

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

**Christine M. Beitzl, Nikita Gaibor**

*Department of Anthropology, University of Maine, USA*

*Office of Technical & Scientific Sub direction, Instituto Nacional de Pesca, Letamendi y La Ría, Guayaquil, Ecuador*

## **Abstract**

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

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

## **1. INTRODUCTION**

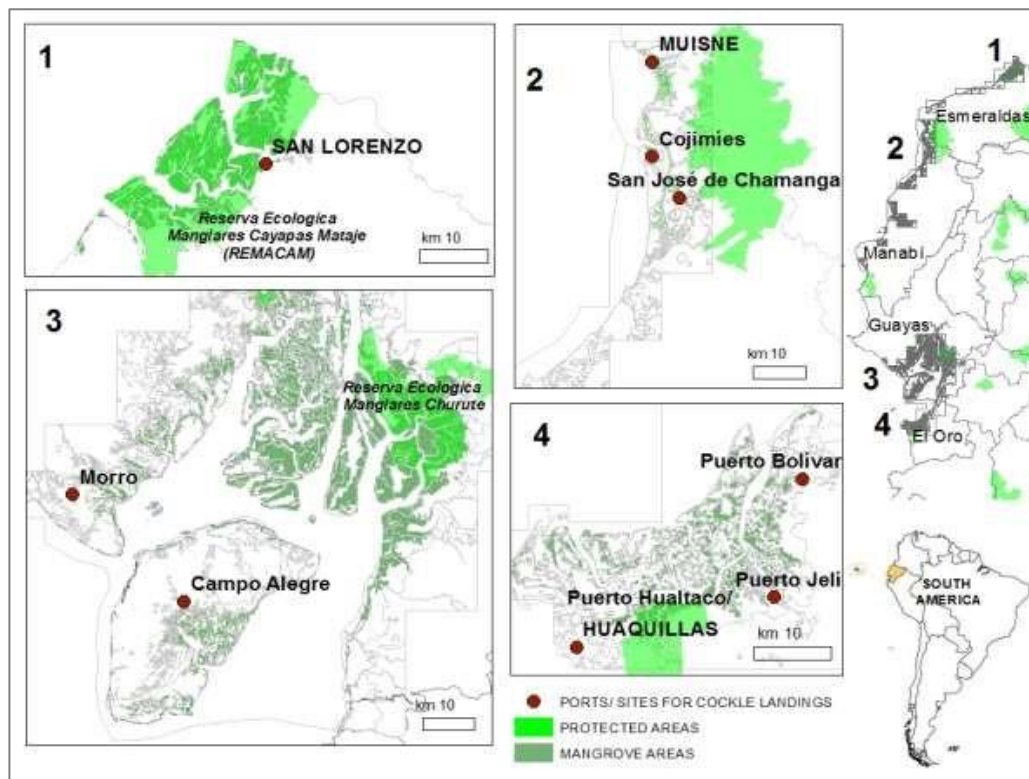
### **1.1 Description of the fishery**

Ark clams or mangrove cockles have been an important resource within coastal communities, dependent on mangrove forests in the intertidal swamps of Central and South America since pre-Colombian times. In Ecuador, mangrove cockles are gathered from the roots of mangrove trees during low tide periods by artisanal fishers throughout the coast (Figure 1). In the northern province of Esmeraldas, cockles are traditionally harvested by family groups, women and children; however, the lack of employment in recent years has driven more men to enter the fishery<sup>1</sup>. Throughout the rest of the country, the fishery has been

---

<sup>1</sup> Source: Mera Orcés, 1999; Ocampo-Thomason, 2006.

primarily dominated by men who harvest cockles for commercial markets<sup>2</sup>. The cultural and economic value of mangrove cockles is particularly high in Ecuador and Colombia, which represent over half of the estimated fishers that harvest cockles throughout their range from wetlands from Mexico to Peru<sup>3</sup>.



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

- 1) Ecological Reserve Cayapas Mataje (REMACAM) in the province of Esmeraldas;
- 2) Muisne-Cojimies Estuary bordering the provinces of Esmeraldas and Manabí;
- 3) Puerto El Morro and Campo Alegre in Guayas Province;
- 4) Archipelago Jambelí in El Oro Province.

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

Three species of mangrove cockles are harvested for commercial markets in Ecuador (*Anadara tuberculosa*, *A. similis*, and *A. grandis*). There have been no official stock assessments, meaning the current status of the fishery is poorly understood. However, since 1997, there have been a handful of studies conducted by non-government organizations (NGOs) and Ecuador's Instituto Nacional de Pesca (INP), which is a government research institution established in 1960. These studies suggest harvesting

<sup>2</sup> Source: Beitzl, 2014a; Beitzl, 2014b.

<sup>3</sup> Source: MacKenzie, 2001 ; MacKenzie & Buesa, 2006.

pressures have been increasing<sup>4</sup>. On the other hand, there is a great deal of spatio-temporal variability in fishery production. One study of the cockle fishery in the Archipelago Jambelí showed a 41 percent decline in catch rates between 2005 and 2009 and an increase of 4-10 percent since 2010<sup>5</sup>. The reasons for variability in harvesting pressures and catch rates are complex and unclear, but most likely attributed to habitat destruction associated with shrimp farming and urbanization since the 1970s. Livelihood strategies and management practices have responded to such economic and environmental uncertainty in recent decades<sup>6</sup>.

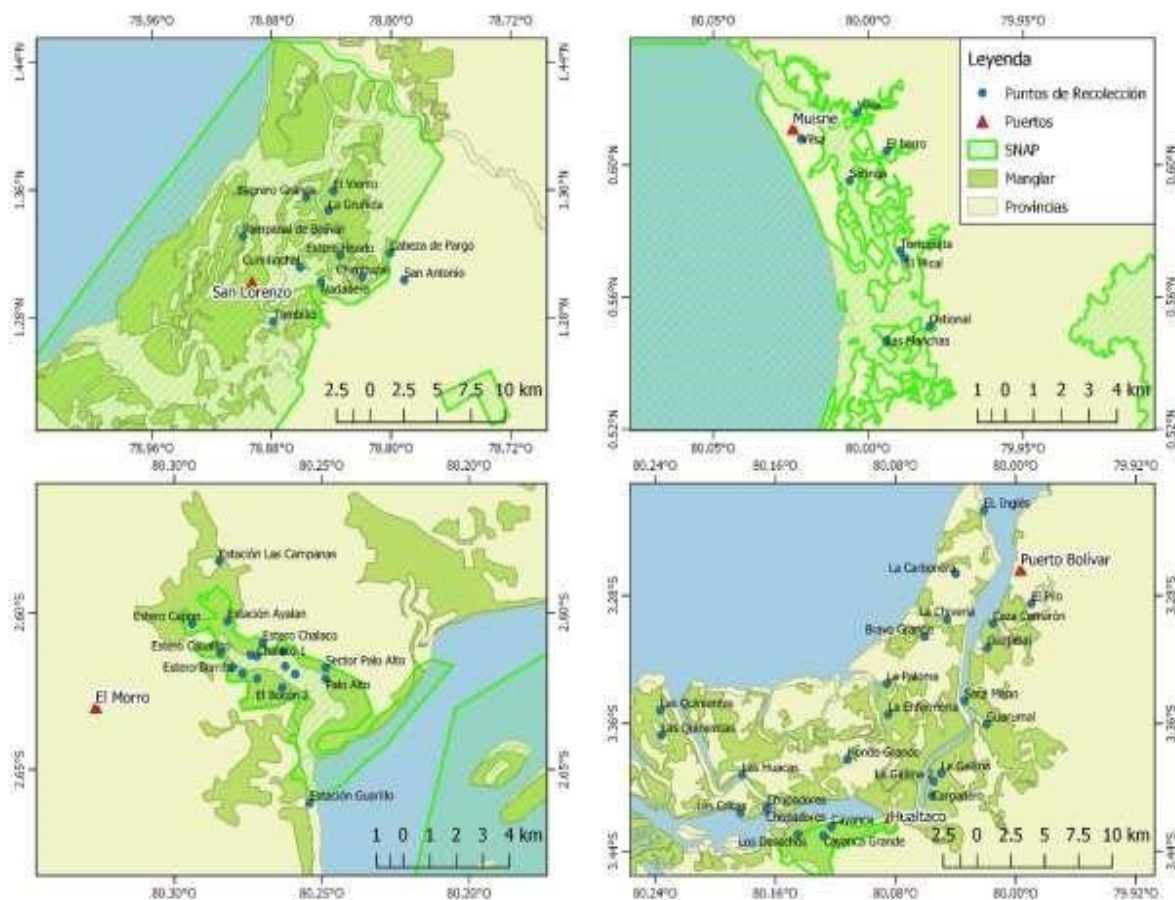
Fishers participating in Ecuador's cockle fishery are often from communities located within mangrove forests and adjacent urban areas throughout the coast (Figure 1). Cockles are landed in 10 major ports: San Lorenzo, Muisne, San Felipe (not shown), Cojimies, San Jose de Chamanga, Morro, Campo Alegre,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

---

<sup>4</sup> Source: Flores & Mora, 2011; Mora & Moreno, 2009; Mora et al., 2009, Mora et al., 2011; Mora et al., 2010<sup>a</sup>; Mora et al., 2010<sup>b</sup>; Moreno C N.D., Moreno Cáceres, 2005; Moreno Cáceres & Ortega González, 2003; Moreno Cáceres & Ortega, 2002; Moreno et al., n.d.

<sup>5</sup> Source: Zambrano et al., 2017.

<sup>6</sup> Source: Beitzl, 2014<sup>a</sup>; Beitzl, 2014<sup>b</sup>; Elao & Guevara, 2006; Mera Orcés, 1999; Ocampo-Thomason, 2006



**Figure 2. Cockle gathering grounds around ports with the highest landings.**

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

During low tide periods, artisanal fishers travel individually or in groups to gathering grounds in small boats, canoes, or on foot. Harvesting cockles for commercial consumption is generally an individualized activity, though some family groups (i.e. parents and their children) may pool their catch. Fishers identify productive fishing grounds through their own experience and customary use of preferred spots. Certain fishing associations and cooperatives may occasionally conduct collective harvests to raise money for their organization. In areas where mangrove concessions are present, associations may coordinate group transportation to communal harvesting areas.

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

Muisne to rent paddle canoes carrying up to 4-5 people, which requires a great deal of travel time investment, particularly for more remote gathering grounds.

The spatiotemporal distribution of cockles corresponds to the conditions of mangrove habitat, changing economic conditions, and broader socio-political change. While Ecuador's baselines have been debated,<sup>7</sup> the conversion of mangrove wetlands to alternate uses such as shrimp aquaculture and urbanization has been as high as 75 percent in some estuaries, with an overall average loss of about 27 percent for the entire coast.<sup>8</sup> These landscape transformations have often resulted in the displacement of artisanal fishers and conflict in some areas. Moreover, the booming shrimp industry triggered demographic shifts and infrastructural developments (i.e. roads, bridges, public transportation, sewerage and sanitation, aquaculture facilities, processing and packing plants, etc.) throughout the 1980s and 1990s. Not only have these developments attracted migrants from other parts of the country, but they've contributed to problems of contamination in mangrove areas. Increased demand and proximity to markets may have further exacerbated fishing pressures.

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

### **1.2 Economic contribution and social implications of the fishing activity**

Mangrove cockles that are captured are primarily used for human consumption as ingredients for traditional coastal cuisines of Ecuador, Colombia and Peru. In Ecuador, cockles are in high demand during holiday seasons and in tourist areas to be served in ceviche, with coconut sauce and rice, or roasted. Most landings are destined for local and regional markets throughout the coast and highlands, though some are traded in international markets. In Hualtaco on the southern border, about half of the 14 merchants transport cockles to Peru. In San Lorenzo, cockles are imported from Colombia. Live cockles are transported in burlap or polypropylene sacks of three different sizes, the largest having a capacity of 5 000 shells. Small rural communities may have one or two merchants, who serve as intermediaries to facilitate transport to larger port areas and landings sites. More remote areas like REMCAM have relied heavily on intermediaries<sup>9</sup>.

Ecuador's INP estimates about 3 000 fishers participate in the fishery, a drop from the estimated 5 000 in previous studies<sup>10</sup>. Reliable estimates are difficult to determine since fishing effort may vary significantly over time and space; livelihood decision-making is dynamic, in the face of environmental variability and economic uncertainty.

---

<sup>7</sup> López-Angarita et al., 2016.

<sup>8</sup> CLIRSEN-PMRC, 2007.

<sup>9</sup> Source: Ecobiotec, 2009

<sup>10</sup> Source: MacKenzie, 2001 ; MacKenzie & Buesa, 2006

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

## **2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH**

### **2.1 Management of the fishery**

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

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

At landing sites, catch monitoring programs are currently conducted in six ports by INP. Since 2008, the Subsecretaria de Recursos Pesqueros (SRP) has designated fish inspectors in five of the major ports for cockle landings, to enforce minimum size requirements. Different communities with concessions have their own rules and conflict resolution mechanisms. In some cases, the incidence of social conflict among different user groups has increased where mangrove concessions are present. Overall, mangrove custodias have strengthened the ability of cockle harvesters and other artisanal fishers in Ecuador to denounce violations of the laws upholding the mangrove forest conservation, which was a significant challenge throughout the 1980s and 1990s<sup>11</sup>. It is increasingly clear that adequate enforcement of mangrove conservation laws has played a critical role in the resolution of aquaculture-fishery conflicts.

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

At the national level, the SRP introduced the first measures for managing the cockle fishery through Ministerial Agreement No. 170 in October 2001, based on recommendations from the INP. These measures included 1) a closed season for the capture, transport, possession, processing, and commercialization of *A. tuberculosa* and *A. similis* between 15 February and 31 March of each year; and

---

<sup>11</sup> Source: Beitzl, 2012; Beitzl, 2017.

2) the prohibition of the capture and commercialization of cockles with shell lengths less than 45 mm. The shell size regulation was made permanent in 2005 by way of a reform to Article 2 of the Ministerial Agreement 170. However, with respect to the closed season, these measures were considered ineffective for promoting the sustainability of the fishery.

There has been some scientific debate about spawning periods. One study from Colombia found that *A. tuberculosa* reproduces primarily during December, February, April, and August<sup>12</sup>. In light of these debates and given the difficulty in enforcing a closed season in Ecuador, this regulatory measure was lifted in 2006. The only national regulatory measures currently in place are the size limits and rights-based area management in locations where custodias are present.

Traditionally and within open-access areas of the fishery, communities practice a form of informal customary rights. Cockle fishers typically harvest from their preferred areas on a regular basis. Individual preferences emerge from cultural norms of avoidance and mutual respect similar to customary practices in other small-scale fisheries (SSFs)<sup>13</sup>. Harvesters, meanwhile, customarily leave undersized cockles in the mangroves to promote growth and spawning. In small communities where fishing effort is relatively low, a self-organized informal division of fishing space serves to maintain relatively reliable catch rates for individual harvesters. These versions of informal social organization have been vulnerable to demographic change and boom-bust economic conditions. Mangrove concessions have served to strengthen local resource rights, particularly in regard to conflicts with the shrimp aquaculture sector. On the other hand, consequently, some independent cockle harvesters feel they have been losing their customary gathering grounds, first to an encroaching shrimp industry, and now to mangrove custodias.

### **2.3 Rights-based approach: allocation and characteristics**

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

Mangrove custodias allocated to local associations explicitly stipulate the goal of sustainable use and are valid for 10-year periods, with the possibility of renewal<sup>14</sup>. To obtain a mangrove concession, communities must first organize into formal groups legally recognized by the state. Then, they should identify a partner organization to provide technical assistance for a two-year commitment period (i.e. NGO, university, or business enterprise). Once accredited as a civic organization, they are eligible to submit a package to the Subsecretaria de Gestion de Recursos Costeros office within the Ministry of Environment containing a list of their members, the names of executive officers, maps of the area, and a management plan to meet basic needs. Local organizations often include women members who are active participants in the cockle fishery in the northern province of Esmeraldas.

---

<sup>12</sup> Source: Lucero et al., 2012.

<sup>13</sup> Source: Cordell, 1992; McGoodwin, 1994; Quimby, 2015.

<sup>14</sup> See also Acuerdo Ministerial 172 published in Registro Oficial No. 365, January 20, 2000.

In neither the formal rights-based system nor the informal customary system can fishing rights be sold, transferred or inherited. There are limitations to the rights that can be officially held by one community at a time. Community associations may only apply for one concession at a time. However, individuals may simultaneously hold customary rights and legally recognized communal rights granted to their fishing association.

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

#### **3.1 Sustainable use of the resources**

There is evidence to suggest that the rights-based approach practiced in some custodias may effectively improve cockle catch rates and shell sizes<sup>15</sup>. However, it should not be assumed that territorial fishing rights necessarily promote sustainable fishing behaviour by individuals. Compliance with minimum size regulations remains a significant challenge recognized by scientists, authorities, and fishers alike. Membership in associations and awareness of the problem may not be enough to address this challenge. For example, one study found most cockle fishers were concerned about the status of the fishery; yet there were no differences in fishing behaviour among members of associations compared with independent harvesters<sup>16</sup>. The same study suggested that characteristics of the fishing grounds were more likely to explain differences in harvesting behaviour than membership in an association. Therefore, management efforts should ensure healthy mangrove habitat as a necessary precondition for sustainable fishing. However, more research is needed to evaluate the impacts of mangrove restoration and TURF arrangements on mangrove cockle production.

#### **3.2 Economic viability of the fishery**

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

#### **3.3 Social equality**

Prior to the implementation of the rights-based system, customary fishing rights were assumed by individual cockle harvesters. Since the implementation of rights-based approaches, only formally recognized associations qualify for territorial rights. This has implications for equity in the distribution of fishing resources. The initial allocation criteria aimed to achieve the three pillars of sustainability. Having access to gathering grounds allows individuals to meet their basic livelihood needs. However, some independent harvesters have been displaced from their customary gathering grounds, which has resulted in the unintended consequence of increasing harvesting pressures in remaining open access areas.<sup>17</sup> Moreover, many independent harvesters prefer to maintain their independence as they lack the time, trust, and money to commit their own resources to membership in local associations.

At the same time, mangrove custodias ensure the protection of mangrove forests, which is necessary to support sustainable livelihoods for future generations of fishers. It remains to be seen whether TURFs are

---

<sup>15</sup> Source: Beitzl, 2011.

<sup>16</sup> Source: Beitzl, 2014°.

<sup>17</sup> Source: Beitzl, 2012.



adaptable to potentially shifting resource distributions that happen as a consequence of climate change and environmental uncertainty.

#### **4. MAIN CHALLENGES AND WAY FORWARD**

##### **4.1 Challenges for the fishery**

One mid-term evaluation of the custodias demonstrated a number of challenges such as irresponsible fishing practices, lack of respect for minimum size regulations, trespassing, and the use of machete in collecting cockles<sup>18</sup>. The report suggested that with a few exceptions, the majority of communities had difficulty enforcing territorial management due to a lack of social organization, control, and vigilance. The authors suggested that technical assistance and support from authorities were critical factors in successful management and conflict resolution. Despite these challenges, the report concluded that the benefits of the concessions outweighed any drawbacks.

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

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

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

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

##### **4.2 Improving fishery sustainability in the future**

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

It is necessary to create opportunities for diversified livelihoods in locations where TURFs or similar forms of territorial use privileges are implemented. This recommendation is based on the reality that a number

---

<sup>18</sup> Source: Coello et al., 2008.

of independent cockle harvesters may be displaced by a growing system of territorial use rights, which reduces their access to their customary gathering grounds. While many cockle fishers prefer fishing based livelihoods and take pride in their livelihood, there are others who may have entered the fishery as a last resort during difficult economic times.

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

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

## **5. LESSONS LEARNED**

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

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

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

## **ACKNOWLEDGEMENT**

First and foremost, we would like to acknowledge all of those artisanal fishers who have participated in Beitzl's ethnographic research on Ecuador's fishery for mangrove cockles since 2006. Without their openness and contributions, this case study would not exist. The authors would also like to express their gratitude to several individuals whose work has contributed to knowledge about the state of Ecuador's fishery for mangrove cockles, in particular, Juan Moreno at the Instituto Nacional de Pesca, Elba Mora at the Red Interinstitucional para el Estudio de Ecosistemas Acuáticos del Ecuador and the Universidad de Guayaquil, and Luis Flores at Universidad de Guayaquil. We also thank Xavier Carchi at the Subsecretaria de Gestion Marino Costera of the Ministry of Environment for sharing recent information about mangrove concessions. Finally, we are grateful to INFOPECA for providing generous travel support and to Jaixi Wang at FAO for facilitating our ability to participate in User Rights 2018.

## REFERENCES

- Afflerbach, J.C., Lester S.E., Dougherty, D.T., & Poon, S.E.** (2014). A global survey of “TURF-reserves”, Territorial Use Rights for Fisheries coupled with marine reserves. *Global Ecology and Conservation*, 2, 97-106.
- Beitl, C.M.** (2011). Cockles in Custody: The Role of Common Property Arrangements in the Ecological Sustainability of Mangrove Fisheries on the Ecuadorian Coast. *International Journal of the Commons*, 5, 485-512.
- Beitl, C.M.** (2012). Shifting Policies, Access, and the Tragedy of Enclosures in Ecuadorian Mangrove Fisheries: Towards a Political Ecology of the Commons. *Journal of Political Ecology* 19, 94-113.
- Beitl, C.M.** (2014a). Adding Environment to the Collective Action Problem: Individuals, Civil Society, and the Mangrove-Fishery Commons in Ecuador. *World Development*, 56, 93-107.
- Beitl, C.M.** (2014b). Navigating Over Space and Time: Fishing Effort Allocation and the Development of Customary Norms in an Open-Access Mangrove Estuary in Ecuador. *Human Ecology*, 42, 395-411.
- Beitl, C.M.** (2015). Mobility in the mangroves: Catch rates, daily decisions, and dynamics of artisanal fishing in a coastal commons. *Applied Geography*, 59, 98-106.
- Beitl, C.M.** (2017). Decentralized mangrove conservation and territorial use rights in Ecuador’s mangrove-associated fisheries. *Bulletin of Marine Science*, 93, 117-36.
- Bravo, M.** (2000). Concesiones para el Uso y Custodia del Manglar: Componentes de Gestion Ambiental en el Golfo de Guayaquil. *Ministerio del Ambiente, Guayaquil*.
- Bravo, M. & Olmedo, J. (2007).** Analisis de la Base Legal Para el Otorgamiento de las Concesiones de Manglar, Responsabilidades Jurídicas Respecto a Talas en Zonas Concesionadas, y Competencias para Expedir los Acuerdos de Uso Sustentable y Custodia del Manglar. *Programa de manejo de recursos costeros, Procedimiento CCI No. PMRC-035-2005 Actualización de los planes de manejo de las concesiones del manglar*, 1-46.
- Bravo, M., & Altamirano, M.** (2006). Actualización del Plan de Manejo del Manglar Concesionado a la Asociación de Pescadores Artesanales, Mariscadores y Afines Costa Rica: Archipiélago de Jambelí, Guayaquil, Ecuador. *Programa de manejo de recursos costeros, Procedimiento CCI No. PMRC-035-2005*.
- CLIRSEN-PMRC.** (2007). Actualización del Estudio Multitemporal de Manglares, Camaroneras y Áreas Salinas en la Costa Continental Ecuatoriana al Año 2006. *Centro de Levantamientos Integrados de Recursos Naturales por Sensores Remotos & the Programa de Manejo de Recursos Costeros, Guayaquil, Ecuador*.
- Coello, S., Vinueza, D., & Alemán, R.** (2008). Evaluación del desempeño de los acuerdos de uso sustentable y custodia de manglar de la zona costera del Ecuador. *Ministerio del Ambiente del Ecuador – Conservación Internacional – Unión Mundial para la Naturaleza (UICN) – Comisión Mundial de Áreas Protegidas de UICN – Programa de apoyo a la gestión descentralizada de los recursos naturales en las tres provincias del norte del Ecuador (PRODERENA) – Ecobiotec*, 52, 1-52.
- Félix-Pico, E.F., Ramírez-Rodríguez, M., & Holguín-Quiñones, O.** (2009). Growth and Fisheries of the Black Ark *Anadara tuberculosa*, a Bivalve Mollusk, in Bahía Magdalena, Baja California Sur, Mexico. *North American Journal of Fisheries Management*, 29, 231-36.
- Flores, L., & Mora, E.** (2011). Evaluando Variaciones en la Talla de *Anadara tuberculosa* y *Anadara similis* en el Archipiélago de Jambelí: Hay Indicios de Sobrepesca. *Revista de Ciencias del Mar y Limnología*, 5, 33-49.
- Hamilton, S.E., & Collins, S.** (2013). Livelihood responses to mangrove deforestation in the northern provinces of Ecuador. *Bosque*, 34, 143-53.

- Latorre, S.** (2014). Resisting Environmental Dispossession in Ecuador: Whom Does the Political Category of 'Ancestral Peoples of the Mangrove Ecosystem' Include and Aim to Empower? *Journal of Agrarian Change*, 14, 541-563.
- López-Angarita, J., Roberts, C.M., Tilley, A., Hawkins, J.P., & Cooke, R.G.** (2016). Mangroves and people: Lessons from a history of use and abuse in four Latin American countries. *Forest Ecology and Management*, 368, 151-62.
- MacKenzie, C.** (2001). The Fisheries for Mangrove Cockles, *Anadara* spp., from Mexico to Peru, With Descriptions of Their Habitats and Biology, the Fishermen's Lives, and the Effects of Shrimp Farming. *Marine Fisheries Review*, 63, 1-39.
- MacKenzie, C., & Buesa, R.** (2006). Vida de los Pescadores Costeros de Pacífico desde México a Perú y su Dependencia de la Recolecta de Conchas (*Anadara* spp.), Almejas (*Polymesoda* spp.), Ostiones (*Crassostrea* spp.), Camarones (*Penaeus* spp.), Cangrejos (*Callinectes* spp), y la Pesca de Peces de Escama en Los Manglares. *US Dept Commerce, Northeast Fisheries Science Center, Woods Hole, MA*.
- Martinez-Alier, J.** (2001). Ecological Conflicts and Valuation: Mangroves versus Shrimps in the Late 1990s. *Environment and Planning C-Government and Policy*, 19(5), 713-728.
- Maya, D., & Ramos, P.** (2006). El rol del género en el manglar: heterogeneidad tecnológica e instituciones locales. *Cuadernos de Desarrollo Rural* (56), 53-81.
- Mera Orcés, V.** (1999). Género, Manglar, y Subsistencia. Quito, Ecuador: Abya Yala. 171 pp.
- Mora, E., & Moreno, J.** (2009). La Pesquería Artesanal del Recurso Concha (*Anadara tuberculosa* y *A. similis*) en la Costa Ecuatoriana durante el 2004. *Boletín Científico y Técnico*, 20, 1-16.
- Mora, E., Moreno, J., & Jurado, V.** (2009). La Pesquería Artesanal del Recurso Concha en las Zonas de Esmeraldas y El Oro, Durante el 2008. *Boletín Científico y Técnico*, 20, 17-36.
- Mora, E., Moreno, J., & Jurado, V.** (2011). Un Análisis de la Pesquería del Recurso Concha en Ecuador Durante el 2010. *Boletín Científico Técnico*, 21, 1-13.
- Mora, E., Moreno, J., Jurado, V., & Flores, L.** (2010a). Aspectos Pesqueros y Biológicos de la Concha Prieta (*Anadara tuberculosa* y *Anadara similis*) en Ecuador, Año 2009. *Instituto Nacional de Pesca, Guayaquil, Ecuador*.
- Mora, E., Moreno, J., Jurado, V., & Flores, L.** (2010b). La Pesquería de la Concha Prieta en el 2009: Indicadores Pesqueros y Condición Reproductiva en la Zona Sur y Norte del Ecuador. *Boletín Científico Técnico*, 20, 35-49.
- Moreno Cáceres, J.** (2005). Situación de la Pesquería Artesanal del Recurso Concha (*Anadara tuberculosa* y *Anadara similis*) en las Principales Comunidades Concheras Pertenecientes a la Reserva Ecológica Manglares Cayapas-Mataje (REMACAM) durante el Periodo 2003-2004. *Instituto Nacional de Pesca y Fondo Ecuatoriano Populorum Progressio, Guayaquil, Ecuador*.
- Moreno Cáceres, J., & Ortega González, W.** (2003). Seguimiento de la Pesquería Artesanal del Recurso Concha (*Anadara tuberculosa* y *Anadara similis*) en Seis Comunidades Pertenecientes a la Reserva Ecológica Manglares Cayapas-Mataje (REMACAM) durante el 2002. *Instituto Nacional de Pesca y Fondo Ecuatoriano Populorum Progressio, Guayaquil, Ecuador*.
- Moreno Cáceres, J., & Ortega, W.** (2002). Estudio de la Pesquería Artesanal del Recurso Concha *Anadara tuberculosa* y *Anadara similis* en tres comunidades de la Reserva Ecológica Manglares Cayapas-Mataje. *Instituto Nacional de Pesca, Guayaquil, Ecuador*.
- Nguyen Thi Quynh, C., Schilizzi, S., Hailu, A., & Iftekhar, S.** (2017). Territorial Use Rights for Fisheries (TURFs): State of the art and the road ahead. *Marine Policy*, 75, 41-52.
- Ocampo-Thomason, P.** (2006). Mangroves, People and Cockles: Impacts of the Shrimp-Farming Industry on Mangrove Communities in Esmeraldas Province, Ecuador. In C.T. Hoanh, T.P. Tuong, J.W. Gowing, B. Hardy (Ed.) *Environment and Livelihoods in Tropical Coastal Zones: Managing Agriculture-Fishery-Aquaculture Conflicts* (140-53 pp), Oxon, UK: CAB International.

**Veuthey, S., & Gerber, J.F.** (2011). Accumulation by dispossession in coastal Ecuador: Shrimp farming, local resistance and the gender structure of mobilizations. *Global Environmental Change*, 22, 611-622.

**Zambrano, R., Flores, L., & Mora, E.** (2017). Cambios espacio-temporales en los rendimientos de pesca de concha en el Archipiélago de Jambelí, Ecuador. *La Técnica: Revista de las Agrociencias*. e-ISSN 2477-8982: 07-15.