understanding of the importance of marine fisheries to coastal peoples' livelihoods, which further explains why the real contribution of the sector to the national economy is not adequately reflected (Tuda and Wolff, 2015).

1.1 Description of the fishery

The Marine fisheries sector in Kenya is categorised into two subsectors; the coastal artisanal inshore fishery and an offshore fishery conducted mainly in the Exclusive Economic Zone (EEZ). The coastal fisheries are characterised by artisanal fishers, as small, non-motorized dugout canoes with rudimentary sails operate within an area of approximately 800 km^2. They extend between the shore and the continuous fringing reefs, staying within three nautical miles of shore and not exceeding 20 m depth (Kaunda-Arara et al., 2003; Ochiewo, 2004).

Most of the fishing activities are conducted from the beach to the shallow coral reef lagoons, mangrove and seagrass habitats (Hicks and McClanahan, 2012). As a result, the catches, which are multi-species, are dominated by coral reef-associated species, which are estimated to constitute about 80 percent of fish catches with considerable overlap between seagrass and mangrove associated species (Bosire et al., 2012). Overall, the demersal fish species dominate the total marine catch, accounting for approximately half. In the year 2015, the demersal fish species accounted for 45 percent of the total marine landings (10 135 Metric tons)(State Department of Fisheries, 2014). Pelagics contributed 35 percent (7 843 Metric tons), while Molluscs accounted for nine percent (2 044 Metric tons). Sharks, rays and mixed-species (NIE) contributed eight percent (1 762 Metric tons), and crustaceans contributed three percent (620 Metric tons).

Overall, species belonging to the families Siganidae, Scaridae and Lethrinidae dominate the catches, reflecting the most abundant and commercially important species. Of the commercially important species landed by the artisanal fishers, at least 13 species dominate and represent more than 75 percent of overall catch (Hicks and McClanahan 2012; Tuda et al. 2016). Among these, six of the most common species are the shoemaker spinefoot rabbitfish (*Siganus sutor*) - which accounts for 11 percent of the artisanal fish landings - the marbled parrotfish (*Leptoscarus vaigiensis*), the blackspot snapper (Lutjanus fulviflamma), the pink ear emperor (*Lethrinus lentjan*), thumbprint emperor (*Lethrinus harak*), and the Carolines Parrotfish (*Calotomus carolinus*).

Over the past decades, there has been increasing evidence of fishery decline with some commercially important species considered overexploited (Hicks and McClanahan, 2012; Kaunda-Arara et al., 2003; McClanahan et al., 2008). However, the status of fish species exploited in these fisheries remains relatively unknown (Kaunda-Arara and Ntiba, 2006; Ntiba and Jaccarini, 1988). Out of the 121 commercially exploited species, only about 45 have been studied biologically, mainly due to insufficient or inadequate data to conduct a full assessment (Fondo et al., 2014). Most of the data that is collected by the state department of fisheries is nonspecific (i.e., landings not defined to species) and is reported in highly aggregated items. Thus, the majority of the stock assessment studies are based on specific species and limited to specific regions and may not be fully representative of the entire fishery. More recently, an attempt to assess the overall stock status of *Siganus sutor* along the Kenya coast has revealed that the species is exploited way above its sustainable limits (Wambiji et al., 2015).

1.2 Fishing communities and fishing activities

Historically, fishing has been the domain of the local communities that live along the coastline. However, given the changing socio-economic conditions along the coast, fisheries have expanded to include a new generation of fishers. These fishers may come from non-traditional fishing communities, and there's also been an increase in migrant fishers from neighbouring countries (Versleijen and Hoorweg, 2008; Wanyonyi et al., 2016). This has resulted in an increase in fishers numbers (undocumented) and landing sites, and also the introduction of fishing gears and practices, which have tremendously changed the fisheries (Crona et al., 2010; Ochiewo, 2004). Even though section 84 of the Fisheries Management and Development Act, No. 35 (2016), states that a valid and applicable licence shall be required for using an artisanal fishing vessel for commercial purposes, the majority of

the fishers and the fishing crafts operating at the Kenyan coast are not licensed, due to weak regulations (FiD, 2013).

1.3 Fishing boat fleets and gear

The fishery is a multigear-multispecies one in nature. Commonly used fishing gears include traditional gears such as basket traps and spearguns as well as more conventional gears such as hand lines, beach seines, ring nets and gill nets (Alidina, 2005; Obura, 2001; Samoilys et al., 2011). According to the results of the biannual marine frame survey conducted in 2016, there has been an increase in the number of recorded gears, which could be an indication of an increase in fishing capacity directed to the inshore coastal fisheries Table 1. Therefore, the government has set out to experiment with offshore fish aggregation devices (FADs) in an attempt to reduce the pressure inshore and to encourage offshore fisheries. The number of fishing crafts has also increased in the past years, with the number of mechanised vessels increasing marginally compared to the manually operated crafts, which are propelled by poles, paddles and sails (see Table 2). The majority of fishing crafts are smaller than 10 m in length and are dominated by dug-out canoes propelled by either paddles, poles or rudimentary sails. Regarding ownership, up to 95 percent of the fishing crats are owned by boat owners, with only a few of the crafts owned by fishers (Karuga and Abila, 2007; Wamukota, 2009).

Table 1. Results of the bi-annual marine frame survey detailing the number of fishing gears.

Fishing Gears	Years					
	2004	2006	2008	2012	2014	2016
Gill nets	7431	5916	3956	4168	3325	3835
Monofilament gill nets	902	1050	1472	3239	2692	2739
Prawn seine	226	264	545	730	610	445
Beach seine	294	560	139	217	193	131
Reef seine	158	146	146	63	89	157
Trawl nets	21	20	28	3	-	-
Cast net	520	812	499	408	332	357
Ring nets	1	11	15	22	31	38
Trammel nets	28	23	35	48	9	-
Long lines	10608	8224	9009	16476	9349	14511
Hand lines	5682	6540	4132	4686	5806	4358
Traps	6318	5224	3169	4438	4057	3483
Scoop nets	562	764	596	652	566	827
Trolling lines	608	500	625	741	803	554
Spear gun/Harpoon	449	624	1007	2939	2423	1700
Hand gathering	-	-	-	-	391	376
Others	956	2116	290	443	8	45

Data source: State Department of Fisheries, 2014.

Table 2. Results of the bi-annual marine frame survey detailing the number of fishing crafts.

Fishing crafts	Years					
	2004	**2006**	**2008**	**2012**	**2014**	**2016**
Inboard engines	66	61	98	71	72	41
Outboard Engines	69	133	221	296	428	587
Paddles	1023	991	1021	1242	974	1243
Sails	1075	1179	1227	1340	1248	1042
Poles	-	3	120	167	191	61
Total crafts	2233	2368	2687	3118	2913	2974

Source: State Department of Fisheries, 2014.

1.4 Economic contribution and social implications of the fishing activity

The handling and marketing of fish start at the landing sites, with boat owners (who also double as fish dealers) playing a significant role in the value chain (Wamukota, 2009). In a subsector that is dominated by women, the exact number and contribution of those directly involved in the processing and marketing of fish is scanty; remote estimates, however, suggest that close to 200 000 people may be directly employed in auxiliary services such as fish trade, boat building, engine repair and gear sales (Mwakilenge, 1996). Nevertheless, the women play a significant part in the value chain, directly involved in the purchase of fish from the fish traders and intermediaries, from where the fish is processed and sold to the local households (Wamukota, 2009). It is estimated that women control over 95 percent of the marine fish retailing function, where the majority of the catch (~96%) is sold and consumed locally, and only a small proportion is taken home for local consumption (Hoorweg et al., 2003). However, men are more directly involved in the actual fishing, with women representing merely two percent of this segment of the workforce (see Table 3).

Table 3. Results of the bi-annual marine frame survey detailing the number of fishers.

Year	Number of fishers	
	Male	*Female*
2004	9017	-
2006	10254	-
2008	12077	-
2012	13706	-
2014	12748	167
2016	13162	255

Source: State Department of Fisheries, 2014.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

Since independence, the management of fisheries in Kenya has been under the control of the central government through the state department of fisheries, which implemented a top-down approach to manage fisheries resources (Alidina, 2005). However, considering the low compliance to fisheries regulations and continued decline in fish stocks, a co-management approach through BMUs was

introduced with the aim of involving fishers in the decision-making, implementation, and monitoring processes.

In a sense, the BMUs, through the Beach Management Units Regulations, 2007 of the Fisheries Act, 1989, have the primary rights over fish landing sites and are required to provide data on catches and develop co-management plans, in order to ensure sustainable fisheries. Nevertheless, BMUs must comply with the fisheries measures, which include licensing of fishers and fishing vessels, restriction of certain fishing gears and compliance with mesh size regulations. Despite the introduction of co-management, the department of fisheries still has the primary mandate to perform Monitoring, Control and Surveillance (MCS) activities, but it has severely underperformed given the low budgetary allocations and inadequate staff and expertise. Therefore, even though the sector has a well-developed structure in place, the lack of followup and enforcement have rendered these measures ineffective.

2.2 Brief history of the former rights-based approaches used in the fishery

Historically, traditional and customary rights served in some ways as fisheries management measures in Kenya (Glaesel, 2000). The local level leaders in the form of village elders like modern fisheries managers played a central part in marine conservation by regulating access to fishing grounds, restricting fishing gear and fishing times, and determining who gained access to their resources (Alidina, 2005; McClanahan et al., 1997). However, following independence, the management of fisheries was taken over by the central government. The state department of fisheries introduced a top-down approach with little input from local stakeholders. However, with the introduction of the co-management approach in 1994, fisheries management has changed to include the participation of fishers and other stakeholders in the decision-making process.

2.3 Rights-based approach: allocation and characteristics

Artisanal fisheries on the Kenyan coast are under an open-access regime and, like many common property resources that suffer from open-access conditions, fisheries are characterised by overcapacity. According to the Fisheries Act Act Section 9(1), “No person shall fish in Kenya fishery waters unless he is a holder of a valid fishing licence or is an employee of a licensee or he is fishing for his consumption.” The issuance of fishers’ licences is restricted to persons who are citizens of Kenya; foreign or migrant fishers must typically work for a craft owner whose licence 'covers' them but must stipulate the number of the crew onboard the craft.

However, most of the fishers do not have a fishing licence: it is estimated that up to 82% of the fishers are not licensed (GOK, 2013). The main problem with the licensing regime on the coast is that most of the fishers operate as casual fishers under a boat owner, and are thus provided for by the craft or gear owners. Therefore, even though the regulations require that fishers and craft licences be renewed annually, the majority of the fishers do not comply with these regulations. With the onset of the co-management approach, the BMUs have the primary rights over fish landing sites but are expected to establish by-laws, which serve to regulate the fishing operations within their jurisdiction. It is noticeable that most of the by-laws are influenced and determined by informal regulations, but unfortunately, they are undermined by the activities of other fishers from other BMUs and the erosion of cultural and informal rules and traditions by new entrants to the fisheries. The result is an increase in non-compliance with gear restrictions and an increase in the use of smaller mesh sizes and destructive gears such as beach seine and monofilament nets.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

The management of artisanal fisheries in Kenya is confounded by non-compliance with fishery regulations, which stems from poor/lack of monitoring and enforcement both at the national and local

level. At the local level, BMUs have been ineffective in implementing the regulatory measures meant to guide fisheries management decisions, due to the lack of skills and expertise and financing mechanism to sustain their roles as co-managers. At the National level, the department of fisheries has been unable to realise its mandate of promoting sustainable fisheries management due to inadequate budgetary provisions to hire staff and engage in research extension stem the problem of diminishing fish stocks. As a result, monitoring of fish catch, one of its prime responsibilities has been severely compromised for decades, which hampers the proper assessment of the status of marine stocks. Nevertheless, as underlined in many studies, the increase in fishing effort occasioned a progressive rise in fishers numbers, yet non-compliance with fisheries regulations has been highlighted as the cause of the falling catch per unit of effort (CPUE) and the decreasing mean size of fish caught, which are indicators of a declining fishery (Mangi and Roberts, 2006; McClanahan and Mangi, 2004).

3.2 Economic viability of the fishery

The general trend in the artisanal fisheries in Kenya is characterised by a consistent increase in fishing capacity and effort resulting from the open-access nature of the fisheries, which omits attempts to regulate effort. There are indications suggesting that the increased fishing effort has compounded levels of competition within fisheries and, as such, altered the fishing patterns. For instance, Le Manach et al. (2015) indicate that fishers are now active fewer days per year since the initial decline in CPUE. Even though much of the fishing effort is concentrated inshore, there are indications that fishers using some of the nets (such as ring nets) are increasingly exploiting offshore *fish* resources. Further, fishers have, in response to the declining inshore resources, started modifying their gears. For instance, the traditional hand line to target deepwater demersal species to depths of 200m in offshore grounds (State Department of Fisheries, 2014). The increasing number in the use of mechanised boats and the interest to deploy fish aggregation devices are indications of the declining inshore resources and the need to exploit offshore grounds, which have been considered underutilised in the past. However, as the investment in mechanised crafts increases due to desire to access offshore grounds, the ownership of gears and vessels continues to shift towards investors, most of whom are fish dealers directly engaged in the fishing. Thus, the dynamic of the artisanal fisheries is changing in such a way that the access to the fishery resource is gradually determined by the capacity to invest in modern fishing gears and mechanised crafts. As a result, most of the new entrants into a fishery participate as labourers – this affords the low investment and easier access (Mangi et al., 2007a).

3.3 Social equality

Even though the artisanal fisheries operate under an open-access regime providing equal opportunities to both male and female, fishing is mostly male-dominated with women performing complementary activities such as fish processing and trade. Despite their contribution to the artisanal fisheries, information relating to the role of women in fisheries is still scanty. Social and cultural beliefs are the major impediment to women's involvement in fishing in Kenya, and this has hindered attainment of the fisheries policy objectives, which is geared towards enhancement of the oceans and wealth creation from the fishery sector, as well as increased employment for both youth and women (National Oceans and Fisheries Policy, 2008). Nevertheless, fisheries are a platform for a close-knit activity with close ties of kinship, where male members of the same family often use similar gears or fishing vessels and in some cases fish in the same areas. Therefore, in the past, the rights to fish could be passed on from generation to generation, from father to son, or through a marriage where, for instance, migrant fishers would intermarry with the locals and by marriage attain access to the marine resources of another community (Crona et al., 2010). Unfortunately, the introduction of illegal and destructive fishing gears has largely been attributed to the sharing of fishing rights with foreign fishers. This has led to conflicts between the local fishers and foreign fishers who are seen as outsiders. Despite the existence of current regulations, which limit the issuance of fishing rights (license) to

Kenyan citizens, the local communities consider themselves to have rights over their area's resources, and to be able to determine who gets access.

4. CHALLENGES FOR THE FISHERY

In general, progress has been made in the fisheries sector bordering around legislative and policy framework, which are meant to enhance growth, development and inclusion in the fisheries sector in Kenya. However, the implementation and actualisation of these policy changes have been impeded by funding and staffing constraints, which has limited the capacity of the state department of fisheries to fulfil their mandate. Therefore, key responsibilities such as monitoring and collection of fisheries data and information remain neglected. This creates an enormous shortfall in information regarding fishing pressure and the status of the fish stocks, which are at the core of fisheries sustainability.

Recent decades have seen a tremendous increase in the number of fishers, which unfortunately has not been matched by supportive infrastructures such as cold storage, access roads and sanitary facilities including piped water. For instance, out of the 197 fish landing sites currently listed in the Kenyan coast, (serving approximately 14 000 fishers) there are only seven functional cold rooms, with only 30 landing sites connected to both electricity and potable water. These services are prerequisites for improving post-harvest catch quality and ultimately, the value of the fish. However, given these constraints, fishers in remote landing sites are forced to sell their fish cheaply to intermediaries due to the highly perishable nature of fish. The lack of cooling and sanitary facilities at the landing sites is one of the major constraints of the artisanal fisheries, yet often they appear the most neglected.

Other major challenges include the rampant use of illegal and destructive fishing gears, which indiscriminately target small-sized fish and juveniles, thus compromising the sustainability of fish stocks. The weak enforcement of regulations and MCS system have been blamed for the rising cases of IUU fishing, as compliance rates among fishers are low. Thus, the sustainable use of these fishery resources cannot be guaranteed - even with current regulations such as restrictions on mesh size, gear, and the sale of juvenile fish.

4.1 Improving fishery sustainability in the future

Improving the sustainability of the fisheries can only be achieved if there is a concerted attempt from the government and the BMUs to regulate effort, reduce unsustainable fishing practices and ensure that only licensed fishers and fishing crafts have fishing access. Already there is a well laid out framework that allows BMU to participate in the vetting process before the issue of fishers licenses and the report offenders and any illegal fishers to the fisheries authority.

However, the above represents a very demanding mandate. This places importance upon the provision of sustainable financing schemes to BMUs, and of incentives that ensure compliance with current management regulations, by supporting investments such as infrastructure, which will ensure the quality and standard of catch. Additionally, there must be continued capacity-building efforts targeted towards BMUs in order to empower them as local fishery regulations enforce and to support community-based monitoring and information collection. Together, these measures will ensure that the local fishers, through BMUs, have full access and significant influence over resources: tenure and access rights will define the success or failure of the intervention in these fisheries.

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Small-scale fisheries and access rights in Timor-Leste

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Abstract
The marine fishing fleet of Timor-Leste consists entirely of small scale and artisanal vessels. Compared to agriculture's contribution to domestic food supplies, income and employment, and to the contribution of oil and gas to public revenues and foreign exchange, fisheries play only a limited role in the national economy. Small-scale fisheries (SSFs) support livelihoods in coastal communities in terms of income and informal employment and increased resilience through diversification of production. In particular, in more remote coastal rural areas, fisheries are considered an important driver of local economies, and a major source of food security and nutrition.

This paper examines the different access regimes governing in the EEZs of the Northern and Southern coasts and the management issues and challenges they imply. Uniquely, in comparison to other fisheries, access to the entire Northern EEZ is granted exclusively to small scale and artisanal vessels; access to the Southern EEZ is structured following a conventional, albeit unenforced, zoning approach. A recent stakeholder consultation process confirmed implications for management of these different access regimes: in the Northern EEZ higher levels of environmental threats on mangroves, reefs, seagrass, and of pollution due to more population/resource pressure were recorded, with higher fishing pressure, particularly on reefs. In the Southern EEZ, IUU fishing by foreign semi-industrial fleets occurs, due to lack of monitoring, control and surveillance.

Based on these conclusions, the paper contemplates the extension of exclusive fishing rights for small scale and artisanal vessels to all of the Timorese EEZ, and discusses the legal, regulatory financial and development support requirements for improved sustainable resource use under this premise, including means necessary to ensure compliance. It further proposes technical assistance measures to increase small-scale and artisanal fish production within sustainable limits, for example by diversifying fishing grounds, vessels and gear, and improving effectiveness and efficiency of value chains.

1. INTRODUCTION

The Ministry of Agriculture and Fisheries (MAF) of the Government of the Democratic Republic of Timor-Leste (GoDRTL), through its General Directorate of Fisheries (DGP), is leading a consultative process of developing a new National Fisheries Strategy (NFS) for Timor-Leste. The aim of the NFS is to sustainably manage marine fisheries resources in Timor-Leste's EEZ, thereby increasing production sustainably and improving food and nutrition security, in particular for low-income households in rural areas. It is committed to principals of ecosystem-based fisheries management and an approach to sector governance that puts the sustainability of resource utilization and livelihoods and human rights of coastal fishers first. The theory of change projected in the NFS is shown in Box 1[39].

[39] National Fisheries Strategy for Timor-Leste, 2nd Draft, Dili. 2018.

Box 1. Theory of Change.

The **vision** proposed on **policy level,** i.e. the aspired future state of the fisheries sector of Timor-Leste is formulated as:

"Timor-Leste's marine fisheries provide for sustainable livelihoods, incomes and employment, and contribute significantly to food and nutrition security while marine living aquatic resources and coastal environs are safeguarded for future generations".

The **policy principles** underlying the vision are that:

- *All Timorese fisheries resources which can be caught by small scale and artisanal fishers should be caught by small scale and artisanal fishers.*
- *All Timorese fisheries resources which can be caught by Timorese fishers should be caught by Timorese fishers.*

On the strategy level, the **overall objective** to attain the vision is:

"Responsible, sustainable and equitable management of fisheries and living aquatic resources based on a co-management arrangement and complying with regional and international laws, voluntary instruments, agreements and covenants".

Two **specific objectives** are formulated as:

"Co-management of marine resources by small scale and artisanal fishers, their families and communities represented socio-politically by legitimate basic democratic organizations, facilitating ownership and in compliance with legal and regulatory provisions, in concert with GoDRTL competent authorities", and

"GoDRTL competent authorities exercise their sovereign function of providing and enforcing a legal and regulatory framework conducive to co-management of marine resources in the EEZ for the benefit of the Timorese people, together with artisanal fishers, their families and communities."

Major **assumptions** are:

(i) The existence of political will to prioritize sustainable resource use over short term economic and political gains, and (ii) the continuing support of the donor community to improved governance of the fisheries sector. **Risks** include (i) negative impacts of climate change on coastal and marine environments, (ii) the unregulated development of coastal areas (e.g. by brackish water shrimp culture, infrastructure development) (iii) the unchecked/unlicensed entry of fishing capacity, in particular of semi-industrial and industrial vessels and (iv) the existing and potential future impacts of illegal fishing (by all fleet segments) on stock abundance and diversity.

The NFS identifies four **strategy areas**:

(i) Sector governance, (ii) fisheries management, (iii) protection of marine and coastal environs, and (iv) food and nutrition security, improving value chains and post-harvest. For each strategy area, the draft listed **strategic actions** is identified**.**

Source: National Fisheries Strategy for Timor-Leste, 2018.

1.1 Description of the fishery

The national marine fishing capacity is made up of small-scale and artisanal vessels. The small-scale and artisanal effort is restricted to shelf area of the country's EEZ, with focus on reef fisheries and fish aggregation devices (FADs). Reliable data on landings by small-scale and artisanal vessels are scarce. Available data, however, shows an increasing trend - from early FAO data of some 3.2 million metric tons based on MAF statistics, and more recent estimates of close to 5 metric tons. FAO reported the number of artisanal fishers reaching nearly 5 300 in 2009, using nearly 3 000 fishing vessels – this is up from 4 940 fishers and 2 230 fishing vessels in 2004.

Major deep-sea fishing grounds within Timor-Leste's EEZ are located South and Southwest of the mainland, with the shallow Sahul banks in the South considered the most productive. As Timor-Leste does not have a domestic commercial/offshore fishing fleet, these fishing grounds are reportedly fished by foreign commercial vessels, apparently illegally, as no licenses were issued (with one notable exception discussed in 2.2 below). In 2003, annual losses from illegal, unreported and unregulated (IUU) fishing were estimated at some USD 20 million/year[40]; in 2013 the National Plan of Action (NPOA) to combat IUU fishing[41] estimated national losses from IUU fishing at some USD 40 million/year[42].

1.2 Economic contribution and social implications of the fisheries

Compared with the contributions of agriculture to domestic food supplies, income and employment, and of gas and oil production to public revenues and foreign exchange generation, fisheries play only a limited role in the national economy, providing some 1.25% of GDP. However, SSFs and artisanal fisheries support livelihoods in coastal communities in terms of income, employment creation, diversification of production and livelihood resilience. In particular, in more remote coastal rural areas, coastal fisheries are considered an important driver of economic growth and a major source of food security and nutrition, both via markets and via direct consumption. Additionally, the widespread practice of gathering (gleaning) of marine aquatic organisms in shallow waters (including by women and youth) provides for supplementary household income, while improving household food and nutrition security.

The domestic market for fish remains stunted, however. While for consumers along the coast and in the capital Dili, fisheries are a major source of protein, average per capita consumption of fish and fishery product remains low at an estimated 4-6 kg/year. In many upland communities in the country's interior, and in spite of assumed demand, erratic supplies and high prices limit consumption. Deficient infrastructures, e.g. lack of processing and landing facilities exacerbate uncertainty of supplies. Insufficient availability of ice impacts the quality of fish and constrains consumption further. Together with a lack of consumer education and product promotion, these aspects perpetuate the marginal role of fish and fishery production in local diets.

2. MANAGEMENT OF THE FISHERY

2.1 Policy and legal frameworks

The policy framework of natural resource management is governed by the Constitution of the GoDRTL of 20th of May of 2002, which includes a fundamental objective to protect the environment and to preserve natural resources:

[40] FAO Fishery and Aquaculture Country Profiles, The Democratic Republic of Timor-Leste, Rome 2009.
[41] MAF, National Plan of Action for combatting Illegal, Unreported and Unregulated Fishing (NPOA-IUU), Dili, 2013.
[42] The NPOA makes reference to "Regular reports of illegal industrial fishing very close to the shore (within 1NM) are made by coastal communities on the South coast of Timor-Leste".

"(i) Everyone has the right to a humane, healthy, and ecologically balanced environment and the duty to protect it and improve it for the benefit of future generations
(ii) The State shall recognize the need to preserve and rationalize natural resources
(iii) The State should promote actions aimed at protecting the environment and safeguarding the sustainable development of the economy."[43]

A more specific vision with respect to the management of the marine environment and the most recent addition to the policy framework is the National Ocean Policy (NOP). This encourages: "A healthy and secure ocean that sustains the livelihoods, prosperity and social and cultural values of the people of Timor-Leste in a fair and equitable manner"[44].

The Strategic Development Plan (SDP) 2011-2030 is the overarching policy that guides the development of all sectors of Timor-Leste's economy. The SDP is the basis of MAF's Strategic Programme for Promoting Agricultural Growth and Sustainable Food Security which includes, among its five strategic objectives, (i) sustainable increase in the production and productivity of selected crops, livestock species, fisheries and forestry subsectors and (ii) enhanced sustainable resource management, conservation and utilization.[45]

For 2016 to 2020, the Strategic Programme aims at improving management of coastal and inland fisheries, increasing the productivity of traditional fisheries, and expanding fishing beyond ten nautical miles by providing appropriate fishing gear, development of fish landing sites and market facilities. It considers the potential of offshore fishing oriented towards exports and the development of fishery centres along the southern coastline.

The legal framework of the marine fisheries of Timor-Leste is constituted presently[46] by the Decree-Law No. 6/2004 of 21 April 2004 and the Government Decree No 5/2004 of July 2004, General Fisheries Regulations. The Law decrees that "aquatic biological resources are the property of the State and their exploitation shall be conducted in accordance with the present decree-law and applicable regulations."

As a main instrument for the utilization and sustainable development of the sector, a fisheries management plan is postulated, to be developed in consultation with fishing communities, the fishing associations and other social, professional and economic partners associated with the sector. It is to be implemented on the basis of available scientific and technical data. The Law specifies that the fisheries management plan needs to (i) manage the economic exploitation of fishing resources in a sustainable manner, respect the principle of precaution and only authorize measures, methods and fishing gear that do not cause harm or damage to the preservation of species, to the ecosystems or to the protection of the marine and aquatic habitats, (ii) bear in mind the policies and practices of countries in the region as well as the relevant international and regional recommendations, and (iii) involve other services, public institutions and private entities, whose function or activity is associated with or affects the sector.

The Law emphasizes the need to promote and support measures that encourage the development of small-scale fishing, bearing in mind its important social, economic and professional roles, particularly to the lives of the fishing communities. It exempts subsistence fishing from licensing but stipulates that small-scale fishing may be subject to monitoring, surveillance and access limitations. These are in accordance with local customs or internal rules of functioning and management of fishing communities and their associations.

[43] Constitution of the Democratic Republic of Timor-Leste (2002), Section 61 (Environment).
[44] MAF/PEMSEA, National Oceans Policy of the Democratic Republic of Timor-Leste, Dili, May 2017.
[45] Timor-Leste Strategic Development Plan 2011-2030 (Version submitted to the National Parliament).
[46] The legal framework is presently in the process of being revised.

A significant provision of the Law concerns possible co-management arrangements: in order to ensure better management of the fishing resources, co-management committees or similar bodies shall be created and their functions, composition, functioning and jurisdiction shall be established by specific regulation. In the context of co-management, it makes particular reference to the customary approach to natural resource management of tara bandu, a traditional decision-making system based on social/kinship relations.

An in-depth assessment of the policy and legal frameworks was carried out in the course of the 2017 scoping mission.[47] It contained an analysis assessing the political, economic, social, technical, legal and environmental (PESTLE) dimensions of the sector and a summary of pros and cons. At the policy level, pros were listed as:

- The clear dominance of the goals of sustainability of resource utilization, preservation of species diversity and protection of coastal and marine environments, e.g. by banning destructive fishing including trawling
- The *de facto* and *de jure* preservation of Timor-Leste's Northern EEZ for small scale and artisanal fishing as the major positive policy decision for maintaining the contribution of small-scale artisanal fisheries to income and employment, sustainable livelihoods and local economies, and food security and nutrition;
- Political will to join regional and international efforts focused on transboundary/regional management of fisheries;
- Increased consideration of international laws, covenants, agreements and voluntary instruments;
- In this context, the formulation of a NPOA IUU and signing the respective Regional Plan of Action (RPOA-IUU).

Meanwhile, cons were listed as:

- No effective law enforcement.
- Insufficient inter-ministerial coordination.
- Limited capacities for implementation of policies at central and local levels, which will be further challenged by decentralization and deconcentration.
- Lack of continuity of policy implementation induced by assistance projects, e.g. vessels registration and catch monitoring systems.

For the legal framework governing the fisheries sector of Timor-Leste, several pros and cons can be identified. Pros include:

- Provisions for co-management arrangements allowing full participation of communities and other stakeholders in resource management.
- Clearly defined exclusive fishing zones, including the obligation for semi-industrial and industrial vessels to install and operate VMS (vessel monitoring systems) onboard of semi-industrial and industrial vessels, are in place, as well as the mandate for GoDRTL to implement a satellite system for vessel monitoring.

Cons include:

- The Law governing the sector includes inconsistencies and contradictions.
- Legal and regulatory provisions are not enforced.

[47] Ulrich W. Schmidt, Strategy for the development and management of the fisheries of Timor-Leste, Dili, October 2017.

- Some provisions do not take the reality of the sector into account, e.g. the prohibition of reef fishing.
- The inadequacy, at least for demersal multispecies tropical fisheries, of management instruments such as TACs (total allowable catch) and quota that is proposed.
- The NPOA IUU fishing is not yet implemented.

The present sector planning framework is confronted with two further issues: (i) the GoDRTL decentralization and deconcentration initiative which will place management and development functions with local governments diluting already limited capacities on central level further, and (ii) the past lack of political commitment to and sufficient means for MCS (monitoring, control and surveillance), which resulted in the unchecked loss of national resources following the licensing of foreign vessels (see below).

2.2 Access regimes: allocation and characteristics

Regulations of access to Timor-Leste's marine fishery resources are decidedly different for the Northern and Southern EEZs. Uniquely in the world, small-scale and artisanal fisheries are given *de facto* exclusive access to the fishery resources of all of the Northern EEZ whereas access to the Southern EEZ is regulated by the zoning of fishing grounds, restricting access of semi-industrial and industrial vessels.

Implications of this dichotomy of management regimes identified by observers and resource persons were, for the Northern EEZ, higher levels of environmental threats on mangroves, reefs, seagrass, and of pollution due to higher population pressure. Meanwhile, there was higher overall higher fishing pressure, in particular on reefs. In the Southern EEZ, and beyond the small-scale and artisanal effort, IUU fishing by foreign semi-industrial fleets is assumed. This assumption is supported by the fact that semi-industrial and industrial fishing is regularly observed, although there are no semi-industrial Timorese vessels operating at present and no licenses have been/are being issued to foreign vessels, with the exception discussed below.

Higher resource pressure in the Northern EEZ was confirmed at a recent TWG meeting on the NFS. Participants ranked mangroves as the most threatened critical habitat. Threat levels were considered highest (most threatened) in the North, and lower (threatened) in the South and the Atauro Island (see map). Seagrass beds were considered the second most critical habitat, ranked second most threatened in the North and the Atauro Island, and least threatened in the South. Reefs came third in the ranking of critical habitats, with the reefs of the Northern EEZ and Atauro Island believed most threatened and those of the South least.

Correlating threats to critical habitats with fishing pressure, it is more likely that fishing impacts reefs most. Given the prevalence of passive gear used by small scale and artisanal effort, it is less likely that fishing is effecting seagrass beds (except, maybe, compressor diving). Threats to mangroves are likely to be land-based, linked to deforestation and the collection of firewood. These assumptions are based more on anecdotal evidence than on hard data - there was a clear consensus among the participants that the state of coastal and marine habitats is still poorly known due to lack of data and information. This appears to be the case in particular with respect to fishery resources, where no comprehensive assessments of abundance and diversity are available at present.[48]

In spite of uncertainties, stakeholders were overwhelmingly in favour of extending exclusive access by small-scale and artisanal vessels - already in place for the Northern EEZ - also to the marine resources to the Southern EEZ. Reasons given were the absence of conflicts and a notable decrease in destructive fishing practices, such as the use of poison and explosives in the North. They emphasized, however,

[48] The catch monitoring carried out with assistance by the Government of Spain/FAO Regional Fisheries Livelihoods Programme was discontinued after the termination of the Programme.

the long term need for regulating access (including by technical measures as spatial and temporal restrictions) and functioning MCS.

The choice of stakeholders to opt for preferential access of small-scale and artisanal fishing to the Southern EEZ, and the emphasis on the need for functioning MCS, was most probably influenced by a past policy decision they considered detrimental to national interests and to resource sustainability. In 2016, fishing licenses were issued to a foreign (Chinese) semi-industrial fishing fleet, in spite of the fact that the company operating the vessels was found guilty of IUU fishing in neighbouring countries and beyond. When the vessels were found to be fishing selectively (and illegally) for shark, in breach of zoning regulations and prohibition of transshipments in 2017, licenses were suspended, and the vessels were retained. In 2018, however, the vessels were released to leave Timorese jurisdiction, complete with the illegal catch[49]. Since then, no other licenses were granted to foreign vessels.

Reflecting on these experiences, the NFS has been formulated based on the policy principles cited above, i.e. (i) that all Timorese fisheries resources which can be caught by small-scale and artisanal fishers should be caught by small-scale and artisanal fishers. If the resource cannot be caught by the national fleet, and licensing foreign fleets can lead to national benefit, then foreign fleets might be permitted, provided they are legal and sustainable.

3. MAIN CHALLENGES AND WAY FORWARD

3.1 Challenges for the fishery

Whatever the choice of stakeholders and decision-makers will be, the postulate of sustainability of resource use, as it is manifested in the existing legal and regulatory frameworks that will most certainly also be the cornerstone of the revised Fisheries Law, is in full consideration of FAO's Code of Conduct Art:

"6.1: *States and users of living aquatic resources should conserve aquatic ecosystems. The right to fish carries with it the obligation to do so in a responsible manner so as to ensure effective conservation and management of the living aquatic resources."*[50]

However, the need for ensuring responsible and sustainable fisheries as the essential precondition for maintaining the contribution of fisheries to livelihoods and local economies must be balanced with the human rights-based policy objectives.

> This is expressed in the relevant SDGs and in FAO's Small-Scale Fisheries Guidelines:
>
> "*enhancing the contribution of small-scale fisheries to global food security and nutrition through the promotion of a human rights-based approach, by empowering small-scale fishing communities, including both men and women, to participate in decision-making processes, and to assume responsibilities for sustainable use of fishery resources, and placing emphasis on the needs of developing countries and for the benefit of vulnerable and marginalized groups."* [51]

In the particular context of Timor-Leste's marine fisheries, the policy choices discussed above have different implications:

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[49] http://www.abc.net.au/news/2018-06-30/million-dollar-illegal-catch-forgotten/9925890

[50] FAO Code of Conduct for Responsible Fisheries, Rome 1995.

[51] FAO Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication, Rome 2015.

- Maintaining exclusive access of small scale and artisanal fisheries to the Northern EEZ and, possibly, extending their *de jure* and ensuring their *de facto* exclusive access beyond present zoning, would yield optimal socio-economic benefits in terms of coastal livelihoods and spurning of local economies. At the same time, this policy would foster chances of improving food security and nutrition benefits are given that, in all likelihood, catches would be landed in the supply of domestic markets.
- Compared to this, licensing either domestic or foreign semi-industrial and/or industrial vessels, even under the conditions pointed out in the diagram above, would yield no such positive impacts. As the Timorese market provides few incentives for foreign vessels in particular to land their catches, semi-industrial or industrial fishing will create neither significant impacts in terms of local supplies, food security and nutrition, nor provide income and employment onshore. At the same time, effective and sustained MCS effort would be required, incurring substantial investment and recurrent costs. Thus, while causing probable damage to resource sustainability and aquatic ecosystems, the only benefits from semi-industrial and/or industrial fishing would be state revenue from license fees. As shown from experience with licensing semi-industrial vessels outlined above, such revenues would not be in balance with the economic and ecological costs incurred to the Timorese economy.[52]

3.2 Improving fishery sustainability in the future

The NFS embraces these challenges by endorsing preferential access of small-scale and artisanal vessels in all waters under Timorese jurisdiction. The implementation of the NFS envisages, under the respective strategic areas of intervention, strategic actions that include:

- Formulating a national fisheries management plan reconfirming exclusive access of small-scale and artisanal vessels to the Northern EEZ, and extending preferential access of small-scale and artisanal fishing to the Southern EEZ, based on revised zoning.
- Mapping and ranking factors and aspects critical for resource sustainability at present and in the future e.g. anthropogenic threats to critical habitats, institutional challenges, competition for coastal resources, pollution (including by plastic waste) and related to climate change as a starting point of an Ecosystem Approach Fisheries Management (EAFM).
- Planning and carrying out exploratory fishing, vessel and gear trials at representative samples of fishing grounds in both the Northern and the Southern EEZs, to identify potentials for diversifying small-scale and artisanal fishing and increasing sustainable production.
- Developing and implementing local area, species and/or gear specific fisheries management plans, including spatial and temporal restrictions of fishing effort and appropriate technical measures.
- Assessing infrastructure needs e.g. boatyards, engine repair shops, to support diversified and increased production.
- Assessing present value chains from catch to markets and consumers, while identifying and ranking critical paths and structural constraints and identifying scope for improvement.
- Formulating and implementing a plan to build technical and entrepreneurial capacities on appropriate fishing/gear technology, handling and storage of catches on board, navigation and safety at sea.
- Identifying and facilitating efforts and inputs necessary to improve value chains e.g. technical assistance to SMSEs and SMEs and training in basic business and entrepreneurial skills.
- Assess the technical/financial feasibility of fisheries-specific credit lines and, in case outcomes are positive, design of approach and methodology for access to credit.

[52] The case of the Chinese vessels shows the gross imbalance between benefits to the Timorese economy. The license fees amounted to USD 500 000/year for the entire fleet of 15 vessels while revenues to the company were claimed, by the company, to be in the vicinity of USD 1 million per vessel.

Regarding the policy option of licensing either domestic or foreign semi-industrial or industrial vessels, this paper urges the need to base policy decisions on the outcome of the assessment of its socio-, micro- and macroeconomic costs, including costs of building and maintaining effective and efficient MCS enforcement. Only if benefits clearly outweigh all costs should this option be considered.

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Volume 3

History and experiences in limited access fisheries: input controls (licences, IEs, TURFs)

Abstract

The Global Conference on Tenure and User Rights in Fisheries 2018 took place in Yeosu, the Republic of Korea, 10-14 September 2018. Case studies were presented on a number of topics relating to tenure and user rights in global fisheries and their relation to the SDGs. Through the exploration of case studies in eight concurrent thematic sessions, the best practices, shortcomings, and challenges associated with rights-based approaches were discussed. The conference was a platform for the exchange of ideas about how to support the implementation of sustainable governance solutions to rights-based fisheries management.

This document presents case studies from Session 3 of the UserRights 2018 conference, “History and experiences in limited access fisheries: input controls.” All case studies are published as submitted, with minor changes for spelling and grammar. The case studies span across various geographical and socio-economic contexts. These include:

- the managed access areas in the Philippines;
- the management sardine fisheries in the Bolivarian Republic of Venezuela;
- the community-based fisheries management in Korea;
- the management arrangements for user rights in the Philippines;
- the status of Lake Victoria under limited access fisheries;
- the limited entry permit system for Salmon in Alaska;
- the fishery co-management in Korea;
- the transfer of legislative powers to the commercial fishing industry in Australia;
- the fisheries management in data deficient Sierra Leone;
- the institutional management plans for fisheries in China;
- the management approach to small-scale fisheries in Belize; and
- the maritime fisheries management in China.

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Re-examining User Rights in the Philippines: Selected Cases in Panay

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Abstracts
Property rights largely influence the manageability and sustainability of renewable resources like fisheries. The area-specific user rights mandated by the Philippine Fisheries Code has provided more secured fishing grounds, particularly for the small-scale fisheries, in the context of competing resource stakeholders. Several variations of user rights have emerged depending on the localization of such fisheries codes in various provinces and municipalities. This paper reviews the overall enabling Philippine legislations (and relevant traditions) on securing user rights in fisheries resources and their conservation, as related to the attainment of relevant, sustainable development goals (SDGs). It looks into existing arrangements in two municipalities of the Iloilo Province in Panay Island. It will attempt to trace back customary tenure rights and traditional practices if they existed.

1. INTRODUCTION

The Philippines ranked among the top fish producing countries in the world in 2013 with its total production of 4.7 million metric tons of fish, crustaceans, mollusks, and aquatic plants. The fishing industry contributes some PHP 197 billion in current prices and PHP 130 billion in constant prices to the country's Gross Domestic Products (GDP). The total volume of fisheries production in the Philippines in 2014 reached 4 689 084 metric tons.

The Philippine fishery industry is predominantly small-scale and employed a total of 1 614 368 fishing operators nationwide (NSO 2002 Census for Fisheries). The municipal fisheries sector accounted for more than one million (1 371 676) operators while the commercial and aquaculture sectors added some 16 497 and 226 195 operators, respectively. Given the considerable number of municipal fishermen in the country, the Philippine Fisheries Code of 1996 or Republic Act 8550 expanded coverage of municipal waters from about 5.6 kilometres (km) from the coastline to 15 km from the coastline in order to increase the access of small scale fishermen to coastal resources. The code also protects the rights of municipal fisherfolk of the local communities in the preferential use of the municipal waters.

In addition, the enactment of the Local Government Code of 1991 or Republic Act 7160 ushered the formal devolution of powers and responsibilities from the central government to the local government units (LGU) and people's organizations. RA 7160 enabled local leaders to come together with the community and various stakeholders to plan, enact laws and implement programs suited to the area (Boeh, et al., 2013). The municipality of San Joaquin embraced a co-management arrangement for coastal resources with the LGU and the community that recognizes the territorial use rights of fisherfolks.

This study is a review on tenure and user rights in capture fisheries in the Municipality of San Joaquin, especially among the municipal fishers. It specifically identifies and describes fishery resources, fishing activities and fishery management in the area. It analyzes fishing rights arrangements using the Food and Agriculture Organization of the United Nations (FAO) instrument.

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1.1 Description of the fishery

The municipality of San Joaquin is a second-class municipality located in the southern tip of the Province of Iloilo, in the island of Panay. It is composed of 85 barangays (or villages), twenty-two of these are coastal with a population of 51 645 people (Cordero and Subade, 2018). The barangay is the basic political unit of government in the Philippines. In 2011, the coastal barangays in San Joaquin counted 15 marine sanctuaries along the coastline, with each sancturary covering an area of 2 000 hectares (ha). In the 1970s, prior to the establishment of these marine sanctuaries, some of the areas were used as traditional fishing grounds where destructive fishing practices took place. To develop a practical response to the diminishing fish catches, the LGU classified some fishing areas as sanctuaries. Destructive fishing methods, spearfishing, anchoring, discharge of oil and other harmful substances became forbidden in these areas (Municipal Ordinance, 2009).

Fishing in San Joaquin usually takes place throughout the year, with peak seasons for certain species of fish. The targeted fishes include sardines, tuna, threadfin bream, red snapper, mackerel scad and two spot banded snapper. These fishes are either overexploited or fully exploited. Decreasing fish stock is a perceived threat in the area. Some residents claimed that the decreased fish catch was due to the establishment of marine protected areas (MPA) in regions that were previously their main fishing grounds. Others blamed the issue on the destructive fishing methods that devastated the coral reefs even before the establishment of MPAs.

Most fishers in San Joaquin are from the same barangay or municipality, but fishers from adjacent municipalities occasionally fish in the area as well. Within the 22 coastal barangays, there are over ten fish landing sites. Fishers are permitted to land and sell their catch in their own barangays or in adjacent barangays, with the exception of sanctuary areas. Given that fishing areas are open to other coastal communities, the increase in fishing population will also mean that the area will be shared, eliciting competition between the fishers. Furthermore, commercial fishing vessels that fish within the 15-kilometer municipal waters create additional competition among fishers, thus contributing significantly to the decrease in fish catch. This is one of the reasons why a fishing organization was established that requires the registration of all fishers. Only registered municipal fishers are allowed to fish within the 15-kilometer zone.

The most common fishing gears that are used include hook and lines and gillnets. Some fishermen also use lift nets and seine nets. Most of the fishermen choose fishing grounds near their barangay since their vessels are usually small motorized boats powered by an engine. These boats have outboard engines with less than 100 horsepower (hp), they are also 12 meters (m) in length and less than ten gross tons. Alternatively, some fishers still use non-motorised sailboats. These sailboats are not equipped with cold storage for the catch; thus some fishers use ice boxes on deck. Given the proximity of the coastal barangays to the fishing grounds, some fishers simply refrigerate their harvest when they arrive back on land. Fishing usually takes place alone or in the company of a family member (usually male). Some people also pay crew members to carry out the fishing operation. Some fishermen use fish corrals such as “punots”. A “punot” is a fish trap anchored in order to catch fish in open water. A typical deep-water fish corral or “punot” is a fish trap set about 10-15 meters deep at strategic points along the coast. The set-up is made of bamboo poles and slabs of split bamboo. The gear is maintained and operated by 12 to 16 men (Kawamura and Bagarinao, 1980).

According to fishery municipal officers, fishermen in San Joaquin also use fish aggregating devices such as “payao”. Payaos consist of a floating raft which is anchored by a weighted rope with suspended materials, such as palm fronds, which serve to attract pelagic and schooling species commonly found in deep waters (Philippine Fisheries Code, 1998). This device was originally intended to serve as a spawning area of fishes and for sustenance fishing using hook and line. However, studies have shown that it has contributed to overfishing. The deployment of payao inside the municipal waters has

encouraged the illegal entry of commercial fishers, most especially the ring net and purse seine operators, who are attracted to the large volume of fish that can be caught in areas surrounding a payao (Babaran and Ishikazi, 2011). This problem prevails in San Joaquin, where there is an existing practice of payao owners entering into an agreement with commercial fishers to have their payao driven by kubkoban or ring nets for a certain share in the total catch. This practice continues despite the Municipal Fishery Ordinance No. 03 s. 2002 that makes it unlawful (Espectato and Napata, 2012).

Fishing vessels that operate in the area are owned by the local communities. Most of the operators are also owners of fishing vessels, but non-fishing individuals are owners as well. Most of the fishing gears are owned by fishers from the local community or nearby communities. Some of the fishermen are part of the crew that maintains the fishing gear such as the “punot”, while fish aggregating devices are only owned by fishers from the local community. Women are allowed to own fishing vessels and gears, but most women, especially fishermen’s wives, often sell the catch as well. Less than 6 hours are usually spent fishing, mainly because fishers often partake in other economic activities to further support their family income. Fishers usually travel between 100 meters to ten kilometres from the shoreline because they only use small motorized boats.

Despite the enactment of the Philippine Fisheries Code of 1998, there are still problems with its enforcement and compliance and some fishery areas remain in a degraded state. Municipal Trial Court statistics in the country reveal cases of outright defiance of the laws by resource stakeholders in some localities (Catedrilla et al., 2012). Conflicts often arise over issues of management between those who manage the fisheries. The Local Government Unit officials of San Joaquin claimed that there were numerous cases of apprehension in the municipality as a result of monitoring and surveillance. There were cases filed in the local court and these cases usually involved the use of trawl and other active gears and fishing without a license. Those who were convicted were fined, and the gears were confiscated. In Southern Iloilo, where San Joaquin is located, a total of 65 fisheries laws violations were recorded for the period 2000-2010 (Catedrilla et al., 2012).

Competition over coastal resources also takes place between fishing communities and other migrant fishers. Most of the cases of apprehension involved commercial fishers — these involved poaching in municipal waters and the use of active gears. Local authorities were also aware of a few cases involving the use of superlight, sonar, cyanide and dynamite. In the case of sonar use, it was apparent that the respondents associate such devices with commercial boats that fish within the municipal waters. Some fishers also perceived the intrusion of “pangayaw” or other fishers from neighbouring towns as cases involving commercial fishers (Catedrilla et al., 2012).

Fishers have a negative outlook on the establishment of the Marine Protected Area (MPA). This is due to the fact that fishers are not allowed to extract any of the marine resources within the boundaries of the MPA. They consider these restricted resources as a source and support for their livelihood. While there are are many factors contributing to the decrease of fish catch, such as encroachment of commercial fishing, overfishing, and climate change, the constraints imposed by the establishment of the MPA was the main factor that the fishers associated with their decrease in fish catch (Cordero and Subade, 2018).

Despite management efforts to address concerns regarding the fishery in San Joaquin, fishing pressures remain, both because of natural disturbances and human activity. The usual hindrances to fishing are storms and typhoon, which usually visit the area from July to September. These cause strong waves and surges as well as floods. These events can cause damage to the fishermen, fishing vessel, and gears. After each typhoon, fishermen refrain from fishing for up to three days, waiting for the sea to calm down. For instance, some fishers remember the repercussions of a large tsunami that

occurred during the 1940s. Others recall the world coral bleaching phenomenon that took place in 1998 when the municipality's coral reefs were greatly affected as well (Apresto and Reyes, 2005).

The considerable amount of solid waste in the coastal waters, especially during rainy days or after storms is another major problem in the area. Some residents do not follow local ordinances for waste disposal. In addition, the coastal waters are affected by siltation and agricultural pollution brought about by some unsustainable agricultural activities by the upper agricultural communities (Apresto and Reyes, 2005).

1.2 Economic contribution and social implications of the fishing activity

The majority of catches from the municipal fisheries are either for household consumption or they are sold, mostly in retail quantities, directly in traditional landing sites or local market. None of the catch is used for non-human consumption. Women or fishermen's wives usually vend the fish caught in small volumes by going house-to-house in the surrounding communities. There are usually middle persons who buy fish from fishers. The catches are either frozen for local processing, sold at wet markets or processed into dried, cured, smoked or fermented products.

The municipality of San Joaquin has about 1 298 fishermen. They are either full-time or part-time fishers. Full-time fishers are entirely reliant on fishing as their source of income, while part-time fishers receive other sources of income as well. The majority of the fishers choose to have a second source of income in addition to the revenue they receive from fishing. Only about 25 percent of their income comes from fishing. The fishers have attested that income from fishing alone is insufficient to meet their daily needs.

Most of the fishers are engaged in farming; some are farm labourers helping the farmers during harvest season or in the tilling of the grounds. Others are engaged in boat renting, jeepney drivers, construction workers, carpenters, privately employed or own a business, such as a "sari-sari store" (Cordero and Subade, 2018). Only about 25 percent of the people involved in the fishery are women; they are either gleaners or fish vendors.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

In the Philippines, the enactment of the Local Government Code of 1991 or Republic Act 7160 (RA 7160) ushered the formal devolution of powers and responsibilities from the central government to the local government units (LGU) and people's organizations. Administrative arrangements resulting from RA 7160 have encouraged an environment for co-management to prosper. An administrative power shift placed the local governments at the forefront of coastal resource management (CRM) and enabled the local leaders to come together with the community and various stakeholders to plan, enact laws and implement programmes suited to the area.

At present, co-management is increasingly used in the Philippines to manage resources. In areas where there are shared common resources, co-management utilizes the involvement of several sectors in the society collaborating with inter-LGU partnerships and different resource sharing schemes among stakeholders (Adan, 2004; Napilan, 2004). Resource sharing schemes and power are delegated among several stakeholders and several LGUs that form alliances or integrated councils. Due to the nature of common coastal resources, problems in coastal areas of a particular local government go beyond its jurisdictional boundaries and can only be addressed effectively through collaborative management with adjacent coastal governments (Christie and White, 1997).

The Southern Iloilo Coastal Resource Management Council (SICRMC) is one of the examples of the co-management alliances formed to manage and develop coastal and marine resources in Iloilo's

southern coastal communities. The municipality of San Joaquin is one of the five members of the council, together with the coastal municipalities of Oton, Tigbauan, Guimbal and Miag-ao.

For the past years, the LGU of San Joaquin initiated a co-management arrangement involving the coastal communities. The LGU has entered into a partnership with the community through fisheries ordinances and resolutions. The municipality has designated an authority structure delegated to the community through a Municipal Technical Working Group (MTWG) led by the municipal mayor as the chief administrator. The MTWG implements all administrative orders to the community with the help of the Municipal Marine Sanctuary Management Board that consists of the barangay representatives from the coastal communities. Several municipal ordinances and resolutions were passed to manage and protect their coastal resources, and to establish marine protected areas (MPAs) or sanctuaries in 15 of the 22 coastal barangays from 2009 to 2011 (Boeh et al., 2013).

The LGU of San Joaquin together with SICRMC came up with a 5-year coastal resource management plan that serves as a guide in the rehabilitation, protection and preservation of the coastal resources. All barangays with MPAs are tasked to institute a Barangay Marine Sanctuary Board under the umbrella of the Municipal Marine Sanctuary Management Board which was put in place to oversee activities or programmes in the MPAs or marine sanctuaries (Boeh, et al., 2013).

In particular, the LGU still initiates plans and programmes as well as ensures participation among stakeholders. In response to LGUs management plans, community groups (e.g. barangay council, fisherfolk association, women's group, youth group, senior citizens group, NGOs) were organized at different levels. These community-level groups were expected to give their support, cooperation and participation to LGU's activities. The LGU still oversees all management efforts at the municipal and community-level.

The LGU of San Joaquin has issued several ordinances for coastal management, one of these is the Municipal Ordinance No. 03 series of 2002. This is an ordinance that provides provisions for the regulation, development, management, protection and conservation of fisheries and aquatic resources of the Municipality of San Joaquin. Closed season was established to regulate the use of particular fishing gears.

In MPA areas, no person is allowed to engage in any form of activity within the Core Zone of the Marine Sanctuary except for recreational, educational and research purpose upon payment of a fee (Municipal Ordinance No. 7, 2009).

Licensing grants fishers the right to gain access to the fishery resource and to engage in fishing activities for a specified period. The legal basis for granting fishing privileges in municipal waters through fishery licensing is embedded in Fisheries Code and the Local Government Code. The LGU is tasked with maintaining a registry of municipal fisherfolk who are fishing or may desire to fish in municipal waters. In addition, it seeks to limit the entry into the municipal waters, and monitor fishing activities. In Southern Iloilo, local officials have complained about the low number of applicants for fishing permits (Espectato and Napata, 2012). Not all of the fishers are registered or are members of the fisherfolk organizations (Cordero and Subade, 2018).

The physical boundaries of the coastal areas are defined to avoid possible conflicts related to resource utilization and jurisdictional responsibilities. The National Mapping and Resource Information Authority has clearly defined and certified the boundaries of the municipal waters of San Joaquin and officially landmarked it in 2002 (Boeh et al., 2013).

Over the past years, the LGU of San Joaquin initiated a co-management arrangement involving the coastal communities through fisheries ordinances and resolutions. The municipality has designated an authority structure delegated to the community through a Municipal Technical Working Group (MTWG) led by the municipal mayor as the chief administrator. This group implements all administrative orders to the community with the help of the Municipal Marine Sanctuary Management Board that consists of the barangay representatives from the coastal communities.

In order to operationalize fishery law enforcement, a Law Enforcement Committee was formed. Members of the committee are the Philippine National Police (PNP), Philippine Coast Guard Auxiliary (PCGA) assigned to the Municipality of San Joaquin, the Punong Barangay, Barangay Kagawads and Barangay Tanods/ Barangay Police Security Officer, MFARMC/BFARMC, members of Fisherfolks Organization, and members of the Marine Sanctuary Management Board who have undergone fishery law enforcement training conducted by the BFAR and have been designated by the Municipal Mayor of San Joaquin as Deputized Fish Wardens.

Each Marine Sanctuary area has organized Deputy Fish Wardens/Bantay Dagat Groups, as part of the Law Enforcement Committee which conduct surveillance and operation. The Law Enforcement Committee is responsible for the enforcement of the municipal ordinance.

On the other hand, the establishment of the Southern Iloilo Coastal Resource Management Council (SICRMC) by the five LGUs to jointly manage their resource was a major factor in strengthening of law enforcement operation in the coastal waters in Southern Iloilo.

Through the SICRMC, the Maritime Group of the PNP was requested to assist in the fisheries law enforcement by providing massive seaborne operation and patrolling of the waters of Southern Iloilo to apprehend illegal fishers. The SICRMC provided a system where point persons were identified. Mobile phone cards were provided to allow them to immediately send text messages to the hotline number of the Maritime Group. As a result, enforcement activities were facilitated, and cases were, therefore immediately filed in court.

The violators usually settle and pay the fines. There were convictions that were usually in the form of fines and confiscation of fishing gears. However, very few cases have been closed, and where a verdict has already been reached, the accused were made to pay the fines or imprisoned for the offense. Cases that have been dismissed or withdrawn were usually due to the lack of substantial evidence or the failure of the prosecution to present evidence. The paid administrative fine is the amount agreed upon by the parties concerned without any court proceeding (Catedrilla et al., 2012).

The MTWG through the Philippine National Police serves as venues for arbitration and resolution of conflicts among fishers in the municipality of San Joaquin, especially those involved in conflicts in resource use and enforcement of the fisheries laws. Most of the complaints raised about resource use are brought to the attention of the management board. A case is elevated to the Municipal Trial Court if it cannot be resolved in the board. About 50 percent of concerns brought to the management board were immediately and amicably resolved. The Municipal Judge also confirms that issues are usually resolved peacefully (Boeh et al., 2013).

2.2 Brief history of the former rights-based approaches used in the fishery

Previous rights-based management system among municipal fishers are common in the country and among municipalities. The discussion on this section is primarily based on the work by Barut et al., 2003 entitled “Assessment, management and future directions for coastal fisheries in Asian countries”. Before the institution of a centralized fisheries management by the Spanish and American colonizers, the resource utilization and property rights in the Philippines were based on common property principles within a barangay and managed by those who belonged to the barangay. The

Philippines has a long history of indigenous fisheries and resource management systems where the barangay had jurisdiction over natural resource use and access (Pomeroy and Carlos, 1997).

When the Spaniards arrived in the country, they established a centralized system of government, including a state-led, centralized system for managing fisheries (Pomeroy and Carlos, 1997). The barangays were eliminated as administrative entities and with them went the territorial fishing rights claimed by each barangay. This ushered in the decline of common property management and open access use of resources. Later, American colonizers continued the centralized scheme translated to a development thrust with progressively increasing fishing effort and resource utilization. Thus, several fish companies embarked on large scale (or commercial) fishing, while poor coastal communities were encouraged to exploit their adjacent fisheries resource intensively. This pattern of centralized governance prevailed through the fifties and sixties (Pomeroy and Carlos, 1997).

During the 1970s, the expansion, use and development orientation of the country's fisheries policy continued under Presidential Decree 704 also known as the Fisheries Decree of 1975. The government continued to support the needs of the sector through the Expanded Fish Production Program (EFPP). In the small-scale fisheries sector, the strategy of the program was geared towards enabling the small fishers to venture into deeper waters by equipping them with more efficient boats and fishing gears with the underlying assumption that the fishery resources could support the increased fishing effort. However, the effects of a virtually open-access regime began to manifest in declining catches, rent dissipation and increasing poverty among small scale fishers (Barut et al., 2003).

Due to the overexploitation of the resource and the extreme perishability of the catch, fisheries policy gradually shifted towards decentralized management. Although the Fisheries Decree of 1975 granted overall control over management and regulation of fisheries to the then Secretary of Agriculture and Natural Resources, the Decree recognized that small scale or municipal fishing was within the jurisdiction of municipalities. The latter had the authority to issue licenses and grant fishing rights to small scale fishers (which can operate within 7 km from shore). From the mid-1980s, the policy environment for fisheries was generally characterized by the following shifts: a. from centralized governance to localized system; b. from open access to limited access, and; c. from development focus to management (Barut et al., 2003).

2.3 Rights-based approach: allocation and characteristics

The enactment of the Local Government Code (LGC) of 1991 firmly established the jurisdiction of municipalities over small scale fishing. The LGC expanded the coverage of municipal waters from 7 km from the shoreline to 15 km from the shoreline. The expansion of municipal waters aimed to limit the access of commercial fishers and to provide a more equitable distribution of benefits to the marginalized municipal fishers.

The Philippine Fisheries Code of 1998 reinforces provisions in the LGC that are aimed at strengthening local governance of municipal fisheries. The Fisheries Code also seeks to encourage and institutionalize community participation through the creation of Fisheries and Agriculture Management Councils (FARMCs) at the barangay, municipal, regional and national levels. Access limitations are more straightforward in the Fisheries Code with mechanisms such as: (1) registry of municipal fisherfolk; (2) exclusion of non-resident fishers in certain municipal waters with the attendant coding of vessels; (3) mapping and delineation of municipal waters; (4) traditional limitations such as closed areas and seasons; and (5) non-traditional access limitations such as use of economic rent indicators to set production targets for the fishery. These provisions for access limitation in the Code indicate a progressive shift in policy from full development to co-management (Barut et al., 2003). The devolution is to give substantial participation for the fisherfolk who actually utilize the resources. The old centralized set-up was the reason why some national policies did not succeed since the complex situations at the local levels had never been considered (Martinez, 1998).

The new arrangements could provide an opportunity for municipal fishers to obtain considerable participation in the management of resources that they utilize.

In addition to the Local Government Code, the Fisheries Code and the Implementing Rules and Regulations of the Fisheries Code, fisheries are also governed by various fisheries administrative orders issued by the Bureau of Fisheries and Aquatic Resources and Municipal Ordinances issued by LGUs. The LGU of San Joaquin together with SICRMC came up with a 5-year coastal resource management plan that serves as a guide in the rehabilitation, protection and preservation of the coastal resources. The plan was subjected to a series of public consultations to incorporate relevant comments and suggestions from the communities. All barangays with MPAs are tasked to institute Barangay Marine Sanctuary Board (BMSB) under the umbrella of Municipal Marine Sanctuary Management Board which was put in place to oversee activities or programmes in the MPAs or marine sanctuaries. Then the Integrated Coastal Resource Management Plan (ICRMP) was formulated. This ICRMP covers major components in coastal management that include, among others: legal aspects, livelihood, zoning and tourism and waste management. The ICRMP also include programmes on livelihoods and food security of the community, eliminating illegal fishing, regulating activities in the different zones and controlling the entry of fishing vessels and transient fishers in the municipal waters (Boeh et al., 2013).

The Municipal fishing area of the Municipality refers to the area fifteen (15) kilometres from the low water line on toward the sea. These areas may be utilized by the Municipal Fisherfolks and the Peoples Organization or cooperative who are listed as such in the registry of Municipal Fisherfolks. Commercial fishers are not allowed to fish within this area. The use and exploitation of fishery and aquatic resources in the Municipal waters are reserved exclusively to bonafide residents of the Municipality. However, research and survey activities may be allowed under strict regulation for purely research, scientific, technological and educational purposes that would also benefit the residents of the Municipalities.

Although the LGU issues permit to operate to qualified fisherfolk applicant, all municipal fisherfolks engaged in fishing and/or fisheries within the municipal waters are required to register with the BFARMC in their respective barangays for determining priorities among them. Fishers are also given preferential rights in the utilization and management of coastal resources in the municipal waters in compliance with municipal regulations. Women were also allowed to fish, particularly beach seine or “sahid” fishing. Most cleaners are women and children, however, this activity is now regulated.

Fisherfolk from other municipalities may be allowed to undertake fishing activities within the 10.1 kilometres to fifteen (15) kilometres area through a permit issued by the Municipal mayor or his duly assigned representative upon recommendation of the MFARMC. They are also required to pay fees for the permit. No permit to operate is issued to applicant fisherfolk, PO’s or Cooperatives who have not previously secured the Certificate of Registration for the fishing vessels and gears. Only fishing gears or equipment considered legal by the FARMC as duly confirmed by Fishery Technician of BFAR Personnel will be allowed to operate in the municipal waters.

The Fishery License is renewed annually. Fishing rights cannot be leased or sold, but they can be inherited. There are no limitations on how many fishing rights can be held by one person, corporation or community. Closed season was established to regulate the use of particular fishing gears rather than to specifically regulate catching of specific species of fish. A municipal ordinance stipulates that, beach seines operation may be allowed to operate starting October of the year to 15 March of the following year. Before and beyond this period beach seines operators are considered illegal unless the legal size mesh nets are used. Danish seines (Hulbot-Hulbot) and encircling gill nets (Likos) are absolutely prohibited in the territorial waters of the municipality. It is unlawful for a payao owner to

have his/her payao, which is installed within the ten 10 km exclusive zone, driven by any commercial vessel and it is unlawful to engage in fishing with the use of super lights in the municipal waters (Municipal Ordinance No. 3, 2002).

Compliance and non-compliance among fishers can be viewed as a result of the interplay of several factors, which include the uniqueness of a fishery in terms of its institutional design and control and enforcement system (Nielsen, 2003). Some fishers have violated ordinance by fishing inside the core zone of MPA. For some fishermen, certain stipulations in the Fisheries Code and in their respective Municipal Fisheries Ordinances are difficult to follow or obey. These were the stipulations on the use of fine-mesh nets, poaching in municipal waters by commercial fishers, and use of active gears. Non-compliance is usually due to 1) many of the fishers have fishing as their only source of livelihood, 2) poverty, 3) rich and powerful men own the active gears, and 4) the existing confusion on fine-mesh net sizes (Catedrilla et al., 2012).

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

The local community depends mostly on the coastal resource for their economic activities (fishing and gleaning) and recreation (swimming). Sand and stones are occasionally quarried and used as building materials for local constructions. Due to the problem of declining fish catch and degradation of the coral reef areas in the coastal waters of the municipality, the municipality of San Joaquin established the MPAs for resource conservation and protection of marine habitats and aquatic resources. Each MPA has a 2-ha core zone or no-take zone. While it is the municipal LGU that initiated the establishment of the MPAs, the responsibility of sustaining the initiative was turned over to the local community.

Although no stock assessment for fishery has been conducted, according to fishermen, size of target species increased since the establishment of MPAs and regulation of fishing area and gears. This was validated by results of a study on MPAs that reveals an overall increase of 1-5 times in terms of fish biomass from 2007. This is attributed to both an increase in abundance and in fish size, particularly from 2011 to 2013. Several large individuals were observed during the 2013 surveys, which were 2.3-3.3 times larger than the size of fish in 2007. This increase in fish size and the accompanying increase in biomass are typical changes resulting from protective management, particularly the cessation of fishing activity in the area (Espectato et al., 2017).

An initial study of three MPAs recorded a total of 202 reef fish species belonging to 35 families. Overall reef fish abundances ranged from 571 to 1038ind/500m2, which registered an overall mean abundance of 841ind/500 m2. Results of the biological assessment conducted in this study showed an increase in abundance and fish size, consequently resulting in a significant increase in biomass. These results on fish biomass and abundance are much higher than other MPAs in the country (Espectato et al., 2017). This is indicative that the protection accorded by the no-take zones of the small-sized MPAs can be effective. The increase in the average sizes of target species in the coastal area is attributed to the spillover effects of MPA.

3.2 Economic viability of the fishery

The municipality has 1 065 municipal fishers based on the municipality's 2016 Fish Registration (FishR) data (Espectato et al., 2017). As of 2018, the number of municipal fishers increased to 1 298. The increase in fishing population will also mean that the area will be shared, eliciting competition between the fishers. This competition is also an important factor that could lead to a decrease in fish catch. Fishing activity has not changed much despite the implementation of coastal resource management in the area. Average fishing trip and distance travelled by municipal fishers has not

changed. Although there are restrictions on the type of fishing gears to be used, some fishers still used the gears that they were familiar or accustomed with despite the fact that some gears are prohibited.

The use of fish aggregating devices has not changed despite the municipal ordinance prohibiting the use of such to be driven by a commercial vessel. Some payao owners enter into an agreement with commercial fishers to have their payao driven by kubkoban or ring nets for a certain share in the total catch. Adjacent municipalities have different regulations on the use and establishment of payao. In reality, fishers cannot be separated from their livelihood for a long time; thus, there is a need to have a shorter but optimally effective closed season for fishing gears.

Despite the increase in the number of fishers and gears, income from fishing is still low and seasonal. Poverty and hunger are still one of the major problems of fishermen. A number of municipal fishers still remain below the poverty line (Cordero and Subade, 2018). The lack of alternative livelihood only exacerbates the situation. Fishers also have several health problems associated with their occupation and they cannot afford or have access to quality healthcare (Cordero and Subade, 2018).

The number of fishing vessels without engines have decreased while vessels with inboard engines have increased. Vessels' characteristics in length, gross tonnage and horsepower (hp) has not changed. Fishing vessels owned and operated by a paid crew has increased while those owned by an individual and leased out to fishers has decreased. This is about the catch sharing system which results in low income for fishing labourers who can neither own a vessel nor gear.

3.3 Social equality

Fishing rights held by individual fishers and fishing vessels have increased. Legally recognized fishing rights take into consideration the ability of poor and vulnerable communities to access their basic livelihood needs.

The privilege of catching Bangus Fry or Prawn Fries is open for free to all fisherfolks in the municipality, provided that the registration fees and permit fees for every unit of their fry-sweeping device used for the said operation are paid annually.

Rights to fish for the next generation of fishers is taken into consideration. However, more women than men involved in fishery recognized the need to manage the sea and the marine resources sustainably for future generations (Espectato et al., 2017). A study found that women in San Joaquin played an important role in resource protection initiatives such as MPAs, even if their roles were not formally recognized. Their delegated task of attending meetings on behalf of their husbands was an additional role they played in the community on top of their productive and reproductive roles. In possessing a "sustainability mindset" and a generally higher level of environmental awareness than men, women could make a very good medium for social marketing programs related to resource management (Espectato et al., 2017).

In the case of a hazardous event occurring, it is possible to identify individual fishing rights holders in order to deliver aid (e.g. emergency relief, cash transfer, replacement of equipment and infrastructure, etc.). The BFARMC has the list of all registered fishers in the barangay; it is therefore easy to identify fishers that could be needed in times of calamities. Fortunately, the municipality was not hit by super typhoon Yolanda.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

During 1970-1980s, illegal fishing was prevalent in the area with the use of cyanide and dynamite fishing. Cyanide fishers use a poisonous and noxious substance locally known as "lagtang". There are

no strict regulations on fishing, even for commercial fishers, and outsiders were allowed to fish. The coastal fisheries exploited by municipal fishermen are open access in nature in the sense that the resource belongs to the fishermen who harvest the catch. Commonly used gears include mesh nets like sahid (beach seine) and panunton (handline). Despite the existence of illegal fishing, fish was abundant in the area, thus no one cared to prohibit it. In fact, during the 1960s the Development Bank of the Philippines even gave soft loans to fishermen to enable them to purchase motor engines for boats. There are no restrictions on loans as long as they are paid for. This is in support of the expansion program of the government to enable municipal fishers to venture to deeper areas. However, the increasing fishing intensity in the municipal waters has caused overfishing. Coupled with the destruction of coral reefs by dynamite fishing and the use of fine-meshed nets, catches have considerably decreased. When entry to fishing is not restricted or controlled, the inevitability of overexploitation of the resource and over-capitalization of the industry is predictable (Martinez, 1998). Through time, the impact of illegal, unregulated and overfishing activity was evident not only with the reduction in catch but also in declining fishers' income.

Competition for access and resources involved poaching in municipal waters by the commercial fishers and the use of fine-mesh net, trawl and active gears in municipal waters. There were also a few cases involving the use of superlight, sonar, cyanide, dynamite and fishing without a license. In the case of sonar use, it was apparent that the respondents associate such device with commercial boats that fish within the municipal waters. Conflict in the region is mainly caused by Illegal fishing such as the *use* of payao by municipal fishers, which are dragged by commercial vessels (10 percent of the catch go to the owner of payao). Other issues include encroachment of commercial fishers in municipal waters and the overlapping of fishing areas among barangays and municipalities.

The challenges that the conflicts have created for fishery are (1) To whom does the fishing area belong; (2) Whom to prioritize; (3) Coherent policy on various fishing gears and fish access. Addressing poverty of coastal fishers, (4) Conflict on ownership and access outside MPAs fishing area; (5) Barangays communities are overprotected of their own MPA area. They do not want other barangays fishers to have access to their area. The introduction of a rights-based management system has reduced conflict. However, it has also created confusion in the law and difficulty for local officials to apply the rules.

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The status of Lake Victoria Fisheries under limited access fisheries

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Abstract
Lake Victoria has a commercial fishery dominated by three species; Nile perch (*Lates niloticus*), Nile tilapia (*Oreochromis niloticus*) and Dagaa (*Rastrineobola argentea*). The estimated total fish landings are about 900 000 tonnes; fishing is conducted with about 76 929 fishing canoes operated by 219 919 fishers with a beach value of about USD 600 million. The main challenges of the fisheries of Lake Victoria include: increased fishing pressure; inadequate and unsustainable funding to implement research and agreed management interventions; increased illegalities due to weak enforcement; inadequate infrastructure for fish quality and safety and underdeveloped aquaculture to meet the demand of fish and relieve fishing pressure from capture fishery. The objective of this study was to assess the status of the fisheries of Lake Victoria and provide possible recommendations to improve management. The assessment drew on the data from Frame, Catch Assessment and Hydroacoustic surveys and management reports during regional meetings. Lake Victoria fisheries have been managed under lake-wide plans since 2003, but the hydro-acoustic survey results in 2017 showed that the majority of the Nile perch in the lake are young, with only 5.9 percent above the slot size (50 cm total length) allowed to be caught. The only legally recognized fishing rights are fishing vessel licenses. Anyone with legal fishing gears and seaworthy canoes can be given a license. Controls include gillnet/seine net mesh sizes, fishing methods and sizes of fish. However, the number of fishers, fishing gears, fishing canoes and illegal fishing gears have been increasing and fish catch decreasing despite enforcement on the lake. It is recommended to develop and implement a specific rights-based program for small scale fisheries with the participation of key stakeholders for the improvement of the fishery.

1. INTRODUCTION

1.1 Description of the fishery

Lake Victoria, with a surface area of 68 800 km^2, is the second-largest freshwater body in the world and the largest in Africa (Figure 1). The largest part of the lake, 35 088 km^2 (51%) is in Tanzania, followed by the Ugandan part 29 584 km^2 (43%) and the Kenyan part 4 128 km^2 (6%). The lake has a shoreline length of 3 450 km: 1 150 km (33%) in Tanzania, 1 750 km (51%) in Uganda and 550 km (16%) in Kenya. The lake's fishery is dominated by three species: Nile perch (Lates Niloticus), Nile Tilapia (Oreochromins Niloticus) and Mukene/Dagaa/Omena (Ratrineobola argentea) but there is also an upcoming haplochromine fishery especially in the Tanzanian part of the lake. The utilization of the catches is as follows: about 50 percent of Nile Perch is exported, Nile Tilapia is mainly for domestic consumption and regional exports while about 70 percent of Dagaa catches are used for the production of animal feeds.

Fishing takes place in the coastal areas, but the Nile Perch fishers are extending to the deeper waters with reduced catches. The lake has got 1 535 landing sites, and 76 929 fishing canoes operated by 219 919 fishers. The fishery is open to fishers within the fishing communities but also to those within the country so long as they meet the required conditions, such as being registered with Beach Management Units, having legal fishing gears and seaworthy canoes. Kenya and Tanzania do not allow persons outside the country to own fishing canoes, but in Uganda, non-citizens can pay a special fee

to acquire a fishing license. The ownership of fishing canoes is open to both men and women, but very few are owned by women (0.1%, 4 830) probably because of cultural influence and affordability. The fishing is a full-time job and is conducted through the year except for Dagaa where there is limited fishing during the moonlight period. The fishing operations are mainly night trips where the fishing gears are set at night and removed in the morning but there are also day trips. There are very few fishers who stay on the lake for two to three days, especially for Nile perch. The fishing canoes mainly use paddle (56.1%), 33.5 percent use outboard engines, 9.5 percent use sails while 0.1 percent of the canoes are towed. The main fishing gears used include gillnets, boat seines and longline hooks. Some illegal gears like cast nets, beach seines and traps are also used. The fishing gears are manually operated by the crew, with the exception of few fishing vessels for Dagaa in Uganda where a winch is used to operated lift nets. The only fish aggregation done is by use of light from kerosene lamps or solar lamps to attract Dagaa on moonless days.

The main conflicts reported on the lake are between the Nile Perch and Dagaa fishers regarding fishing grounds and use of light. Dagaa is one of the food sources for Nile perch. The increase in Dagaa catches coincided with the decline in Nile perch catches. Fishers of Nile perch in some parts of the lake blame the decline in Nile Perch catches to Dagaa fishing. The Nile Perch fishers also attribute the reduced catches to the use of light in Dagaa fishing, thinking it chases the Nile Perch. There have been cases of sand mining from the lake, especially in the northern part of the lake in Uganda. This activity affects the inshore areas which act as nursery and breeding areas for all the species. Agricultural practices close to the lake and use of fertilizers without adequate buffer zone results in a lot of nutrients entering the lake and encourage algal blooms which reduce oxygen levels as they decompose and change the aquatic environment.

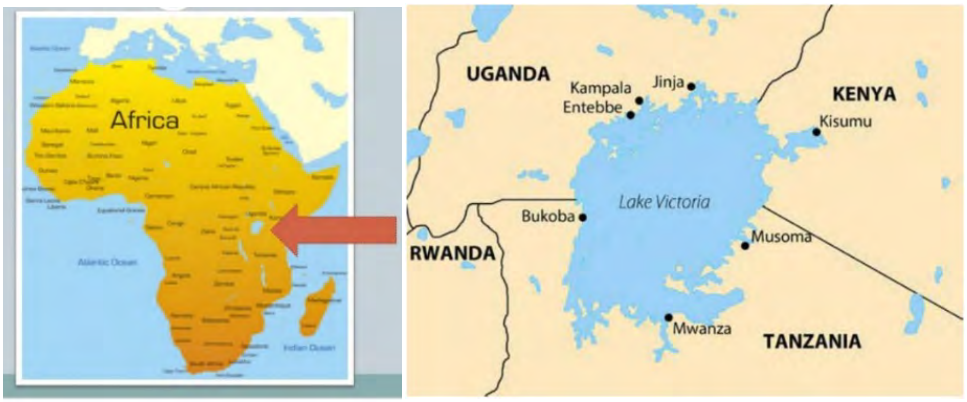

Figure 1. Map of Lake Victoria.
Source: Google Maps, with author's edits.

1.2 Economic contribution and social implications of the fishing activity

The estimated fish production in Lake Victoria is 876 547 tonnes (2015)[54]. Sixty-five percent of the catch is derived from Dagaa which is mainly sun-dried at landing sites and sold to the domestic and regional markets. However, Dagaa contributes only 32 percent to the total beach value (USD 588 680) because of the low value caused by poor processing. Of the three countries sharing Lake Victoria, Kenya is the main importer of Dagaa. The majority of Dagaa catch (70%) is used for the production of poultry, animal and fish feed, and only 30 percent is used for human consumption. Some Dagaa is sold to neighbouring countries like the Democratic Republic of Congo (DRC), Rwanda and South Sudan, but the trade is informal and data scanty. Dagaa is an important fishery targeted by 32 percent (70 513) of the fishers, but the majority are men; only 227 women are involved. Nevertheless, Dagaa provides

[54] Lake Victoria Fisheries Organization Catch Assessment Report, April 2016

employment opportunities to women, especially in the post-harvest sector. Dagaa can be sold in small quantities which are affordable to low-income earners and therefore, it is important for food security.

The most important fishery is Nile Perch, which is targeted by 52 percent (115 515) of the fishers. It contributes 19 percent to the total catch, but the contribution to the total values is 52 percent because it is a high-value species. The catch is sold fresh or chilled to industrial processing plants which export different products to international markets. The products include chilled fillets, frozen head and gutted/fillets/chops. Some of the Nile Perch is sold fresh or smoked to the domestic and regional markets while some are salted and sundried for the DRC market. The Nile Perch fish maws are exported fresh or sundried to Hong Kong and China. They are of high value compared with the fillets and driving the prices of Nile Perch upwards. Nile Perch is exported to more than 50 countries, with 60 percent exported to Europe. The export value is about USD 400 million annually.

The most appreciated fish within the region is Nile Tilapia. It contributes only two percent (20 370 metric tonnes) to the total catch but is targeted by 12.4 percent (27 723) of the fishers. The catch is mainly sold in the domestic market as fresh, smoked, sundried or fried. It is considered vital for food security, and Tanzania does not allow the export of Nile Tilapia. Uganda exports Tilapia to Kenya, Rwanda, South Sudan and DRC, but the trade is mainly informal, and the data is scanty. The estimated beach value of Tilapia from the lake is USD 34 651 annually. Other fisheries include haplochromines, clarias and protopterus, which contribute 3.4 percent to the total catch. These species are mainly for domestic consumption. The non-fishing livelihood activities around the lake include farming (crop/livestock), artisanal fish processing, boat repair and mending of nets.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

The three Partner States sharing Lake Victoria (i.e. the Republic of Kenya, the United Republic of Tanzania and the Republic of Uganda) have been managing the lake through agreed management plans to ensure the sustainability of the fisheries resources. The first Fisheries Management Plan was developed in 2001 and implemented from 2005 to 2008. This was followed by the second Management Plan for the period 2009 to 2014. The lessons from the first two plans were used during the review process to come up with the Lake Victoria Fisheries Management Plan III (FMP III) 2016-2020. The FMP III provides management goals and objectives for Nile perch, Tilapia and Dagaa with target indicators, reference points and decision control rules with proposed management measures. The plan also indicates the strategic actions and expected outputs.

LVFO provides a forum for discussion and consultation about the issues that affect the lake. Once the measures have been agreed upon, the implementation is conducted by the Central, regional and Local/Devolved Governments as well as the communities. The Central Governments are responsible for the formulation of national policies, strategies, guidelines and standards. They are also responsible for technical support, guidance, mentoring, supervision and monitoring of implementation and reporting. The Local/Devolved Governments also perform the oversight role to the fishing communities. LVFO established community management Units at all gazetted/designated landing sites called Beach Management Units (BMUs). The BMUs leadership are responsible for the management of the landing sites which include vetting of fishers before issuance of fishing vessel licenses, catch data collection, management of conflicts and ensuring the use of recommended fishing gears and methods. The BMUs have formed networks with leadership at the national and regional level.

The main control of access to the fisheries of Lake Victoria is licensing. Fishing canoes are required to be vetted and approved by BMU leadership to ensure that they have the recommended fishing gears before they are licensed. The fishing canoes are also inspected for seaworthiness by the appropriate

authorities before being licensed. A fee is charged to get a fishing vessel license, and other charges include a daily landing fee. Both the fishing and landing fees are the same for all fishing vessels on the lake in each country regardless of the commercial value of what they catch.

At the regional level, the number of fishing canoes for Lake Victoria since March 2018 was agreed to be 70 696 of which 13 403 in Kenya, 29 154 in Tanzania and 28 139 in Uganda. The number of fishing vessels for Nile Perch was also agreed not to go beyond 37 679 (7 531 in Kenya, 15 327 in Tanzania and 14 821 in Uganda). Other controls in the lake include the size of Nile perch to be caught (50 cm to 85 cm total length) and the minimum size of Tilapia to be caught, which is 20 cm. In addition, the minimum gillnet mesh size for Lake Victoria is 5 inches while for the Nile Perch fishery it is 7 inches. A number of breeding and nursery areas have been identified and some gazetted for protection. For Dagaa, fishing is not allowed within 2.5 km from the shoreline to reduce harvesting of juvenile fish.

The Central Government is responsible for the development of rules and regulations and ensuring compliance. It collaborates with the Local/Devolved Governments and BMU leadership in monitoring, control and surveillance (MCS). The MCS systems used to monitor fishing activities including the vetting of fishers,an inspection of fishing gears and vessel, lake patrols, an inspection of catch at landing time, during transportation, in markets and inspection of processing plants. The enforcement measures which are used to ensure compliance with the fishery's regulations include: fines, suspension from fishing, confiscation of fishing equipment, peer pressure from the community and criminal charges and imprisonment. The frequency of enforcement varies from country to country and may be irregular, thus affecting the rate of compliance. The most non-compliance experienced on Lake Victoria is the use of illegal fishing gears and catching of undersized fish.

2.2 Brief history of the former rights-based approaches used in the fishery

Lake Victoria does not have an elaborate rights-based approaches other than the licensing system.

2.3 Rights-based approach: allocation and characteristics

Access to fishing in Lake Victoria occurs through fishing vessel licensing. To obtain a fishing vessel license, one needs to be registered with BMUs, have legal fishing gears and a seaworthy canoe. In March 2018, the Fisheries and Aquaculture Sectoral Council decided to limit the number of fishing vessels for Lake Victoria and for the Nile Perch fishery as per the numbers indicated in the Frame Survey of 2016. Each country is to limit the total number of fishing vessels, including the number of fishing vessels for the Nile Perch fishery, to the numbers they had in their countries as per Frame Survey report of 2016. The incorporation of the decision in national regulations is yet to be done. When implemented, it is expected to control the increase in fishing effort and promote sustainability.

The right to own a fishing vessel license varies from country to country. In Kenya and Tanzania, only nationals have the right to get a fishing vessel license while in Uganda, non-citizens pay a higher fee to acquire a fishing license. Within the countries, there are no restrictions regarding women or ethnic groups in obtaining a fishing vessel license.

A fishing vessel license is valid from the date of issue to 31 December of that calendar year, and it cannot be leased or sold to another person neither can it be inherited. Currently, there is no limit to the number of fishing vessels an individual can have. There is also no customary and traditional consideration when issuing fishing licenses. In addition, there is no special consideration to the poor and vulnerable individuals, women and other categories.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

Hydroacoustic surveys conducted on Lake Victoria show a decline of Nile perch stock over-time from 1.23 million tonnes in 2014 to 0.851 in 2016. During the survey of 2017, there was a 32 percent increase to 1.12 million tonnes but the size structure did not change much. The stocks were dominated by juvenile fish, and 96 percent of the stocks were below the slot size of 50 cm total length. The Dagaa stocks, which increased to 1.29 million tonnes in 2014, dropped to 0.718 million tonnes in 2016 and further reduced to 0.706 in 2017. The haplochromines, which are the main food for Nile Perch show wide fluctuations between surveys but overall have been on the increase for the last ten years. To ensure the sustainability of the different species, LVFO has agreed to the Species-Specific licensing, and regional guidelines have been developed to guide the process.

3.2 Economic viability of the fishery

LVFO has been conducting biennial Frame Surveys since 2000, and the trends on fishing characteristics provide variable information about the fisheries of the lake. Between 2006 and 2016, the number of fishers increased by 12 percent, the fishing vessels by eight percent, the seines targeting Dagaa increased by 221 percent and the longline hooks targeting mainly Nile Perch increased by 67 percent. The continuous increase in the number of fishing gears has contributed to the decline in fish catches. This may necessitate limiting the number of fishing gears per vessel to ensure the sustainability of the target species. There has also been an increase in the number of fishing vessels using outboard engines by 102 percent during the same period, thus indicating that fishers are travelling longer distances to fish as the catches reduce in the coastal areas. While the laws of member states regarding gillnets allow single nets, the majority of gillnets have triple panels (62%).

3.3 Social equality

In the Lake Victoria fisheries, the requirements to acquire a fishing vessel license do not consider the social aspect but rather the biological, ecological and sustainability of the fisheries resource. Therefore, issues of social equality, gender equality, human rights, rights to the new generation of fishers to the resource and the right to food are yet to be considered.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

The Lake Victoria fisheries are faced with increased Illegal, Unreported and Unregulated fishing. Between 2006 and 2016, small hook (≥ 10), which are illegal and mainly targeting Nile Perch increased by 302 percent from 3 million to 14 million. Monofilament nets, which catch fish discriminately and are illegal, increased from 2 293 to 72 101 during the same period. The catching of smaller sizes of Nile Perch has resulted in the decline in Nile Perch catches by 37 percent from 264 070 metric tonnes in 2016 to 165 083 metric tonnes in 2015. The number of industrial processing plants decreased by 59 percent from 41 to 17 with loss of jobs and redundant processing capacity. The volume of Nile Perch exports to international markets decreased by 57 percent from 109 million tonnes to 47 million tonnes. However, the value increased by 115 percent from USD 186 in 2006 to 400 million in 2015 as a result of the increase in fish prices and the trade-in Nile Perch fish maws. The high-,value maw trade is becoming a threat to the fishery and needs to be regulated and controlled.

The illegal small seines mainly targeting Dagaa also increased by 170 percent from 4 370 in 2006 to 11 805 in 2016. Catching of young Dagaa could have contributed to the decline in Dagaa catches from 602 295 in 2006 to 566 570 in 2015 and also the reduction in fish stocks by 45 percent from 1.29 million tonnes to 0.71 million tonnes. LVFO has agreed on mesh size for Dagaa seines to be 10 mm and fishing to be beyond 2.5 km from the shoreline to avoid catching of juvenile Dagaa which have concentrations in shallow waters. But this requirement is not always complied with.

Partner states have intensified enforcement in the effort to ensure the sustainability of fish stocks. Uganda has deployed the army which reports to the President and Tanzania has also increased the number of lake patrols. The last hydroacoustic survey of 2017 showed some increase in Nile perch stocks but with the dominance of juvenile fish. If the enforcement efforts are maintained, there will be the recovery of the Nile perch and Dagaa stocks. However, there is a need to enhance engagement of the users for long term benefits.

4.2 Improving fishery sustainability in the future

Recommendations for improving fishery sustainability are analyzed as follows:

a) Currently, there is no limit on the number of fishing vessels an individual can have. Information on individual ownership is not documented, but field visits show that some individuals have more than 100 fishing vessels. There is a need to limit the number of fishing vessel per individual and provide for social equitability.
b) The increase in effort is mainly on the number of gears compared with the number of fishing vessels. There is a need to establish appropriate limits on the number of fishing gears per fishing vessel according to the target species.
c) The fishing vessel license charges are the same despite the target fishery. The economic value of these fisheries is not the same. There is a need to evaluate and set licensing charges according to the commercial value of the species.
d) Several processing plants closed due to the shortage of Nile Perch. The value of Nile Perch maw is encouraging catching of bigger sizes of Nile Perch which have a higher value. There is a need to regulate and control the processing and trade of fish maws.

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Kodiak's Setnet Salmon Fishery in the Context of Alaska's Limited Access Management System

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Abstract
The seafood industry is a cornerstone of Alaska's economy. By all measures, salmon are responsible for the greatest economic impact (jobs, income, and total value) in the Alaska seafood industry. This case study presents the Kodiak salmon set gillnet fishery in the context of Alaska's statewide salmon fishery. It provides a brief history of the development of the modern Alaska salmon fishery following the Klondike gold rush in 1890 through the adoption of the Limited Entry Act and enclosure of the salmon fishery in 1973 under a limited entry permit system. An overview of the Kodiak salmon set gillnet fishery, and its management is presented. This is followed by a discussion of how the limited entry system has supported utilizing salmon resources for the "maximum benefit" of Alaskans, as required by the Alaska Constitution, both in terms of long-term sustainable use of the salmon resource and toward ensuring the socioeconomic viability of the fishery. Finally, the case study explores challenges and shortcomings of Alaska's limited entry permit system for salmon and considers next steps for improving the contribution of the rights-based approaches to achieving sustainability goals.

1. INTRODUCTION

1.1 Description of the fishery

1.1.1 Alaska Seafood and Salmon

Salmon are the cornerstone of Alaska's seafood industry, and they underpin a traditional subsistence lifestyle in rural communities across the State. Seafood is the second largest sector of the Alaska economy, after Oil and Gas and ahead of Tourism and Mining. By all measures, salmon are responsible for the greatest economic impact (jobs, income, and total value) among all species caught by the Alaska seafood industry.

Currently, the harvest in Alaska represents about 80 percent of the total wild-caught North American harvest of salmon, Canada's harvest accounts for about 15 percent, and harvests from Pacific Northwest states (Washington, Oregon and California) make up the remaining 5 percent.

Alaska's 2016 seafood harvest of 5.6 billion pounds had a total ex-vessel value[55] of USD 1.7 billion. Processors produced 2.7 billion pounds of Alaska seafood products in 2016, worth a first wholesale value[56] of USD 4.2 billion. Seafood directly created an average estimated 26 800 full-time equivalent (FTE)[57] jobs in Alaska in 2015/2016[58]. Alaska fisheries employed an average of 29 200 commercial fishermen in 2015/2016, including 16 500 Alaska residents. The processing sector employed an average of 24 500 workers in 2015/2016, including an estimated 7 200 Alaska residents.

[55] The dollar amount received by fishermen for their catch when delivered to a processor. This includes both initial payments and any bonuses or year-end adjustments paid by processors.
[56] The value of seafood products when sold to buyers outside a processor's affiliate network. This is the value of the raw fish delivered to the processor (ex-vessel value) plus the value added by the first processor.
[57] Many seafood industry workers are employed in seasonal jobs or earn a year's worth of income in less than a year. FTE employment figures in this report represent an annualized estimate of jobs created in each study area, allowing comparison to other industries.
[58] Due to biological and environmental factors, harvest of wild seafood is inherently volatile. For example, total odd-year harvests of Alaska pink salmon can be double or triple even-years. In order to reduce this volatility, figures have been averaged or otherwise combined from the two most recent years (2015-2016) where appropriate.

The average 2015/2016 harvest of salmon was 792 million fish with an ex-vessel value of USD 418 million and first wholesale value of USD 1.36 billion or 32.4 percent of the seafood industry's first wholesale proceeds. The statewide salmon fishery's contribution to the economy included approximately 16 600 direct FTE jobs or 61.9 percent of total seafood jobs in Alaska.

Alaska also has important sport and subsistence fisheries for salmon. Many Alaskans depend heavily on subsistence-caught salmon for dietary needs and as well as deeply rooted cultural and religious purposes. Fishery management plans in Alaska give top priority to the subsistence use of fish resources.

1.1.2 Alaska Salmon Management

The State of Alaska and the Federal Government manage commercial fisheries from zero to three nautical miles (nm) and three to 200 nm offshore, respectively. In state waters, the limited entry permit program regulates access to most commercial fisheries, including salmon. Salmon fishing in Alaska is managed under the jurisdiction of the State, in cooperation with Federal Government and relevant international fisheries bodies. Salmon fishing in Alaska occurs primarily in State waters or in one of three historical State-managed fishing areas, which extend beyond three nm offshore into federally managed waters - Cook Inlet, Prince William Sound, and the Alaska Peninsula – but that are managed under the jurisdiction of the State of Alaska.

Management of salmon fisheries occurring beyond three nm offshore in Alaska is guided by the Federal Fishery Management Plan for the Salmon Fisheries in the EEZ off the Coast of Alaska (AK Salmon FMP). The AK Salmon FMP allows a commercial troll fishery in federally managed waters off Southeast Alaska and closes the remaining Federal waters off Central and Western Alaska to commercial salmon fishing. The AK Salmon FMP does not include the three historical State-managed areas (which are managed under State FMPs), and it defers management of the commercial troll fishery in Southeast Alaska to the State of Alaska and, under the Pacific Salmon Treaty, the U.S.-Canada Pacific Salmon Commission.

Table 1. Alaska Salmon Permit Fisheries by Gear Type and Area.

Alaska Salmon Permit Fisheries by Gear Type and Area																
GEAR TYPE	**AREA**	(A) Southeast	(B) Statewide	(D) Yakutat	(E) Prince Wm Snd	(F) Atka	(H) Cook Inlet	(K) Kodiak	(L) Chignik	(M) AK Pen/Aleut	(P) Upper Yukon	(T) Bristol Bay	(W) Kuskokim	(X) Kotzebue	(Y) Low Yukon	(Z) Norton Sound
Seine																
01 purse		S01A			S01E		S01H	S01K	S01L	S01M						
02 beach								S02K								
Gillnet																
03 drift		S03A			S03E		S03H			S03M		S03T				
04 set				S04D	S04E	S04F	S04H	**S04K**		S04M	S04P	S04T	S04W	S04X	S04Y	S04Z
Troll																
05 hand			S05B													
15 power			S15B													
Fish wheel																
08 fish wheel											S08P					
Source: https://www.cfec.state.ak.us/bit/MNUSALM.htm																

Salmon may be commercially captured in Alaska between 1 June and 31 October. There are 27 commercial salmon fisheries in Alaska, prosecuted across 15 management areas using seven gear types: purse and beach seine, drift and set gillnet, hand and power troll, and fish wheel (Table 1).

Alaska has directed management plans for five species of Pacific salmon (Figure 1): Oncorhynchus gorbuscha commonly known as pink or humpback salmon; O. nerka commonly known as sockeye or red salmon; O. keta commonly known as dog or chum salmon; O. kisutch commonly known as silver or coho salmon; and O. tshawytscha commonly known as king or chinook salmon. Two other Pacific salmon species spawn exclusively in Asian river systems and are not caught in Alaskan waters.

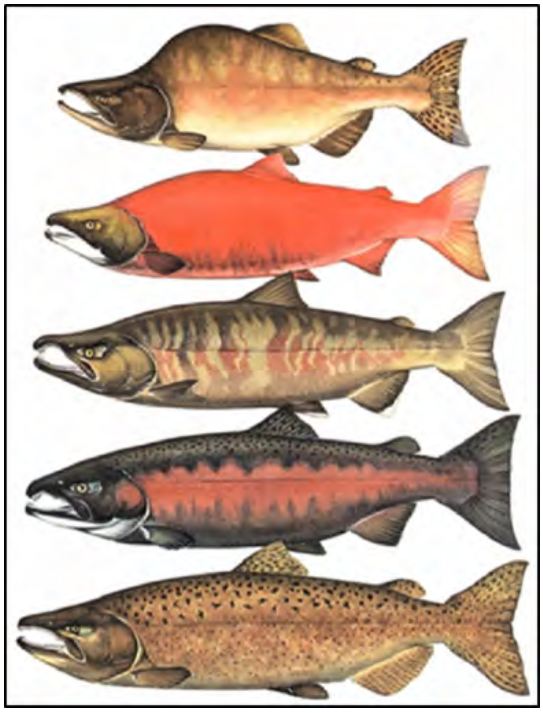

Figure 1. Pacific salmon species.
Source: https://www.reed.edu/biology/professors/srenn/pages/melati_website/kaye_home.html.

1.1.3 Kodiak Management Area and Salmon Fisheries

Kodiak is a remote and isolated archipelago of volcanic origin located in south central Alaska. The archipelago lies in the North Pacific Ocean and is made up of 28 islands that cover an area 285 km long and 67 miles 108 km across. Kodiak Island is the largest island in the archipelago, other major islands include Afognak, Shuyak, and Raspberry.

Kodiak is awash in spectacular natural beauty, including glaciers, steep mountains, rushing rivers, deep, clear bays and inlets, and an abundance of terrestrial and marine wildlife, including the world-famous Kodiak brown bear. A strong oceanic current, known as the Kuroshio, brings mild, wet weather year-round. Kodiak has been called the "Emerald Isle" due to the lush green vegetation that carpets the land in summer months.

The marine waters around Kodiak are among the most productive in the North Pacific. Offshore upwelling combines with abundant freshwater runoff to make near shore waters rich in nutrients. There are over one hundred species of marine fish native to the waters of Kodiak, including the five species of Pacific salmon. A majority of the archipelago's lands are protected wilderness; ensuring critical fish and wildlife habitats are preserved.

The Kodiak Management Area (KMA) includes State waters of Alaska south of a line extending from Cape Douglas (58° 51.10' N. lat.), west of 150° W. long., north of 55° 30.00'N. lat., and north and east of a line extending 135° southeast for three miles from a point near Kilokak Rocks at 57° 10.34' N. lat., 156° 30.22' W. long. (the longitude of the southern entrance of Imuya Bay), then due south (Figure 2).

In the KMA salmon may be commercially harvested using the following gear types: purse seine, beach seine, and set gillnet. This case study focuses on Kodiak's set gillnet salmon fishery.

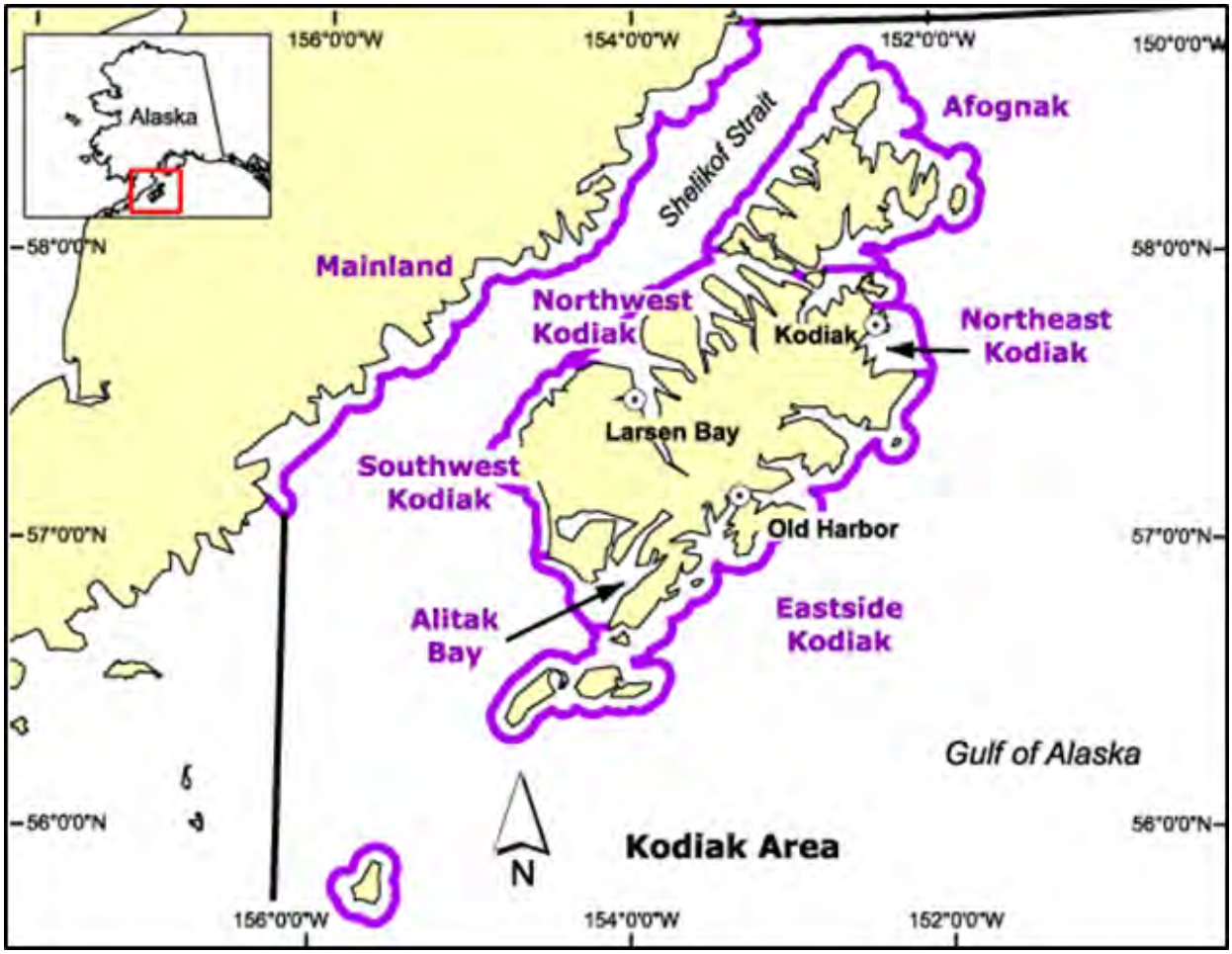

Figure 2. Map of Kodiak.
Source: https://www.adfg.alaska.gov.

1.1.4 Set Gillnet Salmon Fishing

Set gillnet fishing for salmon in Alaska predates Western contact. While the principles of set gillnet fishing have not changed over the years, nylon has replaced nettle and cedar netting, and stone anchors have been replaced with steel and concrete. Today, set gillnet fishing remains an effective, low-cost, labour-intensive method of fishing for salmon.

There are 188 State issued set gillnet permits in the KMA. Set gillnet operations in Kodiak are land-based, perhaps because of this fishing with immediate and extended family members is common. Set gillnet operations are commonly referred to as 'fish camps' as they are only inhabited seasonally during salmon fishing. The vast majority of Kodiak set gillnet fish camps are in remote and isolated locations. Lodgings consist of simple wood cabins and outbuildings or sheds where fishing equipment is stored when not in use.

Fish camp residents typically include the captain or permit holder as well as one to two additional crew members. These crew frequently consist of relatives, close friends and associates of the permit holder and their family. Though less common, captains also contract individuals where no connection or previous relationship exists. Spouses, small children, and others that are not part of the fishing crew (i.e. going out to pick the nets) are often present at fish camp and occupy various essential roles in the day-to-day work.

In the KMA set gillnets are placed near shore in submerged lands. Typically, a series of anchors and lines are used to secure one end of the set, while the other end is fixed to a rock near the tide line.

The gillnet is then hung on the set. As salmon move along the shore, fish are entangled or caught by their gills in the net. Salmon are harvested from the net using an open skiff with outboard engine.

Several times per day fishers work their way along picking the fish that have been captured. Salmon are either delivered directly to a tender vessel or temporarily stored in totes with slush ice or in refrigerated seawater holds until the tender arrives. Tender vessels are an essential middleman between set gillnet fishermen and fish processors. Tender vessels are contracted by fish processing plants and dispatched at regular intervals to remote set gillnet sites, typically based on season-long contracts that are negotiated before fishing begins. The tender boat weighs and purchases the fish, loads it into their hold, and transports the fish back to the contracted processing plant where they are cleaned, packed, and ultimately sold. The tender boat also provides a critical lifeline, resupplying fish camps with food, fuel, and anything else they need to stay out and keep fishing.

Every time a set gillnet fishermen sell or deliver fish, typically to a tender vessel, they are required to submit a fish ticket, the fish ticket must indicate the number of fish of each species and the total weight by species for each delivery. Because of the fixed nature of set gillnet gear, a permit holder's reporting area (statistical area) is usually consistent between landings. In the event that a set gillnet is moved into a new statistical area, fishermen must make sure that information is reflected and reported on their fish tickets.

A person who holds a limited entry permit for set gillnet gear must be physically present at the fishing site during fishing operations. An individual may hold only one permit. A permit holder may operate no more than two set gillnets, with no more than 150 fathoms of set gillnet in the aggregate. No gillnet may be more than 125 meshes deep. Seine webbing no greater than 3.75 inch nesh size, or polypropylene webbing 3 mm or greater in diameter, may be used on the shoreward end of a set gillnet and the length of the seine webbing used may extend not more than 50 fathoms seaward of the beach at the lowest tide of the current day. Set gillnets must be operated in a substantially straight line, except that no more than 25 fathoms of a set gillnet may be used as a hook in any configuration. The shoreward end of a set gillnet must be attached to a point of land that is exposed at the lowest tide of the day or to a rock that is within five feet of the surface at the lowest tide of the day.

The owner and operator of a set gillnet must place the name of the fisher operating it, together with the fisher's five-digit permit serial number, in a conspicuous place on or near the set. In addition, the owner and operator shall plainly and legibly mark the fisher's five-digit permit serial number on kegs, buoys or clusters of floats associated with the set with.

1.2 Economic contribution and social implications of the fishing activity

1.2.1 Composition of Alaska's Salmon Industry – Markets and Products

Seafood is Alaska's biggest export, topping USD 3 billion in sales, and targeting over 120 countries in 2015. Alaska accounts for 55 percent of U.S. seafood exports by value. In this section, the context about which species, product types, and markets drive value in Alaska's salmon industry is presented. This information is assumed to be largely consistent with species, product type, and market destinations for fish produced by the Kodiak set gillnet salmon fishery. Comparisons represent an average of 2014 and 2015 because pink salmon harvests in odd and even years tend to fluctuate substantially, leading to skewed percentages based on analysis of single calendar year data.

1.2.1.1 Ex-vessel value by species

Sockeye and pink salmon account for the largest share of harvest volume and ex-vessel value –a combined 84 and 78 percent, respectively, over the past two years. Keta (i.e. chum), coho, and chinook salmon accounted for the other 16 percent of harvest volume and 22 percent of the fishery's ex-vessel value.

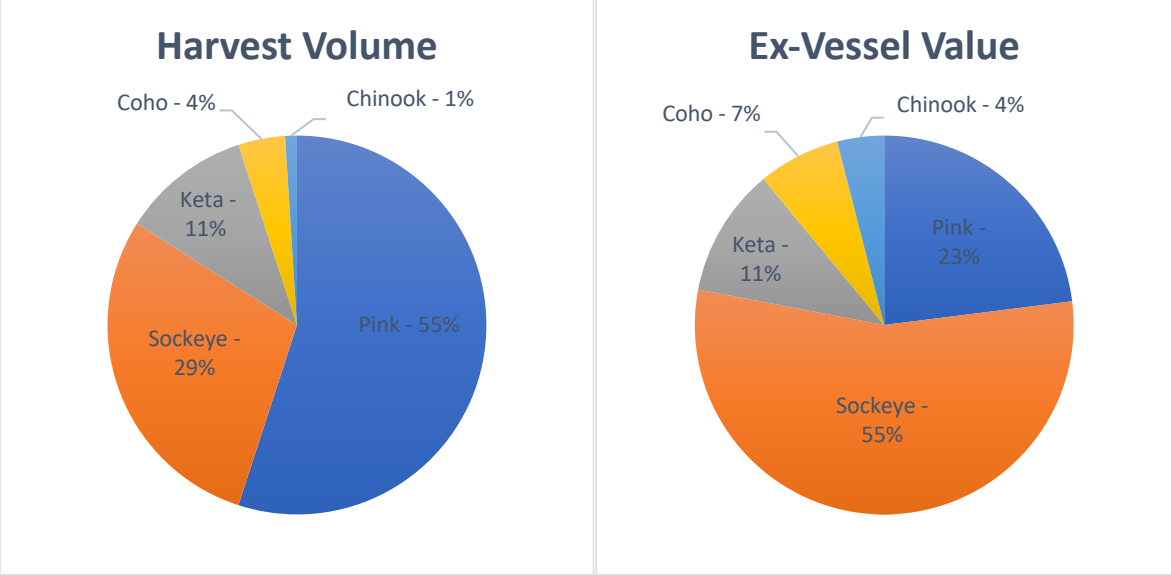

Figure 3. Harvest Volume and Ex-Vessel Value by Salmon Species, 2014-2015.

1.2.1.2 First wholesale sales volume and value by product type

Frozen head and gut (H&G) and canned product forms account for the vast majority of Alaska salmon production, but other key product forms provide a significant share of production (i.e. first wholesale) value. Over the last two years, frozen H&G and canned product accounted for 81 percent of production volume and 61 percent of first wholesale value while all other product forms (roe, fillets, fresh H&G) combined accounted for 19 percent of production and 39 percent of first wholesale value.

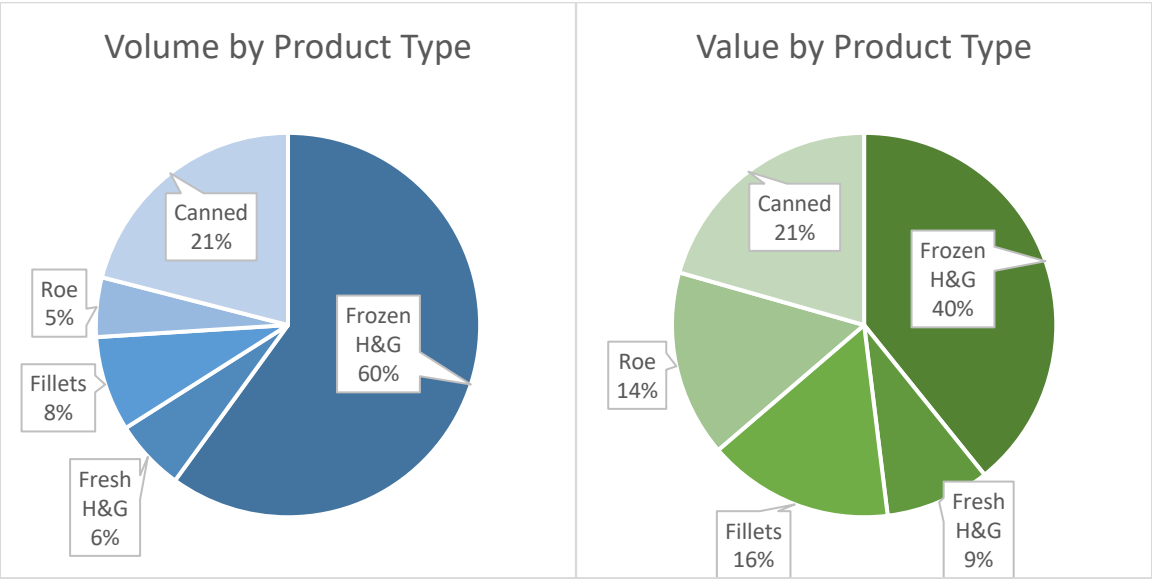

Figure 4. First Wholesale Sales Volume and Value of Key59 Salmon Products, 2014-2015.

1.2.1.3 Alaska Salmon Market Composition

It is estimated that the U.S. is the largest market for Alaska salmon products, but export markets as a whole account for approximately three-quarters of first wholesale sales. China is the largest export

[59] Some Alaska salmon processors produce a wider range of salmon products than those presented here, such as fish meal/oil, strips, and frames. However, the value of these ancillary products is a relatively small portion of total sales. In 2014, ancillary salmon products were valued at $34.4 million according to ADF&G's Commercial Operators Annual Report, or 2.7 percent of the first wholesale value of product sold in 2014.

destination, but the vast majority of product exported to China undergoes additional processing and is re-exported (primarily to Europe, the U.S., and Japan). South Korea and Thailand also import significant volumes of intermediate products for further processing or storage. In terms of final consumption, the U.S., Europe, and Japan are Alaska's biggest salmon markets. Canada and South Korea are also major markets.

Table 2. Estimated Market Share of Total First Wholesale Sales Value, 2014-2015 Average.

Market[60]	**Pct. of First Wholesale Sales Value**	**Key Products**
United States (Est.)	27%	Fillets/H&G (fresh & frozen), canned pink salmon
China	18%	Frozen H&G pink/keta
Europe	15%	Frozen H&G sockeye and canned salmon
Canada	14%	Canned salmon, fillets/H&G (fresh & frozen)
Japan	11%	Roe and frozen H&G sockeye
South Korea	4%	Frozen H&G sockeye
Others	10%	Canned salmon, frozen H&G pink/sockeye

Sources: ADOR (Alaska Salmon Price Report), ASMI Alaska Seafood Export Database, and McDowell Group estimate.

1.2.2 Employment, income and reliance on the fishery

1.2.2.1 Kodiak's reliance on the Fishing

Total population of the Kodiak archipelago, including the six villages of Port Lions, Ouzinkie, Larsen Bay, Karluk, Old Harbor and Akhiok, is nearly 14 000 with approximately 11 000 of those residents living in and around the city of Kodiak. Transportation in Kodiak is limited to floatplanes and watercraft, with the exception of a short road system around the city of Kodiak.

The seafood industry, including fish harvesting and processing, is the single most important economic activity in Kodiak. The fishing industry drives the area's economy and employed an estimated 5 900 FTE workers, accounting for approximately 40 percent of the region's employment in 2015/16. Kodiak waters produce several commercial species leading to more consistent production throughout the year, as a result, Kodiak's seafood processors employ the highest percentage of local residents (48 percent) of any major production region in Alaska.

In 2015, Kodiak was the second largest commercial fishing port in the U.S. by volume landed, and third in terms of ex-vessel value, with landings worth USD 262 million. Other key Kodiak area ports include Larsen Bay, Alitak Bay, Old Harbor, and Chignik.

1.2.2.2 Employment

According to the report, "Alaska's Fishermen: Harvests, earnings, and their other jobs", published by the Alaska Department of Labor Workforce and Development (ADLWD), about 32 200 people were directly employed by the seafood industry in 2011, including about 9 900 permit holders who made at least one landing that year and more than 22 000 crew members: salmon harvesting represented

[60] Note: Some countries, such as China, South Korea, and Canada re-export substantial quantities of Alaska salmon products. These data should not be regarded as market share of final consumption, but rather an estimate of market share in terms of first wholesale sales.

more than half of the total jobs. During the salmon fishing season, up to 5 000 people are employed in Kodiak's commercial salmon fishery, including harvesting, processing, and management jobs.

The State of Alaska has issued 188 licenses or limited entry permits in the Kodiak salmon set gillnet fishery. A typical set gillnet operation directly employs 2-3 individuals, including the permit holder. However, this figure doesn't fully capture participation in the set gillnet fishery. Because it is land-based, fishing with immediate and extended family members is especially common in the Kodiak set gillnet fishery. Often, the labour of the 2-3 member crew is supplemented by other individuals in a fish camp.

For example, many women play a central role in the day-to-day operations of a fish camp, both supporting fishing operations from shore, and working in the boat, though not necessarily as paid crew. Statistics on gender balance in the Kodiak set gillnet fishery are not available, but according to the 2011 report from the ADLWD, women accounted for approximately 14 percent of commercial fishers in the State – both skippers and crew – and about one-third of processing workers.

1.2.2.3 Income

The averaged 2015/2016 harvest of Kodiak salmon had an ex-vessel value of USD 34 million and first wholesale value of USD 301 million. In 2015/2016 ex-vessel landings worth USD 4.6 million were generated by the 146 set gillnet permits fished, on average.

In the five-year period, 2013-2017, average gross earnings per set gillnet permit in Kodiak was USD 50,246. This number does not account for costs associated with operating a set gillnet site, including crew shares, license fees and taxes, transportation to/from the site, fuel, provisions, and so forth. To put this in context, in 2016, the U.S Bureau of the Census reported the annual real median personal income at USD 31 099, and the real median household income at USD 59 039. In other words, the average set gillnet permit, after expenses, generates income on par with the national average annual personal income.

Fish harvesting in Alaska is seasonal, and fish harvesters in Alaska often hold more than one job. According to the 2011 report from the ADLWD, almost 9 000 active permit holders and crew had payroll jobs[61] in 2011 — that is, they worked for an employer when they weren't fishing. Over 29 percent of the more than 9 900 permit holders and 27 percent of 22 200 crew members held second jobs in Alaska where they drew a wage. A number of other fishermen may have also been self-employed when they weren't fishing. Further, the information necessary to track permit holders and crew into the workforce is not always available (for example, second-job information for fishermen who worked in other states, for the federal government, or who participated in other commercial fisheries).

Operating a set gillnet site in Kodiak is a full-time job, but set gillnet fishing only occupies between eight and 16 months of a given year. Set gillnetting is seldom the permit holder's only source of income. According to the 2011 ADLWD Report, set gillnet permit holders were especially likely to have other jobs. More than 50 percent of all set gillnet permit holders also had a known wage and salary job. Statewide they earned nearly USD 41 million of the USD 84.5 million in payroll earnings of all harvesters in 2011.

[61] Most payroll jobs in Alaska — those where employers pay a wage or salary — are covered under state unemployment insurance laws. Employers are required to report job numbers and wages to the Department of Labor and Workforce Development, which uses those numbers to count jobs and record wages. Counting fish harvesters is more difficult because most commercial fishermen are considered self-employed and do not pay into the unemployment insurance system, and crew generally work for a share of the profit rather than a set wage. Without these unemployment insurance records, the department uses a variety of other sources to estimate employment.

Table 3. Estimated Total Gross Earnings (Nominal) for the Kodiak Salmon Set Gillnet Fishery, with Average Gross Earnings (Nominal) by Permit, 2013-2017.

Year	Residency	Total Permits Issued/ Renewed	Total Permits Fished	Total Pounds	Average Pounds	Total Gross Earnings	Average Gross Earnings
2017	Resident	129	98	10,525,746	107,406	$6,940,681	$70,823
	Nonresident	59	45	3,115,384	69,231	$2,154,669	$47,882
	Year Totals	188	143	13,641,130	95,393	$9,095,350	$63,604
2016	Resident	131	91	4,082,897	44,867	$3,300,503	$36,269
	Nonresident	57	46	1,460,071	31,741	$1,165,955	$25,347
	Year Totals	188	137	5,542,968	40,460	$4,466,459	$32,602
2015	Resident	132	105	8,217,282	78,260	$3,640,978	$34,676
	Nonresident	56	49	2,249,640	45,911	$1,111,819	$22,690
	Year Totals	188	154	10,466,922	67,967	$4,752,798	$30,862
2014	Resident	131	104	5,341,435	51,360	$6,872,007	$66,077
	Nonresident	57	42	1,542,455	36,725	$2,087,912	$49,712
	Year Totals	188	146	6,883,890	47,150	$8,959,918	$61,369
2013	Resident	133	105	6,646,341	63,298	$7,390,116	$70,382
	Nonresident	55	47	1,762,092	37,491	$2,155,085	$45,853
	Year Totals	188	152	8,408,433	55,319	$9,545,201	$62,797

Source: CFEC.

Table 4. Alaska Permit Holder's Other Jobs Wage and Salary Earnings 2011.

Alaska Permit Holder's Other Jobs Wage and Salary Earnings 2011				
By Species, Gear, and Region	**With WS Earnings**	**No WS Earnings**	**Percentage with WS Earnings**	**Average Earnings**
Statewide Salmon	2,237	4,540	29.3%	$29,306
Statewide Set Net	1,410	1,379	50.6%	$28,982
Kodiak (all fisheries)	110	543	16.8%	$28,822
Source: AK Department of Labor and Workforce Development				

No published data on non-fishing employment for the Kodiak set gillnet fishery was available. Though based on this authors experience, non-fishing employment in the set gillnet fishery is consistent with the 2011 Report published by ADLWD. According to the report, jobs in the construction trades were the most common for both permit holders and crew when they weren't fishing, together, over 13 percent of permit holders and crew worked construction jobs when not fishing. Nearly seven percent of fishers worked in material moving occupations, such as marine cargo handling, the job category with the second-highest number of participants. Food processing, mostly in fish processing plants, was the third-highest category, which is logical given the proximity of fish processing plants to fishing grounds, especially for small communities where the seafood industry is a major part of the economy, and other opportunities are limited. Another significant category of non-fishing employment was

education, as the seasonality of teaching jobs allows educators to take advantage of their free summers to earn money fishing.

Permit holders earned more on average than the crew in their other, non-fishing-related jobs. This is not surprising as crew members were much younger on average than permit holders, with an average age of 21. In 2011 permit holders had an average age of 47. Permit holders earned on average around USD 29 000 each in non-fishing wages. In contrast, crew members earned USD 18 650 working payroll jobs, on average.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

2.1.1 Alaska Salmon Management Overview

Pacific Salmon are anadromous; they return to the stream of their birth after spending a fixed lifespan in the ocean. The annual "run" takes place during several weeks each summer. Some salmon populations swim only a few hundred yards upstream; others travel as far as 2 000 miles up the Yukon River at speeds of 50 miles a day against the current. Each fish returns to the unique stream in which it was born, and many streams harbor multiple discreet populations. There are approximately 10 000 different spawning populations that must be considered. Stream-jumping by salmon populations only occurs in geologic time, however, it was not until well into the 20th century that biologists understood that each run is genetically unique and that successful long-term conservation of the aggregate salmon resource requires adequate "escapement" of spawning populations in each and every stream (Cooley, 1963)[62].

Alaska's salmon fisheries are not managed by harvest quota. Today the dominant feature of Alaska's salmon harvest policy is "fixed escapement," or ensuring that sufficient numbers of adult spawning salmon escape capture in the fishery and are allowed to spawn in the rivers, thus maintaining the long-term health of the stocks. For the most part, salmon are caught when they return to spawn and die in their rivers of origin. Fishery managers must ensure that a sufficient number of fish escape up the river while avoiding potential economic harm to fishers by allowing excess escapement. In what can sometimes be a very short period, the fleet has an opportunity to catch all remaining fish not needed to meet escapement goals.

Salmon managers open and close fisheries on a daily basis to ensure that adequate spawning escapements are achieved. When run failures occur, managers close fisheries to provide for predetermined escapement needs and therefore ensure long-term sustainable yields. When run strength is strong, managers liberalize harvest regulations to utilize surpluses. Alaska's focused emphasis on in-season management by local biologists with delegated regulatory authority to ensure sustained yields is a key ingredient to successful salmon management.

Another key aspect of Alaska's successful model for sustainable fisheries management is the separation of powers among government agencies that set policy (Alaska Board of Fisheries or BOF) and those that implement and enforce allocations and harvest limits (Alaska Department of Fish and Game or ADF&G). Alaska changed from federal management of its fisheries to state management in 1959 when it became a state, the ADF&G and BOF were formed the same year. While the ADF&G was formed with a strong conservation mandate to manage salmon fisheries for sustained yield, the BOF, on the other hand, was given the responsibility for allocating fishery resources among users. Another agency, the Commercial Fisheries Entry Commission (CFEC), was formed in 1973 to implement Alaska's limited entry law, it issues and regulates fishing permits for state fisheries.

[62] Salmon Biology - http://www.alaskool.org/projects/traditionalife/fishtrap/fishtrap.htm

2.1.2 Kodiak Area Salmon Management

The Kodiak area commercial salmon fisheries are managed by local area ADF&G biologists following 10 area management plans and a harvest strategy that emphasizes the following three criteria:

1) Promote maximum sustained yield for future KMA salmon returns by ensuring salmon escapements of sufficient magnitude and distribution.
2) Provide for orderly fisheries while maximizing harvest opportunities on the highest quality salmon.
3) Adhere to the biological and allocative requirements of all management plans adopted by the Alaska Board of Fisheries (BOF) for the KMA salmon fishery.

In the KMA salmon may only be taken from 1 June through 31 October during fishing periods established by the ADF&G. There are ten salmon management plans for Kodiak, developed by the BOF that direct ADF&G management activities for specific areas and during explicit time periods. These plans are used for both conservation and allocative purposes. Allocation considers both issues relating to salmon harvests within the Kodiak area among the three authorized gear types and issues relating to salmon harvests between Kodiak and adjacent management areas[63], including Cook Inlet, Alaska Peninsula, and Chignik.

Management of Kodiak area salmon fisheries is complex. Salmon spawning activity has been documented in about 800 streams within the Kodiak area. An estimated 440 streams support significant salmon production. Of those streams, four support Chinook salmon spawning populations, 39 support sockeye salmon spawning populations, 174 support coho salmon spawning populations, all support pink salmon spawning populations, and about 150 support chum salmon spawning populations.

When decisions must be made, annual run sizes are often uncertain; salmon stock composition is often unknown and must be assumed. Many in season management decisions for the Kodiak area commercial salmon fisheries are based upon estimated salmon run abundance and timing indicators. In season catch data, catch per effort data, test fish data, catch composition data, and escapement information from a variety of sources is used to assess stock strength in season. These various data and predictions, along with BOF management plans, are used by ADF&G to regulate fishing areas and times to achieve escapement targets and allocative criteria set by the Board of Fisheries. In season adjustment in areas open to fishing and fishing time are dictated by escapement goals. Escapements of several important stocks of salmon are monitored continuously with weirs, while aerial and ground-based surveys index escapement abundance of other stocks of salmon in the Kodiak area.

Within the KMA, there are seven districts, which are further broken down into sections and statistical areas. All fishermen must indicate catch by species and place of capture (statistical area) at the first point of sale or landing. All salmon buyers, including processing facilities and fish transport vessels (aka tenders), must be licensed and are required to report all landings data to ADF&G immediately. The data is compiled and evaluated daily by ADF&G.

In season run timing models are used to predict escapement levels using historic run passage information. Salmon run timing within the KMA follows a general chronology by species. Commercial fisheries management is based on the run timing of four targeted salmon species: sockeye - Oncorhynchus nerka, coho - O. kisutch, pink - O. gorbuscha, and chum - O. keta.

[63] Salmon tagging studies have demonstrated the presence of nonlocal stocks of salmon in the commercial salmon harvests of the Kodiak area. Nonlocal stocks of salmon present in Kodiak area commercial salmon fisheries include sockeye salmon migrating to streams in Cook Inlet, Chignik, and the southern portion of the Alaska Peninsula and Chinook salmon from Oregon through Cook Inlet.

Management of major sockeye salmon runs are based on escapement and utilize daily escapement information from salmon counting weirs on several of the larger streams. Due to inadequate funding for aerial surveys, escapement data for many small streams are obtained much later in the season. Because of this lag in timing, ADF&G will employ a more conservative management approach, which includes increased closed water areas and reduced fishing time. These management actions occur for systems that have the potential to be overharvested or have shown signs of overharvest in previous years.

The length of the initial fishing periods for pink salmon are determined preseason based on the magnitude of the wild stock pink salmon forecast. Adjustments in weekly fishing time and areas open to fishing will occur as the actual run strength becomes apparent through assessment of harvest and escapement estimates.

Initially, chum and coho salmon are incidentally harvested in fisheries directed at sockeye or pink salmon. Terminal or near-terminal fisheries targeting chum or coho salmon are managed based on an assessment of actual run strength and current harvest information. Commercial fisheries are not currently directed toward Chinook salmon O. tshawytscha. Incidental harvests of Chinook salmon occur during directed sockeye and pink salmon fisheries.

2.2 Brief history of the former rights-based approaches used in the fishery

Since pre-historic times the annual return of pacific salmon has been a mainstay in the lives of Alaska Native peoples. Immense river systems, including the Yukon and Kuskokwim, allowed salmon to play an integral role in the lives of Alaska Native peoples living as far as 1 500 miles from the ocean.

In the 1800s, prior to the first contact with Eurasians, coastal Alaska Native peoples had well-developed property rights to particular salmon streams. The rights were vested with the nuclear family or clan, not the individual. In times of scarcity, a clan could fish in a neighbouring clan's stream by paying a royalty on the catch.

The arrival of first Russian, and then American settlers, and the advent of commercial salmon fishing upset these long-established traditions. In 1878, the first salmon canneries were built in Alaska, presaging a dramatic decline in the salmon resource. The number of canneries grew rapidly between 1878 and 1920. During this time there was also a drastic proliferation of purse seine and gillnet fishing vessels. This growth occurred in the absence of any effective governmental regulation and, had it not been for the sharp drop in demand due to the Great Recession after the First World War, might have completely destroyed the fishery.

Salmon packing companies were issued Federal permits to harvest fish, in some instances at the exclusion of all other users, granting large operators exclusive access to key salmon runs. Many canneries in Alaska employed fish traps, which were remarkably efficient. Often built to fence off entire streams, the fish traps built by early canneries allowed for virtually no salmon escapement. Another stated benefit of fish traps at the time was their low labour requirements. The high catch efficiency and low labour requirements of fish traps were viewed as a fault by local fishermen and labourers, to say nothing of the Alaska Native peoples, who were increasingly marginalized and excluded from the resource. To make matters worse, it was standard practice of cannery owners to import Chinese labour to work in the canneries.

To build canneries and fish traps the industry had to concentrate capital, labour, and materials in remote locations for the intense but short fishing period, it was risky business. In 1944, 396 of the 434 fish traps were owned by “outsiders”, meaning business people who did not live in Alaska, but profited from the salmon resources of the State. Just a handful of large companies controlled over half of the

annual production between 1919 and 1959. It appeared to some that all of the benefits and revenue stemming from Alaska's salmon resource were leaving the State, and that local fishers were being left out of the deal. The fish trap was a central issue in debates concerning rent capture between residents and nonresidents, owners and labourers, and Federal vs State control of resources. Banning fish traps ultimately became a rallying cry for Alaska statehood.

In 1959, with the adoption of the Alaska State Constitution, fish traps were banned by referendum, "As a matter of immediate public necessity, to relieve economic distress among individual fishermen and those dependent upon them for a livelihood, to conserve the rapidly dwindling supply of salmon in Alaska, to ensure fair competition among those engaged in commercial fishing, and to make manifest the will of the people of Alaska, the use of fish traps for the taking of salmon for commercial purposes is hereby prohibited in all the coastal waters of the State."

A long-run decline in the salmon catch began after the peak year of 1939. It was temporarily arrested after Alaska became a state and instituted new conservation measures, including the banning of fish traps and setting escapement targets. During this time the salmon fishery was open access, where any individual could participate by purchasing a fishing permit for a nominal annual fee. In 1975, nearly 100 years after the first salmon canneries were built in Alaska, the State issued limited entry permits for salmon fisheries, leading to a recovery in the health and abundance of salmon stocks throughout the State.

2.3 Rights-based approach: allocation and characteristics

Today, the privilege to fish commercially in Alaska requires a permit issued by the State Commercial Fisheries Entry Commission (CFEC), which is an agency administratively attached to the Alaska Department of Fish & Game (ADF&G). CFEC permits are specific to species, gear type, and administrative area.

Prior to 1959, Alaska was a territory of the United States. When Alaska became the 49th State in 1959, its fishery resources converted from Federal to State management. Voter referendum and a constitutional amendment in 1972, in response to biological and economic failures in State salmon fisheries in the preceding decades, paved the way for the Alaska limited entry system.

Earlier attempts to limit entry into state fisheries were thwarted by a provision in the State constitution, which states, "no exclusive right or special privilege of fishery shall be created or authorized in the natural waters of the State" (Alaska Constitution VIII: 15). The State constitution was amended to expressly allow for the limitation of fishery access, "for the purposes of resource conservation, to prevent economic distress among fishermen and those dependent upon them for a livelihood."

Following the constitutional amendment, in 1973 the Alaska State Legislature enacted the Limited Entry Act, establishing the Commercial Fisheries Entry Commission (CFEC) and giving it the authority to administer the program. The objective of the CFEC is to "limit entry into commercial fisheries and provide annual licensing and permitting of fisheries to facilitate the management and development of fishery resources for the maximum benefit of those dependent upon them and the economy of the state."

Some key features of the limited entry program are: to restrict the issuance of permits to natural persons; prohibit permit leasing; prevent the use of permits as collateral for loans; and allow for free transferability. Limited entry permits cannot be held by nonpersons, such as corporations, communities, or other entities, and permit holders must be citizens or permanent residents of the U.S. and actively participate in the harvest of fish delivered under their permit. The Limited Entry Act prohibits permits from being pledged, leased, mortgaged, encumbered or transferred with any

retained right of repossession, and the permit itself cannot be used as collateral for a loan[64]. Leasing permits are not allowed, except for medical emergencies. Limited entry permits are transferable on the open market, meaning they may be sold or gifted to another person.

The Limited Entry Act also defines entry permits as a use-privilege that can be modified by the legislature without compensation. Federal regulations, not specific to commercial fisheries, have a significant impact on the administration of the State Limited Entry Program. The Federal Interstate Commerce Clause prohibits State governments from discriminating against residents of other U.S. states, which has the effect of keeping Alaska's State-managed fisheries open to all U.S. citizens.

Alaska's limited entry program was implemented in 1975 when 19 salmon fisheries[65] were limited. Among them were the salmon set gillnet fisheries in Kodiak, Prince William Sound, Cook Inlet, Alaska Peninsula, and Bristol Bay.

Permits were issued to individuals who demonstrated both a history of fishing and economic dependence on the fishery. During the phase, when an individual's permit qualifications were determined, they were issued as an interim-use permit (IUP). More than 2 300 IUPs were issued to individuals in the five-set gillnet fisheries. Eventually, individuals who met the minimum qualifications were issued permanent CFEC limited entry permits. Additional limited entry fisheries were established in the following years. Today there are 65 commercial fisheries managed by area and species under Alaska's limited entry program, of which 27 are salmon fisheries.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

Alaska has succeeded in sustainable yield management of its salmon fisheries since the enclosure of the salmon fishery under a limited entry permit system. In reference to salmon populations, the limited entry permit system has been vastly successful in increasing populations; catch has rebounded to record levels. In the Kodiak area, sustainable harvest levels of salmon have increased over the past 40 years.

Alaska's salmon catch had grown steadily with the rapid expansion of the cannery capacity, beginning in 1878 through 1920. However, without adequate controls, this led to overfishing and a long-run decline in stock abundance and catch after the peak year of 1939. By 1953 stocks were so depleted that President Eisenhower declared a federal disaster in Alaska. In 1959, statewide harvests totaled only about 25 million salmon, which is less than 20 percent of the current sustained production.

The decline was temporarily arrested after Alaska became a state and instituted new conservation measures including escapement targets, however, the inexorable entry of additional participants (prior to 1975, all fisheries in Alaska were managed as open access, where any individual could obtain a fishing permit for a nominal annual fee) and technological improvements to fishing gear caused further decline to record low levels in 1972. In the same year, the people of Alaska voted to amend the State Constitution to allow for a restriction on entry to Alaska's fisheries for certain purposes: conservation, prevention of economic distress, and promotion of aquaculture.

[64] Two exceptions to this rule are loans financed by the State of Alaska, Division of Economic Development (CED) or by the Alaska Commercial Fishing and Agriculture Bank (CFAB). These two agencies are authorized under Alaska Statute to take a limited entry permit as security for a loan they extend.

[65] Permit fisheries are defined by CFEC as a specific gear type for a fishery resource within a defined administrative area.

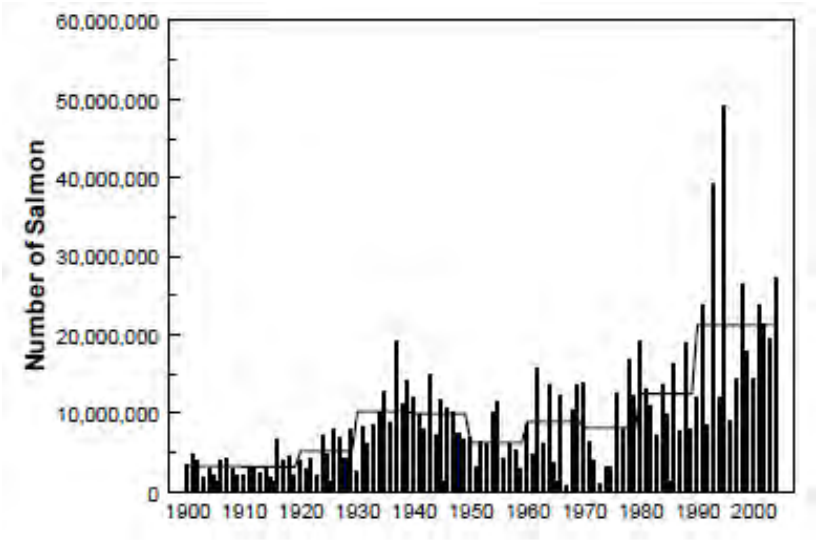

Figure 5. Commercial salmon harvests (all species) in Kodiak from 1900-2004 (bars provide annual catches and lines provide decade averages).
Source: The Commercial Salmon Fishery in AK. Clark, McGregor, Mecum, Krasnowski, and Carroll.

3.2 Economic viability of the fishery

Alaska's license limitation program was designed for the salmon fisheries, in other words, a fleet of individual owner-operators participating in a fishery managed for escapement and not by quota. The limited entry permit system has been beneficial to the economic viability of Alaska's salmon fisheries in several ways.

Net economic benefits have accrued to permit holders that would not have existed under an open-access regime. Limited entry permits are a property right of the holder and may be sold, bought and are heritable. A tradable entry permit gives its holder a permanent stake in the fishery, which provides an incentive to conserve the resource, to obey conservation laws, and to promote investment to rebuild salmon stocks as needed.

Alaska's license limitation program contributed to limiting fishing capacity because it is coupled with other limitations on an effort such as vessel size and gear restrictions. Taken together, Alaska's license limitation and other management tools allow managers to calculate with some assurance the power of the fishing fleets they are tasked to manage. Implementation of the Limited Entry Act also protected Alaska's fisheries from an influx of new fishermen from West Coast fisheries where fishing opportunities have been severely reduced by court decisions and stock conditions.

This combination of factors – a limited pool of fishers, with a vested interest in the fishery – created a scenario where managers we able to consistently achieve escapement targets, which over time resulted in increasing and sustained salmon harvests. Due to the magnitude of the Alaska salmon fishery, state biologists collect extensive information and statistics for management decisions. The objective of biologists, managers, and policymakers is to ensure healthy stocks and productive fisheries for harvesters and the businesses that rely on their catches. It is a virtuous circle.

In 2015, ADF&G's Division of Commercial Fisheries operational budget for Kodiak salmon totaled approximately USD 730 000, which was used to pay the salaries of management staff, for stream surveys, five weir projects, and sampling for the commercial fishery. The investment, paid in part by the industry through taxes, helps to ensure the continuation of a commercial fishery whose annual inflation-adjusted ex-vessel value since 1985 has averaged USD 47 million, and that supports more than 400 small businesses and thousands of jobs in the region.

3.3 Social equality

Alaska's limited entry program has always been controversial. The initial allocation process, which has not been fully presented here, is complex, expensive, and requires years to complete. While the program has survived all major legal challenges, courts have modified the program. Although the percentage of permits held by Alaskan residents has remained stable, in some areas, the number of permits held by local, rural Alaska residents has declined. Additionally, the high cost of permits in some fisheries, including salmon fisheries, has made the initial entry into some fisheries difficult.

Despite the controversy, Alaska's license limitation system has won general acceptance and has twice been supported by the voters. As stated, the electorate passed a constitutional amendment forming the basis for limited entry in 1972. Subsequently, in 1976, the voters defeated a referendum to abolish limited entry in Alaska by a margin of almost two to one.

The relatively free transferability of entry permits is not without challenges. The Alaska Legislature intended an entry permit to give its holder a permanent stake in the fishery in the hope of providing an incentive to conserve the resource. The Legislature also intended free transferability to ease hardship to an individual disabled from the fishery and to fishing families intending to maintain their access to a fishery. Finally, for the sake of simplicity and economy, the Legislature intended to leave redistribution of entry permits largely to the marketplace and to avoid involving the state in the re-issuance of entry permits.

Depending on the perceived value of a fishery, the current costs of entry permits range from several thousand to several hundred thousand dollars. The current market value of a Kodiak salmon set gillnet permit is USD 77 500. A high market value is a mixed blessing. On the one hand, it may reflect the perceived economic health of the fishery. On the other hand, the high price may present an obstacle to a local individual seeking to enter the fishery as a captain for the first time. And for those individuals who borrow funds to purchase an entry permit, servicing that debt may create an incentive to fish harder, increasing demands on the resource.

Additionally, it has been argued that transferability, or rather the high permit values resultant from transferability rules and market forces, disadvantages some Alaskans. In some rural areas of the state, more permits have been transferred from the area than have been transferred to the area. This net rural drain of entry permits in areas where economic alternatives to commercial fishing are limited is a serious concern.

While the Limited Entry Act is neutral with respect to residency, overall transferability has tended to serve residents of the State of Alaska. Through 2005, a total of 16 264 limited entry permits were issued in 65 fisheries. Over 80 percent of permits issued were initially issued to Alaska residents. As of year-end 2005, there were 14 536[66] remaining entry permits, 77 percent of which were held by Alaska residents. While total permit holdings by nonresidents have risen since initial issuance, the reason is mainly due to migration (Alaskan permit holders moving out of state), and not permit sales from Alaskans to non-Alaskans.

The most significant decline in permit holdings among Alaska resident types is from rural Alaskan permit holders living in an area local to their fishery (ARLs). Migrations of permit holders within and outside Alaska have led to a net decline in permit holdings by rural and urban Alaskans local to their fishery. Permit holdings of ARLs have also declined due to net transfer activity. Total permit holdings by ARLs have declined by 605 permits due to net transfer activity, 728 as the net result of migration,

[66] Between initial issuance and the end of 2005, 1 728 had been eliminated, primarily due to cancellation of non-transferable permits (non-transferable salmon hand troll permits accounted for over 1 000).

and 600 due to cancellation. However, of all permits held by Alaskans, Alaska rural residents hold more than 50 percent.

License limitation permits for the Kodiak salmon set gillnet fishery (S04K permits) were issued starting in 1975. Today there are 188 S04K permits. Of this total, Alaska Locals received 65.4 percent (123/188) of the permits, Nonlocal Alaskans received 7.4 percent (14/188) and Nonresidents received 27.1 percent (51/188) of the permits. Every permit issued was a transferable permit.

The number of permits held by each resident type can change for three reasons: permits can be transferred to other resident types (transfer); permit holders can move from one location to another (migration); or permits can be cancelled (such as when a permit holder does not pay the renewal fee for two consecutive years). This table indicates the extent to which these factors have contributed to net changes in permit holdings in this fishery. Migrations have had the largest impact on the changes.

Table 5. Initial Issuance and Year-end 2015 Totals of Kodiak Salmon Set Gillnet Permits.

Initial Issuance and Year-end 2015 Totals of Kodiak Salmon Set Gillnet Permits, With Net Changes Due to Permit Transfers, Migrations, and Cancellations, by Resident Type										
PERMIT	Initial Issue		Transfers		Migrations		Cancelled		2015 Year-end	
RESIDENCY	Total	Percentage	Change	Percent change from Initial	Change	Percent change from initial	Change	Percent change from initial	Total	Percentage
local	123	65.4%	37	30.1%	-53	-43.1%	0	0.0%	107	56.9%
nonlocal	14	7.4%	0	0.0%	11	78.6%	0	0.0%	25	13.3%
nonresident	51	27.1%	-37	-72.5%	42	82.4%	0	0.0%	56	29.8%
Total	**188**	**100.0%**	**0**	**0.0%**	**0**	**0.0%**	**0**	**0.0%**	**188**	**100.0%**
Source: CFEC										

While transferability of entry permits remains controversial, alternatives to transferability also present problems. If entry permits were to revert to the state to be reissued among applicants according to a ranking system, the process would be very expensive and time-consuming. If permits were reissued periodically through a lottery, fishers would be denied the opportunity to plan for their business. If permits were awarded periodically by competitive bid, the individual dependency on fishing protected by the current grandfathering system would be ignored, and individuals with better access to capital would benefit. Additionally, limiting the time during which an individual could hold an entry permit would eliminate the long-term stakes in a fishery believed by the legislature to be necessary to promote conservation. Finally, eliminating transferability would remove the incentive for the holder to maintain or enhance the value of the permit through the conservation of the resource.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

Alaska's salmon fisheries are essential to sustaining the social, cultural and economic vitality of communities around the State. Numerous challenges confront the industry, including the rising cost of access rights (permits), which threatens local fisheries access and participation, contributing to the 'graying of the fleet' and the rural-to-urban migration of fishing rights, and global competition in the marketplace including from farmed salmon, among others, contributing to an overall loss in value of the fishery. Other factors, largely beyond the control of stakeholders and policymakers, such as climate change, threaten the long-term health of salmon stocks and sustainability of Alaska's salmon fisheries.

4.1.1 Greying of the fleet

4.1.2 Farmed Salmon
4.1.3 Climate Change

4.2 Improving fishery sustainability in the future

Alaska has a range of programs and policy provisions designed to support Alaskan access to commercial fisheries.

Explore supplemental forms of access to commercial fishing that are not market-based to facilitate new entry and provide diversification opportunities.

Establish youth permits or student licenses and mentorship or apprenticeship programs to provide young people with exposure to and experience in fishing and a pathway to ownership.

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A case study on Fishery Co-management in Korea: 'Fishery Closures' of Fisheries Cooperatives

Changsoo Lee

Please refer to the case study presentation available at:
http://www.fao.org/3/CA2425EN/ca2425en.pdf

Providing legislative powers to the commercial fishing industry to set management arrangements

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Abstract
In November 2017, the Minister for Fisheries provided legislative powers to commercial fishing industry representatives in the Spencer Gulf Prawn Fishery (SGPF) to set the management arrangements for a one-year trial period. The legislative powers allow industry representatives to sign the legal instruments that set the area and period of a fishing run (prawn fishing between the quarters of the lunar cycle that include a new moon). The legislative powers have been provided under terms and conditions that require the commercial fishing industry representatives to adhere to the requirements of the harvest strategy for the fishery when setting the management arrangements. The harvest strategy sets Total Allowable Catch (TAC) and areas to be fished based on the results of Fishery Independent Surveys (FIS), which ensures fishing is undertaken at sustainable levels. This is the only example in Australia where the commercial fishing industry had been provided legislative powers to regulate the management of a fishery. The delegation of legislative powers to manage the SGPF is an acknowledgement of the strong history of collaboration between industry and government on co-management of the fishery. By providing industry more ownership of the management, they have become more invested in ensuring the sustainability of the fishery. A review of the powers provided will be undertaken in October 2018. Following the results of the review, consideration will be given to how to improve the arrangements. As a result of this work, other fisheries in Australia are now examining how they can move to a model providing powers to the commercial industry to set management arrangements.

1. INTRODUCTION

1.1 Description of the Fishery

1.1.1 Overview

There are three commercial prawn trawl fisheries in South Australia: the Spencer Gulf Prawn Fishery (SGPF), the Gulf St Vincent Prawn Fishery and the West Coast Prawn Fishery (Figure 1). The SGPF is the largest in terms of production and number of licence holders. It is a single-species prawn fishery, based on the capture of the King Prawn (*Melicertus latisulcatus*). In addition to prawns, licence holders in the fishery are permitted to retain and sell Slipper Lobster (*Ibacus* spp), and Southern Calamari (*Sepioteuthis australis*) caught incidentally when targeting prawns. The fishing season is from November to June, with a pre-Christmas (1 November to 31 December) and post-Christmas (1 March to 30 June) fishing period. The major home ports for vessels in the fleet are Port Lincoln and Wallaroo, with minor activity at Port Adelaide and Port Pirie (Figure 1).

The SGPF was officially established in 1968 when forty permits were offered to fish a number of different management zones across South Australian waters. Initially, twenty-five prawn trawling permits were taken up and, when fishers operating in zones on the West Coast of South Australia were offered the opportunity to fish in Spencer Gulf in 1976, the total number of licenses in the SGPF was set at 39. Fishing is permitted in all waters of Spencer Gulf greater than 10 m (Figure 1). In addition to a restriction on the number of licenses in the fishery, which are able to operate one vessel each, vessels are restricted to an overall length of 22 m, an engine restriction of 336 Kw horsepower, a net mesh size of 4.5 cm and a maximum of two trawl nets, which are restricted to a headline length of 29.26 m.

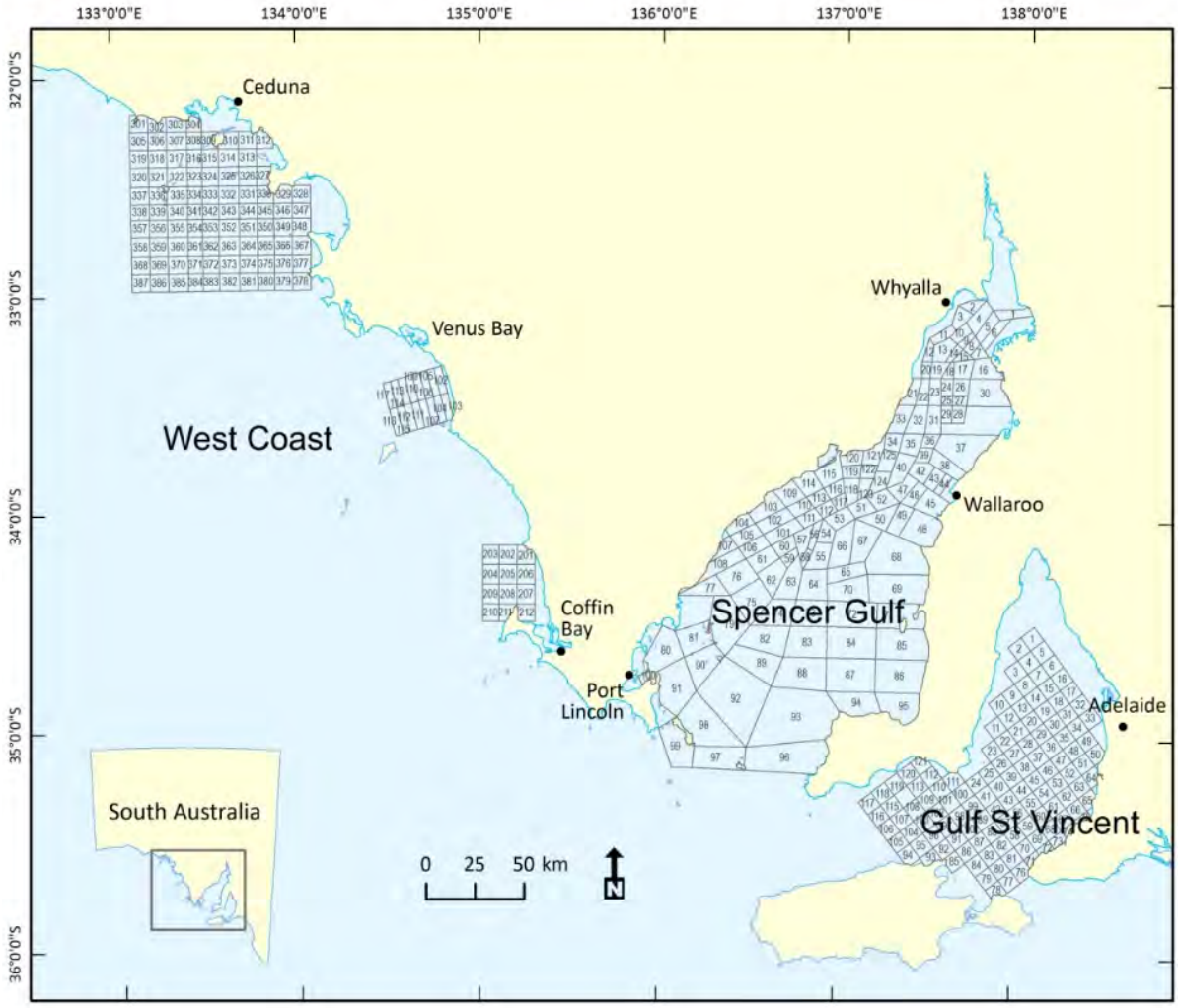

Figure 1. Map of the area and fishing blocks in the three commercial prawn fisheries in South Australia.
Source: PIRSA 2014.

On 25 July 2011, the SGPF became the first prawn fishery in Australia to gain independent third-party certification from the Marine Stewardship Council (MSC). The fishery was recertified in 2016. In gaining this certification, the SGPF has established itself as one that demonstrates best-practice ecologically sustainable fisheries management. As part of gaining the MSC certification, a number of conditions were placed on the SGPF. Progress towards meeting these conditions are assessed through the annual MSC audit of fishing operations.

1.1.2 Fishing Activity

Commercial fishing is undertaken using the demersal otter trawl technique, which involves towing a funnel-shaped net leading into a bag (a 'cod end') over the seafloor (Figure 2 and Figure 3). A separate large meshed bag ('crab bag') is held within the cod end and acts to retain Blue Crabs and megafauna such as sharks and rays, while prawns flow through to the cod end. The crab bag reduces crab mortality, and incidental damage to prawns, and allows crabs and other species not permitted to be retained to be returned promptly to the sea. Otter and bison boards are used to keep the trawl nets open horizontally whilst being towed (Figure 3).

Trawling is undertaken during the night between sunset and sunrise, and generally between the last quarter of the moon – through the phase of the new moon to the first quarter. Trawl shots are of

short duration relative to other prawn fisheries, averaging between 30 to 60 minutes. All vessels in the SGPF are fitted with a grid and hopper, into which the contents of the cod ends are spilt (Figure 2). The grid separates out the megafauna, which is immediately returned to the water to maximise species' survival. The hopper is flooded with water to increase the survival of by-catch. The contents of the hopper trickle onto a conveyer-belt system where the retained catch is sorted from the by-catch and discarded by-catch is returned directly to the water (Figure 2). The prawn catch is then placed through a commercial grading machine that sorts the prawn catch into weight categories. The graded catch is then usually packed and frozen immediately, either cooked or green, into 5 kg or 10 kg cartons.

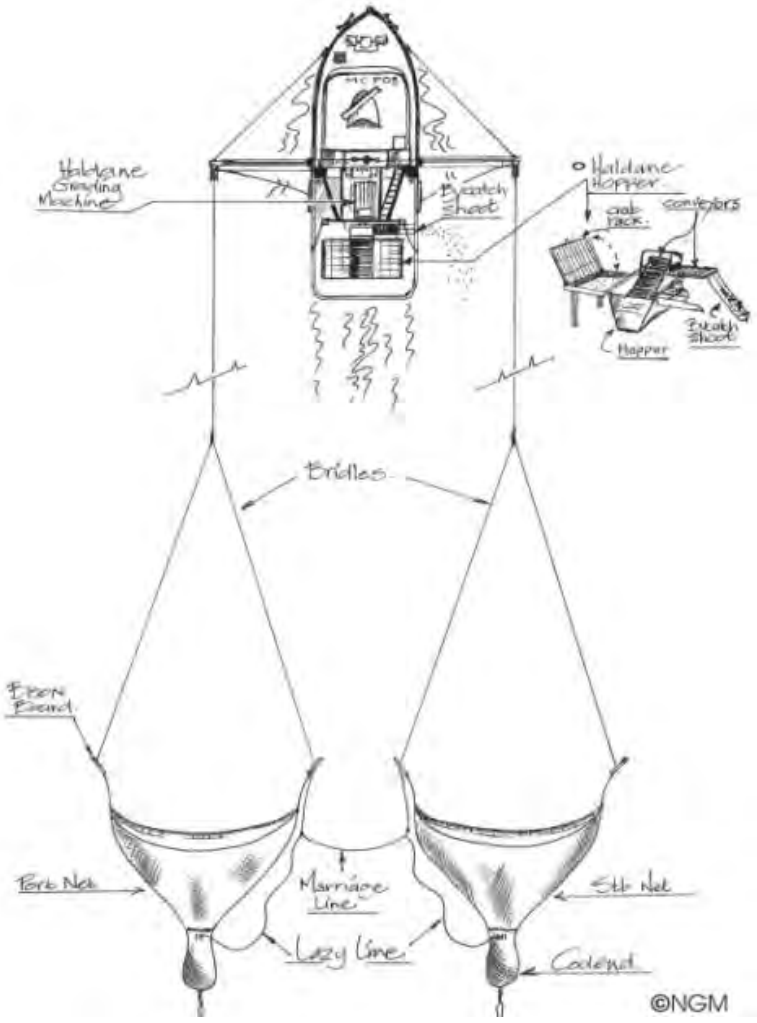

Figure 2. Double rig trawl gear and location of hopper sorting and prawn grading systems used in the SGPF.

Source: PIRSA, 2014.

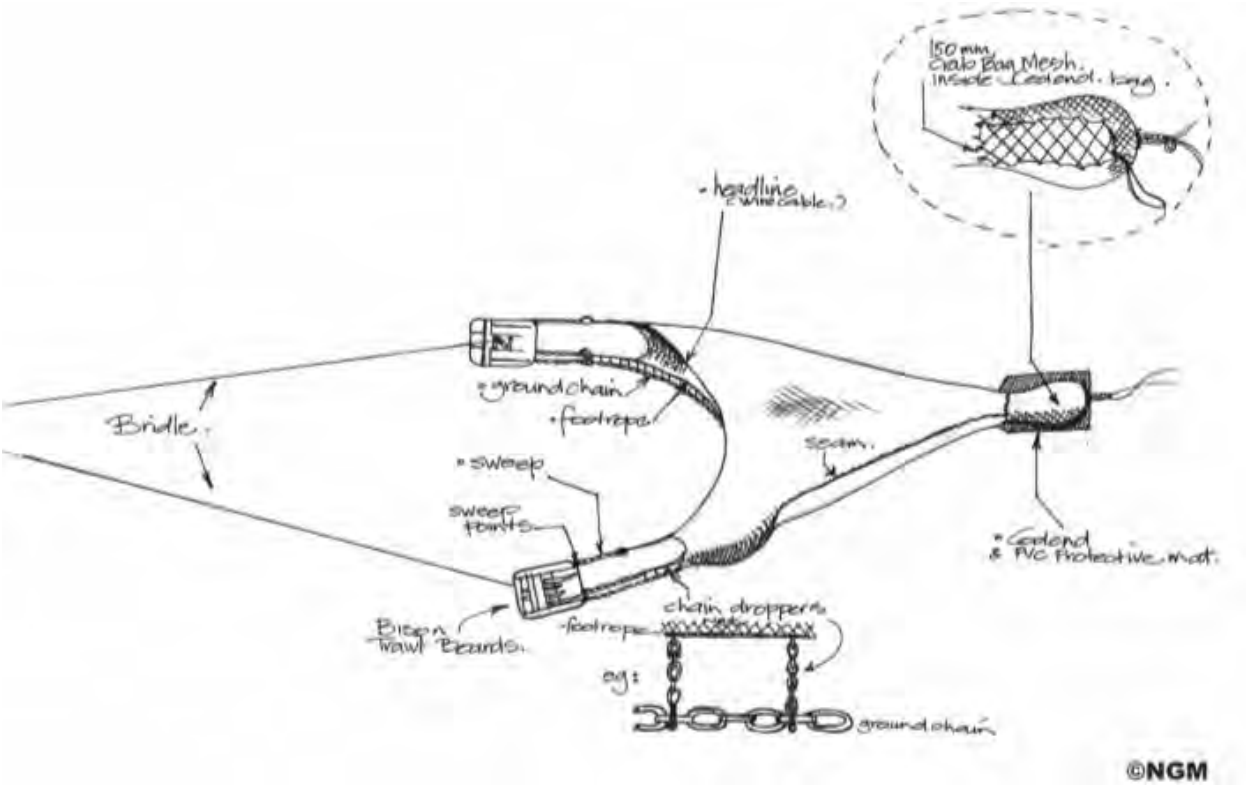

Figure 3. Trawl net configuration showing trawl boards, head rope, ground chain and cod end with crab bag.
Source: PIRSA, 2014.

1.1.3 The Spencer Gulf and West Coast Prawn Fishermen's Association (SGWCPFA)

The fishing industry body representing all 39 licence holders in the SGPF is the Spencer Gulf and West Coast Prawn Fishermen's Association (SGWCPFA). The SGWCPFA is a non-profit Primary Resources Development Corporation formed in 1968 and incorporated in 1984.

The Association is actively involved in activities ranging from the management of the fishery through to marketing and promotion and public relations. However, the core function of the Association is engaged in the management of the fishery.

Since the initial development of the SGPF in 1968, license holders have worked together managing the fishery in collaboration with government. The Association's initial work involved restricting the number of nights fished in the early 1970s, 300 nights were fished by the fleet annually thereafter. Since 1981, the SGPF has halved its total effort while maintaining stable catches (Figure 3) (PIRSA, 2014).

Again in the mid-1980s, when catches declined despite significant reductions in fishing effort, the Association worked closely with government scientists to develop solutions to enable the stock to recover. The result was self-regulated management by the Association to prevent the harvesting of small prawns. This management measure increased recruitment in the fishery resulting in increased catches and catch rates (Figure 4).

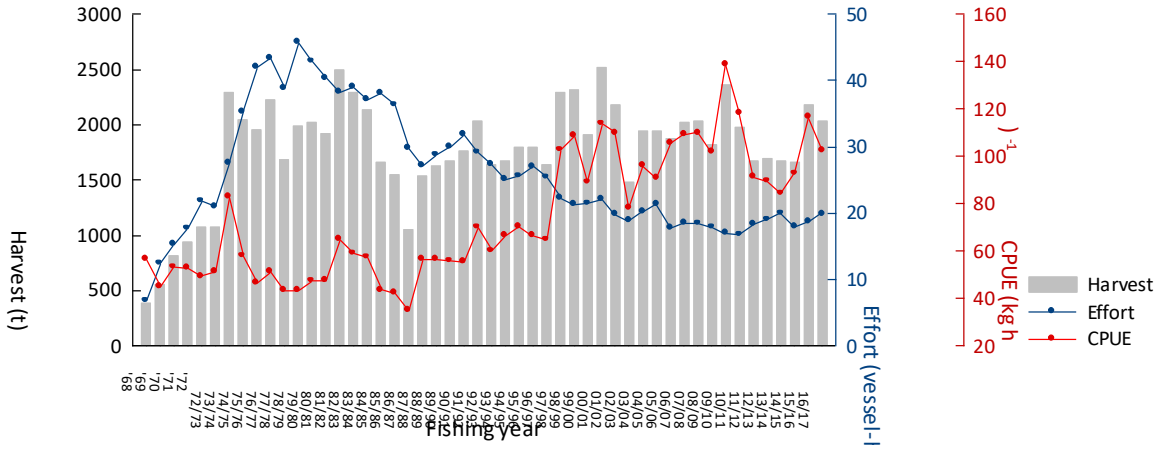

Figure 4. Historical catch, effort and catch per unit effort in the SGPF.

1.2 Economic contribution and social implications of the fishing activity

1.2.1 Overview

The management plan for the SGPF has the high-level economic objective to "ensure optimal utilisation and equitable distribution" (PIRSA 2014). Under this high-level objective, the following economic performance indicators that are reported on annually in an economic report have been developed (Econsearch 2018).

- Trend in Gross Value of Production (GVP) of commercial fishery;
- Trend in Gross Operating Surplus (GOS) of commercial fishery;
- Trend in Return of Investment (ROI) of commercial fishery; and
- Number of FTEs directly and indirectly employed.

These performance indicators provide an overview of the economic contribution and social implications of the fishing activity. Table 1 shows the most recent four years reporting against these performance indicators and other key economic and social information in the fishery.

Table 1. Comparison of key economic and social information in the SGPF over the period 2013/14 to 2016/17.

Indicator	2013/14	2014/15	2015/16	2016/17
Catch	1 805t	1 848t	2 357t	2 205t
Gross value of production (GVP)	USD 29.8m	USD 31.4m	USD 41.4m	USD 41.9m
Fee/licence	USD 26 781	USD 27 161	USD 23 396	USD 26 675
Fee/GVP	3.6%	3.5%	2.3%	2.7%
Return on total capital	3.4%	4.6%	3.6%	3.5%
Licence Value	USD 3.2m	USD 3.3m	USD 3.7m	USD 3.7m
Gross state product [b]	USD 68m	USD 76m	USD 103m	USD 113m
Employment [b]	507 fte	567 fte	763 fte	839 fte
Rent/GVP	7%	15%	4%	5%

Source: Econsearch 2018.

[a] Dollar values in this table are in real 2016/17 dollars. Note that economic contribution measures include the West Coast Prawn Fishery for 2016/17 but excludes it for the period 2013/14 to 2015/16.

[b] Note that economic contribution measures include the West Coast Prawn fishery for 2016/17 but exclude it for the period 2013/14 to 2015/16.

1.2.2 Catch and Gross Value of Production

Total catch in the SGPF has been relatively constant from 2002/03 to 2016/17, with some annual fluctuations. The most significant fluctuation occurred in the late 2000s. Catch peaked at over 2 400 tonnes in 2009/10 before falling to around 1 800 tonnes in 2011/12 (Figure 4). The catch in 2016/17 was 2 205 tonnes (Table 1).

The real value of the SGPF catch increased by seven percent from 2002/03 to 2016/17 (Table 1). This slight increase in value was a result of a significant increase in catch (despite year-to-year fluctuations) offsetting a real price reduction (27%) (Econsearch, 2018).

Both the nominal and real price decreased significantly through to 2009/10 but have followed an increasing trend since. The average nominal price of SGPF prawns was two percent higher in 2016/17 ($19.00/kg) than in 2002/03 ($18.71/kg), which equates to a 27 percent real price decline (Econsearch, 2018).

1.2.3 Contribution to South Australian economy

Fluctuations in total output and gross state product (GSP) contributions are generally related to changes in price and fishery catch. The total employment contribution of the fishery has fluctuated over the 15 years but followed an increasing trend overall. In 2016/17, the estimated total contribution to GSP (directly and indirectly) was estimated to be USD 113 million, and the total employment contribution was estimated to be 839 fte jobs (Econsearch, 2018).

Employment in the fishery is in and around the townships of Port Lincoln and Wallaroo (Figure 1). The fleet is based in Port Lincoln and operates out of Wallaroo when fishing the northern part of Spencer Gulf.

All the catch in the fishery is supplied to domestic markets. In the mid-1980s to the early 2000s when the Australian dollar was weaker against the US dollar up to 50 percent of the catch was exported. Should the Australian dollar weaken against foreign currencies or the landed price increase, the incentive may be created to again export.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

2.1.1 Legislation managing the fishery

All fisheries under South Australian jurisdiction operate under the *Fisheries Management Act 2007* (the Act). Unless otherwise defined in an Offshore Constitutional Settlement (OCS) arrangement between South Australia and the Australian Commonwealth government South Australia has management jurisdiction for all fish resources from the high water mark out to the three nautical mile baseline adjacent to the coast.

The Act provides the overarching legislative framework for the SGPF. Underneath the Act, the *Fisheries Management (General) Regulations 2007* and the *Fisheries Management (Prawn Fisheries) Regulations 2007* provide the specific legislation for the management of the SGPF. Section 5 of the Act states that each commercial fishery must have a management plan, containing a harvest strategy clearly detailing the linkages of research to the application of management for the purpose of

maintaining fishing activities at sustainable levels. Consequently, the management plan for the SGPF is the principal legislative instrument used to manage the fishery.

Under the Act, management plans must be comprehensively reviewed every five years. The purpose of reviewing the document every five years is to ensure the most effective research and management are applied in a fishery.

2.1.2 Application of research to the management of the fishery

The harvest strategy in the management plan for the fishery has regulated and applied strict decision-making rules for catch rates and size of prawns that were previously self-regulated by the SGWCPFA. The first harvest strategy was applied in the 2007 management plan and in the 2014 management plan, the harvest strategy was refined.

The 2007 harvest strategy was developed in collaboration with the SGWCPFA. Consistent with the techniques already applied by the SGWCPFA, the 2007 management plan sought to ensure biological sustainability and promote economic efficiency, through the application of spatial and temporal closures to manage the fishing effort.

The harvest strategy for the SGPF provides a structured framework for decision-making that specifies pre-determined management actions necessary for the fishery to achieve the ecologically sustainable development (ESD) objectives of the Act. The Harvest Strategy brings together all of the key scientific monitoring, assessment and management elements to form an integrated package to make decisions about the level of fishing intensity that should be applied to the stock (PIRSA, 2014).

The 2014 management plan, and subsequent harvest strategy applies research monitoring of the fishery through three fishery-independent stock assessment surveys (SAS) as well as industry at-sea monitoring of catch and effort. The three fishery-independent SAS are undertaken in February, April and November annually and provide an estimate of catch per unit effort in kilograms per hour (kg/hour) or pounds per minute (lb/min), which is used to determine the stock classification of the fishery (Figure 5). The stock classification, in turn, sets the management arrangements and level of effort within those management arrangements for the pre-Christmas fishing period (1 November to 31 December) and the post-Christmas fishing period (1 March to 30 June) (Figure 6).

The terminology of the stock classifications overfished, transitional and sustainable comes from the ‘Status of key Australian fish stocks reports’ (Flood et al., 2012), which was written to provide clear definition around the classification of all Australian fish stocks.

- Sustainable: stock for which biomass (or biomass proxy) is at a level sufficient to ensure that, on average, future levels of recruitment are adequate (i.e. not recruitment overfished) and for which fishing pressure is adequately controlled to avoid the stock becoming recruitment overfished.

- Transitional recovering: biomass is recruitment overfished, but management measures are in place to promote stock recovery, and recovery is occurring, or Transitional depleting: biomass is not yet recruitment overfished, but fishing pressure is too high and moving the stock in the direction of becoming recruitment overfished.

- Overfished: the stock is recruitment overfished, and current management is not adequate to recover the stock, or adequate management measures have been put in place but have not yet resulted in measurable improvements.

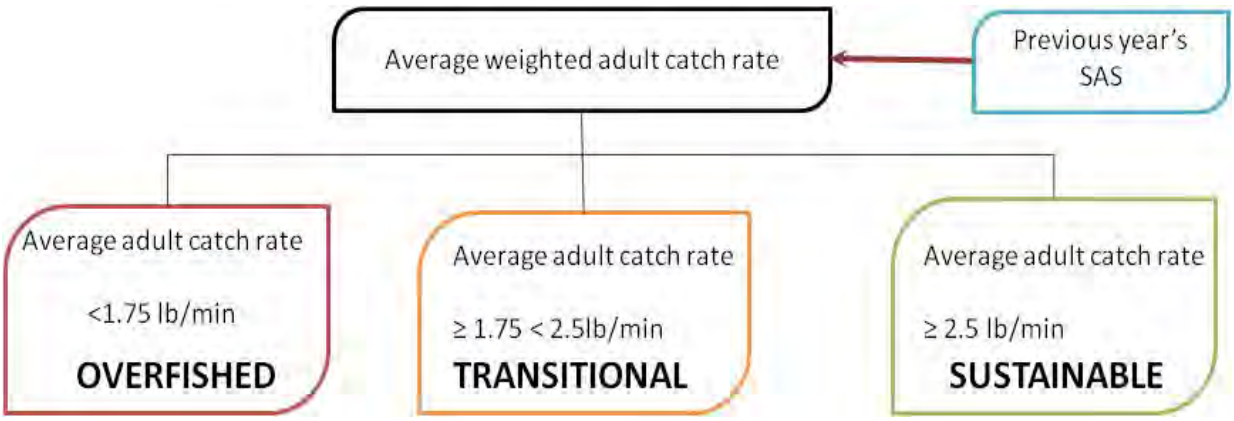

Figure 5. Flow diagram describing how catch rate as pounds per minute determines stock classification in the SGPF for the season.

Figure 6 shows the setting of the management arrangements for the season based on the stock classification for the pre-Christmas and post-Christmas fishing periods.

The stock status classification from the SAS in the previous season determines the management arrangements for the upcoming season. These management arrangements are broken down into two pre-Christmas and post-Christmas fishing periods (Figure 6).

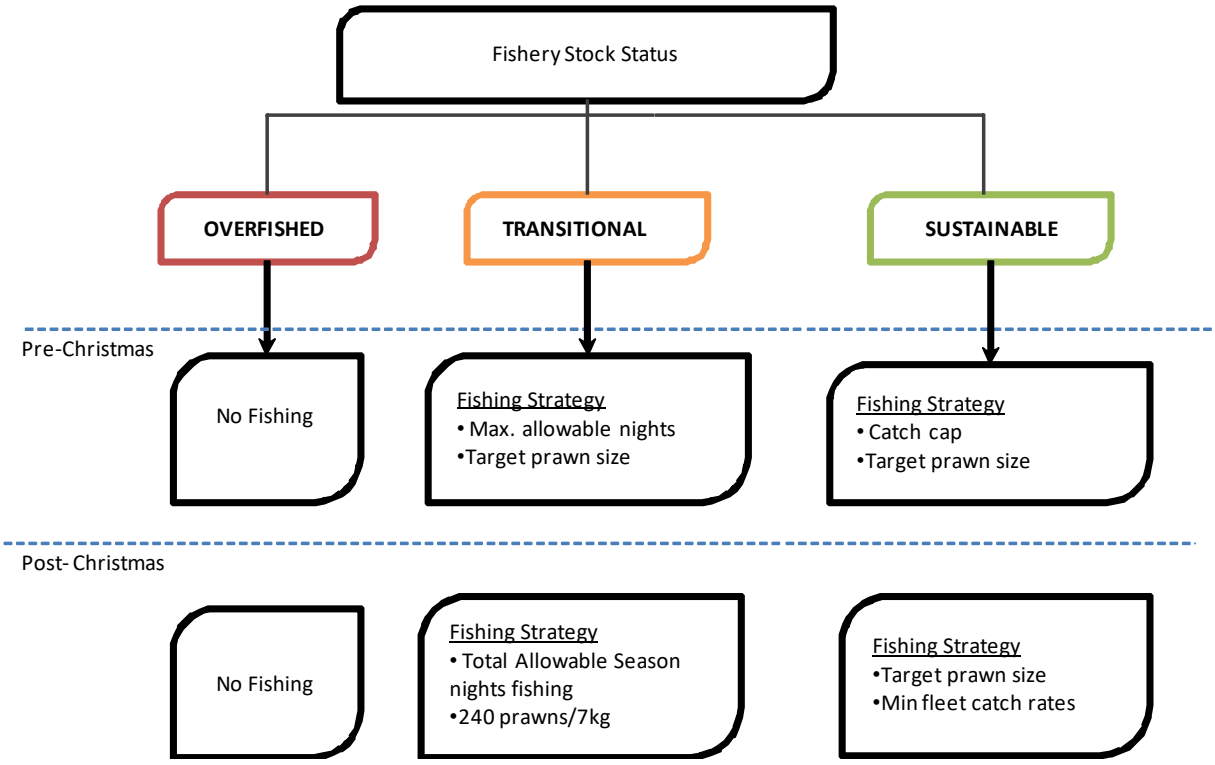

Figure 6. Application of seasonal management arrangements set following the determination of the stock status classification.

Since the establishment of the current SGPF management plan, in October 2014, the SAS have only ever resulted in the fishery achieving a sustainable stock status classification. Under a sustainable classification, the area and periods of fishing runs, prawn fishing between the quarters of the lunar cycle that include a new moon, are set for both the pre-Christmas and post-Christmas fishing periods.

The SGWCPFA management committee meets to discuss and make a recommendation for each fishing run in the pre-Christmas and post-Christmas periods. The SGWCPFA management committee is made up of seven commercial industry representatives, who can be either licence holders or skippers in the fishery, the Primary Industries and Regions South Australia (PIRSA) Fisheries Manager and the government scientist from the South Australian Research Development Institute (SARDI). The management committee makes decisions or recommendations by consensus where possible and, where consensus cannot be reached, the voting members of the committee, the seven commercial industry representatives, cast a vote.

Under a sustainable classification, the management committee determines the area to fish based on the size of prawns caught in each survey shot undertaken in the most recent SAS. The number of prawns in a seven-kilogram bucket or bucket count is recorded in the locations surveyed (November survey 182 surveys shot locations and February and April 207 survey shot locations) in each of the three SAS throughout Spencer Gulf (Figure 1). Only areas where the most recent SAS has recorded survey shot bucket counts above the criteria specified in the harvest strategy within the management plan can then be fished within a fishing run[67]. Should the size of prawns drop below the harvest strategy criteria in an area then the fleet is moved on to other areas designated for fishing in the fishing run.

In addition to the bucket count criteria, a total allowable catch limit, set across the fleet, is applied to pre-Christmas fishing when the stock status classification of the fishery is sustainable. The total allowable catch limit applied is based on the November SAS catch per unit effort results (kg/hour) (Table 2).

Table 2. Pre-Christmas total allowable catch limits based on November SAS catch per unit effort.

Adult catch rate (kg/hr)	Adult catch rate (lb/min)	Total allowable pre-Christmas catch
<28.4	<1.04	0
28.4	1.04	120 t
37.5	1.38	200 t
46.9	1.72	300 t
52.6	1.93	350 t
58.2	2.13	375 t
64.8	2.37	400 t
73.2	2.68	425 t
81.6	2.99	450 t
90.1	3.30	475 t
98.5	3.61	500 t
107.0	3.92	525 t

[67] Pages 48 and 49 of the harvest strategy in the 'Management Plan for the South Australian Commercial Spencer Gulf Prawn Fishery' show the bucket count criteria for setting areas that can be fished.

115.4	4.23	550 t

If the fishery is classified as transitional, each vessel in the fishery is restricted to a maximum number of fishing nights for the pre-Christmas and post-Christmas fishing periods (Table 3), as well as fishing in areas where the bucket count from the most recent SAS is 240 prawns per bucket or less. The catch per unit effort (kg/hour or lb/min) of recruits from the three SAS combined is used to determine the reference point (Table 4), which is then used to set the number of fishing nights for the season and the pre-Christmas period (Table 3).

Table 3. Total allowable fishing nights for a Transitional Fishery, and maximum nights for fishing pre-Christmas.

Recent juvenile abundance level as determined Table 4	Maximum allowable season fishing nights	Maximum allowable fishing nights pre-Christmas
High	37	11
Medium	31	9
Low	25	7

Table 4. Reference points for recent recruit prawn abundance from weighted annual average recruit catch rates from the previous season's SAS.

Reference point	Recruit catch rate
High	≥ 2.4 lb/min (≥ 65.5 kg/hr)
Medium	≥ 1.2 < 2.4 lb/min (≥ 32.7 < 65.5kg/hr)
Low	< 1.2 lb/min (< 32.7 kg/hr)

If the fishery is classified as overfished, the fishery remains closed for the season and is reassessed following the completion of the three SASs during the closed season.

2.1.3 Delegation of powers to set management arrangements

When the fishery is classified as sustainable or transitional a legal instrument is issued under section 10 of the Act to set the number of fishing nights, area and timing of the fishing run depending on the stock status classification of the fishery.

Prior to the Minister for Fisheries providing legislative powers to officers of the SGWCPFA for a one year trial period from November 2017, the PIRSA Fisheries Manager responsible for the management of the fishery would set the fishing run and the terms and conditions of the fishing run under regulation 10 of the *Management (Prawn Fisheries) Regulations 2007.* With the Minister for Fisheries delegating powers to set the fishing runs for a trial period to the Executive Officer and Co-ordinator at Sea, positions within the SGWCPFA industry now have the delegated powers to set the fishing run under regulation 10 of the *Management (Prawn Fisheries) Regulations 2007.* Consultation on each fishing run is still undertaken through the SGWCPFA management committee. The consultation provides the ability for all stakeholders to have input prior to the SGWCPFA Executive Officer or the Co-ordinator at Sea signing and issuing the legal instrument to set the fishing run and the terms and conditions of the fishing run.

2.2 Rights-based approach: allocation and characteristics

The implementation of limited entry in the fishery early in 1968 established the ability to restrict fishing effort and subsequently catch. Once limited entry was in place, other input controls to constrain catches could be applied (see section 1.1.1). The ability to only be able to catch prawns in

commercial quantities seven nights either side of the complete dark of the moon has also constrained catches in the fishery.

When the fishery was first established in 1968, up to 300 nights per vessel were fished. By the early 1970s, fishers understood that prawns were only available in commercial quantities seven nights either side of the dark of the moon and that by restricting fishing nights, recruitment in the fishery could be increased and annual catches could be maintained at constant levels (Figure 4). As a result, by 1971 licence holders imposed self-regulated restrictions on the number of nights of operation in the fishery.

This self-regulation around the setting of fishing nights forms the basis of the management arrangements that are applied today in the fishery. From self-regulation, formal rules around the setting of fishing nights have been established in the harvest strategy for the fishery (see section 2.1.2). The setting of fishing nights forms the direct relationship between research and management to maintain the sustainability of the fishery.

In 2013, when a review of the management plan for the fishery was undertaken, consideration was given to the implementation of an Individual Transferable Effort (ITE) or an Individual Transferable Quota (ITQ) management regime. Traditionally, in Australia, ITQ management regimes have not been applied to prawn fisheries due to the significant fluctuations in stock abundance from year to year, which make the accurate setting TACs difficult. While not making the fishery more sustainable, an ITQ or ITE management regime would address overcapitalisation and increase safety by creating an incentive not to fish in bad weather.

At present, vessels in the fishery race to fish in order to catch the largest share of a finite resource at any given time. Effort creep[68]in the fishery is not substantial due to the input controls in place, however, the race to fish continues to increase capital investment. Under an ITQ or ITE management regime, the race to fish would be removed, preventing overcapitalisation and subsequently increasing profitability. While fishing continues to be undertaken at sustainable levels and catches are maintained, limited incentive will remain for industry to move to an ITQ or ITE management regime.

The introduction of an ITE or transferable rights management regime in the South Australian Gulf Saint Vincent Prawn Fishery (see Figure 1) has illustrated the considerable economic benefits associated with an output control management regime, including increasing the value of licences and enabling licence holders to restructure their business operations by transferring nights.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

The restriction on fishing nights and the limited entry management regime are the key management measures that have enabled the fishery to maintain a sustainable stock classification for a prolonged period. Should the stock classification change from sustainable, the application of management measures through the harvest strategy that reduce or remove fishing effort will provide the ability for the stock to recover to a sustainable level (see section 2.1.2).

Based on the manipulation of fishing effort through management measures, over the last 45 years—since the fisheries inception-- somewhere between 50 and 55 fishing nights for each vessel per year is considered appropriate to maintain the stock at a sustainable level. Figure 4 shows that since the mid-1990s catch has remained constant when applying this level of effort.

[68] An increase in fishing efficiency over time due to the adoption of a series of adjustments in fishing practices, through either technology or behaviour, that result in higher catch rates (ISSF website, 2018).

Through co-management mechanisms, fishers have been directly involved in the management of the fishery since its commencement. Government has developed and established mechanisms to enable fishers to better engage in the management of the fishery. The first formal engagement was the *Fisheries (Management Committee) Regulations 1995* that established consultative committees and commercial fishing industry membership on the consultative committees. When the legislation was implemented in 1995, a consultative committee for the SGPF was established. The committee comprised commercial industry representatives, a government scientist, a government fisheries manager and an independent chair. Advice from the committee was provided to the government regulator and the Minister for Fisheries. This consultative committee formalised the consultation undertaken with industry.

In 2013, PIRSA released the document 'Policy for the Co-management of Fisheries in South Australia'. The purpose of this document was to develop and promote co-management[69] in South Australian fisheries. The document provided clear guidelines for industry and government on how to progress from a solely government regulated fishery with little or any industry consultation to a delegated model where industry are delegated management powers (Figure 7).

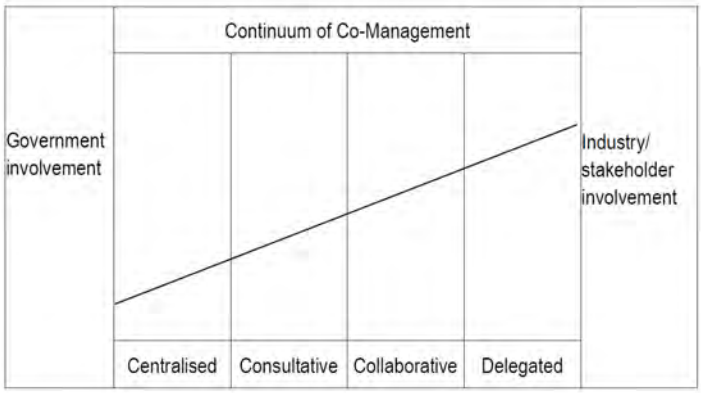

Figure 7. The continuum of co-management showing the four broad stages of co-management and the level of government/industry/stakeholder involvement at each stage of management.
Source: Neville et al., 2008; modified from Pomeroy and Berkes 1997.

Through the application of the co-management policy, the SGWCPFA were able to progress to a model where they had delegated powers to manage the fishery, through fishing runs, in consultation with stakeholders. The fishery was already in a collaborative position on the continuum of co-management and, through engagement with PIRSA, a delegated model was developed (see Figure 7).

The first step in moving to a delegated model was providing the capacity for industry to regulate moving on from fishing areas when catch rate or prawn size decreased to prescribed levels. Under this arrangement, the government set the area and period of fishing and industry determined when fishing was moved within the defined area set by the government. The move on provisions, defined in the harvest strategy for the fishery, outlined set criteria around prawn size and catch rate for the industry to move out of an area. This management is referred to as 'realtime management'. By preventing fishing of small prawns and maintaining catch rates recruitment is upheld, which translates to sustainable fishing practices.

[69] Co-management is an arrangement where responsibilities and obligations for sustainable fisheries management are negotiated, shared or delegated between government, the commercial fishing industry, recreational fishers, Aboriginal and Traditional fishers and other key stakeholders such as conservation groups (Neville et al., 2008).

The next step on from this has been a completely delegated management model, where industry set the fishing run (Figure 7). This is the first instance in a South Australian fishery where legal delegation to set management arrangements has been provided to a body outside of government.
The reasons why the SGPF was able to move to a delegated co-management model include:

- Fishers have developed technical knowledge of the fishery over time, which has placed them in the best position to advise on and implement management.
- The input control management regime in the fishery requires management decisions to be made quickly to address changes in catch rate and composition.
- All licence holders in the SGPF are members of the SGWCPFA, which ensures effective consultation and distribution of information.

The unique characteristics associated with the management regime and the application of realtime information to management, have made the fishery a candidate to apply delegated co-management arrangements. There may not be any incentive for other fisheries to move to a delegated co-management model, as the benefits for the industry may not exist. In the case of an ITQ managed fishery with a TAC set prior to the commencement of the season, this is considered to be the case.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challengers for the fishery

The Minister advised the SGWCPFA that, prior to the completion of the initial one year trial period of the delegation to industry to set the fishing runs, a review of the arrangement would be undertaken by the government. The purpose of the review is to assess the effectiveness of the delegation, specifically the terms and conditions incorporated in the delegation. At the time of writing this paper, the trial period for the delegation had not concluded, however, the review had commenced.

Feedback from the SGWCPFA, as part of the review process, was that government involvement in reviewing legal instruments to set fishing runs, as specified in the terms and conditions of the delegated arrangements, should be scaled back. This is consistent with the view of industry to set management arrangements in the fishery with limited government involvement.

This position highlights the issue of the management of a common property resource by a body outside of government. Some consider that a common property resource, such as a fish stock, can only be managed or regulated by the government as they are the only party or stakeholder without a vested interest. The view of the industry is that they are invested in the long term sustainability of the resource, as the value of the licence and the ability to make an ongoing financial return from the fishery is directly related to sustainable fishing practices. As a result, the challenge is to maintain a balance between government oversight and capturing industry ownership of management and technical understanding of the fishery. Noting that this issue relates to governance of the resource, which indirectly relates to sustainability through the capacity of stakeholders, including government, to have input into management and monitor its effective application.

The other challenge for the fishery is maximising economic efficiency, specifically increasing profitability and reducing overcapitalization (Kompas, 2005). While the management arrangements applied to ensure the fishery is defined as sustainable (Flood et al., 2013) and high catches are maintained, there will continue to be limited incentive for the introduction of output controls to maximise economic efficiency (see section 2.2).

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Fisheries management in data deficient industrial fisheries of Sierra Leone: Input controls and ecological risk assessment

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Abstract
Managing fisheries in data deficient situations could be challenging in developing countries such as Sierra Leone, where technical capacities are not yet fully developed. We present a diagnosis of industrial fisheries management planning based on input controls of licenses, inshore exclusion zone limitations, ecological risk assessment and bio-economic limit reference points. Existing industrial fisheries user rights in Sierra Leone based on license allocations relying on gross registered tonnages (GRT), mesh size regulations and area restrictions, do not account for allowable catches, and could be reactive to top-down approaches. Management decision making based on this system has often been characterized by weak evidence and minimum transparency. We have therefore used an Ecological Risk Screening (ERS) technique to gauge information on the effects of fishing on different ecological systems in order to assess impacts, prioritize issues and proffer advice on the risks associated with fisheries management units. The ecological risk assessment reveals associated fisheries management challenges including illegal, unreported and unregulated (IUU) fishing, seaweed and plastic pollutions, and degradation of mangrove habitats. The evidence of coastal erosions associated with climate change events, scanty knowledge on catch levels for inshore pelagics, shrimps and demersal resources, limited credit facilities for fishers, post-harvest losses, poor hygiene and fish trade limitations are critical risk areas to address. Over 100 fishing trawlers currently operate in the industrial fisheries of Sierra Leone without quota management restrictions for catches. Our empirical analysis reveals that revenues at maximum economic yield (REV MEY) can be maximized at levels of 1.5 (slightly over 60%) greater than the sustainable yield revenues for shrimps. A precautionary fleet limitation of 20 fishing vessels for shrimp fishery is proposed under a dual scheme of demersal fish, and shrimp licenses, with fishing, restricted to night hours, from 6 pm to 6 am, to minimize bycatch.

1. INTRODUCTION

1.1 Description of the Industrial Fishery of Sierra Leone

The industrial fishery of Sierra Leone is conducted within 6 to 200 nautical miles (nm) in the continental shelf and the exclusive economic zone (EEZ). Sierra Leone is located in West Africa, bordered in the North by the Republic of Guinea, in the South by the Republic of Liberia and in the West by the Atlantic Ocean (Figure 1). The country lies within latitudes ($6^0$55'-10^0N) and longitudes ($10^0$14'-$13^0$17'W), with a coastline extending up to 560 kilometres (km) and a continental shelf area of 300,000 km^2. The coastline is wider in the North and narrower in the South. The fishing areas are located in the continental shelf, including offshore waters and waters superjacent to the sea bed and subsoil of the Atlantic Ocean, which lies within national jurisdictions. Common fishing grounds can be found in coastal waters, river estuaries, creeks, bays and the open ocean.

The country's continental shelf is favored by two current systems, the Guinea current that flows from the North-West and the Canary current that flows from the South-East, creating the Guinea Current and the Canary Current Large Marine ecosystems (GCLME & CCLME) that are associated with estuaries, mangroves and upwelling areas that support large quantities of fish resources. These ecosystems host small pelagic fish, tuna, billfish, shrimps and demersal fish resources, with a biomass

of around 124,00 to 600,00 mt, and potential yields around 150,000 mt. These ecosystems also support other rich biodiversity of migratory birds, threatened manatees, seals, monks, marine mammals, sea turtles, porpoises, sawfish and crocodiles.

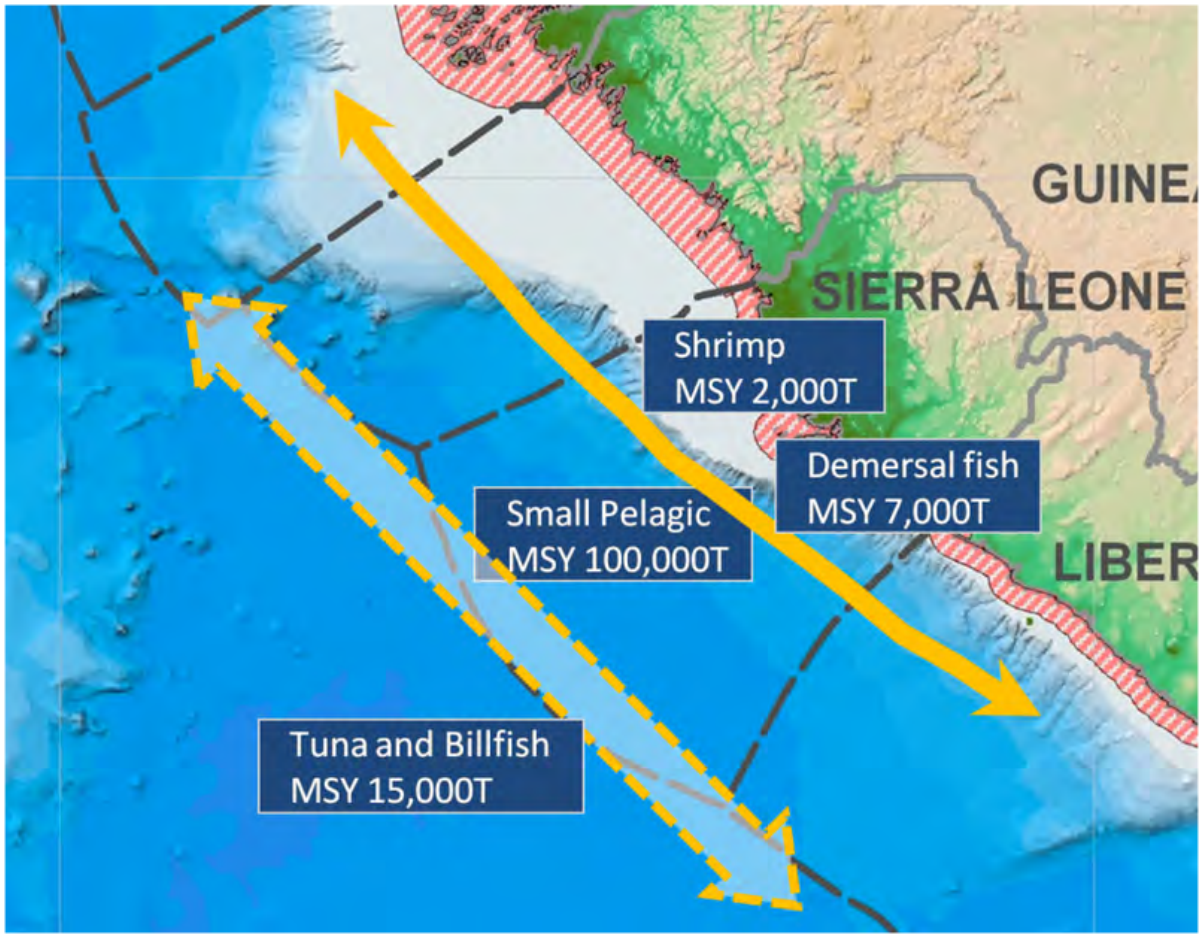

Figure 1. Sierra Leone Exclusive Economic Zone.
Source: MFMR, (2016). Fisheries and Aquaculture Bill. MFMR, 7th Floor, Youyi Building, Freetown, Sierra Leone.

The fishing grounds in Sierra Leone are supported by nutrient inputs from river systems in the Western Area, Northern and Southern Provincial Districts around Freetown, Portloko, Kambia, Moyamba, Bonthe and Pujehun, which empties into the Atlantic Ocean. The major river systems include the Scarcies river estuary in the North which has rich mangrove forests around Yeliboya and Kortimaw Islands, serving as fish breeding grounds and the Sierra Leone River estuary in the North Western region which receives nutrient-rich waters from tributaries and creeks. The Sherbro River estuary and the Yawri Bay are other river systems that host rich fishing grounds around the Sherbro Island and Cape Saint Ann in the south, which are influenced by strong tidal ranges, with the peak of the rainy seasons (July and August) favouring increased nutrient inputs from runoff water discharges. There are fishing grounds around the Southern coastal borders of Liberia, which has rivers that extend into a lagoon that contain nutrient-rich waters.

Popular fishing grounds within the continental shelf of Sierra Leone are presented in Figure 2. The South Western Coast in the Moyamba District and part of the Western Area are favoured by a bay and creek –the Yawri Bay and Kagboro Creek, which contain wetlands of intertidal mudflats and 14 percent of the country's mangrove cover and other rich biodiversity and fish resources.

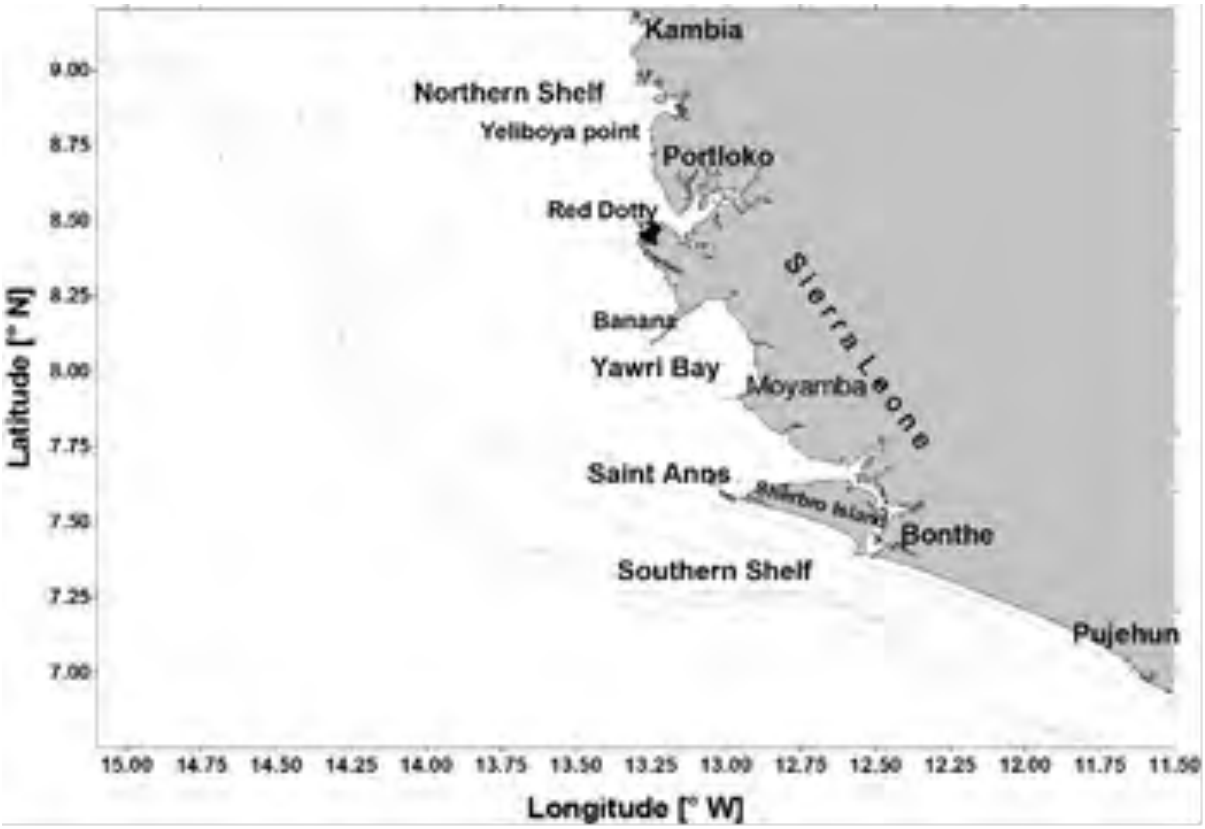

Figure 2. Major Fishing grounds in the Continental Shelf of Sierra Leone[70]**.**
Source: MFMR, (2016). Fisheries and Aquaculture Bill. MFMR, 7th Floor, Youyi Building, Freetown, Sierra Leone.

About 188 species of fish were identified in the continental shelf during the 2009 fishery abundance survey and they include commercially important pelagic, shrimp and demersal fish resources[71]. These fish stocks are targeted by both industrial and artisanal fishing gears and have been categorized as: Penaeid shrimps (Penaeidae), Croakers (Scaienidae), Seabreams and Dentex (Sparidae), Groupers (Serranidae), Snappers (Lutjanidae), Threadfins (Polynemidae), Grunts (Haemulidae), Sardinella, Bonga Shad, West African Ilisha and Anchovy (Clupeidae), Scads, Jacks, Horse Mackerels and Pompanos (Carangidae), Barracudas (Sphyraenidae), Tuna, Tuna Like and Mackerels (Scombridae), Sole *(*Cynoglossidae), Cuttlefish, Squid, Snail, Crab (Portunidae), (Sharks (Carcharhinidae) and Rays (Rajidae)[72]. Royal Spiny Lobsters (*Panulirus regius*) are also caught, but the Lobster fisheries are currently not developed. The pelagic fish resources are shared stocks among the Eastern Central Atlantic. These stocks have been defined as:

1) Northern Stock, shared by Guinea Bissau, Guinea, Sierra Leone and Liberia;
2) Western Stock, shared by Cote d'Ivoire, Togo, Ghana and Benin;
3) Central Stock, shared by Nigeria, and Cameroon; and
4) Southern Stock, shared by Congo and Angola.

[70] Khan, A., and Sei, S. (2015). The Co-Governance of Fisheries in Post- Conflict Sierra Leone: Is the Transition for Better or for Worse? In S. Jentoft, and R. Chuenpagdee (eds.) *Interactive Governance for Small Scale Fisheries.* Springer.
[71] Turay, I., O'Donell, C., Schaber, M., Corten, A., Sarre, A., Sei, S., Seisay L.D., Mustapha C., Kamara, M., Lamin P., and Lahai M. (2009). Sierra Leone Fisheries Resource Survey, Third Survey, 24 May to 13 June 2009. Cruise Report, EU funded Institutional Support to Fisheries Management Project (ISFM), 9ACP SL 19. Ministry of Fisheries and Marine Resources
[72] Longhurst, A.R., and Pauly, D. (1987). *Ecology of Tropical Oceans*. Academic Press, Inc., Harcourt Brace Jovanovich Publishers, Sandiago, 407p.

The most common shared pelagic fish stock, the Sardinellas (herring), is targeted by both artisanal and industrial fishing fleet and has potential yields around 2.5 million metric tons in the Eastern Central Atlantic region. Other important target species in the industrial fishery include: *Penaeus notialis* (Pink shrimp), *Dentex Congoensis* (Congo Dentex), Bobo Croaker (*Pseudotolithus elongatus*) (Gwangwa), false Scad (Pollock) (*Decapterus rhoncus*), Sompat Grunt (*Pomadasys jubelini*). Some fish categories including the Penaeid shrimps, the Seabreams and Dentex are usually not separated during data collection and reporting and are commonly mislabeled as Snappers. This causes mislabeling of species of the sparidae family as snappers of the Lutjanidae family. The snappers are also wrongly labelled as groupers. This introduces errors in the commercial fishery statistics reporting. In addition to this, the fishery stock assessment has not been regular due to funding bottlenecks. Comprehensive fishery-dependent data has been collected for commercial fish production since 2009; industrial catch data was collected by fisheries observers from 2010 until today. No fisheries independent data (scientific surveys) is available for 2011-2018. Available assessments reveal that some of the demersal fish species are either fully exploited or at the point of being harvested unsustainably[73]. Some species of the Sparidae, Grunts, Croakers, Sardinella, and Pink shrimps are fully exploited[74]. The Northern pelagic fish stock of Bonga Shad is considered overexploited, with yield potential below current biomasses and high fish mortality[75]. The offshore pelagic fish stocks of carangidae, mainly Pollock and Atlantic Bumper, are underexploited. Biomasses reported for major fish stocks show that pelagic fisheries account for about 65 percent of the total biomass[76] of around 600,000 mt. Transhipment for offloading of industrial vessel catches take place at designated ports in Kingtom, Muray Town Wharf, Government Wharf and other designated areas of the Port of Freetown, following each fishing trip that took place over one to three months. There are also several other ancillary fish landing ports in the Western Rural coastal communities that aid fish discharges into Cold storage facilities –these ports are operated by about 25 fishing Companies in the Country. Rights granted under licenses are based on vessel types, and fishing gear characteristics, gross registered tonnages, vessel ownerships and establishments, and have been regulated into the following categories:

1) Demersal Fish Trawlers
2) Shrimp and Cephalopod Trawlers
3) Pelagic and Mid-Water Trawlers
4) Tuna Purse Seiners
5) Tuna Long Liners
6) Purse Seiners for Small Pelagic
7) Mothership with canoe support, pots, traps or lines
8) Fish processing vessels, carriers for transshipments and fish
9) Motherships for fish processing
10) Transhiping vessels with local licences
11) Transhiping vessels with foreign licences
12) Local fish carriers/supply vessels
13) Processing plants and establishments

There are non-refundable fees charged for letters of intent for authorization of newly registered fishing companies, entry clearance authorizations, applications for licenses, transhipments, canoe support operations and processing authorizations. Additional post-fishing right levies apply for catch origin certification, fish import and export, and local fish discharge. Major fishing right restrictions for industrial fishing vessels include their exclusion from fishing within the inshore exclusion zone (IEZ)

[73] FAO (2008/2009). FAO CECAF Working group reports on assessment of demersal fish resources

[74] Andrew Baio and Sheku Sei (2017). Management plan for small pelagic, shrimp and demersal fisheries of Sierra Leone. Consultancy report, NEPAD/PAF West Africa Pilot Project (WAPP)

[75] FAO/CECAF Working group reports on Assessment of pelagic fish resources (2010)

[76] Mehl, S., Lundsør, E., Turay, I., Sei, S., & Lamptey, E. (2007). 2007 Surveys of the fish resources of the western gulf of Guinea. Auinea Bissau, Guinea, Sierra Leone and Libera. Survey of pelagic and demersal resources. 5 May-29 May 2007.

and mesh size restrictions. The IEZ is solely reserved for artisanal fishing boats. However, industrial vessels often flout the IEZ regulation, which results in conflicts with artisanal boats for fishing grounds, often leading to the destruction of artisanal fishing nets, crafts and sometimes loss of life. Conflicts also exist for fishing grounds outside the IEZ as some larger artisanal fishing boats share fishing grounds with industrial vessels. There is a barter relationship between industrial fishing companies that target the Bobo Croakers (Gwangwa) and the artisanal fishermen. The latter sells the Gwangwa fish caught in the artisanal fishery to industrial fishing companies, while the former provides the artisanal fishers with fishing nets in exchange. Direct sales of artisanal fish catches of croakers to industrial vessels have increased competition for fishing grounds among artisanal fishers who strive to reap the high returns from Gwangwa, a fish species in high demand in Asian markets. The vulnerability of industrial fishing operations to climate change and pollution is increasingly felt in Sierra Leone. The impact of global climate change on fisheries can include coastal erosions, floods that inundate jetties, and severe weather that reduces fishing time. In relation to severe weather events at sea, trawling often has to be interrupted, usually during the months of July and August. Other detrimental impacts include pollution due to oil discharges, high nutrient loading from runoffs during rainy seasons and uncontrolled sewage disposal including plastics at sea.

1.2 Economic contribution and social implications of the fishing activity

The fisheries sector of Sierra Leone contributes about 10 percent to the gross domestic products (GDP) of Sierra Leone. The industrial fishery accounts for over 90 percent of sector revenue earnings. Sierra Leone industrial fish and fishery products are traded in local, regional and international markets, including within the sub-regional African countries of Guinea, Ghana, Senegal, Nigeria and international markets of Asia, Europe and the USA. Annual revenues of about USD 6 million are generated from the industrial fishing operations and related services. Fish is traded in the local markets in frozen, chilled or smoked forms. All species of industrial fish caught in Sierra Leone including bycatch are traded for human consumption. Local direct sales of fish for household consumption occur at ports of landing and in local markets nearby landing ports. Fish caught can be delivered to fishing companies and fish processing establishments operating cold storage facilities, including ice producing and fish processing factories. Fish and shrimps caught are usually in frozen form and wrapped in cartons on fishing vessels before being transshipped for export via fish carriers or containers. Refrigerated trucks are used to distribute fishery products to market outlets in the country, including the provinces. The Bobo Croakers (*Pseudotolithus elongatus)* caught by artisanal fishers are usually battered and sold to industrial fishing companies in exchange for fishing gears. In most cases, the Asian fishing companies pre-finance artisanal fishermen to purchase fishing boats and nets, to encourage them to sell their catches to them. This barter trade has increased the demand for Croaker fish stocks, attracting the establishment of several fish processing factories (establishments) in coastal communities. This serves as an incentive for overexploitation of the croaker fish stocks. The croaker fishery products are considered very valuable in Asian markets as their consumption is assumed to increase human life longevity. Major Asian markets include China and Korea. Sierra Leone is currently not listed among countries allowed to export fish and fishery products to the European Union Markets due to the inability of the country to meet minimum EU hygiene and sanitary requirements. However, fish caught and processed by foreign fishing vessels, including tuna vessels, which are listed among compliance vessels, are exported to EU markets. There are also indications that illegal fish caught in Sierra Leone waters ends up in EU markets under the so-called port of convenience window. About 5,000 fishermen are currently involved in industrial fishing operations, and 100 percent of the fishermen are male. An additional 250,000 people are involved in post-industrial fishing operations in the country, mainly as retailers and fish processors.

Most industrial fishermen work full time throughout the whole year, with their entire income earned from fishing. Both foreign and local crew are allowed under fishing license rights to participate in fishing operations, either as engineers, captains, Coxswains, fishermen, cooks, navigators or first aid

service delivery. Women only participate in post-fishing operations including fish processing and fish marketing, and serve as Agents and fishing company owners or representatives.

2. MANAGEMENT OF THE FISHERY

The Ministry of Fisheries and Marine Resources (MFMR) is the sole government authority in charge of the management of the industrial fisheries of Sierra Leone, under the sale of fishing rights through licenses, royalties and associated levies. There are input controls on fishing gear types and mesh sizes based on the 1994 fisheries Management and Development Act and the fisheries regulations of 2010, which stipulates a minimum mesh size of 60 mm at cod end for demersal trawl nets and pelagic trawl nets respectively. A 45 mm cod end mesh size is stipulated for shrimp trawl nets, and the minimum requirement for seine nets is 30 mm. In all cases, it is required that the mesh sizes on the sides of trawl nets must be below those at the cod end[77]. There are also local landing obligations where licensed fishing trawlers are required to land 40 percent of their total catch for sale in the local markets while the licensed shrimp trawlers must land 70 percent of bycatch and 5 percent of shrimps caught during each fishing trip. Conservation measures imposed on fishing rights under the current license regime include:

1) Designation of local person (Sierra Leonean Agent) to represent foreign companies is a requirement for license;
2) No fishing without fisheries observers on board or without a logbook;
3) Observers must be allowed onboard without hindrance, to collect and report daily catch data and other scientific information to MFMR;
4) Observers must be allowed to collect samples from catches of licensed fishing vessels anywhere in the fishery waters for Scientific purposes;
5) Vessel operators are required to pay travel costs and salaries for Authorized Fisheries Observers while Government is required to arrange insurance for Observers and other authorized officers;
6) Illegal catches on board and illegal fishing gears can be confiscated for violations;
7) Poaching vessels (vessels fishing without valid license) can be immobilized or damaged;
8) Authorized officers must be allowed without hindrance to stop and board vessels during fishing operations at sea at any time;
9) The use of VMS transponders and payment for air time is a requirement for license;
10) Infractions can be enforced using VMS or other devices such as AIS;
11) No unauthorized transhipment of catch or offloading;
12) No transhipment or offloading of catch at sea except at authorized areas;
13) No fishing by vessels in marine protected areas;
14) Access agreement is required for foreign companies prior to fishing;
15) Certificate of competency is required for captains or Coxswains operating motorized vessels above 60GRT;
16) Licenses granted for fishing are not transferable or inherited;
17) Prohibition for catching marine mammals, young and gravid crustaceans including lobsters during fishing;
18) Prohibition from using drift nets, explosives, poisons or other devices or chemicals that render fish to be easily caught;
19) No destruction of artisanal fishing gears in the IEZ by industrial vessels;
20) Compensation for destruction of artisanal fishing gears in cash or kind and compensation for loss of fishing time;
21) No stowage of illegal nets onboard trawl vessels or other fishing boats;

[77] Government of Sierra Leone. (1994). The Fisheries Management and Development Act of 1994, Section 39(a-d), Supplement to the Sierra Leone Gazette Vol. CXXV No.58. Forestry Division, Ministry of Agriculture and Natural Resources

22) No use of seine nets in rivers;
23) Right holders are required to clearly place markings or call signs and vessel names on both sides of their vessel;
24) No export of live fish from Sierra Leone and no import of live fish into Sierra Leone;
25) Clearance required for entry and exit of industrial vessels in and out of Sierra Leone fishing waters;
26) Fishing right holders are required to adhere to the provisions of the Fisheries Act in force;
27) Fines stipulated for contravention of all offences must be paid or court actions can be sought;
28) Bonds can be placed for release of seized fish or fishing gears;
29) Fish and other perishable goods seized for infractions can be sold and the proceeds lodged with the court, pending the outcome of court action for infractions, where applicable.

Despite all the above conservation measures, the Government objective for managing fish resources remains largely focused on revenue generation through licenses, without setting allowable catches for target fishery. This makes the current management regime ineffective and is rendering some commercial fish stocks to be exploited unsustainably[78]. Placing fisheries management emphasis on revenue generation can promote fishing fleet overcapacity, as was evidenced by the 1976 bilateral fishing agreement between the Government of Sierra Leone and the former Soviet Union (now Russian Federation), which lasted for fifteen years until 1990. This arrangement saw an increase in the number of fishing vessels from 183 in 1981 to 327 in 1987 (Table 1). There were inadequate surveillance activities during this period and the collaborative surveillance arrangements between the Department of Fisheries and the Naval Wing of the Republic of Sierra Leone Armed Forces was not effective. Drawing the dichotomy between fisheries surveillance patrols and security patrols in resource mobilization on the part of the Navy was also a challenge. The surveillance system under the bilateral arrangement was, therefore, malleable and associated with the challenges of understanding and clearly defining maritime enforcement collaboration and Departmental conflicts of interest.

[78] Andrew Baio and Sheku Sei (2017). The management plan for pelagics, shrimps and demersal fish resources of Sierra Leone

Table 1. Licensed industrial fishing vessels of Sierra Leone, 1981-1993.

Year	Shrimp Trawler	Demersal Trawler	Purse Seiner	Canoe Support Vessel	Liner	Netter	Processing Carrier	Total
1981	60	96	15	3	3	0	6	183
1982	27	70	30	7	5	0	1	140
1983	27	60	24	11	3	0	1	126
1984	52	82	29	9	7	0	1	180
1985	31	78	44	13	10	1	5	182
1986	27	93	54	11	8	0	6	199
1987	84	144	59	13	8	0	19	327
1988	63	72	52	11	3	0	27	228
1989	84	98	35	10	3	0	27	257
1990	66	83	16	6	0	0	13	184
1991	49	19	19	1	5	0	5	98
1992	65	34	15	5	1	0	6	126
1993	51	29	5	1	0	0	6	192

In order to improve benefits from the industrial fisheries and sustain the artisanal fisheries, the Sierra Leone Government conceived the idea of a public-private partnership (PPP) arrangement through a joint venture with a private sector company. Accordingly, the Government amended the fisheries Act in 1990 (The fisheries amendment Act of 1990) that could allow licensing of industrial vessels and delivery of MCS services by a private enterprise. In 1991, the Government of Sierra Leone introduced the idea of privatizing some of the fisheries management activities, including industrial fishing licensing and monitoring control and surveillance. This privatization was rolled out through a Joint Venture Company, the Maritime Protection Service (Sierra Leone) Limited (MPSSL), a partnership between the Sierra Leone Government and the Marine Protection Services (MPS) of the United Kingdom. Under this PPP arrangement, 51 percent of the shares were owned by the Government and 49 percent of the shares owned by the MPS. The MPS provided the initial costs for setting up the joint venture company and played a very key role in the decision making of the MPSSL. A major conflict area was that the 51 percent share allocated to the Government made the MPSSL a Government parastatal, which was also seen to be supervised by the then Ministry of State Enterprises of Sierra Leone, thus making the control by the Department of Fisheries (DOF) over the MPSSL weak. The idea of this PPP arrangement was to improve on revenue generation from the fisheries and to ensure the sustainability of the resource. This arrangement was faced with several challenges as early as the second year of operation and was discontinued in 1993, allegedly due to political interference from top-level Government ranks and files. Although the arrangement led to the improvement of fishing access controls, reduction of artisanal-industrial fishing conflicts, and the collection of access license fees, the revenues that were meant for the government nevertheless dissipated through unaccounted means. Artisanal catch productions also declined during the period of operation of the MPSSL arrangement, which indicated that the Joint Venture had failed to meet one of its key objectives of enhancing food security through improved artisanal fishing. Additionally, during the operations of the MPSSL, fishing companies were not able to maximize profit from their activities, as license fees set under the MPSSL were considered very high. The annual transhipment costs imposed on fishing companies were considered very high as well and could have funded the entire yearly MCS activity of the MPSSL[79]. The surveillance activities of the MPSSL, during the first year of operations, nonetheless

[79] Fadlu-Deen, T. (1994). *The economics of enforcement in fisheries management* (Unpublished Masters Dissertation). University of Portsmouth, United Kingdom

apprehended an increasing number of illegal fishing vessels in the IEZ[80]. But given that the MPS was a private sector investor within the MPSSL framework, their main motive was profit-making. This objective conflicted with those of the government, which were focused on creating employment for the people, while simultaneously preserving the fishery resource base. Another key limitation that contributed to the ineffectiveness of this arrangement was that the MPSSL largely monopolized fishery management functions and did so by taking advantage of the limited legal framework in place at the time of privatization[81]. Consequently, the activity of the MPSSL made industrial fishing a less attractive activity for the local fishing companies, who withdrew their operations once profit-making staggered. Several efforts by the parties to introduce new scopes of management to generate increased financial benefits through strict management measures were not attainable for contract renewal. It has been suggested that an improvement to the PPP arrangements could have been to limit the activities of the MPSSL to the mere role of delivering surveillance operations. In this case, the MPSSL would be contracted by the Government of Sierra Leone, which would retain the generated revenue in order to continue funding the MPSSL[82].

A new form of co-management arrangement now exists between the MFMR and other key institutions under a Joint Maritime Committee (JMC), established through a memorandum of understanding (MOU) for improving monitoring control and surveillance and maritime security in Sierra Leone. The JMC is comprised of the MFMR, the Maritime Wing of the Republic of Sierra Leone Armed Forces (RSSLAF), the Sierra Leone Maritime Administration (SLMA), the Office of National Security (ONS), the National Revenue Authority (NRA), the Foods Unit of the Ministry of Health and Sanitation (MOHS) and the Labor Ministry. The Sierra Leone Industrial Fishing Agency Association (SIFCA) and Fisher Organizations including the Sierra Leone Artisanal Fishermen's Union (SLAFU) and the Sierra Leone Amalgamated Artisanal Fishermen's Union (SLAAFU) and the Sierra Leone Indigenous Artisanal Fishermen's Union (SLIAFU) also collaborate with the MFMR in fisheries policy development and decision-making processes. Although some consultations are made with the SLIFCA and artisanal Fishermen's Organizations, fisheries management decision-making is largely made by the MFMR with scientific advice from the Scientific and Technical Committee, which comprises of experts in fisheries matters including retired Directors of fisheries, University Researchers and Policy Analysts. An arrangement is proposed in the new fisheries bill of 2016 to adopt a quota management system for the industrial fisheries based on total allowable catches (TACs), relying on advice from an inclusive Fisheries Advisory Board that will take into consideration the views of local traditional stakeholders on the status of the fish resources and management issues. If the new bill is enacted, this fisheries advisory board will consist of an expansion of the technical and scientific committee to include artisanal fishermen's association and the newly constituted community management associations (CMAs). The CMAS or artisanal fishermen's organization will proffer advice on artisanal fisheries' interactions with the industrial fishery. The new arrangement is sought in order to address the numerous concerns of the artisanal fishery sector, arising from the impacts of trawl fishing on food security in poor fishing communities. The ongoing fisheries management initiative of introducing territorial use rights in fisheries (TURFs) in the artisanal fisheries through co-managed marine protected areas will contribute towards sustaining the resources. This initiative which is supported through the West African Regional Fisheries Program in Sierra Leone (WARFP-SL), with funding support from the Global Environment Facility (GEF), through the World Bank, will rebuild declining fish stocks in the artisanal sector, with spillover effects on the industrial fishery sector through recruitment. Community management associations (CMAs) are now enforcing fisheries management regulations on the use of illegal fishing nets in their communities. Stewardship responsibilities among local stakeholders are developing in some fishing communities. However, this effort must be

[80] MPSSL (1991) Brief on MPSSL Freetown Mimeo MPSSL

[81] *Ibid*

[82] Golley-Morgan, E.T.A. (1991). Background paper: fisheries subsector group report. Paper presented at the National Seminar on Fishery Industry Development, 25-29 November 1991, Freetown, Sierra Leone.

expanded to include a robust alternative livelihood scheme. Additionally, surveillance operations, including community surveillance, must be strengthened. Without effective surveillance efforts, the successful efforts to rebuild the declining fish stocks, through the management of MPAs and later TURFs, will be overturned due to the continued incursion of fishing trawlers into the IEZ.

2.1 Rights-based approach: allocation and characteristics

The allocation of fishing rights-based on the sale of licenses is legally recognized in Sierra Leone, and it is regulated through the Fisheries Management and Development Act of 1994 and the Fisheries Regulations of 2010, currently in force. Fishing licenses are issued for specific periods of time, usually for three months, six months and one-year maximum, for any given time and they cannot be sold, transferred or inherited. Licenses can be renewed once a port inspection has taken place to ensure that gear characteristics have remained unchanged over time, and after paying the requisite license fees for renewal. Every license has specifications on restrictions by the Director of Fisheries, and these restrictions can be modified as the Director deems fit, as long as it is for the conservation and sustainability of the fish stocks. Since both the modification of mesh sizes and the incursion of fishing vessels into the IEZ in order to increase catchability are the most common offences committed by licensed fishing vessels, these restrictions are always included on the licenses issued. The allocation of licenses is made to local and foreign fishing vessels operating under fishing companies owned by individual Sierra Leoneans serving as Agents. Sierra Leoneans serve as Agents to represent the interest of foreign partners who own fishing vessels or are associated with foreign fishing companies. It is required by law that foreign fishing companies or foreign cooperation cannot be allocated fishing rights except after the designation of a local Agent to represent their company in Sierra Leone. It is further required that all local fishing companies owned by local agents must have onshore cold storage facilities and audited bank accounts. Agents designated by foreign partners must be Sierra Leoneans with continuous resident history in Sierra Leone over five years, and without a history of conviction, to administer fishing operations and represent their interest in Sierra Leone. Fishing rights allocated through licenses recognize the food security needs of local fishing communities. The licenses that are issued largely prohibit fishing in the IEZ in order to prevent the destruction of fishing nets owned by fishermen and to protect juvenile fish populations that breed in the IEZ. Licenses are issued based on categories of fishing vessels, types of fishing gears and target species. The category of fishing vessels currently operating in Sierra Leone includes Demersal fish trawlers, shrimp and cephalopod trawlers, pelagic and mid-water trawlers, tuna purse seiners, purse seiners for small pelagics, mothership with canoe support, pots, traps or lines, fish processing vessels and carriers for transshipments. A new policy has been introduced that restricts the establishment of new fishing companies. This policy was adopted by the MFMR in 2016 in order to cap the number of fishing vessels operating in the industrial fishery. Under this moratorium, only existing fishing companies can operate fishing vessels based on the history of their previous fleet capacity. This arrangement may not hold in the long run since most Sierra Leoneans do not currently own a fishing vessel. The reduction of fleet numbers under this arrangement may only be temporal, as Agents are highly incentivized to scramble for foreign partners in order to bring new vessels under their allowed capacity. Coupled with the current priority of the Government of Sierra Leone to increase revenue, fishing fleet numbers are expected to increase in the future. The inshore exclusion zone (IEZ) limitation has defined coordinates within five nautical miles from which industrial trawling is prohibited. If fully enforced, this control measure alone can improve on fish stock sustainability. Additionally, the fishing right allocation requirement of access agreement is a control measure to reduce over-capacity of the industrial fishery. It is provided by the 1994 Fisheries Act that licenses should not be granted to foreign vessels for the purpose of fishing in the fishery waters of Sierra Leone unless an access arrangement is in place, which shall be in the form of an Access Agreement or Charter Agreement. This provision is however, not strictly implemented by the MFMR due to the urgent need from the Government to generate revenue. Fishing rights allocations also consider the status of fishing vessels with regards to their previous engagement in IUU fishing elsewhere. The Fisheries Act of Sierra Leone does not allow the issuance of licenses to vessels previously convicted for fishing crimes elsewhere and without settlement of the infraction, and where

the license was withdrawn. It is also a condition that fishing vessels clearly display at all times, all vessel markings including international radio Call sign, on both sides of the vessel during fishing. Vessels granted fishing rights are also required to fly their national flag at all times.

2.2 Sustainable use of the resources

An industrial fisheries catch data collection and analysis scheme has been developed based on a fisheries observer scheme where logbooks for shrimps, demersal and pelagic fish data is reported on a daily basis. The observers also send daily radio catch reports to the Ministry of Fisheries and Marine Resources for monitoring. The industrial fisheries database system (IFDAS) has been developed for detailed analysis of production data. The production of accurate data for a total production including associated artisanal fisheries was stopped by the end of 2009 when the comprehensive data collection under the EU funded Institutional support for fisheries management ceased. Only industrial fish catch production data is available for 2010 through 2013 (Figure 3). An eleven-year civil war impacted industrial fishing as regulations were not effectively enforced between the years of 1996 to 2002. These periods witnessed a drastic decline in fish production, mainly due to a reduction in fishing vessel numbers as a result of reduced investment in the fishery. The earlier years of the 1980s to 1990 benefitted from increased fish production even when vessel numbers increased (Figure 4). This can be attributed to a situation of healthier resources, which maintained sustainable productions with consistent average fleet numbers around 200 vessels. Industrial fish productions returned sharply to pre-war levels by 2002 to 2010 when hostilities ceased, and fisheries management activities began to take shape. The increasing number of fleets in the late 1980s was believed to surpass the number of fleets that would adequately sustain fish resources[83].

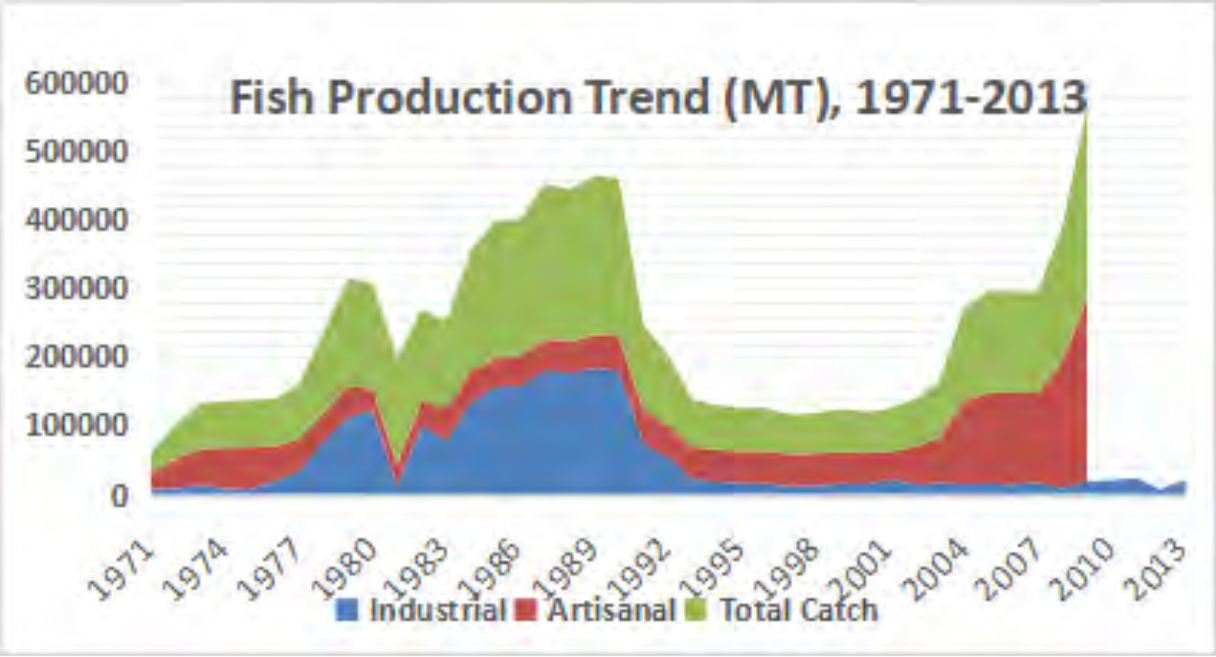

Figure 3. Fish production trends for industrial and artisanal fishery[84].

The Industrial fishing rights through licenses allows the participation of both local and foreign fishing companies. Industrial fishery investment led to a greater number of fishing fleets; the period between 1981 and 1993 saw an additional 150 fleets in operation, with 308 vessels in 1987 alone. The peak of

[83] Garcia, S., and Poinsard, F. (1989). The committee for the Eastern Central Atlantic Fisheries (CECAF) and the management of West African resources: critical review. In E.L. Miles (eds.) *Management of World Fisheries: Implications of Extended Coastal State Jurisdiction. University of Washington Press, Seattle and London,* 121-156

[84] Baio, A., and Sei, S. (2017). Management plan for pelagic, shrimps and demersal resources of Sierra Leone

the civil war subsequently led to a decline in fleet numbers in the period from 1996 to 2002. Increased investment in tuna purse seine vessels in 2010 and 2011 contributed to a return to pre-war levels.

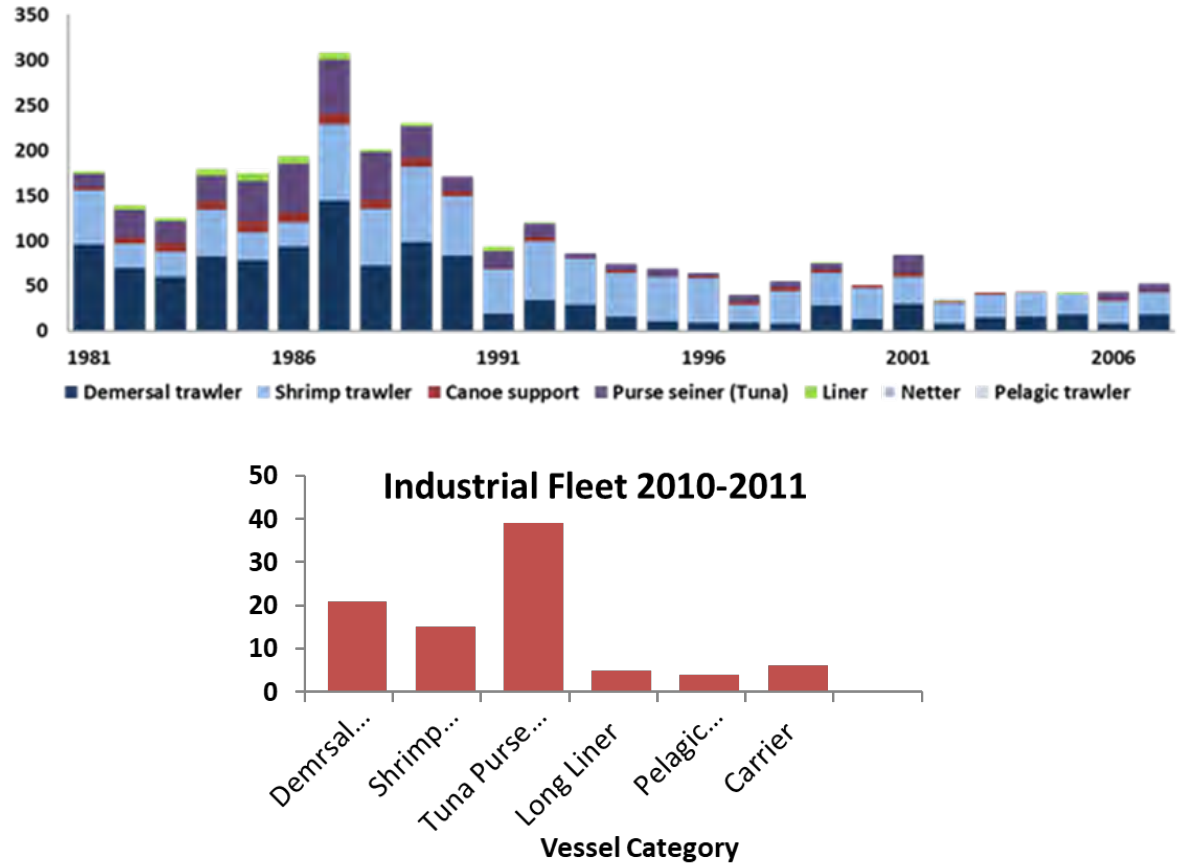

Figure 4. Industrial fishing fleet Composition, 1981-2006, 2010-2011[85].

Over 100 foreign fishing vessels currently operate in the industrial fisheries of Sierra Leone. These fleets are primarily of European and Asian nationality, although African countries including Guinea, Senegal and Cape Verde also participate in the fishery as flag states of tuna vessels. An example of the list of fishing companies and their fleet composition in 2017 is presented in Table 2.

Table 2. Industrial Fishing Companies and fleet composition in 2017.

No.	**Fishing Company/Locality**	**Category of Vessels**	**No. of Vessels**	**Flag State**
1	Afric Fishing Company/Western Freetown	Tuna longliner	1	China
		Midwater trawler	8	China
		Demersal Trawler	18	chinese
2	Ann Senkal Fishing/Western Freetown	Tuna Purse Seiner	29	Guatemala, Spain Belize, Cape Verde, panama,

[85] MFMR. (2014). Sierra Leone Fisheries Investment opportunities

				Curacao, Cote d'Ivoire, Senegal
		Cephalopod Trawler	4	Italy
		Supply Carrier	8	Spain, Panama
3	Okeky Fishing Agency/Western Freetown	Shrimp trawler	8	China
		Demersal trawler	7	China
		Fish Carrier	2	China
4	Horse Fishing/Western Rural District		0	
5	Peninsula Fishing Agency Ltd.	Midwater trawler	2	Korea
		Demersal trawler	3	Spain, Korea
		Fish Carrier	1	Korea
6	Sonit, Sierra Leone Ltd/Eastern Freetown	Midwater trawler	2	Korea
		Demersal trawler	3	Korea, Spain
		Fish carrier	1	Korea
7	Atlans Fishing/Western Freetown		0	
8	Aljan Fishing Company/western Freetown		0	
9	Africana Fishing Cooperation		0	
10	MDA Fishing Company/Western Freetown		0	
11	Coastal Fishing company/Western Freetown		0	
12	Africa Yuhai Fishing Co./Western Freetown	Demersal trawler	4	China
13	Sabco Fishing Company/western Freetown	Midwater Trawler	9	China
14	Senelone Company/Western Freetown	Tuna Purse Seiner	1	Spain
15	Sierra Fishing Company/Eastern Freetown	Midwater Trawler	2	China, France
	Western Freetown, Southern Province	Demersal trawler	19	China
		Fish Processing Carrier	2	China
		Fish carrier	3	China
16	Tima fishing Trading Ent./Western Freetown	Midwater Trawler	10	China
17	Korea Group	Semi-industrial	2	Sierra Leone
18	Hill Fishing Agency/Western Freetown	Shrimp Trawler	1	Guinea
19	Red Sea Fisheries	Semi Industrial	6	Sierra Leone
20	Kombra Fishing Company/Western, Southern	Midwater Trawler	3	St Kitts and nevis
21	Sierraquin Fishing Co. Ltd./West. F/Town		0	
22	Veeds Business & Beverages/West. F/Town		0	
23	White Pole Ltd./Western Freetown		0	
24	Monza Sierra Leone Ltd/West. F/Town		0	
25	F&I Solutions/Western Freetown	Demersal trawler	2	Korea

A regulatory system to monitor unreported catches has been instituted by the MFMR, where Dock Observers are deployed at major industrial fish landing ports to monitor catch landings and offloading activities of industrial fishing vessels. This data is collected in order to verify the daily catch reports sent by Scientific Observers and to enforce official controls for hygiene and sanitary standards, in collaboration with other stakeholders. A collaborative monitoring of transhipment and local fish discharges, where various institutions collaborate to implement port state measures, is proving productive for industrial fisheries regulation enforcement. Sampling for statistical data is continuous throughout the license period of every fishing vessel. Biological catch sampling is also done for some species. Data on size distribution and other growth parameters have been analysed to produce precautionary reference points which are used for management decision making based on fisheries management plans. Fishery independent data is also collected through scientific fishery abundance surveys including hydro-acoustic surveys for pelagic fish resources and the swept area survey for demersal resources. The fishery dependent surveys have also been grossly irregular due to funding bottlenecks since such surveys are very expensive. Fishery abundance surveys have mainly been funded through development projects. Details of fishery independent surveys from 1991 to 2010 are presented in Table 3 and Figure 5.

Table 3. Fish stock abundance estimates for Sierra Leone.

Year	Pelagic (000 mt)	Demersal (000mt)	Total (000 mt)	Project/Organizations/ Research Vessel
1981-1991	513.40	105.00	618.40	GoSL/USSR/FAO
2000	360	110.00	470.00	IMBO, USL
2006	269	35.66	304.66	GCLME/EAF-Nansen/R/V Dr. Fridtjof Nansen
2007	100	24.04	124.04	GCLME/EAF-Nansen/R/V Dr. Fridtjof nansen
2008	241	109.54	351.04	ISFM/ R/V Itaf Deme
2009	282.10	170.32	452.40	ISFM/ R/V Itaf Deme
2010	231.40	84.00	315.40	ISFM/ R/V Itaf Deme
2017	Pending			EAF -Nansen Project

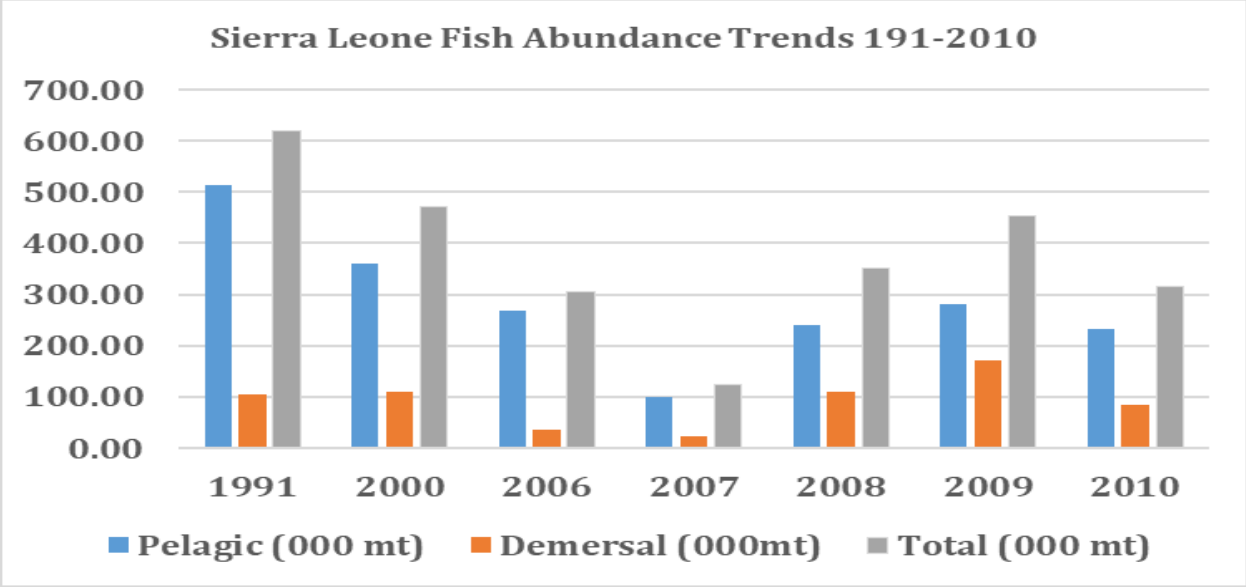

Figure 5. Fish abundance estimates for Sierra Leone, 1991-2010.

Fishery independent surveys for the estimation of resource abundances have been supported through research projects implemented through development cooperation with FAO, the European Union and the Norwegian Institute of Marine Research. The USSR /Sierra Leone had collaborated to carryout abundance surveys between 1976 and 1982, while the Norwegian Research Vessel R/V Dr. Fridtjof Nansen in collaboration with FAO conducts surveys in the continental shelves of countries in the Gulf of Guinea region. Given that most surveys were carried out on demersal resources, and the information on fish stocks in the Gulf of Guinea was scanty, the Fishery Committee for the Eastern Central Atlantic (CECAF) conceived the idea of carrying out fishery abundance survey in 1988, in order to improve the understanding on deeper water fish stocks in the Gulf of Guinea region between Sierra Leone and Ghana. The survey, referred to as the 'Guinea 90', was carried out in April 1990 in collaboration with the Spanish Oceanographic Institute, in the continental shelves and slopes of Sierra Leone, Liberia, Cote D'Ivoire and Ghana, using commercial vessel. Several other survey efforts and stock assessment have been supported through the GCLME and EAF-Nansen project on board the R/V Dr Fridtjof Nansen in 2006 and 2007. Additionally, through the EU funded institutional support for fisheries management project, bi-annual surveys were conducted in the continental shelf of Sierra Leone from 2008 to 2010. A recent pelagic and environmental survey was conducted under the EAF-Nansen project from 21/07 /2017 to 20/09/2017 in the continental shelf of Cote d'Ivoire, Ghana, Guinea, Guinea Bissau and Liberia. The series of surveys up to 2010 documented total pelagic and demersal fish biomass around 124,000 mt to 618,00 mt with the pelagic biomass accounting for over 70 percent of the total fish biomass in the continental shelf of Sierra Leone. Stock assessments carried out through the FAO/CECAF working groups and experts hired through projects have shown that some demersal and pelagic fish resources in Sierra Leone, mostly the Mandarian Sardinnela (herring), the Gwangwa (Croakers) and the red snappers (Lutjanidae) are fully exploited, while the Bonga Shad is overexploited. Although estimated potential yields show a general picture of healthy fish resources for Sierra Leone (Figure 6), the potential yields for most of the pelagic clupeids and demersal fish stocks are nearing their biomasses.

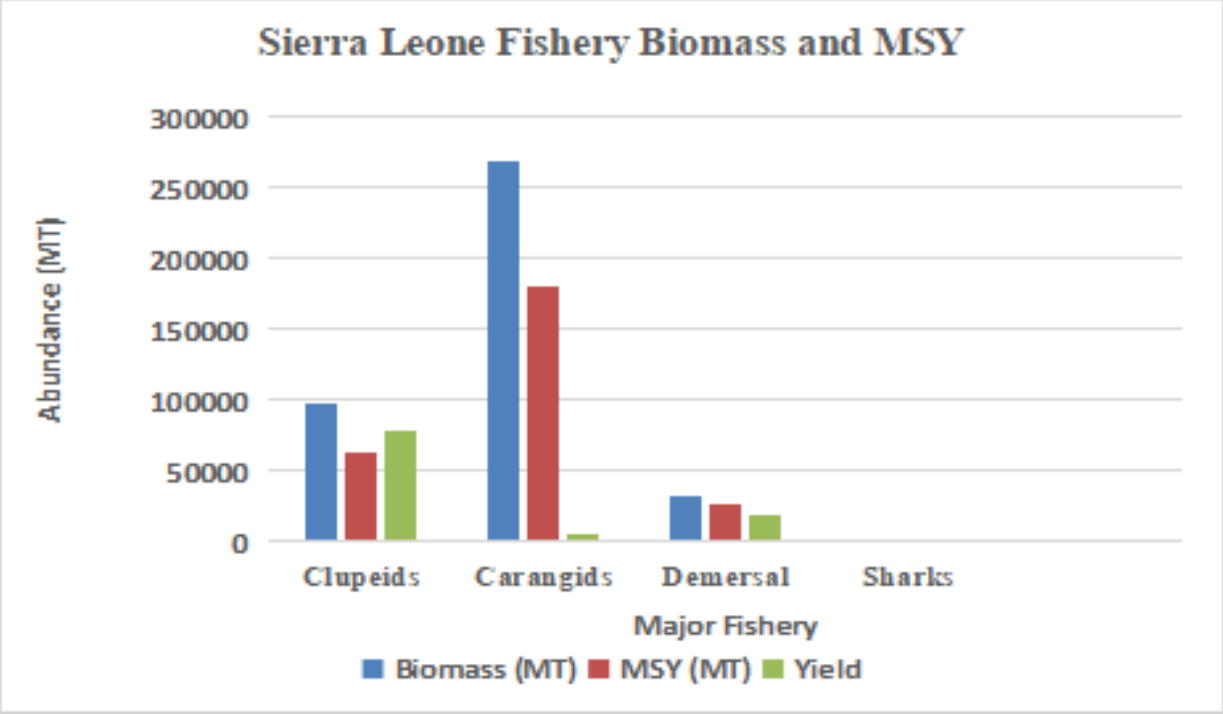

Figure 6. Fish stock abundance and potential yields for Sierra Leone.

The indications are that high fishing pressure is exerted on the demersal fish stocks. The status of the carangidae, mainly the Jacks, Mackerels, False Scads, Pompanos and Atlantic Bumpers, most of which are in offshore waters are underexploited and presents an opportunity for increased investment.

Shrimp fishing in Sierra Leone is more problematic as it is associated with about 70 percent of bycatch of finfish as a result of the utilization of undersized mesh nets by shrimp trawlers below the 45 mm cod end stipulations by law. Most of the pressure on demersal fish stocks is exerted by shrimp fishing gears, which take away a substantial amount of demersal fish species as bycatch. The bycatch of shrimp fishery can, therefore, be considered as a target catch in Sierra Leone. A bio-economic analysis of the Penaeid shrimp fishery (mainly *Penaeus notialis*) for fishing vessels from 1991 to 2008 with fleet numbers ranging from 20 to 65 vessels (Table 4) and unit cost of effort of USD 4,429,600, shows that economic benefits can be maximized more than double below the sustainable yields (MEY is 2.1 times <MSY). Revenues at maximum economic yield are about 1.5 times (over 60%) more than the revenues obtained at maximum sustainable yields (REVMEY=1.5>REVMSY).

Table 4. Licensed Shrimp Trawlers of Sierra Leone, 1991-2008.

Year	No of vessels
1991	49
1992	65
1993	51
1994	48
1995	49
1996	49
1997	20
1998	36
1999	36
2000	34
2001	30
2002	23
2003	25
2004	26
2005	23
2006	25
2007	24
2008	28

The biological reference points and management implications for the Penaeid shrimps of Sierra Leone are presented in Table 5. The analysis results show that revenues increased during the earlier years of 1991-1996, even when the fishing effort increased. As shrimp trawl investments increased, the revenues fluctuated with a sharp decrease observed in 1997, followed by a further decrease from 1998 to 2008 (Figure 7). The earlier increases in the number of fishing vessels in the fishery were favoured by increases in revenues followed by a sharp decrease as investment continued. A further reduction in the cost of fishing effort resulted in increases in revenue.

Table 5. Bio-economic reference points for Penaeid shrimps of Sierra Leone.

BRP &ERP	Values	Management Implications
MSY	2 450	MSY is slightly more than 1,55mt previously estimated.
MEY	3765.8	Profit can be maximized at a level above the sustainable yield. Care must be taken in shrimp fishing investment.
Fmsy	1,225 fishing days	Fishing mortality at maximum sustainable yield is less than 2816 fishing days previously reported by ISFM project.
Fmey	903 fishing days	Maximum economic yield can be obtained at low efforts for shrimps.
Cost Fmsy	2,768,500,000	Cost of effort at MSY is higher than cost at Fmey.
Cost Fmey	2,039,926,592	Cost of Effort at MEY is lower than cost at MSY.
REV fMEY	15,846,600,000	Economic revenue can be maximized in the fishery about 1.5 times greater than revenues at maximum sustainable yields.
REV fMSY	10,309,600,000	Revenue at Maximum Sustainable yields.

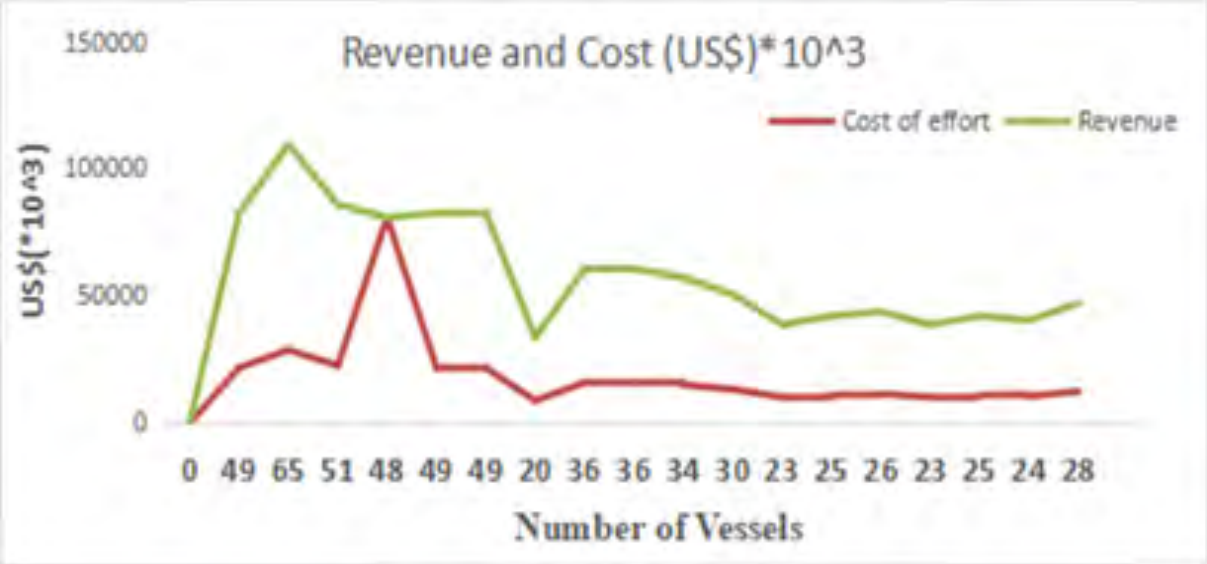

Figure 7. Cost and revenue profile for shrimp trawl investment in Sierra Leone[86].

Economic data collection and reporting by fishing companies in Sierra Leone is currently very irregular, as the companies are mostly not willing to report financial information on their investment for fear of increases of the license fee by the government. Using available information obtained from some fishing companies, the authors undertook an investment analysis based on net present value (NPV) discounting appraisal technique for shrimp trawl investment, over a period of of 10 years (2009-2019), using 2009 as the base year and discounting bank charges of USD 37,800 (on the principal investment and interest rates). The analysis suggests that the current shrimp fishing in Sierra Leone is viable. The viability is partly due to the cash inflow for the bycatch of finfish species, which accounts for an average annual cash inflow of USD 132,140 (19%) of the cash inflow accounting for shrimp exports. A positive NPV of USD 739,700 is generated for the investment, with an Internal Rate of Return (IRR) of 37 percent for a loan amortization period of 15 years (Table 6).

[86] Baio, A., and Sei, S. (2017). Management Plan for pelagic, shrimps and demersal fish resources of Sierra Leone

Table 6. NPV investment analysis profile for shrimp trawl fishing.

Investment Profile	**Values**
Period of investment (years)	10
Sales services for base year (%)	25
Sales services (other years) (%)	100
Loan amortization period (years)	15
Cash Inflow	
Export of Shrimps-Annual average (US$)	562,750
Export and local sale of bycatch-Annual average (US$)	132,140
Cash Outflows	
Fixed Asset Costs	
Lease purchase of trawler or agency arrangement cold storage Facility, office space, furniture bikes, vehicles and vans (USD)	581 000
Operational Costs	
Licenses, royalties, crew salaries, food and water, gear cost, spares for maintenance, repair costs, Bank service charges (Principal and interest) (USD)	113 400
Administrative costs including insurance, taxes and other levies	154 000
NPV (USD)	739 700
IRR(%)	37

In order to fully understand the performance of the fishery, an ecological risk screening (ERS) was done on target and non-target species. The management of declining fish stocks of demersal, pelagic and shrimp fisheries were screened based on their interactions within the ecosystem and the fishing gears. The objective was to design a management plan aiming to rebuild the declining fish stocks and enhancing food security, economic growth and resource conservation within a period of 5 years. The existing exploitation and management regime of the fish stocks were screened to determine the wellbeing of the ecosystem; the risk issues studied included the ecosystem structure, environmental impacts, external factors such as climate change effects and anthropogenic effects of pollution, coastal developments, mangrove harvesting, the use of illegal fishing nets, IEZ incursions etc. The screening relied on qualitative risk assessment methods based on likelihoods (L) and the consequence of the risk occurring, (C). Consequences were evaluated in the matrix against likelihoods. This was used to identify the critical risk areas that had to be addressed in order to implement an effective management plan for the pelagic, shrimp and demersal resources (Table 7 and Table 8). The following fish stocks were considered in the ERS:

Category 1: Demersal Croakers, Grunts and Threadfins.
Category 2: Pelagic Clupeids, mainly Sardinella and Bonga Shad.
Category 3: Penaeid shrimps, mainly *Penaeus notialis*, which is the main target shrimp associated with high bycatch.

Table 7. Qualitative Risk Screening Matrix.

Likelihood		**Consequence Level**			
		Minor	**Moderate**	**Major**	**Extreme**
		1	**2**	**3**	**4**
Remote	**1**	1	2	3	4
Unlikely	**2**	2	4	6	8
Possible	**3**	3	6	9	12
Likely	**4**	4	8	12	16

The consequence levels are considered minor, major or severe based on the duration it will take for declining fish stocks to recover, considering the available and future management opportunities. The ERS Screening combining likelihoods and consequence levels considers the ecosystem inhabited by fish stocks and the wellbeing of the investment community interactions, including fishing operations, compliance by fishing vessels, and enforcement of MCS activities. The impact of trawl fishing on the IEZ, including the MPAs and TURF activities, and natural environmental effects such as climate change were all discussed in a workshop with stakeholders. The advantage of the ERS process is that it presents an opportunity for all stakeholders, including fishermen, to interact and provide ideas on the status and management of fish stocks. The consequence levels were scored using the following criteria:

1- **Minor**, meaning that the impact of activities on fish stocks is minimal and recovery of the fish stocks can take place within months after applying management measures

2- **Moderate**, meaning that the fish stock is fished near the MSY and recovery can take between months to a maximum of one year, after applying management measures

3- **Major**, meaning that the fish stock has been fished below the MSY and it would require years for recovery to take place. Robust management measures are needed

4- Extreme, meaning that recruitment overfishing has occurred, where the ecosystem functions have been altered significantly. The fish stock (s) will require decades to recover.

The following likelihoods criteria were used for the risk screening:

1- Remote, meaning that no one ever heard of the consequence of the risk. There is < 2% chance of the consequence happening within five years.

2- Unlikely, means that consequence is not expected to occur. Chances of the consequence occurring are 2-10%

3- Possible, means that consequence may occur, but not likely within five years

4- Likely, means that the consequence level will occur within five years of the management plan

The screening matrix scores for major and extreme situations lie within 12 to 16 and moderate screening scores are between 6 and 8. The tree diagrams for the screening of ecosystem functioning and community wellbeing for assessment of the target industrial demersal, pelagic and shrimp fisheries are presented in Figure 8 and Figure 9. The assessment matrix scores are presented in Table 8 and Table 9.

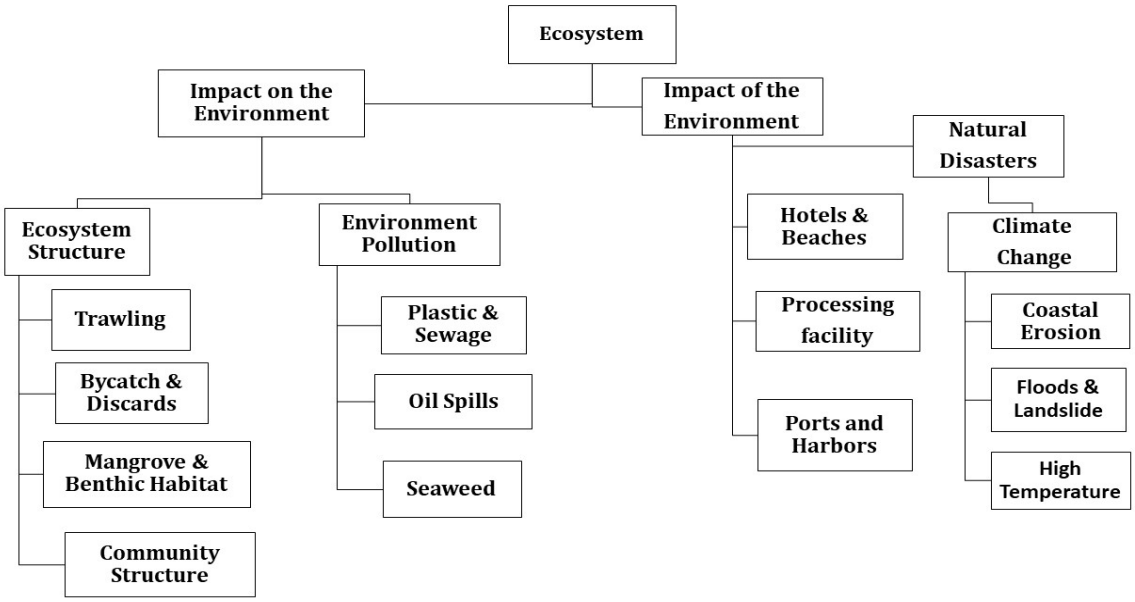

Figure 8. Ecosystem Risk Screening diagram for the industrial fishery of Sierra Leone.

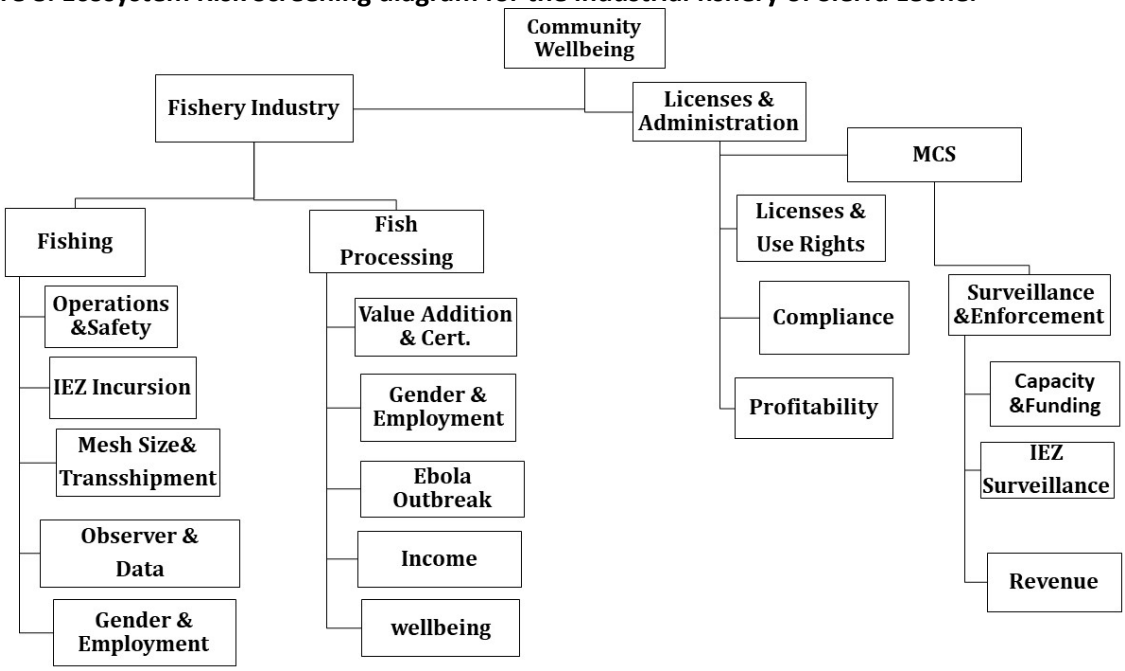

Figure 9. Risk Screening diagram for fishery community Wellbeing.

Table 8. ERS Screening for Croakers, Grunts and Penaeid shrimps.

Risk Issues	L	C	ERS Score	Risk Level	Comments
Ecosystem structure Problem	2	4	8	High	Allowable catches must be set for the stocks
Environmental Pollution	2	3	6	Medium	Although pollution is not currently an alarming problem, the bloom of seaweed (brown algae) that is washed on the beaches during the rainy season calls for research to

					investigate the consequences of the bloom
Mesh size and IEZ Incursion problem	2	5	10	High	Currents MCS efforts have not kept trawlers from the IEZ. Regular surveillance patrols are needed to combat Trawler Incursions into IEZ. Communities must be empowered for coordinated fisheries patrols
Low Value Addition	2	4	8	High	Additional effort is needed to construct fish harbor complex, improve standards of fish testing laboratories and conduct collaborative inspections of fishing vessels. Collaboration with fishing companies is required
Weak Compliance	2	4	8	High	Fishing right holders must improve compliance. Vessel Captains must be trained to understand the provisions of the Fisheries Act.
Data Collection Not Regular	2	4	8	High	Data collection must be improved. Quota Management Authority should be created to finance data collection and set up TACs for target fishery
Weak MCS	2	4	8	High	Regular patrols are required to achieve compliance
Low Revenues to Govt.	3	3	9	High	Fishing right regime must be replaced by quota systems so that fishing rights are allocated based on allowable catches. This will increase revenues
Use Rights ineffective	3	3	9	High	Fishing right allocation must be based on TACs
Weak capacity	2	2	4	Medium	Additional human resource capacity is needed. CMAs must be trained to collect catch and effort data
Low benefit Sharing	2	4	8	High	The fisheries development fund should be established to set aside percentages of revenues to be used to develop the fishery including support to artisanal sector
Climate Change Effects	2	3	6	High	The indications of future impacts is felt. The recent flooding and landslide event calls for climate change adaptation and mitigation initiatives.

Table 9. ERS Screening for pelagic Clupeids, mainly Sardinella and Bonga Shad.

Risk Issues	L	C	ERS Score	Risk Level	Key Measures
Ecosystem structure Problem	3	4	12	High	The problem is very serious as the main species of small pelagic clupeids including Sardinella are overexploited
Environmental Pollution	2	3	6	Medium	Coordinated pollution regulation among key MDAs is required. Dumping of plastic at sea must be prohibited
Mesh size and IEZ Incursion	2	4	8	High	Regular surveillance patrols is needed to meet objectives
Low Value Addition	2	4	8	High	This is a serious problem. Collaborative effort is required by stakeholders to improve official controls
Weak Compliance	2	4	8		Existing effort must be improved through regular patrols in order to meet management objectives
Data Collection Not Regular	2	4	8		Data collection system must be improved through increased funding for comprehensive data collection. Annual surveys must be conducted
Weak MCS	2	4	8		Regular surveillance patrol is required. Fishing communities must be empowered for community surveillance
Low Revenues to Govt.	3	3	9		Rights must be allocated based on allowable catches
Use Rights ineffective	3	3	9		Use rights must be improved with quota management system
Weak capacity	2	2	4		Human capacity must be built and CMAs must be trained in surveillance patrols
Low benefit Sharing	2	4	8		The fisheries development fund must be operational
Climate Change Effects	2	3	6		Important and signs of future effects is felt. Climate adaptation initiatives must continue and be improved

The Ecological Risk Screening (ERS) output provides important information on the effects of fishing on different ecological systems. The screening output reveals that the current management system where fishing rights are allocated through licenses is not effective to meet the fisheries management objectives of promoting food security, economic growth and fishery resource conservation. Efforts must be made to ensure that rights are allocated based on total allowable catches (TACs) to rebuild declining fish stocks. Fisheries management challenges that require immediate attention include the strengthening of MCS through regular surveillance patrols. Trawler incursions into the IEZ, data

collection and the use of fishing nets with the wrong mesh sizes are important areas that need improvement. Seaweed and plastic pollution are key issues. The pieces of evidences of coastal erosions associated with climate change events, insufficient knowledge on catch levels for inshore pelagics, shrimps and demersal resources, limited credit facilities for fishers, post-harvest losses, poor hygiene and fish trade limitations are critical risk areas to address.

3.2 Economic viability

Industrial trawler operations cause significant impact on associated fisheries through the destruction of habitats. Juvenile fishes are caught in large quantities by shrimp trawlers, and this is partly responsible for declines in the population of some fish stocks in Sierra Leone. Industrial trawling can, therefore, have a future impact on the long term sustainability of fish stocks in Sierra Leone. There is a need for the non-disturbance of important fish habitats such as mangrove forests, to protect the fish stocks that are already fully exploited. The commencement of a temporary restriction (moratorium) on the establishment of new fishing companies and the capping of fleet numbers at original levels operated by previous fishing companies, could permit temporarily reducing the expansion of trawl fishing. However, this activity is not envisaged to continue due to the current priority of the revenue generation objective for the fishery. In Sierra Leone, the number of fishers in the industrial fishery, as well as the distance travelled by fishing vessels to access fishing grounds, have both been increasing over time. Fishing vessels now spend more time at sea in order to increase their catch. The trawling activities of shrimp vessels are particularly longer due to the life history of the shrimp. Penaeid shrimps burrow into the mud during the day and come out at night to feed. Therefore, shrimp vessels fishing during the day actually targets a number of demersal fish species as bycatch. As some captains of shrimpers modify the cod-end mesh size of the gears in order to increase the catchability of gears, there is bound to be an increase in the bycatch of juvenile fish species by shrimp vessels during the day. Fishing trips for fish trawlers also last between 30 days and two months prior to transhipment. This is largely due to the reduction of fish concentrations in fishing grounds owing to their declining populations, and thus shifting shrimp concentration areas as well. Additionally, there has been a decrease in the number of industrial trawlers, as well as in the size and powers of licensed fishing vessels, particularly trawlers, compared to the early 1980s and 1990s. This is an indication that fish stocks are declining in Sierra Leone. Efficient offshore vessels such as pelagic and mid-water trawlers will be required to catch the fast-moving offshore pelagic fish stocks that are currently underexploited. Although analyses suggest that the shrimp fishing is viable, precautionary approaches must be applied to restrict fishing activities of shrimp trawlers to night hours, when the shrimps are actually available to the shrimp gears.

3.3 Social equality

Fishing rights under licenses, royalties and fishing associated levies is legally established in Sierra Leone based on the 1994 fisheries management and development Act and the 2010 Fisheries Regulations. These instruments have been updated into the new fisheries and aquaculture bill of 2015 and fisheries regulations of 2016, which would pave the way for stiffer penalties for violation of regulations. The current fishing license right allocation considers revenue generation and food security within a precautionary domain of economic viability of the fish stocks and conservation of marine biodiversity. Major provisions exist as fishing right limitations, including --but not limited to-- mesh size restrictions, exclusion zones (IEZ), illegal transshipments and conservation restrictions on specific non-target species. However, there are no limitations on the number of fishing vessels (fleet numbers) and catch levels (allowable catch) under the rights allocated for the fishery. The concentration of industrial fishing rights to foreign-owned fishing vessels in the current advent, where very few Sierra Leoneans own fishing vessels, have been questioned by the Artisanal Fishermen's Association--the Sierra Leone Amalgamated Artisanal Fishermen's Association (SLAAFU). The Fishermen Union advances the quest for Government to leverage the ownership of vessels at the advantage of indigenous Sierra Leoneans, and to share revenues collected from the industrial fishing right allocations with the artisanal fishing communities. This request expatiates on the grounds that fishing

trawler incursions into the IEZ are having an unaccounted impact on the livelihoods of these fishers, who often lose their nets to trawlers without adequate compensations. The issue of inequality with regards to purchasing power parity has also been cited as a key social factor affecting the distribution of fishery benefits among Sierra Leoneans. Even where fish is available in the local markets, some groups of people, particularly the vulnerable poor who are not able to purchase the fish. This phenomenon is regarded as an impediment on the achievement of nutritional security from the fishery[87]. In the new fisheries bill, the establishment of a fisheries development fund ('*the fund*') is provided for, to allow the setting aside of a separate fund from percentages of licenses, royalties, and other levies to be used for the development of the fisheries of Sierra Leone[88]. The MFMR has also suggested that part of this fund be used for the development of artisanal fisheries as a way of sharing the proceeds from the allocation of industrial fishing license rights. This is a semblance of the Sierra Leone Government's response to the call of artisanal fishermen to get equity in the distribution of the proceeds from license right allocations as an impetus of the new co-management initiative forged. As women entrepreneurs in Sierra Leone have increased since the 1980s and 1990s, their involvement in industrial fishing has risen, but fishing vessel ownership among Sierra Leonean entrepreneurs remains less than one percent nonetheless. It is envisaged that the introduction of a quota management system will facilitate the effective involvement and contribution of indigenous Sierra Leoneans from the industrial fishing right allocations.

Natural disasters, including flooding and coastal erosion due to climate change effects also affect the fishery. The poor fishing communities are often prevented from accessing fishing grounds during harsh weather conditions as their boats are small. Therefore, there is disproportionate access to fish resources between the artisanal sector and the industrial sector, with the latter benefiting due to technology and gear advantages. Fishing Companies operating fishing vessels in Sierra Leone are legally registered with recognized operational addresses and can be easily located in the event of hazardous events, including the effects of climate change. A recent landslide resulting from heavy downpours of rains in 2017 claimed over 1,000 lives and destroyed properties worth slightly over USD 30 million. Some families of fishing right holders were affected and fishing operations at sea were stopped during this period of heavy rains and flooding. During the aftermath, several fishing companies that were not adversely affected by the landslides and flooding donated fish and non-food items to displaced homes. Other reports of heavy weather effects include damaged fishing vessels at sea, the sinking of trawlers, and the loss of human lives. However, there is no compensation mechanism within the fishing right allocation for such damages due to hazards at sea, but licenses can be renewed to compensate for lost fishing time. There have also been situations where fishing companies have donated fish and fishery products to quarantined homes affected by the outbreak of the Ebola Virus Disease in Sierra Leone, which was considered to be carried by bush meat.

4. MAIN CHALLENGES AND WAY FORWARD FOR IMPROVING RIGHTS-BASED APPROACH

4.1 Challenges for industrial fisheries management

The major challenge for the management of the industrial fisheries of Sierra Leone is the weakness in the country's capacity to combat illegal, unreported and unregulated (IUU) fishing. This was exacerbated by the Ebola crisis in 2014, during which monitoring, control and surveillance efforts of the MFMR dwindled. The effect of IUU fishing is impacting negatively on the food security of the 7 million people of Sierra Leone, 80 percent of whom depend on fish as the main source of animal protein. Sierra Leone is among the West African countries with high incidences of IUU fishing, even though recent efforts of MCS investments from the West Africa Regional Fisheries Program (WARFP)

[87] Bangura, P., and Sei, S. (2018). Review/Analysis of the contribution of National Policies and Strategies of Fisheries and Aquaculture to the Food and Nutrition Security of populations in West Africa. Report of the National Consultation for the Republic of Sierra Leone. GCP/INT/244/EC Food and Nutrition Security Impact, Resilience, Sustainability and Transformation (FIRST) (Under Preparation). FAO, Sierra Leone

[88] Government of Sierra Leone (GoSL) (2015). The fisheries and Aquaculture Bill of Sierra Leone

has upgraded capacities to combat IUU fishing. The existing MCS system still suffers from funding bottlenecks, as regular surveillance is not conducted. Comparatively, however, there is increasing MCS effort in Sierra Leone through cost-effective vessel monitoring system and the use of Automatic Identification System (AIS). Over 80 incidences of IUU related offences were reported between 2010 and 2017; the country loses around USD 50 million to IUU fishing alone[89]. In a recent encounter in April 2017, an environmental non-governmental organization, Greenpeace, using their ship, the Esperanza, under a joint surveillance patrol with the Sierra Leone Government Authorities, rounded up 4 IUU fishing trawlers caught fishing illegally in the Sierra Leone EEZ[90]. This was a patrol aimed at documenting IUU activities in the EEZs of West African countries that are members of the sub-regional fisheries commission (SRFC), in order to contribute towards the enhancement of food security in West Africa. Two of the vessels apprehended, Fu Hai Yu 111 and Fu Hai Yu 222, were caught with illegal fishing nets that had mesh sizes below the required 60 mm required for pelagic and demersal fishing trawlers, under national regulations. The nets were found hidden onboard the fishing vessels; it is common practice to conceal illegal nets at sea. The vessels also conducted fishing in Sierra Leone waters without logbooks onboard, thus under-reporting their catches. There were additional evidence of unauthorized offloading of the catches by these same vessels in the port of neighbouring Liberia. The Fu Hai Yu vessels are owned by a Chinese Company, the Fu Hai Fishing Company. Another fishing vessel, F/V Eighteen, an Italian fish trawler owned by the Italian Company Asaro, was caught in possession of shark fins, which is illegal under European Council Regulations, although this is not yet enforced in the National Fisheries Act of 1994 currently in force. However, under the new Fisheries and Aquaculture Bill of Sierra Leone, which has not yet been enacted, the possession of shark fin onboard industrial fishing vessels is illegal. Another Korean vessel, CONA was also caught covering its name and illegal fishing nets were found on board the vessel with mesh sizes around 52 mm at cod end, which is far below the 60 mm minimum requirement. All these vessels are operated under Local Agents representing the interest of the Industrial fishing partners under some sort of agreement. Three of the apprehended vessels were fined for the violations based on the Fisheries Act of 1994. The falsification of catch labeling, concealing of fishing vessel call signs, illegal fish discharges, IEZ incursions and the turning off of vessel monitoring system (VMS) transponders at sea are among the numerous IUU fishing offences encountered in Sierra Leone. This is hampering the sustainability of the fisheries and fish food security in Sierra Leone. In the state opening of the 5th Parliament of Sierra Leone in May 2018, the newly elected President of the Republic of Sierra Leone emphasized IUU fishing as a key challenge for revenue generation and food production from the fishing sector. The President noted that IUU activities of industrial fishing vessels are negatively impacting the food security of Sierra Leone people. He also noted the challenge of the absence of a fisheries infrastructure including fish 249arbor complex and laboratories without necessary hygiene and sanitary control standards, which is impeding on the ability of Sierra Leone to meet the EU minimum standards for fish exports. He promised to provide the necessary resources and cooperate with development partners for effective surveillance of the fishery waters to combat IUU fishing, strengthen value addition for fish and fishery products, and promote the development of fisheries infrastructure[91].

The issues surrounding value addition for fish and fishery product is a key challenge, as Sierra Leone is currently not listed among countries allowed to export fish to the EU markets. This is because Sierra Leone has yet to meet the EU minimum standards of official controls for hygiene and sanitation. Although the government has been contracting the EU food audit firm PRECON to build national capacities of official control for hygiene and sanitation since 2013, the process has been delayed by funding requirement delivery bottlenecks and ineffective cooperation among stakeholders. The Government has moved to set up a food safety authority to leverage hygiene requirements for the

[89] Government of Sierra Leone (2018). Presidential Speech, State Opening of Parliament. State House, Freetown
[90] Greenpeace Africa. (2017). *Hope in West Africa Ship Briefer.* Retrieved from https://www.greenpeace.org/africa/en/publications/1941/hope-in-west-africa-ship-tour-briefer/
[91]Government of Sierra Leone (2018). Presidential Speech, State Opening of Parliament. State House, Freetown

improvement of the trade of food products, including fish and fishery products. However, this process is also hampered by limited funding to develop national laboratory standards for testing and certification of fish and fishery products. The designated Competent Authority of the Foods Unit of the Ministry of Health and Sanitation has not been effective due to funding limitations and weak human and technical capacity. A key challenge to address urgently is the poor data collection on target fishery, leaving the status of inshore fish populations largely unaccounted for. Stock assessment is not regular and even where abundant surveys are undertaken, the research vessels have not been able to survey inshore waters less than 15 m deep. Comprehensive data collection to account for total fish production was halted in 2009 when the EU funded Institutional Support for Fisheries Management project phased out. Additionally, there is no fisheries research vessel in Sierra Leone as compared to other sub-regional countries of Guinea, Senegal and Cape Verde. This has posed difficulties for fishery independent data collection, as surveys relying on hiring research vessels are generally expensive. As a result, no allowable catches have been set for the fishing right regime, as licenses are only based on the size of the fishing vessels. This makes it difficult to sustainably manage the fishing capacity. A quota management regime as proposed by the fisheries management plan of Sierra Leone, can reduce the number of fishing vessels and control the intensity of declining fish populations[92]. The current fishing right regime of licenses allocated to every vessel without any limitation on catches has decreased populations of commercial fish stocks and serves as an incentive for artisanal fishing net destruction conflicts through vessel incursions into the IEZ.

4.2 Improving future sustainability

Comprehensive data collection and analysis for both artisanal and industrial fisheries, including data on inshore fish populations is key for the future sustainability of the fisheries. Reliable data will be required for setting up a quota management regime, where licenses will be based on total allowable catches (TACs). A quota management and regulation authority must be set up as a separate arm of the MFMR, charged with the responsibilities of setting up and managing a quota system for the target species/categories of commercially exploited fish stocks. Shrimp trawling is causing untold impacts on inshore fish populations that interact with shrimps. In order to minimize bycatch and discard unwanted catches at sea, fishing rights for shrimp trawling should be restricted to 12-hour operations per day and should take place at night, from 6 pm to 6 am. This will improve the targeting of shrimp stocks as they come out of their mud burrows during the night to feed off the water column. An alternative to this proposal would be to introduce a dual license scheme where both finfish and shrimps are considered as target species under the fishing license rights allocated for shrimp trawlers.

The availability of a fast-moving fishery patrol vessel is an opportunity for increasing fishery surveillance patrols in Sierra Leone. The authors propose that this vessel should be used under a cooperation arrangement with SRFC member states in West Africa, to conduct joint surveillance operations where resources can be pooled from each country from time to time, to facilitate MCS operations. SRFC already had an effective sub-regional patrol scheme that worked well from the late 1990s to early 2000. The implementation of a sub-regional integration for regular fisheries surveillance operations under this proposed joint scheme will minimize IUU fishing in the region. Such joint patrols can be done under a regional memorandum of understanding (MOU), which can permit hot pursuits and apprehension of vessels in waters of SRFC member states. This arrangement can be further strengthened within the ECOWAS integration scheme for maritime operations in cooperation with the Mano River Union (MRU) and at the level of the African Union (AU) supported by New Partnership for Africa's Development (NEPAD) fisheries program, to give it the necessary recognition. Monitoring control and surveillance of the industrial fishing activities must also be improved by empowering local communities with the ability to report all spotted industrial vessels in the IEZ to the MFMR. Since patrols at the national level are often uncoordinated, regular and use large patrol vessels, they can be expensive; the surveillance operations must thus consider the inclusion of active artisanal fishermen

[92] Baio, A., and Sei, S. (2017). Management plan for pelagic, shrimps and demersal fish resources of Sierra Leone

as part of the MCS operations, through the strengthening of a community surveillance scheme forged through a coordinated effort. Under this scheme, coordinated communication technology between the patrol teams of the larger patrol vessel and smaller fishing community patrol boats can share real-time information, where the former can relay information on observed fishing vessels in the IEZ or nearby waters.

The improvement of fish handling and processing infrastructure is an important aspect of enhancing value addition for industrial fishery products. A fish harbour complex investment opportunity should be pursued, under a public-private partnership (PPP) arrangement, for the construction and operation of a multi-purpose fish harbour complex. The opportunity already exists, and feasibility studies by MFMR have identified spacious waterfront areas and natural harbour extensions, around most of the fish, offloading and transhipment points. A fishing port that operates cold storage facilities, bonded stores and ice producing units, and facilities for dry docking and vessel maintenance, rented under a PPP arrangement, will boost fish handling and processing and reduce post-harvest losses. This infrastructure should interface with improved national fish testing laboratories and the improvement of official control capacities of private fishing companies. A cooperation between the Fisheries Ministry, the Competent Authority (CA), and the Fishing Companies for a coordinated official control system are envisaged. Under this system, the Government would assign trained staff to fishing companies for the enforcement of official controls onsite, in line with EU guidelines. Once the hygiene and sanitary standards are improved, there will be a comparative advantage for Sierra Leone industrial fishery to leverage trade linkages in the sub-region as well as with international markets. This will help reduce fish trade vulnerabilities to the unexpected trade limitation shocks that are currently impeding on national fisheries investments and revenue generation.

The ongoing artisanal fisheries management initiative through marine protected areas will support the rebuilding of commercially important declining fish stocks, which will subsequently become available to the industrial fishery. This system of MPAs and territorial use right fisheries (TURFs) must be strengthened through alternative livelihood schemes and capacity mobilization within the fishing communities. The incursion of fishing trawlers into the IEZ is a key challenge in sustaining the fisheries within the partially regulated MPAs. This is affecting the livelihoods of fishermen whose nets are often destroyed by the trawlers. There is a conflict resolution system where the Ministry of Fisheries and Marine Resources arbitrate for settlement of net destruction conflicts and ensure that the industrial fishing companies compensate the victims. However, fishers are sometimes dissatisfied with the compensations reckoned. As stated earlier, surveillance efforts must be strengthened through the empowerment of the MPA management associations (CMAs) to undertake community surveillance in order the keep trawlers out of the IEZ. Alternative livelihood activities must be identified and supported by the ongoing development projects in order to sustain the MPAs and TURF management efforts.

Initiatives for the mitigation of, or adaptation to, natural disasters arising from climate change impacts must be considered in the allocation of fishing access rights. Considerations for creating resilience in coastal and estuarine habitats, including mangrove ecosystems, will support the breeding of fish stocks and the adaptation of communities to extreme weather events. A devastating flood and landslide occurred in Sierra Leone as a result of deforestation and heavy rainfalls in 2017, which lead to the loss of more than 1,000 human lives coupled with the destruction of properties worth about USD 31.65 million. Higher death tolls occurred in vulnerable and low-income communities around river valleys, creeks and slums. Trawl fishing activity at sea was also affected during this period of harsh weather. Hydro-acoustic surveys in Sierra Leone have also shown evidence of sea surface warming and unfavourable salinity regimes accounting for the disaggregation of fish schools. Pollution control mechanisms must also be coordinated among Government Ministries, Departments and Agencies (MDAs) including the Sierra Leone Maritime Administration (SLMA), the Environment Protection Agency (EPA), the Universities and Marine and Oceanographic Research Institutes including

those in the sub-region. The frequent observation of seaweed bloom (Sargassum vulgare) during the rainy season presents a concern for detailed research into the causes of algal blooms and their effects on fish resources. The blooms have been linked to high nutrient loading and sediment perturbations from mining activities that introduce heavy metals into the water column. There are concerns of the reduction of oxygen concentration due to anoxic conditions that might be associated with blooms. However, the algae that sink to the water column could also provide energy in the form of carbon to fishes and invertebrates in deeper layers of the sea. There are discussions that the Sargassum may actually be swept away during severe currents from the North Atlantic gyres of the Sargasso Sea[93].

Finally, a consideration for a multilateral fishing access agreement between countries having an interest in the industrial fisheries of Sierra Leone must be considered in the process of introducing fishing rights-based on TACs. This will help towards the sustainable control of fishing capacity and a number of problems, including the regulation of fishing vessels by flag states. Most of the foreign crew operating in the industrial fisheries of Sierra Leone are either Chinese, Koreans, Italians or French; they often find it difficult to communicate effectively in English or write English. This language barrier also serves as an impediment for the understanding of national fisheries management regulations. Fishing right allocation arrangement under multilateral cooperation with countries operating embassies in Sierra Leone will permit ease for mutual understanding. Fishing right arrangements through bilateral arrangements where countries are represented in Sierra Leone, could further support the simplicity of these operations. Partner countries are more likely to afford interpreters onboard their fishing vessels than individual foreign fishing companies, the latter being more interested in profit-making than enhancing the sustainability of the fisheries where they operate. This example has been practiced in the past through the Sierra Leone –USSR fishing agreement, which worked well for several years, although the management arrangement for future agreements would require improvement.

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Marine Fishery Development and User Rights Management in Jimo (China)

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Abstract
In 2017, Jimo was established as a district in eastern Qingdao, a city located in the southeast of the Shandong Peninsula. In 2016, the city was ranked 9th among the top 100 counties in China. The eastern part of the city borders the Yellow Sea, encompassing 2 517 km^2 of sea and 183 km of coastal line. The area is made up of seven natural bays, 28 islands of varying size, and 15 fishing port docks. Jimo benefits from abundant marine fisheries resources from its coast. The fisheries in this area have been operating since antiquity and today are mainly concentrated in the area of the Yellow Sea and Bohai. The economic output of the farming, forestry, animal husbandry and fisheries industries of Jimo was valued at RMB 11.5 billion in 2016, with fisheries accounting for a 33.5 percent of the total, or approximately RMB 3.85 billion. This case study explores the development and management of Jimo's marine fishery. First, it presents the current situation of marine fishery production and the mode of cooperation of the fishing village. It provides an overview of the formation and development of fishery management administration and measures in Jimo. Second, this study discusses the effects of the fishery management measures on fishery production and resources. Finally, it explores the challenges and shortcomings of Jimo's current fishery management system and considers future approaches to fishery management based on user rights to achieve the restoration of the fishery.

1. INTRODUCTION

At the end of 2017, Jimo became a district in eastern Qingdao, which is located in the southeast of the Shandong Peninsula in China (Figure 1). Prior to 2017, Jimo was a county-level city of Quingdao, which ranked 9th among the top 100 counties in mainland China. The eastern part of the city borders the Yellow Sea, encompassing 2 517 km^2 of the sea and 183 km of coast. There are ten natural bays in the area, including Dingzi Bay, Aoshan Bay, and Kaolao Bay. In addition, the territory holds 28 large and small islands, with a total area of 5.04 km^2, accounting for 34.8 percent of the total number of islands in Qingdao, and 1.8 percent of the total area. There are also 15 fishing ports including Lady island, which is a first-class fishing port and a second class opening port, with an area of 83.33 km^2 in an intertidal zone, and 15.33 km^2 in a rocky reef area[1].

In 2012, Jimo's Aoshan Bay Street and Spring Street became the core sites for Qingdao's Blue Silicon Valley, which is part of the Chinese marine economic development policy. Many projects were introduced including the construction of a National Deep-Sea Base, the Shandong University (Qingdao Campus), the Qingdao National Laboratory for Marine Science and Technology, and other projects. The 4.7 km Dingziwan Cross-Sea Bridge, which spans across the Dingzi Bay and connects the cities of Haiyang and Jimo, was recently completed as well.

The coast in Jimo comprises abundant marine fisheries resources, which have attracted fishing operations in the area since antiquity. The economic profit from farming, forestry, animal husbandry, and fisheries industries located in and around Jimo was estimated at RMB 12.1 billion in 2017, and fisheries were estimated to account for 34.21 percent of the total, or approximately RMB 4.14 billion. The capacity of marine fishing was 62 000 tons, accounting for 43.97 percent of the total fishing in Qingdao.

Jimo has an excellent geographical location and abundant fishery resources. It is an important production area for marine fishery in Qingdao. Through a field investigation in Jimo, we found that the fishing village has unique features in marine fishery production due to geographical and human differences, and the fisheries organization has accumulated rich experiences in marine fishery management. Based on these particularities, this study expounds an appropriate management system for the fishery in the Jimo area based on territorial user rights for fisheries and anticipates the future developments as well as possible obstacles for the management of this fishery.

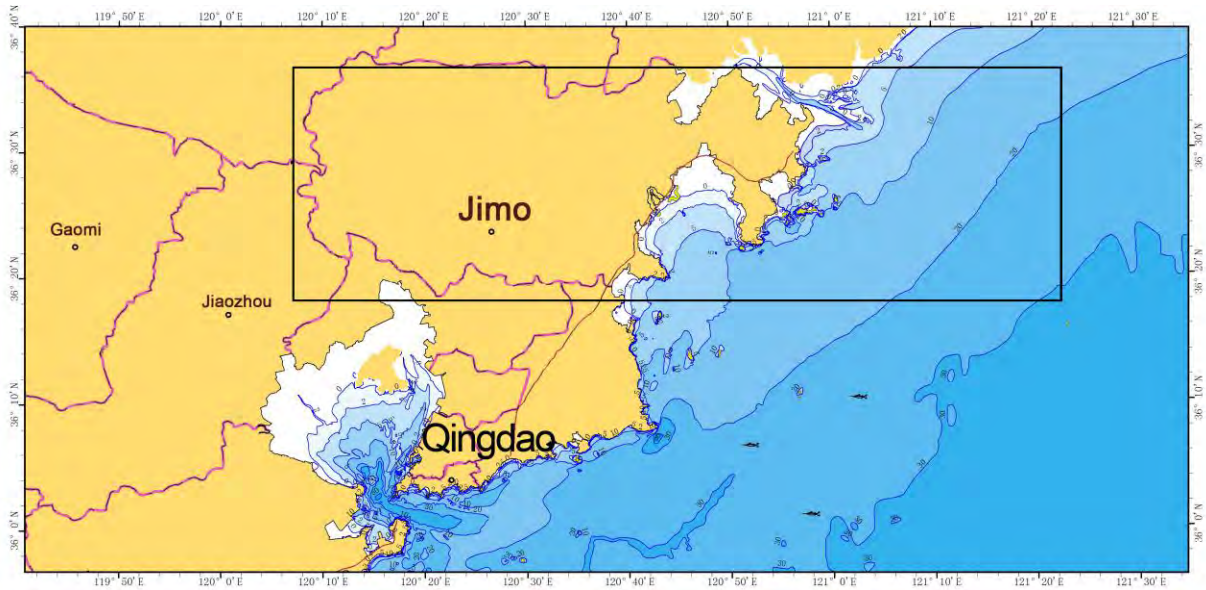

Figure 1. The location of the Jimo District.
Source: Arcgis.

1.1 Development of the marine fishery in Jimo

1.1.1 Overview of Jimo fishery village, fishing port, and fishery resources

The fishing period of small yellow fish, hairtail, Spanish mackerel, Chinese herring, mackerel, and wahoo in Jimo takes place from April to June, and the fishing period for jellyfish is from summer to winter. Since 1992, due to the depletion of resources, the burnt-end ark became the main fishing target. In 1993, there were approximately 100 perennial operating vessels, and fishing operations were carried out in the marine area around the Qianli Island. The rest of the vessels were mainly engaged in small bottom trawl production. The fishing area in Jimo is mainly offshore. Currently, there are four main offshore fishing grounds in Jimo. The southeastern fishery of Shidao is a crucial fishing ground; it is located at the intersection of the coastal stream of the south of the Chengshan Mountain and the warm current of the Yellow Sea in the north, which has led to the establishment of an excellent spawning and feeding ground for the cold-water fish and a wintering migration route of the bottom fish. Yanwei Fishing Ground is a migratory fishing ground where fish and shrimps enter and leave the Bohai Sea and the Yalu River during spring and autumn to lay eggs, feed bait and overwinter. They mainly produce carp, white croaker, prawns, and hawk claw shrimp, which mainly produces mackerel, white croaker, prawn and white-hair rough shrimp. The Haizhou Bay fishing ground is a spawning and bait field for different kinds of economically valuable fish and shrimp. Jimo's gill nets and bottom trawls often operate in this area. LVSI Fishing Ground is located in the brackish water of the North Jiangsu coast and the Yangtze River estuary freshwater low saltwater system, with the high saltwater system in the outer sea. It is rich in bait and is the working area of a large horsepower fishing boat in Jimo. There are 15 fishing ports in Jimo, including Aoshan Port, Lady Island Port, Qigou Fishing Port, Qisan Fishing Port, Daguan Island, Xiaoguan Island Fishing Port, Tianheng Island Fishing Port, and Shandongtou Fishing Port.

1.1.2 Fishery population and community status in Jimo District

The number of people working in the fisheries sector in Jimo went from 2 788 people in 1949 to 4 085 in 1953, 13 761 in 1987, and 39 875 in 2003, which accounted for 15 percent of the coastal population (Figure 2). There are five coastal towns engaged in fishery production, including Aoshanwei Town, Wenquan Town, Tianheng Town, Tianheng Island Provincial Tourism Resort, and Jinkou Town. The Aoshanwei Town, Tianheng Town, and Tianhengdao Provincial Tourism Resort are engaged in marine fishing, while the other two towns focus more on marine aquaculture. The Aoshanwei Town and Tianheng Town mainly have small fishing boats (less than 12 meters long). The resort is dominated by medium-sized fishing boats (about 23-24 meters long), which makes it the largest fishing village in Jimo. In 2017, Jimo had 92 coastal fishing villages and employed 23 296 marine fishery professionals (which represents a 7.60 percent drop compared to the previous year) and 2 090 females [1].

The fishermen are usually local villagers who come from a family tradition of fishermen. The wooden powered fishing boats are mainly small and medium-sized and are owned by the captain. Due to the high risk of operation, the difficult conditions, and the high labor intensity, there are practically no women working on the fishing boats. The captains also come from local villages and work full-time in fishing. The fishing period stretches from 100 to 120 days annually. Throughout the rest of the year, including off-season, they usually repair fishing vessels and fishing gear but do not engage in other employment. A small fishing boat employs 1-2 crew members, in addition to the captain, while a medium-sized fishing boat employs 8-9 crew members, all of which come from the local community. The annual net income of a medium-sized ship is about RMB 60-80 thousand, and for small boats, it is RMB 30-50 thousand, which represents the main source of fishermen's income. Because of the reduced fishery resources and high fuel costs, the majority of families have only one fishing vessel.

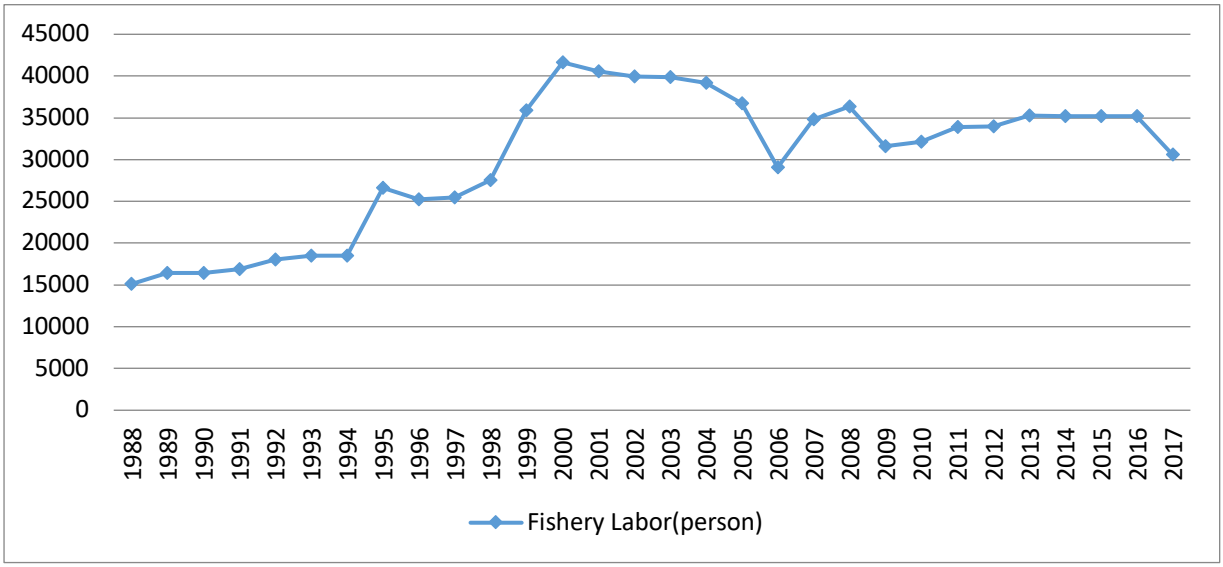

Figure 2. Fishery Labour of Jimo Marine Fishing from 1988 to 2017 (unit: person).

1.1.3 Catches of marine fishing in Jimo District

In the early 1950s, the number of fishing vessels in Jimo increased annually and the fishing period grew from seasonal operations to part-time, rotational and perennial operations. In the late 1950s, owing to the reduction of marine resources, tools lagged behind, and catches were in an unstable condition; catches dropped to 3 038 tons in 1958. In the 1960s, various traditional catches were generally reduced due to the severe decline in resources. In the 1970s, the fishing area was expanded, the technology of manufacturing fishing gear and fishing vessels was improved, and a new fishing target was developed, which caused the output to slightly increase. In the 1980s, two kinds of deep water gill nets were used to catch shrimp and silvery pomfret; their production remarkably increased as well. In the 1990s, the fishing gear and fishing methods were modernized, the operation time was

extended, and the larger horsepower for fishing boats was developed for the offshore operation. The total fishing output reached 524 thousand tons between 1990 and 1999; it then lowered to 352.9 thousand tons during the period 2000-2003. In 2005, catches were estimated at 61 798 tons and decreased year-by-year after that. In 2007, the six main catches included 8 760 tons for shellfish, 4 620 tons for mantis shrimp, 2 310 tons for Acetes Chinensis, 2 194 for octopus, 1 313 tons for barracuda, and 1 056 tons for swimming crab (Figure 3).

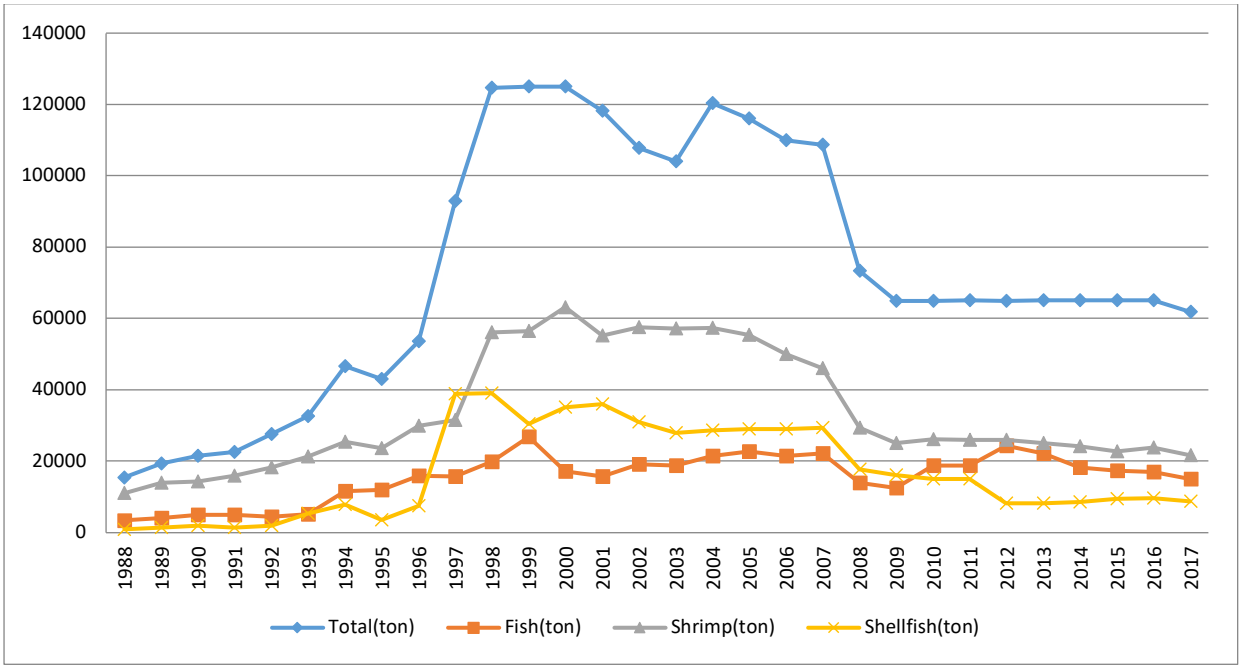

Figure 3. Marine Fishing Quantity of Jimo from 1988 to 2017 (in tons).

1.1.4 Fishing boats and gear in Jimo fishery production

After the Chinese Revolution of 1949, fishery production was supported by the government, and the number of fishing boats continually increased. In 1955, the number of fishing boats reached 2 679. After 1972, the area focused on developing motorized sailboats. In 2003, the number of fishing vessels in the Jimo District amounted to 2 161 sailboats, with a total horsepower of 37 419 kW. In 2017, there were 986 registered motor ships in Jimo, with a total power of 25 240 kW[2] —most of these were small (less than 12 m) and mid-sized ships (less than 24 m). These ships are usually built of wood, and the engine is placed in the cabin. Medium and small-sized ships generally navigate 50-60 and 5-10 nautical miles from the shoreline, respectively. The voyage period is 1 and 3-4 days for small and mid-sized ships, respectively. Fishing gear is placed mechanically and borrows the power of the fishing boat engine. The fishing boat is equipped with ice storage boxes, and generally, there is no refrigerator. Due to the long sailing period of mid-sized fishing ships, some vessels trade their catches at sea.

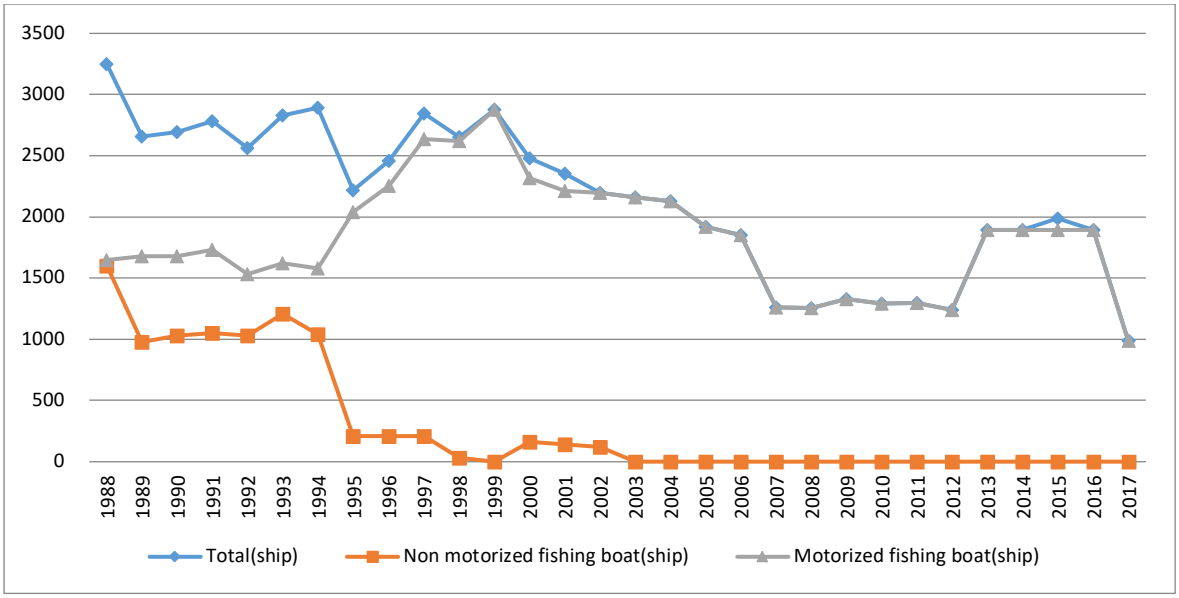

Figure 4. Number of marine fishing vessels in Jimo, from 1988 to 2017 (unit: ship).

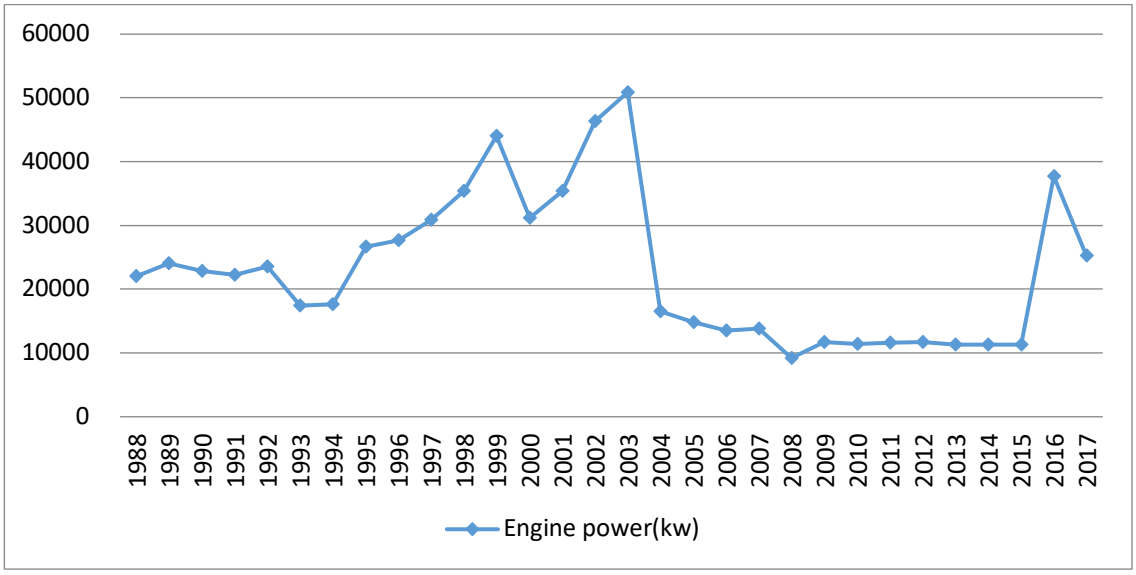

Figure 5. The engine power of the motorized fishing boat.

The fishermen in Jimo generally use net fishing gear, fishing tackle, and miscellaneous fishing gear. Some examples of fishing tackle include longline fishing and fishing rods. Some examples of miscellaneous fishing gear include a snail farming net, crab cage, clam rake, and submersible lights. Some examples of fishing nets include gill net, purse seine, trawl net and trap net. Due to the extensive exploitation of clams in the 1950s, the production of small nets gradually condensed two decades later, while the production of clam rakes rapidly increased and became the main offshore fishing gear. Throughout the 1980s, driftnets were widely used to catch the White-hair rough shrimp, and clam dredges were sometimes used to collect hard shells. In the 1990s, offshore fishing was launched, and large ring nets were used. At the end of 2017, among the 986 registered fishing vessels, 758 were engaged in gill net production, 101 were employed in fishing tackle production, and 120 vessels were engaged in the production of trap nets [1].

Fishing vessels are equipped with the BeiDou Navigation Satellite System (BDS), a Chinese satellite navigation system, Global Positioning System (GPS), Automatic Identification System (AIS), as well as radio frequency identification (RFID) tags. Fishing vessels with engine power below 29.4 kW are

equipped with code division multiple access (CDMA) acoustic telemetry and communication terminals.

Table 1. 1988-2017 Jimo Marine Fishing List.

Year	Labour (person)	Fishing vessel			Catches				
		Total (ship)	No engine vessel (ship/ton)	Engine vessel (ship/ton)	Total	Fish	Shrimp and Crab	shellfish	algae
1988	15099	3249	1602/660	1647/22041	15461	3462	11041	925	33
1989	16408	2659	980/972	1679/24052	19395	4056	13950	1353	36
1990	16416	2691	1030/851	1681/22821	21444	5058	14412	1944	30
1991	16852	2784	1051/837	1733/22258	22517	5053	15970	1437	57
1992	18065	2561	1029/857	1532/23498	27550	4430	18323	1862	54
1993	18467	2832	1210/986	1622/17443	32637	5169	21407	5270	38
1994	18467	2892	1042/884	1580/17578	46687	11587	25398	7780	24
1995	26574	2215	207/212	2038/26671	43000	11929	23588	3491	1
1996	25246	2459	207/212	2252/27622	53534	16025	29955	7554	—
1997	25429	2844	210/132	2634/30882	92817	15846	31522	38987	16
1998	27508	2653	32/32	2621/35354	124721	19871	56035	39108	30
1999	35922	2875	—	2875/43977	125000	26843	56521	30496	49
2000	41640	2481	162/280	2319/31216	125000	17189	63207	35129	25
2001	40536	2354	140/70	2214/35344	118233	15821	55181	35971	26
2002	39907	2195	120/60	2195/46305	107716	19235	57487	30970	24
2003	39875	2161	—	2161/50890	104075	18865	57224	27955	31
2004	39151	2130	—	2130/16560	120426	21430	57340	28758	36
2005	36694	1920	—	1920/14822	116034	22766	55461	29001	36
2006	29028	1852	—	1852/13476	110000	21438	49987	28990	—

2007	34815	1262	—	1262/13843	108693	22186	46096	29353	—
2008	36370	1255	—	1255/9190	73398	13971	29468	17662	—
2009	31568	1328	—	1328/11660	64896	12561	25081	16129	—
2010	32148	1294	—	1294/11382	65002	18752	26186	15035	—
2011	33917	1295	—	1295/11558	65048	18752	26071	15039	—
2012	33947	1239	—	1239/11734	64948	24318	26071	8138	—
2013	35287	1895	—	1895/11325	65048	22145	25071	8138	—
2014	35192	1895	—	1895/11325	65048	18293	24171	8638	—
2015	35192	1985	—	1895/11325	65048	17349	22834	9533	—
2016	35192	1895	—	1895/37729	65048	17049	23876	9660	—
2017	30562	986	—	986/25240	61798	15049	21626	8760	—

Data Source: Oceanography and Islands of Jimo, Jimo Statistical Yearbook of Marine Fisheries (2014-2018).

2. MANAGEMENT OF THE MARINE FISHERY IN JIMO

2.1 Marine Fisheries Management Agency of Jimo

The Marine Fisheries Management Agency of Jimo was formally established in the autumn of 1952. In June 1956, the Fishery Bureau of Jimo was established. On 27 December 1997, the Jimo Fisheries Bureau changed its name to the Jimo City Ocean and Fishery Bureau and was tasked with marine management functions. In November 1998, the Jimo Marine Supervision Team was established to perform marine supervisory tasks. This event led to the promulgation of Jimo's provisional regulations on the use and management of sea areas, which promoted the United Nations Convention on the Law of the Sea (UNCLOS). By the end of 2012, Jimo's clear use of the marine area exceeded 127 km^2. More than 700 certificates of marine use right were issued. Both the examination rate of certificates of marine use right and the collection rate of sea area use fees were 100 percent.

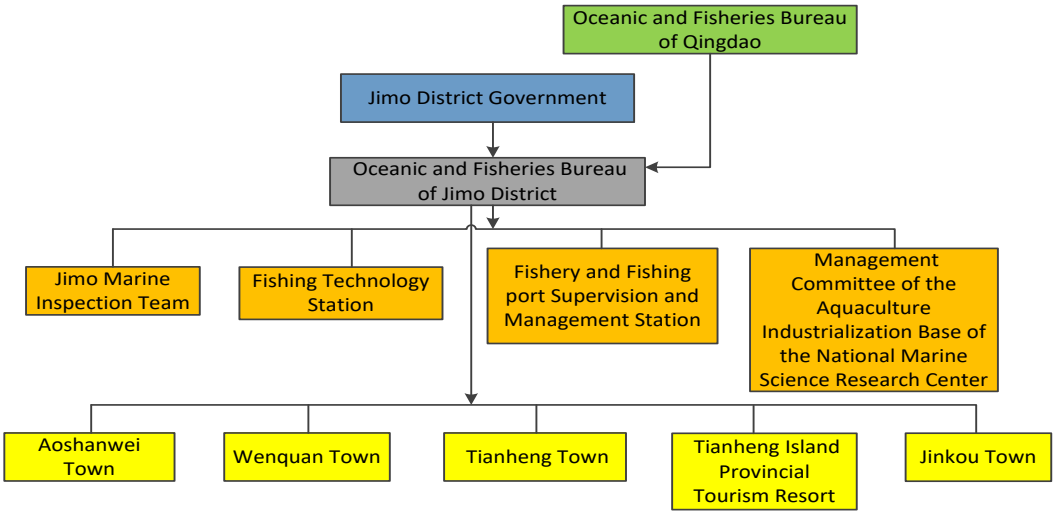

Figure 6. Administration relationship of the Jimo Oceanic and Fisheries Bureau.

2.2 Management of marine fishery user rights in Jimo

2.2.1 Fishery user rights management based on fishing license

A fishing license must be approved by the Chinese government for fishermen to engage in fishing operations. China initiated the fishing licensing system in 2002. In 2007, the property law declared the rights of fishery farming and fishing rights as a usufructuary right, which is of great significance for protecting the legitimate rights and interests of marine fisheries[3]. The licensing system includes a fishing licence, a ship inspection certificate, and a ship registration certificate. The government promoted the "three certifications in one" reform, implemented the reform on fishery inlands by 2016, and carried out the reform research of "three certificates in one" in small-sized fishing vessels. A fishing license is divided into seven categories: marine fishing license, public sea fishing license, inland fishing license, special (chartered) fishing license, temporary fishing license, foreign fishing boat fishing license, and fishing auxiliary ship license.

A license certifies, amongst other things, the type of operation, the territorial area, the time limit, the quantity and the specifications of fishing gear, and fishing species. The species and the area of fishing should be approved on the license. The license also specifies the engine power, length, tonnage, and the owner's individual details of the fishing vessel. Within the territorial sea, fishing vessels must not operate at cross-border regions, and fishing gear other than those specified on the license cannot be used. Licenses cannot be sold, leased, or transferred to other individuals. The validity period of the marine fishing license and the inland fishing license is five years. The validity period of other types of fishing licenses is determined by actual needs. However, it does not exceed three years. A fishing license with over one-year validity is annually reviewed. Within the territorial sea, a license is generally issued by the fishery department of the local government, which is also responsible for the annual review. The age of the various types of fishing vessels is also regulated; fishing vessels that exceed the age limit are not validated.

In addition to the use of licenses for fishing gear management, the management agency has also implemented a minimum mesh size system for the use of fishing gears and transitional fishing gears. In order to strengthen the management of fishing gear and protect marine fishery resources, with the help of scientific researchers and the practice of fishing production, the Ministry of Agriculture issued "the Notice on the Implementation of the Minimum Net Size System for Marine Fishing and transitional Fishing Gear" in December 2013, which regulated the use of fishing gear.

2.2.2 Fisherman's qualification certificate is a threshold for fishing

“The Regulations on the Issuance of Marine Fisheries in the People's Republic of China” divides the fishery crew into professional crew members and ordinary crew members. The professional crew members are the drivers, engineers, electricians, and radio personnel. According to the specific parameters of the fishing vessel, such as the gross tonnage, engine power, and other indexes, the number of crew members and the corresponding competency certificates should be provided. “The Regulations of the People's Republic of China on the Examination and Issuance of Certificates for Professional Basic Training of Ordinary Seafarers on Fishery Vessels” declares that the ordinary crew should obtain the “Certificate of Professional Training for Fishermen's General Crew” required for work permission.

According to the above-mentioned policies, the fishery management system has basically established itself around “fishing boats, fishing gear, and fishermen”, and formed the access threshold of fishery in the offshore area.

2.3 Other marine fishery management policies in the Jimo

2.3.1 A double-control system for fishing vessel

Since 1987, China implemented a “double-control system” for marine fishing, which mainly controls the number of fishing vessels and their engine power, and proposed a "double-control" target during 1986-1990, 1991-1995, 1996-2000, and 2003-2010. In 2002, the Ministry of the People's Republic of China issued the “Interim Provisions on the Retirement of Fishery Vessels”. For the first time, the fishing vessels that reached the age of scrapping in China were compulsorily scrapped. The government supplied the subsidy to help fishermen change their jobs. Under the “double-control” policy, all fishing vessels were motor sailing vessels, in which 2 161 fishing vessels carried 16 580 tons, with a total power of 37 419 kW in 2003. In 2012, Jimo had 986 motor vessels, with a loading capacity of 7 768 tons, and total power of 25 240 kW. The number of vessels was reduced by nearly 50 percent. Both the total loading capacity and total power decreased.

2.3.2 Fishery oil price subsidy system

The subsidy for the fishery oil price is an important policy that supports fisheries and increases profits. It is also the broadest policy supporting fisheries that the government has implemented since 2006. The Jimo district enjoys diesel subsidies for fishermen and fishing enterprises engaged in offshore fishing and breeding, and that use mobile fishing vessels. Since 2015, these subsidies were adjusted by taking into consideration factors such as the age of the ship and the ecological restoration. Domestic fishing boats are classified for oil subsidies according to the type and the size of the vessel. The scale of subsidies for large-scale and medium-sized fishing vessels has gradually decreased, and subsidies for small-scale fishing boats have remained the same. Subsidies can thus be considered a cost-sharing mechanism for fishermen. Old fishing vessels that reached the age limit were not subsidized in 2018. The double-bottom trawl, sailing net, and single-vessel surrounding net with a large fishing intensity, which have serious negative effects on resources, will not be subsidized in 2020.

2.3.3 Summer fishing moratorium system

In order to protect fishery resources, the summer fishing moratorium system was implemented, and the fishing season was clearly defined. The fishing season, time, and grounds were clearly adjusted to the changes in Jimo’s ban on certain fishing periods and fishing areas. In 2017, the fishing period was changed from 1 June to 1 May and lasts until 1 September. The fishing season has effectively protected the reproduction and growth of most of the major economic species, improved the quality of catch, and increased the sales price thanks to the larger sizes of the fish. At the same time, the system reduces the fishing time and the production cost. According to the statistics, every 15 to 44 kW of fishing vessels can save RMB 14 thousand, and 15 kW of fishing boats can save RMB 8 thousand. However, despite the risk of being severely punished, some small fishing vessels have been prone to

illegal fishing during the moratorium period because of the high seafood prices. After the moratorium, increased competition weakened the conservation results of the moratorium season.

Fishing inspectors remain at sea for 24 hours and conduct both circuit inspections and surprise inspections to curtail illegal fishing. Combining the fishing moratorium season management with the fuel subsidies would be helpful to incentivize fishermen to engage self-control and to refrain from illegal behavior. Working groups are stationed at important ports and fishing villages to block the entry of illegal fishing boats. This allows them to coordinate and keep abreast with the dynamics of fishing vessels. The Ocean and Fishery Bureau also conducts crew training courses in coastal towns and villages. They train 150 crew members and ordinary crew members in fishery safety production, laws and regulations, and relevant business skills. Those who do not participate in training courses or fail the training exams are not eligible to receive certificates and are not allowed to engage in fishing production. The summer fishing moratorium system also stipulates that special fishing can be carried out for special species of fish, such as prawns and jellyfish. In the sea area of Jimo, the period of 20 July to 30 July is the fishing season of jellyfish, and the period of 20 August to 30 August is the fishing season for prawns. Fishing vessels can legally operate according to the approved scope and fishing gear on the fishing licences.

2.3.4 The system of fishery resources proliferation and protection fee

In the middle and late 1980s, China began to gradually implement the fishery resources proliferation and protection fee. In accordance with the “measures for the use of the collection and use of the protection fee for the proliferation of fishery resources”, all units and individuals who have captured natural growth and artificial proliferation of aquatic animals and plants in the sea area under our jurisdiction must pay the protection fee for the proliferation of fishery resources. The collection and use of fishery resources fees should be based on the principle of "Taking it from fishing, and using it for fishing." The charge of proliferation protection can be used as an economical means to limit fishing investment and to reduce the fishing intensity. It can be used as the cost of the release of fishery resources, and it can also support the law enforcement expenditure of local fisheries administration departments. In order to further reduce the burden of enterprises, especially small and micro enterprises, the State Council approved the suspension of the collection of fishery resources proliferation and protection fees from 2015.

In 2018, Jimo’s fishery resources fund proliferation was 2.38 million yuan, of which the central capital paid 1.8 million yuan, and Qingdao municipal government paid 5.8 million yuan. This helped restock the Chinese shrimp to 86.11 million tails, Japanese shrimp to 68.08 million, three wart swimming crab to 8.337 million, flounder fish to 335 000 tails, a total of 162.862 million units. The released seed was purchased byways of bidding.

2.4 Fishery monitoring and controlling in Jimo

The Fishery and Fishing port Supervision and Management Station is responsible for the monitoring and controlling of Jimo fisheries. The station is responsible for:

1) Promoting and implementing fishery laws and regulations, supervising and administrating fishing, fishing ports, and fishing vessels.
2) Implementing and supervising fishing license and the summer fishing moratorium.
3) Dealing with maritime accidents in fishing ports and maritime disputes.
4) Undertaking the registration, inspection, and issuance of various documents for fishing vessels, organizing the rescue of fisheries, supervising and managing production safety.
5) Protecting aquatic wildlife and supervising and managing fishery reserves.
6) Contributing to the management of fishing vessel radio stations.
7) Guiding the energy-saving and emission reductions efforts of fishing vessels.

Financial penalties are usually exerted for violations of regulations. The 14 kinds of illegal activities are reprimanded through deductions from the fishing oil price subsidy –six of which are deducted from annual oil price subsidies, and eight of which are deducted below 70 percent of oil price subsidies. Due to the high penalties and frequent patrols from 13 monitoring vessels, there are fewer violations than before, but the problem has not disappeared. While the catches are confiscated and dumped back into the sea, violating fishing boats are also temporarily detained.

Each community has one fishery assistant who reports directly to the Jimo Fishery Supervision Station. The fishery supervision station allocates funds according to the size and quantity of the vessels managed by the assistant. The fishery assistant cooperates with the supervision station and is mainly responsible for:

1) Becoming familiar with the basic situation of fishing vessels and crews, maintaining communication between them, and ensuring positive dynamics between them.
2) Promoting laws and regulations, system measures and other related regulations on fishery safety production. Conveying the requirements and relevant information on safe productions to the fishing vessel owners and the captain in a timely manner.
3) Ensuring that fishing vessels are equipped with safety gear such as fire protection and life jackets, as well as safety terminal equipment such as communication and navigation devices. Overseeing that fishing vessels engage in mutual insurance and that crew members lacking a certificate of competency attend to this problem by undergoing their required training.
4) Communicating the weather warning information to fishing boats in due time and guiding vessels to take shelter from wind and other harsh weather.
5) Carrying out safety production inspections by relevant departments, conducting regular inspections of fishing port terminals, conducting timely investigations into hidden dangers, uncovering and correcting fishing violations.
6) Cooperating with entities organizing fishing vessel inspections, crew trainings, emergency rescues, and the management of the summer moratorium.
7) Ensuring a positive relationship with the daily inspection teams of the coastline. If any illegal use of the sea area, illegal reclamation, pool building and damage to the marine environment are discovered, the case shall be reported to the town street and the competent authorities in a timely manner.

The fishing station is also responsible for the safety inspection of fishing vessels during the fishing moratorium season. The medium and large fishing vessels must be repaired in the dock, and the small fishing boats should be checked onshore. The rescue and escape equipment of fishing vessels is the primary focus of the inspection. The inspection fee is free, and the cost of repair is borne by fishermen. After the moratorium season, fishing boats continue to undergo random inspections. In recent years, fishing vessels have had fewer accidents. The accidents that were recorded were mainly due to mechanical failures or where the crew fell into water because of bad weather (with the fishery administration station actively taking part in the rescue operations). The compensation is paid by the insurance. The owner or operator of the fishing vessel should have employer liability insurance for fishery mutual insurance for the employee. The total insurance amount is 2 000 yuan per year. Employers only need to pay 740 yuan per year for employees, and the rest is paid by the government. If the fishermen are injured and killed, the maximum compensation is 320 thousand for the fishery aid insurance. The captain can also choose commercial insurance to increase the compensation amount. Those who participate in fishery aid insurance can enjoy free crew training, life jacket equipment, liferaft maintenance, low-interest shipowner finance and other fishing policies which are paid for by the government. In view of safety considerations, fishing vessels should be organized in the form of free cooperation of cooperatives or towns (streets) and villages. It is required that fishery vessels form

teams when they go out at sea; at least three vessels from the same town or village must fish together. The fishery vessels in a team have the responsibility of mutual assistance.

3. CHALLENGES FACING THE MANAGEMENT OF MARINE FISHERIES IN JIMO

3.1 Illegal operations of other province fishermen across the sea territory

In recent years, local and central governments in Shandong province have invested a large number of funds strengthening the conservation of fishery resources, which has enabled the recovery of many offshore fishery resources as well. The fishing period in Jimo saw the arrival of fishing boats from many provinces including, for instance, Hebei and Liaoning, seeking to compete with the local fishermen for the limited fishery resources. When it became evident that their fishing grounds had been occupied by foreign boats, the local fishermen attempted to squeeze out their competition, thereby causing various fishing disputes.

Fishing vessels operating in the sea area of the coastal provinces must act in accordance to the fishing license. The “Measures for the Implementation of Fisheries Law of Shandong Province” stipulates that fishing vessels coming from other provinces and municipalities to engage in fishing in another jurisdiction must apply for a fishing license which must be approved by the fishery administrative department of the provincial department. It is common for fishing boats from Liaoning province to enter the Jimo fishing area illegally. The hull and horsepower of their fishing boats are much greater than the fishing boats from Jimo, which creates high competitive pressure for the locals. All foreign vessels entering the Jimo fishing area have more than 300 horsepower and can have up to 10-12 vessels operating in a single team. These teams have caused a great deal of difficulty for local fishing inspection operations. Furthermore, local fishermen have complained that the local fishery inspection equipment lags behind and that the province lacks an effective coordination mechanism which makes monitoring difficult and sometimes ineffective.

3.2 Land occupied by project development

The ongoing developments in Jimo, such as the China Blue Silicon Valley, National Marine Science and Technology Laboratory, Deep-Sea Base, Shandong University (Qingdao Campus), Qingdao National Marine Science Research Center, Aquatic Seedling Industrialization Base, Qingdao Yangfan Shipbuilding, Tianhengdao Provincial Tourism Resort, and the Huaneng Wind Power Project, have meant that some fishing villages are facing land occupations, thus forcing some fishermen to change profession and decreasing the number of fishing villages altogether. Due to the shortage of fishery resources and the increase in oil prices, fishing costs have risen, thus creating high vulnerability for fishermen’s incomes, which, in some cases, have decreased. These land expropriations have given way to considerable compensations, housing resettlements and an overall better standard of living for fishermen. Thus, excluding some fishermen who are reluctant to leave, many fishermen do not take issue with these projects and, on the contrary, have taken this opportunity to retire. Due to their old age and lack of alternative skills, the majority of them have not engaged in other types of work.

3.3 The contradiction between fishery management policies

In order to protect and restore fisheries resources, China implemented the fishing licence system in 2002, the control over horsepower and total tonnage in 1987, as well as other input controls. Similarly, China adopted the summer fishing moratorium system as well as artificial proliferation and release fees, which led to increased fishery monitoring and controlling. However, despite these efforts, the degradation of fishery resources did not improve, especially in the areas near the coast. In addition, as oil prices increased, so too did fishery production costs, which put downward pressure on fishermen’s income. The phenomenon of "more fishing, more losses" motivates fishing vessels to stop at the harbor during favorable weather conditions of non-prohibited fishing periods. Thus, the production of fisheries has decreased and has left the future of fishermen uncertain. In order to ensure the normal operation of fishery production, the state has introduced a series of policies for fishing and

fishery, such as the fishery oil price subsidy policy, the fishery resources proliferation and release fees exempting policy, the ship inspection fees exempting policy, and the fisherman' mutual insurance subsidy policy. These policies have reduced the production cost of fisheries and decreased the number of fishermen that were suspended from fishing. The implementation of the oil price subsidy policy has led to some contradictions between the different policies. For example, some old-age fishing vessels deferred scrapping in order to obtain oil price subsidies, directly affecting the double-control policy for fishing vessels and the target of reducing the fishing intensity policy. For this reason, the Ministry of Agriculture of the People's Republic of China refined the target of subsidies and subsidy standards in 2015. The subsidies for the livelihood of fishing vessels remained unchanged, while the standard of subsidy was lowered year-by-year.

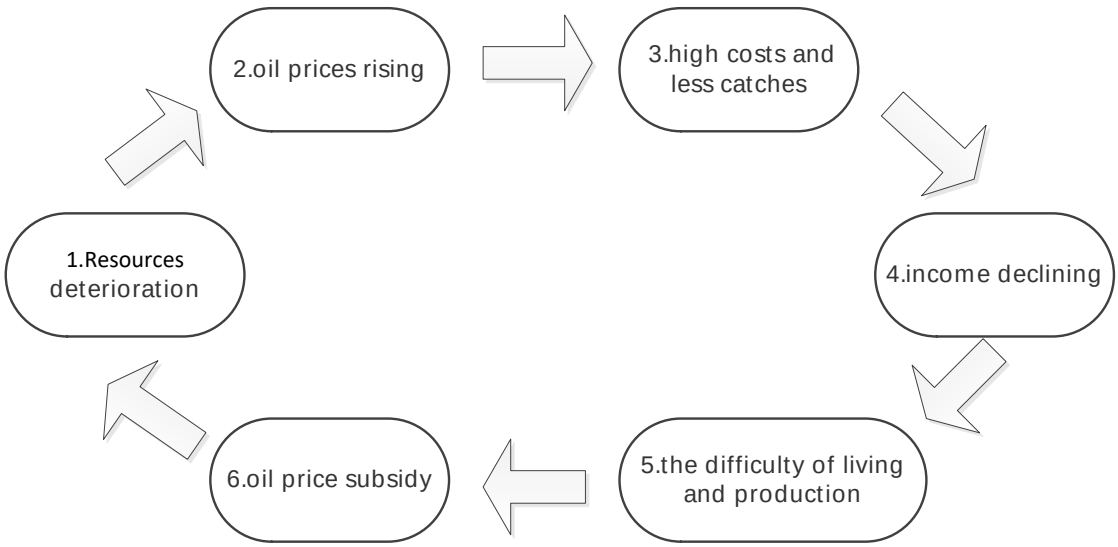

Figure 7. The vicious cycle leading by the fisheries policies.

3.4 Management Recommendations

At present, marine fisheries management in the Jimo area mainly consists of a fishing permit system, with a mid-summer fishing moratorium and a variety of fees for the protection of marine resources. With the goal of restoring the maturity and stability of the Jimo coastal ecosystem, the policy recommendations for achieving sustainable fisheries include:

1) Expanding the fishing permit system, implementing a ‘double control’ system for fishing vessels (regulating both the number of fishing vessels and their engine power), reducing fisheries fuel subsidies, and increasing subsidies for individuals who leave fishing to work in other industries, all of which can reduce the fishing intensity.
2) Expanding the mid-summer moratorium and reducing illegal fishing during the moratorium period by enforcing cooperation with the fishing quota system to avoid excessive competition immediately after the moratorium period, while increasing the effectiveness of monitoring and enforcement.
3) Cracking down on the exploitation of the abundant marine resources that can be found in the numerous gulfs along the 180 km Jimo coastline by fisherman looking to supplement their income during the moratorium.
4) Developing an offshore aquaculture industry to increase the supply of seafood and reduce fishing pressure on coastal resources.
5) Management agencies should strengthen fisheries enforcement and reduce cross-regional illegal fishing.
6) Increasing the protection and restoration of coastal fishery resources; this would ensure that the fishermen feel that they are getting value for the marine resources protection fee.

CONCLUSIONS

Marine fisheries management in the Jimo District has established entry thresholds for fishing vessels, fishing gear, and fishermen. A fishery user right management system based on fishing licenses is established as part of a fishery production input control. The license has restrictions in terms of fishing areas, fishing gear, fishing species, and time limits. Currently, the management of the Jimo District has not implemented the fishery resources, fishery resource assessment, and the fishing quota systems. Fisheries management on output control has not yet been carried out. In 2017, the Ministry of Agriculture of the People's Republic of China selected Shandong province and Zhejiang province as pilots for the implementation of quota fishing. The quota fishing system will be gradually implemented in the future.

The majority of the fishermen in Jimo are local people, who have been engaged in fishery production for generations, inheriting fishery production skills from their ancestors. The fisheries and fishing villages improve the livelihoods of locals while reinforcing their cultural heritage. Qingdao also has a regional development plan for the protection of traditional fishing villages. For example, the Fengjiahe village in the Jimo District is planned to be a fishing village. Therefore there is no requirement for this fishing village to reduce the number of fishing ships and fishermen. However, most of the fishermen's offsprings lack the necessary skills and motivation to engage in fishing. Fishery production and fishing village culture are facing sustainability problems as well.

In order to restore coastal fishery resources, the authorities have introduced policies to reduce the number of vessels with small horsepower. Better horsepower and improved hull material will lead to bigger and more powerful ships, thereby reducing the number fleets and encouraging offshore fishing. However, these powerful ships have also created new demand for offshore fishing technology, production safety, and cooperation among fishermen. Fisheries authorities require technical support to train the fishermen. But in order to better adapt to the rise in offshore fishing, the authorities have encouraged and supported the formation and development of various types of fishery cooperation organizations. With the continuous changes of fishery production, the marine fishery management in Jimo District will face more new challenges.

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Managed Access: A Rights-Based Approach to Managing Small Scale Fisheries in Belize

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Abstract
Belize's commercial and subsistence fisheries are important for the livelihoods of approximately 2 800 fishermen, their families and coastal fishing communities. Belize's Fisheries were considered an open access fishery up until 2011. The threat of resource depletion became clear when fishermen's catches gradually declined. July of 2011 marked a turning point in the history of fisheries management in Belize, as the Belize Fisheries Department (BFD) in partnership with Toledo Institute for Development and Environment (TIDE), Wildlife Conservation Society (WCS) and Environmental Defense Fund (EDF) pioneered, at two of its marine reserves, the implementation of a rights-based approach to fisheries management known as Managed Access. The program was designed to empower traditional fishers by ensuring greater participation in the decision-making process which impacts their livelihood, and by improving the benefits to be derived from the fish stocks in terms of increased fish landings, reduction in fishing effort, larger size classes and increased prices and revenues. In addition, in the long term, there will be benefits accrued to the ecosystem, which will contribute to the maintenance of the overall health and sustainability of the Belize Barrier Reef System. Key to the success of this program are several components which include, but are not limited to: improvements in the licensing/registry system and process; a good monitoring and fishery-dependent catch data collection program; a dedicated presence of enforcement personnel and use of new enforcement technologies; and most importantly, the greater active involvement of fishers themselves in the program via fishing area based committees. All of which, coupled with an extensive social marketing campaign and consultation process, has yielded significant success and benefits for the resources as well as the stakeholders. Initially, Managed Access sought to complement Belize's successful marine reserve network with a system of limited access that would allow access to fishing within the general use zone of the marine reserve only to its *bonafide* fishermen. Managed Access eventually metamorphosed, and five years after the implementation at the pilot sites, the positive results and consultation process triggered the expansion of the program beyond just the initial proposal to roll out to the marine reserve network. Thus, in June of 2016, Managed Access was rolled out to the entire territorial waters of Belize and it now secures tenure for fishermen to fish in two of eight designated fishing areas, called TURFs (Territorial User Rights for Fishing), with the additional option of Area 9 that is designated for deep-sea fishing. In the process of the national expansion of Managed Access, The Belize Fisheries Department Managed Access Task Force evolved into the Managed Access Working Group (MAWG), which now incorporates a broader array of stakeholders. The establishment of the MAWG was realized in order to have a better participatory intervention of both stakeholders and technical capacities that would better guide the expansion under an ecosystems based approach.

Keywords: Rights-based management, Belize, Open access, Fisheries Management tool, Managed Access, TURF, small-scale fisheries

1. INTRODUCTION

1.1 Description of the fishery

Belize is located between 15° 52' 9" and 18° 29' 55" N and 87° 28" y 89° 13' 67" W with a territory of 22 965 km^2, including 688.94 km^2 of islands and an Exclusive Economic Zone (EEZ) of 35 000 km^2. Bordering to the north of Belize is Mexico with Guatemala to the west and south and facing the Caribbean Sea to the east (Figure 1). Belize is blessed with the second-longest barrier reef in the world

that is approximately 269 km long, with a shallow lagoon between the coast and the barrier reef, which includes three offshore atolls with shallow inner lagoons. Inside the reef, the water is rarely deeper than a few metres, but beyond the offshore areas drop off, it plummets to between 1 000 to 4 000 feet depth. The combination of warm, shallow bays and lagoons, mangrove cayes, barrier reef and abyssal depths form ideal habitats for numerous species of marine life, including the spiny lobster, queen conch and several species of finfish making it one of the more productive fisheries in the region.

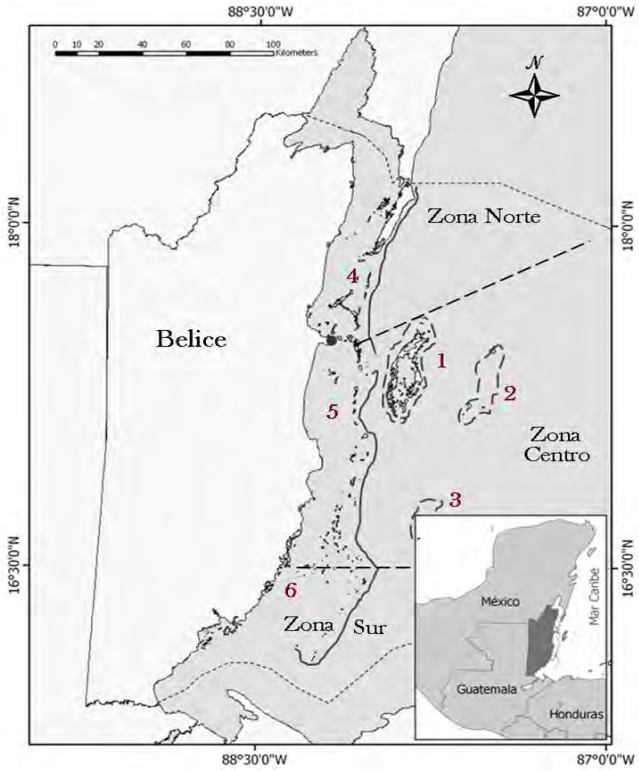

Figure 1. Country of Belize and Management Zones. Bordered by Mexico, Guatemala and the Caribbean Sea.
Source: Adriel Enrique Castañeda 2009. Analysis Bioeconomico de la pesquería de Langosta, Panulirus argus, de Belice. Thesis de Maestría, El Colegio de La Frontera Sur.

The Belize Barrier Reef System is divided into three distinct reef zones: a) North Zone, with approximately 46 km of shallow reefs from “Rocky Point” to “Gallows Point” with very developed reef systems that are almost continuous and with canals at certain points; b) Central Zone, with almost 91 km of shallow reefs from “ Gallows Point” to “Gladden Spit” with the more developed and continuous reefs; c) Southern Zone, with 10km of shallow reefs from “Gladden Spit” to “Sapodilla Cayes” described by less continuous and developed reefs (Burke, 1982; Mcfield, 2001). Therefore, for management purposes, the coast of Belize is divided into three provinces (north, central and south) and these are subdivided into six fishing areas each with a mosaic of benthic habitats (see Figure 1).

The commercial fishing industry of Belize is characterized as a small-scale artisanal fishery that focuses mainly on lobster (*Panulirus argus*), conch (*Strombus gigas*), and various species of finfish and other emerging fisheries such as sea cucumber, stone crab and sharks. The fishing fleet is composed of vessels of two types: wooden sailing sloops and skiffs. The sailing sloops, mainly with an auxiliary outboard engine of 40 horsepower (hp), have a capacity of approximately eight canoes and ten divers and are equipped with an icebox to preserve catch. Their duration at sea varies between six to ten days depending on the amount of ice carried, the catch, weather conditions and food supply among others. On the other hand, the skiffs, which are 23-25 feet in length and have crews of one to four fishers, are made of fiberglass and use engines ranging from 15 to 115 hp. Their fishing trips mostly

have a duration of one day but might last up to five days for fishers with fishing camps. Fishing for lobster and conch is done with free diving to depths between six to 20 meters. Commercial fishing with the use of SCUBA is prohibited by law.

The Belize Fisheries Department has kept a registry since 1997 of the number of fishermen that engage in commercial fishing. Records indicate a steady rise in number from 1 359 fishers in 1997 to its peak of 2 829 fishers in 2015 (Figure 2). This rapid increase in the numbers of fishers was due to the open-access nature of the fishery, which had limited criteria for obtaining a license and engaging in fishing. However, the numbers of registered fishers have started to decline since the implementation of Managed Access in 2016 at the National level, which instituted measures to ensure that only *bonafide* fishers can obtain a license.

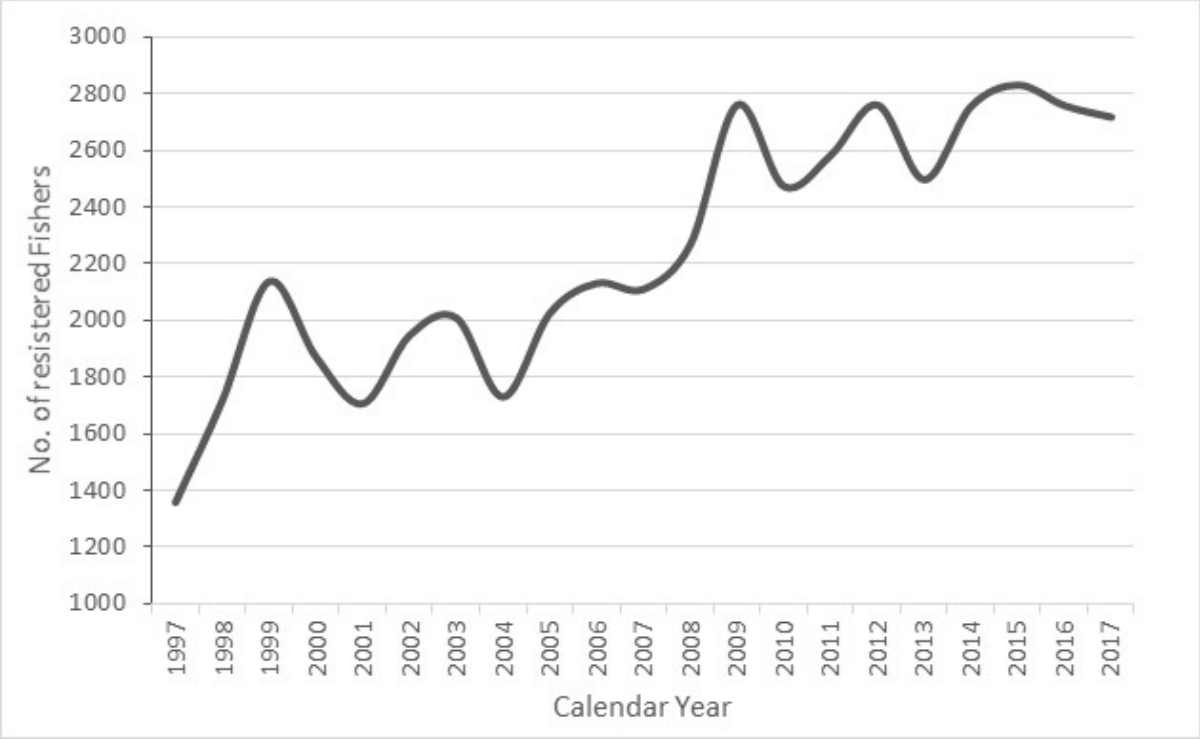

Figure 2. Number of registered fishers in Belize from 1997 to 2017.
Source: Belize Fisheries Department.

Open-access nature of the fishery has led to uncontrolled increase

The Managed Access Program, although expanded nationally in 2016, was initially piloted in July 2011 at Glover's Reef Marine Reserve (GRMR) on Glover's Reef Atoll and Port Honduras Marine Reserve (PHMR) in the southern seas off Punta Gorda Town. These two pilot sites that were identified in 2011 met the following criteria: 1) Site-specific management was in place. 2) Legislative framework existed to allow for a more restrictive form of management. 3) Fishery Dependent and Independent data existed.

1.2 Economic contribution and social implications of fishing activity

"Fisheries, including aquaculture, provide a vital source of food, employment, recreation, trade and economic well-being for people throughout the world, both for present and future generations and should, therefore, be conducted in a responsible manner" (FAO, 1995). Small-scale fisheries contribute significantly to the nutrition, food security, sustainable livelihoods and poverty alleviation of many countries, especially developing ones yet remain poorly understood and valued (FAO, 2004). Oceans and seas cover about three-quarters of our earth's surface and are hence of vital economic,

ecological, political and social importance, providing a myriad of services to mankind. For instance, they provide essential and biodiverse habitat, are a valuable source of protein, minerals and fossil fuels among many others. Fisheries resources were thought to be limitless based on the vastness of the oceans, but this is no longer a common thought; fisheries have declined, and many have been described as being in a state of crisis (Pauly and Zeller, 2003; Pauly, 2009; Defeo and Castilla, 2005; Defeo, 2015; Clark, 2006). Unlike other renewable resources, fisheries resources present unique challenges (Berkes, 2003; García and Charles, 2007; 2008) that have kept many scientists working full time trying to resolve the issues of overfishing. Despite Garret Hardin (1968) describing the underlining culprit, open-access fisheries management still poses many challenges to modern science because traditional management does not address the underlying causes of overfishing – the lack of clearly defined access rights. Traditional command and control approaches to fisheries management have largely failed because they do not provide the incentives for a long term harvesting regime, but rather instill a race to fish leading to the collapse of many fisheries. Moreover, many countries have a *de facto* open-access system provided for by the constitution or by cultural tradition. Hence, fisheries management in developing countries poses an even greater challenge because of the social, environmental, economic, and political challenges (Ostrom, 2009) that these countries face, confounded even more so by the inherent complexities of the resources themselves (Dudley, 2003).

Recent advances in fisheries management have identified that the use of rights-based fisheries could greatly improve management (Enriquez and Camargo, 2000) and ensure the social, economic and environmental outputs sought. In Belize, fisheries used to operate under an open-access regime in which the Government acted as the trustee for the public by managing fisheries in the interest of protecting the rights of future generations. The Government of Belize – The Belize Fisheries Department, and a coalition of NGOs and fisher organizations are now innovating methods of rights-based management appropriately designed and scaled for the unique needs of small-scale fisheries in the developing world. Fisheries are, in many cases, the sole source of income for families and a critical component of community and national economies. Belize's commercial fisheries contribute to approximately 3.5 percent of the gross domestic product (GDP) and, with 15 000 Belizeans directly dependent on the fishing industry as a means of making a living, the need for a shift in the management regime became imminent. Belize's National Fishery faced the threat of resource depletion as indicated by an increase in the number of fishers and a decline in their catches especially for the most lucrative species –Spiny Lobster (*Panulirus argus)* and Queen Conch (*Strombus gigas*). Hence, fisheries resources in Belize became increasingly faced with the predicament of too many people chasing too few fish.

This decline occurred despite Belize's extensive marine protection efforts – MPAs, spawning protections, destructive gear bans. This is because traditional control methods are not sufficient as long as there is a lack of clearly defined access rights, and no controls on landings (Costello, 2008). Thus, Managed Access, as an innovative initiative, seeks to revolutionize fisheries management in Belize by implementing a system of TURFs, combined with rigorous data collection and enforcement, the enhancement of the current licensing system, the empowerment of fishers so that they contribute to management decisions in their fishing areas and the establishment of an apprenticeship program for new entrants to the fishery. This, along with the new markets incentives, value-added and traceability systems, seeks to promote sustainable fishing and thus ensure that the resource thrives and that the livelihoods of fishermen are secured.

Before Managed Access, fisheries and fishermen faced the perpetual pressure of increasing numbers of fishermen in a mature fishery. The challenge was that, under the current management framework, any Belizean over 18 years old is qualified to obtain a commercial fishing license upon making payment of a prescribed fee, which is very minimal. The requirements for obtaining a license were also minimal and thus easily met. This allowed for a drastic increase in the number of fishers, for example, from

2004 to 2008 the number of licensed fishermen increased from 1 731 to 2 267, representing a cumulative increase of 30 percent. The number of fishing vessels also increased from 621 to 643 during the same period showing an overall increase of over 8 percent. Despite the increase in fishing effort, however, catches increased by only 2.42 percent when compared to 2007. Lobster landings declined by 24 percent from 277 tons in 1999 to 211 tons in 2009. Another issue faced at the time was that fishers and stakeholders complained about illegal fishing and uncontrolled harvest by "nontraditional fishers" and trans-boundary fishers.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

In order to address the issues caused by the then open-access nature of the fishery, the Managed Access process began in early 2008 with a scoping exercise. This was followed by the development of a framework and design for the pilot sites, which was introduced on 1 July 2011. The national expansion of Manage Access took effect on 13 June 2016. In this paper, we attempt to show the process followed by the Belize Fisheries Department, partner NGOs and fishermen organizations that led to the adoption of the national rights-based fishery management program, which is also a form of catch shares. This case study will allow participants to understand the process for developing a strong stewardship program that improves partnership amongst managers and stakeholders and promotes the fair, transparent and equitable distribution of fisheries resources backed up by a robust science program.

An intensive consultation and education and outreach process was carried out by a Managed Access technical team for a year before implementation at the pilot sites, but this was limited to the stakeholder communities of the two marine reserves where implementation would occur. In the following three years, in preparation for the national expansion of the program, the same technical team embarked on an extensive consultation process with key stakeholders of the fishing industry to guide the development of the design framework for the national roll-out of Managed Access in Belize involving all licensed fishers. The work was done through a series of workshops, surveys, technical consultations, focus group sessions, community-wide meetings, one-on-one sessions, forums and participation in education & outreach activities in these communities. The consultations, surveys, and meetings were deployed in order to ensure that the policies developed and promulgated by the Department had the support of fishers and would be successfully implemented. These sessions had direct input from fishers on the key components of Managed Access including: eligibility for Managed Access license; area allocation; catch data collection and submission; compliance with Managed Access conditions; and the Managed Access Committees. More than 2 000 fishers were contacted, and all 15 major fishing communities were reached, plus outlying areas with smaller numbers of fishers. The Managed Access technical team employed highly participatory techniques, which ensured that fishers were able to provide their input to the process adequately. In addition to sessions with the general population of fishers, the technical team held a series of meetings with fishermen organizations such as the fishermen cooperatives, the fishermen associations and umbrella organizations such as the Belize Federation of Fishers, and the Belize Fishermen Cooperative Association. The technical team also received input from key staff members from the Belize Fisheries Department, the marine reserve staff, and co-management organizations of marine protected areas. Fishers across Belize were familiar with Managed Access and expressed a general consensus that Managed Access would be beneficial to them as users of the marine resources. The feedback and consensus from the consultation process is reflected in the recommendations for the policies, design, and roll-out of Managed Access. This consultation process that was carried out was perhaps one of the most extensive to ever engage Belize's fisher community.

As a result of the consultation and extensive social marketing campaign, stakeholder buy-in increased significantly leading to the national expansion of the program, to the point where all fishermen

organizations expressed their formal support for the program via endorsement letters to the fisheries authorities. The positive results seen in the different components of the program also garnered the support of the fishing communities.

In order to ensure the better tracking of licenses issued and that the process was legitimate, the licensing database system was upgraded and has been continuously worked on and improved since 2011. The licensing hardware and software infrastructure were updated to a system that can store information from all fishers, including coding according to the area of fishing and the incorporation of the legal history of each fisher as well as information of all fishing vessels. Said registry has been fundamental in the implementation of Managed Access as it has allowed Fisheries Authorities to have a better understanding of the users of the resource, to keep a record of them and subsequently to provide structure in the allocation of licenses. The licensing system also provides for new protocols for the issuance of licenses that involves more checks and balances and the reconciliation of data that is input by specific users. The fisherfolk and vessel licenses began to be printed on PVC cards instead of only being laminated, which ensured the integrity of the licenses. During the first four years of implementation, fishers at the pilot sites were asked to fill out a socio-economic survey when they renewed their license at the end of each calendar year. The data obtained from these surveys over those years helped to provide the Department with a clear understanding of the fishers' perspective of the program. One of the results indicated by said surveys and also by enforcement records was the decrease of illegal fishing at the pilot sites by foreigners from neighboring countries. There was considerable flexibility in the issuance of licenses for GRMR and PHMR in 2011 and 2012, as fishers transitioned to the Managed Access system, with over 250 fishermen having access to each of these fishing areas. Now in 2016, five years after implementation at these pilot sites, the requirements and criteria have resulted in approximately 140 fisherfolk licenses issued for Glover's Reef Marine Reserve and 130 fisherfolk licenses issued for Port Honduras Marine Reserve. This has ensured that the persons that obtain access to these areas are *bonafide* users of the area.

The data collection component began on 15 June 2011 in order for it to coincide with the opening of the lobster season of that year. Fishermen were expected to provide reports of their catch as part of the criteria for renewal of their licenses. During the first years, there was a lot of leniency with said catch data requirements. Presently, under national roll-out, there is a 100 percent catch data submission by fishermen from the pilot sites and the Department is in the process of distributing catch logbooks and carrying out training sessions with fishermen from the other fishing areas for them to also be able to begin submitting their catch data. Over time, the catch data showed that fishermen reported higher catches and their willingness to submit said data to help inform management decisions also increased.

The formation of area-based committees, called Managed Access Committees, was integral to the licensing process. Applications for Managed Access licenses were submitted to the Committees that were responsible for vetting them– the first time fishers were involved in decisions on who could fish by making recommendations to the Belize Fisheries Department. The Committees were and continue to be key in ensuring transparency in the licensing process. The Managed Access Committees are composed primarily of elected affiliates (part of a fishermen organization) and independent fishermen from each stakeholder community. The elected members are tasked with making management recommendations for their respective area(s), vetting applications, representing fishermen from their community that are users of said area(s) and providing feedback to their fellow fishermen in their communities. These Committees also include co-management partners of the marine protected areas and representative(s) from the Belize Fisheries Department. Each committee is guided by a specific terms of reference.

Infractions and violations declined significantly at the pilot sites since the implementation of Managed Access, whilst the intensive education and outreach efforts and increased stewardship encouraged an increase in compliance. The "race to fish" during the opening of the conch and lobster season was considerably less at these sites. Traditional fishers were content to see that "opportunistic" fishers were not present in their fishing areas, and they did not have to compete for fishing grounds and product. Generally, fishers were satisfied with the implementation of the Managed Access program. Fishers also began to cooperate more by reporting infractions via telephone calls to the fisheries authorities. Improvements in the use of enforcement technologies, such as the piloting of unmanned aerial vehicles (drones) and the future piloting of vessel monitoring systems (VMS) as a mechanism for surveillance and reporting, has yielded and is expected to further yield positive enforcement results. It is highly important to note that the road to national expansion was and continues to be a learning and adaptive process.

2.2 Rights-based approach: allocation and characteristics

Managed Access deploys a set of policy interventions that are related and mutually dependent. As an integrated program, these elements will improve fisheries management, empower fishers, and employ the use of scientific and economic tools to ensure benefits accrue to livelihoods, social conditions, and biodiversity. To achieve these objectives, the National Expansion of Managed Access has a framework based on:

2.2.1 Zoning of TURFs and Boundaries

Managed Access establishes nine fishery management areas allocated to fishers through a process managed by the fishers themselves. Eight areas are the nearer-shore region and atolls, where the vast majority of fishing occurs. A ninth deeper-water area is also delineated for expansion and diversification into deeper slope fisheries that will add production and revenues for the industry, and alleviate pressure on the lobster and conch fisheries. The Minister and Fisheries Administrator are authorized to declare these areas in that they enable the stewardship of resources for the benefits of the Belizean people. The Fisheries Act, Chapter 210 of the Laws of Belize under section 13 (1) C. authorizes the Minister responsible for Fisheries to enact regulations "for prohibiting the taking of fish at such times and within such areas as may be defined in the regulations." During the community consultations, the zoning was not a major area of contention largely because it requires minimum change for how fishers currently operate – it was developed based on their historic fishing patterns. According to research conducted in the development of Managed Access, a vast majority of fishers do not use more than two of the demarcated areas. The goal is not to exclude nor displace fishers from fishing in their current areas, but rather to stop the unsustainable growth in the number of fishers; and empower existing users to steward the resource, and make sure they are rewarded for their stewardship with better catches.

2.2.2 Characteristics of the Managed Access License

Fishers select their two main fishing areas during the annual licensing process in December and January. The fisherfolk license issued to fishers thus indicates the areas selected by the fishers. It is the mechanism through which both rights and responsibilities are established. Fishers are empowered by having Managed Access privileges to fish in the TURFs, and in turn, have a responsibility to steward the areas. Licenses are established through a rigorous process that verifies the legitimacy of the residency of the applicant. Licensed fishers are also subject to background checks by officials of the Fisheries Department. In doing so, it greatly reduces the illegal expropriation of Belizean natural resources to neighboring countries and illegal trans-boundary use of Belize's waters. Teams of Fisheries Department staff are available for every licensing period to assist fishers in filling out renewal application forms. The Fisheries Administrator has the ultimate authority to determine allocations of licenses, including considering any appeals from fishers on whether they meet the criteria. A provisional license is issued for fishers under appeal. Fishers who hold licenses are assured renewal unless they have committed infractions or are non-compliant with regulatory conditions of license.

The Managed Access Committees for each TURF collaborate with the Fisheries Department on the renewal process.

2.2.3 Transferability of Licenses and New Entrants

Licenses are transferable to a next of kin or other recipient indicated by the fisher on the license application but must be taken to the Managed Access Committee of that respective TURF, which taking into account science-based assessments of the resource, and social considerations will pass on a final recommendation to the Fisheries Department. The Fisheries Department retains the final authority to approve transfers of licenses and new entrants. One of the components which will be phased in soon is that new entrants will be required to go through a fishers apprenticeship program in which new fishers are mentored by certified, experienced fishers and pass through a government-led fishing education program. This program will be established by and governed by the Belize Fisheries Department in collaboration with the Managed Access Committees, fisher associations, and other civil society organizations.

2.3.4 Data Collection

The Fisheries Department and its partners already conduct an extensive data collection process to assess the status of the fisheries. The Managed Access program adds to that with a system of logbooks in which fishers are required to record their catch per-trip. The value of this data is incredible. For fishers, it provides the information they can use to manage their fishing business. For managers, it is a key source of data to assess whether or not the fisheries are responding to the management measures. Most fishers do not have objections to submitting data but have expressed the continuous need for feedback regarding the results of the data that is analyzed. Based on this, the Department and Managed Access Working Group partner organizations conduct annual forums where these results are presented to the stakeholders of the different fishing areas. Currently, there are efforts by the MAWG partner organizations and the Fisheries Department to make the collection of data more efficient by using electronic systems that will also provide the basis for the implementation of traceability systems.

2.3.5 Governance and Monitoring

Managed Access uses two powerful elements for monitoring and enforcement – incentives for compliance and robust, modernized enforcement. Managed Access seeks to obtain voluntary compliance via stewardship and community participation in the management of the resources. As seen at the pilot sites, the number of infractions declines significantly once there is an allocation to fish in a specific area(s). Fishers become active participants in the protection of their resource. Simultaneously, there needs to be a strong and effective enforcement presence at sea to prevent, deter and reduce illegal fishing. Under Managed Access, fishers and managers work together to integrate a robust monitoring and enforcement regime established as part of its National Enforcement Strategy that includes:

a) A thorough training and capacity building program for rangers and other staff present on the water.
b) The color coding of fishing vessels. Certain parts of the vessels are being distinctly colored per fishing area so it is easy to identify whether the vessel is authorized to fish in the area.
c) The three-strike rule pioneered in the pilot sites has been continued with national roll-out. The three-strike rule provides provisions for the suspension or removal of license for repeated infractions, depending on the severity of the infractions.
d) A “crime stoppers” system is also applied to fisheries so that fishers may anonymously report violations to authorities. Fishers have demonstrated an eagerness to participate in enforcement, but they want the security that they will not be identified.
e) SMART patrol information, utilizing electronic tablets, is currently being used to better plan and coordinate patrols. Infractions are immediately uploaded to the licensing system to allow managers to have more readily accessible information regarding offenders.

f) Unmanned aerial vehicles (UAVs) have been piloted and strategically deployed in certain areas to assist with the surveillance at sea. This has yet to be used in other areas outside GRMR but is recommended as a valuable tool for efficient monitoring and enforcement.
g) Co-managers and marine reserve staff based at the ranger stations in the various marine reserves play a crucial role in monitoring the entire fishing areas.

2.3.6 Managed Access Committees

Managed Access Committees are a crucial part of enacting effective management of fisheries in a way that empowers fishers. The committees are primarily made up of representatives of fishing communities, selected by fishers; as well as from Fisheries Department officials and co-managers. The purpose of the committees is to empower fishers and to establish a platform through which fishers and managers can constructively collaborate. During the consultation process, fishers were very supportive of the establishment of the committees. There is one Managed Access committee per area, with the exception of Area 4 & Area 5 that merged together because the users are the same. Thus, there is a total of 7 Committees. The Managed Access Committee representatives serve for a two-year term and are eligible for reelection if that is the will of his/her fishing community. An alternate representative is also elected along with the main representative in order to ensure that there is always community representation at committee meetings in the event where the designated representative is unable to attend. These Committees meet on a quarterly basis, or as frequently as necessary. Managed Access fishers from the community have the right to remove and replace representatives that are not fulfilling their role, particularly in keeping open and timely communications with the fishers they represent and similarly ensuring that fishers are kept fully informed of the activities and functions of the Managed Access Committees.

2.3.7 Strengthening of Cooperatives and the Industry to Access Premium, Higher-Revenue Market Opportunities

The national roll-out of Managed Access creates new economic opportunities for fishers. The most direct and obvious value is that over time, the biomass of fish will grow and fishers will have more product to sell. However, even more value can be derived from linking Belize's sustainable fisheries to premium markets. This includes access to higher-value retailers in global markets, developing a domestic demand for sustainable products for tourists, specialized processed products, and preferential labelling. Therefore, in parallel with the national roll-out, the MAWG is implementing a market and finance strategy. The MAWG and other partners have conducted several studies to analyze this market opportunity. These include an analysis of local and global demand for Belizean seafood and a value-chain analysis for lobster and conch. As a result of these studies, several conclusions can be reached:

1. The transformation to sustainable fisheries can double the value of Belize's fisheries industry through a range of market diversification opportunities and more productions.
2. Market reforms and supply chain reconfigurations can be leveraged to strengthen Belize's system of cooperatives, including ending the cycle of debt.
3. Expanding and diversifying Belize's fisheries to include deep-water stocks that will generate more revenue for the industry, as well as alleviate the pressure on traditionally targeted stocks in shallower waters.

2.3.8 Adaptive Management Framework

Since mid-2013, the Belize Fisheries Department convened a team of fisheries scientists to develop a science-based process for analyzing the status of fisheries and determining a total allowable catch (TAC). The Department is developing an adaptive management framework (AMF) that builds on existing data collection and analysis conducted by the Department. As a first step, the AMF is being used to develop a national assessment and fisheries management plan for lobster and conch. Over time, the AMF will be applied to each TURF to ensure that each Managed Access area is fished within

sustainable limits. Belize is already collecting significant and valuable data to populate the adaptive management framework, and this data can be used to inform and compare indicators within this framework in lieu of conventional stock assessments and still result in valid science-based management decisions. The AMF empowers Belize's fishery managers to make fishery management decisions based on science, even when data and capacity are limited.

2.3.9 Education & Outreach

All of the above-discussed components have been socialized to stakeholders. Most of the concepts resulted from recommendations made by fishers during the consultation process and all were adapted to meet the needs of Belize: of fishers, the resource and management authorities. On the road to national expansion, additional staff was hired to develop a social marketing and branding campaign to garner the support of the fishing communities. Numerous education and outreach efforts carried out by the Managed Access technical team, along with these campaigns, yielded positive results and allowed for a smooth transition from an open access system to a Managed Access system. There were many lessons learnt along the way, but perhaps the most important was that the management approach being adopted has to be flexible and adapted to the needs of the country, its fishery and its people.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

The primary successes of the Managed Access program include:

- A reduction in fishing effort;
- Increased food security and territorial integrity;
- Use of a special licensing system that is managed by the stakeholders via the Managed Access Committees with oversight from the Fisheries Department;
- Sustained and increased catches of lobster, conch and finfish and an increased CPUE recorded for lobster and conch (although it is recognized that other factors could also have contributed to these increases);
- Improved data collection with good estimates of total catch available for the pilot sites; this has enabled analyses to be initiated to determine the sustainable level of catches for lobster and conch and post-national expansion will enable the same to be done for all other fishing areas nationwide;
- A decline in the number of infractions due to improved surveillance and enforcement efforts and increase compliance as well as a growing sense of stewardship by fishers; and
- Overall strong support for the program by fishers.

3.2 Economic viability of the fishery

This rights-based program has involved most of the elements necessary to foster sustainable fisheries, such as managing access, managing fishing effort, involving stakeholders in management, developing a culture of compliance, improving data collection and having effective monitoring and enforcement all of which strongly align with the small scale fisheries guidelines (FAO, 2015) and the Code of Conduct for responsible Fishing (FAO, 1995). There is currently a lot of ongoing work within the program and a lot more work to be done. One of the elements that is still in its developmental phases is the economic aspect, for example, market-based incentives are in the process of being developed to ensure better prices for the sustainable-fished products, thus providing direct and tangible benefits to the fishers. The Managed Access program is not intended to be a panacea for all fisheries problems, but we strongly believe that this management approach, which has been rolled out nationally in Belize, is an excellent example of the potential for developing a sustainable small-scale fisheries management model for the region.

3.3 Social Equality

Trends in social organization, social behaviour and gender roles significantly influence fishery and other activities in small-scale fishing communities. In Belize, fishing has traditionally been and remains a male-dominated and family-oriented activity where the older males are the boat owners, and crew members and the male children are expected to follow in their elders' footsteps once they become 18, which is one of the requirements for obtaining a fishing license. Women in these communities play no active role in the actual fishing activities; their primary role is managing all aspects of the household. This could be due to several factors such as the high degree of fisher mobility and short closed seasons that shorten the time the males spend at home; to even cultural factors where males are considered the breadwinners and females as housewives. This mainly occurs where fishing is the main source of livelihoods, and only a few alternative livelihoods options exist within the community. As such, this scenario is less evident in areas where alternative livelihood options are readily available allowing women to play a more prominent role in the community and income generation - this is normally observed in communities where tourism occurs. Furthermore, fishing is mostly artisanal, and the living conditions may become too adverse and inappropriate for females- living conditions on board the sailing boats, for example, are rustic (no bathrooms, extended hours of fishing at sea (average of 8 days), limited freshwater, etc.). Nonetheless, there are approximately 30 fisherwomen mostly in the southern part of Belize who engage in fishing for lobster, conch and finfish on a daily basis using skiffs. Administratively, both males and females have the same right to become fishers or participate in the process. Managed Access has supported the inclusion of women in the area based Managed Access Committees and in all other aspects of the program. In fact, both fisherwomen and fishers' wives were actively involved in the consultation process. Managed Access will seek to further empower women's groups and youth groups currently in existence within each fishing community as a basis for further expansion and development. As the main household managers, it is likely that future projects and grants will be more successful with the enhanced participation of women and youth in their implementation. As such, it is recognized that there are clear and diverse social-role expectations for women, men, children, adults and elderly along gender, age and class lines.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

Some of the challenges faced in the implementation process include:

- Illegal fishing by fishers from neighboring countries pose significant challenges to the sustainability of the fishery resources;
- Insufficient budgetary support does not allow for effective law enforcement;
- Initial resistance from fishermen for implementation of Managed Access;
- Skepticism from Fisher Organizations (Cooperatives & Associations);
- Availability to meet and influence key decision makers;
- Initial minimal participation of fishers;
- Initial lack of organization and limited capacity of fishing communities;
- Limited human and financial resources;
- Limited legal framework for national expansion; and
- Institutionalization of the management tool.

4.2 Improving fishery sustainability in the future

The future sustainable use of fishery resources in Belize will highly depend on continued and greater political commitment from decision-makers and increased funding for data collection, as well as research and law enforcement activities from both government and external sources.

The lack of effective fisheries law enforcement may discourage good fishers from continuing to respect fisheries regulations when they witness illegal fishing activities in "their" fishing areas, and law enforcement is minimal.

In addition, increased institutional support to maintain fishers' participation and ownership of the management tool is extremely important. Fishers need to be fully convinced that "their fishing areas" are secure and that those management decisions for these areas are based on sound science and not just hypothetical scenarios. For example, field research is badly needed to gather sufficient fish biomass data to support the establishment of appropriate fishing effort in each fishing area. In the absence of such information, management may not be necessarily justified in blocking additional fishing effort in a particular fishing area.

Fishers' participation in the fisheries management decision-making process needs to be further strengthened so that the Manage Access community committees truly represent the interests and wishes of fishers.

4.3 Lessons learned

Involvement of fishers in decision making is key for the implementation of TURFS. The presence of a competent monitoring and control authority is essential for the success of rights-based systems, as it ensures that fishers know that their rights are being respected and that illegal fishing is not occurring. The implementation of closed areas for fishing does not necessarily affect fishing activities negatively, provided the decision on where to put the limits is discussed and agreed upon with all stakeholders.

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China’s maritime fisheries management since the implementation of the Fisheries Act in 1986

Yang Han

Please refer to the case study presentation available at:
http://www.fao.org/3/CA2436EN/ca2436en.pdf

Volume 4

History and experiences with limited access fisheries: output control (TAC, IQ, CDQ, Catch Shares, QMS)

Abstract

The Global Conference on Tenure and User Rights in Fisheries 2018 took place in Yeosu, the Republic of Korea, 10-14 September 2018. Case studies were presented on a number of topics relating to tenure and user rights in global fisheries and their relation to the SDGs. Through the exploration of case studies in eight concurrent thematic sessions, the best practices, shortcomings, and challenges associated with rights-based approaches were discussed. The conference was a platform for the exchange of ideas about how to support the implementation of sustainable governance solutions to rights-based fisheries management.

This document presents case studies from Session 4 of the UserRights 2018 conference, "History and experiences with limited access fisheries: output control (TAC, IQ, CDQ, Catch Shares, QMS)." All case studies are published as submitted, with minor changes for spelling and grammar. The case studies span across various geographical and socio-economic contexts. These include:

- the effects of the IQ regime on the pelagic fishing industry of Chile;
- the institutional management arrangements for the Paiche resource in Peru;
- the fishing quotas for small-scale fishers in Chile;
- the quotas allocation by vessel (IVQ) management of the Peruvian amchoveat fishery;
- the TAC based fishery management in Korea;
- the TAC system for the gazami crab fishery in China;
- the evolution of the rights-based system to fisheries in Sweden;
- the regulations in the U.S West Coast Pacific Groundfish Fishery; and
- the management of the small pelagic fishery in Angola.

Contents

Effects of the individual quota regime (IQ) on the pelagic fishing industry of jack mackerel (*Trachurus murphyi*) from the south central zone of Chile.

Rodrigo Zamora Gomez
SONAPESCA

Abstract
During the 1990s, when fishery resources were scarce, vessels competed for fishery resources in a so-called “Olympic race”. This way of fishing resulted in many inefficiencies and poor economic performance, which in turn generated continued pressures to increase fishing quotas, thus contributing to the overexploitation of fishery resources, including jack mackerel (*Trachurus murphyi*). The fishery in central-southern Chile was characterized by an over-investment in fishing fleets, low incentives to develop a complementary industry—mainly due to the uncertainty regarding access and availability of the resource—and a markedly seasonal and concentrated fishing activity at the beginning of the season, which erupted in a climate of job instability. The start of 2001 saw a very important regulatory change with the emergence of the individual quota (IQ). The main advantages of the IQ included giving rationality to the industry, allowing planning of fishing activity, encouraging the growth of the industry, improving economic efficiency, and reducing the levels of uncertainty. This regime strengthened fishing rights and gave greater stability to the industrial fishing sector. This case study seeks to show the benefits of an IQ system and its contribution to the system of industrial fishing. The IQ system has served as a guideline for the establishment of the artisanal regime of extraction (régimen artesanal de extracción, RAE); this variant of the IQ system has largely improved the quality of small-scale fishing rights.

Keywords: Chile, Chilean jack mackerel, IQs

1. INTRODUCTION

1.1 Description of the fishery

Jack mackerel is the main fishing resource of the industrial fishery between the lll and X regions. It constitutes one of the main fishery products of the country, and in the volume of capture represents one of the most important fisheries in the world. The fishery for jack mackerel in central-southern Chile began commercially at the beginning of the 1980s and rapidly became the main fishery in the country, with an exponential increase in catches due to increased fishing effort and the greater availability of the resource in this area.

In addition, between 1978 and 1991, an international fleet comprised of trawlers factory vessels of the former Soviet Union, Poland and Cuba among others, operated on the high seas adjacent to the coasts of Chile, with catches averaging at 800 000 tonnes per year. National landings in the central-southern area reached a maximum volume of 4.5 million tonnes in 1995. These landings subsequently began to decline due to the application of measures by the fisheries management authority and the overfishing condition of the resource. The Chilean authority managed to stabilize landings between 2001 and 2007 thanks to the implementation of quotas that allow approximately 1.5 million tonnes to be captured each year.

Chilean fisheries are divided between "traditional" and "industrial" fisheries. The difference between these fisheries depends on the size of the boat and its loading capacity. They are also subject to different administrative requirements. The industrial boat has a length greater than or equal to 18

meters (m) in length and at least 80 m^3 capacity. In addition, industrial fishing has access from five nautical miles (nm) to international waters even outside the Exclusive Economic Zone (EEZ) of Chile.

The small-scale fleet that operates on the jack mackerel resource is divided into two categories of vessels—those of less than or equal to 15 m in length and those between 15 and 18 m (greater boat), with a capacity of less than 80 m^3. This fleet operates exclusively within the first five nautical miles fishing zone but is allowed to fish outside this area.

1.2 Economic contribution and social implications of the fishing activity

Jack mackerel is a very nutritious fish that contains 19.75 grams of protein, high concentrations of potassium and vitamins D, A, B3 and B12, properties that make it sought-after by the fishmeal industry. Since the beginning of the 1970s, most of the exports have been directed to Nigeria, Sri Lanka, Peru, Cuba and United States of America.

Exporters of jack mackerel products destined for human consumption systematically increased until 2015, reaching a 20 percent increase in 2016, with 24 exporters. As for fishmeal products, there are 28 exporters, the same number observed in 2014.

The export value of jack mackerel destined to human consumption decreased dramatically from USD 185 million in 2009 to USD 85 million in 2016. Canned products experienced the most pronounced decline (from USD 82 million to USD 26 million), while frozen products went down less, from USD 100 million to USD 66 million.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACHES

2.1 Management of the fishery

From 2011 to date, management of the fishery has been made jointly with the SPRFMO. At the beginning (2011-2012), a global catch quota for the South Pacific was established based on history and landing, without allocation by country. From 2013 onwards, quotas were established and divided among each of the participating countries.

The Law N°20.657 modified the General Law of fisheries and aquaculture (LGPA, Ley General de Pesca y Acuicultura) in several ways, the most important improvement is the establishment of quotas. This development assigned a key role to the Technical Scientific Committees for the evaluation of the state of the resources and for the recommendation of a range of biologically acceptable quotas, using the best scientific information available to achieve the Maximum Sustainable Yield (MSY).

This new framework introduced the Individual Transferable Quotas (ITQ) class A for resources that are fully exploited and have global catch quotas. These quotas are fully transferable, separate from the original vessel of the quota, and have a duration of 20 years. Another mechanism exists as well that allows for the incorporation of new actors into the fishing industry, but only when the resource is not overexploited.

2.2 Brief history of former rights-based approaches used in the fishery

The year 2001 saw the beginning of deep reform in Chilean fisheries regulation with the implementation of instruments of assignment of individual quotas, called maximum capture limits (MCL), in the industrial sector. The application of the MCL had similar effects to the individual quota allocation systems: the elimination of the Olympic race; the elimination of the irrational exploitation of fishery resources and the exaggerated overinvestment in fishing effort; a better use of catches; an increase of investments in plant and value addition to exports; and finally, stability and job security. It

is worth mentioning that this adjustment process was carried out without direct incentives from the State.

2.3 Rights-based approach: allocation and characteristics

The new law includes Individual Transferable Quota (ITQ), with a duration of 20 years and the possibility of renewal, provided there are no reasons for revocation such as labour, environmental and fishing issues. Property of the vessel is separated from the fishing right. There are two kinds of ITQ: ITQ class A, which are the perpetrators of the MCLs and are assigned by historic criteria as a percentage of the industrial quota, and ITQ class B, which result from the auction of a maximum of 15 percent of the ITQ. The transfer of ITQ class A is simple and direct since holders can sell all or part of their ITQ without having to sell their vessels, which substantially reduces transaction costs. Any natural or legal person, whether industrial, small-scale or otherwise, can acquire an ITQ or part of it. This new law strengthened the fishing rights and gave greater stability to the industrial fisheries since it went from a 10-year period up to a 20-year period with the possibility of renewal. However, the small-scale sector, which today accounts for more than 50 percent of the landings, still retains much more precarious fishing rights.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

The purpose of the Management Plan is to "retrieve and keep the mackerel fishery biological, economic, social and ecological levels sustainable", which is consistent with the objective of the Ley General de Pesca y Acuicultura (LGPA) in relation to the conservation and sustainable use of fisheries (Art. No. 1B).

According to information published by the Undersecretariat for fisheries and aquaculture in Chile, the jack mackerel fishery has restricted access to new operators, a global quota of capture and individual quotas for vessel owners. The state of this resource was overexploited between 2013 and 2016, but there was a recovery of the biomass in 2017, and the resource can now be classified as fully exploited. Beyond the exclusive economic zone (EEZ), jack mackerel is available to any fishery, since it is widely available in international waters.

From the point of view of conservation of resources, individual transferable quotas are not considered more effective than global catch quota or quotas for individual fishing (MCL). However, they are capable of generating more cost-effective and productive incentives than other options of fisheries regulation, by encouraging efforts of self-regulation and longer-term planning horizons. In addition, they allow increasing levels of maximum sustainable yield and decreasing levels of incidental catches, which helps to distribute mortality by fishing over one period of time. However, their implementation requires a solid legal framework.

3.2 Economic viability of the fishery

After the introduction of the IQ, the number of vessels in operation decreased, thus generating savings in overall fishing costs. However, significant changes in the level of the annual total catch occurred until 2008. Econometric estimates analyzing the impact of the IQ system on yield capture (average per vessel) and on fishing efforts of industrial fleets (the number of vessels in operation and the number of fishing trips conducted by each vessel) have shown that with the IQ system:

- Catch per vessel has been higher on average than during the “Olympic race”;
- Monthly trips by vessel have been lower; yields per unit of extractive fishing have been better; and
- There have been substantial operational benefits derived from the current trend to allocate production towards direct human consumption (mainly frozen and canned).

3.3 Social equality

The IQ system resulted in lower employment levels in the fleets. However, the remaining fishermen were more competent, and their careers were longer, which created more stability in the monthly catches. The general safety at sea improved and the number of accidents reportedly declined after the introduction of the IQ. This result can be somewhat attributed to the better planning of fishing operations and improved fishing conditions.

Since the beginning of the preparation of the law, the aim was to improve the "quality" of artisanal fishing rights in order to achieve a more efficient market. In the case of the craft attached to an RAE on a voluntary basis, there was a recognition of their historic fishing rights. In 2010, the sectoral authority attempted to increase the length and coverage of the RAE for more fisheries and more small-scale groups. This gave them the possibility to include in the draft law a comparison of maximum capture limits for small-scale owners. It was decided to establish new RAEs, in particular, through the inclusion of criteria to recognize the historic rights, greater transparency and penalties for failure to comply with assigned quotas, and the possibility to transfer quotas directly between artisanal and industrial actors.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

The challenges identified in the management plan of the fishery are the following:

1. Fishing quota compliance level;
2. Illegal, unreported, and unregulated (IUU) fishing;
3. Level of expenses associated with the transfer of quotas;
4. Effects of anomalous events in the fishery environment;
5. Low presence of agreements and conservation and management measures of fisheries in the area of distribution of the resource (EEZ and High Sea);
6. Lack of renewal in the registry of small-scale fishers;
7. Interaction with other species;
8. Industrial crew loses benefits due to quota transfer;
9. Ignorance of regional regulation when managing by-catch;
10. Interaction with other activities;
11. Lack of infrastructure and technology for value addition to the products; and
12. Theft of catches.

4.2 Improving fishery sustainability in the future

A plan of action or strategies need to be developed that allow compliance measures or management actions defined by a goal, which, in general terms, should consist of establishing the tasks or activities to be carried out; who should perform them; the deadlines to be met and; the identification of relevant actors with key functions/activities to ensure their implementation.

The action plans will include actions of coordination and direct execution through the Undersecretary of fisheries and its subsidiary bodies, which are binding to the Management Plan in accordance with the provisions of current legislation. The Undersecretary of fisheries and aquaculture in conjunction with the Committee of management of the fishery will establish management strategies.

The objectives of the fishing industry are to ensure that the Chilean product is internationally recognized not only for its quality but also for its sustainability. Some sectors have turned their efforts to develop, in the short term, an eco-certification, such as the principles set out by Marine Stewardship Council (MSC), IFFO Responsible Supply, Friends of the Sea, among others.

Fisheries will thus be at the forefront of Chile's goal to achieve the Sustainable Development Goals (SDG), in particular, those related to reduced inequality (SDG 10), life below water (SDG 14), responsible production and consumption (SDG 12) and decent work and economic growth (SDG 8).

5. LESSONS LEARNED

Individual quotas that are transferable guarantee economic benefits to the owners of the quotas.
The increase of the duration of the quotas and the possibility of extension even after the 20 years of initial duration have provided investment security to the industrial fisheries.

However, the impact on resources has yet to be observed, as jack mackerel resources are only slowly recovering from over-exploitation.

Small-scale fisheries are still far away from a clear quota system, although the RAE is an interesting way forward in this direction. The sector is suffering from the no-entry and closed registries for fishers, as no replacement is taking place.

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Fisheries management of paiche "*Arapaima gigas*" in Cocha (lake) El Dorado of the Pacaya Samiria Reserve - Loreto, Peru.

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Fisheries and Aquaculture of INFOPESCA, Peru

Abstract
Natural resources are the Nation's heritage. The State promotes with adequate legislation in accordance with the Constitution of Peru the sustainable use of natural resources, the conservation of biological diversity and protected areas, and the sustainable development of the Amazon. The General Law on Fisheries – Decree-Law N° 25977 is a framework legislation established to regulate fisheries activity and promote its sustainable development as a source of food, employment and income. It also aims to ensure the responsible use of aquatic living resources, thus optimizing economic benefits while safeguarding the environment and conserving biodiversity. The Regulation on Fisheries Management in the Peruvian Amazon (RFM) was introduced into this framework with the objectives of setting the foundation for the rational and sustainable use of aquatic living resources; developing the Amazon fisheries in accordance with the Code of Conduct for Responsible Fisheries; safeguarding the ecosystems and biodiversity; and ensuring a dynamic equilibrium between economic growth, encouragement of investment, and conservation of resources. The RFM of the Peruvian Amazon establishes Fisheries Management Programs that ensure a controlled exploitation of species or groups of species in a particular environment, under norms and regulations, monitored periodically and responding to socioeconomic needs. The latter refers to the protection of commercial or subsistence fishing of a fishing community and the conservation of one or several species that sustain these fisheries. In this context, the Management Plan for the A*rapaima gigas* of Cocha El Dorado in the Pacaya Samiria Reserve was approved. The Social Organization of Fishermen and Artisanal Processors Community Fishing Unit Yacu Tayta (CFU Yacu Tayta) extracts experimental quotas of paiche after monitoring, thus guaranteeing the sustainable use and profitability of the extraction of the resource. Through appropriate fishing gear, surveillance and control regarding minimum sizes, the organization contributes to the recovery of the species, and the plan improves the life quality and recognition of the community. Paiche fishing quotas in the Cocha El Dorado area are exclusively given to the CFU Yacu Tayta, with the aim to protect the recovery of the paiche population. Illegal fishermen are involved in paiche fishing, leading to various conflicts with the legal owners of the paiche fishing quotas. The CFU Yacu Tayta have formed control and surveillance committees to fight the presence of illegal fishermen.

1. INTRODUCTION

1.1 Description of the fishery

Paiche, pirarucu or arapaima (*Arapaima gigas*) is a species of osteoglossiform fish in the Arapaimidae family. It is the second-largest freshwater fish in the world. It grows larger than 3 meters (m) in length and weighs up to 250 kilograms (kg). This fish lives in low oxygen waters at certain times of the year; the oxygen absorbed through its gills is consequentially insufficient. The paiche must thus breathe oxygen from the air. In normal circumstances, the animal breathes surface air for a period of 15 minutes, but it can hold up to 40 minutes if it is in danger or is being pursued. Its swim bladder is highly developed, very large and vascularized, with a similar function to a human lung.

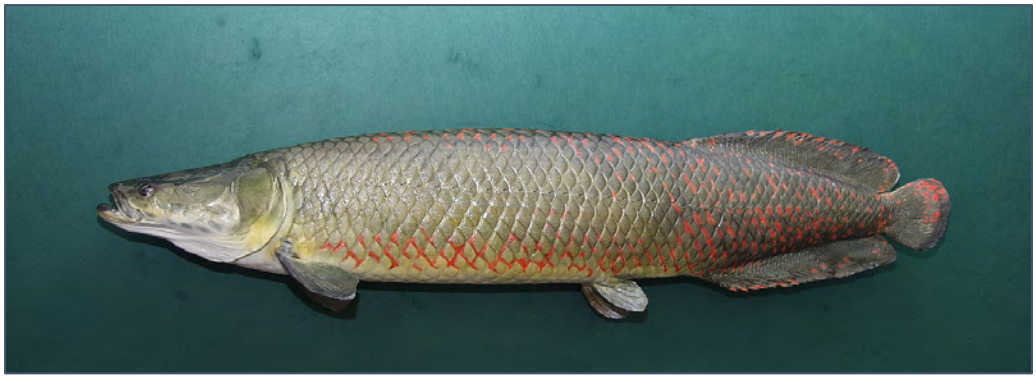


Figure 1. Paiche (Arapaima gigas).
Source: LEOA – UFMT/Campus Universitário de Rondonópolis.

Paiche (*Arapaima gigas*) is an important species for the Peruvian Amazonian population since it constitutes a source of food and of income through the marketing of its products. Consequently, the species has been subject to intense fishing operations, which have led to a reduced stock. Today, the species is threatened with extinction and is included in the Convention on International Trade of Endangered Species (CITES) Appendix II. In Peru, the presence of paiche is mostly confined to Protected Natural Areas, such as the Pacaya-Samiria National Reserve where it concentrates in Cocha El Dorado.

The fishing of this species is banned permanently in some areas of the Peruvian Amazon and is banned during the reproductive periods in other areas, with the fishing season taking place from March to September of each year. The Pacaya Samiria National Reserve (PSNR) is a protected area located in the Loreto Region of the Peruvian Amazon, with the Marañón River to the north and the Ucayali to the south, and covering an area of 2 080 000 hectares (ha) (20 800 km²) (Figure 2). It is the largest in Peru, and the fourth largest protected area in all of South America. It is also the largest protected area of the Amazon rainforest in South America. It was established as a RAMSAR site in 1986. According to the categories of protected areas of the International Union for Conservation of Nature (IUCN), PSNR is considered a "Protected area of managed resources".

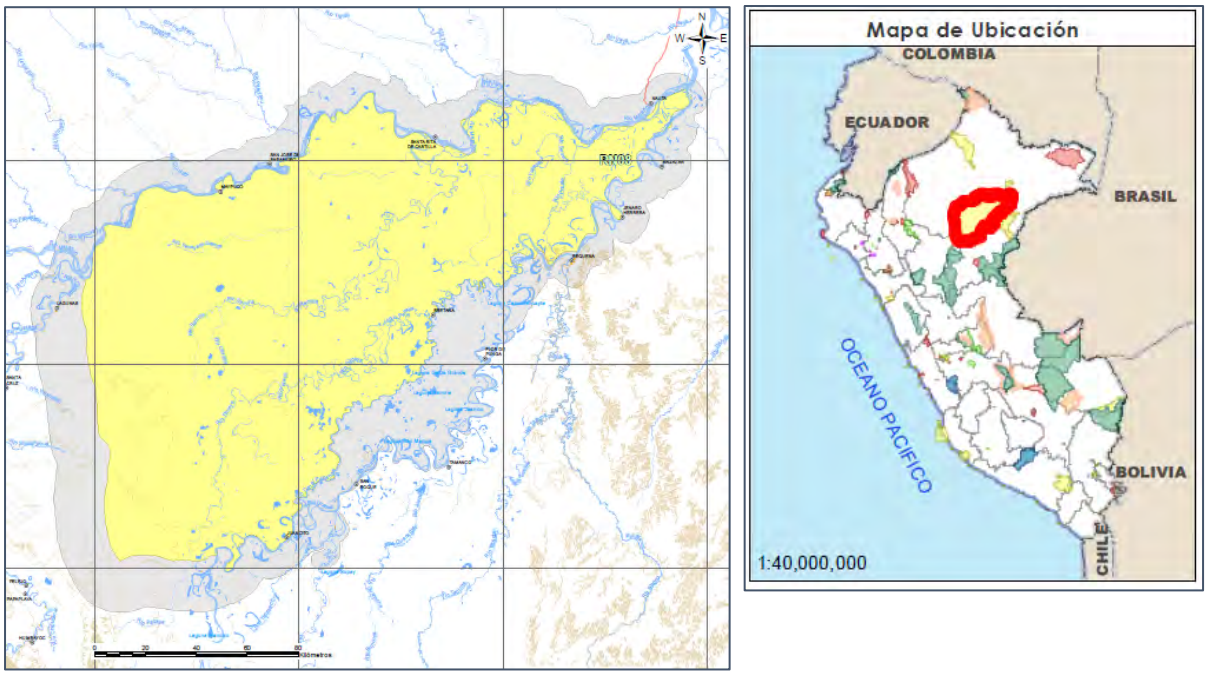


Figure 2. Map of the Pacaya Samiria National Reserve - Loreto, Peru.
Source: Ministerio del Ambiente (MINAM), 2018.

Cocha El Dorado is located to the northeast of the PSNR, in the upper section of the Yanayacu - Pucate basin. It has an estimated area of 462.91 ha and a perimeter of 30 217.09 m (Figure 3). It is located at 9 439 397 N and 574 672 E.

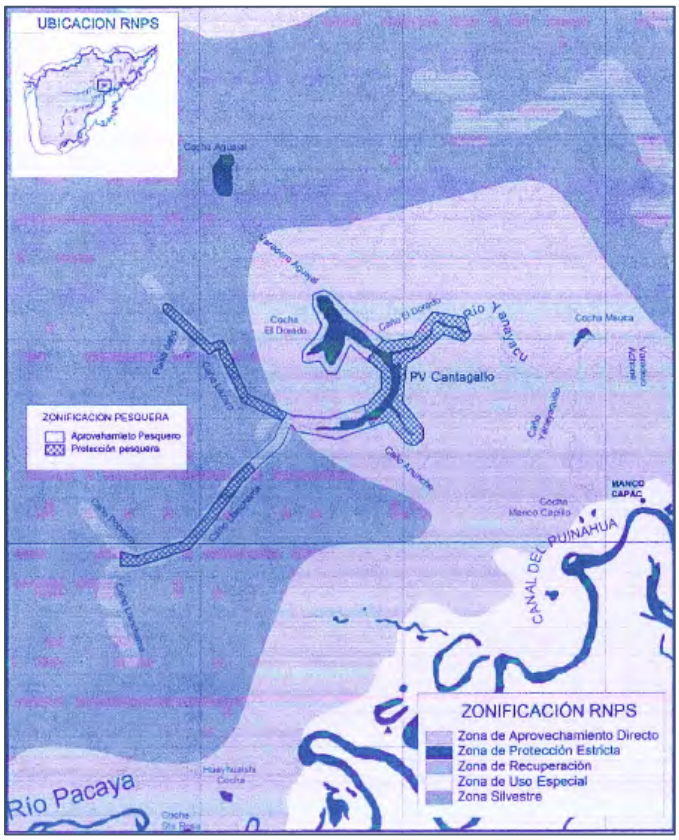


Figure 3. **Map of El Dorado Cocha in the Pacaya Samiria National Reserve - Loreto, Peru.**
Source: Programa de Manejo Pesquero (PROMAPE) Cocha El Dorado, 2015.

A small stock of merely ten paiche (*Arapaima gigas)* was found in Cocha El Dorado in 1994. This discovery led a group of artisanal fishermen from the Community of Manco Cápac to form the CFU Yacu Tayta to conserve hydrobiological resources for the sustainable use of paiche, with the support of a variety of public and private institutions.

Fishery management plans were established under the RFM of the Peruvian Amazon, among other directives, in order to recover overexploited resources and support their sustainable use –Paiche (*Arapaima gigas*) is the main species.

In this framework, with the Directorial Resolution N°747-2004-GRL / DIREPRO[94], the first Fisheries Management Program of the paiche resource "*Arapaima gigas*" of Cocha El Dorado was approved. This program gave the CFU Yacu Tayta the opportunity to establish experimental quotas for the resource, after monitoring, guaranteeing the sustainable use and profitability of the extraction of the resource. Thanks to appropriate fishing gear and the implementation of surveillance and control regarding minimum sizes, the area saw an improved recovery of the species, a better quality of life, and recognition of the community.

Locals in Cocha El Dorado carried out a new census to study some of the new fishing management experiences. The results showed a significant increase in the paiche stock, which reached a population

[94] Dirección Regional del Ministerio de Pesquería (DIREPRO)

of 703 paiche specimens in 2014. In order to provide stability in the assignment of rights, in the context of the Supreme Decree Nº 015-2009-PRODUCE, the RFM of the Peruvian Amazon was updated, with the aim to i) Establish the bases for the rational and sustainable use of hydrobiological resources and development of the Amazonian fishery, in accordance with the principles of the Code of Conduct for Responsible Fisheries; ii) Guarantee the dynamic balance between economic growth, promotion of investments and conservation of resources, including the protection of the environment and the biological diversity; iii) Facilitate the formalization of extractive and processing activities that affect the different fisheries of the Peruvian Amazon, promoting their development through PROMAPE, training, technology transfer and support to social organizations of fishermen and; iv) Contribute to the integral development of fishing as a source of food, employment and income.

Within the framework of PROMAPE of Cocha El Dorado, fishermen of the CFU Yacu Tayta were granted the right to manage and exploit the paiche resource. They established the use of gillnets, particularly gillnets of 12 “inches of mesh opening with thread N° 240 of 180 m of length and 18 m of height” to capture adult specimens with a minimum size of 1.60m. Additionally, they defined an experimental quota of annual catch of 15 percent (20 to 60 specimens per year), subject to the availability and abundance of the species. Fishing is conducted with canoes of 4 to 6 m in length, with 6.5 hp engines that allow the captured specimens to be transported to the Organization’s camp, in order to be processed.

Figure 4. Paiche capture.
Source: Diario el Comercio, 2018
https://elcomercio.pe/somos/historias/fiesta-paiche-cuida-soberano-rios-amazonicos-fotos-noticia-551829.

Figure 5. Paiche fishing boats.
Source: Diario el Comercio, 2018
https://elcomercio.pe/somos/historias/fiesta-paiche-cuida-soberano-rios-amazonicos-fotos-noticia-551829.

It is important to point out that illegal fishermen are operating in the Cocha El Dorado area and extracting the resource protected by the CFU Yacu Tayta. Within the framework of PROMAPE, the CFU Yacu Tayta have formed Vigilance Committees to protect the paiche resource from illegal fishermen.

Economic contribution and social implications of the fishing activity

Paiche catches are usually brought to the local market. The main product forms are whole fresh Figure 6) and dried/salted (Figure 7). This is due to the scarce availability of processing and cold storage systems in the fishing areas. In addition, paiche is also produced via aquaculture and sold through exports or national markets.

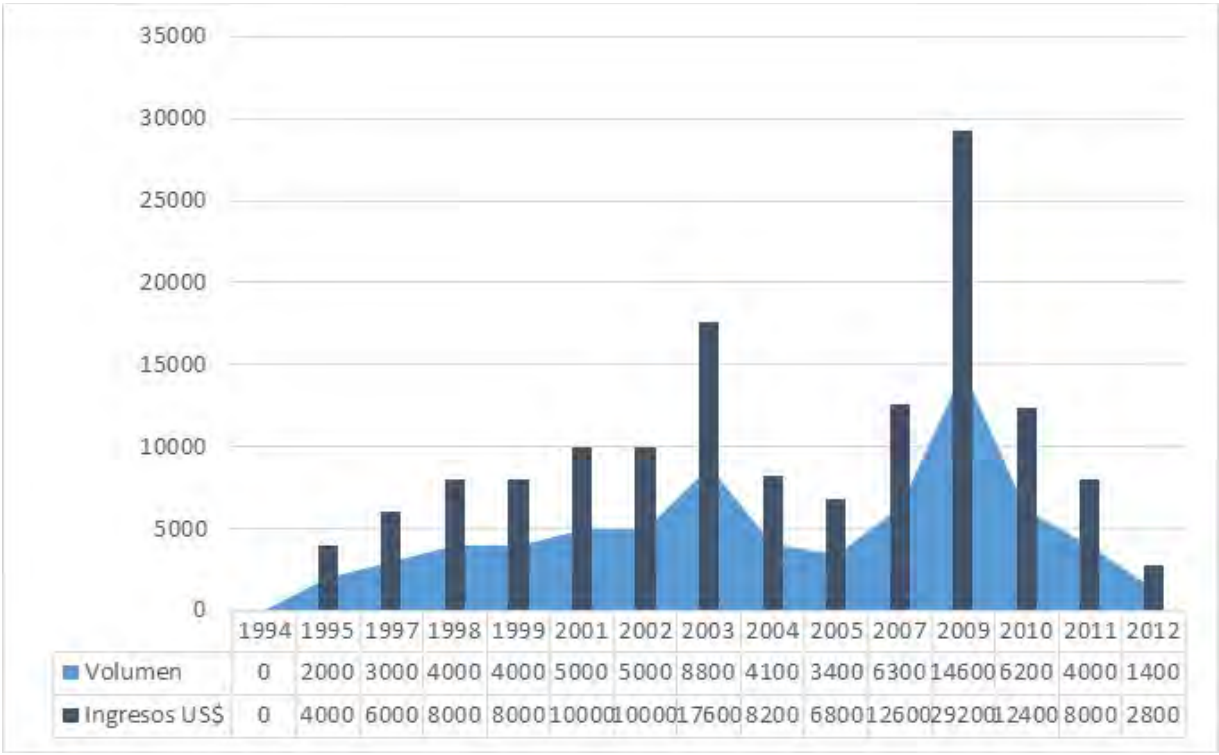
There are some cases in which paiche is sold to intermediaries who distribute the products to other markets, in Iquitos or Lima. In other cases, the same fishermen vend their product to gourmet

restaurants, which provides better economic benefits. However, the demand in this type of marketing is still low.

Figure 6. Fresh whole paiche.
Source: Diario el Comercio, 2018
https://elcomercio.pe/somos/historias/fiesta-paiche-cuida-soberano-rios-amazonicos-fotos-noticia-551829.

Figure 7. Dried/salted paiche.
Source: INFOPESCA, 2009.

The residents of the reserve have reported that their income has increased since the implementation of this model. Thanks to a greater available stock and larger specimens, it has become easier to fish.



	1994	1995	1997	1998	1999	2001	2002	2003	2004	2005	2007	2009	2010	2011	2012
Volumen	0	2000	3000	4000	4000	5000	5000	8800	4100	3400	6300	14600	6200	4000	1400
Ingresos US$	0	4000	6000	8000	8000	10000	10000	17600	8200	6800	12600	29200	12400	8000	2800

Figure 8. Income from the management of paiche in Cocha El Dorado.
Source: Author's elaboration based on information from the Instituto de Investigaciones de la Amazonía Peruana (IIPA) and PROMAPE 2015.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

The main authority managing the fishing activity is the Ministry of Production, which is the fisheries governing body at the national level. The most relevant aspects of fisheries management are presented in the RFM of the Peruvian Amazon, as well as the National Service of Natural Protected Areas (SERNANP), which is the governing entity of the Natural Protected Areas in the country that defines the management and resource use models as well as the areas of economic development. The DIREPRO of Loreto evaluates, approves and supervises the Fishing Management Programs proposed for the management of hydrobiological resources.

It should be noted that organized artisanal fishermen are the ones who suggest the Fisheries Management Program to the DIREPRO Loreto, with the support of scientific and technical entities such as NGOs and research centers. They define the type of hydrobiological resource to manage, the type of administration to be carried out, the objectives and results of the Program, the rights and obligations within the framework of the current regulations, the monitoring and follow-up, the use of the resource, the control and surveillance, as well as the evaluation mechanisms of the Program. This proposal is reviewed and evaluated by the DIREPRO who approves it through a Directorial Resolution. It should be noted that SERNANP also supervises the Management Program.

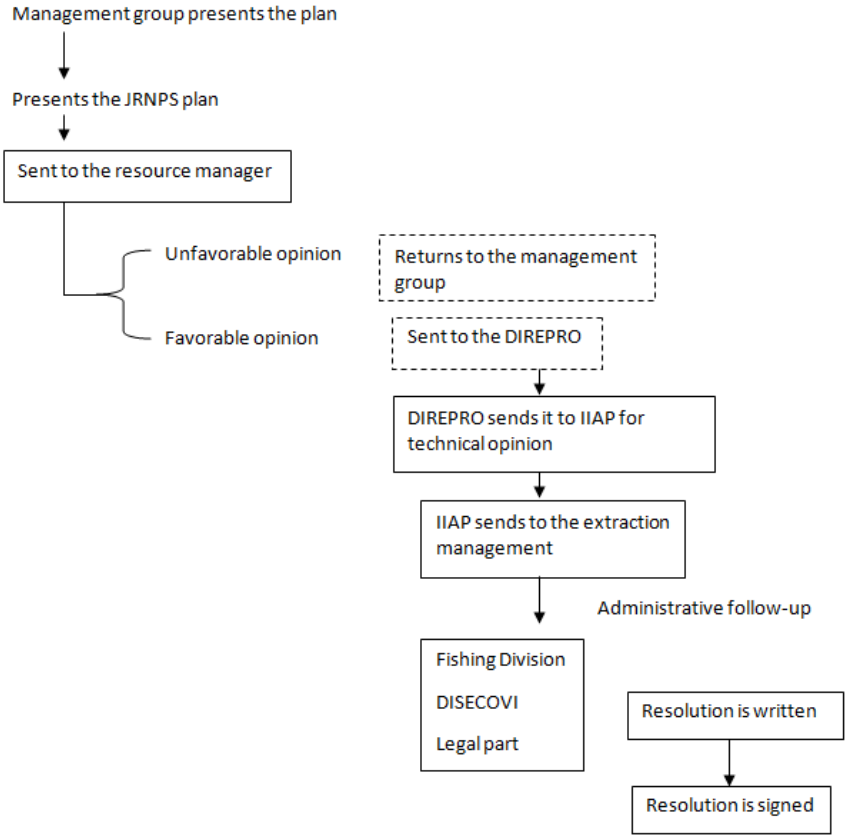


Figure 9. Flow chart for approval by PROMAPE.
Source: ProNaturaleza, 2009.

The management of administrative law is governed by a Fisheries Management Program approved by the Regional Government of Loreto through a Directorial Resolution, within the framework of the RFM of the Peruvian Amazon. The approval of the PROMAPE gives organized artisanal fishermen who

presented the Program the right to manage the resource, carry out restocking actions, and define an extraction quota of 15 percent of the adult population (prior to stock assessment and measures of monitoring of stocks). They also have the right to carry out control and surveillance actions in order to ensure the respect of the fishing gear approved for the extraction of paiche, minimum sizes of capture and avoid the intervention of possible illegal fishermen that affect the sustainability of the resource. It should be noted that artisanal fishermen receive technical assistance from universities and research centers such as the IIPA.

2.2 Brief history of former rights-based approaches used in the fishery

The allocation of rights for the use of the paiche in the Reserve areas is done based on the presentation and approval of a PROMAPE for the resource framed in the RFM of the Peruvian Amazon. The allocation of rights and fisheries management would not be possible without this instrument. The PROMAPE is approved for a period of five years and is subject to an assessment of compliance, which focuses on the recovery of stocks, the respect of bans, the respect of minimum sizes and use of fishing gear allowed, compliance in the use and management of the quotas granted, and the sustainability of the operation.

2.3 Rights-based approach: allocation and characteristics

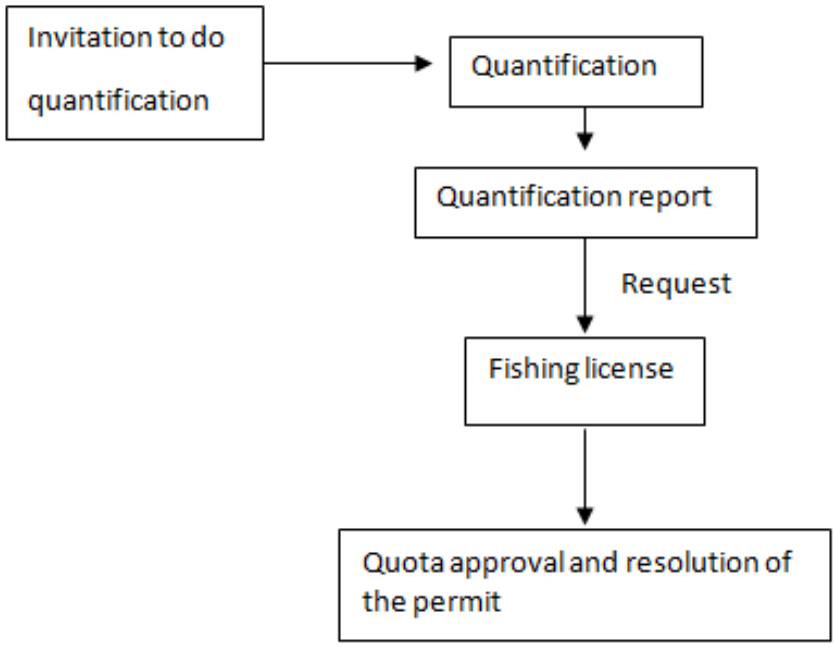


Figure 10. Flow chart to obtain the quota and fishing permit for PROMAPE.
Source: ProNaturaleza, 2009.

This type of program and the assigned quotas are not transferable, as the management and execution are entrusted to a formalized social organization in the area with the support of technical and research entities. The defined and approved quotas are also non-transferable as they are granted to the organization in the framework of PROMAPE. It has to be noted that there are several illegal fishermen in the area, and the legal holders of fishing rights try to defend their rights through control and surveillance.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

Paiche is a species in recovery contained in Appendix II of the CITES Convention and in the case of the management of the Cocha El Dorado. The management is focused on recovering the stock and promoting the sustainable use of adult specimens. Fishing rights are given to the CFU Yacu Tayta, since they are responsible for fisheries management within the El Dorado Cocha on the basis of an approved PROMAPE. These are granted with a legal device (Directorate Resolution) of the DIREPRO of the Regional Government of Loreto. Paiche stocks evaluation is carried out by the artisanal fishermen of the CFU Yacu Tayta with the collaboration of the IIPA and the supervision of the DIREPRO of the Regional Government. This stock evaluation is always carried out in the pre-capture period in order to determine the extraction quotas of adult specimens. These fish are caught based on the quotas approved for each season.

3.2 Economic viability of the fishery

The fishing effort capacity of the artisanal fishermen of the beneficiary Social Organization has improved according to the availability and abundance of adult specimens, but it varies between 2.3 and 11.2 (Figure 11).

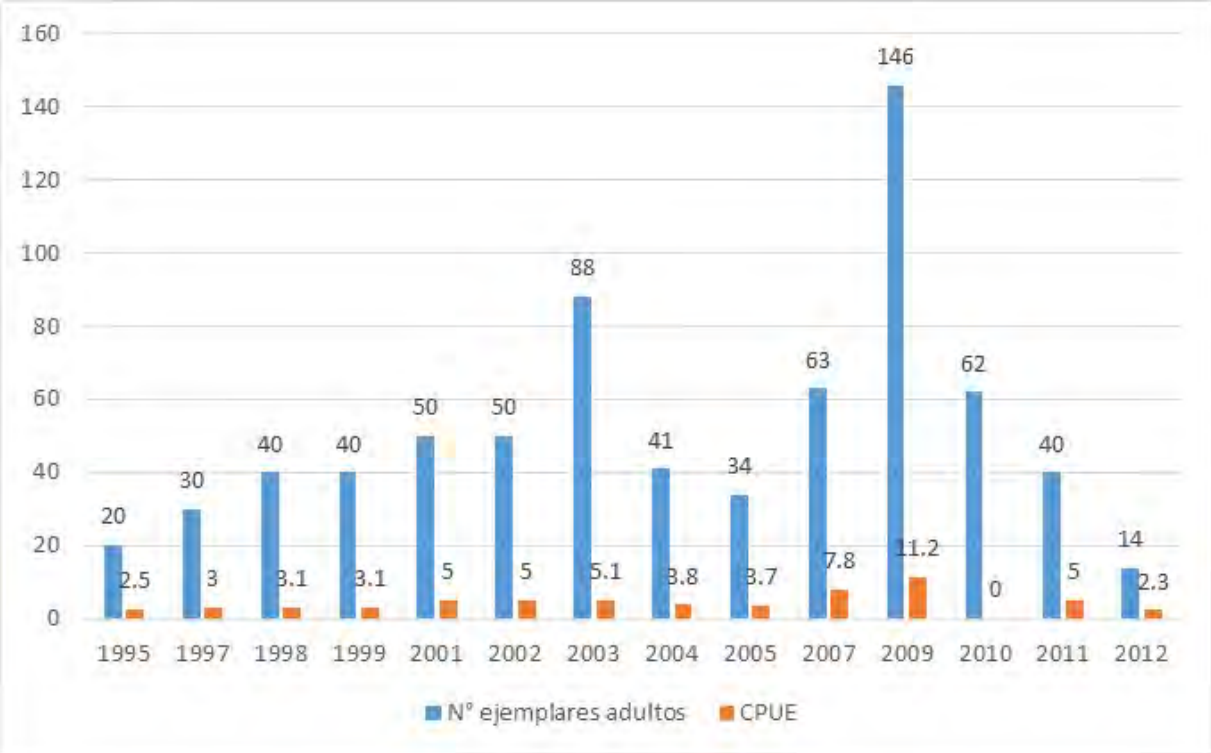


Figure 11. Capture per unit of effort of adult paiche specimens in Cocha El Dorado.
Source: Author's elaboration based on information from IIAP and PROMAPE 2015.

These quotas are granted to the community that administers the PROMAPE, benefiting all the artisanal fishermen members (14) with direct employment and improved family income. The percentage of quotas has varied over time, between eight percent and 15 percent in the period 2004 – 2011, based on the abundance of adult specimens (Figure 12).

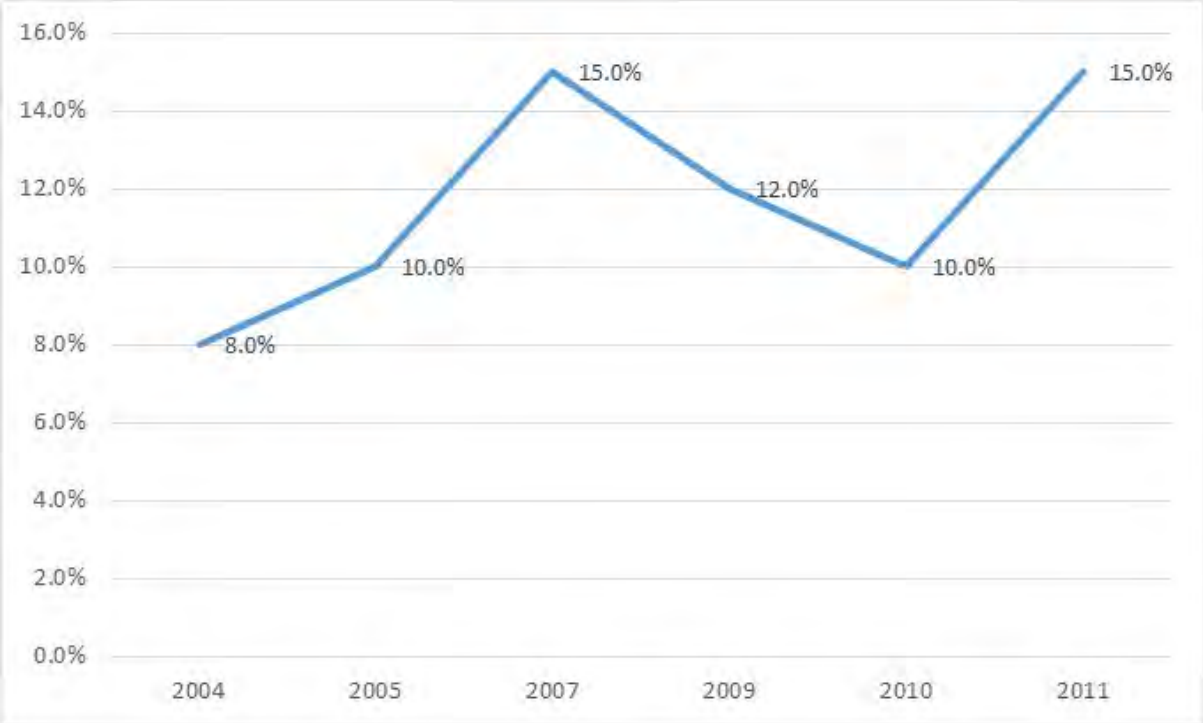


Figure 12. Evolution of the capture quota of adult specimens in Cocha El Dorado.
Source: Author's elaboration based on information from IIAP and PROMAPE 2015.

3.3 Social equality

Quotas improve the regulation of the extraction of paiche in the Pacaya Samiria National Reserve, contributing to sustainability and preventing illegal extraction. They also generate an economic benefit in the local community of Manco Cápac, thus contributing to its development.

In addition, according to a report presented by the IIAP in 2003, 150 inhabitants of the Manco Cápac community directly benefit from the economic income generated by the commercialization of the managed resource each year. This includes 18 fishermen from the CFU Yacu Tayta and 14 fishermen from the CFU Los Tibes, along with their respective families, which represents 35 percent of the total population. It is important to mention that the CFU Los Tibes also began working in the same sector as the Yanayacu-Dorado since 2000, thus becoming direct beneficiaries of the resources of the management area.

In addition, 429 people in the community (90 families) benefit indirectly from these resources because two percent of the income generated by the commercialization of fishery products is allocated to the community as a form of social service depending on their needs (health, education, electrification, management and others). The funds that the CFU Yacu Tayta give to the community are delivered to the Municipal Agency and managed by the Communal Assembly.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

In order to strengthen the sustainable management of the fishery, it is important to include the concept of aquaculture-based fisheries and restocking actions in the PROMAPE planning.

In addition, it is necessary to replicate this experience in other areas of the Amazon with communities and public and private organizations, in order to support management, conservation and exploitation of other fisheries in the global environment.

It is necessary that administrative procedures for the approval of catch quotas become less bureaucratic within the PROMAPE framework because this bureaucracy delays the use of resources during the fishing season.

4.2 Improving fishery sustainability in the future

The replication of the structure of the PROMAPE in other Amazon areas, within the RFM of the Peruvian Amazon, is considered vital. A broader legal framework within the General Fisheries Law of Peru and the National Fisheries and Aquaculture Policy is essential as well. This is an important tool that supports co-management and acknowledges the contribution of fisheries based aquaculture in the sustainability of fisheries.

4.3 Lessons learned

The experience of paiche fisheries and the quotas allocated to the CFU Yacu Tayta have shown that rigorous management and the allocation of fishing rights can readily reverse threats to the survival of a species. This is only possible if national laws, regional administrations, Non-Governmental Organizations and fishermen work together to implement sustainable fisheries. Clear rules and user rights are the basis for any fisheries management. The high prices of paiche products have attracted illegal fishing in the area. As a consequence, surveillance groups by legitimate fishermen were created to enforce the existing rights.

ACKNOWLEDGEMENTS

A special acknowledgement to FAO and INFOPESCA for the invitation to participate in the UserRights 2018 meeting and present relevant cases related to tenure and rights in the fishing sector.

Fishing quotas for small scale fishers' groups, the Chilean example

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Abstract
Fisheries management is necessary to avoid the overexploitation of fishery resources. The Chilean legislation recognizes as key elements of the management of fisheries the fixing of quotas, restrictions on entry and assignment of user rights, in its various forms. This fisheries management includes coastal reserve for use (exclusive use of artisanal fisheries), allocation of quotas between artisanal and industrial, allocation of quotas to the industrial fisheries as individual transferable quotas (ITQs), allocation of ITQs via auction for any user, and other forms of quota assignment inside the small-scale fisheries sector. This case study highlights the advances in the allocation of individual quotas inside the artisanal fisheries. It analyzes the risks, challenges and opportunities that these models involve through an in-depth study of the Bío Bío Region with a focus on common the sardine and anchovy fishery.

Keywords: Chile; Artisanal fisheries; Bio Bio region; ITQs, sardine, anchovy

1. INTRODUCTION

1.1 Description of the fishery

The small pelagic fishery in the Center-South of Chile is a purse seine fishery that operates between the regions of Valparaiso (V region) to the Lakes region (region X). The fishery targets anchovy (*Engraulis ringens*) and common sardine (*Strangomera bentincki*).

Pelagic resources play an important ecological role and are fundamental in food chains. Studies carried out in Chile show that these resources are important in the diet of sea lions, sharks, mackerel, hake and conger eels. Common sardine and anchovy possess a geographical distribution linked to the coast, a short life cycle, with a maximum life span of five years, and a high natural mortality. They are species that make up dense schools and that are heavily influenced by environmental factors, such as the availability of food, predation or superficial variations in temperature. Biologically, these species have a continuous annual spawning with maximum reproductive activity in the second period of the year. The size at first sexual maturity is 12 centimeters (cm) for the anchovy and 11.5 cm for the common sardine, within the first year of life.

Two different fleets target these species: the industrial fleet, which operates off the reserved fishing area (five miles from the coastline measures) under ITQs, and the small-scale fleet, which operates inside the first five nautical miles but can also operate offshore depending on the autonomy of the boats. The main landing sites for both fleets are San Antonio in the region of Valparaiso, Colonel, San Vicente and Talcahuano in the region of Bio Bio, Corral in the region of Los Ríos and Calbuco and Puerto Montt in the region of Los Lagos.

Sardine and anchovy landings are used as raw material for the production of fishmeal, which is either exported or marketed internally for the elaboration of feed for poultry, pigs and aquaculture. The global catch quota is split between artisanal and industrial subsectors, in line with Law 20.657 of the year 2013, with 78 percent (300 000 tonnes) of the overall quota assigned to the artisanal sector.

The industrial fleet includes 16 vessels in the anchovy fisheries and 17 in the sardine fisheries. It is estimated that about 9 800 people—86 percent fishing crew members and 14 percent ship-owners—participate in the artisanal small pelagic fisheries. Of the total, 40 percent are registered in the Bio Bio region, leaving in evidence the importance of this region for the anchovy and sardine fisheries. The fisheries involve 1 400 vessels, with 48 percent of them listed in the Bio Bio region. It should be noted that only a fraction of them are operational, with 26 percent of fishers in macro-regions V - X, and 52 percent of the fishers registered in the Bio Bio region.

The business model of this industrial fishery is a vertically integrated one with fleet, plant and marketing, while the artisanal fleet is the main supplier of raw material. The processing takes place in approximately 20 fishmeal factories, with 15 in the Bio Bio region.

1.2 Economic contribution and social implications of the fishing activity

The estimated ex-vessel value of the anchovy and sardine production in the central-southern regions of Chile was USD 82 million in the year 2017. It is difficult to estimate the total value of the fisheries. However, taking into account the fact that the total export of fishmeal in the year 2017 was USD 255 million, and that approximately 39 percent of fishmeal production in Chile derives from anchovy and sardine fisheries of the central and southern region, total export earnings amount already to at least USD 100 million. Then, given that domestic consumption accounts for about 24 percent of the total production, an additional USD 30 million can be added, which indicated that the total value of the anchovy and sardine fisheries is about USD 130 million.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

Chilean legislation recognizes as fundamental to the management of the fisheries, the limited entry in the fisheries and, as a complement, four different types of allocation of rights of use:

- allocation of quotas between artisanal and industrial;
- allocation of quotas to the industrial fisheries as individual transferable quotas (ITQs);
- allocation of ITQs via auction for any user; and
- four forms of quota assignment inside the small-scale fisheries sector:
  - benthic regime of extraction and management;
  - artisanal management areas;
  - artisanal extraction areas (RAE from the Spanish acronym Régimen Artesanal de Extracción); and
  - the particular case of toothfish allocation which is accessed via auction.

The RAE allocates individual quotas among artisanal fishers, generating incentives for the best use of the resource, decreasing the race for fish and creating the administrative regime for more efficient use. This regime recognizes historic rights and does not create new rights. It is a tool complementary to the suspension of the access via closed fishers registry and an assignment inside fishing that recognizes the validity of vessels and/or fishers registration in the fishery concerned. This recognition is given to all that are enrolled in the artisanal fisheries register and for the volumes that are historically recorded for each fisher. The RAE has been applied to the anchovy and the sardine fisheries in the Central Southern regions of Chile since 2004. No new entries are allowed in these two fisheries.

2.2 Brief history of former rights-based approaches used in the fishery

The anchovy and sardine fisheries in the Central-Southern area of Chile has three types of allocations, the ITQs for the industrial fisheries, the ITQs via auction for the industrial fisheries, and the RAE for the artisanal fisheries. Table 1 shows the changes in the allocations of catch quotas over the years. It is important to note that the total quota has been reduced in recent years.

Table 1. Quota allocations of Anchovy and Sardines among fisheries (in tonnes).

Year	Anchovy		Total Anchovy	Sardine		Total Sardine	Total Fisheries
	Industrial	Artisanal		Industrial	Artisanal		
2001	67.771	87.169	154.940	105.543	249.577	355.120	510.060
2002	163.020	207.480	370.500	119.250	278.250	397.500	768.000
2003	149.882	234.480	384.362	90.204	270.613	360.817	745.179
2004	129.960	240.768	370.728	75.800	290.320	366.120	736.848
2005	170.925	276.236	447.161	80.043	239.470	319.513	766.674
2006	170.984	197.616	368.600	89.870	359.480	449.350	817.950
2007	185.856	236.544	422.400	102.720	308.160	410.880	833.280
2008	183.920	234.080	418.000	225.150	525.350	750.500	1.168.500
2009	181.830	231.420	413.250	261.900	611.100	873.000	1.286.250
2010	119.931	152.639	272.570	260.243	607.232	867.475	1.140.045
2011	29.466	37.502	66.968	315.176	735.411	1.050.587	1.117.555
2012	30.435	38.735	69.170	312.849	729.981	1.042.830	1.112.000
2013	25.528	90.509	116.037	128.462	455.458	583.920	699.957
2014	9.091	32.233	41.324	123.307	437.181	560.488	601.812
2015	7.380	26.165	33.545	76.721	272.009	348.730	382.275
2016	8.574	30.398	38.972	70.375	249.363	319.738	358.710
2017	12.558	44.524	57.082	72.402	256.698	329.100	386.182
2018	10.626	37.676	48.302	74.242	263.223	337.465	385.767

2.3 Rights-based approach: allocation and characteristics

The following text will concentrate on the evolution of the RAE in the Bio Bio region:

1. The annual renewal system for the years 2004 to 2008 had intensive regional work led by the fisheries authority. It determined the enabling parameters to achieve the allocation of a more equitable fee, which was then used as the basis for long-term determinations.
2. Collaborative work carried out in 2008 led to the establishment of a quota allocation for the period 2009-2011. This exercise was successful in achieving a consensus in the formula of determination, which resulted in the redistribution of a ten percent share of the quota from the largest shareholders to those who had less presence in the fishery.
3. Following the period of three years and with the experience of years 2004-2011, there was already a greater consensus on the need to establish better certainty to the operation of the fleet. This resulted in the redistribution of an 18 percent share based on criteria of consensus. This led to the extension of the regime in the long term (for 15 years).

It should be noted that transfers of quotas are possible, but the holder of the quota can only sell over a three-year period, up to 50 percent of the quota allocated to that period and only to registered artisanal fishers or fishing boat owners.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

According to the latest report on the situation of the fishery in the year 2017, the anchovy resource is over-exploited while sardines are fully exploited. It is important to note that it is difficult to assess the impact of the RAE system on the sustainability of anchovy and sardine resources as it is an environmental variable and its consequent effect on global availability of resource, climate change, and pollution from other areas, all contribute to changes in the resource's performance.

A survey for the year 2013 shows that RAE is not necessarily better for the resource than a simple global quota or an 'Olympic race'. The reason is that it is a 'mixed fishery', where the catch does not determine which resources will be targeted and nets can contain species for which the quota is already exhausted. The above study also carried out a survey on the perceptions of fishery participants, which showed that flawed fishing practices in the past were believed to have played an important role in the current condition of the anchovy resource. The participants also believed that regulatory asymmetries between the types of fleets in favor of the smaller vessels fostered unreported catches as well as the practice of declaring one species caught for another, not covered by the quotas.

3.2 Economic viability of the fishery

As pointed out before, since the introduction of catch quotas, there has been a steep decrease in overall catch quotas. At the same time, there has been a significant increase in catches labelled as by-catch, which are a cause of concern for fisheries managers.

Statistics of the year 2017 show an important decline in the number of vessels in the pelagic fleet of the VIII region operation, accompanied by a registered drop in the fees from the year 2012 until today. These occurrences put at risk the economic viability of vessels and encourage transfers between organizations within the same region, from other regions inside the macro-region, and to and from the industrial sector. This shows that the distribution of quota systems improves efficiency through the selection of those most efficient operators.

3.3 Social equality

The closed register of fishers aims to improve the condition of the fishery operators. The improvement is twofold. First, it provides certainty of access to a fixed quota. Second, it achieves a better distribution of the quota, from industrial towards artisanal fisheries.

In practical terms, this resulted in a reallocation of 17 percent of the quota in favor of artisanal fisheries. In addition, the flexibility in terms of the transfer of quotas provides additional income through the sales of quotas. In fact, field research shows that there is a perception among fishery participants that the allocation of fishing rights has generated improvements in the welfare of fishers' households thanks to the secure access to quotas and borrowing capacity due to the ownership of future fishing quotas.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

It is necessary to improve the monitoring of the recruitment and breeding process in order to be timelier in the establishment of the respective periods of fishing bans. There is a need to improve the compliance with the regulations, in particular in the field of operation of illegal vessels.

More financial resources are needed for research in the economic and social arena, with special regard to the RAE. It is necessary to address the issue of the mixed fishery for anchovy and sardine common, which constitutes a challenge for management and is responsible for practices such as the underreporting, misreporting and discards of catches.

4.2 Improving fishery sustainability in the future

The model of management of this fishery has strengthened over the years through the implementation of the technical Scientific Committee and its Management Committee. In particular, it has encouraged the participation of fishers in the decision-making process, particularly during the stages of information gathering and analysis, as well as during the design and implementation of control and supervision processes.

On the other hand, the authority must continue its efforts to communicate the most sensitive issues of management and manage the expectations of users in the short term concerning the operation, namely closed periods, quotas and management in general. This will require a permanent review of communication and transparency policies.

The complex territorial dynamics in which the fishery is developed and the large and heterogeneous number of operators make it necessary to constantly rethink models of control and supervision. It is also crucial to review the research model upon which fishery management is built. Both of these models are fundamental pillars for the projection of fisheries management in the long run.

On the other hand, an urgent review is required of the different types of operators to remove any regulatory voids that would constitute an incentive to underreport or misreport catches, and other bad practices. It is necessary to design strategies that would allow for a business that is more efficient; in particular, it is important to create an alternative to fishmeal production as it would create more value-added. In turn, this would generate higher revenues for operators with lower quotas and more viable economic activity, thus diminishing incentives to transgress the norm.

5. LESSONS LEARNED

The distribution of fishing quotas between industrial and artisanal fishers was quite successful. However, some fishermen misreport their catches once the quota of the target fish is filled. Strong enforcement of the quotas and control of fishing boats and landing sites is required to avoid exceeding the fishing quotas.

Nevertheless, the closing of the fishers' registry has created a great economic benefit for the fishers in the system, avoiding the change in generations. The fixed quota allocation every year is an asset that can be used as collateral for loans. The possibility to sell quotas is interesting for the fishers, but it can also put their livelihoods at risk when fishermen sell all of their left-over quotas prematurely.

A positive impact of the quota system on the sustainability of the resource, especially the anchovy resource, has yet to be demonstrated. On the contrary, the quotas, as suggested by scientists are far lower than what they were ten years ago. Water temperature evidently plays an important role in the availability of the small pelagic resource, but the misreporting of catches can also contribute significantly to the overfishing of the quota, and thus have a destructive impact on the resource.

Quotas allocation by vessel (IVQ) management of the Peruvian achoveat fishery, in a strong environmental variability ecosystem

R. Bernales, A. Guidice and U. Munaylla

Please refer to the case study presentation available at:
http://www.fao.org/3/CA2440ES/ca2440es.pdf.

Towards a TAC-based Fishery Management in Korea – Experience and Challenges

Jungsam Lee

Please refer to the case study presentation available at:
http://www.fao.org/3/CA2441EN/ca2441en.pdf.

The fishery right of Zhoushan in the Context of Limited Access Management System

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Abstract
In 2017, north Zhejiang introduced a Total Allowable Catches (TAC) system for the gazami crab fishery. This was the first TAC pilot introduced in China's domestic waters. The system established a limit on the volume of gazami crab catches, and the fishery was distributed in accordance with certain restrictions (i.e. prohibited fishing areas for trawl nets). The gazami crab is a central coastal fishery in north Zhejiang and has an important influence on the local fishermen community. This paper aims to discuss the management of the fishery and assess the contributions and challenges of the rights-based approach to achieving sustainability. This paper introduces the countermeasures that prevent negative influences caused by the introduction of a quota system in the region.

1. INTRODUCTION

1.1 Description of the fishery

The gazami crab has a short life cycle, rapid generation transition, early individual maturity, strong fertility and rapid growth, all of which contribute to the economic importance of this species. In recent years, the fishing intensity of the gazami crab grew continuously, which led to a considerable decline in the fishery resource. In 2017, China launched its first TAC pilot on the gazami crab fish in north Zhejiang. This pilot was created in order to experiment with an alternative fishery management system in China—from input control management to input control combined with output control. The TAC pilot project was located at the east of the Zhoushan islands, 30 to 31 degrees north latitude and 122 to 30 degrees east longitude. It covered an area of about 2 300 km^2 or about 1.5 times the size of the Zhoushan continental area.

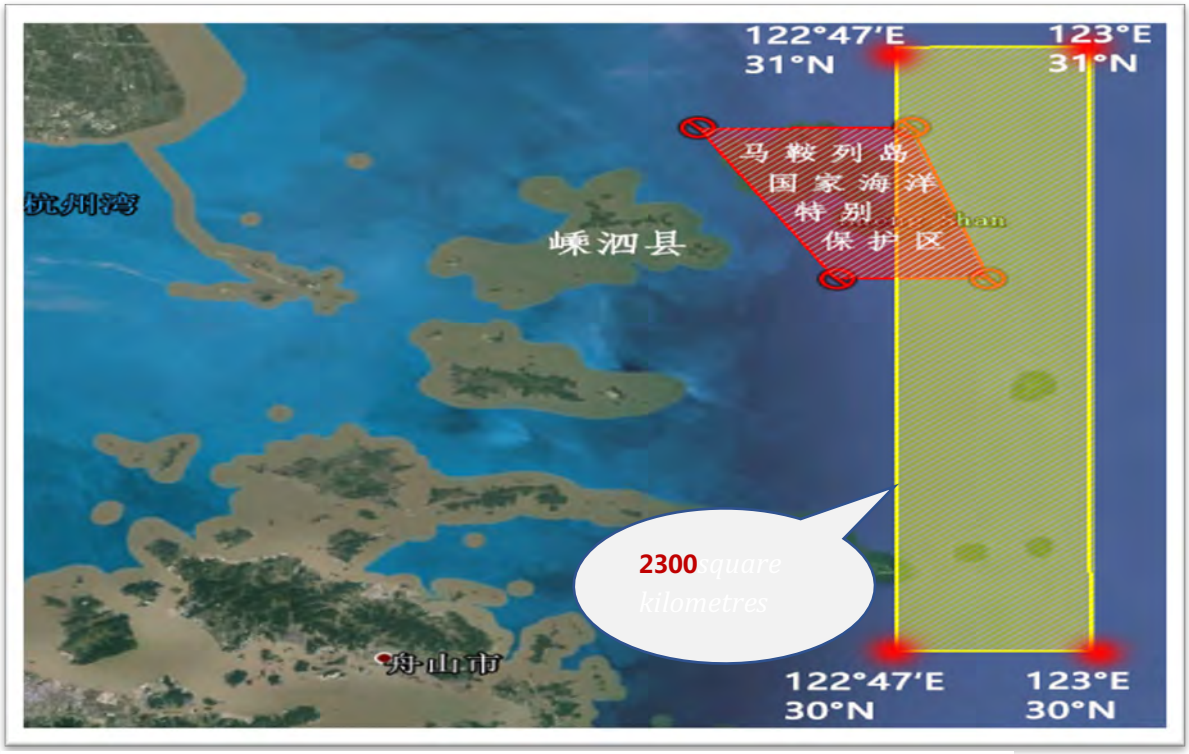

Figure 1. TAC pilot sea area in Zhoushan.
Source: Zhu Wenbin, Zhejiang marine fisheries research institute.

1.2 Economic contribution and social implications of the fishing activity

Zhejiang province is a major marine fishing province in the east sea region. It underwent major economic development in recent decades thanks to the doubling of the price of gazami crab products following the resumption of stream-net operations in the 1970s, and to the declining output of other fish resources. By the 1980s, the catch yield of gazami crab in Zhejiang province exceeded 50 000 tons. By the middle of the 1990s, due to the successful promotion of crab cages, the catch was over 60 000 tons. In 2012, it reached more than 80 000 tons, accounting for 40 percent of the fishing catch in the East China Sea. The catch yield of gazami crab is unprecedented, but the resource quantity of gazami crab is volatile.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

In 2017 and 2018, under the guidance of the Ministry of Agriculture and the Marine Fisheries Research Institute and fisheries organizations, quotas were determined and allocated within a threefold framework: “Sites transaction and quota management plan”, “Supervision and inspection plan for vessels in TAC pilot sea area” and “Resource survey and monitoring plan”. There were then six systems: Designated sites transaction; Fishing logbook; Vessel location notification; At-sea observers; Reward and Punishment.

2.2 Brief history of the former rights-based approaches used in the fishery

Some changes have occurred in the biological characteristics of the gazami crab, such as individual miniaturization, early sexual maturity and single age structure. For this reason, Zhejiang province has adopted a number of positive measures to protect the species. In 1983, it adopted the annual May to June ban period for gazami crab fishing, mainly to protect the gazami crab brood. In 1999, the province implemented limits on the production scale of the main fishing gear—the crab cage and the fixed gill net—and enforced regulations on the fishing period and protected area to manage the crab resources. In 2000, the east sea area banned the main crab cage boats from entering the area because there were too many of them. In 2001, the province adopted a ‘proliferate and release’ method in order to increase the gazami crab stock. During the 2017 Marine fishing moratorium, the fishing period was extended by a month for some fishing vessels including circular and single ship girder (girder pole shrimp), cage pot, gill net, purse seine etc.; the new fishing period is from 1 May, 12 pm to 1 August, 12 pm.

2.3 Rights-based approach: allocation and characteristics

The above traditional “command and control” approach to fisheries management fails to control the volume of catches, which can cause overexploitation and declining fish stocks. Solving the plight of the gazami crab resources and achieving sustainable development and the utilization of effective methods requires limiting fishing management. The gazami crab resource regeneration and supply level must be in a state of balance. In other words, catches must be lower than the regeneration of the species. The implementation of a total allowable catch (TAC) system thus has important strategic significance in this regard.

There are 102 fishing boats in the region, including 73 in Linhai and 29 in Sanmen. The formulation of the total catch quantity takes into account data on the number, yield and output value of fishing boats between 2011 and 2016; the breeding and release time, location and quantity of the gazami crab are also taken into account.

In 2017, the ministry of agriculture (MOA) decided to carry out TAC fishing management of gazami crab in waters north of Zhoushan. The establishment of the TAC is based on investigations conducted by scientific research institutions, following the principle that the growth of biological resources must exceed the catch amount. The government departments allocate the quotas to the fisheries

cooperatives, who can then allocate them to fishermen. The trade of quotas is conducted at sea through the vessel, and under the supervision of monitoring vessels. Finally, the output is reported, and the warning quota is achieved.

Figure 1 is a partial grid map of the area. It excludes the sea area of the national Marine special reserve in Shengsi. The area is grid managed, and each year the fishermen acquire catch waters by drawing lots. The north sea of Zhoushan uses an average distribution method in free distribution. This system reflects the principle of absolute fairness because the amount of quota is the same for each individual unit. While the cost of this allocation method is relatively low, it does not take into account the differences between the subjects in reality. In turn, this may lead to over-allocation or under-allocation of gazami crab resources. To some extent, this is a restriction to the promotion of TAC management of gazami crab.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

Local authorities have identified the hydrological environment characteristics of the pilot water area during the summer vacation, the composition and quantity distribution of gazami crab population along the coast of Zhejiang, and their relationship with the environment (Figure 2). The results show that environmental factors such as water depth, bottom dissolved oxygen and surface bottom salinity had a great influence on population distribution in spring. In autumn, environmental factors such as salinity, water depth and temperature at the bottom layer had a great influence on population distribution. The impact of the whole fishery on the biological and ecological environment was understood through the observer plan. According to the analysis results of the observer, a total of 42 species were found to be caught concurrently, with an average proportion of less than two percent.

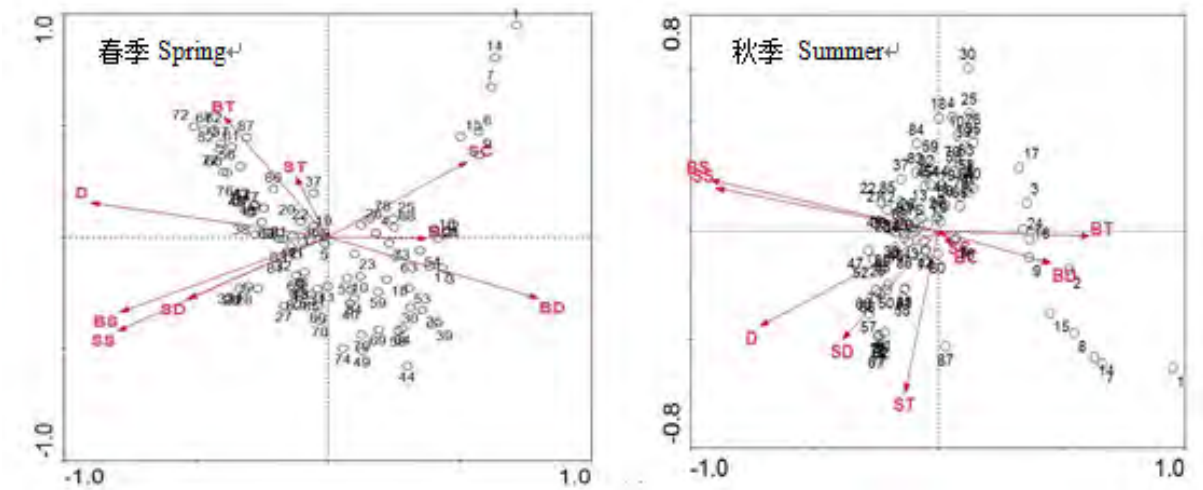

Figure 2. The relationship between population distribution and environment.

3.2 Economic viability of the fishery

The total catch in 2017 was 1 612 tons, which represents 50.39 percent of the TAC (3 200 tons). The official pilot period was from 16 September to 31 May. The actual fishing period is from 1 October to 15 January. The effective harvesting in the TAC pilot area averaged at 1 559 vessels per day, the number of gillnet pieces was 0.768 million in total, and the average CPUE was 2.1 kg/P. Overall, the first year of TAC was half-complete. Since the basic data set by the TAC is derived from fishermen's self-reports, it is reasonable to believe that during the first year of the pilot scheme, fishermen reported high production for fear of insufficient quotas.

3.3 Social equality

The pilot boats came from the same community, the boats were relatively uniform in size, and the fishermen were familiar with each other and supervised each other. Self-discipline and management skills have proven important to reduce frictions and contradictions between the fishermen. Autonomous fishing organizations not only provide a way for fishermen to actively participate in fishery management, but also contribute to the implementation of the quota management system. The strict control of autonomous organizations will reduce the cost of quota management.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

The relevant people's understanding of quota management is insufficient. According to the survey, many fishermen, fishery managers and stakeholders in Zhoushan, such as captains, have a lack of knowledge about the content and significance of quota fishing management policy because it has yet to have a profound impact on their work and life.

It is difficult to determine the total resources of *gazami crab*. The production complexity of the entire Zhoushan sea area is much higher than that of the northern sea area mentioned above. First, the area of the sea has increased roughly four-fold with a wider distribution of resources. Secondly, the variety of fishing gear of *gazami crab*, including gill netting (fixed gill netting and streamer netting), crab cage, single trawl and shrimp net, etc., increases the complexity of resource evaluation. Thirdly, there is a lack of comprehensive and long term fishing resource surveys. Fourthly, the proliferation and release of *gazami crab* will only be carried out in Zhoushan once a year.

The allocation of *gazami crab* is difficult. Determining an adequate way to allocate the catch quota is crucial to the implementation effect of quota management. However, the distribution of the northern waters of Zhoushan is barely compatible with quota allocations because of the different fishing intensities of the gazami crab in different waters. For instance, in the last ten years, the gazami crab catch in Daishan county has been four times as much as in the Punto district, 4.9 times higher than in the Shengsi county sea area, and 28.6 times higher than in the Dinghai county sea area. In addition, the fishermen use different fishing boat types as well as different gazami crab fishing tools, including the crab pot and gill net home but also shrimp nets, trawls single, double girder rod trawl etc., which make the scales of different operations difficult to grasp and the allocation of gazami crab quotas between areas very difficult.

Real-time monitoring of catch is very difficult. Firstly, the Zhoushan area includes many different types of fishing boats. The fishing gear for gazami crab fishing is diverse as well, including gill net (streamer net and fixed gill net), shrimp net, bottom trawl and other strong catch. Even installed camera equipment can be insufficient to evaluate the specific number of gazami crabs in marine productions. Secondly, the operation at sea takes a long time. Thirdly, in order to maximize their profits, some vessels carry quotas from several fishing vessels in addition to their own. It is, therefore difficult to define the traceability of the catch.

4.2 Improving fishery sustainability in the future

The first goal is to strengthen the influence of limited fishing management. There are some misunderstandings among the people involved in the fishery regarding the basic principles of the TAC system; there are also some fishermen or fishery companies that could be considered more egoistic and are therefore less apt to accept the TAC management system. Managers should publicize and guide the fishermen and their stakeholders, strengthen communication and contact with the fishermen in the management process, and ensure that the fishermen express their concerns in order for them to feel like the TAC system is beneficial to them in the long run and does not deprive them of their wealth.

The distribution of quotas should be equivalent to the distribution of wealth. When one navigates the rivers in the north of Zhoushan, it becomes obvious that the region will not survive more complicated water conditions. Therefore, the countermeasures against the allocation of quotas are discussed as follows. Firstly, there are two ways to choose the subject of quota: one is the fisherman as the subject of allocation, and the other is the fishing boat as the subject of allocation. Second, the determination of the executors of allocation quotas can be implemented by introducing community management. Finally, for the selection of a quota allocation method, the following options are available: (1) the distribution can be based on the percentage of catch of gazami crab in the specific county of this sea area; (2) distribution according to operation mode and proportion of catch obtained by main fishing gear of gazami crab; (3) distribution in accordance with the flood season of gazami crab; (4) distribution according to fishing effort; (5) distribution is conducted freely and through auction; (6) when the fishermen want to withdraw from the fishing or the quota has surplus, the ITQ system can be implemented to transfer the quota under the supervision of the government. It is conducive to increasing the income and resources of fishermen to be fully utilized.

The total allowable catch is the core of the implementation of quota catch. In this implementation process, a reliable and effective supervision and monitoring system is needed to comprehensively monitor the issuance of quotas and the transaction process of catch to provide security for the total allowable catch. Zhoushan sea area has a large fishing capacity, numerous fishing ports, and vast shore trading regulations. These regulatory measures are not sufficient for the vast sea area in northern Zhoushan; they must be complemented by an effective monitoring system at the shore.

Finally, there could be improvements in terms of social stability. The limited gazami crab resources coupled with the excessive fishing capacity, the limited efforts to solve the excessive fishing, the need to guide the fishermen multi-functioned gathers, but also for subsequent compensation mechanisms to solve fishermen’s livelihood problems will all require a number of countermeasures. First, to consummate the fishermen multi-functioned gathers subsidy measures. Second, through appropriate regulation of market prices to ensure fishermen's sales income. Third, to improve the social security system in fishing areas such as medical insurance, endowment insurance and unemployment insurance. Fourth, to establish a fishery compensation fund.

What are the key factors for a successful design and implementation of a right-based system in the allocation of fishing opportunities in the demersal fisheries in Sweden?

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Abstract
With a background of the needs created by the landing obligation, the Swedish Agency for Marine and Water Management (SwAM) in 2017 introduced a system with individual annual fishing opportunities that can be temporarily transferred between fishermen during the year. The individual allocations are, with some exceptions, based on reported catches during the reference period 2011-14. The design of the system paid particular attention to small-scale coastal fisheries fishing with passive gears for which unallocated quotas are reserved. The new system means increased flexibility and better possibilities for individual fishermen to adjust their fishing opportunities during the year, which probably gives them better possibilities to comply with the landing obligation. The first year with the new system has recently been evaluated by SwAM. The evaluation showed, among other things, that the number of quota transfers was already high in the first year. At the same time trade frictions existed (e.g. difficulties to find someone who could transfer fishing opportunities). There are also other challenges connected with the system. Although the system allows for increased flexibility, quotas may still be limiting at the individual level. Given economic incentives to maximize the value of the own fishing opportunities, this may affect compliance as it creates incentives for high-grading and discard of unwanted by-catches. Another concern is that since the fishing opportunities are only annual, fishermen face uncertainty about what fishing opportunities and income they will have the coming years. A further challenge is that various "lock-in" effects can be observed in the present system. In case the system would be adjusted to allow for longer-term fishing rights, the design of such a system is of critical importance in order to avoid unwanted effects.

1. INTRODUCTION

1.1 Description of the Swedish demersal fisheries

The Swedish demersal fisheries can broadly be divided into the following fisheries: nephrops fishery, fishery for northern prawn, white-fish fishery and fishery for cod in Baltic Sea. Fishing is carried out with both passive and active gears, where active gears are responsible for the greatest shares of catches. The fisheries for nephrops, northern prawn, and cod in Baltic Sea is described a little closer below.

Nephrops fishery

The Swedish fishery for Nephrops takes place with the following gear categories: pots, bottom trawl and bottom trawl with grid. Before 2017, when individual allocations were introduced, the nephrops quota was divided among these three gear categories in order to ensure a high use of selective gears (trawl with grid and pots).

The conditions for those who fish for nephrops changed in many ways since 2017. The new system of individual annual allocations was introduced from 1 January 2017 and, at the same time, the European Union's effort system (which regulated fishing effort in kilowatt days/days at sea) was abolished. This meant greater freedom for fishermen fishing with trawl/trawl with grid to allocate their fishing effort

using the gears for which they have permits. In addition, because individual allocations were introduced, no breakdown of the nephrops quota for the different gear categories was made.

The development of gear utilization in this fishery is therefore, important to follow. During the year 2017, an increase of fishing effort with trawl without grid was observed. This is worrying since, given compliance of the landing obligation, a higher use of trawl with grid would instead be expected.

While the new system gives better opportunities for individual fishermen to plan their operation and probably also provides better conditions to avoid choke species and species for which they have low or no quota, one must also be aware that incentives for illegal discards exist. This is due to economic incentives to maximize the value of their own fishing opportunities. This also shows the importance of monitoring.

Fishery for northern prawn
Another important Swedish fishery is the Northern prawn. In Sweden, there are at present 62 permits/vessels fishing for northern prawn. Regarding the allocation of fishing opportunities, this fishery is subject to the system of individual annual allocations. Data on landing sizes indicate that illegal high-grading might exist in this fishery, which is a challenge to be handled in the management in this fishery. Another issue is that many of the vessels do not have high activity and just fish sufficiently to keep their permits.

Cod in the Baltic Sea
In the Baltic Sea, fishing for cod takes place with bottom trawl and with passive gears. In the last years, the quota utilization in this fishery has been very low, and the number of active fishermen has decreased compared to 5-6 years ago. Individual fishermen have not been restricted by their allocated fishing opportunities (the trawl fishery is covered by individual annual allocations). Instead, other factors explain the low quota utilization (low-quality fish, low prices). Also, in this fishery, data indicate that illegal high-grading exists.

1.2 Economic contribution and social implications of the fishing activity
Swedish fishery is dominated by small companies. In 2008, there were 1 211 companies active in professional fishing, which together had about 2 000 employees. During 2015, there were 968 companies. Between 2008 and 2015, the number of registered and active fishing vessels decreased from 1 150 to just under 1 000.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery in Sweden
In Sweden, the Swedish Agency for Marine and Water Management (SwAM) has the overall responsibility for how fishing is carried out and which rules apply. This also includes fishing licenses, gear permits and allocation of fishing opportunities. Another agency, the Swedish Board of Agriculture, has the task of promoting fisheries and is responsible for a marine and fisheries program.

When it comes to the allocation of fishing opportunities in the Swedish demersal fisheries, many changes have recently taken place. In order to create better conditions for the Swedish demersal fisheries to comply with the landing obligation, annual individual fishing opportunities were introduced in 2017. The first year with the new allocation system (2017) has been evaluated by the SwAM. The evaluation was largely a descriptive analysis summarizing data on, for example, quota utilization (on national and individual level), quota transfers, reported discards and gear use. In addition to the descriptive analysis, a survey among fishermen was conducted. The questions in the survey aimed to improve knowledge about how fishermen perceive regulations, what they think about

the new allocation system and whether it gives them better conditions to comply with the landing obligation, and whether there were frictions in the quota transfer market.

The results of this evaluation and the identified challenges for the future will be described in this case study.

2.2 Brief history of the former rights-based approaches used in the fishery

Allocation of Swedish demersal fishing opportunities before 2017
Until 1 January 2017, a system of catch limits, on a weekly or monthly basis, was applied for several demersal species in the North Sea. For nephrops, plaice, cod, haddock and cod (and the pelagic species mackerel), catch limitations were applied per week, while catch limitations per month were applied to Northern Prawn (with a possibility to temporarily transfer quantity since 2015). Furthermore, fishing with cod catching gear in the North Sea was limited by a fishing effort system, which required a special permit (effort permit) and fishing restrictions by kilowatt days (days at sea) for vessels with a length of at least 10 meters. A total number of kilowatt days were determined for different Member States each year by decisions in the EU Council of Ministers, which was then distributed nationally between the fishing vessels through the effort states. For fishing with bottom trawl equipped with grid (which was exempted from the EU's effort regulation), Sweden applied a national effort system. The EU abolished the system of kilowatt days in 2017. In the Baltic Sea, special permission was required for vessels of at least 8 meters in length using cod catching gears (which is also the case today). Trawling for cod in the Baltic Sea was regulated by a system of catches per year. This fishery was also regulated by a maximum number of days a vessel was allowed to fish during the year. Part of the quota was also annually allocated for passive gears.

2.3 Rights-based approach: allocation and characteristics

Background to the introduction of the new system: the introduction of the landing obligation
Within the framework of the EU's Common Fisheries Policy, an obligation to land the catches of all quota species is introduced gradually between 2015 and 2019. This new regulation, the landing obligation, aims to limit unwanted catches and discards. The goal is to minimize discards and accelerate the development of more selective fishing. The regulation means that all catches of quoted species, as a basic rule, shall be reported, landed and deducted from the quota. Even whitefish and seafood under a minimum size shall be landed and quota-deducted. The landing obligation is introduced step-by-step between 2015 and 2019 and will be fully implemented in all the fisheries on 1 January 2019.

2.4 The introduction of the new rules for the distribution of demersal fishing opportunities
The introduction of the landing obligation places great demands on adaptations of different parts of the management, for example, with regards the allocation of fishing opportunities. How to allocate fishing quotas nationally is one of several tools that the EU Member States are expected to use in order to adapt management to landing obligations. Due to the landing obligation, SwAM investigated during 2015-2016 whether the previous system of allocating quotas in demersal fisheries was compatible with the new regulations. There were a number of consultation meetings with various stakeholders on the matter. In the fisheries industry, discussions about the allocation of fishing opportunities during a landing obligation were also initiated in cooperation with the EDF (Environmental Defense Fund).

SwAM made the assessment that the previous system of distributing demersal fishing opportunities for a variety of reasons was incompatible with the landing obligation. One of the reasons was the contradiction of the catch limit system with the obligation to land all catches of quota species with the many "breakpoints" where catches have to be matched to the permitted catches and where excessive catches are risked to be discarded. Another reason was the risk of fishing stop for all gears at risk of

catching a specific species if the quota of that species ended before the end of the year. In the previous system, there was also no possibility for fishermen to plan their fishing during the year, as they had to consider the weekly/monthly catch limits.

In 2014, SwAM was given the legal right to introduce annual individual fishing opportunities that may be temporarily transferred during the year. A proposal for a design of such a system was submitted in the fall 2016, and the new regulations entered into force on 1 January 2017. The main goal of the new system was to facilitate the introduction of the landing obligation by creating better conditions for individual fishermen to comply with the landing obligation. In the design of the system, particular attention was paid to small-scale coastal fishing by establishing so-called coastal quotas, which were not distributed on an individual level. In total, seventeen demersal quotas were allocated individually.

Following approval from SwAM, the demersal fishing opportunities can be transferred between fishermen during the year. Quota transfers are denied if they, for example, mean that concentration levels are exceeded or that the transfer is considered to be in violation of compliance with the landing obligation. The individual allocations are based on historical catches during the reference period 2011-2014, where the least good year by species and quota area were eliminated. Some adjustments to historical catches have been made (such as allocation of by-catches and "base levels"). Another model than historical fishing was used for the allocation of Northern Prawn as this was suggested by the industry.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Evaluation by SwAM of the first year with the new system to allocate demersal fishing opportunities in Sweden

3.1.1 Purpose and limitation of the evaluation

The new distribution system introduced in demersal fishing on 1 January 2017 aims at creating better conditions for individual fishermen to adapt their fishing opportunities and comply with landing obligations. It is one of several tools aimed at enabling the implementation of the landing obligation. The first year with the new system, 2017, was evaluated by SwAM in the spring of 2018.

The primary purpose of the initial evaluation of the system was to evaluate how it has helped to increase the opportunities for individual fishermen to comply with the landing obligation. As a successful implementation of the landing obligation also means compliance with the discard ban, the evaluation also analyzed if the system contributed to compliance with the landing obligation. The evaluation also reviewed how the system administration worked out during the first year. Finally, a description of certain "lock-in" effects was made. The purposes of the evaluation are summarized below:

- The contribution of the new system to facilitate the introduction of the landing obligation.
  This means to evaluate how the system:
  - facilitates the compliance of fishermen with the landing obligation
  - contributes to incentives for compliance. For example, how it contributes to the non-occurrence of illegal discards.
- Evaluate how the administration of the system, such as practical handling of transfers, has worked out in the first year. What worked well and what could be improved?
- Identify lock-in effects in the present system.

As only one year has passed since the new distribution system came into force, not all aspects could be included in the evaluation.

3.1.2 Methods used in the evaluation

The following methodologies were used in the evaluation:

- Data compilation (catches and quota utilization, reported discards, observed changes in fishing patterns and gear use, transfers of fishing opportunities, fishing efforts, etc.).
- Survey to fishermen.

The evaluation largely consists of a descriptive compilation of data from 2017. The possibility of assessing the effects of the introduction of the new system on the basis of such an analysis is limited. Major changes in management systems, such as the introduction of the new way to allocate fishing opportunities, can be expected to affect behaviour and fishing patterns in a variety of ways, which are often difficult to predict. Behaviour can also be affected by the fact that it was the first year with the new system. There are also many other factors that may be behind altered patterns, such as natural variations in the occurrence of species. Therefore, it is difficult to distinguish to what extent changed patterns depend on the system to allocate fishing opportunities.

The survey was sent in May 2018 to a total number of 244 fishermen, which are all part of the system with annual individual fishing opportunities. A total of 111 responses were received, corresponding to a response rate of 45.5 percent. The survey was to complement the descriptive part of the evaluation. Its purpose was to give the management a better picture of how fishermen perceive rules and regulations (as this, in turn, may affect willingness to comply with rules) and to give an understanding of how the transfers of fishing opportunities have worked out the first year (is it difficult to find someone to transfer quota?). The survey also had some open questions where the respondents could comment on what they see as advantages and disadvantages of the system to allocate quotas and suggestions for improvements they have.

3.1.3 Some main observations in the evaluation

Some of the main observations in the evaluation of the new system to allocate demersal species are summarized below:

- The new system means increased flexibility and better possibilities for individual fishermen to adjust their fishing opportunities during the year. The survey showed that many fishermen find the increased planning possibilities to be an improvement.
- The quota utilization in 2017 was low for many demersal quotas in Sweden. According to the evaluation, this seems to be due to a combination of factors such as the fact that many fishermen have been "cautious" and did not want to risk running out of quota and because of natural variations in the availability of fish. There are also indications that quota has been locked in because of frictions in the quota trade market (difficult to match buyers and sellers). If illegal discards have taken place, then this means that the quota utilization on the paper is lower than in reality.
- The survey and the descriptive statistics show that there were trade frictions in transfers of fishing opportunities, as also mentioned above. Many fishermen found it difficult to find certain quotas, although as indicated by the low quota utilization, there were quantities left. Several of the survey respondents mentioned that during the first year, the quota market was not working well enough.
- Despite the frictions in the quota trade market, a large number of quota transfers took place during the first year. The e-service provided by SwAM is considered easy to use.
- In the nephrops fishery with trawl, the use of less selective gears (i.e. trawl without grid) increased during 2017. As described above, 2017 meant major change for those who fish for nephrops with a bottom trawl. The effort system (days at sea) was abolished and individual allocations introduced. This meant greater freedom and planning possibilities, and greater possibilities to choose gear (as long as you have a gear permit). The trend in gear use during 2017 is worrying with regards to compliance and may suggest that the system must be combined with increased gear regulations.
- In the Baltic Sea, codfish after cod have not been limited by their individual allocations, but the low quota utilization is due to other factors (low prices, low-quality fish, etc.).

3.1.4 Conclusions, discussion and analysis

Has the system contributed to facilitating the ability to comply with the landing obligation?
In Sweden and in the other EU Member States, choke species have been considered one of the major challenges associated with the introduction of the landing obligation. Choke species refer to quotas caught in several different gear/fish and whose national quota is likely to end before the end of the year. Distribution of fishing opportunities is considered one of several tools to handle this challenge. Other tools include the development of more selective tools, changing fishing patterns, exempting landing obligations, national quota changes and flexibility rules.

By introducing individual responsibility for fishing opportunities, the need for collective fishing stops as a result of quota closures is reduced. This was one of the reasons that a system of individual fishing opportunities was considered better suited to landing obligations compared to the previous system (with catch limitations). However, fishing opportunities can be limiting at the individual level, despite increased planning possibilities and transfer opportunities, if for example there are large differences between quota composition and catch composition (which is the case for the Swedish mixed demersal fishery).

If only looking at quota use at the national level, the low quota utilization may give the idea that limiting species were not a problem in 2017. However, the low quota use may be due to several different reasons. The ability to plan fishing over the year may have contributed to the fact that fishermen could, to a greater extent, avoid catches of quotas for which they have low allocation. In addition, there are other factors that may have affected this phenomenon as well, such as weather and nature. Although quota use has been far from full for many species, the evaluation showed that is has been difficult to find available quantities of these species. Another reason for the low quota use may be illegal discards. When comparing the catch composition in trawl fisheries (without grid) in the North Sea, it deviates substantially from the expected catch composition, which is quite remarkable. This might indicate that illegal discards are taking place.

It is difficult to determine how the system, during the first year, contributed to managing the challenge with choke species. It is, for example, difficult to know which of the transfers were intended to handle this particular issue. However, the high number of transfers in the year 2017, of both target species and those that can be caught as by-catch, is a good sign that the desired flexibility of the system is working quite well already the first year.

Individual allocation of fishing opportunities and incentives
In a system of individual annual allocations, everyone must relate to the fishing opportunities they have been allocated and/or that they obtained through temporary transfers. In order to be able to fish throughout the year with the quotas allocated to a license holder, it may be necessary to adapt fishing patterns, fishing methods, equipment use and, if necessary, try to use the possibility of temporary transfers. The requirements for such adjustments will be particularly important if the composition of quotas available in fisheries today does not match the catch composition in previously engaged fishing. There is also an economic dimension to consider; economic incentives to maximize the value of their fishing opportunities can in the worst case lead to illegal discard of bycatches for which the quota is missing or subject illegal high-grading

Prior to the introduction of the landing obligation, the imbalance between catch and quota composition seemed to be one of the major challenges, given previous fishing patterns and catch compositions. Because of the high quota on nephrops and low quotas for fish (such as cod), one would expect a higher usage of more selective tools, such as grid. Therefore, the increased use of trawl with grid is remarkable.

The fact that the economic incentives for discards are contained in systems with individual allocations are well known in both theoretical literature and practical experience. Research points to several factors that, in addition to fisheries control, affect regulatory compliance. In addition to the traditional economic factors, literature addresses factors such as personal perception of fairness, regulatory legitimacy, perceived involvement in the design of rules, norms, social control and how one experiences the ability to comply with the regulations (which could, for example, be that the individual allocation of different quotas is in line with the catch composition). If the individual allocation of quotas is deemed unfair, too small or incorrect, it may contribute to incentives for non-compliance. In view of the above research and experience, and given the fact that many of those who fished a mixed fish fishery (without grid) in the North Sea probably have a combination of individual fishing opportunities that do not match the catch composition of previously engaged fishing, it is likely that financial incentives for illegal discards exist.

Quota utilization, transfers and possible lock-in of fishing opportunities
The possibility of transfers during the year is an important part of the system as it is this part that is intended to contribute to the flexibility and ability to adapt their fishing opportunities to the landing obligation requirements.

The low quota use of many demersal quotas in 2017 appears to be due to a combination of different factors, including the fact that many have been "careful" and wanted to be sure of remaining fishing opportunities until the end of the year and that there were trade frictions in the market for transfers. Many questionnaires suggest that the matching of transferees and receivers did not work well enough.

There is, therefore, a need for improvements in the match of transferees and recipients in order for fishing opportunities to be used by those who need them. Of those responding to the survey, there was a relatively high proportion that stated that they were unable to acquire fishing opportunities due to their inability to find available quantities (25 percent of respondents) or because the demanded compensation was too high (16 percent of respondents). Although the number of transfers was high during the first year of the new system and the e-service that SwAM provides is considered easy to use, the evaluation suggests that some of the quantities may have been locked in because of frictions in the market.

3.2 Sustainable use of the resources
As indicated in the description above, the new system to allocate demersal fishing opportunities in Sweden was introduced in order to create better conditions for individual fishermen to comply with the landing obligation through better planning possibilities and more flexibility.

However, the presence of economic incentives for illegal discards (high-grading and discard of bycatches) is a challenge. With regards to sustainable use of the resource and the compliance of the landing obligation, it is important to consider this in future adjustments in the management.

3.3 Economic viability of the fishery
According to an annual report on balance between fleet and fishing opportunities, which EU member states annually have to submit to the Commission of the European Union, economic indicators show critical values only for the segments fishing with passive gears. For trawl fisheries, the report shows no critical values for the economic indicators.

Annual allocations mean uncertainties in income from year to year. For example, it may be unclear if one can do the same quota transfers each year. This has also been pointed out by respondents in the survey to fishermen. Several of the respondents hope that the system will be further developed to a system of long-time fishing rights.

3.4 Social equality

Taking account of social considerations may mean for example protection of small scale fisheries, regional concerns, recruitment of fishermen and avoidance of ”harbour death”. In the new system of annual individual fishing rights in the Swedish demersal fisheries, social considerations are made in different ways. For example, unallocated quotas are set aside for the small scale fisheries, concentration limits are applied, and there are in some cases rules for how transfers can be made. In 2018, regional quotas of cod were introduced for the regional trawlers fishing for cod in the Baltic Sea.

4. MAIN CHALLENGES AND WAY FORWARD

The new system means increased flexibility and better possibilities for individual fishermen to adjust their fishing opportunities during the year, which probably gives them better possibilities to comply with the landing obligation. It may however, also be concerned with challenges that have to be considered in future adjustments of the system. For example, although the system allows for increased flexibility, quotas may still be limiting at the individual level. This, in turn, may affect compliance (illegal high-grading and discard of by-catches) because of economic incentives to maximize the value of one’s own fishing opportunities.

Another concern is that since the fishing opportunities are annual and can only be transferred during the year, individual fishermen’s long-term planning is impeded because of uncertainty about what fishing opportunities and income they will have in the coming years. This may, in turn, contribute to a reluctance to invest in better and environmentally friendly technology. Also, in the survey to fishermen, several respondents commented that although they think the new system is an improvement, they would prefer a system with longer-term fishing-rights.

Another challenge is that various “lock-in” effects can be observed in the present system. This relates to the presence of “quota vessels” and license holders who are not active fishermen. The current system of annual allocations in combination with the catch requirements for renewed permits, which gives an individual allocation of fishing opportunities for the next year, has led to a situation where fishing vessels with no real fishing operations remain in the system. The fact that fishing license holders want to keep permits/ships even though they do not conduct any real fishing may be due to several factors. For example, they may want to keep the licenses for the future, or they may want the fishing opportunities to be transferred to another vessel where the fishing is actually carried out. Keeping these "quota vessels" in the system involves a cost for the fishing companies, and it implies a burden on the environment.

At the moment, the SwAM has no legal possibility to introduce a system with permanent or long-term fishing rights for the demersal fisheries in Sweden. In case the system would be adjusted to allow for longer-term fishing rights, the design of such a system is of critical importance in order to avoid unwanted effects. Such unwanted effects include, for example, a too high concentration of fishing rights by certain actors and/or in certain regions and unwanted structural change. However, it might be a way to increase profitability for active fishermen, and thereby also improve compliance. It might also be a way to mitigate the lock-in effects described above.

A key question is, therefore, how to successfully design and implement a right-based system in the allocation of fishing opportunities in the Swedish demersal fisheries.

This raises, for example, the following sub-questions:

- Initial allocation: What is the role of the initial allocation of fishing rights and their duration?
- System design and social goals: How can goals regarding consideration and protection of the small scale fisheries be met in a right-based system? How can unwanted structural change connected with unwanted capitalization and high prices be avoided?

- System design and compliance: What are the key factors for achieving compliance with regulations? How can the challenge of limiting quotas and choke species be met?
- System design and environmental concerns: How can incentives for use of selective and environmental friendly gears be created? How can an ecosystem approach be considered within a right-based system?

Pacific Groundfish

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Abstract
In 2011, the Pacific Fisheries Management Council (the Council) established a catch-share program for the Pacific Groundfish Fishery which spans the entire West Coast of the U.S. Catch-share programs typically divide the total allowed a quota of fish among fishermen, with each quota owner getting a certain percentage of the total. At the time of implementation, the Council established an Adaptive Management Program (AMP) that reserves ten percent of the quota to address any potential issues that arise from the implementation of a catch-share system. The five potential issues that were identified by the Council at the start of the program were barriers to new entrants, community stability, processor stability, conservation, and any other unintended consequences of the catch-share. During the first few years of the catch-share program, the AMP quota was passed through to the fishermen to avoid any disruption to fishermen's livelihoods. After the first few years, the Council could not determine any pertinent issues or ways to address those issues with the ten percent quota, so the pass-through to fishermen continued. Now, with an upcoming five year review of the program, the Council will be deciding whether to permanently pass the ten percent AMP quota through to fishermen, effectively removing the AMP from the catch-share program, or to determine some more permanent plan for it. For our capstone project over the next year, we will be evaluating policy options for the AMP quota, determining if there are alternative uses for it that could address any issues within the fishery, or if it should be permanently allocated to fishermen. Our client, Frank Lockhart, Program Director at the National Marine Fisheries Service (NMFS) West Coast Region, has identified three specific issues that he feels are the most important to consider in our evaluation: 1) barriers to new entrants, 2) community stability, and 3) processor stability.

1. INTRODUCTION

1.1 Description of the fishery

This case study examines the U.S. West Coast Pacific Groundfish Fishery. The fishery spans along the west coast, from California to Washington, including Oregon. The fishing grounds are located in the open ocean, offshore areas within national jurisdiction. There are 90 plus species being caught in the fishery, including pacific cod, pacific whiting (hake), rockfish, and sole. The Shorebased IFQ Program allocated quota to permit owners for 30 different groundfish species and rockfish complexes, and individual bycatch quota for Pacific halibut, based on catch history (Guldin et al*.,* 2017).

The areas are, from south to north: Conception - Southern boundary of EEZ to 36^{o}00' N latitude Monterey - 36^{o}00' N latitude to 40^{o}30' N latitude Eureka - 40^{o}30' N latitude to 43^{o}00' N latitude Columbia - 43^{o}00' N latitude to 47^{o}30' N latitude Vancouver - 47^{o}30' N latitude to northern boundary of the EEZ (Figure 1). The groundfish fishery has had a limited entry (LE) system based on license limitation since 1994. Under the LE system, vessels were given limited entry permits (LEPs) based on their catch history. LEPs are endorsed for use with trawl and/or fixed gears. There is a smaller portion of the commercial groundfish fishery that is not permitted and is the open-access fishery. The gears in the open-access fishery include longline, vertical hook and line, troll, pot, setnet, trammel net, shrimp and prawn trawl. Open-access trawl gear cannot be used to target groundfish but may land incidental groundfish as bycatch. Open-access trap/pot and longline vessels may target groundfish under certain restrictions. The IFQ program was implemented for the limited entry trawl sector.
The sectors of the fishery are further described as seen on the NOAA website, below:

- Limited entry trawl. This sector is comprised of fishermen with limited entry permits endorsed for trawl gear, including bottom and pelagic trawls. The limited entry program limits the number of vessels allowed to participate in a fishery. This sector is rationalized in a system of individual fishing quotas and harvest cooperatives. Visit our Groundfish Amendment 20 for more information.
- Limited entry fixed gear. This sector is comprised of fishermen with limited entry permits endorsed for line or pot/trap gears. Those limited entry fixed gear permits with a sablefish endorsement are able to target sablefish during the primary season (April through October) to catch individual vessel limits (termed tier limits) of sablefish. While sablefish is the primary target species in this sector, limited entry fixed gear fishers also target other groundfish species such as rockfish.
- Open access. This sector of the groundfish fishery is comprised of fishers targeting groundfish without limited entry permits, and fishers who participate in non-groundfish fisheries that incidentally catch groundfish. Trawl gear may not be used in the directed groundfish open access fishery. Trawl gears for target species such as pink shrimp, California halibut, ridgeback prawns, and sea cucumbers are exempted from this rule.
- Recreational. This sector includes anglers targeting groundfish species and others who target non-groundfish species but who incidentally take groundfish under recreational gears and regulations. The West Coast recreational fisheries are managed by the coastal states with management coordinated in the Council process.
- Tribal. This sector is made up of tribal commercial fishers who have a federally recognized treaty right to fish for federally managed groundfish in their “usual and accustomed” fishing areas. These tribes, all located in Washington state, include the Quinault, Hoh, Quileute, and Makah. Formal allocations to these tribes exist for sablefish, and Pacific whiting. Other groundfish species allocations for this sector are decided by annual Council action.

There is evidence that participants in the catch share program are taking advantage of increases in flexibility. Harvesters and processors have altered their participation in non-catch share fisheries, days at sea, the timing of landings, the number of fishing trips, the location of landings, participation in co-ops and risk pools, diversification, gear switching, carryover of quota and exiting the fishery.

When the Council implemented the IFQ program, it included a provision that allows participants with LEPs to fish their quota pounds with trawl or any other legal groundfish gear, referred to as “gear switching.” Most vessels that have taken advantage of this provision are those utilizing fixed gear prior to implementation and that typically target sablefish. Gear-switching was intended to allow the flexibility for each vessel to choose the most profitable fishing strategy, as well as for environmental reasons, because fixed gear was thought to have fewer habitat impacts. Since implementation, an average of 16 vessels have taken advantage of the gear-switching provision each year, and an average of six vessels switched from using trawl to using fixed gear for part of the year. An additional average of 10 vessels from 2011 to 2015 purchased or leased trawl permits and quota to fish with fixed gear in the IFQ program.

Since there was not 100 percent observer coverage prior to IFQ implementation, NFMS does not have exact data on total number of trips from 2005 to 2010, but have approximate data using fish ticket data. The number of trips decreased post implementation, and average delivery size (pounds of IFQ groundfish) and trip length (hours) increased. Delivery size has increased by about 10 000 pounds on average since IFQ implementation.

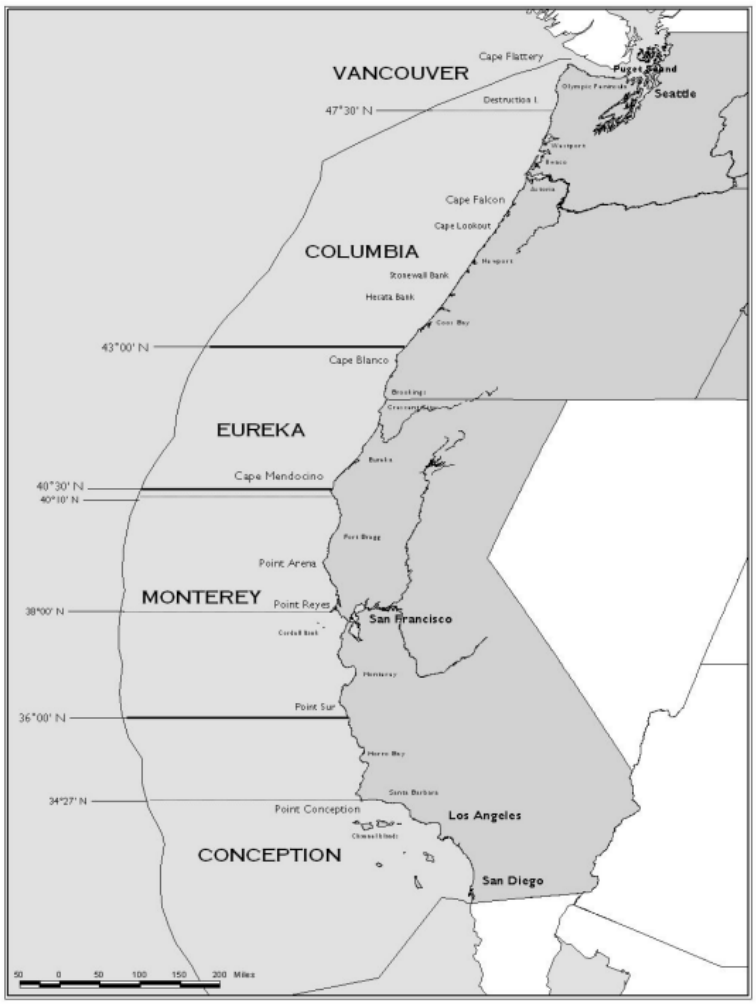

Figure 1. Extent of Pacific Groundfish Fishery.
Source: National Marine Fisheries Service 2018.

1.2 Economic contribution and social implications of the fishing activity

The number of shore based processing companies purchasing Pacific whiting decreased from an average of 12 before IFQ implementation to an average of eight after IFQ implementation. The number of shore based processing companies purchasing non-whiting species remained relatively constant.

To restrict consolidation in the shoreside catch share program and mothership co-ops, the Council limited the percentage of quota share (the long-term harvest privilege) that entities in those sectors may control. Additionally, the amount of annually issued quota pounds that a shoreside vessel may use and hold, the annual amounts that a mothership catcher vessel may deliver, and the annual amounts that a mothership may process were limited. Most vessel account and quota share owners do not currently appear constrained by these limits.

Most crew on catcher vessels are paid a percentage of the total revenue earned by the vessel after certain expenses are deducted. The crewmembers in the groundfish fishery have been in the fishery for an average of 20 years, and they earn an average of 98 percent of their annual income from fishing (in all fisheries, not just the groundfish trawl fishery) (Russell et al. 2014).

Catcher vessels in the catch share program earn only about 50 percent of their annual revenue from the catch share fishery (data available on FISHEyE). They participate in a wide variety of other activities, meaning that the catch share program and other fisheries are interdependent.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

The fishery is managed by the National Oceanic and Atmospheric Administration (NOAA). The Pacific Fishery Management Council (Council) oversees the management of the fishery. The Groundfish Management Team (GMT) provides objective scientific information to the Council, contributing to the development of fisheries management plans. There is also a Groundfish Advisory Subpanel (GAP), which is made up of three fixed gear (at-large) commercial fishers, one conservation representative, two processors, one at-sea processor, three sport fishers, two open access fishers, three trawlers, four charter boat operators (one each for Washington and Oregon, and two for California), and one tribal fisher. The general purpose of the GAP is to advise the Council on management decisions. Input from all the groups are considered, but the Council makes the final management decisions.
Below are general processes used to regulate groundfish harvests found on the NMFS website. Since these processes can take up to six months, they may be streamlined for some decisions.

- **The process for controversial or complex issues** takes at least three Council meetings. Proposals for management measures may come from the public, from participating management agencies, from advisory groups, or from Council members. If the Council wants to pursue these proposals, it asks for other possible solutions to the problem being addressed and then directs the Groundfish Management Team (GMT), the National Marine Fisheries Service (NMFS), and/or Council staff to prepare an analysis. At the next meeting when such a proposal is on the agenda, the Council reviews the analysis and chooses a range of alternatives and possibly a preliminary preferred alternative. The analysis is then made available for public review, and the Council makes a final decision at the next meeting the item is scheduled.
- **The biennial management process** was implemented in 2003 through Amendment 17 to the groundfish FMP and is detailed in Council Operating Procedure 9. Under the biennial cycle, eligible management measures are implemented for a two-year period and adjusted through the routine in season actions. Those management measures not eligible for implementation within the biennium can be considered for future action by the Council in June of the even years (e.g., June 2014). Separate harvest specifications (overfishing limits [OFLs], acceptable biological catches [ABCs] and annual catch limits [ACLs]) are identified for each year in the two-year period. This cycle provides more time for the Council and NMFS to work on other critical groundfish issues and more time for public comment. At least a three-meeting process (typically September, November, April, and June) is used to decide biennial harvest specifications and management measures:

o September (in odd years): the Council adopts final preferred OFLs and range of ABCs where possible and provides initial fishery management guidance, including a range of new management measures for preliminary analysis
o November (in odd years): the Council decides on a preliminary range of harvest levels, including ACLs, for public review and range of management measures for more detailed analysis
o April (in even years): the Council decides final harvest levels, and decides preliminary management measures for public review
o June (in even years): the Council decides final management measures

2.2 Rights-based approach: allocation and characteristics

The fishery is managed through an Adaptive Management Program (AMP), which includes an Individual Fishing Quota (IFQ) program for the shore based trawl fleet, and cooperative programs for

the at-sea mothership and catcher/processor trawl fleets. Quota was initially allocated based on historical catch. Ten percent of the quota was reserved at the start of the AMP to address any potential issues that could arise from the implementation of a quota share system. The five main issues identified by the Council included barriers to new entrants, community stability, processor stability, conservation, and any other unintended consequences of the catch-share. That ten percent has been passed through to the fishers, as the Council could not determine a way to use the reserved quota to address the aforementioned issues. The Council now must decide whether to permanently pass through the quota to the fishermen or decide on some other use.

The Makah, Quileute, Hoh, and Quinault Tribes off the Washington coast participate in tribal commercial, ceremonial and subsistence fisheries for groundfish according to their treaty rights. Participants in the tribal commercial fishery use gear similar to that used in non-tribal commercial fisheries operating off Washington. Groundfish caught in the tribal commercial fishery is typically sold through the same markets as non-tribal commercial groundfish catch. Management of tribal fisheries is conducted by the individual tribes.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

One major factor affecting the measurement of changes since the baseline period is the high natural variability in Pacific whiting biomass and its corresponding total allowable catch (TAC). During the Economic Data Collection (EDC) baseline period (2009-2010) and the Pacific Coast Groundfish Fishery Social Survey (PCGFSS) baseline (2010), the average TAC for whiting was about 70 percent of the 1995 to 2015 average. In contrast, average TAC since implementation (2011 to 2015) was about 120 percent of the 1995 to 2015 average, about a two-thirds increase from the baseline. This increase, coupled with the importance of whiting to the overall fishery (on average, 50 percent of all ex-vessel revenue), has a major effect on nearly all analyses.

One of the primary intentions of Amendment 20 was to reduce bycatch and discard mortality for all species. The vessel-level accountability provided by catch shares has resulted in significant reductions in the catch and discards of overfished species, exceeding Council goals for overfished species. When Amendment 20 was implemented, only lingcod and Pacific whiting had been rebuilt.

Discards of six of the seven historically overfished rockfish species dropped at least 90 percent after implementation of an Amendment to the catch share program. For each, bottom trawl gear accounted for 90 percent or more of the discards prior to implementation. Total fishing mortality decreased, likely due to the decrease in discards. Widow rockfish was declared rebuilt in 2012, although the Council elected to continue precautionary low harvest levels through 2016. Discards of widow rockfish did not decline as drastically, as widow rockfish are more pelagic than the other overfished rockfish species and are commonly caught in the midwater trawl and directed whiting fishery.

3.2 Economic viability of the fishery

The Final Environmental Impact Statement (FEIS) predicted that elements of the catch share program might contribute to improvements in product quality and prices. The average value of at-sea whiting production per metric ton (mt) declined from the 2009-2010 period to the 2011 to 2015 period by about 8 percent in the catcher-processor sector. Production value per pound in the Pacific whiting shoreside sector follows this trend. Seafood certification and labeling programs help inform consumers. The West Coast groundfish limited entry trawl fishery was certified as a sustainable fishery by the Marine Stewardship Council in 2014 (the Pacific whiting fishery was certified in 2010). The Monterey Bay Aquarium's Seafood Watch Program promoted several major species from "avoid" to either "best choices" or "good alternatives." Both designating entities indicated that their findings had been based on management changes in the groundfish fisheries, including the catch share program

and its stringent monitoring requirements. These designations may lead to increased consumer awareness and preference for West Coast groundfish in the future.

3.3 Social equality

The catch share program created a new type of fishery participant: a quota share owners, who have the option to lease their annual quota pound allocations to other participants. This type of fishery participant earns income from the fishery while avoiding some of the risks and costs of direct participation. Some operators who depend on quota leasing have stated the conditions are destabilizing for their employment. In an IFQ program, as consolidation increases, the vessels that remain in the fishery will likely spend a larger portion of their revenue on quota share purchases and/or leases of quota pounds from quota share owners who have exited or who fish less in the catch share program. At the start of 2014, NMFS lifted the moratorium on quota share ownership transfers.

Since the 1990s, the number of groundfish (whiting and non-whiting) buyers have declined on the West Coast. Overall, the greatest decline in the number of buyers occurred in California ports. Historically lower-volume port areas continued to experience declines, and four low-volume port areas (Bodega Bay, north Washington Coast, other Washington ports, and Tillamook) that had historically purchased limited entry trawl groundfish no longer did so in the catch share period. Notable increases in non-whiting ex-vessel revenue were observed in the Morro Bay and Monterey areas between 2011 and 2015, some of which is driven by vessels operating under the gear-switching provision to harvest southern sablefish.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

One issue that has recently been raised in the Council and in the community hearings is a spatial conflict between catch share harvesters (catch share gear switching vessels targeting sablefish using fixed gear fishing south of the 36˚ N. latitude line) and vessels fishing in the open access and daily trip limit sablefish fisheries. The conflict is, in a sense, created by the existence of the 36˚ line that separates northern and southern trawl sablefish quota. Northern sablefish quota is nearly fully utilized, while the southern sablefish quota has been between 14 percent (2013) and 50 percent (2011) utilized. This means it is likely that a vessel permitted in the catch share fishery and willing to fish south of 36˚ N. latitude can relatively easily acquire quota to do so.

Another issue is the question of what to do with the AMP quota. Although ten percent was reserved for public use, it has not yet been utilized. With the recent 5 year review, fishers inside and outside of the fishery are eager to find out the plan for this quota.

4.2 Improving fishery sustainability in the future

The ecological sustainability of the fishery has improved with the catch share implementation. In order to improve management of the fishery, the Council must decide what to do with the reserved quota for public use. An analysis of the main problems in the fishery should be conducted to see where the quota can be most effectively used. Doing so has the potential to increase economic viability and social equitability of the fishery.

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The case of the Small Pelagic Fishery in Angola

Vieira Ferreira Nzambia Codia
Please refer to the case study presentation available at:
http://www.fao.org/3/CA2445EN/ca2445en.pdf

Volume 5

History and experiences with rights and the post-harvest sector

Abstract

The Global Conference on Tenure and User Rights in Fisheries 2018 took place in Yeosu, the Republic of Korea, 10-14 September 2018. Case studies were presented on a number of topics relating to tenure and user rights in global fisheries and their relation to the SDGs. Through the exploration of case studies in eight concurrent thematic sessions, the best practices, shortcomings, and challenges associated with rights-based approaches were discussed. The conference was a platform for the exchange of ideas about how to support the implementation of sustainable governance solutions to rights-based fisheries management.

This document presents case studies from Session 5 of the UserRights 2018 conference, “History and experiences with rights and the post-harvest sector”. All case studies are published as submitted, with minor changes for spelling and grammar. The case studies span across various geographical and socio-economic contexts. These include:

- the contribution of women to the Amazon fisheries in Colombia;
- the unequal status of female clam collectors in Tunisia;
- the promotion of sustainable fisheries in landing sites in Costa Rica;
- the evolution of regulations in the U.S. West Coast Shoreside Pacific Whiting fishery;
- the advanced post-harvest management in Korea; and
- the community effects of the crab fishery management arrangements of the Bering Sea.

Contents

Women in Amazon fisheries (capture and post-harvest activities)

Elsy Perucho Gómez
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Abstract
In the Amazon fisheries in Colombia, women play an active role in fishing activities. With the help of their husbands' fishing gear, they are involved in gutting and selling of the products in landing sites, municipal markets, and along the public road. Similarly, women of the communities of Lago de Yahuarcaca are involved in fishing and fish marketing. In addition, they are implicated in the control and data collection on fisheries outputs in the lake, thus contributing to the sustainability of fishing resources based on community agreements. Existing regulations establish licenses for fishing and marketing, fishing methods, gears, minimum catch sizes, and closed seasons. Despite the existence of the Rural Women Program and the commitment by FAO Colombia to disseminate the voluntary guidelines on tenure, there is a problem of low institutional commitment to the fishing sector and to tenure in fisheries, especially for the female participants in this sector. Co-management is working well in the commercial fisheries of the Amazon River in Colombia, but shared stocks with other communities in Peru and Brazil are creating problems. Collaboration between fishing communities establishing fishing days for one community and other days for the other community work well. Control of illegal gear and illegal fishing activities is essential, and can only be pursued by the local fishermen. Education of fishermen on issues of sustainable fisheries is key to success.

1. INTRODUCTION

1.1 Description of the fishery

The National Authority of Aquaculture and Fisheries (AUNAP)[95] have 55 000 fishermen registered in inland fisheries, including men and women; 200 of them are in the Amazon area (Figure 1), of whom 20 are women. The role of women in the fisheries sector is multifold, including preparation of food for fishermen, cleaning gears and equipment, participation in capture, handling of fish upon landing, processing and commercialization. The fishing activity is classified as commercial and subsistence along the 116 km on the margin of the Amazon River (Colombian territory).

Commercial fishing in the Colombian Amazon is artisanal. Small wooden boats are used with low power engines and sometimes with rowing propulsion. They do not have a compartment for product storage. This activity is carried out by indigenous fishermen and colonizers and targets species of high economic value with great demand and preference in the market.

Subsistence fishing, as the main source of food for the population, is a daily activity carried out by natives and colonizers in streams and lakes near the communities, with finfish as the preferred target for cultural reasons. Women are involved in the value chain at the post-harvest level. They sell fish on the road to Leticia, department capital of Amazonas, or near the waterfront, close to hospitals and municipality market places.

[95] AUNAP: Autoridad Nacional de Acuicultura y Pesca

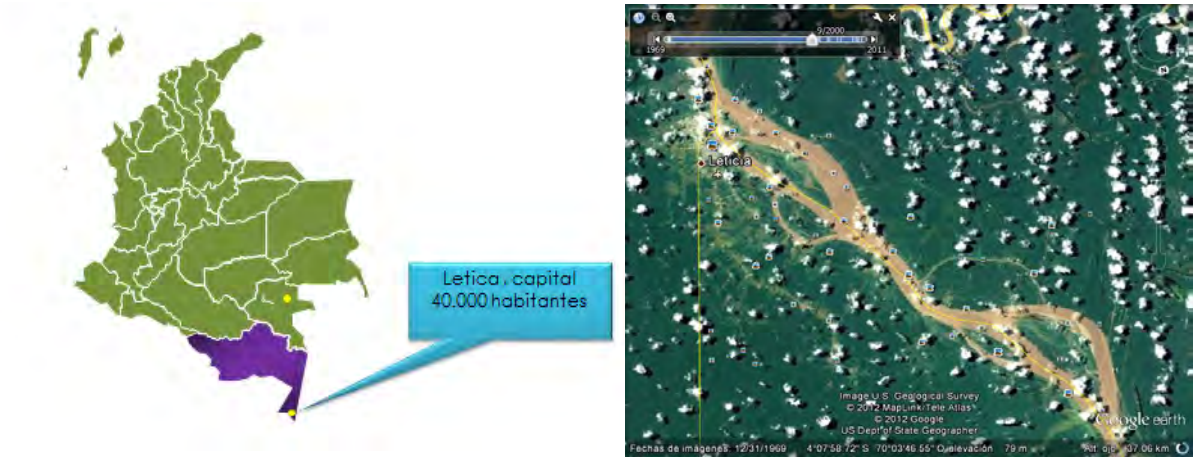

Figure 1. Fishing areas in Amazonas – Colombia.
Source: Elsy Perucho Gómez, 2018.

The daily commercial fishing is carried out by the riparian communities, with an average of four hours of work in the areas of La Milagrosa, Fantasía, Santa Rosa (shared zone with Peruvian fishermen), San José and Puerto Alegría. Large catfish is the most important fish, marketed towards Bogota, capital of Colombia, and from there onto other parts of the country. With such high demand, the species experiences great fishing pressure and is now considered at risk of being overfished. Other species with high demand and landings throughout the year include the spotted tiger shovelnose catfish (*Pseudoplatystoma punctifer*) and Gilded Catfish (*Brachyplatystoma rousseauxii*) (on IUCN Red List), followed by Laulao catfish (*Brachyplatystoma vaillantii*) with catches from March to August and Jau catfish (*Zungaro zungaro*) from August to November.

The lagoon area of Yahuarcaca is located at 4 ° 11'48 "LS and 69 ° 57'19" LW, at an altitude of about 82 m.s., and two (2) kilometres west of Leticia. Subsistence fishing is carried out by indigenous communities of La Playa, San Antonio, San Juan de los Parentes, San Pedro, San Sebastian, El Castañal and La Milagrosa, who are authorized to extract 6 kilos of fish per family (4 for sale and 2 for consumption), according to regulation of the AUNAP. Fisheries focuses on Black Prochilodus (Prochilodus nigricans) and Black Cachama (Colossoma macropomum) from July to November in the lakes Shuyo, Boa Anaconda, Pozo Hondo 2, Carlos and Isla de Ronda, an area shared with Peruvians.

Products are landed in the civil port (waterfront), old port and port of Maí. According to official statistics, landings show declines in catches and in sizes, however, there is no recovery of the resource because there is no stock control in the Colombian sector.

The majority of the fishermen work individually in the small scale commercial fishing sector, nevertheless, catfish catches with gillnets require 2 or 3 people. The fishing equipment consists of a wooden boat of 9 to 10 meters in length, 1.5 meters wide and 0.6 meters high. The most popular engine is a small engine called the “pequepeque” with 5-10 hp of power; it is a slow but very economical engine compared to the outboard motor. In subsistence fishing, the wooden boat has a small engine “pequepeque” (5.5 hp), or rowing propulsion.

Figure 2. Lake Yahuarcaca
Source: Elsy Perucho Gómez, 2018.

Gears are varied, and the elaboration and use depends on the species to be captured, the hydrological cycles of the water bodies, the economic availability and the raw material, as well as the ability to elaborate them. Gillnets are made with monofilament and braided multifilament thread. In the boat, there is no compartment for storing products nor for using ice. This activity is carried out by indigenous fishermen and settlers and targets species of high economic value with great inland demand and preference in the market.

1.2 Economic contribution and social implications of the fishing activity

Figure 3. Fishing in action.
Source: Elsy Perucho Gómez, 2018.

The economic contribution of artisanal fishing in the Amazon River and Lake Yahuarcaca are different, as the latter merely includes subsistence fisheries while the former is 90 percent commercial fisheries. The subsistence fishing in Lake Yahuarcaca is regulated by AUNAP, which allows each family to catch a maximum of eight strings of fish each day (a string includes eight to 12 fish of one or several species, linked together with a thread or a rope). This quota includes two strings for self-consumption and up to 6 strings per family per day for sale. In addition to the fish, handicrafts from fish scales and leather products from fish skins are sold locally in the marketplace or on the public road mainly by women, particularly fishermen wives. The species of greatest commercial value are sold to wholesalers or middlemen, who keep them in cold storage rooms and then transport them by air to Bogotá and from there to the inland of the country. Fishery products are a source of nutrition for the family and economic activity for the population.

Women have little participation in fishing but play an important role in the organization of gears and other supplies for fishing, as well as the washing and handling of the products in the local markets. They generally purchase fish directly from the fishermen at the dock and bring it to the market. (Figure 4).

Figure 4. Participation of women in the fishing chain. a. Transportation; b. Processing; c. Landing; d. Buying; e. Selling in the village; f. selling at the street; g. Selling in retail; h. Selling in wholesale
Source: Elsy Perucho Gómez, 2018.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Fishery management

Fisheries regulations are based on Law 13 of 1990, Regulatory Decree 2256 of 1991, Decree Law 4181 of 2011 and Decree 1071 of 2015, which define the regulatory framework for the rational exploitation of fishery resources. This framework seeks to ensure the sustainable use of fisheries in order to improve the socio-economic conditions of fishermen and raise the living standards of the population, in accordance with the National Policy on Food and Nutrition Security PSAN and the Comprehensive Policy for the Development of Sustainable Fisheries in Colombia.

Based on the above framework, AUNAP is in charge of exercising the fishing and aquaculture authority in Colombia. It is responsible for planning, research, promotion, regulation, registration, inspection and monitoring and control of fishing activities and aquaculture. It can also apply sanctions within the policy of promotion and sustainable development of resources. This authority acknowledges that

fisheries management should include citizen participation, and therefore calls upon the fishing community to debate and establish the best criteria for the sustainable use of fishery resources.

Based on the action plan of the integral policy for the development of sustainable fishing, AUNAP issued the measures in Lake Yahuarcaca for subsistence fishing. This is according to the strategic axes "sustainability of fishery resources" and "participatory governance", which contemplate co-responsibility agreements with local actors for the responsible use of species of commercial interest and develop the capacities of organizations to exercise social control and self-regulatory measures to improve fisheries management. It is also important to highlight the participation of the environmental police and fishing associations in campaigns aimed at raising awareness of the responsible use and exploitation of fishery resources.

On the other hand, for the control and surveillance of capture and marketing of fishery resources that do not match the minimum sizes, use of legal gear and the seasonal closure, AUNAP and the police have inspection and surveillance patrols, most of the time ending with the seizure of gear and products that are forbidden or below catch sizes. The confiscated fishery products are donated to charities for food security. The fishing permit is revoked, and the fishermen or marketers are prosecuted for having committed a crime against natural resources.

Illegal fishing and marketing have led to the deterioration of the working environment and have engendered a number of conflicts. This has reduced the number of inspections due to the difficulty to coordinate the patrols, the lack of budget and the few personnel assigned to these activities. On the other hand, and in order to mediate the internal conflicts, AUNAP conducts awareness workshops to convince fishermen about the necessity to comply with the regulations.

2.2 Brief history of former rights-based approaches used in the fishery

The institutionalism of fishing in Colombia began in the 1960s, with the establishment of the Hunting and Fishing office, a branch of the Ministry of Agriculture. It was followed by the creation of the National Institute of Renewable Natural Resources INDERENA, an entity responsible of the administration of fishing (among other functions). Then, with the agreement 0015 of 1987 and resolution 089 of May 1987, the Pirarucú species underwent regulations including a fishing prohibition (from 1 October to 15 March) and a minimum size of capture (1.50 m of standard length). Agreement 0018 of 1996 established the closure for Arawana from 1 September to 15 March.

Subsequently, with Law 13 of 1990 and Regulatory Decree 2256 of 1991, the functions of the National Institute of Aquaculture and Fisheries INPA were established: "To manage, promote and control the fishing and aquaculture activity, to issue the norms for exercise and establish the procedures and requirements for the granting of authorizations, permits, patents and safe conduct". "Set and collect the number of fees and duties that must be collected for the exercise of fishing activity". Currently, AUNAP is the government entity in charge of regulating fishing activity in Colombia. One of the shortcomings for management and administration refers to the minimum sizes of capture because they are still based on initial data that was collected a long time ago. There lacks a new study that could better reflect the present situation. This is one of the demands made by fishermen.

2.3 Rights-based approach: allocation and characteristics

Artisanal fisheries is an open-access fishery. The fishing authority, however, issues the license for five years to the artisanal fishermen (Figure 5). With this, they can exercise the activity indicating area of action, gear and species to be captured. This document has no cost for them. Fishermen say that the document helps them to access projects developed by the Colombian state. Fish marketers have to make a written request for a permit, attaching the plan of activities to be executed and the expected volume of traded fish and the species, signed by a competent professional in the fishing area. The permit is valid for one year, must be carried by the transporter or marketer and is not transferable.

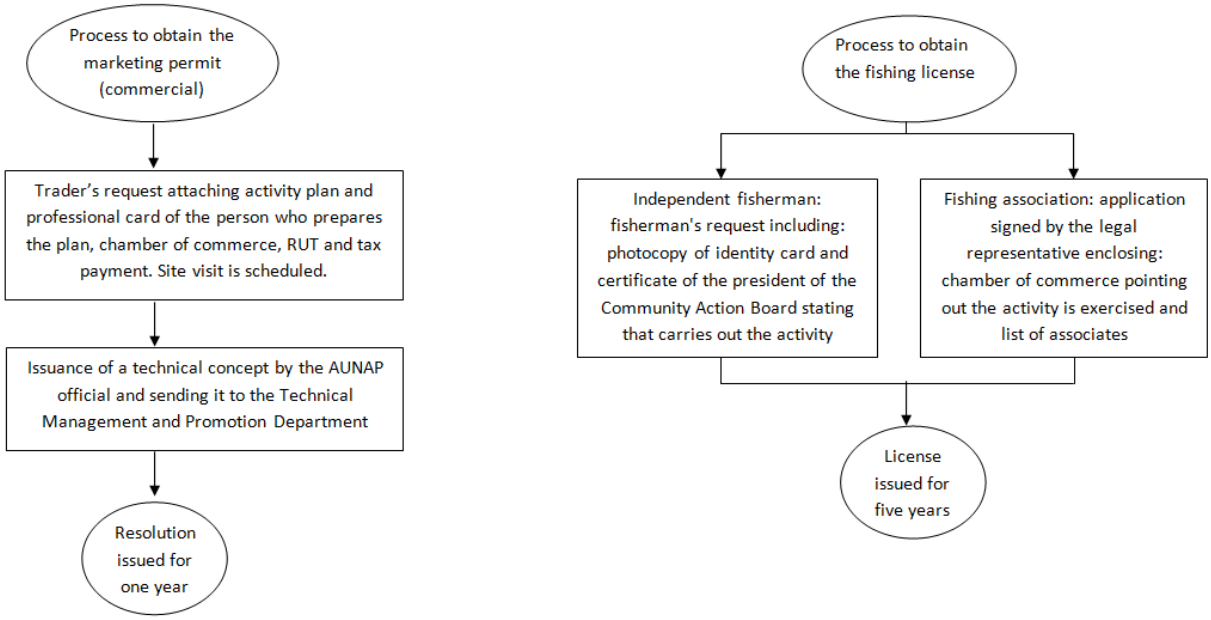

Figure 5. Process of obtaining permits to catch or market fish.

For fishing in the Amazon River, the fishermen agreed freely and in consensus to delimit five fishing zones where they develop the work. In the same way, they established day and night shifts to rotate weekly and alternate with Peruvian fishermen. In Lake Yahuarcaca, the situation is different because of the training provided by the National University of Colombia, Amazon headquarters, within the framework of the project "Community management of fishing resources in Lake Yahuarcaca". The community showed interest to form the association of artisanal fishermen with the seven (7) communities of the aquatic system of the lake in order to have representation and also to use, manage and conserve resources based on traditional knowledge and the application of the agreements of fishing. Their aim was also to form a monitoring and control committee. Because of the agreements, a decrease in the use of gill nets has been observed, which has led to a recovery of paco and gamitana species.

Figure 6. Fisherman with a net.
Source: Elsy Perucho Gómez (2018).

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

The greatest difficulty the fishing sector faces in the Amazon River sector of Colombia is the lack of clear guidelines to manage small scale fishing despite having a comprehensive policy for the development of sustainable fisheries. In the capture and post-capture stages, measures are used to regulate the minimum sizes of capture, gear and seasonal bans. Measures have not been effective for multiple reasons. First, fishermen, traders and consumers have not shown much interest in understanding the importance of following regulations to ensure that resources are sustainable and of good quality. Second, there is a lack of public policies that provide fishermen with alternatives for integral development, which makes them the most vulnerable stakeholder against supply and demand action and, consequently, the reduction of products in the landing ports that affect the food security of the native population of Leticia and the adjacent communities.

From the perspective of women participating in the fishing process, there is no training to develop and improve their skills and understanding of good food practices and good fish handling, conservation and commercial practices at the sale point. Therefore, a regulation that seeks to promote the sustainability of the resource should combine environmental, social and economic aspects.

3.2 Economic viability of the fishery

Since fishing takes place throughout the year, fishermen experience periods of abundance and scarcity according to the water levels. Fishery statistics show a constant decrease in landings in Leticia and continuous exploitation of the fishing stock.

The table below shows statistics of volume and prices of products caught over a period of 15 days in a good fishing season (year 2018).

Table 1. Volume of catches.

Species	volume (kg)
Pirabutón	680
Bocachico	596
Pintadillo	300
Amarillo	280
Dorado	150
Cachama	130

Table 2. Price of commercialization by species.

Species	Fisher price COP (kg)	Sales price COP (kg)
Pirabutón seco	10.000	14.000
Bocachico	10.000	15.000
Pintadillo	8.000	9.000
Amarillo	6.000	7.000
Dorado	9.000	16.000
Cachama	8.000	15.000

Fisheries are the main source of livelihood for riverine communities and settlers, both for consumption and sale. They contribute to the wellbeing of the population by providing a source of protein and covering their basic needs thanks to surpluses generated by marketing. There is also a trend in the inland of the country to get Amazonian fish as an alternative to improve consumption habits. As a result, greater pressure has been exerted on the resources, with unfavourable consequences for sustainability.

With fishing as a pillar of the Amazonian economy, many fishermen have been forced to move to more remote places and stay longer at sea in order to capture the species that are most desired by the local and national consumers, and generate higher income. In addition, they have been forced to become directly involved in the sale, which has partially disenfranchised the women who were involved at this stage.

3.3 Social Equality

Limits established on artisanal fishing in a concerted manner between the communities, without the need to exclude others, have played a key role in the performance of fishing agreements in the Amazon River and Lake Yahuarcaca. Rights to limit the volume of capture and days of fishing have made it possible to build efficient and equitable processes. As the communities themselves established the measures, they have strengthened as a group and are able to discuss and analyze the importance of following the rules on responsible fishing without the control of authorities. Agreements are examples of self-management and social responsibility. However, some members have reported isolated cases of discontent and non-compliance.

Another obstacle is the distrust of a few groups as a result of the decisions taken by some to lease shifts to people outside the community. This has generated conflicts among fishermen. These impasses are discussed within the organization. They resolve them and arrive at concrete commitments in order to avoid further conflicts generated by the lack of communication.

The exploitation of fishery resources in the Amazon River sector of Colombia is shared with fishermen from Brazil and Peru, which generates conflicts despite the fisheries agreements. For this reason, it is important to make good use of the local fishing associations, in order to provide the opportunity to discuss the criteria of use and management of resources.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

Fisheries management in the Amazon is a difficult task to carry out due to the geographical extension, the complex access and socio-economic situation of the communities. One of the challenges is to improve the supervision of standards in artisanal fisheries. It is necessary to encourage fishers and marketers to register and obtain permits to carry out the activity, as well as to sensitize them to issues of sustainable fisheries, provide them with tools to focus on conservation and develop lines of credit.

Another action is to strengthen the fishing associations so that it works as a scenario to set community fishing quotas, taking into account the difficulty to regulate the fishery through individual quotas. It is important to incorporate proposals into municipal and departmental government plans to achieve the government's objectives of sustainable and inclusive growth.

In addition, encouraging investment in education is expected to provide opportunities and perspectives for alternative livelihoods to fishing and post-harvest with a gender approach, in order to facilitate other activities that reduce the pressure on the resource.

4.2 Improving fishery sustainability in the future

It is important to visualize and professionalize artisanal fishing in an educational training program directed by the National Service of Learning SENA. It is essential to include fishermen and informal marketers in the social security program of the Colombian state.

It is necessary to improve the efforts to control the fishing. For this, it is important to count on the fishery census and to work in coordination with the local authorities, in order to join technical and administrative efforts to carry out the inspection outputs.

4.3 Lessons learned

Co-management is working well in the commercial fisheries of the Amazon River in Colombia, but shared stocks with other communities in Peru and Brazil are creating problems. Collaboration between fishing communities, which establish fishing days for one community and other days for the other community work well. Control of illegal gear and illegal fishing activities is essential, and can only be pursued by the local fishermen. Educating the fishermen on issues of sustainable fisheries is key to success. Women play a traditional role in the marketing and the processing of fishery products. However, there is a tendency to marginalize them. Alternative livelihoods should be found for them.

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Better rights for female clam collectors in Tunisia

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Abstract
In Tunisia, the clam production sector employs more than 4 000 women at 17 production sites, primarily concentrated in two major coastal areas – Gabès and Sfax – with an average annual production of 700 tons mostly directed to export markets. These women have no rights on the resource they are collecting even though these resources represent their only source of income. Thanks to the joint-coordination between FAO and the Tunisian government, together with private stakeholders, Tunisian women clam collectors have been given privileged access to the high-value European market, with an equity partnership with the main Italian importer of clams. Women collecting clams have increased their sales price by about double due to this agreement. However, they have no right to own the beach grounds or get concessions for aquaculture activities, where they could grow undersized clams. This problem with user rights, originating in the Tunisian law for aquatic resources, is also an obstacle for potential culture and growing of other bivalves, such as razor clams, which the FAO project had identified as a product with excellent growing possibilities and with good market opportunities. It is still a long way for the women to have equal rights to the clam resource.

1. INTRODUCTION

1.1 Description of the fishery

The Gulf of Gabès in southern Tunisia is a particularly rich fishing area. The most productive areas are in the Governorates of Sfax and Gabès, where a large proportion of the local population earns its living primarily from coastal fisheries. This wetland is known for its natural beds of carpet shells and razor clams, bivalve molluscs of the clam family. Foreign demand for clams is growing steadily. In Tunisia, the clam production sector employs more than 4 000 women at 17 production sites, primarily concentrated in two major coastal areas – Gabès and Sfax – with an average annual production of 700 tons mostly directed to export markets.

Over the past five years, production has averaged at 500 tonnes, worth 1.9 million Tunisian dinars (one million euros), or nearly one percent of the value of domestic fishery production during this period. Southern Tunisia is responsible for 98 percent of domestic clam production. Clam-digging is an artisanal activity carried out mainly by rural women living in precarious and marginalized conditions.

1.2 Economic contribution and social implications of the fishing activity

Most rural women living around the two coastal areas of Gabès and Sfax derive their main livelihood from beach clam collection. There are no other forms of livelihood sustainment available in these very poor areas.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

As part of a policy of gradual State withdrawal and to overcome numerous health, administrative and organizational challenges and build momentum around beach clam fisheries, clam development and harvesting groups (GDP) have been set up in production areas. These GDP are responsible for the management of the fishery, for handing out licenses, and for the control of the water quality (sanitary measures). There are fishing zones established which are controlled for water quality and are closed on a rotation basis. The resource situation of the clam resource is unknown, but there are several

indications that the resource is overexploited. In the past, women were exploiting all different types of clams, without respecting a minimum size.

Since 2011, FAO is helping female clam collectors to better access markets through a document called "the Programme". Prior to the Programme, the female collector had no negotiation power with the middlemen, including the transporters to the fishing areas. This Programme created cooperation between the female collectors, the depuration plant and the Italian importer, guaranteeing a minimum price for each kg of clams collected. In addition to the stronger bargaining power of women clam collectors through cooperation among stakeholders and the organization of the female collectors, FAO's advocacy at the policy level triggered a more transparent environment for marketing transactions. This is especially true for the traceability of the process from the landing, weighing and purchase of clams to the delivery to the clam exporters.

2.2 Brief history of the former rights-based approaches used in the fishery

Before the creation of the GDP, the clam collection was an open-access fishery.

2.3 Rights-based approach: allocation and characteristics

At present, the GDP gives out licenses to female collectors. Each woman can collect a maximum of 5 kg per day. The fishing period is fixed. Generally, clam collection is allowed from October to May, and the areas are closed during the remaining months. The GDP has also created zoning, with closed areas that rotate, in order to give some recovery time to an area.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

The Programme established a premium fee to reward women collectors who exploit larger sized clams. This incentive has created a more sustainable production system.

3.2 Economic viability of the fishery

Thanks to the minimum price paid with the establishment of the Equity Link through the Programme, the price of one kilo of clams rose from USD 3.30 per kg to USD 7.60 per kg for the entire collection season. This new pricing increases the income of the women and improves their families' standard of living.

3.3 Social equality

The FAO project focuses on empowering women collectors and developing a strategic partnership with the private sector to improve the women's income by giving them direct access to valuable markets. This new approach to clam commercialization in Tunisia provides a win-win scenario for all stakeholders. A fixed price set in advance guarantees the predictability of payments and receivables for both the importer and the women collectors throughout the harvest season, while onsite purchasers (representatives of the depuration centre) pay mandatory cash payments to the women collectors.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

Despite the positive results for the female clam collectors, the resource situation in the Gulf of Gabès could be better. The resource is still overexploited, but the growing awareness of the female collectors towards avoiding the collection of undersized specimens will lead to some improvements in the near future.

4.2 Improving fishery sustainability in the future

With the premium price and the organization of the women, a resource protection mechanism could be implemented, using the existing organizations. The single female producers are now far more attentive to the minimum size and would be receptive to further management measures implemented with their collaboration. It is crucial to ensure better involvement of women in the GDP by giving them a voice and management roles within the organization. Illiteracy and the lack of any form of guidance or training, are the main reasons for their exclusion, together with the traditional gender roles.

Another important step towards sustainability of the fisheries would be the creation of growing facilities, licensed to the female clam collectors, for both undersized clams and for razor clams, which have proven to be an attractive species for growing, with huge market potential. There are already some areas dedicated to this type of activity, and if it proves successful, further areas could become open for these activities as well.

The involvement of the importer side in fair trade has proven to be difficult, but it is ultimately the right path to guarantee a better life for women in line with SDG 5, 12 and 14.

Small-scale fishery promotion in high-value markets

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Abstract
The community of Costa de Pájaros in the Pacific of Costa Rica fulfilled legal requirements for the creation of a responsible fishing marine area (RFMA) on its traditional fishing grounds. The area is open access to any licensed fisher that complies with special regulations within the area, however, this has caused conflicts with fishers that use less responsible gear that were displaced and with fishers from other communities that travel to the RFMA to fish. Fundación MarViva has worked for several years with members of the fishers' community and three landing sites to promote responsible fishing. Currently, these three landing sites sell to corporate buyers or to intermediaries that work with corporate buyers willing to promote responsible fishing, and these include restaurants, hotels and supermarkets. Fishers help the landing site managers carry out monitoring of catches and managers fill traceability questionnaires so that corporate buyers can be sure of the origin of the product. Fishers comply with special gear regulations that go beyond the requirements of the RFMA and landing sites only sell fish above minimum landing sizes as responsible.

1. INTRODUCTION

1.1 Description of the fishery

Costa de Pájaros is located in the central Pacific region of Costa Rica, specifically in the inner part of the Gulf of Nicoya (Figure 1). Fishing in this area is limited to small-scale fishers that use gillnets, a hand line and bottom longline to catch weakfish, snook, mackerel, catfish and shrimp. Fishers usually own the boat they use for fishing and take one or two helpers onboard. Their activity is carried out once or twice per day, returning home after a five to six hours of fishing, depending on the moon phase and winds.

Costa de Pájaros is a Responsible Fishing Marine Area (RFMA) that only allows the use of hand line within its borders. This has caused conflicts between the user of the RFMA and fishers that use gillnets that are excluded from the area. The RFMA harbor Bajo Las Peladas is a very important fishing ground for weakfish. Thus, when the RFMA was created, it caused conflicts with gillnets fishers. In order to demonstrate their displeasure, they have sunk car batteries hoping to affect handline fishers and have moved or cut buoys that had been placed to mark the RFMA.

The community is located in an area that is incorporated into the annual closed season of the Gulf of Nicoya. During these three months of closure, another conflict arises between fishers that respect the closed season and illegal fishers. Unfortunately, there are many fishers that continue their activity during the closed season, reducing its effectiveness in protecting the reproduction peak of weakfish and shrimp and there are continuous rumors of receiving centers that continue to operate during the closed season. This causes responsible fishers to lose faith in the Coastguard, Fishing Authority and local police since there are few controls during the three-month closure.

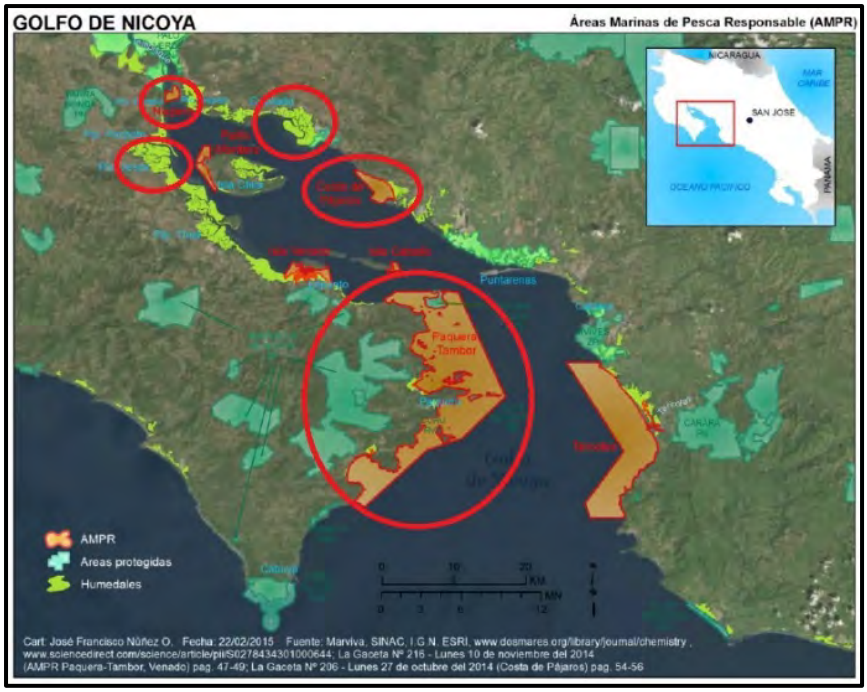

Figure 1. Map of the Gulf of Nicoya.
Source: Marco Castro, Fundación MarViva.

The fishery is a multi-species coastal marine fishery –the stock is mobile and migrates along with different areas of the Gulf of Nicoya, found only within national jurisdiction. Weakfish (Cynoscion sp.), mackerel (Scomberomorus sierra) and snook (Centropomidae sp.) are all found year-round. Weakfish populations along the Pacific coast of Costa Rica are considered either fully exploited or over-exploited by scientists. In the Gulf of Nicoya, studies by the GiZ and UCSB found that resources are overexploited; these results are in line with previous studies from the National University and INCOPESCA. The size of weakfish caught has been decreasing for over three decades; in 1992, the size of the first maturity for corvina reina was calculated at 75 cm, 20 years later it was calculated at 55 cm.

Target species are caught for sale in national markets, smaller individuals and non-commercial species may be kept for personal consumption. Fishers generally have a second livelihood source in case they cannot go fishing due to closed season or strong winds. This secondary income usually comes from agriculture or construction. Due to the lack of job opportunities in the area, the fisher populations have been increasing. Some of the newest fishers are fishing illegally because of the lack of licenses, which is causing local migrations to coastal areas when the agricultural season is over. There are also an important migration of fishers from other communities to the fishing grounds used in the Costa de Pájaros RFMA.

The fishing gear types used vary between the more responsible fishers and the others. Within the RFMA, only hand lines are used, with either one, two or three hooks. Outside the RFMA, gillnets are very common, varying from 2.5” (illegal) to 8”. However, a recent regulation also does not allow the use of gillnets larger than 5” in order to protect large reproductive animals (usually 400 meters long). Bottom longlines have between 150-300 hooks and can be 500-800 meters long. Dredges are illegal, but an estimated 1 000 illegal dredges are found inside the Gulf of Nicoya.

The owners of the vessels are fishers from the local community; communities do not own vessels collectively in Costa Rica. Sometimes the owners of the receiving centres possess boats, but they often register them under the name of fishers so that they can manage them. The local fishers usually own

the fishing gear. However, there are cases where the owners of receiving centres loan money to fishers to enable them to purchase the gear. In return, the fishers are obliged to sell their catch to that person. Management of the fishery is under the Fisheries Authority. However, each RFMA has a local commission constituted by fishers and authorities that can decide to change how the RFMA is managed. The Fisheries Authority board of directors must approve any changes before they are made.

1.2 Economic contribution and social implications of the fishing activity

There are close to 17 communities in the Gulf of Nicoya that target the same resources as Costa de Pájaros, with a total of about 5 000 fishers in the region. Of these, about six percent are women, mostly dedicated to the collection of mollusks. Most of the fishers are full-time, generating at least 90 percent of their livelihoods from this activity.

The fishers have remained in the same fishing grounds for generations, as it is one of the most productive areas in the Gulf of Nicoya. However, the depletion of resources in other fishing grounds has attracted fishers from neighboring communities into the area, thus causing conflict.

Fishers use motorized boats for their activity, with an average length of 5-7 meters, average GT of 300 kilos and average power of 40 kW. The length of fishing vessels has increased, as have the capacity of boats and power of motors in the last thirty years. After an increase in the number of vessels at the start of this century, the number has stabilized due to restrictions from the Fisheries Authority for new licenses.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

Fishers have formally recognized rights in the form of individual non-transferable licenses. Currently, there is a prohibition on assigning new licenses due to a lack of knowledge on the state of marine resources. This current system of licenses has been on-going for several decades. Each license allows owners to fish as many resources as they can.

In recent years, there has been work in allocating rights for mollusk collectors, most of which are women and to appropriately manage the fishery in order to reduce pressure. Fishing rights are allocated to individual fishers and to vessels. Each license details which species and gear the fisher/boat is allowed to catch/use.

The license is valid for a period of six years. Fishers must pay an annual quota every year and renew the right at the end of the six-year period.

In the case of the RFMA, the commission in charge of its management can propose changes to fishing gear, seasons, size restrictions, etc. There is little to no data collection. Occasionally the Fisheries Authority monitors catches. Currently, the only constant monitoring of catches is being done by three receiving centers working with MarViva Foundation.

2.2 Brief history of the former rights-based approaches used in the fishery

Prior to the current approach, over half a century ago, fishing rights were more informal, and it was an open access system.

2.3 Rights-based approach: allocation and characteristics

Fishing rights cannot be sold or leased, but there have been efforts to promote rights to be hereditary. The access to the resource is regulated by the Fisheries Authority through licenses and by the Coastguard. However, every person has a right to fish if it is for subsistence purposes. In this case,

catches cannot be sold and subsistence fishers must register with the Fisheries Authority, they must also comply with fishing regulations.

Vessel owners are required to comply with yearly inspections of the port authority based on vessel clearance and complying with safety standards. Receiving centers must have permits given by the Fisheries Authority and the National Animal Health Service.

It is frequent to observe fishers without licenses operating in fishing areas, even within the RFMA. These fishers have been linked to the use of illegal fishing gears. The communities cannot act on their own to stop illegal activities, and even if they could, illegal fishers are very aggressive and sometimes possess handguns. Responsible fishers occasionally alert the Coastguard, however, inaction on their side has caused complaints to go down.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

The limitation of access to the fishery through licenses is designed to reduce pressure and guarantee the sustainability of the resource. However, ineffective management, use of illegal fishing gear, lack of implementation of landing sizes, lack of supervision of gear used and near non-presence of the Coastguard have caused resources to be overexploited.

3.2 Economic viability of the fishery

Fishing effort and capacity has increased, though the implementation of licenses has curtailed the growth of the number of legal fishers. The distance, in the specific case of Costa de Pájaros has remained constant, however, other communities that have seen their resources reduced, migrate to the fishing grounds of the RFMA.

Even though the distance has not increased, the average length of fishing trips has increased, as fishers must remain in the water longer to increase their catches due to overexploited resources. This goes together with a decrease in the use of hand lines and an increase in the use of gillnets, which have also seen a reduction in the mesh size. Fishing vessels with outboard engines have increased in the last half-century, as has the power of the engines. Average length and gross tonnage have also increased. It is common to find boat owners that have one or two helpers go out fishing with them, distributing income from catches in pre-accorded percentages.

3.3 Social equality

There are no indigenous communities in the area. However, they would have the same rights as any other resource user. The registry of legal fishers through the licensing system allows the Ministry of Social Aid and Fisheries Authority to give financial aid to legal fishers during the closed season and in case of natural disasters that reduce their fishing capacity.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

The main challenge faced by this fishery is dwindling stocks. The Fishery Authority has recently tried to implement regulations focused on recuperating stocks (i.e. minimum and maximum landing sizes). However, lack of enforcement and control of illegal gears has not allowed recovery of stocks. The effectiveness of the three-month closed season is reduced each year due to a lack of patrolling by the Coastguard and control of receiving centers not operating during the closure by the Fisheries Authority and local police.

The presence of illegal fishers and illegal fishing gear is an important challenge for fishers, affecting their livelihoods directly and their safety at sea since illegal fishers are aggressive and can be armed. The lack of presence from the Coastguard has affected the perception of this police force within coastal communities; they are seen as ineffective and more interested in drug-running than natural resources.

4.2 Improving fishery sustainability in the future

In order to improve the sustainability of resources, several steps should be taken:

- Improved monitoring of catches in order to better evaluate resources and health of fish stocks.
- Increased presence of the Coastguard to control illegal fishers, especially during closed seasons.
- Improved research on key habitat areas for species and constant monitoring of reproductive stages for better implementation of closed seasons.
- Better communication with communities so that they can understand the importance of minimum and maximum landing sizes, gear size restrictions, responsible fishing, monitoring.
- Promoting the insertion of responsibly caught seafood into value chains that recognize this effort and are willing to pay more to the fisher, thus reducing the amount of fish they must catch to receive the same amount of money for their catch.
- Analyze the effectiveness of the closed season and the monetary aid given to fishers and verify if resources can be applied differently in order to produce a more significant impact.
- Attend the social problems of coastal communities in an integral manner, including health, education, safety, housing, etc.
- Promote job creation in coastal areas in order to give options to fishers, especially for their children, so that livelihoods can be gained by alternative means.

US West Coast Shoreside Pacific Whiting Fishery (non-tribal)

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Abstract
The US West Coast shoreside Pacific whiting fishery takes place off the coasts of Washington, Oregon, and California. Harvesters target Pacific whiting, a migratory pelagic species sometimes marketed as Pacific hake, and deliver catch to land-based processing facilities. Harvester participation is constrained by a limited entry permit program. Harvests are constrained by a total allowable catch, which is set annually through a bilateral management agreement between the US and Canada known as the Pacific Whiting Treaty. Through 2010, Pacific whiting catch was monitored within seasons, and the derby fishery closed when the sector allocation or a bycatch limit was reached. In 2011, individual tradeable fishing quota was introduced into the fishery through the implementation of the West Coast Groundfish Trawl Catch Share Program. The complex program is comprised of a number of provisions, including a mandatory annual cost-earnings survey of all participants and 100 percent observer coverage. The program also included an allocation of 20 percent of Pacific whiting harvesting quota to eligible shoreside processors. Initial quota allocations for all quota shareholders, including processors, were based on historical participation during qualifying years. Allocation of harvesting quota to shoreside processors was intended to compensate for projected adverse impacts of catch shares on the sector, including stranded capital and shifts in bargaining power in the ex-vessel market due to season lengthening. Some observed changes under catch shares include season lengthening, consolidation in both the harvesting and processing sectors, higher ex-vessel prices, and increases in operating profit for the average vessel and processor. These changes are influenced by a variety of factors including large increases in the TAC occurring under catch shares but exogenous to the program.

1. INTRODUCTION

This case study provides an overview of the US shoreside Pacific whiting fishery and the introduction of individual fishing quotas (IFQs) in 2011. For a more detailed description and analysis, please see the five-year review of the West Coast Groundfish Trawl Catch Share Program (PFMC and NMFS, 2017). The results reported in this case study are obtained by comparing summary statistics before and after IFQ implementation, and should not be interpreted as causal. Data utilized include cost-earnings data from the Economic Data Collection (EDC) Program,[96] fish ticket data from the Pacific Fisheries Information Network (PacFIN),[97] and qualitative data from the Pacific Coast Groundfish Fishery Social Study.[98]
All errors and opinions are our own and do not reflect the beliefs of the University of Washington or NOAA Fisheries.

1.1 Description of the fishery

Pacific whiting (*Merluccius productus*), also called Pacific hake, migrates north up the West coasts of the US and Canada in the spring and summer months (Grandin et al., 2016), and is a round fish with an average size of 40 cm (2011-2016 average). This migratory species is harvested in Canada as well as in several fisheries in the US: the shoreside fishery, the at-sea fishery, and the tribal fishery. This case study focuses on the US shoreside fishery, in which catcher vessels target Pacific whiting and

[96] For more details, see: https://www.nwfsc.noaa.gov/research/divisions/fram/economic/overview.cfm
[97] For more details, see: https://pacfin.psmfc.org/
[98] For more details, see: https://www.nwfsc.noaa.gov/research/divisions/cb/ecosystem/humandim/groundfish-study.cfm

deliver to land-based fish processors. The primary shoreside fishing season begins on 15 June each year and continues until the end of the calendar year or until the whiting allocation, or a bycatch limit is met. In recent years, most fishing has occurred off the coasts of Washington and Oregon (42-48 degrees N, 124-126 degrees W), generally between 15 and 60 nautical miles off the coast (Somers et al., 2017), on fishing trips lasting an average of several days.

The Pacific whiting fisheries are higher volume than other fisheries on the West Coast, with an average annual catch of over 80 000 metric tons in the shoreside fishery from 2011-2016. Pacific whiting is the single target species in the fishery, and rockfish species comprise much of the bycatch, with an annual average bycatch rate of 1.7 percent from 2014-2015 (Steiner et al., 2017). The stock is assessed annually and, in most years, the fishery is close to full utilization of the total allowable catch (TAC). Natural variability in the Pacific whiting stock biomass has led to large fluctuations in TAC over the years with particularly high levels in recent years, coinciding with, but likely unrelated to, the introduction of catch shares into the fishery. Pacific whiting was declared overfished in 2002 and was rebuilt by 2004, due to reductions in commercial harvests coupled with strong recruitment ("Rebuilding plans," 2016). The West Coast Pacific whiting fisheries earned Marine Stewardship Council (MSC) certification in 2009, prior to the implementation of IFQs in 2011, and the fishery was recertified in 2014.

An average of 24 vessels participated in the fishery each season from 2011-2016, and tend to be fairly large and mechanized compared to vessels in other non-whiting fisheries on the US West Coast. Vessels that use midwater trawl gear to target whiting were an average length of 29 meters with inboard engines of 1126 horsepower on average, and generally have holds below deck where fish is kept cold using refrigerated seawater. Vessel crews included 2-3 paid crewmembers on average from 2011-2016 (Steiner et al., 2017). Most vessels have home ports in the major whiting ports of Astoria and Newport, Oregon; although, some vessels have home ports in communities outside the fishing grounds and must travel to access the fishery. There are a variety of vessel and gear owners in the fishery including fishers and non-fishers from both local communities and outside the fishing grounds, as well as fish processors. Vessel ownership by foreign entities in the fishery is limited by 46 U.S.C. 12113, which states that a vessel owned by an entity is eligible for a fishery endorsement only if at least 75 percent of the interest in the entity, at each tier of ownership and in the aggregate, is owned and controlled by citizens of the United States.[99]

1.2 Economic contribution and social implications of the fishing activity

An average of 8 fish processors participated in the fishery in 2011-2016 (Guldin et al., 2017), with vessels delivering Pacific whiting to 3 major port areas. An annual average of around 3 000 individuals worked at Pacific whiting processors as processing workers or other employees from 2013-2016, although, it is likely not all were involved in Pacific whiting processing specifically. These large multi-species processors produce several whiting products including headed-and-gutted, frozen whole, filleted, and others. An annual average of 94 percent of overall whiting landings was designated as destined for human consumption in the fish ticket database from 2011-2016. Low-quality whiting and scraps/byproduct can be generated into products like bait and fishmeal. The average product recovery rate was 58 percent from 2011-2016 but varies considerably depending on final product form.

The shoreside Pacific whiting processing sector earned a total of USD 42 million dollars in revenue per year on average from 2011-2016. Pacific whiting degrades quickly, so most products are frozen and exported abroad to be sold globally. In 2014, total national exports of Pacific whiting were more than 60 000 metric tons worth USD 100 million, with the majority going to Russia and Ukraine as well as other European countries (Guldin et al., 2017). Some processors have indicated domestic markets for Pacific whiting as well (Pacific Seafood, 2017).

[99] https://www.law.cornell.edu/uscode/text/46/12113

An average of around 90 total individuals (captain and crew) participated in the Pacific whiting harvesting sector each year from 2011-2016. Vessels spent an annual average of 52 days at sea targeting Pacific whiting in the shoreside fishery. Some vessels that participate in the US shoreside whiting fishery also participate in the US at-sea whiting fishery (spending an annual average of 47 days at sea), in Alaskan fisheries, like Pollock, (spending an annual average of 94 days at sea), and in other fisheries (spending an annual average of 21 days at sea). Vessels generally earn between 26-50 percent of their total fishing income from participation in the shoreside Pacific whiting fishery (Steiner et al., 2017). Much of the above information is vessel-specific and not fisher-specific, due to the nature of the data collection. The Pacific Coast Groundfish Fishery Social Study asked West Coast groundfish fishers (not necessarily Pacific whiting fishers) about what jobs they hold outside the fishery and they indicated the following industries: fishery services, mechanic or building maintenance, real estate, agriculture/farming, processing, construction, city services, as well as some other industries.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

The Pacific whiting stock is assessed annually, and a TAC is set each year through a bilateral management agreement between the US and Canada known as the Pacific Whiting Treaty. After a portion of the US Pacific whiting TAC is set aside for the tribal sector, the remainder is allocated between the shoreside sector (42%) and the at-sea sectors (58%). The tribal allocation may be reapportioned to the shoreside and at-sea sectors throughout the season (generally after 15 September) if it is determined that it will not be utilized by the tribal sector.

The US Pacific whiting fisheries are managed by the Pacific Fisheries Management Council (PFMC), a regional management body with jurisdiction over the exclusive economic zone off Washington, Oregon, and California. The management process is bottom-up and inclusive of Council staff, the federal government, regional government, stakeholders, non-governmental organizations, and the public.[100] The Council develops management measures, which are implemented by the federal government via regional offices of the National Marine Fisheries Service (NMFS). Management measures are enforced by NOAA's Office of Law Enforcement (OLE).

The Pacific whiting fishery falls under the purview of the Pacific Groundfish Fishery Management Plan (FMP), which was approved in 1982 and established economic and biological goals to promote sustainable fisheries management (Warlick et al., 2018). In 1994, the Pacific whiting fishery was one of several on the US West Coast where a license limitation program was put into place to address issues of overcapacity and to better meet FMP goals, with the understanding that it was a stopgap measure (Warlick et al., 2018). The program required vessels to obtain federal permits with different gear-type endorsements to participate in the fishery. Permits were based on vessel length to discourage capital stuffing (Warlick et al., 2018). In 1997, several management measures were introduced into the Pacific whiting fisheries, including season start dates, fishery-specific harvest allocations, and provisions for reapportioning unused quota between fisheries towards the end of the season. These measures eliminated existing derby fishing conditions between the shoreside fishery and the at-sea fisheries but the race to fish within the shoreside fishery remained (Warlick et al., 2018). Discussion and consideration of an individual fishing quota (IFQ) program began in the 1990s but was stalled by the nationwide moratorium on new IFQ programs in 1996, which lasted until 2002 (Warlick et al., 2018). To deal with persistent overcapacity in the interim, a federal buyback program removed a number of permits from the Pacific whiting fishery as well as other fisheries on the West Coast in 2003. A five percent fee on landings of groundfish, crab, and shrimp was implemented to repay the USD 10 million public funding appropriation and the USD 36 million loan (Warlick et al., 2018). In 2002,

[100] https://www.pcouncil.org/

Rockfish Conservation Areas were established, which closed certain areas and depths to fishing in order to minimize bycatch of rebuilding rockfish species. There are several additional management measures that affected certain aspects of the fishery that are not mentioned specifically here. For more details, see Warlick et al. (2018) and the groundfish regulations (50 CFR part 660, subparts C – G, 2017).

There are several monitoring, control, and surveillance systems in place in the fishery. OLE uses patrol boats and collaborates with a number of organizations including the US Coast Guard to enforce fishery regulations.[101] Before a vessel leaves port, a declaration report must be submitted declaring the gear type to be used on the trip. All vessels are required to have a vessel monitoring system (VMS) on board to transmit the vessel's location to OLE. Electronic software assists in recordkeeping for logbooks and fish tickets. Observers and catch monitors are also used to track discards and catch of bycatch species. In the event of noncompliance, economic sanctions may be applied as well as criminal charges. For more details, see the groundfish regulations (50 CFR part 660, subparts C – G, 2017).

2.2 Brief history of the former rights-based approaches used in the fishery
As noted above, the fishery has been operating under a license limitation program since 1994.

2.3 Rights-based approach: allocation and characteristics
In 2011, an IFQ program was introduced into the shoreside Pacific whiting fishery, as well as the shoreside non-whiting groundfish trawl fishery through the West Coast Groundfish Trawl Catch Share Program. The catch share program also included cooperative programs for the at-sea Pacific whiting fisheries. Some of the main goals of the program were to resolve issues with overcapacity and high amounts of discards in these fisheries (PFMC and NMFS, 2017). The Council considered a number of different alternatives prior to the implementation of the program taking into account stock sustainability, economic outcomes of harvesters and processors, community outcomes, tribal fishing rights, and new entrants, amongst other considerations (PFMC and NMFS, 2010). The complex program is comprised of a number of provisions, including a mandatory annual cost-earnings survey of all participants and 100 percent observer coverage.

With the introduction of the catch share program, the US tribal fishery maintained the right to 17.5 percent of the total US TAC of Pacific whiting. In the shoreside non-tribal fishery, 80 percent of the fishing quota was allocated to vessel permit owners (which include a variety of entities) based on catch histories between 1994 and 2003. The remaining 20 percent of the fishing quota was allocated to eligible processors based on historical purchases between 1998 and 2004. Eligibility required the purchase of at least one metric ton of Pacific whiting in at least two years from 1998 to 2004 (PFMC and NMFS, 2010). Allocating harvesting quota to processors was motivated by concerns of stranded capital in the processing sector as well as potential shifts in bargaining power towards vessels in the ex-vessel market that could arise with season lengthening under IFQs (PFMC and NMFS, 2010).

Fishing quota allocations have no sunset clause, but may be revoked, limited, or modified at any time per 16 U.S.C. 1853a SEC. 303A.[102] In order to own a fishing quota, one must be a US citizen, a permanent resident alien, or corporation, partnership, or other entity that is eligible to own a US fishing vessel with a fishery endorsement under 46 U.S.C. 12113 (50 CFR part 660, subparts C – G, 2017). Fishing quota can be leased and, starting in 2014, permanently bought/sold in units smaller than the original allocation if desired.

Fishing quota can also be inherited. Quota accumulation limits restrict the amount of quota any one entity can hold. Initial allocations over the limit were given an initial grace period and then required

[101] https://www.fisheries.noaa.gov/about/office-law-enforcement
[102] https://www.law.cornell.edu/uscode/text/16/1853a

to divest any amount in excess of the limit (Warlick et al., 2018). All catch of IFQ species (retained or discarded) must be covered by quotas, or the vessel must stop participating in the fishery until any deficit is resolved.

The West Coast Groundfish Trawl Catch Share Program included some explicit costs for industry participants. Cost recovery fees, federally-mandated to recover government costs associated with private use of a public resource (not to exceed three percent of ex-vessel revenue in a given year), were implemented in 2014 (Warlick et al., 2018). Costs of observers increased under IFQs with 100 percent coverage. During the transition, NMFS provided a subsidy that gradually decreased from USD 330 per day to USD 0 from 2011 to 2016 (Warlick et al., 2018).

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

The transition to IFQs in the shoreside Pacific whiting fishery ended the race to fish that existed prior. Under derby conditions, seasons were an average of 20 weeks from 2005-2010 and extended to an average of 27 weeks under IFQs, with the average processor purchasing whiting almost twice as many days (72 days under IFQs compared to 38) (Guldin and Anderson, 2018).

The IFQ program was also intended to reduce discards and bycatch. Individual accountability can make bycatch more constraining if fishers engage in very risk-averse behaviour to avoid disaster tows, particularly for species where individuals were allocated very small amounts of quota. Bycatch in the shoreside Pacific whiting fishery has been more constraining in recent years because of the rebuilding of overfished species (PFMC and NMFS, 2017). An informal risk pool was created in the shoreside sector to share information and quota in the event of a “lightning strike” (Holland and Jannot, 2012). Since 2011, there has been one incident in the shoreside whiting fishery where a vessel had a disaster tow and exceeded their individual quota limit (PFMC and NMFS, 2017).

3.2 Economic viability of the fishery

Consolidation was projected to occur under the IFQ program in both the harvesting and processing sectors, as less capital would be required to harvest and process fish over a longer season (Errend et al., under review; Guldin et al., under review; PFMC and NMFS, 2010). The shoreside Pacific whiting fleet consolidated 29 percent from 2009-2010 to 2011-2015, from an average of 34 vessels to 24 vessels (PFMC and NMFS, 2017). The average length of vessels in the fishery has increased by 7ft and engine horsepower has increased by almost 150. The number of land-based Pacific whiting processors dropped from 12 in 2009 to eight in 2015 (Guldin et al., under review). This decrease in participating processors had little effect on the Herfindahl-Hirschman index (HHI) of pounds purchased, as exiting processors had comparatively small market shares that were then distributed across remaining processors (Guldin and Anderson, 2018). In terms of regional purchasing behavior, most port areas experienced decreases in the number of Pacific whiting buyers from 2006-2010 to 2011-2015. The most notable declines occurred in southern Oregon and northern California, with no purchases of Pacific whiting in California under catch shares where some smaller operations existed previously (Guldin et al., under review).

Potential increases in Pacific whiting prices, both first-wholesale and ex-vessel, were anticipated under catch shares. Longer seasons could provide opportunities to increase value in the fishery, thus leading to higher first-wholesale prices, and potentially higher ex-vessel prices (PFMC and NMFS, 2010). In addition, season lengthening could induce shifts in bargaining power in the ex-vessel market towards harvesters, potentially mitigated by the allocation of quota to processors (PFMC and NMFS, 2010). Processors paid higher ex-vessel prices under IFQs with an average of USD 0.12/lb. compared to UDSD 0.09/lb. in 2009-2010 (Guldin et al., under review). However, no corresponding increase in first-wholesale prices was observed, possibly indicative of a shift in bargaining power (Guldin and

Anderson, 2018; Guldin et al., under review). The industry average markup (total fish production value divided by total fish purchase cost) for Pacific whiting decreased from an average of 3.7 in 2009-2010 to 2.9 in 2011-2015 (Guldin et al., 2017).

Variable cost net revenue (revenue minus variable costs) is a measure of operating profit. Variable cost net revenue per metric ton is examined to compare across years with widely-varying TAC. Variable cost net revenue per metric ton from shoreside Pacific whiting harvesting increased substantially for the average vessel, from USD 32 in 2009-2010 to USD 126 in 2011-2014 (PFMC and NMFS, 2017). Fleet-wide expenses as a percentage of revenue decreased over this period as well (PFMC and NMFS, 2017). Variable cost net revenue per metric ton from shoreside Pacific whiting processing operations decreased for the average processor, from USD 415 in 2009-2010 to USD 294 in 2011-2014. The longer seasons were anticipated to lower costs of production for processors, allowing them to utilize their labour and utilities more efficiently. Guldin and Anderson (2018) explore changes in production worker and utility expenses per processed pound for all operations at Pacific whiting facilities, finding weak evidence of efficiency gains. Whiting harvesters and processors are heterogeneous and there is a large variation in many of these metrics, particularly net revenue. More information and other metrics can be found on NOAA Fisheries' FISHeries Economics Explorer (FISHEyE).[103]

Individual crewmember compensation (for all operations) increased on vessels participating in the Pacific whiting fishery, with average daily wages 83 percent higher and average annual wages 118 percent higher in 2011-2015 compared to 2009-2010 (PFMC and NMFS, 2017). Respondents of the Pacific Coast Groundfish Fishery Social Study indicated that they felt there were fewer jobs connected to the groundfish fishery than prior to catch shares (PFMC and NMFS, 2017). However, it should be noted that this information includes the perspectives of those fishing in the at-sea whiting fishery and the non-whiting groundfish fishery.

Discussions of concentration of ownership of vessels, gear, and quota are limited by available information and challenges associated with linking affiliates.

3.3 Social equality

The IFQ program created a new type of fishery participant, quota shareowners, that don't necessarily have to directly participate in harvesting and processing. Quota shareowners can lease their quota in entirety (or in smaller units) and earn income from the fishery via indirect participation. Data suggest that vessels that have chosen to remain in the whiting fishery are spending a larger portion of revenue on quota purchases and leases from those that have exited or have decreased participation (PFMC and NMFS, 2017). The quota also increases the cost of participation for new entrants into the harvesting and processing sectors.

Of the processors originally allocated whiting quota, whiting quota share ownership has increased from 20 percent to 23 percent (PFMC and NMFS, 2017). These processors currently own quota shares for non-whiting species as well; although, they own no more than 2.114 percent of any one quota species aside from Pacific whiting (PFMC and NMFS, 2017). It is important to note that these values exclude any other processors (those that were not originally allocated whiting quota) and any accounts linked to processors that may have acquired quota. Regarding processor use of harvesting quota, there is little evidence that processors are directly capturing the value of their quota by leasing in the quota market. Only three percent of transfers of processor-affiliated quota to independent vessels involve an explicit cash value, although it is possible that the price was not known at the time of the transfer or that the price was not recorded (PFMC and NMFS, 2017). Processors seem to be using quota to support bargaining relationships with vessels to secure deliveries, by offering quota as

[103] https://dataexplorer.northwestscience.fisheries.noaa.gov/fisheye/

a percentage of landings to delivering vessels (PFMC and NMFS, 2017). There is mixed evidence that processors extract value from quota through ex-vessel price adjustments. The following are quotes from the Pacific Coast Groundfish Fishery Social Study from processors describing how they are utilizing the processor quota allocation within the catch share program:

> "I entice boats to come in with fish, not money. Fish equals money, right? … I tell them you bring your fish to me and I will match your deliveries by 20%...I am paying you to catch my fish" —Oregon Processor

> "We're not leasing it out, we have to give it to them… You can't even charge a lease fee for it. If we want their 5 million pounds of whiting, we have to give them 1.5 million of our own" —Washington Processor

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

Challenges and competing interests between fishers arose during the development of the West Coast Groundfish Trawl Catch Share Program given that it covered multiple fisheries and multiple species. Some fishers in the Pacific Coast Groundfish Fishery Social Study believed that the Pacific whiting fisheries had more influence on management, and both whiting and non-whiting fishers believed the program would benefit the Pacific whiting fisheries more than the non-whiting groundfish fishery (PFMC and NMFS, 2017). Some of these conflicts have persisted through catch shares, as it is generally perceived that Pacific whiting outcomes have been better under IFQs than outcomes in the non-whiting groundfish fishery.

Conflicts between fishers and managers have arisen as well. In the Pacific Coast Groundfish Fishery Social Study, some fishers expressed that the program favored the interests of fish over those of fishers, perceiving the program's emphasis on 100 percent accountability as an indication of distrust in the industry (PFMC and NMFS, 2017). In addition, some expressed that the management process would discount fisher experience in favor of science (PFMC and NMFS, 2017).

Regarding conflicts over allocation of the resource, there was mixed support for allocating fishing rights to processors in the shoreside Pacific whiting fishery during program development. Some believed that processors would be disadvantaged without an initial allocation of quota, while others believed it would give processors too much power in the ex-vessel market (PFMC and NMFS, 2010). The provision was also debated by researchers, some in support (Matulich, 2010) and others expressing concern (Wilen, 2009). In addition, lawsuits arose after program implementation where vessels and processors challenged the control dates used for developing initial quota share allocations, however the original allocations were upheld after a review (Pacific Dawn, LLC, et al. v. John Bryson, et al., 2011; Pacific Dawn, LLC, et al. v. Penny Pritzer, et al. and Midwater Trawlers, et al., 2013). There have also been some conflicts over access to bycatch between fishers targeting Pacific whiting in the shoreside and at-sea fisheries as well as with fishers participating in other fisheries including recreational fisheries.

Conflicts also exist between fishers and processors, and within the processing sector. Several lawsuits have been filed in recent years citing anticompetitive behavior, including *Whaley v. Pacific Seafood Group* (2010), *Boardman v. Pacific Seafood Group* (2016) and *Seawater Seafoods Co. v. Dulcich* (2016). The first of which reached a settlement agreement, the second of which was dismissed, and third of which was dropped.

4.2 Improving fishery sustainability in the future

This case study highlights some of the benefits and challenges associated with rights-based management. In general, it is perceived that IFQs have improved conditions in the Pacific whiting fisheries (although partially influenced by increasing TACs), particularly regarding the elimination of the race to fish. Regarding the allocation of harvesting quotas to processors, discussions with industry members appear to indicate that a mutually beneficial situation has arisen with regards to the use of quotas. However, more research is required to understand the full effects.

The complexity of the catch share program and sometimes-competing interests of participants within fisheries as well as across fisheries illustrate the challenges associated with multispecies fisheries management. As the program continues to mature and develop, careful consideration must continue to be given to interactions between fisheries, communities, and stocks.

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A Case Study of Advanced Post Harvest Management in Korean Fishing Village Community

Heon Dong Lee

Please refer to the case study presentation available at:
http://www.fao.org/3/CA2456EN/ca2456en.pdf

The Bering Sea/Aleutian Island Crab Rationalization Program: Addressing Community Effects with Processor Quota

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Abstract
The Bering Sea/Aleutian Islands crab fishery has been made famous by Discovery Channel's Deadliest Catch program, which shows viewers how harvesters brave the ice and storms of the Bering Sea to catch king, snow and tanner crabs. Although always well managed biologically, in 2005, the fishery implemented an ITQ program in order to reduce overcapitalization and reduce the competitive fishing that created dangerous conditions. In the first year of the program, the number of vessels participating decreased by two thirds. Many exiting vessel owners have continued to benefit from the fishery by leasing their quota allocations to vessels that are still fishing, but their hired crews have been displaced. A distinctive feature of the BSAI crab program is that, in addition to harvest quota, processors were allocated processing quota. This means a pound of landed crab must be offset by harvest quota, and by processing quota. This feature is designed to maintain the geographic distribution of landings, and in particular sustain historic processing participation in island communities in the Bering Sea that are near the fishing grounds, and which had a considerable advantage during the derby. This case study will draw on several recent NOAA studies, including the recently completed ten-year review of the effects of the catch share program.

1. INTRODUCTION

1.1 Description of the fishery

The Bering Sea/Aleutian Island crab fishery pursues several valuable stocks in the Bering Sea, west of Alaska and north of the Aleutian Islands. An overwhelming majority of the landings are Bristol Bay red king crab (*Paralithodes camtschaticus)* and snow crab (*Chionoecetes opilio and Chionoecetes bairdi*). There are smaller fisheries, open in some years, on golden king crabs, and two populations of blue king crabs; this analysis focuses on the red king and snow crabs, since they constitute enough of the catch as to determine fleet-level outcomes.

Figure 1 shows the trawl survey abundance of the male red king and *opilio* crabs targeted by the fishery; effort location is considered confidential, but tracks abundance for king crab and is on the southern region of *opilio* abundance, due to polar ice during the fishing season. The king crab season opens 15 October, and harvesters typically then return home for the holidays before beginning the snow crab season, which is most intensive January through April. King crab are harvested at depths of 90 to 300 feet, while snow crab are harvested at depths of 240 to 320 feet.

BSAI crab stocks are considered to be sustainable, with stocks at or near MSY (NPFMC 2017b). In 2017, the Eastern Bering Sea snow crab stock was estimated to be at 0.71 B_{MSY}, and the Bristol Bay red king crab population at 0.85 B_{MSY}. Most other assessed populations were above B_{MSY}, except Pribilof Island blue king crabs, which is designated as "overfished", reflecting low stock levels arising from ecosystem shifts in its range; it has not been fished since the 1980s and is not returning to its previous level.

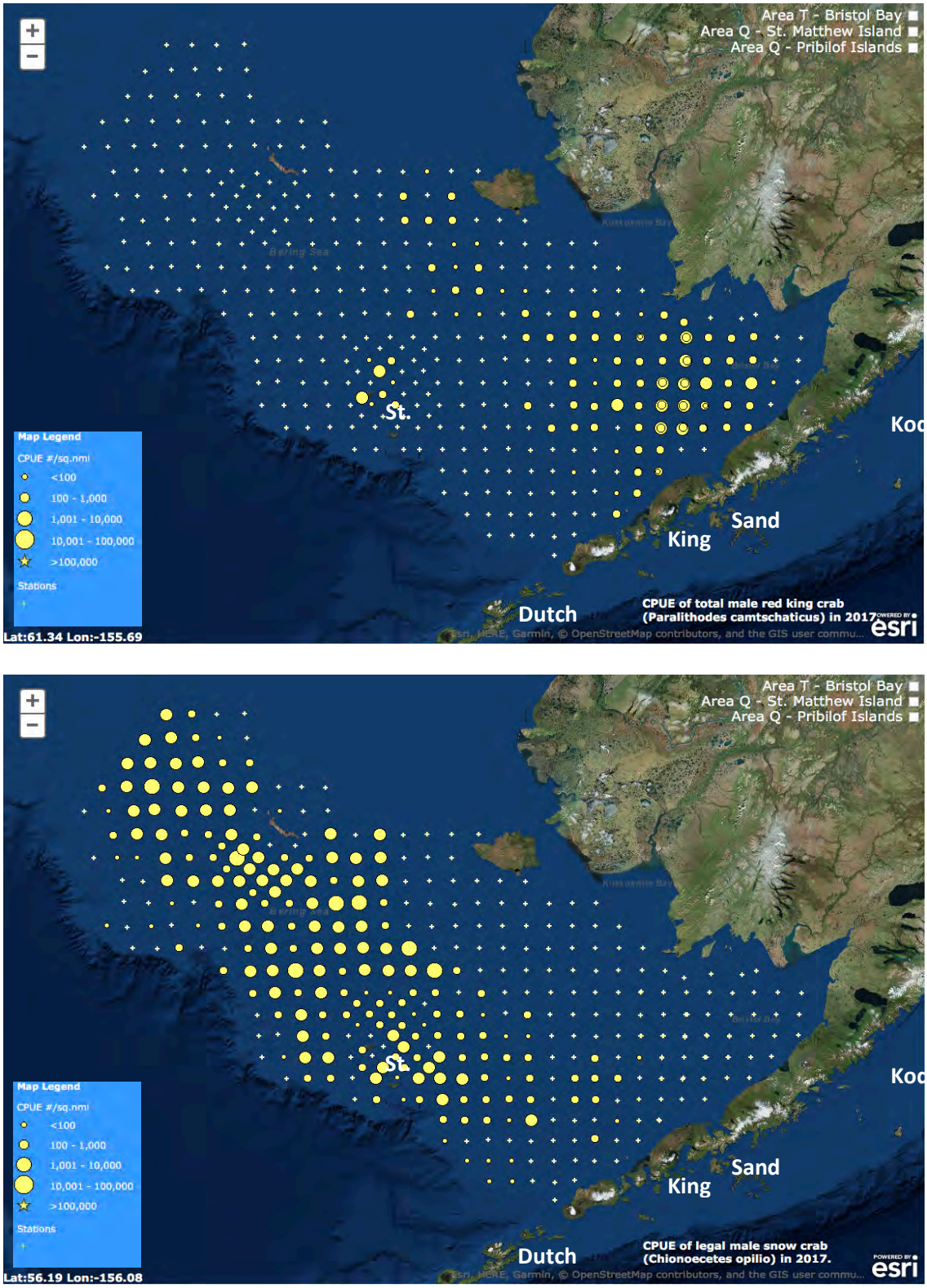
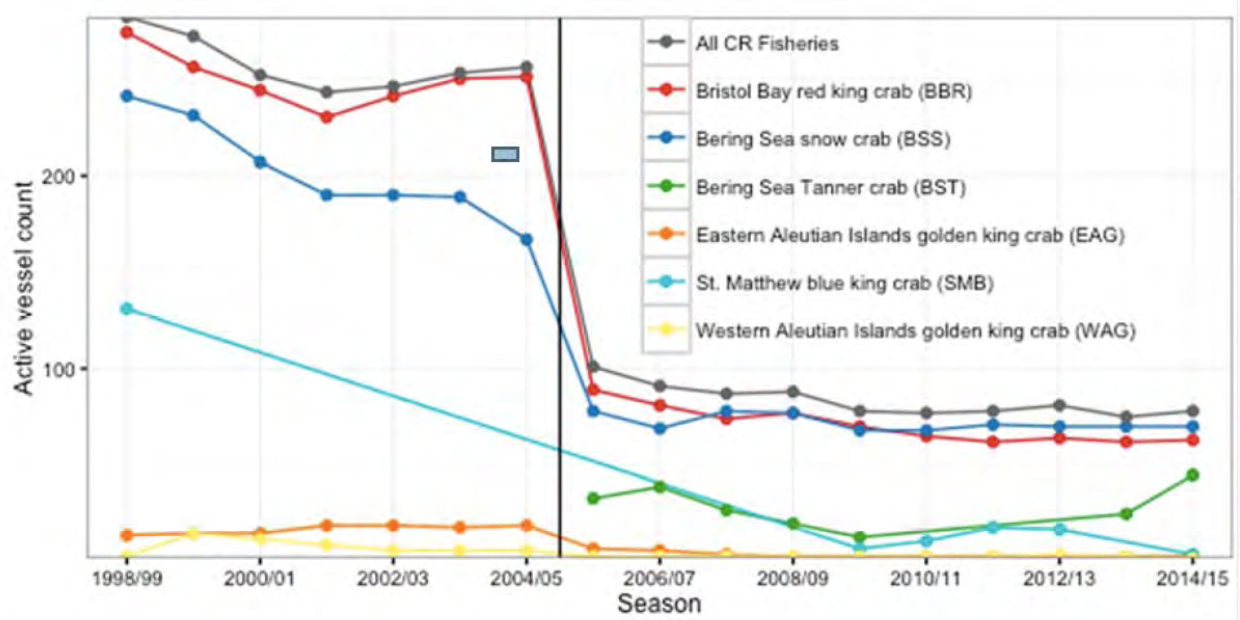


Figure 1. 2017 trawl survey abundance and key processing ports in the BSAI crab fishery.
Source: https://www.afsc.noaa.gov/maps/crabmap/crabmap.html

The fleet averages around 90 active vessels, with roughly 25 percent from Alaska, in equal measure from Kodiak and all other ports (Figure 2). Seventy percent of the vessels are from Washington state, predominantly home ported in Seattle, over 1 700 miles away. Majority foreign ownership is prohibited in this fishery.



Source: NMFS AKRO RAM Division IFQ accounting database.

Figure 2. Active vessels each season, before and after the transition to ITQs.
Source: NPFMC 2017a Figure 5-1.

While some vessels have the capacity to process onboard, most of the catch is landed and processed shoreside. Major processing communities include Dutch Harbor/Unalaska, St. Paul, King Cove and Kodiak. These are all small to very small communities whose primary industry is fishing, and in the case of St. Paul and Dutch Harbor, primarily fish processing. Dutch Harbor is the primary port for the industrial groundfish fleets which account for most of the volume of Alaska's fisheries, and St. Paul's primary industry is crab processing (NPFMC 2017a Table 1-a). St. Paul's location in the middle of the Bering Sea, and close to the crab grounds, was an important competitive advantage during the pre-ITQ derby, a factor that will be discussed later.

Figure 3 shows a standard configuration for a BSAI crab vessel. Most vessels in the fishery are between 100 and 150 feet in length, with a median size of 197 gross tons (NPFMC 2017a Table 5-6). Their engines range from 500 to 2 000 horsepower, with a median of 940, reflecting the importance of being able to maneuver in very rough seas as well as a legacy of a race-to-fish, which required fast vessels. Vessels have recirculating seawater tanks in which the caught crab are stored live. The fishery uses steel pots with mesh sides of approximately 7'x7'x3', baited with a combination of cod, small pelagics and squid, deployed as shown in Figure 4. Vessels typically operate with a deck crew of 4, plus a captain who may be the vessel owner or may be hired. Vessels, gear and quota share are typically owned by individual families, although the legal structure of the family business varies (see NPFMC 2017a Table 4-5 for quota ownership information, which roughly mirrors harvest capital ownership).

Figure 3. 125-foot BSAI crab vessel Northwestern.
Source: http://fvnorthwestern.com/northwestern/#jp-carousel-2302

Figure 4. Pulling a crab pot in calm seas.
Source: AFSC 2016.

Fishing trips are typically five to ten days, giving harvesters a chance to set gear, find crab populations, catch and load crab, and deliver to their processor before dead loss mounts; dead loss is a concern when crab have been on board for five to seven days. Vessels have delivery appointments at processors that often dictate when fishing ends and transit to the processor begins.

Given the isolated nature of the resource, and sideboard and gear configuration arrangements that prevent others from catching crab, there are minimal conflicts with other groups. Of course, there are differing ideas about how to evolve the fishery that work through the Council process, but the fishery has not been subject to any disasters during the period of the IFQ program.

1.2 Economic contribution and social implications of the fishing activity

Caught crabs (Figure 4) are immediately sorted onboard to remove females and undersized males, which are returned to sea; current discard mortality estimates are between one third and one half. Legal size males are retained and delivered live to processors; processors do not accept dead crab, though dead loss is counted against a vessel's IFQ. Crabs are quickly cooked, then frozen and portioned. Snow crabs are sold globally as clusters (clusters of five legs from each side of the animal) and king crab are sold as individual legs. The catch is then shipped frozen. Between 2010 and 2014, 57 percent of the snow crab volume was sold within the US, with China representing 24 percent of sales, primarily for reprocessing and export to Japan and other Asian markets (AFSC 2016 p. 115). Forty-four percent of king crab was consumed in the United States, while Japan is the largest export market, accounting for 34 percent of the total (AFSC 2016 p. 126).

The high-value products that come out of the BSAI crab fishery make up the majority of income for nearly everyone who participates in the fishery. The seasons of the individual crab fisheries are spaced out, so most LLP holders participate in multiple crab fisheries to make up a year-round business. Many vessels will tender for salmon processors in Bristol Bay or southeast Alaska during the summer when no significant crab fisheries are open, and some will also use their pots to catch pacific cod. However, BSAI crab nevertheless drives the economic outcomes of their businesses.

For the crew, including hired captains, hired engineers and deck crew, the BSAI crab fisheries provide the opportunity to make a comfortable year's salary in a few months of very hard, dangerous work. The crew are paid on a shared system, where the vessel subtracts certain costs such as food and divides the remainder of the revenue among the boat, captain, and individual crew members.

For processors, crab fisheries range from a critical component of a multi-fishery processing strategy to the lifeblood of the community. Kodiak, for example, was home port for much of the Alaska-based fleet prior to the ITQ program. Processors there, who focused mainly on summer fisheries like groundfish and salmon, would buy the fleet's last load as they came home at the closure of the season. Kodiak was home to a number of smaller or less well-maintained boats, and its fleet consolidated disproportionately. However, processors have remained in business to handle groundfish and salmon during the summer. In contrast, St. Paul Island developed a significant specialist crab processing plant during the derby, and it is the island's major employer. Although it is very expensive to operate in the middle of the Bering Sea, their proximity to the resource gave them an advantage in a derby, where full vessels could offload without taking the additional time to steam to Dutch Harbor; by saving steam time, vessels could get back to competing for a larger share of the TAC sooner. However, with quotas, vessels do not need to compete with one another for a share of the catch, so the steam time does not lead to foregone catch. Due to higher operating costs, the plant in St. Paul could not compete with other plants on the price for crab or other products, and thus faced the threat of going out of business under a standard ITQ system.

To address concerns by St. Paul and communities with other small processing plants close to the fishing grounds, the Council developed the concept of IPQ, which was assigned to processors based on their history, and transactions were geographically restricted. The BSAI fishery region, and subregions within it that dictate the movement of IPQ are legally defined, and operations within them are licensed and taxed as commercial businesses. Additionally, there is a tax on fish landings in the state of Alaska, and in some communities. Some cooperatives voluntarily tax their own landings in order to fund operating expenses.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

The management of harvest quota share provides for allocations to two separate groups: the fishing fleet and Community Development Quota (CDQ) groups (https://alaskafisheries.noaa.gov/fisheries/cdq). CDQ groups are seven regional corporations representing coastal communities in western Alaska, most of which have predominantly indigenous residents. They receive quota allocations in several fisheries, some of which, like halibut, coastal communities have significant participation histories, and others of which, like crab, pollock and groundfish, the communities have not had the harvesting capital or technology to participate historically.

2.1 Management of the fishery

BSAI crab populations are managed jointly by the Alaska Department of Fish and Game (ADF&G), and the North Pacific Fishery Management Council (NPFMC). They are regarded as very well managed, with the most important stocks being the Bristol Bay red king crab and the Eastern Bering Sea *opilio* and *bairdi*, both marketed as "snow crab". The NPFMC establishes TACs, size and sex restrictions and other conservation measures as part of the Fishery Management Plan Framework, while ADF&G establishes reporting requirements, state bycatch limits, and aspects of gear (see NPFMC 2011).

Federal regulatory authority is provided by the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The MSA establishes eight regional councils around the United States; the NPFMC regulates fisheries in the portions of the Bering Sea and Gulf of Alaska within the US EEZ. The NPFMC process is considered co-management, as the Council is a politically appointed body of representatives primarily of the North Pacific fishing industry, often leaders within individual fishing industry groups. It is further advised by two appointed bodies, an industry Advisory Panel (AP) which consists of representatives of major industry groups, and a Scientific and Statistical Committee (SSC) comprised of academic and agency scientists. Meetings of these groups follow US public meeting and rulemaking regulations, with extensive notice and opportunities to provide public comment before and during each public meeting. Measures are proposed by the process, given an analysis by Council or National Marine Fishery Service staff, provided for public review and testimony, peer review by at least the AP and SSC, before being presented for approval by the Council. Opportunities for public input, and especially input by industry organizations, are many.

Each year, the NPFMC uses this process to establish a total allowable catch (TAC) for each population. In US law, a TAC is a hard cap on fishing landings, and which, when met, shuts down fishing with gear capable of catching the species. For the reasonably well targeted crab fisheries, this means the fishery stops when the TAC is met.

The TAC for the key populations are based on annual stock assessments, which are developed by a lead assessor and refined through critique by an NMFS Plan Team of stock assessment scientists (NPFMC 2017b). This means that not only are new data introduced every year, but the form and structure of the stock model is refined and evolved. The recommended stock assessment model is then presented to the SSC, which uses the results of the recommended and alternative models to select an Allowable Biological Catch (ABC). The models on which crab ABCs are set have improved dramatically in the last decade, and now include estimates of reference points and quantified

uncertainty, which qualifies as Tier 3 within the Council's five-tier system of classifying stock assessments. Based on the assessment, a harvest control rule is applied, and uncertainty-scaled buffers added, to establish a fishing mortality that will not exceed maximum sustainable yield and an ABC. The Council then sets a TAC, which may not exceed the ABC under US law.

While the effective mortality and effort controls are through the TAC and quantity of quota issued, there are a number of supplemental regulations. Vessels must hold a limited entry license permit (LLP) to be eligible to fish. Gear is restricted by pot size, and escapement vents must be placed within the pot netting, with size varying by the fishery. The fishery only retains legal size (varies by species) mature males, so undersize males and all females are returned to the ocean. The fishing season is selected to minimize discard mortality, with no fishing allowed during the molt or soft shell stages. Within these restrictions, however, harvesters can fish as much gear as they can transport and take as much crab as they can catch. There are no regulations on vessel size or power. The need to have several-hour offloads at a processor around which a cooperative is organized institutes a *de facto* port schedule.

Depending on the nature of conflicts that arise, different resolution mechanisms are available. For conflicts about fishery policy, the Council process effectively allows parties to bring their positions into a public process that evaluates potential changes. Torts among participants are resolved in US courts, though smaller scale disputes may be resolved interpersonally, or through the cooperatives. Overall, clearly defined property rights ensure there are relatively few unresolved conflicts.

Activity in the fishery is monitored through a range of mechanisms. The US Coast Guard is responsible for certifying vessels as safe to operate, and they also ensure compliance with safety regulations at sea, with boardings from vessels and monitoring from helicopters. Vessels are required to use VMS and keep logbooks of when and where they fish and how much they catch, though at-sea verification is for form rather than correct counts. The fishery has onboard observers, dockside observers, and fishery independent trawl surveys. Landings are entered by processors in the eLandings system to ensure accurate catch accounting. Violations of these regulations can bring about heavy fines, criminal charges, and social sanctions.

2.2 Brief history of the former rights-based approaches used in the fishery

The BSAI king crab fisheries were first developed in the 1950s, primarily by foreign interests. Following the establishment of EEZs, US interests took over the open-access king crab fisheries and developed the snow crab fisheries, with catches in the former peaking around 1980 and the latter in the early 1990s. A moratorium on new entrants was enacted in 1995, with limited entry licenses (LLPs) issued to vessels that developed the various crab fisheries in 2000. Importantly, these vessels were primarily based in Seattle, Washington, more than 1 700 miles away. Coastal Alaska communities lacked the capital and did not historically participate in this offshore fishery in notoriously rough waters; they rather developed participation history in the processing sector. Under the limited entry system, mortality was managed as an Olympic derby: at an appointed time, fishing would open for a population. Vessels would race to the fishing ground in an attempt to catch as much crab as possible before the fishery closed. ADF&G would track catches each day until it gauged that the guideline harvest level (GHL) was being approached, and then announce the fishery closure.

This derby had several effects on fishing strategies. First, the fishery was badly overcapitalized: vessels were used that could carry many pots in one trip, and store large amounts of crab, so available fishing time was not wasted moving gear or product back and forth to port. This led to excessive costs and low levels of profitability that caused some vessels to be under-maintained. Third, even with larger capital, it was common for vessels for overload themselves with crab or gear, which compromised safety because overloaded vessels were more likely to capsize, especially during the winter *opilio* season when ice storms could coat loaded gear in thick sheets of ice. Fourth, because vessels lost the

opportunity to fish if they delayed their fishing because of poor weather, vessels fished in very bad weather and very dangerous sea conditions.

These fishing behaviors had three key adverse consequences, which were the focus of the Council's purpose and need statement for the ITQ program. First, racing to fish, overloaded and in bad weather, meant fishing was extremely dangerous, and this relatively small fishery lost an average of more than one life per year (NPFMC 2017a Appendix C, Fig. 7), making it one of the most dangerous jobs in the United States, and inspiring the title of a popular reality TV show, *Deadliest Catch*. Thus, the primary reason many supported the movement to ITQs was to eliminate the derby and improve safety in the fishery. Second, because harvesters were loading boats heavily, there was measurable dead loss in the fishery. Thus, the Council wished to improve yield and catch the accuracy of catch accounting. Finally, the stock of excessive, poorly maintained capital meant the Council wished to restore profitability by reducing excess harvesting capital. Thus, the elimination of many vessels from the fleet was a stated objective of the ITQ program.

The derby induced by the limited entry management also dictated the structure of the processing industry. In-season surges of crab landings meant enormous processing capacity was needed. Further, since landing meant time away from the fishing derby for the vessels, processing capacity close to the fishing grounds was valuable. Thus, large processing plants with highly seasonable employment were built in a number of isolated communities in the Bering Sea. Most notable among these is the plant on St. Paul Island, in the Pribilofs. The plants often provide the most significant source of employment in some communities, and in the case of St. Paul Island, they do not process for other fisheries.

2.3 Rights-based approach: allocation and characteristics

The user rights system in the BSAI crab fishery has two main components, a transferable individual fishing quota (IFQ) system for harvesters and a unique parallel set of individual processing quota (IPQ) to process caught crab. Both quotas are defined as a permanent right to a percentage (or share) of the annual TAC. This share is referred to as a quota share (QS), which each year beget an entitlement to a number of pounds based on the current year's TAC. These annual rights are termed quota pounds (QP), and selling them corresponds to a single year lease of quota. These are mediated by an extensively used cooperative system, in which harvesters may join cooperatives centered around processors to facilitate trading of quota to ensure small quota pound residuals on each vessel are efficiently caught at the end of the season.

Under the current system, once a TAC is established, 90 percent is allocated to holders of harvest quota shares, and ten percent to the Community Development Quota (CDQ) or Adak Community Allocation (or Western Aleutian golden king crab). Of the harvest QS, roughly 97 percent was allocated to LLP license holders based on their vessels' historic participation in the fishery, and the remaining three percent to hired captains (referred to as "C shares" or "crew QS") based on their individual participation. Of the harvest QS, approximately 90 percent must be landed at a processor holding IPQ, which is the right to process a share of the TAC allocated to individual processors at the outset of the program. For LLP holders who do not process themselves, or without an ownership link to a processor (an overwhelming majority of the fleet), the allocation is divided into 90 percent A shares and ten percent B shares. The motivation behind the B shares is to allow flexibility for the harvester (e.g., for small trips at the end of the season, or for offloading in the event of mechanical difficulty), to ensure harvesters have some leverage in price negotiations by threatening to take their B shares to other processors (NPFMC 2017a p. 10), and potentially to allow for entry of new processors (NPFMC 2017a p. 13).

The effect of this A/B split on markets has not been determined. Despite a vigorous ex ante argument about the appropriate division to prevent processors monopsony (e.g., Matulich et al. 1996; see also Wilen's (2010) response to extending these lessons to another fishery) there has not been an analysis

of whether this ensures competitive pricing, as the market that would set prices for ex-vessel crab has completely collapsed. Mathematically, taking the market for wholesale crab as given, it is possible to solve for prices in the markets for landed crab and therefore the value of harvest quota. However, introducing processing quota means that there is no unique solution for the price of IFQ and IPQ, only the sum of the two (Matulich and Sever 1999). Market participants have been unable to resolve this competitively, and a binding arbitrator has set ex-vessel crab prices to preserve the historic division of rents between harvesters and processors every year of the IFQ program (NPFMC 2017a p. 20).

Quota pounds to cover a catch may be acquired after landing. Leasing is allowed only for members of a cooperative, a provision which was delayed for five years to allow the formation of relationships necessary to support networks for leasing (NPFMC 2017a p.10). Therefore, the owner of the quota does not need to be on board a vessel while it is being fished.

To prevent pure speculation in quota, quota holders must be a US citizen and have at least 150 days of sea time as a harvester in some US fishery. Corporations or partnerships that are at least 75 percent US-owned, and at least 20 percent owned by a US citizen meeting the 150 day criteria, may also own quota (NPFMC 2017a p. 11). To prevent excessive concentration, there are vessel use caps that limit the owned plus lease quota harvest of vessels, typically one percent in the largest fisheries. (see https://alaskafisheries.noaa.gov/sites/default/files/reports/1415ifqquotacaps.pdf)).

Complementary to the harvest quota system, the "rationalization" program established a parallel quota instrument held by those wishing to process crab landed with A IFQ shares. PQS shares were allocated to incumbent processors in proportion to their processing activity during pre-rationalization qualifying years. To restrict vertical integration, no PQS holder may hold over 5 percent of the QS of any fishery. No processor can hold more than 30 percent of the PQS in any fishery, except the northern region snow crab fishery, where the cap is 60 percent. Importantly, custom processing arrangements where crab is processed to its (harvesting owner's) specification without taking ownership of the crab, are exempt from these processing caps.

Community protection, for communities involved primarily through processing, is provided through "regionalization" of processor shares, which by implication require A shares to be landed in specific communities. While the transfer of PQS and IPQ is allowed, it is not generally allowed across regions. Further, communities retain a "right of first refusal", which allow key community groups to match offers to sell IPQ out of the community (NPFMC 2014).

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

As the rationalization program simultaneously implemented harvest ITQs and IPQs, effects of both were observed. The ten-year review (NPFMC, 2017a) presents a comprehensive review of these effects, but this report emphasizes the unique effects of the IPQ, and hence presents only the major effects of the ITQ program.

3.1 Sustainable use of the resources

The BSAI crab fisheries were well managed prior to the IFQ program, so the rights program itself has not changed the structure or health of the stock or the characteristics of the retained catch. However, there is some evidence that the quality of data, and therefore, the models which can be built based upon them, have improved. The ten-year review of the IFQ program identified several improvements in sustainable resource use, although the resources were used relatively well prior to the program on a global scale. In a derby fishery, hitting a GHL can be difficult, and though overages were generally small, the GHL was exceeded in two of the five years immediately prior to the IFQ program in the BBR fishery, and in four of the five years in the BSS. Neither fishery has ever exceeded the TAC since IFQs. This improvement is supported by increases in the quality of catch accounting, including required

onboard logbooks and reports by processors into the eLandings catch accounting database. In the IFQ period, the quality of the crab stock assessments has increased, so the major stocks have credible estimates of their reference points. However, it is difficult to ascribe this change exclusively to the IFQ program, as many fisheries in the North Pacific have undergone similar improvements in stock assessment methodology.

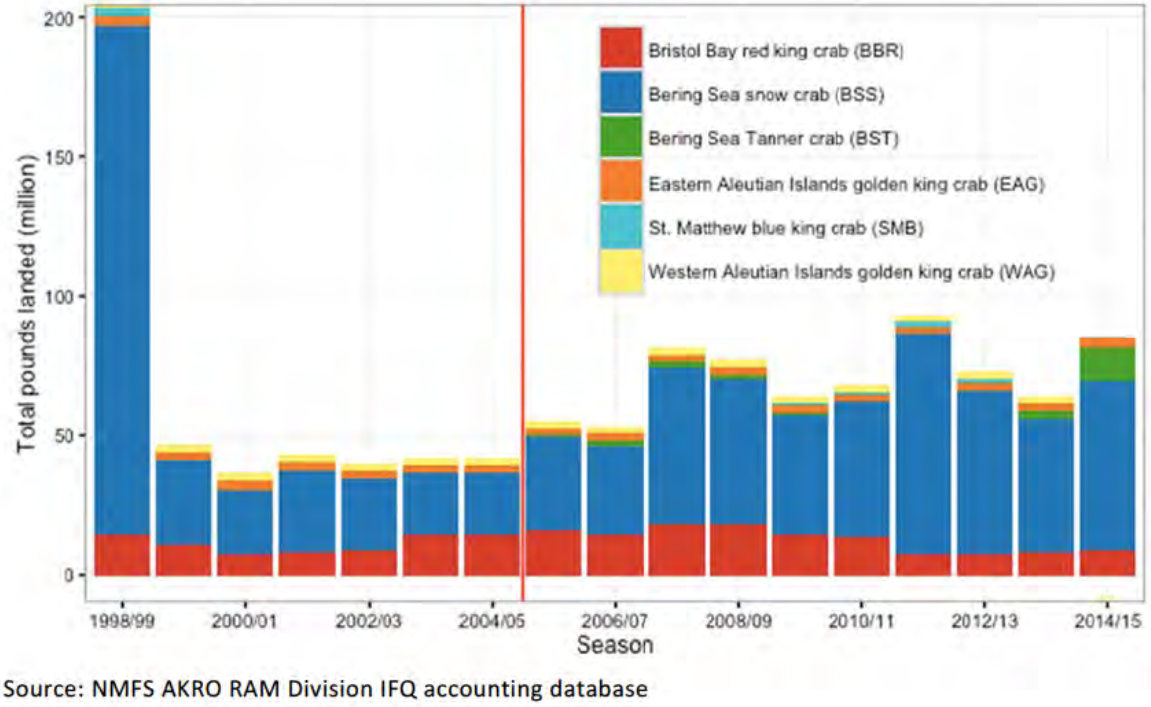


Figure 5. Annual catch in the BSAI crab fisheries.
Source: NPFMC 2017a Figure 5-2.

In addition to supporting improvements in data collection, since the ITQ program, the industry has also worked through the Bering Sea Fisheries Research Foundation, which uses industry contributions to fund research supporting the fishery. This has included survey net selectivity experiments, growth studies, and discard mortality research. An additional group, the Aleutian King Crab Research Foundation was formed to conduct similar studies for the smaller Aleutian king crab stocks.

3.2 Economic viability of the fishery

The most dramatic effect of the ITQ program was an immediate decrease in the number of vessels participating: the fleet dropped by about two-thirds, from 250 to 80-90 (Figure 6). The vessels that exited the fishery were from Alaska and Washington, and other geographies in about equal proportion. Other than the smallest vessels, less than 80 feet, vessels of all sizes exited in equal proportion.

Figure ES-5 Number of unique BSAI crab vessels with earned ex vessel revenue, by state, 1998 through 2015

Note: Figure based on data from Table 1-13b.
Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

Figure 6. Time series of number of participating vessels, by vessel owner's home state.
Source: NPFMC 2017a Figure ES-5.

The technology, length and distance covered on fishing trips were largely unchanged. In order to catch the same amount of crab with fewer vessels, the season lengthened. With fewer boats on which to work, the structure of the labour market for crew changed. The job changed to be a longer-term appointment, and much safer: the fishery shifted from an average of one death per year to having no deaths in the first ten years of the IFQ program (though one vessel was lost in 2017). While the number of positions dropped by slightly more than half, pay to each crew member increased by roughly 2.5 (Table 1).

Table 1. Crew employment and earnings.

Table 5-21 Crew employment and earnings, aggregated over all CR Program fisheries - 1998, 2001, and 2004 through 2014 calendar year fisheries

Fishery	Year	Number of vessels	Total crew positions	Mean crew size	Mean vessel harvest (pounds)	Mean days at sea	Captain pay ($)		Mean crew pay (excluding captain)	Crewmember pay ($)	
							Mean	Median		Mean	Median
All CR Fisheries	1998	212	1266	6.0	1,017,733	96	117,276	115,785	249,780	40,249	39,744
	2001	211	1251	5.9	199,825	52	61,540	40,973	123,271	19,936	14,625
	2004	235	1395	5.9	192,605	32	73,609	66,613	154,847	25,541	22,138
	2005	169	1007	6.0	320,039	37	78,770	55,911	152,893	25,903	20,264
	2006	101	640	6.3	628,448	68	86,828	75,006	174,865	28,204	26,858
	2007	86	572	6.7	758,928	68	134,958	129,146	283,763	45,274	42,429
	2008	94	632	6.7	1,069,194	90	175,376	175,115	383,915	59,896	56,582
	2009	88	588	6.7	947,489	82	130,190	128,226	284,227	44,260	42,796
	2010	77	493	6.4	999,199	96	162,080	154,244	349,985	55,129	50,619
	2011	76	500	6.6	1,040,932	86	218,737	218,875	485,532	74,306	70,103
	2012	83	564	6.8	1,467,050	93	227,378	223,413	494,148	73,933	71,940
	2013	81	542	6.7	1,248,407	78	196,037	199,614	428,422	65,232	62,077
	2014	76	513	6.8	1,259,443	93	202,485	184,286	443,124	66,892	63,681

Source: NMFS AFSC BSAI Crab Economic Data Report (EDR) database, 2005 and later crew positions information from eLandings
Notes: Excludes vessels that did not report any payment to the captain for labor, and vessels for which the gross percentage share paid to crew was greater than 75 percent, based on EDR data. Data for 1998-2004 excludes vessels without qualifying history for CR Program initial allocation. In results aggregated over all CR fisheries, data for the year 2005 includes the 2005 Bering Seas snow crab fishery, which occurred prior to CR Program implementation. Gross share percentage for catcher/processor crew payment uses estimated ex-vessel value of catch based on average price of CV sector landings.

Source: NPFMC 2017a Table 5-21.

The slowing of the race to fish has lengthened the processing season. This has reduced the maximum staffing level and quantity of overtime pay. However, it has also lengthened the term of employment and provided for steadier work.

In combination, the ITQ program has achieved its goals of reducing overcapitalization and increasing safety by eliminating competition for catch through quota allocations. This has reduced the number of vessels, and numbers of crew jobs, but increased professionalization of the crew as the seasons are now longer and employment more stable; pay to the crew in aggregate has not changed. However, the community of Kodiak, home to a disproportionate number of exiting vessels with locally based crew, has experienced adverse effects from the transition to an ITQ system.

3.3 Social equality

While the concentration of quota at the vessel level has not been a concern, and no reallocation is being considered, the primary issue with the IFQ program has been that of intergenerational turnover, and the related issue of quota leasing. Many crew members feel that there is an inadequate opportunity for them to buy into the fishery as owners, and build a holding of quota necessary to develop their own vessels. There are two components to this argument. First, the quota share that is sold is often transacted through tight small interpersonal networks, which makes it difficult for someone not heavily connected with those networks to know that quotas are for sale. For example, quotas will often be transacted within families, or with long-term crew members on the same boat, or fishing partners on different boats. Second, the price of quotas is perceived to be high, making it difficult for many crews to buy blocks of quotas that become available.

Absent an owner-on-board provision, many entities that received initial allocations do not choose to sell their quota share after they retired or stopped fishing. Rather, they choose to lease the quota—selling quota pounds—to active vessels. Since the marginal cost of catching additional crab is low once on the grounds and an abundant area has been identified, the lease rates for quota are very high. Figure 7 shows they are approaching 65 percent of ex-vessel value for red king crab and 50 percent for snow crab.

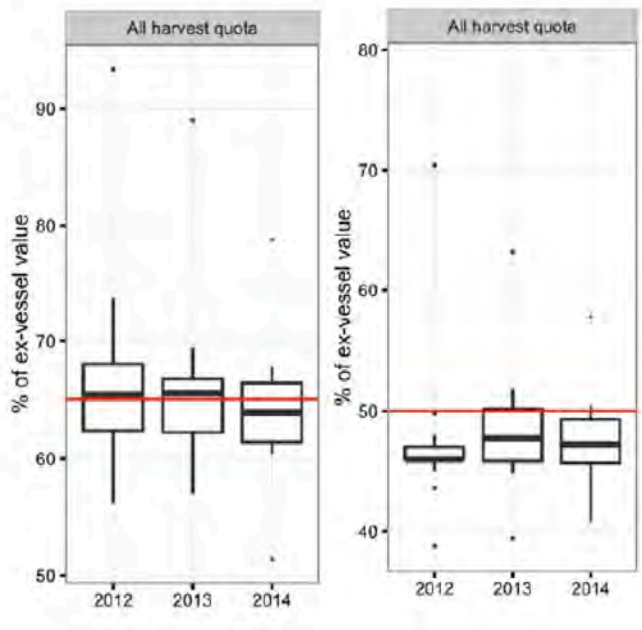


Figure 7. Share of ex-vessel value paid as lease rate for quota share in the red king crab (left) and snow crab (right) fisheries.

Source: NPFMC 2017a Figures 5-5 and 5-7.

Figure 8 shows the effect of these lease rates on perceptions of accessibility of additional quota for different parties, especially crew. Because current quota holders can lease their quota at high rates, they would only be willing to sell for the present discounted value of these high annual values: quota prices are high. Thus, most parties feel that these prices are a deterrent to purchasing quota shares and initiating or expanding their ownership investment in the fishery.

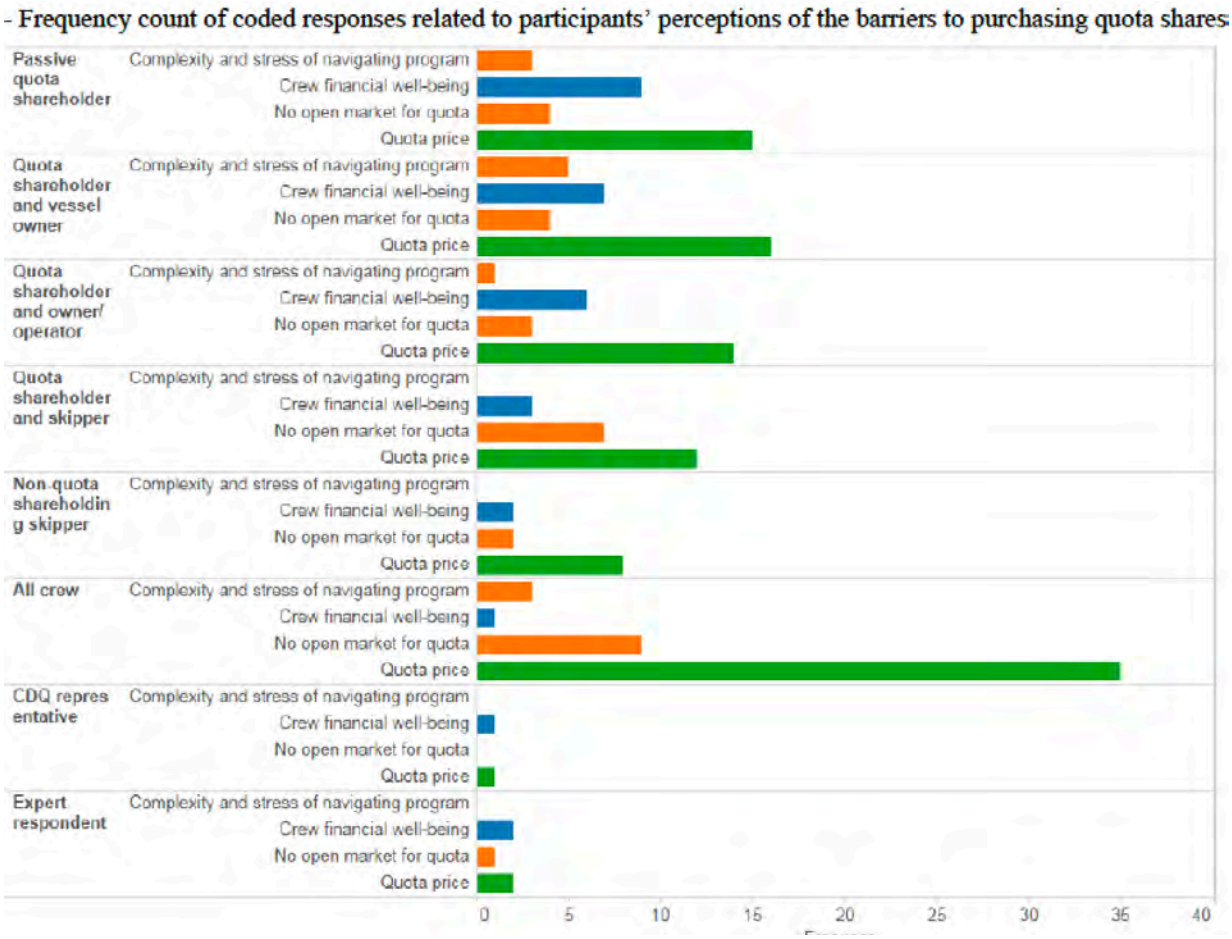


Figure 8. Participants' perceptions of the barriers to purchasing quota shares.
Source: Himes-Cornell (2015) Figure 6.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

The IFQ rationalization program has largely achieved its goals of reducing excess capacity, improving safety, and continuing engagement of historically active processing communities. While vessels under 80 feet all left the fishery, all vessels in this fishery would have been considered large scale.

4.2 Improving fishery sustainability in the future

Biological threats to this fishery are not from overfishing, but rather from ocean acidification and broader ecological shifts in subpolar seas driven by climate change. The current catch, processing and distribution system is effective at efficiently capturing the TAC and delivering it to high-value markets in its highest value product form. From this perspective, the economic viability of the fishery is strong, and it is likely to remain successful as long as biological productivity is feasible.

The primary challenges going forward will be distributional, chiefly between those who currently hold quota and those who wish to make a career out of the fishery in the future. However, it is difficult to identify an appropriate level of accessibility to quota for the crew. The quota is an asset that is valued

like other assets, as the present discounted value of the stream of annual profits it provides. Data is not available on how long current owners served as crew in the fishery, or what proportion of historical crew has the financing and skill to advance into capital ownership. Those referencing the cost of entry during the open-access development phase of the fishery, when entry cost only included the value of a boat, should associate that with an unprofitable fishery: one where paying for maintenance was difficult, and safety was compromised. Crab quota shares are now valuable because the fishery is profitable, and people are willing to pay a lot for them. Thus, making the fishery more accessible by reducing the price of quota is tantamount to making it less profitable.

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Volume 6

History and experiences with rights and competing fishing stakeholders (migratory fishing, industrial and SSF, national, regional, international issues)

Abstract

The Global Conference on Tenure and User Rights in Fisheries 2018 took place in Yeosu, the Republic of Korea, 10-14 September 2018. Case studies were presented on a number of topics relating to tenure and user rights in global fisheries and their relation to the SDGs. Through the exploration of case studies in eight concurrent thematic sessions, the best practices, shortcomings, and challenges associated with rights-based approaches were discussed. The conference was a platform for the exchange of ideas about how to support the implementation of sustainable governance solutions to rights-based fisheries management.

This document presents case studies from Session 6 of the UserRights 2018 conference, "History and experiences with rights and competing fishing stakeholders (migratory fishing, industrial and SSF, national, regional, international issues)". All case studies are published as submitted, with minor changes for spelling and grammar. The case studies span across various geographical and socio-economic contexts. These include:

- the successful mitigation conflict between small-scale and semi-industrial fishers in Costa Rica;
- the practical response to the croacker resource related disputes in Uruguay;
- the conflicts of interest between the artisanal and industrial fishing activities in the Colombian Pacific;
- the impediments to the productive development of the hake fisheries in Peru;
- the management plans in Sri Lanka to solve the disputes between small-scale and mechanized trawlers;
- the conflicts between fisheries and regions in Korea;
- other examples of fishing disuputes in Korea;
- the implementation of user rights in the Lake Albert fisheries of Uganda;
- the management of pelagic resources in north-west Africa
- the realities of designing strong tenure rights programmes in Eastern Pacific Tropical Tuna fisheries; and
- the urgent management requirements for small-scale fisheries in Sierra Leone.

Contents

Successful mitigation case of small-scale fishers of Tárcoles

Germán Ignacio Pochet Ballester, Vivienne Solis Rivera, David Chacón Rojas
CoopeTárcoles R.L
CoopeSoliDar R.L

Abstract
The co-existence of small-scale and semi-industrial fisheries in Tárcoles, Costa Rica, degenerated into conflicts between these two sectors. Conflicts were reinforced by the over-exploitation of the main target species, the white shrimp, which ultimately disappeared from the catches. In 2010, the two sectors reached an agreement establishing a withdrawal area for the semi-industrial vessels of up to one mile starting from the coastline –although the small-scale sector had initially asked for a 3 miles withdrawal area. Soon after the agreement, the positive impact on the white shrimp resource became evident, as the species returned to the catch, and its presence grew over the years. In view of this successful experience, in 2017, the State expanded the coverage to the whole country and increased the withdrawal for the semi-industrial fisheries to 5 miles.

1. INTRODUCTION

1.1 Description of the fishery

Around the world, the small-scale fishing sector and the semi-industrial fleets have a long history of conflicts and rivalry. For the most part, this situation is due to disputes over resources and fishing areas, since both fleets seek the same or similar areas to operate.

Costa Rica ended this cycle of conflicts in 2010, with a win-win negotiation between the small-scale fisheries and the semi-industrial fisheries, where the latter agreed to withdraw from the one mile area starting from the coastline. This agreement was limited to the Responsible Marine Fishing Area (RFMA) of Tárcoles; the governance of the area is shared between the government and the small-scale fishers.

The Tárcoles community operates less than 100 vessels, mainly with outboard or inboard engines of less than 100 CV. These are less than 12 metres in length, with less than 10 GT tonnage and with covered ice containers. The fishing trips take between 3 to 12 hours on average.

1.2 Economic contribution and social implications of the fishing activity

In general terms, there are around 100 fishers in the community; some additional 50 women are involved as well. This activity is practically the only way to make a living for these people; all of their earnings thus come from fishing. This implies that these fishers are engaged in full-time, year-round fishing activities.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACHES

2.1 Management of the fishery

The Costa Rican Institute of Fishing and Aquaculture (INCOPESCA) is the governing body in the fisheries field, which in turn is under the Ministry of Agriculture and Livestock.

2.2 Brief history of former rights-based approaches used in the fishery

Prior to 2010, there was no rights-based approach used in the fishery. The conflicts between small-scale and semi-industrial fishers were strong. In addition, some factors placed the small-scale sector at a disadvantage vis-a-vis the semi-industrial sector, including the fact that the latter had

representation in the INCOPESCA, while the participation of the small-scale fishers in this institution was very limited.

2.3 Rights-based approach: allocation and characteristics

In the negotiation process, an agreement was reached in the year 2010, in which the semi-industrial vessels accepted a withdrawal area of up to one mile starting from the coastline of the Pacific Ocean, even though the initial expectations of the small-scale sector was to agree on a 3 mile zone. Nevertheless, the small-scale fishers of Tárcoles, Pógeres and Playa Azul agreed to the terms with the semi-industrial sector.

The agreement, however, included some difficulties. There were some factors that placed the small-scale sector at a disadvantage with regard to the semi-industrial sector, including the lack of organization. This was in some way solved by the mediation of CoopeTárcoles in the process. Another entity that helped the fishers and mediated between the sectors was CoopeSoliDar, which facilitated the dialogue, the agreements and contributed its vision about human rights, marine conservation, as well as its approaches on participation and popular education.

In this context of disparity between the fleets, a successful agreement was reached in which the semi-industrial vessels accepted a withdrawal area of up to one mile starting from the coastline of the Pacific Ocean, even though the initial expectations of the small-scale sector was to agree on a 3 mile zone. Everyone –including environmentalists—viewed the agreement as unfavourable for this particular reason.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

In the few months following the agreement, it had already become clear that the agreement was a great arrangement for both sectors and for the ecosystem. The discussion, oriented towards the participative ordering of marine spaces, allowed for the first reappearance of the white shrimp, an important species for the small-scale fishers and for the food chain of the ecosystem.

3.2 Economic viability of the fishery

The agreement created a win-win situation for both fisheries, the semi-industrial and the small-scale fisheries. The reappearance of the white shrimp resource made revenue increase for both sectors.

3.3 Social equality

The fact that small-scale fishers managed to derive results from the negotiation, increased their social standing in the society. Moreover, the successful implementation led to an even more important agreement at the national level. The negotiation between both fleets prompted the process associated with the presidential directive 21-P, published in the Gaceta No. 101 of 27 May 2015, translated as 'For the creation of a General Policy of Sustainable Exploitation of Shrimp, Job Creation and Combat of Poverty'. Therefore, seven years after the initial agreement in Tárcoles, a dialogue table was created with all fishing sectors, the state institutions, the academia and the civil society, which yielded a participative zoning map in benefit of all the sectors and the environment. As a result, the model agreement of Tárcoles was extended to the whole country and on both coasts. The results were later ratified, institutionalized and established as legal norms through INCOPESCA's Managing Board agreements AJDIP/158-2017 of 20 April 2017 and AJDIP/483-2015 of the 13 November 2015. Thus, INCOPESCA approved a general zoning map for the whole country where the semi-industrial fleet had to withdraw in a range of 5 miles from the coastline. It is important to note the mediation of CoopeSoliDar in this process as well, both for the dialogue's success and for the elaboration of the zoning map with a participative approach.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

Trawler fisheries have long been under attack from the environmentalist community. This led to the prohibition of shrimp trawling in 2013. In theory, fishing rights for trawlers would not be renewed, and the last fishing licenses were supposed to expire in 2018. However, in practice, these fishing rights continue to be renewed, as the impact on various jobs would be too great. The strengthening of the two sectors in their capacity to negotiate and come to agreements will be, without doubt, fundamental for the future with the aim of achieving sustainable fisheries and a fair and equitable distribution of benefits.

4.2 Improving fishery sustainability in the future

The successful implementation of the agreement has already shown its positive impact on sustainability. The perpetuation of the agreement will continue to have positive effects on the recovery of the valuable shrimp resource.

4.3 Lessons learned

Several lessons were learnt from this experience

1. Negotiation over rights is a long process, but it is possible when small-scale fishers become organized and aware of their power.
2. The agreement on zonal fisheries allocation can be reached between private actors and without the presence of the State.
3. The positive environmental situation of the agreement has to be studied by research institutes to underscore the impression of the recovery of the resource.

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The coastal fishery of croaker (Micropogonias furnieri) in Uruguay and the assignment of user rights

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Abstract
Croaker (*Micropogonias furnieri*) is a resource that is present in the waters of the South-West Atlantic and is managed (in the common fishing zone) jointly between Argentina and Uruguay by the Comisión Técnica Mixta del Frente Marítimo or Joint Technical Commission for the Maritime Front (of the Treaty of the Rio de la Plata) (CTMFM). This commission fixes the Total Allowable Catch (TAC) every year. This case study explores the way in which Uruguay assigns the user rights of the different types of fisheries, with emphasis on small-scale fisheries, which are very important from a social point of view. In Uruguay,abd there are two fisheries exploiting the croaker resource: the industrial fisheries and the small-scale fisheries. The industrial fisheries have 33 vessels operating bottom and twin trawls, and the small-scale sector operates approximately 363 boats (of the 418 that fish in the area) which target the croaker resource either full time or occasionally. In the past, the interaction between the two fleets has occasionally been troublesome despite the prohibition of entry of the industrial trawler fleet in the five miles coastal area reserved for the small-scale fisheries. About 10 years ago, the industrial fleet was obliged to install a Vessel Monitoring Systems (VMS) ending, almost completely, the conflicts between the two fleets. The two fleets have restrictions on their operation. For the industrial fleet, these restrictions include assigned fishing zones, spatial and temporary fishing bans, minimum mesh sizes, minimum size of landings, and fishing (assigned to each country) quota; VMS. For the small-scale fisheries, they include assigned fishing areas, minimum size, and temporary prohibition of work less than 300 metres from the coast. The relevant legislations aim to give sustainability to the resource, maintain a balance in the equity of access to resources for all users, and reduce conflicts within and outside each fishery, which includes protected areas, fishing and water sports among others.

Keywords: Uruguay, croaker; Small-scale fisheries

1. INTRODUCTION

The croaker fishery (*Micropogonia furnieri*) is one of the most important fisheries in the coastal area of the South-West Atlantic. It takes place mainly in the FAO area 41 sub-areas 2.2 and 2.3 (Figure 1). Three countries participate in these fisheries: Argentina, Brazil and Uruguay.

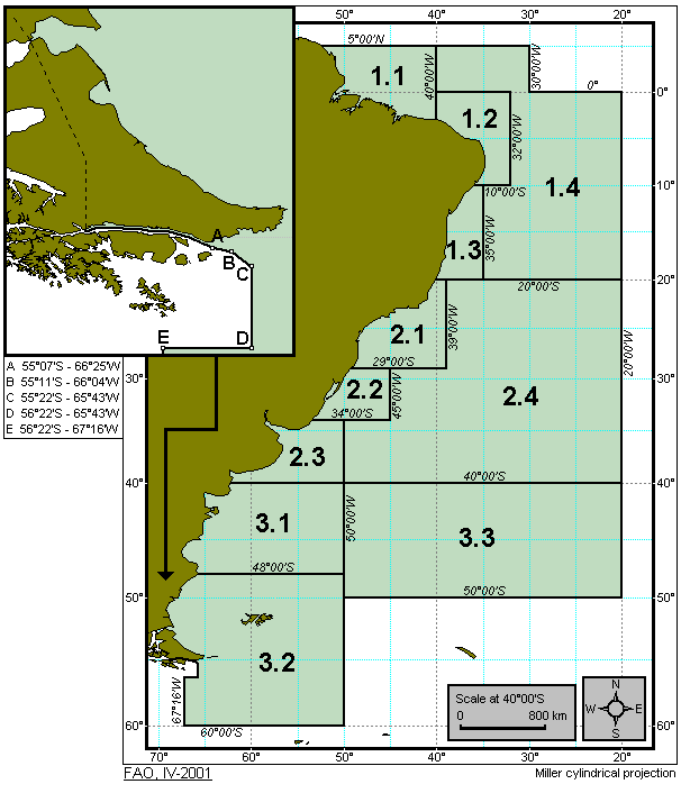

Figure 1. The coastal fisheries of croaker take place in FAO area 41, Sub-areas 2.2 and 2.3.
Source: https://www.researchgate.net/figure/FAO-major-fishing-area-41-and-subareas_fig5_333456311.

For Uruguay, croaker is a resource of vital importance. In recent years, it was either the first or the second species among all the landings. Three groups of fishers exploit this resource: the industrial, the small-scale and the sport fisher. These groups interact and compete with each other for the same resource, thus occasionally generating tension and conflict over the resource, but also over the use of the aquatic and land areas. Currently, the Administration is working on updated regulations, which aim to provide user rights for different types of fisheries.

Commercial fishing in Uruguay is categorized according to the target species and the type of vessel. There are five basic categories:

- Category A: Vessels whose target species are hake and its bycatch. These vessels do not operate in the Río de la Plata and do not catch coastal species.
- Category B: Vessels whose target species are the croaker and whiting and its bycatch. These vessels may not disembark species that make up the bycatch of hake.
- Category C: Vessels engaged in non-traditional fisheries, i.e. those whose target species are other than hake, croaker and whiting.
- Category D: Vessels exclusively enabled to operate outside the territorial waters of Uruguay and the common fishing zone established in the Treaty of the Rio de la Plata: small-scale vessels with the Gross Registered Tonnage (GRT) not exceeding ten tonnes.

Zones A, B y C Río Uruguay
Zones D y E Río de la Plata
Zones F, G, H e I Río Negro
Zone J Merín Lagoon
Zone K Coastal Lagoons
Zone L Atlantica Ocean

Figure 2. Small-scale Fisheries Zones (the Small scale fisheries in the country is divided into 12 zones and 3 sub-zones).
Source: http://noticiasrocha.com/economia/prohibida-la-pesca-con-redes-de-enmalle-en-rios-y-arroyos-del-pais/.

1.1 Description of the fishery

In Uruguay, the croaker fishery is a coastal activity and develops in the Río de la Plata and the coastal area of the Atlantic (Figure 3). At certain times of the year, this fishery can be considered a multispecies fishery, but the main target species remains the croaker.

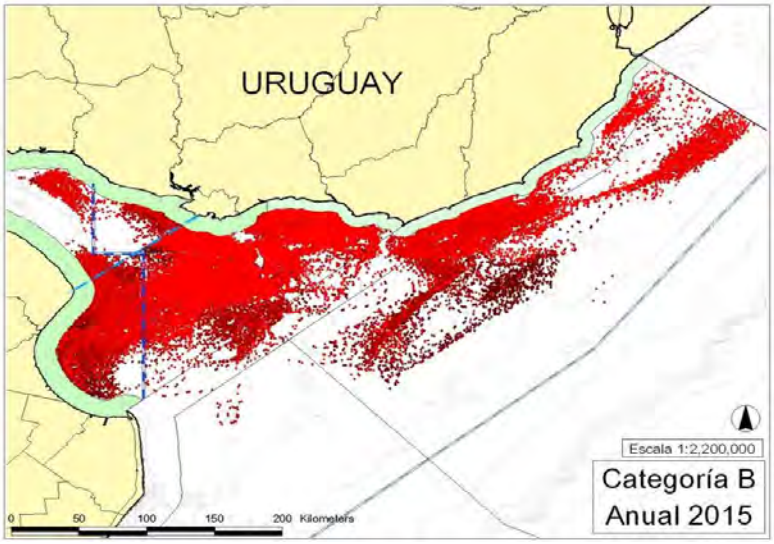

Figure 3. Small-scale Fisheries Area (in green) and Industrial Trawling (Category B, in red).

This fishery is developed on the coast (up to 50 meters deep), with the most common attendant species are being Stripped weakfish (*Cynoscion guatucupa*), king weakfish (*Macrodon ancylodon*), Brazilian codling (*Urophycis brasiliensis*), Parona leatherjacket (*Parona signata*), narrownose smooth-hound (*Mustelus schmitti*) and Brazilian menhaden (*Brevoortia aurea*). Ports and communities in the areas where the fishery takes place differ depending on the nature of the fishing (industrial or small-

scale). For the industrial fleet, the most important port of operations is Montevideo. The small-scale fisheries develop from a series of ports and beaches along the coast (Figure 4).

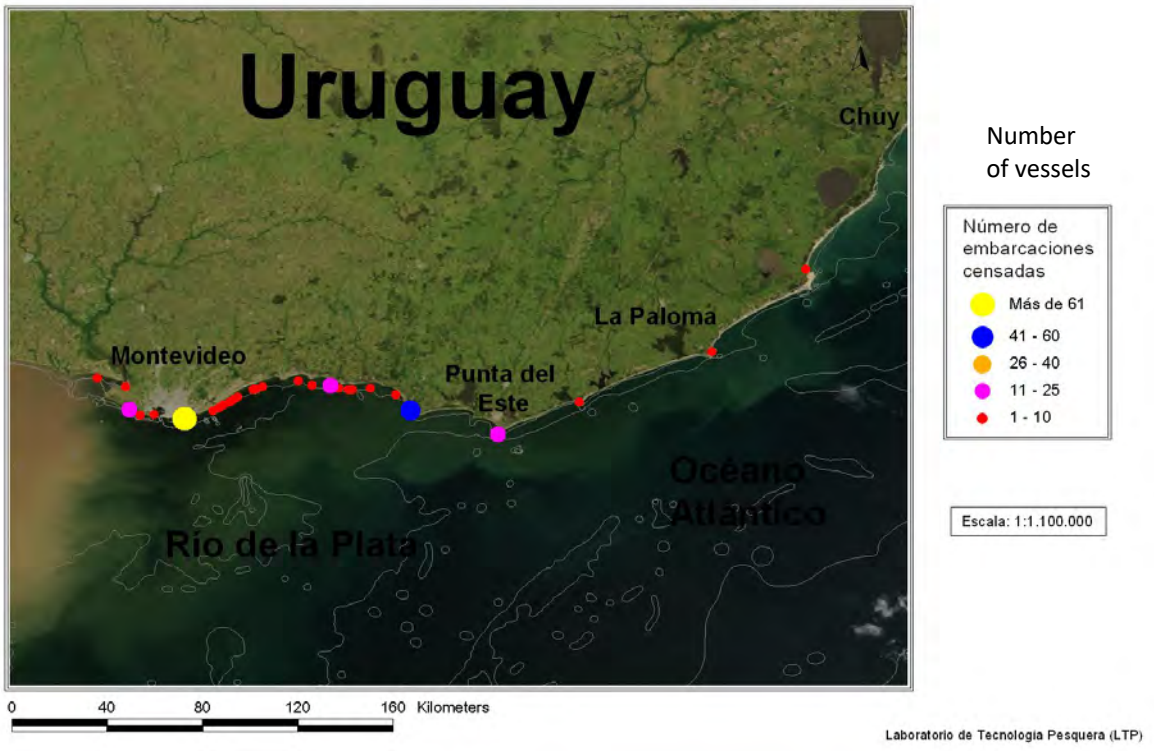

Figure 4. Ports and landing sites, of small-scale and industrial croaker fisheries.

The coastal industrial fleet consists of 33 vessels, employing some 330 crew members whose main target species is croaker. This fleet consists mainly of twin trawlers, which are 23 meters of length and employ ten crew members. The landing of croaker by the industrial fleet were 13 441 tonnes in 2015.

The small-scale croaker fisheries operate in three zones (D, E, L of fig. 2). Some 363 boats are involved, which provides employment for 1 062 crew members. The boats use gillnets and longlines. They are between 5-10 meters in length, have a GRT of 1-10, and outboard motors of 15-100 HP. The catch was 4 160 tonnes in 2015. No estimates exist on the production by the sports fisheries, but at times it can be both important and a source of conflict.

1.2 Economic contribution and social implications of the fishing activity

Of the entire coastal fisheries, both industrial and small-scale, more than 90 percent of the catches are exported. Brazil, Nigeria, China, the European Union, and Colombia represent the major export markets. From an economic point of view, the industrial croaker fisheries are more important than the small-scale fisheries, as the former produces about three times the volume of the latter. However, the situation is reversed with regard to the social importance, with small-scale fishing activity creating more employment.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

The fishery is subject to a double jurisdiction, first to the CTMFM, and second to the central Governments of each country in their exclusive zones, which can establish areas and fishing gears for each of the different modalities. CTMFM fixes annual TACs based on joint assessments of the two countries. In Uruguay, all fisheries are managed with legally recognized rights of fishing.

2.1 Management of the fishery

In the following section, the specific case of the exclusive fishing zone of Uruguay is described. In this exclusive zone, Uruguay has banned trawling in the 5 miles area from the coast, reserving this area for fishing gear used by the small-scale fleet. Uruguay also prohibits the small-scale fisheries from fishing less than 300 metres from the coast during the tourist season in order to prevent conflicts with this economic segment.

An important milestone in the management of fisheries was provided in law Nº 19.175 of 2013, which created a non-binding, a National Advisory Council for Fisheries and 12 Zonal Advisory Councils for small-scale fisheries zones (see Figure 2). The latter was created with the intention to involve fishers in the management through a participatory process. This institutionalization of participation allows all stakeholders, such as businessmen, fishers, maritime authority and administration, to have a say in the decision-making process. The Fisheries Council consults with the stakeholders, problems are identified, and solutions are sought, but the last word always rests with the administration.

Management measures are diverse and include:

- Total Allowable Catch (TAC)
- Regulations on fishing gear
- minimum sizes for landings
- restrictions on fishing effort
- spatial and temporal fishing bans
- restricted areas for fishing

Similar to all other commercial fisheries, the croaker fishery has legally recognized rights of fishing. A permit of fishing (license) granted by the national administration is mandatory to practice commercial fishing. For the industrial fishing (vessels of more than 10 GRT), permissions have a cost that depends primarily on the species that are being exploited and the capacity of the vessel. For the small-scale category fishing, permits are free.

All legal documents of the boat and the crew have to be presented before each trip. Further control is carried out at all point of the value chain: patrol boats and VMS systems are in place to control the activity at sea; sworn statement of catches is required during landing and post-harvest; documentation is required during transport and reception at fish processing plants; another sampling of catches are also carried out at various points in the chain.

2.2 Brief history of former rights-based approaches used in the fishery

Historically, the management system has always been the same; there have always been legally recognized fishing rights. What has changed are TACs, no entry of new fishing units, regulation of the fishing gear and implementation of closed areas. For industrial fishing, legally recognized rights are granted through a fishing permit, valid for five years, which specifies the boat and name of the owner as well as the category defined by the fishing methods and species or group of species.

The small-scale fishing permit is also valid for five years and contains the same indications as the industrial permit with the addition of the DINARA zone (Figure 2). The fishing permit, since the law Nº 19.175 of 2013, cannot be traded. According to article 36, sales involving fishing permits are prohibited. The transfer of the fishing permit is only allowed by inheritance. There are no restrictions to access by gender, age, religion, etc. An assignment of rights is made to fishers historically involved in the activity whenever the fishery supports an increase in effort.

With respect to industrial fishing, no new licences are given, as the catch is already at the maximum permitted yield. For the industrial fleet, the degree of non-compliance to current regulations is low or

very low. In the small-scale fleet, there is slightly more non-compliance, the most common cases being fishing without license or fishing outside area, but overall, it does not represent a serious problem.

There are no specific instruments for conflict resolution. The only mechanism is through complaints to the authorities (fishing or maritime) or to the judicial system. However, in recent years, the creation of fishing councils has provided an authority to deal with potential problems and come up with possible solutions.

2.3 Rights-based approach: allocation and characteristics

The granting of fishing permits in the areas covered by the Treaty is the responsibility of each State. In Uruguay, the law Nº 19.175 of 20 December 2013 (Responsible Fisheries and Aquaculture Development Act) and in Argentina the law Nº 24.922 (Federal Fishing Regime) of 9 December 1997, set out the requirements for access permissions or access rights to fishing.

To obtain a fishing permit, interested parties, natural persons or legal residents in the country – without existing restrictions on communities or on gender, must submit a project that demonstrates their biological, environmental and socio-economic sustainability. The permission granted is tied to the vessel for which it is requested.

In the case of Argentina, vessels are merely granted permission to access the fishery; they are also assigned a catch quota or authorization of capture in the event that the species is not under quota. Permission may only be transferred to another unit or units of equivalent capacity (i.e. not involving an increase in fishing effort). The replacement can be done, if it becomes necessary due to an accident, force majeure or when a vessel needs to be replaced given its age, always depending on the agreement of the enforcement authority.

The permissions granted in Uruguay include the target species to which the fishing can be directed, identifying whether it is coastal fishing (croaker and its by-catch), high sea fishing (hake and associated species) or non-traditional species. The vessel associated with the permission can be replaced by another unit of equivalent capacity, which does not involve an increase in the fishing effort (for species fully exploited), being forbidden the sales or donations of permissions. Permits are granted for five years in Uruguay and ten years in Argentina, but validity can reach ten and 30 years respectively if vessels belong to fish processing plants on land.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

Since the implementation of user rights in fisheries, some resources have experienced a decline in biomass. The scientific evaluation of the stock levels is constant through the CTMFM, and determine the TAC.

3.2 Economic viability of the fishery

The distance travelled, and the average length of a fishing trip in the industrial fleet has increased. The fishing gear used in the trawl fleet has not changed. In the small-scale fleet, although the gears are the same, there has been an increase in the meters of nets used. This increase is linked to the growth in length, GRT and engine power of small-scale fishing boats. These variations in the structure of the small-scale fleet were due to the need of the fishers to increase catches in order to improve their income in view of a possible decline in CPUE.

3.3 Social equality

The legally recognized fishing rights have led to the controlled and acceptable management of the fishery, resulting in the sustainability of resources both from the economic and social point of view.

With respect to equality of access to the resource, there are no restrictions with respect to gender, youth, indigenous or ethnic groups, but there are restrictions with respect to the number of permits or industrial licensing. Regarding permissions for the small-scale fisheries, there is more flexibility, and social aspects are prioritized in certain circumstances.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

The main challenges are the sustainability of resources and the improvement of the social use of the fishery. Much of the technical literature on fisheries management addressed, for decades, only the biological aspect of fisheries. Today the focus has shifted more towards small-scale fisheries, driving a more multidisciplinary approach that treats the activity as a complex system of human and natural resources, which increasingly uses the knowledge of fishers to broaden the spectrum of information available for decision-making. Currently, fisheries administration needs people who have skills in biology and social sciences so that it can work with fisheries, environmental issues and people at the same time.

4.2 Improving fishery sustainability in the future

In the future, improving fisheries will require a diversification of catches, targeting new species that have little to no value today. On the small-scale fisheries level, it will be crucial to design larger boats that can travel greater distances and contain cold storage facilities in order to improve the quality of the capture and therefore, its value.

5. LESSONS LEARNED

The creation of dedicated fishing councils helps conflict resolution and promotes discussion over resource allocation. A well-designed fisheries policy that allocates certain areas to tourist activities during the main tourist season, other areas exclusively to the small-scale fisheries, and finally other areas for the industrial fisheries, results in clear allocations of resources and a reduction in conflicts between the sectors. In fisheries management, scientists should listen more to fishers and use their knowledge, based on experience and daily operations.

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Conflicts of interest between the artisanal and industrial fishing activity in the Colombian Pacific

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Abstract
Fisheries in the Colombian Pacific started about 50 years ago with the capture and processing of marine shrimp. This industry was strengthened through major investments in infrastructure and technological support. However, conflicts were engendered when the shrimp resource became overexploited, prompting many industrial fishers to invade small-scale fishing grounds, thereby reducing their field of action. Following this invasion, in 1982, artisanal fishermen introduced monofilament threads, known in the region as "electronic trammel". This new technology of low investment and high impact on catches reduced the activities of industrial fishers, causing a drop in their shrimp production and many of them to go bankrupt. Fishing quotas for shrimp were established several years ago, however, the impact of these measures on the sustainability of the shrimp resource has yet to be observed. A second conflict between small-scale and industrial fishers began when industrial tuna boats, with their high capture capacity, invaded small-scale fishing grounds, thereby leading to the complete impoverishment of small-scale tuna fishers. This generated a series of protests by small-scale fishers, but no major action was taken by the government. The overall evaluation of the case study shows that small-scale fishers are losing out to industrial fishers, and many communities are severely impacted by declining catches and falling income. Overall, it has to be noted that several different government agencies are involved in fisheries management in the Pacific area. Better coordination among government agencies responsible for control and surveillance of the implementation of measures of fisheries management is needed.

1. INTRODUCTION

1.1 Description of the fishery

Shrimp fishing started 50 years ago. It has been a prospering business ever since, generating an important fleet and some of the main processing infrastructure for Colombian fishing. Shrimp fisheries are both industrial and small-scale.

Figure 1. Map of the exclusive economic zones of Colombia.
The blue zone shows the area of influence of fishing in the Colombian Pacific.
Source: Dirección técnica de investigación, ordenamiento y foment (2010).

Towards the beginning of the 1980s, a new fishing gear, monofilament gill net (commonly called "electronic trammel"), was introduced. This fishing gear, which was mainly used by small-scale fishers, had a deep impact on the fishery of the region due to its relatively small cost and the high yield of the catch. At present, shrimp fishing systems range from industrial trawling, mainly for shallow-water shrimp (White shrimp (*Penaeus occidentalis*), titi shrimp (*Xiphopenaeus riveti*)), to small-scale fishing carried out for the same species with gillnets known locally as "electronic trammel", and trawl nets in artisanal boats equipped with outboard motors and called "Changas". The industrial shallow-water shrimp fleet has trips of 18 days on average.

Similarly, the tuna industry emerged as an important industrial alternative that generated more than 70 percent of the Colombian Pacific fishery output, with most of the companies processing their production in plants located in Barranquilla and Cartagena. At present, industrial tuna fisheries involve purse seiners, while the small-scale tuna fisheries use gillnets.

There also exists an industrial whitefish fishery. The boats are maximum 12 meters in length and the fishery targets resources such as hake, bravo, snappers, groupers, saws, sharks. The white fishing fleet stays at sea between 8 to 25 days. All fishing activities in the Pacific concentrate in four main areas, namely Solano Bay, Buenaventura, Guapi, and Tumaco. Buenaventura is the main port, as the industrial fisheries are based there.

1.2 Economic contribution and social implications of fishing activity
Fishing in the Colombian Pacific is an important generator of foreign exchange and food sustainability. This activity generated USD 200 million in export earnings, to which shrimp fisheries contributed USD 2.5 million.

All the fishing in the Colombian Pacific is carried out either by the industrial fleet or by small-scale fisheries. Most of the products from industrial fishing are destined for export. Some products from small-scale fisheries are also exported, such as shrimp and tuna, on the condition that they pass the quality tests required by the rules of sanitary and phytosanitary measures, listed in the fisheries Codex. However, products from the small-scale fisheries are mostly destined to the national market.

2. FISHERIES MANAGEMENT AND RIGHTS-BASED APPROACHES

2.1 Management of the fishery

All fishing regulations are based on Law 13 of 1990 and its regulatory decree 2256 of 1991, and the Decree 4181 of 2011. The fisheries management in Colombia is under the Ministry of Agriculture and Rural Development and under the Direction of the Aquaculture and Fishing Authority (AUNAP). AUNAP collaborates with fisheries researchers from the sector to determine the exploitation status of the fishery resources. In turn, fisheries models are structured, and the allocation of fishing quotas is recommended, taking into account the objective reference points as a percentage of the maximum sustainable yield, the maximum economic yield, and the biological yield.

AUNAP then submits a proposal on annual quotas to the Ministry of Agriculture and Rural Development. Following an evaluation of the proposal, the Ministry issues an administrative act, which is executed by AUNAP, indicating percentage quotas that are divided between artisanal fishing and industrial fishing. Finally, industrial fishing is assigned individual quotas in line with their production in the previous year. All the quota assignments and management decisions would be incomplete without the involvement of the fishers. Thus, AUNAP has designated two systems, the Fisheries Statistics System (SEPEC) and the Fishers Observer Plan of Colombia (POPC). The SEPEC, which is established in Law 13 and its regulatory decree, has the function of obtaining information on the landings of the different fish stocks, as well as the value at first sale, biological-fishing information such as the fishing effort, fishing gear, fishing places or fishing grounds, and final destination of the production. On the other hand, the POPC is responsible for obtaining information related to fishing "in situ", by determining the relative yields per resource, catch per unit effort (CPUE), sizes, sex, sexual maturity, type of gear used, and general evaluation of fishing grounds.

Other entities that collaborate in decision-making are the Ministry of Commerce, the Maritime General Directorate (DIMAR), the autonomous regional corporations, the fishers' associations, the fishing industry associations, the scientific community with the research organizations and the public and private universities.

2.2 Brief history of rights-based approaches previously used in this fishery

Government presence in fishing activities began in the 1960s, with the establishment of the hunting and fishing office, which is an office of the Ministry of Agriculture. Later, the National Institute of Renewable Natural Resources (INDERENA) was created and tasked with the responsibility, among other functions, of the environmental management of the fisheries, the organization and administration of fishing, and the evaluation of fisheries resources with the help of international entities.

Thus, organizations such as Food and Agriculture Organization of the United Nations (FAO), Japan International Cooperation Agency (JICA), Norwegian Agency for Development (NORAD), IMARPE of Peru, carried out an evaluation of the fishery resources and found that resources such as shallow-water shrimp (white shrimp), which is the basis of the Pacific fishing economy, needed a limit of their catch and fishing effort. Based on these studies, a limit to fishing efforts was agreed upon. From then until the approval of Law 13 in 1990 and Regulatory Decree 2256, a fishing quota was assigned to fishing boats and a closed season was created for the carduma (*Cetegraulis mysticetus*).

On the other hand, permit holders both national and foreign vessels could access fishing grounds, provided that AUNAP declared that fishing quotas were not exceeded. Permits had a five-year duration. Permit holders had to pay an annual fee, called a fishing license, without which they were not be allowed to fish.

3. CONTRIBUTION OF RIGHTS-BASED APPROACH TO FISHERIES MANAGEMENT TO ACHIEVE SUSTAINABILITY

According to the law in force, the government policy should focus on the sustainability of fishery resources in time and space, and should promote an ecological balance. At the same time, the application of bioeconomic models can sustain an industrially sustainable system that guarantees that artisanal and industrial fishermen and investors have a clear horizon of the approach they can perform without risking their economic integrity.

3.1 Sustainable use of the resource

The main problem facing the management of fishery resources in Colombia is the fact that it is a multispecies fishery, which renders a target species approach to fisheries management very difficult. Unfortunately, in Colombia, the management of resources through fishing quotas has not shown a clear improvement in the sustainability of the fishery resources, although it is likely that without these measures the situation of the fisheries would have been worse. The measures of fishing quotas, as already mentioned, have not had the desired effect due to the multiple species that are caught in the fisheries, more than 30 species on average per fishing trawl.

White shrimp are considered overexploited. The MSY is calculated at 1 200 tonnes in 2016, down from 1 500 tonnes in 2009. The titi shrimp, on the contrary, is fully exploited with a growing MSY, set at 3 600 tonnes in 2016, up from 2 200 tonnes in 2009. Catches of white shrimp levelled at 789 tonnes in 2009 and 98 tonnes in 2016, before going back up to 529 tonnes in 2017. Titi shrimp production was 1 683 tonnes in 2009, decreasing to 289 tonnes in 2016 and 805 tonnes in 2017. Environmental aspects such as El Niño are affecting shrimp catch in the Pacific.

3.2 Economic viability of the fishery

Currently, some control is exercised over the industrial shrimp fleet, while the tuna fleet is under the control of the Inter-American-Tropical-Tuna-Commission (IATTC) and the International Commission for the Conservation of Atlantic Tunas (ICCAT). However, small-scale fishing lacks a minimum level of monitoring, therefore, this activity is out of control.

Interaction between the industrial and artisanal shallow-water shrimp fisheries has caused social and economic conflicts that have prevented the administrative measures from having the desired effects. Small-scale fishers are also using gears that are smaller than what is permitted.

3.3 Social equality

Social aspects can be considered the weakest point of the regulation. While particular efforts have been made to improve the living conditions of fishers, Colombia still lacks a national programme with a social focus.

One of the social problems faced by fishing communities of the Pacific was the conflict between the fishers of Bahía Solano and tuna vessels. An active solution to this problem was the creation of Exclusive Fishing Zone on 29 July 2013. Although no specific evaluations have been made yet, it is observed that local fishery resources, in terms of their landings, have improved.

Another problem that was urgently addressed was the fishing of a resource called piangua (*Anadara tuberculosa* y *Anadara similis*), a type of bivalves which is collected by women in mangrove areas in the Colombian Pacific. The fishing authority has managed to group these fisherwomen into associations, managing the sizes of the catches in a way that ensures that the resource is collected in a sustainable manner.

Fishers, in general, do not have any social security; especially small-scale fishers who are entirely unprotected. There exists no government policy to improve their quality of life.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Main challenges for the fishery

Under the current institutional and private scheme, the main challenges facing the Colombian Pacific fishery are the professionalization of small-scale fishing, as well as the sustainable utilization of fishery resources. It is essential to educate the small-scale fishers about good fishing practices and good practices of process and management. Equally important is to change the policy of the fisheries administration from monospecies to multispecies approaches, as the tropical ecosystems of the Colombian Pacific have a multitude of species of fish, crustaceans and molluscs.

Management strategies should tend to resolve conflicts between small-scale and industrial fishers, especially in relation to the overlapping of fishing areas; this conflict has already led to imbalances in the management of fisheries. These conflicts have their origin in the deficient regulation of the fishing areas since the regulations mention that the first mile from the coast is reserved to the small-scale fishery, but the geological conformation is such that the ocean is very deep already a few meters from the shore. If this regulation were applied, the industrial fishing of shallow water shrimp would disappear. Furthermore, deep shrimp fishing has very high investment costs and only mixed companies that fish, process and export these resources can survive.

In the fisheries of the Pacific, the conflicts that have been generated are the following:
1. Allocation of fishing quotas to both industrial and artisanal, who complain that fishing quotas are very low and this undermines their economic stability.
2. Discrepancies, in the way fishing quotas are assigned among fishermen, since not all their needs, which cover the supply and demand of the resource, are taken into account.
3. Conflicts between industrial and artisanal fishermen since fishing zones overlap and quotas are not clearly established for each other, which has led to unfair competition between the different actors in the system.

One additional challenge is that several government agencies are involved in the implementation of management measures, and the coordination among them is not very smooth.

4.2 Improving the sustainability of the fishery in the future.

It is important to review the methods of administration of fishery resources, especially fishing quotas that are not fully functioning. It would be interesting to study the possibility of regulating the fishing effort in such a way that the two measures are complementary.

It is very important that two fundamental aspects are reinforced: control and surveillance and the evaluation of fishing communities. To achieve these objectives, it is important to have a research system with a budget and ample and sufficient staff. This would imply one dedicated department in AUNAP of fishery statistics and one for social aspects of fisheries.

The latter would allow management to be carried out in a participative manner where the fishers are empowered to manage their own fish resource.

Finally, the control and survey department needs to be strengthened in order to control that all fisheries management activities are carried out in a correct manner.

5. LESSONS LEARNED

Once a resource is overexploited, cuts in quotas create conflicts among stakeholders, in the case of Colombia, among industrial fishers and small-scale fishers. Stakeholder dialogue must be implemented in order to create an understanding of fisheries management and sustainability of the resources.

Exclusive fishing zones for small-scale fishers are only viable if the implementation is realistic. In the case of Colombia, the main resource exploited by the industrial fisheries is close to the shore. Thus, the implementation of closed fishing areas is not possible or would mean the disappearance of a whole industry.

Better coordination among the government agencies responsible for control and surveillance of the implementation of measures of fisheries management is needed. It would be more efficient to have only one agency responsible; AUNAP seems like the best choice.

ACKNOWLEDGEMENTS

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Conflicts in productive development in hake fisheries (*Merluccius gayi peruanus*) in Peru

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Abstract
There are two types of fleets catching hake in Peru: the industrial fleet that operates in areas authorized by the Ministry of Production (PRODUCE), and the small-scale fisheries that operate mostly in front of Paita - Piura. The hake resource is in the process of recovery, and many regulations and decrees are applied to its fishery, establishing fishing periods, fishing zones, Total Allowable Catches (TAC) and Individual Fishing Quotas (IFQs). These quotas only apply to the industrial fleet. While small-scale vessels do not have a fishing quota and are not subject to prohibitions related to fishing areas, they must follow the seasonal closure and meet certain requirements, including not selling their catches to processing plants, which means that they can only market their produce as fresh/chilled products to the domestic market at very low prices. These aspects generate conflicts between both actors due to the possibility of illegal fishing by small-scale boats and, on the other hand, the prohibition of productive development of the small-scale fisheries.

1. INTRODUCTION

1.1 Description of the fishery

Hake (*Merluccius gayi peruanus*) was discovered as an exploitable resource in 1965. Since then, a very dynamic extractive activity based on the Paita port (05° 00`S) was developed for this resource. This resources experienced two situations of overfishing, in 1980 and in 2002, the latter being the most intense one. After evaluating various environmental, biological and anthropogenic factors, the Institute of the Sea of Peru (IMARPE), recommended in November 2002, the closure of the entire hake fishery. RM Nº 047-2002-PRODUCE and its complementary in article 5 of RM Nº 055- 2002-PRODUCE, defines the zones of allowed hake fisheries, prohibiting capture south of the parallel 06° 00' Latitude South, except for artisanal boats. After the reopening of the hake fishery in 2004, the Ministry of Production began to allocate individual fishing quotas.

Figure 1. Map of the authorized fishing zone for industrial hake fishing, Peru.
Source: PROMPERU, 2018.

Since the ban on hake fishing, landings increased from 30 000 tonnes in 2005, to 78 000 in 2017. The trend has not been a continuous one, but overall production increased, especially during the last three years.

The Peruvian hake fishery is carried out on the continental shelf between the extreme north of the Peruvian maritime domain and the 06º00'S (Punta La Negra); this is the area authorized for industrial extraction. There are two types of fleet in this fishery: the industrial trawler fleet that operates in the area authorized by the Ministry of Production and the artisanal fleet that operates mostly in front of Paita, although artisanal fishing has no restrictions in terms of fishing zones.

1.2 Economic contribution and social implications of fishing activity

Hake from the industrial fisheries goes to frozen processing, as interleaved fillets, block frozen hake headed, and gutted products. These products are exported to Western Europe (mainly to Germany), United States of America, and Eastern Europe. The artisanal hake fisheries produces for the domestic market. Total export value of hake was USD 29.3 million in 2017, which compares to the record of USD 39.4 million reached in 2014.

In the case of the domestic market, there is no precise figure available, however, it can be estimated that 42 563 tonnes of fresh hake were sold in the domestic market in 2016, for an estimated value of USD 26.6 million. In summary, the value of frozen products from hake in 2016 reached USD 29.3 million and fresh products USD 26.6 million, resulting in a total value of USD 55.9 million.

2. FISHERIES MANAGEMENT AND RIGHTS-BASED APPROACHES

2.1 Management of the fishery

The management of fisheries in Peru is carried out by the Ministry of Production (PRODUCE), through its Vice Ministry of Fisheries and Aquaculture, which is advised by the Institute of the Sea of Peru (IMARPE). Type of fisheries and outlets of the products are indicated by the type of fisheries. Industrial fishing is under a quota system, while the small-scale fisheries is outside the quota system.

In 2001 and 2003, Peru through the Supreme Decree No. 029-2001-PE and Supreme Decree N ° 016-2003-PRODUCE, approved the Fisheries Management Regulation (ROP from the Spanish Reglamento de Ordenamiento Pesquero) for the hake resource. The objectives of the ROP are: to achieve the recovery of the hake resource in the medium term, for the subsequent sustained use of this resource and its by-catch, to harmonize the participation of different actors involved in the catch and processing of the hake resource, to optimize the operational efficiency of the trawler fleet that allows them to access new fishing areas of the hake resource, reducing fishing pressure in traditional areas; as well as protecting the growth process of the specimens and their biological development.

The ROP and the following regulations establish fishing periods, fishing zones, Total Allowable Catches (TAC) and Individual Fishing Quotas (IFQ), the latter two to be fixed each year. After the reopening of the fishery in 2004, the Ministry of Production began to allocate individual fishing quotas. In accordance with the Regulation of Fishing Regulation, the quotas would be non-transferable from the reopening of the fishery. Then, through the D.S. N ° 016-2006-PRODUCE given in September 2006, the quotas became transferable, and, once again, non-transferable since August 2008 (DS N ° 016-2008-PRODUCE repeals DS No. 018-2006 -PRODUCES). Individual fishing quotas are valid for one year and their remainders do not accumulate from one year to the next.

The IFQs are applied to the industrial fisheries, while the small-scale fisheries are excluded from this system. The small-scale sector, however, must comply with the respective reproductive closures and minimum sizes. Furthermore, they must have valid fishing permits and may only carry out longline

fisheries. They are not allowed to sell their catch to the processing plants. Thus their produce can be sold only in fresh form to the domestic market.

The ROP specifies that the extraction of hake in Peruvian jurisdictional waters shall only be carried out with national flag trawlers. New authorizations for fleet increase or fishing permits for larger trawlers or factory vessels are not granted. The ROP also indicates that vessel capacity of the Peruvian hake fisheries should not exceed 600 m3 of holding capacity or 70 meters in length. These industrial vessels have to operate at least ten nautical miles from the coast and in depths greater than 100 meters. The small and medium-size fisheries carry out their activities in the first five (5) nautical miles from the coastline.

2.2 Brief history of rights-based approaches previously used in this fishery

The bottom trawl fishery is one of the most complex fisheries in Peru, whose target resource is hake. This species was over-exploited in the late 1970s, but recovered in the second half of the 1980s, probably due to two main factors:

1. The decrease in the fishing effort during and after the El Niño event 1982-83, as the coastal fleet was more dedicated to the fishing of shrimp and factory boats to the extraction of horse mackerel and mackerel; and
2. The increase in the biomass of the sardine, preferred prey of hake over 50 cm, from the mid-1980s. A second drastic reduction in hake stock levels due to overexploitation and others occurred in the early 2000s. Based on the recommendation of IMARPE, an 18-month closure was established (September 2002 to April 2004), and since the establishment of Provisional Fishing Regimes, restrictive measures of fishing effort were applied, closed by reproduction and by the presence of juveniles. However, the expected results were not obtained in relation to the recovery of hake stock, mainly in relation to the population structure.

In 2003 and 2004, IMARPE convened two panels of experts to evaluate the status of hake stock under a conventional approach. The recommendations of both panels became the main axes of the recovery process of this species.

2.3 Rights-based approach: allocation and characteristics

Each year, IMARPE recommends a TAC, and the PRODUCE determines the participation coefficient of each shipowner or company in accordance with their Fishing Declarations and the net storage capacity. Fleet increases are not authorized for Peruvian hake fishing nor are new fishing permits granted. In addition, in accordance with the IMARPE monitoring of the location of spawning areas and juvenile specimens, different non-fishing areas and closed seasons are established each year. The quotas are non-transferable. Small-scale vessels are excluded from the IFQs system.

3. CONTRIBUTIONS OF RIGHTS-BASED APPROACHES TO FISHERIES MANAGEMENT TO ACHIEVE SUSTAINABILITY

3.1 Sustainable use of the resource

Hake lives in coastal waters, between 50 and 600 m deep. In Peru, it is distributed from the border with Ecuador 3° 23'S to 10° 03'S in Huarmey. It is the most abundant species of the demersal system of Peru and is closely associated with the Southern Extension of the Cromwell Current.

The IMARPE carries out several research campaigns each year: two cruise campaigns that are carried out with their own economic resources and at least two complementary campaigns carried out with the collaboration of the commercial fleet. These complementary campaigns are aimed at monitoring the fishery and verifying the conclusions reached using data from observations at landing points. Based on the findings of these campaigns, IMARPE fixes a TAC, which is generally not fished.

After the two periods of extreme overfishing, which led to the introduction of IFQs for the industrial fisheries, the hake resource seems to be sustainable now.

3.2 Economic viability of the fishery

In recent years, the gap between the TAC and landings has decreased from 22 percent to 19 percent. This difference may be due to various factors, such as the reduction of effort due to compliance with the closure of fishing zones when juveniles are present in large quantities, and because the population is still weak in numbers.

3.3 Social equality

The fishing rights are given to fishing companies, and the quotas are assigned to their vessels and oriented to the extraction of the resource in the areas authorized by the Ministry of Production. It should be noted that the artisanal fleet does not have assigned quotas for extraction but must comply with regulations related to reproductive closures and minimum catch sizes. This measure, which was chosen for social reasons, is subject to discussion.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Main challenges for the fishery

While the introduction of IFQs and the ROP has generally resulted in a recovery of the hake resource, it has engendered conflicts between the small-scale and the industrial sector as well.

The small-scale sector argues that they are excluded from any value addition to their product, as they are not allowed to sell to the processing plants, which are producing for the export market. In fact, the ex-vessel price of their hake catch is very low, at USD 0.60 per kg, a value which is adequate for a small pelagic but not for a groundfish species. The small-scale sector should be integrated into the normal value chain, allowing them to sell to processing plants, thus enabling them to generate value-addition.

On the hand, the industrial fisheries argue that since artisanal fishing is not subject to quotas, there have been situations in which illegal landings or black hake fishing occur in the various small-scale landing sites in the area, mainly during the night. These landings come from apparently artisanal vessels that operate with very small mesh towed nets, and whose annual landing figures are estimated at around 10 000 tonnes. This group of boats also does not respect the closed season. The circuit of commercialization of these illegal products seems to be the domestic market, mainly Lima, and the products generally do not comply with all marketing, health and tax regulations.

Another challenge is the incorporation of the ecosystem approach into the hake ROP, given that fisheries management should not be merely based only on the dynamics of the fish populations. It should also take on board the economic and social aspects, as well as the impact of the environment on fishing activity and environmental monitoring, which also determines the abundance of resources.

4.2 Improving the sustainability of the fishery in the future

The ROP has been an important instrument for proper management of the hake fisheries. The ROP should be revised to ensure that also the small-scale fisheries have catch quotas, in order to improve the management of fisheries, to avoid or reduce illegal fishing, and allow small-scale fishers into the full value chain. It is believed that these actions will contribute to the reduction of existing conflicts and incorporate artisanal fishermen in the value chains, where they can contribute with their scaling, productive development, welfare and also with the reduction of fishing pressure.

5. LESSONS LEARNED

Clear allocation of fishing rights and TACs improve the resource situation. However, the mixed system where industrial fisheries have IFQs and small-scale fisheries are excluded create tensions. Leaving small-scale fishers outside the quotas system, but also outside the value chain does not work, as it

provides limited income to the small-scale fishers, and leads to illegal fishing, landing and marketing, which creates a risk for the health of the population. The industrial fishery also argues that the small-scale fisheries should follow the strict quota rules. An obvious solution is to give catch quotas to fishing communities, which they can allocate to the participants in the small-scale fishery. In turn, this would allow the produce of the small-scale fisheries to enter processing plants, thus assuring higher income and possibly less pressure on the resource.

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User Rights: Conflict between Sri Lanka's small scale fishermen and mechanized trawlers in Northern Sri Lanka

Sashini Fernando
Tropic Sri Lanka

Abstract
Sri Lanka is an island state consisting of a 1 340 km long coastline and claims sovereign rights of 223 000 km^2 of Exclusive Economic Zone (EEZ) in the Indian Ocean. The open-access nature of the fishing grounds has expanded fishing effort over the years. The small-scale fishing boats used in the coastal fishery usually consist of non-motorized and motorized vessels reaching between 4-14 m in average length. Fiberglass reinforced plastic boats powered by outboard motors ranging between 15-25 hp are used to carry out gill-net, longline and hand-line fishing operations. Multi-day 3.5tonne fishing boats are between 8-9 m long and equipped with two cylinder diesel engines of 25-30 hp. Fishermen in Northern Sri Lanka depend on traditional boats and gear such as nets and hand-lines due to the shallow nature of the fishing grounds. These fishermen compete for resources with over 5 000 south Indian large-scale mechanized bottom trawlers. The bottom trawling fishermen illegally cross the Indo-Sri Lankan Maritime Boundary (IMBL), breaching the treaty signed by both countries in 1976. The Fisheries and Aquatic Resources Act No 2 of 1996 has been adopted for Sri Lanka's overall fisheries management. Restriction of destructive fishing practices and gear have been implemented through the Sri Lanka National plan of action to prevent, deter and eliminate Illegal, Unreported and Unregulated (IUU) fishing. Therefore, industrial scale bottom trawlers have left Sri Lankan fishermen with reduced fish stocks, destroyed marine habitats and gear. Creating severe conflict between the scale of fisheries and neighbouring countries. This case study discusses and proposes the use of environmentally friendly fishing practices such as size segregated (SS) pole and line fishing and the introduction of modernized gear as a solution to mitigate the conflict. Statistics reported for the year 2016 from main fishery districts in the north have been taken into consideration for the purpose of this case study.

1. INTRODUCTION

Sri Lanka historically due to its strategic geographical location and the tropical nature of the Indian Ocean, has been relying on its rich diversity of fishery resources as a source of income and livelihood. The fisheries industry provided livelihoods for more than 2.7 million coastal communities with over 272 140 individuals actively fishing throughout the country in 2017. The fisheries sector of Sri Lanka can be divided into marine, coastal, inland and aquaculture. The 2016 Fisheries Outlook report published by The National Aquatic Resources Research and Development Agency (NARA, 2018) reported that 86 percent of Sri Lanka's annual fishery production consisted of marine fish. The marine sector, consisting of fish caught within Sri Lanka's EEZ and high seas is used for both local consumption and export purposes.

Sri Lanka's fishing industry is considered small scale with the fishing fleet consisting of:

- Multi-day boats (offshore waters) avg. length 9.8m - 17.9m boats with an inboard engine (40 - 60 hp or over) (consists of insulated fish holds, without larger scale facilities such as freezers, longline spools, Echo Sounder, Fish finder etc.)
- One day Boats (coastal waters) avg. length 8.8m - 12.2m boats with an inboard engine (40 hp) (Insulated fish hold only)
- Boats (Coastal water) avg. length 5.5 m - 7.2 m boat with outboard engine (15 – 25 hp)
- Non-Motorized Traditional crafts

Figure 1. Ocean depths surrounding northern fishing districts of Sri Lanka.
Source: Stokke, Kristian & S. Soosai, A & Shanmugaratnam, N. (2008). Impacts of Intra-state Warfare and International Resource Conflicts on Livelihoods of Fishing Communities in Northern Sri Lanka.

Fishing grounds in the northern areas of Sri Lanka are significantly shallower with a wider continental shelf when compared with fishing areas in the rest of the country (Fig.1). Therefore, motorized and non-motorized traditional fishing crafts with gear such as gillnets and handlines are predominantly used. The Palk Bay and the Gulf of Mannar has been found to be a biodiversity hotspot as it is estimated to include over 20 percent of marine life from the entire Indian Ocean. The Gulf of Mannar alone is inhabited by more than 3 600 different species. 30.8 percent of Sri Lanka's annual fish production (marine) resulted from the Northern provinces (2016). Prior to 1985, Jaffna district was a dominant fish-producing district that contributed more than 25 percent to the total marine fish production while contributing 7 precent to the annual production of 2016. Although women in the northern districts are not actively fishing, they have a significant role in activities such as sorting and selling fish and fishery products, production of dry fish and repairing of nets.

Figure 2. Small scale, motorized boat used for squid fishing, Jaffna, Sri Lanka.
Source: https://www.newsheads.in/world/news/indian-fishermen-

Sri Lanka's Squid Fishery

Eight species of squid have been recorded within the Sri Lankan EEZ (Figure 3). This resource is underutilized due to the increased amounts of manpower and resources needed to fish for squid using traditional methods. Squid fishing in Sri Lanka is carried out using nets, hand lines or jig lines that must be pulled up manually. Jigging can be defined as a method of catching squid by continuously lowering and retrieving a line from a fishing vessel. The scale of the above-mentioned methods more often outweighs the benefits and therefore is not feasible long term. The current methods used in squid fishing are labour-intensive compared to large-scale fleets, which use purse seins, drift nets with trawlers in order to catch entire schools of squid at a time. Sri Lanka's fishing industry utilizes a significant amount of bait for various fisheries due to prohibition of purse seining, trawling and reduced use of nets. Currently, the majority of the squid used is imported from countries such as the Falkland Islands, Argentina and China. The Sri Lankan tuna industry currently imports 100 precent of their squid bait.

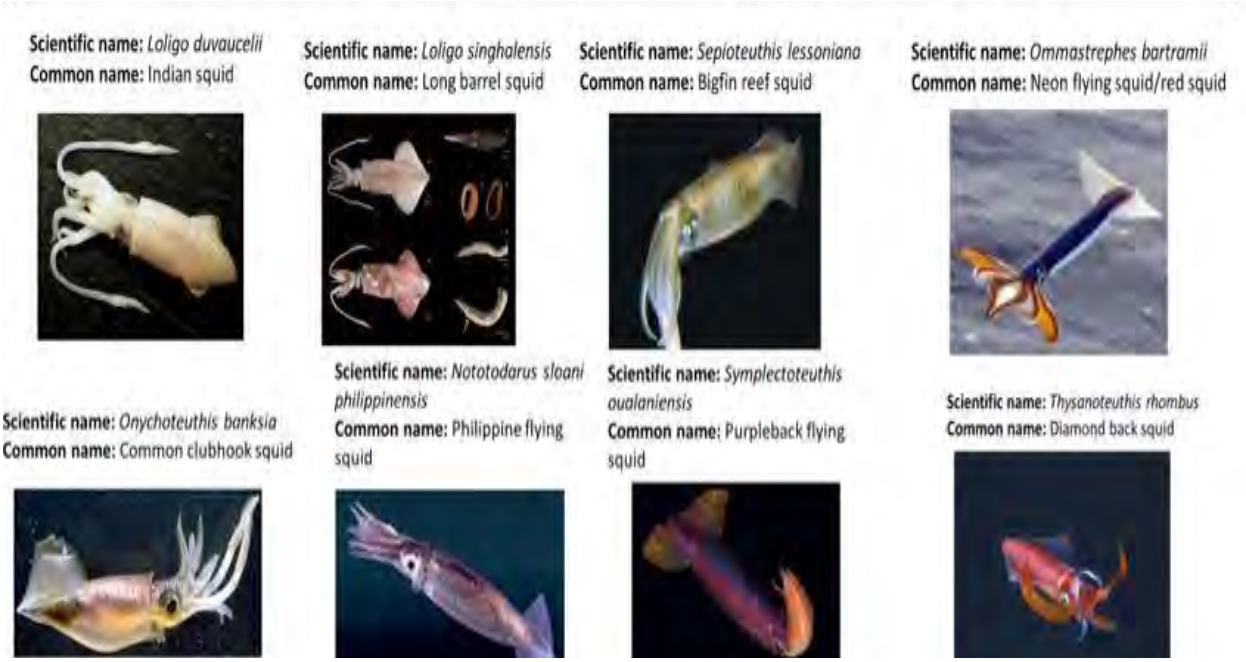

Figure 3. Squid species available within Sri Lanka's EEZ.

Sources: https://www.theguardian.com/lifeandstyle/shortcuts/2016/oct/19/squids-out-are-there-any-that-it-is-still-ok-to-eat#img-5,http://keralamarinelife.in/view.aspx?searchid=1229:, https://www.flickr.com/photos/wagnbat/2913086617, http://mostlyopenocean.blogspot.com/2013/02/flying-squid-really-fly.html, http://tolweb.org/tolarchive/19419/20070709/Onychoteuthidae.html, http://www.divephotoguide.com/underwater-photography-special-features/article/photo-series-social-life-purple-backed-flying-squid/, https://www.pinterest.com/pin/421508846365714339/?lp=true.

2. MANAGEMENT OF THE SRI LANKA'S MARINE FISHERY AND RIGHTS-BASED APPROACH

Sri Lankan fishermen have open access to overall marine fisheries, excluding the beach seine and stake-net fisheries (Atapattu 1994). Even though the fishery has an all-access approach, the fishery is highly regulated and managed on several levels. Fishing within the Sri Lankan EEZ is only permitted to licensed fishing vessels of Sri Lankan origin and ownership to maintain better fleet management.

The entire fishing sector is regulated using the "The Fisheries and Aquatic Resources Act No 2 of 1996" and the Sri Lanka Coast Conservation Act no. 57 (and the Amendments of 1988) to ensure fishing carried out in Sri Lankan waters are stringently monitored and regulated. These Acts also ensure that

fishing is carried out sustainably with minimal environmental impact. Sri Lanka has implemented and enforced a National plan of action to prevent, deter and eliminate Illegal, Unreported and Unregulated (IUU) fishing (2013). Fisheries and marine laws are constantly being updated to ensure regulation and management of aspects such as import-export management, prohibition and reduction or unsustainable fishing gear and practices, protection of Endangered, Threatened and Protected species. Furthermore, all fishing vessels are required to be registered and licensed for fishing, maintain a logbook for each catch and Marine Protected Areas and habitats have been established across the country. At an international level, Sri Lanka has ratified the FAO agreement on port state measures (PSM). The country also works closely with the Indian Ocean Tuna Commission (IOTC) to ensure that fishing conducted in FAO area 57 is sustainably carried out and has adopted the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

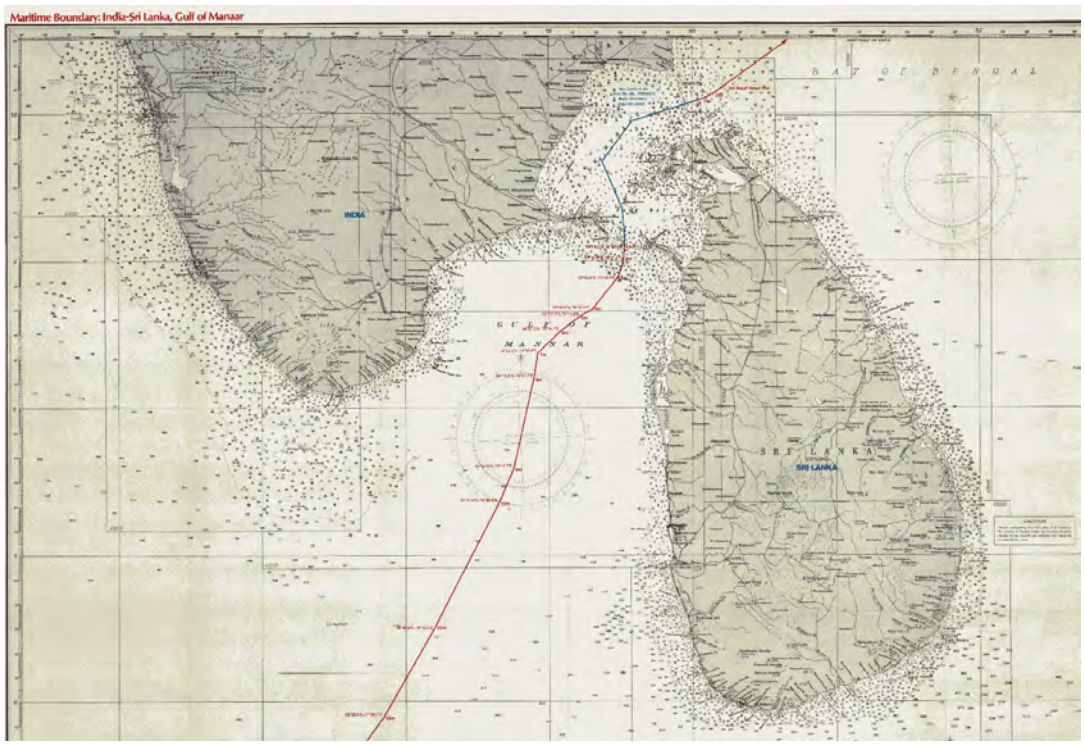

Figure 4. Original map used for the establishment of Indo-Sri Lankan Maritime Boundary Line (IMBL).
Source: "Maritime boundaries: India-Sri Lanka". Limit in the seas. U.S. State Department. 77. 16 February 1978.

3. MAIN CHALLENGES AND WAY FORWARD

3.1 Main Challenge: Conflict between Sri Lanka's small-scale squid fishery and mechanized trawlers

Although several measures have been put in place to ensure that Sri Lanka's marine resources are utilized sustainably, the fishermen from the northern districts of Sri Lanka are faced with restriction of fishing grounds and depletion of fishery resources due to large scale fleets of mechanized bottom trawlers. Fishermen from the North and East of Sri Lanka were restricted from going out to sea due to the ethnic conflict that began in 1983. During this time, fishermen from regions such as Tamil Nadu began to cross the Indo-Sri Lankan Maritime Boundary Line (IMBL), which was established in the mid-1970s. The crossing of the IMBL goes against the treaty signed by both countries regarding Sri Lanka's sovereign rights to fish in Sri Lankan historic waters. The mechanized bottom trawlers crossed into areas such as the Palk Strait and the Gulf of Mannar to meet the resource demands of their prawn and fishery industry.

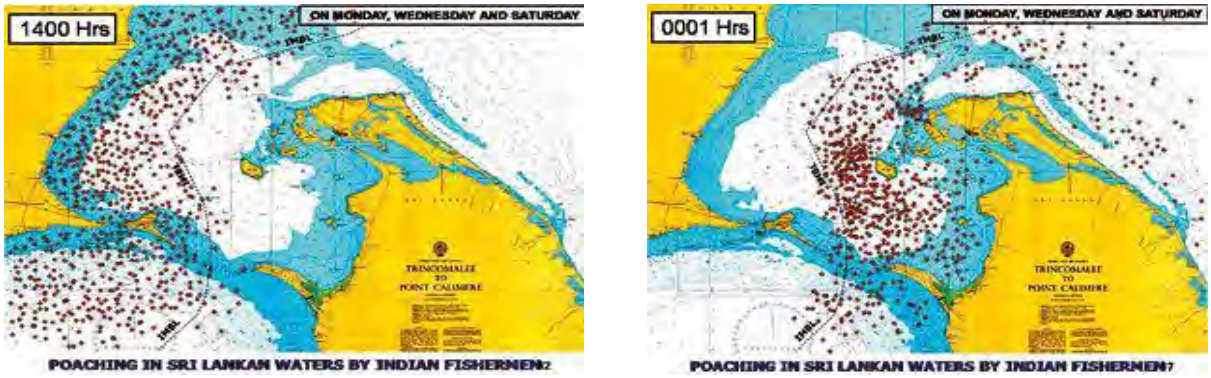

Figure 5. Satellite images provided by Sri Lankan Navy showing the movement of Mechanized bottom trawlers crossing the IMBL.
Source: http://www.sundaytimes.lk/110227/News/nws_17.html

Reports have shown that in 2001, India's bay consisted of 12 727 fishing vessels while the Sri Lankan region was found to have 5 135 in 2002. The signing of a cease-fire agreement between the LTTE and the Sri Lankan government in 2002, enabled the fishermen to resume fishing in the north and the east of the country. However, the increased presence of the illegal bottom trawlers in Sri Lanka's waters during the absence of Sri Lankan fishermen resulted in a severe degradation of marine habitat and allowed limited access to the local fishermen.

The Fisheries Act of 1996 defines "bottom trawl net" as a towing net having a cone-shaped body and a bag of cod end connected to the apex with or without two wings connected to the other end and towed by motorized or mechanized fishing boats. The use of bottom trawling fishing gear by Sri Lankan fishermen was prohibited due to the severe damage the fishing gear causes to the environment. The Act states that no person shall engage in bottom trawling practices, nor purchase or sell bottom-trawling nets for the purpose of the operation. It further states that no license shall be issued by the Director-General under Part II of this Act for operations carried out by bottom trawl nets to be towed by a motorized or mechanized fishing boat in Sri Lanka Waters. If found guilty of the utilization of bottom trawling in Sri Lankan waters, the responsible parties will be subjected to criminal charges and be liable to imprisonment. Therefore, the number of mechanized trawler vessels were significantly higher than that of Sri Lanka's small-scale traditional vessels. It has been recorded that up to 150 mechanized trawlers illegally cross the IMBL daily, with approximately 2 500 boats trawling up to date.

Figure 6. a) Size difference between Sri Lankan fishing boat and multiple illegal mechanized bottom trawler b) Mechanized bottom trawl catch including several turtles in Sri Lankan waters.
Source a: http://www.dailynews.lk/2016/03/14/features/why-bottom-trawling-should-be-banned
Source b: http://tamildiplomat.com/india-proposes-subsidy-to-end-bottom-trawling-in-sri-lankan-waters/

3.2 Depletion of Sri Lanka's Marine resources due to illegal bottom trawlers

The use of mechanized bottom trawlers is depleting Sri Lanka's once abundant marine resources. Bottom trawling is carried out by a net that digs into the first foot of the seafloor and dredges up everything as the net is dragged across the ocean floor. The dragging of the iron bars or metal plates fixed at the mouth of the trawling net has a detrimental effect on the ocean floor and its surrounding environment. The dredging of the sea bottom dislodges all sediment, coral and vegetation as the net is dragged, thus destroying the entire ecosystem. The extent of the damage of bottom trawlers to the environment is such that the recovery rate is minimal, and the ecosystem is almost never completely restored.

The unsustainable nature of bottom trawling practices is not only a major threat to Sri Lanka's coastal biodiversity but also a major threat to the livelihood of the fishing community. In addition to the destruction of the physical environment of the ocean floor, discarded by-catch is a significant negative effect of the use of bottom trawlers. In most cases, 80 to 90 percent of the catch using trawlers is considered by-catch. The by-catch most often includes non-target species such as endangered marine mammals, turtles, juvenile and nursery stocks of finfish that are discarded. Furthermore, due to the nature of the fishing gear, most fish must be discarded due to the loss of value attributed to the external damages seen on the fish when hauling in the catch (economic wastage = economic loss). The loss of marine life due to discarded by-catch and damaging of the ocean bed leads to the lack of fish and other target species and potential income for small-scale fishermen.

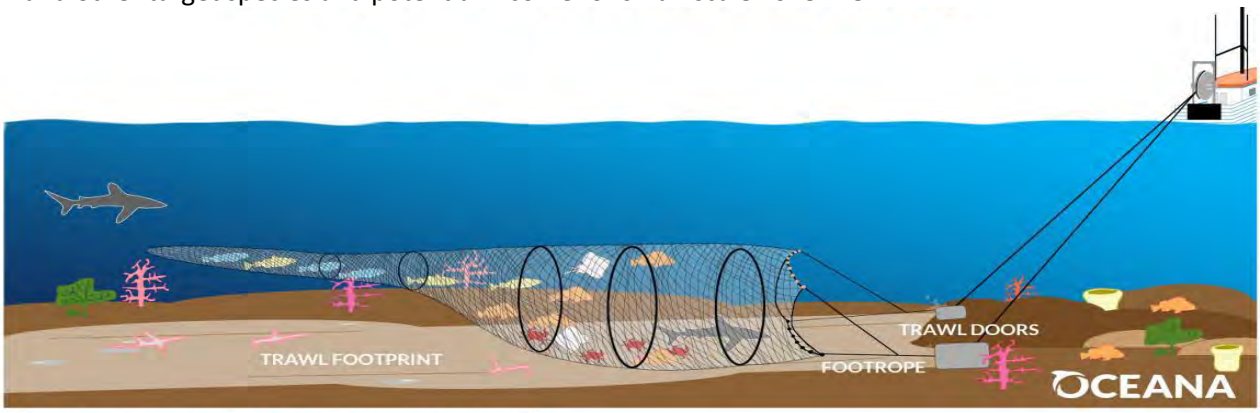

*Illustration is representative of gear used, not set to actual scale.

Figure 7. Mechanism of bottom trawling and negative impact on marine habitat and ecosystem.
Source: https://usa.oceana.org/bottom-trawling, http://www.coraltriangle.org/conservation/Conservation-CoralTriangle-Marine-Culture-Biodiversity-Fisheries.html, https://ocean.si.edu/conservation/fishing/net-full-bycatch

Economic loss due to mechanized bottom trawling

The loss caused by the illegal mechanized bottom trawlers has been estimated to be over USD 750 million annually (Roshan Fernando, former president of SEASL, 2007). 29 772 Indian fishermen illegally engaged in fishing using mechanized bottom trawling in Sri Lankan waters in 2008 (Madanayaka & Madanayaka, 2015).

Relevance to Squid Fishery

Sri Lankan fishers targeting squid using jig lines on boats, which are usually 17-23ft in length, are significantly smaller than the 28-46ft mechanized bottom trawl vessels. The large vessels have been found to damage local vessels and fishing gear by running over/cutting nets. Thus, the fishing community avoids going out to sea during times when the mechanized bottom trawlers are active.

4. SQUID FISHERY POTENTIAL

The recent changes in oceanic water temperatures around the world has affected distribution patterns of many marine species. However, the increase in temperature in certain areas has been found to be favourable for cephalopod species, such as squid. Therefore, a significant spike in squid production has been observed in the global seafood industry.

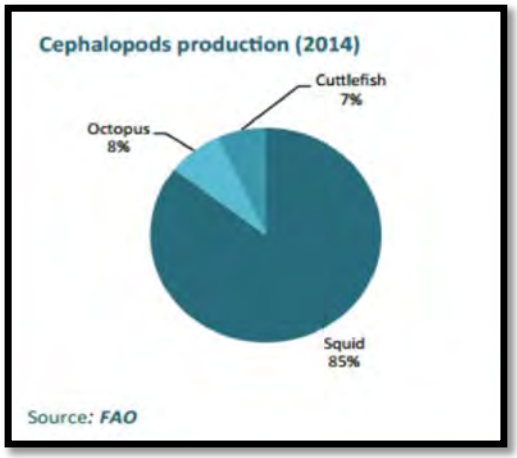

Figure 8. Cephallopods Production, 2014.
Source: http://www.fao.org/3/a-i5803e.pdf.

BBC reports show that today, squid are being caught at 60 percent of survey stations located in the North Sea compared to the 20 percent observed in the 1980s. These environmental changes, however, can also disrupt the global squid market. FAO reports (Jan- March 2016) show that leading squid exporters, (China and Peru) exhibited a reduced number of shipments to locations such as Spain and Japan. However, squid exports from locations such as Chile were shown to increase by 27.2 percent and India up to 85.7 percent (5 200 tonnes) as the strong El Niño affected squid landings in South America. The report also suggests that because of reduced catch, depending on availability, the overall price of squid fluctuated between EUR 6.00-6.10/Kg.

Due to the increased demand for squid products in today's seafood industry, Sri Lanka can become one of the larger suppliers if automated squid jigging practices are introduced. The data presented on figure 8 summarizes the top importers of squid at a global scale with its suppliers for the year 2015. The above-mentioned countries should be taken as potential export markets for Sri Lankan caught squid, ensuring a positive effect on the country's already prominent place in the global seafood industry.

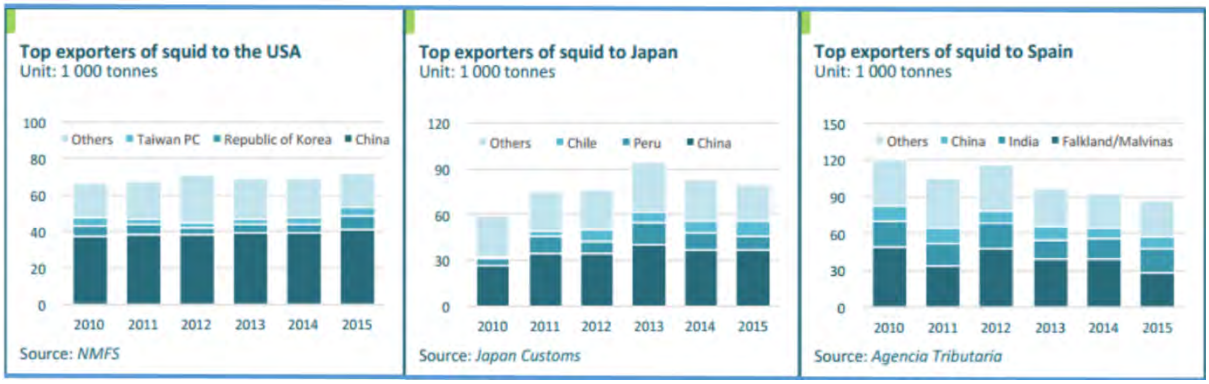

Figure 9. Top squid importers around the world (2010-2015).
Source: http://www.fao.org/3/a-i5803e.pdf.

5. MOVING FORWARD: INTRODUCTION OF ENVIRONMENTALLY SUSTAINABLE FISHING PRACTICES AND MODERNIZED GEAR TO INCREASE FISHING OPERATIONS

It is proposed that the introduction of environmentally friendly fishing practices, modernized gear and stringent enforcement of prohibited fishing gear as per Fisheries act no. 2 of 1996 will ensure that fishermen can sustainably utilize marine resources. The continuous presence of Sri Lankan fishermen in the fishing grounds due to revitalized operations increased vigilance and reporting will result in the reduction of illegal mechanized bottom trawlers.

Studies are being carried out for the application of size segregated (SS) devices in pole and line fishing and automated squid jigging as a viable environmentally friendly solution to mitigate the conflict currently faced by small-scale fishermen. Such promotion will reduce the over-exploitation of the fish stocks, pollution and environmental degradation of the sea bottom caused by dragged gear currently employed by Indian fishermen.

5.1 Size segregated devices in pole and line fishing

As mentioned previously, the majority of fishermen in the north of Sri Lanka use gillnetting or beach seining as a preferred fishing method due to the shallow nature of their fishing grounds. Gillnets are considered to be one of the least catch controllable and least environmentally sustainable gears. Due to the indiscriminate nature of gillnet fishing on the already depleted marine resources ascribed to bottom trawling, it is suggested that marine fishermen switch to longline, handline, jigging and pole and line gear. However, it is also suggested that all vessels involved in pole and line fishing have a catch size regulation device installed onboard. The use of this device would enable the pole and line fishery to be more sustainable and mitigate the catch of juvenile fish.

The Yellowfin tuna (YF), a highly migratory, pelagic species is one of the most commercially valuable species caught by Sri Lankan fishermen. This tropical species is found to spawn in the Indian Oceans throughout the year. As spawning takes place close to the surface reproductively active fish and juveniles are almost always found at the surface. It has been suggested that a mature adult at about 2.8 years would weigh >25 kg while having a length greater than 105 cm (Fromentin and Fonteneau 2001). Reports show that intermediate age individuals are rarely taken into commercial fisheries because of juveniles and new recruits being caught by shallow gear such as gillnets, hand lines and pole and line, while matured fish are caught using deep-set gear such as long lines. IOTC reports have shown that Indian Ocean Yellowfin Tuna (YFT) catch by pole and line gear mostly consist of juvenile individuals (approximately 60cm or less). Considering the low recruitment rates reported in the latest IOTC stock assessments, this study proposes that a minimum catch size is introduced for pole and line fishing to minimize juvenile catch

5.2 Automating squid jigging in Sri Lanka

This method is less labour intensive, as manpower is only needed to operate the machinery and the final sorting of the catch and therefore increases productivity and incentivizes the fishermen to engage in more fishing operations.

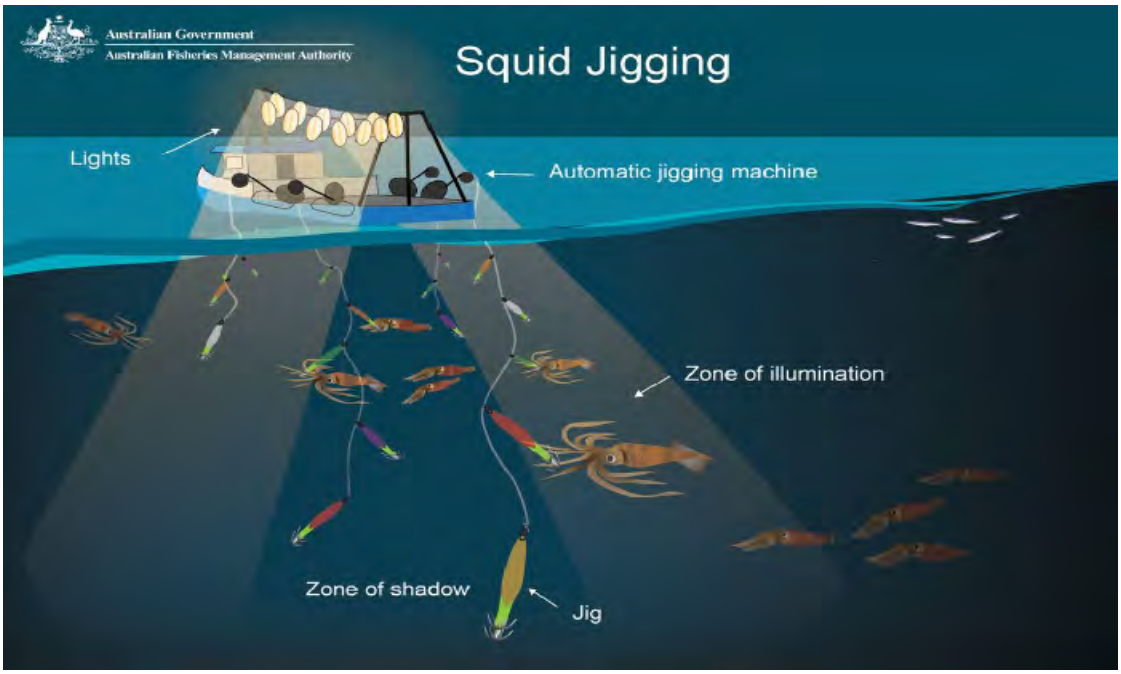

Figure 10. Squid jigging.

Source: https://www.afma.gov.au/fisheries-management/methods-and-gear/squid-jig

For example: 2 fishermen + 2 automatic jigging machines = estimated the productivity of 10 fishermen using hand jigging the same cost of production

5.3 Social benefits

Introducing automated squid fishing using jigging, benefits the fishing community socially through their involvement during catch landings on a weekly basis. Due to the involvement of the DFAR and organizations such as NARA, educational courses and training can be conducted within the community. In turn, the local fishermen benefit from new skills and increasing opportunities for advancement.

Sri Lanka has employed an open access rights approach system for fishing with restriction to environmentally unsustainable fishing practices and gear due to the small-scale nature of their fleet. The breach of the agreement signed in November 1976 regarding fishing rights and access to Sri Lanka's EEZ by mechanized bottom trawl vessels have led to the limited access to fishing grounds and depletion of marine resources for Sri Lanka’s small-scale fishermen. The introduction of SS pole and line fishing and automated squid jigging will ensure that the fishermen can increase their fishing presence in northern fishing grounds with modernized boats and higher catch rates. The use of environmentally sustainable fishing practices and increased presence will ensure future catch, improved employment opportunities and reduction of border crossing by the bottom trawlers, regaining full access to their fishing grounds.

Conflicts (or Competition) between fisheries and regions in Korea

Young Tae Shin

Please refer to the case study presentation available at:
http://www.fao.org/3/CA2458EN/ca2458en.pdf

Examples of fishing disputes in Korea

Joon Mo Park

Please refer to the case study presentation available at:
http://www.fao.org/3/CA2459KO/ca2459ko.pdf

Implementation of user rights in Lake Albert fisheries, Uganda

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Abstract
This paper presents the fisheries user rights system that is practiced in Lake Albert in Uganda. The Lake Albert fishery is an open access fishery by all standards. Controls are implemented in the fishery through the issuance of licenses. These licenses are issued on an annual basis, and they are species-specific, meaning that the fisher has to own a license for each fish that he/she intends to fish. The processes of the issuance of licenses involves the registration of the fishers and an application on their part expressing their interest to operate in the kind of fishery for which a license is issued. In order to get licenses, the fishers have to log in online; this kind of licensing is referred to as e-licenses. Since the fees collected are deposited in the government consolidated fund, the fishers require tax identification numbers before they can log on to the licensing portal. Licenses are given on a first come first served basis, and the amount of fee is directly charged (taxed) on the transport vessels for fish and fisheries products. Before fishers are granted licenses, they are vetted to remove those who have engaged in illegal fishing practices. The research noted in 2006 that the decline in the stocks of fish in the main water bodies, Lake Albert inclusive, is mainly due to the increased number of illegal fishing practices in these water bodies. In order to develop a practical response to this issue, the Government withdrew fisheries licensing from the local government and transferred it back to the central government (Ministry of Agriculture, Animal Industry and Fisheries). Since the Ministry has had the Licensing system re-strategize with the main objective of reducing illegal fishing activities, thereby rebuilding the declining stocks. This paper, therefore, acknowledges that much as User Rights are exclusive in nature, the practice in the Ugandan context in the fisheries licensing system is very important for the promotion of sustainable fisheries management. It is also worth noting that this system is costly - in both time and financially. In addition to the above-mentioned disadvantages, it is also socially exclusive in that those who cannot pay for the licenses are incentivised to fish illegally. Nonetheless, it can contribute to the sustainable exploitation of the fisheries resource, thus supporting several of the Sustainable Development Goals (SDGs) most especially goal 14 (1), which advocates for the Global protection of aquatic life which is very important for human life on earth.

1. INTRODUCTION

1.1 Description of the Fishery

Lake Albert is an inland lake that is situated between the boundary of two countries, the Democratic Republic of Congo (DRC) and Uganda. About 54 percent of the lake is estimated to be in Uganda, and about 46 percent is in DRC. It is one of the Great African lakes and is situated at the far end of the western part of the East Africa Rift Valley, making it a rift valley lake. The lake is estimated to be 160 km long and 30 km wide. Lake Albert is currently the second-largest contributor to the fish production in the country, accounting for 30 percent. This ranges between 144 000 MT to 160 000 MT annually. The waters generally consist of a multi-species fishery, with the main commercial species being Nile tilapia, Nile perch and the small sardine like ragogi and muziri. About 80 percent of the total catches from the lake consist of Ragogi and Muziri, 6 percent represent Nile perch (not that the Nile perch species of Lake Albert consists of two forms that differ in biological and morphological characteristics: the larger *Lates Niloticus* grows to adult size at about 2 meters and occurs mainly in the shallower parts of the Lake, whereas the smaller *Lates Macrophthalmus* grows to about 70 cm and occurs mainly in the deep waters) (Lake Albert Policy Brief 2012) and the remaining 14 percent is shared between Nile Tilapia and the other species. In addition, there is a reasonable quantity of other species such as

Alestes and Hydrocynus. Overall, more than 20 species from the Lake are harvested on a commercial basis.

Figure 1. Map of Uganda showing the location of Lake Albert.
Source: https://www.un.org/Depts/Cartographic/english/htmain

1.2 Economic contribution and Social Implication of the Fisheries

The fisheries sector in Uganda contributes about 5 percent to the National GDP, 1.5 percent of which is estimated to derive from the Lake Albert fishery. As noted above, the Lake Albert Fishery is currently the second-largest source of capture fish in the country. It contributes about 30 percent to the total capture fisheries production in the country.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACHES

2.1 Management of the Fishery

The fisheries of Lake Albert is managed based on an input control mechanism. The main fishing methods and fishing gears are controlled to ensure that the stocks are sustainably harvested. All active fishing methods such as boat and beach seining, tycooning (beating the waters to scare fish into fishing gears), cast netting etc. are illegal as prescribed in the Fish Act and other subsidiary legislations. For non-active methods, there are size restrictions; for instance, the minimum allowed size of the gillnets is restricted to 4.5'' inch and above. For longliners, the size of hooks allowed is 9 and below. Fishing in fish breeding areas is prohibited, and fishing using baskets, dynamites, chemicals and other traps is also prohibited. Fishing should occur more than 200 m off the shorelines. In addition to these methods of control, licensing is also prominently used. On the Democratic Republic of Congo (DRC) side, closed season fishing is also practiced.

2.2 Brief History of former rights approaches used in the fishery

In 2008, the Directorate of Fisheries Resources (DFR) came back on its decision to delegate licensing of fishing activities to District Local Governments, and recentralized this function within the national

government, with the main objective of revitalizing the declining stocks from all the water bodies by using licensing as a fisheries management tool rather than a means to generate revenue. This initiative was taken because of the continuous decline of the fish stocks that was attributed mainly to the breakdown in co-management structure and rampant illegal fishing activities comprising mainly the use of illegal fishing gears. It was also noted that the District Local Governments were using licensing as a revenue-generating activity rather than fisheries management. The recalled licensing activities necessitated the development of a new strategy that, amongst many factors, required that fishing boats should have their registered numbers on a permanent marking similar to the vehicle number plates: the Fishing Vessel Identification Plates (FVIPs). The FVIPs are a good identification mark on boats since they are more permanent and are difficult to forge, unlike the paint marking that was previously used. However, these plates are expensive, and since 2011, when the implementation of the new Licensing strategy began, only about one-third of the required Fishing Vessel Plates have been procured.

2.3 Rights-based approach: Allocation and Characteristic

Currently the single most common mechanism that allows the Fishers to carry out fishing activities is the possession of a valid fishing license. It is a paper-based document that is given to the fishers. It is species-specific, meaning that for each fishery that a fisher wishes to engage in, they require a specific license.

3. CONTRIBUTION OF RIGHTS-BASED APPROACHES TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

The fish stocks in Lake Albert are generally overfished. The Nile Perch that used to be one of the main commercial stocks now contributes less than 6 percent to the total catch of the Lake. Other species, such as Alestes barimose and Hydrocynus, are no longer considered economically viable for fishing.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges of the fishery

a) Changing and cumbersome system of licensing (Acquisition of Tax Identification Numbers, Possession of internet, having the knowledge to use the internet, electricity etc.)
b) Delays in procurement of Licensing Inputs (Fishing Vessel Identification Plates, Certificate of Vessel Ownership (CVOs))
c) Limited enforcement that makes those who have paid for the fish license equal to those who have not yet paid
d) Unharmonised policies, laws, regulations with the neighbouring DRC
e) Conflicts –Political Insecurity in Eastern Congo
f) Political interference at all levels

4.2 Improving fisheries sustainability in the future

a) Establishment of a Regional Fisheries Management Organization (RFMB) for the Fisheries that border DRC. This could be done in many ways, for example, expansion of the mandate of the LVFO or creation of a different organization altogether
b) Harmonization of fisheries policies, laws and regulation with DRC (closed season in DRC and nothing in Uganda)
c) Conflict resolution between the users: Mukene/ ragogi fishers (Light fishers and the Gill netters / longliners
d) Conducting a comprehensive licensing as provided for in the law

ACKNOWLEDGEMENTS

I would like to express my utmost gratitude to the FAO. In particular, I would like to thank Rebecca Metzner for all the help she has provided, for her role in coordinating the organization the Fisheries Tenure and User Rights conference held in Korea in 2018, and for inviting me to the conference. I am also eternally grateful to the Lake Victoria Fisheries Organization (LVFO) for funding my participation including providing facilitation for accommodation, meals, air ticket and visa fees that enabled me to participate in the conference. I also wish to appreciate the Ministry of Agriculture, Animal Industry and Fisheries through the office of the Undersecretary for providing the necessary documentations and recommendations to the Embassy of the Republic of Korea in Uganda that enabled my swift (and punctual) visa processing.

Management of coastal and cross-border pelagic species in North-West Africa

Birane Sambe

Please refer to the case study presentation available at:
http://www.fao.org/3/CA2462FR/ca2462fr.pdf

Complications of designing tenure rights programs for highly migratory fisheries Eastern Pacific Tropical Tuna Fisheries

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Abstract
This paper focuses on the realities of designing a strong user rights program for a highly migratory fishery with a high seas component. Its specific focus is the purse seine sector of the tropical tuna fishery in the Eastern Pacific, where the current weak user rights program based on vessel hold capacity and complementary measures is reaching its limit of effectiveness. Stronger forms of user rights have been considered by members of the Inter American Tropical Tuna Commission, the regional body responsible for setting region wide management measures for this fishery. Agreement on allocation and other design features to achieve a region wide solution is complicated by the multilateral decision making process, where member states who have a lot to gain are not always willing to compromise with those who want to enter or increase participation in the fishery and vice versa. A stepwise approach is proposed to allow participants to gradually change current behaviour and to learn and adapt the system towards the desired end goal. While the paper is focused on the Eastern Pacific case, these insights are relevant for other tuna producing regions depending on the context as tuna fisheries are heterogeneous across many dimensions including vessel size, catch composition on the high seas versus exclusive economic zones, value chain complexity, current value and potential post transformational value, strength and capacity of governance institutions and other enabling conditions for reform.

1. INTRODUCTION

1.1 Description of the fishery

Tropical tuna fisheries in the Eastern Pacific Ocean (EP) are trans-boundary spanning several coastal states' Exclusive Economic Zones (EEZs) as well as high seas areas (Figure 1). In accordance with international agreements, management and coordination of these fisheries are carried out by Regional Fishery Management Organizations (RFMOs), as they require regional cooperation to be successful at meeting ecological and socio-economic objectives. The Inter-American Tropical Tuna Commission (IATTC) carries out these functions for EP tuna fisheries and is currently comprised of 21 members, including coastal states and distant water fishing nations.[104] The IATTC was created by a treaty in 1949, also known as the 1949 Convention.[105] It entered into force in 1950 and was enhanced in 2010 after the adoption of the Antigua Convention.[106]

[104] The members of the IATTC are Belize, European Union, Nicaragua, Canada, France, Panama, China, Guatemala, Peru, Colombia, Japan, Chinese Taipei, Costa Rica, Kiribati, United States, Ecuador, Korea, Vanuatu, El Salvador, Mexico, and Venezuela. Bolivia, Honduras, Indonesia and the Cook Islands are Cooperating Non-Members.
[105] The 1949 Convention: http://www.iattc.org/PDFFiles/IATTC_convention_1949.pdf
[106] The Antigua Convention: http://www.iattc.org/PDFFiles2/Antigua_Convention_Jun_2003.pdf

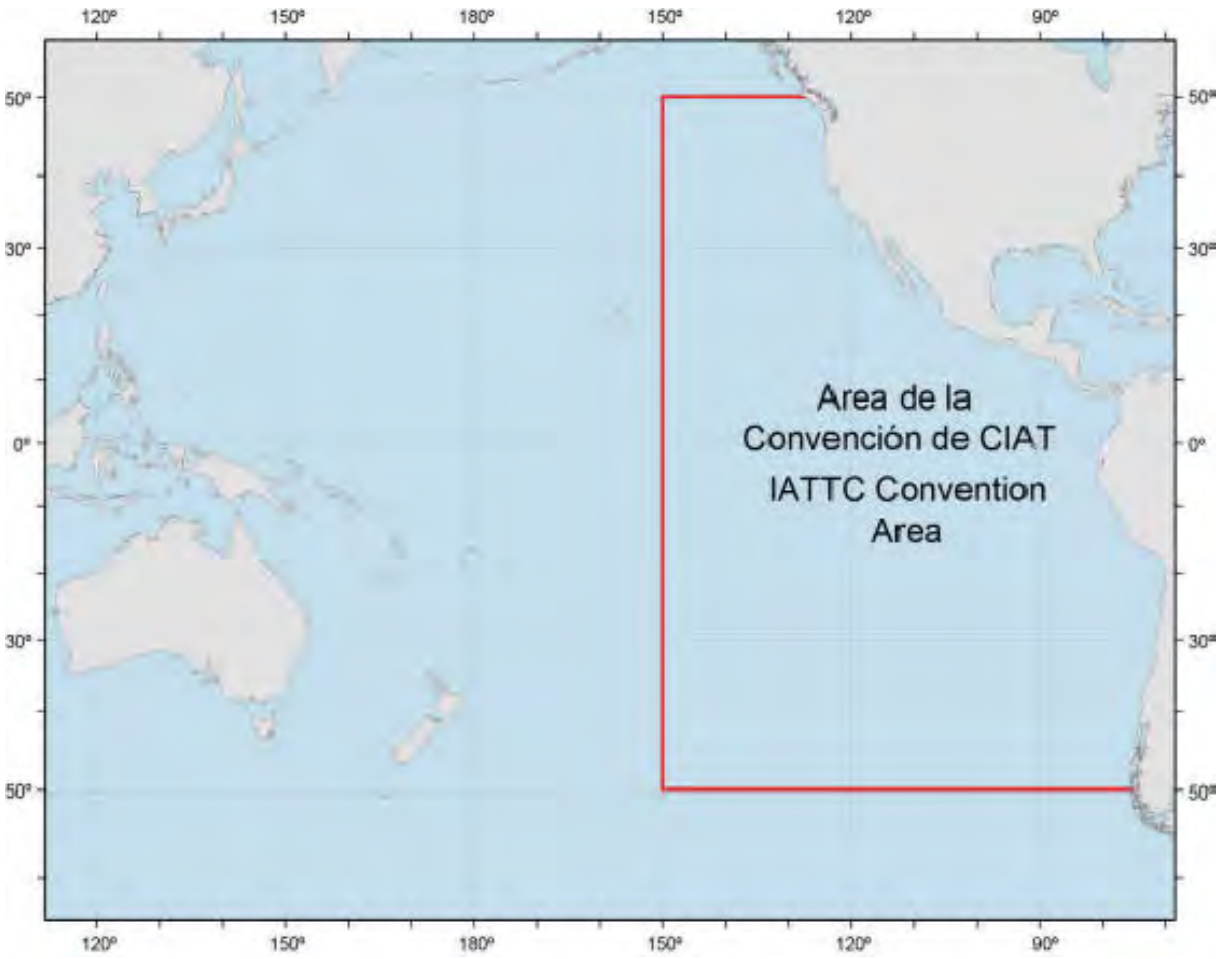

Figure 1. Agreement area for the Inter-American Tropical Tuna Commission as defined in the Antigua Convention.
Source: https://www.iattc.org/images/WebPics/EPOmap.jpg.

Tropical tuna catches from the Eastern Pacific Ocean (EPO) constitute about 12 percent of the world's total catch of tunas, and thus fluctuations in EPO catches have little to no effect on prices at the dock (Bucaram, 2016). The three most important tropical tuna species are yellowfin, bigeye and skipjack. Since 2011, yellowfin landings have declined to levels below that of skipjack due to the drop in catches by Mexican, Venezuelan and Ecuadorian flagged vessels (Figure 2).[107]

Purse seines are the dominant gear used, contributing about 91 percent of the total EPO landings in recent years (Figure 3). Purse seine tuna catches from the EPO ranged between 450 000 to around 640 000 metric tons during the period 2007 to 2016, and typically, skipjack tuna comprises the largest component (49%), followed by yellowfin tuna (39%) and then bigeye tuna (10%)

[107] From IATTC catch/effort public domain database http://www.iattc.org/Catchbygear/IATTC-Catch-by-species1.htm

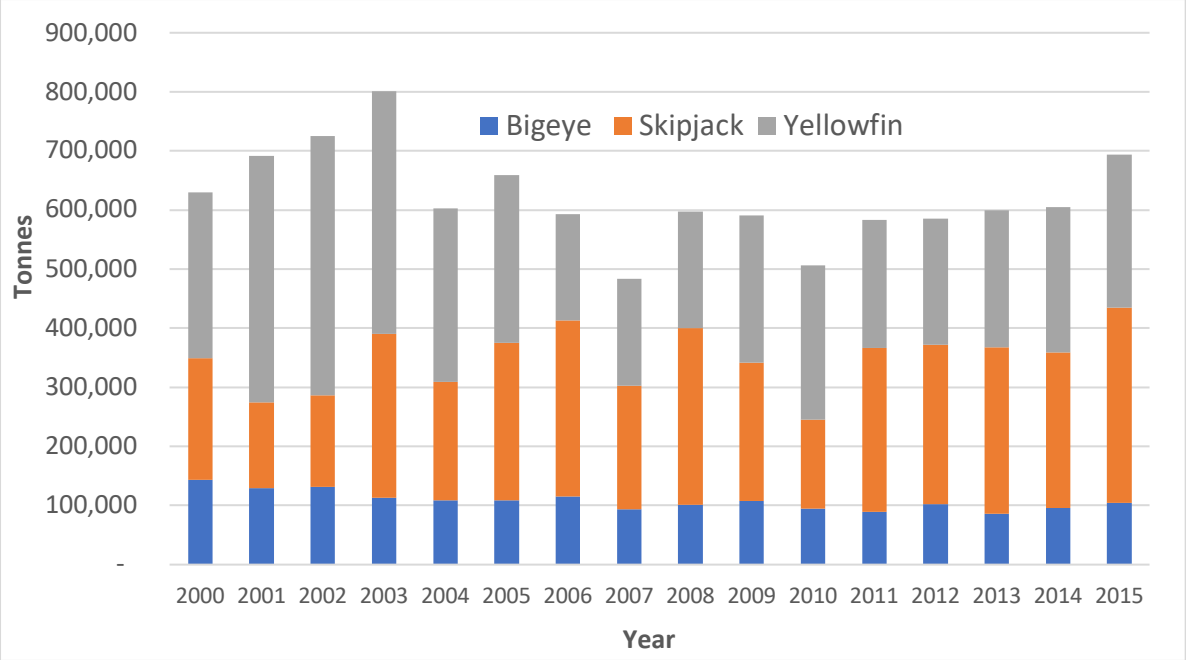

Figure 2. Total Catch of Yellowfin, Bigeye and Skipjack Tuna in the Eastern Pacific Ocean from 2000 to 2015.
Source: IATTC. Catch Reports Data. https://www.iattc.org/CatchReportsDataENG.htm.

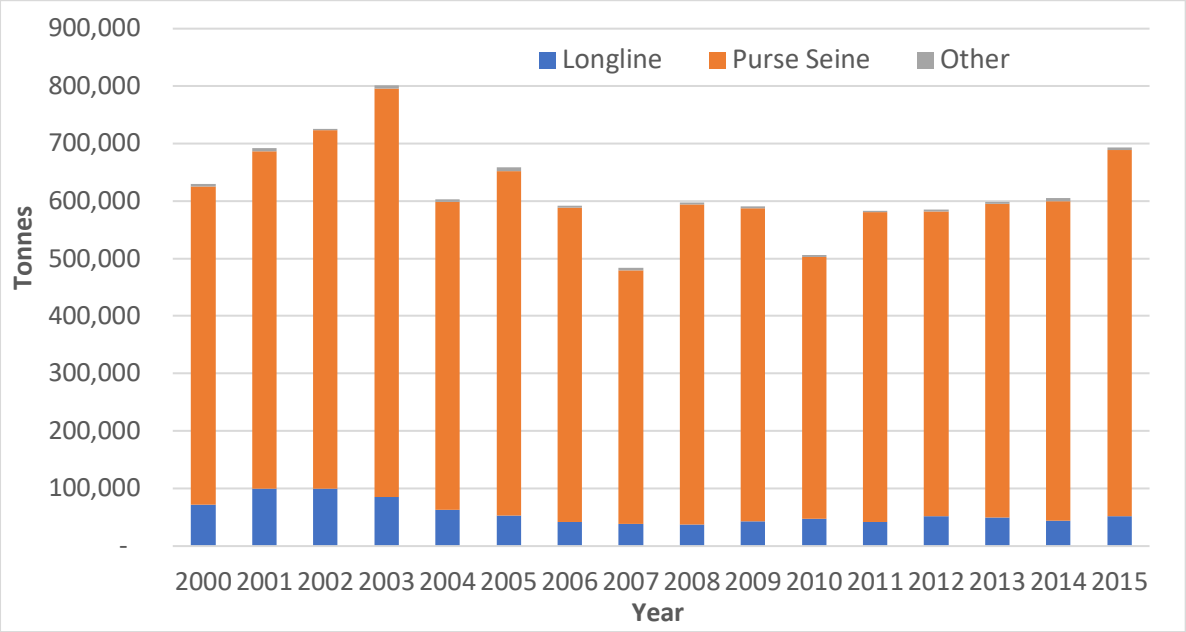

Figure 3. Total Catch of Yellowfin, Bigeye and Skipjack Tuna in the Eastern Pacific Ocean from 2000 to 2015 classified by Gear.
Source: IATTC. Catch Reports Data. https://www.iattc.org/CatchReportsDataENG.htm.

The purse seine fleet operates in the EEZs and on the high seas. In 2013, vessels flagged by five Latin American coastal states (Ecuador, Mexico, Panama, Venezuela and Colombia) took just over 80 percent of the purse seine catch (Maharaj, 2016). More recently, the US purse seine fleet authorized to fish in the EPO became more active in this region and is now the third-largest operational fleet (Figure 4). The purse seine fleet is broadly divided into two categories. One category of vessels set mostly on fish aggregation devices (FADs) targeting skipjack tunas and incidentally capturing small sizes of bigeye and yellowfin tunas in which Ecuador is the major participant. The other category of

purse seine vessels set on dolphins targeting larger sizes of yellowfin tuna in which Mexico is the major participant.

The longline sector primarily targets adult bigeye taken largely by distant water fishing nations (Japan, Korea, China and Taiwan) operating exclusively on the high seas. These vessels also operate in the Western Central Pacific and are subject to the rules of both RFMOs.

There is heterogeneity in the purse seine sector by mode of fishing and vessel size. While the fleet is highly industrialized, there is variability in vessel sizes (Figure 4), with most of the fleet in the Class 6 group (greater than 426 m^3). Currently, a larger portion of the fleet primarily fishes over FADs, and there is more variability in vessel sizes in this category of purse seiners (Figure 5).

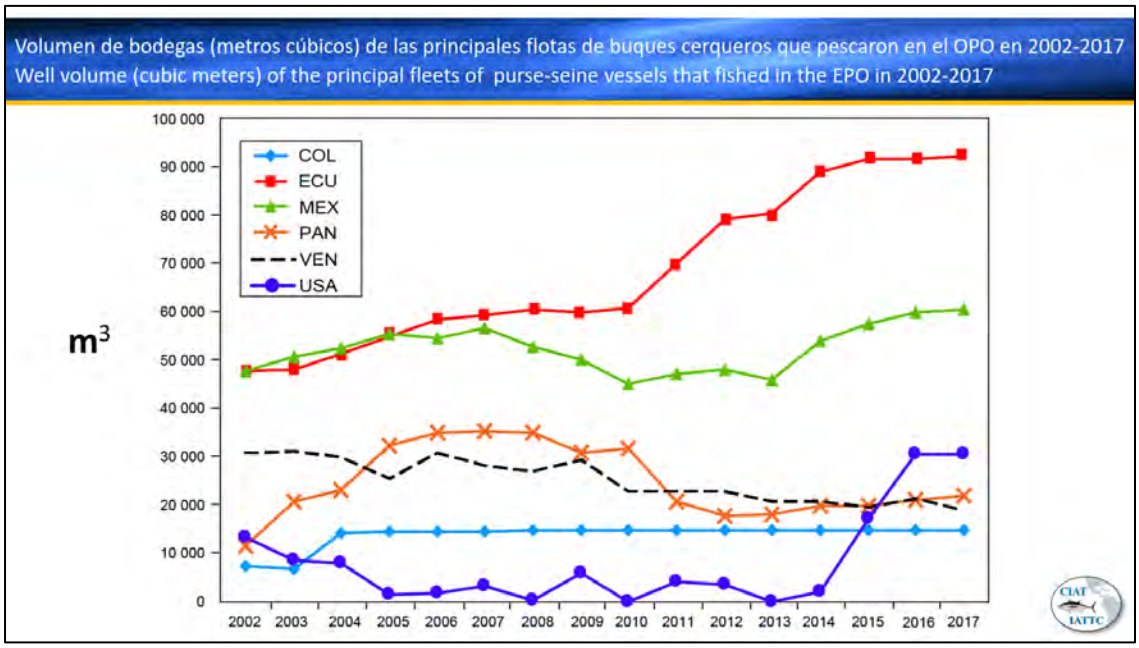

Figure 4. Operational Capacity of the major fleets in the Eastern Pacific Ocean.
Source: CAP-20-PRES (IATTC, 2018).

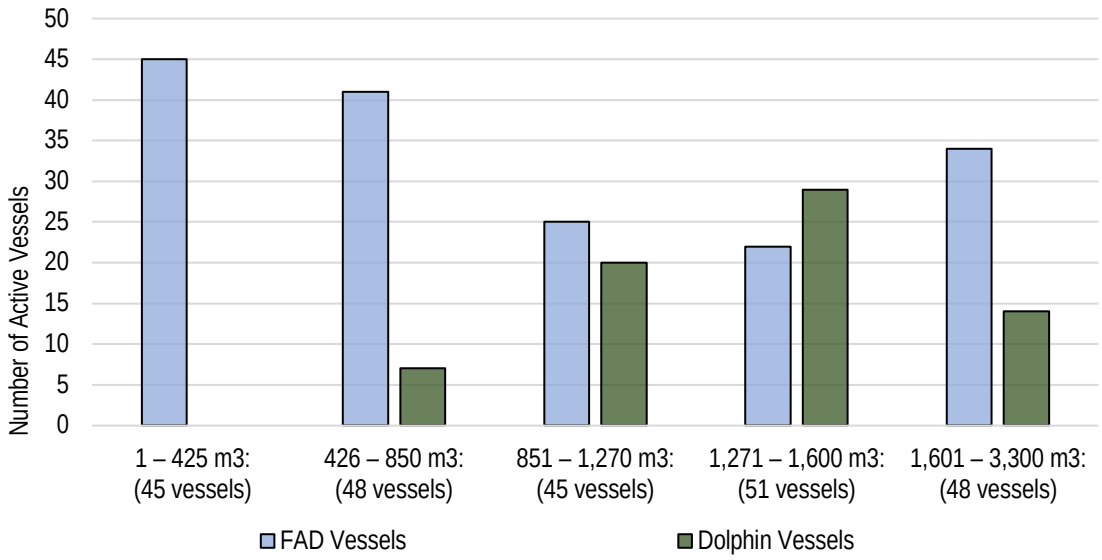

Figure 5. Distribution of Dolphin and FAD Vessels by Capacity Bins from 2016.
Source: Developed by Northern Economics using IATTC data (Northern Economics, 2018).

1.2 Economic contribution and social implications of the fishing activity

The purse seine catch is primarily destined for the canned tuna market, while the longline catches go to the high-end sushi market. Currently, most of the economic benefits from the tropical tuna fisheries are derived from the landings associated with the purse seine sector. The economic benefits derived from the EPO tropical tuna fishery not only accrue to actors along the value chain but also the communities dependent on this commerce.

The primary focus of this paper is the industrial purse seine fleet that has demonstrated fluctuations in net operating revenue, with what appears to be a decline since 2013 by nearly USD 200 million (Figure 6). There is also wide variability in profitability across the fleet and from year to year. To assess the variability in this fleet, vessels are categorized into whether they primarily fished over dolphins or FADs. In both subsectors of the fleet, on average a larger proportion of dolphin vessels are in the red where operating costs exceed revenue. The net operating revenue for most vessels does not exceed USD 2.5 million per year (Figure 7).

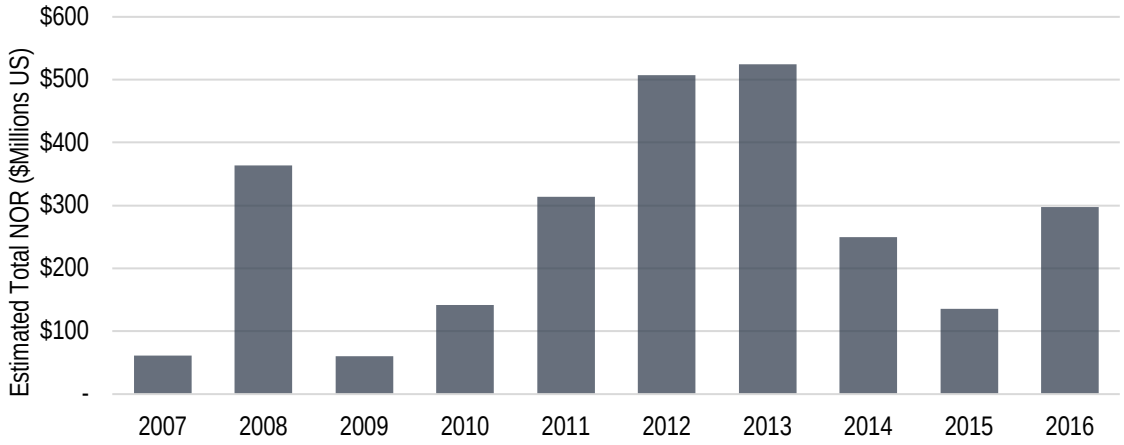

Figure 6. Estimated Nominal Fleet-wide Net Operating Revenue, 2007–2016.
Source: Northern Economics (2018).

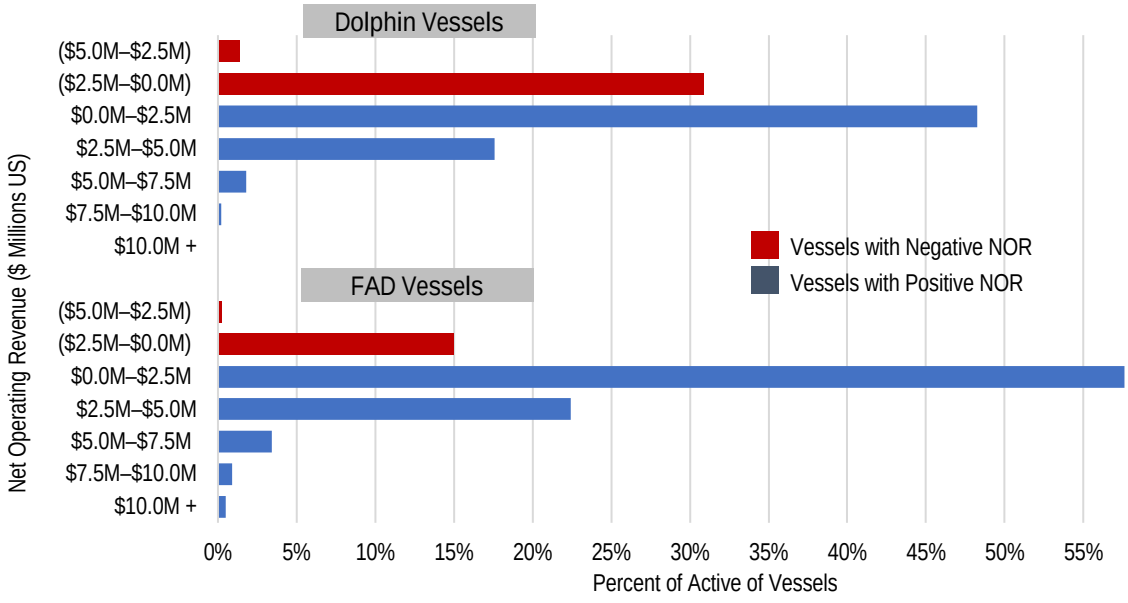

Figure 7. Distribution of Net Revenues per Vessel by Vessel Type, 2010–2016.
Source: Northern Economics (2018).

The canned tuna processing sector is a major source of employment in specific “hot spots” in Latina America. Ecuador is the second most important producer and exporter of canned tuna in the world (Bucaram 2016). Manta, Ecuador is recognized as the most important processing cluster in the Eastern Pacific, as its processing plants receive tuna landings not only from the Ecuadorian fleet but also by fleets from other countries that include Colombia, Panama, Costa Rica and the European Union (Bucaram 2016).

Prieto (2012) estimated that 73 203 direct and indirect jobs were in the harvesting and processing sectors in 2010. This value is an underestimate, as it does not include employment in Spain that depends on the EPO tuna fishery. The majority of these jobs are in the processing sector, as around 33 000 people are estimated to be employed directly in the various Latin American canneries in the region. An estimated 5 773 jobs are crewmembers on fishing vessels, which also provide around 500 000 days of temporary work in maintenance and unloading. The direct employment in other parts of the value chain was not captured in these figures. The number of direct jobs in the national and international distribution or administration of harvesting enterprises is significant.

The communities that have the highest index of dependence on the tuna fishery are Manta and Posorja in Ecuador, and both are the largest communities dependent on tuna as a source of employment. There are smaller communities with a high index of dependence, such as El Salvador, Guatemala and Costa Rica, where large tuna processing plants dominate the industrial sector (Prieto, 2012).

Employment in the harvest sector is male-dominated, and the processing sector is female-dominated. Crew members on fishing vessels are generally skilled with higher education levels compared to processing workers who rarely receive formal training (Prieto 2012). More recent interviews carried out by Bucaram (2015) revealed that vessel captains and crew members typically have good salaries and social standing.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

The member states of the IATTC are responsible for the management of this fishery and consensus is required for the adoption of management measures that apply to the Eastern Pacific. Ratification of this voluntary system is required at the national level by member states who are responsible for enforcing these measures. In addition to IATTC wide management measures, member states can also implement additional measures that apply to their respective flag vessels and EEZs.

2.1 Management of the fishery

Given the complexity of management under a multilateral regime, no single management tool is expected to address all issues in high seas fisheries. This is the case for the Eastern Pacific. Currently, the IATTC manages the purse seine fleet primarily through input restrictions and the longline fleet through output restrictions.

Since 2002, the primary means of management of the purse seine fishery has been through the limitation of capacity that is discussed further in the section below. The following additional measures apply to the purse seine sector.

1. *Seasonal Closure of 72 days*. All class 5 and class 6 purse-seine vessels must stop fishing in the EPO for a period of 72 days. Members and cooperating non-members (CPC) of the IATTC decide which of the following two closure periods to observe: from July 29th to September 28th, or from November 18th to January 18th. Class 4 purse-seine vessels are able to make only one 30 days fishing trip during the specified closure periods, provided that any such vessel carries an observer from the On-Board Observer Program of the Agreement on the International Dolphin Conservation Program (AIDCP).

2. *Area Closures*. Prohibition of fishing activity by purse seiners in the area located between 96° W and 110° W, and 4° N and 3° S, an area known as "El Corralito", from 00:00 hours on September 29th to 24:00 on October 29th.
3. *Observer coverage:* There is a 100 percent observer requirement for all Class 6 vessels.

Purse-seine vessels of IATTC capacity classes 1-3 (182 metric tons carrying capacity or less), longline vessels less than 24 meters' length, as well as pole-and-line, troll, and sport-fishing vessels are not subject to these measures.

The main target of the longline sector is bigeye tuna, and the IATTC manage this sector through bigeye tuna catch limits allocated by member country for vessels greater than 24m as follows:

Metric Tons	2014-2016
China	2 507
Japan	32 372
Korea	11 947
Chinese Taipei	7 555

2.2 Rights-based approach: allocation and characteristics

For the purse seine sector, IATTC Resolution C-00-06 in June 2000 established a Vessel Register with the intent that only those vessels that fished before June 2002 would be authorized to fish in the Eastern Pacific. This quasi limited entry measure to some extent, initially allocated the number of vessels by member states active in the fishery. Documented capacity, measured as vessel hold space, on the Register could be corrected. New vessels could only enter the fishery if vessels were removed from the Register and provided that the total capacity of any replacement vessel does not exceed that of the vessel or vessels replaced. IATTC Resolution C-02-03 created a target capacity level of 158 000 m^3 of vessel hold space (capacity) and established the initial allocation of capacity by a member state. However, in order to obtain agreement across member states, provisions were made to:

- allow Costa Rica, El Salvador, Nicaragua, and Peru to collectively add 18 720 m^3 of capacity to the register; and
- allow up to 32 vessels from the U.S. that are authorized and licensed by other RFMO's (e.g. WCPFC) in the Pacific to take a single trip in the EPO not to exceed 90 days.

The intent of IATTC members was to strengthen measures to reduce fleet capacity after 2002. However, the capacity management plan has yet to be approved, and total potential capacity continually increased (Figure 8). This was primarily due to the settlement of disputes and correction of measurement errors after 2002 that allowed an increase of nearly 20 000 m^3 of vessel hold space. Capacity can be leased and sold across member states in the IATTC, and this resulted in disputes based on who owns the rights: the vessel owner or the flag state. The opportunity to sell/lease fleet capacity partly motivates the "new claims" by member states who want to participate in the fishery without developing or increasing the size of national fleets. Currently, claims and disputes account for 53 000 m^3.

Operative capacity has grown substantially since 2002, and that growth is directly related to the increase in fishing effort and mortality on the stocks (Figure 8). For example, in 2015, an additional 25 000 m^3 of capacity was activated, and this resulted in an increase of 10 percent of catches per year. Furthermore, measures to address effort creep were not put in place. As a result, effective effort per m^3 increased as more efficient vessels of the same size replaced older vessels and other unrestricted

inputs usage increased, such as more effective FADs and larger nets that fish deeper in the water column.

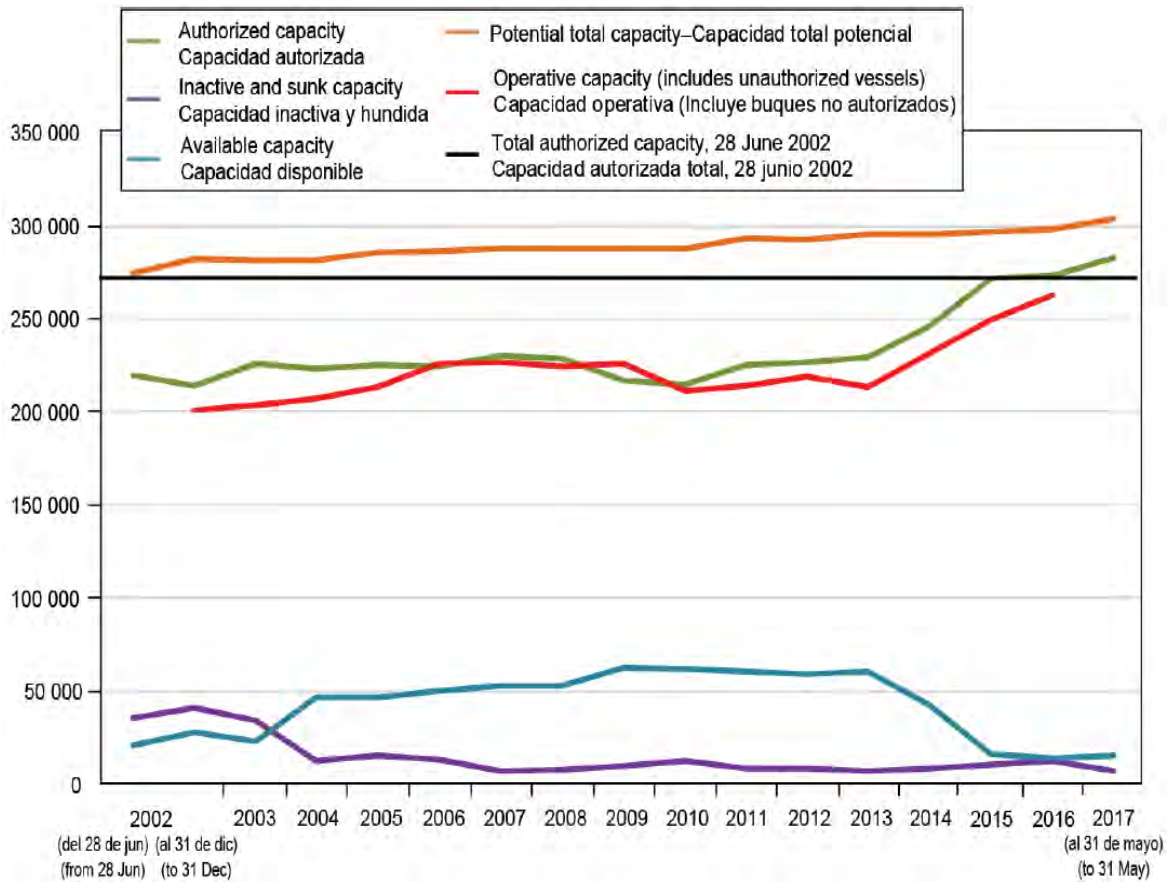

Figure 8. Authorized, Inactive, Available, Potential Total, and Operative Capacity (m3), 2002–2017.
Source: Reproduced from IATTC Document CAP-18-03 (2016).

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

The IATTC estimated the Maximum Sustainable Yield (MSY) of bigeye tuna to be 113 700 tons. This MSY was reduced to about half its level in 1993, due to the expansion of the floating-object fishery, including fish-aggregation-devices (FADs), which increased mortality on the smaller sizes not yet at sexual maturity. Similarly, the IATTC estimated that the MSY of yellowfin tuna is 275 300 tones (IATTC, 2016). Reducing the catch of small bigeye and yellowfin will increase the MSY and overall productivity of these species. To achieve these increases in MSY, the number of sets on floating objects will need to be decreased, and the cost will be borne by the vessels that primarily use FADs. The beneficiaries will be the longline fleet that targets adult bigeye and the purse seine fleet that targets larger sizes of yellowfin tuna.

In recent years, sustainability issues arose with bigeye and yellowfin tunas and management recommendations are provided to the IATTC Commissioners to keep these species on a rebuilding trajectory or to end overfishing. It is important to emphasize that management measures are derived through consensus and that political economy plays a role in the speed at which the agreements are reached and whether the effectiveness of the final measures meet the scientific recommendations.

Due to the life history characteristics of skipjack tuna, the stock assessment results typically indicate uncertainty about stock health, and it is difficult to assess MSY reference points and biomass levels.

Prior to 2017, the scientific staff concluded that there is no evidence to indicate a credible risk to the biological health of skipjacks stocks. However, other indicators of stock health that the IATTC utilizes such as average size and catch per unit of effort caused some concern among the IATTC scientific staff in 2018. Further, the staff recommended limits on the number of sets on FADs and unassociated schools (SAC, 2018).

As described earlier, there are established complementary measures to control mortality of bigeye and yellowfin in the EPO. Usually, seasonal closures are adjusted to account for the effects of the increased fleet capacity and to reduce mortality of bigeye and yellowfin. The problem with this approach is the ever-increasing length of the closed season that reduces the net operating revenue across the fleet. In 2002, the IATTC implemented a 31-day closure period during the month of December for all purse seine vessels.[108] Since 2002, there has been a trend to continually increase this closure period. The closure period was expanded to 42 days in 2003, 59 days in 2009, 62 days in 2010 and 72 days in 2018. The real question is whether the current system of capacity rights and closure periods has proven effective at keeping the stocks healthy. If all EPO capacity became fully operational, the seasonal closure would need to be increased by at least another 20 days (Northern Economics, 2018). In that event, it is unclear whether there will be agreement across all parties to increase the seasonal closure to this extent. In addition, as the catches of adult yellowfin declines, this could result in an increase in sets over FADs by vessels that traditionally fish over dolphins, further exacerbating the mortality of sexually immature bigeye and yellowfin tunas.

3.2 Economic viability of the fishery

The economic viability of the tropical tuna fishery is described in the way the three subsectors (industrial longline, FAD purse seine, dolphin purse seine), interact and is threatened by the continued increase in purse seine fleet capacity and effective effort.

There is evidence that increased effort in FAD purse sector leads to reductions in the abundance of adult yellowfin and bigeye tunas and the MSY for these species. This change in population structure will have a negative impact on the economic performance of the purse seine fleet primarily fishing over dolphins that target adult and medium sizes of yellowfin tuna and the longline fleet that primarily targets adult bigeye. Increases in purse seine capacity and effective effort will also result in longer closed seasons that will have a negative impact on the profitability of the entire purse seine fleet. As described previously, in an effort to control the growth in purse seine operative capacity and resulting effort, the seasonal closure continually increased. The current closure is costing the purse seine harvest sector at least $46 million annually (Northern Economics, 2018). Increases in the seasonal closure would further undermine the economic performance of the purse seine sector and are likely once unused capacity becomes operational and “effort creep” continues. This continual downward spiral will not only result in losses to vessels owners but will also have impacts across other sectors of the canned tuna industry, undermining businesses and employment in vulnerable communities. There would be food security implications if stocks of bigeye and yellowfin decreased substantially due not only to overall health of the stocks but also to structural changes in the yellowfin and bigeye populations.

4. MAIN CHALLENGES AND WAY FORWARD

The overall assessment by this author shows that the input based right on hold space (capacity) may have slowed the growth of “effective effort” in the purse seine sector. As the current fleet capacity is nearly double the optimum estimates and the IATTC has not put measures in place to move the fleet to its optimum size as it agreed to do in 2003, the effectiveness of this system is likely at its limit. As

[108] See IATTC Resolutions C-02-09 BET YFT, C-03-12, C-04-09, C-06-02, C-09-01, C-10-01, C-11-01, C-13-01, C-17-02 at https://www.iattc.org/ResolutionsENG.htm for additional details on closures.

discussed in previous sections, this situation creates a tendency towards the over-exploitation of the resources, with the probability of worsening during the coming years. The latter opinion was shared by experts during a survey based on the fishery performance indicator methodology (Bucaram, 2016)

The IATTC has debated the use of more well-defined rights that could replace or complement the current system. However, allocation deliberations have not reached a settlement. Dissemination of information on the potential economic gains from stronger, more well-defined types of rights gained a lot of attention among stakeholders in the region. Gentner (2011) demonstrated that strengthening the current rights-based management through the adoptions of a transferable ITQ program could increase wealth in the tropical tuna fishery anywhere from USD 2.7 to 21.4 billion. Sun (2005) indicated that overall profitability would increase in the Eastern Pacific under an ITQ program from a reduction in small tunas in the FAD fishery and a resultant increase in the longline catch. Sun (2010) extended earlier an analysis, and the results indicate that the longline sector is likely to purchase a large share of the purse seine bigeye tuna if cross-sector trading was allowed. This is not likely to eliminate the purse seine sector but reduce its capacity, reward vessels that could avoid small bigeye and require those with bad avoidance skills to buy expensive quota. Bucaram (2016) demonstrated that net operating revenue would increase for the fleet under an individual quota program instead of an increase in the closed season sufficient to cover the cost of increased monitoring (even without the transferability provision). Northern Economics (2018) conducted a more recent analysis on an ITQ program for both bigeye and yellowfin and estimated the equilibrium fleet size to be 195 vessels with a total capacity of 211 003 m^3 and an increase in net operating revenue of 169.4 percent to the remaining active vessels.

4.1 Challenges for the fishery

As described previously, the challenges in the current system would most likely result in worsening of the biological health of bigeye and yellowfin. While stronger forms of rights will improve the overall economic performance of the fleet and improve the biological health of bigeye and yellowfin, challenges remain in the implementation.

Transferable catch based user rights assigned to individual vessels, groups of vessels or communities require improved monitoring (Bucaram, 2016). In the case of the EPO purse seine fishery, additional monitoring may entail increased observer coverage, use of camera systems on the vessels to avoid the tendency to discard bigeye and yellowfin. Increased monitoring of catches at the processing plants will be required to verify catches by vessel and correct misidentification of small tunas.

More well-defined types of input-based user rights have been analyzed as replacing or augmenting the current capacity right. These include vessel days at sea (Squires, 2018) and limits on sets over floating objects and unassociated schools (IATTC, 2018). Similar to the case of user rights for vessel hold space, “effort creep” is likely to occur in these input rights systems that will require adjustments overtime to avoid overharvesting of bigeye and yellowfin. Such adjustments could take the form of reduced total allowable effort and reduced total allowable sets. Costs of management could exceed that of a catch based system depending on the methodology chosen to control effort creep.

Allocation of better-defined rights is another major challenge, especially in this multilateral context where there are substantially higher seas catches. In this RFMO context, the allocation is a two-stage process: at the member state level and then at the level of participants in the fishery (e.g., vessels, groups of vessels, communities). The objectives of the state could be different from the participants in the fishery. These complications will likely entail a lengthy process to settle on allocation at the IATTC level and other design features of a new user rights system. Having said that, there is strong interest from certain members to move a catch based system forward as Ecuador, Colombia and

others have presented proposals to the IATTC to allocate catch rights to member states and with other design elements for vessel level catch systems.[109][110]

Typically, a socio-economic crisis tends to drive action by motivating stakeholders to come to the bargaining table and compromise to reach a solution. It is unclear whether member states of the IATTC are at that point. While some stakeholders are willing to take action due to expected improved economic conditions and concerns about the future of the status quo system, IATTC wide change will occur only if the majority of its members are incentivized to act.

4.2 Improving fishery sustainability in the future

There is no doubt that stronger forms of rights can resolve the negative ecological and socio-economic impacts in the Eastern Pacific tropical tuna fisheries. However, the first best solutions are unlikely given the complexity in deriving management resolutions across diverse interests among member states of the IATTC. Five-member countries account for 80 percent of tuna landings and around 60 percent of purse seine vessels are flagged to two member countries. Other developing coastal states want to achieve their aspirations to participate in the fishery or increase current participation and benefits from the fishery.[111] Nonetheless, significant improvements over the current weak user rights system can be achieved by creatively navigating this diversity in political economy.

Effective second-best solutions may require a stepwise approach to reach the desired end state. This gradualist approach must be sequenced appropriately, and intermediate steps should be carefully analyzed to avoid setbacks in the overall transformation process. A recent example to illustrate this point comes from the IATTC's setting of global quotas for bigeye and yellowfin in the tuna purse seine sectors. In 2017, member states agreed to Resolution C-17-01112, which set a global catch quota for the purse seine sets over dolphins and purse seine sets over FADs as an intermediate step towards allocation to member states. Unfortunately, the result was a race to fish that almost resulted in a shutdown of the fishery that primarily operates over FADs in August of that year. Due to this experience, certain member states that previously championed this approach were reluctant to take allocation discussions forward.

The IATTC could divide the transformation into two phases. Phase 1 would include measures that reduce effort creep, allow learning from demonstration projects and control mortality for a portion of the fishery. The Phase 1 programs described below were selected from reviews of relevant proposals submitted by Commissioners of the IATTC, recommendations from expert meetings held under IATTC auspices and an OPP study to support the IATTC in the development of its capacity management plan of action:

1. Replacement vessel associated with a retirement of 20 percent of that vessel's capacity. The Japanese delegation presented a proposal to the IATTC along similar lines –whenever there is a request to reassign capacity, additional capacity must be removed from the vessel register. Japan's proposal (Prop-H-2-JPN) will slowly decrease both the technological and actual vessel hold capacity and may compensate for expanded use of unregulated inputs (effort creep). A modified proposal that would require new vessels to "retire" 40 percent of its equivalent capacity on the vessel register will reduce capacity to the optimum in 23 years assuming the current replacement rate.

[109] https://www.iattc.org/Meetings/Meetings2016/Oct/Pdfs/Proposals/IATTC-90-PROP-G-2-ECU-Tuna-conservation-2017-2018-CLEAN.pdf

[110] https://www.iattc.org/Meetings/Meetings2016/Oct/Pdfs/Proposals/IATTC-90-PROP-G-3-COL-Individual-Vessel-Quotas-IVQs.pdf

[111] This is clearly borne out by the claims for fleet capacity that currently amounts to 53,000 m^3.

[112] https://www.iattc.org/PDFFiles2/Resolutions/C-17-01-Tuna-conservation-2017.pdf

2. IATTC member states with the greatest capacity are rewarded for reducing capacity by reductions in the seasonal closure. Compensation could be paid to those who choose not to fish by vessel owners benefiting from the shorter closed season, or the vessels could be removed through an industry-funded buyback program. This demonstration project could motivate other member states to support permanent capacity reduction measures after observing the economic gains. Depending on the duration of this pilot, measures to control "effort creep" may be required.
3. Uniform threshold limit for small bigeye and yellowfin tunas in the purse seine sector. A similar alternative to IVQs is a uniform limit on small bigeye, and yellowfin tuna catches for all vessels in combination with improved monitoring on the vessels and at the processing plants. The uniform limit approach will constrain the least number of purse seine vessels and redistribute most of the costs of the closed season to vessels harvesting large quantities of small tunas. Such an approach would require improved catch monitoring at the processing plants and onboard fishing vessels.
4. Pilot IVQs to test monitoring of catch rights. Vessels volunteering to participate in this program would be exempt from the closed season and would be subject to increased catch monitoring onboard the vessel and at the processing plants. If successful, this program could be modified and expanded using a stepwise approach to full adoption across the entire fleet.
5. Ecuador could establish an IVQ program for bigeye tuna. Ecuadorian flagged vessels are the main contributor to the mortality of small bigeye tuna, and direct control of mortality can be accomplished through the action of one member state. If successful, this could be the precursor for the full adoption of catch shares for the main tropical tuna species.
6. Promote alternatives ways to benefit from the fishery without increasing fleet capacity. This is especially important for developing coastal states that want to currently participate in the fishery or gain some benefit from the resource.

A number of the above proposals could be implemented and as stated the "right mix" and sequencing are important in design. Once the appropriate phase 1 programs are demonstrating benefits and prompting the "right" behavioural response, phase 2 measures should be implemented. Phase 2 alternatives will apply IATTC wide and are expected to lead to significant capacity reduction through stronger forms of rights such as transferable catch share or transferable effort (days at sea, set limits) share programs.

Consistent with the findings in many fisheries around the globe, individual transferable quota (ITQ) approaches in the EPO can result in reduced fleet size that is close to the optimum (Northern Economics, 2018). The IATTC can sequence this system by addressing bigeye and yellowfin and then consider whether skipjack should be included. Transferable effort (days at sea, set limits) are an alternative to catch share programs and usually implanted when it is too difficult to verify catches at the vessel level. However, these programs will require complementary limits on other inputs such as net sizes and FAD usage in the Eastern Pacific. The transferability part of this program will also require a conversion to transfer effort across vessels of different sizes.

Allocation negotiations can take some time, and the first step is generating sufficient interest to initiate negotiations. As discussed previously, a number of delegations submitted formal proposals to establish ITQ systems. While these proposals were not settled, recent negotiations revealed specific interests and barriers across member states. For example, catch share allocation criteria seem to revolve around near term catch history and/or volume of well capacity (Northern Economics, 2018). Thus, even if allocation proposals are not initially adopted, deliberations can move negotiations to completion by the continual refinement of such proposals. Transferability is sometimes a concern and can be restricted to ensure that certain countries retain participation in the fishery or benefit from the fishery. The concentration of rights in the hands of a few is another major concern associated with

rights trading, and such concerns can be addressed through quota aggregation limits at the vessel and state levels. Trade is essential to reduce fleet capacity and secure the profitability of the industry.

Buybacks in combination with other measures (e.g., quotas) could be used to settle disputes, reach an allocation settlement and should only be used as part of a package of reform, as buybacks without subsequent measures to eliminate incentives for increased effort are unsuccessful. Other forms of side payments may also be needed to obtain an IATTC wide solution and should be explored. However, as in the case of buybacks, settlement of claims should only be considered if it is part of a larger suite of capacity reduction measures.

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Small-scale (artisanal) fisheries in Sierre Leone

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Background
The small-scale fisheries in Sierra Leone is dominated by men. Women have important roles along the value chain, including in post-harvest operations, all the way to being financiers and boat owners. The sectors include approximately 18 000 artisanal fishermen and over 11 000 fishing canoes. Local Ghanaian types of canoes operate in the area; they are either dugout or plank with an onboard engine of 8-40HP. The sector is characteristically labour intensive, using mostly traditional methods of fishing. However, some small boats are mechanized with traditional fishing gear, such as gillnets, cast nets, beach seines, purse seines, ring nets, traps and hooks and hand collection method. The artisanal fisheries account for about 80 percent of the total marine fish landings. In the year 1982, the total marine artisanal production was about 35 000mt with more than 70 percent consisting of small coastal pelagic species. The catch of the artisanal fisheries mainly consists of small pelagic species (Sardinella and Ethmalosa).

Figure 1. Small scale (artisanal) fisheries in sierra leone.
Source: The Artisanal Fisheries Management Plan for Sierra Leone EAF NANSEN project in the Ministry of Fisheries and Marine Resources, Sierra Leone.

1. DESCRIPTION OF THE SMALL-SCALE FISHERY

The Ministry of Fisheries and Marine Resources has its mission to plan, develop, rationally manage and conserve all living aquatic resources of the country for the benefit of the country. The overall policy of the ministry aims at promoting the attributes of good governance in sustainable fisheries management, combating illegal fishing, promoting economic value addition to the fisheries, and augmenting marine fishery production through sustainable development of aquaculture and inland fisheries, consistent with the Agenda for prosperity.

Sierra Leone is endowed with abundant and diverse fish resources in its marine sector. These resources are found along the entire coastline. The coastline is continuously replenished with rich

nutrients by a series of rivers emptying into the continental shelf, thereby making the richest in the sub-region. The exploitation of the Marine fisheries resources is divided into the following sectors;

- The Marine Industrial Fisheries and
- The Marine Artisanal Fisheries

The industrial sector is mainly export-oriented, with 30 percent of it catch landed for local market sales. The marine artisanal exploitation is carried out by local individual fishermen residing along the coastline of the country. It also provides a significant source of employment and livelihood in Sierra Leone. More than 80 percent of the population depends on fish for animal protein, and the bulk of this fish comes from the artisanal sector. Over 120 000 metric tons of fish are produced yearly by the artisanal sector, thus contributing immensely to the enhancement of livelihood in coastal communities. Women are actively involved in the processing and marketing sector. As stated in the national framework (MFMR/IMBO 2003), approximately 75 percent of post-harvest workers are women, 85 percent of which are processors (World Bank survey 2010).

Artisanal Fishery is a major activity in the coastal communities of Sierra Leone. There are more than 11 000 boats used in the artisanal sector, with over 750 landing sites all over the country. It is of paramount socio-economic importance to the country as it provides employment and income to the rural youth, women etc. and, above all, because 80 to 85 percent of fish comes from this sector.

Therefore, the sustainable development and management of the Marine fishery resources could be ensured through capacity building of the sector by way of:

- Introducing improved and appropriate technology and techniques and
- Rational management of the resources through efficient extension delivery services

Figure 2. Standard 5-10 canoes in Sierra Leone.
Source: Switsalone online News Media.

Figure 3. Women engaging in fish processing.
Source: Value chain analysis and the role of women in the artisanal fisheries sector in Sierra Leone (Ranita Sandi Koroma, 2017).

Figure 4. Women doing primary processing on Herring.
Source: Artisanal Fisheries Management Plan for Sierra Leone EAF NANSEN project in the Ministry of Fisheries and Marine Resources, Sierra Leone.

Figure 5. Ghana type boats, used by local and migrant fishermen in Sierra Leone.
Source: Artisanal Fisheries Management Plan for Sierra Leone EAF NANSEN project in the Ministry of Fisheries and Marine Resources, Sierra Leone.

2. IMPROVED AND APPROPRIATE TECHNOLOGY TECHNIQUES

Fishing techniques include hand-gathering, spearfishing, netting, angling and trapping. Recreational, commercial and artisanal fishers generally use different techniques, but sometimes they use the same techniques. Recreational fishers fish for pleasure or physical activity, while commercial fishers fish for profit. Artisanal fishers fish for survival or as cultural heritage; they use traditional, low-tech methods. Mostly, recreational fishers use angling methods, and commercial fishers use netting methods.

There is an intricate link between various fishing techniques and knowledge about the fish and their behaviour, including migration, foraging and habitat. The effective use of fishing techniques often depends on this additional knowledge. The appropriate techniques to use mainly depend on the target species and their habitat.

3. CHALLENGES

Albeit the vibrant nature and prospects of the artisanal fisheries sector, this presentation highlights the challenges that require urgent management attention before they impede on the development of the sector. These challenges include, for instance, Illegal Unregulated Unreported (IUU) fishing, poor management of Marine Protected Areas, deforestation of mangroves, the licensing of artisanal canoes as fishing crafts and attendant gears.

Some important target fish species in the artisanal fishery, such as Sardinella Spp (herring), Ethmalosa fimbriata (bonga shad), are either fully exploited or over-exploited. There is also a growing use of illegal fishing gears in the artisanal fisheries sector including the use of undersized mesh nets, such as beach seines, and other gillnets catching juvenile fishes, which could be necessary to recruit and form the next breeding population.

Fish is the main source of animal protein for over 90 percent of the Sierra Leone population, and the fisheries sector contributes 10 percent to the country's gross domestic products (GDP).

Sierra Leone has a comparative advantage in West Africa, hosting high fish biomass of Shrimps, Demersal Finfish, Pelagic and Tuna Fishery with Potential Yields for the Small Pelagic of about 100 000mt. The country's marine ecosystem benefits by the Guinea Current Large Marine Ecosystem and the Canary Current Large Marine Ecosystem (CCLME) that flow with nutrient-rich waters supporting large quantities of demersal and shared small pelagic fish stocks (Figure 6 and 7).

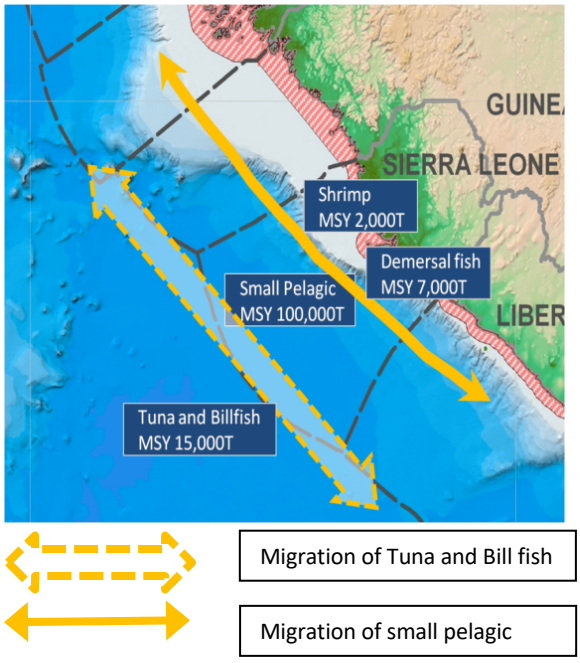


Figure 6 The Guinea Current Large Marine Ecosystem and the Canary Current Large Marine Ecosystem.
Source: Artisanal Fisheries Management Plan for Sierra Leone EAF NANSEN project in the Ministry of Fisheries and Marine Resources, Sierra Leone).

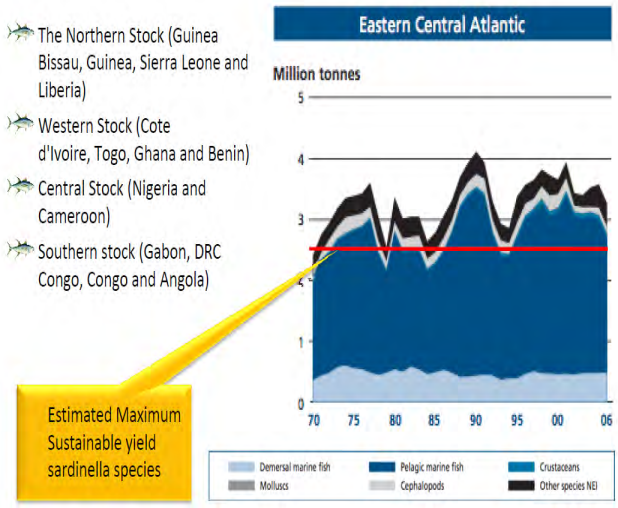


Figure 7 The stock status in the Eastern Central Atlantic.
Source: Switsalone online News Media.

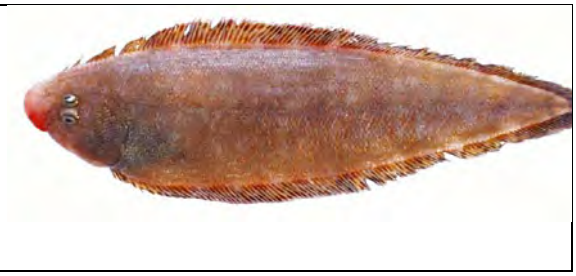
Exploitation Status of Major Fish Stocks

Fish stock assessments have been conducted by FAO/CECAF demersal, and pelagic working groups and the Institutional Support for Fisheries Management (ISFM) Project showed that some of the commercially exploited fish stocks in Sierra Leone are either fully exploited or overexploited (Table 1).

Table 1. Status of Major fish stocks in Sierra Leone.

Fish Species	**Status**	
Pseudotolithus elongatus (Bobo Croaker	Overexploited	
Pseudotolithus Spp (Other Croakers)	Fully Exploited	
Galeiodes decadactylus (African Threadfin)	Fully Exploited	

Arius spp (Sea catfish)	Overexploited	
Sparidae (Denex and Sea Breams)	Overexploited	 
Sardinella aurita (Round Herring)	Fully Exploited	
Sardinella maderensis (Flat Herring)	Overexploited	
Ethmalosa fimbriata (Bonga Shad)	Overexploited	
Pomadasys Spp (Grunts)	Overexploited	

Cynoglossus Spp (soles)	Overexploited	

Source: the Artisanal Fisheries Management Plan for Sierra Leone EAF NANSEN project in the Ministry of Fisheries and Marine Resources, Sierra Leone.

This revised fisheries policy and operational framework of 2010 has management objectives for the artisanal fishery. There is an operational management framework for shared small pelagic fish stocks and other fish stocks, which calls for cooperation and concerted effort in the management of fish stocks exploited in the sub-region by West African countries.

4. WAY FORWARD

While Illegal Unreported and Unregulated fishing in the small fisheries is a global problem, Sierra Leone artisanal fisheries need to structure an effective Monitoring Control and Surveillance scheme that will seek to provide good management of the sector.

Pursuing voluntary compliance in these situations might be the best option. It should occur in addition to a form of enforcement and monitoring of landing data, such as from enumerators at fish landing sites by the use of mobile phones via the cloud.

The introduction of new technology like the Automatic Identification System (AIS) can play an important role in monitoring vessel's movements and enhancing other management benefits such as safety, identifying the Marine Protected Area (MPAs) and Marine Spatial Area (MSP). Furthermore, protecting species that are overexploited requires good monitoring and surveillance measures that should be mandated and afforced through National Policies and Regulation.

The Vessels and the boats registration process should be more than just basic licensing formalities of marking and payment of fees; it should be a thorough process of inspection of gears size, safety condition of the boats and material, and if implemented tracking systems for monitoring and surveillance processes.

Figure 8. Prohibited fishing method (beach seine).
Source: Switsalone online News Media.

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Volume 7

History and experiences with multiple-use in coastal zone management and rights (aquaculture, MPAs, tourism, etc.)

Abstract

The Global Conference on Tenure and User Rights in Fisheries 2018 took place in Yeosu, the Republic of Korea, 10-14 September 2018. Case studies were presented on a number of topics relating to tenure and user rights in global fisheries and their relation to the SDGs. Through the exploration of case studies in eight concurrent thematic sessions, the best practices, shortcomings, and challenges associated with rights-based approaches were discussed. The conference was a platform for the exchange of ideas about how to support the implementation of sustainable governance solutions to rights-based fisheries management.

This document presents case studies from Session 7 of the UserRights 2018 conference, “History and experiences with multiple use in coastal zone management and rights (aquaculture, MPAs, tourism, etc.).” All case studies are published as submitted, with minor changes for spelling and grammar. The case studies span across various geographical and socio-economic contexts. These include:

- Indigenous Fishing User Rights and Traditional Marine Management: Namena Marine Reserve;
- The Treaty of the Rio de la Plata and its seafront between Argentina and Uruguay;
- Fishing areas for abalone in the Los Lagos Region in Chile;
- Solution and competition of using fishery resources between commercial fishing and recreational fishing in Korea;
- A case of conflict among multi-layered customary rights groups for fishing in Okinawa, Japan; and
- Policy challenges in the coastal fisheries management of the Marshall Islands.

Contents

Indigenous Fishing User [Tenure] Rights and Traditional Marine Management: Namena Marine Reserve

Alisi Rabukawaqa
Coral Reef Alliance, Suva, Fiji

Abstract
The Namena Marine Reserve (*tabu*) was founded in 1998 to ensure the conservation of marine resources that are in the customary fishing grounds (*qoliqoli*) of the Indigenous People of Kubulau district, in the province of Bua, Fiji. Villagers adjacent to the marine protected area (MPA) have traditional fishing user rights of the Namena Barrier Reef, and they are dependent on these rights for their livelihoods (mainly subsistence fishing). An increase in commercial fishing in the 1980s and 1990s posed a serious threat to Namena's reefs. Leaders of the ten villages in the district responded by placing a total ban on fishing. Through their own traditional governance structure and processes, the creation of the Namena Marine Reserve was possible. It represents a significant portion of the overall *qoliqoli* area. The Kubulau Resource Management Committee was then established to oversee the management of the area. It not only addressed the growing problems of poaching in the *qoliqoli* and depleting fisheries but offered an alternative means of economic development for villagers who were mainly reliant on fishing. This was undertaken through various means to tap into tourism's potential, including the establishment of a voluntary contribution charge to individuals diving in the Reserve portion of the *qoliqoli*. The Namena Marine Reserve has become a great example of indigenous peoples with tenure rights in Fiji, as it spearheads solution-based approaches to the growing problem of poaching in the *qoliqoli*, as well as the issue of depleting fisheries. The Reserve continues to be Fiji's largest no-take, locally managed marine area and serves as a top global dive site. However, the journey has not been without its issues. A particular challenge is for the Reserve to continue to prioritize the health of its ecosystem and continue to rate as a "premium destination" while leveraging the Marine Reserve to facilitate positive, community-driven economic development using traditional Fijian governance management and processes sometimes not in tandem with fisheries regulations and laws.

1. INTRODUCTION

1.1 Description of the fishery

Surrounding the tiny island of Namenalala and stretching between the two main Fiji islands of Viti Levu and Vanua Levu is the Namena Marine Reserve (NMR). Its geographical coordinates are Latitude: -17 08' 00'' and Longitude: 179 08' 00''. Eleven villages from the district of Kubulau, in the province of Bua, have customary user rights in the Reserve. NMR was established through a *tabu* by the traditional leaders of the district, and this was supported by local dive tour operators as well as two NGOs - Wildlife Conservation Society (WCS) and Coral Reef Alliance (CORAL). The villagers set up the Reserve to address the threat of overfishing, particularly from tuna pole and line vessels in the 1990s (Sykes *et al*. 2018), and to invest in alternative livelihoods, i.e. increasing community benefits from tourism.

NMR encompasses both Namena Island and the surrounding horseshoe-shaped barrier reef. It is home to more than 1 000 species of invertebrates, 400 known corals, and 445 documented marine plants and over 1 100 fish species. It is an incredibly unique and diverse place that carries a reputation worldwide as a biodiversity hotspot.

In Fiji, it has been estimated that 50 percent of all rural households are involved in some form of subsistence fishing (Fiji Fisheries Dept. 2008). Reef fish in Fiji are graded into three main categories: A, B and C. The grade A fish, which are most valued and targeted, include emperors (*Lethrinidae*), groupers (*Epinephelidae*), trevallies (*Carangidae*), and reef snappers (*Lutjanidae*). The grading also distinguishes the commercial importance of these fishes, making them valued target species. A study

conducted in Bua in 2001 estimated the total amount of fish coming from Bua and sold in the Suva market at seven to eight tons per week (Yeeting *et al*. 2001). Since this time, there is no further study or data detailing landed catches from the district.

Nationally, there have never been any stock assessments for groupers. According to the Fiji Fisheries Resource Profile (Lee *et al*. 2018), several studies and analyses over the past 15 years indicate "decline in catches per unit effort, reduced market sizes, shifts in dominant species marketed and a general erosion of spawning potential in more heavily fished areas." This has led the Ministry of Fisheries to seasonally ban groupers, locally called *kawakawa* and *donu* (Susu 2018), in order to buffer food security, economic benefits and protect local extinction of some species.

There are a wide variety of fishing techniques used in coastal fisheries. The most common commercial methods are gillnetting, hook-and-line fishing and spearfishing, involving about 1 300 mainly small outboard motor vessels (Fiji Fisheries Dept. 2008). Subsistence fishing revolves around reef gleaning, hook-and-line fishing and spearfishing. The local landing sites in Fiji for most coastal commercial fisheries are at the urban population centers; Suva, Lautoka, and Labasa, while subsistence fisheries landings occur throughout the coastal parts of the country.

1.2 Economic contribution and social implications of the fishing activity

The estimated total catch for the artisanal and subsistence fisheries for reef associated species is 17 777 metric tonnes (mt), worth USD 51 million (FJD 94 million) to fishers (Gillet 2009). Artisanal and offshore-commercial fishing activities accounted for 3.16 percent of Fiji's GDP in 2009 and, while it is not officially recorded as GDP, some estimates suggest that subsistence fishing activities produce as much as 4 percent of Fiji's annual GDP, employing approximately 3 000 people in 2003 (ADB 2005). Subsistence fisheries employed approximately 3 000 people in 2003; in the same year, the fishing industry as a whole employed 9 144 people (3.8% of the country's workforce) (ADB 2005).

Coastal fishing is carried out primarily for subsistence purposes; however, in recent years the distinction between subsistence and commercial fishing has become distorted. This is particularly true in the larger, less isolated islands due to the increased monetization of fishing. For Kubulau, the reliance on the fishery was shifted more towards tourism. In 1998, through a verbal agreement with local land-based tourism operators in the northern island, like Moody's Namena Island, Jean-Michel Cousteau Resort Fiji, Koro Sun, Namale Resorts, and dive operators including Sea Fiji and liveaboard operators NAI'A Cruises and Sere ni Wai (Fiji Aggressor), and later with Namena Divers and the Fiji Siren liveaboard ship, divers were given the option of making a voluntary contribution (currently FJD 30 per diver) in return for an annual dive tag.

Contributions are collected by the tourism/dive operators and are paid into a trust fund. This is used to cover management costs for the Reserve, to provide tertiary education scholarships to selected youth from the district, and to carry out other development activities for the benefit of the district. The board of trustees comprise members of the community and representatives from the tourism industry. The dive tag, which is produced and paid for by CORAL, has provided at least 160 scholarships to children from Kubulau district, three bus shelters, maintenance of moorings, and supported Fish Warden Trainings. Upwards of 1 500 dive tags were sold annually in recent years, indicating the economic success of shifting toward dive tourism overfishing. However, after Cyclone Winston in 2016, damages sustained by the coral reef ecosystem lowered the income generated from the Reserve drastically, as fewer visitors arrived. Anecdotal commentary from communities suggest that there was also more pressure on the fisheries due to families trying to provide basic necessities and keep up with social obligations.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

At a national level, the mission statement of the Ministry of Fisheries is "to drive sustainable resource management, economic growth and improve livelihoods through SMART fisheries and forest policies that is based on applied research and development." Broadly this can be taken as the management plan for the fisheries. In coastal commercial fisheries, the aim is to gain maximum economic return allowable without collapsing the industry or negatively affecting subsistence fisheries. For subsistence fisheries, there are 406 traditional management areas/fishing grounds, where management is generally for food protection for villagers. NGOs such as CORAL come in to assist as biodiversity conservation becomes a more prominent management objective, while Marine Protected Areas (MPAs) are the most popular tool to achieve this, as they are grounded in traditional methods of resource management.

CORAL has worked to improve management capacity in Fiji for over 15 years in NMR. In addition to engaging directly with the local community and the KRMC, it has worked closely with Fiji's Ministry of Fisheries and private businesses to train local fish wardens in community enforcement and marine patrol protocols. In addition to building capacity, it has also trained all marine tourism providers conducting business within the marine reserve in sustainable marine recreation protocols and helped install moorings throughout the protected area, creating Fiji's first anchor-free MPA.

There is no single, global definition of an MPA, nor has Fiji adopted one in national legislation (FELA, 2017). Fiji is still currently reviewing its marine and law policy. The existing MPA mechanisms in Fiji are divided into two groups:

i. Statutory law mechanisms (referred to as 'formal' mechanisms)
ii. Customary law mechanisms (referred to as 'informal' mechanisms).

The vast majority of existing MPAs in Fiji, like the NMR, are established using informal mechanisms with customary users, to establish *tabu* areas in their respective traditional fishing grounds. In the Policy and Law Discussion Paper prepared by Fiji Environment Law Association, "Towards an Effective Legal Framework for Marine Protected Areas in Fiji," the systems for recognizing customary rights to access resources within fishing grounds under the Fisheries Act are clearly explained in detail. The first system is essentially hereditary: each indigenous person is born into a *mataqali* or clan (landowning unit), which is part of a larger *Yavusa* or tribe, each of which has their own fishing grounds. Once the person is registered with the administrative body, the iTaukei Land and Fisheries Commission, a formal recognition of said person's right to access and use the resources in the fishing ground connected to their tribe is established, affording them customary fishing rights in that particular traditional fishing ground. Such customary fishing rights are dependent on land ownership. The other system requires individuals to obtain permits in order to fish in registered traditional fishing grounds. The permit provisions are very complicated to navigate.

While tabu areas are not established by legislation, they may be created by the customary fishing rights owner by declaring a tabu on a strictly customary basis, e.g. the death of a Chief, or establishing a locally managed marine area (LMMA) as is the case with Namena. Fishing restrictions may be recognized in the fishing ground in this way and may be a condition to a fishing license.

The management of NMR is currently carried out by the Kubulau Resource Management Committee (KRMC), a body established in 2005 to oversee the implementation of the Kubulau District Ecosystem-Based Management Plan. The KRMC has fish wardens that are trained by the Ministry of Fisheries, whose duties are the prevention and detection of offences under the Fisheries Act and the

enforcement of the provisions thereof. This gives KRMC more powers in policing and enforcement. The Minister has powers to appoint these honorary fish wardens under the Fisheries Act.

Being located around 7.5 nautical miles offshore offers NMR a natural buffer from local subsistence fishing, but the distance makes it difficult for the KRMC to regularly and effectively police the waters. Additionally, the Reserve is still vulnerable to larger fishing vessels in the area. From the time NMR was established, monitoring and policing of the waters was done primarily by the staff and owners of Namena Eco Resort on Namenalala Island. In 2013, the resort changed ownership and closed indefinitely, following extensive damage from the category 5 Cyclone Winston in February, 2016.

2.2 Brief history of the former rights-based approaches used in the fishery

Fiji's fisheries law and governance arrangements are complex, as a dual governance system incorporates traditional indigenous governance systems with western legal governance. All of Fiji's land and inshore waters were held under customary communal tenure and governed by customary law until Fiji's Cession to Great Britain in 1874. This resulted in the introduction of the common law doctrine of public trust, and subsequently the Crown (State) ownership of the seas and shore, and resources within. The recognition of customary rights over foreshore and seabed then became limited only to customary fishing rights. This disrupted traditional integrated governance, as well as land and marine resource management systems (FELA 2017).

The Constitution of the Republic of Fiji 2013 continues to recognize the customary right of access to marine resources (i.e. customary fishing rights) but does not recognize resource ownership. Customary fishing rights are established and recognized formally under the (Fiji) Fisheries Act (CAP 158).

2.3 Rights-based approach: allocation and characteristics

Fishing licenses for all areas of Fiji's fisheries waters are granted and regulated by the Ministry of Fisheries. It functions under the Offshore Fisheries Management Decree 2012 and Offshore Fisheries Management Decree Regulations, 2014. This is different for traditional fishing grounds, where commercial fishing licenses are given under the Fisheries Act 1942 and its regulations, as amended. Under the Fisheries Act, permits are issued by the Commissioner of the Division in which a registered fishing ground is located, with provisions that the relevant customary users and Fisheries Officers be consulted before the permit is granted. The final decision is eventually at the discretion of the Commissioner. For commercial fishing licenses outside these customary fishing grounds, this is not required.

Certain fishing activities require a license under the Fisheries Act. Customary users do require a fishing license to fish, even in their registered *qoliqoli* if they take fish for trade or business purposes, and non-customary users generally do require a permit to fish in a registered *qoliqoli*. Customary fisheries resource users can fish in their own registered fishing grounds (*iqoliqoli*) without a permit for subsistence use by any fishing method, except those prohibited under the Fisheries Act, e.g. the use of explosives. They can even fish for trade or business in their registered fishing ground without a license as long as they only fish with a line from the shore or spear, or have been granted an exemption by the Minister. Non-customary fisheries resource users do not require a permit either, if, they fish by hook and line, or spear, or a portable trap which can be handled by an individual, and, the fish is not taken by way of trade or business.

Generally, customary user rights for individuals registered in their traditional fishing grounds is for life. There are circumstances though when there is planned development that may impact on a fishing ground, and the customary users may waiver their fishing rights to the area and are compensated for this. Any fishing license or permit issued by the Ministry of Fisheries is valid for a year. The relationship between the permit conditions and the license conditions are not addressed in the Fisheries Act.

However, if a license applicant also needs a permit, then under the terms of the Act, the permit conditions will be attached to the license conditions. So, a breach of a customary *tabu*, such as the Namena Marine Reserve, becomes an enforceable offence under the Fisheries Act. At this point, it is important to highlight that because of the complexities of the provisions in the Fisheries Act, it makes room for multiple, inconsistent interpretations. This, in turn, leads to compliance and enforcement challenges, among other things.

A practice by the (then) Department of Fisheries to insist on fishing license applicants to first obtain a permit, even if they were applying for commercial fishing licenses outside of traditional fishing grounds, has affected management by the customary users because a fishing license is now connected to their fishing grounds. This does not seem to align with the objective of the Act, which was to allow applications for fishing licenses solely outside of traditional fishing grounds. There was also a practice of permit applicants making "goodwill payments" to the customary users of the fishing grounds in exchange for permission to fish there. The Government recently prohibited this practice mainly because it was unregulated. The Ministry of Fisheries is still in the process of conducting consultations to establish a new permit fee system that it will manage.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

Over the years, CORAL has helped the Kubulau community strengthen its resource management committee and establish a sustainable financing mechanism to fund implementation of the Kubulau Ecosystem-based Management Plan, which includes Namena Marine Reserve management. In 2015, the community raised more than USD 20 000 from voluntary user fees. CORALs work in Kubulau has created a model for building an effective local management system with the financial means and staff capacity to achieve independence. This approach to management is has measurable ecological impacts. For example, a study published in the journal Coral Reefs in 2013 found that sharks were two to four times more plentiful in the Reserve than in surrounding unprotected areas (Goetze and Fullwood 2013).

Coral reef monitoring, conducted by WCS that works primarily on conservation and research, and currently oversees the long-term biological monitoring on the Reserve has shown that coral cover has remained fairly stable, with a 17.3 percent decline following Cyclone Tomas in 2010, and 20.6 percent decline following Cyclone Winston in 2016, and fish biomass has been consistently above 1 000 kg/ha in the Reserve from 2009−2016 (WCS unpublished data), indicative of healthy fish communities (Sykes *et al*. 2018), and a positive outlook for the Reserve in continuing to be a world-class dive spot.

3.2 Economic viability of the fishery

NMR has been a no-take area since the implementation of the *tabu* in 1998. If adhered to, the tabu would lead to significant decreases in length of travel to the fishery and duration of fishing in the area. There are also no fishing vessels, no fishing devices, or fish aggregating devices used in this area as per the *tabu*. However, the *tabu* is not necessarily adhered to explicitly. Only tour dive operators' vessels brought in increasing levels of guests over the years, but this trend waned after TC Winston in 2016. In turn, this has negatively affected employment and economic returns from NMR via voluntary contributions. This is only now beginning to build back up to a regular level.

3.3 Social equality

Social equality at a policy level is quite clear, particularly for indigenous rights access to marine resources as stipulated in the Fisheries Act. The 2014 National Gender Policy for Fiji focuses on the commitment to gender equality (Fiji Ministry of Women 2014). Its mission is the elimination of gender inequalities in all sectors of national life, in order to achieve the nation's goal of sustainable development. The Green Growth Framework for Fiji is a tool developed to accelerate integrated and

inclusive sustainable development which will inspire action at all levels - to strengthen environmental resilience, drive social improvement and reduce poverty, enhance economic growth and also build capacity to withstand and manage the anticipated adverse effects of climate change (Fiji Ministry of Strategic Planning 2015)

The direct positive implications of these policies at the community level in terms of gender equality, sustainable use, and ensuring access for a new generation of users is difficult to determine. This is especially true when trying to directly link to evaluating the social impacts of fishing rights: TC Winston 2016, a Post Disaster Needs Assessment (Fuller 2016) - conducted by the Government of Fiji. It identified environment, gender, and culture and heritage as cross-cutting issues pegging recovery and reconstruction needs at FJD 99.7 million. The PDNA projected production losses of fisheries at FJD 200 million, and Estimated Value of Per Capita Disaster Effects per Province had Bua at FJD 9 990.00 per person. This data would then help to distribute aid to fisheries participants post hazardous event. At district and village level, depending on the NGOs who work in the area, there were also assessments conducted to determine what aid was needed by communities. CORAL assisted in conducting one such assessment[113] in partnership with WCS and other partners at the request of the (then) Department of Fisheries. This was across 154 villages, 36 districts and six provinces that were directly along the path of the cyclone in Fiji. The only province that was not surveyed was Lau, due to inaccessibility and challenges conducting the assessment.

The eventual distribution of aid was led by the (then) Department of Fisheries based on information gathered by the needs assessment.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

As detailed in 2.3, the greatest challenge stems from the complexities of the provisions of the Fisheries Act, which can cause many inconsistent interpretations. The Fisheries office at an operational level has an advisory role to play to the 410 customary fishing grounds resource users. The dual governance system also requires communities and the Fisheries office to work in sync. Their management consists of the issuing of licenses, restrictions on exports, usage of proper fishing gears, banning of extracting certain species, and restrictions on destructive fishing and areas. Poor documentation of this may point to a lack of communication. This, in turn, has led to compliance and enforcement challenges, as well as difficulty in prosecuting poachers caught in tabu areas. Additionally, it has affected the management of traditional fishing grounds by the customary users. Another challenge in regulating marine areas is the dual governance system in Fiji. Customary law continues to play an important role in many communities, whilst its integration with western law locally continues to be at the forefront of discussions.

At NMR, even with the commitment shown by the customary resource users over the last two decades, there are still issues with monitoring and policing of the area. Being some 14km offshore, the Reserve has a buffer from the local community in terms of subsistence fishing. However, it is still vulnerable to large fishing boats from the mainland, both Viti Levu and Vanua Levu. Until 2013, main enforcement agency at NMR was the staff of Moody's Namena EcoResort on Namenalala Island. Since 2016, when the EcoResort changed hands and then closed down, the policing of the area has not been as consistent. Although a local day-boat dive operation has technically taken over enforcement and monitoring of the park, taking on associated costs themselves, informal reports suggest that without a constant and diligent presence on the island, poaching continues to increase (Sykes 2018).

[113] Online link to report: https://global.wcs.org/DesktopModules/Bring2mind/DMX/Download.aspx?EntryId=33407&PortalId=82&DownloadMethod=attachment&test=1

4.2 Improving fishery sustainability in the future

There are several things that could be done within the existing legal framework to improve the fishery's sustainability:

i. Improve management, by ensuring the protection of tabu areas within traditional fishing grounds in fishing license conditions given to successful applicants.
ii. Have stricter approval processes by non-renewal of licenses to vessels that deliberately breach community rules, in particular, and also national laws.
iii. Ensure that trained and appointed fish wardens have operational funding - to assist in their monitoring and enforcement of fishing grounds, to increase patrols of tabu areas, and to report breaches to the relevant authorities.
iv. For MPAs, locally managed marine areas (LMMAs) are a way of bridging customary and modern management techniques. Recognition of LMMAs under formal law may aid in effective implementation.
v. Legal and institutional reform in the Fiji fisheries sector in order to: improve training for community fish wardens; conduct fisheries enforcement training for the police and magistrates; increase penalties for offences under the Fisheries Act, and formalize management powers for community resource management committees.

In addition, replication of CORALs model of work, which is explicitly designed to allow for a reduction in external involvement over time and allows resource users to move towards independent management, is a positive step in improving fisheries sustainability.

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The experience of the Treaty of the Rio de la Plata and its seafront between Argentina and Uruguay

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Abstract
The Treaty of the Rio de la Plata and its seafront, signed in 1973 by Argentina and Uruguay, established a Common Fishing Zone (CFZ) for both countries. At the same time, the Joint Technical Commission of the Frente Maritimo (Comisión Técnica Mixta del Frente Marítimo (CTMFM)) was created, an intergovernmental body composed of Argentina and Uruguay, whose task is to study and adopt measures for the conservation and rational exploitation of living resources and the protection of the marine environment in the CFZ. The Administrative Commission of the Rio de la Plata (CARP) delegated to the CTMFM part of its competencies for fisheries research and management in the entire area of the Treaty. In the last ten years, the CTMFM has made significant progress in the implementation of management decisions based on science, applying the ecosystem approach to the management of fisheries in the area. The CTMFM receives annual scientific advice of six working groups on the state of fisheries resources and the environment. At the same time, CTMFM promotes scientific activities and training for researchers of both countries. In the area of the Treaty, more than 70 species of fish and shellfish are captured, and 90% of the volumes have management measures such as total allowable catch, fishing effort restriction, areas of spatial and temporary fishing closures, and minimum sizes of landing (among others), based on scientific advice. Among other obligations, fishing vessels operating in the area of the Treaty must have a valid license granted by one of the two States, be equipped with a System of Location of Vessels (SLV) and report to the fisheries authority the information about their activities and catches.

Keywords: Argentina, Uruguay, Frente Maritima; Industrial fisheries, Treaty of the Rio de la Plata

1. INTRODUCTION

1.1 Description of the fishery

In the Rio de la Plata and its maritime front, artisanal or small-scale fishing and industrial fishing coexist. These two fisheries share fishery resources, allocating their products to the domestic market and export markets. Small-scale fisheries usually develop on the fringes of exclusive jurisdiction of coastal States (Argentina and Uruguay) or the territorial waters thereof.

This case study will concentrate on the industrial fisheries, since this is what provides the largest volume of landings in the area of the Treaty, directing its effort to two groups of species: the varied coastal species, where croaker (*Micropogonias furnierii*), the Striped weakfish (*Cynoscion guatucupa*), Brazilian flathead (*Percophis brasiliensis*) and chondrichthyans fish, among others, constitute the major landings and fishing for hake (*Merluccius hubbsi*). These two industrial fisheries by bottom trawlers, twin trawling for the coastal species and otter trawls for the hake fisheries. There are other fisheries of lower volume, such as fishing for bream (*Pagrus pagrus*) with traps or pots, or anchovy (*Engraulis anchoita*) with midwater trawling, among others. Fishing licenses generally belong to commercial companies and to a lesser extent to cooperatives or individuals.

[114] The statements and opinions expressed in this work are the sole responsibility of the author, therefore, its contents do not reflect the official position of the Joint Technical Commission of the Frente Maritimo or that of its Member States

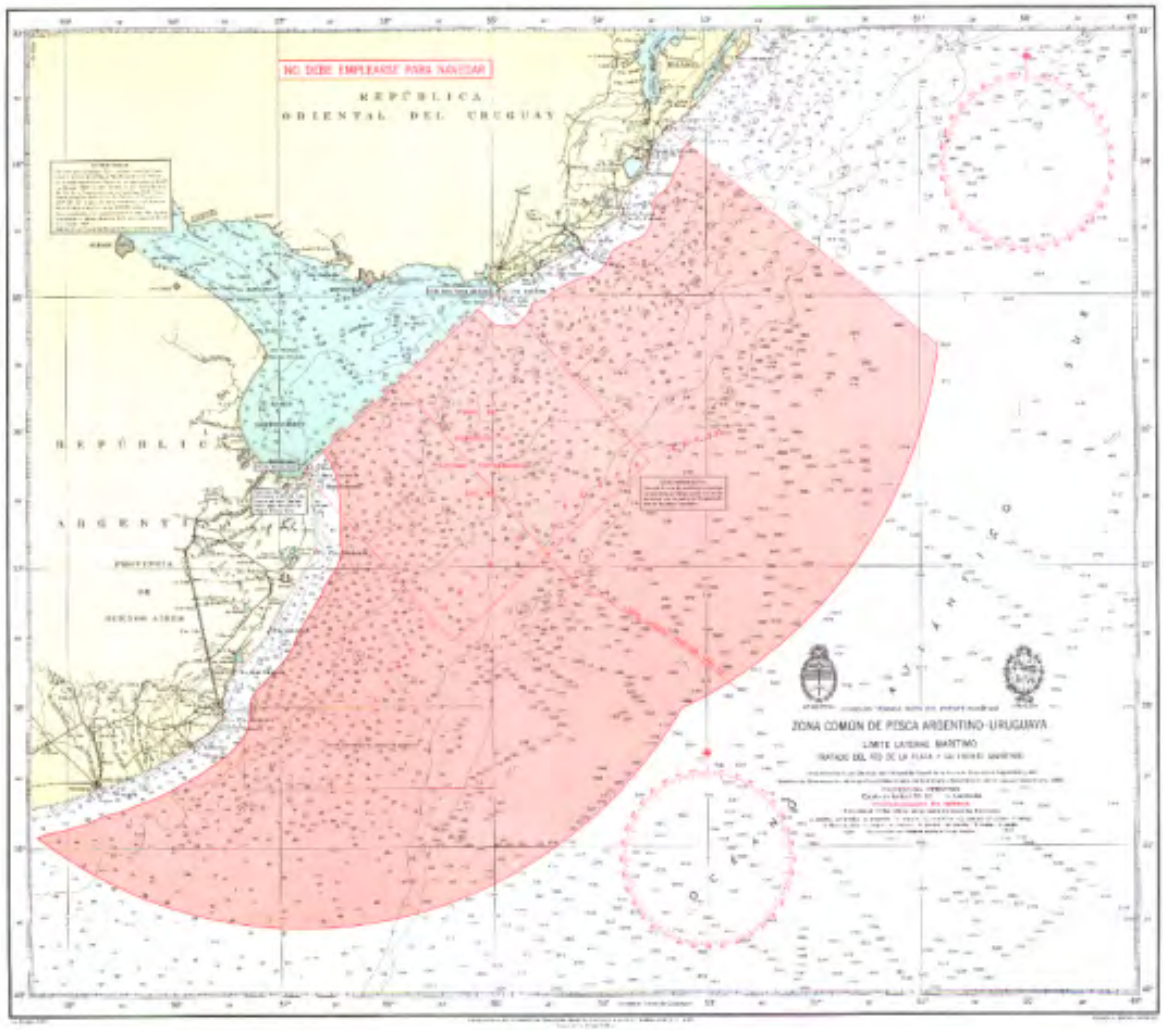

Figure 1. Common Fishing Zone under the Treaty of the Rio de la Plata.
Source: Joint Technical Commission of the Maritime Front between Argentina and Uruguay, http://ctmfm.org/sitio/documentos-basicos/carta-de-la-zona-comun-de-pesca-argentino-uruguaya/

1.2 Economic contribution and social implications of the fishing activity

The catches in the area of the Treaty mainly target the export market, with only small quantities going to the domestic market. The main export markets for hake are the European Union, United States and Brazil; for croaker and other fish in whole frozen form, they are African and Asian countries (mainly Nigeria, China and Taiwan Province of China). Exports in the year 2017 of the three main species can be estimated at approximately USD 80 million. In their vast majority, landings are processed on land, and then frozen and packaged for subsequent export. There are some factory ships where the fish is processed, frozen and stored until it is unloaded to freezer containers.

There are no updated figures on the number of fishers in the area of the Treaty, but estimates based on the number of boats operating regularly indicate that both fleets currently generate about 2 000 direct jobs in the area of the Treaty. This number is the lowest since the 1980s and the decline is due to multiple causes related to the availability of resources, market prices in recent years, and the development of other fisheries that have attracted vessels and fishers (e.g. fishing for shrimp in the Exclusive Economic Zone (EEZ) of Argentina).

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACHES

2.1 Management of the fishery

The management of the fishery is under the CTMFM and the management authorities of the two countries party to the Treaty. The States part of the CTMFM set their policies and national legislation for fisheries. Fisheries research, monitoring, control and surveillance and control are performed by the authorities of each country. In all these tasks, the CTMFM and CARP support the national fisheries authorities and research institutes. At the same time, the two countries must submit the information relevant to the work of the CTMFM. Vessels authorized to fish in the CFZ must deliver information, which includes data on species, volumes and geographical references of the catches. They also possess an SLV that reports, each time, the location, direction and speed of the unit.

CTMFM primarily deals with the fishery regulations, establishing management measures by resolution. It is thus CTMFM that ensures the sustainability of fisheries resources by implementing management measures based on scientific advice. These regulate:

- Total Allowable Catch (TAC)
- spatial and temporal fishing bans
- restrictions on fishing effort
- minimum sizes for catch
- good practices for the catch of some species

These measures are taken on the basis of the scientific advice received from groups of scientists from both countries. CMTFM carries out regular monitoring (monthly, bi-weekly, or weekly as appropriate) of catches with the aim to determine eventually fishing bans and TACs.

In the case of Uruguay, there is a non-binding Consultative Council for fisheries management integrated by the National Direction of Aquatic Resources (DINARA), other ministries with related competencies, entrepreneurs, and workers in the sector. In Uruguay the tax regime is similar to that of other industries and is linked to the business income. As a peculiarity, fishing licence holders must pay for the fishing license and also an export tax, which should be destined at the national fisheries research fund.

In Argentina, the Federal Council of Fisheries (FCF) brings together representatives of the national government and provincial governments. It has competencies for fisheries policy and the policy of national fisheries research, as well as the planning of the national fisheries, the establishment of the maximum allowable catch by species (outside the CFZ and the Rio de la Plata Treaty) and catch quotas. At the same time, the FCF is in charge of approving experimental and commercial fishing permits, setting guidelines for sharing in the National Fisheries Fund, fees for fishing, and establishing catch rights.

Both countries have in their legislation a punitive system that includes temporary suspensions of the license (to the final withdrawal of permission to a repeated serious fault) and fines.

2.2 Brief history of former rights-based approaches used in the fishery

As the CTMFM has been operating for more than 40 years, former rights-based approaches are not presently significant.

2.3 Rights-based approach: allocation and characteristics

The granting of fishing permits for the area of the Treaty is the responsibility of each state. Requirements for access permissions or access rights to fishing are set out by the law Nº 19.175 of 20

December 2013 (Responsible Fisheries and Aquaculture Development Act) in Uruguay and the law Nº 24.922 (Federal Fishing Regime), of 9 December 1997, in Argentina.

To obtain a fishing permit, interested parties, natural persons or legal residents in the country (not existing restrictions on communities or on gender) must submit a project that demonstrates its biological, environmental and socio-economic sustainability. The permission granted is tied to the vessel for which it is requested.

In the case of Argentina, the permissions are granted to vessels only to access the fishery. Also necessary is an assigned catch quota or authorization of capture, in the event that the species is not under quota. Permission may only be transferred to another unit or units of equivalent capacity, not involving an increase in fishing effort. The replacement can be done if it becomes necessary, due to accident, force majeure, or when the vessel needs to be replaced due to age. This is always contingent upon agreement from the enforcement authority.

Permissions granted in Uruguay include the target species to which the fishing can be directed, identifying whether it is coastal fishing (croaker and its by-catch), high sea fishing (hake and associated species) or non-traditional species. The vessel associated with the permission can be replaced by another unit of equivalent capacity that does not involve an increase in the fishing effort (for species fully exploited). Sales or donations of permissions are forbidden. The validity of the permits granted is five years in Uruguay and ten years in Argentina, which can reach ten and 30 years respectively for vessels belonging to fish processing plants on land.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

In 2017, 88 percent of the landings were species that have management measures established by the CTMFM, according to the scientific advice received from the six Advisory working groups. Of the 15 main species landed, 11 have annual resolutions that set the Total allowable catch (TAC). Seventy-three percent of them are levels of sustainability. The remaining do not suffer from overfishing and, for example, hake (*Merluccius hubbsi*) is under a management plan for the recovery of the stock, showing encouraging signs. For two other species, the TAC has been reduced and now the resource situation is stable.

At the same time, CTMFM promotes scientific activities, publications, and training for researchers of the two countries, as well as playing an important role in other joint activities, such as the recent publication of the Regional Plan for the conservation of the chondrichthyans fish in the Area of the Treaty or the binational program of marking and capture of narrow nose smooth-hound (*Mustelus schmitti*), currently underway.

Most of the species landed in the area of the Treaty are straddling stocks and also are subject to fishing by foreign fleets, in international waters or in the EEZ of other countries. This means that measures taken by the CTMFM are undermined, as equivalent standards do not exist in these fishing areas.

3.2 Economic viability of the fishery

The CFZ fishery is a fishery with limited access to those vessels that have a valid license. Both countries party to the Treaty have limited entries to the fisheries, with the purpose of ensuring efforts on major species under full exploitation do not increase. Hake, currently under a recovery management plan, was the subject of overfishing in the past, which led to a decrease of size and Catch per Unit of Effort (CPUE). This saw a consequent increase in the duration of the fishing trips.

Argentina implemented a system of quotas for hake (and other species) in its EEZ. However, transferring these to the CFZ presents some difficulties, in particular, the setting of quotas for each country in the first instance. The legislation includes a reserved quota for artisanal fishers. In Uruguay, without a quota system, there was previously a concentration of permits in the hands of commercial societies. This phenomenon was attributable to the economic capacity of the enterprises and their production and marketing strategies. The already commented situation of hake, but also other situations, especially related to prices and markets, has been the cause of the reduction in the number of fishers in the area, which induced a loss of positions in the value chain.

3.3 Social equality

There are no legal restrictions on the participation of women, either in the crews of fishing enterprises owners of industrial vessels or in fishing licenses. However, women's participation in these activities remains minimal. In the small-scale fisheries, which take place mostly in adjacent waters under national jurisdiction, the participation of women in activities linked to fishing is more visible. Its activities are fishing, preparation and repair of Arts and rigs, support processing of capture, and so on.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

As already mentioned, in waters under the states' jurisdiction, adjacent to waters of the Treaty, a small-scale fishery takes place directed to coastal species, mainly croaker. This fishery creates conflicts with the industrial fisheries, targeting the same croaker, competition for the resource and the territory. These tensions are mitigated by controls that are applied mainly on the industrial fleet and are based on the SLV preventing their entry into shallow waters, where the effort of the artisanal vessels focuses.

The resolution of the conflicts in the fishery is addressed by the countries party to the Treaty. However, the work of the CTMFM is important to establish management measures, following the advice from scientists of the two countries in joint projects. It allows information to be standardized, data to be validated, and joint recommendations to be formulated. At the same time, the transparency in the work of the CTMFM - publishing on its website the biological, fisheries and species stock assessment information, as well as monthly catch statistics - contributes to standardize the information available to the main actors of the system.

4.2 Improving fishery sustainability in the future

The CTMFM performs important work for the sustainability of the fishery in the region. However, in order to ensure the sustainability of the fishery in the CFZ, it is necessary to continue analyzing internal factors. For example, adjusting fishing capacity to the established allowable catch volumes and advancing an analysis of the percentages of the TAC that correspond to each of the countries, in order to optimize the development of the fishery. These two issues of significant impact on the management of the fishery, are already examples in the resolution of the Commission. On the other hand, there are external factors related to the pressure suffered by some of the species, whose fishing is shared with vessels of third countries in international waters or EEZ of coastal countries, for which there is a lack of reliable and up-to-date information. No less important in what corresponds to the socio-economic sustainability is access to external markets, the natural destination of fishery products, and the establishment of limits on fishing subsidies since these contribute to overcapacity and overfishing. These factors combine to damage access to the fishing grounds and distort the market access of riparian countries with less economic capacity.

4.3 Lessons learned

Collaboration for coastal countries in the managing of joint fish resources is a must, in order to guarantee the sustainability of the fisheries. However, it is difficult to mitigate conflicts over shared

resources outside the CFZ, such as the small-scale fisheries on the one hand, and foreign vessels on the other. The different fishing management systems in the two countries, ITQs in Argentina, fishing licenses and quotas in Uruguay create problems when trying to define fishing allocations for the two countries in the CFZ for the first time.

Appendix 1.

Acronyms

CARP	Administrative Commission of the Rio de la Plata
CFZ	Common Fishing Zone
CPUE	Catch per Unit of Effort
CTMFM	Comisión Técnica Mixta del Frente Marítimo or Joint Technical Commission for the Maritime Front (of the Treaty of the Rio de la Plata)
DINARA	Dirección Nacional de Recursos Acuáticos (National Direction of Aquatic Resources)
EEZ	Exclusive Economic Zone
FCF	Federal Council of Fisheries
SLV	System of Location of Vessels
TAC	Total Allowable Catch
USD	United States of America dollars

Fishing areas for abalone in the Los Lagos Region in Chile

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Abstract
From the year 1997, the State of Chile has implemented the Area of Management and Exploitation of Benthic Resources (AMERB from the Spanish acronym). Such a system, enshrined in the General Law of fisheries and aquaculture, grants rights to legally constituted fishers organizations for use or exclusive exploitation of benthic resources (benthic invertebrates and algae), prior to the approval of a management plan based on the sustainability of the resources in that territory. This case study summarizes the current state of the implementation of the AMERB in southern Chile, focused on the case in the Los Lagos region. The fishery is associated and authorized in the resource management plans of the Loco or Chilean abalone (*Concholepas concholepas*), a mollusc of high commercial value for small-scale fishers. This system has achieved, on the one hand, regular access to the benthic fisheries. It promotes the conservation of these resources and the consolidation of fishers' organizations and their management capacity, making the production levels recover in the AMERBs, as well as increasing fishers' incomes through organized commercial management (the management, exploitation and marketing of the resource). Finally, the AMERBs generated a new form of governance between users and administrators in the territory. Since the establishment of the first AMERB sectors and after more than 20 years of implementation, it is possible to say that this has been valued by fishers' organizations, since they have improved the conservation of resources in their assigned area. This leads to the positive economic and social development of the fishing communities. However, there are aspects that can be improved, such as security, and market price, declining due to increased supply.

Keywords: Chile, Chilean abalone, AMERB

1. INTRODUCTION

1.1 Description of the fishery

The Chilean abalone resource is distributed along the Chilean coast from Arica (18° LS) to Cape Horn in Chile (55 ° LS), including the islands of the archipelago of Juan Fernandez. Fishing is carried out in coastal areas at a maximum of 3 nautical miles from the coastline. The fishery of the abalone resource within the AMERB is a selective fishery since fishing occurs through Hooka diving in areas authorized by approval of the annual management plan by AMERB. This derives results through direct assessments of the stock of the primary and secondary resources in the area. This fishery is characterized by being in full exploitation, with other secondary benthic resources that can generally be caught in the authorized areas of the Los Lagos region.

In the Los Lagos region, there are more than ten landing sites of benthic resources, which accommodate fishing communities. This information is relevant as the extraction is by fishing area, the AMERB, which is itself administered by an association of fishers to which the area is assigned. The relevant management plans assign these areas to one or more groups of fishers. Each group can define an independent management plan in spaces that can be separated by kilometres or overlapping. An example of this is shown in Figure 1, of a territory located in the Los Lagos Region. Of the 11 areas listed, they are administered by 11 independent fishers associations, but they share 1 or 2 ports. It should be noted that this situation is repeated along the coast of the region, whereby a total of 284 current AMERB, 67 are operational for exclusive abalone extraction.

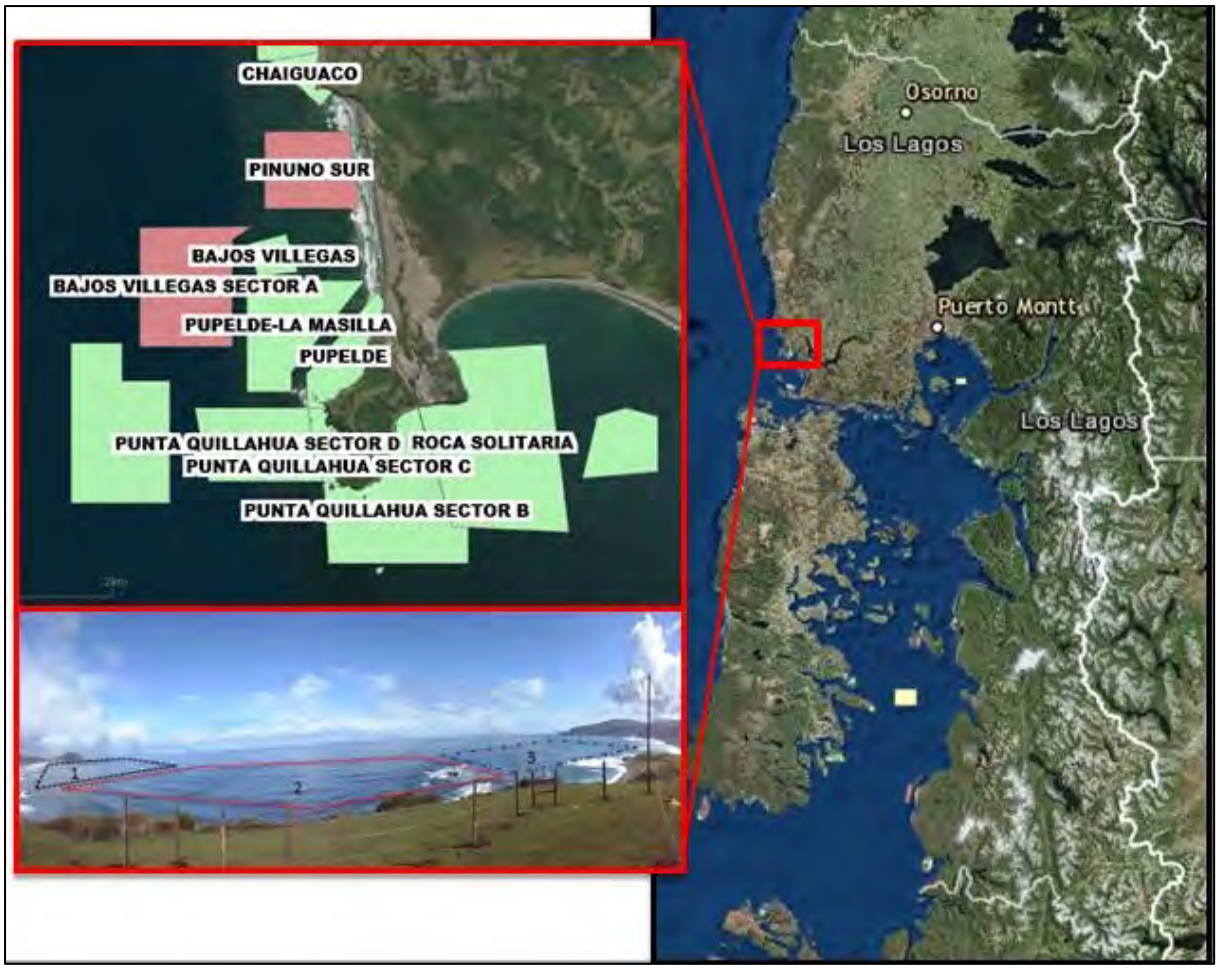

Figure 1. Map of various AMERBs in the Los Lagos Region.
Source: Subpesca map viewer.

The fishing occurs mainly through Hooka diving. This is a kind of semi-autonomous diving through which the diver is given air from a compressor on boats ranging from six to 12 meters, with an outboard motor of about 80 horsepower (hp). Normally, the operation is for 1-6 hours, with two divers and one diver Assistant. The abalone extracted cannot exceed the volume indicated in the management plan, and it must meet the minimum size of 10 cm. The abalone are kept in nets, to be landed later on the beach and counted by the buyer. The final destination in 90 percent of cases is plant processing, which carry out canning or freezing, for marketing in international markets.

1.2 Economic contribution and social implications of the fishing activity

The abalone resource is for direct human consumption; ten percent is going to domestic consumption, while 90 percent of canned and frozen products are exported to Taiwan (Province of China), Japan, Singapore, Hong Kong, China, United States of America, Canada, Mexico and Malaysia. Exports of abalone reached USD 13.2 million in 2016, nine percent less than during the year 2015.

The Los Lagos Region has 25 500 small-scale fishers, the highest number in the country. This region also accommodates the highest number of AMERB, (284) with approximately 6 000 people directly involved in the fishing of benthic resources. With regard to abalone, in September 2018 there were a total of 67 AMERB operating, involving more than 1 300 people, with an authorized extraction of 5.1 million units of abalones.

With regard to income, due to the fact that 90 percent of the product is going to processing plants, the income of fishers is only 25 percent of the final value of the finished product in international

markets. It should be noted that this fishery has a strong rural component associated with multiple employment, where fishers are engaged in agriculture, livestock or services, as the abalone resource undergoes a seasonal ban. Fishers occupy 40 percent of their time in the abalone fishery, and the remaining in other activities. Despite this and the low beach price paid per abalone (USD 1.5), it remains a profitable activity for fishers. Fisheries is close to the coast, not more than 10 km of distance or more than six hours of navigation, meaning that areas tend to be managed by communities of fishers who live nearby.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACHES

The Undersecretary of Fisheries and Aquaculture (SUBPESCA) implements administrative measures in line with the General Law of Fisheries and Aquaculture (LGPA N ° 20.653), articulated through their decrees and administrative decisions. SUBPESCA is assisted by the Scientific Technical Committee, who makes recommendations from a biological point of view to regulate the fishery with a precautionary approach. In the Los Lagos Region, given the socio-economic relevance of this fisheries, there exist regional panels for abalone, which is composed by small-scale fishers who make recommendations to the authority from an ecosystem approach.

2.1 Management of the fishery

The fishery of the abalone is subject to a plan of management and exploitation, which includes all activities under the AMERB system must meet these requirements. To summarize, the management plan must comply with the following minimum requirements:

- Study methodology;
- Information on extractive fishing activities carried out during the previous period;
- Information on management actions in the previous period;
- State of the population of the main species of the management plan. Direct assessment or other indicators generally accepted for the informed species may be used for such purposes;
- Analysis of the overall performance of the area considering the objectives for the project management and the indicators established by the Secretary;
- Actions of management and operation proposed for the next period;
- Programme of activities and schedule; and
- Sources and amounts.

The National Service of Fisheries and Aquaculture (SERNAPESCA), an entity of the Ministry of Economy, Development and Tourism, carries out comprehensive control and health management. In conjunction with the Navy of Chile, through port authorities, they carry out control and supervision of fishing activities in the AMERBs, from monitoring the catch and landing in authorized ports. SERNAPESCA also performs inspections in the processing of plants. Sanctions for illegal fishing range from economic sanctions to the confiscation of boats and fishing gear. In some cases, there can be a civil penalty from the local police. The illegal cases punished correspond to thefts of abalone, through illegal diving in the AMERB, and in some cases of fishers from neighbouring communities and other cases, people from the same communities.

2.2 Brief history former rights-based approaches used in the fishery

Initially, the abalone fishery was open-access without registration, and there was no AMERB. This changed given the collapse of the fishery during the end of the last century. In 1985 began the application of two management systems, with the assignment of user rights or restricted access called "Benthic regime of extraction" (RBE) and the AMERB system, in addition to other measures such as the establishment of a legal minimum size, a biological fishing ban, the closure of the artisanal fisheries register (RPA) and an extractive fishing ban for the resource in the areas of free access.

Only in 1998 with the exploitation of the abalone resource did AMERB become a fully consolidated system. Between 2001 and 2016, 94 percent of annual landings of abalone came from the AMERB. Annual national landings in this period averaged 2 800 tonnes, with a maximum of 4 662 tonnes in 2016. In 2017, a strong increase in the number of registrations (up to 23 411 from 15 833 in 2016) came from the categories of collectors and fish workers, while the number of divers declined slightly.

2.3 Rights-based approach: allocation and characteristics

The rights of this fishery, circumscribed exclusively inside an AMERB, are of the exclusive use of fisherfolks' organizations. They must possess an ROA (register of an artisanal organization) that is validated by the national fisheries service, (an entity that certifies that its members are formed exclusively by fishers). These organizations may be unions, professional associations, cooperatives, federations or indigenous communities. Extraction quotas can be assigned annually or biennially. These fishing rights may not be rented or sold, and in the case that SERNAPESCA irregularities are detected, this can lead to losing the rights over this area for the managed fishers' organization.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

In the last indirect assessment of the abalone resource, using an estimation of biological parameters and growth in key areas of extraction from VIII to XI Region during the year 2017, it is estimated that the average length of the abalone is slightly less than the historical average. Estimates of growth parameters did not show significant differences between regions.

The age of recruitment is estimated at five years. Above this age, the contribution of individuals is generally poor in the analyzed AMERBs. This can be explained by the high levels of exploitation they are subjected to. Since 2011, size and average weight have been declining. At the seasonal level, the average weight of the abalone decreases steadily from the second quarter onwards (March-May). This is probably related to the reproductive process. The value of the natural mortality is estimated to be next to 0.36. Fishing mortality average for the last five years in 123 AMERB, suggests that stocks of abalone between the VIII and XI regions are overfished.

3.2 Economic viability of the fishery

The fishing effort and the fishing capacity have increased in the last five years, due to the interest generated by the stability of the price of abalone. Durations in effort and distance travelled remain the same, given that the AMERB tend to be located near to the fishing communities. In this context, the operating cost is low in fuel supplies, given the renewability of the fleet with engines that are more efficient. In general, there is no concentration of ownership of the gears or vessels, as the community is managing the resource, and each member of the community brings his own boat. There is, however, a concentration for the intermediate buyers and processing plants.

3.3 Social equality

In the processing plants, 80 percent of the workforce are women. With regard to income, due to the fact that 90 percent of the product is going to processing plants, the income of fishers is only 25 percent of the final value of the finished product in international markets. Among fishers, there are practically no women involved.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

On the basis of official information available, AMERB implementation has enabled the fishery to stay alive. However, there remain problems associated with expectations for current production in the AMERBs, economic benefits, and illegal exploitation. The main conflicts among fishing communities

occur when one AMERB gets a higher allocation than another. This competition between communities for the same resource can lead to abalone theft from a neighbouring AMERB, producing economic damage. Another conflict is created through the figure of the intermediaries and their concentration of buying power, given that about 80 percent of the purchase is in the hands of three companies. This impacts the beach price being paid to fishers. Finally, inter-agency coordination must be strengthened for the more intensive environmental and health monitoring of the AMERBs.

4.2 Improving fishery sustainability in the future

The abalone is fully over-exploited. Thanks to the AMERB system, permanent monitoring of the management plans is implemented that ultimately authorizes and protects the control of fishers' organizations who manage their respective areas. It is necessary to implement programmes of surveillance of these management measures, on the basis of direct territorial assessments of the AMERB. This is particularly relevant as today there are no institutional verification mechanisms that ensure what is assessed in the area is effective, if they are actually evaluating the stock directly, or if it's only an indirect historical data report.

On the other hand, it is found necessary that the ecosystem approach is implemented in benthic fisheries stock assessments, integrating the economic, social and environmental factors. Otherwise, the purely biological approach tends to close the access to the fisheries, thus leading to illegal fishing and the black market of abalone trade.

5. LESSONS LEARNED

The abalone resource is presently allocated by a Territorial Use Rights for Fishing (TURF) system that allocates certain amounts of abalone to each AMERB system. The system seems to work well, albeit, the albacore resource seems to be overexploited, and all major indicators of the health of the resource are declining. Fishers are involved in the drafting, presenting and implementing of management plans, together with the authorities.

Conflicts and problems that occur are between small-scale fishers' communities in neighbouring AMERBs. When one area receives a higher allocation than another, this leads to resource theft. A better explanation of the reasoning behind resource allocation needs to be given by the government authorities. Yet, another problem is the concentration of the buyers, which leads to low beach prices. One obvious way out from this situation would be for fishers' organization to also become involved in the processing and marketing of the abalone resource.

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Appendix 1

Acronyms

AMERB	Áreas de Manejo y Explotación de Recursos Bentónicos, Areas of Management and Exploitation of Benthic Resources
LGPA	Ley General de Pesca y Acuicultura, General Law of Fisheries and Aquaculture
SERNAPESCA	National Service of Fisheries and Aquaculture
SUBPESCA	Undersecretary of Fisheries and Aquaculture
TURF	Territorial Use Rights for Fishing
USD	United States of America Dollar

Problems of competition between commercial fishing and recreational fishing in Korea and their solutions

Kwang-Nam Lee

Please refer to the presentation of this case study available at:
http://www.fao.org/3/CA2478EN/ca2478en.pdf

Whose custom is important? A case of conflict among multi-layered customary rights groups for fishing in Okinawa, Japan

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Abstract
I introduce a case study of Shiraho village, Okinawa Japan, as a case of conflict among multi-layered customary rights groups for fishing activities. Japanese Fisheries Cooperative Associations have been regarded as one of the world's oldest and best-established fisheries institutions that involve resource users for coastal resource management. In Okinawan islands, located the most south-western part of the country, however, there was a different history of the establishment of common fishing rights and FCAs. Common fishing rights were granted to the FCAs consisting of *Itoman* fishers -professional fishers group, not to the coastal villages in Okinawa. The case study site, Shiraho village is located in the south-eastern part of Ishigaki Island, Okinawa. The village lagoon has been utilized by local farmers-fishers for subsistence activities for a long time. However, the common fishing rights are not granted to the Shiraho Village but to Yaeyama (the name of a district in Okinawa that includes Ishigaki Island) FCA that mainly consists of *Itoman* fishers, just like other Okinawan coastal villages. This multi-layered user rights system resulted in a serious conflict over the airport construction plan on the village lagoon which was declared in 1979 by the Okinawa government. Residents of Shiraho village fought against that construction plan for over 20 years. The government and FCA consistently pushed the plan, while the local community consistently opposed to the plan during this period. Thus, the Shiraho airport conflict became a battle between governments, FCAs, and local residents because the fishing rights have been granted to the FCA consisting of *Itoman* fishers. This case indicates the complexity and dynamism of customary rights for fishing activities and the potential risk of institutionalization of customary rights, which could result in a serious conflict among multi-layered customary rights groups.

1. INTRODUCTION

1.1 Customary fishery management system in Japan general and in Okinawa

Japanese fishing rights have been regarded as one of the world's oldest and best-established fisheries institution that involves resource users for coastal resource management (Pomeroy and Berkes, 1997; Makino, 2011). During the Edo period (1603–1868), which was after the establishment of feudal villages, the Edo government initiated a policy stating that 'coastal resources belong to the coastal village' because there were increasing conflicts over fishing grounds among various federal villages (Fisheries Information Center, 2005). This policy has succeeded as a common fishing rights policy after the Meiji fisheries law until today (Kumamoto, 2010; Makino, 2013), and here the common fishing rights had been codified by the fisheries law in Japan. Based on the fisheries law, Fisheries Cooperative Associations (FCAs) were established as bodies to be granted the fishing rights by the government (Makino, 2013). However, in Okinawan islands (the most south-western part of the country), there was a different history of the establishment of common fishing rights and FCAs. Common fishing rights were granted to the FCAs consisting of *Itoman* fishers (professional fishers group based on Okinawa island), not to the coastal villages in Okinawa (Kumamoto, 1995). It was because the Ryukyu government granted the right to use fishing grounds to the *Itoman* group for enabling them to develop the fishery production system in 1673 (Akimichi, 1984).

1.2 Brief description of the case study site

The case study site, Shiraho Village is located in the southeastern part of Ishigaki Island in Okinawa Prefecture (Figure 1). It has a population of 1 570 with 703 households (Ishigaki City, 2014). The village lagoon has been utilized by local farmers-fishers for subsistence activities for a long time (Tamanoi, 1995; Tabeta, 1990). In addition to the subsistence fishing activities, professional fishing was started by immigrants after World War II (Tabeta, 1990). Currently, there are approximately 20 fishers who mainly depend on fishing for all of their income and are recognized by local residents. They mainly consist of immigrants from other Okinawan islands or prefectures (Sugimoto, 2016). Similar to other (sub) tropical islands, fishers are likely to catch a wide range of species, rather than focusing on limited kinds of species.

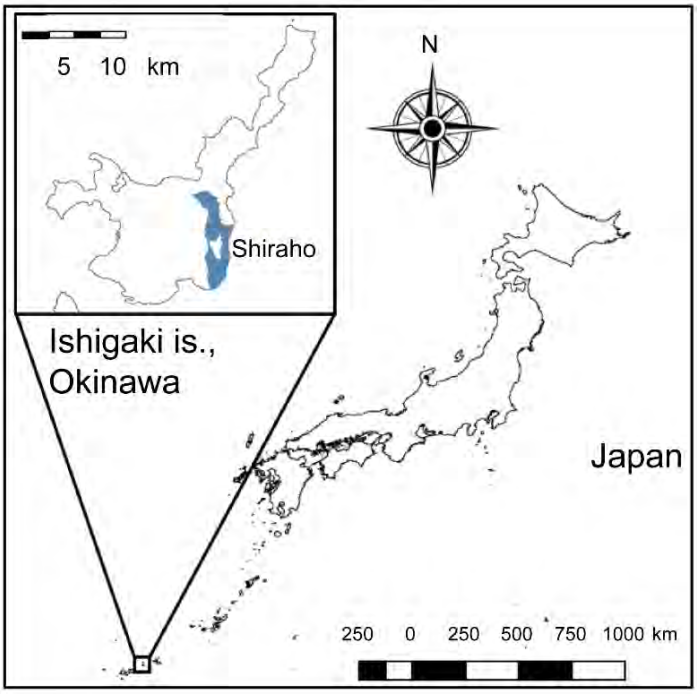

Figure 1. Location of the case study site: Shiraho Village, on the east coast of Ishigaki Island.
Source: created by the author.

1.3 Economic contribution and social implications of the fishing activity

In Shiraho village, the dependence on the fishery is not high: none of the villagers (including professional fishers) were observed to fish as a mere means to sustain their livelihoods. It is common for villagers to fish as a second or minor subsistence activity. However, this does not mean they can build their livelihood without fishing activities; fishing still remains very important livelihood means for them. Also, with regard to the market of fishery products, there are not many villagers selling their catch to the official market (through Fishery Cooperatives), but rather it is common for villagers to distribute/share the catch among their families, relatives, friends and neighbours in the local community. This helps the villagers to enhance social relationships and cultural practices which have been generated through a long history of interaction between the community and the natural environment (Sugimoto, 2016). Thus, fishing activities are offering important socio-cultural values to the community, in addition to the economic contributions.

2. LIMITATION OF RIGHT-BASED APPROACH: IMPLICATION FROM SHIRAHO AIRPORT CONSTRUCTION CONFLICT CASE

2.1 Shiraho village airport construction conflict: A victim between formal fishing rights and people's sense of ownership

The Ishigaki new airport construction plan was declared by the prefectural government in 1979. It was supposed to be developed over the lagoon of Shiraho village. Since it was obvious that local farmers-fishers' daily practices over the lagoon would be severely affected by the construction plan, many villagers strongly opposed this plan. However, the common fishing rights are not granted to the Shiraho Village but to Yaeyama (the name of a district in Okinawa that includes Ishigaki Island) FCA that mainly consists of *Itoman* fishers, just like other Okinawan coastal villages. This multi-layered user rights system resulted in a serious conflict over the airport construction plan on the village lagoon. Residents of Shiraho village resisted against that construction plan for over 20 years. The government and FCA consistently pushed the plan, while the local community consistently opposed the plan during this period. After the long, severe conflict, the plan was finally amended to relocate the runway over the terrestrial part of the village, in 2000. Thus in Shiraho village, common fishing rights did not assure the principle "coastal resources belong to the coastal village". However, Shiraho villagers were still able to protest against the airport construction plan. How did they do that?

2.2 What shapes peoples' sense of ownership over the lagoon?

An environmental sociologist documented the local perception during that time. One narrative that was commonly expressed by villager is as follows: "even without any knowledge about the law, directly, residents living here can say that here (the sea) is ours, I think...as Shiraho people, we get just embarrassed to hear that the airport will be constructed here, no other place than Shiraho…" (Yanaka, 1996: 227)

Thus we can notice here that, without any assurance nor recognition of the 'rights', the residents did have a sense of ownership over the lagoon: "the sea is ours". Based on such narratives, Yanaka (1996) discussed that the Shiraho residents could fight against the construction plan not because they had some official 'rights' in advance, but because they had the following elements: 1. A shared image of the environment and a connection with it, which had been generated by daily practices of individual residents, and 2. A social mechanism which generated a sense of collective struggle against the construction plan, by collecting the individual 'image of the environment'.

2.3 Lessons learnt from Shiraho case

Based on the above case, my thought about fishing or any use rights of natural resources is as follows. At first, there is people's interaction with the natural environment. And when the pressure hits the community, the sense of ownership can be realized. Hence, I'd suggest that people's interaction with natural resources generates a sense of ownership which should be the precondition for the rights-based approach, rather than the 'rights' coming first. And because of this, any 'official rights' (once formally institutionalized) could have the potential risk of causing conflict among different resource user groups since the interaction between people and environment is always dynamic, even when their practices are called 'customary'.

3. MAIN CHALLENGES AND WAY FORWARD

3.1 Challenges for the fishery

This case indicates the complexity and dynamism of customary rights for fishing activities, and the potential risk of institutionalization of customary rights, which could result in serious conflict among multi-layered customary rights groups. One lesson from this case may be that any formal institution including the fishing rights, could cause conflict among the diverse resource user groups. This would be especially true for the countries which have great socio-cultural diversity in terms of geographical,

linguistic, religious senses. We should always be careful of the legitimacy of 'customary' rights so that the decision-making process for using/managing the target resources could work well. Similar to the rest of Japan and elsewhere, as the fluidity of people and economic activities increases more and more in Okinawa, so does the pressure for fishery/coastal resources. Given this, it is critically important for the right-based fishery management approach in this region to craft legitimacy through careful dialogue with various stakeholders.

3.2 Improving fishery sustainability in the future

The interaction between people and natural resources is always diverse, and the way people use, manage natural resource is diverse and dynamic. Given this, the rights-based approach should also be flexible and adaptive enough to meet such diversity and dynamics. My final message in this article is that we should not focus on the 'right' itself, but the social mechanism that is supporting the actual local practices under the rapidly changing social-ecological environment.

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Policy challenges in the coastal fisheries management of the Marshall Islands

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Abstract
Traditionally, the ownership of the coastal resources of the Republic of the Marshall Islands has always lain with the coastal communities. The coastal resources management, by law, requires the national authority to take measures for the management and development of local fisheries, including in internal waters and within five miles (which is the local jurisdiction) of the baselines from which the territorial sea of any atoll or island is measured. However, before any measures are taken, the national authority should consult with the Local Government Council affected by the proposed measures and, as appropriate, convene public hearings. However, jurisdiction, power and responsibility of traditional landowners with respect to Biodiversity resources are ambiguous. Different atolls have different traditions as to where land and marine ownership is claimed. Some claim ownership from the land to the ocean as far as the eye can see; others claim ownership of marine resources and reefs that may be on the opposite side of the atoll from the land. Although powers and responsibilities associated with ownership are not formally defined in law (or tested in the court system), traditional resource owners hold considerable power over the use of the resources, de facto. In this sense, policy challenges in the management of the coastal fisheries is analysed.

1. INTRODUCTION

1.1 Description of the fishery

Marshall Islands fishery is defined into two major subdivisions: coastal and oceanic fishery. The oceanic fishery includes living and non-living resources; it is governed and managed by the state on behalf of the people of the Marshall Islands. The rights to access for resources in the 200 nautical miles (NM) Exclusive Economic Zone (EEZ) is held by the government and, in the case of Marshall Islands, the Marshall Islands Marine Resources Authority (MIMRA). The management regime implemented by the state is the rights-based/zone-based approach in the form of the Vessel Day Scheme (VDS) for Purse Seiners of the skipjack fishery. The Longline VDS is being implemented, and full implementation is a work in progress.

The Coastal fishery, which is the case study of this paper, on the other hand, consists of subsistence, artisanal, including aquaculture, and small-scale commercial fishery, which is managed and governed by the government. The local government has jurisdiction within the five miles of the baseline from which the territorial sea of any atoll or island is measured. The target species in most of the outer islands are grouper, unicorn fish, rabbit fish, sea cucumber, lobster and turtles. There is a limit to turtles and a sea cucumber regulation for the harvest an export of sea cucumber. There are fish bases in the outer islands that are managed by MIMRA. MIMRA sends its boats to these fish bases, where the local communities supply stocks they had harvested for MIMRA to bring them to the capital to be sold at the domestic market. There are more than ten landing sites altogether in the Marshall Islands.

Most of the boats are owned by local fishermen who are involved in the fishing activity, either in small-scale or for subsistence purposes. On average, less than 12 meter-long, motorized boats are used with outboard engine. There are between 21 and 100 boats. The nature of the fishing operation is either owned by families or cooperative groups. Anchored fishing aggregated devices (FADs) are used which has been deployed around the two main islands, Majuro and Kwajelein. These FADs are supplied by MIMRA with the help of the Secretariat of the Pacific Community (SPC), to assist fishers and game fishing activities in the Marshall Islands.

Women are generally involved in the fishing activity, including owning fishing gear and participating in the management. The fishing trips, on average, take place between 100 meters and 10 kilometres from the shoreline/high water mark. These trips are mainly a 6-24 hour duration. Since the fishery is still 70 percent subsistence catch, there has rarely been a conflict between stakeholders. The rest of the 30 percent, which is commercial on a smaller scale, is enforced and managed by the government agency.

1.2 Economic contribution and social implications of the fishing activity

There have been changes in the Marshall Islands over the last decade, as studies are conducted with improved data collection. In a study by Echigo (2010), coastal fisheries production was estimated to be around 4 500 metric tonnes (mt), comprised of catch for both subsistence and commercial purposes. The study, however, did not include exported fishery products such as aquarium fish, sea cucumber and trochus.

Species such as grouper, unicorn fish and rabbit fish are mostly sold in the domestic market, whereas species like sea cucumber are sold in the international market. There is a moratorium on turtles, which can only be harvested based on special requests, and it is illegal to harvest turtles when beaching. Lobsters are either harvested for household consumption or sold in the domestic market for monetary payment. Some of these species, including rabbit fish, go through value-adding in the post-harvest processing mostly for human consumption. Almost all of the catch is destined for human consumption as the general population depend heavily on fish for protein.

The approximate number of fishers involved in the fishery is around 700, including shore-based processing and vessel support (EPPSO, 2017). Amongst these, less than 25 percent are women fishers. This equates to about less than 25 percent of income derived from fishery participation. In the Marshall Islands, being a fisher is a full-time job and, in the absence of a well-established tourism industry, most fishers spend almost all of their time fishing. There are, however, alternative livelihoods in the form of agriculture, farming (crop/livestock), processing (including post-harvest), restaurants and bars, recreational fisheries, and retail.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

In the coastal fisheries, there are many stakeholders involved in the harvest of the resources. The right to exploit the fisheries resources lies, in many cases, with the land-owners. The following figure illustrates the definition of customary ownership of the resources, which is also recognized by the law and the various jurisdictions in coastal fisheries management:

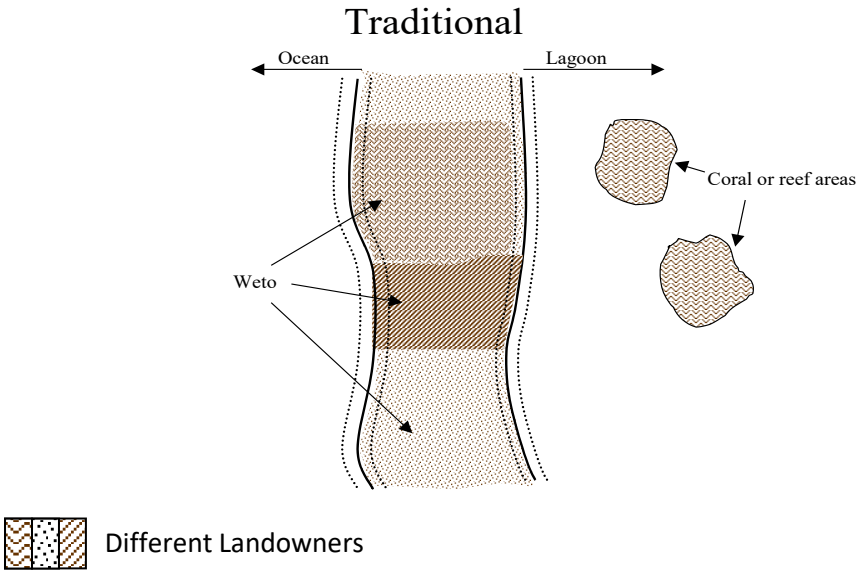

Figure 1.
Source: OEPPC, 2004

Jurisdiction, power and responsibility of traditional landowners with respect to Biodiversity resources is ambiguous. Different atolls have different traditions as to where land and marine ownership is claimed- some claim ownership from the weto on land to the ocean as far as the eye can see, and to the centre of the lagoon. Others claim ownership of marine resources and reefs that may be on the opposite side of the atoll from the land-based weto.

Although powers and responsibilities associated with ownership are not formally defined in law or tested in the court system, traditional resource owners hold considerable de facto power over the use of the resources. Local communities may be more likely to take direction over the use of the resources from traditional landowners, than they are from laws and regulations that are difficult to enforce.

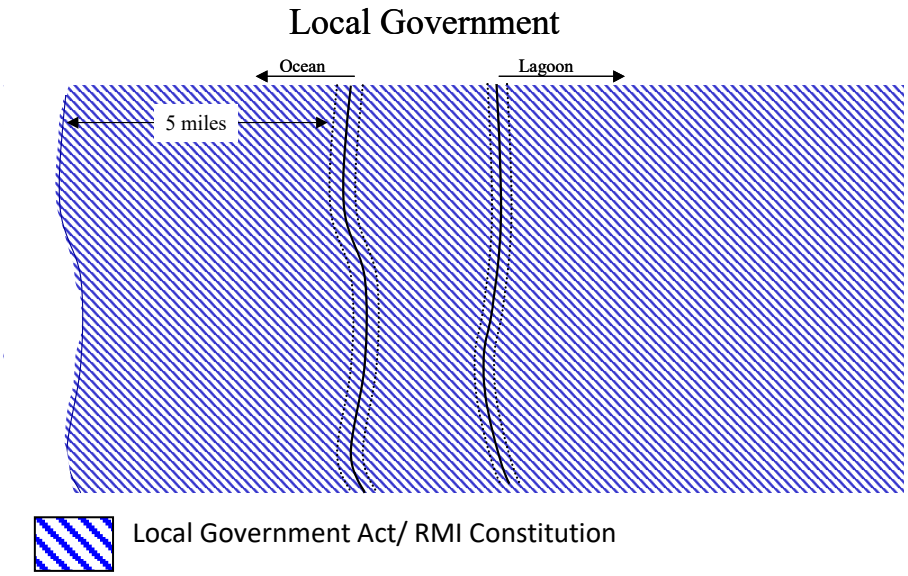

Figure 2.
Source: OEPPC, 2004

Local Government Act/Constitution
Act describing the establishment and governance of local governments.

Powers
Local government has the power to make any ordinances, as long as they are not inconsistent with any Act or with any other legislative instrument that has the force of law in the Marshall Islands (such as regulations formed by MIMRA or EPA, for example).

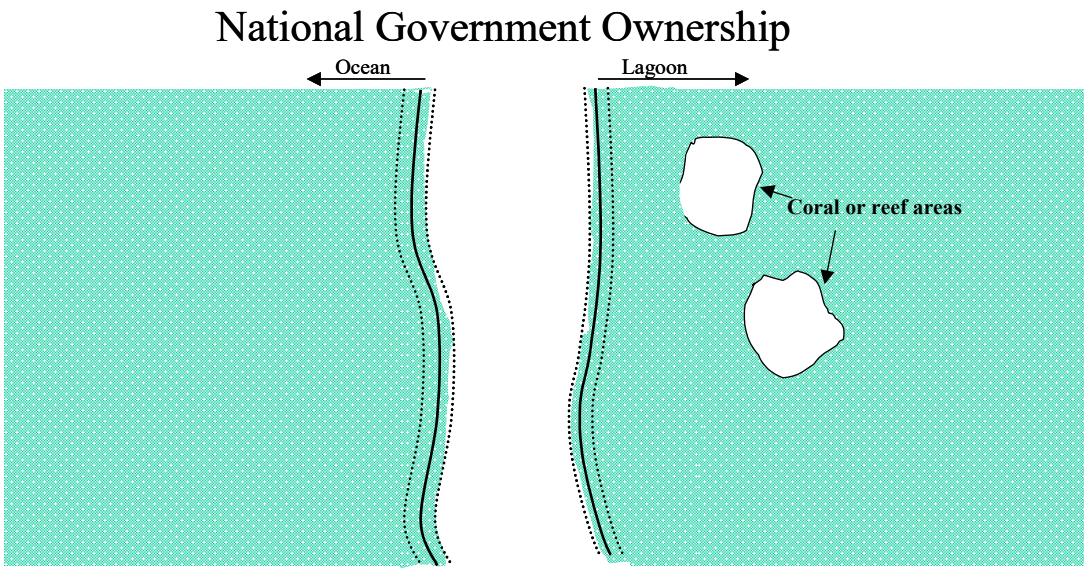

Figure 3.
Source: *OEPPC, 2004*

Public Lands and Resources Act
This Act defines ownership over areas by the government of the Republic of the Marshall Islands. It takes the basic definition of public lands as those owned or maintained by the Japanese government during the Japanese administration. Specifically, all marine areas below the high-water mark belong to the government, with the following exceptions:

- Fish weirs and traps and the right to erect these as recognised by customary law;
- Fishing rights on, and in water over reefs where the general depth of water is less than 4 feet at low tide, as recognised by customary law;
- The traditional and customary right of the individual landowner, clan or municipality to control the use of and materials in marine areas below the high-water mark (subject to the inherent rights of ownership of the government); and
- Any legal interest in or title to such marine areas.

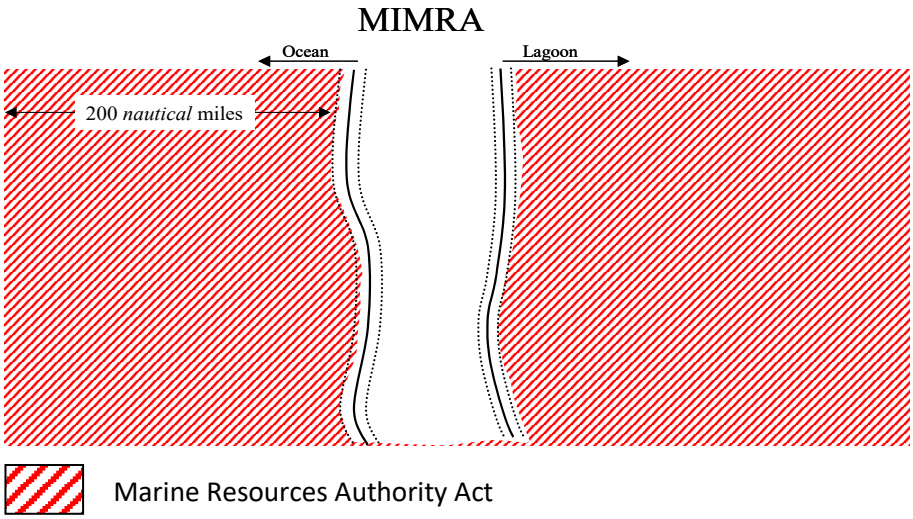

Figure 4.
Source: *OEPPC, 2004*

Marine Resources Authority Act (MIMRA)
MIMRA establishes the Marshall Islands Marine Resources Authority.

Responsibilities
MIMRA's duties related to Biodiversity conservation include:

- To conserve, manage and control exploration and exploitation of all living resources in the Fishery Waters (all water within the EEZ measured from the baseline of each atoll)
- To issue fishing licenses
- To negotiate and conclude foreign fishing agreements (with the final approval by Cabinet)
- To participate in the planning and execution of programs related to fisheries or fishing
- To appoint authorised enforcement officers and observers.

Powers
MIMRA has the power to carry out its duties. In addition, MIMRA may:

- Develop local fisheries, in consultation with the Local Government Councils
- Issue local fishing licenses for commercial and non-commercial fisheries
- Make regulations with respect to:
    - the conservation, management and protection of fish and other aquatic organisms
    - use of fishing gear and equipment
    - terms and conditions of licenses
    - pollution of fishery waters
- Give rewards for information leading to the conviction of foreign fishing vessels.

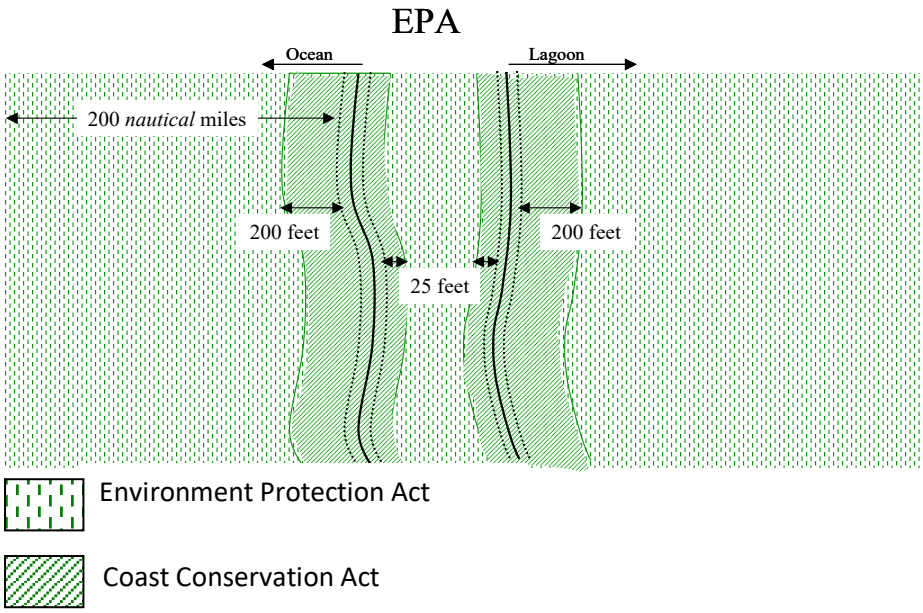

Figure 5.
Source*: OEPPC, 2004*

Environment Protection Act
Establishes the National Environment Protection Authority (EPA).

Responsibilities
EPA has broad functions and duties. Amongst those most relevant to biodiversity conservation are:

- Policy recommendations for management and conservation of the RMI's natural resources and environment, including animals and plants within the EEZ
- Recommendations for a system of rational management of fisheries and aquatic resources, with the assistance of MIMRA
- Requirements for environmental impact assessment
- Provision of information and education to the public regarding the protection and improvement of the environment.

Powers
EPA has all necessary power to carry out its objects, duties and functions (responsibilities).
EPA may regulate harvesting and marketing of threatened species of fish or other aquatic life.
EPA has the power to make regulations regarding the preservation of important historical, cultural and natural aspects of the nation's culture and heritage.

Coast Conservation Act
This defines 'coastal zone' as the area laying within 25 feet landward of the mean high water line, and 200 feet seaward of the mean low water line. Implementation and enforcement of the Coast Conservation Act lie with the RMI EPA.

Responsibilities
It requires the EPA to develop, amongst other things (specific to Biodiversity):

- Inventory of all coral reefs within the coastal zone;
- Inventory of all estuarine or wetland areas with an indication of significance as fisheries or wildlife habitat;
- Coastal zone management plans including consideration of living resources; and
- Environmental impact assessment process.

2.1 Management of the fishery

Under the legal framework, the people of every populated atoll or island that is not part of an atoll shall have the right to a system of local government which shall operate in accordance with any applicable law, whereby the local government system in each case extends to the sea and the seabed of the internal waters of the atoll or island and to the surrounding sea and seabed, to a distance of 5 miles from the baseline from which the territorial sea of that atoll or island is measured. The law also recognizes that the whole of the land and sea areas to which any system of local government extends, shall lie within the jurisdiction of a local government. Where there is more than one local government, the land and sea boundaries of their respective jurisdictions shall be defined by the law.

Under the broader legal framework, MIMRA as the national fisheries government agency is responsible for the conservation, management and development of the coastal fisheries. The Title 51 gives powers to MIMRA to take measures for the management and development of local fisheries, including in internal waters and within five miles (which is the local jurisdiction) of the baselines from which the territorial sea of any atoll or island is measured. However, before any measures are taken, the national authority should consult with the Local Government Council affected by the proposed measures and, as appropriate, convene public hearings.

The development of the local fishery is mainly through aquaculture, aquarium trade, sea cucumber harvest, trochus, giant clams and the sale of reef fish in the local market.

2.2 Rights-based approach: allocation and characteristics

The current system of rights-based coastal fishery in the Marshall Islands is described as customary ownership and indigenous rights to resources. This is also the traditional form of ownership of coastal resources in the Marshall Islands. The chief or landowners of the atoll or community hold the power to grant or restrict access to the resources.

The allocation of the customary or traditional fishing rights for this fishery is controlled by the chiefs, who are also community leaders and landowners. The rights allocated are based solely on the chief's preference; he or she grants the rights to the communities because they play a role in providing for the chief and his or her family and the participant's family. The rights also play an important role in managing the fishery, whereby specific fishing gear type is allowed to harvest a particular species. These are based on the season - because some species are seasonal, certain gears are used to reduce bycatch, and certain gears can only be used on special occasions.

These rights are valid until the chief decides otherwise, including with the introduction of closure season as and when required. They also consider the cultural sensitivities of the community, dependence on basic livelihood needs and the sustainability and viability of the fisheries as a whole. The rights are transferable between the fishers as access is provided to the local communities equally. Therefore, fishers can transfer those rights to their family members, making it inheritable.

However, there are restrictions to commercial aspects of the fishery. Chiefs can either allow their fishery to be commercialized, or to be conserved and protected. Implementing marine protected areas (MPAs) can only be pursued with the authority of the chief. In terms of compliance, monitoring is a challenge due to the proximity of fishing grounds being scattered and the costly nature of

enforcement. There may be cases of non-compliance such as poaching, however, reporting and documenting is a difficulty.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

The customary rights-based nature of fishery in the Marshall Islands plays an integral role in the sustainability of the resources. The jurisdiction of the local government provides the basis for the resources to be managed sustainability. Economic viability depends heavily upon the sustainability of the resources. In addition, social equality reinforces the need for inclusion and mutual benefits, to improve the quality of life for individuals and the community as a whole.

3.1 Sustainable use of the resources

The target species in the Marshall Islands are grouper, unicorn fish, rabbit fish, sea cucumber, lobsters and turtles. There has not been a stock assessment conducted because of the lack of technical and financial capacity. The lack of these capacities has led to an albeit small increase in assistance, meaning there is some improvement in the data collection. However, this has not resulted in a stock assessment that is country-wide.

Nevertheless, a precautionary approach is being used to manage the fishery. In using this approach, a conservation plan was designed a little more than a decade ago, known as the Reimaanlok. Reimaanlok provides the basis for sustainable development and whilst it advocates for conservation, protection, it also encourages the provision of alternative livelihoods such as aquaculture. In implementing Reimaanlok, there are stages that every outer island communities need to go through.

Specifically, the Reimaanlok eight-step process, when triggered by an atoll community's leadership (Step 1), includes: a scoping and budgeting exercise (Step 2); site visits by Reimaanlok facilitators to build awareness on the need for resource planning by the target atoll community (Step 3); the gathering and analysis of various natural and social resource data parameters (Step 4) in order to design (Step 5) and ultimately legislate (Step 6) an integrated atoll resource management plan inclusive of programs to ensure ongoing monitoring and adaptive management (Step 7); and lastly, local commitment retention (Step 8).

Given the specific needs and unique circumstances of atoll municipalities, the Reimaanlok facilitation consortium known as the Coastal Management Advisory Council (CMAC) may follow these eight steps in a linear or iterative process. This helps foster a sense of trust and shared purpose within the community and of the Reimaanlok facilitators so that the process itself is an empowering experience for atoll communities and a vehicle for national cohesion and shared purpose among members of CMAC.

3.2 Economic viability of the fishery

The local communities depend heavily on the marine resources for sustenance and livelihood. According to Gillet (2016), who has written a report on fisheries in the economies of the Pacific Island countries and territories and commissioned by the South Pacific Community (SPC), the coastal fishery catch is attributable to about 30 percent commercial and 70 percent subsistence. The increase in commercialization from a study done in 2009 by Gillet is based on the improved data collected by MIMRA. Aquaculture also plays a significant role in the commercial activities of the coastal fishery:

Table 1. Annual Fisheries and Aquaculture Harvest in the Marshall Islands, 2014

Harvest Sector	Volume (mt, pcs where indicated)	Value (US$)
Coastal Commercial	1 500	4 350 000
Coastal Subsistence	3 000	6 000 000
Aquaculture	10 000pcs	50 000
Total	**4 500 mt and 10 000pcs**	**10 400 000**

Source: Gillet, 2016

In the case of the coastal communities, MIMRA buys catch from outer islands and sells it to the local market. The reliable collection of the catches indicates that local communities in the outer islands have increased their catch over the past decade and that communities rely heavily on the national government to subsidize transportation due to the high cost associated with the intra-island sea transportation.

The increased commercialization of coastal fishery has led to a decline of some reef fish stocks and other marine resources, which now is being addressed through the national conservation plan (the Reimaanlok). The lack of good quality data such as vessel size, duration of each fishing activity, and the characteristics of the fishing vessels, does impact on the economic viability of the resources. Coastal fisheries are largely still an informal sector in the Marshall Islands.

3.3 Social equality

Since the resources are largely held in the form of customary rights, and the community members have access to these resources, social standards are difficult to measure. Fishing has been predominantly done by males, but in recent years, women too have become involved in fishing activities. Women are still mostly involved in the gleaning and post-harvest process.

There has also been an increase in migration from outer island communities, to either the capital or to the United Sates. Under the Compact of Free Association, Marshall Islands citizens are eligible to live and work in the US. This benefit has seen an increase in outward migration of most Marshallese citizens and it has impacted on the population in the outer islands. Communities have been on the decline, and some outer island communities have not been able to recover from population decline.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

This section aims to discuss the challenges that this fishery as a whole – including fishers, processor, post-harvest stakeholders, managers, and others – has faced during the development and implementation of the current management and rights-based approach. It also discusses illegal, unregulated and underreported fishing activity.

The Marshall Islands coastal fishery is based on customary rights and is managed by taking into account the traditions and customs of resource ownership. There are many challenges being faced by the coastal communities. One of the key ones is the technical and financial capacity to conduct fisheries-related studies and assessments. Illegal, unregulated and underreported fishing activity is prevalent in the coastal areas. Issues related to geography, weather conditions and equipment play a major role in the monitoring, surveillance and control efforts.

Since the fishery is 70 percent subsistence-based, there has not been any major conflict with small-scale fishers and large-scale commercial. The fishers usually fish within a 3-mile zone from low-water mark for small-scale fishing. Conflicts have arisen during the implementation of the MPAs. The

conflicts have been between chiefs and families who have land abutting the protected areas. These are ongoing conflicts which have not been resolved.

For commercial activity, a license has to be permitted and issued by MIMRA. Since licenses are mostly for sea cucumber, aquarium trade, trochus and giant clams, monitoring and enforcement have improved. However, leakages persist. It is a major challenge for MIMRA to fully implement the laws and regulations as there are capacity issues and financial burden that MIMRA carries.

4.2 Improving fishery sustainability in the future

This section aims to provide our personal opinion about what, if anything, could be changed or improved in the management of this fishery in order to increase the fishery's sustainability, including the long-term sustainable use of the fisheries resources, economic viability, and social equitability.

The Marshall Islands coastal fisheries have many challenges and strengths, as well. Good relationships have been established between the local communities, local government and national government. This strength is drawn from the collaborative efforts of the stakeholders involved. The implementation of conservation plans have been a particular success in this regard.

However, there is a need to assess the socio-economic situation of the outer island communities in order to improve the decisions on policymaking at the national level. Investment in a technical capacity for stock assessments, fisheries economics, fisheries scientists, and - most importantly - the need to improve data collection build the foundation for thoughtful decision-making. The need to invest in alternative livelihoods such as aquaculture is mandatory, and building capacity is also a must. Research and development play a fundamental role in the coastal fisheries development. Therefore, the need to build capacity in these areas ar extremely important.

Marshall Islands held the inaugural national oceans symposium in 2017, to harmonize the existing inter-agency framework and to assess and improve the issues related to oceans. A bottom-up approach was in the design to address the objectives of the oceans conference. In doing so, an oceans policy document known as the *Guiding Principles to sustain and be sustained by our Oceans and Coral Reefs*, which covers offshore and coastal fisheries management issues and socio-economic issues, has been drafted and approved by the government. An implementation plan has been designed to assist in the implementation process of the ocean policy. Work is still in progress, but there is much room for improvement in terms of achieving equitable benefits and managing coastal fisheries resources for the outer island communities.

ACKNOWLEDGEMENT

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Volume 8

Social aspects of tenure and user rights in fisheries (human rights, right to food, gender, Indigenous Peoples, youth)

Abstract

The Global Conference on Tenure and User Rights in Fisheries 2018 took place in Yeosu, the Republic of Korea, 10-14 September 2018. Case studies were presented on a number of topics relating to tenure and user rights in global fisheries and their relation to the SDGs. Through the exploration of case studies in eight concurrent thematic sessions, the best practices, shortcomings, and challenges associated with rights-based approaches were discussed. The conference was a platform for the exchange of ideas about how to support the implementation of sustainable governance solutions to rights-based fisheries management.

This document presents case studies from Session 8 of the UserRights 2018 conference, “Social aspects of tenure and user rights in fisheries (human rights, right to food, gender, indigenous peoples, youth).” All case studies are published as submitted, with minor changes for spelling and grammar. The case studies span across various geographical and socio-economic contexts. These include:

- a mixed artisanal fishery in Spain;
- the invisible Fishers and Fish processors in Honduras;
- the involvement of women in a fishery in southern Sri Lanka;
- the fisheries and governance challenges in the Colombian Amazonian
- sustainable community fisheries management in Cambodia;
- development issues of a fishing community in Korea
- pooling period and individual operation periods in Wagu spiny lobster fishery;
- a small-scale fisheries management in southeast Sulawesi, Indonesia;
- the fishery management in Norway
- User Rights in Nigeria’s Coastal and Inland Fishing Communities;
- the upgrading of traditional fisheries management in Indonesia
- Rights-Based Fisheries to end Manta Hunting in Lamakera.
- the transition from input to output control in Korea.

Contents

Mixed artisanal shellfishery (Noia, Galacia, Spain)

Juan Manuel Gómez Blanco
Please refer to the case study presentation available at:
http://www.fao.org/3/CA2483ES/ca2483es.pdf

Garifunas in Honduras: The invisible Fishers and Fish processors

Graciela Pereira
INFOPESCA

Abstract
The Garifuna are an ethnic group descended from African slaves who were brought from what is today Nigeria to the American continent. They managed to escape to the island of San Vincent in the year 1635, where they mixed with indigenous Caribbean populations. From the Caribbean island they moved to Central America, and now there are some 600 000 people who identify themselves with the Garifuna tribe, living scattered in Honduras, Belize, Guatemala, Nicaragua, and the United States. Garifuna speak English, Spanish and the Garifuna language. Having been moved to Honduras by British authorities in 1802, their residence there dates back more than 200 years. The present study was conducted in various villages of Honduras in the Bay of Tela. The port of Tela is surrounded by Garifuna communities, several nature reserves, and the Los Micos lagoon. The living environment is a purely tropical area, and fish is the basic ingredient in Garifuna nutrition. In addition, fishing is one of the few means of income. Living in an area of huge tourism potential and development, these communities are often displaced by tourism's growth. On the other hand, the Honduran State refuses to recognize the Garifuna as indigenous people, thus denying them the right to land and access to their traditional fish resources. Female fish processors who, since ancient times were processing the fish on the beach, are removed from their sites without financial reimbursement. Garifuna argue that they suffer from significant cultural loss through the presence of tourists and that their culture is marketed by other intermediaries. Corporations and landowners are moving forward with monocultures of oil palm, threatening food sovereignty. The proliferation of agro-industrial, hydropower and mining, and tourism projects - in addition to the presence of drug trafficking and organized crime - already caused the disappearance of some communities. This is attacking the survival of the Garifuna communities.

Keywords: Garifuna; female fish processors, right to land, right to landing sites, conflicts with the tourist industry, conflicts with other ethnic groups

1. INTRODUCTION

1.1 Description of the fishery

Garifuna fishers (mainly men) in the Bay of Tela catch demersal species (mainly snapper), mackerel and crab. Fishing is carried out almost every day in the marine areas of the Bay of Tela, but also in the Los Micos lagoon and adjacent areas.

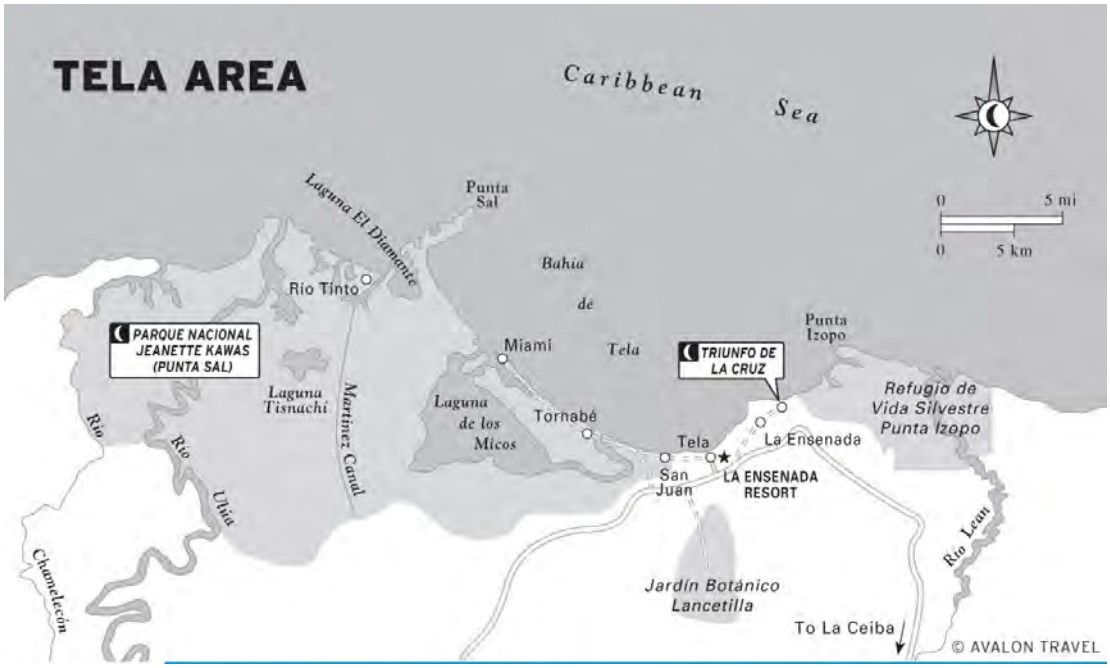

Figure 1. Bay of Tela, with the main Garifuna fishing communities in Miami, Tornabé, and Triunfo de la Cruz.
Source: AVALON TRAVEL.

Fishing gears used are gillnet, trammel nets, traps (for the crab fishers), as well as hand lines and harpoons. Garifuna women play a fundamental role in marketing and in the preparation of products. This serves as the fundamental basis for family support.

1.2 Economic contribution and social implications of the fishing activity

Garifuna society is a matriarchate, where women are running the family. In the Bay of Tela area, the main activity of the women is fish processing - salting, drying and smoking, in line with the traditional African products. These products, together with some fresh fish, are sold at the Tela communal market. The income from sales is practically the only income for the families. The traditional processing areas, as well as the traditional landing sites, are in an area being taken over by the development of tourism, forcing out the Garifuna settlers.

The economic contribution of fishing activities carried out by the Garifuna is the fundamental basis for the survival of this group. Apart from representing a primary source of income, fish and fish products are one of the main protein sources for the members of the Garifuna living around the Bay of Tela. In this context, the source of food and income are closely linked to the tenure of lands, ancestrally occupied on the coastal fringes and, in the light of the tourist start-ups, agriculture is increasingly put at risk.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

Overfishing in the maritime areas and the Los Micos lagoon puts at risk the survival of this fishery and consequently, the future of these communities. Overall, the management system does not seem to be very efficient, and overexploitation of the main species is a reality.

Several public and private institutions are involved in the management of resources, which is of extreme complexity, but the role of the Garifuna fishers is not recognized by the authorities.

In addition, there are conflicts with resident fishers in the lagoon, descendants of the Spaniards (called Latinos). The Los Micos lagoon is under co-management by the resident fishing communities. However in assigning the fishing rights, the State and the regional fisheries authority considered only the resident fishers on the coast of the lagoon, while the Garifuna fishers, mainly resident in Miami (the marine tip of the lagoon), were not considered in fishing rights / co-management arrangements. This is despite the fact that they have been fishing the lagoon resources since ancient times.

2.2 Brief history of former rights-based approaches used in the fishery

The fisheries in the marine areas of the Bay of Tela are open access in nature, while the Los Micos lagoon is managed by the authorities and the local Latinos communities. In the lagoon fisheries, the Garifuna community are not considered as residents, and are therefore excluded from the fishing rights.

2.3 Rights-based approach: allocation and characteristics

Garifuna communities are not considered rights owners, either for the fishery resources or for the land at the landing sites, where the communities have been residents for decades if not centuries. Tourist developments eliminate the possibility of fishers to access their traditional fishing areas, while the women lose their traditional places of fish drying, not to talk about the traditional housing of the communities.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

As mentioned, the lack of a resource management system and absence of effective public policies is notorious, with possibly severe consequences for the fisheries of the region and, more specifically, the fisheries of the Garifuna communities around the Bay of Tela. However, fishing is not only a source of food and money – it is also based on the ancient culture of these people.

3.2 Economic viability of the fishery

Until 1992, with the exception of Trujillo, Garifuna communities had the right to the land where they were resident. In that year, the Honduran Government issued a new law for modernization and development of the agricultural sector, which refuses to recognize their status as Indigenous People and deny their right to land. This decision puts the Garifuna communities into an impossible situation - their economic viability is practically wiped out.

3.3 Social equality

The Garifuna are often marginalized by society, struggling with severely limited access to education and employment. The denial of the right to land has put the Garifuna communities into an unequal situation when comparing them to agricultural people or lagoon fishers of the Latino community. The cultural aspects of the Garifuna fishing communities are jeopardized, as their traditional residential areas are attractive places for tourist developments. In fact, one community has been displaced by a new resort building.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

The Garifuna fishing tradition is at risk for various reasons:

- Overexploitation of the traditional resources;
- Exclusion from management discussion, as not recognized as stakeholders by the State;
- Displacement by touristic development, including access to the traditional landing sites;
- Displacement of female fish processors from their traditional fish processing places;

- Problems with the quality of fish products, as they have to travel further in order to be sold or processed;
- Loss of culture based on fishing and fish processing; and
- The fault of rights lead the younger generation into crime, drug dealing, and prostitution.

4.2 Improving fishery sustainability in the future

Garifuna communities have to be recognized by the State as rights owners, both to the traditional fishing grounds and to the land areas close to the traditional landing sites. The Garifuna must be included in stakeholder meetings on co-management of the declining fish resources, and they must also become more visible in the governmental discussions.

A special commitment has to be dedicated to the female fish processors of the Garifuna communities around the Bay of Tela. Their rights to process the fish in the areas since ancient times dedicated to this commercial activity are jeopardized. Being women in an overlooked social group, they are even more at risk of losing their traditional rights. In fact, in various coastal places, their fish processing stalls have been replaced by touristic installations. This displacement has an impact also on the quality and health aspects of the fishery product.

4.3 Lessons learned

There are several lessons that are learned from this experience:

- Communities that have been resident at landing sites for a very long time, and who are using the resources, should be considered as indigenous people, and their rights should be recognized.
- The culture of the community, the origin of the community, or the colour of the skin should not be a reason to exclude fishers and fish processors from the right to the resource and the right to land.
- Tourist investments can be attractive, but the right to the land of the resident population and their culture has to be protected.
- Making people become invisible and without rights only helps crime and exploitation.
- In roles overlooking a community, women become even more invisible without rights.

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Women's involvement in Fisheries on Socio-economics in a Coastal Fishing Community in Ambalangoda, Southern province of Sri Lanka

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Abstract
The present study was carried out to evaluate the impact of the involvement of women in fisheries on the socio-economics of fisher households in Hirewaththa and Patabandimulla, two fishing villages in Ambalangoda, Southern province of Sri Lanka. Households for the study were selected after a preliminary survey. Households were separated into two categories based on the level of women's participation in fisheries. One hundred households from each category were randomly selected, and the information was collected using a questionnaire survey. The categories were families in which women were involved in fisheries (WIF families) and families in which women were not involved in fisheries (WNIF families). Information was collected on socio-demographics such as civil status, religion, family size, the literacy level of women, school attendance of children, nature of the house, daily activities of women, household income. Other knowledge acquired was on the willingness to participate in fishing activities, whether people were descendants from fishing families and existing barriers and opportunities in fishery activities. The results indicated that there were significant differences between the two groups with regard to family size composition, literacy level, education of the children, monthly income, regular liquor consumption, habits of husbands and loans taken from the banks and repayments ($p < 0.01$). Housing conditions of two categories showed significant differences ($p < 0.05$). No women in the village engaged in pre-harvest activities and the catching of fish. Of the women involved in fisheries, about 44 percent involved themselves in fish processing activities such as gutting, salting, sun drying and *jaddy* preparation, around 70 percent of which involved in gutting fish. About 12 percent were involved in marketing the catch, 26 percent in removing fish from the small meshed gill-nets, and ten percent in collecting fish into transportation baskets. The balances involved in the ancillary support services, five percent of women engaged in providing foods and three percent of women engaged in supply fuel for the boats. The labour of women involved in salting and drying and collecting fish into transportation baskets was found to be exploited through gender discrimination. The present study indicated that, even though the WIF households earn a higher income, living conditions in WNIF households were similar. This may be mainly due to the low literacy rate, large family size composition, and loans taken from the bank among the women involved in fisheries. This suggests it is necessary to carry out social development programs in order to enhance living standards.

1. INTRODUCTION

1.1. Description of the Fishery

Sri Lanka is an island state in the Indian Ocean, south-east of the Indian sub-continent between latitudes 6-10º N and longitudes 80-82º E. The island is approximately 66 000 km^2 with a coastline that's 1 340 km in length. Sri Lanka claims sovereign rights of approximately 22 300 km^2 of Exclusive Economic Zone (EEZ) of the Indian Ocean. There is evidence that shows freshwater fish have been harvested in Sri Lanka since ancient times (Wickramasinghe, 2001).

The Fishery sector provides 60 percent of the total animal protein (Fisheries Industry Outlook, 2016) consumed in Sri Lanka. This sector can be divided into three sectors; marine, brackish water and freshwater fisheries. Marine fisheries in Sri Lanka can be broadly categorized into coastal and offshore fisheries. The coastal fisheries can be further divided into pelagic and demersal fisheries. Coastal fisheries still account for about 67 percent of the marine fishes caught, but there are some

uncertainties regarding further expansion in coastal fishing activity (Wijayaratne, 2001).

As a whole, the fishery sector provides full-time employment for around 120,000 persons and accounts for 1.3 percent of the Gross National Production (GNP). Exports of fish and aquatic products were valued at around 178 million USD in 2016 (Fisheries Industry Outlook, 2016). Marine fisheries contributed over 90 percent of the total national fish production of 456 990 tonnes in 2016, of which 274 160 tonnes were from the coastal fisheries subsector. The offshore and deep-sea fisheries are still in a development stage - production amounted to 182 830 tonnes (in 2016 Fisheries Industry Outlook, 2016).

The coastal fisheries are confined to waters of the relatively narrow continental shelf and its slope area. This is 22 km wide on average and rarely exceeds 40 km. The total area of the continental shelf is about 26 000 km^2, which is approximately 11 percent of the Sri Lankan EEZ (Fisheries Industry Outlook, 2016). Of the variety of gear used, small-mesh gill nets and beach seines are the main methods used for exploitation of small pelagic fish in the island. Gillnets contributed over 80 percent of the landings, while beach seines account for most of the remainder (Maldeniya, 1997).

1.2 Economic contribution and Social implications of the Fishing Activity

The fishery sector provides a livelihood for the majority of people living in the coastal belt and around irrigation tanks and reservoirs. The sector currently provides direct employment to about 650 000 people, comprising 150 000 who are engaged in fishing, 100 000 people in service activities and 400 000 people in fish trade (Fisheries Industry Outlook, 2016). There are at least 1 337 fishing villages in the marine sector, with 1 289 in the inland sector. A total of about 2 626 villages considered their main income to be derived from fisheries. This implies about 132 600 households in marine fishing villages and 11 920 households in inland fishing villages - a total of about 144 520 fishing households for the country as a whole. The marine sector accounts for 85 percent of the employment in the fisheries sector. About 250 000 people are actively engaged in fishing in the marine, inland and aquaculture sectors, and another 100 000 persons are believed to be indirectly employed in fisheries, especially in marketing and other ancillary services (Fisheries Industry Outlook, 2016).

1.3 Role of Women in Fisheries

Women are engaged in a wide variety of activities in fisheries throughout the world. These include pre- and post-harvest activities, as well as actively catching fish. The pre-harvest activities include some skilled and time-consuming jobs that take place onshore, such as net mending and net preparation. In addition, women help in carrying nets and other fishing gear to the shore. When catching fish, most of the time they use small implements, wading and gleaning the shores and lagoons for shellfish and seaweeds. Sometimes they serve as crew members and also own fishing vessels (Saison *et al*., 2002). The post-harvest activities that women are involved in include the processing and marketing of catch. Many women serve as workers in seafood processing plants. Other post-harvest activities that women are involved in include fish sorting, icing, packing, loading fish into transport vehicles, smoking and drying. When marketing the catch, women vendors are capable of maintaining secured buyers and establishing marketing networks.

Women in many countries are involved in aquaculture and inland capture fisheries. Sometimes, women of fisher families work in non-fisheries sectors and earn supplementary income for their families (Sverdrup and Jensen, 2002). Many women engaged in fisheries have organized themselves into various societies and are members of fish worker movements and fishers organizations. Women also contribute to the fisheries sector by developing knowledge on fisheries through research and imparting knowledge through teaching. As such, they help to address the global problem of food security (Saison *et al*., 2002).

While directly involved in fishery-related activities, women continue to take care of the family, whilst maintaining social networks and a community culture. They have not changed the gender-based household division of labour even with the diversification of physical, economic and social environments and circumstances. Due to their economic contribution, they play a vital role at all levels of the fishery chain.

However, women's role in fisheries appears to be largely invisible and unacknowledged. Although women make up the majority of workforce in fish-processing plants, they are mainly involved in low grade, unskilled jobs. They are largely unwelcome in marine capture fisheries also. Usually, women from poor fisher households are involved in fishery-related activities. Women also lack opportunities to hold managerial and decision-making positions on many occasions (Saison *et al*., 2002).

It has been estimated that more than 50 million women are engaged in fisheries throughout the world (Sothirak, 2002). Women are involved in the sorting, gutting and processing of fish in many coastal areas of Sri Lanka. Sometimes, they help their husbands to drag boats ashore. Women in coastal areas of Sri Lanka are involved in beach seining, and some women in those areas own beach seines and boats (Saison *et al*., 2002). Women are also involved in wholesale and retail marketing of fish throughout the island. Sometimes, they supervise the marketing of catch. Although the fishery-related activities that women carry out in Sri Lanka are documented (Saison *et al*., 2002), their contribution to the fisheries sector has not been studied in detail. There is a shortage of literature regarding systematic studies of the contribution of women to fisheries in Sri Lanka.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the Fishery

A separate Ministry of Fisheries was established in 1970, which became the primary fishery policy-making body and after 2000 became Ministry of Fisheries and Aquatic Resources Development.

The central government Ministry of Sri Lanka is responsible for fisheries. It formulates and implements the national policy on fisheries and aquatic resources development and other subjects which come under its purview. In general, promotion, development and management of fisheries in Sri Lanka is the responsibility of the Ministry. It also performs regulatory, extension, research, training and welfare functions in support of the fishing industry, through a number of specialist departments and institutions.

The Department of Fisheries and Aquatic Resources governs under the Ministry of Fisheries and Aquatic Resources Development and is responsible for developing and managing living aquatic resources in Sri Lanka. The Fisheries and Aquatic Resources Act, No. 2 of 1996 is the principal legal instrument governing the fishing industry of Sri Lanka. This Act replaced the Fisheries Ordinance of 1940 and all the amendments to it. It provides for the management, regulation, conservation and development of fisheries and aquatic resources in the country.

2.2 Brief History of the Former Right-based Approaches used in the Fishery

In Sri Lanka, women play an important role in fish processing and marketing. They also normally assist their fisher husbands in sorting the fish at the landing sites and in repairing nets, while handling the family budget. In fishery organizations such as Rural Fisheries Organizations, women make up about a fifth of members. The Fisheries and Aquatic Resource Act No. 2 of 1996 and Amendment No. 35 of 2013 provide a basis for involving fishing communities in decision-making processes. Women are represented on the Advisory Board to the Fisheries Minister. The coastal fisheries sector is vulnerable to climate change and disaster risks, including sea-level rise, floods and droughts, which can destroy the properties of fishing communities and also affect the fishery resources. Other risks and constraints in the small-scale coastal fishery include safety at sea issues because of unsafe boats, limited access

to markets, poor infrastructure (including sanitary and drinking water facilities), and a lack of alternative livelihoods and youth employment opportunities.

However, there are also strengths and opportunities: the Ministry of Fisheries and Aquatic Resources has a relatively strong institutional network, with regional fisheries officers covering all coastal districts. One of the Ministry's objectives is to improve the nutritional status and food security of the population, and there is a three-year fisheries development plan focusing on averting malnutrition. Some of the areas in the FAO's Small-Scale Fisheries (SSF) Guidelines are already being addressed, and the Ministry's vision and mission is to increase fish production and fish consumption while improving the socio-economic conditions of fishing communities. The SSF Guidelines will be an important tool for supporting these processes.

In Sri Lanka, the role of Civil Society Organizations in the SSF Guidelines development process was critical, and three dedicated consultations were held: one on marine capture fisheries, one on inland fisheries, and one on women in fisheries. Civil Society Organizations also play a particularly important role in making complex principles like those in the SSF Guidelines accessible to SSF communities.

2.3 Right-based Approach: Allocation and Characteristics

On the south-west coastal line in Sri Lanka, there were 62 fishing villages and a total fishing population of 24 500. The fishing community in Ambalangoda on the south-west coast consists of about 395 households (2 066) persons and has an active fishermen membership of 275 engaged in the coastal fisheries. About 37 fishermen migrate each year from the south coast to the northwest coast during some of the northeast monsoon months. The number of persons employed in activities ancillary to fishing such as marketing, fish curing, boat building, etc. is estimated to be 134. The employment in ancillary activities is shown in Table 1.

Table 1. The Employment in Ancillary Activities to Fishing.

Employment in ancillary activities	Activity No. employed
Marketing	75
Boat building	15
Net mending	28
Ice making	17
Fish processing	49
Total	**134**

Before the Tsunami disaster, 44 percent of fishing households did not own any boats or fishing equipment and provided only labour. Forty percent owned fishing craft, while the balance owned fishing gear only. After the disaster, however, most of the Government and Non-Government organizations donated fishing gears and crafts as subsidies. The above percentages have been seen to increase by 60 percent.

The average monthly income of the fishing households is estimated to be around from USD 100-200, with an average monthly expenditure of USD 150. The major part of the income is spent on food and repayment of debts, whereas substantial amounts are spent on alcohol, tobacco, gambling, and kerosene for cooking and lighting. The expenditure on children's education and clothing is minimal. Additional sources of income in this area include toddy tapping, manufacture and sale of handicrafts by the women, and coconut fiber-based cottage industries.

Hirewaththa and Patabandimulla are two fishing villages (6° 23'N; 80° 06'E) in Ambalangoda (Plate 2.1) on the south-west coast of Sri Lanka selected for this study.

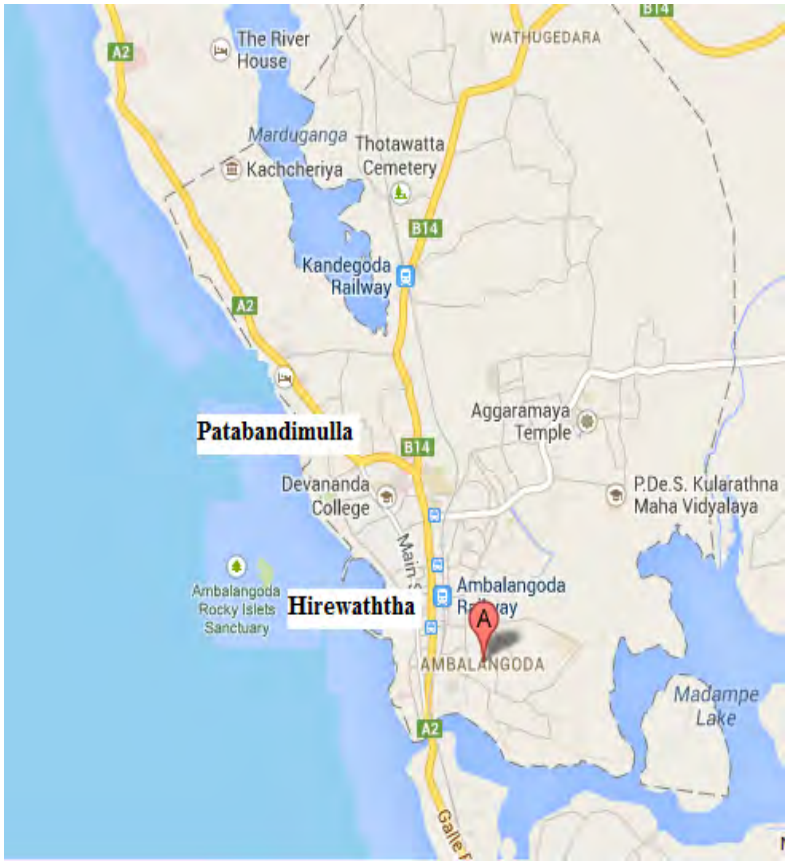

Figure 1. Experimental Location.
Source: Google maps.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the Resources

The extent of Sri Lanka's EEZ is about 517 000 km^2, around 5.7 percent of which is covered by the continental shelf with an average width of 22 km. The coastal fisheries subsector in this continental shelf area produces about 50 percent of total annual fish production. In the offshore and deep-sea fisheries subsector, multi-day boats are operated, and the major fishing gear types are drift gillnetting and long lining. There has been a recent trend that crew members of some multi-day boats (especially in southern Sri Lanka) operate surrounding nets to catch fish. The major species caught are *Decapterus russelli*, *Elagatis bipinnulata*, *Coryphaena hippurus* and *Abalistes stellatus*.

3.2 Economic Viability of the Fisheries

3.2.1 General Economic Over View of Fishery Village

The income from fishing is also subjected to fluctuations, along with uncertainties of the duration of fishing trips (uncertainty of the boats returning on a particular day). The women are confronted with a high risk of falling into financial crises. A large number of women were engaged in earning income from various activities such as rope making, fish drying, selling prepared food items, sewing and selling garments, etc. Since fishing and non-fishing income are not correlated, women's involvement in earning an income could be seen as an important strategy adopted to smooth consumption when fishing incomes fall short of family consumption needs. The present study also revealed that revolving credit schemes like '*seettu*' and spend on activities would strengthen inter-family ties. Women also resort to intra-family adjustment strategies when they are confronted with income shortfalls.

The monthly income of WIF families was USD 100–150 and the average monthly income was USD 125. The income of the WNIF fisheries was USD 100–150 (Figure 2). This difference was statistically significant ($p < 0.05$). The income of the WIF families was significantly higher than that of the WNIF families to the simple reason that both husband and wife were earning an income. Since the present study was carried out during the southwest monsoon period, the average income levels of both categories may be different from the values of the present study when the entire year is considered.

3.2.2. Fisheries Activities of the Fishing Families

The women in this area were not involved in pre-harvest activities such as net mending and net preparation as well as catching fish. However, they were engaged in many post-harvest activities, including removing fish from small meshed gill-nets, collecting fish into baskets, fish processing and fish marketing (Figure 2).

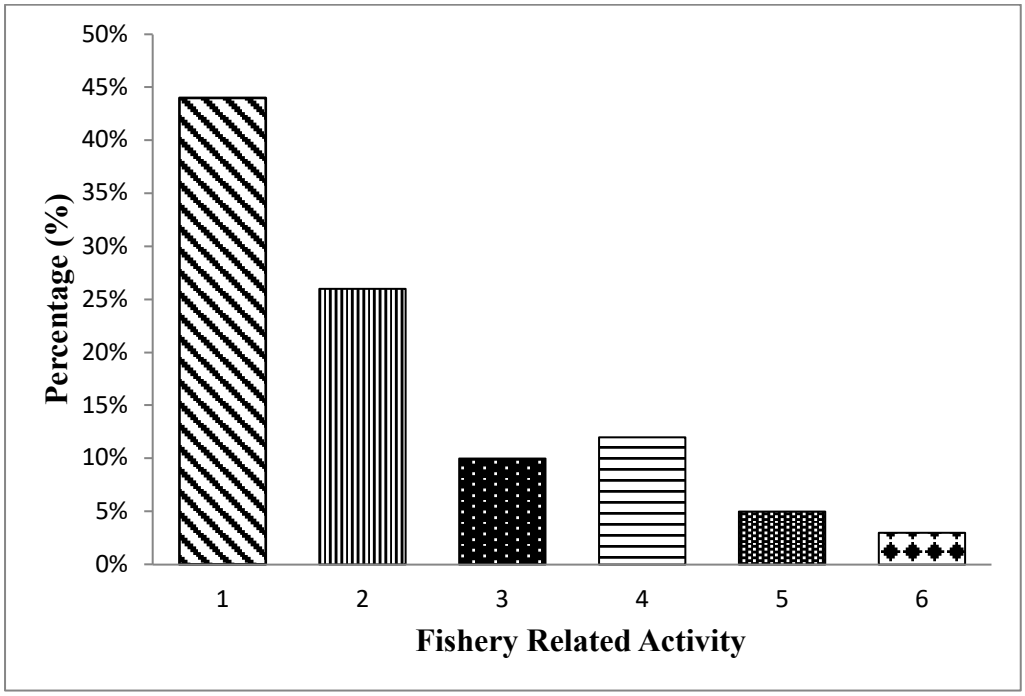

Figure 2. Percentages of Women involved in Different Types of Fishery related.
Activities 1. Fish processing 2. Removing fish from the nets 3. Collect fish into the baskets 4. Trading raw fish 5. Provide foods for boats 6. Supply fuel to the boats.

Forty-four percent of the women involved in fisheries were engaged in fish processing activities such as degutting, salting, sun drying and *jaddy* preparation, of which about 70 percent were involved in gutting fish. They work from about 7.00 a.m. to 1.00 p.m. and degut about three baskets of small pelagics, mainly *Amblygaster sirm* (Indian mackerel). These baskets, which were made up of cane, are parabolic in shape. With a diameter of about 1.2 m at the mouth and a depth of about 0.3 m in the middle, each basket holds around 400 fish. The women involved in degutting were paid USD 1 for one basketful of fish, and thus, they earned about USD 3 per day. Women involved in salting and drying fish worked from about 7.00 a.m. to 7.00 p.m., and each of them was paid USD 2.30 as the daily wage. Twelve percent of the women were engaged in marketing the catch at the market place close to the landing site. Of these 15 percent sold, large fish such as tuna were sold, whilst the others sold small fish such as mullets, carangids, clupeids etc. They purchased fish from the auction place at about 5.30 a.m. and marketing was over by around 9.00 a.m. Each of the women who sold large fish earned a profit of about 10 USD per day, while each of those who sold small fish earned a daily profit of about USD 5. Twenty-six percent of women engaged in removing fish from small meshed gill nets operating mainly for clupeids. The main species removed were *A. sirm* and *Sardinella* spp. They worked from about 5.30 a.m. to about 7.30 a.m., and each of them was paid USD 3/ day. Ten percent of women

were engaged in collecting fish into cane baskets to be carried to the auction place. They worked from about 5.30 a.m. to 7.30 a.m. and each of them was paid USD 1/ day if the catch was poor and USD 2 if the catch was good.

The women had a little involvement in the ancillary support services such as providing food and supplying fuel to the boats. Five percent of women were engaged in providing food for the fishermen, boat owners and women involved in fisheries-related activities. They started this service near to the auction place. The government had donated two stalls under the *Divi Naguma* Program for two women. They opened their stall from about 5.00 a.m. to 12.00 noon, and each earned a daily profit of about USD 4.3. About three percent of women were engaged in supplying fuel such as kerosene oil and diesel for the boats. They opened their stalls near to the boat landing places throughout the day and used part of their homes for the stall; each of them earned a daily profit of about USD 5.

Women in the Hirewaththa and Patabandimulla fishing villages, where the present study was carried out, were not involved in catching finfish or shellfish. In many coastal regions of Sri Lanka, women are engaged in pre-harvest activities such as net mending (Saison *et al*., 2002). However, in the fishing community studied, women were not engaged in such activities. Women's roles in fisheries in the Hirewaththa and Patabandimulla villages are predominantly in the fish processing and marketing sector, with little participation for ancillary support services. It has been reported the majority of the workforce in the fish processing sector in the world consists of women (Williams, 2001).

In the studied community, it was also found that nearly 50 percent of women were engaged in fish processing activities that involve low grade, unskilled jobs such as gutting, salting and sun-drying as reported by EC (2003) for many European countries.

3.3 Social Challenges

Results of the statistical analysis of socio-demographic conditions of WIF fishing families and of WNIF families are summarized in Table 2. There was no significant relationship between the civil status and the women involvement in fisheries ($p > 0.05$) (Figure 3).

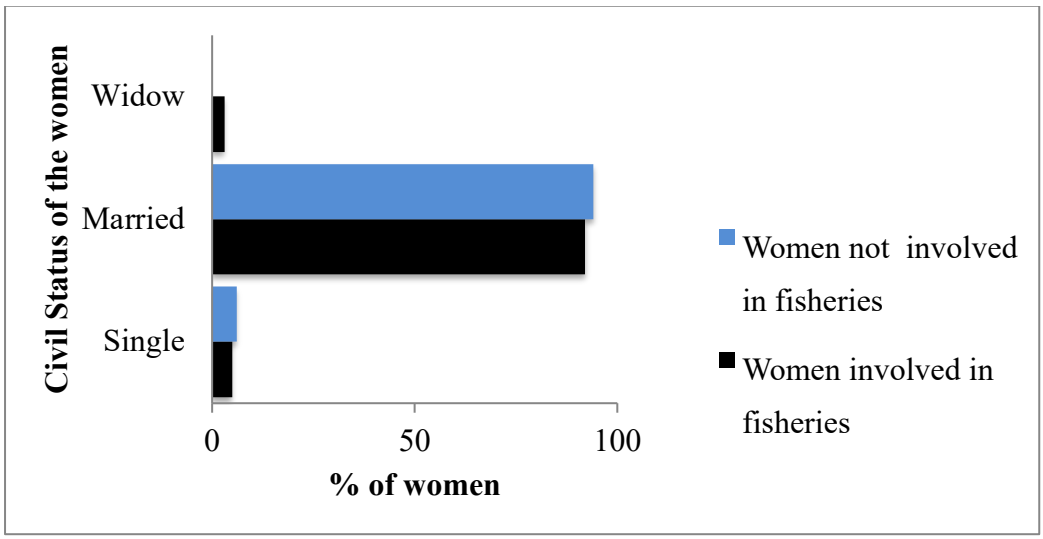

Figure 3. Civil Status of women involved in fisheries and women not involved in fisheries.

Table 2. Demographic Characteristics of the Two Study Groups.

Characteristic	Women involved in fisheries (n = 100)	Women not involved in fisheries (n = 100)	Significance Level
Civil status			
Single	05	06	Not sig.
Married	92	94	
Widow	03	00	
Religious Affiliation			
Roman Catholic	98	100	Not sig.
Hindu	02	00	
Family size			
Composition 4 or <4	23	82	P < 0.01
Composition >4	77	18	
Literacy			
Able to write and/or Read	32	98	P < 0.01
Not able to write and/or read	68	02	
Education of the Children			
Having School going children	42	68	P < 0.01
Not having School going Children	18	00	
Housing			
Living in a rented house	29	02	P < 0.05
Living in an own house	71	98	
Income (Monthly)			
US$. 50 -100	28	67	P < 0.01
US$. 100 -150	72	33	
Family (the woman)			
Descendant of a fishing family	90	98	Not Sig.
Not a descendant	10	02	

Age of the women in the study population ranged between 19 to 55 years while the younger age group, 21-25, was dominant. Civil status of the women involved in fisheries indicated that 92 percent of the women were married, five percent were single, and three percent were widows. In the group in which women were not involved in fisheries, 94 percent were married, and 6 percent were single. There were no widows in this group. Thirty-five percent of women got married before they reached 18 years of age in both categories and 5.2 percent of women in the age group of 15-19 had entered matrimony.

There was a significant relationship between family size and the women's engagement in fisheries ($p<0.01$) (Figure 4).

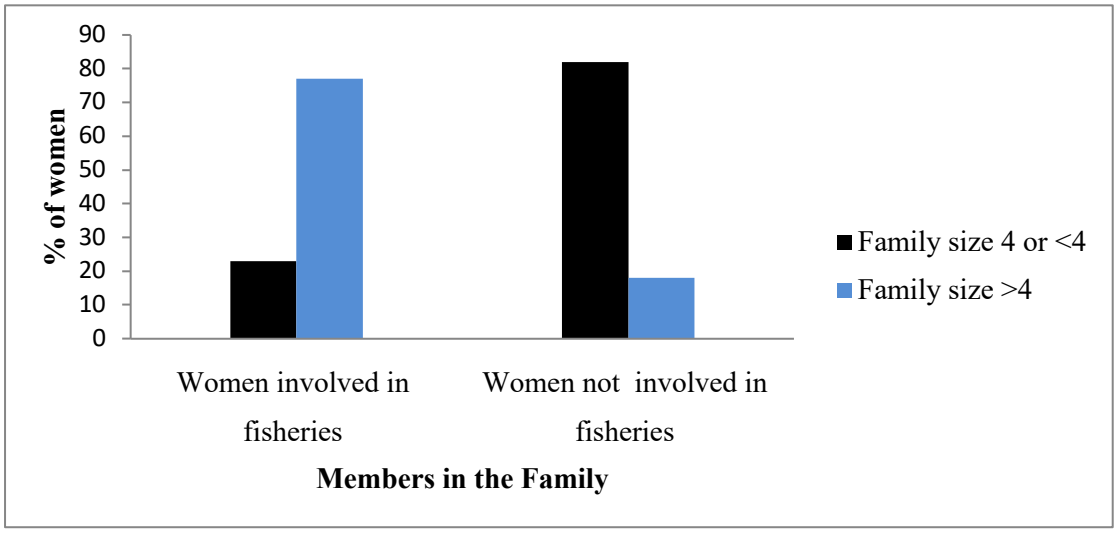

Figure 4. Family size of the study population.

Seventy-seven percent of the WIF families and 18 percent of the WNIF families had family sizes of more than 4 members. Eighty-two percent of the WNIF families and 23 percent of the WIF families consisted of 4 or <4 member families.

Religious affiliation of the families studied indicated that 99 percent of the families were Roman Catholics (Table 2); the other one percent were Hindus. They had migrated from Batticoloa due to migrating fishing activities. There was no significant relationship between religion and the women involvement in fisheries ($p>0.05$). 94 percent of the women of the studied community were descendants of fisher families (Table 2). There was no significant relationship between women involvement in fisheries and the fact that they were descendants of fishing families ($p > 0.05$).

It was evident that the ability to write and/or read among women, and their involvement in fisheries, has a close relationship. The number of women who can write and/or read was significantly higher among those not involved in fisheries than those involved in fisheries ($p < 0.01$) (Table 2).

Most of the fishery-related activities in which women were involved require unskilled labour and – even without an ability to read and/or write – they can be employed. There was found to be a literacy rate among women not involved in fisheries; this may be the reason for the high rate of attending school of their children.

There was a significant relationship between women involvement in fisheries and children attending school ($p < 0.01$), too. In both categories, the number of families in which children were going to schools was higher than the number of families in which children were not going to schools. Among

the WNIF families, there was not a single-family with children of school-going age who were not attending schools (Table 2). Forty-two percent of children were attending school in the WIF families. Thirteen percent of the children of the studied community belonged to 1-5 years age category, 18 percent of the children were 6-11 years age category, and 11 percent of the children were in the 12-18 years age category. Sixty-eight percent of children were attending school in the WNIF group. Twenty-nine percent of the children of the studied community were in the 1-5 years age category, 17 percent of the children were between 6 and 11, and 22 percent of the children were 12-18 years age category. Forty percent of children in WIF families and 32 percent of children in WNIF families had left school at the age of 16, going on to marry and enter jobs.

However, it appears that, although the percentage of illiterate women among those who were involved in fisheries was high, most of them try to educate their children. Therefore, the percentage of families with children who were not going to school was low in this category too.

According to available socio-demographic data, there was a significant relationship between the proprietorship of a house and the women involvement in fisheries ($p < 0.05$). In both categories, the number of families living in their own houses was higher than those living in rented houses. Ninety-eight percent and 71 percent of the families in which women were not involved in fisheries and women involved in fisheries where living in their own houses respectively. Twenty-nine percent of the families live in the rented houses where women were involved in fisheries because these families were affected by the Tsunami. Even though the government has provided them with new houses, they were situated further away from the coast. Therefore, they have sold these houses and are living in rented houses in close proximity to the beach.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the Fishery

4.1.1 Housing Conditions

Based on the physical nature, the houses of the fisher community could be divided into two groups, i.e., the houses with cemented floors and asbestos or galvanized sheet roofs, and the houses with cemented floors and tiled roofs, with the latter part covered by thatched coconut fronds. In both categories, the number of families living in houses with cemented floors and asbestos or galvanized sheet roofs was higher than those living in houses with cemented floors and tiled roofs covered with thatched coconut fronds. Most of the families affected by the Tsunami have received asbestos or galvanized sheets as subsidies, in order to construct their roofs. Forty-four percent of the women involved in fisheries and 96 percent of the women not involved, were living in houses with cemented floors and asbestos or galvanized sheet roofs. Four percent of the families in which the women were not involved in fisheries, and 16 percent of the families in which women were involved in fisheries, lived in houses with cemented floors and tiled roofs, with the latter part covered with thatched coconut fronds (Figure 5).

All households in the fishing community had access to pipe-borne water. However, 78 percent of households in which women were not involved in fisheries had their own water supply, whereas 88 percent of the other category shared a common pipe by the roadside (Figure 5). A statistically significant relationship was observed between the availability of electricity in the household and women's involvement in fisheries. About 96 percent of the households where women were not involved in fisheries had electricity, while only 58 percent of the households of the other category had this facility (Figure 5). The relationship with TV, Radio and telephones, as well as computers available in the houses and the women involvement in fisheries or not, were analyzed. Of the households where women were not involved in fisheries, about 100 percent had TV, Radio and telephones, and 10

percent had computers. Of the households where women were not involved in fisheries, about 41 percent had TV, Radio and telephones, and two percent had computers (Figure 5).

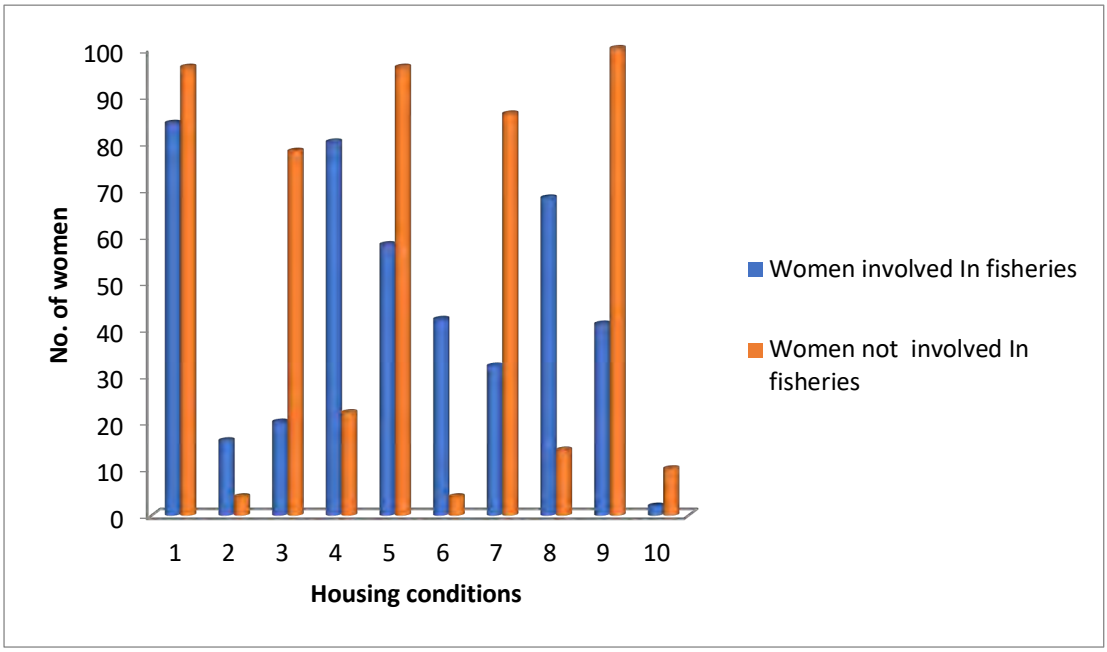

Figure 5. Housing Conditions of the Two Study Groups.
1. Houses with cemented floors and Galvanized/ Asbestoses sheets 2. Houses with cemented floors or tile roof and later part thatched roof 3. Houses with separate pipeline 4. Share the common tap 5. Houses with electricity 6. Houses without electricity 7. Used LP gas or kerosene for cooking 8. Used fire-wood for cooking 9. Availability of TV/Radio/telephone 10. Availability of Computers

The sources of energy used for cooking in the studied community were LP gas, kerosene and fire-wood. Of the WIF households, about 68 percent used fire-wood and the rest used kerosene for cooking; none of them used LP gas. Of the WNIF households, about 12 percent used LP gas, and about 74 percent used kerosene for cooking. About 14 percent of women not involved in fisheries used fire-wood. A relationship was noted between the source of energy used for cooking and women's involvement in fisheries (Figure 5). Most of the fishers in the study, regardless of the involvement of women in fisheries, live in houses of fairly good condition. As such, there is no significant relationship between the nature of the house and women involvement in fisheries. However, a majority of WIF households were without electricity, used fire-wood for cooking, and shared a common tap by the roadside.

Meanwhile, the majority of WNIF households had electricity, used LP gas or kerosene for cooking, and had their own pipeline. Therefore, the families where women were involved in fisheries, although earning a higher income, appear to live in a more traditional way. WNIF families, on the other hand, although receiving inferior income, appear to live in a more sophisticated manner. This may be due to the high literacy rate among the women who were not involved in fisheries.

4.1.2. Alcohol use in the Family

Husbands of all women in the studied community consumed liquor. However, in 76 percent of the WIF families, husbands were regular consumers of liquor, while the rest were occasional consumers. However, in WNIF families, only 16 percent of husbands were regular consumers, with 84 percent being occasional consumers (Table 3). As such, there was a relationship between the involvement of women in fisheries and consumption of liquor by husbands. All the women interviewed denied that they consume liquor.

Table 3. Alcohol use in the Family.

Alcohol use	Women involved in fisheries (%)	Women not involved in fisheries (%)	Significance Level
Husband was a regular consumer of liquor	76	16	P < 0.01.
Husband was an occasional consumer of liquor	24	84	

It appears that liquor consumption by husbands is low when women are not involved in fisheries. The reasons for this may be the low income and high literacy rate among women of these households.

4.1.3 Loan had taken from the Banks

There was a significant relationship between the women who have taken bank loans and the women involved in fisheries ($p < 0.01$) (Table 4). Seventy-nine percent the women involved in fisheries and 32 percent of the women not involved in fisheries had taken loans from the banks ranging from USD 50 to 200. Both categories have not paid back their loans. Twenty-one percent of the WIF group and 34 percent of WNIF group had not taken loans.

Table 4. Loans from the Banks.

	Women involved in fisheries (%)	Women not involved in fisheries (%)	Significance Level
Taken loan from the bank			
Yes	79	32	P < 0.01
No	21	68	

4.1.4 Low Income and Gender Discrimination of the Fishery related Activity

The income of women engaged in degutting was more or less equivalent to the daily wage of a male casual labourer. A male casual labourer working for 8 hours per day was paid only USD 6.6 during the period of this study. Therefore, it cannot be considered that the labour of women involved in gutting fish is exploited with gender discrimination. After 1.00 p.m., these women go back to their homes and spend the rest of the day with the family, attending to day to day activities of the household. However, women labour of those involved in salting and sun-drying appears to be exploited by employers with gender discrimination. In addition, they did not have much time to spend with their children and attend the day-to-day activities of the household.

The work of women involved in removing fish from gill nets also appears to be not exploited by employers through gender discrimination. However, the labour of those involved in gathering fish into transportation baskets appears to be exploited with gender discrimination when the catch is poor.

This may be the reason that a low number of women are engaged in activities such as salting, drying and gathering fish into transportation baskets.

In many countries throughout the world, women are involved in marketing the catch. Compared with other fishery-related activities, marketing the catch appears to be the most lucrative activity, as the women engaged in marketing earn the highest income for the time they spend. Most of these women were over 50 years of age and supported extended families. Husbands of some of these women were not employed, and the entire family depended on the income earned by them. Many widows were also engaged in fish marketing. Therefore, it appears that economic demands have diversified their roles, although they have not changed the gender-based, household division of labour. Such complex demands in women's labour due to changing economies and social environments have been experienced in many countries.

4.2 Improving Fisheries Sustainability in the Future

The problems faced by the women who were involved in fisheries in these two areas are multi-faceted with various manifestations. There were also specific problems such as: lack of financial assistance and insurance schemes for fisheries families from the government; illiteracy; poor sanitation conditions and lack of infrastructural amenities like medical attention, pipe-born water, electricity etc.; lack of fisheries extension services; lack of credit and capital facilities, and lack of Government presence during unexpected disasters. In addition to these, the major constraints faced by the women are non-involvement in the decision-making process, some cultural practices, and an absence of organized markets.

In conclusion, the present study indicates that the WIF households earn a higher income than WNIF households do. However, even with the higher income, it appears that the living conditions of WIF families were not better than those of the other category. This may be mainly due to low literacy rate, large family size and the higher number of loans taken from the bank among the women involved in fisheries. Therefore, it is necessary to carry out programmes on social development, financial handling and communication skills, development programmes to educate them and to enhance their living standards. Adult education, post-harvesting and marketing programmes – conducted with the help of universities, NGOs and governmental organizations – would be very useful in this regard.

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Fisheries and governance in the Clombian Amazonian Trapeze: Challenges during environmental crisis time

Liseth Escobar Aucu

Please refer to the case study presentation available at:
http://www.fao.org/3/CA2486ES/ca2486es.pdf

Sustainable community fisheries management: a case in Cambodia

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Abstract
In Cambodia, fisheries are predominantly small-scale, utilizing almost the entire inland waters. The livelihoods of millions of rural people depend greatly on fisheries and fisheries-related activities. In 2001, small-scale fishers were granted new user rights with the revised legal framework from the Cambodian government to fish in their exclusive fishing zones, which would improve their livelihood and encourage participation in sustainable fisheries management. In total, 516 community fisheries (CFi) have been established throughout inland and marine waters. There are only 39 CFi in the coastal area. This study presents the case of Koh Keo CFi in Tonle Sap floodplain, Kampong Chhnang Province. Despite some challenges in the implementation of CFi management, it is the way toward maintaining sustainable fisheries and an equitable distribution of fishery resources. Community fishers play very important roles in fisheries management and conservation. The study also discussed the impact new user rights had on community fishers and their livelihood.

1. INTRODUCTION

1.1 Description of the fishery

CFi fisheries in Koh Keo, Kampong Chnang Province, Cambodia, are the freshwater lacustrine and floodplain fisheries, covering the area of 1 200 hectares (ha) in Tonle Sap floodplain, Cambodia. The fishing activities take place mainly in their own community fishing ground Koh Keo in Svay Chrum Commune, Roleab Ear District, Kampong Chhnang Province. The fisheries take mainly small-scale or family subsistence forms, arranged under CFi co-management between the government and fishing community. They target multiple species, commonly capturing 55 species for family consumption; the surplus is for currency exchange. Most of the fish species caught every year are small, cyprinid species. So far, there is no scientific study about the status of fish stock in this community fishing ground. Community fishers reported that some species are overexploited, while some others are recovering. There are some 900 fishers, members and non-members of the CFi from the fishing community within the Svay Chrum commune, and some others from nearby communes within 20 kilometres (km) from the community fishing ground. Most fishers have regular access to this fishery. The community currently allow individual fishers or family fishers to hold the legally recognized rights for this fishery.

The community fishers commonly used cast nets, gillnets, set gillnets, traps (bamboo tube trap for eel, brush bundle trap (Khmer name: kansum)), plunge baskets (Khmer name: Ang rut), hooks and lines, hand dragged seine nets and wedge-shaped scoop baskets (Khmer name: chhneang day). The fishing boat has an engine capacity of 6-20 horsepower (hp). Fishing is done by family members without hiring any crew, on motorized and non-motorized boats. No fish aggregating devices are used in this fishery and fishing with aggregating devices is illegal. The boats are less than ten m long, and less than ten gross tons in weight. No boat has any ice storage, as the fish catches are freshly stored and brought to nearby markets. There are no fish landing sites either. Every individual fisher owns the fishing boat, operating it by themselves less than ten km away from the shoreline in an area of up to 6 m in depth.

The average duration fishing trip takes less six hours per day in this fishery. The fishing boat and facilities are owned by a family, while men usually do fishing. Sometimes, women may accompany to help fish. The conflict happened between small-scale fishers and large-scale fishers (the owners of fishing lots) before the reform of the fishery sector, over the invasion of small-scale fishers in fishing

lots. The fishery reform abolished all fishing lots, handed over to local fishers and established CFi. After this (2007), there have been no conflicts. The conflict between community fishers and agricultural farmers over the use of water in farming may still occur in other fishing communities. Pumping water from a lake adjacent to the Tonle Sap Lake in the dry season caused drought and led to the death of fish. Occasionally, community fishers may suffer from floods, drought, storm, and fish diseases, which cause damages to crop, houses and school, and the death of fish in the dry season.

1.2 Economic contribution and social implications of the fishing activity

The fishery is very important for food security and family income for the daily livelihoods of community people. Rice and fish are Cambodian staple foods with a long history in Khmer culture (Thuok and Lieng, 2008). This rural community of fishers depend fully on freshwater fisheries. Most rural Cambodians, particularly Koh Keo community fishers, are both farmers and part-time fishers for food and family income. They are full-time fishers in the wet season and farmers/part-time fishers in the dry season.

Most fish catch was sold to nearby local markets for local consumption. The fish catch from the fishing community was sold to international markets less than in the past when the fish catch came from large-scale fishing (fishing lot). The rural community fishers ate fish almost every day. Generally, Cambodians eat 67 kg of fish per person per year (Hortle et al., 2004). In addition to food consumption, fishing provided an annual family income of around USD 589 – 1 433 (NIS, 2014). The income from fishing contributes to around 30 percent of the total family income. The money gained from fishing is not only used as family cash income, but also to buy fuel, rice seeds, and fertilizer for rice farming (Lieng et al., 2018). The income from fishing contributed to part of the family income because the Cambodian GDP per capita in 2016 was USD 1 269.9 (WB, 2018). The average family size in Cambodia is five persons (NIS, 2014). Typically, a household has more than one occupation and may grow crops, run a small business, or raise cattle, pigs, chickens, or ducks in their home lots (Lieng et al., 2018). Seventy-eight percent of the households in the Tonle Sap region raised livestock and/or poultry (NIS, 2009).

The community fishers performed other fishery-related activities, such as fish culture, fish processing and marketing. Hap et al. (2016) reported that there was a need for community fishers to perform many economic activities to earn a living. A study in the two nearby community fisheries in the Tonle Sap region found that most rural households owned farmland of approximately 0.5–1.5 ha and cropland of a similar size (Lieng et al., 2018). This finding was similar to the 2013 census of agriculture in Cambodia, which found that rural Cambodians owned an average of 1.64 ha of farmland (Oxfam, 2012). Rice production yield, on average, is 4.2 tons per hectare (Oxfam, 2012). The diverse livelihood activities may contribute to improved fishery management, and could divert some efforts to appropriate alternative occupations, relieving pressure on natural resources (Marschke and Berkes, 2005). Although the income of the two rural communities did not depend fully on fishing, CFi members of the were likely to focus on fisheries (Lieng et al., 2018). Effective fishery co-management requires the involvement and active participation of local community members (Marschke and Berkes, 2005; Barakagira and Wit, 2017).

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

The fishing rights of the community fisheries are defined by the Law on Fisheries (RGC, 2006), sub-decree on community fisheries, and internal rules and regulation of CFi (RGC, 2005). According to the above law, sub-decree, rules and regulation, CFi have roles and a duty to participate in managing, conserving and utilizing fisheries resources for their livelihood need in a sustainable manner. It must be in compliance with the by-laws and community fishing area management plan and with laws and other instruments related to fisheries. All CFi members have equal rights in the sustainable use of

fisheries resources as stipulated in the by-laws. The by-laws are formulated and adopted by CFi members. CFi have the rights to organize fishing activities in compliance with the law and other regulations and to cooperate with nearby competent fishery authorities to suppress all fisheries violations in the community fishing area. The boundary of the community fishing area is clearly defined.

CFi is given the responsibility to manage the fisheries resources in the community with agreement from the government. The fisheries have signed the community fishing area agreement with the Fisheries Administration that represents the government. CFi shall develop a plan for the management of a community fishing area as well as an appropriate strategy, and mechanisms/methods for successfully monitoring and implementing the community fishing area management plan. The community fishing area management plan shall be formulated and adopted with the participation of community fisheries members, the local authority, and the Fisheries Administration. The community fishing area management plan describes demography, socio-economic conditions, and the status of fishery resources. It defines the conservation area and action, allowable number and types of fishing gears, management action measures, and aquaculture development plan. There is no scientific research study in the community. The community fishers do the participatory planning and assess the status of fisheries resources and management of the action plan. Small-scale fisheries in Cambodia are not required to get fishing licenses and have no need to pay a fishing fee to the government. The Fisheries Administration follows up, monitors and enforces the implementation of the community fishing area agreement and management plan, making an annual evaluation with the participation of local authorities, local people and community fisheries.

The community fishing area has multiple uses such as a farming area in the dry season, family water use, agricultural irrigation and navigation and transport. The conflict may happen over the different use of water-related resources. The conflict is solved according to the existing fisheries and other relevant laws, rules and regulations. The conflict resolution is followed via consultation and coordination from low (commune and district authority) to a high level (provincial and national level) authority/court, the relevant competent fisheries authority, and a local authority.

2.2 Brief history of the former rights-based approaches used in the fishery

In the past, fisheries management measures have traditionally concentrated on larger water body (Zalinge et al., 2004). The large-scale fishing gears such as fishing lots (barrage fisheries), arrow-shaped trap, seines, trawls, and bagnets (Dai) are the focus on their management (Zalinge et al., 2004). The large-scale fishers were given rights to fish through bidding and/or licenses. They had to pay a fishing fee to the government revenue. The management of large-scale fisheries, particularly the fishing lots, are not based on an integrated management approach in a sustainable way and intend simply to maximize profits (Zalinge et al., 2004; Degen et al., 2000). However, because of its effective control of the fishery resources in the fishing lots, it was termed as “the best management practice” (Coates, 2001). However, if social issues exist, they can be addressed. Prior to 2000, many conflicts happened between small-scale and the large-scale fisheries (fishing lots) over the use of fishery resources and around fishing ground encroachment. Fishery co-management had been implemented in Cambodia in the early 1990s by NGOs and in the lower Mekong countries. In order to solve the problems in fisheries, the Cambodian government decided to decentralize the fishery authority in the fishery policy reform of 2000. In the reform policy, all fishing lots were abolished and handed over to local fishers as CFi was established. The community fishers are given the rights and responsibilities to manage, conserve and utilize the fisheries resources in a sustainable manner.

2.3 Rights-based approach: allocation and characteristics

The fishery had legally recognized fishing rights since the establishment of CFi in 2008 and in Cambodia more generally in 2001. The traditional fishing rights are respected, permitted for use and inclusion in the fisheries law. The current fishing rights are allocated by CFi, and there is a community-based effort

quota practiced in the designated area of the community fishing ground. Migratory/outside fishers and members of other CFi can fish in a given community fishing ground, permitted that the committee of the community fishery is informed and the rules and regulations are respected. The sustainable livelihood of the CFi, the poor or vulnerable people, rights to fish for the next generation, gendered dimensions, and sustainability of the fish stock, were all factors considered in the consultation of the law on fisheries and relevant rules and regulations. These issues were included in the existing fisheries legal framework. There is neither an individual catch nor individual processing quota, but CFi defines a limited number and types of fishing gears permitted to fish in their fishing ground. The fishing rights are equally given to all CFi members and non-members, individual fishers, family members of fishers, and community in compliance with the law on fisheries, with no limitation of time and space.

The committee of community fisheries, local authority, and local fisheries officers cooperate together to allocate and monitor the traditional fishing rights and law enforcement in general. The fishing rights cannot be leased or sold. The law on fisheries does not mention heritage, but if the next generation still lives in the present CFi, then they bear the current fishing rights. The fishing rights have no limitation to any person, community fishers and any Khmer fisher, but foreign fishers are not permitted to hold fishing rights. As long as they are fishers, they have the same fishing rights, they have no need to transfer the rights, and the law does not mention that transfer of rights is not permitted. The traditional fishing gears are gillnet, trap, and hook and line, permitted by law and commonly practiced to fish by local community fishers. Those fishing gears capture many small cyprinid fish species such as small-scale mud carp, Siamese mud carp, Smith's barb, and tawes.

There is not any study to assess the status and trend of the compliance of the rights-based approach so far. Illegal fishing activities still happened in many CFi. The rate of compliance could more or less vary in time and space. Fish poaching in the conservation area of the CFi can still be the case. The use of small, mesh-sized nets is defined as illegal, but in many cases in the community, it still persists.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

The fisheries resources in CFi are co-managed by CFi members, local authority and the nearby fisheries administration (FiA). To maintain the sustainability of the CFi fisheries resources, the fisheries resources are given to the CFi to responsibly conserve and manage, utilizing them in a sustainable manner. The CFi has established an annual and five-year rolling-fisheries action plan. The plan addressed the management and control of fishing capacity, improvement of the CFi fisheries domain, conservation area, the flooded forest fish habitat, law enforcement, awareness-raising about fisheries management and conservation to community fishers, livelihood development, tourism development, and savings group (revolving fund).

So far, no fish stock assessment has been done for the community, but with the participation of CFi fishers, community members can understand the status of some fish species. For instance, the status of fish abundance of giant barb, tawes, Smith's barb, and a siluridae fish species (wallago dinema) has seen an increasing trend.

3.2 Economic viability of the fishery

The general characteristics of the fisheries have been observed as unchanging. This may be due to the geographic location of the fishing villages and the freshwater fisheries resources in the Tonle Sap floodplain. Fishing boat and gears are owned by individual fishers, who travel the same distance from their home villages to their fishing grounds. The number of outboard engines was reported to have increased. The aggregating devices, which are defined as part of illegal fishing practices, are not used to attract fish to support fishing. The characteristics of their fishing boats such as length of the boat, the capacity, and the power capacity of their boat engines, have also not been changed compared to

prior and after the introduction of new fishing rights in 2008. However, it was reported by the CFi fishers that the individual fishing effort of gillnet, hook and line, and fish trap had been reduced due to the decision of the CFi committee. With the participation of CFi fishers, the total number of fishers has increased along with the growth of local people. Therefore, it may not be possible to control the CFi fishing capacity, as there is a growing need of local people for livelihood. It is hard to leave other fishers out of the fisheries, giving more pressure on fisheries resources.

3.3 Social equality

The law on fisheries in Cambodia aims to ensure that fishery resource management enhances aquaculture development, the management of production and fish processing, and promotes the livelihood of people in local communities for the social-economic and environmental benefits. This aims toward the sustainability of fisheries resources for the next generation of the Cambodian people. The law also ensures the rights on traditional use of fishery resources for local communities under the regulations of this or other, related laws. During the formulation of the fisheries law, sub-decree on community fisheries management and declaration on the CFi guideline, several factors were taken into account. These included the ability of the poor, the rights to fish of migratory fishing community fishers, livelihood needs, the sustainability of fish stock, and women's rights.

After the introduction of the fishery reform policy, the new fishing rights have been given to the community fishers, the fishers have more secure access to fish, are able to eat more fish, experience increased solidarity among the CFi members, and have a fair and improved distribution of resources, improving livelihoods (Kurien, 2017). There is an increasing need for more fish, as the number of people in the community increased. Fishery conservation has been recognized as an important action for sustainable fishery resources for the next generation. Additionally, women have been noticed as playing an essential role in peacefully preventing illegal fishing activities (Kurien, 2017). In the case of natural disaster, all the affected community fishers and villagers will receive aid from different sources.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

The introduction of the new fishing rights to the community fishers does improve the fisheries conflicts. Since the introduction of new fishing in 2000 and 2012, there is almost no existence of large-scale fisheries at all. The conflict, so far, happened between the small and large-scale fisheries. When there is an absence of large-scale partners, no conflict happens between the two groups. The other conflicts occur between the CFi committee and the outside fishers who overfish in the CFi fishing ground. Generally, conflicts have decreased after the introduction of new fishing rights in 2008.

With the introduction of the new fishing rights, community fishers have been given the legal responsibility to manage fishery resources in their own community fishing grounds. Fisheries have an obligation to formulate their fishery management action plan, and a lack of funds hampers the operation of the fishery action plan. Many community fishers are in poverty, too, which creates difficulty with the enforcement of fishery law, rules and regulation. The challenges to fish lead to the introduction and intensification of the fishing to get more effective fishing. Illegal fishing practices still happen in many cases. The effect of managing the fisheries resources in the community fishery area is that there is a need for the enthusiastic participation of community fishers. This is vital for leadership, management capacity and funds for the CFi area operations. The introduction of fishing rights does not cause the damages on houses, roads and other infrastructure, regardless of small or large-scale fisheries.

4.2 Improving fishery sustainability in the future

The existing fishery law, rules and regulations are good at ensuring the sustainability of fishery resources for the next generation, social equity and economic viability of the community fishers, but it is important to translate those fishery policies to meaningful actions. The current fishing rights shall be improved to enhance the CFi operational action plan. The current legal framework has given all relevant stakeholders involved with roles and responsibility, but the main obstacles existing are the implementation capacity of the action plan and funds for the CFi operation. The improvement of CFi livelihoods will also release the pressure on fishery resources and help to maintain the sustainability of fishery resources. The key to successful fishery management is to maintain fishery reproductivity. This may come through the protection and conservation of fish brood stock, spawning grounds and fish habitats (for spawning and feeding).

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Improvement of membership issues of fishing village for continuous development of fishing community in Korea

Kwang Nam Lee

Please refer to the case study presentation available at:
http://www.fao.org/3/CA2489EN/ca2489en.pdf

Two institutions for one fisheries management: Pooling period and individual operation periods in Wagu spiny lobster fishery

Hiroe Ishihara[115], Kanae Tokunaga[116], and Hirotsugu Uchida[117]

Abstract
We studied a lucrative spiny lobster fishery in Japan operating under Territorial Use Rights in Fishery (TURF) through unique two-part periods with different institutions; i) pooling period a followed by ii) individual operation period. In the first half of the season, when crowding inefficiency can be the greatest, this fishery operates as a group, i.e., full spatial fishing effort coordination, sharing the total revenue equally among the fishermen ('pooling'). In the second half of the season, the fishermen switch to individual-based regulated open access (ROA) operation. The two institutions operate within its designated and mutually-exclusive fishing zones, and the area of the group operation zone has gradually expanded over the years by taking ROA zones away. This case-study poses a fundamental question regarding the fisheries management: "why have fishermen chosen two separate management systems, i.e. institutions, for one fishery management?" Using a unique dataset of individual vessels' harvest volume and locations from 1991 to 1997 (i.e. prior to the introduction of the current regime), we argue that fishing grounds that had yielded a higher share of the catch at the beginning of each season were often designated as a fishing ground for a pooling system. Further, by using semi-structured interviews to all fishermen, we reveal that individual operation plays a vital role in reducing the discontent of younger fishermen and fostering the necessary and critical shared understanding of the socio-ecological condition for pooling system.

1. INTRODUCTION

1.1 Description of the fishery

The Wagu district, in the Shima City of Mie Prefecture, is located at the centre of Japan as shown in Figure 1. The spiny lobster, trammel net fishing (the topic of this paper) is only one of the many kinds fisheries conducted in the district. For example, there is dive fishery (called 'Ama' in Japanese) for abalone, top-shell and seaweeds; pole-and-line fisheries for skipjack tuna and three-line grunt; troll or trammel net fisheries for yellowtail, and offshore pole-and-line fisheries for skipjack tuna, other tunas and squid fly fishing.

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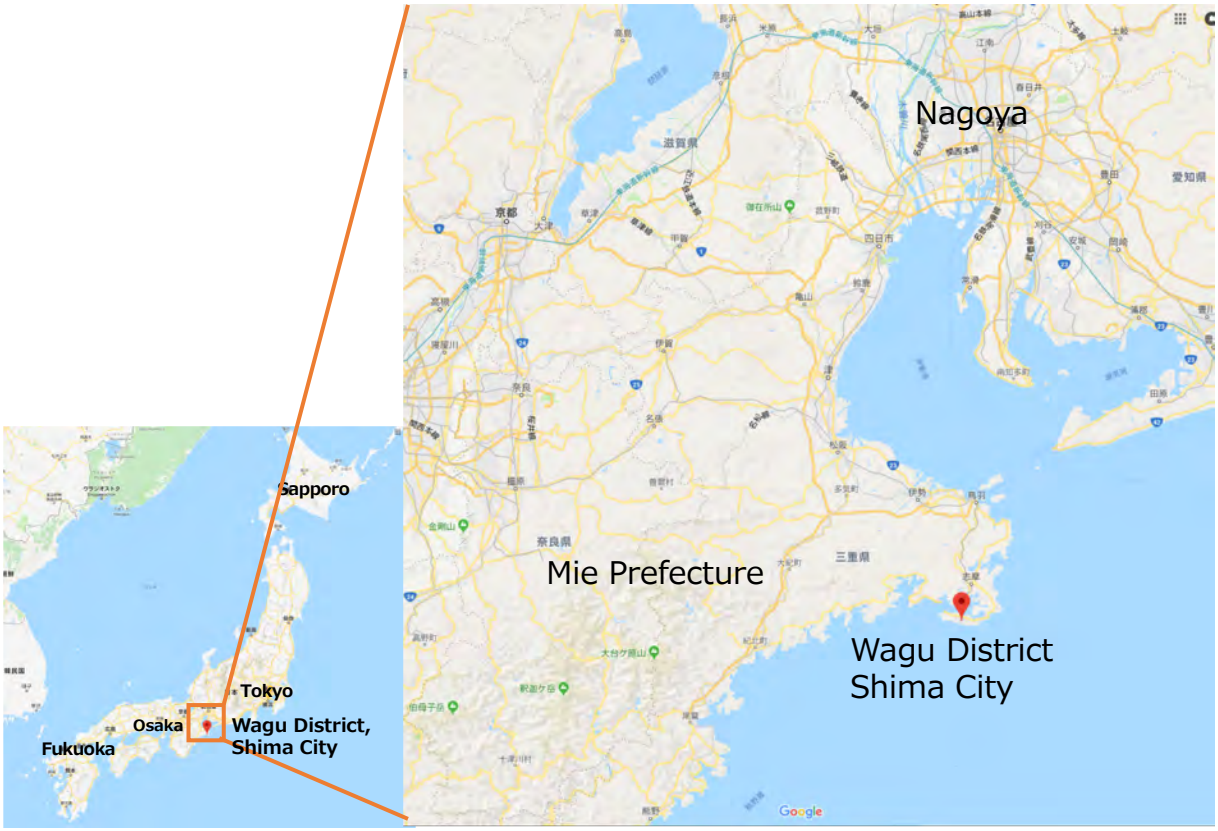


Figure 1. Location of Wagu district, Shima city, Mie Prefecture.
Source: the authors created from Google Maps.

Shima Peninsula, where Wagu is located, is one of the top two producers of spiny lobster in Japan along with Boso Peninsula in Chiba Prefecture. The Wagu district alone produces around 20-40 metric tons annually with a production value of USD 1.8 million. Figure 3 shows the shift in landing of spiny lobster in the Wagu district from the 1970s. Currently, 26 households conduct the spiny lobster fishing using trammel nets (see Figure 2). All these fishermen are required to belong to the Spiny Lobster Fishermen's Union ('Ebi-ami Domeikai') under the Mie Gaiwan Fisheries Cooperative Association (FCA). Those who belong to the Union are the only ones who are permitted to fish within the area assigned to them as territorial user rights fishing (TURFs) ('kyodo-gyogyoken gyogyo'). Further, the Union decides the management schemes that are additional to government regulations, as described in Section 2.1.

Figure 2. Gillnet for spiny lobster.
Source: Photos taken by the author.

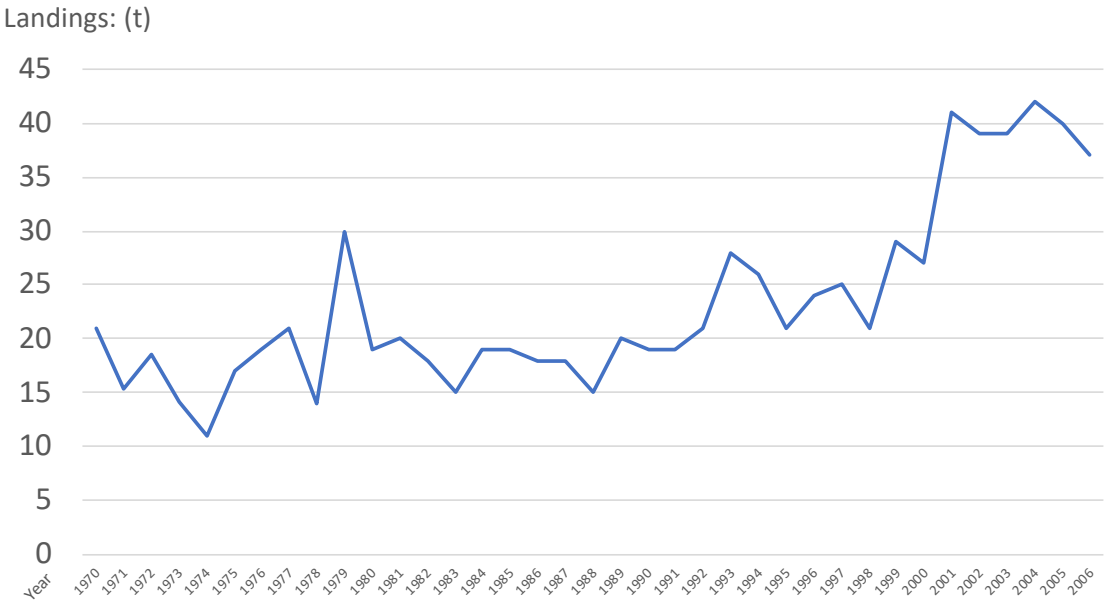


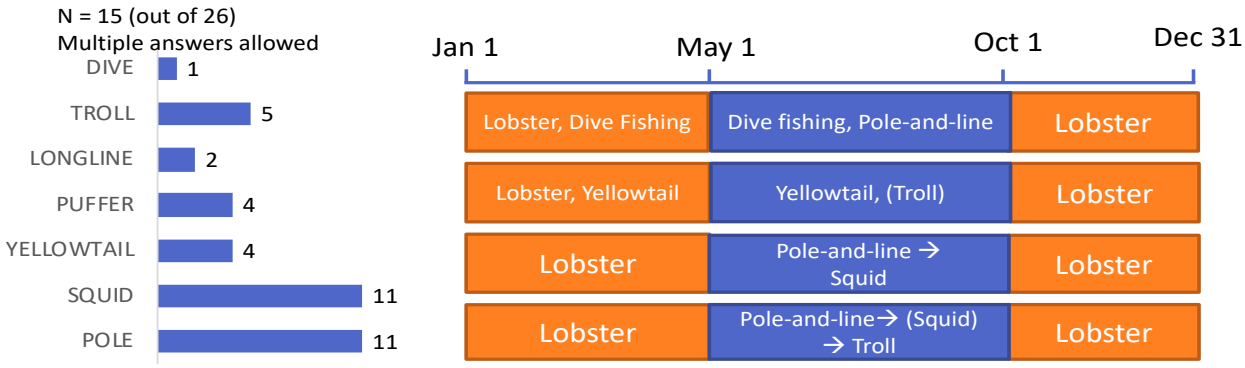
Figure 3. Annual landings of spiny lobster in Wagu district.

The spiny lobster fishing is conducted from 1 October to 30 April. Fishermen leave the port to set the trammel net either at 15:00 or 14:00 depending on whether it is during the pooling period or the individual operation period (for the details of the periods see Section 2.1.). The vessels used differ according to the period, too – during the pooling period small boats with an outboard engine are used, whereas during the individual operation season, bigger vessels with an inboard engine are used (see Figure 4). They come back in an hour or so to the port, and the next morning trammel nets are picked up around 7:00-7:30 AM. The local seniors and relatives help to remove the lobsters and repair the nets (see Figure 5). These helpers are compensated with the by-catches (various fish that are caught in the trammel nets) rather than cash.

Figure 4. Vessels used individual operation season to set the gillnets.
Source: author.

Figure 5. Next morning: the landing of the lobsters and helpers taking out the lobster from the net.
Source: author.

During the off-season for the spiny lobster fishing (1 May to 30 September), the fishermen mainly engage in squid fishing, pole-and-line fishing, and troll net fishing for yellowtails (based on author's interviews and surveys conducted in April 2017 – see Figure 6).



Source: Interview & survey (April 2017) conducted by the presenters

Figure 6. Alternative fishing conducted by the spiny lobster fishermen.

The main conflict of the trammel net spiny lobster fishery comes from dive fishing, which targets spiny lobster along with abalones, sea cucumber, and seaweeds. Sometimes, the trammel nets get entangled with the divers. This creates a serious job hazard for the divers. In order to avoid this, once the diving season starts (in April), the spiny lobster fishermen are not allowed to set the net before 15:00.

1.2 Economic contribution and social implications of the fishing activity

The Wagu district, with a population of 5 400, is heavily dependent on fishing activities due to a lack of land suitable for agricultural production. From the 1920s, it has depended on dive fishing, skipjack tuna fishing and pearl aquaculture. According to the Fisheries Census in 2008, there are 253 male and 176 female fishers. The rate of full-time fishers (69.4 percent) is much higher than the national average of 37.5 percent in 2005. There are 219 households in the Wagu district which have joined the Gaiwan FCA, out of which 26 are spiny lobster fishermen. This constitutes less than 15 percent of the total fisherman in the district.

Spiny lobster fishery contributes to maintaining a network within the Wagu district and beyond the community. For example, as mentioned previously, the helpers who support this fishery by taking off the lobster from the net are not paid in cash. Rather, they are compensated with by-catches resulting from lobster fishing. When the spiny lobster fishing season is over, the vessel owner often hosts a small party or exchange of gifts during the end of the year ('*seibo*') or in August ('*chugen*'), as a token of appreciation. This shows that social ties are kept without the exchange of money.

An interesting and more recent effort involves the use of spiny lobster and its fisheries to create new networks with urban populations. For example, the youth group in the FCA has started a new festival called the 'trammel net owner system' (Figure 7 shows the poster and owner's ticket of this system). This is a system to invite the urban population to the district. An individual can purchase a trammel net for a day with JPY 15 000 (around USD 130). On a specific day in October when the festival is held, the individual can experience the spiny lobster fishing and can get all the catches from the trammel net. This event is held not just to sell the spiny lobster, but to disseminate the information regarding Wagu district and its fishing in general.

Figure 7. (Left) Poster of 'Trammel net owner system'; (Right) Owner's ticket.
Source: authors.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

In general, TURF claims the ownership over a certain area of coastal water. The green area in Map 2 shows the area that the fishermen in Wagu district are given exclusive access to through fishing rights. The fishermen who use this area are required to be members of the Wagu Branch of Mie Gaiwan FCA. Wagu branch has 5 Unions: i) Spiny Lobster Fishermen's Union, ii) Pole-and-Line Fishermen's Union, iii) Skipjack Tuna Fishermen's Union, vi) Dive Fishermen's Union and v) Squid Fishermen's Union. In order to use each of the fisheries, fishermen have to take part in these unions. The unions make the rules for the management while controlling and monitoring each fisher's action.

Currently, the Union imposes voluntary management measures, such as gear restrictions (thickness of the net, and the number of nets per fishermen), no harvesting rules during the full moon, and a release rule for lobster under 100 g in the designated areas. On top of these measures, there are two separate management system operating during two periods: i) pooling period (from 1 October to end

of December or beginning of January) and ii) individuals operation period (from the end of December/beginning of January to 30 April).

During the pooling period, the fishermen operate in four groups (called '*hama*') of 4-6 fishermen. Each fisherman sets two nets in designated areas for the pooling period. Who sets the nets where is decided by the council, called '*Nen-gyoji*,' which is composed of the Union's president, vice-president as well as the leaders of each group. Each group will use a small boat with an outboard engine to set and collect the net. The fishing grounds used during this period are the area closer to the shore, indicated as A, B, C in Figure 8. These are highly productive. The revenues from the spiny lobster during this season are shared equally among the 26 fishermen leading to low competition (Uchida, 2017). Although there is a fluctuation in daily landing from 250 kg to 500 kg, the daily revenue is more stable at around JPY 2 million per day (around USD 18 000; see Figure 9).

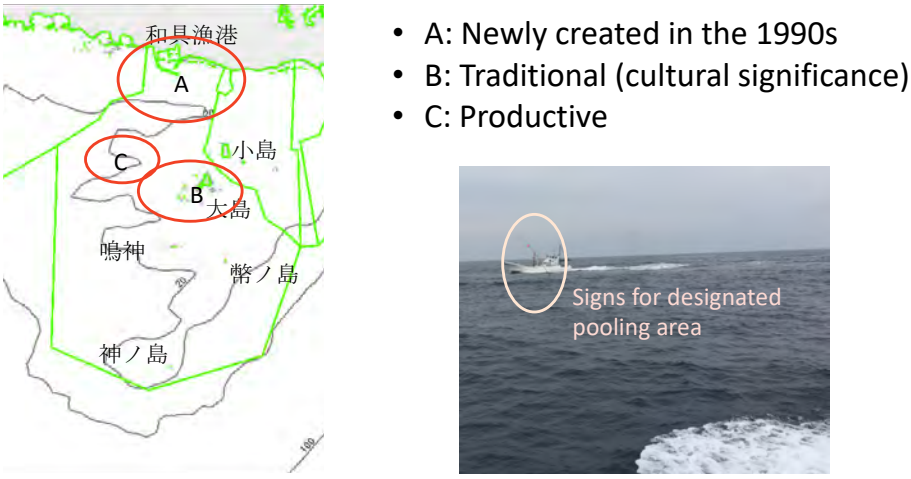


Figure 8. Map of fishing grounds used during pooling period.
Source: Mie-Gaiwan FCA.

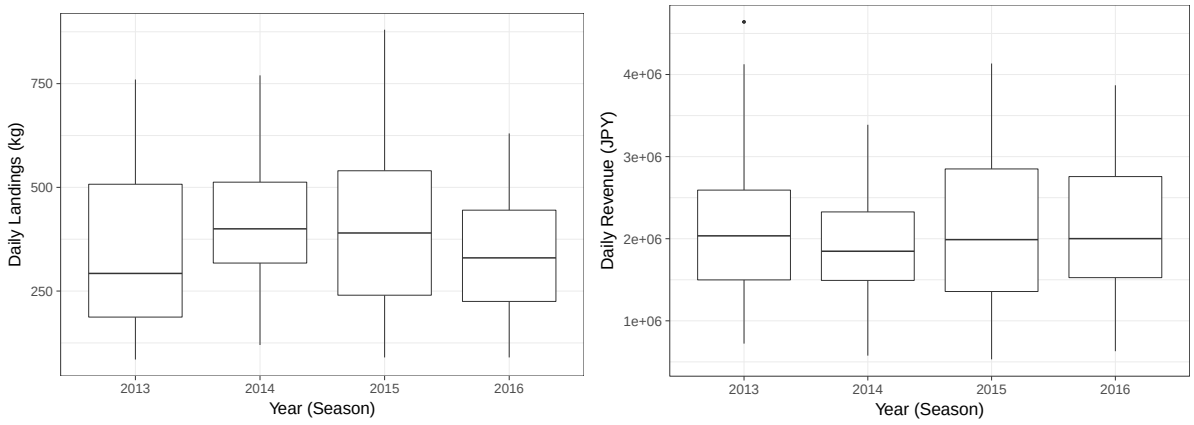


Figure 9. Comparison between daily landing and daily revenue.

Unlike the pooling period, fishing during the individual operation period is highly competitive. There is no allocation of areas to set the net; it is based on the rule of 'first come, first served.' During this period, the fisherman can use a maximum of eight nets (as of 2018). Each fisherman decides individually where to set nets and how many to set, weighing the size of the boat's engine and the

number of helpers he is able to convene. The number of helpers is a crucial factor because some of the fishing grounds that are highly productive tend to be places where the tide is fast. This means that the net is likely to collect many by-catches (including rocks and occasionally trash) and require a lot of repairs. Fishers without enough hands aren't able to set nets in these places. The main differences between the pooling period and the individual operation period are summarized in Figure 10.

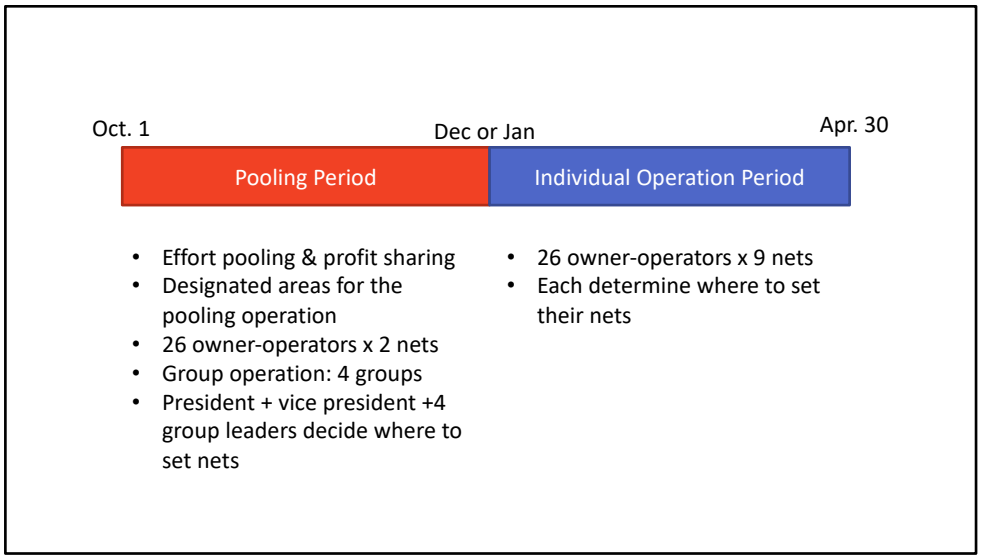


Figure 10. Main difference between the pooling period and the individual operation period.

It is important to note that, even during the individual operation period, there are precise coordinations set by Spiny Lobster Fishermen's Union. For example, during this period, all fisherman meetings are held every day to decide on when to go fishing and when not to. Important decisions about the time to switch from pooling to individual operation, and about the modification of management rules, are made during these fishermen meetings. Figure 11 shows how these two different types are held during the fishing year.

- Two type of meeting for decision making mechanism:
  1. All fisherman's meeting
  2. Leaders' meeting: Chair/ Vice chair + group leaders

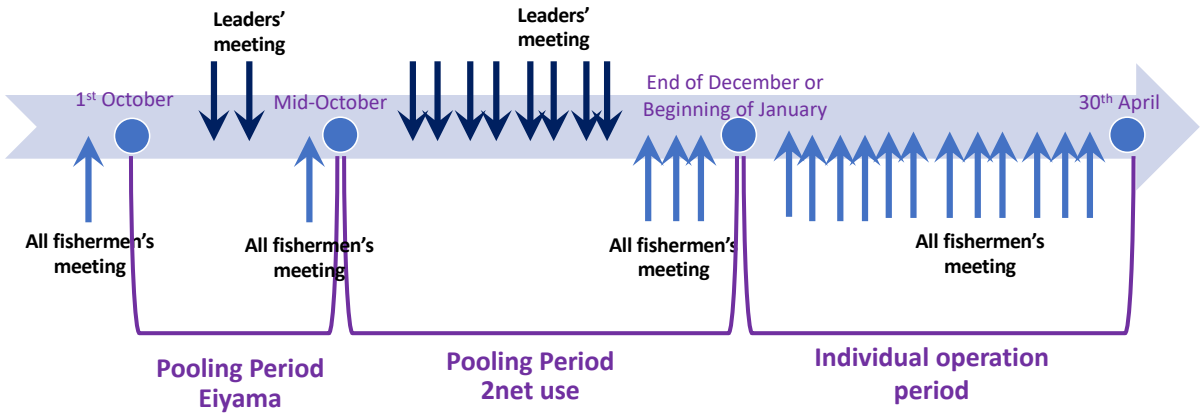


Figure 11. Meeting held during the spiny lobster fishing season.

2.2 Brief history of the former rights-based approaches used in the fishery

The TURF has been implemented since the Edo-period (1603-1868) as a customary right. The Meiji government, which succeeded the Edo government in 1868, tried to abolish TURFs and to introduce central government control on fisheries. However, it was met by strong resistance from the local communities all around Japan (Makino, 2011). As a result, the central government had to institutionalize the TURF in their new modernized legal system.

During the 19th century, the fishermen in Wagu district were given a TURF for spiny lobster fishery, and in the 20th century, the different rules were set up to regulate the use of fishing grounds. The Wagu FCA was established in 1903 and later integrated into Mie Gaiwan FCA. However, Wagu FCA remains as a branch under Mie Gaiwan FCA and still manages the TURF in Wagu district through the five aforementioned unions.

During the 1960s, the Mie prefectural government implemented two projects. One was to improve the fishing grounds for spiny lobsters; the other was to increase the size of the marine protected areas ('*Kinryo-ku*') to conserve their breeding grounds. During the 1980s, the fishermen agreed to restrict the mesh size, the thickness of the net, and the number of nets that the fishermen can possess. These voluntary restrictions were not implemented on scientific foundation but rather came from conventional wisdom (Nishimura, 2013).

However, from the 1990s, the national government implemented a project to establish science-based management of spiny lobster stock in this region. Despite the fact that stock assessments were conducted in 1991 and 1992, it was not easy to convince the fishermen to reduce the number of nets and to release the smaller size lobsters. During this period, a committee composed of 23 representatives from FCA, government and researchers, was convened to discuss the management of spiny lobster. After several meetings, the fishermen came to consensus in conducting three voluntary measures: i) to release the lobsters which are under 70 grams, ii) no fishing during the full moon, and iii) to restrict the time to set the net (during the pooling period after 15:00 and the individual operation period after 14:00).

During the 2000s, Wagu lobster fishermen decided to take additional measures such as the pooling period. According to our interviews, the origin of the pooling period is not certain. However, it started as fishing for special communal occasions, such as festivals and New Year's bonus. Originally, it was conducted in a small protected area, though this area gradually expanded to include October and November. It was further agreed that the fishermen would use only two nets per household to reduce the labour cost. These measures were taken in order to adapt to the social context of the community – it is an ageing community with a smaller number of young residents who engage in fisheries. According to our interviews, many fishermen mentioned that the pooling period is conducted to 'gain profit with minimum effort' (*Rakushite Moukeru*).

2.3 Rights-based approach: allocation and characteristics

According to the current management system, during the pooling period, the harvest revenue from the spiny lobster is distributed equally among the 26 fishermen, which is around JPY 77 000 daily (around USD 675). The sharing of costs is more subtle. For example, each group leader usually provided the vessel to be used, and the cost of fuel is not shared. However, since all 26 fishermen take a turn to be the group leader, the cost is also born equally by the fishermen. The opportunity cost during this period, defined as the cost that the fishermen must forego to attend the spiny lobster fishery, is nevertheless high during this period for some particular fishers. Because of the pooling system, all 26 fishermen are required to participate in the lobster fisheries, even when it might be more lucrative for fishermen to go to other kinds of fisheries.

During the individual operation period, all the fishermen go out at 15:00 together with the command by the president of the Spiny Lobster Fishermen Union. During this period, the fishing ground is decided by the 'first come, first served' principle. Unlike during the pooling period, fishers are also able to switch to other types of fisheries if they wish. However, this does not mean that there is no control or management. What to do for spiny lobster is decided collectively with the all fishermen meeting as indicated in Figure 11. If one fisher breaches this rule and goes on to fish when they are not supposed to, they will be banned from fishing for the next couple of days. What must be noted is the combination of the pooling and individual operation function to ameliorate some of the fishermen's discontent. (for details, see Section 3.3).

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

It is difficult to assess the relationship between the rights-based approach and the ecological sustainability of the spiny lobster due to a lack of stock assessment since 1991-1992. Further, the biology of spiny lobster itself makes it difficult to assess this relationship. The life cycle of spiny lobster starts with spawning in April to October around the Pacific Ocean side of Japan; however, once it becomes Phyllosoma larvae, they travel to the Mariana trench. As they develop into Puerulus larvae, they come back along the Black Current (Kuroshio) east of the Philippines, and settle in the Pacific Ocean side of Japan. Due to this long-distance travel and wide habitat, there is a high level of uncertainty in stock (Yamakawa, 1997).

3.2 Economic viability of the fishery

The current management system described in Section 2.1. was designed to mitigate the effect of an ageing community. As with other parts of rural Japan, the Wagu district is ageing rapidly. In the 1990s, there were 36 fishermen in the Union, but currently, there are only 26. Among these, only four households have a young generation willing to succeed the spiny lobster fishing. The other issue is that, given the community's age, it is becoming difficult for some of the fishermen to gather helpers to take off the lobster from the net. The pooling period was designed to mitigate these issues by reducing the cost of operation by only using a small boat of the group leader, the number of helpers by only using two nets; at the same time, obtaining a stable income using the pooling of the revenue. This what the fishermen express as ''gain profit with minimum effort' (*Rakushite Moukeru*).

Further, this pooling of revenue acts as a certain type of social welfare system. As some fishermen have indicated during our fieldwork, as long as the fisherman (no matter how old he may be) can come in the morning to collect their nets, they can receive the revenue. Some mentioned that at one point, the union representative had to retire one fisherman because it was becoming dangerous for him to come to fishing even during the pooling period. The function of pooling period, however, is seen as one of the sources of discontent by young fishermen, as we see in the next section.

3.3 Social equality

As discussed in the previous section, the income is distributed equally during the pooling period. There seem to be no significant issues in terms of social equality. However, as mentioned previously, the pooling period is a source of discontent among younger fishers, despite its function as social welfare. This is because of the heterogeneity among the generation in terms of income needs. The fishermen, who are above 65, receive a pension from the national pension scheme. The older fishermen are empty-nesters, whereas the young fishermen are supporting a young family and they need a lot of money. As such, the pooling period serves as a substantial burden, prohibiting movement to other, potentially more lucrative fisheries.

At present, the individual operation is functioning to ventilate some of this discontent, as we see in figure 13 (below). It is taken from the day that the fishermen started the individual operation period.

The writer wrote about the 'long-waited start of the individual operation period.' Further, as we see in the meeting schedules, shown in Figure 11, the time to switch from the pooling to the individual operation is carefully discussed in all the fishermen's meetings. Currently, the combination of the pooling period and individual operation period is functioning well to create a 'fit' between the heterogeneous demands of the different fisher generations.

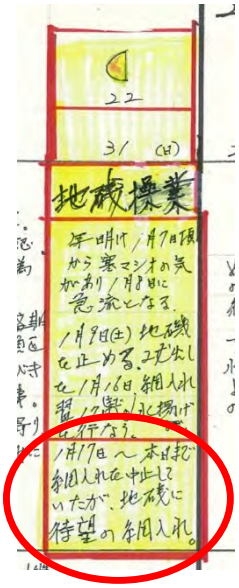


Figure 13. Fishing diary of one fisherman.
Source: author.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

The main challenge to this fishery is its ageing population. As we have mentioned previously, only four households have successors who are willing to inherit the spiny lobster fishing business. Further, it is becoming more and more difficult to find helpers too. Although the introduction of the pooling period was a way to adapt to this ageing community, if the ageing continues at the current pace, further institutional reform will unlikely to deal with it. Some of the FCA members are already relaxing the rules so that the Spiny Lobster Fishermen's Union can accept new members who are not necessarily inheriting the family business as they enter spiny lobster fisheries. However, as described in Section 2.2, agreeing upon the new institution took a long time; many discussions within the committee and with the fishermen were undertaken to build consensus. The challenge lies in the question of whether it is possible to come to agreement among the people who are heterogeneous in their needs and motivations for fisheries.

4.2 Improving fishery sustainability in the future

The management of fisheries in Japan poses a unique question, which is very different from that of developing countries where over-exploitation is a measure problem. Rather, our case study shows how to maintain social sustainability as well as the ecological sustainability of the spiny lobster fishing. It is our understanding that, in order to improve fisheries' sustainability, it is not sufficient to discuss the ecological sustainability or the sustainable management of the stock. Rather, we need to include social sustainability to think about meeting people's needs and aspirations. It is our sincere hope that the present case study is one of the first steps in this direction, as we move to discuss the socio-ecological sustainability of fisheries.

A managed access approach to sustain small-scale fisheries management in southeast Sulawesi, Indonesia

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Abstract
Managed access is a form of Territorial Use Rights for Fishing (TURF) and is a well-known solution to address overfishing and transition away from open-access fisheries. 'Managed access with reserves' is a community rights-based fisheries management approach that provides coastal communities with exclusive access privileges for fishing in defined areas. Protected areas (i.e., reserves) are established inside or adjacent to these exclusive access areas. Understanding the need to recover fisheries in Kolono Bay, Indonesia, communities from five villages came together and agreed to establish 1 264 hectares (ha) of managed access area, along with 50 ha of the marine reserve (managed access with reserves). A community management body was established to manage the area and enforce agreed-upon rules such as fishing zone and fishing gears. Two years after the agreement to use managed access with reserves in Kolono Bay, fish biomass inside the reserve was maintained or slightly increased, coral cover in the area slightly improved, and community knowledge of sustainable fishing and compliance with regulations increased. Building on this success, the Government of Southeast Sulawesi Province plans to replicate managed access with reserves across the province's waters. However, to ensure it will be an effective solution to overfishing in areas outside Kolono Bay, thorough and systematic site selection must take place. Site selection criteria must include type of fisheries targeted, socio-cultural dimensions, community and government acceptance, seascape, and other spatial issues. Ideally, the criteria will help assess and identify the likelihood of managed access with reserves being successful and enable us to identify potential challenges early in the planning and implementation phase. This case study elaborates the establishment of managed access with reserves in Kolono Bay, Indonesia, as an example of community-based small-scale fisheries management, and the effort by the provincial government to scale-up the solution to a province-wide initiative.

Keywords: managed access; open access, marine reserve, scaling up, sustainable fisheries

1. INTRODUCTION

1.1 Description of the Fishery

Overfishing is common in 'open-access' fisheries, where entry to the Fishery is unrestricted. As more people rely on the sea for their income and daily food intake, fishers find ways to catch as many fish as possible. In some cases, they have turned to highly destructive fishing practices despite the long-term damage these practices do to the marine environment and fisheries. 'Managed access' is a form of TURF and is a well-known solution to address overfishing, transitioning away from open-access fisheries. 'Managed access with reserves' is a community rights-based fisheries management approach that provides coastal communities with exclusive access privileges for fishing in defined areas, and in which protected areas (i.e., reserves, or no-take zones) are established inside or adjacent to these exclusive access areas.

In 2014, under its global Fish Forever program, Rare Indonesia selected Kolono Bay – an open access bay located in the East Kolono Subdistrict, South Konawe District in Southeast Sulawesi Province – as one of its fifteen Indonesian sites for establishing a community rights-based managed access with reserve approach to small-scale fisheries management.

Over the course of three years, Rare partnered with five villages (Lambangi, Tumbu-Tumbu Jaya, Ngapawali, Batu Putih and Rumba-Rumba) as well as the local government authority (The District of South Konawe Office for Fisheries and Marine Affairs (DKP Konawe Selatan)), to create a 1 264 hectare (ha) managed access area with two reserves (in sum 50 ha) within the 5 400 ha that comprise the Bay. Together, the heads of the five villages, 362 fishers, local government authorities, fishing households and other fishing stakeholders also created a management body, Forum Peduli Laut Teluk Kolono, to manage the new "Kolono Bay Marine Sanctuaries." For further background, see Section 2.1.

Harvesting activities for the new Kolono Bay Marine Sanctuaries occur full-time throughout the year in the narrow Bay's coastal and coral reef ecosystems, up to two nautical miles (nm) from shore (see map below). The 362 male fishers in these five villages harvest fish and receive landings in the managed access area and surrounding area (some at a formal government-created landing site; many others informally near their homes). They primarily target snapper (*Lutjanus* sp.) and grouper (*Plectropomus microcephalus*) –both of which are depleted species – although capture fishery commodities in this area consist of a wider spectrum of marine biota that also includes rabbitfish, squid, emperor fish, giant trevally, threadfin breams, black pomfret and mackerel.

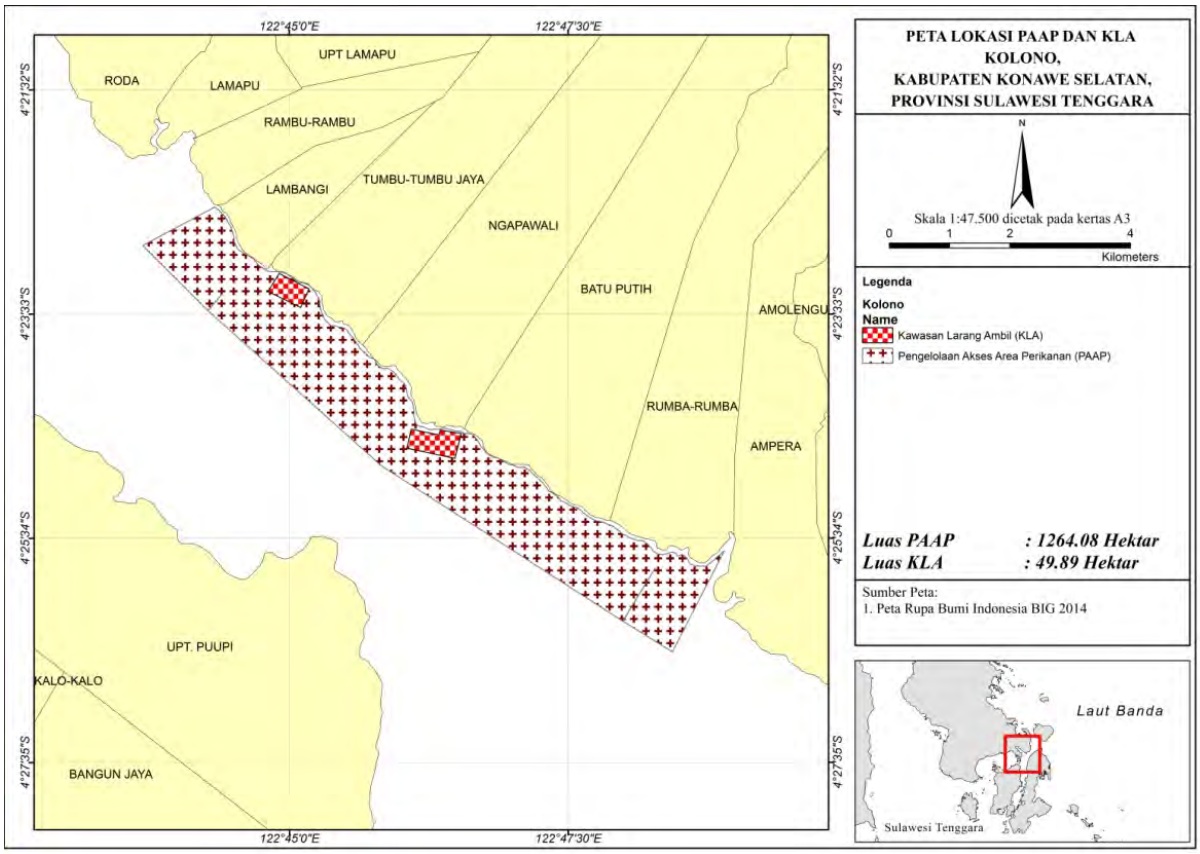

Figure 1. Map of the Managed Access Area with Reserve in Kolono Bay, Southeast Sulawesi (PAAP means Managed access Area, while KLA means Reserve).
Source: Indonesia National Meteorology, Climatology, Geophysics Agency.

Kolono Bay's small-scale fishers use gillnets and entangling nets (e.g., set gillnets, drift gillnets), and hooks and lines (e.g., hand lines, long lines) for fishing, without any type of mechanization. Individual fishers and/or family members travel to catch fish on over 100 fishing vessels with outboard/inboard engines (generally less than 100 horsepower) that measure less than 12 meters long and weigh less than ten gross tons to catch fish. These fishing vessels and gear are either personally owned by a local community member or a middleman who agrees to loan his vessel in exchange for fish, gas, etc. When

fishing, fishers travel, on average, up to two nm from the shoreline/high-water mark, and they may travel from a few hours to a full day to fish. There is no cold storage for catch on the fishing vessels, nor do the fishers use fish aggregating devices.

Women in Kolono Bay participate in post-harvest fish operations such as processing and selling fish. While they could theoretically own vessels, gears, fish aggregating devices and so on, they have historically been employed solely in post-harvest processing.

Competition and Conflict
Competition and conflict for Kolono Bay's resources are common. For example, fishers from outside the five communities, including seasonally migrant fishers, encroach on the managed access with reserves areas, despite regulations that discourage outsiders who don't have rights to access the fishery. Additional sources of conflict are fishers with access rights to the fishery that continue to fish in the no-take reserve and fishers that continue to use seine fishing gear, a non-regulated gear that decreases the catch of regulated gillnets and hook and line. Further, shipbuilding activities often cause wood waste in the sea, which disrupts important coral reef habitat.

1.2 Economic contribution and social implications of the fishing activity
Grouper and snapper, the targeted species in Kolono Bay's managed access area, may be consumed directly but are generally chilled for local and factory processing before being sold to domestic and international markets. Only ten percent of the overall catch, normally the lowest quality catch or bycatch, will remain in the local markets; 90 percent will travel to the capital city, Kendari, and if the quality meets high standards, it will be exported outside Indonesia. Given that grouper and snapper are valuable fish commodities, none of the catch is used for non-human consumption.

On average, 51-75 percent of fisher income comes from year-round, full-time fishing activity. It is likely that they spend only half of that time fishing in the managed access area. Seasonally, based on weather, fishers also support livelihoods through agriculture and farming. During the rough season, most fishers use their time to fix their fishing gear, maintain their boat and do gardening and livestock.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the Fishery
Through Fish Forever, Rare Indonesia has facilitated the development of a managed access with reserves approach in Kolono Bay, and based on the program's impact, the Bay's small-scale fisheries are now co-managed by the local government and new community-based fisheries management body. No community rights-based fisheries management system existed in the Bay prior to the Fish Forever intervention. In 2014, Indonesian law transferred authority for small-scale fisheries management from the national to the provincial government, and this law (Law No.23 of 2014) disannulled the authority of district or city governments on managing coastal waters (Susanto et al., 2015). Furthermore, in 2016, the Ministry of Marine Affairs and Fisheries (MMAF) enacted a new legal guideline that gives communities living in and around Marine Protected Areas the opportunity to co-manage their fisheries alongside government partners. Based on these two important policy shifts, Kolono Bay's five villages could pursue rights-based co-management.

In September 2015, Rare worked with the five villages to establish a representative working group named "*POKJA PAAP Teluk Kolono*." Comprised of 20 members (local fishermen, the five village heads, public figures, religious leaders, and local government), the group's purpose was to design the managed access areas and related management plans. Because this design process was inclusive, transparent and participatory, this working group was able to transition into a more formal management body called "Forum Peduli Laut Teluk Kolono" (hereafter, "The Forum").

The Forum, still active today, was formed to agree on management measures, which include acceptable fishing areas and their restrictions (including no-take zones and marine reserves), fishing rules (including the type(s) of fish targeted and gear used), fishing vessels characteristics, and the group's work plans. Everyone on the body can participate in providing advice, opinions, and formulating governance rules for fishery management. While fishing operations are formally registered by the DKP (local district fisheries and marine affairs office), fishers are not taxed or charged a fee for their fishing activities.

The working group has defined the managed access with reserves area boundaries alongside the local government, based on an agreement among the five village heads and with support from the District government. While the two marine sanctuaries have been legally established through Decree of Head Village, the Kolono Bay managed access area has not yet received formal legal recognition from the provincial government (see Section 4 for further discussion on this challenge). Further, fishers and local government are now responsible for monitoring fishing activities and enforcing the regulations. This is accomplished primarily by catch monitoring during fish landings (no other monitoring, control and surveillance systems are used to monitor fishing activities in this area). Given the lack of formal, legal recognition, the community is limited in enforcement measures, using peer pressure as the rule enforcement mechanism. When conflicts occur, either the management body or the governmental fisheries management authority help stakeholders to resolve conflicts—informal methods that may likely need to be formalized in the future.

2.2 Rights-based approach: allocation and characteristics

Fish Forever facilitated Kolono Bay's small-scale fishing community to locally recognize managed access as a form of Territorial Use Rights for Fishing (TURF) in 2017. These rights were uniformly allocated across fishers that historically participated in the Fishery; they did not recognize informal customary or traditional fishing rights, given that they didn't previously exist. There are no restrictions on who can hold, receive or purchase the fishing rights, and the fishing rights cannot be leased, sold or inherited. Further, the rights allocation for harvest is restricted to fishers using hook and line and gillnet.

The initial allocation criteria for distributing the rights took the economic viability of the fishing activity into consideration, as well as the rights to fish for the next generation of fishers. Allocation is based on an agreement among five villages around the Bay, focusing on fishing and gear limitations in the reserves (i.e., no-take zone) within the managed access area.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

Based on Fish Forever Program Results, 2014-2017, the rights-based approach and the allocation of rights are helping to achieve sustainable use of Kolono Bay's Fishery. Two years after establishing managed access with reserves in Kolono Bay, fish biomass inside the 50 ha reserves has increased, coral cover in the area slightly improved, and community knowledge of sustainable fishing and compliance with regulations increased.

Fish Forever used human-centered behavioral design — focusing on users' and other stakeholders' needs and preferences – to create a suite of tools to support staff and local fishing communities and institutions in addressing coastal fishing challenges and adopting more responsible fishing behaviors. The resulting Fish Forever Toolkit enabled fisheries data collection, fisheries management body development, fisher and community goal-setting and management plan development, and a process for implementing the Fish Forever approach.

A ‘Pride campaign’ for Kolono Bay, Rare’s primary tool and existing community engagement methodology to support new behaviour adoption, focused on accelerating local adoption of managed access with reserves for coastal waters. The campaign in Kolono Bay targeted individual fishers, the wider fishing community and local government leaders and was designed to help fishers and fishing communities adopt sustainable fishing behaviors – in particular, fisher/boat/gear registration, participation in management (reporting violations, reporting catch and attendance at community meetings), fishing in the right place using the right gear, compliance with the local fisheries code, and rule enforcement.

The campaign also built the community support necessary for enabling effective and sustainable management bodies. This improved the communities’ knowledge about coastal fisheries management, the benefits of reserves, and the responsibilities that come with access rights. Including local government representatives ensured that the bodies had the legal authority to design and execute rules for coastal waters and fisheries. Rare strengthened existing and new management bodies’ capacities to design the management process, collect data, clearly communicate fisheries regulations, organize a local enforcement system, set priorities and plan zonation, and gather the information that would guide collective fisheries planning and decision-making.

Lastly, the campaign focused on government agencies from district to national level, working on the attitudes, opinions and behaviours that make embedding a managed access with reserves approach into existing local and sub-regional governance frameworks possible. These included approving legal instruments (ordinances, management plans, etc.), allocating resources (financial, human and in-kind) and politically sponsoring the idea of managed access with reserves areas.

Rare in Indonesia administered Knowledge Attitude and Practice (KAP) and household surveys to Kolono Bay fishers at the beginning and end of the Fish Forever campaign to attain a baseline understanding of a fishing community’s knowledge, attitudes, interpersonal communication and practices surrounding fishing. The surveys provide the basis for targeting the multiple behaviour changes needed to support a successful management approach, and they were used to measure relatively immediate campaign impacts: increasing awareness (Knowledge), shifting viewpoints (Attitudes), more frequent discussions (Interpersonal Communications) and adopted behaviours. Rare also conducted conservation data surveys to assess the ecological responses to the managed access with reserves approach.

<u>Social responses to the managed access with reserves approach</u>
Three examples of social responses to the managed access with reserves approach are the following:

Knowledge of sustainable fishing
Throughout the campaign, Rare consistently observed that when fishers gain knowledge about sustainable management, they realize how they need to modify their behaviour and discuss these changes with others. This primes them to adopt new practices that foster fisheries recovery. Community knowledge of sustainable fishing improved in Kolono Bay. Survey responses reflected an increased understanding of managed access and reserves, as well as of regulations surrounding the Bay.

Compliance with regulations
Rare measures compliance using two metrics: compliance with managed access regulations (which include applying minimum size limits and gear restrictions, respecting managed access boundaries and obeying seasonal and species-specific closures) and reserve compliance (no fishing in reserve areas). Rare observed increased compliance for both metrics in Indonesia. Although these results are self-reported, the positive trend indicates a willingness to respect the rules and regulations associated

with managed access areas and, consequently, that social norms and responsible fishing behaviour are changing.

Change in Social Trust
Social trust – in government and other community members – drives cooperative behaviour. Survey responses related to trust in the community at large showed improvement. The campaign increased trust by providing individuals opportunities to interact, discuss issues, air grievances and constructively work toward a long-term solution. Further, Rare's local impressions confirm that active involvement and validation of the individual fisher as a valued member of the management process built greater trust across the board.

Ecological Responses to the managed access with reserves approach
Rare in Indonesia conducted fish and coral transects and counted individual fish to measure the ecological responses to Fish Forever. Examples of these responses are the following:

Fish in Water
During fish recovery, populations will first stabilize (maintaining biomass) – and then sustained population protection will provide time for fish to reproduce and recruit. As the populations protected by reserves increase, they should start to spill over into surrounding areas, leading to measurable biomass increases outside reserves. On coral reefs, small fish with short life cycles and rapid growth should recover most quickly when protected. This would include small herbivorous fish like surgeonfish and parrotfish (significant change likely detectable in two to five years). Larger predatory fish such as snapper and grouper, that grow more slowly, reach maturity later and reproduce less frequently, would be expected to take longer to show signs of recovery when protected from fishing pressure (five to seven years).

The total fish biomass of ten fish families inside Kolono Bay's reserves was maintained within the reserves, which Rare interprets as a positive ecological response. Given that stock assessments for target species were not conducted during the Fish Forever campaign, it is unclear whether there have been any size changes in Grouper or Snapper caught since the rights-based approach was implemented in 2017.

Ecosystem Health – Coral Cover
A three-year, global coral bleaching event began in 2014 and was the longest and most damaging coral bleaching event on record. This event followed another severe bleaching in 2010, leaving little time for recovery. Maintaining or increasing coral cover in the face of these global impacts is difficult and it must be noted that marine protected areas do not provide direct protection against climatic threats – i.e., they do not stop causation from storms or sea surface temperature. But, evidence from global data shows that protecting coral from local impacts, especially fishing and pollution, increases the resilience of reefs to recover from exogenous impacts. Although these bleaching events devastated reefs globally, there were encouraging signs of reef resilience across other Fish Forever sites in Indonesia with maintained or increased coral cover (inside of the manage access with reserve areas).

The coral cover in Kolono Bay's managed access area improved only slightly; Rare interpreted that cover was maintained, rather than increased. These results may suggest that effective protection of fish life in water slows local-level decline in coral cover, even in the face of global change.

3.2 Economic viability of the Fishery
Since the rights-based approach was enacted in 2017, there have been no changes in the type of fishing gear or fishing vessel used (those with an outboard engine), the average characteristics of the fleet, vessel and gear ownership (those owned by individuals and leased out to fishers), or in the use

of fish aggregating devices. It is unclear whether the total number of fishers participating in this Fishery has changed since then either.

However, based on qualitative discussions with local fishers, fishers cite that the reserves have provided enhanced economic benefits to the communities, in the form of bigger catch, fishing areas closer than before, and decreases in the average distance travelled and duration fishing. Some believe that the managed access area has contributed to these benefits.

3.3 Social equality

The initial allocation criteria for distributing legally recognized fishing rights took into consideration the economic viability of the fishing activity (aiming to increase it) and the rights to fish for the next generation of fishers (aiming to create a locally-led and sustainable management approach). As mentioned in 3.2, fishers struggled with decreasing catch, increasing travel time, competition with bigger fishing vessels, and conflicts with migrant fishers. However, based on qualitative discussions with local fishers, since managed access with reserves was established, interpersonal communication among fishers has significantly improved, and knowledge of the importance of collective action for managed access has increased. Fishers also cite enhanced confidence in monitoring, surveilling, and reporting illegal activity in the Bay.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the Fishery

Indonesia's provincial government manages territorial/coastal seas up to 12 nm. The communities must ultimately get formal recognition from the provincial government to set up managed access areas with reserves. Communities, with support from district government, have proposed to the provincial government that fishing rights be valid for 10-15 years (to account for the life cycles of different species).

Given that the provincial government doesn't yet legally recognize the managed access area, there is technically no time limit that can be regulated for the health of the fish or ecosystem. While the community of five villages now agreed to have a managed access area with reserves, the lack of legal recognition of managed access with reserve areas causes challenges, e.g., weak enforcement of the rules (the management body cannot enforce the rules to outsiders). To date, the five villages have together agreed to set up and follow the rules for managing this area, but they are limited in being able to enforce them.

Another challenge that Rare is working to solve is in helping Kolono's fishing communities adopt more sustainable fishing behaviours long after Rare's support to the communities ends; e.g., participating in management, maintaining compliance, trusting other fishers, etc.

4.2 Improving fishery sustainability in the future

One of the most significant management improvements for Kolono Bay’s Reserve would be the formal legal recognition from the provincial government for the Bay’s managed access with reserves. In the meantime, Rare will continue the process of supporting Kolono Bay's fishing communities to get formal legal recognition from the provincial government and continue supporting the Fishery's management body to become both legal and functional.

Further, Rare is continuing to partner with the SE Sulawesi provincial government to ensure allocation of 0-2 NM for small-scale fishing within provincial marine spatial planning. Rare is also supporting the government’s interest in replicating community rights-based fisheries management in that spatial area across 11 districts in Southeast Sulawesi (out of the 16 coastal districts across the province) over

the next several years, using the success of the five communities in Kolono Bay as a model for other potential managed access with reserves areas.

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Adapting a fishing fleet to conflict goals –Norway – too special to be an example?

Jan Frederik Danielsen

Please refer to the case study presentation available at:
http://www.fao.org/3/CA2493EN/ca2493en.pdf

Competing Fisheries Stakeholders: User Rights in Nigeria's Coastal and Inland Fishing Communities

Stella Williams
Mundus Maris Sciences and Arts for Sustainability

Abstract
Governance of tenure and fishing rights are critical to food security, poverty alleviation, livelihoods sustenance and sustainable utilization of fishery resources for small-scale fisheries, particularly in developing countries. In Nigeria, there is a paucity of literature or studies on tenure, fishing rights and management rights of the small-scale fisheries. Hence, this paper presents a situational analysis of the artisanal (small-scale) inland and coastal fisheries in Nigeria with respect to tenure and user rights, which are tangential to achieving 2030 UN Sustainable Development Goals. The research methodology adopted involved collection of primary data from surveys with the FAO Tenure and User rights Questionnaire, secondary data from reviewed literature, and over three decades of authors' cumulative knowledge and engagement in small-scale fisheries. The small-scale fisheries are heterogeneous, multi-species and multi-gear characterized on the basis of the environment and crafts. They contribute over 70 percent to total domestic fish production. Statutorily, governance assumes a hierarchical approach, with legislations for the inland and coastal small-scale fisheries within the purview of the State and Federal Governments, respectively. However, the governance structure of small-scale fisheries inclusive of tenure and user rights exists formally (State), informally (tradition), and through fishers cooperatives/organizations/institutions. Most inland fisheries are under communal property regimes, and access to resources (fishing rights) specified mostly by fishing gear while the small-scale fishery operating in the coastal waters has statutory (formal/legal and recognized) and exclusive fishing rights to fishery resources within first five nautical miles in the coastal waters. Nigerian women fisherfolks are excluded from fishing in deep waters but they hold fishing rights in the nearshore waters, creeks, rivers, mangrove swamps where they own and harvest mainly small crustaceans, molluscs and fish, less frequently, using passive gears, gleaning and nonmotorized crafts. Extra-sectoral interactions and hazardous events that pose challenges to tenure and fishing rights are excluded in extant fishery policies and management, and hence need to be addressed.

Keywords: Tenure, User rights, Human right, Right to food, Gender, indigenous peoples, youths, fishing, local and global issues.

1. INTRODUCTION

1.1 Description of the Fishery

Artisanal fishery is the largest form of fishing carried out by the small-scale fisheries (SSFs) both in the maritime fishing communities on Nigeria's southern coastline as well as in the brackish water, coastal streams and lagoons in the Inland freshwater fisheries in the lakes, dams, rivers and tributaries.

The SSFs are heterogeneous, multi-species and multi-gear and characterized on the basis of the environment and crafts. They contribute over 70 percent to total domestic fish production. The geographical area where harvesting activities for this Fishery take place is the coastal areas less than three nautical miles from the shore, as well as in the coastal areas between three and five nautical miles from the shore by fishers using canoes. These artisanal fishers also harvest fish from inland, freshwater ecosystems.

Figure 1. Figure 1. Demographic Map of Nigeria showing its southern coastline from Lagos (west) all the way to Cross River (south-east). Also the Inland waterways within the country.
Source: US Geological Survey, 2018.

One unique aspect of the artisanal fisheries ecosystem in Nigeria is that both men and women are fishers, especially the 'Aworis' in Lagos and Ogun States. Also, the 'Ijaws and Ilajes' in Ondo State while in the Niger Delta there are other ethnic groups – 'Urhobos', 'Adonis', 'Efik' 'Ibibios' where both men and women fish. The women and children fish close to the shore,[118] in rivers, creeks, lagoons, estuaries, lakes, and mangrove. They use their canoes and oars to move around the fishing grounds and Swamps, while the men fish far into the deep waters in rivers, lakes, lagoons and the sea.

Table 1. Most important species of fish caught by Artisanal Fishers in Nigeria.

Common Name	Scientific Name	Fishing Season
Croaker[b]	*Pseudotolithus* spp.	All year
Bongafish[b]	*Ethmalosa fimbriata*	November to April
Catfish[a]	*Chrysichthys nigrodigitatus, Clarias gariepinus*	All year
Tilapia[a]	*Oreochromis aurea, Oreochromis niloticus Tilapia guineensis,*	All year

[118] Source: Mafimisebiet al., 2016; Williams, 1987; Williams, 1994; Williams 2001 c; Williams and Adedoyin, 2002; Williams et al, 2006

	Coptodon zilli	
Periwinkles, oysters and clams[a]		All year
Bony Tongue	*Heterotis niloticus*	All year
Land Crab[a]		November to April
Blue SwimmingCrab[ab]	*Callinectes amnicola*	November to April
Sole[b]	*Cynoglossus* spp.	All year
Grunter[b]	*Pomadasys* spp.	All year
Grouper[b]	*Epinephelus* spp.	All year
Shiny nose[b]	*Polydactylus* spp.	All year
Red snapper[b]	*Lutjanus*spp.	All year
Barracuda[b]	*Sphyraena* spp.	All year
Mullet[a]	*Mugil* spp.	All year
Threadfin[b]	*Galeoides* spp.	All year
		[a] are fish species from inland waters including estuaries, lagoons, rivers, lakes, creeks, mangroves swamps etc. [b] are fish species from small-scale coastal fishery

Table 2. Overall status of fish species.

Mangrove swamp crab	Blue Crab	Periwinkle	Crayfish	Catfish	Bonga fish
Fully exploited	**Fully exploited**	**Fully exploited**	**Fully exploited**	**Fully exploited**	**Fully exploited**

1.2 Economic contribution and social implications of the fishing activity

According to the Nigerian Fisheries Data (2008-2015), the average employment in the primary sector is unsegregated by gender; however, the average employment by secondary sector is segregated by gender which shows Male 8.18 million (29%) and Female 20.02 million (71%). From our research work with the women who are unreported to participate in the primary employment of the artisanal fishery, we would say that on the average if 8.62 million (85%) of participants are males, 1.5 million are female (15%).

This information results in the following:

- Primary participation in artisanal fishery Male: 85%; Female 15%
- Secondary participation in artisanal fishery Male 29%; Female 71%

Primarily, artisanal fishery catches are strictly for domestic food consumption, however, with more and more members of the society investing in fish farming activities, there is a need for some of the products to be diverted into the non-human consumption such as fish meal. For example, juvenile Clupeids and juvenile shrimps are the most feasible artisanal fishery products that fishers could sell for such an enterprise.

Indeed, most of the artisanal fishery products are either cured, smoke-dried or salted to preserve them from spoilage. Even with these techniques, artisanal fishery post-harvest losses are very high in Nigeria. To reduce poverty and zero hunger while enhancing gender equity (by reducing gender inequality within the society), meanwhile ensuring responsible consumption and production of fishery products, is one of the strategies for achieving the United Nations Sustainable Development Goals (SDGs).

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACHES

2.1 Management of the Fishery

While there were two parallel governing systems, the traditional (customary) and the modern (state) systems, the former has remained the most popular, effective, and successful (A form of meta-governance of fisheries exists in Nigeria whereby according to Schedule II Part I, Item 29, of the 1999 Constitution (Nigeria Constitution 1999), all issues relating to inland SSFs are within the purview of the state government to legislate on.

Village level institutions have as their major goals the enhancement of social capital (e.g. reciprocal activity and assistance to the needy). Such organizations operate through long-standing customary rules/laws, norms and taboos. In addition, Village Heads or Sarkin Ruwas (Head Fishermen), and Bulamas (Water Chiefs) usually preside and exercise some level of regulatory power with respect to fishery access. They act as links between the rural community and village level formal institutions such as the local representative of the Federal Department of Fisheries (if present). They have no firm advocacy/lobbying powers at the national (macro) or middle (meso) levels but are vital at the local government levels, where they are able to influence access to the fisheries. This is most common in major fishing communities of Kainji/Jebba and Chad basins, the confluence of the Niger/Benue, and Nguru–Gashua Wetlands, North-East Nigeria.

In Lagos State, fishers are organized into State-registered cooperatives and, through collective action, are able to wield some influence over resource management. Most inland fisheries are under communal property regimes and access to resources (fishing rights) that are specified mostly by fishing gear, while the SSF operating in the coastal waters has statutory (formal/legal and recognized) and exclusive fishing rights to fishery resources within first 5 nautical miles in the coastal waters.

Nigerian women fisherfolks are excluded from fishing in deep waters but hold fishing rights in the nearshore waters, creeks, rivers, and mangrove swamps where they own and harvest mainly small crustaceans, molluscs and less frequently fish using passive gears, gleaning and un-motorized crafts. Extra-sectoral interactions and hazardous events which pose challenges to tenure and fishing rights are excluded in extant fisheries policies and management, and hence need to be addressed.

2.2 Brief history of former rights-based approaches used in the Fishery

Most fisheries tend to be open-access but limited by community ownership regimes. In many inland fisheries, boundaries are ill-defined as are the boundaries for the resources which move freely. However, the fishing area of a community is delimited by the extent of fishing grounds allotted to the fishers. Fishing areas exist but are not strictly adhered to by fishing participants.

2.3 Rights-based approach: allocation and characteristics

In an open-access regime, there are obviously no allocations. The SSF has exclusive fishing rights to fishery resources within the first five nautical miles in the coastal waters, but there is some invasion by industrial trawlers in this exclusive zone.

Extra-sectoral interactions and hazardous events (in detail described in chapter 4.1) which pose challenges to tenure and fishing rights are excluded in existing fisheries policies and management, and hence need to be addressed.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

Only sporadic stock assessments on the fishery resource in Nigeria have been carried out by individual researchers, especially PhD candidates. However, for most indigenous fishing communities, no stock assessment of the Fishery is undertaken. A few biologists with research grants carry out a limited form of stock assessment of various water bodies in Nigeria.

Generally, with many of these ecosystems where artisanal small-scale fishery is practiced, there has not been a stock assessment of most of the species listed in Table 2, because of their limited economic value compared to those listed in Table 1, such as croaker, sole, grunter, grouper, shiny nose, and red snapper, which have higher economic value in the export market/trade.

3.2 Economic viability of the Fishery

The number of fishers in the Fishery has not changed. However, over the last ten years, the fishers have aged and become poorer because the fish caught are smaller in size and there are fewer younger fishers joining them to fish.

The distance travelled during an average fishing trip has not changed either. However, they encroach on each other's fishing grounds compared to the past ten years following the fish stocks. The economic situation is causing them to compete more vigorously. They spy on one another in an effort to ensure they harvest as much of the available fish stock as possible.

3.3 Social equality

Women are allowed to own fishing gear and fishing boats. Their participation in the fisheries is quite high, with 15 percent in the primary sector. As in all other West African countries, the post-harvest sector is mainly in the hand of women, with 71 percent. The role of artisanal fishers is well recognized by the government; in fact, five miles are assured for this fishery sector. Fishers generally are carrying out day trips.

The fishers from Nigeria travel to access this Fishery, for example, the Ilaje fishers from Ondo State travel to Lagos Island, the Urhobos from Edo and Delta State travel to Borno State to access the Fishery in the lakes and dams, and the Tivs from Benue travel to the Lake Chad to access the fishery in the Lake. Some fishers from Benin Republic travel to Badagry for access too. There are Ghanaian fishers, using what are known as Ghanaian Boats to fish especially with purse seine for bonga in AkwaIbom and Cross River States. There are also Ijaws, Igbos and Yorubas in the area as fishers, fish traders and/or suppliers fishing equipment. Migratory fishers lead to problems with the local resident fishers.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the Fishery

The main challenges for the artisanal fishery come from competition between fishing communities and seasonally migrant fishers. There is an influx of migrant fishers and increased fishing effort, but weakened social capital and social norms. This conflicts may increase non-compliance.

Conflicts between local small-scale fishers and industrial fishers represent the main challenge for small-scale fishers. The illegal fishing by fishing trawlers is a major problem for the small-scale fishers. The regularity of trawler incursions into the non-trawling zone of five nautical miles has exacerbated the call for increased use of the monitoring, control and surveillance (MCS) systems in small-scale fishing zones[119].

In addition, there exist conflicts between fishers with fishing gear targeting the same species. The fishing grounds for most artisanal fishers are the same. With a decreased catch in species like catfish and croaker, which is probably due to effects of climate changes, there are arguments between the fishers and suggestions for the fishers not to fish very close to each other. Each fisher tends to lay claim on a certain location or region of the area for him or herself.

Also important are the conflicts between fishing communities and Oil Producing Companies. Oil Platforms are installed on traditional fishing grounds, and fish are denied access. Oil spills destroy fishing gears and pollute the water and fish; this constitutes an economic loss. In the case of oil and natural gas extraction, in the Niger Delta, the conflict between the oil and gas industry has generated political bad blood to the extent that armed personnel have been invited to control the environment. Legal cases have been taken to The Hague and compensations have been paid to various groups by either the Government (in the case of SaroWiwa who was killed by the Abacha Government) or Shell Petroleum, which has had to pay Community Leaders compensation for various reasons including pollution of the ecosystem. Women were also involved in protesting that their husbands could not go fishing, and this has affected their livelihoods.

An important challenge for the inland fishery is represented by agriculture activities (Fertilizer- run-offs from farm pollutes inland waters causing eutrophication, nuisance algal bloom). With agriculture, the need for physical reward from employment is the reason for the conflicts. When fishing is not as lucrative as it was in the past, young members of the population hire themselves out to farmers who pay them regularly for the job performed.

In the case of sand mining, the need for sharp sand for construction is competing for labour just like the agriculture; hence, the young members of the population want a job that will pay for their services. Besides, sand mining and dredging are destructive to fishing. The sound generated from the equipment drives fish further away. The miners are also known to destroy fishers' nets and other gears. They are alleged to mine around, in the fishing grounds and spawning areas.[120]

This year, the issue of plastic pollution was well demonstrated as an environmental issue, and there was extensive educational mitigation in all the Maritime States to inform the inhabitants how and what the plastic pollution is all about and show the impact on the Ocean – vis-à-vis SDG 14.

4.2 Improving fishery sustainability in the future

The customary fishing rights are recognized but informal because they are not statutory or legal. As far as one knows there is no mention of fishing rights for inland fisheries. However, fishing rights existing for the SSF operate within the five nautical miles of the coastal waters. The same is operational in the inland area, but under the jurisdiction of SarkinRuwa and Bulamas (Water Chiefs) in consultation with the Village Chiefs and Ruling Chief as, for example, in Argungu, where the Royal (Emir) is recognized.

Intra-fishing conflicts are resolved largely within traditional fishing resolution mechanisms, in which case fish leaders intervene and find solutions and spirituality. For conflicts with other stakeholders such as sand miners and industrial fisheries, fishers resort to the Government. While the former has been effective, conflict resolution outside the Fishery has not been entirely successful.

[119] Source: Akintola et al., 2017

[120] Source: Akintola and Fakoya 2016

There are a number of NGOs working with and within communities all over Nigeria to resolve conflict even within the small-scale fishing communities. The NGOs have been very effective.

5. LESSONS LEARNED

There are several lessons that are learned from this experience:

- Even when the customary rights are recognized, like in the case of the artisanal fishery in Nigeria, illegal fisheries by industrial fisheries can invade the allocated zones, if there is no MCS. Both State and Federal MCS units are constrained by inadequate logistics and human resources. Most of the fishing settlements along the coastline and littoral zones of inland waters are poorly accessible due to poor or non-existent access roads and susceptibility to flooding during the rainy seasons.
- New economic activities such as oil exploitation and sand mining impact the artisanal fishery. When competing with these strong competitors, the artisanal sector loses out, as economic interests are on the side of the competitors.
- Inland fisheries are less visible. MCS is even less effective in the inland fisheries sector. Agriculture impacts severely the performance of inland fisheries, which are generally losing out. More visibility of the role of the inland fisheries sector with regard to food security is needed in national policy discussion.

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The upgrading of Traditional Marine Resource Management in Maluku and Papua: Process, Outputs and Outcomes

Dedi Suriadi Adhuri

Please refer to the case study presentation available at:
http://www.fao.org/3/CA2495EN/ca2495en.pdf

Developing Rights-Based Fisheries to end Manta Hunting in Lamakera, Indonesia

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Abstract
Lamakera, a small fishing community located in East Flores, Indonesia, is one of the most prolific manta ray hunting communities in the world. The international trade in manta ray body parts is worth around USD 10 million annually, and Indonesia is one of the largest global manta fisheries. Lamakerans have been fishing manta rays since ancestry. Until around the late 1990s, the community hunted mantas on an artisanal and subsistence scale, however, as commercial markets developed, the fishery expanded into a commercially driven fishery with a significant increase in fishing effort. Comparison of catches across a 12-year period (2002 to 2014) revealed a 75 percent decline in manta ray and mobula catch despite an increased fishing effort. In January 2014, following the international recognition of both species the of manta ray (*Manta birostris and Manta alfredi*) as vulnerable species, Indonesia introduced legislation that banned all manta ray hunting in national waters. The new regulation empowered a coalition of manta conservationists and NGOs, including Misool Foundation, Reef Check Indonesia and Manta Trust to address Lamakera's unsustainable (and now illegal) hunting of manta rays. This coalition aimed to reduce the hunting, safeguard food security for the coastal communities within East Flores, and drive change in marine protection policy in the area. Lamakera community members were invited to join this coalition and, since establishing these partnerships, community associations have been built for those people who made an official pledge to stop hunting manta rays. NGO and governmental support have been provided so that community members can become independent and take ownership of their livelihoods. The initial efforts to transition Lamakera away from illegal manta hunting have included community-based conservation initiatives and law enforcement by the Wildlife Conservation's Society (WCS) WCU (Wildlife Crime Unit) and East Flores law enforcers to stop the remaining hunting activities.

1. INTRODUCTION

In 2013, member countries of the Convention on International Trade in Endangered Species (CITES) voted to include both species of manta ray (*Manta alfredi and Manta birostris*) under Appendix 2, thus regulating the trade in these animals' body parts. In January 2014, Indonesia went a giant step further by banning all hunting of manta rays in national waters. The regulation, issued by the Marine and Fisheries Ministry Regulation (Kepmen KP No. 4 2014), banned the hunting, selling and distribution of both species of the manta ray. Violation of this regulation can incur a punishment of a maximum prison sentence of 6 years and a fine of approximately USD 100 000.

Lamakera, a small fishing community located in East Flores, Indonesia, was one of the most prolific manta ray hunting communities in the world. The new regulation empowered a coalition of manta conservationists and NGOs, including Misool Foundation, Reef Check Indonesia and Manta Trust to address Lamakera's unsustainable (and now illegal) hunting of manta rays. This coalition aimed to reduce the hunting, safeguard food security for the coastal communities within East Flores, and drive change in marine protection policy in the area. Additionally, this work intended to support the United Nation's Sustainable Development Goal 14: *Conserve and sustainably use the oceans, seas and marine resources for sustainable development.*

This case study discusses fisheries development with Lamakera and the rights-based approach that has been developed to enforce regulations and support economic stability. It is worth noting that the manta ray trade is part of the larger mobulid fishery (mobulids include both manta rays and mobula rays). The mobulid fishery is referenced in this document to add context where necessary. However, the present case study focuses primarily on manta rays.

1.1 Description of the fishery

Lamakera location and demographics

Lamakera in East Flores, Indonesia, is infamous as one of the world's largest targeted mobulid fisheries, where thousands of mobulids are landed annually to supply the global demand for mobulid products. Manta rays comprise the majority of Lamakera's targeted mobulid catch, but both manta and mobula rays are hunted, primarily for their gill plates (or branchial filaments). These body parts fetch a high price in the Non-Traditional Chinese Medicine market. Manta meat is a by-product and provides a secondary source of income to this community. Historically, Lamakera hunted manta rays on a subsistence, artisanal scale for hundreds of years. However, in the last two decades, this fishery developed as a commercially-driven fishery; fishing activity has since had a devastating effect on the populations of these vulnerable species in the surrounding waters.

Lamakera is located on the east coast of Solor island, East Flores Regency, East Nusa Tenggara Province. The village is divided into two smaller villages - Motonwutun and Watobuku. The total population is 2 504, and there are 661 households. The total land area is 162 hectares. The arid land makes farming impossible and, consequently, marine resources are the main source of income and food. There are 345 fishers in Lamakera (13% of population), and these fishers earn 71 percent of the community's income (Table 1).

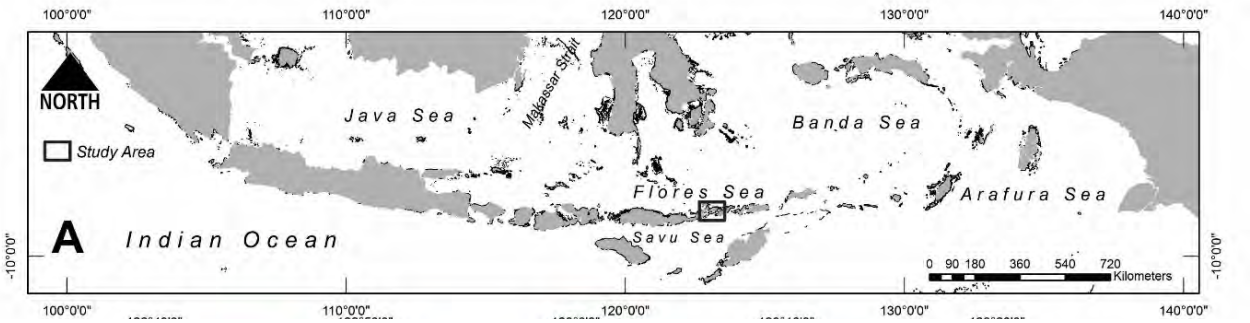

Figure 1. Lamakera's location within Indonesia.

Table 1. Demographic data from Lamakera.

Demographics	Watobuku	Motonwutun
Percentage of under 20 years old	51%	38%
Percentage of population earning income	19%	20%
Percent of income earners who are fishers	75%	90%

Data source: social survey carried out in 2014 by Vanessa Jaiteh.

The manta ray hunting season lasts for eight months, from March to October inclusive. The peak month for manta landings is July. From January to March, the area experiences seasonal rain, making it impossible to dry the gill plates. High winds and waves make the ocean impassable.

Mantas are hunted using traditional spearing techniques. In addition to targeted hunting, the use of gill nets has increased in the last five years, and mantas are now threatened by accidental and

intended catch in these nets. Until recently, spearing manta rays made up a substantial part of Lamakera's income, however, fishers also use a variety of fishing techniques including bottom-set gillnets, drift gillnets, bottom and pelagic longlines, handlines, trolling, and bombs, targeting different pelagic fish species such as tuna, sardinella and mackerel.

Figure 2. Fishing grounds of Lamakera fishermen.

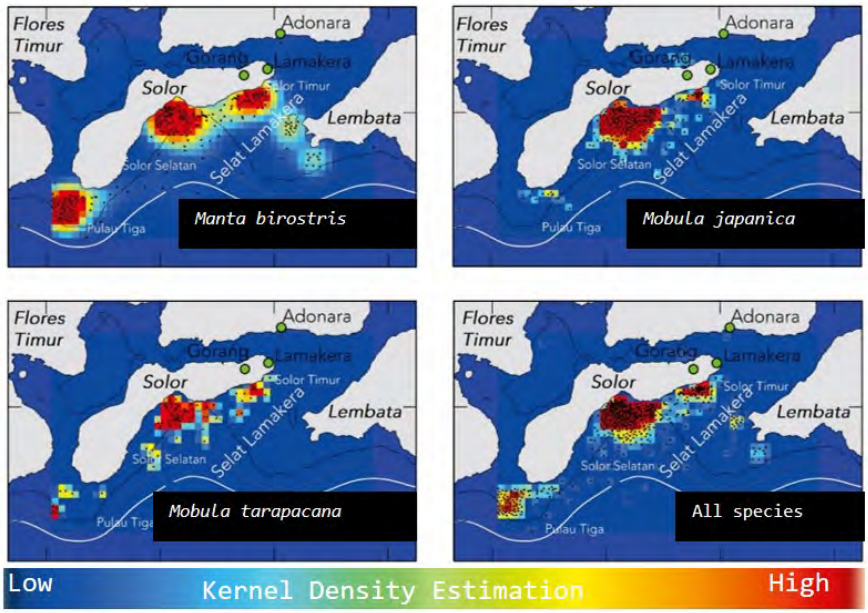

Figure 3. Mobulids fishing ground map.
Source: Mobulids landing conducted by Iqbal Herwata (2018).

Manta Fishery structure

The manta fishery is structured as follows:

- Fishers and boat owners/captains: One fishing boat normally consists of one captain and five to ten crew members
- Papalele: Papalele are the fish collectors, primarily women, whose role is to buy the catch from the fishermen, process the manta gill plates and meat and sell to buyers
- Middlemen: Many middlemen are located within Lamakera, and they sell the dried gill plates directly to the external traders
- Traders: Buyers, the majority of whom are in Java and Bali, who are responsible for sales and export to China and other Asian countries

The gill plates are sent to Surabaya, Java, and then exported to China. The lower value meat is sold locally. Processed fish and fresh yellowfin tuna and skipjack are exported to the USA and Japan by three fish factories (Okishin, Primoindo, and Jasa Putra Abadi).

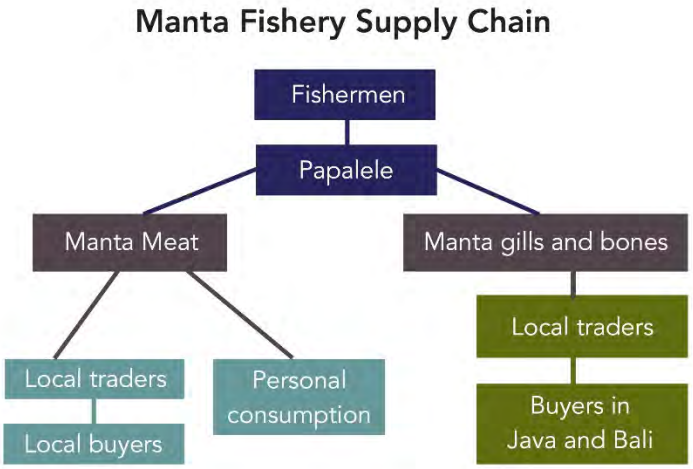

Figure 4. Supply chain diagram.
Source: based on the draft Indonesia Marine and Climate Support report by USAID of NTT.

Economic contribution and social implications of the fishing activity

The international trade in manta ray gill plates is worth around USD 10 million annually, and Indonesia is one of the largest global manta fisheries (O'Malley et al. 2016). Data from Lamakera shows that in 2013-2014, 94.5 percent of 212 mobulid fishing trips were profitable, with 76 percent earning over USD 85. Gross revenues from the mobulid trade, based on landing numbers and market prices for dried gill plates and meat, were estimated at USD 295 862 in 2002. Increasing prices for gill plates somewhat offset the declining catches from 2002 to 2014, and overall gross revenues from the mobulid trade fell to less than USD 93 000 by 2014 (Table 2). With the recent reduction in gill plate prices, these revenues can be expected to decline sharply in 2015 (Table 3).

Table 2. Manta Trade Revenue 2002-2014.

Manta Trade Revenue from 2002 - 2014			
	2002	2010	2014
Manta catch	975	228	138
Avg. Yield Meat (kg)	50	50	50
Price/kg meat (US$)	4	6.9	6.9
Avg. Yield gills (kg)	5	5	5
Price/kg dried gills (US$)	19	69	10
Total Revenue (US$)	295,862	157,241	118,965

Source: Lewis et al., (2015*)*

Table 3. Income from Manta Trade 2015-2017.

Income from Manta Trade		
Year	Total Manta Catch	Gross Income
2015	178	US$ 89,000
2016	75	US$ 37,500
2017	6	US$ 3,000
Manta trade income decrease between 2015 and 2017 = USD 86 000		

Source: Field data collected by Misool Foundation team (2015-2017) based on average cost of USD 500 per manta.

The Lamakera manta ray fishery landed an estimated 975 mobulid rays in 2002 (Dewar 2002.). Catch comparison across a 12-year period (2002 to 2014) revealed a 75 percent decline in manta ray and mobula catch despite an increased fishing effort (Lewis et al. 2015) (Figure 5). Interviews in 2011 and 2014 revealed that fishers found it increasingly difficult to locate mantas, further suggesting that populations may have declined significantly due to fishing pressure. Despite recognizing the fact that stocks may be depleted, there was no effort from the fishermen to reduce hunting efforts.

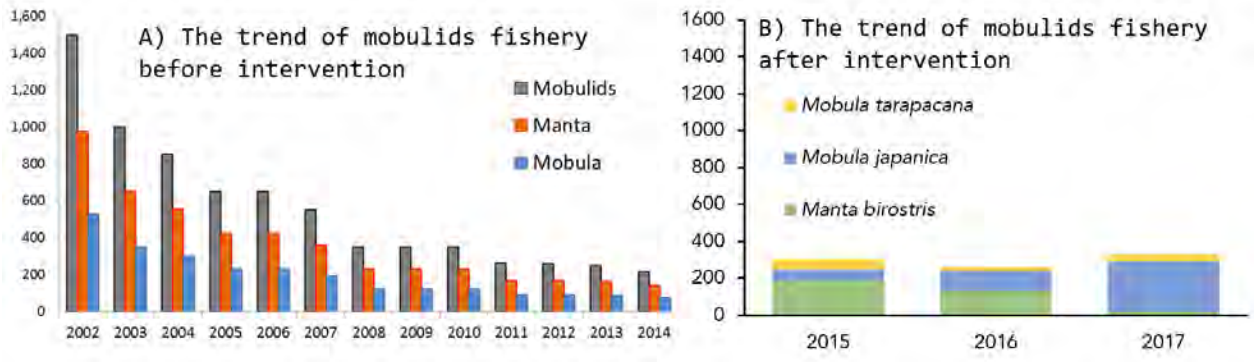

Figure 5. Annual trends of mobulids fishery in Lamakera.
X-axis indicate the total numbers of mobulids caught annually.
Source: A) data based on Lewis et al., (2015); and B) Putra and Lewis, 2018a**.**
Note: graph (A) shows that before the intervention, fishing efforts for manta rays is higher rather than mobula, but after the intervention in graph (B) the species composition has changed due to the decrease in manta hunting effort. Additionally, the gillnet fishery effort has increased, leading to an increase in mobula landings.

The social effects of the fishery can be felt in several ways. Continuing to practice manta hunting puts fishermen at risk of arrest. Furthermore, the fishery supports a debt cycle that affects many residents. Our field team have observed that traders typically provide loans to fishermen and other community members, often in times of hardship or emergencies. This leaves the fishers indebted to the traders, both financially and personally, meaning that the fishers must continue hunting to repay these loans. Finally, unsustainable fishing practices have the potential to impact the future food and livelihood security of this community, which is reliant on a healthy marine ecosystem, making the expansion of sustainable fisheries more critical each day.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

In 2014, the NGO coalition began working with the Indonesian Ministry of Marine Affairs and Fisheries, local government and coastal villages to introduce a comprehensive, community-based conservation program designed to collect scientific data, influence marine policy and diversify livelihoods within the

community. In 2016, realizing the need for a local enforcement component to complement the community work, the Wildlife Conservation Society's (WCS) Wildlife Crimes Unit (WCU) was brought in to begin a local patrol initiative. This multi-faceted approach is described in more detail below.

Government
The Department of Fisheries is responsible for official regulations such as boat licenses, fishing licenses and authorising marine patrols.

Regulations
- Minimum mesh size for purse-seine fishers (≥1 inches)
- Banning of destructive fishing such as bombing, compressor diving, manta hunting
- 0-10 GT boats permitted to fish in the region (East Flores) or 0-4 miles from the coast
- 10-30 GT boats permitted to fish 4-12 miles from the coastline and permitted to land catch in province harbours with official authorisation letters

Quotas
No quotas have been developed for the sustainable hunting of manta rays. All hunting is banned, and manta ray experts and leading marine scientists agree that mantas cannot be fished sustainably due to their very low reproductive rates, small population sizes and other life history traits.

Zonation
The Savu Sea area (within which East Flores is located) is reserved as a Marine Protected Area (MPA). However, since it has been established, management has been limited. Additionally, East Flores is not currently included in any of the MPA zonation plans. In 2018, the East Nusa Tenggara Governor declared the intention to create zonation for fisheries and conservation areas. This policy aims to create zones for small and large fisheries and usage of fishing gear. However, the province currently lacks the systems, human resources and budget to manage this area, which spans 700 islands and 15 million hectares. The Misool Foundation has been working in an advisory capacity to provide recommendations for MPA policies (Figure 6).

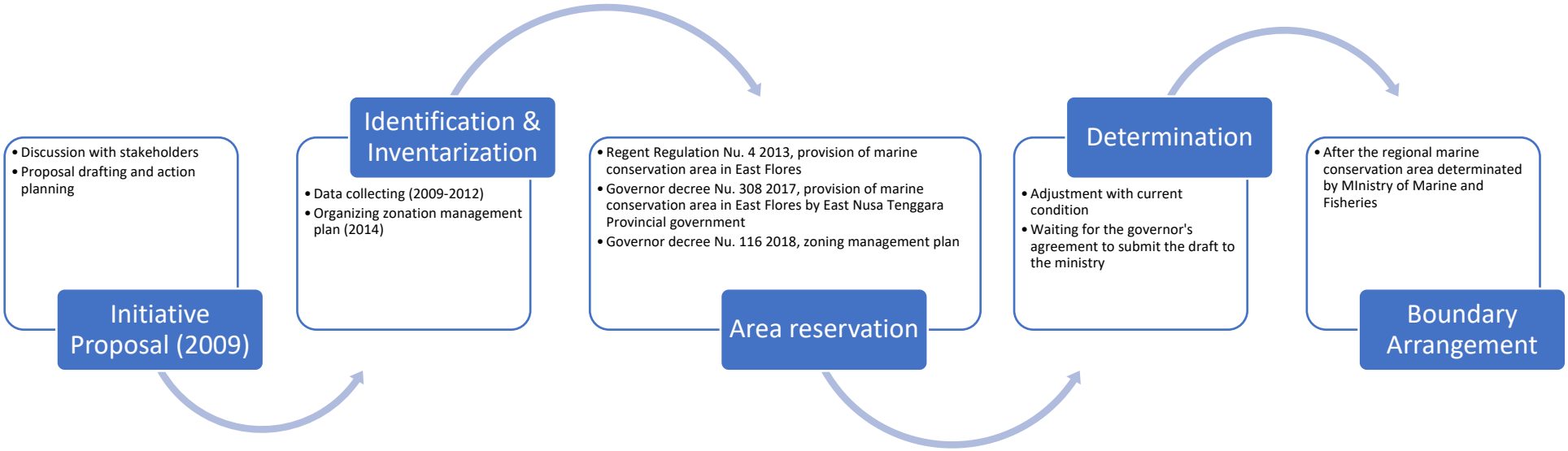

Figure 6. East Flores MPA planning process.

Enforcement

Despite the initial efforts to transition Lamakera away from illegal manta hunting using only a community-based conservation approach, some manta hunters found the temptation to continue hunting mantas to be too strong. To ensure that this already severely depleted manta population does not become extirpated, it was imperative that immediate action was taken to stop the remaining hunting activities. In the first two years since the manta law was passed, WCS and their marine WCU actively pursued arrests of key manta gill plate traders around the country, including an important arrest in Lamakera in July 2015. That arrest, in particular, caused a significant backlash against our team on the ground in Lamakera. At that point, we began intensive discussions with WCS about the need to initiate an active patrol system designed to stop the manta hunt, with the important caveat that our team on the ground and our community engagement program be kept explicitly separate from the patrol system. WCS and their WCU agreed to take on the implementation of the patrol system, and they began working with the Fisheries Department, Marine Police and Marine Ministry Controller to develop a comprehensive enforcement schedule. This began in September 2016 and patrols are now conducted around 14 days a month, depending on conditions and fishing season. The Misool Foundation research team has developed an environmental model to predict occurrences of large megafauna. This data is used to provide recommendations for priority patrol dates and locations. The collaborative approach aims to change attitudes and norms towards manta ray conservation through community outreach and incentives (both positive and negative).

2.2 Brief history of the former rights-based approaches used in the fishery

Lamakerans have been fishing manta rays, in their words, since ancestry (*sejak nenek moyang*). Until around the late 1990s, they were only fishing mantas on an artisanal and subsistence scale and only used the meat for local consumption; the remaining body parts (including the gill plates) had no value and were thrown away. However, as commercial markets developed and reached Lamakera, buyers told them that they could also sell the skin, bones and gill plates. Since then, every part of the manta is used, and the fishery expanded from an artisanal fishery into a commercially driven fishery with a significant increase in fishing effort.

In the past, it would take Lamakera hunters two days and a night to get to Pulau Tiga (the main manta fishing ground). The boats would spend approximately 15 days at sea and return with a catch of about five to seven mantas per boat. In the late 1990s, government subsidies helped to finance a shift from traditional sailing boats to motorised vessels. The number of boats increased from 18 to 30 boats (M. Songge personal communication 2011, in Lewis et al. 2015). These changes dramatically shortened the journey time to fishing grounds and fishers only needed to fish for a day to yield similar catch results.

The manta ray hunting tradition was based on an internal hierarchy. The spearing captain (the person in charge of the harpoon) comes from a historical lineage of hunters. People not born into such a family will probably never become spearing captains, but they can still spear mantas. Although pride in their skill is no doubt a part of Lamakera's manta hunting, the culture of manta hunting has been lost in recent years, and many Lamakerans admit that it is primarily driven by economic incentives.

2.3 Rights-based approach: allocation and characteristics

This development of a rights-based approach intended not only to give fishermen the ability to voice their needs and concerns but also to encourage ownership of sustainable fisheries management. Embedding the fisheries governance challenge within a broader perspective of human rights enhances the chances of achieving both human development and resource sustainability outcomes in SSFs of developing countries (Allison et al. 2012).

Since the manta hunting ban was introduced, the community has been involved in multiple socialization meetings with the Indonesian Ministry of Marine Affairs and Fisheries, local government

departments and NGOs. These meetings aimed to provide clarity to the regulation, provide a forum for community members to raise their concerns or share their perceptions and start discussions about possible alternative livelihood options.

These discussions were met with mixed feelings from the community. Some felt their income was threatened, while others understood the law and were keen to seek alternative options. The Misool Foundation responded by developing new income streams that are decoupled from manta hunting. We engaged ex-manta hunters and the community members who were ready to change. Our priority was to give them the option to stop hunting in exchange for NGO and government support. We gathered those people and asked them to sign an agreement to state that they would stop hunting mantas, an agreement ratified by the local government departments. In return, and with consultation from the fishermen, we completed several surveys to understand how we could best address their needs. We invited Indonesian-based non-profit organization, Yayasan Masyarakat dan Perikanan (MDPI) to conduct a Rapid Assessment on the Potential for Sustainably Focused Program Development in Lamakera.

The assessment concluded that most of the Lamakeran fishers are opportunistic and take multiple gears with them on their fishing trips. This assessment showed that fishers were open to new methods, therefore giving the potential to explore other options such as the development of new supply chains of high-value species like skipjack tuna and high-value demersal fish (MDPI Survey 2016).

POKMASWAS “Ocean Rangers”

The effects of manta hunting are felt by the wider community, and these communities were encouraged to take an active role in protecting their own marine areas. To further this, the Misool Foundation team worked with the government to reestablish the POKMASWAS groups. POKMASWAS is a government-supported entity that is supported to become a local community ambassador network for the marine environment.

In September 2016, we organized POKMASWAS training and socialization events. These were attended by residents from five districts. We also launched a call center to provide a mechanism to report IUU fishing and incidents of vulnerable and protected species – those caught as bycatch or those that were stranded. Along with the Fisheries Department and the WCS, we set up a rapid response team to respond to these reports.

This initiative yielded impressive results, and in May 2018, the Misool Foundation expanded the POKMASWAS group to include 39 participating villages. Since then, the number of bycatch reports has increased significantly. In 2016 and 2017, we received an average of 2.5 reports per month. In 2018, this has grown to an average of four reports per month. This year we have released 27 large, vulnerable marine animals, including manta rays and whale sharks.

Cooperative Development

In 2016, we developed a fishermen’s cooperative as an economic device, to support the fishers’ transition away from hunting manta rays. By January 2018, 26 ex-manta hunters and a total of 93 community members had joined the cooperative. The main stipulation of cooperative membership is that all members will sign the official agreement to stop hunting.

The cooperative is registered with the Department of Cooperatives and is a legal entity. This means that members receive support and training on financial management and reporting. Additionally, the cooperative is eligible for grants from the local government.

Based on interviews with the community and survey results, five small business units were established within the cooperative framework; microfinance, community minimarket, ice production, seaweed farming, and a mini purse-seine boat.

Microfinance

Our microfinance unit, which is available for the cooperative members, sets low-interest rates for loans and high-interest rates for savings to help members to develop their livelihoods and stimulate savings. Since this program began, 48 people have received loans, and 60 people have started saving. Seventeen recipients, with an average loan amount USD 314, have used their loans to start small enterprises such as restaurants and shops. Loans are also used to buy equipment, provide extra capital to buy fish and to improve household water supplies. Anecdotal comments from the community are positive, and recipients are pleased to receive investment capital to improve livelihood options.

Ice Production

One obstacle for Lamakera fishers is the lack of consistent ice supply, which makes it difficult to preserve catch quality. The ice production unit was developed to provide good quality ice service to Lamakera and the surrounding villages, in order for them to attain a higher price for their catch on the market. The ice service began operating in March 2018 and has several regular customers.

Community Mini-Market

The Community Mini-Market meets the needs of cooperative members by selling households goods at competitive prices and reducing the costs of travelling to the mainland to buy these goods. Cooperative members receive preferential rates and can pay for their purchases on an instalment basis. Along with the economic benefits to the community, this has become an effective tool to recruit more cooperative members, therefore ensuring more people sign the agreement stating they will not continue to hunt mantas or trade their body parts.

Mini Purse-Seine Fishing Boat

The Mini Purse-Seine fishing boat is designed to be a high-income business unit. This fishing boat is the largest mini-purse seine in the area, and the design ensures that the target species are sustainable (as per recommendations from the Fisheries Department and WWF-ID). This boat is not suitable for catching mantas and large marine mammals. There are eight ex-manta hunters in the crew.

Seaweed Aquaculture

Seaweed is one of highest value marine products, suitable for development in the East Nusa Tenggara waters. A lack of seeds and environmental data to support seaweed farming development has led to an absence of farms in East Flores.

To address this, we signed an MOU with Artha Wacana Christian University Kupang (UNKRIS) in July 2018. Together we will conduct research on the ideal species and environmental conditions for local seaweed farming. UNKRIS will collect data and train cooperative members on farming techniques.

Training

Developing new skills is an important part of achieving long-term success in livelihood diversification. Since May 2017-2018, we have held 23 training sessions for 40 cooperative members.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

Manta rays are a large, slow-growing, long-lived species, with extremely low reproductive rates, which makes them particularly vulnerable to overexploitation (Dulvy et al. 2014). However, little data still exists globally on population numbers and migration patterns.

Anecdotal evidence of local manta population extinctions at several locations throughout Indonesia (in some cases due to even very minimal fishing pressure) further highlights these species' extreme vulnerability to fishery pressure. However, the highly migratory nature of these species and lack of data on the population ecology of mantas in Indonesia and throughout their range makes it difficult to determine whether natural fluctuations might be playing a part in the declining catch per unit effort in Lamakera, and understanding to what extent the current level of exploitation is affecting regional populations (Lewis et al. 2015).

Numerous studies on these species indicate that it is extremely likely for manta rays found off Lamakera migrate to other parts of Indonesia, possibly crossing international borders. Manta rays are extremely valuable as a living resource to the dive and snorkel tourism industry globally, with Indonesia being the second most valuable manta tourism industry in the world (O'Malley et al. 2013). As such, Lamakera's hunting could have a severe impact on the livelihoods of the many people in Indonesia who rely on manta tourism and a healthy marine environment. A key aspect in ensuring the continued recovery and preservation of this population is understanding movements and threats in areas outside of Lamakera.

Despite initial challenges, our monitoring data shows that manta catch was reduced by more than 90 per cent between 2015 and 2017. These encouraging results provide evidence that our two-pronged approach to enforcement and livelihood development is working. Additionally, increased interest in and membership sign-up to the fishermen's cooperative proves that behaviour change is occurring at a local level, also demonstrating that community members have an increased understanding of the need to transition to new fishing practices.

3.2 Economic viability of the fishery

Since partnerships were built with the Fisheries Department and other related departments, the community began to receive grants from the local government and Misool Foundation. So far, fishers have received 20 small boats, an ice production machine, scholarship for fishers' children, and microfinance capital to help them to develop alternative livelihoods. Mentoring and skill development are carried out continuously so that communities can become independent.

The community business units are structured in a way that enhances existing incomes, lowers household costs and – in the case of the mini purse-seine fishing boat– provides a higher income by using alternative fishing methods. Ice production and more cool boxes mean that the fishers can increase the value of existing catch in a simple way without having to increase catch numbers. The cooperative is legally recognized and has clear management system, with targets issued by the government.

The Community Mini-Market reduces household costs and allows the cooperative members to purchase goods on a payback system. This is particularly important as it reduces the need for community members to take out high-interest loans from traders, thereby breaking the debt cycle. In addition, the mini-market has begun working with distributors to increase the effectiveness and profitability of their small businesses within the community.

The income projections for the mini purse-seine boat show the potential to become more economically viable than manta hunting. Operational costs from this fishing method are significantly lower than manta hunting expenses, creating a greater pool of available profit for fishermen. The high season for fishing pelagic fish is March to October when fishermen can make up to 14 days fishing trips per month. Per trip, our projection show that fishers could yield around USD 1 680) with only USD 160 in operational costs.

3.3 Social equality

The women within the fishery (papalele) are an integral part of the system. The main motivation for women to work as papalele is the opportunity to boost their husband's income and improve family wellbeing and financial stability. The papalele form small groups or alliances of around four women, working together and sharing profits from a boat. There are two ways in which they sell the fish – either by taking fish from the fishermen and paying after they have sold. This method results in a narrow margin of profit (around 17%). Sometimes, the women have enough funds ('modal') to pay the fishers directly and then sell the parts, keeping all the profits (Jaiteh 2014). To assist the papalele in becoming more financially independent, our microfinance loans give them more options to grow their business and buy fish outright, therefore generating more profit.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

In the East Flores region, Lamakera is the primary supplier of mobulid products to the local and international market. As such, they dominate the market and have no interaction with large-scale fishers who target different species. Lamakera fishers also use gill nets or small purse seines to catch sardinella, mackerel, skipjack and yellowfin tuna with 0-5 GT boat. The neighbouring fishing communities use purse seine boats that have larger nets and boats (10-20 GT) and catch the same pelagic species as Lamakera fishermen. The pole-and-line fishers from Larantuka also catch mackerel and sardinella for tuna fish bait, which competes with Lamakera. As a result, fishers find it increasingly difficult to get sardinella and mackerel.

Community transition to a new industry can be extremely difficult, especially in a place like Lamakera where the manta hunt is not just a source of income for locals but the source of their identity. Transitions of this nature take a great deal of time. Based on the Environmental Defense Fund program on Chilean National Benthic Resources Territorial Use Rights for Fishing Program, it took more than ten years to implement TURFS for Chile's highest value mollusc species. Since this implementation, landings have increased five-fold, the mean sizes of individual organisms have increased, catch per unit effort is up and some fishing organizations have established no-take zones to enhance spawning within their TURF (Environmental Defense Fund).

Some members of the Lamakera community are still opposed to the regulations and often attempt to influence public opinion, citing that the regulation is infringing upon their rights to practice their tradition. Lack of respect for the rule of law, combined with the minimal punishments handed out for the most egregious fishing tactics, continue to provide challenges to transition Lamakera away from hunting mantas.

At the government level, fisheries management still needs to be improved. Overlapping inter-institutional obligations are not accompanied by multi-sector cooperation in the management of fisheries and marine resources. This results in ambiguous management policies that are not applied properly. Fishery management still needs co-management from other stakeholders (NGOs and other organizations). While the motivation to extend the Savu Sea MPA to include East Flores is strong, political and legal issues are the most challenging factors for fisheries in Indonesia. Ministerial reshuffles, legislative elections and policy and leadership changes make it difficult to implement new policies in an effective and timely manner.

Declining catch numbers have been recorded not only for mantas but also pelagic fish such as yellowfin tuna, skipjack, mackerel, and sardinella. Data from the East Flores Fisheries Department in 2016 and 2017 shows that the landing numbers of yellowfin tuna, skipjack tuna mackerel and sardinella had declined by 15%. Interviews with the Fisheries, Marine Management Departments and fishers

revealed that fishers need to travel further to catch fish. There is currently no stock assessment or Harvest Control Rate (HCR) survey in this region.

4.2 Improving fishery sustainability in the future

As economics drive manta hunting and there are no quotas for manta hunting, the development of alternative sources of income is critical to address the economic threat to the Lamakeran community, which is largely dependent on unsustainable use of declining resources.

Data collection and legal fishing rights

Comprehensive stock assessments need to be carried out in the region. Previous data must be collated, and the local government needs to develop an archiving and management system to track fisheries and changes in fish stocks.

Management of fishing activities should include output control of the catch and input control, including fishing efforts. To formulate a policy on the utilization of fisheries and realize sustainable fisheries management in East Flores Regency, data collection and analysis of the Harvest Control Rules (HCR) should be carried out for species of fish that are predominantly targeted. This data should formulate a fisheries management action plan for the target species. In a place like Lamakera, one of the fisheries management systems that can be tried is TURFs. Territorial Use Rights for Fishing programs, or TURFs, allocate secure, exclusive privileges to fish in a specified area to groups, or in rare cases individuals. Well-designed TURFs have appropriate controls on fishing mortality and hold fishermen accountable to comply with these controls. TURFs tend to be a valuable approach for curbing the overfishing problem in places where government resources are limited. They empower local fishermen and communities to control and steward their own fisheries through a solid system of fishing rights, responsibilities and rewards. Well-designed TURFs have appropriate controls on fishing mortality and hold fishermen accountable to comply with these controls (Environmental Defense Fund 2018).

Zonation

Even though the regional government has reserved 150 000 hectares for marine conservation, this cannot be executed before the ministry decree for the East Flores MPA is issued. This means that it is on hold until 2019. While delays can be problematic, this is the ideal opportunity for multi-sectoral stakeholders to collaborate and ensure that rights-based approach principals are incorporated into the MPA design. This will have the overall impact of balancing natural resource sustainability and improving the community's economic life.

Sustainable fisheries

Further programs are needed to provide sustainable fishing gears and, to assist the community in converting to sustainable fishing, techniques such as handline tuna fishing and mini purse-seine fishing are needed.

Additionally, an urgent assessment of the impact of the gillnet fishery in the region needs to be presented to the government with a view to issuing bans or restricted fishing areas for this type of fishing gear. Many fishers from this region are using gillnets, including Lamakera, and our catch records and initial assessments of this fishery in East Flores has revealed significant manta ray catch and frequent entanglement of other vulnerable and protected species such as turtles, whale sharks and dolphins. Although many fishermen report that the manta catch is unwanted and accidental bycatch, they are still landing and selling this catch, indicating that it is not necessarily unwanted but rather a valuable secondary catch.

Our primary long-term goal for addressing the gillnet threat is twofold: first, to work with the East

Flores government to ban the use of gillnets within the proposed East Flores MPA; and second, to help the communities transition to sustainable fishing gears. As this transition may take a long time, our team is currently experimenting with ways to reduce bycatch. We know that using different color LED lights on the gillnets can help to discourage megafauna from entering the gillnets and that the 'right' colored lights would theoretically do so without interfering with the fishermen's primary catch.

Collaboration from multi-sectoral stakeholders

There is a need to change the perception that fisheries management is the sole responsibility of the fisheries department. Cooperation from multi-sector stakeholders, such as community, tourism services, transportation, environmental, public infrastructures, health, and the economy is required to ensure effective management of the fishery. Each stakeholder has responsibility for fisheries management based on a rights-based approach in the field. Coordination with all parties will ensure that the implementation of fisheries management is aligned and not overlapping. Monitoring and evaluation should be carried out for measuring the success of implementation.

Law enforcement

The Indonesian government should be commended for its efforts to conserve manta rays by prohibiting the catch of these species. However, lack of law enforcement staff and sustained funding will become a problem to law enforcement bodies. More specifically, ongoing marine patrols are dependent on budget allocation from the government. In 2018, the Region of East Flores had allocated USD 100 000 for surveillance vessels and thousands of dollars for operational costs in 2018. This will provide a good foundation to migrate responsibility from third party management to the government management of marine patrols. Better collaboration between several enforcement teams (marine police, navy, fisheries department) through establishing an integrated team could be a good strategy for developing sustainable marine patrols. A tactical strategy is needed to further the implementation of penalties. Currently, the process is complicated, and, in the case of manta landings in Lamakera, prosecutions are often impossible because the evidence that is collected does not satisfy the legal requirements for prosecution. Furthermore, sensitivities and conflict surrounding the manta law in Lamakera make it challenging and dangerous for local law enforcement to enter the community after reports of manta landings. Compounding this it is the stigma around the notion of arresting 'poor' fishermen. This mindset has made law enforcers reluctant to follow through with arresting fishermen. Strategies to improve manta law enforcement in Lamakera are therefore critical in ensuring the sustainable future of fisheries in East Flores.

Supporting sustainable alternative livelihoods

Community-based conservation that involves the community in conservation management programmes and provides benefits to the community will provide a good channel to achieve long-term success in biodiversity conservation. Development and socialization of alternative sources of income and educational facilities for Lamakera will be critical in ensuring community acceptance and compliance with conservation measures. Support should focus on enabling these communities to become financially independent. Additionally, success in this area could lead to recognition and mirroring behaviour from other community members, as they observe evidence that they do not need to hunt mantas to earn an income.

Demand

Finally, despite a lack of comprehensive data on sales and consumption across consumer markets, the continued targeting of mobulid rays, and the reported rise in consumption in Hong Kong in 2016 (O'Malley et al. 2016) indicate that the international market for mobulid gill plates has not collapsed.

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Fishery management in Korea: Transition from input controls to output controls

Ilhwan Cho

Please refer to the case study presentation available at:
http://www.fao.org/3/CA2497EN/ca2497en.pdf