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Rights-based management in Latin American fisheries

Cover photograph:
Lobster Fishermen in Selkirk Island, Juan Fernández Archipelago. Courtesy of Billy Ernst (U. of Concepción, Chile).

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Preparation of this document

The request for an overview of rights-based management in Latin American fisheries emanated from the 2010 Latin America and Caribbean regional consultative meeting on securing sustainable small-scale fisheries: bringing together responsible fisheries and social development, held from 20 to 22 October in San José, Costa Rica. The workshop, attended by participants from 15 countries and 22 national, regional and international organizations and agencies including civil society organizations and non-governmental organizations, concluded that there was a need to promote small-scale fisheries in the region and secure their access to resources. The present document responds to the workshop's request to make available information on how various fishing rights systems in the region are performing and their impacts on the livelihoods of small-scale fishers and communities. Many countries in the Latin America and Caribbean region support the development of local level co-management and community-based management regimes that include in some cases well-developed rights-based systems. The present document seeks to present an overview of the experiences on these systems in the region to facilitate knowledge dissemination and cooperation and to provide recommendations and best practices to inform, *inter alia*, the implementation of the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forestry in the Context of National Food Security (VG-Tenure) as well as the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication once they are approved by the Committee on Fisheries.

Some of the case studies in the present document were originally prepared for the FAO Workshop on Governance of Tenure for Responsible Capture Fisheries held on 4–6 July 2011 in Rome. The objective of the workshop was to generate inputs and guidance on the contents and process of developing a fisheries sector specific implementation guide for the implementation of the VG-Tenure.

Abstract

This document aims to provide a better understanding of the wide range of rights-based fisheries management systems in Latin-America. Rights-based management in the Latin American region is evolving, thus creating a wide diversity of schemes responding to local fisheries contexts, and institutional, resource and ecosystem dynamics and governance capacities. The document has been developed in two parts. Part I (edited and co-authored by Jose Maria Orensanz) presents case studies of fisheries targeting sedentary resources while Part II (edited and co-authored by Juan Carlos Seijo) presents case studies of industrial and small-scale finfish fisheries in the region The case studies presented in Part I include the following regimes: (i) limited entry or moratoria combined with a total allowable catch; (ii) catch shares; (iii) territorial-use privileges; and (iv) territorial communal rights by [customary? and indigenous users). Case studies of finfish fisheries include the following: (i) individual vessel quotas combined with spatial quota allocation rights; (ii) individual fishing quotas; (iii) rights of access to particular fishing areas or territories; and (iv) individual effort quotas. Each case specifies the main attributes of the access rights (in a broad sense, including privileges), whether formal or informal: (i) how the rights are conferred and upheld; (ii) exclusivity of participation in the fishery;(iii) duration of the rights conferred; (iv) security or quality of the title conferred by the rights; (v) transferability, divisibility and flexibility in the use of the rights; and (vi) actual rights enforceability and corresponding compliance. The study also reports on aspects of the harvest strategies in place, including: (i) fishing methods and gear; (ii) when fishing is authorized to take place; (iii) harvest controls; and (iv) monitoring.

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Abbreviations and acronyms

ACB	Associação Caminhos do Berbigão
AIM	Autoridad Interinstitucional de Manejo (Ecuador)
AMERB	Área de Manejo y Explotación de Recursos Bentónicos (Chile)
AMP	Panama Maritime Authority
ANAM	Autoridad Nacional del Ambiente (Panama)
APAPM	Asociación de Pescadores Artesanales de Puerto Madryn (Argentina)
ARAP	Autoridad de los Recursos Acuáticos de Panamá
AREMAPI	Associação da RESEX Marinha do Pirajubaé (Brazil)
ASCONAR	Asociación de Concheras de Nariño (Colombia)
CCDRU	Contrato de Concessão de Direito Real de Uso (Brazil)
CD	Conselho Deliberativo (Brazil)
CDF	Charles Darwin Foundation (Ecuador)
CEDO	Centro Intercultural de Estudios de Desiertos y Océanos (Mexico)
CENPAT	Centro Nacional Patagónico (Argentina)
COMPEB	Comisión de Manejo de las Pesquerías Bentónicas de las Regiones X y XI (Chile)
CONADI	Corporación Nacional de Desarrollo Indígena (Chile)
CONANP	Comisión Nacional de Áreas Naturales Protegidas (Mexico)
CONAPESCA	Comisión Nacional de Acuacultura y Pesca
CPUE	catch per unit of effort
DGRMC	Dirección General de Recursos Marinos y Costeros
DOF	Diario Oficial de la Federación (Mexico)
ECMPO	Espacio Costero Marino de Pueblos Originarios (Chile)
FEDECOOP	Federación de Cooperativas Pesqueras (Mexico)
GMR	Galapagos Marine Reserve (Ecuador)
GNP	Galapagos National Park
IBAMA	Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis
ICMBIO	Instituto Chico Mendes de Conservação da Biodiversidade (Brazil)
IEQ	individual effort quota
IFOP	Instituto de Fomento Pesquero (Chile)
IMARPE	Instituto del Mar del Perú
INAPESCA	Instituto Nacional de Pesca (Mexico)
INIDEP	Instituto Nacional de Investigación y Desarrollo Pesquero (Argentina)
ITQ	individual transferable quota
IVQ	individual vessel quota
LGAPS	General Law on Sustainable Fishing and Aquaculture (Mexico)
MAE	maximum allowable effort
MCLS	maximum catch limit per ship owner/stakeholder
MRMZ	marine resources management zone
MSC	Marine Stewardship Council
NGO	non-governmental organization

NOM	Mexican Official Norm
PMB	Participatory Management Board (Ecuador)
PMCPV	percentage of maximum catch per vessel
PROFEPA	Procuraduría de Federal de Protección al Ambiente (Mexico)
RBAGDC	Biosphere Reserve Upper Gulf of California and Colorado River Delta
REB	Régimen de Extracción Bentónica (Chile)
RESEX	Reserva Extrativista (Brazil)
RVM	Vaquita Refuge Area
SAGARPA	Secretaría de Agricultura, Ganadería y Pesca (Mexico)
SEMARNAT	Secretaría del Medio Ambiente y Recursos Naturales (Mexico)
SKBR	Sian Ka'an Biosphere Reserve (Mexico)
SNUC	Sistema Nacional de Unidades de Conservação da Natureza (Brazil)
TAC	total allowable catch
TFL	tradable fishing licence
TURF	territorial use rights in fisheries
UMATA	Unidad Municipal de Asistencia Técnica Agropecuaria (Colombia)
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIVALI	Universidade do Vale do Itajaí (Brazil)
WWF	World Wildlife Fund

Executive summary

This study reports on a diversity of cases of rights-based benthic and finfish fisheries from Latin America. For benthic fisheries, Part I of this technical paper documents management experiences including: (i) limited entry or moratoria combined with a total allowable catch (TAC) in the Galapagos Islands sea cucumber fishery, and in the sea urchin and Juliana clam fisheries of Chile; (ii) catch shares in the diving fisheries for scallops from San José Gulf (Argentina) and for the loco snail in Chile (a system now defunct), and the Patagonian scallop industrial fishery (Argentina); (iii) Territorial use privileges based on sea bed tracts in Chilean territorial use rights in fisheries (TURFs, "AMERBs"), concessions from central Baja California (Mexico), "predios" of sustainable use in Mexico, and concessions for seaweed extraction in Argentine Patagonia; (iv) individual use privileges over fishing "campos" in spiny lobster concessions of Punta Allen (Mexico), "marcas" in the Juan Fernández lobster fishery, and "parcelas" in Chilean algal harvests; and (v) territorial communal rights (traditional and indigenous users) in the Seri Indian fishery of Mexico, Brazilian Reserva Extrativistas, and the piangua fishery of Colombia's Afro-American communities. For finfish fisheries, Part II presents rights-based management study cases for: (i) individual vessel quota (IVQ) management of the anchovy (*Engraulis ringens*) fishery of Peru; (ii) individual stakeholder quota management of the hake (*Merluccius gayi gay*i) fishery of Chile; (iii) community territorial use rights in the Gulf weakfish (*Cynoscion othonopterus*) fishery of the Gulf of California, Mexico; and (iv) individual effort quotas (IEQs) for artisanal communities in the multispecies fishery at Coiba National Park, Panama.

Each case specifies the main attributes of the access rights (in a broad sense, including privileges), whether formal or informal: (i) how the rights are conferred and upheld; (ii) exclusivity of participation in the fishery; (iii) duration of the rights conferred; (iv) security or quality of the title conferred by the rights; (v) transferability, divisibility and flexibility in the use of the rights; and (vi) actual rights enforceability and corresponding compliance with use rights limitations. The study also reports on aspects of the harvest strategies in place, including: (i) fishing methods and gear; (ii) when fishing is authorized to take place; (iii) harvest controls; and (iv) monitoring.

For fisheries targeting benthic organisms, main findings for the major categories of privileges or rights were:

- **Limited entry**. A moratorium on the number of participants (boats and/or fishers), possibly combined with a TAC, often has been the first reaction to symptoms of overfishing. Moratoria are, in principle, a short-term instrument that should evolve into formal limited-entry systems with specified entry/exit rules, a form of "non-quantitative access rights". In practice, closed registries tend to become frozen, which results in an informal market for the privileges of registered but inactive fishers and a distortion of fishing effort statistics.
- **Catch shares**. Catch shares have fared better in situations where there are few participants, whether the shares are granted to individual coastal gatherers, small-scale boat-owners or industrial vessels. In limited-entry systems (with or without catch shares) where the fishing units are small boats (typical of commercial diving), whether access privileges are vested on individual fishers or boats has significant implications for management. The dynamics (entry, mobility, ageing, attrition and exit) of fishers and boats are very different. Fishers are generally more transient than boats, and often move across jurisdictional boundaries. Systems based on catch shares granted to individual

fishers have failed when the number of participants is large, mostly because inflated or outdated registries and poor enforcement have frustrated effective implementation.

- **Territorial use privileges** typically consist of concessions to fishers organizations, such as Mexican cooperatives and Chilean "sindicatos", for the use of specific resources in tracts of seabed (TURFs). Differences in design have significant management implications. In the case of Chilean AMERBs, the tracts are relatively small, leaving variable extensions of background areas where fishing for key target species is nominally banned, but regulations are unenforceable. The result has been severe depletion of valuable resources (e.g. loco snails) in background areas and an illegal market for small, sublegal shellfish. Mexican cooperatives from central Baja California, instead, have concessions over extended tracts contiguous with each other, so that there is no unclaimed background territory. This system has been very successful on most accounts. Overall, TURFs have fared better in cases with a long history of collective territorial appropriation, informal in its beginnings, than in systems introduced *de novo* by design. Moreover, they have been more effective in cases where the tracts are close to fishing communities, particularly in rural areas, which facilitates vigilance and deterrence of intruders.
- **Individual privileges for access to fishing spots**, a particular form of TURF, are as a rule regulated by some form of customary marine tenure. These systems are typically associated with interception gear, such as traps or attraction devices. Informal individual privileges are usually tradable under a variety of arrangements (monetary or else) and can be inherited. The "parcela" system of algal harvesting from Chile is based on resources with a high turnover rate, and privileges may be temporary and re-assigned through a lottery. Informal customary marine tenure systems are the result of a protracted process of adaptive adjustment. Formalization of customary systems poses significant risks because, in the absence of effective feedback, formality can be a straightjacket for systems whose resilience is conditioned on their adaptiveness.
- **Territorial communal rights granted to traditional and indigenous users** are different from all of the preceding because access rights to fishing are usually only part of a broader package. Restitution of rights is always accompanied by significant devolution of management authority. This results in two-tier governance systems, in which some decisions are made at the national level (e.g. "bounding" the community), while rules for the access to resources or benefits by individual members are decided within the community. Issues of legitimacy raised by the definition of "community" can be very complex. Moreover, the granting of exclusive communal rights may be in conflict with national legislation.

The main attributes of the rights-based systems in place for the finfish fisheries reported in this study are the following.

For the IVQ system in the anchovy (*Engraulis ringens*) fishery of Peru, exclusive rights are granted for ten years with a contract warrant to industrial vessels targeting anchovy for indirect human consumption outside the five-mile limit allocated to artisanal vessels. There is no transferability of rights independent of the vessel unit, and divisibility is allowed to substitute capacity of individual vessels removed from fishing. For the individual stakeholder fishing quota of the common hake (*Merluccius gayi gayi*) fishery in Chile, the current fishery law in operation allocates 5 miles from the coast for exclusive use of the artisanal fishing. In addition, the common hake fishery is declared in full operation and a limited-entry scheme is in place for both industrial and artisanal. A maximum catch limit per stakeholder MCLS is also in place. By law, a TAC must be defined annually to assign 35 percent for the artisanal sector and 65 percent for the industrial one. Rights are renewable on a yearly basis, and the State guarantees the right to a fraction of the total TAC, subject to biomass accessibility. Rights are non-transferable and non-divisible. With the community territorial use rights of the Gulf

weakfish (*Cynoscion othonopterus)* of the Gulf of California, Mexico, exclusive territorial fishing rights with limited entry are granted for two years to a coastal community with limited entry. Security is provided by fishing title rights for the period covered by the fishing licence. In this Mexican fishery, rights are non-transferable and non-divisible. For the multispecies fishery at Coiba National Park, Panama, exclusive fishing rights are granted, through IEQs, to fishers of 47 small-scale boats. Rights are granted for one year with the possibility of renewability. These rights are secure rights as long as there is full compliance with regulations of the Coiba National Park. Transferability or divisibility of these rights is not allowed.

The study also explores and discusses the following questions: How can the property rights systems illustrated in the case studies improve the incentives for stewardship, conservation and sustained profitability? What sorts of distributional implications are there in each of the rights-based finfish fisheries reported? What sorts of operational requirements do the different types of property rights documented demand in terms of research, enforcement, administration and actual fishing operations?

The diversity of rights-based management schemes reported for benthic and finfish fisheries in Latin America seems to respond to: (i) local fishery contexts; (ii) institutional, resource and ecosystem dynamics; and (iii) governance capacities in place. At this stage of establishing rights-based schemes in Latin America, a commonality found in virtually all study cases is the non-transferability of formal privileges. It seems to reflect the concerns for potential concentration of fishing rights in a few hands were transferability introduced. In many of the cases discussed, non-divisibility of rights is also specified. In contrast, informal access privileges are effectively transferable and divisible in some customary tenure systems where sea bed resources are targeted. Enforcement and compliance continues to be a challenge for many of the cases reported, particularly in artisanal fisheries. Community self-policing in fisheries with a limited number of participants seems to facilitate compliance with regulations and granted rights. Because of the relatively short time span in which the reported formal right-based systems have been in place, the sustainability performance of most of them cannot yet be properly assessed. The main exceptions are spiny lobster fisheries from Mexico (Baja California and Quintana Roo) and Chile (Juan Fernández Islands), in which sustainability has been achieved through a long history of informal access arrangements preceding (or coexisting with) more recently established formal privileges.

PART I

Latin American rights-based fisheries targeting sedentary resources

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1. Introduction

The assessment and management of fisheries targeting sea bed resources pose many specific problems, largely related to the sedentary nature of benthic organisms (Orensanz and Jamieson, 1998). In this context, "sedentary" means that the spatial scale of individual movements is small as compared with the operating scale of the fishing process. As perceived by fishers, the spatial structure of the target populations is persistent in time (resources are "viscous"). Invertebrates that crawl over the sea bed, such as crab and lobsters, are sedentary by those standards. The sedentary nature of the resources favours harvesting strategies and tenure systems that emphasize the spatial dimension. More localized forms of governance and exclusivity of access to delimited territories offer a suitable alternative to the classical command-and-control approach, by creating incentives for fishers to protect their local resources and to participate in their management (monitoring, assessment, decision-making and enforcement).

Fisheries targeting benthic resources range from coastal gathering along the seashore to sophisticated offshore industrial operations. Here, that diversity is illustrated with a selection of fisheries from Latin America. Most of them are small-scale fisheries (sometimes called S-fisheries [Orensanz *et al*., 2005]), but one (the Patagonian scallop offshore fishery) is fully industrial. Selected cases of Latin American small-scale fisheries have been reviewed before by Castilla and Defeo (2001), Defeo and Castilla (2005) and Orensanz *et al*. (2005). These fisheries often target one or a few species, and their products are generally destined to affluent consumers, frequently exported. In that sense, they differ radically from the usual cliché of the artisanal fishery (multispecific and subsistence-oriented).

The fisheries considered span a diversity of forms of access and tenure, from limited entry combined with a total allowable catch (TAC) to territorial use privileges and rights, and include both formal and informal management systems. After introducing a selection of illustrative cases, several transversal issues across systems are discussed and the following questions addressed: (i) how the different access regimes may affect the incentives for stewardship, conservation, sustained profitability and equitable distribution of benefits; and (ii) the implementation requirements of the tenure systems regarding scientific/technical support, enforcement and administration.

CONVENTIONS

The account of each of the main cases considered is supplemented with a "case table" and a composite figure. In addition, the Annex provides information about agencies and legislation pertinent to each case.

In the case of Chile, the "traditional" political division is used: Regions I–XII (numbered from north to south). Two of these were recently subdivided, but historical fishery data are only available for the old regions.

CASE STUDIES

As a rule, small-scale fisheries in Latin America started as open access within national jurisdictions, supplying domestic markets. A good example is the pepitona clam (*Arca zebra*) fishery from Venezuela (Bolivarian Republic of) (Lodeiros *et al*., 2012), one of the largest clam fisheries in the world, which supplies a significant canning industry.

TABLE 1
Case studies (includes cases that are fully developed and some that are addressed in general sections for comparative purposes)

Tenure system	Case	Management jurisdiction	Registration region	Territory for exclusive use of target resources	Access privileges vested on
Open access	Pepitona clam fishery, Sucre State, Venezuela (Bolivarian Republic of)	Shelf between Sucre and Nueva Esparta (Margarita I.) States	NA	NA	NA
Moratoria and total allowable catch (TAC)	Galapagos Islands sea cucumber fishery (Ecuador)	Galapagos Marine Reserve (GMR)	GMR	GMR	Individual divers and boats
	Sea urchin fishery of Regions X–XI (south Chile)	Chile	Regions X–XI	Regions X–XI, contiguous zone	Individual fishers
	Juliana clam fishery (Chile)	Chile	Region X	Fishing grounds	Individual fishers and boats
Catch shares	San José Gulf scallop diving fishery (Argentina)	Chubut Province, inshore	Zone I (Madryn)	San José Gulf	Boat owners
	Chilean loco fishery, REB (1993–98)	Chile	Region	Region	Individual divers
	Individual transferable quotas (ITQs) in the Galapagos Islands sea cucumber fishery (2001)	GMR	GMR	GMR	Individual divers and boats
	Patagonian scallop industrial fishery (Argentina)	Shelf under federal jurisdiction	Federal	Designated fishing grounds (change annually)	Industrial vessels
	Mussel gathering in El Riacho (Argentina)	Chubut Province, inshore	Zone I (Madryn)	Sector of tidal flats and rocky reefs	Individual coastal gatherers
	Beach clam fishery of Uruguay	Uruguay		Sector of beach	Individual coastal gatherers
Territorial use privileges: sea bed tracts	Chilean AMERBs	Chile	Region	AMERBs	Fishers organizations
	Concessions from central Baja California (Mexico)	Mexico	Variable	Area of concession	Fishing cooperatives
	Predios of sustainable use, Gulf of California (Mexico)	Mexico	Region	Predios	Juridical entities (companies, cooperatives) or individuals
	Concessions for seaweed extraction in Chubut Province (Argentina)	Chubut Province, inshore areas and coastal zone		Area of concession	Individuals or commercial firms
Territorial use privileges: fishing spots	Lobster concessions of Punta Allen (Mexico)	Mexico	Landing port	Concessions, but see cell to the right	Two-tier system: formal privileges vested on cooperatives; informal access rights to campos by community members
	Lobster fishery of Juan Fernandez Archipelago (Chile)	Chile		Juan Fernández Archipelago, but see cell to the right	Formal privileges vested on registered fishers; informal access rights to "marcas" held by community members
	"Parcela" system of algal harvests (Chile)	Chile	Region	Stretch of coast, but see cell to the right	Two-tier system: access privileges over stretches of coastline appropriated by communities (customary tenure) or formally allocated to fishers organizations as AMERBs; the two may overlap. Within communities, access privileges are variously allocated to groups, families or individuals

Continued

Tenure system	Case	Management jurisdiction	Registration region	Territory for exclusive use of target resources	Access privileges vested on
Territorial communal rights (traditional and indigenous users)	Seri Indian benthic fishery (Mexico)	Mexico		Sea adjacent to Tiburón I.	Community
	Brazilian RESEXs	Brazil		RESEXs	Community
	Chile's EMPCO	Chile		Territory	Community
	Piangua fishery, Colombia's Afro-American Communities	Colombia		Collective entitlements (territories of community councils)	Community

The products of these fisheries eventually found acceptance in more lucrative markets, including tourists, affluent urban consumers, exports, or industrial supplies (mostly in the case of algae). In many cases, demand, mostly from far-east countries, grew rapidly starting in the 1970s. The result was the explosive development of export-oriented fisheries targeting a variety of resources, ranging from sea urchin and loco snails in Chile (Castilla *et al*., 1998; Moreno *et al*., 2007), to sea cucumbers in Ecuador and Mexico (Reyes-Bonilla and Herrero-Pérezrul, 2003; Toral-Granda and Martínez, 2004), to, more recently, geoduck clams in Baja California, Mexico (Calderón-Aguilera *et al*., 2008). Explosive development led to recurrent crises, some collapses, and frequently to draconian measures (such as complete closures) at a high social and economic cost to fishing communities. Crises prompted management reforms, among them access regulations (for examples, see Orensanz *et al*. [2005]). In other cases, access regulations evolved spontaneously (customary marine tenure) or were formally introduced when a fishery developed in response to market opportunities, under the oversight of a fisheries authority.

The selected cases were classified according to a typology that captures the main axes of the observed diversity (Table 1); including limited entry combined with a TAC, catch shares, territorial use privileges, and rights restored to communities of traditional users or indigenous peoples. Access regulations include cases of catch-, effort- and territorial-based privileges or rights of access (Charles, 2009). Here, the term "catch shares" is used in a narrow literal sense, meaning shares of a catch quota.

2. Limited entry or moratoria combined with a TAC

CASE 1: THE GALAPAGOS ISLANDS SEA CUCUMBER FISHERY (ECUADOR)

The Galapagos Marine Reserve (GMR, Figure 1:A) includes the Galapagos Islands, an archipelago of more than 130 islands and inlets about 1 000 km off the coast of Ecuador, and its surrounding open ocean (Toral-Granda, 2008). Commercial diving within the GMR expanded rapidly in the early 1990s, when depletion of sea cucumber grounds off mainland Ecuador prompted fishers to move to the islands lured by the rapid development of a new lucrative, export-oriented sea cucumber (*Isostichopus fuscus*) fishery (Toral-Granda and Martínez, 2004). Commercial divers also target spiny lobsters (*Panulirus penicillatus* and *P. gracilis*) and a variety of minor resources (slipper lobsters, octopus, snails and whelks). Concerned by the explosive expansion of the fishery under open access, the central government banned sea cucumber extraction in 1992, but illegal fishing continued until 1994 when an experimental fishery was allowed (Castrejón, 2011). The catch in the experimental season was estimated at 6 million sea cucumbers, more than 10 times the allowed quota (Figure 1:B). After this failed experiment, the fishery was closed for five years, a period of escalating conflict between fishers and managers. In 1995, the Galapagos National Park (GNP) and the Charles Darwin Foundation (CDF) were blockaded by angry fishers who demanded a sea cucumber opening (Powell and Gibbs, 1995; Shepherd *et al*., 2004).

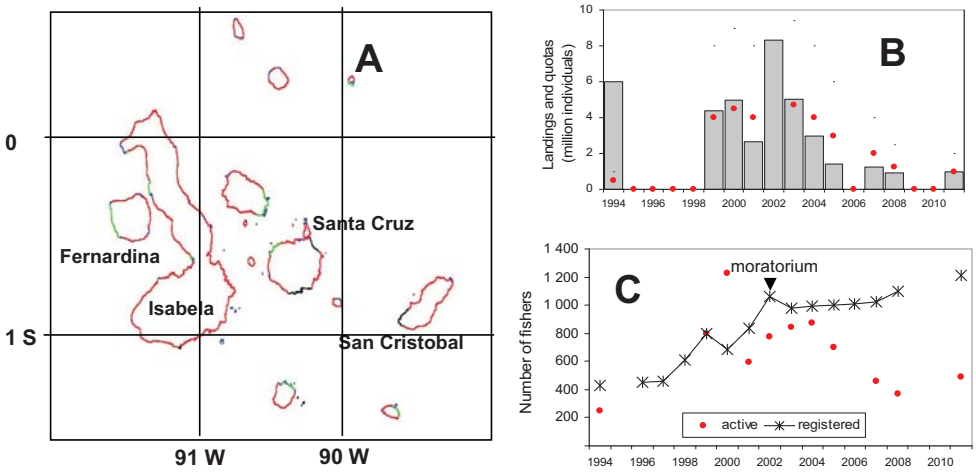
A comprehensive management plan for the reserve was urgently needed, not only to regulate fisheries but also to control demographic growth, tourism and development. To that end, a participatory process was established that culminated with the passing of the Galapagos Special Law in 1998, a legal instrument that gave exclusive access to the fishery resources to the artisanal fishers from the islands (Table 2). A Management Plan for the Marine Reserve, approved in 1999, introduced zoning and a comanagement system that involved both local and national stakeholders (Toral-Granda and Martínez, 2004; Baine *et al*., 2007). At the local level, the Participatory Management Board (PMB) includes artisanal fishers cooperatives, the Galapagos Chamber of Tourism, naturalist guides, representatives of the science, education and conservation sectors (the Ministry of Education, non-governmental organizations [NGOs] and any other group involved in conservation), and the Directorate of the Galapagos National Park. At this level, all decisions involving activities within the reserve must be made by consensus. The CDF provides scientific support for management and informs the decision-making process. However, decision-making power is retained by the national stakeholders, represented in the Autoridad Interinstitucional de Manejo (AIM). The latter normally ratifies decisions made by consensus at the PMB (Heylings and Bravo, 2007). The GNP is in charge of implementation and enforcement.

These included a catch quota, a fishing season (about two months), a minimum legal size, closed areas, and a requirement that fishers and boats had a licence to fish. A monitoring programme of the catches and a participatory survey of the sea cucumber stock, before and after the fishing season, were implemented and used by scientist of the CDF to provide management advice (Toral-Granda, 2008). Fishing licences, valid for two years, are personal and non-transferable, and allow fishers to harvest any

resource within permitted areas of the reserve. Annual fishing permits are vested on the boats, and can be transferred together with the boat as long as the new owner has a fishing licence.

Many factors contributed to impair the management system, making many of the regulations ineffective (Hearn, 2008; Toral-Granda, 2008). Catch quotas were negotiated at the PMB and decisions largely ignored the technical advice provided by the CDF, which was considered highly uncertain and not impartial. In 2002, following a failed attempt to establish an individual transferable quota (ITQ) system in 2001, no quota was established and the catch reached a maximum of more than 8 million sea cucumbers (about 1 660 tonnes, fresh weight). The minimum legal size, which is smaller than the size limit recommended, is hard to enforce owing to the plasticity of the sea cucumbers (Toral-Granda, 2008). Finally, poaching in closed areas has been a recurrent problem (Murillo and Reyes, 2008; Castrejón, 2011).

FIGURE 1
Galapagos Islands sea cucumber fishery, Ecuador



Notes: (A) Zoning of the Galapagos Marine Reserve; red: areas available for harvesting, other colours: fishing not allowed under different protection regimes. (B) Historical series of landings of sea cucumbers (bars), and total allowable catches (dots). (C) Number of artisanal fishers registered with the Galapagos National Park (*), and number of fishers that were active in the sea cucumber fishery (dots).
Sources: (A) modified from Bustamante *et al.* (2005), their Figure 3, with permission. (B) and (C) based on Murillo and Reyes (2008).

The decision-making process also had some structural problems (Bustamante *et al.*, 2005). Because decisions are not made locally but at the AIM, stakeholders often bypassed the PMB to lobby at the higher level of the AIM, which weakened the participatory process. Prior to 2006, when the PMB appointed a Technical Committee, there was no clear separation between science and management, as the CDF (primary provider of technical support) had a conservation advocacy role. This fuelled recurrent friction between fishers and scientists, as the former mistrusted the CDF's real intentions. No incentives to the industry were in place to transform the gold-rush mentality that marked the origins of the fishery. Instead, owing to the large income generated by the sea cucumber fishery in the early 2000s, the PMB was used as a political platform by representatives of the fishers. Fishing cooperatives are poorly organized, do not provide any support or benefits to members, and are rather seen as a source of conflict, their leaders being perceived as too politicized and detached from their constituencies (Hearn, 2008). The legitimacy of the associations was further distorted by a requirement that, in order to obtain a licence, fishers had to be members of one of the four existing fishers cooperatives (Defeo, Castilla and Castrejón, 2009).

TABLE 2
Case 1: Galapagos Islands sea cucumber fishery (Ecuador)

Main attributes of the access regime	
How the rights are conferred and upheld	By law, access to fisheries resources within the Galapagos Marine Reserve (GMR) are conferred to individual artisanal fishers, resident of Galápagos, who must exert the activity directly, and for whom fishing is the main source of income. Fishers must be registered with the administration of the Galapagos National Park, and must have a fishing licence (PARMA). Boats must also be registered and have a fishing permit. Both registries have been closed since 2002.
Exclusivity of participation in the fishery	Access to all fishing resources in the GMR is exclusive to artisanal fishers resident from Galapagos.
Duration of the rights conferred	Fishing licences (PARMAs) vested on the individual fishers are valid for two years; fishing permits vested on boats are annual.
Security or quality of the title conferred by the rights	Fishing licences are renewable. Individuals are removed from the registry when they have not renewed their PARMA in two consecutive years, or when artisanal fishing has not been their main source of income for four consecutive years.
Transferability of the rights	Fishing licences (PARMAs) are non-transferable; fishing permits can be transferred together with the boat.
Divisibility of the rights assigned	Fishing rights are individual and fishers fish in a competitive way. Only in 2001 was a system of individual transferable quotas used, which was considered a failure.
Flexibility in the use of the rights	Fishers must follow harvest regulations, including spatial and temporal restrictions. Fishing areas are restricted by the zoning plan of the GMR, and also by temporary closures.
Enforceability of rights and compliance with use-rights limitations	Enforcement from land and using fast patrol boats is conducted by the Galapagos National Park, in collaboration with the Ecuadorian navy. Poaching in closed areas has been a recurrent problem, leading to confrontations between control agents and offenders. Depletion of Isostichopus fuscus has led to illegal fishing of other prohibited sea cucumber species.
Harvesting strategies	
Fishing methods and gear	Diving is the only fishing method allowed. The fleet is composed of small (< 10 m) wooden boats ("pangas") or fibreglass fast boats ("fibras") that work from larger (up to 18 m) mother boats ("botes"). Boats are equipped with air compressors. By law, artisanal boats cannot exceed 18 m, and 250 hp.
When fishing is authorized to take place	Fishing season lasts two months (15 June–15 August).
Harvest controls	A threshold density of 11 sea cucumbers per 100 m^2 must be attained on the west of Isabela Island as a condition for opening the fishery. Annual total allowable catches are established as a fraction of annual estimates of abundance obtained from a direct participatory survey of fishing grounds conducted in April. Minimum size limits are 20 cm for fresh and 7 cm for dried sea cucumbers. Temporary closed areas may be established owing to low density or high abundance of juveniles, in addition to those defined by the zoning plan of the GMR.
Monitoring	Population surveys are conducted before and after the fishing season. The fishery is also monitored at landing sites and occasionally by patrol boats that sample catches and record information on effort and fishing locations. An annual report is prepared on the status of the stock and the fishery based on a set of pre-agreed indicators. Results of assessments are discussed at participatory workshops. Based on average density, the stock is classified as in critical condition (< 0.11 m^2), recovering (0.11–0.209 m^2), or healthy (≥ 0.21 m^2).

The expectation behind this requirement was that the cooperatives would themselves control access, preventing an excessive growth of the fishing sector (Castrejón, 2011). This expectation did not materialize, and the number of registered fishers grew from 457 in 1997 to 1 059 in 2002 (Murillo and Reyes, 2008). This requirement was eliminated in 2008.

A moratorium on the issuing of new fishing permits (excepting sons and daughters of fishers) was established in 1998, but the measure was not implemented until 2002, three years after the opening of the sea cucumber fishery. By then, the membership of the cooperatives was already inflated (Figure 1:C). Many of the people that were incorporated to the registry between 1999 and 2002 were newcomers, with no connection to the participatory process that in the end granted them exclusive rights. Their main motivation was to benefit from the alternatives promised as compensation for the closing of areas as part of the zoning plan (Castrejón, 2011). In recent years, the number of active fishers has been less than half the number in the registry, but there are no legal means to terminate inactive licences; as a result, the moratorium has had

no effect on fishing effort control. The registry for boats was also closed in 2002, but the number of boats registered (446) exceeded the maximum established (300 boats, Castrejón, 2011). To reduce the size of the fleet, groups of small "pangas" are allowed to be replaced by larger speedboats, but not by a large mother boat. In order to provide an alternative livelihood and reduce overcapacity, registered fishers have been allowed to exchange their fishing permit for a highly coveted tourism licence (otherwise impossible to obtain). Contrary to its intent, this policy, together with rumours that a buy-back programme might be introduced, attracted opportunistic newcomers to the fishing sector (Hearn, 2008).

Failed attempts to regulate the fishery, together with reduced recruitment (Hearn *et al.*, 2005), resulted in dwindling stocks and catches that fell short of the allowed quotas (Figure 1:B, Toral-Granda, 2008). In the early 2000s, both spiny lobsters and sea cucumbers were the focus of a series of long-lasting conflicts between the GNP and fishers who were unhappy about the management regime (Toral-Granda, 2008). The sea cucumber fishery was closed in 2006, after less than half the TAC was harvested in the 2005 fishing season.

A new participatory process was initiated in 2006 to conduct an in-depth review of the fisheries comanagement system. A Technical Committee was established to formulate a more effective management model (Castrejón, 2011). The Fisheries Chapter of the Management Plan for the GMR was approved unanimously by the PMB and AIM in January 2009 (CTM, 2009). It specifies management goals, harvest controls, indicators and monitoring strategies, and a regular process of management reviews and adaptation. Specific goals for the sea cucumber are the biological and economic rebuilding of the fishery and improving the quality of life of fishers and their families, while strengthening governance (fishers' participation and institutional capacity for comanagement). The plan defines a decision rule for the re-opening of the fishery based on a minimum density threshold (11 sea cucumbers per 100 m^2 on the west side of Isabela Island). The sampling plan for annual monitoring was redesigned in order to provide more reliable estimates of density and biomass on which to base the decision of whether to open the fishery, and the determination of the annual TACs (Wolff, Schuhbauer and Castrejón, 2012). Based on this rule, the fishery was kept closed in 2009 and 2010, and re-opened in 2011 with a quota of one million sea cucumbers. Although not all aspects of the Fishery Chapter have been implemented, the development of a strategic plan that contemplates mechanisms for participation and a schedule for revisions has reduced conflicts and created a more collaborative environment. Concrete actions for improving enforcement were also delineated in the Fisheries Chapter, an aspect that would be critical for the success of the new management plan. Above all, the revamping of the system of licences that protects the rights of the active fishers seems to be a first, necessary step to improve ecological and institutional sustainability in this fishery.

CASE 2: THE SEA URCHIN FISHERY OF THE LOS LAGOS AND AYSEN REGIONS (SOUTH CHILE)

The sea urchin (*Loxechinus albus*) fishery of southern Chile contributes more than half of the world's supply of sea urchin roe (Moreno *et al.*, 2007), providing for the livelihood of hundreds of artisanal divers and their families, and fuelling a significant export-oriented industry. Almost half of the national production comes from fishing grounds located in a remote and largely unpopulated maze of islands, fjords and channels in the Los Lagos and Aysen Regions, spreading over four degrees of latitude (42–47°S) (Figure 2:B). Prior to 1975, catches were small and they were sold at local markets for fresh consumption. The fishery expanded rapidly in the 1980s in response to an increase in demand from Japan, first in the Los Lagos Region, and gradually

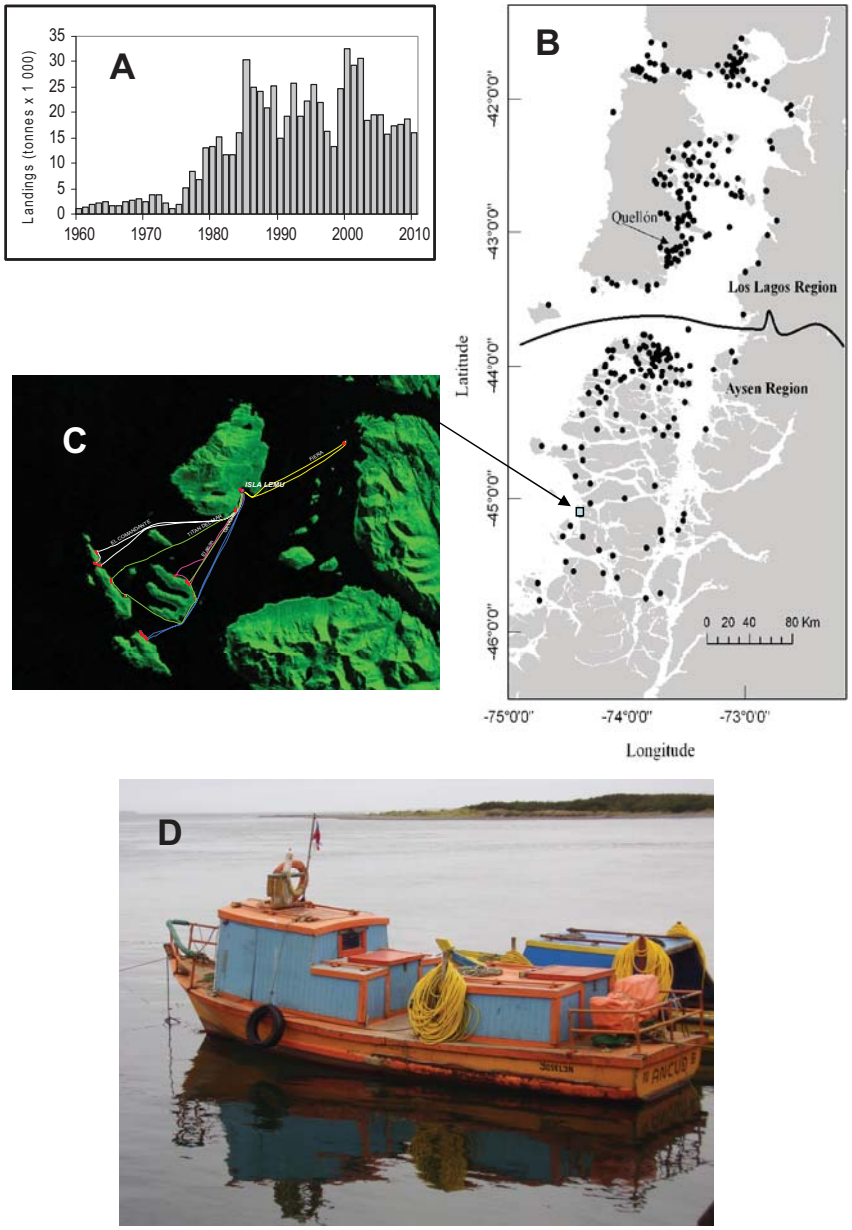
moving south to the lightly populated Aysen Region, as grounds around Chiloe Island became depleted (Moreno *et al*., 2007). In the last 25 years, combined landings from the two regions have fluctuated around 20 000 tonnes (Figure 2:A).

Fishing units include "lanchas" (12–15 m long, with a small cabin, Figure 2:D) and boats (8–10 m long). Much of the fishing takes place in remote areas that are too far from the ports to allow daily commutes (Figure 2:B). Groups of 10–20 boats are organized into "faenas" by operators that tow or lead them to temporary camps, from which they move to adjacent fishing areas (Figure 2:C). Operators provide services through mother boats ("lanchas de acarreo"), typically 15–25 m long, which transport supplies from the nearest harbour to the faena, and the catch from the faena to processing plants. Fishers are required to be registered in only one region, for specific resources (Table 3). The registry for sea urchin has been closed since 1995. A survey conducted in 2004 found that of the 3 731 and 514 divers registered in the Regions of Los Lagos and Aysen, respectively, only 639 and 288 were active sea urchin fishers (Moreno *et al*., 2007). The size of the fleet has decreased since 2005, from 700–833 in 2002–05 to an average of 500 boats in 2009-2011 (N. Barahona, Instituto de Fomento Pesquero [IFOP], personal communication). In addition to the fishing force, the fishery employs about 2 800 people (Molinet *et al*., 2008) in 17 processing plants located in the Los Lagos Region (Pupelde, 2011). The processors, many of whom depend on a steady and orderly supply of sea urchin roe, have a substantial role in discussions about the management of the fishery.

Since 2002, the fishery has operated under a special legal regime known as Pesca de Investigación (Research Fishery, suspended in 2011), aimed at improving monitoring of fishing operations. In the case of the sea urchin, its main motivation was to collect information on active participants (fishers, boats and tender boats), and their region of origin. The expectation was that the list of active fishers would be "cleaned" and completed in a few years, providing criteria for granting access privileges thereon. The approval of the management plan in 2005 included a limited-entry programme, clear access rules, and monitoring of effort with participation of the fishers' federations. It was seen as a first step towards the introduction of stewardship incentives. In reality, the fact that the Artisanal Registry had been closed, together with certification requirements for divers, betrayed the purpose of the Research Fishery regime. Many active divers could not enrol in the Research Fishery because they were not certified. The closing of the registry resulted in a substantial, yet uncertain, fraction of divers and fishing effort not being accounted for in the fishery statistics, with a consequent distortion of some of the key monitoring indicators.

FIGURE 2

Sea urchin fishery of the Los Lagos and Aysen Regions, south Chile



Notes: (A) Landings, 1960–2011. (B) Fishing locations recorded in IFOP's port sampling programme. (C) Trips originating from the "faena" of Isla Lemu, October 2005, data logger and observer data; red dots indicate fishing locations. (D) Fishing boat equipped with compressor and hookah.

Sources: (A) SERNAPESCA; (B) C. Molinet; (C) Molinet *et al.* (2008), their Figure 2.18; (D) N. Barahona, IFOP.

TABLE 3
Case 2: Sea urchin fishery of Los Lagos and Aysen Regions (south Chile)

Main attributes of the access regime	
How the rights are conferred and upheld	Individual fishers must be registered in a regionalized species-specific Artisanal Fishery Registry. Registry for sea urchin has been closed since 1995. In addition, fishers must enrol annually for the Research Fishery, a legal regime under which the sea urchin fishery has operated since 2002.
Exclusivity of participation in the fishery	Enrolled fishers have exclusive legal access to the fishery. Sea urchins are also targeted within territorial use rights in fisheries (TURFs), but that is a very small fraction of the landings, which is destined to the domestic market.
Duration of the rights conferred	NA
Security or quality of the title conferred by the rights	Fishers from Region X can fish in Region XI through an agreement between the two regional governments. The terms of the agreement are revised every three years. Security of access for fishers from Region X is pending on continuity of this agreement.
Transferability of the rights	Non-transferable.
Divisibility of the rights assigned	NA
Flexibility in the use of the rights	Fishers are allowed to fish until the total allowable catch (TAC) is reached under a competitive system. The TAC is subdivided in macroregions.
Enforceability of rights and compliance with use-rights limitations	Port samplers register a number of divers substantially larger than the number enrolled for the Research Fishery. This is a result of the closure of the Artisanal Fishery Registry – many active fishers are not in the Registry and therefore cannot sign up for the Research Fishery.
Harvesting strategies	
Fishing methods and gear	Sea urchins are exclusively extracted by diving.
When fishing is authorized to take place	Fishing season lasts two months (15 June–15 August).
Harvest controls	Annual TACs decided by the Comisión de Manejo de las Pesquerías Bentónicas de las Regiones X y XI (COMPEB). A report of indicators is presented by the Technical Advisory Group but no formal rule is in place for setting the TAC. Minimum size limit reduced to 60 mm in 2011, from the 70 mm size limit established in 1986. Fishery is closed in the reproductive season, from 15 August to 30 November.
Monitoring	Catches are monitored through a port-sampling programme conducted by the Instituto de Fomento Pesquero (IFOP). A private consultant is contracted out to control access to the Research Fishery.

CASE 3: THE JULIANA CLAM FISHERY (CHILE)

The Juliana clam (*Tawera gayi*) is distributed in the Interior Sea of Chiloe (Region X), where it forms extended, high-density beds. This species was not commercially exploited before 1989, partly because its maximum size is below a minimum size limit that applies collectively to several clam species (5.5 cm). Following an initial assessment, the fishery opened in 2001–04 under a Research Fishery regime (see Case 2), which included a TAC and an ad hoc registry of participating "extractive fishing units", each composed of a boat and its crew (1–5 divers, an assistant and a skipper). In that period, landings fluctuated between 4 000 tonnes and 4 200 tonnes; the fishery involved 219 boats and 365 fishers, and catches were landed in three main ports either directly or through mother boats. About 11 plants process the product, which is exported frozen (≈80 percent) or canned, mainly to Spain (SUBPESCA, 2012).

In 2007, the fisheries authority introduced an advisory committee with representation of the public and private sectors, including divers, boat owners, intermediaries, processors and public entities. This contributed to building trust and facilitated collaboration between the different sectors. Because enrolment for the Research Fishery was done in the small villages located on the islands, implementation of the regime gave de facto exclusive access to local fishers, thus eliminating conflicts with outsiders coming from distant urban centres. Fishers shared their knowledge about the distribution of the resource, which was used to expand the area surveyed and the number of beds included in the annual estimation of abundance (the basis for the TAC). Landings increased as a result, reaching about 9 000 tonnes in 2010. In response, the fisheries authority declared the fishery as "fully exploited", a different status recognized by the Chilean Fisheries Law. Under this regime, access is granted to all

fishers registered in the region, in this case all fishers registered for Juliana in Region X. This contrasts with the exclusive privileges previously allocated to the local fishers who were active in the development of the fishery. When the registry for Juliana was closed in 2011 (Table 4), more than 3 000 divers were registered. Paradoxically, a change in legal status that was meant to prevent further growth of the fishery and fishing power may allow the entry of many more fishers than were active in the development phase. This may be prevented if a management plan were approved, which would formally recognize the Juliana fishery as a unit within the larger Region X, and define a specific limited-entry regime for it. Management plans are contemplated in a new fisheries act, to be implemented in 2013.

TABLE 4
Case 3: Juliana clam fishery (Chile)

Main attributes of the access regime	
How the rights are conferred and upheld	Fishers must be registered in a species-specific regionalized Artisanal Fisheries Registry, which was closed in 2011. Until 2011, the fishery operated as a Research Fishery. In order to participate, each extractive unit (fishers and boat) had to enrol with a private consultant firm in charge of monitoring the fishing operations.
Exclusivity of participation in the fishery	Under the Research Fishery, only local fishers had access to fishing.
Duration of the rights conferred	Enrolment in the Research Fishery was annual.
Security or quality of the title conferred by the rights	Suspension of the Research Fishery and declaration of the fishery as "fully exploited" in 2011 opened legal access to all fishers registered for Juliana in the Artisanal Fisheries Registry.
Transferability of the rights	Privileges are non-transferable.
Divisibility of the rights assigned	NA
Flexibility in the use of the rights	There is a monthly limit of extraction in addition to the global total allowable catch (TAC).
Enforceability of rights and compliance with use-rights limitations	Good enforceability.
Harvesting strategies	
Fishing methods and gear	Hookah diving. Boats from 9 m to 15 m long, with 40–220 hp motors; can operate with 1–5 divers.
When fishing is authorized to take place	All year round.
Harvest controls	Annual TACs are established as a fraction (15–20 percent) of annual estimates of exploitable abundance obtained from a direct survey of fishing grounds. Minimum size limit is 27 mm.
Monitoring	Skippers required to complete a logbook, including information about the crew, size and origin of catches, and diving effort. Landings are monitored through a port-sampling programme conducted by a private consultant firm. A direct survey of fishing grounds is conducted annually with participation of the commercial fleet.

LIMITED ENTRY OR MORATORIA COMBINED WITH A TAC – RECAP

A moratorium on the number of participants (boats and/or fishers), possibly combined with a TAC, has often been the first reaction to symptoms of overfishing in Latin American fisheries targeting valuable sea bed resources, as exemplified here with the sea urchin fishery of south Chile (Case 2) and the sea cucumber fishery of the Galapagos Islands (Case 1). Implementation of moratoria requires a registry or cadastre. When these are first compiled, it is easy for prospective entrants with no history in a given fishery to gain access to them. Once closed, registries are difficult to update. Moratoria are, in principle, a short-term instrument that should evolve into formal limited-entry systems with specified entry/exit rules, one of the forms of "non-quantitative access rights" identified by Charles (2009, his Figure 10.1). In practice, closed registries tend to become frozen, which results in a distortive informal market for the privileges of registered but inactive fishers. The third case considered here (the Chilean Juliana clam fishery, Case 3) is unusual in that it started as a regulated fishery under a special formal regime ("Research Fishery") and peculiar circumstances (enrolment of local fishers).

Paradoxically, formalizing limited entry under the provisions of an inflexible piece of legislation threatened the sustainability of the fishery by expanding the number of prospective legal entrants.

3. Catch shares

CASE 4: THE SAN JOSÉ GULF SCALLOP DIVING FISHERY (ARGENTINA)

A commercial diving fishery targeting mostly scallops (*Aequipecten tehuelchus*) developed in San José Gulf (Chubut Province, Argentina) in the 1970s (Orensanz *et al.*, 2007). The San José Gulf is an oval-shaped basin (817 km^2) with a mean depth of 30 m, connected to the larger San Matías Gulf through a narrow mouth (Figure 3:A) (Amoroso *et al.*, 2010). The fishery takes place within an ecologically sensitive area of special significance for conservation. The San José Gulf was declared a provincial marine park in 1974 and since 2001 it has been part of the Natural Protected Area Península Valdés, which comprises the whole peninsula and neighbouring coastal areas. The region was declared a Natural World Heritage Area by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1999.

The fleet consists of 21 fibreglass boats, 8–10 m long , equipped with outboard or inboard motors, compressors and hookah; most operate with two divers. Boats are launched from sandy beaches with the help of tractors (Figure 3:G). The fishery involves about 80 people directly (crew members, boat owners, tractor drivers) and ≈150 people indirectly in processing plants.

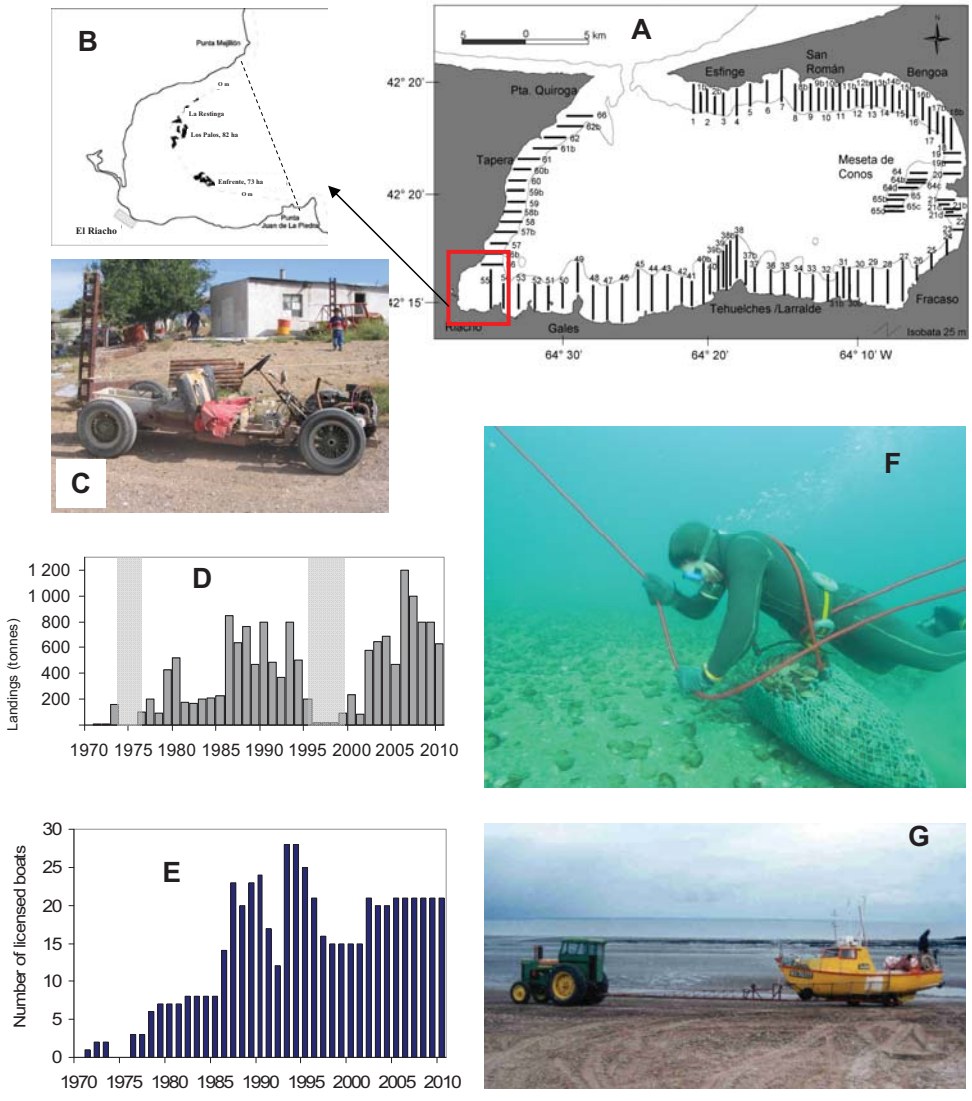
The harvest of tehuelche scallops started as a boom-and-bust dredge fishery in the San Matías Gulf in late 1960s (Orensanz, Pascual and Fernández, 1991; Ciocco *et al.*, 2005), to supply a demand created by a decline in scallop landings from the Georges Bank, Canada (Caddy and Lord, 1971). After four years of intensive dredging (1969–1972), which unselectively removed scallops as well as the top shelly substrate on which spat settle, the fishery collapsed. A decade of virtually no recruitment followed. The San José Gulf suddenly became attractive for commercial dredging. The fisheries administration of Chubut Province, fearing that the story of the adjacent Río Negro Province would repeat itself in Chubut, banned dredging in San José Gulf for two years (1974–75) out of concerns about the impact of dredging on the grounds. Commercial diving was developed as an economically viable alternative in 1976 (Figure 3:F), and dredging has been effectively banned ever since (Orensanz *et al.*, 2007). Although scallops have historically been the backbone of the fishery, other resources (mainly mussels and clams) have played an important complementary role allowing continuity and diversification of fishing activities.

The scallop diving fishery operated with minimum regulations (a size limit and a fishing season) for 20 years. The fleet expanded (to about 40 boats, many unlicensed) in the mid-1990s under a licence system that did not put a cap on effort (Figure 3:E) (Orensanz *et al.*, 2007). The fishery collapsed in 1995, and remained closed for three years (Figure 3:D). After reopening in 1999, the provincial fisheries administration created a technical advisory committee with representation of the local fishers' organization (Asociación de Pescadores Artesanales de Puerto Madryn [APAPM]), scientists from a federal institute (Centro Nacional Patagónico [CENPAT]), and staff from three government branches: fisheries, tourism and protected areas. The committee recommended the implementation of a limited-entry programme that privileged fishers with a history of participation in the fishery. A de facto moratorium has been in place since 2001, capping the number of boat permits at 21 (Figure 3:E and Table 5).

Permits are annual, renewable, non-transferable, and vested on boat owners. They grant exclusive privileges for extraction of molluscs by commercial diving within the gulf, where industrial fishing is not allowed. Each permit holder can own and

operate only one boat; the permit holders recruit their teams from a pool of divers and deck-hands who do not hold a permit. A provincial registry of artisanal fishers has been established to document participation of all crew members. Scallop harvests are currently regulated through a TAC, a minimum legal size (60 mm) and a season. Scallop surveys (Figure 3:A) are conducted annually with participation of fleet units, scientists and technical staff from the provincial fisheries administration. Results are discussed in joint meetings, and an annual TAC is agreed upon, which is divided up in equal shares among permit holders. While quota shares are formally non-transferable, in practice they are leased under a variety of ad hoc arrangements. The harvest of other resources (clams, mussels, snails, etc.) is virtually unregulated.

FIGURE 3
San José Gulf fisheries, Argentine Patagonia



Notes: (A) San José Gulf, showing the transects used in annual scallop surveys. (B) Detail of the El Riacho tidal flats, showing the location of intertidal mussel beds. (C) One of the vehicles used to collect the catch from the flats. (D) Scallop landings from the diving fishery, 1970–2011. (E) Number of boats participating in the scallop fishery. (F) Commercial diver harvesting scallops. (G) Fishing unit, including the tractor used to manoeuvre the boat on the beach.
Sources: (B) Santa Ana (2004); (C) L. Loto; (F) J. Signorelli; (G) P. Oroquieta.

A new comprehensive management plan was drafted based on input received from a series of meetings between managers, fishers and technical advisors. The plan was legally adopted at the end of 2011 and is yet to be implemented. Among the most controversial aspects during the drafting of the plan were the exit/entry rules of the limited-entry programme. Although the provincial Artisanal Fisheries Law passed in 2001 requires permit holders to be active fishers, this regulation was never enforced. This has been a source of conflict because, while some permit holders are inactive, some long-term divers who regularly participate in the fishery have been denied permits. The conditions to grant or deny permit renewals and to re-assign permits were established in the new plan. Recording of violations and documenting active participation of permit holders and crew members are still unresolved aspects in terms of implementation. Some novel mechanisms for involving peers in the documentation of participation by fishers were suggested. Weak enforcement of quotas and legitimacy of permit holders have been the most persistent problems in the management of the fishery.

TABLE 5
Case 4: San José Gulf scallop diving fishery (Argentina)

Main attributes of the access regime	
How the rights are conferred and upheld	Permits are granted to boat owners who receive an equal share of the scallop total allowable catch (TAC). The fishery is subject to limited entry (21 permits); entry/exist rules have recently been formalized. Permit holders must be registered, active fishers (physically onboard), with at least three years of residence in the province, and comply with administrative requirements (e.g. tributary, maritime authorizations). Each permit holder can operate only one boat and hold only one commercial diving permit. The permit holders can hold permits for other small-scale fisheries (beach seining, coastal gathering) but not for industrial fisheries. Crew members (other than permit holders) are registered but do not have access rights. Non-renewed permits can only be reassigned to active registered fishers, selected by history of participation in the fishery. Declared heirs have priority in case of death.
Exclusivity of participation in the fishery	Permit holders have exclusive rights for commercial diving for scallops and other molluscs in the San José Gulf. Diving and coastal gathering are the only methods permitted for harvesting molluscs; no industrial fishing is allowed within the gulf.
Duration of the rights conferred	Permits are annual, renewable, and contingent on: infraction records; boats must have fished during the preceding season; permit holders must have participated in fishing and fulfilled their scallop quotas. Long-term (> 10 years) fishers do not need to be onboard but must provide logistic support to their boat and fishing team.
Security or quality of the title conferred by the rights	Provincial legislation defines artisanal permits as "precarious" (i.e. they can be revoked). However, a de facto limited entry effective since 2001 and legally adopted in late 2011 protects fishers with an extended history of participation in the fishery.
Transferability of the rights	Permits are non-transferable, nor are their associated scallop quotas. There is informal trading of quota and use of licensed boats.
Divisibility of the rights assigned	Fishing benefits are shared among crew members: divers receive 30–35 percent of the earnings from their own catch; assistants receive 12–15 percent of the total; the rest goes to the boat owner who bears operational and maintenance costs.
Flexibility in the use of the rights	Permits are multispecific. Boat owners can decide when to take their scallop quota, and how many divers to use in their team.
Enforceability of rights and compliance with use-rights limitations	Enforcement of quotas is feasible because the catch is transported to processing plants in urban centres, going through a control post at the narrow isthmus of Península Valdés. However, legal constraints, lack of coordination between agencies, and a weak judiciary system make enforcement ineffective. The requirement that permit holders must be active has not been enforced.
Harvesting strategies	
Fishing methods and gear	Fibreglass boats, 8–10 m long, equipped with outboard or inboard motors, compressors and hookah; most operate with two divers. Boats are launched from sandy beaches with the help of tractors.
When fishing is authorized to take place	Scallop fishing season from March to 15 December; extraction of other species restricted by red tide closures.
Harvest controls	Scallop harvest regulated through a TAC, legal size limit (60 mm) and season. The harvest of other resources (clams, mussels, snails, etc.) is virtually unregulated.
Monitoring	Annual scallop surveys are funded by the fisheries authority and conducted with participation of the artisanal fleet and scientists from a research institute (Centro Nacional Patagónico [CENPAT]). Results are discussed in joint meetings with stakeholders, and a TAC is agreed based on a variable fraction of the estimated legal-size biomass. Monitoring of the fishery is planned but not yet implemented.

CASE 5: THE CHILEAN "BENTHIC EXTRACTIVE REGIME"

Perhaps the most significant case of a catch-share system in Latin American small-scale fisheries is the Benthic Extraction Regime (REB for the Spanish term Régimen de Extracción Bentónica), contemplated in the Chilean legislation. Implementation of the REB was prompted by an overfishing crisis in the loco snail (*Concholepas concholepas*) fishery (see Case 7), historically the most important benthic shellfishery in the country (Stotz, 1997; Castilla *et al.*, 1998). The REB, applied in the case of resources designated as fully exploited, was expected to solve the problems created by open access (Bernal *et al.*, 1999). It consisted of regional TACs, split into individual non-transferable quotas among registered divers. In 1993, following a three-year closure, the loco fishery was re-opened under the REB and a registration moratorium. The TACs were established on the basis of an analytical size-based stock assessment. Difficulties with enforcement and uncontrolled harvest rates led to a new crisis – by 1998 loco abundance in some of the main traditional grounds was at a historical low (González *et al.*, 2006). In retrospect, the system is viewed as a failure (Bacigalupo, 2000; Orensanz *et al.*, 2005).

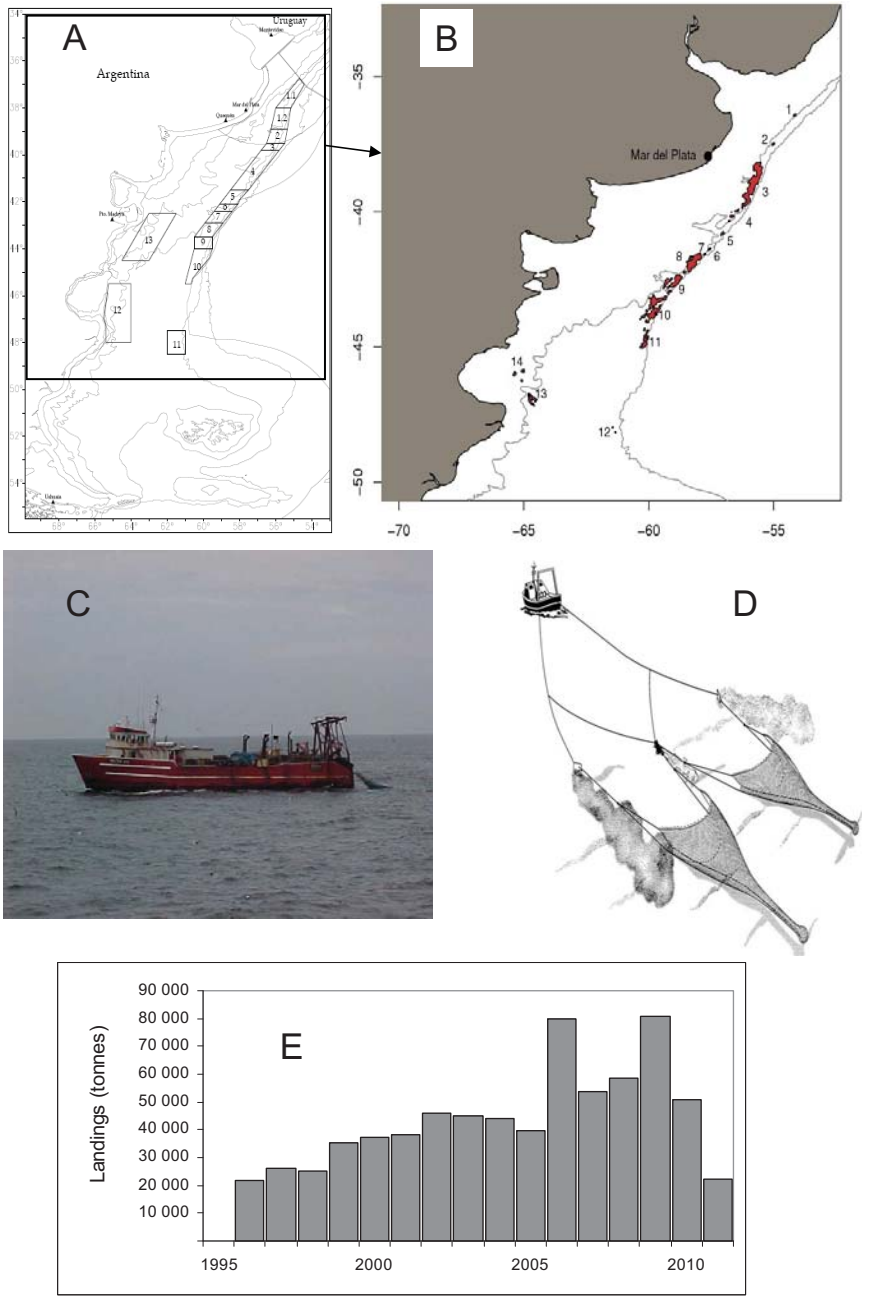
In 1999, managers considered bringing the sea urchin fishery of south Chile (see Case 2) under the REB regime. A size-based model similar to that developed for loco snail was used to assess total regional abundance of sea urchin, using size composition data of the landings. Lacking spatial structure, the model could not capture the spatial dynamics of the stock and the fleet, nor the size/shape plasticity of sea urchins. Aware of these limitations, scientists abandoned the model-based assessments in 2001. The REB was never implemented.

CASE 6: THE PATAGONIAN SCALLOP INDUSTRIAL FISHERY (ARGENTINA)

Patagonian scallop (*Zygochlamys patagonica*) stocks have been targeted by an industrial fishery in the Argentine sector of the southwestern Atlantic shelf since 1996 (Figure 4:A), following an experimental fishery conducted in 1995 (Ciocco *et al.*, 2005). Main fishing grounds are distributed offshore (90–120 m depth; Figure 4:B), coincidentally with a shelf-break frontal system (Bogazzi *et al.*, 2005). The fleet is composed of four factory vessels (Figure 4:C) belonging to two fishing companies (Table 6). Gear consists of twin otter trawls (Figure 4:D). Annual catch reached 80 000 tonnes in 2006 and 2008 (Figure 4:E; conventional conversion factor between meats and live weight is 7.14; CFP, 2009), making this one of the largest scallop fisheries in the world (Ciocco *et al.*, 2005; Pottinger *et al.*, 2007). Virtually all the production is exported to Canada, the United States of America and the European Union (Member Organization).

A resolution from the fisheries authority (CFP, 2008) provided a provisory regulatory framework for the management of the fishery, for which there is no formal management plan. An ad hoc advisory committee is integrated by two members of the fisheries authority, two from the National Institute for Fisheries Research and Development (INIDEP), and two from the industry (one from each company). There are 14 management units, with extensions ranging from 2 500 km^2 to 29 000 km^2 (Figure 4:A), but not all are opened every year. An annual TAC for each opened unit is calculated on the basis of a dredge survey conducted by INIDEP. The TAC is set at 40 percent of the minimum confidence limit for the stock biomass estimate, although the fisheries authority raised that fraction to 50 percent in 2009–2010. Catch eventually obtained outside the management units does not count towards the TAC or the quotas. Each vessel is allocated almost 20 percent of the TAC and the State retains a 20 percent "reserve" quota, which has been occasionally allocated to the industry. Quotas are only transferable among the four participating vessels, within or between fishing companies, upon payment of a fee. So far, transfers have taken place only within

FIGURE 4
Patagonian scallop industrial fishery, Argentina



Notes: (A) Southwestern Atlantic, with indication of management units (predios 1.1-13); ZCP-AU: common fishing zone shared by Argentina and Uruguay. (B) Fishing beds identified by means of spatial statistical analysis of fishing intensity. (C) Fishing vessel. (D) Pictorial representation of fishing gear. (E) Annual landings (tonnes of frozen meats); the figure for 2002 includes 20 300 tonnes of tehuelche scallop.
Sources: (A) and (E) based on data from Consejo Federal Pesquero (Argentina); (B)–(D) from Bogazzi (2008)

companies. Licences are due to expire in 2014, but in the absence of a management plan there are no criteria established for renewal or re-assignment.

Licences are granted exclusively for the Patagonian scallop, but in 2002 the fisheries authority promoted the harvest of newly discovered grounds of tehuelche scallop (*Aequipecten tehuelchus*) north of 40 °S, a resource targeted further south by an inshore

TABLE 6
Case 6: Patagonian scallop industrial fishery (Argentina)

Main attributes of the access regime	
How the rights are conferred and upheld	Access privileges are vested on four industrial vessels owned by two fishing companies. About 20 percent of the TAC is allocated to each vessel. The State retains the remaining 15–20 percent as a safeguard, which in some years has been allocated to the fleet.
Exclusivity of participation in the fishery	Exclusive for the four participating vessels.
Duration of the rights conferred	Licences, initially granted for 10 years and renewed for 5 more years in 2009.
Security or quality of the title conferred by the rights	Have been highly secure so far. It is not clear what criteria or mechanism will be used for the renewal or re-assignment of licences after 2014.
Transferability of the rights	Transferable among vessels with permits. So far, quota has been transferred only between vessels belonging to the same company.
Divisibility of the rights assigned	Quota is divisible.
Flexibility in the use of the rights	The licences are not valid for other resources.
Enforceability of rights and compliance with use-rights limitations	Fully enforced. Daily catch reports and vessel monitoring system (VMS). Virtually all the production is exported, which makes it traceable.
Harvesting strategies	
Fishing methods and gear	Vessels, 48–58 m long, operate with two bottom otter trawls and are equipped with onboard processing plants that produce frozen meats in blocks or individually quick frozen (IQF). Most of the catch is landed in Mar del Plata and Ushuaia, occasionally in Puerto Madryn. Each vessel completes 7–14 trips per year, with a duration of 20–50 days each. Normally, the vessels complete 40–60 hauls per day, with an average duration of 15.6 minutes (average distance of 1.9 km). Crews are composed of 30–34 persons, including 15–17 processing plant personnel (2–3 shifts per day).
When fishing is authorized to take place	Fishing activities run around the clock, all year long.
Harvest controls	Minimum legal size (55 mm shell height). TAC established for each of 14 management units at 40 percent of the lower confidence bound of its estimated commercial biomass, except for temporarily closed units. Fourteen "reproductive reserves" (about 4 percent of grounds), one per management unit. The proportion of juveniles cannot exceed 50 percent in order to open a management unit.
Monitoring	Onboard observers (partial), VMS, daily reporting by the skipper. Annual surveys of scallop grounds conducted using the commercial vessels. Companies are required to contribute 20 days of each vessel to conduct the survey, and to cover all survey costs.

fishery in northern Patagonia (see Case 4) (Pottinger *et al.*, 2007; Bogazzi, 2008). The volume harvested that year by the industrial fleet (20 300 tonnes) was commensurate with the cumulative catch of the artisanal fleet over three decades; the grounds targeted were wiped out in one year.

The fishery was certified by the Marine Stewardship Council (MSC) in November 2006 (Pottinger *et al.*, 2007). It was the first industrial fishery from a developing country to be certified. The last surveillance report (Morsan *et al.*, 2010) concluded that "no significant issues which could affect the sustainability and conduct of the fishery that require further investigation were identified". Yet five years after being certified the fishery is still managed through executive resolutions. Collateral ecological effects pose serious questions (Orensanz, Bogazzi and Parma, 2008). According to Morsan, Barón and Gavensky (2010, p. 8), scientists familiar with the fishery indicated that "as high density beds have already been fished, and the bed boundaries have become diffuse, captains have started to request information to researchers on where to find high density spots". This appears to indicate that the "rotational strategy" envisioned when the fishery was certified (Pottinger *et al.*, 2007) has evolved into serial depletion. Those issues raise serious concerns regarding the three principles upon which the MSC certification is based. The certification of this fishery is interesting in the sense that it constitutes a test of institutional conditions required for the success of the certification process.

CATCH SHARES – RECAP

Inflated and outdated registries (discussed above) and poor enforcement have frustrated the effective implementation of systems based on catch shares granted to individual fishers, particularly when the number of participants is high (Case 5). These problems led to the failure of a brief experiment with ITQs in the sea cucumber fishery of the Galapagos Islands in 2001 (Murillo *et al*., 2002; Toral-Granda, 2008). Illegal trading of individual quota by illegitimate registrants during the implementation of the Chilean REB (Case 5), often used to launder illegal catches, was one of the reasons for the abandonment of the system (Bacigalupo, 2000; Orensanz *et al*., 2005). Catch shares have fared better in cases where there are a small number of participants, whether the shares are granted to artisanal boat owners (Case 4), industrial vessels, or coastal gatherers. The latter are well exemplified by a small community of shellfish gatherers established in San José Gulf (Argentine Patagonia; Figure 3:A–B) and digging for yellow clams (*Mesodesma mactroides*) in Uruguay.

In limited-entry systems (with or without catch shares) where the fishing units are small boats (typical of commercial diving, Cases 1–4), whether access privileges are vested on individual fishers or boats has significant implications for management. The dynamics (entry, mobility, ageing, attrition and exit) of fishers and boats are very different. Fishers are generally more transient than boats, and often move across jurisdictional boundaries, particularly when fishing is one among other components of their livelihoods (often the case in artisanal fisheries).

4. Territorial use privileges – sea bed tracts

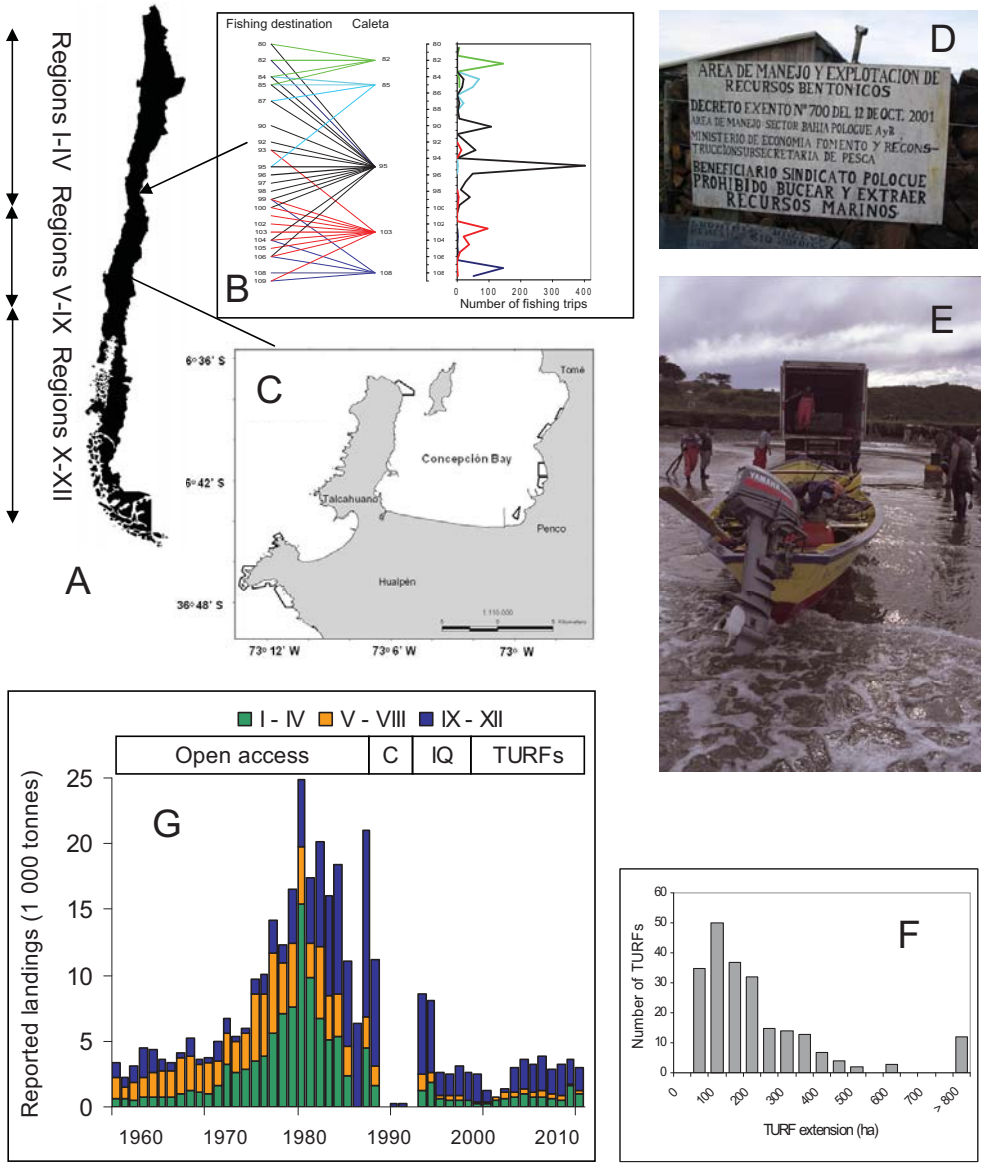
CASE 7: CHILEAN AMERBS

In contrast to other systems of marine territorial use rights in fisheries (TURF) that evolved gradually from customary tenure (Johannes, 1978; Christy, 2000), the Chilean system was established *de novo* by legislation. Historically, commercial diving for benthic resources developed as open access, regulated only by size limits and seasonal closures on some species. Until the mid-1970s, catches of the loco snail were sustained at less than 5 000 tonnes. A surge in international demand (Schurman, 1996) led to a rapid expansion of the fishery, with catches soaring to more than 20 000 tonnes in 1980. A drop in catch rates precipitated a crisis, and the fishery was closed in the entire country between 1989 and 1992 (Figure 5:G), leaving behind a legacy of economic hardship and social unrest (Aviléz and Jerez, 1999). The first attempt to address the consequences of open access was the introduction of a licence moratorium and individual diver quotas in 1993 (the REB regime described above, Case 5). The Chilean legislation passed in 1991 also contemplated TURFs, known as AMERBs (after the Spanish term Areas de Manejo y Explotación de Recursos Bentónicos), for the management of artisanal fisheries, but the regulatory framework for their implementation had not been established. AMERBs had wide support from the fishing sector, after some pilot experiments conducted by fishers of some well-organized "caletas" (coastal locations that serve as operational bases for the local artisanal fleets), sometimes in partnership with scientists, showed fast recovery of depleted resources after protection (Castilla *et al.*, 1998; González *et al.*, 2006).

The precipitous failure of the loco quota system urged fisheries managers to confront a daunting challenge: to design a process for the implementation of TURFs where they had not been established by tradition. The move required replacing a system of individual quotas, which at the time involved more than 10 000 registered divers authorized to operate, with one that granted fishers organizations exclusive privileges to harvest benthic shellfish resources from tracts of seabed (Figure 5:C–D). The fact that the introduction of AMERBs was precipitated by a series of crises resulting from a failure to control harvest rates conditioned the design of the implementation process. Priority was given to the achievement of biological sustainability (San Martín, Parma and Orensanz, 2010), and managers were reluctant to devolve management responsibility to the fishers organizations. The result is a very administratively involved process, highly demanding in terms of the biological information that organizations have to provide in order to request a TURF (including a detailed baseline survey of the area and a harvesting plan). The regulations require that professional consultants be hired to coordinate the baseline study (Table 7) and the annual surveys conducted to determine a TAC for each target resource (Orensanz and Parma, 2010). The consultant has to prepare a report including estimates of abundance of the target species, past catches, and a harvest plan for the year, which needs to be approved by the fisheries authority. Other non-biological aspects related to who should receive access privileges were left unattended; TURFs were granted on a "first-come, first-served" basis provided there were not overlapping claims and no conflicts with alternative

uses of the territory (San Martín, Parma and Orensanz, 2010). This allocation system was not too problematic in central and northern Chile, where the overlap of fishing territories between neighbouring caletas prior to the advent of AMERBs was relatively small (an example from Region IV is shown in Figure 5:B), but led to conflicts in other situations. In Ancud Bay (Region X) AMERBs were granted on fishing grounds frequented by thousands of fishers living in the city of Ancud (Chevalier, Tapia and Buckles, 2007). A protracted conflict resulted in some organizations renouncing their granted AMERBs.

FIGURE 5
AMERBs, Chile



Notes: (A) Chile, with indication of the north, central and south sectors of the coast; region boundaries as defined in the 1990s, when individual quotas (REB regime) and AMERBs were implemented. (B) Region IV, sector of Los Vilos: allocation of fishing effort during the REB regime (pre-AMERBs, 1993–97); left: spread of fishing trips originating in five caletas, right: spread of fishing intensity corresponding to the same caletas (identified by colour). (C) AMERBs in the area of Concepción (Region VIII). (D) Sign posted at the Polocué AMERB (Chiloé Island, Region X), indicating exclusive access privileges of the syndicate. (E) Landing of loco for a pre-arranged sale at Polocué, May 2004. (F) Frequency distribution of the extension of active AMERBs. (G) Landings of loco snails (sectors of the coast as in A), with indication of successive management regimes: open access, closure (C), individual quotas (IQ) and AMERBs (TURFs).
Sources: (B) modified from González et al. (2006); (F) data from SUBPESCA.

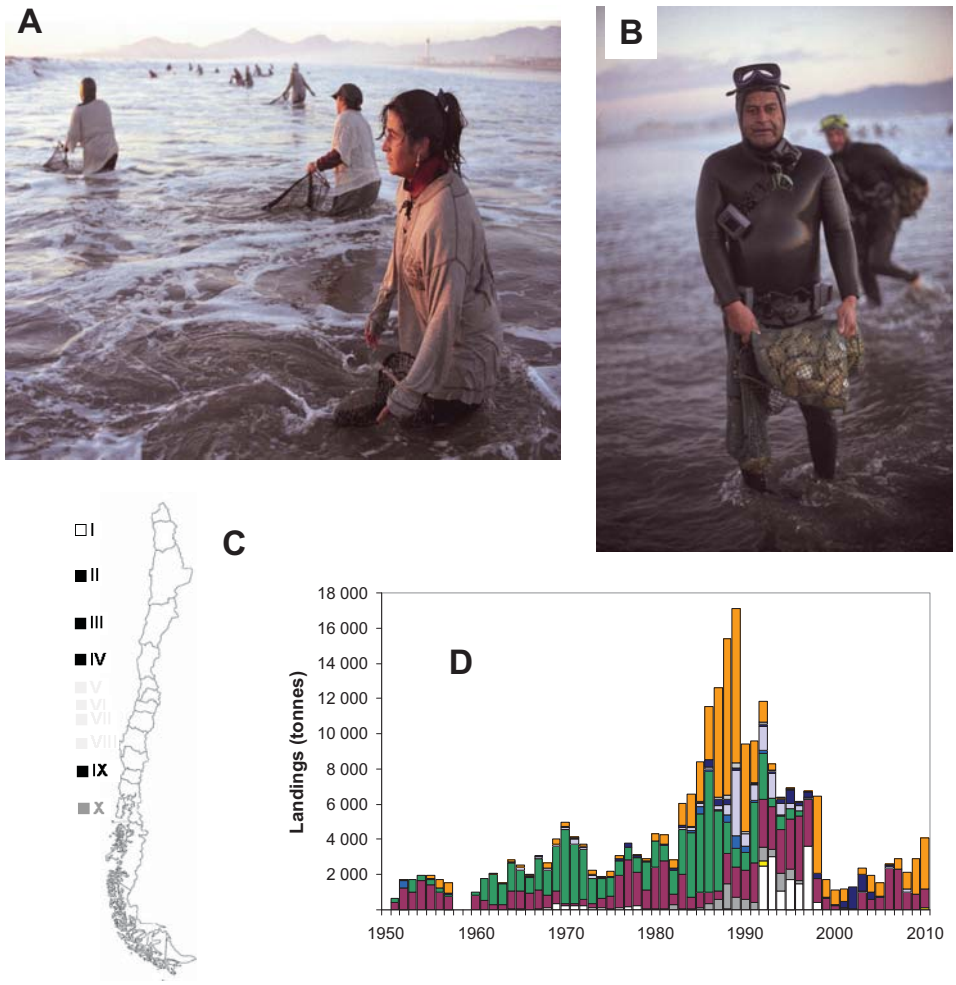
The transition from individual quotas to AMERBs was rapid. The two regimes coexisted in only one year (1999), after which harvesting of loco outside the AMERBs was banned (González *et al*., 2006). After five years, more than 500 tracts (most of less than 250 ha) had been designated as AMERBs, 400 of them had a baseline study completed and 224 had an approved management plan (San Martín, Parma and Orensanz, 2010). In 2011, there were 769 sectors designated as suitable for AMERBs, 520 of which had been assigned to an organization (75 533 ha). Almost 340 organizations involving about 23 000 people have been assigned at least one sector (from one to four), and as many more organizations are requesting AMERBs. Most AMERBs have loco as a primary target, complemented by other species (e.g. limpets, sea urchin, and crabs). The combined area held by each organization is highly variable, but in the case of AMERBs having loco as a primary resource it is usually less than 400 ha, with an average of 243 ha per organization (SD = 480) (Figure 5:F).

TABLE 7
Case 7: Chilean AMERBs

Main attributes of the access regime	
How the rights are conferred and upheld	AMERBs are granted to formal organizations of fishers (syndicates, associations or cooperatives). The designation of a tract as a possible AMERB is first consulted with various government institutions (regional fisheries councils, maritime authority, etc.). Once approved, the requesting organization has to conduct an ecological baseline study with help from a consultant. If two or more organizations request the same tract, priority is decided on the basis of number of members and distance from the community. Members have to be enrolled in a registry for any of the available resources (seaweeds, molluscs, crustaceans or fishes) and categories of activities (diver, diver's assistant, finfish fisher, rower, or coastal gatherer). At the local level, entry to fishers organizations is controlled by the fishers themselves, according to rules established by each organization.
Exclusivity of participation in the fishery	Exclusive-use privileges are granted for specified resources within the AMERB. Although in principle other species can be harvested by outside fishers, outsiders are excluded de facto from the AMERBs for any type of activity.
Duration of the rights conferred	AMERBs are initially granted for four years and are renewable. An annual fee is required after the first renewal.
Security or quality of the title conferred by the rights	Grants can be revoked owing to non-compliance with the approved management plan or for not paying the required annual fee.
Transferability of the rights	Non-transferable.
Divisibility of the rights assigned	Membership, participation in the harvest and other activities (maintenance, vigilance, etc.) and distribution of benefits are arranged by the fishers within their organizations, according to well-established rules. The latter vary among organizations.
Flexibility in the use of the rights	An annual harvest plan including a total allowable catch (TAC) has to be approved by the fisheries authority.
Enforceability of rights and compliance with use-rights limitations	Fishers patrol their AMERBs, often around the clock, to deter poachers; physical confrontations with intruders are frequent. The maritime authority has been generally slow to react to reports of violations. Violations are reported by the "alcalde de mar", a community member designated by the maritime authority who keeps track of fishing activities. Internal rules are usually strictly enforced and penalties can be significant (up to termination of membership). Generally, harvests are conducted on designated dates, with participation of all the members, which reduces non-compliance.
Harvesting strategies	
Fishing methods and gear	Most resources are extracted by hookah diving, using wooden boats 8–9 m long; each team is composed of 2–4 members. Coastal gathering, hand-picking of beach clams or crab trapping are also practised in some cases. No dredging or trawling is allowed along the entire coast of Chile (5 miles from shore); the ban is respected and supported by fishers.
When fishing is authorized to take place	Most resources have closed reproductive seasons. The timing of loco closures varies among regions. Keyhole limpets do not have a seasonal closure. In both cases, harvests are concentrated in a few days, pre-arranged with the buyers. Macha clams and scallops are harvested over longer periods (4–7 months), depending on weather conditions and demand.
Harvest controls	An annual harvest plan is prepared by a hired consultant and approved by the national fisheries authority. The plan specifies a TAC for each of the target species. Size limits are established by the fisheries authority.
Monitoring	TACs are established based stock abundance, estimated by consultants based on diving surveys conducted by the fishers. A report of catches, prices and stock assessments is presented to the fishery authority as a requirement for the granting of the TAC.

More than a decade after the inception of TURFs, a mixed record emerges. On some accounts, the system has been successful (Aviléz and Jerez, 1999; Cereceda and Czischke, 2001; Agüero, 2004; Defeo and Castilla, 2005). Loco abundance recovered within many of the tracts, leading to increased public and private benefits (González *et al*., 2006; Grafton *et al*., 2008). Management moved away from a reactive mode prompted by the recurrent crises that punctuated the history of the loco fishery. Fishers organizations have developed internal rules to control membership, and to divide the work and the profits extracted from coordinated fishing and pooled loco sales (Figure 5:E) (Cancino, Uchida and Wilen, 2007; Orensanz and Parma, 2010). However, the degree of success in achieving biological sustainability has been uneven (Techeira, 2012), and problems are surfacing related to broader economic and social management objectives (SERNAPESCA, 2005; Cinti, 2006; González *et al*., 2006; Castilla, Gelcich and Defeo, 2007; Gelcich *et al*., 2010; San Martín, Parma and Orensanz, 2010).

FIGURE 6
Macha clam fishery, Chile



Notes: (A) "Taloneras" gathering clams in the surf zone, Coquimbo Bay. (B) Commercial divers, Coquimbo Bay. (C) Chile, showing historical registration regions. (D) Recorded catch of macha clams, 1960–2011, by regions (colours as in C).
Photo credit: J. Rodríguez.

Experience gained from the implementation of AMERBs oriented to loco harvesting is not necessarily applicable to every other benthic resource. Loco is very productive, tends to respond rapidly to protection (partly owing to immigration from adjacent areas), and is relatively long-lived, which buffers interannual variability in recruitment. All these attributes contribute to justify investment by fishers in protecting and managing AMERBs where loco is the target species. Other resources appear to be less suited to local management. The macha clam (*Mesodesma donacium*) is a case in point. Macha is harvested in shallow subtidal waters along extensive sandy beaches by divers, "orilleros" and "taloneras" (Figure 6:A–B). The latter, mostly women, probe the substrate for the presence of macha using their heels ("talones"). Historical landing statistics by region indicate a highly variable resource at the local scale; catches tend to fluctuate out of synchrony in neighbouring regions (e.g. Regions IV and V) (Figure 6:C–D). Some precipitous drops in landings can be associated with episodes of massive mortality caused by flooding following major El Niño events (Aburto and Stotz, 2013). Historically, macha fishers were nomadic, moving up and down the Chilean coast while tracking pulses of macha productivity (Aburto, Thiel and Stotz, 2009). This behaviour, which buffered spatial variability, is incompatible with the AMERB regime, as well as with a regionalized registration policy that locks fishers into a single region. Most AMERBs that had macha as a target resource did not perform well. Out of 14 AMERBS that had completed a baseline study, only 3 remained active by 2009 with abundance of macha recovering. The rest were abandoned either because the stocks did not recover or they were depleted after a few years of exploitation.

CASE 8: CONCESSIONS FROM CENTRAL BAJA CALIFORNIA (MEXICO)

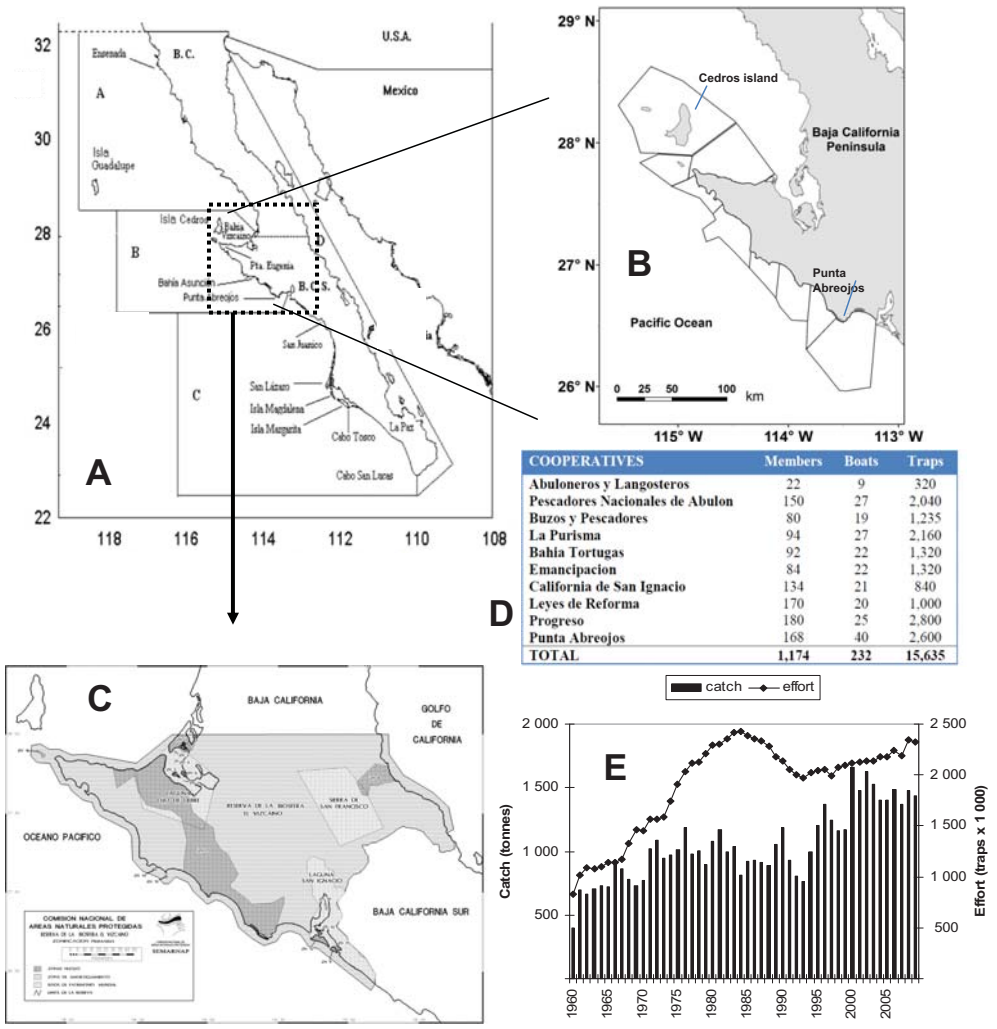
From the 1930s and up until 1992, Mexican fishers cooperatives had exclusive privileges to harvest the most valuable commercial benthic resources (lobster, abalone, shrimp, oysters, etc.) within delimited territories (Vega *et al.*, 1997). In 1992, a legislative reform allowed the private sector access to these fisheries (Bourillón-Moreno, 2002). Under the current regime, territorial concessions can be granted to juridical or natural persons by the national fisheries authority (Table 8; DOF, 2007a). They last 20 years, and are renewable upon compliance with requirements and conditioned on evidence of continued productivity of the target species. Grantees are required to conduct annual assessments of resource abundance, to keep logbooks, and to present an annual harvest plan and reports of fishing activities inside the concession. A concession grants exclusive access and use privileges to certain species within a specified geographic area. Those privileges do not extend to other species, which can be harvested by outside fishers.

Territorial concessions held by fishing cooperatives on the Pacific coast of central Baja California target lobsters (*Panulirus interruptus*) (the primary resource), abalone (*Haliotis* spp.), turban snail (*Megastraea undosa)* and sea cucumber (*Parastichopus parvimensis*). The area extends from Cedros Island in Baja California State through Punta Abreojos in Baja California Sur State, including Guadalupe Island, about 250 km off the coast of Baja California (Figure 7:A–B). Ten cooperatives operate in the area, involving 1 174 members and 232 boats in total (Figure 7:D; Sosa-Nishizaki, Lluch-Belda and Daume, 2011). Each cooperative is granted one concession located in the vicinity of a fishing community (the exception is one cooperative incorporated to the Federación de Cooperativas Pesqueras [FEDECOOP] in 2010). The concessions are clearly delimited, have an extension of the order of 500–1 000 km^2, and are spatially contiguous (Figure 7:B) (McCay, Weisman and Creed, 2011). The cooperatives are grouped into a federation, founded in the 1940s (FEDECOOP, www.fedecoop.com.mx/), which provides technical and marketing support to its members.

These cooperatives operate in an area of exceptional value for conservation; most of the fishing grounds fall inside two protected areas, the Vizcaino Biosphere Reserve (created in 1988) and the Guadalupe Island Biosphere Reserve (created in 2005). The large Vizcaino Reserve includes over 6.5 million acres (about 2.6 million ha) of islands and mainland and a 5 km coastal strip on both sides of Baja California (Figure 7:C), aimed at protecting the migratory route of grey whales and fishery resources (INE, 2000). The Guadalupe Island Reserve is rich in species of marine mammals and birds, and also an important refuge for white sharks (CONANP, 2007).

FEDECOOP and its member cooperatives are politically influential and effective organizations, among the most successful in the country with regard to the sustainable use of their fishery resources. Cooperatives supply about 80 percent of the lobster catch in the Baja California peninsula. Landings have trended upwards in the last four decades, albeit with interannual variation owing to El Niño/La Niña events

FIGURE 7
Concessions from central Baja California, Mexico



COOPERATIVES	Members	Boats	Traps
Abuloneros y Langosteros	22	9	320
Pescadores Nacionales de Abulon	150	27	2,040
Buzos y Pescadores	80	19	1,235
La Purisma	94	27	2,160
Bahia Tortugas	92	22	1,320
Emancipacion	84	22	1,320
California de San Ignacio	134	21	840
Leyes de Reforma	170	20	1,000
Progreso	180	25	2,800
Punta Abreojos	168	40	2,600
TOTAL	1,174	232	15,635

Notes: (A) Baja California, showing the four lobster management zones (A–D) and the regions where concessions to cooperatives grouped in FEDECOOP are located. (B) Boundaries of the nine concessions under FEDECOOP. (C) Zoning of the El Vizcaíno Biosphere Reserve; shading indicates categories: core (dark), buffer (intermediate) and world heritage (light). (D) Number of fishers, boats and lobster traps in each cooperative. (E) Catch and effort, 1960–2009.
Sources: (A) and (E) after Vega *et al.* (2010); (C) after CONANP; (D) after Sosa-Nishizaki, Lluch-Belda and Daume (2011).

TABLE 8
Case 8: Concessions from central Baja California (Mexico)

Main attributes of the access regime	
How the rights are conferred and upheld	Concessions can be granted to juridical or natural persons by the national fisheries authority. Each cooperative is granted one territorial concession (located in the vicinity of a fishing community). Cooperatives are grouped into a federation (Federación de Cooperativas Pesqueras [FEDECOOP]), which are politically influential and effective organizations.
Exclusivity of participation in the fishery	Access and use privileges are exclusive to certain species within concessions. Other species can be harvested by outside fishers.
Duration of the rights conferred	20 years; renewable.
Security or quality of the title conferred by the rights	The duration of the privilege makes it highly secure. Renewal is conditioned on evidence of continued productivity of the target species and compliance with requirements, including payment of a fee, participation in monitoring, support to authorities for inspection and vigilance, and re-stocking of some species (e.g. hatchery production of abalone seed).
Transferability of the rights	Non-transferable.
Divisibility of the rights assigned	Decisions on who is allowed to harvest and how benefits are distributed among participants are left to title holders. Cooperatives from central Baja California have significant autonomy for internal administration and enforcement, and have developed their own rules in addition to those imposed by the authority. As an example, whereas the government establishes the maximum number of lobster traps to be employed in each concession, the cooperatives decide how traps are allocated among members and where they are deployed.
Flexibility in the use of the rights	High, conditioned on compliance with the annual harvest plan and regulations. Cooperatives develop their own internal agreements to harvest, distribute benefits and afford costs.
Enforceability of rights and compliance with use-rights limitations	The cooperatives have demonstrated an outstanding capacity for enforcing internal rules and for preventing poaching by outsiders.
Harvesting strategies	
Fishing methods and gear	Fibreglass boats, 8–9 m long with outboard motors (40–115 hp), operated by 2–3 people. Navigation devices (GPS, Sonda) are utilized. Traps for lobster; hookah diving for abalone and sea urchin.
When fishing is authorized to take place	Lobster fishing season of variable duration. Since 1993, closures of management zones have been "stepped" in line with latitudinal variation in the reproductive season. FEDECOOP has agreed to close the fishery when 10 percent of the females in the catch have attached spermatophores, regardless of the formal date of closure established for the zone.
Harvest controls	Regulations imposed by the fisheries authority and local rules limit the number of boats and traps. Lobsters have a minimum legal size (82.5 mm of cephalothoracic length), and catching of egg-bearing females is prohibited. Fishers and the authorities have agreed on the mandatory use of escape windows and biodegradable fasteners on traps.
Monitoring	Cooperatives and the fisheries authority collaborate in several monitoring programmes: (i) logbook programme (daily catch and effort); (ii) monthly samples of size and sex structure of the catch; (iii) monitoring the reproductive stage of lobster during closures. Market prices are monitored throughout the fishing season in order to assess the economic feasibility of operations.

(Figure 7:E) (Vega *et al.*, 2010). The cooperatives and the fisheries authority comanage the fishery, and collaborate in monitoring and enforcement. Although participation has only recently been formally required, the cooperatives have a long history of collaboration with various institutions (academic, governmental, NGOs) to coproduce information relevant for management (Ponce-Díaz, Weisman and McCay, 2009). In the case of lobster, fishers participate in a technical committee instituted by the Instituto Nacional de Pesca (INAPESCA) in 1988 (Comité Técnico Consultivo de la Pesquería de Langosta del Pacífico) (Ponce-Díaz *et al.*, 2009), where assessment results and management recommendations (including harvest levels) are discussed before submision to the fisheries authority for approval. The fishery is primarily regulated through effort controls, attending to recent harvest history, stock size, and biological and economic indicators (Sosa-Nishizaki, Lluch-Belda and Daume, 2011). Workshops define monitoring protocols for the upcoming season, and each cooperative defines an annual harvest plan, which has to be approved by the Comisión Nacional de Acuacultura y Pesca (CONAPESCA). In addition, there is a state-level subcommittee (Subcomité Estatal

de Langosta de Baja California Sur, in place since 2003) with representation of lobster producers, fisheries and environmental authorities (Ponce-Díaz *et al*., 2009).

FEDECOOP cooperatives have significant autonomy for internal administration and enforcement, and they have developed their own rules. Whereas the government establishes the maximum number of traps to be employed in each concession, the cooperatives decide how traps are allocated among members and where they are deployed (McCay, Weisman and Creed, 2011). In order to participate in the harvest, fishers must be members of the cooperative and have had significant production levels in the five preceding seasons. To fulfil the monitoring requirements, each cooperative has its own fisheries department in charge of recording fishery information (Sosa-Nishizaki, Lluch-Belda and Daume, 2011).

FEDECOOP cooperatives have been very effective at enforcing internal rules and preventing poaching by outsiders (Ponce-Díaz, Weisman and McCay, 2009; McCay, Weisman and Creed, 2011). They developed an inspection and surveillance system for the ten cooperatives, with operational costs of about US$2.5 million per year and investment costs of about US$1.5 million in equipment (Sosa-Nishizaki, Lluch-Belda and Daume, 2011). The system is implemented through a community surveillance committee legally recognized by the authority. The committee also helps enforce the minimum legal size by checking the catch with a quality control group. In the event of violations by a cooperative member, sanctions may include economic penalties, suspensions, and even exclusion from the cooperative.

FEDECOOP has played a role in proposing changes in fishery legislation at the national level (McCay, Weisman and Creed, 2011). As an example, it participated in the formulation of an article of the Federal Penal Code, which imposes incarceration penalties on those who, illegally and with premeditation, capture, process, store, transport, destroy or commercialize lobsters or abalone (Ponce-Díaz, Weisman and McCay, 2009). The federation also had a leading role in pursuing the certification of the lobster fishery by the MSC, which was achieved in 2004 and renewed in 2011. This was the first artisanal fishery from a developing country to be certified by the MSC.

CASE 9: "PREDIOS" OF SUSTAINABLE USE, GULF OF CALIFORNIA (MEXICO)

The Mexican authority for the environment, the Secretaría del Medio Ambiente y Recursos Naturales (SEMARNAT), regulates the use of species listed as "under special protection" independently from the fisheries authority (CONAPESCA). SEMARNAT has a special regime that grants exclusive access to specified resources within areas designated as "predios" (short for "Predios Federales Sujetos a Manejo para la Conservación y Aprovechamiento Sustentable de Vida Silvestre" [DOF, 2000]). Predios have been implemented in the Gulf of California (Figure 8:A) since 2003, primarily for the harvest of sea cucumbers (*Isostichopus fuscus*) and rock scallops (*Spondylus calcifer*) by commercial divers, with mixed results (Avendaño-Ceceña, 2007; Cudney-Bueno *et al.*, 2009a; Cinti, 2010; Martínez-Tovar and Turk-Boyer, 2012).

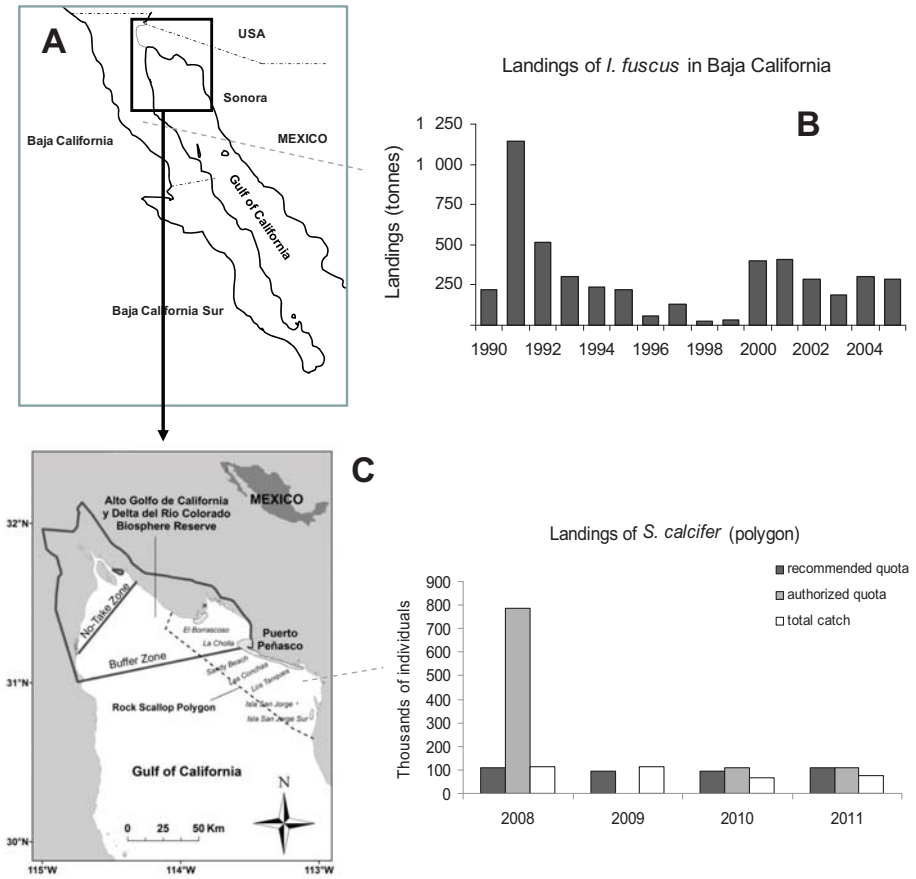
Access may be granted to juridical (e.g. companies, fishing cooperatives) or natural persons for one year; contracts are renewable upon compliance with regulations, and transferable (Table 9). A regional management plan includes a harvest season, size limits, and a TAC. The latter is based on annual assessments conducted by a technical/scientific provider (research institute, university, NGO or private consultant), which may or may not involve the participation of fishers. Results are reported to a technical committee created for each authorized resource or group of resources: the committee advises SEMARNAT on quotas and licence renewals. Committees may be integrated by government agencies (federal, state or municipal), academic institutions, NGOs, fishers organizations, the industry and/or other social or private stakeholders.

Outcomes have been more positive in predios located inside protected areas where enforcement is more effective (e.g. inside the Loreto Bay National Park), when fishers participate in resource monitoring and as part of the committee, and when there is external support for capacity building and for fulfilling the legal requirements of the system (Avendaño-Ceceña, 2007; Cudney-Bueno *et al*., 2009a).

In Baja California Sur State (east and west coasts) sea cucumber fishing had been authorized in eight predios as of 2010. One of them is located inside the National Marine Park of Bahía de Loreto, where fishers from several cooperatives operate (Reyes-Bonilla *et al*., 2008). Cooperatives must conform with the predio management plan and the management plan of the park. The park enlists supplementary inspectors paid by NGOs (M.T. Sanchez, personal communication), which significantly improves enforcement compared with predios located outside park boundaries. The sea cucumber committee for the state has functioned relatively well thanks to the active participation of the fishers and enforcement agents (including police, army, navy and customs agents) (M.T. Sanchez, personal communication), and the political will and support of participatory management by government officials (Avendaño-Ceceña, 2007; Herrero-Pérezrul, Ponce Larios and Calderón-Aguilera, 2011). This is in sharp contrast with Baja California State, where predios were established for sea cucumber and Pismo clam (*Tivela stultorum*) starting in 2005 (Avendaño-Ceceña, 2007). As of 2009, about 15–20 predios had authorization for sea cucumber extraction, most of them granted to individuals and only a few to juridical persons (Cinti, 2010). In the surroundings of Bahía de los Ángeles (and presumably in other sectors as well), compliance with quotas has been poor, and the resource is severely depleted (Valdéz and Torreblanca, 2008; Calderón-Aguilera and Herrero-Perezrul, 2011), as reflected by dwindling catches (Figure 8:B). As predios are the only legal way to exploit protected species, they are used to launder illegal catches (harvested outside predios or by unauthorized persons), as is also the case in other fisheries managed under fishing licence regimes in the Gulf of California (Bourillón-Moreno, 2002; Cinti *et al*., 2010). The fishing sector does not participate in the state sea cucumber committee (Avendaño-Ceceña, 2007). Although some of the predios are located inside a marine protected area (the Bahía de los Ángeles Biosphere Reserve; Danemann and Ezcurra, 2007), no management plan is yet in place and resources for enforcement are limited (Cinti, 2010), in contrast to the Bahia de Loreto National Park.

Predios have also been implemented in Puerto Peñasco (Gulf of California, Sonora) for the rock scallop fishery (Figure 8:D), one of the most significant artisanal fisheries in the region. Rock scallops are harvested by a local cooperative of commercial divers (≈12 boats, 2–3 crew members per boat). In 2000–02, fishers participated in voluntary efforts to rebuild local stocks through a network of marine reserves, while working closely with researchers from a conservation NGO (Centro Intercultural de Estudios de Desiertos y Océanos [CEDO]) and academy (Cudney *et al*., 2009a, 2009b). Initially, the absence of formal rights to the grounds surrounding the reserve attracted fishers from distant communities, leading to overharvesting and disruption of local governance (Cudney-Bueno and Basurto, 2009). Predios (covering 383 688 ha) were finally granted to the cooperative in 2006. The fishery has a comprehensive management plan (Martínez-Tovar and Turk-Boyer, 2012). Members of the cooperative participate in management conducting assessments, monitoring in cooperation with CEDO, and patrolling the predios. Participation of fishers in the state committee has been irregular owing to lack of continuity of committee meetings convened by the authority. The cooperative has internal rules aimed at promoting compliance with management requirements (e.g. participation in assessments and vigilance). Lack of government support for vigilance is a critical constraint. As part of the rock scallop predio overlaps

FIGURE 8
Predios of sustainable use, Gulf of California (Mexico)



Notes: (A) Gulf of California, showing jurisdictions. (B) Sea cucumber landings, Baja California State, 1990–2005. (C) Location of rock scallop predio and fishing zones, northern Gulf of California, showing overlap with the "Alto Golfo de California y delta del Río Colorado" Biosphere Reserve. (D) Quota (recommended and authorized) and catch of rock scallops.
Sources: (B) courtesy of L. Calderón; (D) modified from Martínez-Tovar and Turk Boyer (2012).

with the "Alto Golfo de California and Delta del Río Colorado Biosphere Reserve" (Figure 8:C), environmental legislation mandates that title holders must present an environmental impact assessment of the activities to be performed inside the reserve (Martínez-Tovar and Turk-Boyer, 2012). The first impact assessment of this kind conducted by the cooperative in collaboration with CEDO was approved in 2009.

TABLE 9
Case 9: "Predios" of sustainable use, Gulf of California (Mexico)

Main attributes of the access regime	
How the rights are conferred and upheld	Access privileges to shellfish resources within a specified geographic area or predio may be granted to juridical (e.g. companies, fishing cooperatives) or natural persons.
Exclusivity of participation in the fishery	Exclusive-use privileges are for specified resources within a predio. Exclusivity is not extensive to other species, which can be harvested by outside fishers.
Duration of the rights conferred	Predios are granted for one year and can be renewed.
Security or quality of the title conferred by the rights	Renewal is contingent upon compliance with requirements, mainly on the basis of reports on activities performed inside the predios and resource assessments.
Transferability of the rights	Title holders may transfer their privilege in whole or in part and receive benefits from it. Authorization must be solicited to the environmental authority by specifying the recipient, what will be transferred (all or part of the privilege) and for how long (within the annual granting period).
Divisibility of the rights assigned	Title holders are allowed to subcontract others to help in the harvest or other tasks; they may also transfer their titles to others. Contract agreements and identification of people involved in those agreements must be reported to the environmental authority.
Flexibility in the use of the rights	Cooperatives can develop their own internal agreements to harvest and distribute benefits and afford costs; title holders are allowed to subcontract others, provided that the management plan and other requirements of the system are followed.
Enforceability of rights and compliance with use-rights limitations	Enforcement and management have been more effective (i) in predios located inside protected areas, where vigilance is intensified (e.g. inside the Loreto Bay National Park); (ii) when fishers participate in resource monitoring, vigilance, and as part of the technical committee (rock scallop in Puerto Peñasco, sea cucumber in Baja California Sur State); (iii) when external support for capacity building and for fulfilling the legal requirements of the system are provided (Puerto Peñasco). Enforcement by government agencies has been generally weak, a primary reason for failure.
Harvesting strategies	Grantees must comply with a regional management plan for each species exploited in the predio. The regional management plans specify harvest seasons, size limits and guidelines for establishing catch quotas for each predio.
Fishing methods and gear	Commercial divers using fibreglass boats, 8–9 m long, equipped with air compressors and hookahs.
When fishing is authorized to take place	A reproductive closure has been established from July to September in the case of predios of rock scallop in Puerto Peñasco, Sonora.
Harvest controls	Sea cucumber: minimum legal size/weight is 20 cm or 400 g. Rock scallops: minimum legal size 13 cm (shell length), and a TAC calculated at 10 percent of the abundance of legal-size scallops evaluated within exploitable beds defined by densities in excess of 5 scallops per 100 m^2. The management plan also includes recommendations for implementation of reproductive reserves and temporary closure of recovery areas.
Monitoring	Permit holders must keep daily logbooks and submit a report of fishing activities by trip, including information on catch, fishing location, who harvested the resource, effective fishing time, contractual conditions if the privilege was transferred, and sales information. Surveys of resource abundance must be conducted using methodologies specified in the management plan. The annual report must also include information on costs incurred in fulfilling the requirements of the management plan relative to the profits generated for the use of the predio.

CASE 10: CONCESSIONS FOR SEAWEED EXTRACTION IN CHUBUT PROVINCE (ARGENTINA)

Marine benthic algae are harvested in Chubut Province (Argentina) and used for the production of agar-agar (*Gracilaria verrucosa*) and carrageenans (*Gigartina skottsbergii*) (Boraso de Zaizso, Ciancia and Cerezo, 1998). Algae are collected under two regimes: collecting permits and industry concessions, both non-transferable (Table 10). Collecting permits allow only the harvest of naturally stranded algae, and are valid for three years. Industry concessions are granted for longer periods (20–30 years), and allow the harvest, commercialization and processing of algae cropped from natural meadows in addition to strandings. Concessions give exclusive access to exploitation of algae, not affecting other uses. Currently, there are three active commercial firms harvesting algae, one of which holds a concession over 100 km of coastline that produces more than 1 000 tonnes of dry algae per year.

TERRITORIAL USE PRIVILEGES: SEA BED TRACTS – RECAP

Typically, these consist of concessions to fishers organizations, such Mexican cooperatives (Cases 8 and 9) and Chilean "sindicatos" (Case 7), for the use of specific resources in tracts of seabed (TURFs). Differences in design have significant management implications. In the case of Chilean AMERBs (Case 7), the tracts are relatively small, leaving background areas of variable extension where fishing activities are nominally regulated, but where regulations are unenforceable. The result has been severe depletion of valuable resources (e.g. loco snails) in background areas. Instead, Mexican cooperatives from central Baja California (Case 8) have concessions over extended tracts contiguous with each other, so that there is no unclaimed background territory. This system has been successful on most accounts. The TURFs have functioned better in cases where the tracts are close to fishing communities (the case of many caletas from Central Chile), particularly in rural areas (as in central Baja California). Vigilance, deterrence of intruders and enforcement are difficult where the TURFs are located away from fishing communities (as in much of south Chile). While TURFs, in general, have performed relatively well, they have fared best in cases with a long history of collective territorial appropriation, informal in its beginnings. Systems introduced by design (institutional engineering) have faced unexpected and undesirable implementation problems as illustrated by the Chilean TURFs (Gelcich *et al*., 2006; Orensanz and Parma, 2010; San Martín, Parma and Orensanz, 2010) and contrasts in the success of predios in the Gulf of California (Case 9).

5. Territorial use privileges – fishing spots

CASE 11: LOBSTER CONCESSIONS OF PUNTA ALLEN (MEXICO)

Fishing cooperatives harvest spiny lobsters (*Panulirus argus*) along the Caribbean coast of Mexico, corresponding to Quintana Roo State. The three fishing cooperatives of Punta Allen have their lobster fishing grounds in Ascensión and Espíritu Santo Bays (Figure 9:A). Before 1992, fishing cooperatives were the only organizations to have legal access to spiny lobster resources. Although this exclusive privilege was eliminated in the 1992 legislation, cooperatives are, de facto, still the only organizations that have been granted fishing concessions in the region. This is because of their background and expertise as historical users, their readiness to fulfil the new requirements to obtain concessions and their political influence (Sosa-Cordero, Liceaga-Correa and Seijo, 2008). The Pescadores de Vigía Chico cooperative has a concession to an area of 850 km^2 entirely enclosing Ascensión Bay (Figure 9:B); two other cooperatives (Cozumel and Azcorra) hold concessions in Espíritu Santo Bay (350 km^2) (Sosa-Cordero, Liceaga-Correa and Seijo, 2008). Ascensión and Espiritu Santo Bays are located within the boundaries of the Sian Ka´an Biosphere Reserve (SKBR), created in 1986 and administered by a federal agency, the Comisión Nacional de Áreas Naturales Protegidas (CONANP), within the environmental and natural resources authority (SEMARNAT). The management plan for the SKBR specifies zoning of uses, restricting human activities related to fishing and tourism. The fisheries authority (CONAPESCA) is part of a different secretariat, the Secretaría de Agricultura, Ganadería y Pesca (SAGARPA).

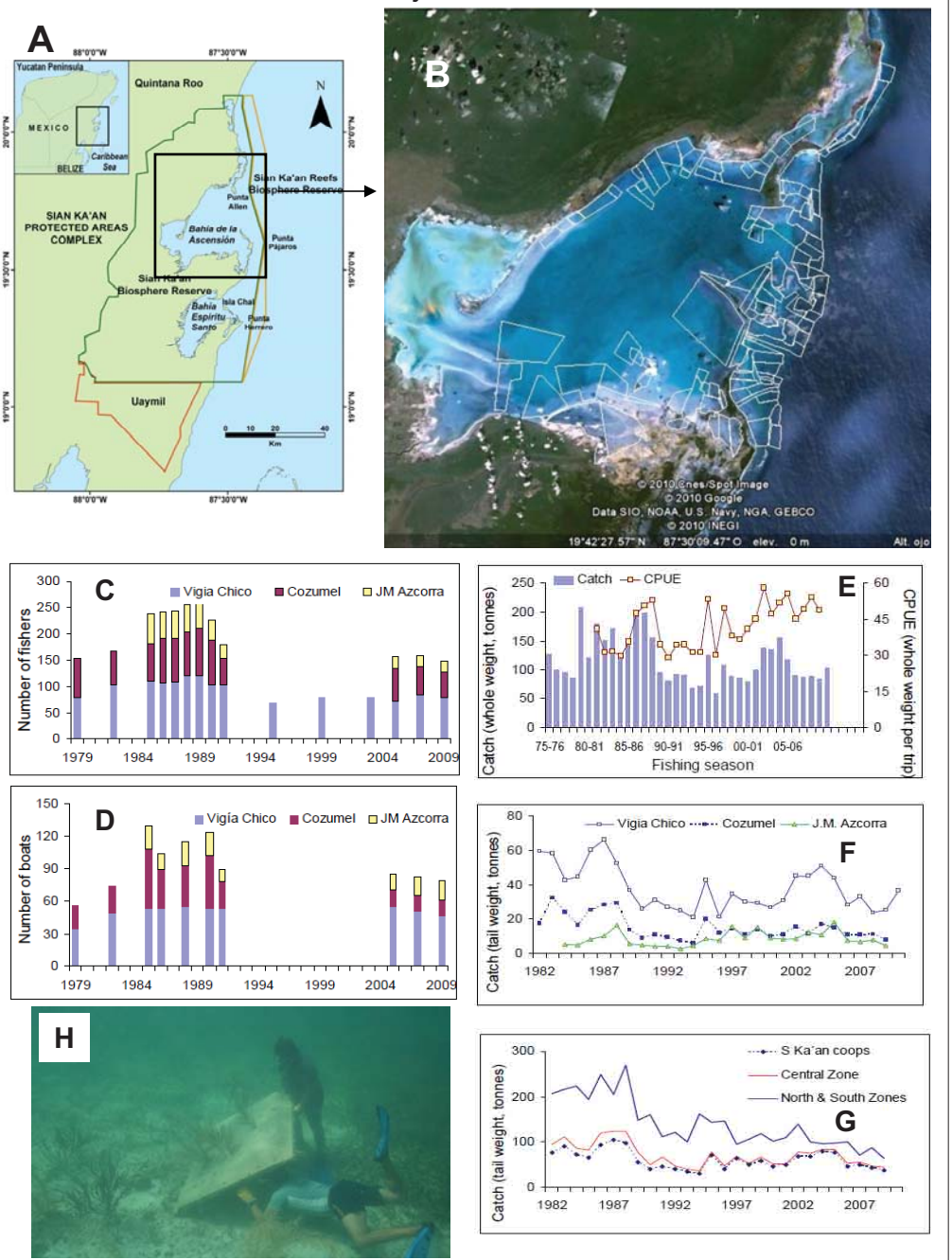
Lobsters are harvested from artificial shelters ("casitas", Figure 9:H), where they seek refuge during their ontogenetic migration out of the bay (Lozano-Alvarez, Briones-Fourzán and Phillips, 1991). Originating in Cuba, casitas were introduced to the Mexican Caribbean in the late 1960s. Before the early 1980s, casitas were built mostly with logs of a local palm tree. Palm tree cutting was banned in 1988, forcing fishers to introduce alternative designs built entirely of ferrocement (Briones-Fourzán, Lozano-Álvarez and Eggleston, 2000). Harvesting is conducted by skin-divers with the help of hand-nets ("jamos"). Scuba and hookah are banned by internal agreements (Ponce-Taylor *et al.*, 2006; Sosa-Cordero, Liceaga-Correa and Seijo, 2008).

Landings from Bahía Ascensión have oscillated without a consistent trend in the last two decades, while catch per unit of effort (CPUE) has increased steadily (Figure 9:E). Total catch from the three cooperatives (expressed as tonnes of tails) since 1982 has fluctuated between 105 tonnes (1987) and 31 tonnes (1994), Vigía Chico (Bahía Ascensión) having been always the main contributor (Figure 9:F). On average, the Sian Ka'an cooperatives contribute about 30 percent of the catch in the state (Figure 9:G). Recently, there has been an increase in the fraction of lobsters marketed alive, which fetch a better price. The number of fishers has been in the range of 150–160 in recent years, down from 240–260 in 1985–88 (Figure 9:C). The combined number of boats has also decreased, from 115–130 in 1985–88 to 80–85 (Figure 9:D).

Concessions are partitioned into individual campos, marine plots allocated to members of the cooperatives where they deploy their casitas (Miller, 1989; Seijo, 1993; Sosa-Cordero, Liceaga-Correa and Seijo, 2008). A survey

conducted in 2006 registered 101 campos in Ascensión Bay (Pescadores de Vigía Chico cooperative) (Figure 9:B), 84 in Espiritu Santo Bay, 45 in Cozumel and 39 in the Azcorra cooperative (Sosa-Cordero, Liceaga-Correa and Seijo, 2008). Each season, members form working teams of two to four fishers, which last from months to years. In 2006, there were 29 teams in Vigía Chico cooperative, 12 in Cozumel, and 11 in Azcorra. Not all members have a campo, but all are part of a team as this

FIGURE 9
Lobster fishery of Punta Allen, Mexico



Notes: (A) Boundaries of the Sian Ka'an Biosphere Reserve. (B) Boundaries of campos in Ascensión Bay, 2010. (C) Number of boats in the three cooperatives, 1979–2009. (D) Number of fishers, 1979–2009. (E) Aggregated catch for the three cooperatives, 1970–2009 (bars, whole weight, tonnes) and CPUE. (F) Production (tail weight) by cooperative, 1982–2010. (G) Landings of lobsters in Quintana Roo State (total weight), by zones, showing the contribution of the Sian Ka'an cooperatives, 1982–2010. (H) Skin-divers taking lobsters from underneath a casita.
Source: (A) from R. Borges, O. Guzman and K.L. Cooper.

provides access to the campos. Entry is closed except for sons of fishers. Internal regulations include rules for conflict resolution and penalties for undesirable behaviour (Sosa-Cordero, Liceaga-Correa and Seijo, 2008, their Table 3), including forfeiture of the boat, motor and artificial shelters to protect "campos" ownership. Fishers violating the closed season may face expulsion and loss of property. In at least two cases, expelled members went to trial, but judges upheld the internal rules of the cooperative in court because they had been signed by all members. In general, the fisheries authority has tacitly accepted the internal rules of the cooperatives.

TABLE 10
Case 11: Lobster concessions of Punta Allen (Mexico)

Main attributes of the access regime	
How the rights are conferred and upheld	The state grants territorial concessions to users, including fishers cooperatives.
Exclusivity of participation in the fishery	The cooperative has exclusive use rights over the target resources.
Duration of the rights conferred	20 years, renewable upon compliance with regulations and conditioned on evidence of continued productivity of the target species.
Security or quality of the title conferred by the rights	Highly secure.
Transferability of the rights	Concession rights are non-transferable.
Divisibility of the rights assigned	Rights are fully divisible among cooperative members. While the sea bed is federal property, the shelters used as attracting devices are private property. The campos partition is justified by the need to protect property.
Flexibility in the use of the rights	Very flexible.
Enforceability of rights and compliance with use-rights limitations	Internal and federal regulations are strictly enforced by the cooperative resulting in high compliance.
Harvesting strategies	
Fishing methods and gear	Lobsters are harvested from artificial shelters (casitas built of ferrocement) by skin-divers with the help of hand-nets ("jamos"); use of gaffs has been virtually abandoned in both bays. Fishing boats are made of fibreglass, 6.4–7.8 m long, equipped with 40–60 hp outboard motors.
When fishing is authorized to take place	Closed season from 1 March to 30 June.
Harvest controls	Minimum legal size (13.4 cm tail length, corresponding to 74 mm carapace length). Catch of egg-carrying females is prohibited. A ban on scuba and hookah, originally imposed through an internal agreement, has been incorporated into the management plan.
Monitoring	Mandatory. Catch and effort have been monitored by the cooperatives, since 1975 in the Vigía Chico cooperative. Cooperatives collaborate actively with research projects.

Factors key to the success of these cooperatives have been: (i) the non-intervention of government in internal matters; (ii) judicial backing of the (severe) sanctions occasionally imposed by the cooperatives on their members; (iii) geographic isolation and alternative sources of employment for fishers expelled from a cooperative; and (iv) diversification of income through participation of members in eco-tourism. The fishery was certified by the MSC in 2012.

CASE 12: THE JUAN FERNÁNDEZ ARCHIPELAGO LOBSTER FISHERY (CHILE)

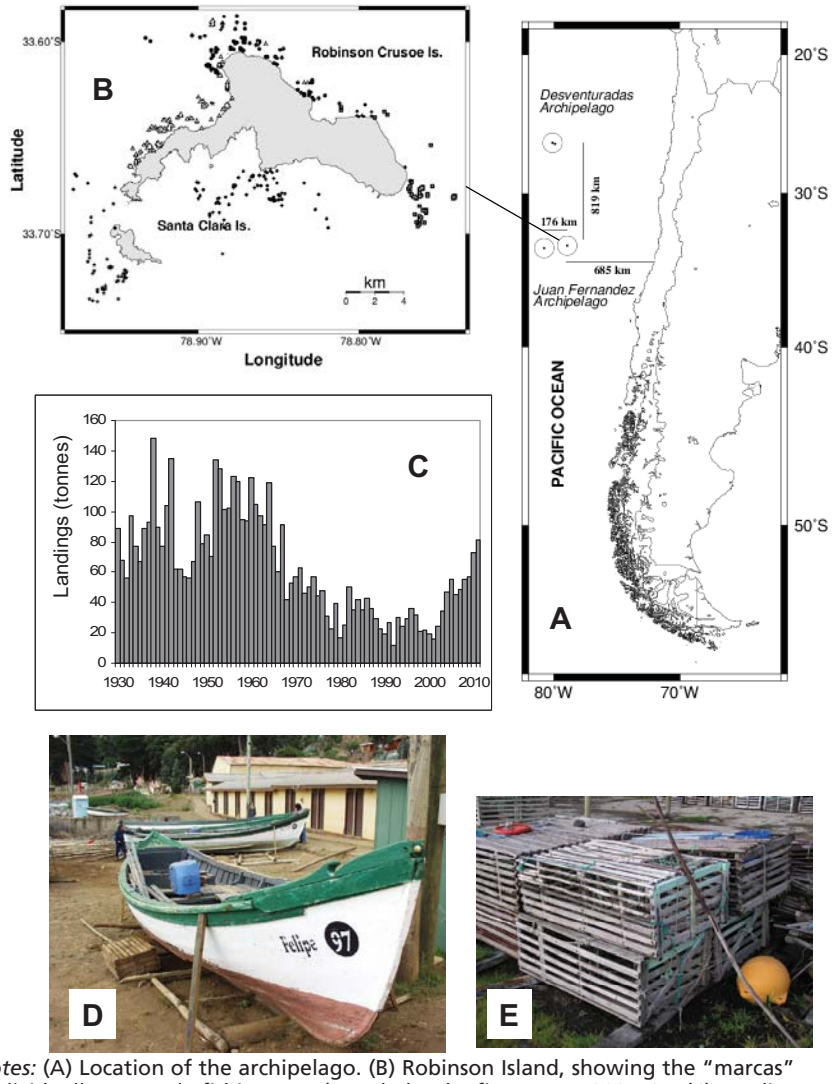
An artisanal rock lobster (*Jasus frontalis*) fishery has operated for decades in the Juan Fernández Archipelago (about 700 km off central Chile) (Figure 10:A). It is the main source of income for a small community located on Robinson Island (San Juan Bautista, population about 630) and a temporary fishing village on Selkirk Island (about 25 fishers and their families) that is occupied only in the fishing season (October–May). Lobster fishing is complemented by small bait fisheries for small pelagics (primary bait), whitefish and moray eels (secondary bait). The modern fishery took shape when a French company established in Robinson in 1914. Annual landings, recorded since 1930, oscillated around 90 tonnes a year until the mid-1960s; afterwards

they gradually dropped to an average of 25 tonnes for the period 1975–2003, and have rebounded since then (Figure 10:C). The most lucrative market is the export of live lobsters to Spain, Italy and France, which reached about US$1 million per year in 2006–09.

The islands were declared a National Park in 1935 and a Reserve of the Biosphere by UNESCO in 1977. Because of their significance for biodiversity, a number of conservation-oriented organizations also play a role in the governance of the fishery. Among them are several NGOs generally active in marine conservation, which have promoted fishery-related research and conservation-oriented action in coordination with government agencies and fishers organizations (e.g. CONAMA *et al*., 2011).

Until 1960, fishers were employed by companies ("apatronados"), which in some cases owned the boats and gear. The apatronados regime vanished in the 1960s, and since 1970 all fishers have worked independently. A cooperative was formed in 1964, but it declined in the 1970s and was formally closed in 1980 under a political climate unfriendly to cooperatives.

FIGURE 10
Juan Fernández Islands lobster fishery, Chile



Notes: (A) Location of the archipelago. (B) Robinson Island, showing the "marcas" (individually "owned" fishing spots) tended to by five teams, 2005–07. (C) Landings, 1930–2011. (D) Fishing boat. (E) Lobster traps.
Sources: (B), (D) and (E) courtesy of B. Ernst; (C) data from SERNAPESCA.

With Chile's return to democracy, fishers organized themselves as a syndicate; three fishers organizations currently exist. Until recently, when a moratorium on the registry was introduced, there were no formal effort controls of any sort, other than gear type (no diving). However, an effective but unwritten sea-tenure system, established by tradition, has put a cap on the size of the fishing force, and regulated access for decades (Ernst *et al*., 2010a). Each fisher or fisher's family member may "own" a certain number of fishing spots, known as marcas (Table 11), where lobster traps are deployed, one per spot (Figure 10:B). Most marcas have been discovered and claimed over decades, although occasionally new ones are identified with the help of echo sounders. A survey near Robinson and Santa Clara Islands recorded 3 762 marcas. Each boat, in a given season, fishes a package of marcas that include those belonging to the skipper, the deckhands, their family members, and/or borrowed marcas. Only a subset of that total (30 on average) is active at any given time. Marcas are located by alignments of land features; all fishers know by heart the location of their marcas, and of neighbouring ones belonging to others. Use and transfer of rights over marcas are regulated by informal, but well-established, internal rules. Marcas are not sold but can be transferred with a boat if the latter is sold; they can be inherited by family members, and are often lent to others under a variety of arrangements. In the event that fishers are unable to harvest in their marcas, others can do so, but the marcas return to the "owners" once they go back to fishing. This complex and highly structured traditional

TABLE 11
Case 12: Juan Fernández Archipelago lobster fishery (Chile)

Main attributes of the access regime	
How the rights are conferred and upheld	Access rights to fishing spots ("marcas") are informal.
Exclusivity of participation in the fishery	Fishers must be registered in the National Registry of Artisanal Fishers. A moratorium on boats and fishers was introduced in 2005.
Duration of the rights conferred	Use rights for fishing spots are informal, duration is unspecified.
Security or quality of the title conferred by the rights	Security of access to fishing spots depends on government not introducing disruptive measures, such as quotas or marine reserves.
Transferability of the rights	Use and transfer of rights over marcas are regulated by informal, but well-established, internal rules. Marcas are not sold but can be transferred with a boat if the latter is sold; they can be inherited by family members, and are often lent to others under a variety of arrangements. In the event that fishers are unable to harvest in their marcas, others can do so, but the marcas return to the "owners" once they go back to fishing. This complex and highly structured traditional tenure system enjoys high compliance.
Divisibility of the rights assigned	Fully divisible.
Flexibility in the use of the rights	High.
Enforceability of rights and compliance with use-rights limitations	The marcas system is respected by fishers.
Harvesting strategies	
Fishing methods and gear	The fleet is composed of 50 boats, 8–11 m long and double-ended, built on Robinson Island and powered by 15–18 hp outboard motors (a few ones have inboard motors). Many boats destroyed or damaged by a tsunami in February 2010 have recently been replaced by fibreglass hulls, some equipped with donated 50 hp outboard motors. Gear consists of rectangular traps made of local wood.
When fishing is authorized to take place	Closed season from 15 May 15 to 30 September.
Harvest controls	Minimum legal size (115 mm from the base of the antennae to the posterior edge of the carapace), no keeping of egg-carrying ("berried") females. The latter was respected by fishers as an informal operational rule long before it was formalized.
Monitoring	The fishing authority (Servicio Nacional de Pesca [SERNAPESCA]) compiles catch statistics. More detailed monitoring (catch, effort, sizes, etc.) has been conducted as part of five short-term (1–2 years) projects in the last four decades. Monitoring of catch and effort was started in 2006 through collaboration between the fishers association and independent scientists, and this continues.

tenure system enjoys high compliance. In addition to lobster marcas, fishers identify locations suitable for secondary bait fishing (known as "pesqueros" or "marcas de pescado"): trapping moray eels and longlining for whitefish, both used as lobster bait. Differing from lobster marcas, access to secondary bait marcas is open and information about their location is not shared among fishers. Primary bait (used to catch secondary bait species) is a pelagic fish ("jurelillo"), not associated with marcas.

Assessments and academic inquiries conducted over the last 40 years have recurrently diagnosed that effort is above the optimum level, and on that basis have prescribed generic "solutions": quotas, marine protected areas, closures. Those measures, if ever implemented, would severely disrupt the traditional tenure system and, consequently, fishers' livelihoods and ultimately the sustainability of the fishery itself (Ernst *et al.*, 2012). In artisanal fisheries such as these, which have afforded stability through traditional tenure systems, the potential risks entailed by the introduction of regulatory measures aimed at maximizing fishery yields may largely exceed the opportunity costs associated with maintaining the fishery at a suboptimal level.

On 27 February 2010, Robinson Crusoe Island was hit by three tsunami waves, following an 8.8-magnitude earthquake that shook central Chile. Effects were devastating, but the fishery started to recover soon afterwards. The resilience of the fishery to the unpredictable natural disaster was a result of several factors: most of the members of the tightly knit local community belong to fisher families, fishers are well organized, and the unwritten rules of the traditional tenure system helped the orderly return to fishing activity (Ernst *et al.*, 2010b).

CASE 13: THE "PARCELA" SYSTEM OF ALGAL HARVESTS (CHILE)

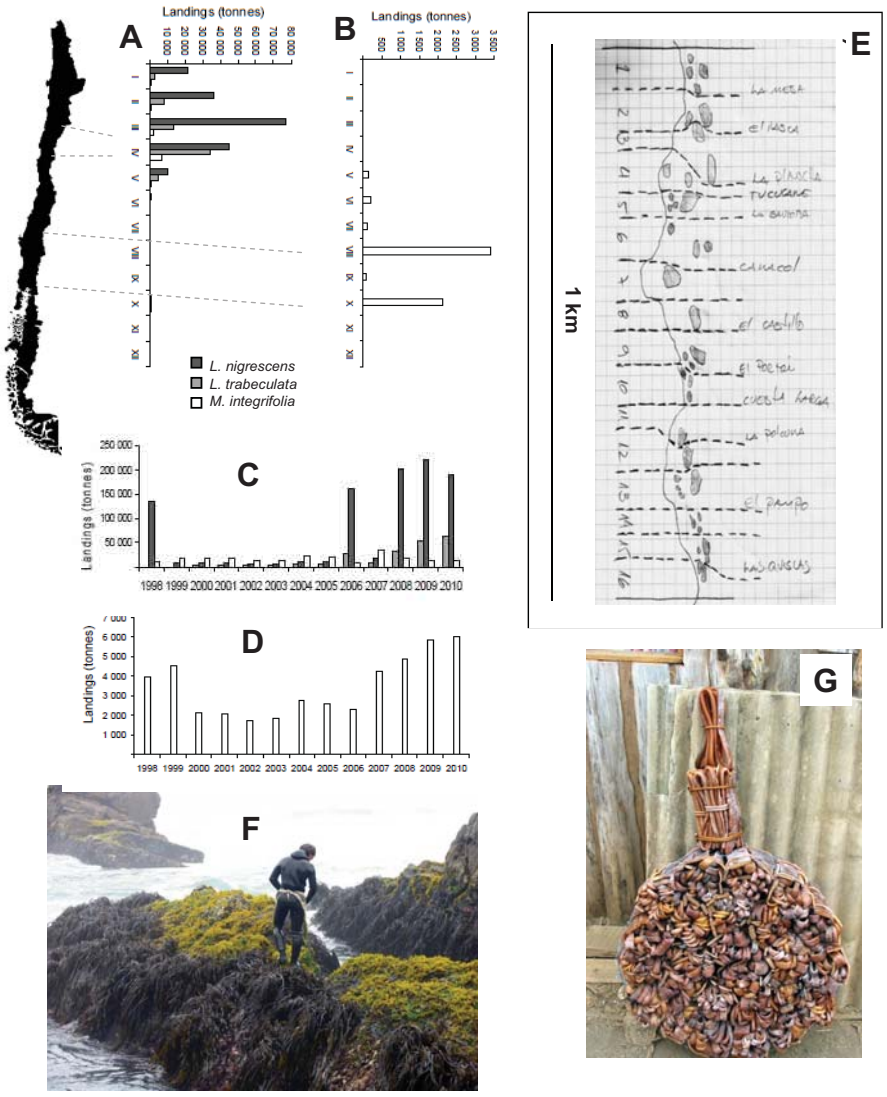
Traditional tenure systems for the harvesting of brown algae from the intertidal and shallow subtidal zones of rocky shores (Figure 11:F) have been in use and adjusted over generations in several sectors of the Chilean coastal zone, notably Regions III, VI and VIII (Figure 11:A–B) (González *et al.*, 2002; Ávila *et al.*, 2005; Gelcich *et al.*, 2006; Araos-Leiva, 2006; Vásquez *et al.*, 2008). These systems consist of the de facto allocation of use privileges over stretches of coastline, known as "parcelas" (plots, Figure 11:E) or "varaderos" (sites where naturally detached algae are stranded), to individuals (and their families), groups of families or communities (Table 12). Although no formal title or harvesting authorization safeguards these traditional tenure systems, they are generally respected by users, community members, and even by agents of the fisheries authority. The only requirements for legal access to algal resources are registration (Registro de Pesca Artesanal), and holding the corresponding licence from the maritime authority. Algal harvests must take place within the administrative region where registration is in effect (applying to all fishery resources), but no other formal spatial specification is in place.

In central and south Chile these systems developed around the extraction of "cochayuyo" (*Durvillaea antarctica*), an emblematic species of Chilean culinary culture (Muñoz-Pedreros and Navarro, 1992; Montecino, 2005), and in north Chile for the harvest of "huiro" (*Lessonia nigrescens*, *L. trabeculata*, and *Macrocystis integrifolia*). Total annual landings of cochayuyo are of the order of 6 000 tonnes (2010), with Regions VIII and X contributing 56 percent and 35 percent of national landings, respectively (Figure 11:B, D). In contrast, huiro harvests (considering all species) have reached almost 250 000 tonnes, with Regions III and IV yielding the bulk of national harvests (35 percent and 32 percent, respectively) (Figure 11:A, C).

In all the cases, collection and processing of algae until it is ready to be sold involve several stages requiring intense physical activity and knowledge regarding the resource, the environment, and harvesting and processing techniques (e.g. when, where, and which algae to collect; currents favouring algal beach-stranding; and best conditions

for natural drying and storage). Algae gathering and processing is a collective activity that involves the participation of family (including women and children) and other community members. Division of labour is common and the benefits derived from parcela or varadero use rights are often shared (beyond family bonds) through a diversity of local arrangements. The seasonality of algae gathering is largely determined by the time of the year when natural drying conditions are optimal (spring and summer in the Southern Hemisphere). The demand for dried alga makes possible its conservation and storage for protracted periods. Hence, commercialization can be delayed until market conditions are most favourable, allowing a better organization of the household economy. Throughout Chile, gathering of algae is often complemented by other economic activities (agriculture, logging and fishing) and temporary jobs in nearby urban areas.

FIGURE 11
The "parcela" system of algal harvests, Chile



Notes: (A) Harvests of huiro (Lessonia and Macrocystis) by region, 2010. (B) Harvests of Harvests of cochayuyo (Durvillea) by region, 2010. (C) Harvests of huiro, 1998–2010, regions aggregated. (D) Harvests of cochayuyo, 1998–2010, regions aggregated. (E) Harvesting cochayuyo, Region VI. (F) Sketch of a subdivision of parcelas in a stretch of intertidal rocky shore (1 km long) harvested by a community (Tocopalma, Region VI). (G) Packing of dried and folded cochayuyo in "muñecos", "maletas" and "rodelas" (the largest).
Sources: Data from SERNAPESCA; (F) C. Sepúlveda); photo credits: C. Sepúlveda.

Cochayuyo harvesting in Region VI

Customary tenure in the harvest of cochayuyo along the coasts of Region VI (Central Chile) has two tiers. First, settlements of coastal gatherers (e.g. Las Quiscas, Los Huachos, and Alto Colorado; Araos-Leiva, 2006) have informal access rights to adjacent stretches of seashore. Tenure is refined by allocation of partitions of those stretches (parcelas) to members of the community. In the traditional system, parcela use rights are customarily allocated to individuals (heads of household) and their families, and are inherited along family lines (Araos-Leiva, 2006; Vázquez *et al.*, 2008). Parcelas are delimited exclusively for cochayuyo extraction; access to other resources within parcelas is open, although non-members of the community or group of gatherers are generally not welcome. Cochayuyo is extracted from the intertidal and shallow subtidal by cutting the plant at the base of the stipe during low tides by skin-diving, and collecting the algae that drift to shore.

In some sectors (e.g. Puertecillo and Topocalma), parcelas are rotationally allocated to individual members of the local fishers organization every 1–2 years (Figure 11:E), at the beginning of the harvesting season, through a lottery supervised by the leader of the organization (Gelcich *et al.*, 2006; Sepúlveda, 2010). According to old fishers the system was introduced in the 1950s or 1960s by the "alcalde de mar" (a respected citizen appointed by the maritime authority to oversee activities in a caleta) from Topocalma to mitigate recurrent conflicts among gatherers (L. Ariz, IFOP, personal communication). Conflicts occurred when algae cut by someone in one parcel drifted away and were collected by others elsewhere.

Parcelas are delimited on the basis of productivity, not size, and are identified by tracing an imaginary line from a distinctive rock on the intertidal to another (Araos-Leiva, 2006; Gelcich *et al.*, 2006). Each parcela covers about 100–150 m of coastline and encloses a number of large rocks (6–8) where the algae grow. Harvesting takes place from November to March (late spring and summer). Once extracted, the algae are left to dry on the side of rocky cliffs (to avoid soil moisture) for 15–30 days depending on weather conditions, and then stored inside precarious constructions on the coast (made of wood and plastic, known as "rucos"), where each family resides in the harvesting season or permanently on occasions. Dried algae are folded back and forth to form a bundle. Bundles are packed together in groups of 25 to form a "rodela" (Figure 11:G), which weighs 7–9 kg, and then sold to intermediaries. In 2005–06, a parcela in Puertecillo produced about 1 200–1 800 kg of dry cochayuyo per season (Gelcich *et al.*, 2006). A parcela holder is allowed to harvest and process cochayuyo accompanied by family or other community members, or temporarily transfer the harvesting rights to others (e.g. leasing a parcela) in exchange for monetary or non-monetary forms of payment (often done by old or disabled members) (Araos-Leiva, 2006; Gelcich *et al.*, 2006). Parcela holders decide how the parcela is to be managed; a common practice is to clean rocks, extracting other kelp species (e.g. *Lessonia* spp.) to promote increased recruitment and production of cochayuyo (Araos-Leiva, 2006; Gelcich *et al.*, 2006; Vásquez *et al.*, 2008).

Cochayuyo harvesting in Region VIII

In Arauco Province (Region VIII, Figure 11:A), de facto partition of the coast for cochayuyo harvesting has taken different forms (Ávila *et al.*, 2005). In some cases (e.g. Caleta Yani), sectors are allocated to individual fishers and their families, much as in Region VI. In other places, with significant indigenous population (e.g. Tirúa Sur), there are community rights based on historical use. The common territory is subdivided in coastal sectors allocated to individual families (e.g. Quilantahue, Casa Piedra and Danquil) or to "cuadrillas" (each integrated by members of 10–15 families) formed as production units (e.g. Quilquilco, Millanao, Ancaten and Pillico). In a few other cases (e.g. Tranicura and Los Chilcos), the whole community harvests cochayuyo in a coordinated manner

during each harvest event, and commercializes the product as a unit. In all cases, algal thalli are cut by skin-divers ("cortadores") from the intertidal and shallow subtidal, occasionally from boats and using hookahs. Harvesting takes place from November to March, coincidentally with the best conditions for drying. Collection of drifted algae from shore, transportation for drying (also with trucks) and packaging are done collectively, involving the collaboration of all the participants in the harvesting event (family, cuadrilla or community members, depending on the case). Cochayuyo is sold to intermediaries in rodelas weighting 50 kg each, and classified into "cochayuyo negro" (black cochayuyo) of higher quality destined to export, and "cochayuyo rubio" (blond cochayuyo) for local consumption. In 2001–02, each community produced about 15 tonnes of dried cochayuyo per season, on average. In some communities, each harvesting sector is left to rest for about 15 days between harvests.

Huiro harvesting in northern Chile

In the case of huiro harvests, de facto use rights over varaderos have been described for northern Chile (Regions I–IV, González *et al*., 2002), which contributes 92 percent of the national landings and involves about 3 000 registered coastal gatherers (SUBPESCA, 2010a). Informal tenure arrangements are most significant in Region III, where landings are highest (35 percent of national landings, about 1 000–1 200 registered gatherers), while open access to algal resources predominates in Regions I, II and IV. In the latter, access is mainly restricted by landowners who control the right-of-pass to varaderos located adjacent to their land. In Region III, communities respect heritable use rights to varaderos held by fishers and their families. The origin of this system can be traced to the prior occupation of many algae gatherers, predominantly displaced artisanal miners or "pirquineros". Pirquineros are independent workers that collect mineral (gold, copper or coal) from rivers and hills, an activity characterized by a strong territoriality over good sectors, individually discovered and appropriated de facto. Use rights for varaderos may be transiently transferred, or leased in exchange for payment or a fraction of the harvest.

Huiro has traditionally been sold dried to intermediaries that resell it to processing plants. In 2000–01, an algae gatherer produced 2–4 tonnes of dried alga per month, on average, reaching up to 9 tonnes in summer months. In the last decade, the demand for fresh huiro to feed cultured abalone (*Haliotis* spp.) has increased rapidly (Figure 11:C; González *et al*., 2002; SUBPESCA, 2010a). This, together with overharvesting of other coastal benthic resources, has led to the sudden advent of newcomers to the activity (e.g. hookah divers who access subtidal algae) and a boom in registration in categories not previously involved in seaweed extraction (hookah diver, finfish fisher, boat owner). Conflicts among user groups has escalated as effort has increased, particularly for *Lessonia nigrescens*, the most accessible species (SUBPESCA, 2010a). Removal from natural grounds has been shown to affect the rate of natural stranding, affecting traditional users, and the ecological services of algal forests are being disrupted with unpredictable consequences (González *et al*., 2002; SUBPESCA, 2010a). The total number of fishers registered for huiro species is in the order of 13 000–19 000, with some regions showing insignificant harvests and exorbitant numbers of registered fishers (e.g. Region VIII, with about 5 000 registered fishers contributing 0.03 percent of national landings; Regions I–IV, with about 3 000 registered fishers contributing about 90 percent of national landings). These figures reflect the problems encountered with registries and cadastres, highlighted in other sections of this publication (see Part II – Discussion). Registration in multiple categories and species, even by inactive fishers, is a generalized practice throughout Chile, creating inflated registries that pose serious difficulties at the moment of introducing access privileges. Recently, the fishery authority has temporarily suspended registration in the registry for all huiro

species (in effect, in Regions V–IX and XII) and prohibited active removal ("barreteo", detaching the holdfast from the substrate) (SUBPESCA, 2010).

Conflict with the introduction of AMERBs. The introduction of TURFS (AMERBs, Case 7) raises concerns about their potential negative effects on pre-existing traditional management practices. Although AMERBs legally grant harvest privileges for benthic resources within designated territories, organizations holding subtidal AMERBs often develop a sense of "extended privileges" over the adjacent intertidal zone, where algae gatherers operate. In some cases, user groups have reached agreements for coexistence. For example, in some sectors of Regions III and IV, algae gatherers are allowed to harvest in the intertidal zone in the vicinity of an AMERB if they provide support for vigilance to the fishers organization that holds the AMERB (González *et al*., 2002).

In some cases, AMERBs have given formal recognition of use rights for historical users to the areas and resources informally managed under the traditional parcelas system (e.g. in Los Huachos and Pichilemu-Alto Colorado, Region VI) (Vásquez *et al.*, 2008). In others, as in some localities in Region VI (Chorrillos, La Vega de

TABLE 12
Case 13: "Parcela" system of algal harvests (Chile)

Main attributes of the access regime	
How the rights are conferred and upheld	Traditional tenure systems for the harvesting of brown alga consist of allocation of use-rights within coastal sectors –"parcelas" or "varaderos"- to individuals (and their families), groups of families or communities.
Exclusivity of participation in the fishery	Participation in alga extraction is limited to family members, groups of families or communities holding use-rights. Access to other resources within parcelas or varaderos is open to others (although they may be subject to formal access regulations).
Duration of the rights conferred	In most cases, use-rights are inherited along family lines. In some cases (i.e. Puertecillo and Topocalma) parcelas are rotationally allocated every 1-2 years through a lottery supervised by the leader of the organization.
Security or quality of the title conferred by the rights	The system has shown to be vulnerable to disruptions by interference with formal management regimes. The recent introduction of AMERBs caused conflicts among user groups and affected traditional management practices in some cases.
Transferability of the rights	Temporary transfer of use rights in exchange for monetary or non-monetary (favours, a portion of the harvest, etc.) retributions has been observed in northern (for huiro) and central (for cochayuyo) Chile
Divisibility of the rights assigned	Algae gathering and drying involves families and community members. Division of labour is common and benefits are shared through a diversity of arrangements, from compensations for help with cutting and/or collecting, to leasing the parcelas.
Flexibility in the use of the rights	Parcela holders decide how to manage them (some may leave it unharvested, the case of some widows in caleta Puertecillo), who will participate in the harvest and processing, and how benefits will be shared.
Enforceability of rights and compliance with use-rights limitations	Customary use-rights are generally honoured by the community. Alga gatherers defend their harvesting zones from intruders. Local enforcement and resource sustainability are being challenged by increased conflicts due to the sudden entrance of new users driven by overfishing of other coastal resources, displacement from other economic activities (e.g. mining), and increased demand for algae (by the alginates industry and abalone aquaculture). AMERBs have disrupted customary practices in some cases, causing the loss of parcela use-rights. In others, both regimes have coexisted relatively well. Agreements among user groups have allowed alga gatherers to operate in the vicinity of AMERBs in exchange for support with vigilance.
Harvesting strategies	
Fishing methods and gear	Cochayuyo are cut during low tides using a blade or knife; naturally stranded plants have poor quality. Traditionally huiro species have been collected from natural strandings using a trident attached to a rope to grab floating algae. Increased demand for fresh huiro has led to harvesting of subtidal populations by diving using metallic bars ("barretas") to detach the holdfasts.
When fishing is authorized to take place	Algae are gathered in spring and summer, when natural drying conditions are optimum.
Harvest controls	The removal of whole huiro plants is banned due to its damaging ecological impact; authorities confiscate the tools used to extract them. Cutting of cochayuyo at the base of the stipe (without removing the holdfast) allows regeneration. Rocks are regularly cleaned up, extracting other kelp to increase recruitment and production. In some indigenous communities of southern Chile, sectors are left to rest for 15 days approximately between harvests.
Monitoring	Monitoring is mostly restricted to landings (by Servicio Nacional de Pesca [SERNAPESCA]). Huiro is surveyed only in Regions III and IV.

Pupuya, Matanzas, and La Boca de Rapel), the introduction of AMERBs generated severe conflicts among fishers, disrupting the parcela system and even resulting in loss of parcela use rights (L. Ariz, IFOP, personal communication). In Puertecillo (Region VI), it induced changes in local access and use arrangements, affecting the way in which local knowledge is used to plan for harvests (Gelcich *et al*., 2006), as the AMERB system requires a government-approved TAC based on a survey.

TERRITORIAL USE PRIVILEGES: FISHING SPOTS – RECAP

In this particular form of TURF, members of the fishing community have individual access privileges to fishing spots under some form of customary marine tenure. The common pool resource can be a formal territorial concession to a fishers organization or fishing community (Case 11), or the entire fishing grounds (Case 12). These systems are typically associated with interception gear, such as traps (Case 12), attraction devices (e.g. casitas, Case 11), gillnets (in the case of fish, e.g. Cordell, 1989) or shrimp nets (Moura, 2009). Individual privileges are usually tradable under a variety of arrangements (monetary or else) and can be inherited. The parcela system of algal harvesting from Chile (Case 13) is based on resources with a high turnover rate and privileges may be temporary and assigned through lottery. Informal customary marine tenure systems are the result of a protracted process of adaptive adjustment. Formalization of customary systems poses significant risks because, in the absence of effective feedback, formality can be a straightjacket for systems whose resilience is conditioned on their adaptiveness (e.g. Hviding, 1998).

6. Territorial communal rights (traditional and indigenous users)

CASE 14: THE SERI INDIAN BENTHIC FISHERY (MEXICO)

The Seri Indians have lived in what is now northwest Mexico (Sonora State) since pre-Hispanic times (Bourillón-Moreno, 2002; Basurto, 2005). The present Seri territory, although still large, is just a fraction of the land occupied by them in the seventeenth and eighteenth centuries (Figure 12:A). During the 1970s, three presidential decrees granted the Seri formal rights to a portion of their historic coastal territory as an "ejido" (DOF, 1970, 1978), a form of communal land tenure, and permanent and exclusive harvesting rights of marine resources inside "the waters surrounding Tiburon Island" (DOF, 1975) (Table 13, Figure 12:B). These permanent and exclusive rights are limited to "the Seri tribe and the Seri fishing cooperative". Unlike fishing concessions (e.g. in central Baja California or Quintana Roo State, introduced earlier), rights are not species-specific but include all the marine species commercially exploitable inside their territory, and are ceded in perpetuity. The main motivation for this restitution is not economic but social, to ensure the survival of the Seri people and its culture.

In addition, Tiburon Island has been a reserve zone and refuge of wild fauna since 1963, aimed at protecting a type of deer endemic to the island. Since 1978, the island has also integrated the area for the protection of flora and fauna (Área de Protección de Flora y Fauna – Islas del Golfo de California), which includes 380 000 ha of islands.

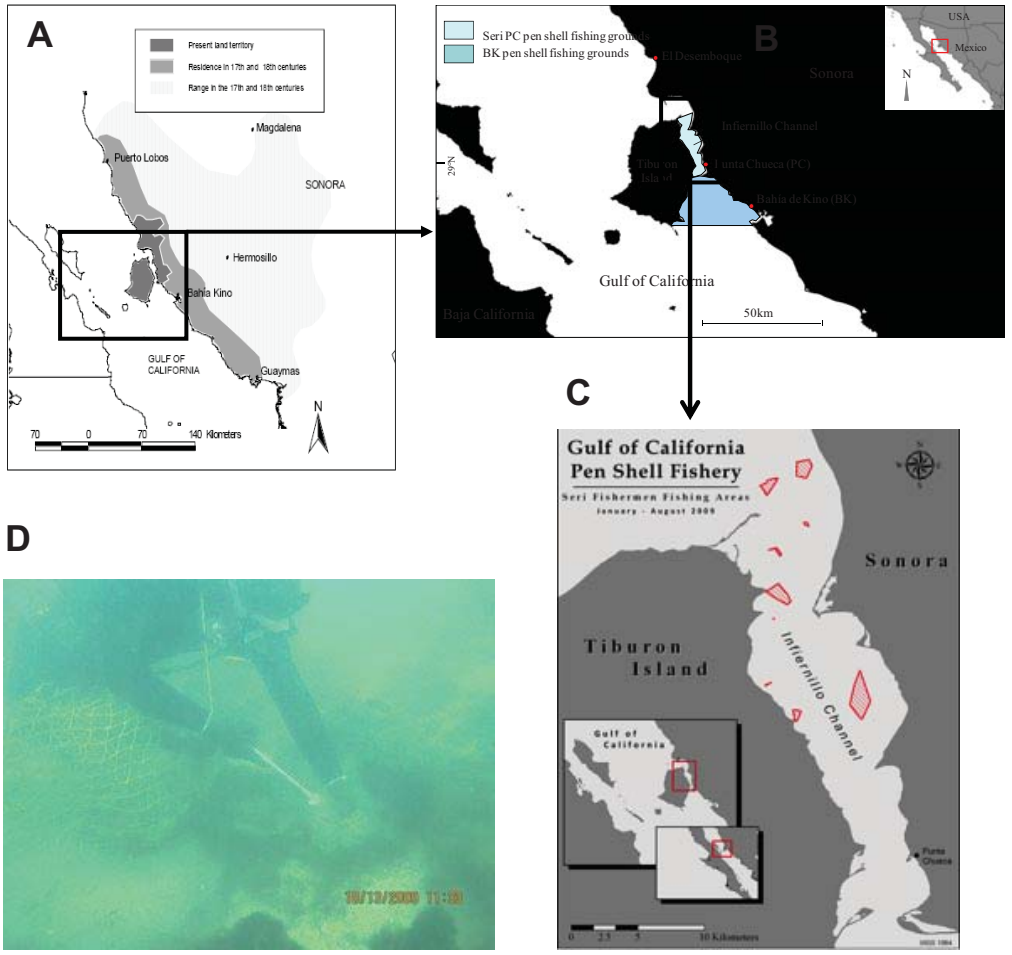
Main targets of Seri fishers are blue crabs (*Callinectes bellicosus*) and pen shells (*Atrina* spp. and *Pinna rugosa*), respectively harvested by means of traps and hookah diving (Figure 12:D) (Basurto, 2006; Torre-Cosío, Bourillón-Moreno and Hudson-Weaver, 2004). There is also some intertidal gathering by adult men and women. The pen shell fishery operates in the Infiernillo Channel (5–15 m deep), which separates the mainland from Tiburon Island (Figure 12:B–C). As of 2009, between 30 and 60 boats operated inside the channel, of which 10–20 targeted pen shells (Basurto *et al*., 2012). While official statistics do not exist, unofficial calculations indicate that Seri landings are in the range of 75–100 tonnes (Basurto, unpublished). Historical accounts suggest that since the first beds of pen shells were discovered in the channel (in 1978) the catch has remained relatively stable (Basurto, 2006). However, some users (Seri and outsiders) perceive that beds are being depleted (Basurto, personal communication).

The most important and powerful political structure in the community is the traditional government, headed by the governor and appointed cabinet members (a secretary and a treasurer). Its formal structure mimics that set up by the federal government to govern ejidos (Basurto, 2005). The Seri have an informal rule system to grant temporary access to outsiders to harvest pen shells inside their territory (Bourillón-Moreno, 2002; Basurto, 2005); blue crabs are harvested exclusively by Seri fishers. The pen shell rules were developed in response to increasing pressure from outsiders to access their fishing grounds, as resources in neighbouring communities were serially depleted beginning in the mid-1980s (Basurto *et al*., 2012). Outsiders must pay the Seri governor an access fee in the form of cash or pen shells and they must include a member of the Seri community as part of the fishing crew (Basurto, 2005).

The access fee brings economic income only to the Seri governor and the governor's family, given that it is not customary to distribute those funds beyond family lines. The second rule compensates other members of the Seri community, given that monetary returns from the catch are shared equally among crew members. Their presence on outsider boats also helps to monitor compliance with other rules-in-use (e.g. not harvesting in culturally significant areas) at a low cost to the community. Participation in this fishery by non-Seri fishers is high: 87 percent of the fishing teams included non-Seri crew members in 2000–01 (Basurto, 2006); the same pattern seemed to hold in 2009 (Basurto, unpublished).

The Seri have managed to set a relatively effective rule system to grant temporary access to outsiders to prevent excessive fishing pressure inside their concession. Nominally, the Seri should comply with regulations that apply to all Mexican fishers, such as the requirement that the cooperative holds fishing permits to sell the harvest legally. However, the Seri do not make use of their own permits and commercialize the harvest through permits owned by others (usually intermediaries from outside the community) (Basurto *et al.*, 2012). In practice, there is no participation of the federal government in any aspect related to Seri fisheries.

FIGURE 12
Seri Indian benthic fishery, Mexico



Notes: (A) Past and present land territory of the Seri tribe, present Sonora State, Mexico. (B) Fishing grounds of the Seri community of Punta Chueca and of the neighbouring community of Bahía de Kino. (C) Pen shell fishing areas in the Infiernillo Channel. (D) Diver removing pen shells with an ad hoc tool.
Sources: (A) after Bourillón-Moreno (2002); (C) courtesy of Nick Mellos; (D) X. Basurto.

The Seri enforce their own rule system mainly through the Guardia Tradicional, an armed, informal group of community members whose main task is to police the Seri marine and terrestrial territory to prevent poaching and land invasions, and to ensure collection of monetary benefits (i.e. that outsider fishers pay the access fee to the governor) (Basurto, 2005).

Several factors are thought to contribute to the maintenance of Seri fisheries and rule system, including (Basurto, 2008; Basurto *et al*., 2012): (i) the narrowness of the Infiernillo Channel and the location of the Seri village next to it, which makes it easy for the Seri to observe the access and exit of boats; (ii) a long history of external threats constitutes a powerful incentive for internal cohesion in the defence of territory and resources, often in a violent or confrontational mode, which deters outsiders from unauthorized fishing in their marine territory; and (iii) the legal restitution of rights that legitimizes the Seri fishers as owners of their resources.

TABLE 13
Case 14: Seri Indian benthic fishery (Mexico)

Main attributes of access regime	
How the rights are conferred and upheld	In the 1970s, three presidential decrees granted the Seri formal rights ("ejidos", a form of land tenure for agricultural communal lands) to a portion of their historic territories on the mainland, and permanent exclusive rights to harvest all marine resources in waters around Tiburon Island.
Exclusivity of participation in the fishery	The concession is limited to the Seri tribe and the Seri fishing cooperative. However, the Seri grant temporary access to outsiders to fish inside their concession.
Duration of the rights conferred	Rights are conferred in perpetuity.
Security or quality of the title conferred by the rights	Highly secure. In practice, the federal government is not involved in any aspect related to the fishery inside Seri territory. Management authority (beyond fishery issues) has been devolved to the Seri tribe.
Transferability of the rights	Rights are non-transferable. Internally, however, the Seri grant temporary access to outsiders to fish inside their concession. Participation by non-Seri fishers in this fishery is high.
Divisibility of the rights assigned	The Seri have developed an informal rule system to grant temporary access to outsiders to harvest pen shells inside their concession. This has been in response to increasing pressure from outside fishers to access Seri fishing grounds, as resources in neighbouring communities have been overexploited (beginning in the mid-1980s). Important rules include: (i) outsiders must pay the Seri governor an access fee in the form of cash or pen shells; (ii) all non-Seri pen shell fishers must hire a member of the Seri community as part of the fishing crew.
Flexibility in the use of the rights	High; the Seri govern themselves without external intervention.
Enforceability of rights and compliance with use-rights limitations	The informal rule system developed by the Seri has been effective to prevent excessive increases in fishing pressure inside their territory. The Seri enforce their own rules through the Guardia Tradicional, an armed, informal group of community members whose main task is to police the Seri marine and terrestrial territory to prevent poaching and land invasions, and to ensure collection of monetary benefits.
Harvesting strategies	
Fishing methods and gear	Commercial hookah diving for pen shells and trapping blue crab are the most important fishery. Fishing teams are formed of 2–4 crew members per boat. In the case of the diving fishery, the crew consists of one or two divers, a helm, and a shucker.
When fishing is authorized to take place	No fishing season regulations. In the past few years, fishing has occurred year-round; production is greatest between October and June.
Harvest controls	No legal size regulations.
Monitoring	Monitoring (blue crab and pen shell) started in 2009 as collaboration between fishers and independent scientists.

CASE 15: BRAZILIAN MARINE EXTRACTIVE RESERVES (RESEXS)

Marine Reserva Extrativistas (RESEXs, Table 14) are a component of Brazil's national system of protected areas, promulgated as such in 2000 (Sistema Nacional de Unidades de Conservação da Natureza [SNUC]). Since 2007, the SNUC has been executively implemented by a special agency, the Instituto Chico Mendes de Conservação da Biodiversidade Instituto Chico Mendes de Conservação da Biodiversidade (ICMBIO). Marine RESEXs originated as an extension of a type of protected area conceived

to reconcile environmental preservation with traditional extractive economies in Amazonia, emphasizing the benefits of common property (Lobão, 2000, 2006). The first two marine RESEXs (including Pirajubaé, discussed below) were created in 1992. Before that time, access to coastal resources in Brazil was regulated only through informal arrangements (Cordell, 2006). A marine RESEX is generically defined as an area used by traditional populations whose livelihood is based on extractivism (artisanal harvest of natural resources), possibly complemented by other activities, having as main goals the protection of the livelihoods and culture of these populations and the sustainable use of the natural resources that they depend upon (Vasconcellos, Diegues and Kalikoski, 2011). Rights are communal and not transferable by individual fishers (Table 15). As rights are formally granted to local users, RESEXs activate an assortment of constituencies and prompt participatory management arrangements between state agencies and users, which imply new duties for the latter in the form of monitoring, decision-making and crafting of rules.

Main steps in the implementation of marine RESEXs (not strictly sequential in time) are:

- An association, created to manage the prospective reserve, starts negotiations with the ICMBIO.
- A concession of use rights (Contrato de Concessão de Direito Real de Uso [CCDRU]) is determined.
- The association approves a management plan by consensus of the assembly of its members. The plan specifies regulations about who can fish, as well as where, how and what can be fished.
- A participatory council (Conselho Deliberativo [CD]) is created, with representation of various agencies and stakeholders. The CD establishes the rules that govern resource use in the RESEX.

The rights conferred are highly secure. Glaser and Oliveira da Silva (2004, p. 231) pointed to fundamental conflicts in the granting of exclusive access rights to local users,

TABLE 14
Brazilian marine RESEXs

State	RESEX	Municipality	Area (ha)	Creation date	Families
Para	Soure	Soure	27 463	22 Nov 01	400
Para	Araí Peroba	Augusto Correa	11 479	20 May 05	900
Para	Caeté-Taperaçu	Bragança	42 068	20 May 05	3 000
Para	Gurupí-Piriá	Vizeu	74 081	20 May 05	4 500
Para	Tracuateua	Tracuateua	127 153	20 May 05	1 400
Para	Chocoaré-Mato Grosso	Santarém Novo	2 785	13 Dec 02	
Para	Maracanã	Maracanã	30 018	13 Dec 02	1 500
Para	São João da Ponta	Curuçá & São João da Ponta	3 197	13 Dec 02	
Para	Mãe Grande de Curuçá	Curuçá	37 062	13 Dec 02	2 000
Maranhão	Cururupu	Cururupu & Serrano do Maranhão	185 046	2 Jun 04	2 600
Piaui/Maranhão	Delta do Paranaíba	Ilha Grande de Sta Isabel/PI, Araióses/MA & Agua Doce/MA	27 021	16 Nov 00	2 500
Ceara	Prainha do Canto Verde	Beberibe	29 805	5 Jun 09	
Ceara	Batoque	Aquiraz	601	5 Jun 03	230
Pernambuco	Acaú-Goiana	Caapoá, Pitimbu & Goiana	6 677	26 Sep 07	
Alagoas	Lagoa do Jequiá	Jequiá da Praia	10 203	27 Sep 01	3 046
Bahia	Baia do Iguape	Maragojipe & Cachoeira	8 117	11 Aug 00	1 150
Bahia	Ponta do Corumbau	Porto Seguro & Prado	89 597	21 Sep 00	500
Bahia	Cassurubá	Porto Seguro	100 767	2009	
Bahia	Canavieiras	Una, Cavieiras & Belmonte	930 490	5 Jun 06	1 300
Rio do Janeiro [1]	Arraial do Cabo	Arraila do Cabo	56 769	3 Jan 97	3 000
Sao Paulo	Mandira	Cananéia	1 175	13 Dec 02	22
Santa Catarina [1]	Pirajubaé	Florianopolis	1 444	20 May 92	200

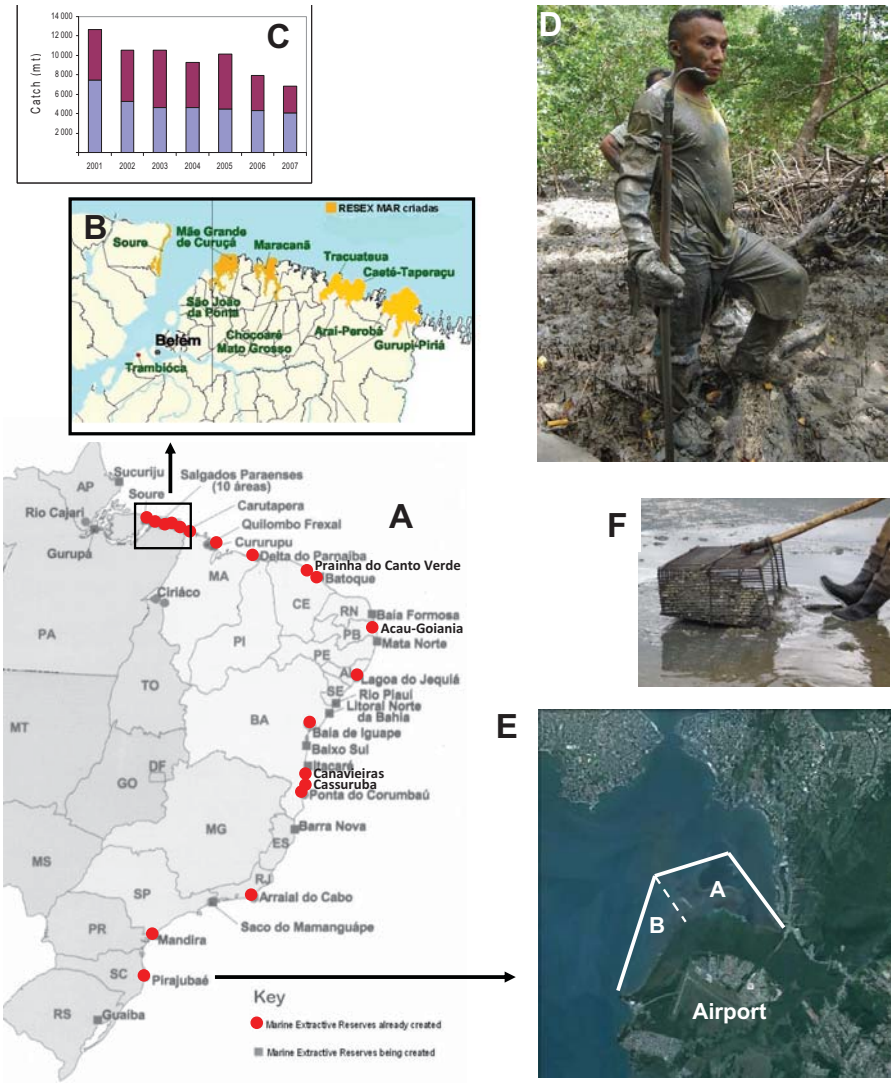
Source: Information from the ICMBIO.

as illustrated by the mangrove crab fisheries: national legislation defines mangrove areas as federal property, and so the exclusion of outsiders would be essentially illegal. These situations, however, can be circumvented, as illustrated by the concession of use rights (CCDRU) extended to the Mandira RESEX (Andrade, 2011). In this case, the federal territorial authority (Serviço de Patrimônio da União) devolved management authority to the environmental authority (Ministério do Meio Ambiente), so that the ICMBIO could make effective the concession of use of public marine territory.

Currently, there are 22 marine RESEXs approved (Table 14, Figure 13:A), and others are under consideration. Two cases, extreme on various accounts, are discussed below. Pirajubaé, located within an urban area, is the southernmost RESEX implemented so far and one of the smallest. The nine RESEXs from Pará, located in rural areas at the northern end of the country, integrate a huge region encompassing the world's largest continuous area of mangrove forests and swamps.

FIGURE 13

Brazilian marine extractive reserves (RESEXs)



Notes: (A) Location of created and projected marine RESEXs along the coasts of Brazil. (B) Marine RESEXs of Pará State. (C) Catch of mangrove crab in Brazil and Pará State (top of the bars), 2001–07. (D) "Catador de caranguejo" (mangrove crab gatherer), Carateateua (Bragança, Pará State). (E) Pirajubaé RESEX showing the two areas rotated (A and B, notice location of RESEX within urban area). (F) "gancho" (pull dredge) used to harvest berbigão clams.

Sources: (A) updated from the ICMBIO; (B) courtesy of E.T. Paes; (C) data from IBAMA; (D) M. Pinheiro, SEBRAE/PA; (F) M. Tavares da Silva.

The Pirajubaé marine RESEX and the berbigão clam fishery

Pirajubaé (Santa Catarina State, Figure 13:E), the first marine RESEX, was created in 1992 (Karam, 2009; P. Pezzuto, personal communication, 2011). The Pirajubaé RESEX is embedded in an urban area (the municipality of Florianópolis, capital of the state) and has an extension of 1 444 ha. The main target resource of artisanal fishers is berbigão (*Anomalocardia brasiliana*), a small clam commercially fished with a push-dredge ("gancho", Figure 13:F). The recorded harvest from Santa Catarina State was about 50 tonnes in 2001–07 (www.ibama.gov.br/documentos-recursos-pesqueiros/estatistica-pesqueira), but this is a gross underestimate; Souza (2007) estimated that the catch was of the order of 950 tonnes in 2005. This is considered a "recruitment fishery", i.e. virtually all the catch is composed of individuals that reached commercial size in the current year (Souza, 2007).

The RESEX was created at the request of a group of 81 fishers, not formally organized. An association (Associação da RESEX Marinha do Pirajubaé [AREMAPI]) was created in 1995 by fishers that depended exclusively on the resources of the RESEX (14–30 families) and others that used those for self-consumption ("beneficiaries", 180–200 families). It functioned well in the beginning, according to rules agreed upon by organized fishers. In 1996, authorized by Brazil's environmental authority, the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA), sand mining for public construction works destroyed part of the clam beds. This brought a conflict between fishers and IBAMA, and discredit of the latter. Starting in 1997, owing to low abundance, IBAMA closed the fishery, although in the absence of enforcement illegal fishing continued unabated and without control. In the end, fishers were marginalized or displaced, and their organization weakened. Problems were compounded in 2001–02 by the allocation of 104 huts ("ranchos") built along the shoreline, a form of mitigation to compensate for environmental damage. Assignment of ranchos was decided without participation of AREMAPI, and some recipients were considered illegitimate.

Following research conducted by scientists from a local university, the Universidade do Vale do Itajaí (UNIVALI), the fishery was formally restarted in 2003. Contacts between fishers (no longer organized) and IBAMA led to a regulatory framework, upgraded some time later with participation of some fishers, IBAMA and scientists from UNIVALI. By 2008, the recently created ICMBIO had established a more consistent presence, while in the meantime scientists from UNIVALI conducted substantial work on the identification of the "traditional population", education and participatory activities. A new organization (Associação Caminhos do Berbigão [ACB]) was created in 2010 making it possible for the federal government to grant a CCDRU. The ACB is required to promote the organization, registry and representation of fishers. The CD of the RESEX has 30 members, including representatives of: (i) fishers who depend exclusively on resources from the RESEX (12); (ii) "beneficiaries" (6); and (iii) the fishing authority and NGOs (12). Current regulations (Instrução Normativa) recognize different categories of users; 25 commercial fishers are the only ones authorized to use the gancho (Table 15). The issue of who obtains fishing permits has been contentious as it is difficult to establish who the "traditional users" are in a RESEX located within an urban area. Access among members of the RESEX is regulated by means of effort controls.

The nine marine RESEXs of Pará and the caranguejo-uçá fishery

The nine marine RESEXs cover a combined area of more than 255 000 ha. According to ICMBIO, about 15 000 families depend on the harvest of natural resources, among which a mangrove crab (caranguejo uçá, *Ucides cordatus*) is one of the most important (Glaser, 2003; Glaser and Oliveira, 2004; Silva, 2008; Silva, Correa de Melo and Santos-Paiva, 2008). Countrywide, recorded annual landings of caranguejo have dropped

by about 39 percent in recent years, from 11 135 tonnes in 2000 to 6 818 tonnes in 2007 (Figure 13:C; www.ibama.gov.br/documentos-recursos-pesqueiros/estatistica-pesqueira). At least in the sector between Ceará and Espirito Santo States, this drop coincided with recurrent incidence of caranguejo mass mortality occasioned by a fungal disease (Boeger *et al*., 2007). Landings recorded by IBAMA also dropped in the Pará fishery, from 5 214 tonnes in 2001 to 2 748 tonnes in 2007. Caranguejos hide in deep burrows, down to more than 1 m in the muddy substrate of mangrove swamps. Crabs are removed from their gallery at low tide by introducing the arm ("braceamento") and/or with the help of a hook ("gancho") (Figure 13:D, Table 15) (Silva, Correa de Melo and Santos-Paiva, 2008). Clogging of the galleries ("tapamento") and snares ("laço"), although nominally banned by IBAMA, are also used. Recorded average daily CPUE (in terms of crabs per day per fisher) is commensurate between different studies: 150 in Bragança in 2003–04 (Araújo, 2006), and 167 in Quatipurú in 2006–07 (Silva, Correa de Melo and Santos-Paiva, 2008). Regulations include a minimum legal size (6 cm carapace width), no take of females, and closures during the "andadas", when crabs come out of the galleries for mating and egg hatching (e.g. DOU, 2012). A size-sex-season strategy may be sufficient to ensure biological sustainability (Glaser and Diele, 2004; Diele *et al*., 2010).

Glaser and Diele (2004) studied one sector of the region in the period 1997–2001, before the nine RESEXs were created, concluding that at the time this was a de facto open-access fishery. The fishery confronted serious issues of social and economic sustainability, in part because a combination of low entry cost and poverty in

TABLE 15
Case 15: Brazilian marine extractive reserves (RESEXs)

Main attributes of the access regime	
How the rights are conferred and upheld	A users association, created to manage the prospective reserve, starts negotiations with ICMBIO, the federal agency charged with implementing "conservation units" (of which RESEXs are one specific type). A management plan is elaborated and eventually approved by the authority, and a concession of use rights (Contrato de Concessão de Direito Real de Uso [CDRU]) is extended.
Exclusivity of participation in the fishery	The group of users is defined in the management plan. Rules are established by a participatory council (Conselho Deliberativo [CD]).
Duration of the rights conferred	Long term (30 years), renewable. Rights can be revoked in cases of non-compliance with the management plan; conditions established in the CCDRU or federal legislation.
Security or quality of the title conferred by the rights	Highly secure.
Transferability of the rights	Non-transferable.
Divisibility of the rights assigned	Access and benefits divisible among members of the community.
Flexibility in the use of the rights	Generally high.
Enforceability of rights and compliance with use-rights limitations	Difficult and often contentious. ICMBIO and IBAMA have enforcement authority. The regime allows for "fiscais colaboradores", who may be fishers or members of other user groups. Fiscais prepare "autos de constatação", which must be backed by three witnesses and may lead to the indictment of violators.
Harvesting strategies: Pirajubaé berbigão fishery	
Fishing methods and gear	Only "gancho", a push net, is authorized for commercial fishing. Other users have to gather clams manually.
When fishing is authorized to take place	Rotation of ground divided in two sectors; 1 November – 31 July: bed A, 1 August – 31 October: bed B.
Harvest controls	Minimum legal size (20 mm shell length), 10 percent tolerance. Only 25 commercial fishers. Time window: 5 am –2 pm.
Harvesting strategies: Pará caranguejo-uçá crab fishery	
Fishing methods and gear	"Braceamento" (introducing the arm in the crab gallery) and/or hook ("gancho")
When fishing is authorized to take place	No fishing in reproductive period or "andada" (Ley No. 7.679/1988), as defined by IBAM. Strong pressure and proposals to better adequate closures to crab reproductive biology.
Harvest controls	Only males, minimum legal size (6 cm carapace width).

rural areas continued to attract new entrants in spite of declining CPUE. In recent years, partly prompted by the implementation of the RESEXs, there has been regular interaction between fishers organizations, government agencies and NGOs, motivated by concerns about the use of the mangrove ecosystem in general and of the caranguejo resource in particular (Glaser and Oliveira, 2004; Diele *et al*., 2010). Consensus about improvements needed in the caranguejo fishery was expressed in the Carta de Bragança (FPCU, 2009), which makes extensive recommendations on education, research, regulations, enforcement, processing, social issues, marketing and institutional arrangements.

CASE 16: COLOMBIA'S AFRO-AMERICAN COMMUNITIES (PIANGUA FISHERY)

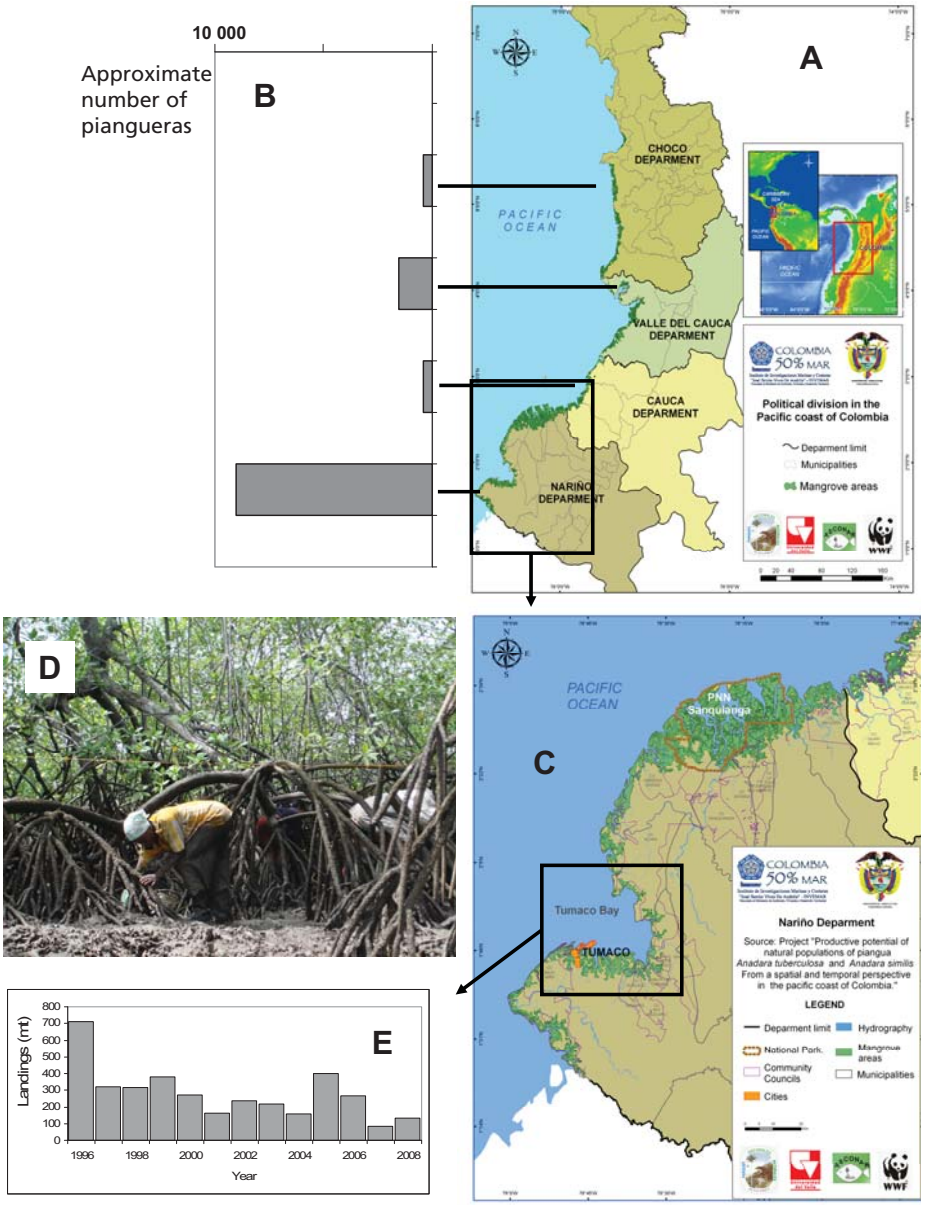
The Colombian Constitution of 1991 and "Law 70" of 1993 (known as "Ley de Negritudes") acknowledged the right to collective entitlement of historic territories occupied by Afro-Colombian communities that make up about 90 percent of the population along the Pacific coast of the country (Figure 14:A, Table 16). These communities are formed by descendants of slaves arrived in the seventeenth century for mining exploitation (DNP, 2007). The area under the regime defined by Law 70 has an extension of almost 6 million ha, including 233 403 ha of mangrove swamps (Orjuela *et al*., 2009). About 40 percent of the rural population in this area are settled along rivers and practise a variety of economic activities, including fishing in mangrove swamps, where one of the main fishing resources is the "piangua" (*Anadara tuberculosa* and *A. similis*, known as blood cockles in English) (Espinosa *et al*., 2009). Harvested by hand in the muddy intertidal zone of mangrove swamps (Figure 14:D), piangua sustains the main mollusc fishery in Colombia. Entitlement over natural resources contemplated in Law 70 (Art. 6) is restricted to soil and forests. It is unclear if muddy bottoms fringing mangrove forests (piangua habitat, technically tidelands, and as such public property) can be legally entitled to the communities (González-Cuesta, 2004), but in any case they can be granted as concessions for administrative and management purposes.

Law 70 specified the procedures to claim rights, defined the beneficiaries, and established the process to accommodate claims by a diversity of public and private stakeholders (Vélez, 2011). Authority has been devolved to communities for issues of cultural identity and the use and conservation of natural resources within a territory. In order to claim territorial rights, communities are required to self-organize around community councils, which implied a major change in governance. Community councils control the use and conservation of natural resources within their territories (Meza, 2010), among other governance functions. There are 157 councils, which vary in membership and in the extension of the territory claimed. In some cases, the councils define entry rules, regulate access to resources, and delimit extraction areas. Trespassing of boundaries of extraction areas defined by towns or community councils is a frequent source of conflict. Within council boundaries, associations have been established in some towns to harvest and sell piangua; 36 such organizations were identified in the Department of Nariño in 2004 (Candelo-Reina, 2005). Occasional conflicts arise among piangua gatherers, intermediaries and Ecuadorian traders, who sometimes offer boats with motors to take piangua harvesters to extraction areas, where the product is paid for on the spot (Espinosa *et al.*, 2010). Armed conflicts involving different factions constitute a major threat to the governance system, and to the social matrix of the communities (González-Cuesta, 2004).

Organizations involved in different aspects of the fishery management include the national fisheries and conservation authorities, municipal-level support (through the Unidad Municipal de Asistencia Técnica Agropecuaria [UMATA]), fishers associations (e.g. Asociación de Concheras de Nariño [ASCONAR]), conservation-oriented NGOs (e.g. World Wildlife Fund [WWF] Colombia), and academic organizations

(e.g. Universidad del Valle). Interaction between players has taken diverse forms, among them a participatory information institution known as Conversatorios de Acción Ciudadana, these are a sort of "town hall" meeting contemplated in the Constitution (Candelo-Reina, 2005). The territories of many communities of piangua harvesters overlap with protected areas, such as the Sanquianga Park (with about 80 000 ha of protected mangrove and more than 2 000 piangua gatherers, Figure 14:C; Zapata and Caicedo, 2011), the Utria Park (with 110 ha of mangrove swamps), and the delta of the Baudo River (a Ramsar conservation site, 5 585 ha of mangrove swamps; Villa *et al.*, 2009). National parks are excluded from the regime, even if fishing communities are

FIGURE 14
The "piangua" clam fishery of the Colombian Pacific coast



Notes: (A) Departments of the Colombian Pacific coast where Afro-Colombian communities have been collectively entitled with user rights over natural resources. (B) Approximate number of "piangüeras" by department. (C) Nariño Department, which concentrates the largest number of piangüeras, with indication of mangrove areas, community councils and the Sanquianga National Park. (D) Piangüera at work in a mangrove swamp. (E) Landings of piangua from Tumaco Bay (a major producing area), 1996–2008.
Sources: (A), (C) and (D) INVEMAR; (B) based on Delgado *et al.*, 2010; (E) based on Borda and Cruz (2004) and Gil-Agudelo *et al.* (2011, their Table 2).

located within their boundaries. Nesting of communities within protected areas has led to ad hoc management arrangements with park authorities, with provisions for specific management-related and monitoring activities (Gil-Agudelo *et al*., 2011). In Sanquianga Natural Park, 52 percent of towns and communities have some sort of organization, well above the average for the Nariño Department (28 percent), suggesting that the existence of the park facilitates self-organization (Zapata and Caicedo, 2011).

It is estimated that more than 11 300 families from rural areas, all of them on low incomes, depend to some extent on piangua gathering along the Pacific coast of Colombia (Figure 14:B); the number of users may increase in periods of high demand (Delgado *et al.*, 2010). Traditionally, harvesting was conducted by women ("piangüeras" or "concheras", about 78 percent of the gatherers in 2004; Candelo-Reina, 2005) and children. However, current demand and low profitability of alternative activities have led to increased entry of men (Espinosa *et al*., 2009; Candelo-Reina, 2005), which has generated gender-related conflicts; women feel displaced by men in areas of difficult access, and also complain about men damaging mangrove roots during piangua extraction. Originally, piangua was consumed locally, but in recent years there has been a growing demand from Ecuador, which imports 80-85 percent of the production (Borda and Cruz, 2004). Landing statistics are fragmentary, based mostly on information provided by associations of concheras (Gil-Agudelo

TABLE 16
Case 16: Colombia's Afro-American communities (piangua fishery)

Main attributes of the access regime	
How the rights are conferred and upheld	Collective entitlement of historic territories to communities of traditional users. Technically, muddy areas fringing mangrove forests are considered tidelands (and as such public), although they can be granted as concessions for management purposes. Within communities, community councils may play a role in regulating access.
Exclusivity of participation in the fishery	Exclusive access rights vested collectively on community members.
Duration of the rights conferred	Rights can be revoked in cases of non-compliance.
Security or quality of the title conferred by the rights	Legally secure entitlement, but threats owing to intruders, illegitimate users and violent conflict.
Transferability of the rights	Non-transferable.
Divisibility of the rights assigned	Contingent upon internal, informal arrangements within communities.
Flexibility in the use of the rights	High.
Enforceability of rights and compliance with use-rights limitations	Enforcement is difficult, in part owing to various sources of conflict. Informal sanctions are weak.
Harvesting strategies	
Fishing methods and gear	Hand gathering in mangrove swamps, mostly by women and children.
When fishing is authorized to take place	Closures are either informal or based on ad hoc local arrangements. In some cases, a "rest season" has been agreed upon due to excessive exploitation. The "rest season" instead of "close season" intends to capture the fact that it is voluntary and not enforced. In the Sanquianga National Park, agreements have been reached with communities, including temporary closures. Piangua can be harvested for only 16 days each month.
Harvest controls	A minimum size (5 cm, shell length) for piangua is the only formal regulation. A smaller minimum size adopted in Ecuador (4.5 cm) generates conflicts because about 80 percent of the production is exported to that country. Some management initiatives have originated from piangua gatherers themselves, in some cases accompanied by government agencies. In the Sanquianga National Park, agreements included temporary closures, restriction of participation by children, rotation of areas, mangrove reforestation, and closures during extreme tides, when a larger fraction of the swamps is exposed. Three communities overlapping with the Baudo River delta Ramsar site agreed to a gradual increase in minimum size, three-month closures, and rotation among communities.
Monitoring	Catch information is provided by associations of concheras. Concurrence of the communities is required for the assessment or exploitation of natural resources. Community members participate in monitoring.

et al., 2011). The best data correspond to Tumaco Bay, where recorded annual landings were in the range of 100–700 tonnes in 1996–2008 (Figure 14:E), and (more recently) to the Sanquianga National Park (Gil-Agudelo *et al*., 2011). The value of annual landings is in the order of U$S10 million (Delgado *et al*., 2010).

The piangua resource is thought to be severely overfished, and is threatened by the degradation of mangrove habitat from various anthropogenic impacts (INVEMAR *et al*., 2010; Delgado *et al*., 2010; Gil-Agudelo *et al*., 2011). CPUE, measured as catch per day, declined slightly in Sanquianga Park since 1998 (Zapata and Caicedo, 2011), but the number of working hours per day has generally increased and gatherers have moved progressively farther from settlements (Delgado *et al*., 2010).

TERRITORIAL COMMUNAL RIGHTS (TRADITIONAL AND INDIGENOUS USERS) – RECAP

These cases are different from the others because fishing rights are usually only part of a broader package of rights restored to communities of indigenous peoples (Cases 5.1 and 5.3) or traditional users (Case 5.2). Significant devolution of management authority results in two-tier governance systems, in which some decisions are made at the national level (e.g. "bounding" the community), while rules for the access to resources (e.g. Case 5.2.1) or benefits (e.g. Case 5.1) are decided within the community. Issues of legitimacy raised by the definition of "communities" can be very complex. Moreover, granting of exclusive communal rights may be in conflict with national legislation, as exemplified by the mangrove fisheries for clams in Colombia (Case 5.3) and crabs in Brazil (Case 5.2.2).

7. Transversal subjects

The following sections discuss several themes that run across cases, attempting to identify commonalties and regularities, and to derive some lessons.

ORIGINS AND OBJECTIVES OF RIGHTS SYSTEMS

The systems of access privileges and rights discussed in the above sections have diverse of origins, an important consideration in order to assess their performance.

Biological sustainability. Concerns about biological sustainability have been the most common reason for the introduction of privileges and rights, usually top-down and designed *de novo*. There have been two basic triggers: (i) overfishing (real or perceived) resulting in a crisis (Cases 1, 2, 4, 5, 7 and 9); and (ii) new or expanding fisheries, usually associated with the development of market opportunities (Cases 3, 6 and 10).

Social equity for access opportunity and conflict resolution. While the customary tenure systems discussed here (Cases 11–13) have been successful from the viewpoint of biological sustainability, in their origin they were motivated by the need to provide rules for an equitable or fair allocation of access opportunities and to reduce use conflicts in tightly knit communities. Elaborate but informal rules that regulated access (transfers, inheritance, lotteries, etc.) have the potential to maintain some level of social equity in the distribution of benefits from the fishery in the cases considered.

Conservation (biodiversity and ecological integrity). This objective is explicit only in the case of the Brazilian RESEXs, which also attend to historical rights and cultural identity. In the case of Chilean AMERBs, while the letter of the law only attends to issues of biological sustainability, in many circles (particularly academia) it is argued that they are also instruments for conservation (Meltzoff, Lichtensztajn and Stotz, 2002). The interpretive document of the law (SUBPESCA, 1995) introduced the notion of "secondary species" (essentially predators and competitors of the target or "principal" species), requiring a detailed baseline study with a description of benthic communities in the area prior to granting the concession of use. The information accumulated over 15 years has not been used for management purposes. Even if conservation was not a consideration in their inception, it is probable that AMERBs have positive collateral conservation effects by providing protection to species other than those targeted (Gelcich *et al*., 2010). Other collateral effects have received less attention. As an example, the ecological consequences of the removal of predatory loco snails (a "capstone" predator), well studied in the rocky intertidal (Castilla, 1999), have not been investigated for the subtidal zone, where AMERBs focused on loco are located.

Restitution of historical rights to indigenous or traditional users. Historical rights and preservation of cultural identity have been the main motivation for the restitution of historical use rights to Afro-Colombian communities (Case 16), the Seri Indians from Sonora (Mexico, Case 14), Chilean originary peoples, and traditional users of the Brazilian coastal zone (Case 15).

DEVOLUTION OF AUTHORITY

Among the fisheries considered here, there are three basic categories of devolution of authority by the State, a driver of institutional sustainability:

None, the case when access privileges are vested directly on individual fishers or boats (Cases 1–6). Participatory ambits, when they exist, have only a consultative role

and are not binding: the PMB in the Galápagos sea cucumber fishery (Case 1), the Comisión de Manejo de las Pesquerías Bentónicas de las Regiones X y XI (COMPEB) in the Chilean sea urchin fishery (Case 2), and the advisory committees of the Chilean Juliana clam fishery (Case 3), the San José Gulf fisheries (Case 4) and the Patagonian scallop industrial fishery (Case 6). However, it is often the case that the fisheries authorities adopt the recommendations made by these bodies, especially when a consensus has been reached. In all cases, the creation of these bodies has had positive results, even when progress is perceived as slow. Participation in boards or committees requires that fishers become organized (associations and cooperatives) and designate representatives. Politicization of the latter and questions about their legitimacy are recurrent problems, particularly when membership is large. Participatory processes are weakened when politicized leaders lobby at the level of the executive authority, where interests external to the reserve and the fishery predominate (e.g. Case 1; Heylings and Bravo, 2007).

Some, when authority is devolved to fishers organizations, typically the case of TURFs and territorial concessions (e.g. Cases 7, 8 and 11). In all cases reviewed, the organizations have full control of membership, and therefore access privileges within their TURFs. Although some organizations cannot legally close their registries, they charge very high entrance fees, which constitutes a de facto limited-entry mechanism. Collective rights foster organization, needed for collective sales, coordination of TURF vigilance, distribution of costs and benefits, sanctioning for non-compliance with internal rules, and building of social capital. Among the cases reviewed, devolution is most significant in the case of territorial concessions to cooperatives with a long history of organization (Cases 8 and 11). One factor that contributes strongly to effective devolution of authority is the upholding in court of sanctions imposed by the organization to rule-violating members (e.g. Case 11).

Significant, when historical rights are restored to communities of traditional users or indigenous peoples. In these systems, as discussed above, there are two tiers of authority.

There is a special circumstance common to many small-scale fisheries targeting sea bed resources that play a central role in institutional sustainability: the overlap between fishing grounds or villages with areas receiving some form of protection for conservation reasons (Table 17). Several of the systems included in this study fall into that category. Interaction between agencies with an ecological conservation mandate, conservation-oriented NGOs and fishers organizations have been generally constructive, resulting in better fishers organization, improved practices and effective enforcement. Initial distrust has often given way to strategic alliances (e.g. Case 4).

TABLE 17
Interfaces with areas designated for conservation

Case	Conservation unit	Relation	Effects on fishery	References
1: Galapagos Islands sea cucumber fishery	Galapagos Marine Reserve (GMR) World Natural Heritage Site (UNESCO) Galápagos National Park (administers the GMR, in charge of implementation of regulations and enforcement).	Fishery fully contained within the boundaries of the reserve	Zoning of uses Creation of participatory board (aim: reserve management, with fishers' participation) Improved monitoring and enforcement Greater definition of access privileges (exclusive for local residents)	Toral-Granda and Martínez, 2004; Baine *et al.,* 2007; Castrejón, 2011

Case	Conservation unit	Relation	Effects on fishery	References
4: San José Gulf scallop diving fishery	Natural Protected Area (NPA) Península Valdés Valdés Peninsula World Natural Heritage Site (UNESCO)	Fishery fully contained within the boundaries of the NPA	Prohibition of damaging fishing gear Zoning of uses Creation of participatory board (aim: fisheries management inside NPA, with fishers' participation) Reinforcement of limited entry Enhanced institutionalization	Orensanz *et al.*, 2007
7: Chilean AMERBs	Isla de Choros Marine Park	Fishery contained within the boundaries of the reserve during specific periods (specified in management plan). The reserve is adjacent to an AMERB belonging to a fishers organization.	Agreements between reserve authorities and fishers for co-administration and vigilance of the reserve Exacerbated conflicts among user groups for unequal access to the reserve (access initially granted to the fishers organization grantee of the adjacent AMERB, excluding 4 other groups with historical use of the area) Lack of coordination among intervening agencies leading to inaction	UCN, CEAZA and CREDHU, 2007
Case	**Conservation unit**	**Relation**	**Effects on fishery**	**References**
8: Concessions from central Baja California	El Vizcaíno Biosphere Reserve Isla Guadalupe Biosphere Reserve	Part of the fishery contained within the boundaries of the reserves	Creation of participatory boards (aim: reserve management, with fishers' participation) (in addition to lobster fishery boards) Prohibition of damaging fishing gear Reinforced vigilance	
9: Rock scallop predio	Alto Golfo de California y Delta del Río Colorado Biosphere Reserve	Part of the fishery contained within the boundaries of the reserve	Creation of participatory board (aim: reserve management, with fishers' participation) (in addition to state rock scallop committee) Increased enforcement (within reserve limits) Greater definition of access privileges (due to limited-entry policy implemented in the reserve) Increased – costly – requirements for the cooperative (e.g. environmental impact assessment)	Cudney-Bueno *et al.*, 2009a; Martínez-Tovar and Turk-Boyer, 2012
Sea cucumber fishery	Bahía de Loreto National Park	Fishery fully contained within the boundaries of the park	Creation of participatory board (aim: park management, with fishers' participation) (in addition to state sea cucumber committee) Improved monitoring and enforcement Greater definition of access privileges	Avendaño-Ceceña, 2007; Reyes-Bonilla *et al.*, 2008; M.T. Sanchez, personal communication
Sea cucumber fishery	Bahía de los Ángeles Canales de Ballenas y de Salsipuedes Biosphere Reserve	Fishery (target of Bahía de los Ángeles fishers) fully contained within the boundaries of the reserve	Creation of participatory board (aim: reserve management, with limited fishers' participation) (in addition to state sea cucumber committee) In the process of further defining access privileges and fishing restrictions	Avendaño-Ceceña, 2007; Danemann and Ezcurra, 2007; Cinti, 2010

Case	Conservation unit	Relation	Effects on fishery	References
10: Concessions for seaweed extraction from Chubut Province (Argentina)	Parque Inter-Jurisdiccional Marítimo Costero Patagonia Austral			
11: Lobster concessions of Punta Allen	UNESCO Sian Ka'an Biosphere Reserve	Most of the fishery contained within the boundaries of the reserve	Zoning of uses Creation of participatory board (aim: reserve management, with fishers' participation) Prohibition of use of a local palm to construct the fishing gear (casitas) (now entirely made of ferrocement) In some cases, internal rules or cooperative agreements have been incorporated to the management plan of the reserve, e.g. prohibition of scuba and hookah as fishing gear.	Briones-Fourzán, Lozano-Álvarez and Eggleston, 2000; Sosa-Cordero, Liceaga-Correa and Seijo, 2008
12: Juan Fernández Islands lobster fishery	Juan Fernández National Park Proposed: Área Marina Protegida de Múltiples Usos			
15: Brazilian RESEXs	RESEXs themselves are conservation units		Creation of participatory board (aim: RESEX management, with fishers' participation) Greater definition of access privileges/rights (exclusive for locals) Higher level of fishers organization and involvement in management Exacerbated conflicts among user groups owing to issues of exclusion and illegitimacy of membership of the association that holds the RESEX	
16: Piangua fishery, Afro-Colombian communities	Sanquianga National Park Utría National Park Baudó River delta RAMSAR site	Part of the fishery contained within the boundaries of protected areas	Agreements between park authorities and fishing communities to establish sites with different exploitation levels and temporal closures Improved monitoring Higher level of fishers organization Environmental authorities work together with community councils for the protection of mangroves	Espinosa *et al.*, 2009, 2010; INVEMAR *et al.*, 2010; Gil-Agudelo *et al.*, 2011; Villa *et al.*, 2009; Zapata and Caicedo, 2011

INCENTIVES FOR RESOURCE CONSERVATION AND STEWARDSHIP

Latin American fisheries targeting sea bed resources vary greatly in the incentives offered for stewardship and conservation, drivers of biological sustainability:

None, including some fisheries important in terms of landings and employment. A notable example is the pepitona clam fishery from Venezuela (Bolivarian Republic of) (Lodeiros *et al.*, 2012).

Weak, the case of moratoria when there are a large number of participants (Cases 1 and 2). Incentives are stronger when the number of participants is smaller (e.g. Case 3).

Basic, in the case of catch shares and some TURFs. Incentives offered by the latter vanish when there are no effective internal rules to regulate the access of members of the fishers organization or cooperative holding the territorial concession (e.g. Case 9), or when the productivity of the TURF is too low to justify transaction costs associated with TURF maintenance. Incentives offered by catch shares vanish under conditions of weak enforcement, even if the number of participants is small (e.g. Case 4).

Strong, in TURFs held by strong organizations and in cases of customary tenure (informal access privileges to fishing spots). In successful TURFs, there are clear internal rules for access by organization members (e.g. Cases 8 and 11) and/or for the distribution of costs and benefits, and a graduated system of sanctions for non-compliance. In successful Chilean AMERBs, the catch (typically, loco snails) is obtained with the participation of all the fishers on predetermined dates. No diving activity by individual members is allowed within the TURF during the rest of the time.

BIOLOGICAL SUSTAINABILITY

Evaluating the biological sustainability of benthic fisheries is difficult for the same reasons that complicate stock assessments: the persistent spatial heterogeneity of stock structure and dynamics, and consequently of the fishing process. Spatial heterogeneity is extreme in cases such as the Colombian piangua and the Brazilian mangrove crab fisheries, where stocks and fishing communities mirror the fragmentation of coastscapes. In the case of the Chilean loco fishery, heterogeneity is exacerbated by the management regime, as hundreds of relatively small TURFs are monitored and managed independently from one another. An effort to assess the performance of the regime (Techeira, 2012) found extreme variability using average density as an indicator of stock status within individual TURFs.

The biological sustainability of some of the fisheries considered here is however attested by a long history free of collapses or crises. This is the case for three lobster fisheries (Cases 8, 11 and 12), in all of which the current management system is rooted in traditional tenure involving some form of territorial access privileges. Two of those fisheries (Cases 8 and 11) have been certified by the MSC, and the third (Case 12) is entering the pre-certification stage.

Indicators other than landings are currently monitored in most of the fisheries considered here, either through surveys (Cases 1, 3, 4 and 6–9, plus intertidal mussel beds in Argentine Patagonia and beach clams in Uruguay) or fishery-dependent information (Cases 2, 11 and 12). In other instances, partial information has been collected through research conducted by academic projects or NGOs (Cases 15 and 16). Most time series are too short (and in some cases information-limited) to judge performance in terms of biological sustainability, but the prospects have clearly improved in most cases in which monitoring was introduced concurrently with institutional consolidation of a participatory management system (e.g. Cases 2–4).

However, some fisheries have proved unsustainable. Vagaries of recruitment and climate-driven episodes of mass mortality (e.g. Case 7, macha fishery) contribute to challenge policies based on incentives for responsible behaviour when communities are too dependent on single-species fisheries. In the Chilean macha fishery, TURFs have aggravated the problem by eliminating fishers migration (a form of spreading risk), locking them into small, intrinsically variable areas (Aburto and Stotz, 2013). Climatic forcing associated with the El Niño phenomenon also contributed to declines in the Galapagos Islands sea cucumber fishery, but here the problems in the management system discussed above were a major cause of collapse.

ECONOMIC SUSTAINABILITY

Several factors hinder the economic sustainability of rights-based benthic fisheries. The following emerged recurrently in this overview:

Poverty, demographic pressure and low entry cost. Entry cost is minimal in many benthic fisheries, particularly in the case of hand gathering. For that reason, the coastal zone has historically absorbed workers displaced by crises in other sectors, e.g. agriculture and mining. Demographic pressure on resources from extended coastlines poses a major challenge to the implementation of access privileges.

High transaction costs of rights-based systems. Transaction costs of rights-based systems are high as a rule, but are particularly demanding to fishers in the case of territorial access privileges. In the Chilean TURF system, the costs of mandatory surveys and vigilance, plus a tax per unit area (to be abolished in 2013), have forced the abandonment of many TURFs by the holding fishers organizations.

Global economic drivers. The economic sustainability of the main fisheries considered here (sea urchins, sea cucumbers, scallops, Juliana clams, loco snails, lobsters, etc.), especially those that supply export-oriented markets, is highly conditioned by contingencies that are beyond management control, such as the monetary policy of the country, and the fluctuations of global markets. Ex-vessel value of landings of Chilean loco and Argentine tehuelche scallops, for example, are driven by supplies of cultured abalone and bay scallop meats from China.

Dependence on one or a few resources. Diversification of the portfolio of opportunities, not only across specific resources but also across activities, is perhaps the best alternative for risk management (Hilborn *et al.*, 2001; Sethi, 2010). The most immediate form is a "basket of resources", often implemented in the form of stackable permits or licences. While in principle this form of diversification may alleviate the impact of external drivers (economic or climate), in practice, the dependence on lucrative, export-oriented resources may be unavoidable given large price differences between those and other resources marketed domestically. Another problem associated with this, particularly in the case of territorial access privileges, is a form of triage in which less-valuable resources are overfished to safeguard the most valuable ones. Diversification may extend to activities other than fishing, including small-scale aquaculture (now promoted in Chilean TURFs), added value (new markets, denominations of origin, certification, pre-processing, etc.) and community involvement in ecotourism (Lopes, Silvano and Begossi, 2011). The latter is facilitated when fishing communities are coincidental with protected areas, a frequent pattern discussed above. However, there are some due caveats. Broadening the scope of territorial use privileges to include activities other than fishing often collides with other users of the coastal zone and with regulatory frameworks for other activities (navigation, recreation, development, etc.). Moreover, tourism can be distortive of the social matrix of fishing communities, some of which have opted for regulating the activity. Tourism-related development frequently encroaches on the traditional territories of fishing communities (e.g. Case 15, Brazilian marine RESEXs; Diegues, 2008).

Fishers' organizations or communities holding territorial privileges or rights have access to fewer conventional opportunities: subsidies, compensations and credit. Many organizations have been very successful in attracting subsidies from government agencies or NGOs, aided by a discourse that has substantial appeal among the public, the media and politicians (Gelcich *et al.*, 2005). Several Chilean TURF-holding organizations have claimed compensation from industries (mining, and industrial aquaculture) for environmental damage, to the extent that in some cases compensations have become a more attractive source of income than fishing. Resources in the TURFs (with the backing of surveys conducted by consultants) have been used in some cases (mostly in central Chile) as collateral for credit, either to individual fishers or to the organizations. On some occasions, this has worked against biological sustainability, as fishers have been more inclined to deplete their holdings rather than default on their debt to the banks.

SOCIAL SUSTAINABILITY

In the cases introduced above, social sustainability hinges on the issues of equitable distribution of access opportunities and legitimacy of the participants. The two are intertwined, as being a legitimate user is a general condition for holding access

privileges (formal or informal). The most common criteria for establishing legitimacy are history of participation, family ties with participants (e.g. Cases 11 and 12) and compliance with rules (formal or informal). Equity problems arise recurrently when a formal rights-based system is implemented and privileges are first allocated, as discussed below. These issues are significant in the case of small-scale fisheries, but are not drivers of sustainability in the one industrial fishery considered here (Case 6, Patagonian scallop industrial fishery). Issues of equity found in this overview fall into three main categories:

Equity among individual rights holders: catch shares. When privileges are granted to boat owners, crew members do not receive a share even if they are legitimate users on account of their history of participation. Privileged permit-holders often become de facto intermediaries, leasing their licensed boats to legitimate but non-privileged participants (e.g. Case 4), or laundering the catch from non-licensed boats (e.g. Case 9; Cinti *et al*., 2010). In general, the granting of individual privileges by the State, whether to boat owners or individual fishers, leads to official registries that do not reflect the active participants and the trading of individual quotas (Cases 4, 5 and the failed attempt to introduce ITQs in the Galapagos Islands sea cucumber fishery).

Equity among user groups. Another form of the initial allocation problem comes with the granting of sea bed tracts to organizations in formal TURF systems. This is well illustrated by two families of consequences of the top-down implementation of the Chilean AMERBs. The first pertains to variation in productivity among the fishing grounds accessible to fishers from different caletas. Faced with the prospects of being left empty-handed during the distribution of sea bed access privileges, fishers organizations felt compelled to request AMERBs even when sea bed tracts accessible to them were not particularly productive. In the end, the transaction costs of keeping low-productive AMERBs were too high relative to benefits, and many organizations "abandoned" their TURFs (e.g. stopped hiring consultants to conduct the annual surveys required for quota allocation).

The second type of problem emerged because there was not a process of stakeholder identification before AMERBs were granted to organizations on a first-come first-served basis. As a result, many users were excluded from their traditional fishing grounds. In some cases, conflict was solved through informal arrangements between user groups, as exemplified by the renunciation of some TURFs in Ancud Bay (Case 7; San Martín, Parma and Orensanz, 2010). In others, there were elaborate access agreements between groups of users, e.g. among macha clam fishers in Coquimbo Bay (San Martín and Norambuena, 2008). There, fishers from three caletas (Peñuelas, San Pedro/La Serena and Coquimbo) historically harvested macha clams from common fishing grounds. In 2000, the fishers' organization of Peñuelas took the lead and formally requested an extensive AMERB, granted in 2002. Discontent of excluded users surfaced soon afterwards. The conflict was resolved through an agreement for the common use and vigilance of the area among the three organizations, representatives of the regional government and the fisheries authority. Peñuelas remained, however, the sole legal holder of the AMERB (Cinti, 2006).

Equity among members of organizations, cooperatives or communities. Criteria for legitimacy are more realistically defined when access rules are established by fishers organizations or local communities, without intervention of the fisheries authority (e.g. Cases 11 and 12). In contrast, difficult problems were encountered during the initial granting of territorial use privileges to Chilean organizations targeting loco snails. The only formal legitimacy criterion was that members had to be registered artisanal fishers – they could be registered for any resource and activity, independently of the target species within the requested tract. This loophole effectively broke down the existing moratorium in the loco fishery, opening a door to individuals with no history of loco harvesting (San Martín, Parma and Orensanz, 2010). In recent years,

most fishers organizations, faced with overblown memberships and dwindling per capita benefits, have adopted strict internal rules to restrict access of new members.

PROVISION OF SCIENTIFIC/TECHNICAL SUPPORT

Input of scientific and/or technical support for management can occur at different levels depending on the structure and nature of the decision-making process: (i) directly to the fisheries authority (Case 6 or the small coastal gathering fisheries targeting yellow clams in Uruguay and mussels in El Riacho, Argentina); (ii) to a participatory advisory committee (Cases 1–3), or (iii) to local fishers organizations. Some of the cases considered here are hybrid, particularly in those involving territorial access rights, where local fishers organizations may retain the services of consultants that report to the fisheries authority (Cases 7 and 9) The cooperatives of central Baja California retain their own experts that monitor resources jointly with agency technicians, which contributes legitimacy to the process (Ponce-Díaz, Weisman and McCay, 2009; McCay, Weisman and Creed, 2011). In Chilean AMERBs, the hiring of a consultant to coordinate the annual survey and produce a report is seen in some cases solely as an administrative requirement to obtain a TAC (San Martín, Parma and Orensanz, 2010). Monitoring of the lobster fishers from the Juan Fernández Islands was started by the collaboration between a proactive fishers organization and independent scientists (Ernst *et al*., 2010a), but is now conducted with funding from the fisheries authority.

The demand for (and cost of) scientific and/or technical support is highest where a TAC is part of the regulations (whether or not including catch shares, Cases 1–6), and minimal in customary tenure systems (Cases 11–13). Where access privileges over tracts of seabed are vested on fishers organizations (Cases 7–9, 11 and 13), these assume at least part of the cost of assessing resources within territorial boundaries, albeit often with direct or indirect subsidies (e.g. Case 11; González *et al*., 2006).

ENFORCEMENT AND COMPLIANCE

Enforcement is inherently difficult in small-scale fisheries, where small boats can land the catch anywhere along extended coastlines. This is in sharp contrast with industrial fisheries, logistically constrained to operate from few locations and for that reason enforceable (Orensanz *et al*., 2005). In fact, enforcement does not present major problems in the one industrial fishery discussed (Case 6). Management of the considered small-scale fisheries faces three main families of enforcement problems:

Exclusion of illegitimate users in the case of territory-based privileges (Cases 7–9, 15 and 16). Vigilance and deterrence displays by organizations or communities are often insufficient to discourage intruders, largely because the former lack legal enforcement authority. Maritime authorities are slow to react, and so violators are rarely prosecuted in court. This has repeatedly led fishers to take justice into their hands, in the form of physical interference with intruders' fishing operations (Cases 11 and 15), which may end up in court.

Rule violations by fishers holding individuals privileges (licences or catch shares). In the absence of the strong internal rules typical of TURFs, ineffective enforcement weakens fishers organizations, promotes a race for fish even within small commons, and dilutes the incentives supposedly associated with restricted access.

Rule violations by members of groups holding access privileges. These are generally well controlled by TURF-holding organizations (Cases 7, 8 and 11). Sanctions in Chilean and Mexican cooperatives may involve reductions in the benefits, suspensions, or even exclusion from the organization. Penalties are, as a rule, more severe than those imposed by the fisheries authority. Endorsement of sanctions by the authority, particularly in the face of litigation in court, is a significant issue.

Participation of community members in enforcement, beyond vigilance and deterrence displays, is difficult because of legal constraints on the devolution of

authority. A solution that has been recurrently implemented is the designation and training of respected members of the community, whose testimony can be used by the corresponding authority. In Chilean caletas, the "alcalde de mar" is a citizen appointed by the maritime authority to supervise activity in a particular artisanal harbour or caleta (e.g. recording boat arrivals and departures) and report violations. This person is usually a respected community member (an ex-fisher in most cases). Brazilian RESEXs allow for "fiscais colaboradores", who may be fishers or members of other user groups. Fiscais prepare "autos de constatação", which must be backed by three witnesses and may lead to the indictment of violators.

DISCUSSION – RECAP

The diversity of access systems introduced in this study and the consideration of several significant issues across cases suggest simple general lessons. Rights and privileges (whether formal or informal) contribute to the sustainability of these fisheries, particularly in the case of territorial access privileges. However, even in that case, success depends on fishers organization, productivity of the territory, enforceability of boundaries and effective devolution of authority. The most salient lessons of this comparative exploration is that there are no general recipes other than the need to attend to the multiple aspects of sustainability (biological, social, economical and institutional) when a system is implemented, providing for flexibility and adaptiveness, creating ambits for interaction among stakeholders (fishers, managers, scientists and environmentalists being the main ones), and counting on transparent and effective support from the State regarding enforcement, legislation and courts.

PART II

Latin American rights-based fisheries targeting finfish species

Juan Carlos Seijo, Minerva Arce, Eduardo Pérez, Álvaro Hernández and Miguel A. Cabrera

8. Introduction

The case studies reported in this Part II specify the main attributes of the property rights (Shotton, 2000) granted or assigned by the corresponding finfish fisheries management authority: (i) the exclusivity of participation in the fishery; (ii) the duration of the rights conferred; (iii) the security or quality of the title conferred by the rights; (iv) the transferability of the rights; (v) the divisibility of the rights assigned; and (vi) the flexibility associated with the use of the rights. One critical aspect in the case studies is the actual rights enforceability, and corresponding compliance with use rights limitations.

The cases also report on: (i) how the rights are conferred and upheld; (ii) how these rights are defined in terms of who has the right to use the specific finfish resources; (iii) which component of the population structure (if any, minimum and/or maximum size restrictions) or portion of the fishery stock TAC may be used; (iv) how it is to be caught (fishing methods and gear used); and (v) when fishing is authorized to take place.

A final discussion section attempts to include answers to the following questions:

- How can the property rights systems illustrated in the case studies improve the incentives for stewardship, conservation and sustained profitability?
- What sorts of distributional implications are there in each of the rights-based finfish fisheries reported?
- What sorts of operational requirements do the different types of property rights documented demand in terms of research, enforcement, administration and actual fishing operations?

The four case studies reported in Part II are:

- individual vessel quota (IVQ) management of the anchovy (*Engraulis ringens*) fishery of Peru;
- individual stakeholder quota management of the hake (*Merluccius gayi gayi*) fishery of Chile;
- community territorial use rights in the Gulf weakfish (*Cynoscion othonopterus)* fishery of the Gulf of California, Mexico;
- limited entry with spatial management of maximum allowable effort (MAE) of artisanal communities in the multispecies multigear finfish fishery at Coiba National.

9. Individual vessel quota management of the anchovy (*Engraulis ringens*) fishery of Peru

INTRODUCTION

Large fluctuations in fish stocks and long-term changes in human harvest of marine resources are well known from long before modern exploitation started and harvesting technology became efficient enough to make significant stock reductions (Hjort, 1914; Jakobsson *et al*., 1995). Historical long-term changes in stock abundance have been related to climatic changes as pointed out by Øiestad (1994), and fish stocks seem to fluctuate over time in relation to warm and cold periods in ocean waters. Andersen and Sutinen (1984) and Ishimura, Punt and Huppert (2005) acknowledged large fluctuations in stock levels and yields on a year-to-year basis due to stochastic recruitment processes, and Hannesson (1993) considered the choice of optimum fishing capacity of fish stocks that vary at random. Conklin and Kolber (1994) reported that stock assessment surveys consistently reveal fluctuating stock levels regardless of whether or not they are subject to exploitation. Seijo (1995) reported an environmentally driven stock-recruitment function with decadal fluctuations for the anchovy and sardine fisheries of Peru, using a sine function with 33year cycles. Steinshamn (1998) applied a dynamic Gordon-Schaefer model using a sine function, with alternative cycles of 4, 8 and 12 years, for the exogenous disturbance affecting fish stock reproduction over time.

A decade ago, Kliashtorin (2001) found that populations of the most commercially important Atlantic and Pacific fish species – Atlantic and Pacific herring, Atlantic cod, European, South African, Peruvian, Japanese and Californian sardine, South African and Peruvian anchovy, Pacific salmon, Alaska pollock, Chilean jack mackerel and some others – undergo long-term simultaneous oscillations. Concerning climate change effects on fish stocks, evidence reported by Cochrane *et al.* (2009) indicates that climate change is modifying the distribution of marine and freshwater species. Schreiber *et al.* (2011) report on the evolution of coping strategies in the anchovy fishery of Peru to deal with climate variability and extreme El Niño–Southern Oscillation events.

Within these complexities, the Government of Peru established in 2008 a rights-based system of IVQs to manage the world's largest fishery – the anchovy (*Engraulis ringens* and *Anchoa nasus*) fishery.

In peak years, landings of Peruvian anchovies (*Engraulis ringens*) account for about 10 percent of global fish, harvested from the most productive marine ecosystem that exists (Bakun and Weeks, 2008). With the IVQ system for the Peruvian anchovy fishery, the share of global fish catches managed by rights-based management systems has increased dramatically, especially in Latin America. It is considered by many a major step for fostering marine stewardship and for mitigating the race to fish in the most productive marine ecosystem of the world (Costello, Gaines and Lynham, 2008). Because of the above, the Peruvian anchovy fishery has received much attention because of its size, and also because it is the most important input for the fishmeal and fish oil industry (Tveteras, Paredes and Peña-Torres, 2011; Chu, 2009). It also means that the representation of developing countries using rights-based management systems in fisheries has increased substantially. Of the 18 countries that had ITQ

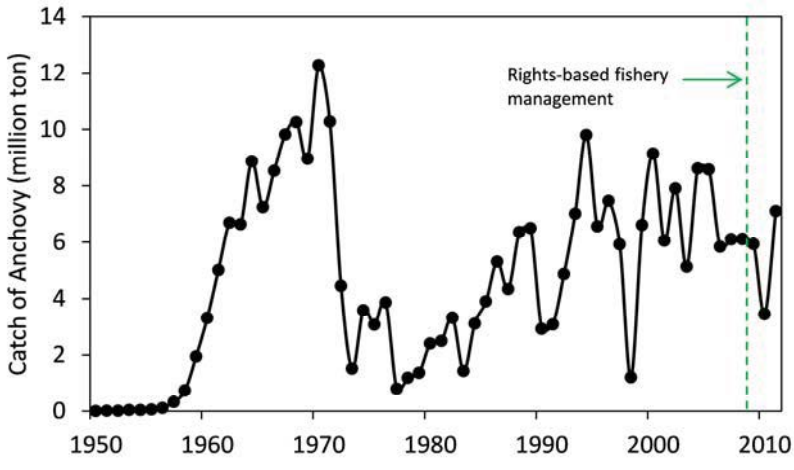
schemes in 2006 only 6 were developing countries (Chu, 2009), including Argentina and Chile that score high on the human development index and are probably better classified as emerging economies. Consequently, it seems that individual quota systems are best suited in countries with strong institutions. However, if a developing country with presumed weak institutions can successfully introduce ITQs for a fishery that generated more than US$1 billion in export revenues in 2009, it could pave the way for a broader application of rights-based management systems around the world.

BRIEF HISTORIC EVOLUTION OF THE FISHERY

The anchovy (*Engraulis ringens*) is a fast-growing small pelagic species that reaches a maximum size of 20 cm. It lives in moderately cold waters (16–23 °C in summer and 14–18 °C in winter) with salinity in the range of 34.5–35.1 UPS. It has a highly gregarious behaviour, forming large and dense schools facilitating their harvest. In the South Pacific, its geographic distribution involves the Peruvian and Chilean coastal area between latitudes 03°30'S and 37°00'S (Ñiquen *et al*., 2000). Two stocks have been differentiated: the northern-centre stock of Peru (03°30'–16°00'S), which exhibits the highest concentrations; and stock of south Peru – north of Chile (16°01'–24°00'S). Spawning occurs most of the year with two periods of high intensity: the highest taking place in winter (August–September) and the other in summer (February–March). Anchovy feeds exclusively from plankton (phytoplankton and zooplankton) (Ñiquen, Espino and Bouchon, 2000b).

It is recruited to the fishery at 5–6 months of age, and a size of 8–9 cm. Recruitment usually occurs between December and April (IMARPE, 2012). The interannual and decadal fluctuating nature of small pelagics as anchovy (Chávez *et al*., 2003), is expressed in Figure 15. Although this marks the beginning of the rights-based fishery management, three years is a relatively short period to assess fishery performance under the rights-based system.

FIGURE 15
Peruvian catch of anchovy (*Engraulis ringens and Anchoa nasus*), 1950–2011



Anchovy fishing takes place along the Peruvian coast area involving 1 200 purse seine vessels using a mesh size of 13 mm. Anchovy is also captured by small-scale vessels within a 5 mile exclusive fishing area for artisanal fishing. Anchovies are usually caught in the coastal area within 60 nautical miles at depths of less than 100 m.

Concerning spatial distribution of target species and fleets targeting the anchovy species, Bertrand, Díaz and Ñiquen (2004) show that: (i) Peruvian anchovy exhibited a composite spatial strategy characterized by a change in biomass associated with both

change in geographical extension and density; (ii) fishing behaviour varied significantly within and among vessels in terms of travel duration, searching duration, and number of fishing sets; and (iii) interactions between fish and fisher behaviour differed according to the spatial scale. As previously reported by McCall (1984) and Csirke (1989), fishing was more efficient with low biomass and high spatial concentration (low stock range and high biomass). Bertrand, Díaz and Ñiquen (2004) also found that at a local fish spatial scale fishing performance was favoured by high mean local abundances and low spatial concentration, and that at the school scale both high abundance and high spatial concentration were favourable to fishing success.

The historic harvest of anchovy shows interannual and interdecadal fluctuations with highest catches reported in 1972, 1994, and 2005 (Ministerio de Producción, 2012). In this period, major El Niño–Southern Oscillation events of 1972–73, 1982–83, 1997–98 caused substantial decreases in annual catches followed by time-varying recovery periods (Ñiquen, Espino and Bouchon, 2000; Ñiquen and Bouchon 2004; IMARPE, 2011).

There were 1 232 registered industrial vessels targeting anchovy for indirect human consumption in 2010, with a total storage capacity of 220 922 tonnes (Ministerio de Producción, 2010).

Spatial area for the anchovy fishing regime

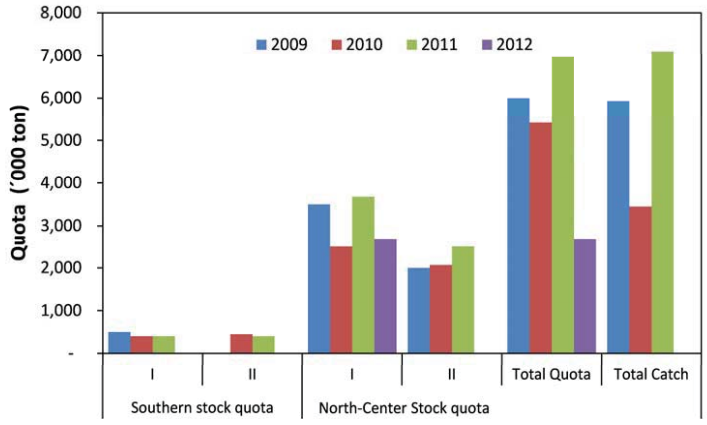
The geographic specification for the application of the Peruvian anchovy rights-based fishery management regime involves the area between the northern extreme of Peru's maritime domain and parallel 16°00'00"S, outside the reserved areas for artisanal and small-scale fishing.

Figure 16 shows the fish quotas allocated by the Ministry of Production to harvest anchovy species in the Northern-Centre stock area as well as in the Southern stock area. Fish quotas are allocated per semester to each of the above-mentioned areas. Fish quotas established for the Northern-Centre stock area are substantially higher than the ones indicated for the Southern stock area.

Figure 16 shows that the TACs of 2010 and 2011 allocated to fish in the North-Centre stock area are 4.4 and 6.7 times greater, respectively, than the ones allocated to fish in the Southern stock area. It can also be observed that 2010 catch of anchovy represented only 63.7 percent of the total maximum fish quota specified for 2010. In 2009 and 2011, the actual catch of anchovy and the corresponding maximum quotas are very similar.

FIGURE 16

Total catch and total allowable catches of anchovy harvested in the North-Centre and Southern stock areas after the rights-based system was established

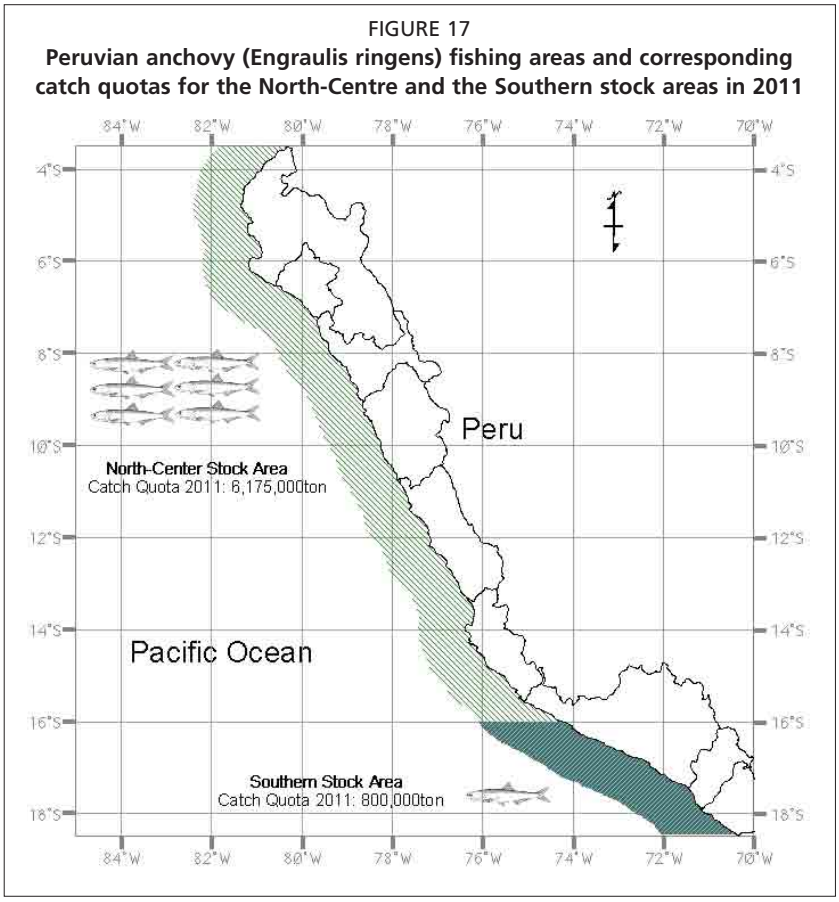


Sources: Ministerio de la Producción – Perú (2009a, 2009b, 2009c, 2009d, 2010a, 2010b, 2010c, 2011b, 2011c, 2011d, 2011e, 2012).

Recently, the Ministry of Production authorized for the first fishing season (April-July) of 2012 for anchovy (*Engraulis ringens* and *Anchoa nasus*) the area comprising the extreme north of Peru's maritime domain and parallel 16°00'00"S. The maximum limit of TAC catch has been established for this first fishing season of 2012 at 2.7 million tonnes. PRODUCE also determined a minimum size restriction of 12 cm for both species. A tolerance of 10 percent of harvest below minimum size is allowed (OLDEPESCA, 2012).

Figure 17 shows the anchovy fishing areas and the allocation of the TACs for harvesting anchovy for indirect human consumption in both the North-Centre stock area and Southern stock area.

FIGURE 17
Peruvian anchovy (Engraulis ringens) fishing areas and corresponding catch quotas for the North-Centre and the Southern stock areas in 2011



FISHERY PROPERTY RIGHTS IN PLACE

The law on vessel quota limits was established through Presidential Legislative Decree No. 1084 issued in June 2008. As stated in its Article 1, it had the purpose of establishing a fisheries management mechanism applicable to the extraction of the anchovy species (*Engraulis ringens* and *Anchoa nasus*) for indirect human consumption. It was aimed at improving the conditions for modernization and efficiency of the industrial sector and securing a responsible use of hydrobiological resources in harmony with the conservation of the marine environment and its biodiversity.

Before June 2008, the Peruvian anchovy fishery had been managed under a regulated open-access regime. As mentioned above, in 2009, an IVQ regime was implemented, and consequently, TAC quotas were established for each of the two stock areas (North-Centre and Southern) per semester.

The law establishes that two fishing seasons will be specified per year for the two stock areas. One fishing season in the first semester of the year, and the other in the

second semester. The duration of the fishing seasons will depend on environmental and biological conditions observed by the Marine Research Institute of Peru (IMARPE). However, for the Southern area, there are no closed seasons specified as in the case of the North-Centre area.

In 2011, the President of Peru abolished Supreme Decree No. 003-2008-PRODUCE, which had established a Special Fishing Regime for anchoveta (*Engraulis ringens*) in the Southern stock area between 16°00'S and the southern extreme of the Peruvian maritime domain. With the above-mentioned Supreme Decree, industrial vessels harvesting anchovy species had the possibility of fishing within the 0–5mile area, historically reserved exclusively for artisanal and small-scale fishing of a high diversity of marine species. It should be pointed out that anchovy harvest by artisanal and small-scales vessels within the 5mile area should be used exclusively for direct human consumption.

Maximum limit of TAC and IVQs

The 2008 fisheries law indicates that the Ministry of Fisheries will establish, for each fishing season, a maximum limit of TAC of anchovy resources (*Engraulis ringens* and *Anchoa nasus*) for indirect human consumption, based on a biomass scientific report prepared by IMARPE. It also specifies that a maximum catch limit per vessel (i.e. IVQ) will be established by multiplying the percentage of maximum catch per vessel (PMCPV) by the maximum limit of TAC for the corresponding fishing season. In accordance with the regime established by Decree No. 25977, the maximum catch per vessel is determined by the Ministry of Fisheries based on a vessel participation index. This index is calculated by adding up the following components:

- 60 percent stemming from the vessel-catch participation index of the year of vessel's highest percentage participation of total catch registered in the Ministry of Fisheries in the period 2004 to date. For this calculation, only anchovy harvested within the area comprising the extreme north of Peru's maritime domain and parallel 16°00'00"S will be considered.
- 40 percent stemming from the vessel storage capacity index resulting from dividing the authorized capacity in the fishing permit to harvest anchovy by the total storage capacity authorized by the Ministry of Fisheries.

Concerning wooden boats, subject to the regime established in Decree No. 26920, the vessel-catch participation is the one involving the highest percent participation of the vessel in the total anchovy harvest from 2004 up to 2009, when the rights-based system was put in place.

The PMCPV ($MCPV_i$), either subject to the regime of Decree No. 25997, Fisheries Law, or the regime established by Decree No. 26920, is calculated by dividing the vessel-catch participation index (VPI_i) by the total sum of all participation indices of authorized vessels, i.e. $MCPV_i = \frac{VPI_i}{\sum_i VPI_i}$

The procedure for calculating the maximum catch limit per vessel (IVQ) indicates that the Ministry of Production, based on the maximum limit of the TAC of anchovy species for indirect human consumption, will determine for each fishing season the maximum catch limit per vessel for every licence owner. The IVQ is obtained by multiplying the PMCPV by the maximum limit of the TAC. The allocated maximum catch limit per vessel is kept during the fishing season, unless the Ministry of Production modifies the maximum limit of the TAC as a result of a scientific recommendation indicated by IMARPE. In such a case, the maximum catch limit for each vessel will be adjusted accordingly. The uncaught biomass fraction of the maximum catch limit for each vessel is not transferable to future fishing seasons.

Exclusivity and duration of the rights conferred

Vessel harvesting of anchovy (*Engraulis ringens*), can only take place if the vessel has a valid fishing licence to harvest anchovy (*Engraulis ringens*) and white anchovy (*Anchoa nasus*) for indirect human consumption. It is also required that each vessel carries an onboard satellite tracking system – SISESAT, which must permanently transmit the geographic position of the vessel through a satellite navigation system.

The 2008 fisheries law also establishes that fishing licence holders can sign permanence warranty contracts with the Ministry of Production to secure the maximum catch limit per vessel established in the rights-based fishing regime. The duration of the permanence warranty contracts is ten years. Nevertheless, the Ministry of Production retains the possibility to regulate the fishery as a result of biological measures recommended by IMARPE.

Security or quality of the title conferred by the rights

Article 6 provides legal stability concerning the PMCPV that will be maintained without alteration during the validity period of the current management measure. If during four consecutive fishing seasons the non-captured percentage of the maximum catch limit of a vessel (IVQ) exceeds 20 percent in each period, the relative participation index of the vessel will be adjusted by deducting the average non-captured percentage in that period.

The sum of the average non-capture percentages deducted from vessels will be proportionately added, in the next fishing season, to the remaining licensed vessels' percentage of maximum catch per vessel not subject to such reduction.

Divisibility of the rights assigned

The catch reported for the same period and geographic area will be considered for the case of fishing permits involving storage capacity substitution. If, because of storage capacity substitution, two or more vessels were granted anchovy fishing permits, the authorized catch for the vessel giving origin to the substitution will be divided in the corresponding proportion.

Transferability of fishing rights

Once a PMCPV has been attributed to a specific vessel, it will be linked to the corresponding fishing licence associated to the vessel from which the initial allocation calculations were made. The PMCPV cannot be transferred in vessel-independent form. If the vessel from which the initial allocation calculations were made is dismantled or dedicated in definite form to another fishery or subject, the vessel licence owner could request authorization to obtain an authorization of substitution of an equal capacity volume of the existing vessel – the PMCPV could be associated or incorporated to another or other vessels of the same licence owner. If the vessel owner still has pending compliance of sanctions determined by the Ministry of Production, the above-mentioned association or incorporation will not proceed.

RIGHTS ENFORCEABILITY

The fact that the anchovy catch does not significantly exceed the fish quotas established is an indication of good fisheries management based on sound enforcement and compliance. However, there are reports indicating that some fraction of the catch of the artisanal sector of southern Peru is still used to produce fishmeal and fish oil instead of using it for direct food consumption, which is the only authorized use of the harvest.

COMPENSATION FUND FOR FISHERIES MANAGEMENT

The 2008 Peruvian fisheries law also created the Compensation Fund for Fisheries Management. This fund will be formed with the contributions of licence owners who

TABLE 18
Summary of main attributes of rights-based management regime in place for the Peruvian anchovy (*Engraulis ringens*) fishery

Main attributes of the access regime	Description
How the rights are conferred and upheld	The individual vessel quota (IVQ) is determined by the Ministry of Fisheries based on vessel participation index. This index is calculated by adding up the following components: a) 60 percent stemming from vessel-catch participation index of the year of vessel's highest percentage participation of total catch registered in the Ministry of Fisheries in the period 2004 to date. For this calculation, only anchovy harvested within the area comprising the extreme north of Peru's maritime domain and parallel 16°00'00"S will be considered. b) 40 percent stemming from vessel storage capacity index resulting from dividing the authorized capacity in the fishing permit to harvest anchovy by the total storage capacity authorized by the Ministry of Fisheries.
Exclusivity of participation in the fishery	The 2008 fisheries law also establishes that fishing licence holders can sign permanence warranty contracts with the Ministry of Production to secure the maximum catch limit per vessel established in the rights-based fishing regime.
Duration of the rights conferred	The duration of the permanence warranty contracts is 10 years.
Security or quality of the title conferred by the rights	Article 6 provides legal stability concerning the percentage of maximum catch per vessel (PMCPV) which will be maintained without alteration during the validity period of the current management measure. Nevertheless, if during four consecutive fishing seasons the non-captured percentage of the maximum catch limit of a vessel (IVQ) exceeds 20 percent in each period, the relative participation index of the vessel will be adjusted by deducting the average non-captured percentage in that period.
Transferability of the rights	The PMCPV cannot be transferred in vessel-independent form.
Divisibility of the rights assigned	If, because of storage capacity substitution, two or more vessels were granted anchovy fishing permits, the authorized catch for the vessel giving origin to the substitution will be divided in the corresponding proportion.
Actual rights enforceability, and corresponding compliance with use rights limitations	The fact that anchovy catch does not significantly exceed the fish quotas established is an indication of good fisheries management based on sound enforcement and compliance.
Harvesting strategies	
Fishing methods and gear	Anchovy fishing takes place along the Peruvian coast area with 1 200 purse seine vessels using a mesh size of 13 mm. Anchovy is also captured by small-scale vessels within a 5mile exclusive fishing area for artisanal fishing. Anchovies are usually caught in the coastal area within 60 nautical miles at depths of less than 100 m.
When fishing is authorized to take place	Fish quotas are allocated per semester to Northern-Centre stock area and the Southern stock area. Fish quotas established for the Northern-Centre stock area are substantially higher than the ones indicated for the Southern stock area.
Harvest controls	In addition to spatial monitoring of vessels, individual vessel recording of harvest is checked against the IVQ on a real-time basis.
Monitoring	Each vessel carries an onboard satellite tracking system – SISESAT, which must permanently transmit geographic vessel position through a GPS.

harvest anchovy species for indirect human consumption. The interest earned from the fund will be reinvested in the fund. The Fund will exclusively finance fisheries management and benefit programmes established in the 2008 law.

A summary of the main attributes of the Peruvian anchovy fishery (*Engraulis ringens*) regime is presented in Table 18.

DISCUSSION OF THE IVQ SYSTEM AND RECENT PERFORMANCE

The property rights system illustrated in this case study seems to improve the incentives for stewardship, conservation and sustained profitability because most of the attributes of non-attenuated property rights seem to be in place in the design of the 2008 fisheries law of Peru.

The IVQ rights-based system described above provides rights exclusivity, a duration of the right regime for ten years, and a warranty contract that provides security of licence ownership. Rights divisibility is allowed, as long as the percentage of maximum catch for the specific vessel that is to be substituted, or its percentage divided up between two or vessels, is not exceeded. Vessel quota rights are non-transferable independently of the vessel unit itself.

Although three years of having the rights-based fisheries management scheme in place might not be sufficient to assess its performance properly, Tveteras, Paredes and Peña-Torres (2011) reported that there have considerable improvements in the fishery as a result of the rights-based management system being put operationally in place since the fishing seasons of 2009.

The initial distributional implications of the 2009 Peruvian fisheries law allowed, under the special fishing regime, industrial vessels to harvest anchovy for indirect human consumption (fishmeal and fish oil) within the 0–5mile limit coastal area. This arrangement involved changing the historic exclusive rights granted to artisanal and small-scale fishers to harvest a high diversity of marine species, including anchovy for direct human consumption within a 0–5mile limit area. However, as noted above, in 2011, the President of Peru abolished the corresponding Supreme Decree No. 003-2008-PRODUCE.

As pointed out by Aranda (2009a), the Peruvian IVQ model aims at stopping the race for fish without allowing the full transferability of rights and thus concentration of wealth among few operators. The current regime provides the possibility of allowing capacity substitution of a withdrawing vessel, which could result in some boat owners deciding to harvest their quotas using fewer vessels. This could involve a reduction in fishing capacity and a corresponding increase in efficiency. However, a highly attractive fishery such as the Peruvian anchovy will tend to foster increases in the price of registered vessels and their associated rights and licences, as the purchase of registered vessels is the only way that outside investors may enter the fishery.

The IVQ system currently in place requires effective surveillance and enforcement mechanisms to yield the expected performance operationally. The IVQ system and its complementary financing instruments strengthens, through cost recovery from stakeholders, the monitoring, control and surveillance of the fishery (Aranda, 2009b).

This new fishing regime is a step in the direction of mitigating unsustainability of fisheries (Seijo, 2008; Seijo e*t al*., 2011) through properly dealing with environmental fluctuations of the Humboldt Current ecosystem, local governance issues and distributional impacts.

The scientific capacity of Peru, through IMARPE, to monitor the state of the Humboldt Current ecosystem and the fishery itself allows for the possibility of having adequate and timely information for establishing fishing seasons per semester and the corresponding TACs for both the North-Centre and Southern stock areas. The existing real-time information system for the anchovy fishery in the Ministry of Production also provides the possibility for following the catch of individual vessels over the fishing seasons. The major challenge seems to be to maintain an efficient and transparent monitoring, surveillance and enforcement system.

10. Individual stakeholder quota management of the hake (*Merluccius gayi gayi*) fishery of Chile

BRIEF HISTORIC EVOLUTION OF THE FISHERY

There is evidence of hake capture in 1930s in the central-southern zone of Chile. Nevertheless, the quantitative available precedents on landings of hake (*Merluccius gayi gayi*) go back to about 1940. According to the Chilean Under-Secretary of Fishing, the development of this fishery was associated strongly with the key role the State played in the process of industrialization and growth of the country at the end of the 1930s.

In the period 1940–45, registered landings did not exceed 15 000 tonnes. In 1946, with the incorporation of industrial vessels, a phase of exponential growth in landings began, achieving maximum harvests of 90 000 tonnes in 1955 and 130 000 tonnes in 1968. In this period, the main destiny of these catches was to be a raw material for the first plants to produce fishmeal that were located in the central-southern zone of Chile, near Talcahuano. The boom in the extraction sector as well as the associated fishmeal production is explained essentially by the application of an economic policy with tributary incentives and dynamic tariff reductions on capital assets, which allowed the blossoming of the fishmeal production sector and the construction of new vessels. However, this intensive expansion resulted in a collapse in the catches, diminishing to levels of 20 000 tonnes at the beginning of the 1980s. At the beginning of the 1970s, a ban was established on using the resource for indirect human consumption, authorizing its harvest only for direct human consumption, with a greater involvement of the State in the production process. The political turmoil in Chile in 1973 also meant a change in public policies, involving: an economic unilateral opening to foreign investment; an aggressive reduction of duties as of 1974; a restitution of private initiative to a leading role in the economy; and the application of policies of open access to fish resources.

This situation resulted, as predicted in fisheries bioeconomic theory (Anderson, 1977; Clark, 1985, Hannesson, 1993; Seijo, Defeo and Salas, 1998; Anderson and Seijo, 2010), to an overinvestment in fleet and plant capacity, with the corresponding resource overexploitation. This resulted in landings falling to 20 000–30 000 tonnes. In 1982, the national fishing authority introduced for the first time the concept of TAC, in addition to other regulations on fishing gear. As a result, in 1983 and 1989, a TAC of 45 000 tonnes was established, which in general was not reached owing to the poor conditions of the stock. Keeping TACs at a low level and the regulation of fishing gear allowed the recovery of the stock after almost a decade.

The 1990s found Chile's economy in good condition, marked by an opening to the global economy reflected in free-trade agreements signed with many nations. The announcement of a new general law of fisheries and aquaculture established the concept of maximum catch limits. The aim was to distribute a given level of the TAC allocated to the industrial sector among stakeholders that have vessels authorized to fish for hake.

The economic prosperity, added to the rebuilding of the stock, influenced an increasing pressure on the part of the extractive and processing sector for an increase

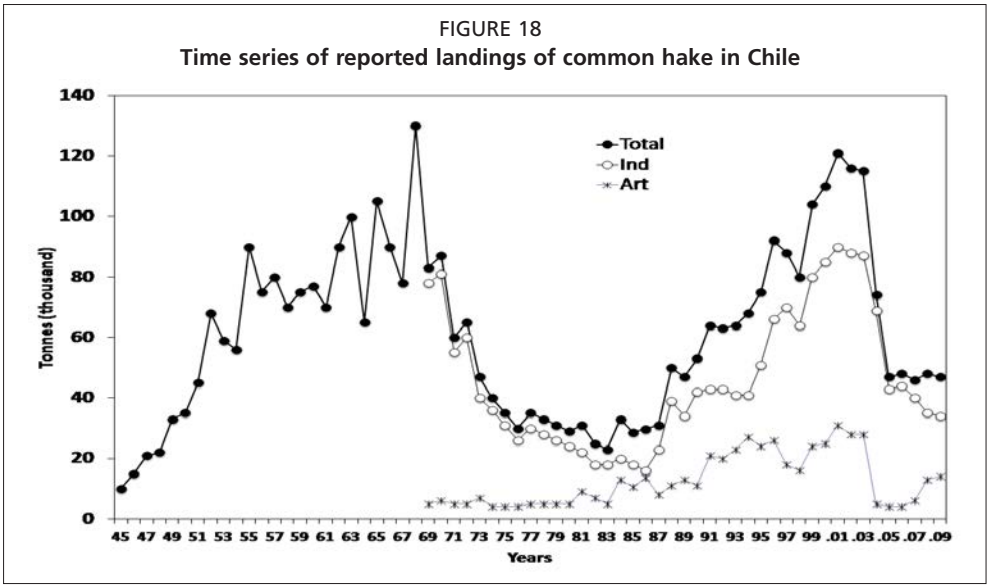
in the TAC. In this period, landings began to be increased until reaching a maximum of 121 000 tonnes in 2001. Landings then suffered a new collapse, a situation that is observed until the present time.

Finally, in December 2011, the Fishing Authority submitted to the Parliament for its discussion a document that modifies the general law of fisheries and aquaculture contained in Law No. 18,892, incorporating for the first time in Chilean legislation the concept of ITQs. This new general law of fisheries and aquaculture was passed by the Parliament on 19 December 2012. A summary of the main attributes of this new law, which is not yet in operation, is presented at the end of this section.

TIME SERIES OF REPORTED CATCH OF COMMON HAKE

The first hake landing records date from the beginning of the 1940s. A predevelopment phase covers the period 1940–46 with catches of about 15 000 tonnes (Figure 18). The growth phase is observed in the historical series from 1947 to 1952, and the full exploitation phase occurred in the period 1953–1961, while the overexploitation phase was between 1962 and 1968. The phase of collapse occurred after a historically observed maximum landing in 1968 of 130 000 tonnes. In this last stage, observed landings fell to about 30 000 tonnes, equivalent to the values observed in the 1940s. Finally, the recovery phase is observed just after 1988 when catches again showed the pace of biomass growth. However, a new fishery collapse occurred in the early 2000s.

FIGURE 18
Time series of reported landings of common hake in Chile

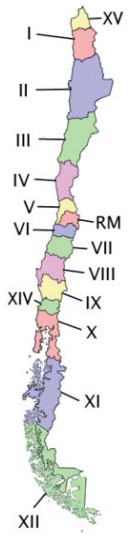


Only since 1969 have catch statistics made the distinction between industrial and artisanal landings. From that year until the early 1980s, the artisanal participation in total landings was low, about 7 000 tonnes. Greater participation in total catch has been observed since 1984, coinciding with the collapse of industrial landings. With the recovery phase and the increase in total landing from 1989, the artisanal sector increased its participation of total landings, reaching 31 000 tonnes, its historical maximum. In the collapse phase in the early 2000s, the artisanal participation decreased to values observed in the 1970s, with landings of only 4 000 tonnes.

SPATIAL DISTRIBUTION OF TARGET SPECIE AND PORT LOCATIONS OF FLEETS

Genetic studies (Hernández, Galleguillos and Oyarzún, 2000) have established that the common hake of Chile is a taxonomic entity other than the Peruvian hake (Woznitza-Mendo and Guevara-Carrasco, 2000).

FIGURE 19
Political subdivision in Chile with distribution of the regions mentioned in the text



It has been determined that there is one population of common hake in Chile (Subsecretaría de Pesca, 2010), which is distributed between 29°S and 47°S, although catches range from 30°S to 41°S (Aguayo, 1994). The main landing ports (Figure 19) are Coquimbo (IV Region), San Antonio and Valparaiso (V Region), Duao and Constitución (VII Region), Talcahuano, Coronel, Tome and San Vicente (VIII Region) and Valdivia (IX Region).

INPUT AND OUTPUT FISHERY REGULATIONS OVER TIME

In its beginnings (1930s), the fishery was in an open-access regime, but the fleet was of artisanal character. A decade later, industrial vessels entered the fishery.

The first TAC regulations were introduced in the early 1980s. In addition, restrictions were introduced on fishing gear, and it was established that the trawl net must have a mesh size not less than 100 mm in the codend.

Since 1991, new entry of artisanal and industrial vessels to the fishery is closed. This has ended the open access regime. In 1995, new management measures affected differentially the fishing effort of artisanal and industrial vessels: mandatory use of longline or gillnet for the artisanal fishers, and bottom trawl net or longline for industrial fishers.

As mentioned above, the fishery has been regulated by catch quotas since 1982, but since 1992 the TAC has been divided between the artisanal fishers and the industrial fleet (Figure 20).

Two years later, the authority decided to divide the fishing season into two periods: January–September and October–December.

By 1997, catch restrictions had been introduced, but in relation to the appearance of hake as bycatch of other fisheries (e.g. in the trawl fishery of crustaceans and stripes). Regulations indicated that incidental harvest of hake catch could not exceed a certain percentage of target species catch.

In 2005, new restrictions on trawling were introduced. For those vessels for which hake was the target, a mesh size of 100 mm was established, equipped on the top panel of the codend with knotless square mesh and a mesh size of at least 90 mm. Similarly, the covered codend was prohibited. For those vessels having other than hake as their target, a minimum mesh size of 120 mm was established.

In 1999, as a result of the early exhaustion of the catch quota, there was a set three fishing seasons per year: January–September, October and November. As shown in Figure 20, since 2001 there has been a TAC for "research fishing". In 2003, the annual TAC was divided in the form of 65 percent for the industrial fleet and 35 percent for the artisanal one.

In the case of the industrial fleet, since 2001, a particular management regime, based on non-transferable individual quotas, called the maximum catch limit per ship owner (MCLS), has been established. The MCLS is the result of multiplying the relative coefficient of participation by a ship owner (expressed as a percentage with seven decimal places) by the total annual catch quota corresponding to the industrial sector,

FIGURE 20
Historical TAC and total landings of common hake in Chile

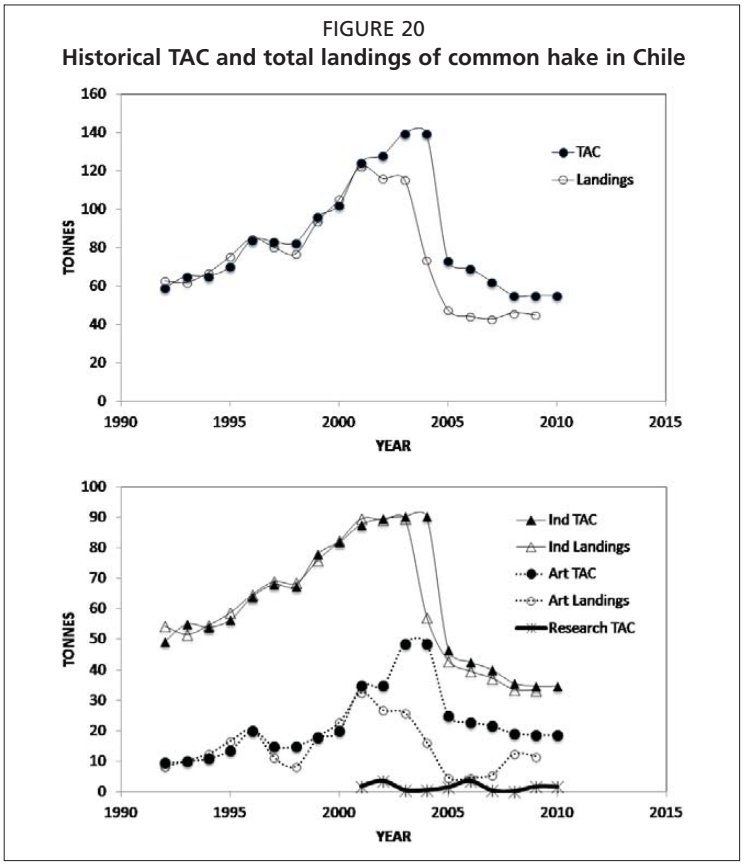


TABLE 19
Artisanal fleets targeting hake resources in different coastal regions of Chile

Region	Quota (tonnes)	Artisanal Extraction Regime by zone	Quota (tonnes)
IV	CTP $_{IV}$	North	CTP $_{IV, North}$
		Centre	CTP $_{IV, Centre}$
		South	CTP $_{IV, South}$
V	CTP $_{V}$	North	CTP $_{V, North}$
		Centre	CTP $_{V, Centre}$
		South	CTP $_{V, South}$
VI	CTP $_{VI}$	North	CTP $_{VI, North}$
		Centre	CTP $_{VI, Centre}$
		South	CTP $_{VI, South}$
VII	CTP $_{VII}$	North 1	CTP $_{VII, North 1}$
		North 2	CTP $_{VII, North 2}$
		Centre	CTP $_{VII, Centre}$
		South	CTP $_{VII, South}$
VIII	CTP $_{VIII}$	North	CTP $_{VIII, North}$
		Centre	CTP $_{VIII, Centre}$
		South	CTP $_{VIII, South}$
IX	CTP $_{IX}$	--	CTP $_{IX}$
XV – X	CTP $_{XV - X}$	--	CTP $_{XV – X}$

expressed in tonnes. According to the law of 1991, to determine the relative catch participation rate for a ship owner, catches of all vessels licensed to the ship owner over a period of two years are divided by the total catches for the same period of all licensed ship owners.

For the case of the artisanal fleet, the allocation of the TAC is more complex to explain as it is indexed geographically. The administrative figure that governs them is called the Artisanal Extraction Regime, that consists of the distribution of the

artisanal fraction of the total quota of catch of a certain region, specified for area, size of the vessels, cove, fishers organization or individually. This is an additional fishery management measure that the authority may establish and that is provided by decree and is applied to fisheries that have their access suspended. For the different country regions, Regions IV, V, VI, VII, VIII, IX, X and XV have artisanal fleets targeting the hake resource. The artisanal quota is then divided in turn by fishing regions and this fraction is subdivided within each region (Subsecretaría de Pesca, 2010; Peña-Torres, 2002a), as shown in Table 19.

Currently, the Artisanal Extractive Regime by fishers organization is operative only for Region V.

On 9 December 2011, the Government admitted in Parliament a number of amendments to the Fisheries Law of Fishing, including the elimination of the transferability of individual quotas. The quota established for industrial ship owners is, at present, non-transferable. This project incorporates aspects such as the transferability of fishing rights, a subject already submitted in the late 1990s and at the beginning of the 2000s (Peña Torres, 1996, 2002a, 2002b), following the classic historical development observed in other fisheries worldwide (Arnason, 2008), which began by assigning individual rights to boats to then evolve to a system based on ITQs.

Throughout this process, the authority has received specialized scientific advice (Payá, 2003). It then decides, in coordination with the National Council of Fisheries, regulatory measures for managing the hake fishery. However, the industrial sector has criticized that independent research sources are excluded from this process.

FISHERY PROPERTY RIGHTS IN PLACE

Exclusivity of participation in the fishery

The current fisheries law in Chile allocates 5 miles from the coast for the exclusive use of the artisanal fishing. In addition, the common hake fishery is declared in full operation and a limited-entry scheme is in place for both industrial and artisanal vessels, not allowing new vessel entry to the common hake fishery (Subsecretaría de Pesca, 2010). In addition, an MCLS is also in place. By law, a TAC must be defined annually to assign 35 percent for the artisanal sector and 65 percent for the industrial one. The TAC allocated to artisanal fishing is exclusive for fishers that at the time of the declaration of full exploitation were properly registered. The artisanal TAC is then subdivided by administrative regions according to the historical participation in the catches, and these are divided in subsectors (Figure 20 and Table 19) in accordance with the Artisanal Extraction Regime (Subsecretaría de Pesca, 2010; Peña-Torres, 2002a, 2002b). In the case of the TAC allocated to the industrial sector, it is divided into parts that correspond to the historical average participation in the fishery (1999 and 2000).

Duration of the right conferred

In the situation of the industrial sector, the MCLS system establishes that each industrial stakeholder will own fishing rights on a fraction of the total TAC, a right that in principle expired on 31 December 2011 (Peña-Torres, 2002b; Glaría, 2010), but was extended for a year. A new draft law was sent to the Congress on December 2011, which could establish another legal figure or a decree to extend the life of the current rights-based system.

Security or quality of the title conferred by the rights

The State guarantees the right, but does not assure the existence of a biomass such that the assigned quota can be found. In fact, in the last few years, the estimated annual TAC has not been caught in its totality (Figure 20).

Transferability of the rights

The fishing rights on the assigned fraction of the TAC are likely neither to be transferred nor to be divided. However, the law states that within the framework of Artisanal Extraction Regime, the holders of assignments will be able to yield the tonnes assigned for the respective year calendar to another holder of the same region or to holders of other regions (Peña-Torres, 2002b). In addition, may hold these legal rights on behalf of one or more artisanal fisher registered in the Artisanal Registry.

Flexibility associated with the use of the rights

The Under-Secretary of Fishing, by means of a resolution, authorizes the concessions described above. Similarly, industrial stakeholders who are subject to the MCLS management regime may yield all or part of the tonnes assigned in the calendar year to an artisanal stakeholder registered in that fishery.

Furthermore, artisanal allocation holders, as a result of the Artisanal Extraction Regime, may yield the tonnes assigned for the respective year to a stakeholder, which must be extracted according to the rules of the industrial sector and within the authorized fishery unit. In this case, the allocations will have a limit of 50 percent of the tonnes assigned each year. Such assignments must be authorized by resolution established by the Under-Secretary of Fishing.

In all the preceding cases, once the allocations are authorized, these are published in the registry of the National Fishery Service. In such cases, the corresponding catch is charged to the original holder of the allocation.

SPECIFICS OF THE RIGHTS-BASED FISHERY

As mentioned above, for all industrial vessels authorized in the licence of a fishing stakeholder the rights are acquired through the observed average catch in the years 1999–2000 while the norm that originated them remains in effect. In any case, the overall TAC for the fishery is determined annually by decree establishing the catch maximum limits. In the case of the artisanal fishing, the Artisanal Extraction Regime has legal support and is of indefinite character until its modification or elimination.

The annual global quota of fishing (TAC) is divided into an industrial section and an artisanal one. Current Chilean legislation indicates the following.

In the case of the industrial quota, the owner of the rights is the industrial stakeholder, defined as a person registered in the industrial registry, that on board executes by its account and risk an extractive fishing activity or one of transformation using one or more fishing vessels or boats of any type, size, design that have to be identified and registered in the registries of the maritime administration.

As for the artisanal sector, the quota is divided into individual quotas for each artisanal stakeholder. The owner of the right is the artisanal stakeholder, defined as an individual who has two small-scale vessels. This stakeholder has a portion of the global quota assigned to the artisanal fleet over which the stakeholder has fishing rights. In addition, a system of coves was established for those who did not want to adhere to the new quota system. Under this additional system, there is specification of what the fishers call a “bagging”, which involves a common quota. At present, Region V Centre is the only zone that works with this management regime (Table 19).

With regard to which component of the population structure could be subject to the rights of fishing, there are no regulations on minimum size of restrictions. (Subsecretaría de Pesca, 2010).

According to the Under-Secretary of Fisheries (2010), fishing common hake must use a minimum diamond mesh size of 100 mm in the codend of the trawl net, with installed square panels of 90 mm of mesh size. The industrial fleet can only operate with bottom trawls or longlines, whereas the artisanal fleet can only operate with longlines or gillnets.

TABLE 20
Summary of the rights-based management regime in place for the common hake (*Merluccius gayi gayi*) fishery in Chile

Main attributes of the access regime	Description
How the rights are conferred and upheld	Rights are acquired through the observed average catch in the years 1999–2000 for all industrial vessels authorized while the norm that originated them remains in effect.
Exclusivity of participation in the fishery	Fishery law allocates 5 miles from the coast for exclusive use of artisanal fishing. In addition, the common hake fishery is declared in full operation and a limited-entry scheme is in place for both industrial and artisanal. A maximum catch limit per stakeholder (MCLS) is also in place. By law, a total allowable catch (TAC) must be defined annually to assign 35 percent for the artisanal sector and 65 percent for the industrial one.
Duration of the rights conferred	Each industrial stakeholder owns fishing rights on a fraction of the total TAC, rights that in principle expired on 31 December 2011. New laws could establish another legal figure or a decree to extend the current rights-based system.
Security or quality of the title conferred by the rights	The State guarantees the right, but does not assure the existence of a biomass such that the assigned quota can be found.
Transferability of the rights	The fishing rights on the assigned fraction of the TAC are likely neither to be transferred nor to be divided. However, the law states that, within the framework of Artisanal Extraction Regime, the holders of allocations are able to yield the tonnes assigned for the respective year calendar to another holder of the same region or to holders of other administrative regions.
Divisibility of the rights assigned	Administrative regions according to the historical participation in the catches subdivide the artisanal TAC, and these are divided as well in subsectors in accordance with the Artisanal Extraction Regime. In the case of the TAC assigned to the industrial sector, it is divided into parts that correspond to the historical average participation in the fishery.
Flexibility in the use of the rights	Industrial stakeholders may yield all or part of the tonnes allocated in the calendar year to an artisanal stakeholder registered in that fishery, or a holder that should extract it in the unit authorized fishery. In both cases, allocations may be made only within the same population unit. Artisanal holders may yield the tonnes allocated for the respective year to a stakeholder, which must be extracted according to the rules of the industrial sector and within the authorized fishery unit.
Actual rights enforceability, and corresponding compliance with use rights limitations	Enforcement is the responsibility of the National Fisheries Service. It is a major challenge to enforce and achieve full compliance in the country's long coastline (> 4 000 km). Monitoring on board the vessels could facilitate controlling discarding, transactions at sea, and the use non-authorized landing sites. These issues make it difficult to ensure execution of the duties that accompany the rights associated to fishing.
Harvesting strategies	
Fishing methods and gear	For vessels for which hake is the target, there is a mesh size of 100 mm, equipped on the top panel of the codend with knotless square mesh and a mesh size of a minimum of 90 mm. Covered codend was prohibited. For those vessels that have as a target other species than hake, the minimum mesh size is 120 mm.
When fishing is authorized to take place	A scheme exists with three fishing seasons per year: January–September, October and November.
Harvest controls	The National Fishery Service (SERNAPESCA) is the state agency responsible for controlling harvest.
Monitoring	The National Fishery Service (SERNAPESCA) is the state agency responsible for monitoring effort and harvest along the Chilean coast.

At present, there is a biological closure between Region IV and parallel 41°S that applies between 15 August and 20 September each year, both dates inclusive. In the closure period, the catch of common hake as bycatch in other regulated fisheries is authorized. In addition, the catch quota is divided into three periods per year: January–September, October and November (Subsecretaría de Pesca, 2010).

Table 20 presents a summary of the rights-based system in place for the common hake fishery in Chile.

DISCUSSION OF THE RIGHTS-BASED FISHERY

In Chile, the main objective of the National Fisheries Authority has been the recovery of the common hake stock in order to increase future catches. The collapse of the observed catch in the past decade led the authority to propose a new management scheme based on the concept of maximum catch per stakeholder. In these terms, the

management scheme has prevented the progressive deterioration of the stock size, although the recovery has been slow. The slowness in this recovery has been attributed to the increased population of the "jibia", a natural predator of the common hake. In fact, various stock assessments indicate that in 2011 the stock is still overexploited (Subsecretaría de Pesca, 2010), so that the long-term effect of the property rights cannot yet be evaluated on their merit, owing to this effect of the increase in predators, which has significantly increased natural mortality of common hake. However, a recovery in the juvenile fraction of the resource has been observed (Subsecretaría de Pesca, 2010), which is a good sign for stock recovery in the medium term. There have not been studies on the effect of hake catch on the ecosystem.

The rights-based scheme under the MCLS concept has not been evaluated from a viewpoint of sustained profitability. In fact, there are no available studies that allow an evaluation of its benefits from the economic point of view. Above all, the industrial sector is reluctant to accept the administrative changes and, initially, the MCLS system was not entirely well received. With time, this perception has been smoothed, especially in light of possible changes of catch quotas that could eventually be transferable. However, the artisanal sector has expressed several objections about how to distribute the TAC between it and the industrial sector. In many ways, the artisanal fishers have felt harmed, although their main objections are oriented to the disappearance of their habits and customs, a critique that points at the disappearance of forms of life and culture that they would prefer to keep, which is not reflected in the fisheries legislation. In this respect, they argue that there has not been a discussion of which elements of the current fishing regime of common hake are to be maintained and which ones modified.

In terms of research, Chile has strong scientific and technical support in the evaluation of stocks (Payá, Ehrhardt and Aguayo, 1998; Payá, 2003; Cubillos, Arcos and Sepúlveda, 2003), where the role of the Fisheries Development Institute (IFOP) and universities has been essential. Fishery management and the corresponding enforcement and compliance mechanisms are solid, although with criticism from the actors associated to fishing. There are regional and national councils where stakeholder consultation takes place concerning management decisions to be implemented. These participatory processes seem essential for achieving institutional support for fishery management measures. Enforcement is the responsibility of the National Fisheries Service. It is a major challenge to enforce and achieve full compliance along the country's long coastline (more than 4 000 km). Monitoring on board the vessels could facilitate controlling discarding, transactions at sea, and the use of non-authorized landing sites. These issues make it difficult to ensure execution of the duties that accompany the rights associated to fishing.

Although it has not been declared a priority by the authority, bioeconomic studies are a route of interesting fishery research. As has been shown in other national resources, such as nylon shrimp (Pérez, 2005), the limitation of the catches is a necessary condition but not a sufficient one to make the use of a fishery resource efficient. Indeed, the erosion of the economic benefit in certain conditions is an expectable effect of a system of quotas (Caddy and Mahon, 1995; FAO, 1996). In terms of sustainability the use of maximum economic yield as a target reference point (*sensu* FAO, 1996), is more precautionary that the maximum sustainable yield (Anderson 1977; Anderson and Seijo, 2010).

Finally, there are two challenges for fishery administration:

- To harmonize the artisanal fisheries right of exclusive use of the first 5 miles offshore with the coastal reality of Chile, which has a narrow continental shelf, making operations by industrial vessels impractical when targeting certain resources. In fact, in Chile, only in Region IV there is harmonic understanding between the two sectors (industrial and artisanal) in order to allow the "perforation

of 5 miles" in such a way that the industrial fleet can fish within 5 miles resources that are not exploited by the artisanal fleet, a reality that is not observed in other regions of the country.
- To balance the interest of the fishing authority for sustainability and resource conservation with the interests of the artisanal users of preserving, along with the resource, their traditions and way of maintaining their social and cultural interactions (Glaría, 2010).

FINAL REMARKS

At the closing of the final edition of this technical paper, a new fisheries law was approved by the Chilean Parliament (19 December 2012). This law establishes important modifications to national fisheries regimes. However, because of its state of collapse, the common hake fishery was excluded from some rules approved in the new law, which relate, primarily, to the conditions for the tender of catch quotas. In summary, the new legislation:

- declares sovereignty by the State on all fishery resources of the country;
- declares the maximum sustainable yield as a target reference point, with the express purpose of "... to obtain the greatest catches without putting at risk the availability of resources in the medium and long term...."
- declares the fractioning of the fishing quotas, with 55 percent of the total for the artisanal fleet and the remaining 45 percent for the industrial, with the exception of some species of crustaceans and cod;
- declares the first mile from the coastline for the exclusive operation of boats of less than 12 m overall length, while protects five miles for fishing by the artisanal fleet (boats up to 18 GRT);
- requires the certification of landings for all vessels of more than 12 m in length;
- sets a payment of patents for artisanal vessels of larger size;
- sets a term of 20 years for tradable fishing licences (TFLs) for the industrial sector, renewable and revocable, while that for the artisanal sector continues with indefinite fishing permits;
- for the quota of the industrial fraction of fully exploited fisheries, a TFL is allocated and based on the MCLS fishing licences (licence class A). These licences class A have a duration of 20 years and are renewable, revocable, divisible, transferable, and susceptible to any legal business. Up to 15 percent of these licences can be bid, generating licences class B.

In the specific case of the common hake, there will not be an open auction market for a period of 5–7 years, which is the estimated period needed for this species, currently collapsed, to exceed 90 percent of the maximum sustainable yield.

A motion of unconstitutionality of the new law has been accepted for processing by the Constitutional Court. Depending on the decision of this court, the enactment of the new law could be delayed or be modified in its structure.

11. Community territorial use rights in the Gulf weakfish (*Cynoscion othonopterus*) fishery of the Gulf of California, Mexico

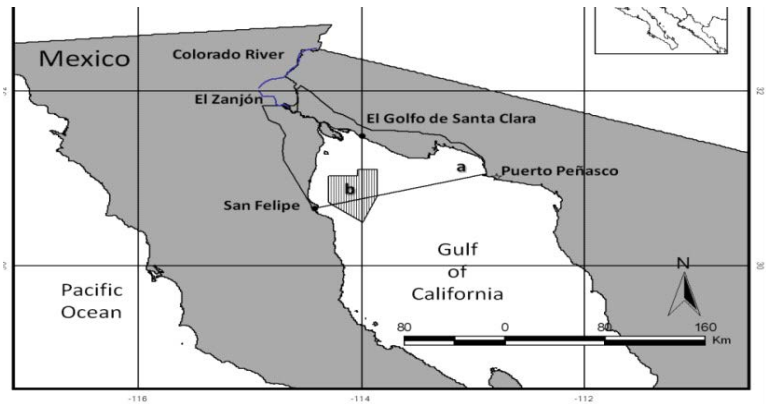
FISHERY DESCRIPTION

Small-scale fisheries are sources of income, both cash and in-kind, but they are also carried on for other reasons including traditions, recreation, identity and religion (Arce-Ibarra and Charles, 2008; Navarro-Smith, Tapia-Landeros and Garduño, 2010; Salas *et al.*, 2011).

The fishery of the Gulf weakfish, *Cynoscion othonopterus* (Jordan and Gilbert), is a small-scale fishery located in the Gulf of California, the most productive fishing area of Mexico. It is carried on for commercial and subsistence purposes but also as part of the ancestral traditions of the Cucapah (Cocopah) indigenous people (Navarro-Smith, Tapia-Landeros and Garduño, 2010; ANAD, 2010; Navarro-Smith, 2011). This fishery is considered the second-most important finfish fishery of the Gulf of California in terms of both volume of landings and economic value (Román-Rodríguez, 2000; IAES, 2011).

In particular, the fishery takes place in the upper Gulf of California, a biocultural region with two marine natural protected areas: the Biosphere Reserve Upper Gulf of California and Colorado River Delta (RBAGDC), and the Vaquita Refuge Area (RVM) (Figure 21). Four coastal communities have traditionally participated in this fishery, two from Baja California (San Felipe and the indigenous Cocopah fishing camp known as "El Zanjón") and two from Sonora (El Golfo de Santa Clara, and to a lesser degree, Puerto Peñasco). In this region, the industry is little developed and, therefore, the majority of local people pursue fishing as their only form of livelihood (Rodríguez-Quiróz, 2008).

FIGURE 21
Gulf weakfish fishery study area



Notes: (a) Biosphere Reserve Upper Gulf of California and Colorado River Delta, and (b) Vaquita Refuge Area. The three communities that participate in the Gulf weakfish fishery are also shown (San Felipe, El Golfo de Santa Clara, and Puerto Peñasco).

The Gulf of California is acknowledged for its high biodiversity including a high degree of endemism of marine species, some of them having a status of threatened and in danger of extinction (DOF, 1994a, 1994b, 2002; IUCN, 2004). One of its endemic species is the Gulf weakfish, which was part of the several open-access commercial fisheries from this region that posed a risk upon the viability of the populations of two endangered species, a marine mammal known as the vaquita (*Phocoena sinus*) and the totoaba (*Totoaba macdonaldi*) (Rojas-Bracho and Taylor, 1999; IUCN, 2004; DOF, 2007b; SEMARNAT, 2008; Barlow *et al.*, 2010). These attributes of the region resulted in necessary conservation policies implemented in the area with agreement of many scholars and environmentalist NGOs but with insufficient consultation with local fishing communities (Ruíz-López, 2009; ANAD, 2010; Navarro-Smith, Tapia-Landeros and Garduño, 2010; Navarro-Smith, 2011). Therefore, both, conservation policies and fishing regulations in place, including spatial management, are not well accepted by local fishers, including the indigenous Cocopah people. As a result, this fishery is acknowledged by stakeholders as both complex and sensitive given that multiple competing management objectives are simultaneously in place (Díaz-de-León and Seijo, 1992).

C. othonopterus is a demersal species with seasonal migrations toward the upper Gulf of California area, seeking lower salinity waters at the Colorado River Delta, in its reproductive season. It is in its reproductive aggregations that local fishers capture this species using gillnets, usually from February to April. This biological attribute makes the population of this species as very vulnerable to fishing, as well as a natural candidate for potential overfishing. Several studies report that this species is also used within a sport fishery that operates in the coastal waters of Baja California.

Brief historic evolution of the fishery

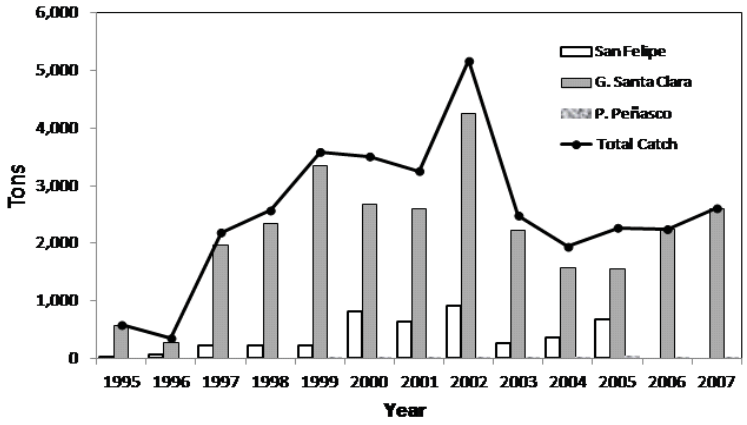
Although there are no fishery statistics prior to the 1990s, Fitch (1949) reports that, from 1917 to 1940, this species was caught in the upper Gulf of California by local fishers and exported to California, the United States of America. More recently, in the early 1990s, just after the crisis of the blue shrimp fishery occurred in this region, the Gulf weakfish fishery was established again (Román-Rodríguez, 2000). Therefore, two periods are recognized for this fishery, one before 1990s and on from 1990s onwards. This study focuses on the latter period.

Time series of reported catch of target species and incidental catch

The target species in this fishery is the Gulf weakfish (*C. othonopterus*). Other species that occur in the incidental catch are the "chano" or Gulf croaker (*Micropogonias megalops*) and several species of sharks (*Rhizoprionodon longurio*, *Alopias* sp., *Sphyrna* sp., *Isurus oxyrhinchus*, and *Carcharodon carcharias*) (Román-Rodríguez, 2000). In turn, the Gulf weakfish is also a bycatch species in the fishery of the Gulf croaker (IAES, 2011).

The time series reported here correspond only to the target species (Figure 22) because no time series were found for the incidental catch of this fishery. The data shown were taken from Rodríguez-Quiróz (2008), who in turn reports that his data were obtained from the fishing offices of SAGARPA of Sonora and Baja California. This author also reports that these official fishing data do not take into consideration a variable amount of catch that each fisher put aside every fishing trip, a catch that could be used either for self-consumption or for later trade. This in turn contributes to having unreported catches in this fishery, every fishing season.

FIGURE 22
Reported catch of Gulf weakfish, 1995–2007



Notes: Time series (in bars) of reported catch to San Felipe, El Golfo de Santa Clara, and Puerto Peñasco. Total catch is represented by the continuous line.
Source: Catch records obtained from Rodríguez-Quiróz (2008).

Another source of unreported catch comes from the captures obtained from the fishing camp El Zanjon (IAES, 2011), a remote site acknowledged by current regulations as an official landing site for the Gulf weakfish (DOF, 2007b). However, although Navarro-Smith (2011) reports that Cocopah fishers based therein have already started to fill in the form to report their daily catch, its remoteness makes it difficult for the fishing authorities to systematically obtain catch records from it.

This commercial fishery is relatively new, with a time series encompassing about a decade. From this short period of reported catch, the only striking characteristic is that it peaked in 2002 at 5 169 tonnes (Figure 22). The majority of the reported landings come from El Golfo de Santa Clara because it is located closest to the areas wherein the reproductive aggregations of this species primarily take place, which are areas with the highest fish abundance (Rodríguez-Quiróz, 2008).

Historical evolution of fishing effort

As happens in many small-scale fisheries worldwide, several studies report that both fishers with and without a fishing permit participate in this commercial fishery (Román-Rodríguez, 2000; Ruíz-López, 2009). However, only the number of fishing permits being used per year is known. This data-sparse situation in fishing effort contrasts with the time series on catch statistics, which are readily reported by several authors.

With respect to an overall evolution of the fishing effort for El Golfo de Santa Clara, in 1996, the community had registered only ten fishing cooperatives; however, in 2007, this number increased to 64 (Ruíz-López, 2009). In particular, in 2007, there were a total of 463 fishing permits issued for finfish fishing, including Gulf weakfish.

At the community of San Felipe, Baja California, in 2006, there were a total of 15 fishing cooperatives registered with 315 fishing permits issued for finfish. Of this number, 295 fishers belonged to cooperatives and the remaining 20 to "permisionarios" (i.e. owners of several outboard fishing boats) (Rodríguez-Quiróz, 2008).

With respect to Puerto Peñasco, in 2006, the cooperativist fishers held 175 finfish fishing permits and the "permisionarios" 24, making a total of 199 permits (Rodríguez-Quiróz, 2008).

In the literature on this fishery, it was noted that the remote site El Zanjón was the location with the fewest data on both catch statistics and fishing effort. According to

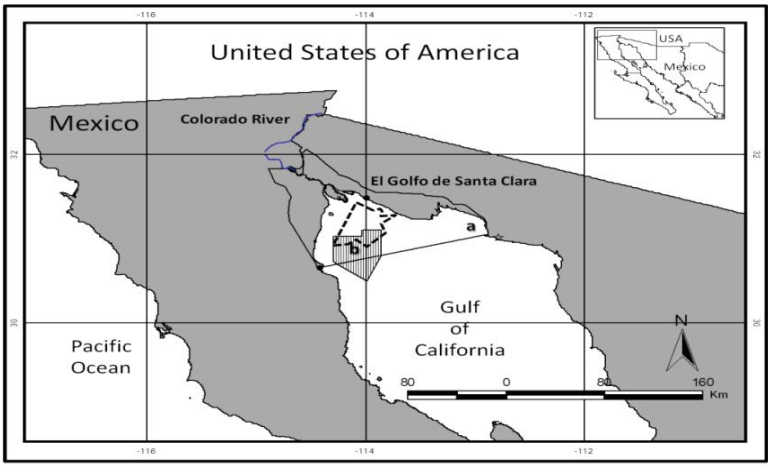
ANAD (2010), in 2008, there were a total of three fishing cooperatives operating at this fishing camp using 50 outboard fishing boats, each having its own fishing permit. The total number of fishers belonging to these cooperatives who were based at this site was 75. The Cocopah fishers acknowledge that their target and most-valued species is the Gulf weakfish.

Spatial distribution of target species and port location of fleets targeting the species

The spatial distribution of the Gulf weakfish is reported to be from the mouth of the Colorado River, to La Paz, Baja California (Román-Rodríguez, 2000). Several studies report on the spatial distribution of the fishing fleets targeting this species, which slightly varies among authors. However, a general agreement among them is that the fishery takes place primarily in the two protected areas, the RBAGDC, and the RVM.

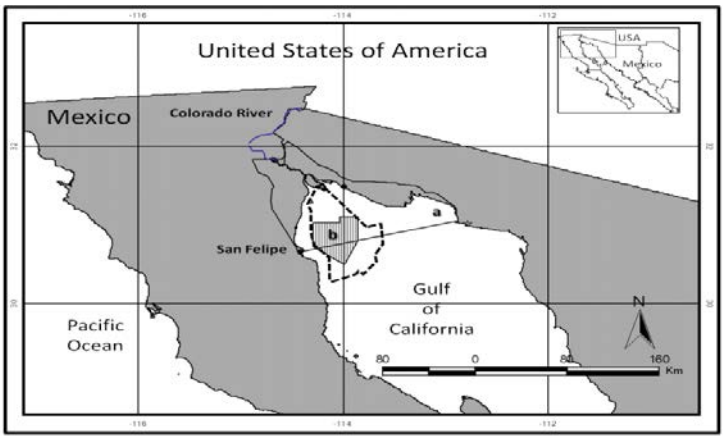
Rodríguez-Quiróz (2008) undertook a social survey interviewing fishers from three coastal communities to determine the spatial distribution of their fishing fleets targeting Gulf weakfish. The following data were redrawn from this author, and show the spatial distribution of the fishing fleets from El Golfo de Santa Clara (Figure 23), San Felipe (Figure 24), and Puerto Peñasco (Figure 25), as well as a pooled area comprising the fishing fleets from these three sites (Figure 26). Port location with respect to target species stock distribution and its corresponding source and sink areas are critical for the performance of closed fishing areas in spatial management of fisheries (Seijo and Caddy, 2008).

FIGURE 23
Spatial distribution of the fishing fleet targeting Gulf weakfish from El Golfo de Santa Clara



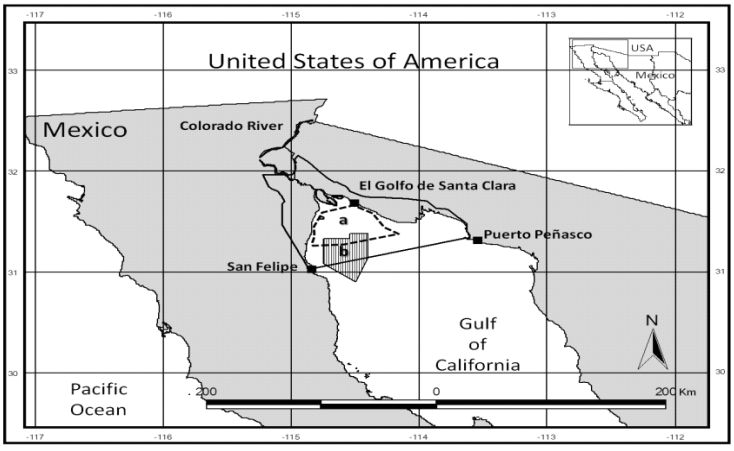
Notes: Dotted lines indicate spatial distribution of the fishing fleet. (a) Biosphere Reserve Upper Gulf of California and Colorado River Delta, and (b) Vaquita Refuge Area.
Source: Redrawn from Rodríguez-Quiróz (2008).

FIGURE 24
Spatial distribution of the fishing fleet targeting Gulf weakfish from San Felipe



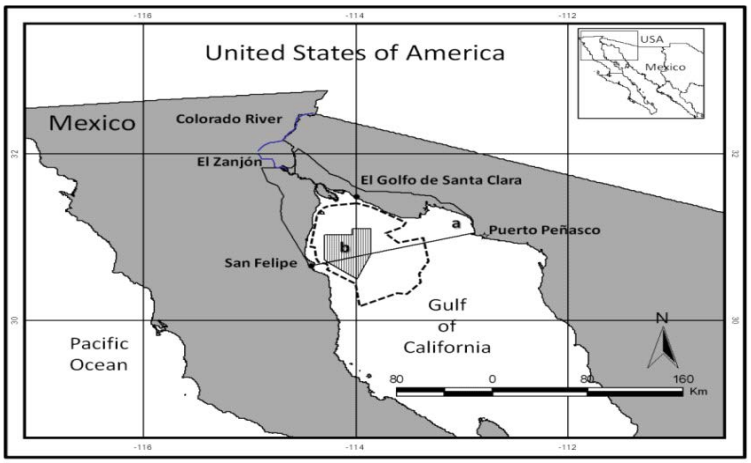
Notes: Dotted lines indicate spatial distribution of the fishing fleet. (a) Biosphere Reserve Upper Gulf of California and Colorado River Delta, and (b) Vaquita Refuge Area.
Source: Redrawn from Rodríguez-Quiróz (2008).

FIGURE 25
Spatial distribution of the fishing fleet targeting Gulf weakfish from Puerto Peñasco



Notes: Dotted lines indicate spatial distribution of the fishing fleet. (a) Biosphere Reserve Upper Gulf of California and Colorado River Delta, and (b) Vaquita Refuge Area.
Source: Redrawn from Rodríguez-Quiróz (2008).

FIGURE 26
A pooled area of the spatial distribution of the fishing fleet targeting Gulf weakfish from three communities (El Golfo de Santa Clara, San Felipe, and Puerto Peñasco)



Notes: Dotted lines indicate a pooled area of the spatial distribution of the fishing fleet. (a) Biosphere Reserve Upper Gulf of California and Colorado River Delta, and (b) Vaquita Refuge Area.
Source: Redrawn from Rodríguez-Quiróz (2008).

Input and output fishery regulations over time

In the early 1990s, no specific regulations had yet been established to this fishery; therefore, it was considered an open-access fishery. From 1993 to 2011, several regulations were issued, including spatial management established at newly decreed protected areas together with fishery regulations (Table 21). Currently, the fishery is considered a regulated limited-entry fishery with territorial user rights allocated to fishing communities, with a management plan that is under development.

Of the conservation and management regulations in place, the most sensitive topic among the fishery managers (federal institutions, including the Procuraduría de Federal de Protección al Ambiente [PROFEPA], CONAPESCA, CONANP and SAGARPA), and the fishers is spatial management. In particular, the RVM overlaps with previous fishing areas acknowledged as important to Gulf weakfish. The debate intensifies with the nucleus zone of the RBAGCDRC, located at the mouth of the Colorado River. It is an area where most fishing is forbidden, but it is the area wherein reproductive aggregations of the Gulf weakfish primarily take place – it is the area with the highest fish abundance (Ruíz-López, 2009; ANAD, 2010; Rodríguez-Quiróz, 2008; Navarro-Smith, Tapia-Landeros and Garduño, 2010; IAES, 2011). Moreover, the Cocopah people also claim this area as their ancestral land in which to fish (ANAD, 2010; Navarro-Smith, Tapia-Landeros and Garduño, 2010).

TABLE 21
Conservation and management regulations in place in the Gulf weakfish fishery

No.	Conservation/management	Authority
1	Decree of the Biosphere Reserve Upper Gulf of California and Colorado River Delta (RBAGDC)	DOF (1993)
2	Management plan of the RBAGDC	SEMARNAP (1995)
3	Closed fishing season for Gulf weakfish	DOF (2005a)
4	Agreement to establish the Vaquita Refuge Area (RVM)	DOF (2005b)
5	Protection programme for the RVM	DOF (2005c)
6	Specific management measures for Gulf weakfish	DOF (2007b)
7	Harvest quota set for the 2011–12 season	DOF (2011)

FISHERY PROPERTY RIGHTS IN PLACE

Exclusivity of participation in the fishery

User rights help in clarifying both who can go fishing and who is affected by management (Charles, 2002). According to the Mexican Official Norm, NOM-063-PESC-2005, which regulates the exploitation of Gulf weakfish in the natural protected areas, three coastal communities have exclusive rights to participate in this fishery. These communities are El Golfo de Santa Clara in Sonora, and San Felipe as well as some fisher organizations from the Lower Colorado River Area including the indigenous Cocopah community from Baja California. However, a literature review reveals that, although to a lesser extent, a fourth community (Puerto Peñasco) also participates in this fishery.

In particular, the NOM-063 authorizes only three exclusive landing sites for Gulf weakfish: El Golfo de Santa Clara, San Felipe and the indigenous fishing camp known as El Zanjón (DOF, 2007b). Therefore, this regulation acknowledges a customary and implicit right allocated to fishers and their boats based at these three communities.

With respect to the direct users of Gulf weakfish, which is part of the finfish multispecies fishery of the Gulf of California, it was found that in Mexico there is no finfish species-specific fishing permit. Rather, any fisher with a fishing boat (registered at the National Registration of Fishing and Aquaculture) and a fishing permit to capture finfish, as well as any permisionario with the same type of permit, is entitled to fish for this species. Therefore, each finfish fishing permit of any boat located at the three landing sites mentioned above provides a right to participate in this fishery.

The fishers of multispecies finfish including Gulf weakfish are organized as follows. Most belong to the social sector, including several types of cooperatives and social organizations whose members are locally called "pescadores cooperativados" (cooperativist fishers). There is also the private sector, with entrepreneurs called permisionarios. These own several boats with fishing gear and, every fishing season, they hire fishers to work their boats. Finally, there are "pescadores libres" or "free fishers", who, in contrast to the other two groups, operate without fishing permits and, therefore, are engaged in illegal commercial fishing (Ruíz-López, 2009). They are an unknown number of "free riders" who contribute to have both illegal and unreported fishing.

Duration of the rights conferred

Whenever a fishing permit for finfish is issued for the first time, it has a duration of two years. However, it can be renewed "n" number of times, each renewal being valid for five years (DOF, 2007c).

Security or quality of the title conferred by the rights

The holders of a finfish permit who have not infringed the fishing regulations in place in the period covered by their permit, and who have fulfilled several of their obligations, including the delivery of monthly catch records to the local fishing office ("Subdelegaciones de Pesca"), have a secure fishing title for the period covered by the fishing permit. However, the security of this title would be dependent upon the fishery objectives and the guidelines set at the fishery management plan for any species (DOF, 2007c). More specifically, the stocks of the target species need to be monitored annually before new fishing permits are issued. For example, should the technical population assessment of the targeted species undertaken by INAPESCA provide evidence that there is enough fishing biomass to issue new or to renew the current fishing permits, the CONAPESCA would grant them.

Transferability of the rights

The fishing permit and therefore the fishing right is not transferable except when the entitled person or owner dies. Should this happen, the authority (CONAPESCA) in charge of issuing permits would give priority to grant an inherited permit to the person previously designated by the late owner (DOF, 2007c). This inheritable right scheme, if properly promoted among the current entitled persons, could be viewed as a long-term incentive to small-scale fishers to protect the stock of their target species that will be eventually caught using the inheritable permit as a fishing right. Concerning divisibility of the rights assigned, in Mexico, rights are assigned through fishing permits (DOF, 2007c).

RIGHTS ENFORCEABILITY

Current rights enforceability

In general terms, in Mexico, legislation that regulates the access, use and management of the fishery resources lies in the General Law on Sustainable Fishing and Aquaculture (or LGAPS). The authority responsible of the application of this legislation is SAGARPA (Ministry for Agriculture, Livestock, Fishing and Food). To this end, INAPESCA and CONAPESCA (two administrative bodies of SAGARPA), undertake the several duties, and to some extent enforce the regulations, as stated at the LGAPS, on fishing and aquaculture. The former is in charge of coordinating and leading scientific and technical research on fishing and aquaculture, and also of devising and updating the National Fisheries Charter, a management instrument for fishing and aquaculture in Mexico. However, most of the enforcement on fishing regulations is conducted by PROFEPA.

To assist in fishery management, the Government of Mexico has also devised an instrument called Mexican Official Norms (NOMs) used to regulate the most economically valuable fishing resources. In the case of the Gulf weakfish, the NOM that sets the regulations on minimum size by species, together with the type of fishing gear authorized to be used, is NOM-063-PESC-2005 (DOF, 2007b). Moreover, whenever the management of any species is within a natural protected area, as is the case with Gulf weakfish, its enforcement falls to both CONANP and PROFEPA. In all enforcement activities, the Secretaria de Marina (SEMAR – the navy) assists in monitoring and detecting any illegal activity undertaken at sea.

With respect to actual rights enforceability for this fishery, PROFEPA staff have been monitoring it so that all fishers are aware that enforcement of the regulations is in place (IAES, 2011). However, very often, enforcement had been undertaken *in situ* either at the departure harbour (reviewing the fishing permits) or at the closed areas of the RBAGDC; in both cases, with fishers targeting Gulf weakfish outnumbering the PROFEPA staff. The latter situation interferes and partially halts the normal progress of the fishing season, and fishers become upset (Román-Rodríguez, 2000; IAES, 2011).

Until 2000, there was little control on the finfish landing sites to ensure that the exclusivity of landing sites for Gulf weakfish, as specified in the Diario Oficial de la Federación (DOF, 2007b), is complied with (Román-Rodríguez, 2000).

Compliance with use rights limitations

For entitled fishers, there are responsibilities as well as fishing rights (FAO, 1995; Charles, 2002). In general terms, the commercial fishery of the Gulf weakfish is relatively new, with about a decade of commercial boom. In this regard, its fishery management system is still under development – a management plan for this fishery is about to be published.

Currently, user rights limitations on this fishery comprise biological, ecological, spatial and time restrictions, as well as limitations on the fishing gear used. Although no in-depth monitoring studies addressing compliance with these limitations have been

found, several authors report that the limitation that is least complied with is spatial management, represented by two sensitive areas, the nucleus zone of the protected area RBAGCDRC and the RVM. With respect to the former, the Cocopah people claim that they only have about 50 fishing permits, which allow them to catch about 5 percent of the catch quota and, therefore, their activity does not pose any risk to the stock of the Gulf weakfish (ANAD, 2010).

The limitation that is the second-least-complied-with is the closed season, which should be observed from 1 May to the end of August (DOF, 2005a). However, records show that fishing for this species occurs also in May and June.

Specifics of the rights-based fishery

The fishing rights are conferred by the federal government (CONAPESCA) to individuals through a fishing permit. However, these people should either be a member of a cooperative or be a permisionario. Moreover, the management also states that entitled persons should land their fish exclusively either at El Golfo de Santa Clara in Sonora, or at San Felipe and the indigenous fishing camp El Zanjón (DOF, 2007b).

In theory, these rights are upheld if the entitled person complies with all the regulations devised for the management of Gulf weakfish.

These rights are defined by the federal government (CONAPESCA) and decreed by the President of Mexico through the Federal Gazette. However, defining who has the right to use the specific finfish resource is a topic that has been rarely addressed in official documents in the scholarly literature related to this fishery. The exception to this is the Fishing Law or LGAPS, which states that fishing permits (including finfish fishing permits) can be an inheritable right. Therefore, any descendant or relative of a current fishing permit holder can be considered a person who could potentially be a fishing right holder. Apart from this, the internal regulations of the fishing cooperatives are the ones that determine whether new members are allowed to in or not. Once admitted, a new cooperative member is acknowledged to have the full potential right to ask CONAPESCA for a fishing permit.

The fisher with fishing rights on Gulf weakfish is granted the right to fish once INAPESCA has set the annual catch quota for this species. This quota is not allocated by communities or by any group of users, neither is a quota that could be transacted in markets. For the fishing season 2011–12, the catch quota was set at 2 300 tonnes live weight (DOF, 2011). However, according to the fishing regulations reviewed, this catch quota should be landed exclusively at the above-mentioned three sites.

At the time of landing, the catch of this species should consist of whole specimens (i.e. no portion of the body should be missing) of a minimum standard length of 65 cm. This minimum size restriction tolerates about 35 percent of specimens below 65 cm (DOF, 2007b).

According to NOM-063 (DOF, 2007b), there is no restriction on the size of the boat used but only on the fishing gear used, with only one monofilament gillnet (with a mesh size of 5.75 inches [14 cm] and 293 m long) per boat on every fishing trip. In addition, one handline per fisher in the boat is allowed. In general terms, most of the fishers use an outboard boat 7–10 m long, with two or three fishers participating in every fishing trip (Rodríguez-Quiróz, 2008; Ruíz-López, 2009).

The fishing trips targeting this species should take place only during daylight with a closed season set from 1 May to 31 August (DOF, 2005a, 2007b).

PERFORMANCE OF COMMUNITY TERRITORIAL USE RIGHTS IN THE GULF WEAKFISH FISHERY

The designation of three communities as exclusive landing sites for the Gulf weakfish is an important start in devising a property rights system to fishers participating in this fishery. If the system is well implemented and enforced, it can readily turn an

open-access fishery into a limited-entry fishery with territorial user rights allocated to fishing communities. The current entitled fishers should be given a certificate as "stewards of their right to fish" which, if well administered, will result in several types of income, namely cash, in-kind and cultural income. Moreover, they should improve the stewardship upon an existing natural capital represented by a dynamic stock of Gulf weakfish, which in order to be able to provide any fishing biomass to entitled persons needs to emigrate for reproduction, recruitment and growth.

TABLE 22
Summary of main attributes of rights-based management regime in place for the Gulf weakfish (*Cynoscion othonopterus*) fishery

Main attributes of the access regime	Description
How the rights are conferred and upheld	Fishing rights are conferred by the federal government (CONAPESCA) through a fishing permit to individuals, who should either be a member of a cooperative or be a "permisionario". Current management also states that entitled persons should land their fish exclusively at three communities (El Golfo de Santa Clara in Sonora, or at San Felipe and the indigenous fishing camp El Zanjón, both in Baja California). These rights are upheld if the entitled person complies with all the regulations devised for the management of Gulf weakfish.
Exclusivity of participation in the fishery	Each boat (and therefore fishers) based at the three exclusive landing sites mentioned in (i) having a finfish fishing permit has a right to participate in this fishery.
Duration of the rights conferred	Whenever a fishing permit is issued for the first time, it has a duration of two years. It can be renewed "n" number of times, each renewal having a validity of 5 years.
Security or quality of the title conferred by the rights	If the holder of a fishing permit has not infringed the fishing regulations in place during the period covered by his/her permit, and provided he/she has fulfilled several of his/her obligations, he/she has a secure fishing title for the period covered by the fishing permit. However, the security of this title would be dependent upon whether there is enough fish abundance to comply with the fishery objectives, as well as with the management regulations in place.
Transferability of the rights	The fishing permit and therefore the fishing right is not transferable except when the entitled person or owner dies. Should this happen, the authority (CONAPESCA) in charge of issuing permits would give priority to grant an inherited permit to the person previously designated by its former owner.
Divisibility of the rights assigned	In Mexico, fishing rights are assigned through fishing permits that are indivisible.
Actual rights enforceability, and corresponding compliance with use rights limitations	Most of the enforcement of fishing regulations falls to a federal institute called PROFEPA. However, CONAPESCA also participate in enforcing aspects related to fishing permits, and CONANP checks that spatial management at the protected areas is being complied with. In all the enforcement activities, the navy (or Secretaria de Marina [SEMAR]) assists in monitoring and detecting any illegal activity undertaken at sea. Most use rights limitations are complied with except spatial management and, to a lesser extent, time regulations (i.e. the closed season). In this fishery, several implicit competing management objectives are in place.
Harvesting strategies	
Fishing methods and gear	Fishing is done using outboard boats 7–10 m long with two or three fishers participating in every fishing trip. There is no restriction on the size of the boat used but only on the fishing gear, with only one monofilament gillnet (with mesh size opening of 5.75 inches [14 cm] and 293 m long) per boat on every fishing trip. In addition, one handline per fisher in the boat is allowed.
When fishing is authorized to take place	The fishing trips targeting Gulf weakfish should take place only during daylight with a closed season set from 1 May to 31 August.
Harvest controls	This fishery is relatively new with about a decade of boom; therefore, it has no limit catch level or predetermined harvest control rules yet. Its management plan is still under development.
Monitoring	The stock of the Gulf weakfish need to be monitored annually to set the catch quota as well as to assess whether new fishing permits can be issued. More specifically, should the technical population assessment of the targeted species undertaken by INAPESCA provide evidence that there is enough fishing biomass to issue new or to renew the current fishing permits, CONAPESCA would grant them.

In spite of the many important research efforts undertaken by the INAPESCA and the several regional research institutions, the fishery dynamics of Gulf weakfish are not yet fully known. Therefore, the management system is still under development and is in need of more research. For example, although there has been some progress in management with the setting of an annual catch quota, the fishery does not have a limit catch level or predetermined harvest control rules (Anderson and Seijo, 2010).

Moreover, there is a need for target and the limit reference points to protect the stock from overfishing (IAES, 2011).

With regard to administration, and given the complexity of this fishery, administration could be improved if managed through species-specific permits instead of the current general fishing permit scheme (Román-Rodríguez, 2000; Rodríguez-Quiróz, 2008; IAES, 2011). Afterwards, a thorough fishery monitoring plan schedule (for stock assessment, catch records and enforcement) needs to be devised and agreed upon with stakeholders. Finally, a fishery management plan needs to be devised wherein the competing fishery objectives should be stated explicitly (Díaz-de-León and Seijo, 1992).

When properly established, the development of TURFS within local fishing communities can lead to effective management control and rights-based operation, resulting in successful management (Beddington, Agnew and Clark, 2007; Hilborn, Orensanz and Parma, 2005). In addition to the community territorial use rights in place, to overcome many of the fisheries management challenges reported in this study case, it seems necessary to achieve a genuine participatory process of rights-based governance aimed at increasing security and reducing poverty for the fishers involved (Allison *et al*., 2012).

Table 22 presents a summary of the main attributes of the current rights-based regime in place for the Gulf weakfish fishery.

12. Individual effort quotas of artisanal communities in the multispecies fishery at Coiba National Park, Panama

FISHERY DESCRIPTION

The multispecies finfish fishery at Coiba Island, Panama, is relatively recent. Used as a prison from 1912 to 2004 (ANAM, 2009), the island was declared a national park in 1991 with legislation increasing its level of protection in 2004. A management plan was approved in 2009 (National Gazette, 2009) after the National Authority of the Environment (Autoridad Nacional del Ambiente [ANAM]), the Panama Maritime Authority (Autoridad Marítima de Panamá [AMP]) and MarViva, an international NGO, worked together to establish and implement the management plan in collaboration with local leaders. After housing about 800 prisoners for almost a century, Coiba Island is now uninhabited. The marine area of Coiba National Park covers more than 2 000 km^2 and the management plan allows artisanal, subsistence and sport fishing by mainland users in some areas (ANAM, 2009).

Brief history of the fishery

For many years, artisanal fishers from the mainland have targeted crustaceans (e.g. lobster, crab and shrimp), molluscs (e.g. conch and scallop), sharks and finfish (e.g. snapper, mackerel, drum, grouper, snook, jack and mullet) in the entire region, including the current Coiba National Park buffer zone and marine resources management zone (MRMZ). The management plan currently allows artisanal fishers to catch all these resources inside the buffer zone, but only finfish can be caught in the MRMZ. Previously, the area's high biological productivity attracted industrial fleets from Panama and other Central American countries. These worked the waters near Coiba Island, targeting shrimp with bottom trawlers, and sharks and finfish with longlines. This ended with implementation of the 2009 management plan, which banned all industrial fishing activities inside the protected area.

Landing records are kept by the AMP, but these do not include detailed landings records per community in Veraguas and Chiriqui provinces, which impedes construction of a landing series data history. Instead, the AMP records landings in the principal ports, about 600 tonnes annually for Veraguas and Chiriqui (Maté, 2005). Because landing records do not include place of origin, it is currently impossible to determine what portion of the catch is from Coiba National Park, other parts of the Gulf of Montijo or the Gulf of Chiriqui. Maté (2005) emphasized the need to keep detailed, trustworthy and current records to fill the data gaps that prevent effective management of area marine resources.

Its high marine biodiversity, presence of top predators and high species richness in a variety of marine ecosystems highlight the fact that Coiba is not an isolated or unconnected system. Fishers use both the Gulfs of Chiriqui and Montijo, targeting several finfish species in different fishing grounds. Strong biological connectivity between Coiba marine and coastal ecosystems makes it vital to identify catch origin.

The keeping of catch records for the entire area that include specific area of origin data will make it possible to generate population and community indices. These can then be integrated into analyses to produce precise stock assessments using an ecosystem approach with complementary data on different life-cycle stages and fish assemblages.

History of fishing effort

Artisanal fisheries began in the Coiba area in the 1980s. Fishers caught finfish species inside what is now the national park area of influence, including the current marine reserve, MRMZ and buffer zone. Fishers from the area of influence continued to enjoy essentially open access even after creation of Coiba National Park and up to 2002 (Crête, 2006). After years of consensus building and social integration of fishing regulations, fishers from communities in the area of influence formed the Coiba Artisanal Fishers Network, which endorsed and supported the Sustainable Artisanal Fishing Subprogramme contained within the Coiba National Park Management Plan (ANAM, 2009). This network encompasses fishers from 16 communities in Veraguas Province and three in Chiriqui Province. People from these communities have fished in the entire area for decades, although pressure is increasing on the area's marine resources as more people shift from agriculture to fishing (Crête, 2006). About 400 fishers from 19 coastal villages habitually use the park area of influence, that is, the buffer zone. However, the management plan allows only 47 artisanal boats (235 fishers) to fish the MRMZ. Artisanal fishing in the MRMZ is permitted with several restrictions on traditional practices to reduce the impact on marine resource populations and ecosystems.

In 2002, Veraguas Province had 44 fishing communities, with 1 108 artisanal fishing boats, making it the second-largest artisanal fishing fleet in Panama (Maté, 2005). Artisanal fishers wishing to fish in delimited zones must register their boat at the park station or the ANAM office in Santiago. Artisanal fishers from the Coiba National Park buffer zone use wooden boats with outboard engines. Traditional fishing gear includes nylon monofilament, braided nylon cord, fishing nets, gillnets, purse seines, harpoons and sticks. Gillnets and harpoons are no longer permitted in the MRMZ.

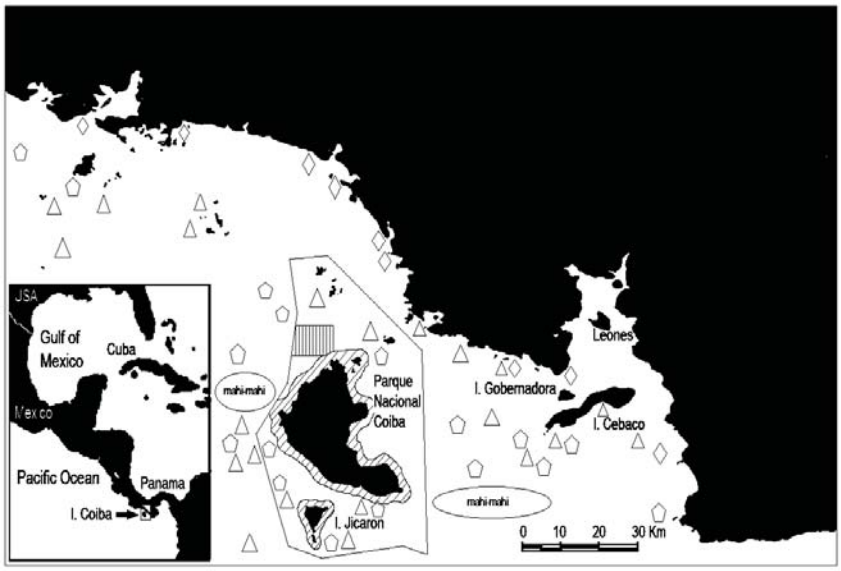
Target species spatial distribution and port location of fleets targeting these species

Coiba National Park is not an independent marine ecosystem. It protects biodiversity and remarkably well preserved marine ecosystems that provide large shelter and nursery areas for myriad marine species, including highly migratory species such as sharks, tuna, and mahi-mahi, and commercially important species such as shrimp, snapper, grouper, jack and mackerel. Regional biological and ecological connectivity is so high that a significant impact on some "subpopulations" in Coiba National Park could affect productivity in the same species outside the park, as well as other species groups in the region. In an integrated study, Maté (2005) identified the main occurrence areas for the most important commercial fisheries: shrimp, anchovy, herring, lobster, squid, demersal fish and general finfish (grouper, snapper, mackerel and mahi-mahi) (Figure 27). The presence of all these species in the area suggests the existence of strong ecological interactions between multiple groups. These interactions create complex fish assemblages, creating favourable conditions for high regional biological productivity through strong connectivity. Monitoring these ecological interactions could be done using ecological monitoring and modelling to generate estimates for ecosystem productivity and surplus fishing production, and thus provide guidance when working towards sustainable fisheries. Finally, protection of reproductive stages would require documentation of the gonad maturity process in the principal species.

There are no fishing ports or villages in Coiba National Park; indeed, it is uninhabited by law. A key provision when the park protection level was increased via Article 5 of

Panama Law No 44 (26 July 2004) was to forbid several activities in Coiba National Park, such as human occupation, logging, industrial fishing, hunting, agriculture, mining and oil exploration, sewage discharge, introduction of non-native species, and building infrastructure other than for scientific purposes or ecotourism activities. The ports harbouring the fleets targeting marine species in Coiba National Park are located in different corregimientos (municipalities) throughout the buffer zone (Figure 27). The most important fishing ports in Chiriqui Province are Pedregal and Remedios, and in Veraguas Province they are Mutis, Bahía Honda and Vidal. Other fishing villages in the buffer zone include Hicaco, Gobernadora and Leones. Most of the fishers with licences for Coiba National Park are from Bahia Honda (187 inhabitants), Isla Managua (77 inhabitants) and Isla Canales de Tierra. A survey of fishers in the Gulfs of Montijo and Chiriqui found that 100 percent of those from Bahia Honda, Pedregal, Vidal and Vacamonte fished in Coiba National Park, while less than 80 percent from other ports (e.g. Mutis, Remedios, Pixvae, Gobernadora, Sta. Catalina, Cebaco, Aguadulce and Hicaco) used the park. Fishers from ports as far away as Vacamonte, an industrial port in the Gulf of Panama 370 km from Coiba, use the park. All the fishers in the area sell their catches at Puerto Mutis or Puerto Remedios; which port they use depends on their proximity at the end of a fishing trip (Crête, 2006).

FIGURE 27
Buffer zone and Coiba National Park polygon



Notes: The marine resources management zone is located between the marine reserve, a 1.8 km strip around Coiba and Jicaron islands (diagonal lines), and the national park polygon border. Inside the park, a subzone is reserved solely for longline fishing of mahi-mahi. The principal ports inside the buffer zone are indicated by black points, and finfish species distribution is indicated with geometric shapes (triangle = snappers, pentagon = groupers, rhombus = drums.
Source: Modified from Maté (2005).

FISHERY RIGHTS

The Coiba National Park management plan is primarily intended to conserve and protect biodiversity and all ecosystems (marine and terrestrial) in the park. It acknowledges the rights of people living in the area of influence, and allows them to engage in artisanal fishing and ecotourism in the park. The plan establishes 5 programmes and 11 subprogrammes. The Natural and Cultural Resources Programme includes four subprogrammes: Historical Resources; Cattle Control; Soil Conservation; and Sustainable Artisanal Fisheries.

The Sustainable Artisanal Fisheries Subprogramme involves fishers from the area of influence in the discussion and design of fisheries regulations. One of the subprogramme's main objectives is to guarantee sustainable use of fishing resources by issuing licences and permits, establishing catch quotas, effort quotas, no-take zones and season closures. Artisanal and sport fishing is allowed only in the MRMZ, located between the marine reserve or no-take zone and the park border. Locals are allowed to engage in subsistence, artisanal, and sport fishing (recreational and tourist). Regulations allow extraction of only three types of target species: snapper (*Lutjanus peru*, *L. guttatus*, *L. colorado*, *L. argentiventris* and *L. novemfaciatus*); grouper (*Epinephelus cifuentesis*, *E. niphobles* and *Cephalopholis acanthistius*); and dolphin fish or mahi-mahi (*Coryphaena hyppurus*). Some Scombridae, Haemulidae, Scianidae and Carangidae species are permitted as bycatch; for example, wahoo (*Acanthocybium solandri*), snook (*Centropomus* sp.), tuna (*Thunnus* sp.), grunts (*Haemulon* sp.), jack (*Caranx* sp.) and eels (Ophidiidae). The three primary closed seasons every year are for snapper (1 January–30 April) and mahi-mahi (1 March–31 May, and 1 September–31 October). Snapper can only be caught using lines with no more than 15 circle hooks (minimum 10/0 size). Each fisher can use just one line, with no machinery other than a pulley. Groupers can be caught with vertical lines with no more than 15 circle hooks (minimum 13/0 size). As with snappers, each fisher can use a single line and only a pulley. Mahi-mahi can be caught using longlines with no more than 500 circle hooks (minimum 13/0 size). In this case, each boat can use only one longline, and it must be anchored to the bottom.

As mentioned, fishing is allowed only in the MRMZ, and it is not permitted in the marine reserve or no-take zone. No matter their purpose (artisanal, sport or research), all vessels entering park waters must have fishing licences issued by ANAM. Boats used for subsistence fishing are not required to have a licence. Every fisher intending to use the park must fill out an "Individual Fisher Record" form provided by the park administration. Each form is valid for one calendar year (January–December). In addition to the licence and form, all boats must request a fishing permit for each trip into park waters. Each boat can receive up to two fishing permits per month, each valid for a single trip of no longer than ten days.

Exclusivity of fishery participation

In 2004, the Panama National Assembly created a Council of Directors to govern Coiba National Park. The council consists of 12 representatives from institutions, local governments, civil society and the scientific community of Panama. ANAM chairs the council and manages financial resources in the area. Article 12 of the Coiba National Park Law mandates establishment of a Commission for Sustainable Fisheries within the MRMZ (Figure 27). Known as the "Fisheries Commission", its main purpose is to prepare fisheries regulations for the MRMZ and define guidelines and policies for marine resources conservation and use. After approval by the Council of Directors, these regulations, guidelines and policies are included in the management plan. The General Office of Marine and Coastal Resources (Dirección General de Recursos Marinos y Costeros [DGRMC]) of the Panama Aquatic Resources Authority (Autoridad de los Recursos Acuáticos de Panamá [ARAP]), convenes and chairs Fisheries Commission meetings. Article 13 of the Coiba National Park Law establishes Fisheries Commission membership composition. Of its 11 members, 5 must represent fisheries sectors and 3 government agencies (AMP, ANAM and SENACYT).

In 2009, the Council of Directors set the maximum number of boats for fishing in the MRMZ at 47. Exclusive fishery rights were then granted via 47 licences issued to boat owners who had fished at least once in the park in that year. These 47 boats were selected from a list of 140 boats owned by fishers from different villages in the park's area of influence. This baseline was established using fishery data from 2006

and 2007, and under the principle that only boats that had previously fished in the national park would receive fishing permits. This agreement was ratified by fishers in 2007. The average number of fishers per boat is five, so 235 fishers are estimated to use the park. According to the Coiba National Park Law, licences entitle the holders to fish the area only if they know and abide by marine protected area regulations. It also guarantees licence holders that no unlicensed fishers will use the area. This principle may seem obvious, but is vital considering that small-scale fisheries in the region have historically been managed under an open-access system, which still prevails in other regional fisheries, including the buffer zone.

When Coiba Island was declared a marine protected area for its valuable ecosystems and natural resources located near the mainland, ANAM, scientists and MarViva identified the most critical threats to conservation as being overfishing and destructive fishing practices, at both industrial and artisanal scales. Once the management plan had excluded industrial fishing (i.e. vessels > 30 feet [9.15 m] with engines > 55 hp) from the area, the next step was to control small-scale fishing. To socially integrate the management plan and involve fishers from all regions, the Council of Directors, through the Fisheries Committee, organized several workshops. The intention was to demonstrate to artisanal fishers the importance of preserving natural capital, and to open discussions about different ways to reduce fishing pressure. Initially, the fishers were reluctant to change their viewpoints and behaviour. They argued that giving up their traditional methods, such as fishing anywhere and anytime without gear restrictions, would negatively affect their income. The same argument was given in response to the proposal to reduce the amount of gear used and to stop the use of gillnets and harpoons. It took the government representative some time to help the fishers understand the benefits of the marine protected area regulations. For example, it was explained how no-take zones near mangroves and large areas of controlled fishing mortality would function as a biological reservoir. This reservoir would provide recruits for portions of the area, including those surrounding the buffer zone where fishing is allowed, directly benefiting fishers. The social integration process often evolves in unexpected ways, leading to concern among marine protected area advocates about the amount of time required. Experience shows that the shift from open access to exclusive rights requires an adaptation period after which new regulations will be fully understood and adopted. Change can be slow in some cases, depending on social conditions and the resources available to implement changes. Final results will depend on advocates' lobbying skills and their ability to influence other stakeholders.

Trust and enforcement are fundamental to the success of new regulations. An effective enforcement strategy guarantees regulation accomplishment, which ensures that fishers follow the guidelines they have agreed to. Substantial enforcement resources have been allocated to Coiba National Park, motivating fishers to follow and support the regulations. Seven patrol boats make daily trips through the no-take and buffer zones. In addition, the limiting of licences to 47 and stiff penalties for infractions help to prevent illegal practices and make it very attractive for fishers to request fishing permits for the MRMZ.

The next pending matter for the Fisheries Committee is to use hard data to calculate the maximum allowable effort within the national park considering the conservation and sustainable use objectives of the management plan.

Duration of conferred rights

Fishing mortality in Coiba National Park is highly controlled by the issuing of an individual, one-year licence per boat. In addition, permits allow for a maximum of 20 days a month in the park to be used in two 10-day trips. All boats must renew their licences annually (calendar year). Depending on demand and availability, new boats

can obtain licences and thus maintain maximum allowable effort. Boat owners with pending fines or a record of illegal fishing are not allowed to renew the licences for their boats.

Security or quality of the title conferred by the rights

Before the MRMZ management plan was published, ANAM and the fishers were in constant conflict. Fishers fished freely in the national park, and ANAM personnel had just one boat to patrol the entire park. This thin enforcement coverage left national park zoning unclear to fishers, who were unsure as to exactly where fishing was banned. In addition, they were uninformed about the regulations and thus unclear as to which of their traditional practices were legal and which were illegal. Once the MRMZ management plan was endorsed in 2009, the first legal actions against illegal fishers demonstrated that sanctions were severe. Fishers understood that the Coiba fisheries were in fact organized and controlled. For example, "failure to comply with rules results in revocation of a vessel's fishing licence for 'a reasonable period of time', which varies according to infraction seriousness" (Crête, 2006). This clear support for management plan regulations ensured that licences and permits were perceived and functioned essentially as titles guaranteeing the fishing rights of those who held them. In conjunction with enforcement, fishing licences and permits in Coiba National Park are high-quality management instruments.

Rights transferability

Fishing rights at Coiba National Park are granted only via licences and permits from the AMP to users. Licences are non-transferable between users, and limited to one year. User who want to renew a licence once it expires must request a new licence for the following year. Permits are also non-transferable and must be requested every time a licence holder wants to fish in the park (20 days maximum per month). If a licence or permit is revoked due to regulation non-compliance, the vacancy is granted to the next registered fisher, pending approval by the Fisheries Committee. Although apparently strict, these practices are legitimate and contribute to controlling fishing pressure effectively.

Divisibility of assigned rights

Fishing rights in Coiba National Park are allocated to persons who demonstrate legal ownership of a boat, and either fished in the park in 2006 and 2007 or have the intention of fishing in the park. Because the Coiba National Park Law assigns all licence rights and privileges to the boat owner, there is a shared responsibility between boat owner and the fishers onboard. If the fishers do not follow regulations, both the fishers and the boat owner will be subject to penalties. However, licences and permits also have the effect of protecting the fishers onboard a boat as long as they comply with regulations. Given that licences and permits are non-transferable, the rights and protections enjoyed by their holders are non-divisible.

Flexibility of rights use

The fishing rights instrument within Coiba National Park Law is inflexible, as illustrated in the above examples. The moral force behind the law and highest legal authority in Coiba National Park is the Council of Directors, which is the channel for all conflict resolution. Because the Council of Directors and the Fisheries Commission consist of representatives from fisheries sectors, institutions, government, civil society and academia, the regulations and actions established in the law are accepted and legitimate. All legal procedures established in the management plan for the MRMZ provide users and authorities with clear rules for the conservation and sustainable use of park marine resources. Both park officers and fishers can appeal to the Council of Directors to

clarify any possible misinterpretations, constituting a check on any abuse of authority against users. Although some fishers do not agree with park regulations because finding new fishing grounds outside the park is challenging, they do acknowledge that catches had been declining over time before adoption of the management plan. As mentioned above, the shift from open access to exclusive fishing rights is not easy for fishers, but this will benefit them in the long run by attaining and maintaining sustainable fisheries.

RIGHTS ENFORCEABILITY

Coiba was declared a national park in 1991, but environmentalists considered it merely a "paper park" in the next 18 years because of lack of enforcement (AECI, ICONA and INRENARE, 1996). ANAM had to struggle with a reduced staff, a single patrol boat and limited financial resources to patrol the entire protected area (Crête, 2006). Even after the park law was modified to establish fishing regulations and sanctions, open-access fisheries prevailed in the protected area and buffer zone. Enforceability is key to guaranteeing the success of the controlled effort system, and it must be well implemented from the outset. In Coiba, it was not until 2009, when the management plan was approved and endorsed, that effective fisheries enforcement truly began in the national park.

Current rights enforceability

The Compliance Monitoring and Enforcement Programme is the last programme in the management plan of the Coiba National Park. It establishes the objectives, specific goals and actions needed to implement effective enforcement and indicates the human resources, vehicles, boats, equipment, facilities and financial resources available to achieve them. Of particular importance is the detailed description of the six marine surveillance rounds to be followed by park guards. These rounds were strategically planned to fulfil different purposes, including natural resource protection, patrol of specific geographic limits, and providing help and support to fishers and visitors. Meeting programme goals and objectives depends heavily on the park's fleet of seven boats (one with a 200 hp engine, six with a 100 hp engine), all equipped with a satellite navigation system, radios, first-aid kits, and buoys. Programme financing includes fleet maintenance and patrol operation costs. It also describes coordination procedures with the National Police, National Aeronautical Service and MarViva Foundation. The instruments provided for in the Compliance Monitoring and Enforcement Programme effectively ensure fisher rights (see above).

Compliance with use rights limitations

Before the Coiba Island became a marine protected area, it formed part of a series of fishing grounds used by three industrial fleets targeting shrimp, tuna, shark and finfish in the Central American Pacific. It was also part of fishing grounds used by a small-scale fleet targeting finfish and shark. Industrial fishing is now prohibited in the park by the management plan, which allows just 47 small-draft vessels. Penalties for poaching are severe, and fines for illegal fishing can be up to US$500 per boat and licence revocation. The number of poaching fines has decreased since 2008, indicating that this approach has improved regulation compliance. Now that fishers understand that enforcement is effective, they make a serious effort to follow park fishing practice recommendations. They are also frequently report illegal activities to park authorities. For example, it was fishers who in 2008 warned park guards of the presence of industrial tuna vessels. Park authorities have since fined several industrial vessels for fishing in the park.

SPECIFIC ELEMENTS OF THE RIGHTS-BASED FISHERY

The Coiba rights-based fishery is perceived as legitimate because fishers and park authorities share the management plan vision and mission. Their general concern

about fishing resource and biodiversity status in the park led them to adopt a fishing rights approach (see above). The resulting fishing rights system arose from active interaction between stakeholders with apparently divergent interests: conservation vs use. Radical positions and inflexibility could very easily have led to a breakdown in negotiations; for example, if conservationists had insisted on an overall fishing ban or if fishers had rejected any regulation at all. During negotiations, the starting point included both positions, and discussions eventually led the stakeholders involved to agree to an intermediate point between the extremes. Both parties acknowledge the other's goals and claims. Both positions were genuine, legal and ethical: conservation of unique natural heritage, and historical fishing rights. The rights-based approach was a compromise that allowed both parties to be satisfied with the final results. It is an example of how to reach a satisfactory solution that meets the end purpose of sustainability. This solution relies heavily on enforcement, which is costly, and gives highest priority to rights compliance over objectives (Nyamu-Musembi and Cornwall, 2004). This is the case despite a negative cost-benefit analysis or if it affects a minority (Montenegro, 2007). However, non-market values must be factored into any cost–benefit analysis of this approach, including prior existence, legacy, indirect use and option values. The declaration of the Coiba area as a World Heritage Site in 2005 demonstrates its importance to Panama, and the world.

A lack of sufficient data to calculate maximum allowable fishing effort for the Coiba area led the Council of Directors to endorse the Fisheries Committee's recommendation to set a maximum number of licences based on fishery records. Detailed monitoring of boats fishing in the park in 2006 and 2007 produced a total of 47 boats, which was fixed as the licence limit (see above). Use of the licences and the regulations governing them were agreed to by stakeholders. A licence holder may use it for one year and renew it for the following year. If a licence holder does not use the licence during this year, the licence cannot be renewed for the following year. Non-compliance with regulations leads to licence revocation. A boat owner on the waiting list can then apply for the available licence. Of the 47 issued licences, 22 are currently for boats out of Chiriquí and 25 for boats from Veraguas (Montenegro, 2007). Fishing effort in the park will probably decline gradually over the next 20 years, as people shift economic strategies from fishing to tourism (Montenegro, 2007). Given this process, fishing rights in the park can be considered a response to fisher interests and their existence in the area.

Use rights for specific finfish resources are assigned by boat, the basic fishing effort unit in the area. The number of fishers (five), amount of gear, number of trip days and species quotas are quantified by boat. Thus, the five fishers on a boat can use the fishing rights assigned to that boat, whether or not the owner is on board. The Fisheries Committee establishes fishing techniques, gear and maximum quotas per species, according to average fish weight and size, seasonality and fishing areas. Legal definition of the boat as the unit of fishing effort allows authorities better control of fishing effort and mortality.

Species quotas do form part of the management plan, but establishing them is an ongoing process. No legal minimum sizes have been established for any species. Instead, this is managed through gear and access restrictions designed to protect juvenile finfish stages, particularly those of snappers and groupers. In the past, the high operational costs of fishing in the park drove fishers to take as much of as many size classes as possible. Market conditions also rewarded taking of smaller snappers as prices were PAB1.5/lb for fish of 1–2 lbs (< 40 cm length), while PAB0.8/lb was paid for larger snappers. The minimum reproductive size for snapper is 55–60 cm (both males and females) (Vega, 2007). To avoid overexploitation of immature snappers, park regulations established a minimum hook size of 10/0; although Vega (2006) states that a more suitable hook size is 11/0. In addition,

banning gillnets considerably reduces juvenile mortality and bycatch. The no-take zone (1.8 km strip around Coiba Island from shore to sea) is mainly intended to protect mangrove and other essential marine habitats vital to larvae and juvenile fish development. Park zoning and season closures also protect adult stages, particularly in reproduction sites. For example, there are two season closures (March–May and September–October) designed to protect mahi-mahi reproductive processes, and one to protect snapper (January–April). Groupers can be caught all year. Other no-take zones in the management plan include Banco Anibal, Montuosa and Isla Brincanco. These appear to be effective as most surveyed fishers stated that they had maximum finfish catches near these no-take zones, mostly from October to December (Montenegro, 2007).

IMPLICATIONS OF THE INDIVIDUAL EFFORT QUOTA FOR IMPROVING INCENTIVES FOR STEWARDSHIP, CONSERVATION AND SUSTAINED PROFITABILITY

For more than 20 years, Coiba area finfish resources were subjected to uncontrolled exploitation. A lack of historical data and research means there is no way of proving resource overexploitation. Nonetheless, available fishery landing records suggest it is a very productive zone, and, therefore, a precautionary approach needs to be applied to promote sustainable use of the area's marine resources. When the new regulations were implemented, fishers were affected in two main ways: those who benefited from the licences had to adjust their effort (i.e. their costs) to maintain profits, while those without licences experienced a significant reduction in profits (Crête, 2006). Because of effective enforcement and temporal restriction (one year) of fishery rights, licence holders reap significant benefits. This provides significant incentive for licence holders to use better fishing practices and maintain accurate records.

Fishers who have been excluded from fishing access at Coiba have been pressing authorities for compensation for loss of these fishing grounds. Mitigation of this impact of the management plan has come in the form of development and retraining projects. In 2006, the United Nations Development Programme (UNDP) approved a six-year project, Multiphase Sustainable Development for Chiriqui Province Program (UNDP Project No. 52224 [UNDP, 2102]), with funding (USD29 647 561) from multiple sources (Panama Government, Panama Canal Authority, Inter-American Development Bank, UNDP funds and Spain UNDP funds). Its main objective is to create balanced development in Chiriqui Province, and it focuses on all the productive sectors in Chiriqui, including fisheries. In 2011, the national Agricultural Development Ministry granted USD570 000 to 30 fishers who had lost their jobs as a result of fishing effort restrictions in Coiba National Park. This programme is intended to retrain those affected in alternative livelihoods, such as ecotourism or other small ventures. In 2012, the national government announced additional grants to fishers in the form of USD750 000 to develop more retraining projects within this programme.

Both the Council of Directors and Fisheries Committee expect fisher profits to improve if fishing trips are well planned. As they no longer feel the pressure to catch all sizes classes indiscriminately in order to attain a profitable catch, they can maximize their catch and reduce costs, generating increased profits, even with gear restrictions. Montenegro (2007) projected that over the next 20 years the number of licensed boats will decrease, CPUE will increase, fishing trip costs will drop and fish prices will rise. Over this period, this scenario represents a net revenue increase per boat of more than 130 percent (t_1 = 23 percent, t_2 = 12 percent, t_3 = 8 percent, t_4 = 7 percent ... t_{20} = 4 percent). Because profits will increase most in the first three years (t_1 = 23 percent, t_2 = 12 percent, t_3 = 8 percent), it is expected that licence holders will actively defend their fishing rights.

Target species and ecosystem effects of current rights-based system

The new rights-based management system in Coiba National Park contributes to maintaining healthy ecosystems. Organization of fishing resources reduces fishing pressure, allowing stock restoration. Significant reductions in finfish landings from essential habitats, and controlled fishing mortality in other areas, will help to rebuild stocks and ecosystems. Market prices are usually highest for top predators, particularly in tropical ecosystems. Excessive extraction of these taxa affects other taxa with ecological interactions such as predator–prey or competition, eventually producing trophic cascade effects. In a comparison of seven reef systems in the Mexican Caribbean, Rodríguez-Zaragoza and Arias-González (2008) demonstrated that changes caused by fishing in coral reef ecosystems modified food-web size components, resulting in habitat loss and compromising ecosystem resilience. In areas where fishing intensity was highest, the food web was compressed, reducing species richness and diversity indices. As more-profitable top predator species are depleted due to overexploitation, fishers increasingly target less-valuable species in lower trophic levels, such as generalist piscivores, omnivores, herbivores, zooplanktivores and/or benthivores. The ecosystem then begins to degrade rapidly.

The current rights-based system in Coiba National Park promotes fish assemblage restoration, and thus supports healthy ecosystems. The system also generates a source–sink dynamic in which protected areas export fish to other areas (in or outside the park) where fishing is permitted, providing direct benefits to fishers. This is supported by fisher reports of high catches near Coiba National Park protected areas (see above).

Implications for fisher distribution

Although the rights-based system in Coiba National Park is producing ecological and economic benefits, it has also apparently had a significant effect on fishing effort distribution through a reduction in the fishing fleet exploiting the area. About 700 fishers used the area in the past, but this has dropped to 235 after implementation of the rights-based system – a 66 percent reduction. If the number of jobs produced by the fishery is considered a social benefit, this reduction in fishers can appear to be a rather serious impact of transition to the new system. However, a fishery's social benefits extend beyond job creation to aspects such as profits and job quality. Open access generally leads to profit reduction in fisheries owing to excessive investment in fishing effort; in other words, labour overcapacity leads to a deterioration in labour conditions.

Fishers in the buffer zone have used the waters around Coiba Island for more than 30 years, during which time the number of fishers in the Coiba National Park buffer zone have increased (Crête, 2006). This has been a disorderly increase, with very few data on fish stock status being collected in this period. Within this historical context, the redistribution of fishing effort begun by implementation of the rights-based fishery is more a removal of excess effort than a policy of systematic exclusion. Limiting of access logically raises the question of who has the right to participate in the Coiba National Park fishery. Historical rights are the most common way of addressing this challenge, but these had not been established for the Coiba National Park area. The solution was to create historical rights by documenting use in 2006 and 2007 (see above). The fact that the rights-based system redistributed fishing effort, affecting 66 percent of former users, has been acknowledged and the national government is addressing this effect by offering credit for retraining fishers in alternative economic activities (see above). However, there is the risk of this subsidy system becoming distorted if appropriate training and mentoring are not provided.

OPERATIONAL REQUIREMENTS: RESEARCH, ENFORCEMENT, ADMINISTRATION AND CURRENT FISHING OPERATIONS

When the Government of Panama and NGOs decided to promote significant changes to Coiba National Park management practices in order to begin recovering its valuable ecosystems, they faced daunting challenges, including social opposition, administrative inertia, fishing sector interests and limited funds.

TABLE 23

Summary of main attributes of rights-based management regime in place for the multispecies fishery at Coiba National Park

Main attributes of the access regime	Description
How the rights are conferred and upheld	All vessels entering park waters must have fishing licences issued by the National Authority of the Environment (ANAM). The maximum number of boats per year is 47. These boats are selected from a list of 140 boats owned by fishers from different villages in the park's area of influence. Fishing rights in Coiba National Park are allocated to persons who demonstrate legal ownership of a boat, and either fished in the park in 2006 and 2007 or have the intention of fishing in the park. Licences entitle holders to fish the area only if they know and abide by marine protected area regulations.
Exclusivity of fishery participation	Exclusive fishery rights are granted via licences issued to boat owners who fished in the park at least once in the previous year. Limiting participants makes it very attractive for fishers to request fishing permits for the marine resources management zone (MRMZ). Support for management plan regulations ensures that licences and permits are perceived and function essentially as titles guaranteeing the fishing rights of those who held them.
Duration of the rights conferred	Individual boat licences are effective for one calendar year (January–December). In addition, permits allow for a maximum of 20 days a month in the park to be used in two 10-day trips.
Security or quality of the title conferred by the rights	In conjunction with enforcement, fishing licences and permits in Coiba National Park are high-quality management instruments. Trust and effective enforcement strategy guarantee regulation accomplishment, which ensures that fishers follow the guidelines they have agreed to.
Rights transferability	Licences are non-transferable between users. Users wanting to renew a licence once it expires must request a new licence for the following year. Permits are also non-transferable, and must be requested every time a licence holder wants to fish in the park. If a licence or permit is revoked due to regulation non-compliance, the vacancy is granted to the next registered fisher, pending approval by the Fisheries Committee.
Divisibility of the rights assigned	Licences and permits are non-transferrable; the rights and protections enjoyed by their holders are non-divisible.
Actual rights enforceability, and corresponding compliance with use rights limitations	Substantial enforcement resources have been allocated to Coiba National Park, motivating fishers to follow and support the regulations. Seven patrol boats make daily trips through the no-take and buffer zones. Enforceability is key to guaranteeing the success of the controlled effort system, and must be well implemented from the outset.
Harvesting strategies	
Fishing methods and gear	Fishing is allowed only in the MRMZ, and it is not permitted in the marine reserve or no-take zone. Authorized traditional fishing gear includes nylon monofilament, braided nylon cord, fishing nets, purse seines, and sticks. Gillnets and harpoons are no longer permitted in the MRMZ. The numbers of gear are restricted per group of species: Snapper can only be caught using lines with no more than 15 circle hooks (minimum 10/0 size). Each fisher can use just one line, with no machinery other than a pulley. Groupers can be caught with vertical lines with no more than 15 circle hooks (minimum 13/0 size). As with snappers, each fisher can use a single line and only a pulley. Mahi-mahi can be caught using longlines with no more than 500 circle hooks (minimum 13/0 size). In this case, each boat can use only one longline, and it must be anchored to the bottom.
When fishing is authorized to take place	The three primary closed seasons every year are for snapper (1 January–30 April) and mahi-mahi (1 March–31 May, and 1 September–31 October).
Harvest controls	Fishing control is highly effective in Coiba National Park. However, although the fisheries subprogramme suggests the use of licences, permits, catch quotas, effort quotas, no-take zones and season closures, there have not been sufficient data to implement all of them. This is the case of catch and effort quotas.
Monitoring	Landing records are kept by the Panama Maritime Authority (AMP), but these do not include detailed landings records per community, which impedes construction of a landing series data history. Because landing records do not include place of origin, every fisher must fill out an "Individual Fisher Record" form provided by the park administration. Each form is valid for one calendar year (January–December). It is necessary to promote studies independent of the fishery, as well as ecological monitoring.

Within this context, the fishing sector played an important role in shaping the new rights-based system. Advocates knew that insufficient financial support could threaten the initiative and its commitments. Creating the Coiba National Park management plan required more than three years of hard work and substantial financial resources. The core element of the plan is the spatial analysis, consisting of numerous charts specifying activity areas. This is directly supported by the programmes and detailed activities descriptions within each programme. The management plan provides detailed descriptions of its goals and terms, and the resources needed to meet them. For example, the overall estimated budget for the next five years is USD11 253 150, of which USD1 023 953 is for research and USD3 148 422 for monitoring and enforcement. Estimated total revenues for the Coiba National Park fishery sector for the next five years are USD32 868 143, with net revenues of USD7 737 943 (Montenegro, 2007). If the research and enforcement budget for the park were applied exclusively to fishing activities and accounted for these financial resources to ensure economic benefits, the net profit in the fishery would be USD3 565 568, a positive value in a benefit–cost analysis. Indeed, fishery profits are expected to increase over time as fishing costs decrease. The Coiba National Park management plan is an example of the investments required to achieve sustainability in this kind of context, which include but are not limited to political will, commitment, accountability, transparency, liability and fulfilment. A summary of the main attributes of the rights-based system currently in place in Coiba National Park are presented in Table 23.

13. Summary of finfish case studies reported

Table 24 summarizes the main attributes associated to the exclusivity, duration, security, transferability and divisibility of the rights-based system in place reported for the four finfish fisheries of this study. Additional sets of fishery regulations are also established in each of the fisheries reported.

TABLE 24
Attributes of the rights-based finfish fisheries of this study

Rights-based fishery	Exclusivity	Duration	Security	Transferability	Divisibility
Individual vessel quota (IVQ) of the anchovy fishery of Peru	Granted to industrial vessel targeting anchovy for indirect human consumption outside the 5 mile allocated to artisanal vessels	10 years	Contract warrant	Non-transferability independent of vessel unit	Allowed to substitute capacity of individual vessel removed from fishing
Individual stakeholder quota (ISQ) of the hake fishery of Chile	Limited entry with exclusive fishing rights allocated to stakeholders	Annual with renewability	State guarantees the right to a fraction of the total allowable catch (TAC), subject to biomass accessibility	Non-transferable	Non-divisible
Community territorial use rights in fisheries (TURFs) of Gulf weakfish of Gulf of California, Mexico	Coastal community, exclusive territorial fishing rights with limited entry	2 years	Secure fishing title rights for the period covered by the fishing licence	Non-transferable	Non-divisible
Individual effort quotas (IEQs) in the multispecies fishery at Coiba National Park, Panama	Exclusive fishing rights through individual vessel quotas granted to fishers of 47 small-scale boats	Annual with renewability	Secure rights as long as there is full compliance with regulations of the Coiba National Park	Non-transferable	Non-divisible

The four case studies reported in Part II show different institutional arrangements indicating that rights-based finfish fisheries management in Latin America is evolving with a diversity of schemes responding to local fisheries contexts, resource and ecosystem dynamics, and governance capacities in place. They report a diversity of management experiences including: (i) IVQs combined with spatial quota allocation rights; (ii) individual quotas; (iii) rights of access to particular fishing areas or territories (TURFS), which allocate units of space to cooperatives or individual fishers from artisanal communities; and (iv) IEQs of artisanal fishers in a multispecies fishery at Coiba National Park, Panama. Non-transferability of rights seems to be the common denominator at this stage of establishing rights-based schemes in Latin America. It also reflects the concerns for potential concentration of fishing rights in a few hands, if transferability is put in place.

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ANNEX TO PART I

Administrative and legislative frameworks

Country	Case	Agencies	Pertinent legislation
Argentina	6: Patagonian scallop industrial fishery	Consejo Federal Pesquero [CFP] [www.cfp.gob.ar/] Secretaría de Agricultura, Ganadería, Pesca y Alimentación [SAGPyA] [www.minagri.gob.ar/site/pesca/_subsecretaria_de_pesca/index.php] Instituto Nacional de Investigación y Desarrollo Pesquero [INIDEP] [www.inidep.edu.ar/]	Ley Federal de Pesca N° 24.922 and Decreto Reglamentario N° 748/99
Argentina (Chubut Province)	4: San José Gulf scallop diving fishery 10: Algal concessions	Secretaría de Pesca, Chubut Province [http://organismos.chubut.gov.ar/pesca/] Subsecretaria de Turismo y Áreas Protegidas, Chubut Province [conservation] Administración Área Natural Protegida Península Valdés [www.peninsulavaldes.org.ar/es/index.php] [conservation]	Ley Provincial XVII N° 86 [regulates artisanal fisheries in the province] Decreto N° 1899, Poder Ejecutivo, Provincia de Chubut [artisanal fisheries] Ley XVII-N° 6 and Decreto reglamentario XVII – N° 759/81 [algal concessions]
Brazil	15: Brazilian marine RESEXs	Ministério da Pesca e Aquicultura [MPA] [www.mpa.gov.br]Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis [IBAMA] [www.ibama.gov.br] [environmental authority] Instituto Chico Mendes de Conservação e Biodiversidade[www.icmbio.gov.br] [implements the SNUC]	Lei da Pesca e Aquicultura N° 11.959 [regulates fisheries in the country] [www.mpa.gov.br/#legislacao/Leis/leis2009] Lei N° 9985 and Decreto N° 4340 [last modified: October 2005] [regulates the National System of Nature Conservation Units, SNUC, including RESEXs]
Chile	2: Chilean sea urchin fishery 3: Juliana clam fishery 7: AMERBs 12: Juan Fernández I. Lobster Fishery 13: The “parcelas” system of algal harvests 16: EMPCO	Subsecretaría de Pesca [SUBPESCA] [www.subpesca.cl] [fisheries authority] Servicio Nacional de Pesca [SERNAPESCA, enforcement] [www.sernapesca.cl] Corporación Nacional de Desarrollo Indígena [CONADI] [www.conadi.gob.cl/] [Implements the EMPCO]	Ley General de Pesca y Acuicultura [LGPA] [last modified: December 2010] [www.subpesca.cl/controls/neochannels/neo_ch617/neochn617.aspx] Reglamento sobre Áreas de Manejo y Explotación de Recursos Bentónicos [last modified: April 2010] [regulates AMERBs]. [www.subpesca.cl/controls/neochannels/neo_ch761/neochn761.aspx]
Colombia	16: Blood cockle fishery, Afro-Colombian communities	Dirección de Pesca y Acuicultura [www.minagricultura.gov.co/08cifras/08_Misi_Pesca.aspx]	Estatuto General de Pesca (Ley N° 13, 1990) and its Reglamento (Decreto Reglamentario N° 2256) [regulates fisheries in the country] [www.incoder.gov.co/normatividad.cfm] Ley N° 70 [known as “Ley de Negritudes”, introduces collective rights for afro-descendent communities]
Ecuador	1: Galapagos Islands diving fishery	Subsecretaria de Recursos Pesqueros [www.subpesca.gob.ec] Instituto Nacional de Pesca [www.inp.gob.ec/]	Ley de Pesca y Desarrollo Pesquero and its Reglamento [regulate fisheries in the country] [www.inp.gob.ec/index.php?option=com_content&view=article&id=116&Itemid=67]

Country	Case	Agencies	Pertinent legislation
Mexico	8: Concessions from Central Baja California (Mexico) 9: Predios of sustainable use (Mexico) 11: Lobster concessions of Punta Allen (Mexico) 14: Seri Indian benthic fishery (Mexico)	Secretaria de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación [SAGARPA] [www.sagarpa.gob.mx/ Comisión Nacional de Acuacultura y Pesca [CONAPESCA] [www.conapesca.sagarpa.gob.mx] Instituto Nacional de Pesca [INAPESCA] [www.inapesca.gob.mx/portal/] Procuraduría Federal de Protección al Ambiente [PROFEPA] [protected areas] [www.profepa.gob.mx/ [enforcement] Secretaría de Medio Ambiente y Recursos Naturales [SEMARNAT] [www.semarnat.gob.mx] Comisión Nacional de Áreas Naturales Protegidas [CONANP] [protected areas] [www.conanp.gob.mx/] Instituto Nacional de Ecología [INE] [www.ine.gob.mx/]	Ley General de Pesca y Acuacultura Sustentables (LGPAS) and its Reglamento [regulate fisheries in the country]. [www.conapesca.sagarpa.gob.mx/wb/cona/cona_leyes_] [www.conapesca.sagarpa.gob.mx/wb/cona/cona_reglamento_de_la_ley_de_pesca] NOM-PESC-006-1993 and later modifications, http://www.conapesca.sagarpa.gob.mx/wb/cona/cona_normas [lobster fishery regulations] Ley General del Equilibrio Ecológico la Protección al Ambiente (LGEEPA, last modified: August 2011) and its Reglamento [regulate protected areas] [www.biblioteca.semarnat.gob.mx/janium/Documentos/Ciga/agenda/DOFsr/148.pdf] [www.biblioteca.semarnat.gob.mx/janium/Documentos/Ciga/agenda/DOFsr/DO2016.pdf] Ley General de Vida Silvestre [last modified: September 2010] and its Reglamento [regulate the use of species listed under special protection]. NOM-059-ECOL-1994 and subsequent modifications.

This study reports on the experiences with a diversity of cases of rights-based benthic and finfish fisheries management regimes from the Latin American region. Each case specifies the main attributes of the access rights (in a broad sense, including privileges), whether formal or informal: (i) how the rights are conferred and upheld; (ii) exclusivity of participation in the fishery; (iii) duration of the rights conferred; (iv) security or quality of the title conferred by the rights; (v) transferability, divisibility and flexibility in the use of the rights; and (vi) actual rights enforceability and corresponding compliance with use rights limitations. The study also reports on aspects of the harvest strategies in place, including: (i) fishing methods and gear; (ii) when fishing is authorized to take place; (iii) harvest controls; and (iv) monitoring.