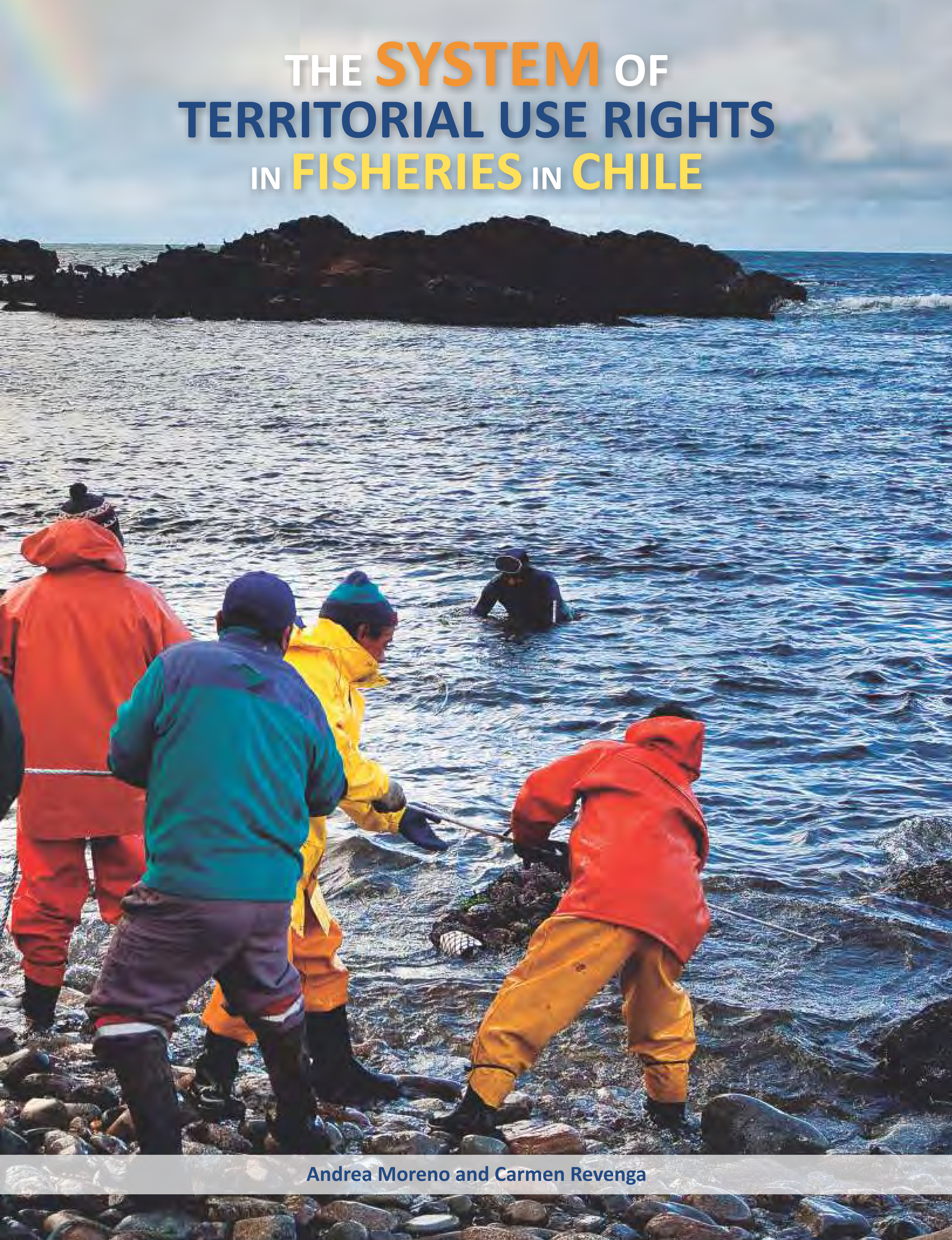
THE SYSTEM OF TERRITORIAL USE RIGHTS IN FISHERIES IN CHILE



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Harvesting of Chilean abalone (*Concholepas concholepas*) in the fishing village of Huape, in Valdivia, Chile. © Ian Shive, July 2012.

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THE SYSTEM OF TERRITORIAL USE RIGHTS IN FISHERIES IN CHILE

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FOREWORD

As fishermen, our first reaction when a resource is depleted in our own *caleta* - our local fishing grounds - is to go somewhere else to fish. After moving up and down the coast from one *caleta* to the next, we come to realize that every *caleta* will eventually be depleted and that the only way to reverse this trend is to go back to our own back yard and start working on ways to recover its productivity. This is how our story began…

Upon our return to our *caletas*, many of us realized that our local fisheries were plagued by situations as complex as any we had encountered elsewhere. In attempting to deal with this, it proved essential for us, in *Quintay* (central Chile), to listen to and learn from the management experiences of other fishers and researchers. Consequently, a small number of fishing associations decided to experiment with different management approaches in our own *caletas*, years before the TURF policy was in place. This proved to be difficult, and we had many conflicts, some very serious, particularly about non-member access rights to our experimental areas. It became apparent that we needed a legal basis to limit the access of those who were not part of our experimental initiatives and to educate our colleagues. So we got down to work!

This is why fishers, mainly through the National Confederation of Artisanal Fishermen of Chile, or CONAPACH as it is known in Chile, as well as scientists and fisheries technicians, started advocating for the TURF policy, until its implementation in 1997. Our journey since then has been full of frustrations, challenges, but also accomplishments. It took a lot of time and effort, and we are far from being finished yet: there are still many questions to answer and challenges to be met.

However, we have identified one essential requirement for TURFs to work: participating fishing associations must be well consolidated, and all the fishers must paddle in the same direction. This is worth emphasizing: all fishermen need to participate in the effort, because all of us will reap the benefits. To this end, another important step in the consolidation of TURFs is for fishing associations to find technical advice and guidance in the process towards a more responsible management of the resources we all depend on. In many cases, with the help of universities and non-governmental organizations, we have been able to access training; we have also learned by interacting with these institutions, which has been extremely valuable.

Years of work at sea, in our *caletas*, but also in universities, offices, and workshops, have now been captured in this report, which documents more than 20 years of TURF implementation history and summarizes the technical and operational aspects of the system, its challenges and opportunities, and the lessons learned throughout our journey.

We have come a long way in Chile. The story has been different in every corner of the country. However, as a fisher, I agree with the authors of this report: TURFs have worked and we have learned a lot as the process has evolved. We are now in a position to improve the TURF system and complement it with other available tools and approaches to make Chile's fisheries sustainable. I hope that our experience is useful for other fishers around the world, by offering them insights into the appropriate management of fishing resources, thus safeguarding their livelihoods and helping them improve their quality of life.

René Barrios
Fisher from the fishing association of *Quintay*,
Region V, Chile.

ACKNOWLEDGEMENTS

This report would not have been possible without the information, data and advice provided by key experts and institutions working on fisheries and conservation in Chile. Special thanks go to Prof. Hugo Salgado, Miguel Quiroga, Mónica Madariaga and Miguel Moreno from the Department of Environmental and Natural Resource Economics at the *Universidad de Concepción* in Chile for their contribution to the socio-economic analysis presented in this report. Thanks also go to Carlos Techeira, a Marine Biologist and researcher at the Fisheries Development Institute (*Instituto de Fomento Pesquero*) in Chile, to Stefan Gelcich, a Ph.D. in Natural Resource Management and researcher at the Center for Marine Conservation (*Centro de Conservación Marina*) of the *Pontificia Universidad Católica de Chile*, and to Jay Udelhoven, Senior Marine Policy Advisor at the Nature Conservancy, for their thoughtful comments and review.

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This report would not have been possible without the generous financial support of the Rockefeller Foundation and the ARGO Mobility Program from the Ministry of Education in Spain. We would also like to thank the David and Lucile Packard Foundation for their financial support in printing this report. Finally, special thanks go to our colleagues Lynne Hale, Ralph Barker and E.J. McAdams for their support and encouragement.

Andrea Moreno and Carmen Revenga

EXECUTIVE SUMMARY

Chile is a leading fishing nation; it ranks eighth in the world in terms of wild capture fisheries and first in terms of seaweed harvest. Much of this production is harvested by artisanal fishers and seaweed collectors. In terms of landings, Chile's artisanal sector has increased in importance, consistently surpassing the industrial catch since 2008.

Artisanal fisheries are a significant source of employment for coastal communities in Chile, and their harvests represent a key source of nutritional food for many rural communities. In 2012, there were a total of 86,132 artisanal fishers in Chile. Shellfish, in particular, are a very important harvested product, largely due to the remarkably high unit value of some products in the international market (e.g. Chilean abalone or *loco*). Even though the artisanal fishers in Chile do not tend to be subsistence fishers - i.e. they sell most or all of their catch - most depend highly on the harvest and sale of these products as a source of income. Declining catches due to overfishing in many regions, however, have forced fishers to find additional employment opportunities to supplement their incomes, though in rural communities these alternatives are limited. Furthermore, limited access to markets and a low capacity for producing value-added products contribute to stagnating incomes. Efforts to recover and sustainably manage nearshore resources, to assist fishers in producing value-added products, and to strengthen the role of fishers in accessing markets, would translate into higher incomes and improved livelihoods for these coastal communities.

Chile is a global leader in developing co-management approaches for nearshore marine resources targeted by artisanal fishermen. After an overfishing crisis led to critical closures of the Chilean abalone fishery in the late 1980s, Chile enacted a Territorial Use Rights in Fisheries (TURF) policy in 1991, which now encompasses more than 700 separate TURFs managed by local fishing associations via community-based catch-share agreements. The Chilean TURF model has proven to be successful in some regions primarily in terms of governance (e.g. the organization of fishers into associations), the recovery of overfished populations, productivity increases, and constructive interactions among stakeholders. The TURF system is seen by many as the example to follow to move small-scale coastal fisheries from the current open-access regime to a rights-based management regime.

Much of the literature on Chilean TURFs to date, mostly originating with the academic community, has focused on particular regions and on specific biological and/or governance aspects. This body of literature has been extremely useful in providing insights into the workings of TURFs, but it offers only a piecemeal picture of the current situation with respect to the socio-economic and governance aspects of the TURF system. In this report, we provide a comprehensive review of existing literature and information, specifically addressing the governance challenges in making the TURF system a successful management approach for small-scale nearshore fisheries in Chile and beyond. We focus on highlighting some of the more successful elements of the TURF system, as well as some of the remaining challenges. We then provide a set of recommendations to improve the system overall.

Some of the most interesting and positive highlights include:

- In the past five years, artisanal landings in Chile have consistently exceeded industrial landings; artisanal landings also have a higher value per ton landed because of the high unit value of some of the harvested products.
- Seaweed harvests are surprisingly important for artisanal fishers; of the top 10 benthic species harvested by this sector, 6 are seaweed and kelp species.
- From a legal perspective, Chile's National Fisheries and Aquaculture Law (Ley de Pesca y Acuicultura in Spanish) is very equitable and transparent with respect to its TURF policy - any registered fishing association can claim a TURF.
- The TURF system has promoted the formation of fishing associations, which has increased the political voice of the sector and improved

communication among fishers, between fishers and the scientific community, and between fishers and the state.

- The system has improved the knowledge of fishers and their access to learning, especially as it relates to harvest management practices, to biological aspects of the resource, and to the interactions of the target species with other elements of the ecosystem. This increased understanding has served to develop a sense of resource stewardship on the part of fishers.
- In some regions, the system has allowed for increased economic stability and diversification of incomes. This has resulted from better management of the resource, which allows fishers to plan and time their harvests according to market and climate fluctuations, and enables them to take up alternative employment during non-harvest or slow fishing periods.
- The system has promoted an increase in labor opportunities for certain sectors specializing in fisheries, such as scientists, consultants and managers.
- An increase in biomass and size of individuals from managed and unmanaged species within properly managed TURFs has been recorded.

While the Chilean TURF model certainly conveys rights to fishers and allows for them to have a greater, collective voice in the long-term management of the resource, there is room for improvement with respect to enforcement, to profitability, and to the adaptability of the policy to local realities, as well as in regard to TURF design and an increase in the participation of fishers in the decision-making process. The report identifies several challenges which could improve the overall performance of TURFs, if addressed; these include:

- A lack of ecological consideration in the design and management of TURFs, which limits the recovery of key resources and affects local livelihoods. Two examples in this respect are the size of TURFs, which may not be sufficient to recover and/or increase the productivity of some species due to their natural cycle or behavior, and the current lack of reserves with restricted fishing or of no-take zones between TURFs; if implemented, these could help maintain key spawning populations healthy and contribute to TURF productivity.
- An uneven distribution of valuable resources and infrastructure among regions (including differences in natural productivity), which makes TURFs more successful in some places than others.
- The operational costs for fishers with TURFs are high (consultancy payments, surveillance, administration, etc.).
- Market access and the capacity to produce value-added products are limited; therefore fishers do not get as much value for their products.
- Insufficient capacity in many of the fishing associations to make TURFs fully successful (lack of training, staff, infrastructure, etc.).
- Prevalence of weak enforcement and surveillance mechanisms provided by the state (particularly in rural areas) and within the fishing associations themselves, with minimal, and often unenforced, sanctions for poachers and illegal fishing.
- A lack of flexibility in the current law to address region-specific conflicts, tailor policies to local realities, and allow traditional and successful management systems to prevail.
- The non-existence of formal mechanisms for the periodic review and subsequent adjustment of the system, and the challenge of designing and implementing an assessment methodology given the existing information gaps or the different formats of the available data.
- The difficulty of transforming the current TURF system into an adaptive regime that addresses multiple outcomes and deals with the heterogeneity of fishing communities (different conditions, needs, problems, aspirations, etc.).

We believe that the system could be substantially improved by understanding these challenges and by drawing on the lessons learned from the Chilean TURF experience; these improvements are described in more detail below.

Because encroachment and illegal fishing is one of the main threats affecting TURFs, one of the most critical improvements is the need for an effective enforcement system. This would entail an increase in enforcement capacity, starting with more funding and support to key enforcement agencies, and an improvement of coordination between fishers, fishing associations and the governmental agencies involved in control and surveillance. The prosecution system should also be reinforced to deter illegal fishing. This could be achieved by training judges and district attorneys with respect to illegal fishing and by a stricter application of the law with the aim to reduce poaching, as well as by improving coordination between the District Attorney's Office and public prosecutors with regard to sanctions and penalties applied to poachers and businesses that buy illegally harvested products.

Secondly, a strong governance system is essential for the implementation of a TURF policy. Mechanisms to strengthen fishing associations and to incentivize fishers to be active stakeholders with full participation in the design, development and management of the system, are key to integrating the knowledge of fishers into the TURF policy. This active engagement would also legitimize management measures in the eyes of fishermen and likely increase support for, and compliance with, regulations. Additionally, the training of fishermen is central. Training modules directed at fishers and focused on marketing, business practices, management, leadership, marine ecology and fisheries biology are all encouraged.

Because the Chilean TURF system relies so heavily on consultancies for the implementation of the TURF policy, consultancy firms and individual consultants should be certified in order to guarantee minimum quality standards across the country. Baseline studies, performance reports and management plans, all required by law, would benefit from following standardized procedures and methods; this would also facilitate their evaluation and comparison across regions to assess regional or country-wide trends and help identify challenges. While the use of consultancies is mandated for all TURF aspects that have to do with resources management, other areas of importance to the success of TURFs could also benefit from the support of consultants. For example, consultancies could incorporate skills in the social sciences, people management, business development, marketing and commercialization, so that they, in turn, could train or support fishers in developing these skills.

A revision of the application requirements for subsidies and funds specifically aimed at covering part of the costs associated with implementation of the system is recommended, in order to target aid at those TURF holders who are in most need, or who are marginalized because of isolated locations. Such a review should take into account the variety of local conditions, such as available infrastructure, rural or urban characteristics of the area, and local capacity. To enhance the profitability of TURFs, fishers should be encouraged to assess and improve their commercial processes and strategies, including their supply chains and their marketing and administration capacities. Targeting current funds and subsidies to support these entrepreneurial and commercial activities could be a way to encourage the full participation of fishers in these activities.

As the TURF system evolves, it provides the opportunity to incorporate lessons learned, to revise and re-shape the system, and to make it a true adaptive management system. This process would be facilitated by a periodic review of the system that takes the knowledge of fishermen and their feedback into account in an endeavor to assess what has really worked and what has been and still is hindering progress. To be most effective, a monitoring system that periodically evaluates the overall performance of the TURF policy should integrate all the available information on TURFs, in order to have an overall picture of their state and trends, including performance and productivity assessments, and their impact on and benefits to fishers and the marine ecosystem. Such a system would also allow the identification of common challenges among the different regions on the one hand and of the peculiarities of individual regions on the other, and would enable the exploration of strategies to address these challenges. The interaction among stakeholders, as well as data sharing and information exchanges within and between regions, would also facilitate the integration of lessons learned into the system and make it more adaptive. For such a monitoring system to be developed, fisheries data collection would need to follow specific formats and procedures that can be easily used and interpreted; if possible, data on TURFs should be made available to the public. In addition to the information on TURFs collected through consultancies, information on other species not managed under TURFs, but harvested in and around TURFs, as well as information on oceanographic conditions and on ecosystem interactions, would all contribute to producing more robust management plans for TURFs and the surrounding areas.

Given that there are large-scale ecological processes occurring in the sea that transcend TURF management and affect the performance of TURFs, stricter management regulations for open-access areas and for other activities or uses that affect the productivity of fisheries need to be developed and applied in combination with the TURF policy. For example, the implementation of no-take zones within or between adjacent TURFs, or the implementation of a more holistic approach of collaborative management between TURFs instead of the current single-TURF management focus could result in ecological, social and economic benefits. Additionally, entities involved in fisheries management and coastal use planning should coordinate their policies and agendas to foresee and solve conflicts and make more efficient use of resources at a local, regional, and state level.

It has been demonstrated that TURFs can be successful instruments for the sustainable management of coastal benthic resources, but, as currently conceived, they do not fit the diversity of resources or the heterogeneity of fishing communities and socio-economic conditions that can be found along Chile's coast. Nevertheless, one of the most important legacies of the TURF system is the support of and incentives for fishers to come together in formal fishing associations; this organizational structure has resulted in giving fishers more voice and legitimate power in decision-making, enabling them to become active stewards of the resource. Additionally, the TURF regime has also facilitated and encouraged the interaction between scientists, fishers and the government, allowing them to learn from each other. We believe these are highly valuable steps forward in nearshore fisheries management.

Finally, the most valuable lesson learned is that TURFs should not be perceived as a single solution for the diverse array of challenges posed by artisanal fisheries management. TURFs are a powerful management tool that should be carefully designed and implemented in combination with other strategies; it should allow for experimentation and continuous improvement, so that it becomes a model of adaptive management in which the knowledge of fishers, scientific principles, and governance systems work in unison to achieve sustainable fisheries management.

View of the TURF “*Sector C*” of the fishing association of *Chaihuín*, in *Valdivia*, Chile.

INTRODUCTION

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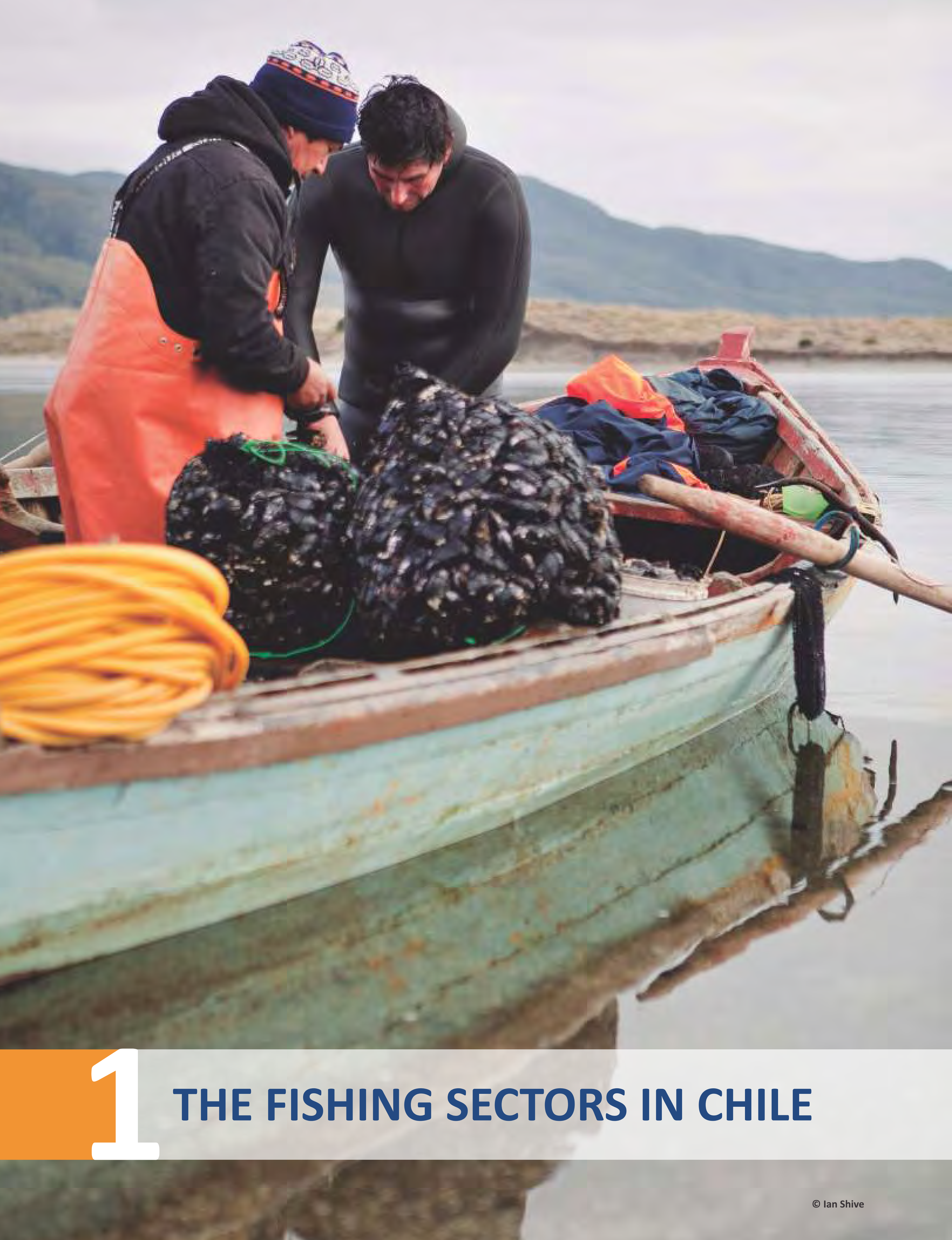
Chile is a global leader in developing co-management approaches for nearshore marine resources targeted by artisanal fishermen. After an overfishing crisis led to the critical closure of the Chilean abalone fishery in the late 1980s, Chile enacted a Territorial Use Rights in Fisheries (TURFs) policy in 1991, which now encompasses more than 700 separate TURFs managed by local fishing associations via community-based catch-share agreements. The Chilean TURF model is seen by many as the example to follow to move small-scale coastal fisheries from the current open-access regime to a rights-based management regime. Much of the literature on Chilean TURFs to date, mostly written by the academic community, has focused on the experience in particular regions and on specific biological and/or governance aspects. While this body of literature has been extremely useful in providing insights into what has been successful in the TURF system, it provides only a piecemeal picture of the current situation with respect to the socio-economic and governance aspects of the system.

With this report we provide a comprehensive review of existing literature and information on the territorial use rights system in Chile, including a review of the historical conditions behind the fisheries reform effort, an analysis of the successful elements of the TURF system, and an in-depth discussion of the remaining governance challenges in making TURFs a successful management approach for small-scale nearshore fisheries. We close the report by providing a set of recommendations to address existing challenges, with emphasis on those that, in our view, would improve the effectiveness of the system overall. In ANNEX I we also provide a set of recommendations for the implementation of a TURF-like framework in countries where no customary rights exist.

Because artisanal benthic fisheries are a significant source of employment in Chile, particularly in coastal and rural communities, this report focuses on the artisanal sector and specifically on the artisanal benthic resources such as shellfish, which are a particularly important source of income for these communities. Indeed, some benthic resources such as Chilean abalone, or *loco* in Spanish, have a remarkably high unit value. These resources have therefore historically driven fishing pressure even at lower yields compared to other resources.

Fisherman sailing along the coast of the Valdivia Coastal Reserve, in *Valdivia*, Chile.



1 THE FISHING SECTORS IN CHILE

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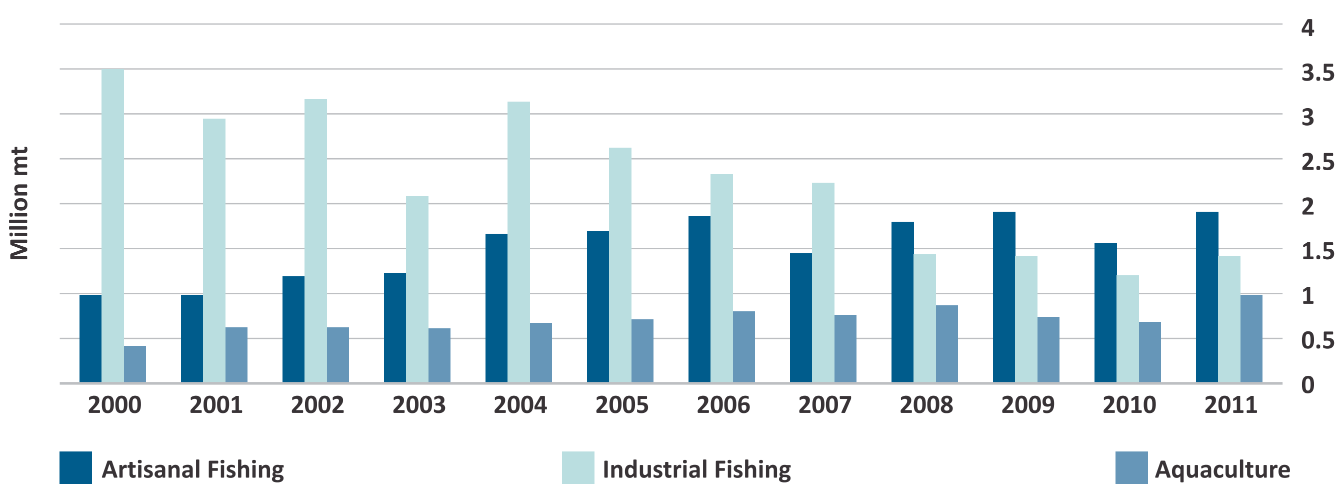
1.1. OVERVIEW OF CHILE'S FISHING SECTORS

Chile is a leading fishing nation. In 2011, it ranked 8th in the world in terms of wild fish catch, producing 4% of the world's wild fish harvest, and 1st in terms of seaweed harvest, representing more than 40% of the world's production of seaweed. Regarding aquaculture, Chile is ranked 8th and 9th among the seafood and seaweed farming countries, respectively (FAO, 2012). Chile's standing as one of the world's fishing nations is a result of considerable investments in the sector and of the natural productivity of its coastal ecosystems, which are part of the Humboldt Current ecosystem - one of the most productive marine upwelling systems in the world.

In 2011, Chile's seafood production (both capture and aquaculture) reached 4.3 million metric tons (mmt) (SERNAPESCA, 2011a), of which industrial production accounted for 34%, or 1.48 mmt (SERNAPESCA, 2011c), artisanal[1] production accounted for 44%, or 1.91 mmt (SERNAPESCA, 2011b), and aquaculture production accounted for 22%, or 0.96 mmt (SERNAPESCA, 2011d).

Since 2008, artisanal landings have consistently exceeded industrial landings (Fig. 1). Finfish farming is the second most important economic activity in Chile after mining, mostly due to the high export value of key species like salmon and trout.

FIGURE 1: FISHING LANDINGS IN CHILE (2011)



Source: Based on data from SERNAPESCA, 2011b, 2011c, 2011d.

In 2006, Chile's Undersecretariat of Fisheries evaluated the role of the artisanal sector in Chile's export market for fishery products using data from 1990 to 2004. Results show that, over this period, the artisanal sector averaged 13% of the total quantity of fish exported and 19% of the economic value generated by this market. This illustrates that artisanal harvests have a higher value per metric ton harvested than the average export products from the fishing sector. This same period also reflects an important increase in the share of fishery products being exported, from 10% in 1990 to over 20% in 2003, reflecting both an increase in harvests and an expansion of the export market.

Tables 1 and 2 show the top landed marine resources from both the industrial and artisanal sectors in Chile. Table 2 further specifies the share of each sector for the top landed species. Of the top 15 landed species, 13 are exploited by both the industrial and the artisanal sectors.

1. Artisanal fisheries refers to extractive activities performed mostly within the first 5 nautical miles from the coast without the use of fishing vessels or by using fishing vessels that are under 18 m long and have a maximum storage capacity of no more than 80 gross registered tons.

TABLE 1: MOST LANDED MARINE RESOURCES BY FISHING SECTOR IN CHILE (2011)

SPANISH NAME	ENGLISH NAME	SCIENTIFIC NAME	LANDINGS (mt)
INDUSTRIAL LANDINGS			
Anchoveta	Anchovy	*Engraulis ringens*	911,829
Sardina común	South American pilchard	*Strangomera bentincki*	202,741
Jurel	Chilean jack mackerel	*Trachurus murphyi*	172,440
Merluza de cola	Patagonian grenadier	*Macruronus magellanicus*	41,283
Merluza común	South Pacific hake	*Merluccius gayi gayi*	28,474
Jibia o calamar rojo	Jumbo squid	*Dosidicus gigas*	23,545
Caballa	Chub mackerel	*Scomber japonicus*	12,033
Bacaladillo o mote	Mote sculpin	*Normanichthys crockeri*	4,874
Agujilla	King gar	*Scomberesox saurus scombroides*	4,678
Langostino colorado	Red squat lobster	*Pleuroncodes monodon*	4,001
Langostino amarillo	Blue squat lobster	*Cervimunida johni*	3,882
Merluza del sur o Austral	Southern hake	*Merluccius cephalus*	3,850
Camarón nailón	Shrimp	*Heterocarpus reedi*	3,579
Reineta	Southern rays bream	*Brama australis*	3,035
Langostino enano	Anomuran crab	*Munida subrugosa*	443
ARTISANAL LANDINGS			
Sardina común	South American pilchard	*Strangomera bentincki*	684,531
Anchoveta	Anchovy	*Engraulis ringens*	279,402
Huiro negro o chascón	Kelp	*Lessonia nigrescens*	241,633
Bacaladillo o mote	Mote sculpin	*Normanichthys crockeri*	173,004
Jibia o calamar rojo	Jumbo squid	*Dosidicus gigas*	138,708
Huiro palo	Kelp	*Lessonia trabeculata*	46,239
Pelillo	Seaweed	*Gracilaria chilensis*	42,224
Erizo	Chilean sea urchin	*Loxechinus albus*	31,901
Luga negra o crespa	Seaweed	*Sarcothalia crispata*	29,559
Reineta	Southern rays bream	*Brama australis*	25,761
Jurel	Chilean jack mackerel	*Trachurus murphyi*	21,282
Almeja	Clam*	*Venus antiqua*	20,359
Huiro (pito o canutillo/ flotador)	Kelp	*Macrocystis spp./M. integrifolia*	19,400
Sardina austral	Falkland sprat	*Sprattus fuegensis*	17,822
Merluza común	South Pacific hake	*Merluccius gayi gayi*	16,858

*Data do not specify clam species, may include *Euromalea spp.* and *Protothaca thaca*.
Table 1. Top 15 most landed species from the artisanal and industrial sectors in 2011.
Source: Based on data from SERNAPESCA (SERNAPESCA 2011b, 2011c).

The two most landed species, anchovy and South American pilchard, are exploited by both sectors; while the landings of industrial anchovy represent 76% of total anchovy landings, artisanal landings of South American pilchard are three times those of the industrial sector. The remaining species that surpass landings of 5,000 mt (i.e., mote sculpin, jumbo squid, southern rays bream) are exploited at much higher rates by the artisanal fleet, with the exception of Chilean jack mackerel and South Pacific hake. Finally, the *Huiro negro* kelp - Chile's third most harvested species - is only collected by the artisanal sector; in fact, all seaweed species, sea urchins and clams are harvested solely by artisanal fishers/gatherers. Of the fifteen most landed resources by the artisanal sector, five are seaweed or kelp species.

TABLE 2: MOST LANDED MARINE RESOURCES IN CHILE (2011)

SPANISH NAME	ENGLISH NAME	LANDINGS (mt)	LANDINGS BY SECTOR (%)	
			ARTISANAL	INDUSTRIAL
Anchoveta	Anchovy	1,191,231	23.45	76.55
Sardina común	South American pilchard	911,829	75.07	22.23
Huiro negro o chascón	Kelp	241,633	100	0
Jurel	Chilean jack mackerel	193,722	10.99	89.01
Bacaladillo o mote	Mote sculpin	177,878	97.26	2.74
Jibia o calamar rojo	Jumbo squid	162,253	85.49	14.51
Huiro palo	Kelp	46,239	100	0
Merluza común	South Pacific hake	45,332	37.19	62.81
Pelillo	Seaweed	42,224	100	0
Erizo	Chilean sea urchin	31,901	100	0
Luga negra o crespa	Seaweed	29,559	100	0
Reineta	Southern rays bream	28,796	89.46	10.54
Almeja	Clam	20,359	100	0

Table 2. Top 12 most landed species from the artisanal and industrial sectors in 2011 (Ladings over 20,000 mt).
Source: Based on data from SERNAPESCA (SERNAPESCA 2011b, 2011c).

Chile is divided into 15 administrative regions (Map 1). Given the extension of the Chilean coastline, each region has particular characteristics that condition the availability of marine resources and therefore the development of certain fisheries. Region XIV (*Los Ríos*) and Region XV (*Arica y Parinacota*) are the most recently created administrative regions[2]. The coast is naturally divided in two segments: a linear zone, spanning from Region XV to the northern part of Region X, and an area of islands, channels and fjords, which extends from Region X to Region XII (San Martín *et al.*, 2010).

2. In 2007, Region XV (in the north) was created by splitting the former Region I in two (currently Regions I and XV), and Region XIV (in the south) was created by dividing Region X in two distinct regions: Region X (*Los Lagos*) and XIV (*Los Ríos*).

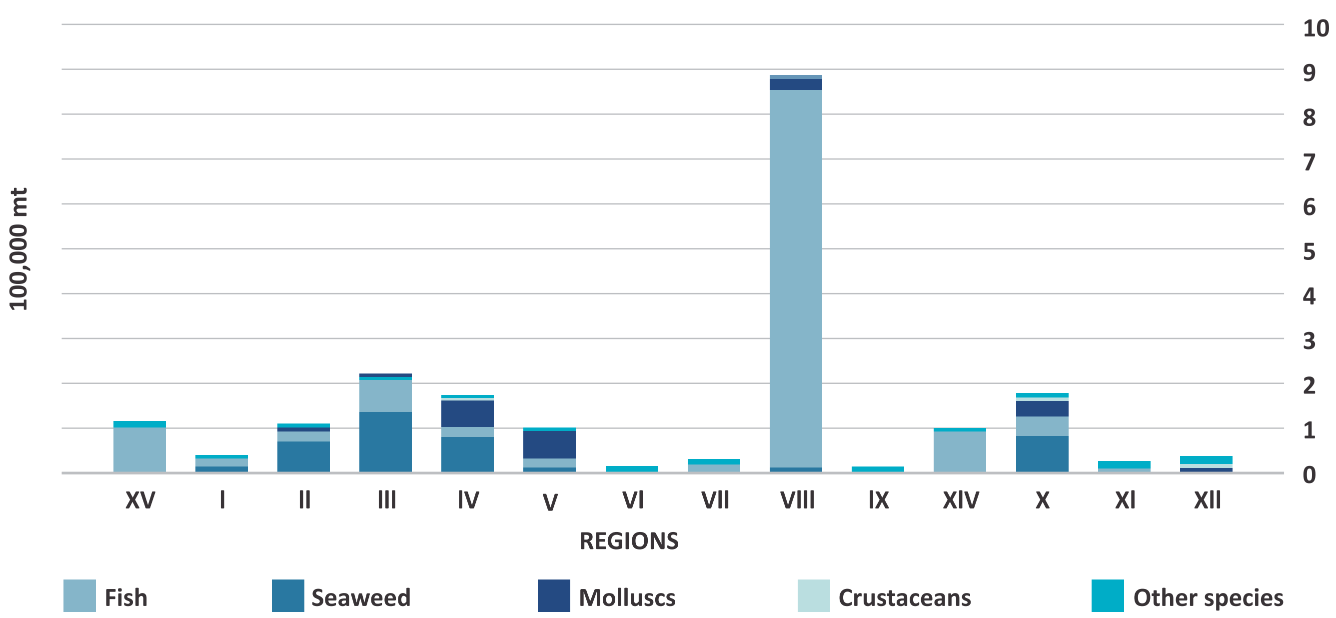
MAP 1: REGIONS OF CHILE

Source: The Nature Conservancy, 2014, based on data from U.S. NOAA and ESRI.

The industrial fishing fleet in Chile is composed of 196 ships that operate within Chilean territorial waters and in the high seas. Industrial fishing takes place mostly in the southern region of *Bío Bío* (Region VIII) and in the northern regions of *Arica y Parinacota* (R. XV), *Tarapacá* (R. I) and *Antofagasta* (R. II) (SERNAPESCA, 2011e). The artisanal fishing fleet comprises 12,757 vessels (RAP, 2012) that operate mainly in nearshore environments.

The artisanal fishing capacity is heavily concentrated in the region of *Bío Bío* (R. VIII) (SERNAPESCA, 2011f), which accounts for almost 46% of the artisanal catch; but it is important to note that this catch is composed of primarily sardines (2011) or anchovy and Chilean jack mackerel (2010), and not benthic species managed under territorial use rights. Other important regions, with considerably less volume of landings, are *Los Lagos* (R. X), *Coquimbo* (R. IV), *Atacama* (R. III) and *Los Ríos* (R. XIV). Figure 2 shows artisanal landings by region and by type of resource. Landings of seaweed are much higher than those corresponding to finfish and other resources in *Antofagasta* (R. II), *Atacama* (R. III), *Coquimbo* (R. IV) and *Los Lagos* (R. X). The extraction of molluscs is particularly important in *Coquimbo* (R. IV), *Valparaíso* (R. V) and *Los Lagos* (R. X). Fish accounts for 66% of the total artisanal landings for 2011, seaweed for 21%, molluscs for 10%, crustaceans for 0.87%, and other species for almost 2% (SERNAPESCA, 2011b).

FIGURE 2: ARTISANAL LANDINGS BY REGION AND BY SPECIES GROUP (2011)



Source: Based on data from SERNAPESCA (SERNAPESCA, 2011b).

1.2. LEGAL AND INSTITUTIONAL FRAMEWORK

Fisheries in Chile are governed by the Fishery and Aquaculture Law (FAL) (*Ley General de Pesca y Acuicultura*), which was enacted in 1991 in order to reform the right to fish for both the artisanal and industrial sectors. The 1991 FAL was aimed at reducing conflict between the artisanal and the industrial fleets, by introducing the concept of regulated access to benthic and pelagic coastal resources. The law was reauthorized on the 31st of January 2013, after extensive consultations by government authorities with stakeholders throughout 2012. The 2013 FAL remains the main piece of legislation regulating fisheries in Chile.

The Ministry of Economy, Development and Tourism (*Ministerio de Economía, Fomento y Turismo*) is the governmental body responsible for the management of the fishing sector in Chile. There are five main government agencies under this Ministry that are tasked with the management of fishing resources.

These include:

- The Undersecretariat of Fisheries (*Subsecretaría de Pesca,* SUBPESCA) is the governmental agency in charge of fisheries management and of the development of fisheries and aquaculture policies. SUBPESCA is represented at a regional level by Zonal Fishing Departments (*Direcciones Zonales de Pesca*) and Zonal Fishing Councils[3] (*Consejos Zonales de Pesca*). In addition to the tasks required to fulfill SUBPESCA's mission, these entities preside over roundtables where private and public stakeholders identify issues or conflicts considered of importance by the different parties, and propose measures to solve them (www.subpesca.cl).

- The National Fisheries Service (*Servicio Nacional de Pesca,* SERNAPESCA) is a governmental agency in charge of enforcement of all the fisheries and aquaculture-related laws and regulations; it also compiles production statistics (www.sernapesca.cl).

- Fisheries Development Institute (*Instituto de Fomento Pesquero,* IFOP) is a non- governmental/ non-profit agency that generates the scientific and technical information required to develop sound management upon which laws and regulations are based. This institution generally works under contract to SUBPESCA and SERNAPESCA (www.ifop.cl).

- The Fisheries Research Fund (*Fondo de Investigación Pesquera,* FIP) is a governmental agency aimed at funding the research necessary to support the adoption of fisheries management measures by the state. The FIP is chaired by the Fisheries Research Council, which is headed by SUBPESCA and constituted by representatives of the National Oceanographic Committee and by specialists from the fishing sector (www.fip.cl).

- The Development Fund for Artisanal Fisheries (*Fondo de Fomento para la Pesca Artesanal,* FFPA) is a governmental agency tasked with promoting and supporting artisanal fishermen via: (i) development of fishing infrastructure, (ii) training and technical assistance for fishers and their organizations, (iii) recovery and cultivation of harvested resources, (iv) commercialization of fishery products, and (v) administration of production centers. The FPPA is chaired by the Council for the Development of Artisanal Fisheries (*Consejo de Fomento de la Pesca Artesanal*), which is headed by SERNAPESCA and constituted by representatives of SUBPESCA, IFOP, the Ministry of Planning and Cooperation, the Ministry of Public Works, and artisanal fishermen. According to the FAL, SERNAPESCA is in charge of the management and monitoring of this fund (www.fondofomento.cl; Art. 56, FAL, 1991).

1.3. TERRITORIAL AND RIGHTS-BASED MANAGEMENT IN ARTISANAL FISHERIES

Many of the fisheries around the world are still managed under what is known as open-access regimes, regimes where there are no restrictions on who can fish or how they can fish. Open-access fisheries are vulnerable to overexploitation because there is no incentive for individual fishers to limit their harvest. Since no one has responsibility for the long-term care of the common property resource, the incentive is to fish until stocks are depleted - a phenomenon called the "tragedy of the commons." Because nearshore coastal fisheries involve thousands of small-scale fishers that operate and land their catch over dispersed areas, most top-down, command and control management approaches are difficult to implement and enforce, and are usually unsuccessful in curtailing overfishing. Instead, it is believed that rights-based management strategies, such as customary marine tenure systems (see Ruddle *et al*., 1992), community-based resource management approaches (see Govan *et al.*, 2006), territorial use rights, and other similar models that assign rights to fishermen or fishing associations are more successful in sustainably managing resources. Castilla and Defeo (2001) define co-management[4] as the "formal participation of fishers in the formulation, planning and surveillance of management measures"; within this context, co-management is considered to be key in mitigating the conflicts that lead to overexploitation (Berkes, 1994; Pomeroy & Williams, 1994; Sen & Nielsen, 1996), and has proven to be a successful management strategy for coastal fisheries in some countries.

3. Currently there are eight Zonal Fishing Departments in Chile; for further information see www.subpesca.cl.
4. See Sen and Nielsen (1996) for a more comprehensive definition of co-management.

Japan has one of the most ancient and successful marine fisheries co-management regimes (Lim *et al.*, 1995; Pomeroy & Berkes, 1997), which has been in place for more than 250 years (Yamamoto, 1995) and consists of a set of self-imposed fishing rules applied by highly organized and empowered fishermen associations to their local fishing grounds (Ruddle, 1989; Uchida & Wilen, 2004). This approach can be understood as the implementation of TURFs (Christy, 1982), complemented by the establishment of fishing-ban areas. In Japan, these management strategies were born as bottom-up initiatives that have been supported by the government (Yamamoto, 1995; Makino & Matsuda, 2005; Matsuda, 2010; Yagi *et al.*, 2010). Close to 88% of Japan's fisheries are managed under these kinds of TURFs (Yagi *et al.*, 2011).

Other countries, with a weaker history of using TURFs compared to Japan, also have interesting experiences in the use of territorial rights-based management, born from different contexts and with highly heterogeneous results. Some of these management systems are formal national regimes, like the marine extractive reserves found in Brazil (see Silva, 2004; Diegues, 2008; Santos & Schiavetti, 2014), or examples of customary marine tenure or community-based coastal resource management, such as those implemented in several Asian nations. The Philippines, Vietnam, Malaysia, Indonesia, and South Korea, for example, have some types of customary marine tenure (see Pomeroy & Carlos, 1997; Wilson *et al*., 2006; Maliao *et al*., 2009; Pomeroy *et al*., 2009, 2011; Uchida *et al*., 2011). Other cases, such as those found in Spain, where TURF-like systems are promoted by fishing associations or *cofradías* and supported by the government in an informal and ad-hoc manner, are successful but not formally instituted at national level (see Molares & Freire, 2003; Franquesa, 2004; Macho *et al*., 2013).

As mentioned above, in Chile, an access-rights management system for the sustainable harvest of benthic resources has been in place for more than 22 years. The system originated from informal implementation through voluntary agreements between artisanal fishermen and scientists; but since the enactment of the Fisheries and Aquaculture Law in 1991, this system has been formally recognized as the Management and Exploitation Areas for Benthic Resources regime (*Áreas de Manejo y Explotación de Recursos Bentónicos,* AMERB), or TURFs as they are widely known in English.

2 THE CHILEAN ARTISANAL FISHERIES

2.1. THE ARTISANAL FISHING SECTOR

In 2012, there were a total of 86,132 artisanal fishers registered in Chile; 55% of these were divers and registered seaweed gatherers. Regions X and VIII concentrate close to 54% of the total number of artisanal fishers. Country-wide, almost 17% of registered fishers are women; most of them are registered as seaweed gatherers (of the total 33,700 gatherers, half are women). Participation of women in other categories of fishers, such as skippers or divers, is very small compared to that of men (RAP, 2012).

While the FAL has detailed descriptions of different categories of artisanal fishers and vessels (see ANNEX II), for the purpose of this report we will follow the classification of the sector by Gelcich *et al*. (2010), which divides artisanal fishers into two main groups:

I. Small-scale fishers: includes divers, inshore finfishers and coastal gatherers. They harvest reef-fish, inshore finfish (using mainly hand-lines, long-lines and nets), benthic invertebrates and seaweed. They operate from open boats (generally < 10 m in length), and harvest by free diving or by using semi-autonomous or air compressor diving gear (i.e., hooka) (Bustamante & Castilla, 1987), or operate without boats in the case of intertidal and shallow subtidal seaweed gatherers (Gelcich *et al*., 2010) (Photos 1 and 2). According to SERNAPESCA (2008b), between 2005 and 2008, small-scale artisanal fishers landed close to 295,000 metric tons/year of benthic resources (excluding seaweed), with an annual production value of around US$250 million (Gelcich *et al*., 2010). This group is the focus of the TURF system.

PHOTO 2. Diver from *caleta Chaihuín*, Region XIV, *Los Ríos*.

II. Mid-scale fishers: includes finfishers using boats of up to 18 m in length (Photo 3), especially targeting high value finfish (e.g. swordfish) and small pelagic species (mainly anchovy, sardine/pilchard and Chilean jack mackerel) (Castilla, 2010), caught mostly using purse seines. This small pelagic fleet tends to be constituted by larger vessels (12-18 m). According to SERNAPESCA (2008b), in 2005-2008 they harvested between 1.50 and 1.84 mmt/year. In 2008, they landed close to 1 mmt of small pelagic species, approximately 43% of the total small pelagic species landed in Chile, with a value of around US$222 million (Gelcich *et al*., 2010).

PHOTO 1. Small-scale artisanal boats and fishermen, Region XIV, *Los Ríos*.

PHOTO 3. Mid-scale artisanal boats. Region XIV, *Los Ríos*.

PHOTO 4. *Caleta Amargos*, Region XIV, *Los Ríos*.

To be allowed to fish, fishers must be officially registered as artisanal fishers in the National Artisanal Fishers Registry (*Registro Nacional de Pescadores Artesanales de Chile*); they register to fish specific species. To register, they are requested to have an "Artisanal fisher" title issued by the Navy (considered the Marine Authority). Vessel registration is mandatory (Art. 50, FAL, 2013). There is no fee for registration.

In summary, an individual is considered an artisanal fisher if he/she (i) is registered as such in the National Registry, (ii) performs extractive activities mostly (but not exclusively) within the first 5 nautical miles from the littoral line and (iii), the fishing vessel used for such activity is under 18 m long and has a maximum storage capacity of no more than 80 gross registered tons.

Artisanal fishers are then organized around coves or *caletas*, which are "strips of land above the high tide mark that are granted as a concession by the State and provide rights to users" (Gelcich *et al*., 2005a). These rights include access to the sea as well as to an area to land a boat and land their catch, anchor boats and build certain infrastructure to repair the ships, prepare the gears, etc. (SUBPESCA, 2012). *Caletas* are legal entities that recognize the traditional use of part of the coastal zone. Some *caletas* are better equipped than others (Photos 4 and 5); those located in urban or tourist ports tend to be better equipped as landing ports than those in rural and/or isolated areas (Gelcich *et al*., 2006). The latter resemble small fishing villages where equipment and infrastructure is more limited and the sale of the catch depends on middlemen who travel considerable distances to buy directly from fishers (Gelcich *et al*., 2006).

Chilean fishers are generally well organized along the coast (González *et al*., 2006; San Martín *et al*., 2010); however, some *caletas* have been historically more active and powerful than others. In 2009, there were 464 legally recognized artisanal *caletas* along the Chilean coast (Decreto 240, 1998). Currently, there are approximately 810 artisanal fishermen organizations (RAP, 2012), the majority of which are legally associated to a single *caleta* (one *caleta* can be legally linked to more than one association). Those organizations that are not legally associated to a *caleta* can still use them as fishing/landing ports. In the *caletas*, different extractive activities coexist, among the most typical are diving for shellfish, seaweed gathering and hand-lining for finfish; long-lining and purse-seining can also occur. Fishermen have variable levels of mobility between these activities. Most of the vessels that operate in the *caletas* are open boats of around 7-8 m in length (González *et al*., 2006).

Caleta-based fisher organizations, mostly known in Chile as *sindicatos*, are then grouped into regional federations, and these into two national confederations: the Chilean National Confederation of Federations of Artisanal Fishermen (*Confederación Nacional de Federaciones de Pescadores Artesanales de Chile* - CONFEPACH, created in 1998) and the National Confederation of Artisanal Fishermen of Chile (*Confederación Nacional de Pescadores Artesanales de Chile* - CONAPACH, created in 1991).

PHOTO 5. *Caleta Bonifacio*, Region XIV, *Los Ríos*.

2.2. THE ARTISANAL BENTHIC FISHERY

A subset of artisanal fishers focus on harvesting over 60 benthic species, including crustaceans, molluscs, sea urchins, tunicates and several species of seaweed (Castilla & Gelcich, 2008; Gelcich *et al.*, 2010). They harvest these species mainly by (a) manual collection during low tide, (b) skin-diving and (c), hooka-diving. Diving usually involves 3-4 men (boatman, assistant and one or two divers) operating from an open boat (5-9 m long) with an outboard motor (10-45 hp), and using air compressors in the case of hooka-diving (Castilla & Gelcich, 2008). Fishers operate during the day and in close proximity to base ports, usually fishing at depths of 25-30 meters within a 15 miles radius from port (Castilla, 1994).

The most important resources targeted by the artisanal benthic fishery, in terms of landings and economic values, are shown in the table below (Table 3).

TABLE 3: TOP ARTISANAL BENTHIC RESOURCES BY WEIGHT AND VALUE (2011)

ORDER	SPANISH NAME	ENGLISH NAME	SCIENTIFIC NAME	LANDINGS (mt)	BEACH SALE VALUE ($/mt)
		BENTHIC RESOURCES RANKED BY WEIGHT			
1	Chascón o huiro negro	Kelp	*Lessonia nigrescens*	241,633	136,909
2	Huiro palo	Kelp	*Lessonia trabeculata*	46,239	145,000
3	Pelillo	Seaweed	*Gracilaria chilensis*	42,224	222,125
4	Erizo	Chilean sea urchin	*Loxechinus albus*	31,901	283,182
5	Luga negra o crespa	Seaweed	*Sarcothalia crispata*	29,559	No data
6	Almeja*	Clam*	*Prothotaca thaca / Euromalea spp. / Venus antiqua*	20,359	324,500
7	Huiro**	Kelp**	*Lessonia nigrescens/ Macrocystis spp.*	19,400	65,400
8	Luga roja	Seaweed	*Gigartina skottsbergii*	14,616	262,250
9	Juliana o Tawera	Juliana clam	*Tawera gayi*	7,494	No data
10	Cochayuyo	Kelp	*Durvillaea antarctica*	6,468	757,143
		BENTHIC RESOURCES RANKED BY VALUE			
1	Loco	Chilean abalone	*Concholepas concholepas*	2,255	6,074,000
2	Pulpo	Octopus	*Octopus mimus*	2,792	1,663,334
3	Lapa	Keyhole limpet	*Fissurella spp.*	1,785	1,227,698
4	Chasca	Seaweed	*Gelidium spp.*	222	784,375
5	Cochayuyo	Kelp	*Durvillaea antarctica*	6,048	757,143
6	Luche	Seaweed	*Porphyra columbina*	16	700,000
7	Navaja o Huepo	Razor clam	*Ensis macha*	4,039	680,789
8	Cholga	Cholga mussel	*Aulacomya atra*	1,555	641,018
9	Piure	Red sea squirt	*Pyura chilensis*	1,033	518,711
10	Ostión del Sur	Scallop	*Chlamis vytrea*	No data	473,000

*Data do not specify clam species, may include *Prothotaca thaca, Euromalea spp.* and/or *Venus antiqua.*
**Data do not specify *Huiro* kelp species, may include *Lessonia nigrescens / Macrocystis integrifolia* and/or *Macrocystis spp.*
Source: Based on data from SERNAPESCA (SERNAPESCA 2011a, 2011b).

The most important species by far in terms of income is the Chilean abalone or *loco* (*Concholepas concholepas*) (Photos 6, 7 and 8), followed by octopus (*Octopus mimus*) and limpets (*Fissurella spp.*); however, neither of these species are in the top ten ranking in terms of weight landed, underscoring the high unit value of these species.

PHOTO 6. *Loco* (*Concholepas concholepas*).

PHOTO 7. Traditional dish with *loco*.

2.3. MANAGEMENT TOOLS DERIVED FROM THE FISHERY AND AQUACULTURE LAW FOR ARTISANAL FISHERIES

The key regulatory tools introduced by the FAL to attain the management of artisanal fisheries include:

I. Regulation of mobility by zoning: this regulation extends to 2,500 km of coastline, from the northern limit of the country (18°36' S) to 43°25'42'' S latitude (Map 2). Under this regulation, exclusive fishing access rights are allocated to artisanal fishers within a zone that extends 5 nautical miles from the low tide mark along this stretch of coastline (Art. 47, FAL, 2013). Additionally, the first mile of this artisanal designated zone is reserved for artisanal fishers using boats that are less than 12 m in length (Art. 47bis, FAL, 2013) (see graphic representation of fishing areas in Map 2).

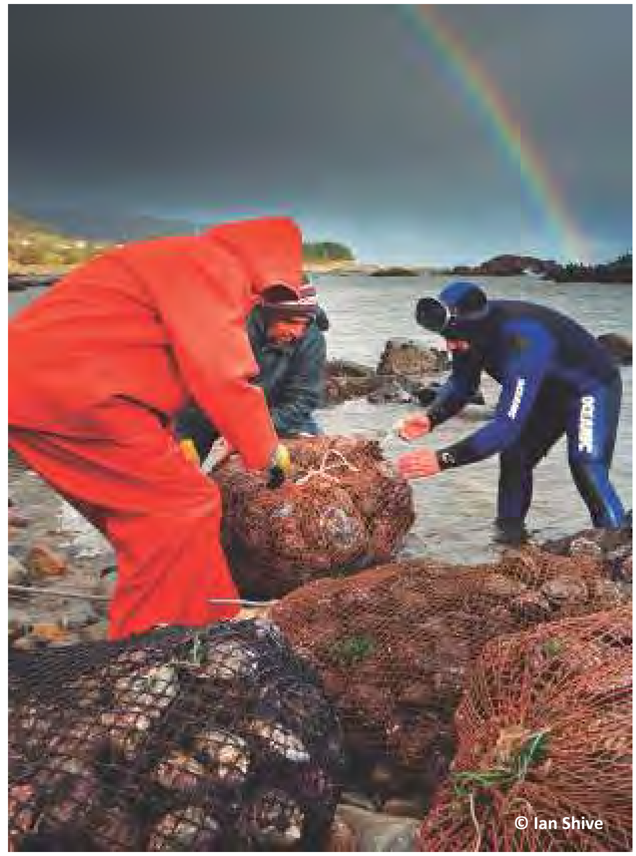


PHOTO 8. Landing of *loco* in *caleta Huape*, Region XIV, *Los Ríos*.

II. Regionalization and registration: under the regionalization scheme, artisanal fishers are restricted to working (diving, finfishing, seaweed gathering) within the coastal region adjacent to their area of residence (with a few exceptions; see Art. 50, FAL, 2013). This regulation also precludes fishers from registering in more than one region (Art. 51, FAL, 2013), limiting the mobility of fishers from one region to the next and therefore controlling fishing efforts more effectively by region. Once a resource reaches the category of "full exploitation" within a region (which means there is no production surplus once the fishermen harvest what is authorized for a particular species; see Art. 2, FAL, 2013), registrations for that target species are suspended (Art. 24 and 50, FAL, 2013).

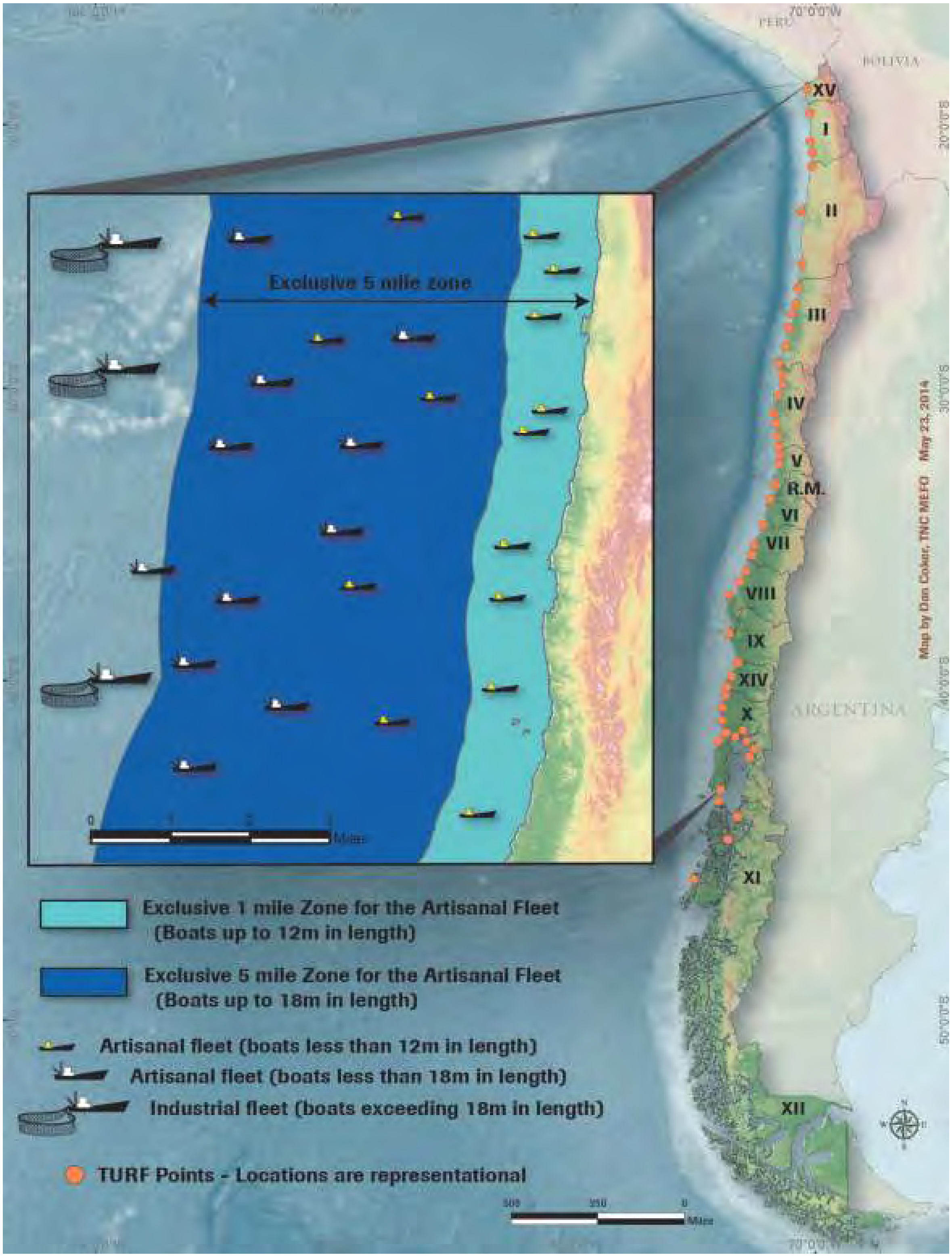
III. Establishment of a Benthic Exploitation Regime for fully exploited species: this exploitation regime consists of the establishment of Total Allowable Catches (TACs), split into Individual Quotas (IQs) among registered fishers for a given fully exploited target species by region. These quotas are non-transferable (Art. 48, FAL, 2013).

IV. Creation of an Artisanal Exploitation Regime for fully exploited species: this regime mandates the allocation of the artisanal fraction of the TACs among areas, fleets, *caletas*, fisher associations or individually registered fishers for these fully exploited species in a given region (Art. 55I, FAL, 2013). Allocation of the artisanal fraction of the TAC depends on the correct registration of fishers, the *caleta's* landing history, the fishing union, the size of the boats, the sustainability of the resource, as well as on other criteria. This regime, however, has so far only been applied in some regions to the Southern and South Pacific hake, the anchovy, and the Chilean Jack mackerel fisheries and has not been applied for benthic fisheries; however it could be implemented for this latter group under the current 2013 FAL (SUBPESCA, 2010b).

V. Allocation of territorial exclusive harvesting rights for benthic resources: seaweed/algae and invertebrates harvest allocations are granted to legally-registered artisanal small-scale fishing associations, under AMERBs or TURFs (Art. 48 and 55A, FAL, 2013).

With the enactment of the FAL and its revisions in 2013, other traditional management or regulation measures have been reinforced and are currently in force, such as seasonal closures and bans, minimum catch sizes, TACs or quotas for species under specific conditions, and regulation of fishing gears, fleets, days at sea, number of fishing trips, etc. (SUBPESCA, 2010b). Open-access fishing areas (known in Chile as *áreas históricas*) (Rivera *et al*., 2001; San Martín *et al*., 2010) outside of the TURFs remain open to those fishers registered in the region, subject to the above mentioned regulations.

MAP 2: GRAPHIC REPRESENTATION OF FISHING ZONES IN CHILE



Source: The Nature Conservancy, 2014, based on data from U.S. NOAA, ESRI, and TNC.

3 THE CHILEAN TURF SYSTEM

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3.1. BACKGROUND

3.1.1. The *loco* fishery as the driver for establishing TURFs

Due to its historical economic importance, the *loco* is considered to have been the key driver in the implementation of the Benthic Exploitation Regime mentioned in the previous section. Under the FAL, the Benthic Exploitation Regime was originally meant to be applied to all harvested benthic species; however, between 1993 and 1999 it was only applied to the harvest of *loco* (SUBPESCA, 2010b). This regime implied the establishment of a TAC for *loco* (based on previous stock assessments) allocated into individual quotas (IQs) among registered *loco* fishermen. The TURF system, though in existence by law since 1991, was not implemented until 1997, at which point allocation of territorial exclusive harvesting rights for all harvested benthic resources occurred.

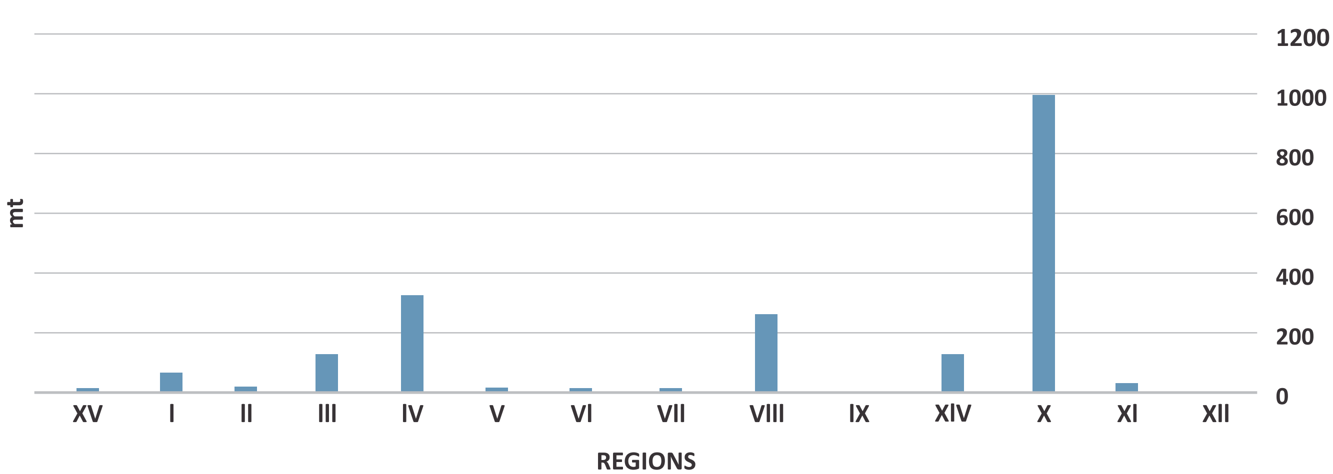
Prior to the FAL, all fisheries, including the *loco* fishery, operated under an open-access regime (Gelcich *et al*., 2005b; Orensanz & Parma, 2010) with only minor controls for some species, such as minimum legal harvest sizes and fishing seasons (Orensanz & Parma, 2010). Artisanal fishers, even if based at specific *caletas*, were able to move freely between regions to harvest resources (Gelcich *et al*., 2005b; Castilla & Gelcich, 2008); they were informally employed by middlemen and/or businessmen who provided the financial resources to invest in fishing gear and who transported fishers (usually divers) and their boats to rich fishing grounds along the coast (Gelcich *et al*., 2005b; Gallardo *et al*., 2011).

From 1960 to 1974, *loco* landings, destined mostly for domestic consumption, were about 3,000-6,000 mt (Castilla & Gelcich, 2008). In a single year, 1974-1975, the demand for *loco* from Asian markets grew rapidly and, in response, the Chilean government invested in local credit programs aimed at fishermen in order to boost production and integrate the artisanal sector into Chile's emergent market-based economy (Bernal *et al*., 1999, as cited in Marín *et al*., 2012). These policies, combined with aggressive exchange-rate policies, substantially improved fishing export earnings to the extent that Chile became the leading exporter of fish and shellfish in South America (Thorpe *et al*., 1999, as cited by Gelcich *et al*., 2008b, 2010). This emerging lucrative market for *loco*, combined with a high unemployment rate in Chile at the time, resulted in an increase in the number of people entering the artisanal fishing sector (Schumann, 2007; Gelcich *et al*., 2005b). Artisanal fishers intensified their mobility, pursuing areas of high *loco* productivity; much migration occurred from the most traditional fishing areas in central Chile to the most productive ones in the south (particularly Region X) (Gelcich *et al*., 2010). This mobility resulted in local overexploitation (Gelcich *et al*., 2005b) and increased the number of conflicts between local fishers and migrant fishers. Interest in restricting the access of fishers that did not belong to local *caletas* grew (Gelcich *et al*., 2010). This period is popularly known in Chile as *'la fiebre del loco'* (or the *loco* fever) (Meltzoff *et al*., 2002; González *et al*., 2006).

From 1976 to 1981, *loco* landings kept increasing, reaching a peak of 24,800 mt in 1980 (Gelcich & Castilla, 2008), a quadruple increase from the previous decade. Between 1980 and 1988, however, landings steadily declined. It was speculated that the decline was a result of overexploitation and depletion (Castilla & Fernández, 1998; Gelcich *et al*., 2010; Gallardo *et al*., 2011), resulting in fishery closures in some regions from 1985 to 1987, and country-wide from 1989 to 1992 (González *et al*., 2006; Castilla & Gelcich, 2008). While harvesting *loco* during this period was illegal, it nonetheless continued (Stotz, 1997; González *et al*., 2006; Gallardo *et al*., 2011).

In 1992, after 4 years of closure, the *loco* fishery reopened under the new FAL regulation; but it was not until 1997 that TURFs started to be fully implemented (Fernández & Castilla, 2005; Castilla & Gelcich, 2008; Gelcich *et al*., 2010). During this transitional phase (1992 to 1997), and because *loco* was considered a fully exploited species, the government experimented with the implementation of the Benthic Exploitation Regime, a national *loco* quota system to be split into IQs. This quota system, according to experts, was “costly to administer and easily circumvented by individual divers” (Gelcich *et al*., 2010). In 1999, while the landings remained stable, *loco* abundance was at its all-time historical low, with populations thriving exclusively in unofficially protected or managed areas (González *et al*., 2006) (usually under the management of scientists and fishermen that self-imposed bans in sections of their traditional fishing areas in order to recover *loco* populations) (Gallardo *et al*., 2011). Since the year 2000, *loco* harvesting is only permitted inside the TURFs (González *et al*., 2006; Castilla & Gelcich, 2008). Thus, since their implementation in 1997 until 2000, TURFs coexisted with the original national TAC and IQ system for *loco*. In the case of benthic resources not fully exploited, the open-access regime outside TURFs remains the *de facto* management system; for species officially considered fully exploited national catch limits (TACs) are in place both inside and outside the TURFs. Figure 3 shows the current contribution of *loco* (*Concholepas concholepas*) landings from TURFs by region.

FIGURE 3: *LOCO* LANDINGS FROM TURFS BY REGION (2011)



Source: Based on data from SERNAPESCA (SERNAPESCA, 2011g).

Prior to the collapse of the *loco* fishery, the fishers had few incentives to implement any management strategy (Gelcich *et al*., 2010); however, the potential recovery of their most economically valued species seemed to work as a major incentive to explore and implement new management regimes.

3.1.2. Marine concessions in the late 1980s and the origin of the first experimental TURFs

The Chilean TURF model was derived from field experiments conducted mainly by local universities in the form of marine concessions for research and conservation. Highly valuable information about the biology and behavior of commercial benthic species and the impact of human intervention in nearshore ecosystems was generated through these efforts (see for example: Castilla & Schmiede, 1979; Moreno *et al.*, 1984; Castilla & Durán, 1985; Moreno *et al*., 1986; Oliva & Castilla, 1986; Durán *et al*., 1987; Moreno & Reyes, 1988; Moreno & Vega, 1988; Godoy & Moreno, 1989; Oliva & Castilla, 1990; Castilla, 1999; Moreno, 2001). Many concessions have been in existence since 1941, but two of them (among the first to be established in the country) were critical for the understanding of the basic ecological knowledge pertaining to the nature and intensity of fishing impacts on the structure of the intertidal and nearshore marine ecosystems. These two concessions were: a 10 ha concession in *Mehuín* established in 1978 (located in Region X in southern Chile), and the 5 ha concession of *Las Cruces* established in 1982 (located in Region V in central Chile) (Fernández & Castilla, 2005; Gelcich *et al*., 2010). Both of these concessions functioned as no-take coastal reserves, where fishing was voluntarily suspended (Gelcich *et al*., 2010). *Mehuín* worked as a voluntary no-take zone from its inception until 1999; however, after 21 years without human impact, incursions by local fishermen depleted the area's benthic resources. After 23 years in operation, *Las Cruces* was finally declared a Coastal Marine Protected Area in 2005 (Decreto 107, 2005).

Because regular monitoring and research was conducted in both concessions from 1981-1988, there are sufficient data to show that human harvesting has great impact and influence over the abundance of *loco* populations and other intertidal and subtidal communities (Castilla, 1999). Research also showed basic ecosystem shifts when the predominantly harvested species, *loco*, decreased in abundance, allowing mussels to dominate the system (Castilla & Durán, 1985; Castilla, 1999). Castilla & Durán (1985) and Moreno (2001) concluded that if harvesting is curtailed, benthic resources, such as *loco*, sea urchins, keyhole limpets, and seaweed could be restored over a 3-5 year period via "natural seeding" (Gelcich *et al*., 2010). These conclusions, together with the increasing concern by artisanal fishers, who for decades had relied heavily on *loco* harvests for their livelihoods, over the state of exploitation of this key resource and its potential recovery, created the opportunity for a strong collaboration and information exchange between fishermen and the scientific community (Castilla *et al*., 1998, as cited in Gelcich *et al*., 2010). Such collaborative research opportunities drove the implementation of the first experimental TURF in 1989 at *caleta Quintay* in Region V, in central Chile (Castilla, 1994; Gelcich *et al*., 2010). The idea behind this experimental TURF was to bring together scientists from *Las Cruces* research station and fishermen from the association of *Quintay* under a special government decree funded by the Chilean National Fund for Research and Technology (Gelcich *et al*., 2010). More *caletas* (e.g. *El Quisco* in Region V, *Los Vilos* and *Huentelauquén* in Region IV) followed this initiative, involving diverse scientific teams in the management of marine resources in their *caletas* (see Schumann, 2010 and Gallardo *et al*., 2011). Fishers and scientists worked together to track stock recovery times, ecosystem dynamics and responses to management and protection measures (Navarrete *et al*., 2010).

Results of this collaborative research show that in those areas with restocking programs in place, "catch per unit effort and mean size of economically important resources such as *loco* increased, whereas searching and traveling time by divers was significantly reduced" (Castilla *et al*., 1998). These pilot experiences constituted a set of critical learning platforms that generated new knowledge and best practices that helped develop a shared vision for local exclusive rights and responsibilities by fisher associations to collectively manage local benthic resources (Gelcich *et al*., 2010). "Several similar initiatives carried out in the middle of a national *loco* overexploitation crisis, (...) helped convince the Fisheries Administration to incorporate the management and exploitation areas in the Fishery and Aquaculture Law" (Fernández & Castilla, 2005).

3.2. IMPLEMENTATION OF TURFS

3.2.1. Rationale behind the TURF concept

TURFs are based on co-management approaches to common property resources; they promote the transfer or establishment of rights among key fishery stakeholders who have an interest to reduce, if not remove, the problems associated with the use of common resources under open-access regimes (Castilla & Gelcich, 2008).

According to the Chilean TURF model, fishers take primary responsibility for managing, harvesting and sustaining fishery resources.

According to the Chilean TURF model, fishers take primary responsibility for managing, harvesting and sustaining fishery resources, under a legal framework and with permanent governmental supervision. This sense of ownership is presumed to lead to stewardship of the resource by the fishermen (Neher *et al*., 1989; Shotton, 2000), with potential positive influence in the fishery, although the management responsibilities are legally shared by fishermen and the state.

The expected benefits of a TURF-based co-management system include:

I. Reduction in management and administration costs. Fishermen are in charge of implementing regulations in their TURFs and are charged with financing the scientific advice required by law for managing these areas.

II. Increase in legitimacy and compliance. Direct fisher participation in the management process and in the collection of information on which the regulations are based reinforces the legitimacy of management measures (Jentoft, 1989) and, consequently, the compliance with such measures (Jentoft & McCay, 1995; Jentoft *et al*., 1998; Castilla *et al*., 2007; Gelcich *et al*., 2007). According to the way the Chilean law stipulates the TURFs, this fact has the potential to create a "greater awareness among fishers of the ecological implications of fishing and the benefits of planned management" (Schumann, 2007).

III. Improvements in the knowledge regarding managed resources and their environment. The Chilean TURF system mandates that fishermen and scientists exchange information; fishermen contribute with their practical knowledge and data, and scientists with their theoretical and, to a certain extent, also with their practical knowledge. Together they create a strong theoretical and practical basis that underpins resource management. This exchange also implies an educational value for both sets of actors.

Quoting the Chilean Fisheries Authorities, the objectives of the TURF policy in Chile are mainly the following (SUBPESCA, 2003):

- Secure the conservation of benthic resources;
- Ensure the sustainability of artisanal fishing through the assignment of natural banks;
- Maintain and increase the biological productivity of benthic resources;
- Increase the knowledge about how benthic ecosystems work;
- Stimulate and promote a participatory management approach.

According to González *et al*. (2006), the TURF system in Chile "is the largest contemporary attempt to introduce a TURF system *de novo*, where it was not established by tradition." This system not only intends to enhance the role of the fishermen as stewards, but also to acknowledge the value and the role of scientists. Therefore, the Chilean experience defines in practice three axis of co-management: government-fisherman, scientist/ consultant-fisherman, and fisherman-fisherman; the three are qualitatively different and in some cases were completely new at the time the TURF system was starting to be implemented (Schumann, 2007).

After TURF-granting legislation was enacted in Chile, the governance transformation was arduous, especially when it came to the allocation of rights.

After TURF-granting legislation was enacted in Chile, the governance transformation was arduous, especially when it came to the allocation of rights (Orensanz & Parma, 2010). The transition involved multiple power struggles and lacked governmental determination. For instance, the approval of the decrees regulating fishers' duties, responsibilities and rights took 4 years. The Undersecretariat of Fisheries, the CONAPACH, which was the only national federation existing at the time, a few particularly committed artisanal fishers associations, and the scientific community were key stewards in this process.

3.2.2. TURF operating principles

Engagement in the TURF system is not mandatory; but for those fishermen who have identified an area of interest and wish to make a claim for a TURF, the process is elaborate; it usually takes around a year or more and requires the following steps[5] (see summarized diagram of the process in ANNEX III):

5. For more information please see 2013 FAL and Decreto Supremo 355 of 1995.

l. A TURF is only granted to fishing associations, not to individual fishers. In order to request the granting of a TURF from SERNAPESCA, the interested fishing association must be officially registered (Art. 1, 7 and 9, Decreto Supremo 355, 1995; Art. 55A, FAL, 2013).

Once the fishing association makes an official request to SERNAPESCA that an area becomes a TURF, the proposed limits of the TURF are evaluated by the Navy, SUBPESCA, the Zonal Fishing Councils[6] and other agencies involved in territorial and sea/coastal use planning, to avoid conflicts with other activities such as coastal development and aquaculture. Once the evaluation is complete and the area is considered to be suitable as a TURF, the Ministry of Economy designates it as a TURF (Art. 55A, FAL, 2013); the fishing association can then apply to SERNAPESCA to be granted the fishing rights for the area (Art. 55B, FAL, 2013). In some cases, fishing associations request the evaluation of an area, the area is awarded TURF status, and then the association fails to apply for the rights because of lack of interest, funding constraints, or similar reasons. In these cases, the designated areas remain as TURFs available to fishing associations for two years (Art. 144, FAL, 2013).

If the TURF is granted, fishers belonging to the association can fish in the TURF even if they are not registered as individual artisanal fishers in the Artisanal Fishermen Registry for the specific resources that they intend to fish in the TURF. Before the 2013 amendments to the FAL, fishers were obliged to be registered (in addition to having the association registered) and have an artisanal fisherman title issued by the Navy in order to participate in the TURF. This is no longer a requirement. Fishers must meet the requirements to obtain the title of Artisanal Fisherman that is issued by the Navy, but it is no longer mandatory to have the title itself (Art. 55C, FAL, 2013). Two or more associations can apply jointly for a single TURF (Art. 7, D.S. 355, 1995; Art. 55E, FAL, 2013).

ll. Development of an initial baseline study (Art. 11, D.S. 355, 1995; Art. 55B, FAL, 2013) that describes bathylogical characteristics of the area, benthic communities found therein, quantification of the main species to be harvested, and the socio-economic characterization of the fishers' communities applying for the TURF (Art. 15, D.S. 355, 1995). Fishing associations are mandated by law to hire scientists (from qualified universities or research institutes; see Art. 32, D.S. 355, 1995) or consultants (both called "implementing institutions") to perform these baseline studies.

lll. Provision of a one year management plan for the harvested resources (Art. 16, D.S. 355, 1995; Art. 55B, FAL, 2013), based on the results from the baseline study. SUBPESCA negotiates the management plans with the fishermen for each TURF (Orensanz & Parma, 2010). The management plan has to specify the exploitation regime, the fishing methods to be used, management measures, the required budget and financial sources, and the species that are intended to be harvested each year (Art. 15, D.S. 355, 1995). According to Gelcich *et al.* (2008a), the harvested species generally number between two and five, but this number varies depending on the natural productivity of the area, fishermen knowledge, available gears and technology, etc. (Marín *et al.*, 2012). The management plans can include aquaculture activities within the TURFs and seed collection following specific regulations (see Art. 55B, FAL, 2013 and Regulations for Aquaculture Activities in TURFs, D.S. 314-04, 2005). The management plans must be designed by scientists or consultants under hire by the fishing associations, as described for the baseline study above. The law also requires that the execution of these plans must be entirely assisted by scientists/consultants (Art. 14, D.S. 355, 1995).

If SUBPESCA considers that the proposed management plan is not adequate due to ongoing overexploitation or depletion of specific resources, negative effects of natural variability (e.g. El Niño), scarcity of prey for target species, or other circumstances, it may suggest not to fish in the area for a specific period of time as a first management measure, thus not granting a quota (Rivera *et al.*, 2001). SUBPESCA can also restrict the use of specific fishing gear that may damage benthic resources or associated fauna in and outside the TURFs, if this is considered appropriate (Art. 33, D.S. 355, 1995).

6. The Zonal Fishing Councils must consult with Regional Fishing Departments, with the National Corporation for Indigenous Development (*Corporación Nacional de Desarrollo Indígena*), and with the fishing associations of the area.

IV. After SUBPESCA evaluates and approves the baseline study and the management plan, SERNAPESCA must sign a use-agreement with the corresponding fishing association; this agreement assigns the fishing rights for that particular TURF to the fishing association (Art. 13, D.S. 355, 1995; Art. 55B, FAL, 2013). Under the 2013 FAL amendments, this agreement is now indefinite as long as fishers comply with the regulations (under the 1991 FAL these agreements were renewable every 4 years). SERNAPESCA is also in charge of enforcement policies (e.g. execution of baseline studies and management plans). The assigned rights are not transferable or for rent (Art. 55B, FAL, 2013).

V. Submission of follow-up performance reports. These reports have to include the estimated abundance and trends of the main harvested species, information regarding extractive activities, management measures of the past year and those projected for the following year, as well as the required management budget and sources of financing (Art. 17, D.S. 355, 1995). The 2013 FAL amendments now require performance reports to include information on the economic and social performance of the TURF. The law states that these reports should be provided on an annual or a 2-3 year basis[7] (Art. 55D, FAL, 2013). As in the case of the baseline studies and management plans, designated implementing institutions (i.e., qualified scientists or consultants) are hired to do the monitoring required for the performance reports. SUBPESCA is responsible for reviewing the follow-up performance reports (Art. 17, D.S. 355, 1995).

If the fishing association does not comply with regulations for more than two years, the use-agreement is cancelled by the authorities (Art. 11, 12, 13, 21, 27, D.S. 355, 1995; Art. 144, FAL, 2013). Noncompliance criteria include (see Art. 144 and 144A, FAL, 2013): (i) not following the designed management plan, (ii) not submitting the performance reports, (iii) not declaring harvests or not fishing for more than three consecutive years, (iv) not identifying in the baseline study a natural bank suitable for exploitation and implementation of a management plan, (v) not formally assigning a designated TURF to a fishing association in two years or (vi) the expiration of the pre-2013 use-agreement without renewal (as pre-2013 agreements had a 4 years term). The TURF can also be voluntarily returned to the government by the fishing association (Art. 30, D.S. 355, 1995). If a fishing association returns its TURF or the management plan expires without renewal, that fishing association will no longer be able to claim the same area as its TURF for a period of three years. In the case of the 4th and 5th non-compliance criteria, the area cannot be designated as a TURF for five years (Art. 55H, FAL, 2013).

If the fishing association does not comply with TURF regulations for more than two years, the use-agreement is cancelled by the authorities.

VI. Based on the baseline studies and management plans carried out by the implementing institutions under contract with the fishing associations, TURF-level TACs are granted by SUBPESCA for each of the species that will be harvested in each TURF. The purpose of these TACs is to have biologically sustainable harvest levels (Castilla & Gelcich, 2008). The fishing association then calculates and divides the TURF-TACs into IQs and allocates them among association members, following internal criteria (Cancino *et al*., 2007). Harvest of non-registered benthic species within a TURF is illegal (Art. 33, D.S. 355, 1995). Fishermen not registered under a certain TURF-holder fishing association are permitted to fish solely for finfish species inside the TURFs, under a prior and specific agreement with the corresponding TURF-holder association. These agreements have to be mentioned in the management plan (Art. 34, D.S. 355, 1995) and can stipulate specific regulations affecting the use of gear and spatial and temporal restrictions for finfishing (Art. 33 and 36, D.S. 355, 1995).

Fishing associations are in charge of the payment of expenses associated with meeting all the requirements set forth above. The baseline studies and other consulting fees are expensive; however, their cost have been covered in large part with government subsidies of various types (for more information on subsidies see CENDEC, 2010).

7. Fishers may request the submission of their performance reports on a 2-3 year basis to be approved by SUBPESCA. For details on the criteria, see Art. 19, D.S. 355, 1995.

While consultants are required by law to perform the assessments and studies, to do so they often give basic training to the fishermen who participate in the studies, as it is common that the data collection efforts fall on the fishers. Fisher participation in data collection is part of an integration strategy to engage fishers more fully in the management process. Despite not being mandatory, some consultants offer training in topics such as ecology, seafood marketing, shellfish repopulation, computer skills, and business administration. Some consultants, however, do charge for these courses (Schumann, 2007).

Until January 2013, payment of an annual fee/tax for the exclusive right to harvest benthic resources was required, but the new 2013 revisions of the FAL no longer requires this payment. Prior to the new amendments to the FAL, a fee was paid every year after the second year of the TURF agreement by the fishing association claiming the TURF. It was a fixed fee per hectare of seabed, irrespective of the region, target species, productivity of the area, catch or revenue (Art. 48, FAL, 1991).

3.2.3. Current distribution and demand for TURFs in Chile

As of March 2013, there were 773 designated TURFs in Chile (SERNAPESCA, 2013a); however, only 351 (45%) of the 773 are considered operative, which means they have been designated and assigned to a fishing association, have a baseline study, a management plan, a use-agreement, and a TAC in place. By the same date, 354 applications for new TURFs were being evaluated. In Chile, designated TURFs range in size from 3.8 to 4,096 ha of seabed (SERNAPESCA, 2013b); the majority are less than 150 ha (SERNAPESCA, 2013a). Together, they account for more than 1,249 km^2 (120,663 ha) of the nearshore seascape (SERNAPESCA, 2013a) (see Table 4 and ANNEX IV for further details regarding landings from TURFs by species and by region). The distance between TURFs is around 4-10 km (SUBPESCA, 2010a), meaning that there is high connectivity between TURFs. Of the 810 existing artisanal fishing associations, approximately 34% have TURFs and around 22% of artisanal fishers participate in TURFs (INE, 2009).

TABLE 4: TURFS BY REGION AND THEIR LANDINGS (2011)

	REGION	Nº DESIGNATED TURFS 2013	Nº OPERATIVE TURFS 2013	AREA DESIGNATED TURFS (ha)	AREA OPERATIVE TURFS (ha)	TOTAL TURF LANDINGS (2011 - mt)	% OF TOTAL TURF LANDINGS (2011)
XV	Arica y Parinacota	3	0	2,916	0	7	0
I	Tarapacá	19	12	2,720	1,216	469	4
II	Antofagasta	36	8	5,172	1,419	114	1
III	Atacama	39	20	4,021	2,816	768	7
IV	Coquimbo	80	59	13,568	10,390	5,192	49
V	Valparaíso	42	12	5,251	1,916	466	4
VI	Libertador Bernardo O'Higgins	35	5	1,949	333	25	0
VII	Maulé	19	13	2,799	1,761	5	0
VIII	Bío Bío	76	38	26,397	14,090	384	4
IX	Araucanía	5	2	1,399	106	0	0
XIV	Los Ríos	45	41	3,673	3,405	200	2
X	Los Lagos	290	132	32,691	14,360	3,003	28
XI	Aysén del General Carlos Ibáñez del Campo	75	9	16,777	2,195	27	0
XII	Magallanes y Antártica Chilena	9	0	1,330	0	0	0
	TOTAL	**773**	**351**	**120,663**	**54,007**	**10,660**	**100**

Source: Based on data from SERNAPESCA (SERNAPESCA, 2011g and 2013a). For more information on TURF landings see Annex IV.

The establishment of TURFs in Chile started gradually, spreading from the north of the country to the south (Rivera *et al*., 2001; San Martín *et al*., 2010), and became very dynamic for some years in terms of active users and a continuous demand for new areas; however, the demand for new TURFs has declined in the past few years. Every year, a number of TURFs are formally returned to the state, either because of non-compliance with legal requirements, or voluntarily, because of low productivity.

As shown in Table 4, the regions with the highest number of TURFs are *Coquimbo* (R. IV) and *Los Lagos* (R. X); these two regions account for almost 80% of the total landings of TURFs. In the case of *Coquimbo*, most of the landings correspond to kelp and seaweed species and surf clams, and in the case of *Los Lagos*, to surf clams and *loco*. Region XII does not have operative TURFs, presumably due to surveillance constraints, given that fishing communities tend to reside far away from the fishing grounds (San Martín *et al*., 2010).

Owing to the demand for TURFs in the past years, open-access areas have become increasingly scarce (Gelcich *et al*., 2005a, 2005b, 2009; Stotz *et al*., 2008). Undoubtedly, this process has livelihood consequences for artisanal fishermen, particularly those that are not members of TURF-holding fishing associations (Gelcich *et al*., 2005a, 2005b, 2009; Castilla & Gelcich, 2008). An interesting and needed area of research is a comparison of the changes in the life style of the different sets of fishermen up and down the Chilean coast since the TURF management regime was implemented, with particular emphasis on fishermen not participating in the system.

As a result of the consultations for the 2013 reauthorization of the FAL, the Chilean government established a three year ban on new TURF applications as of February 9th, 2013. However, the new amendments allowed for applications already submitted to continue to be processed until August 31st, 2013. Requests for the expansion of existing TURF areas, however, will not be accepted during this same period (Art. Vigésimo primero, FAL, 2013). This last measure was taken in order to revise the performance and use of existing TURFs, which in some cases are granted but not used by fishers (C. Techeira, personal communication), and also in order to evaluate existing conflicts with other coastal zone uses.

3.2.4. Principal species harvested in TURFs and relationship with total artisanal landings

Historically, around 50 species have been included in TURF management plans (SERNAPESCA, 2013b). Between 2002 and 2011, the most important resources in volume and value, representing around 63% of the total landings in the TURF areas, were *loco*, *huiro palo* kelp and *macha* clams (Table 5). *Loco* alone accounts for 31% of the total landings, with some regions registering much higher percentages. However, in recent years, *loco* landings have declined while other species are gaining in importance. Between 2007 and 2011, for example, 14,663 mt of *loco* were landed, while the landings of *huiro palo* kelp from TURFs surpassed 17,637 mt (SERNAPESCA, 2007a, 2008a, 2009, 2010a, 2011g). Despite this fact, *loco* remains the most profitable benthic resource in the TURF system by far.

Loco remains the most profitable benthic resource in the TURF system by far.

TABLE 5: TOP 15 SPECIES WITH HIGHEST LANDINGS FROM TURFS (2002-2011)

LANDINGS RANKING	SPANISH NAME	ENGLISH NAME	SCIENTIFIC NAME	TOTAL LANDINGS (02-11) (mt)	% OF TOTAL TURF LANDINGS (mt)	BEACH SALE VALUE (2011 CLP/mt)	PROFITABILITY RANKING
1	Loco	Chilean abalone	*Concholepas concholepas*	28,023	30.74	6,074,000	1
2	Huiro palo	Kelp	*Lessonia trabeculata*	17,676	19.39	145,000	10
3	Macha	Surf clam	*Mesodesma donacium*	12,001	13.16	262,000	7
4	Huiro negro o Chascón	Kelp	*Lessonia nigrescens*	9,868	10.82	135,909	11
5	Pelillo	Seaweed	*Gracilaria chilensis*	7,628	8.37	222,125	9
6	Erizo	Chilean sea urchin	*Loxechinus albus*	3,232	3.55	283,182	6
7	Cochayuyo	Kelp	*Durvillaea antarctica*	1,633	1.79	757,143	3
8	Culengue	Clam	*Gari solida*	991	1.09	318,333	5
9	Lapa regra	Keyhole limpet	*Fissurella latimarginata*	946	1.04	No data	Unknown
10	Luga negra	Seaweed	*Sarcothalia crispata*	920	1.01	No data	Unknown
11	Almeja*	Clam*	*Protothaca thaca / Euromalea spp. / Venus antiqua*	770	0.84	324,500	4
12	Lapa	Keyhole limpet	*Fissurella spp.*	686	0.75	1,227,698	2
13	Locate (caracol)**	Rock snail**	*Thais - stromatita - chocolata*	666	0.73	237,687	8
14	Huiro (pito o canutillo/ flotador)	Kelp	*Macrocystis spp./ M. integrifolia*	548	0.60	65,400	12
15	Luga, Luga cuchara o corta	Seaweed	*Mazzaella laminarioides*	453	0.50	No data	Unknown
TOTAL LANDINGS FROM TURFS (2002-2011)				**91,162**			

* Data do not specify clam species, may include *Prothotaca thaca, Euromalea spp*. and/or *Venus antiqua*. **There is no data regarding sale values for the rock snail *locate* (*Thais chocolata*) for 2009, 2010 and 2011; the value shown corresponds to 2008. Values are in Chilean pesos.

Source: Based on data from SERNAPESCA (SERNAPESCA, 2002-2010a, 2011g)

Not surprisingly, because of the previous area-based fixed fee required for a TURF, most organized fishermen first claimed those relatively smaller areas with higher *loco* suitability and, therefore, higher productivity (González *et al*., 2006; Orensanz & Parma, 2010). According to González *et al*. (2006), catch-per-unit-effort (CPUE) is five to ten times higher in TURFs than in open-access areas; it is important to note, however, that this estimate reflects the fact that areas outside TURFs are less suitable for *loco* (as many of the suitable areas have been claimed as TURFs). It is also presumed that there is rampant illegal fishing and overfishing in open-access areas and that there are areas of localized depletion of *loco* stocks outside TURFs (González *et al*., 2006; Gelcich *et al*., 2008a; Orensanz & Parma, 2010).

Seaweed and kelp species play an important role in the productivity of TURFs - five of the twelve most profitable species harvested in the TURFs are seaweed species; they not only represent a high percentage of the landings (within and outside of TURFs) (see Table 5), but condition the variability of the landings of other resources, such as surf clams (*macha, Mesoderma donacinum*) and scallops (*Argopecten purpuratus*) (Castilla & Gelcich, 2008). According to some authors, the variability of recruitment and landings of some seaweed and kelp species can be attributed to climatological events such as El Niño (Stotz, 1997; Wolff & Mendo, 2000); thus, development of TURFs focused on these particular species can easily fluctuate from success to failure (González *et al*., 2006).

For some species, the percentage of landings from TURFs in comparison with total artisanal landings is significantly higher, while for others harvest within TURFs is considerably lower. In 2011, the total landings from TURFs represented less than 1% of the total artisanal landings. That same year, in addition to *loco*, the legal harvest of *macha* clams was performed almost entirely within TURFs (89% of landings), and close to 50% of the harvest of *choro (Choromytilus chorus*) also occured within TURFs (SERNAPESCA, 2011b, 2011g). These values, however, are highly variable each year. In 2010, for instance, the legal harvest of *lapa negra* (*Fissurella latimarginata*) and *lapa reina* (*Fissurella maxima*) was performed exclusively within TURFs (SERNAPESCA, 2005b, 2010a).

At this point, it is important to remember that (i) the harvest within TURFs is expected to be much lower than in open-access areas due to management plan restrictions, and because the only species banned-for-harvest outside the TURFs is *loco*, and (ii) the establishment of TURFs initially required the payment of an area-based fixed fee, thus TURFs have been generally claimed to harvest those resources that would have higher economic returns with low volumes and using a small area, instead of other resources that would require higher volumes and bigger areas to compensate lower economic return.

3.2.5. Fishermen as managers: Changing the perceptions of fishers and management structures

Since the implementation of TURFs, fishers have taken effective control of their harvesting decisions within their management areas (Gelcich *et al*., 2007; Marín *et al*., 2012), particularly with regard to: (i) the size and location of the TURF, (ii) the number and type of species they want to harvest or will allow others to harvest (in the case of finfish species), (iii) the methods and/or gear they will use, (iv) the TAC to be extracted for each of the target species, the timing of this harvest, and the allocation of IQs for each fisherman (conditioned by the officially-designated harvest season, minimum harvest sizes and approved TAC), (v) the potential accepted prices for their resources, (vi) the buyers to whom fishers will sell, and (vii) how income is distributed between the associated fishermen (Gelcich *et al*., 2006, 2007).

To successfully fulfill the above-mentioned tasks and comply with the purpose of the TURFs (i.e., the sustainable harvest of common property resources), fishing associations have self-imposed strict local rules for resource extraction (Gelcich *et al*., 2010; Orensanz & Parma, 2010), in some cases more stringent than official regulations (Meltzoff *et al*., 2002). Furthermore, fishing associations have constituted Management Area Committees within their organizations; by 2005, approximately 73% of the fishing associations had one of these committees (SERNAPESCA, 2005c).

Since the late 1990s, fishers have also carried out a substantial transformation of the commercialization process. Before TURFs were established, landed catch was bought and sold along beaches (Orensanz & Parma, 2010) and fishers had to bargain individually on sales (Gelcich *et al*., 2006; Orensanz & Parma, 2010), which often led to lower prices and incomes (Orensanz & Parma, 2010). Currently, and specifically for *loco*, sales are arranged prior to harvest (Orensanz & Parma, 2010) and catches are stored in the TURFs to negotiate sales (Orensanz *et al*., 2005). This system allows fishermen to sell their catches exclusively through legal markets and get a better and equitable price for the product (Avilez, 2003; Orensanz & Parma, 2010). Some fishing associations have also created specific commercialization committees that support better marketing and sales; by 2005, more than 30% of the fishing associations had this type of committee (SERNAPESCA, 2005b).

Thanks to the TURF system, "fishers can now better schedule their harvesting period to capitalize on market fluctuations and to allow stocks to mature" (Gelcich *et al*., 2010), improving their revenues by knowing when to harvest and selling more valuable products. Additionally, fishers can adjust the fishing effort to the actual availability of the resource (Aburto & Stotz, 2013) based on the baseline studies and the performance reports, which can translate into a more efficient use of their resources. Furthermore, fishers have more certainty about their income (Aburto & Stotz, 2013) and can complete their harvest quota in a few weeks, allowing them to have alternative jobs and diversify their source of income (Gelcich *et al*., 2010). Such diversification allows the fishermen to cope with low production years in their *caletas*, which can be considered an active risk management strategy (Hilborn *et al*., 2001).

The TURF policy has also awakened fishers' entrepreneurship and has encouraged collaboration between associations, generating collective actions to create innovative business initiatives (World Bank, 2006; Castilla & Gelcich, 2008). For instance, cooperatives and companies have been founded to find new markets for benthic resources (Castilla *et al*., 2007; Castilla & Gelcich, 2008), and/or collectively sell resources from several associations, adding value to their fishery products. Other complementary activities that are taking place (depending on the opportunities available in each community) include the harvest of resources not typically targeted, tourism (e.g. ecotourism, restaurant concessions), and small-scale aquaculture (González *et al*., 2006). The latter is still in the early stages of development within TURFs (A. González, personal communication). As Castilla and Gelcich (2008) point out, all of these initiatives demonstrate how the TURF policy has encouraged self-empowerment and bottom-up governance to manage fisheries.

A study developed by Schumann in 2001 (Schumann, 2007) in two historically important fishing regions in Chile at the time of inception of the TURF system shows interesting indicators for the acceptance and potential outcomes regarding TURF implementation, for the role played by fishers, and for their perceptions. Schumann demonstrates that fishermen have developed a consciousness about their fishery that goes beyond the economic interest in conserving the resource. They seem to have a better understanding of the ecological implications of resource extraction and of the different ways to perform this extraction; they also seem to value management and conservation measures. Schumann suggests that this consciousness is probably a result of the interactions between stakeholders as part of the TURF experience.

The following two statements, quoted directly from Schumann's study (2007), illustrate this point:

- [If you don't manage an Area], your mentality is to catch all the shellfish you can. But if you're in a port where the biologists tell you 'look, you shouldn't keep taking that species because it's going to disappear,' then you acquire another mentality, something like a new consciousness.

- Our way of thinking [with consciousness] is different. For example, we dive outside the area even though it's illegal, we take *loco* anyway, we steal - but we only take big *loco*. We leave the small ones. Fishers who don't manage areas take everything, even the small ones.

At the time Schumann conducted her research, the fishermen were already perceiving benefits from TURF management measures, including: economic benefits (stable employment, a back-up source of income for hard times, a way to save for the future), social benefits (unity of participants, the prestige of having a successful area, the satisfaction of exclusive control of the area), and biological benefits (conservation of the species, balancing the ecosystem, selective exploitation of large shellfish). Other studies have further addressed fishers' perceptions regarding compliance, enforcement, empowerment and environmental awareness. These studies were conducted by Gelcich *et al*. in 2003-2004 (Gelcich *et al*., 2008b) and in 2006 (Gelcich *et al*., 2009) in Regions IV, V, VI and X; their findings also show how the TURF system has indeed shaped the resource stewardship role of fishers, and that duration of fishers' engagement in TURF policy has significantly influenced their perceptions.

Other interesting changes in perceptions are related to the success and profitability of TURFs and the learning process that implementation entails. In Schumann's study (2007), most of the fishermen describe their management experience as successful and assess their management areas as profitable. With regard to learning about management and ecology, the study states that "when asked what they had learned about management, many fishers gave answers focusing on the biological aspects of management (e.g., to repopulate shellfish, to conduct biological studies, to stop overexploiting, to take care of resources for future generations), while others gave answers focused on social aspects (e.g., to work as a team with other fishers, to market shellfish successfully, to be a better leader)." Moreover, more than a third of the interviewed fishermen seem to have acquired knowledge about ecology, as shown by the following responses: "not to be an indiscriminate predator; not to 'clean' the area of harmful species; to respect closed seasons and size limits; to maintain the ecosystem; not to take target species' food." This type of social analysis is very useful in understanding to what extent and how fishers experience the TURF management process.

As Castilla and Gelcich (2008) point out, the sense of ownership has developed important non-economic values that work as drivers to keep the TURF system working, such as pride and accountability (for more information on fishers' perceptions see Gelcich *et al.*, 2005a, 2005b, 2006, 2008b, 2009; Castilla *et al*., 2007).

In summary, partly as a result of the TURFs regime, fishers are much more organized, informed and involved in management activities in comparison to the early 80s and 90s. In general, fisher-to-fisher relationships have been strengthened, developing a real sense of cooperation, solidarity, unity and power-sharing, particularly within fishing associations and in historically highly organized *caletas*. In Schumann's study, fishers identify unity as the most important co-management benefit. Nonetheless, Schumann (2007) points out that this unity also created rivalry between some neighboring *caletas*. Gelcich *et al*. (2005b) reinforce this point describing rivalry and disagreement between associations even within the same *caleta*. However, in spite of local rivalries, this sense of unity reinforced the power of fishing associations.

Despite the crucial role of fishers in the TURF system, Schumann (2007) emphasizes that the "relationship between fishers and the state is characterized by a division of labor rather than by the 'power-sharing' that is often associated with co-management," and that there is a lack of cooperation and communication between the artisanal fishers and the state, resulting in much of the decision power resting with the state. Schumann's conclusion is that, while, in general, interviews with fishers show an existing positive attitude towards the role of the state as enforcer, a subset of fishers who consider themselves conservationists had more negative views of the state's regulatory function, and seem to be disappointed with the state's enforcement activities, suggesting that "as fishers become more aware of the importance of management and ecology, they grow increasingly dissatisfied with the performance of the State in management." In these cases, fishers clearly consider themselves to be the real enforcers; they believe that the state's penalties for poaching are not severe enough and that the government does not have the proper staff capacity to fulfill its obligations (Schumann, 2007; Castilla & Gelcich, 2008). Nonetheless, some of the interviewed fishermen admitted that regulations were good enough, but declared that many of the fishers simply ignore regulations (Schumann, 2007). These statements make it clear that, for the fishermen, enforcement by the state is a key element towards having a successful management system.

In contrast with the fisher-state interaction, Schumann's studies (2007, 2010) found that the consultant-fisher interaction shows a high degree of cooperation. As mentioned earlier, under the TURF regulations, consultants receive the required data from fishers, develop analyses and management plans and, in some cases, play an advisory role to fishers. Consultants are the bridge between the state and the fishers, since they are the ones proposing management plans, setting the objectives and reporting on TURF performance. According to Schumann (2007, 2010), this interaction is the most variable in terms of perception. Some fishers truly value the work of consultants, while others simply believe scientists are not sufficiently prepared to be in charge of assessments and planning (arguing that their knowledge is mainly theoretical). However, independently of the quality of the consultants' performance, it is clear that they play a crucial role, especially in terms of the effects of TURFs on target resources, thus they could be considered co-managers.

3.2.6. Tangible results of TURF management and their conservation potential

A few recent studies have evaluated the performance of TURFs with respect to productivity (see for example: Stotz *et al*., 2008; Techeira *et al*., 2010, 2011, 2012, 2013). These studies generally group the TURFs by region or zone (i.e., group of regions) for their analyses, and focus on the most important species harvested in the TURFs. The results of these studies are somewhat variable; however, overall the authors assert that over time the TURF policy has been positive with regard to productivity, particularly for some of the most economically important resources such as *loco* (Stotz *et al*., 2008; Techeira *et al*., 2011). For instance, Techeira *et al*. (2011), estimate that *loco* populations have reached their natural productivity and are no longer considered overexploited; and that the productivity of limpets has improved or remained stable, though these results are not homogeneous across all regions.

Many studies on the ecological outcomes of implementing TURFs in Chile have focused on biological and ecological comparisons between open-access areas and TURF areas, and in some cases between open-access areas and no-take zones (NTZs).

In comparison with open-access areas, there are significant increases in the abundance and size of managed and unmanaged species within TURFs and NTZs.

The main conclusion is that in comparison with open-access areas, there are significant increases in the abundance and size of managed and unmanaged species within TURFs and NTZs (Castilla *et al*., 1998; Montoya *et al*. 2004, Gelcich *et al*., 2008a, 2012)[8]. TURFs seem to be functioning as effective NTZs for all non-target species (Gelcich *et al*. 2008a, 2010, 2012).

A 2009 study in Region V (Gelcich *et al.*, 2012) compared the ecological effects of open-access areas, Marine Protected Areas (MPAs) and TURFs with different levels of enforcement[9]. The studied TURFs had been managed as such for 7-12 years and included some with high enforcement levels (i.e., 24/7 surveillance system) and some with low levels of enforcement (i.e., surveillance occurs only on days with calm seas). Results show that there is higher species richness, biomass and density of macro-invertebrates and reef-fish in TURFs and in the MPA than in open-access areas. Results are even more encouraging in TURFs with high levels of enforcement, which were significantly similar to those in the no-take MPA for economically important species of invertebrates and fish.

8. Detailed examples for *loco* are provided in Castilla *et al*., 1998; for other shellfish species see Castilla & Fernández, 1998; for non-shellfish species see Gelcich *et al*., 2008a and 2012; for several species see Montoya *et al*., 2004.
9. All the surveyed sites are located in Region V and have similar benthic characteristics (e.g., substrate, depth, kelp forest complexity) including the selected MPA, *Las Cruces*.

In 2005 and 2006, Gelcich *et al*. (2008a) also assessed the effects of commercial species management on subtidal biodiversity and community assemblages by comparing the state of the resource in three of the oldest TURFs in central Chile with the adjacent open-access areas. At the time of the research, the selected study areas had been harvested as TURFs for 6-12 years and had a 24/7 surveillance system during that time period. The results indicate that these TURFs "not only have greater abundances of target species, but show greater richness of reef-fish species (including top predators) than open-access areas."

Additionally, Gelcich *et al*. (2012) demonstrate that conservation benefits are higher the longer the TURF has been implemented. In spite of these encouraging results, caution must be used when associating TURFs with biodiversity conservation, because some of these studies are focused exclusively on specific marine ecosystems; more research on the effects of TURFs on marine biodiversity and community assemblages in different types of subtidal environments is needed. In addition, and to stress the importance of NTZs using *loco* as an example, Manríquez & Castilla (2001) found that NTZs work as effective spawning grounds, and this is likely to be true for other resources as well (Gell & Roberts, 2002).

While TURFs cannot replace NTZs, given their potential positive conservation and management results, they certainly provide a complement to achieve concrete conservation objectives and enhance marine conservation initiatives (Castilla, 2000; Castilla *et al*. 2007a; Gelcich *et al*., 2008a, 2012). While Chile has several legal instruments used to protect marine areas, such as marine parks, marine reserves, marine protected areas, natural sanctuaries, and marine concessions, TURFs are more widely used than these other instruments (Fernández & Castilla, 2005). Additionally, only a limited number of these legal protection instruments actually limit resource extraction, therefore the potential role of TURFs in conservation is substantial. This idea is echoed by many authors (Fernández & Castilla, 2005; Schumann, 2007; Gelcich *et al*., 2008a, 2012), who highlight TURFs as a potential pillar to build a dense network of marine managed areas, where TURFs established for sustainable use and/or restricted harvest are linked with NTZs and MPAs (Fernández & Castilla, 2005; Schumann, 2007; Gelcich *et al*., 2008a).

While TURFs cannot replace NTZs, given their potential positive conservation and management results, they certainly provide a complement to achieve concrete conservation objectives and enhance marine conservation initiatives.

Independently of the spatial management arrangements between TURFs, open-access areas and NTZs, it is important to note that there is still insufficient biological and population dynamics information for highly exploited species managed in TURFs. For example, there is evidence that the recruitment of benthic resources is influenced not only by local populations, but also by populations located further away, through larval and juvenile dispersal (Hilborn *et al*., 2005); however, little is known of the degree of connectivity and interdependence between these local and more remote populations (Ortiz & Levins, 2011). In order to improve the management of both TURFs and open-access areas, further data collection on highly exploited species and research on the role of this interdependence should be encouraged.

4 CHALLENGES AND RECOMMENDATIONS

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4.1. ILLEGAL FISHING

Poaching has been highlighted as one, if not the main, problem for the effective management of a sustainable TURF system (González *et al.*, 2006; World Bank, 2006; Schumann, 2007; Castilla & Gelcich, 2008; Gelcich *et al*., 2009). Illegal fishing is widespread, occurring in both open-access areas and in TURFs. In TURFs, poaching is occurring both between different *caletas* and between association members in a single *caleta*, such as in cases of undeclared catch. Illegal harvests enter the market in several ways: illegal catch is sold to local buyers, sold to processors for export, and, as is often the case with *loco*, sold or smuggled into Peru, where they are processed and exported as "Peruvian *loco*" (González *et al*., 2006). Several authors have estimated that the illegal catch is at least 50% of the total catch (UCN, 2002; González *et al*., 2004, 2006). Not surprisingly, illegal catch is estimated to be higher in open-access areas (González *et al.*, 2006).

Since the implementation of TURFs, the responsibilities and the costs associated with surveillance have increased, falling largely on fishers (Gelcich *et al*., 2009); this is an issue of concern for most fishing associations. Under the legal framework, however, enforcement is a shared task between fishers and the government; therefore, surveillance costs have been partly subsidized by the state (see Art. 56, FAL, 1991 and 2013). This support notwithstanding, not all fishing associations have the same level of organizational skills or the capacity to apply for these subsidies, thus significant financial differences exist among associations.

Furthermore, in cases where fishers live far from their TURFs, as happens often in isolated rural communities, the TURFs are not easy to guard, and support from the state is lacking, TURFs are often abandoned and eventually returned to the state (San Martín *et al*., 2010).

As Orensanz and Parma (2010) observe, "effective enforcement is illusory in a fishery operated by small boats spread along a coastline that spans 38 degrees of latitude," therefore it is reasonable to say that the role of the fishers as enforcers should be strengthened and that this should not be fully dependent on government subsidies. Nonetheless, the state still has a major role to play, since it is the actor with the greatest capacity to shape the co-management system through policy making. Both fishers and state must work together to build not only a strong policy to fight illegal fishing, but also the capacity to do so.

Enforcement efforts within the TURF system that are in need of urgent improvement include:

- An evaluation of the capacity that SERNAPESCA and the Navy have to deal with surveillance and control needs to determine if it is pertinent to invest in additional surveillance staff.

- Improvement in cooperation and coordination efforts between SERNAPESCA and the Navy as well as with fishermen.

- Improvement in the coordination between the District Attorney's Office and public prosecutors with regard to sanctions and penalties applied to poachers and businesses that buy illegally harvested products.

- Training and awareness raising among judges and district attorneys with respect to illegal fishing and the need for stricter application of the law to reduce poaching substantively.

- A revision of existing fines and sanctions applied to poachers so that they truly work as deterrents to illegal fishing. The 2013 FAL has taken a step forward in tackling illegal fishing by authorizing the revision to the fines and sanctions regime. For instance, fines for poaching now range between USD$2,400-8,000 (Art. 120A, FAL, 2013) as opposed to the former US$50 fines that were not sufficient to act as deterrents. In addition, under the new measures, the equipment used to harvest illegally can now be confiscated and poachers are precluded from registering as artisanal fishers, and therefore legally fish, for a period of two years. The 2013 FAL also makes poaching a serious legal offense prosecuted under Chile's criminal code (Art. 139, FAL, 2013). Even higher fines are applied for storage and processing of illegal TURF-products (Art. 120B, FAL, 2013), and the establishment where this processing or storage occurs can be closed down for 30 days. These new regulations have only been in place since January 2013, so their effectiveness will have to be monitored.

- Providing incentives for fishers to report illegal harvests is also needed, as some fishers are discouraged to report illegal fishing events because in the past they have reported incidents but the government has not responded adequately.

- Developing and promoting the use of surveillance strategies that are cost efficient, such as remote surveillance systems.

- Promoting collaboration among fishing associations and between fishing associations and private partners in order to obtain resources to be invested in surveillance. For example, a private agreement between a fishing association and a restaurant can be translated into a profitable venture for both parties: the restaurant gets an exclusive purchase agreement of seafood products harvested by the fishing association in the TURF in exchange for a yearly monetary investment into a surveillance system for the TURF.

- Establishing a public and transparent system that makes all the information about control and surveillance processes available.

Given the threat that illegal fishing poses to the successful management of the TURFs, an assessment of the degree of illegal fishing in Chile that quantifies the illegal catch, investigates the routes and markets for illegal products, and identifies strategies that fishers and buyers of illegal resources follow to evade the authorities, is urgently needed. The results of such a study would help identify measures to crack down and address illegal fishing and improve the overall management of fishery resources in Chile.

4.2. IMPROVING THE PARTICIPATION OF FISHERS IN MANAGEMENT DECISIONS

4.2.1. The role of fishers and consultants in TURF management

The Chilean TURF system is conceived in a way that limits the participation of fishers, even though maintaining the resources and fishers' livelihoods is the main purpose of the system. The role of fishers is limited to helping the consultants with field work (this is not a legal requirement, although it is very frequent and often mandated by the associations' bylaws) (Schumann, 2010) and following and ensuring compliance with existing rules (at least within their own TURFs). To become effective stewards, however, fishers should be more active in the decision-making process and in the design of the management plans. Currently the system is set up so that fishers can assist consultants and scientists, but in many cases this is done without conviction or without the opportunity to internalize findings and translate them into management decisions. Active participation and a process to educate fishers on design of management plans, data collection and interpretation are needed to transform this part of the system.

Under the FAL, consultants play a very important role, making them partially responsible for the effective management of the TURFs. One of Schumann's studies (2007) states that "a third of the fishers interviewed enthusiastically praised their consultants, in some cases asserting that their consultant was the single most important factor determining the quality of their management area experience." Based on the evidence, it seems appropriate to foster a real and constructive dialogue between fishers and consultants, especially given that they are legally forced to work together. As some fishers in Schumann's work highlighted, it is very valuable to blend the theoretical knowledge held by the consultants with the practical knowledge held by fishers. Indeed, many fishers perceive a real benefit from working with consultants (SERNAPESCA, 2005c;

Schumann, 2007, 2010). A recent study (Schumann, 2010), highlights that 64% of fishers identify their interaction with consultants as the most frequently mentioned benefit of the system, because it “offers them the opportunity to expand their knowledge,” allowing them to make sound management decisions. This knowledge most often referred to stock assessment methods, details of shellfish biology, and appreciation of the value of management. The second most important benefit cited by fishers was the “consultants' contribution to structuring co-management, including their aid in organizational strengthening of fisher associations and in communicating fishers' concerns to the State” (Schumann, 2010). Additionally, several fishermen praised the benefit arising from the consultants' third party objectivity.

Of course, not all fishers are in agreement with the consultants; some believe that consultants lack the direct in-the-water experience to inform management plans, while others show resentment over consultancy prices and the unwillingness of the consultants to share their knowledge (SERNAPESCA, 2005c; Schumann, 2010). This is especially true when consultants carry out their assessments and analysis out of sight, instead of sharing the results and processes with the fishermen. It is not surprising to find fishermen questioning the commitment of the consultants to the fishing community and to marine conservation, arguing that the consultants' interest is merely economic (Schumann, 2010).

The design of the system under the law does not help to dissipate such distrust. The law suggests that the work performed by consultants should be endorsed by the fishermen before being submitted to the relevant authorities (consultants deliver on behalf of the fishermen); however, this is not explicitly specified. Moreover, the importance of the fishers' understanding of the scientific basis upon which the harvest plans are based is not integrated in the regulations; the following quote from a consultant reflects this point (Schumann, 2010): “the fishers are our clients, but we turn in our work to the State.”

In order to improve the relationship between consultants and fishers and to fully integrate the knowledge and learning of fishers in the TURF management system, information exchanges and training sessions for fishers are essential. Increased training of fishers on the key scientific pillars underpinning the management strategies to be implemented in the TURFs would go a long way in engaging fishers in the decision-making process. According to SERNAPESCA (2005c), most of the training is carried out by consultants; therefore, it is necessary to train consultants in teaching and communication skills. Some consultants observe that fisher participation in trainings is very low, perhaps due to their resentment over the intrusion of consultants or because of feeling uncomfortable in classroom settings, since most fishers have minimal schooling. Encouraging fishing associations to include training as a clause in their contracts with the consultants would ensure higher participation in, and commitment to, trainings. Also, learning exchanges among fishers should be considered as a training strategy. For example, there are encouraging experiences of fishers creating their own data bases and developing their own monitoring and commercialization efforts before and after the TURFs were implemented; these would be worth sharing more broadly through learning exchanges (see for example: Castilla & Gelcich, 2006; Castilla *et al.*, 2007a; Aburto & Stotz, 2013).

The design of the TURF system relies heavily on the consultants' scientific knowledge and disregards the knowledge of the fishermen.

It is easy to conclude that the design of the system relies heavily on the consultants' scientific knowledge and disregards the knowledge of the fishermen. However, Schumann (2011) quantified the difference in knowledge of the two groups (consultants and shell-fishers), concluding that “Chilean shell-fishers knowledge is neither uniform nor wholly distinct from scientific knowledge,” which seems apt, as fishers that participated in the study have acquired new knowledge or replaced old knowledge via interacting with scientists/consultants throughout the years. We agree with Schumann's conclusion (2011) which states that one objective of the TURF policy should be to reduce the knowledge differences between consultants and fishers, because "allowing resource-user knowledge to permeate and reshape the information base used for management will build trust among resource users toward management endeavors, there by decreasing conflict" (Schumann, 2011). The current TURF policy offers the opportunity to integrate the knowledge of resource users into the management strategies, but only at the consultants' discretion. A concerted effort should be made to establish mechanisms for mutual exchange and learning between fishers and consultants, either through regulation, or as part of agreed terms and conditions in contracts between fishing associations and consultants.

In spite of these observations, some fishers have experienced a positive attitude change towards consultants, managers and the TURF system itself since the implementation of the TURF system (Schumann, 2007, 2010; Gelcich *et al*., 2008b). We agree with González *et al*. 10 (2006), who suggest that the "barefoot ecologist"[10] model proposed by Prince (2010) shows the path towards a more participative and constructive management system, and most importantly, one that is more sustainable in the long run. Some fishers seem to support this idea; they believe they are capable of performing the work of consultants and feel deserving to be trusted to do so (Gelcich *et al*., 2009). Additionally, this approach would eventually reduce administrative costs for the fishermen. In order to put in practice the barefoot ecologist model and empower fishers, it would be necessary to develop a standardized methodology and indicators that assess progress in terms of harvest results, resources availability, social conditions, etc.

Learning how to manage their fishery in order to achieve the potential emancipation from consultants/scientists could work as a strong incentive for fishers to participate. This process would not necessarily imply the elimination of the role of consultants, but merely a transformation and/or evolution of their role. Consultants could perform regular audits to evaluate the performance of associations, and act as external independent entities that can be fully funded by the government or co-financed with the fishing associations. These entities could offer permanent consultancy-advisory services for both the fishers and the state. The transformation from the role of consultant to that of auditor would require the development of a standardized audit system to secure the long term feasibility of TURFs.

Several authors (Parma *et al*., 2001; Meltzoff *et al*., 2002; Schumann, 2010; San Martín *et al*., 2010) suggest the simplification of the stock assessment methodologies currently in use to encourage the participation of fishers in technical tasks in order to promote task-sharing and capacity-building approaches that enable fishers to gain a greater sense of stewardship and ownership of the process.

There is, however, evidence that some fishers and their associations believe that consultants are necessary as intermediaries among fishers or between the fishers and the state (Schumann, 2010); therefore, it is likely that even if it was no longer mandatory, some associations would keep hiring consultants to perform the work.

Regardless of the mistrust of fishers towards consultants, it is less generalized and less severe than the mistrust they have towards the state. In fact, Schumann (2010) asserts that "without consultants, it is doubtful that fishers would have bought into co-management to the extent that they have." Schumann's research reveals that mistrust of the state applies not only to the fishers but to some of the consultants as well; thus, the role of consultants as intermediaries between fishers and the state is not trivial. At the same time, this intermediary role precludes the direct interaction between fishermen and the state, and therefore prevents confidence-building between these actors (Schumann, 2010), which co-management is expected to do.

4.2.2. Improving consultancy and data standards

With the exception of the demands of fishers (which are infrequent, since fishing associations are not used to demanding high standards and customized procedures of consultants, due to ignorance or lack of interest) (C. Techeira and A. Rosson, personal communication), the only criteria that guide the consultants' work are set down in *Documento Técnico*

10. As an example, see the Barefoot Fisheries Advisors (BFAs) model of the TURF system in *Galicia*, Spain (Macho *et al*., 2013).

N° 3 (SUBPESCA, 2001), an official document that establishes general voluntary technical guidelines to carry out the baseline studies, performance analyses and management plans. This document has been in force since 2001; in light of the concerns mentioned in the previous section, it would be advisable to update and revise it taking standardized consultancy procedures into account. Proposed revisions include the addition of a mandatory compliance clause and the simplification and refinement of recommended methods, based on the observation and experiences from consultants and fishers. These revisions are necessary to (i) stimulate fisher participation, (ii) facilitate the evaluation of the performance of consultants, (iii) improve the quality of assessments, (iv) encourage the development of a practical and efficient evaluation system for management plans, and (v) reduce costs associated with these assessments.

With regard to data standards, data from TURFs are currently evaluated independently of each other, and not as a representation of what is occurring in the nearshore marine environment as a whole, largely because the focus of assessments has been on setting quotas for specific resources on a yearly basis.

Data from TURFs are not evaluated from a temporal perspective, making it difficult to look at behavioral trends in stocks or in benthic communities over time.

Moreover, data from TURFs are not evaluated from a temporal perspective, making it difficult to look at behavioral trends in stocks or in benthic communities over time. This lack of holistic evaluation is hindering the use of valuable data to understand population dynamics and the impact of fishing activities beyond single TURFs and beyond a one-year horizon. In order to have a holistic view of the marine environment, this information should be integrated and used to evaluate the performance of the TURF system across spatial and temporal boundaries.

Additionally, a broader effort to standardize the collection of fisheries data for TURFs and open-access areas, and make them available through a public platform would go a long way in improving the system. Plenty of data are generated each year on TURFs and harvests, but in most cases data are submitted in different formats, preventing useful analysis (Stotz *et al*., 2008; Techeira *et al*., 2013). Data standardization would also make evaluation of the TURF system much easier. Certain submission and format standards, combined with an online submission platform, could accelerate the evaluation and approval system and make data readily available for analyses by third parties. The definition of standards and formats would also inform independent research protocols, generating information that could eventually serve to validate, complement and/or evaluate the system.

Finally, the government could adopt technical and regulatory measures to improve the performance of consulting firms. Fishing associations should be part of the process of evaluating the performance of consultants; the government could implement a certification system to evaluate the consultants' work, following specific technical criteria and taking into account reviews made by fishers and authorities to guarantee quality standards. Once in place, this certification could be renewed on a periodic basis.

4.3. SOCIAL DIVERSITY, CULTURAL IDENTITY AND THE CHANGING VALUES RELATED TO TURFS

When TURFs were first implemented, it was done on a first-come, first-served basis (Orensanz & Parma, 2010). Those associations that were best-informed and well-organized managed to claim the most productive areas; thus, the system is inequitable since its inception. Initially, many associations opted to not become part of the system because of lacking information and capacity, the pre-existence of traditional tenure systems, fishers' adherence to their belief that they had a historical legitimacy to fish wherever they wanted, or their fear of losing their cultural identity as migrant fishing communities. This situation has caused a variety of local conflicts; some were solved locally, while others remain a challenge.

To portray an example of these local conflicts, we present a comparative study of the socio-economic dimensions of the TURF policy in three different fishing associations that operate in the *caleta Los Vilos*, located in Region IV (Box 1). This example of conflicts occurring in a single *caleta* highlights several issues that are most likely occurring on a larger scale along the entire Chilean coast: the heterogeneity in fishers' beliefs, aspirations, priorities, differences in their willingness to sacrifice certain values in order to gain other benefits, as well as differences in the measures taken by each fisher to cope with the potential inefficiencies associated with the TURF system.

BOX 1: THE CASE OF FISHER CONFLICT IN THE *CALETA LOS VILOS*

Prior to the implementation of TURFs, fishers from *Los Vilos* belonged to a single association or *sindicato*, called *AG San Pedro*. When the TURF policy was implemented, *AG San Pedro* applied for several TURFs; however, in 1999, tensions over the administration of the management areas drove some of the fishermen to form a separate *sindicato* called C*ooperativa Los Vilos*. These two associations then applied for TURFs separately. In 2001, additional fishers who had never belonged to the original *AG San Pedro* also formed a new *sindicato* called *Los Lobos*, which started applying for TURFs that same year. Despite the creation of these two additional associations, most of the fishers of the *caleta* still belong to *AG San Pedro*. The main benthic resources harvested in the TURFs of *caleta Los Vilos* are *lapas* (*Fissurella spp.*) and *loco*, and they are collected by divers.

As the original association, *AG San Pedro*, had informal TURFs since 1991 (that is, before the formal TURF policy was implemented), fishers from this *sindicato* consider themselves "pioneers in TURF adoption"; they believed overexploitation of the resources was a problem and placed a lot of confidence in the TURF management strategy. However, one of the underlying issues faced by *AG San Pedro* fishers was the low level of individual incomes, partially because of the large number of members. To address this issue, the union took a TURF extension approach, increasing the TURF area per union member. Fishers from *Cooperativa Los Vilos*, on the other hand, did not rush to claim TURFs, but as the harvest of *loco* was banned outside the TURFs, they had no choice but to adopt the TURF policy. It is important to note, however, that at the time the study was conducted the economic performance of the *Cooperativa Los Vilos* TURF was positive, with each of the union members receiving wages three times greater than those from *AG San Pedro*. These fishers opposed the TURF extension approach for solving economic inefficiencies; instead, they optimized financial returns from their TURFs by targeting new species and making better deals with market agents.

As in the case of the *Cooperativa Los Vilos*, the *Los Lobos* association subscribes to an anti-TURF discourse. At the time of the study, *Los Lobos* had been engaged in the TURF policy for a shorter period of time compared to the other two associations. Before their first TURF was granted, they were forced to dive in open-access sites, which were fast becoming overexploited and less productive. According to Gelcich *et al*., (2005b), they "present themselves as historical right claimants" and, despite understanding the purpose behind the TURF policy, they decided not to take part in it, arguing that the policy is usurping their "historical rights over resources," and that "they just want to dive without constraint" and to "avoid the commitment to maintain a TURF." In spite of not wanting to engage in the system, the ban on harvesting *locos* outside TURFs left them with no option but to apply for TURFs, as was the case with the *Cooperativa Los Vilos*. However, their opposition to the TURF system strengthened their appreciation for the historical fishing sites that remained under open-access and tensions related to fishing in these sites became evident. For example, when fishers who had already been granted TURFs were fishing in open-access sites and extracting resources to repopulate their TURFs, those who considered themselves the right claimants believed it was their right to recover those resources, stealing them back from the TURF areas, arguing that (i) since the TURF fishers have their own areas they should not compete with open-access fishers, (ii) resources in open-access sites no longer belong to TURF grantees but to open-access fishers, and (iii) TURFs are just a cover to be able to sell resources harvested in open-access areas.

Source: Gelcich *et al*., 2005b.

Gelcich *et al*. (2005b) note that "the government is unaware of these different perspectives and perceives the success of the TURFs applications largely through the number of applications for management areas it receives." TURF application figures may demonstrate that fishers are organizing in associations, but do not necessarily prove that this is happening without conflicts or without the deterioration of the relationships between fishers, which, among other things, increases the enforcement costs for TURFs (Gelcich *et al*., 2005b).

11% of the fishing associations that have TURFs are run by women.

The situation in *Los Vilos* exemplifies the various, at times competing, identities that form around TURFs, as well as the changing values related to TURFs. The social diversity of TURFs is also illustrated by the Chilean Fisheries and Aquaculture Census conducted in 2008-2009. According to the census, 15% of registered artisanal fishers are women, and most of them are seaweed collectors (46% of seaweed collectors are women), while 11% of the fishing associations that have TURFs are run by women. Therefore, TURF management is an important way in which women contribute to artisanal fisheries (the census also records that around 70% of the members of fishing associations with TURFs work as divers or divers' assistants, 15% as administration and other staff, and the remaining 15% as surveillance staff; thus, an equal proportion of staff is dedicated to surveillance and to administration duties). With regard to the participation of indigenous communities, more than 40% of the fishing associations with TURFs have indigenous people among their members; the southern regions alone (R. VIII, R. X and R. XIV) concentrate 92% of indigenous participants in fishing organizations with TURFs (INE, 2009).

Social heterogeneity among fishing communities in Chile is a fact, and the outcomes of the TURFs may be as heterogeneous as the fishing communities. In order to evaluate the evolution of the TURF system and its perception, it would be useful to commission studies or reviews of the discourses among fishermen with respect to TURFs which are dominant today as compared to those from 10 year ago, as well as an assessment of the diversity and inclusivity of the system today.

4.4. SOCIO-ECONOMIC DIMENSIONS OF TURFS

There are various studies that address the economic performance of TURFs in Chile; in many cases, these also introduce a social perspective of the system (see Soto and Chávez, 2001; Montoya *et al*., 2004; SERNAPESCA, 2005c; Sobenes & Chávez, 2007, 2009; Zúñiga *et al*., 2008, 2010; Techeira *et al*., 2010, 2011, 2012, 2013). Other studies point out the motivation of fishermen applying for a TURF, concluding that TURF applications are not necessarily due to stewardship or sustainability values. Fishers apply for a TURF mostly because they want to keep harvesting *loco*, but also because they associate TURF ownership with:

- Political or social status (Gelcich *et al*., 2005a, 2005b);
- Additional income (Gelcich *et al*., 2005a; Schumann, 2007), especially for associations where the majority of the fishers are mainly finfishers;
- Access to government subsidies to fund development projects (e.g. infrastructure, equipment, training, small-scale aquaculture) (Gallardo *et al*., 2011);
- Increased power to negotiate and obtain financial or material resources from private companies whose activities may negatively affect the fishery (e.g. pollution from outfall pipes, etc.) (Gelcich *et al*., 2005b, 2009; Gallardo *et al*., 2011);
- Secure marine areas to control the expansion of other activities (e.g. intensive aquaculture) (Gallardo *et al*., 2011);
- Easier access to loans and credits from banks (González *et al*., 2006).

The options to ask for compensation from companies that harm the ecosystem or to secure rights against a long list of potential uses of the coastal zone may function as financial incentives; however, they may also mean that fishers are developing the ownership, stewardship and awareness values that have been mentioned earlier in this report. Many authors agree that the above-mentioned reasons motivate fishers to claim and hold their TURFs, even when their productivity is low (Gelcich *et al.*, 2005b; Gallardo *et al*., 2011).

There are also studies that focus on the socio-economic impact of management policies on different fisheries (see Testdata, 1997; ICSED, 2001; IFOP, 2001; UCV, 2001). These studies try to define the variables that may help discern whether TURF management measures are working or not from an economic, institutional, and social point of view, but it is extremely difficult to simply state that TURF performance is either good or bad, given the sheer number of factors to take into account, as well as their heterogeneity.

For example, studies conducted by Zúñiga *et al*. (2008) in the *Coquimbo* Region (R. IV) and by Sobenes and Chávez (2007) in the *Bío Bío* Region (R. VIII) both hypothesize that the main factor leading to economic success in TURFs is the type of resource and its density; however, they both come to the conclusion that TURF performance is impacted by a wider range of factors than initially assumed. In the study by Zúñiga *et al*., 42 of the TURFs that existed in 2004 in the *Coquimbo* Region (R. IV) were analyzed. Two thirds of the *caletas* where these TURFs are located are rural, and most of them mainly harvest *loco* and limpets (*Fissurella picta*). The study looked at three aspects of TURF performance: (i) economic performance (e.g., income per capita and its stability, access to credits, etc.), (ii) institutional performance (e.g., participation in meetings, level of self-governance, etc.), (iii) and social performance (e.g., level of overcrowding at home, health coverage, etc.). The results clearly show that the economic performance scored lower than the institutional and social performance; two thirds of the fishing associations in the studied TURFs had a mediocre or low economic performance score. The social and institutional performance of these TURFs scored higher, especially as it relates to self-governance capacity, the participation of fishers in the decision-making process, and an increase in job safety. Therefore, the authors conclude that, for the *Coquimbo* Region, TURFs have not been a solution to fishers' economic problems, but a complement to their fishing activities. Zuñiga's results concur with those of other authors who have conducted similar studies (Techeira *et al*., 2013).

The study also identified the main variables that explain the economic success of a TURF; these are, in order of importance: income, time span of TURF operation, key harvested species, type of *caleta* (urban *vs* rural), and the association to which the TURF belongs as well as its size (i.e., number of members). Surprisingly, the target species, which the authors had initially assumed to be the main key variable, did not have a more significant impact than other variables, at least for *Coquimbo*.

Sobenes and Chávez (2007) also hypothesized that target resource (*loco*) density and, thus, its production capacity, would be the key variable that determines the economic performance of a TURF; their findings reveal an "inverse relationship between the level of per capita profit and resource density," indicating that there are other variables contributing to a TURF's economic success. In their view, the main characteristics that define differences in economic performance are: the commercial size fraction, the average size of the target resource, the shape and size of the habitable area for the target resource, target and other resources density, target resources growth rate, and the experience of the fishing community leader (Sobenes & Chávez, 2007, 2009). Similarly to Zuñiga's study (2008), the research conducted by Sobenes and Chávez (2007) revealed that there were several variables influencing the economic performance of TURFs; however, these variables differed between the two studies, illustrating the existing heterogeneity in the economic performance of TURFs.

Other factors are emphasized in a study conducted in three regions of northern Chile (*Coquimbo*, R. IV, *Atacama*, R. III, *Antofagasta*, R. II) by Zúñiga *et al*. (2010); they point to urban *caletas* as having better economic performance than rural ones because of

Chile are generally associated to positive socio-economic performance; from an economic point of view this is attributed mainly to an adequate exploitation of resources and an optimization of the commercial exchanges between fishers and buyers. This observation is also consistent with Soto and Chávez's (2001) findings.

Research conducted by the National Fisheries Service identifies similar factors as the most relevant for the profitability of TURFs; according to SERNAPESCA (2005c), the quantity/abundance of resources to harvest (harvest quotas) and the surface of the management area are two of the main elements that have to be taken into account to understand the positive and negative economic impacts of the TURF system. Additional factors highlighted by the National Fisheries Service are:

- Distance from the *caleta* to the management area (harvest + surveillance costs);
- Number of days or trips invested for the harvest (operating costs);
- Selling price of the resource (commercialization).

A review of these and other studies also shows the difficulty in identifying causation when analyzing TURF performance. For instance, if a group of associations with TURFs is studied with a view to assess its institutional dimension, it is difficult to discern if any institutional improvement is caused by the implementation of TURFs, or if good institutional performance is simply because those associations with better institutional arrangements have claimed TURFs in the first place. Most studies show that it is possible to contrast social, institutional and economic situations before and after TURF implementation, or to compare associations with or without TURFs, but it is difficult to fully attribute any success or improvement solely to the TURF regime.

Regardless of direction of causation, income is one of the most important factors impacting economic performance. An important aspect that influences the income of fishers with TURFs is the distribution of profits among association members, which follows the fishing associations' statutes and regulations (see SERNAPESCA, 2005c). Approximately 44% of the associations with TURFs split their incomes equally (which means that, in general, divers, who were the top earners prior to the TURF system, lose part of their original income). Additionally, 19% of associations practice some sort of distribution by share, based on different criteria; 10% of associations allocate a higher proportion to the owners of the equipment, materials and tools used for fishing (e.g., boat owners), and 13% distribute their income according to each fisherman's effort. A minority of TURFs allocate a higher share to divers or fishers according to the quality of the product being landed (INE, 2009). Aside from individual benefits, fishing associations also decide how to distribute their income for community endeavors and needs (schooling, celebrations, assistance for widows, elders or sick members, etc.) (San Martín *et al*., 2010).

An important aspect that influences the income of fishers with TURFs is the distribution of profits among association members.

The high degree of heterogeneity in the income levels of artisanal fishers is also noted in the Chilean Fisheries and Aquaculture Census. The census further states that the discrepancy in income levels is due to the profit allocation system currently in use, which is culturally rooted and depends on the type of fisher and the effort or investment he/she has made. For example, as part of the shares system (or *sistema a la parte* in Spanish) mentioned above, a boat owner makes on average three times the mean monthly salary of a seaweed gatherer (INE, 2009). It is common to count a boat as entitled to a share, so that if two fishers go fishing and one of them owns the boat, they would split the profits in three, with the boat owner receiving the equivalent of two shares (SERNAPESCA, 2005c).

Data on the income of fishers is not readily available, but what is certain is that monthly salaries vary substantially by region and by TURF. Overall, at the national level, figures for 2008 show the average monthly wages from fishing in TURFs fluctuating between 75,000-120,000 Chilean pesos, or about US$150-US$240. More recent data for specific regions, however, show higher levels of income. For example, a Nature Conservancy-funded socio-economic study of fishing communities in parts of Region XIV shows the monthly wages of TURF-holding fishers in 2010 to be between US$380-US$550, including income from *loco* harvests (Andrade *et al*., 2010). Regardless of the region, however, these amounts are close to or lower than the Chilean minimum wage, which was 182,000 Chilean pesos (or US$385) in 2012. Moreover, 65% of the surveyed fishers declared at the time that they are the main household income providers. Close to 10% of the fishing associations also report not having alternative sources of income (INE, 2009).

The economic performance of TURFs is further dependent on the ability of fishing associations to cover management costs.

The economic performance of TURFs is further dependent on the ability of fishing associations to cover management costs, particularly those associated with consultancy and surveillance. Given the inherent difficulties faced by artisanal fishers in their profession, it is easy to understand that dealing with the costs associated to TURFs is not a simple matter. Thus, many fishing associations apply for subsidies to cover at least a fraction of these expenses. According to the FAL, subsidy allocation is made through public tender. From the government's point of view, subsidies were necessary when the system was initially implemented to help fishers in the transition process (Meltzoff *et al*., 2002; Gelcich *et al*., 2008b) and because, at the time, some of the fishing areas were heavily overexploited. Since 2005, a pre-investment governmental program developed by the Corporation for the Promotion of Production (*Corporación de Fomento de la Producción* - CORFO) partially finances up to 70% of the consulting services required to perform TURF baselines studies and up to 50% of the costs for annual follow-up reports. Additionally, there are other public support programs for development activities at national, regional and local level that can be applied to the fishing sector. Overall, TURF management is highly dependent on public funds or subsidies. According to Ramírez *et al*., (2011), about 55% of TURF management costs are covered by the CORFO program, while 40% of the consultancy costs are covered by the fishing associations themselves; however, there is a large heterogeneity in this coverage by region (SERNAPESCA, 2005c; Ramírez *et al*., 2011), probably due to the fact that not all fishing associations have the same level of organizational skills or the capacity to apply for subsidies. In fact, in 2005, SERNAPESCA studied 59 fishing associations and 85 TURFs across all regions and documents significant financial differences between associations.

Organizational and institutional considerations are very important in the success or failure of a TURF. As of 2005, only 35% of the surveyed TURFs were considered financially sustainable from an economic perspective, meaning that members can afford the payment of an annual fee and do not need to apply for subsidies for operation and management of the TURF. Another 54% of TURFs have a weak economic situation, with low income levels for members; some TURFs have even registered economic losses, mainly due to the payment of annual association fees and the cost of consultancies for TURF management. Finally, 11% of TURFs had expenses but no income, thus they were expected to be returned to the authorities (SERNAPESCA, 2005c).

A recent analysis by Mondaca-Schachermayer *et al*. (2011) assessed the impact of Chilean subsidies on small-scale fisheries and found that for the 32 *caletas* studied over a 12 year period, funding was greater for urban *caletas* and for *caletas* with high-value landings. Rural *caletas*, where socio-economic need or poverty was greater, received fewer investments. This echoes the findings of Zúñiga *et al*. (2010) mentioned above, according to which the superior economic performance of urban *caletas* is due to better access to services. A review of the effectiveness of subsidies available for poverty alleviation, as well as of the impediments faced by poor or rural communities when applying for subsidies, could inform future modifications to the system and ensure that public funds are indeed helping the most marginalized and poor communities.

Certain aspects that affect the profitability of TURFs should be addressed, in order to reduce dependency on subsidies over time. For instance, fishers should be encouraged to assess their processing and supply chains, and identify efficiency gains, to develop partnerships with other associations for joint market access, or partnerships with restaurants, guaranteeing their supply of sustainable products in exchange for funds to cover surveillance, processing, technical assistance, etc. Fishers could also be offered support to explore the development of value added products via the creation of local brands and possibly certification labels similar to those used in Europe (e.g., *Denominación de Origen* in Spain, or *Appellation d'Origine Contrôllée* in France), which regulate the quality and geographical origin of specific products. Initially, these initiatives would require a specific set of economic incentives (or subsidies) aimed at the artisanal fisheries sector to support: (i) investment in innovation and experimentation to develop new marketing strategies that guarantee fair prices for fishers, and (ii) the development of training modules for fishers focused on business skills, so that they can become better entrepreneurs. In addition, identifying successful business initiatives that have resulted in profitable TURFs would allow possible replication, as well as the production of guidelines for other fishers to apply lessons learned.

4.5. COLLATERAL EFFECTS OF THE TURF SYSTEM ON TRADITIONAL MANAGEMENT POLICIES

Initially, the implementation of TURFs took place in areas with no traditional management rules. As the policy started to spread along the coast, it began to encroach on areas with existing traditional management practices (Gelcich *et al*., 2006). The most notorious case is the superimposition of the TURF system in regions where bull-kelp (*Durvillaea Antarctica*, locally known as *cochayuyo*) is collected and managed through an informal arrangement called the *parcela* system - a system that is used by approximately 3-4% of fishing associations in Chile (Gelcich *et al*., 2006). The *parcela* system grants access rights to members of a specific community, allowing them to harvest certain resources in designated *parcelas* or fishing grounds. According to Gelcich *et al*. (2006), these customary property rights, “are legitimized by social norms and codes of behavior,” and not by the state. SERNAPESCA has tried to respect this local management system, which has been in use for over a century, and which is implemented especially by indigenous *Mapuche* families (Castilla & Fernández, 1998). *Cochayuyo* is sold in local markets for human consumption (Photo 9), and its extraction is locally and regionally important (Gelcich *et al*., 2006); however, the harvest of *cochayuyo* represents only around 1-2% of the artisanal landings of seaweed in Chile (SERNAPESCA, 2011b).

PHOTO 9. Blocks of *cochayuyo* being sold in the local market in *Valdivia*.

Insights into the governance-related issues deriving from the application of TURF policy on existing *parcelas* can be gained from a study conducted by Gelcich *et al.* (2006) in the rural *caleta* of *Puertecillo* in Region VI. *Loco* and *cochayuyo* are the main species harvested in the *Puertecillo* TURF, each of them accounting for approximately 50% of the income derived from the management area (Estudios Marinos, 2003). *Puertecillo* has developed a sophisticated management and harvest model that consists of the following (Gelcich *et al*., 2006):

- *Parcelas* are divided according to production (not size) and allocated to associated members and fishermen's widows on a yearly basis using a lottery system, which guarantees annual rotational access.

- All the gatherers have the exact same rights when receiving access.

- If a fisher has been granted access but is physically unable to harvest, he/she can sell his or her season to other associated fishers as a "territorial-individual transferable Total Allowable Catch."

- Poaching is formally sanctioned by exclusion from the union for a year.

- When widows are allocated access, they do not extract kelp in their *parcelas* but collect what is naturally washed ashore by waves in their own *parcela* or in the *parcelas* of others (members allow them to do so). Thus, unharvested *parcelas* work as reserve zones (Castilla & Bustamante, 1989; Bustamante & Castilla, 1990). This measure is considered useful by fishers; they believe these areas are sources of valuable information for understanding the ecosystem and for learning how to recover other exploited sectors.

- Once the *parcelas* are allocated, fishers jointly decide how to manage them for the duration of a year. There is a general agreement not to extract *cochayuyo* between the 1st of April and the 30th of September. This decision is based on local observation of the biological characteristics of *cochayuyo* and has been subsequently supported by scientific research (Santelices *et al*., 1980).

- Another community-based agreement is to harvest other species of kelp during the month of August, thus increasing the recruitment of *cochayuyo* spores. The rationale behind this practice is to imitate the natural disturbance caused by storms; this theory is based on observations made by the fishermen and supported by scientific research (Santelices *et al*., 1980).

- The yield of each *parcela* is monitored on a yearly basis in order to compare the production between *parcelas* over time and, if appropriate, to modify the size or layout of *parcelas*.

This traditional management system incorporates not only the continuous evolution of local knowledge of ecosystem features and dynamics, but also the main socio-economic aspects that are necessary to minimize conflicts within the community. It is also easy to see that the *parcela* system is jeopardized by the implementation of the TURFs, because resource access is now dictated by TURF membership; thus, the future of the lottery strategy seems uncertain. As Gelcich *et al*. (2006) assert, the right of access remains recognized; however, fishers must comply with TURF regulations, some of which are inconsistent with the *parcela* system.

Puertecillo is one of those communities where TURFs have forced a change in the former horizontal power structure of the community towards a more vertical one, where some members acquire greater influence and may use it for their own gain, strongly affecting equity and the community's social cohesion. In the *Puertecillo* case, the TURF policy has negatively affected the attitudes of some fishers toward cooperation and solidarity. For instance, since the implementation of TURFs, many fishermen no longer agree to distribute income equitably amongst union members (Gelcich *et al*., 2006).

Another conflict between traditional tenure rights and TURF regulations, at least in the case of *Puertecillo*, is that some of the agreements under the *parcela* system, such as leaving the *parcelas* assigned to widows as buffer zones or small reserves, contravene TURF system regulations and are becoming infrequent. Furthermore, TURF rules dictate that kelp species extracted under the *parcela* system by imitating natural disturbances must be included in the management plan and have to be reported to SERNAPESCA; but Gelcich *et al*. (2006) state that such species are rarely included in management plans and their harvest is difficult to report to SERNAPESCA in advance, as it relies on weather and sea conditions. These conflicts between the two management systems reflect the limitations of the TURF policy in reconciling traditional governance approaches. Furthermore, TURF implementation policies and the evaluation of their outcomes are guided by research-based knowledge, but not necessarily by traditional fisher knowledge. As illustrated by the *Puertecillo* TURF case, the TURF co-management system is actually "discouraging fishers from maintaining an adaptive capacity and effectively using their knowledge for the management of coastal resources" (Gelcich *et al*., 2006).

4.6. LAND TENURE AND RURAL *VS* URBAN *CALETAS*

As mentioned earlier in this report, the FAL offers equal opportunities to apply for TURFs to all registered fishing associations. However, the access to TURFs and the possibility to develop basic infrastructure for their operation is not equally granted to all associations. Land tenure plays a critical role. Private property rights dominate the use of the coastal zone in Chile, especially in rural areas (Caballol *et al*., 2006; Gallardo & Friman, 2010). According to Gallardo (2008), around 76% of *caletas* are in rural areas, thus most of the TURFs assigned to fishing associations in rural *caletas* are adjacent to privately-owned lands.

Most of the TURFs assigned to fishing associations in rural caletas are adjacent to privately-owned lands.

The Chilean legal framework defines beaches as a public good; however, the access to the coast generally occurs through private properties. In spite of the right of way through private land legally granted to fishermen (*paso de servidumbre* in Spanish), Gallardo *et al*. (2011) observe that "there are cases of open hostility" towards fishers exercising this right. Many landowners restrict the access of fishers and their families, as well as the access of researchers, officials, buyers, suppliers, and tourists. Fishers attribute access constraints to the political interests of landowners, to government mismanagement and to inconsistent laws. It is important to note that TURF entitlement guarantees non-eviction by landowners (Gallardo *et al*., 2011).

The existing private property regime also affects the availability of infrastructure in some *caletas*, because the state is not legally able to build or install any facilities necessary for the development of the fishery without the land owner's permission (Gallardo *et al*., 2011). In some cases, fishing communities (particularly those in rural *caletas*) do not have access to very basic services: water, electricity, garbage disposal, etc. (Gallardo & Friman, 2010) and they cannot demand these services from the state if their activities take place in privately owned land. Moreover, fishing communities with *caletas* in privately owned lands tend to live far away from the *caletas* because they are not permitted to build houses and other infrastructures that would allow them to settle near their *caletas*, thus increasing production, surveillance, and transportation costs. In fact, prices of fish products tend to be proportionally set by the distance between the *caletas* and the points of sale: the longer the distance, the lower the prices (Gallardo *et al*., 2011). Legal competencies and jurisdiction conflicts are further collateral effects of living far away from the *caleta* in the case of fishers who are settled in a village that belongs to a different county than the one in which their *caleta* is located. Gallardo *et al.* (2011) mention that in Region IV, the *caleta Huentelauquén*, which is in *Canela* County, is used by fishers who live in the adjacent county of *Los Vilos*, 30 Km to the north. According to the authors, both counties dispute jurisdictional responsibility for problems arising from fishing in the *caleta*, leaving fishers without support for conflict resolution.

One positive aspect of the establishment of TURFs adjacent to private land is that access restrictions prevent outsiders from collecting seaweed that is washed-up on the beach (a common practice often performed by women); this is particularly significant for those communities sustained by seaweed harvests (Gallardo *et al*., 2011).

In general, *caletas* adjacent to state-owned lands have a more positive outlook than those adjacent to private property, and those near urban centers even more so. This is because communities are settled close by and can take care of the area; they are better equipped, transportation costs are significantly lower, and they can build or demand infrastructure (e.g. restaurants) to diversify their income. Moreover, since there are no access restrictions *per se*, conflicts are more visible to authorities and relatively easy to solve (Gallardo *et al*., 2011). Urban settings also provide more business opportunities and higher economic benefits for fishing activities. The downsides include limited space for *caletas* to expand into, and pollution associated with urban activities (ports, drainage, etc.) (Gallardo *et al*., 2011). Only around 24% of *caletas* are located in urban areas.

4.7. IMPROVING THE ADAPTIVE MANAGEMENT OF TURFS

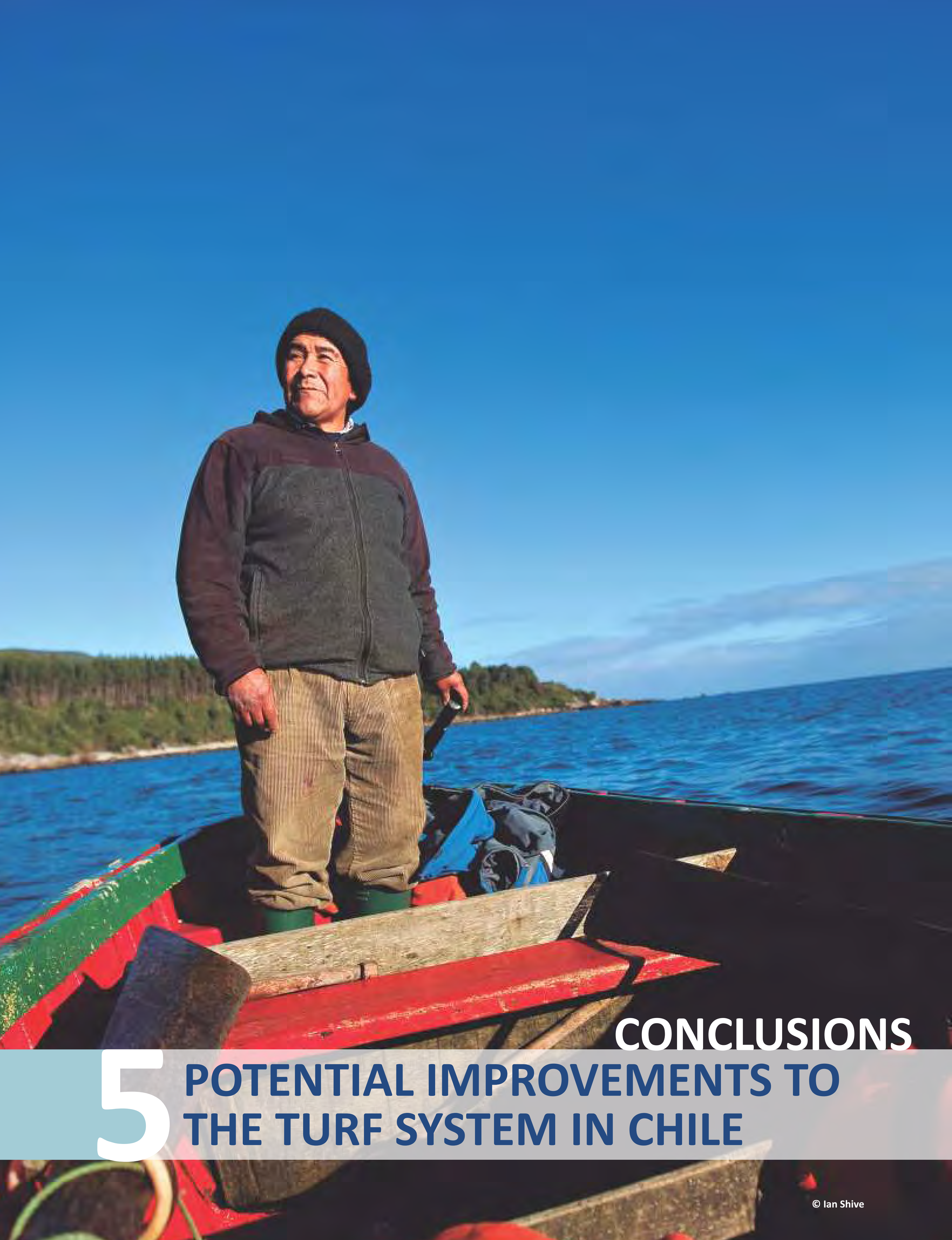
Several authors assert that the Chilean TURF system has no institutional and/or regional coordination, that it leaves few legal alternatives for fishermen to undertake experiments aimed at developing future adaptation strategies, and that it has no formal mechanisms for its periodic review and subsequent adjustments or changes (Gelcich *et al*., 2006; Castilla & Gelcich, 2008; Marín & Berkes, 2010; Orensanz & Parma, 2010; San Martín *et al.*, 2010; Marín *et al*., 2012). Some authors, however, maintain that both SUBPESCA and SERNAPESCA have been flexible when applying the regulations and that, in doing so, they have facilitated adjustments of the system to local situations (Gelcich *et al.*, 2006; González *et al.*, 2006). Indeed, adjustments to TURF regulations have been made throughout the years to address issues brought up by fishers. The possibility to repopulate their management areas and the option to have more than one TURF per association are both examples of adjustments made to the TURF policy at the request of fishers. These adjustments show (i) the government's willingness to deal with some of the conflicts that have arisen since the system's implementation, (ii) the importance of the role fishers play when advocating for their cause, and (iii) that there is room for substantive changes in the regulation. There are a few clauses in the regulations that allow for management adjustments on a case by case basis (see Art. 21, D.S. 355, 1995; Art. 55C, FAL, 2013).

Nonetheless, the development of a monitoring system aimed at evaluating the TURF system periodically and from different angles is necessary, especially if the objective is to make the system more dynamic, flexible and adaptable to local realities. There have been initiatives to design such a monitoring system, but they have not been implemented to date.

While the specific TURF legal framework (D.S. 355, 1995) already regulates certain activities, such as repopulation, the installation of structures to capture larvae, and even small-scale aquaculture, it should be broadened to include proposed changes of common interest to diverse fishing communities, as the new FAL amendments point out. For example, The Nature Conservancy has identified that some fishing associations in the *Los Ríos* Region (XIV) have an interest in implementing NTZs within some of their TURFs as a way to recover some stocks and repopulate adjacent TURFs. This strategy could have medium and long-term outcomes for the communities, especially when the populations of economically important species in these areas are heavily overexploited. The strategy of leaving some areas as NTZs is presumed to lead to the natural repopulation of the area and to the production of large individuals, which is important from an economic point of view. However, leaving a TURF as a NTZ is an economic burden for the fishermen, as they still have to pay for the baseline studies and the performance reports, even if the area is not harvested. Through an adaptive management process, the government could encourage the inclusion of NTZs as part of the management plans. For example, the government could subsidize the baseline or performance analyses for those TURFs that are left (entirely or partly) as NTZs. Additionally, when an association that owns more than one TURF wants to experiment with the implementation of a no-take TURF, some clauses in the regulation could facilitate the rotation of no-take TURFs with regular TURFs as a way to recognize the natural movement or migration of some benthic species of interest, and ensure the proper management of all the TURFs. This approach can also help avoid potential tensions with neighboring unions that may perceive this strategy as a waste of income.

Other ways to improve the TURF management system or to discover potentially effective and adaptive management and conservation strategies include testing the implementation of multi-species harvest plans (including finfish), the introduction of conservation considerations in the management plans (ecosystem approach), the inclusion of other uses (e.g. aquaculture, tourism) in the management structure of TURFs, or rewarding those fishing associations that prove conservation results in their TURFs.

In order to drive an adaptive management approach it is important to identify (i) restrictions in the current legal framework that limit the development of, and experimentation with, management tools and strategies that can be applied both inside and outside the TURFs, and (ii) the legal vehicles that are available to improve TURF management. One of these legal vehicles is the use of the FAL regulations that allow for the establishment of management plans for species harvested outside of TURFs. The 2013 FAL revisions amplify the content and scope of these management plans by specifying management procedures, creating regulatory bodies and other measures that can allow for management at larger scales than single TURFs (Art. 8, FAL, 2013). An ecosystem approach could use this legal framework as a starting point to set management plans that apply to one or more species across an entire region or even at larger scales (e.g., two or more regions) so that stocks that cross TURF or regional boundaries can be managed in their entirety. These management plans could even include the placement and use of NTZs, if applicable. Furthermore, the government could provide economic incentives that support and encourage the development of such joint management plans, so that in the long-run more holistic management approaches at the right scales are in place.



CONCLUSIONS

5 POTENTIAL IMPROVEMENTS TO THE TURF SYSTEM IN CHILE

The Chilean experience is characterized by many crucial elements converging to create the TURF system as it exists today. A key early element in the TURF development process was a recognition by key stakeholders (including fishermen, scientists and the political forces involved in fisheries) of the role that overfishing was playing in the depletion of key resources. Simultaneously, and after more than three decades of dictatorship, there was political will to renew natural resource management policies (Gelcich *et al.*, 2010), as well as the renaissance of CONAPACH, a grass-root institution that actively represented the artisanal fishing associations (Castilla, 2010; Gelcich *et al*., 2010; Marín & Berkes, 2010); the existence of strong scientific institutions focused on generating scientific knowledge with respect to ecosystem dynamics, and which decided to work with fishers, was also a contributing factor. All these elements contributed to the birth of the 1991 FAL and the Chilean TURF system, which then led to a governance transformation of the small-scale fishing sector.

Even though the TURFs were conceived as a way to overcome the *loco* overexploitation crisis, as soon as the strategy started to have positive outcomes for *loco*, its application spread to other resources and a positive perception of the system begun to grow among the Chilean society (Gelcich *et al*., 2005b; González *et al*., 2006; Orensanz & Parma, 2010). The idea was promising: knowing that the enforcement of any regulation is very difficult in a scattered small-scale fishery with multiple landing ports, the most promising approach was to incentivize fishers to protect their resources by granting access rights, while promoting a sustainable fishery.

This report has reviewed the Chilean TURF system in detail, and concludes that it is a good step forward in nearshore fisheries management, but as currently conceived, TURFs are not a "one size fits all" strategy to manage marine resources. One of the most important and powerful legacies of the TURF system is the requirement, support and incentives for fishers to come together in formal fishing associations; this organizational structure has given fishers more voice and legitimate power in decision making, helping them become active stewards of the resource. The TURF regime has also facilitated and encouraged the interaction between scientists, fishers and the government, allowing them to learn from each other.

Overall, TURFs have been successful as instruments for the sustainable management of benthic resources in specific regions (Castilla & Defeo 2001; Castilla & Defeo, 2005; Castilla & Gelcich, 2008), but, as currently conceived, they do not fit the diversity of resources or the heterogeneity of fishing communities and socio-economic conditions that can be found along Chile's coast. The main areas where we believe the system could be improved moving forward are described in more detail below.

5.1. MOVING TOWARDS AN ADAPTIVE MANAGEMENT SYSTEM FOR TURFS

While the government was the *de facto* designer of the TURF system, of the legal requirements and of the system's general concept, many scientists believe that it was "largely shaped by ecologists, who emphasized conservation concerns over economic and social performance" (see Meltzoff *et al*., 2002 and Schumann, 2007, as cited by San Martín *et al*., 2010). The Chilean government should use the lessons learned from the range of outcomes that the TURF system has delivered so far to revise and re-shape the system in a way that includes the diversity of opinions and experiences that existing and potential stakeholders may have. A periodic review of the system that includes the knowledge of fishers and their feedback would complement and inform such an undertaking, and further an understanding of what has really worked, and what has and is hindering progress. To be most effective, a monitoring and review system should integrate all the available information of TURFs in order to have an overall picture of their condition and trends, including assessment of performance, productivity and the impacts and benefits to fishers and the marine ecosystem. Such a system would also allow the identification of common challenges among the different regions and of the peculiarities of individual regions, and support the exploration of strategies to mitigate or address these challenges. The interaction between stakeholders, as well as data sharing and information exchanges within and between regions, would also facilitate the integration of lessons learned into the system and make it more adaptive.

An additional vehicle we and other authors have identified to improve the adaptability of the system is the inclusion of a certain degree of flexibility in the regulations and the promotion of experimentation as a means to develop innovative management tools that may address local realities more efficiently (Castilla & Defeo, 2001; Meltzoff *et al*., 2002; Gelcich *et al*., 2005a, 2005b, 2006, 2008b; Aburto *et al*., 2013). For example, the implementation of NTZs within or between adjacent TURFs, or the implementation of a more holistic approach of collaborative management between TURFs instead of the current single-TURF management focus, could result in promising ecological, social and economic benefits. Along these lines, San Martín *et al*. (2010) suggest that, working with TURFs which share common qualities in a "coordinated network", and by coordinating monitoring and technical support efforts, potential economies of scale could be identified that reduce the overall cost of management.

The idea of collective TURF management is an important consideration that should be taken into account, as both medium and large-scale ecological processes that occur in the ocean and in the coastal zone transcend TURF boundaries. TURFs and open-access areas, for instance, do not function as independent entities; these areas are linked and impacts on one can, and are likely to, influence the other. Thus, stricter management regulations for open-access areas and for other coastal activities that can affect fisheries production in and outside of TURFs (e.g., aquaculture and infrastructure development) should be developed and applied in combination with TURF policies when appropriate.

Another implication of managing TURFs independently from each other, as some authors argue, is that the incessant designation of TURFs along the coast has likely blocked conservation initiatives such as the establishment of marine reserves. It also implies that aquaculture, marine reserves and marine concessions all have to compete for coastal space (Fernández & Castilla, 2005). An integrated management strategy that takes into account all coastal and nearshore uses more consistently is recommended for the long-term success of the TURF system. As daunting as this approach may be, all the entities involved in fisheries management and coastal use planning should attempt to better coordinate their policies to foresee and solve conflicts, and make more efficient use of resources at a local, regional and national level.

5.2. INCREASING THE PARTICIPATION OF FISHERS CAN TRANSLATE INTO MORE SUCCESSFUL TURFS

Building on the belief that promoting the participation of fishers in the development of management rules creates legitimacy and enhances compliance through stewardship values, we concur with several authors who suggest a gradual devolution of management authority to fishing communities (Johannes, 2002; Gelcich *et al*., 2005a; 2006), particularly in terms of their involvement and control over TURF management plans. In practice, this could mean implementing the barefoot ecologist model mentioned in this report for data collection and assessment, and gradually empowering fishers in the decision-making process. Moreover, enriching the management criteria with the knowledge of fishers and monitoring their feedback with regard to socio-economic and ecological changes should be part of the transformation towards a successful adaptive management system.

The Chilean consultancy system for the implementation of the TURF policy, which is currently limited to resource management, as described above, should, in our view, be broadened. One possible approach would be to have consultancies incorporate skills from the social sciences, people management, business development, marketing and commercialization, so that consultants in turn can train and more actively support the capacity of fishers to successfully manage their TURFs. Fishers could request these additional training services as part of their current consultancy contracts and in the process learn new skills that will eventually lead them to be more independent TURF managers. These added skills and training would probably lead to an increase in the cost of services; thus, a national regulatory framework facilitating these services might be more effective. A transformation towards a more adaptive consultancy system would require specific efforts towards evaluating and improving the technical skills of consultants, standardizing methodologies, certifying both consultancy firms and consultants, and creating mandatory rules to regulate their performance and guarantee minimum standards.

Regardless of the role consultants can play in training, the training of fishers is central for improving the performance of TURFs. In many cases, fishers truly value the training they have received and have demanded additional training and capacity building (SERNAPESCA, 2005c). As outlined throughout this report, training modules focused on marketing, business practices, management, administration, leadership, and marine and fisheries biology are all of interest and in demand. Learning exchanges among fishers as a training strategy should also be considered.

5.3. INCREASING SUPPORT FOR FISHERMEN-LED COMMERCIAL INITIATIVES

As in any productive sector, the main incentive for fishermen to keep working under the TURF system is to ensure their economic well-being. While available data do not allow the conclusion that the system has proven economically viable in all instances throughout Chile, fishing associations continue to apply for TURFs, leading us to believe that there are other non-economic benefits for TURF owners. Institutional and social benefits are consistently cited as important benefits to fishermen.

Before the TURF system was implemented in Chile, fishers were loosely organized into associations and therefore, in many cases, they were not used to working together. With the TURF system, fishermen were forced to form associations and learn how to work together, which in some cases has resulted in the creation of joint commercial initiatives and a substantial transformation of the commercialization process. Fishermen went from bargaining individually on sales to arranging sales prior to harvest, which enabled them to get better prices for their products, and to better schedule their harvesting period, allowing them to have alternative jobs, to diversify their source of income and to adapt their harvest to market fluctuations. Many authors conclude that the TURF policy has awakened the entrepreneurship of fishers and furthered the collaboration between associations, facilitating and encouraging the creation of innovative business initiatives (World Bank, 2006; Castilla & Gelcich, 2008). Government support and encouragement of this kind of initiative, through economic incentives like facilitating access to funds, if necessary, should be a priority.

5.4. ADDRESSING ENFORCEMENT IS KEY TO THE SUCCESS OF THE TURF SYSTEM

Because encroachment and illegal fishing have been identified as the main threat to the viability of TURFs, improving enforcement is clearly a key element that needs addressing. This generally entails an increase in enforcement capacity through strengthening enforcement agencies and reinforcing the coordination between stakeholders and the agencies involved in control and surveillance. A review of existing institutional enforcement capacities and structures, including the capacity of SERNAPESCA and of the Navy to deal with surveillance and control needs, is needed to determine if it is feasible to invest in additional surveillance staff. Improvement in the cooperation and communication between these agencies and the fishermen is also needed, especially in rural *caletas*, which may have an increased burden of surveillance costs, as their TURFs are often located far away from population centers.

Encroachment and illegal fishing have been identified as the main threat to the viability of TURFs.

Additionally, the prosecution system needs to be reinforced as well, including by applying the higher fines and penalties approved as part of the 2013 FAL revisions, and by training judges and district attorneys with respect to illegal fishing and the need for stricter application of the law to reduce poaching substantively.

Finally, measures to address illegal fishing and to improve the overall management of fishery resources in Chile can be identified by enabling and incentivizing fishers to report illegal harvests, by supporting the development of low-cost surveillance technology, and by quantifying and sharing information on illegal catches, as well as the routes and markets used for illegal products.

As stated at the beginning of this report, Chile's Fisheries and Aquaculture Law was reauthorized in January 2013. The government made stakeholder consultation an important part of the review process, allowing for adjustments and modifications to the regulations that affect TURFs. Significant positive measures were taken at the time, but implementation and follow-through of these measures will be critical in improving the overall performance of the system. While there are still some challenges and issues to address and learn from, the Chilean experience is unquestionably valuable for those countries considering implementing a TURF-like system, particularly where no customary rights currently exist. It is encouraging that stakeholder involvement continues to be high in Chile, and that scientific information and fisher knowledge keeps contributing to the improvement of the TURF system to assure its future success and sustainability.

REFERENCES

Aburto J. and Stotz W., 2013. Learning about TURFs and natural variability: Failure of surf clam management in Chile. Ocean and Coastal Management 71: 88-98.

Aburto J., Gallardo G., Stotz W., Cerda C., Mondaca-Schachermayer C., and Vera K., 2013. Territorial user rights for artisanal fisheries in Chile - intended and unintended outcomes. Ocean and Coastal Management 71: 284-295.

Andrade M., Barría, N., and Sepúlveda M., 2010. Estudio Social y Ambiental Base para la elaboración de una propuesta participativa en torno a una figura de protección ambiental para el Área Marina comprendida entre el Río Chaihuín y el Río Bueno. Informe Técnico preparado para la Reserva Costera Valdiviana y The Nature Conservancy.

Avilez O., 2003. Experiencia en el manejo y explotación de las áreas de manejo de recursos bentónicos en las caletas artesanales de la IV Región. In: San Martín G.A., Pinto A., Montecinos M., González A. and Guerra J.A. (Eds.). Taller de áreas de manejo-Experiencias y proyecciones. Unidad de Áreas de Manejo, Departamento de Pesquerías, Subsecretaría de Pesca, Valparaíso, Chile.

Berkes F., 1994. Co-management: bridging the two solitudes. Northern Perspectives 22 (2-3): 18-20.

Bernal P., Oliva D., Aliaga B., and Morales C., 1999. New regulations in Chilean fisheries and aquaculture: ITQs and territorial user rights. Ocean & Coastal Management 42: 119-142.

Bustamante R. and Castilla J.C., 1987. The shellfishery in Chile: An analysis of 26 years of landings (1960-1985). Biología Pesquera (Chile) 16: 79-97.

Bustamante R. and Castilla J.C., 1990. Impact of human exploitation on populations of the intertidal southern Bull-kelp *Durvillaea antartica* (Phaeophyta, Durvilleales) in central Chile. Biological Conservation 52 (3): 205-220.

Caballol E., Latorre P., and Martínez C., 2006. Diagnóstico de la situación de la propiedad y acceso a playas de mar, lagos y ríos a nivel nacional. Informe final. Ministerio de Bienes Nacional, División del Catastro Nacional de los Bienes del Estado, Departamento de Estudios Territoriales.

Cancino J., Uchida H., and Wilen J., 2007. TURFs and ITQs: Collective vs. Individual Decision Making. Marine Resource Economics 22: 391-406.

Castilla J.C., 1994. The Chilean small-scale benthic shellfisheries and the institutionalization of new management practices. Ecological International Bulletin 21: 47-63.

Castilla J.C., 1999. Coastal marine communities: Trends and perspectives from human exclusion experiments. Trends in Ecology and Evolution 14: 280-283.

Castilla J.C., 2000. Roles of experimental marine ecology in coastal management and conservation. Journal of Experimental Marine Biology and Ecology 250: 3-21.

Castilla J.C., 2010. Fisheries in Chile: Small pelagics, management, rights and sea zoning. Bulletin of Marine Science 86 (2): 221-234.

Castilla J.C. and Bustamante R., 1989. Human exclusion from rocky intertidal of Las Cruces, central Chile: effects on *Durvillaea antarctica* (Phaeophyta, Durvilleales). Marine Ecology Progress Series 50: 203-214.

Castilla J.C. and Defeo O., 2001. Latin American benthic shellfisheries: emphasis on co-management and experimental practices. Reviews in Fish Biology and Fisheries 11: 1-30.

Castilla J.C. and Defeo O., 2005. More than one bag for the world fishery crisis and keys for co-management successes in selected artisanal Latin American shellfisheries. Reviews in Fish Biology and Fisheries 15 (3): 265-283.

Castilla J.C. and Durán L.R., 1985. Human exclusion from the rocky intertidal zone of Central Chile: The effects on *Concholepas concholepas* (Gastropoda). Oikos 45: 391-399.

Castilla J.C. and Fernández M., 1998. Small-scale benthic fisheries in Chile: On co-management and sustainable use of benthic invertebrates. Ecological Applications 8: 124-132.

Castilla J.C. and Gelcich S., 2006. Chile: Experience with management and exploitation areas for coastal fisheries as building blocks for large-scale marine management. In: Scaling Up Marine Management - the Role of Marine Protected Areas. Environment Department, Sustainable Development Network, Washington DC, World Bank.

Castilla J.C. and Gelcich S., 2008. Management of the loco (*Concholepas concholepas*) as a driver for self-governance of small-scale benthic fisheries in Chile. In: Townsend R., Shotton R., and Uchida H. (Eds.), FAO, Fisheries Technical Paper No. 504, Case studies in fisheries self-governance. Rome, Italy.

Castilla J.C. and Schmiede P., 1979. Hipótesis de trabajo sobre la existencia de zonas marítimas tampones en relación a recursos marinos bentónicos (mariscos y algas) en la costa de Chile. In: Gallardo V. A. (Ed.). Seminario-taller sobre el desarrollo e investigación de los recursos marinos de la VIII Región, Chile. Vicerrectoría de investigación, Universidad de Concepción, Concepción, Chile.

Castilla J.C., Gelcich S. and Defeo O., 2007. Successes, lessons and projections from experience in marine benthic invertebrate artisanal fisheries in Chile. Pages 25-42, in: McClanahan T. and Castilla J.C. (Eds.). Fisheries management: progress toward sustainability. Blackwell, Oxford, UK.

CENDEC, 2010. Informe de Consultoría: Situación del fomento productivo en la pesca artesanal de Chile. Santiago, Chile. Centro para el Desarrollo de Capital Humano, 163 pp.

Christy F.T. Jr., 1982. Territorial use rights in marine fisheries: definitions and conditions. FAO Fisheries Technical Paper 227. Rome, Italy.

Decreto 107, 2005. Declara área marina y costera protegida un sector del borde costero en las cruces, comuna de El Tabo, provincia de San Antonio, V Región de Valparaíso. Ministerio de Defensa Nacional; Subsecretaría de Marina. Available at: http://bordecostero.ssffaa.cl/documentos/normativas_y_reglamentos/3_decretos_amcp_reservas_marinas/DS_107_M_2005_%20AMCP_Las%20Cruces.pdf

Decreto 240, 1998. Fija nomina oficial de caletas. Última Modificación: 21-11-2009, Decreto 237. Ministerio de Defensa Nacional; Subsecretaría de Marina. Available at: http://bordecostero.ssffaa.cl/documentos/normativas_y_reglamentos/1_normativa/DS_%20240_1998_Nomina_Oficial.pdf

Decreto Supremo 355, 1995. Reglamento sobre Áreas de Manejo y Explotación de Recursos Bentónicos. SUBPESCA. Available at: http://www.subpesca.cl/normativa/605/w3-article-11086.html

Decreto Supremo 104, 2012. Reglamento de sustitución de embarcaciones artesanales y reemplazo de la inscripción de pescadores en el registro artesanal. SUBPESCA. Available at: http://www.subpesca.cl/normativa/605/w3-article-80483.html

Decreto Supremo 314-04, 2005. Reglamento de Actividades de Acuicultura en Áreas de Manejo y Explotación de Recursos Bentónicos. SUBPESCA. Available at: http://www.subpesca.cl/normativa/605/w3-article-7779.html

Diegues, A.C. 2008. Marine protected areas and artisanal fisheries in Brazil. Samudra Monograph. Chennai, India, International Collective in Support of Fishworkers, 68 pp.

Durán R., Castilla J. C., and Oliva D., 1987. Intensity of human predation on rocky shores at Las Cruces, central Chile. Environmental Conservation 14: 143-149.

Estudios Marinos. 2003. Estudio de situación base y plan de manejo y explotación para el área Puertecillo, VI Región. Coquimbo, Chile.

FAL, 1991. General Fisheries and Aquaculture Law. Available at: http://www.sernapesca.cl

FAL, 2013. General Fisheries and Aquaculture Law. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=fileinfo&id=42

FAO, 2012. FAO yearbook. Fishery and Aquaculture Statistics. 2010. Statistics and Information Service of the Fisheries and Aquaculture Department. Rome, Italy. 78 pp.

Fernández M. and Castilla J.C., 2005. Marine conservation in Chile: Historical perspective, lessons and Challenges. Conservation Biology 19 (6): 1752-1762.

Franquesa R., 2004. Fishermen guilds in Spain (Cofradías): Economic role and structural changes. International Institute of Fisheries Economics & Trade (IIFET) 2004 Japan Proceedings, 14 pp.

Gallardo G.L., 2008. Seascapes of Extinction, Seascapes of Confidence. Territorial Use Rights in Fisheries in Chile: El Quisco and Puerto Oscuro. Co-Action Publishing. Aberystwyth, Wales: Cambrian Printers Ltd.

Gallardo G.L. and Friman E., 2010. The politicized nature of global trade - the continuous commoditization of land and marine resources, and struggles for livelihoods in Chile. In: Gallardo G.L. and Friman E. (Eds.), Politicized Nature: Global Exchange, Resources and Power, An anthology. Cefo Publication Series, Number 2. Centre for Environment and Development Studies, Uppsala, Sweden.

Gallardo G.L., Stotz W., Aburto J., Mondaca C., and Vera K., 2011. Emerging commons within artisanal fisheries. The Chilean territorial use rights in fisheries (TURFs) within a broader coastal landscape. International Journal of the Commons 5 (2): 459-484.

Gelcich S., Edwards-Jones G., and Kaiser M.J., 2005a. Importance of attitudinal differences among artisanal fishers towards co-management and conservation of marine resources. Conservation Biology 19: 865-875.

Gelcich S., Edwards-Jones G., and Kaiser M.J., 2007. Heterogeneity in fishers harvesting behavior under a Territorial user rights policy. Ecological Economics 61: 246-254.

Gelcich S., Godoy N., and Castilla J.C., 2009. Artisanal fishers' perceptions regarding coastal co-management policies in Chile and their potentials to scale-up marine biodiversity conservation. Ocean Coastal Management 52: 424-432.

Gelcich S., Edwards-Jones G., Kaiser M.J., and Castilla J.C. , 2006. Co-management policy can reduce resilience in traditionally managed marine ecosystems. Ecosystems 9: 951-966.

Gelcich S., Edwards-Jones G., Kaiser M.J., and Watson E., 2005b. Using discourses for policy evaluation: The case of marine common property rights in Chile. Society and Natural Resources 18: 377-391.

Gelcich S., Fernández M., Godoy N., Canepa A., Prado L., and Castilla J.C., 2012. Territorial User Rights for Fisheries as Ancillary Instruments for Marine Coastal Conservation in Chile. Conservation Biology, September 12th 2012.

Gelcich S., Godoy N., Prado L., and Castilla J.C., 2008a. Add-on conservation benefits of marine territorial user rights fishery policies in central Chile. Ecological Applications 18 (1): 273-281.

Gelcich S., Hughes T., Olsson P., Folke C., Defeo O., Fernandez M., Foale S., Gunderson L., Rodriguez-Sickert C., Scheffer M., Steneck R., and Castilla J.C., 2010. Navigating transformations in governance of Chilean marine coastal resources. Proceedings of the National Academy of Sciences of the United States of America 107 (39): 16751-17060.

Gelcich S., Kaiser M.J., Castilla J.C., and Edwards-Jones G., 2008b. Engagement in co-management of marine benthic resources influences environmental perceptions of artisanal fishers. Environmental Conservation 35: 36-45.

Gell F. R. and Roberts C.M., 2002. The fishery effects of marine reserves and fishery closures. World Wildlife Fund for Nature, Washington, DC, USA.

Godoy C. and Moreno C.A., 1989. Indirect effects of human exclusion from the rocky intertidal in southern Chile: a case of cross-linkage between herbivores. Oikos 54 (1): 101-106.

González J., Stotz W., Garrido J., Orensanz J.M., Parma A.M., Tapia C., and Zuleta A., 2006. The Chilean TURF system: How is it performing in the case of the loco fishery? Bulletin of Marine Science 78 (3): 499-527.

González J., Tapia C., Wilson A., Stotz W., Orensanz J.M., Parma A.M., Valero J., Catrilao M., and Garrido J., 2004. Bases biológicas para la evaluación y manejo de metapoblaciones de loco en las III y IV Regiones. IFOP (Chile). IFOP, Project FIP No. 2002-16, final report, Valparaíso. 101 pp.

Govan H., Tawake A., and Tabunakawai K, 2006. Community-based marine resource management in the South Pacific. PARKS, IUCN Protected Areas Programme 01/2006, 16(1): 63-67.

Hilborn R., Maguire J., Parma A.M., and Rosenberg A.A., 2001. The precautionary approach and risk management. Can they increase the probability of success in fishery management? Canadian Journal of Fisheries Aquatic Science 58: 99-107.

Hilborn R., Orensanz J.M., and Parma A.M., 2005. Institutions, incentives and the future of fisheries. Philosophical Transactions of the Royal Society B-Biological Sciences 360: 47-57.

ICSED (Centro Interamericano para el Desarrollo de Ecosistemas Sustentables), 2001. Seguimiento de las áreas de manejo y explotación de recursos bentónicos. ICSED, Servicio de Cooperación Técnica de Chile y SUBPESCA. Santiago de Chile, Chile. 106 pp.

IFOP (Instituto de Fomento Pesquero), 2001. Ordenación espacio-temporal de la actividad extractiva artesanal entre la I y IV Regiones, Informe proyecto FIP 2001-25, 200 pp.

INE (Instituto Nacional de Estadística de Chile), 2009. Primer Censo Nacional Pesquero y Acuicultor 2008 -2009.

Jentoft S., 1989. Fisheries co-management: delegating government responsibility to fishermen's organizations. Marine Policy 13(2): 137-54.

Jentoft S. and McCay B.J., 1995. User participation in fisheries management: lessons drawn from international experience. Marine Policy 19 (3): 227-46.

Jentoft S., McCay, B., and Wilson D., 1998. Social theory and fisheries co-management. Marine Policy 22: 423-436.

Johannes, R.E. 2002. The renaissance of community-based marine resource management in Oceania. Annual Review of Ecology and Systematics 33: 317-340.

Lim C.P., Matsuda Y., and Shigemi Y., 1995. Co-management in marine fisheries: the Japanese experience. Coastal Management 23: 195-221.

Macho G., Naya I., Freire J., Villasante S., and Molares J., 2013. The Key Role of the Barefoot Fisheries Advisors in the Co-managed TURF System of Galicia (NW Spain). AMBIO 42: 1057-1069.

Makino M. and Matsuda H., 2005. Co-management in Japanese coastal fisheries: institutional features and transaction costs. Marine Policy 29: 441-450.

Maliao R., Pomeroy R., and Tuirngan R., 2009. Performance of community-based coastal resource management (CBCRM) programs in the Philippines: A meta-analysis. Marine Policy 33: 818-825.

Manríquez P.H. and Castilla J.C., 2001. Significance of marine protected areas in central Chile as seeding grounds for the gastropod *Concholepas concholepas*. Marine Ecology Progress Series 215: 201-211.

Marín A. and Berkes F., 2010. Network approach for understanding small-scale fisheries governance: The case of the Chilean coastal co-management system. Marine Policy 34: 851-858.

Marín A., Gelcich S., Castilla J.C., and Berkes, F., 2012. Exploring social capital in Chile's coastal benthic co-management system using a network approach. Ecology and Society 17 (1): 13.

Matsuda H., 2010. Risk and resource management. In: Osaki M., Braimoh A., Nakagami K. and Saito O. (Eds.), Designing our future from local and regional perspectives-bioproduction, ecosystems and humanity. United Nations University Press.

Meltzoff S.K., Stotz W., and Lichtensztajn Y.G., 2002. Competing Visions for Marine Tenure and Co-Management: Genesis of a Marine Management Area System in Chile. Journal of Coastal Management 30: 85-99.

Molares J. and Freire J., 2003. Development and perspectives for community-based management of the goose barnacle (Pollicipes pollicipes) fisheries in Galicia (NW Spain). Fisheries Research 65: 485-492

Mondaca-Schachermayer C. I., Aburto J., Cundill G., Lancellotti D., Tapia C., and Stotz W., 2011. An Empirical Analysis of the Social and Ecological Outcomes of State Subsidies for Small-Scale Fisheries: A Case Study from Chile. Ecology and Society 16(3): 17.

Montoya M., Urbina M., and Carroza L., 2004. Informe técnico, análisis del desempeño económico de las áreas de manejo 2000-2002. Departamento de Análisis Sectorial.

Moreno C.A. 2001. Community patterns generated by human harvesting on Chilean shores: A review. Aquatic Conservation 11: 19-30.

Moreno C.A. and Reyes A., 1988. Densidad de Concholepas concholepas (Gastropoda, Muricidae) en la reserva marina de Mehuín: Evidencias de falla en el reclutamiento. Biología Pesquera (Chile) 17: 31-38.

Moreno C.A. and Vega R., 1988. Valor científico de las reservas marinas costeras: Un ejemplo de estudio ecológico con poblaciones intermareales de *Loxechinus albus* (Molina). Informe Unesco de Ciencias del Mar 47: 124-134.

Moreno C.A., Sutherland J.P., and Jara H.F., 1984. Man as a predator in the intertidal zone of southern Chile. Oikos 42: 155-160.

Moreno C.A, Lunecke, K. N., and López M.I., 1986. The response of an intertidal *Concholepas concholepas* (Gastropoda: Muricidae) to protection from man in southern Chile and its effects on benthic sessile assemblages. Oikos 46: 359-364.

Navarrete S.A., Gelcich S., and Castilla J.C., 2010. Long-term monitoring of coastal ecosystems at Las Cruces, Chile: Defining baselines to build ecological literacy in a world of change. Revista Chilena de Historia Natural 83: 143-157.

Neher P.A., Arnason R., and Mollett N. (Eds.), 1989. Rights Based Fishing: Proceedings of the North Atlantic Treaty Organization (NATO) Advanced Research Workshop on Scientific Foundations for Rights Based Fishing. June 27-July 1, Reykjavik, Iceland. NATO ASI Series. Series E. Applied Sciences 169. Dordrecht: Kluwer Academic Publishers.

Oliva D. and Castilla J.C., 1986. The effects of human exclusion on the population structure of keyhole limpets Fissurella crassa and F. limbata on the coast of Central Chile. Marine Ecology 7 (3):201-207.

Oliva D. and Castilla J.C., 1990. Repoblación natural: el caso del loco *Concholepas concholepas* (Gastrópoda: Muricidae), en Chile Central. Pages 273-295, in: Hernández A.H. (Ed.), Cultivo de moluscos en América Latina. Memorias segunda reunión grupo de trabajo técnico. Red Regional de Enticades y Centros de Acuicultura de América Latina CIID-Canada. Noviembre 7-11, Bogotá, Colombia.

Orensanz J.M. and Parma A., 2010. Chile, Territorial Use Rights, Successful experiment? Samudra Report No. 55: 42-46.

Orensanz J.M., Parma A.M., Jerez G., Barahona N., Montecinos M., and Elías I., 2005. What are the key elements for the sustainability of “S-fisheries”? Insights from South America. Bulletin of Marine Science 76: 527-556.

Ortiz M. and Levins R., 2011. Re-stocking practices and illegal fishing in northern Chile (SE Pacific Coast): a study case. Oikos 120: 1402-1412.

Parma A.M., Orensanz J.M., Elías I., and Jerez G., 2001. Diving for shellfish and data: incentives for the participation of fishers in the monitoring and management of artisanal fisheries around southern South America. In: Australian Society for Fish Biology Workshop Proceedings. 23-24 September, Bunbury, Western Australia.

Pomeroy R. and Berkes F., 1997. Two to tango: the role of government in fisheries co-management. Marine Policy 21 (5): 465-480.

Pomeroy R. and Carlos M., 1997. Community-based coastal resource management in the Philippines: a review and evaluation of programs and projects, 1984-1994. Marine Policy 21 (5): 445-464.

Pomeroy R. and Williams M.J., 1994. Fisheries Co-management and Small-scale Fisheries: A Policy Brief. International Centre for Living Aquatic Resources Management (ICLARM) Contribution N◦ 1128. Manila, Philippines. 15 pp.

Pomeroy R., Katon B., and Harkes I., 2011. Conditions affecting the success of fisheries co-management:
lessons from Asia. Marine Policy 25: 197-208.

Pomeroy R., Nguyen K., and Thong H., 2009. Small-scale marine fisheries policy in Vietnam. Marine Policy 33: 419-428.

Prince J., 2010. Rescaling fisheries assessment and management: a generic approach, access rights, change agents, and toolboxes. Bulletin of Marine Science 86: 197-219.

Ramírez E., Modrego F., Viteri A., Escobar G., and Yáñez R., 2011. Evaluación de Impacto: Informe Final Programas de Fomento de CORFO, Ministerio de Economía, Centro Latinoamericano para el Desarrollo Rural (RIMISP).

Registro Artesanal de Pescadores (RAP), 2012. Embarcaciones y pescadores artesanales a 31 de diciembre de 2011. Available at: http://www.sernapesca.cl/index.php?option=com_content&view=article&id=84&Itemid=222

Rivera G., Aroca T., and Paillamán A., 2001. Áreas de Manejo y Explotación de Recursos Bentónicos. Departamento de Pesca Artesanal, SERNAPESCA. Valparaíso, Chile.

Ruddle K., 1989. Solving the common-property dilemma: village fishery rights in Japanese coastal waters. In: Berkes F. (Ed.), Common Property Resources: Ecology and Community-based Sustainable Development, Belhaven Press, London.

Ruddle K., Hviding E., and Johannes R., 1992. Marine resource management in the context of customary tenure. Marine Resource Economics 7(4): 249-273.

San Martín G., Parma A.M., and Orensanz J.M., 2010. The Chilean Experience with Territorial Use Rights in Fisheries. In: Grafton R., Hilborn R., Squires D., Tait M., and Williams M. (Eds.), Handbook of Marine Fisheries Conservation and Management. Oxford University Press, New York.

Santelices B., Castilla J.C., Cancino J., and Schmiede P., 1980. Comparative ecology of *Lessonia nigrescens* and *Durvillaea antartica* (Pheophyta) in central Chile. Marine Biology 59 (2): 119-132.

Santos C. and Schiavetti A., 2014. Assessment of the management in Brazilian Marine Extractive Reserves. Ocean & Coastal Management 93: 26-36.

Schumann S., 2007. Co-management and "consciousness": Fishers' assimilation of management principles in Chile. Marine Policy 31: 101-111.

Schumann S., 2010. A tenuous triumvirate: The role of independent biologists in Chile's co-management regime for shellfish Marine Policy 34 (1): 133-138.

Schumann S., 2011. Navigating the Knowledge Interface: Fishers and Biologists under Co-Management in Chile. Society & Natural Resources: An International Journal 24 (11): 1174-1188

Sen S. and Nielsen J. R., 1996. Fisheries co-management: a comparative analysis. Marine Policy 20 (5): 405-418.

SERNAPESCA, 2002. Desembarques artesanales en AMERB 2002 por Región y Especie, Anuario Estadístico de Pesca 2002. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=fileinfo&id=1031

SERNAPESCA, 2003. Desembarques artesanales en AMERB 2003 por Región y Especie, Anuario Estadístico de Pesca 2003. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=fileinfo&id=768

SERNAPESCA, 2004. Desembarques artesanales en AMERB 2004 por Región y Especie, Anuario Estadístico de Pesca 2004. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=fileinfo&id=428

SERNAPESCA, 2005a. Desembarques artesanales en AMERB 2005 por Región y Especie, Anuario Estadístico de Pesca 2005. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=fileinfo&id=591

SERNAPESCA, 2005b. Informe sectorial pesquero artesanal. Departamento de Pesca Artesanal julio de 2005. Available at: http://www.sernapesca.cl

SERNAPESCA, 2005c. Evaluación Técnica y Económica del impacto de las Áreas de Manejo y Explotación de Recursos Bentónicos. Departamento de Pesca Artesanal.

SERNAPESCA, 2006. Desembarques artesanales en AMERB 2006 por Región y Especie, Anuario Estadístico de Pesca 2006. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=fileinfo&id=2483

SERNAPESCA, 2007a. Desembarques artesanales en AMERBs 2007 por Región y Especie, Anuario Estadístico de Pesca 2007. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=fileinfo&id=2932

SERNAPESCA, 2007b. Informe Gestión Territorial, Áreas de Manejo. Available at: http://www.sernapesca.cl/ index.php?option=com_remository&Itemid=246&func=fileinfo&id=912

SERNAPESCA, 2008a. Desembarques artesanales en AMERB 2008 por Región y Especie, Anuario Estadístico de Pesca 2008. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=fileinfo&id=3430

SERNAPESCA, 2008b. Series cronológicas 1998-2008, Anuarios Estadísticos de Pesca 2008. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=54&func=select&id=378.

SERNAPESCA, 2009. Desembarques artesanales en AMERB 2009 por Región y Especie, Anuario Estadístico de Pesca 2009. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=fileinfo&id=4283

SERNAPESCA, 2010a. Desembarques artesanales en AMERB 2010 por Región y Especie, Anuarios Estadísticos de Pesca 2010. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=fileinfo&id=5094

SERNAPESCA, 2010b. Desembarques artesanales 2010 por Región y Especie, Anuarios Estadísticos de Pesca 2010. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=fileinfo&id=5091

SERNAPESCA, 2011a. Gráfico de series cronológicas 2000-2011, Anuarios Estadísticos de Pesca 2011. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=select&id=734

SERNAPESCA, 2011b. Desembarques artesanales 2011 por Región y Especie, Anuarios Estadísticos de Pesca 2011. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=fileinfo&id=6313

SERNAPESCA, 2011c. Desembarques industriales 2011 por Región y Especie, Anuarios Estadísticos de Pesca 2011. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=fileinfo&id=6321

SERNAPESCA, 2011d. Cosechas de centros de acuicultura 2011 por Región y Especie, Anuarios Estadísticos de Pesca 2011. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=fileinfo&id=6295

SERNAPESCA, 2011e. Gráfico de desembarques y naves industriales, 2005-2011, Anuarios Estadísticos de Pesca 2011. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=select&id=733

SERNAPESCA, 2011f. Gráfico de desembarques y naves artesanales, 2005-2011, Anuarios Estadísticos de Pesca 2011. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=select&id=732

SERNAPESCA, 2011g. Desembarques artesanales en AMERB 2011 por Región y Especie, Anuarios Estadísticos de Pesca 2011. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=fileinfo&id=6309

SERNAPESCA, 2013a. Estado de tramitación de AMERB a 21 de marzo de 2013. Available at: http://www.subpesca.cl/institucional/602/w3-article-5902.html

SERNAPESCA, 2013b. GTI, Información de las Áreas de manejo desde la Región de Arica y Parinacota a la Región de Magallanes (incluye nuevas regiones). Julio 2013. Available at: http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=fileinfo&id=912

Shotton R. (Ed.), 2000. Use of property rights in fisheries management. In: FAO, Fisheries technical paper No 404/1. Proceedings of the Fishrights 99 Conference: November 11-19 of 1999, Freemantle, Western Australia. Rome, Italy.

Silva P., 2004. From Common Property to Co-management: Lessons from Brazil's First Maritime Extractive Reserve. Marine Policy 28 (5): 419-28.

Sobenes C. and Chávez C., 2007. Economic performance of benthic resource management areas in the Bío-Bío Region. Investigación Marina, Valparaíso, 35(2): 83-97.

Sobenes C. and Chávez C., 2009. Determinants of economic performance for coastal managed areas in central-southern Chile. Environmental and Development Economics 14: 717-738. Cambridge University Press.

Soto M. and Chávez J., 2001. Rentabilidad de las áreas de manejo y explotación de recursos bentónicos de la IV Región. Servicio Nacional de Pesca, Valparaíso, 34 pp.

Stotz W., 1997. Las áreas de manejo en la Ley de Pesca y Acuicultura: primeras experiencias y evaluación de la utilidad de esta herramienta para el recurso loco. Estudios Oceanológicos (Chile) 16: 67-86.

Stotz W., Aburto J., Caillaux L., Cecchi F., Escobar M., Garay R., Lancellotti D., Valdevenito M., and Zúñiga S., 2008. Evaluación del proceso de implementación de la medida de administración áreas de manejo y explotación de recursos bentónicos (AMERB), en las Regiones III y IV, y la elaboración de una propuesta de mejoramiento de la medida. Universidad Católica del Norte, Grupo de Ecología y Manejo de Recursos. Centro Regional de Desarrollo Humano, Escuela de Ingeniería Comercial. Proyecto FIP 2005-34.

SUBPESCA, 2001. Documento Técnico No. 3. Áreas de Manejo y Explotación de recursos Bentónicos. Consideraciones Técnicas ESBA, PMEA e Informe anual. Available at: http://www.subpesca.cl/publicaciones/606/articles-9778_documento.pdf

SUBPESCA, 2003. Documento de Difusión No. 1. Áreas de Manejo y Explotación de Recursos Bentónicos. Departamento de Coordinación Pesquera y Departamento de Pesquerías de la Subsecretaría de Pesca. Available at: http://www.subpesca.cl/publicaciones/606/articles-9758_documento.pdf

SUBPESCA, 2010a. Distribución Geográfica AMERB. Available at: http://www.subpesca.cl/template/0foto/05.asp?IDSECCION=2443&b=Microsoft.

SUBPESCA, 2010b. Presentación de Informe "Estado de las pesquerías bentónicas Chilenas". Unidad de Recursos Bentónicos. División de Administración Pesquera de SUBPESCA. XXI Congreso Nacional CONAPACH, Noviembre 2010. Available at: http://www.conapach.cl/home/archivos/11-Estado_Pesquerias_Bentonicas(A_Pinto-Subpesca).pdf

SUBPESCA, 2012. Information about caletas. Available at: http://200.54.73.149/SUBPESCA_V2/template/0foto/13.asp?IDSECCION=411

Testdata (Testdata Consultores S.A.), 1997. Diseño de monitoreo de pesquerías bentónicas. Informe del proyecto FIP 95-26, 221 pp.

Techeira C., Cortes C., Palta E., Grego E., Romero P., Araya A., Álvarez L., Valdenegro A., Wilson A., Vega C., Aguilera A., Díaz L., Peña Y., González F., Ariz L., 2013. Asesoría integral para la toma de decisiones en pesca y acuicultura 2012. Actividad Nº2: Meta cuantitativa asociada al seguimiento de pesquerías bentónicas bajo régimen AMERB 2012. Instituto de Fomento Pesquero (IFOP).

Techeira C., Palta E., Álvarez L., Araya A., Grego E., Stagno N., Cortés C., Montes A., Aguilera A., Valdenegro A., Oroza C., Ariz L., and Recabal M., 2012. Asesoría integral para la toma de decisiones en pesca y acuicultura 2011. Actividad No 4: Seguimiento de pesquerías bentónicas. Indicador de áreas de manejo de recursos bentónicos 2011. Instituto de Fomento Pesquero, IFOP.

Techeira C., Palta E., Álvarez L., Wilson A, Cortés C., Araya A., Valdenegro A., Aguilera A., Bazán V., and Ariz L., 2011. Asesoría integral para la toma de decisiones en pesca y acuicultura 2010. Actividad No5: Pesquerías bajo régimen de áreas de manejo, 2010-2011. Informe Final. Instituto de Fomento Pesquero (IFOP). 647 pp.

Techeira C., Palta E., Wilson A., Ariz L., Álvarez L., Cortés C., Bazán C., Aguilera A., Toledo C., 2010. Programa de seguimiento del estado de situación de las principales pesquerías nacionales. Proyecto: "Investigación situación de pesquerías bajo régimen de áreas de manejo, 2008-2009". Informe final. Instituto de Fomento Pesquero (IFOP). 598 pp.

Thorpe J., Ibarra A., and Reid C., 1999. The New Economic Model and Fisheries Development in Latin America. CEMARE Research Paper 141. University of Portsmouth, Portsmouth, UK.

Uchida H. and Wilen J., 2004. Japanese Coastal Fisheries management and institutional designs: a descriptive analysis. International Institute of Fisheries Economics & Trade (IIFET) 2004 Japan Proceedings, 1-11.

Uchida E., Uchida H., Lee J., Ryu J., and Kim D., 2011. TURFs and clubs: empirical evidence of the effect of self-governance on profitability in South Korea's inshore (maul) fisheries. Environment and Development Economics 17: 41-65.

UCN (Universidad Católica del Norte, Coquimbo, Chile), 2002. Programa territorial integrado-Desarrollo productivo subsector pesca artesanal de la región de Coquimbo. Grupo de Ecología y Manejo (Dept. Marine Biology), School of Commercial Engineering, Final Report, Coquimbo, Chile. 37 p.

UCV (Universidad Católica de Valparaíso, Chile), 2001. Evaluación del impacto socioeconómico de medidas de administración en pesquerías. Informe del proyecto FIP 2001-302, 33 pp.

Wilson D., Ahmed M., Siarb S., and Kanagaratnam U., 2006. Cross-scale linkages and adaptive management: Fisheries co-management in Asia. Marine Policy 30: 523-533.

Wolff M. and Mendo J., 2000. Management of the Peruvian bay scallop (*Argopecten purpuratus*) metapopulation with regard to environmental change. Aquatic Conservation: Marine and Freshwater Ecosystems 10 (2): 117-126.

World Bank, 2006. Scaling up marine management: The role of marine protected areas. The International bank for reconstruction and development, Washington DC, USA.

Yagi N., Takagi A.P., Takada Y., and Kurokura H., 2010. Marine protected areas in Japan: institutional background and management framework. Marine Policy 34: 1300-1306.

Yagi N., Clark M. L., Anderson L. G., Arnason R., and Metzner R., 2011. Applicability of Individual Transferable Quotas (ITQs) in Japanese fisheries: A comparison of rights-based fisheries management in Iceland, Japan, and United States. Marine Policy, 36 (1), 241-245.

Yamamoto T., 1995. Development of a community-based fishery management system in Japan. Marine Resource Economics 10 (1): 21-34.

Zúñiga S., Ramírez P., and Valdebenito M., 2008. Situación socioeconómica de las áreas de manejo en la región de Coquimbo, Chile. Latin American Journal of Aquatic Resources, 36 (1): 63-81.

Zúñiga S., Ramírez P., and Valdebenito M., 2010. Medición de los impactos socio-económicos de las áreas de manejo en las comunidades de pescadores del norte de Chile. Latin American Journal of Aquatic Resources, 38 (1): 15-26.

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http://www.fondofomento.cl
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http://www.subpesca.cl
http://www.ifop.cl
http://www.fip.cl

ANNEX I

RECOMMENDATIONS FOR THE IMPLEMENTATION OF A TURF FRAMEWORK IN COUNTRIES WITH NO CUSTOMARY RIGHTS

Small-scale fisheries contribute about half of global fish catch, but most are poorly managed or unmanaged. In most countries, government agencies lack the resources and capacity to manage and monitor the dispersed nature of small-scale fishing that takes place in nearshore environments. Tenure rights are critical for ensuring and facilitating access to local fisheries, particularly in countries where community-based or customary rights do not exist. Within this context, the idea of a TURF framework is being touted by experts as a good management framework for small-scale nearshore fisheries, particularly in the developing world.

As this report shows, the Chilean experience has been, and will continue to be, extremely valuable for countries considering implementing a TURF - like system. Below we highlight some key recommendations to consider in the design and implementation of a TURF-like system.

I. Because information is key in setting up a functional system that can be adaptive, the role of the government in compiling and analyzing sufficient information about the ecological and social systems to be affected by the TURF policy is critical. The system design, including the process of data collection, should count, ideally, on a multidisciplinary team of experts and a comprehensive stakeholder consultation process. It is particularly important to involve fishers in the design and implementation process from the outset. Additionally, it is important to identify and/or create institutions that could play an advisory role, facilitate the dialog among the stakeholders, and foster and coordinate joint action to improve the overall performance of the system throughout its implementation.

II. Coordination of the policies and the agendas of the entities involved in fisheries management and coastal use planning is essential to foreseeing and resolving conflicts, as well as for the efficient use of available resources at local, regional and national levels.

III. A strong governance system is key for the successful implementation of a TURF system. The first step towards building such a robust governance system is to encourage and facilitate the formation of fishing associations or similar entities. If fishing associations already exist, the system can improve governance by strengthening existing associations. The purpose and incentives of this organizational effort should be clear from the outset and fully supported by the government. Social cohesiveness, trust, and leadership are social values that support the long term success of the system; therefore, they should be promoted and enhanced.

IV. The TURF system should have a legal foundation supported by a national, regional or similar law. The legal framework should be explicit, inclusive and clear about the tasks to be performed by each of the stakeholders that play a role in implementing the system. A rigorous review by a multidisciplinary team is recommended, in order to minimize inconsistencies, and to avoid loopholes and ambiguity. The legal framework should also have strict and dissuasive sanctions to prevent illegal fishing. Finally, the legal framework should remain flexible enough to address local needs or conflicts efficiently, while allowing for experimentation as a means to explore and develop strategies that may address local realities.

V. Effective enforcement is crucial for the operation of the system. This generally entails an increase in enforcement capacity by strengthening enforcement agencies and reinforcing the coordination between stakeholders and the agencies involved in control and surveillance. Additionally, the judicial system, which is in charge of upholding the law, should be reinforced as well; in many cases this includes the training of judges and magistrates in the interpretation of the TURF policy and its associated fees, sanctions, etc.

VI. It is recommended that a scientific or technical advisory body support, guide and evaluate the management measures for the implementation of a TURF regime. In Chile, this happens via a science-consultancy model made up of consultancy firms and academic institutions. In any case, regardless of the model chosen, a system of certification that regulates performance and guarantees minimum quality standards is recommended. Baseline studies, performance reports and management plans should follow mandatory standardized procedures and methods to facilitate their elaboration and evaluation, as well as to guarantee minimum quality standards.

VII. The training and capacity building of fishers is central to the success of a TURF system. Training modules focused on marketing, business practices, management, administration, leadership, marine ecology and fisheries biology are encouraged.

VIII. A detailed assessment of the costs associated with the implementation of the system, and of the responsibilities of the government and the fishers, should be done at the outset. This assessment will facilitate the creation of mechanisms for the efficient use and allocation of public funds and loan programs directed specifically at the artisanal fisheries sector, to cover part of the costs of running a TURF system. The requirements to apply for these funds should be carefully determined, taking into account the variety of local conditions.

IX. Similarly, a detailed assessment of the exploitation history of fishing grounds by fishing communities should be conducted from the beginning, so that the granting of fishing rights can be done according to historic use, if this is deemed appropriate. It is also important to evaluate the existence of local management systems in use prior to any implementation of a new TURF policy, in order to minimize negative effects on existing management systems that are working.

X. Commercial initiatives by fishing associations should be supported and encouraged from the beginning to ensure the economic viability of the TURFs.

XI. Fisheries data collection within and around TURFs should follow specific formats and procedures, and be available for public use, so that data can be easily used and interpreted; it should also allow for trend analyses at different geographical and temporal scales.

XII. It is highly recommended that the system is designed to allow for the effective management of a range of species within each TURF, taking into account the behavior of the species to be harvested and the interconnections between harvested and not-harvested species, including interactions with species outside the TURFs.

XIII. A monitoring system that periodically evaluates the performance of the TURF policy from an economic, ecological and social point of view should be designed and implemented. Such a system could include mechanisms for consultation with all the stakeholders involved in the management of TURFs. The interaction and exchange of experiences, views and initiatives among groups of stakeholders would allow the integration of lessons learned into the policy and modify it accordingly, making it more adaptive.

XIV. The legal system of the country intending to implement a TURF policy should allow for periodic improvement of the policy based on the evaluations coming from the monitoring system.

XV. The implementation of a holistic, collaborative approach to management between adjacent TURFs instead of a focus on single-TURF management should be considered. TURFs could be grouped according to common features and to their monitoring activities, while technical support and commercial efforts could be effectively coordinated, reducing implementation costs.

ANNEX II
CATEGORIES OF ARTISANAL FISHERS AND VESSELS

ARTISANAL FISHERS

To better understand Chile's artisanal fisheries sector, it is necessary to clarify the legal definition of ”artisanal fisher” in the country. The FAL defines four categories of artisanal fishermen (Art. 2, FAL, 2013): (i) Artisanal fishers as such (i.e., a skipper or a crew member on an artisanal boat); (ii) Artisanal ship owners (*Armador artesanal*), includes fishers and boat owners who can own up to two vessels; (iii) Divers, includes fishers harvesting shellfish; (iv) *Seaweed gatherers* (with or without the use of a boat). These categories are not mutually exclusive (Art. 2, FAL, 2013). In 2012, there were a total of 86,132 artisanal fishers registered in one or more of these categories; specifically, there were 52,435 fishers (skippers and crew), 12,979 ship-owners, 14,426 divers, and 33,700 registered seaweed gatherers and free divers (divers who do not use breathing equipment).

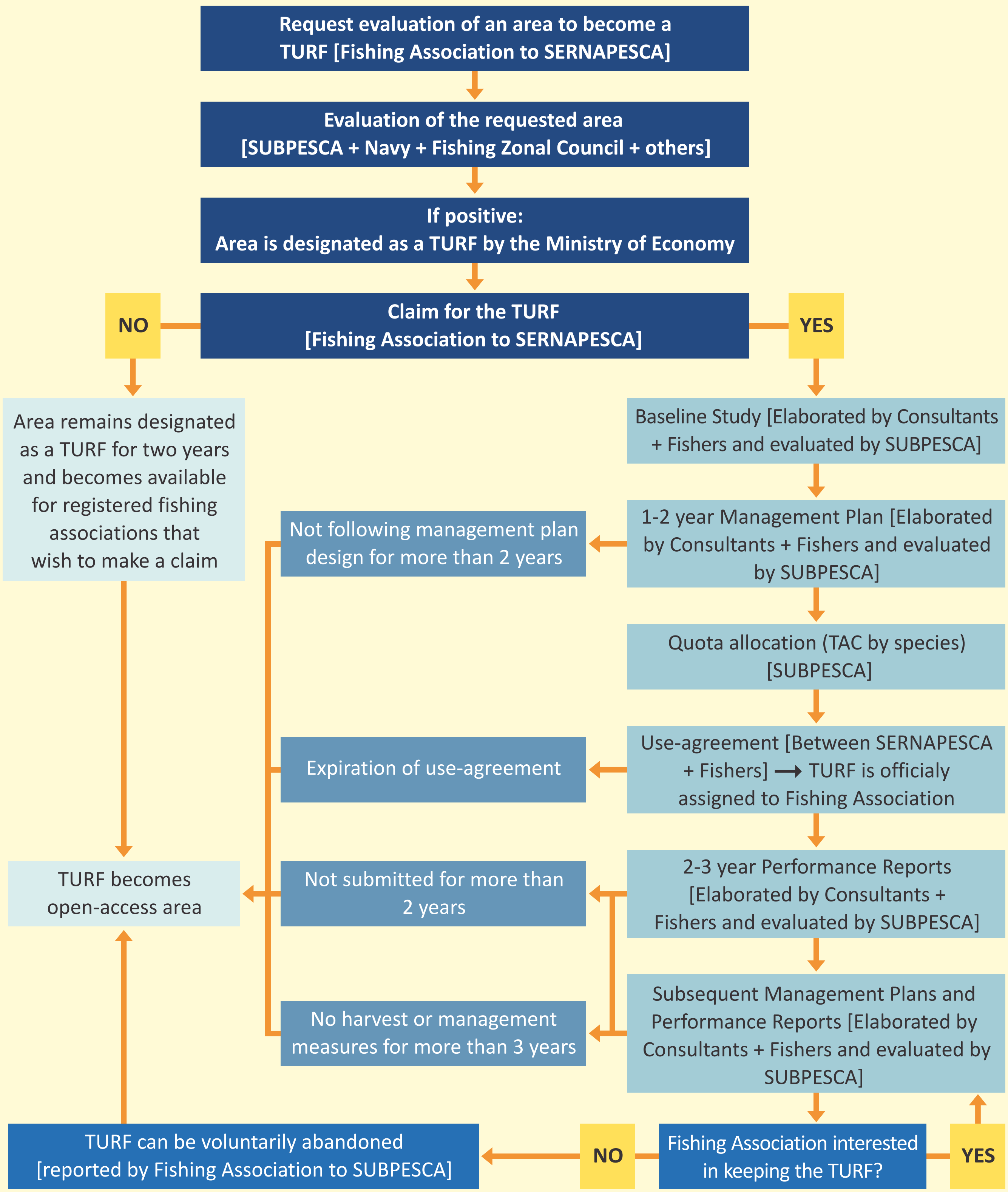
PHOTO 10. Undecked artisanal boats without engine.

ARTISANAL BOATS

Current regulation defines four categories of artisanal boats (D.S. 104, 2012): (i) First class (artisanal) boats, which are less than 8 m in length and have a hull capacity of 5 m^3, with or without deck, and with or without outboard engine (*bote a motor* or *bote a remo* respectively in Spanish) (Photo 10); (ii) Second class (small) boats, which range from 8 m to a maximum 12 m in length and have a hull capacity of less than 15 m^3, with or without deck and with inboard engine (Photo 11); (iii) Third class (medium) boats, which are between 12 m and 15 m in length, have a hull capacity of less than 45 m^3, and are decked with an inboard engine; and (iv) Fourth class (large) boats, which range from 15 m to 18 m in length, have a hull capacity of less than 80 m^3, and are decked with an inboard engine. The last three categories are known as *lanchas artesanales*. The 2013 FAL specifies that, in essence, an artisanal vessel must not exceed 18 m in length and must not have a hull capacity exceeding 80 m^3. Larger vessels are considered part of the industrial fleet (Art. 2, FAL, 2013). In 2012, there were 12,757 artisanal boats (943 boats without engine, 7,824 boats with engine, and 2,739 small boats, 591 medium boats, 660 large boats - these last three categories adding up to 3,990 *lanchas artesanales*) (RAP, 2012).

PHOTO 11. Decked small boat with engine.

ANNEX III
SUMMARIZED PROCESS FOR CLAIMING AND MANAGING TURFS



ANNEX IV
LANDINGS OF SPECIES INCLUDED IN TURF MANAGEMENT PLANS 2002-2011

REGION		N° TURFs (2013)	Area (Ha) (2013)	SPANISH NAME	ENGLISH NAME	SCIENTIFIC NAME	LANDINGS (mt)										
							2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	TOTAL
XV	Arica y Parinacota	3	2,916	Erizo	Chilean sea urchin	*Loxechinus albus*	5		27								32
				Loco	Chilean abalone	*Concholepas concholepas*	2		6	28							36
							TOTAL										**68**
I	Tarapacá	19	2,720	Almeja	Taca clam	*Protothaca thaca*					6	6	31	12	16	2	73
				Choro zapato	Giant mussel	*Choromytilus chorus*	178	136	7	9	20						350
				Culengue	Clam	*Gari solida*					1	6			42	3	52
				Erizo	Chilean sea Urchin	*Loxechinus albus*		256	220	213	223	141	109	481	59	18	1,720
				Huiro (pito o canutillo / flotador)	Kelp	*Macrocystis spp. / M. integrifolia*				26							26
				Huiro negro o Chascón	Kelp	*Lessonia nigrescens*	63	555	474	344							1,436
				Huiro palo	Kelp	*Lessonia trabeculata*		56	8								64
				Loco	Chilean abalone	*Concholepas concholepas*	63	104	245	179	37	43	102	113	127	27	1,040
				Lapa / Lapa reina	Keyhole limpet / Giant keyhole limpet	*Fissurella spp. / Fissurella maxima*	8	162	28	24	12	8	9	35	15	15	316
				Lapa regra	Keyhole limpet	*Fissurella latimarginata*	4	1	7	3	4			6	20		45
				Locate (caracol)	Rock snail	*Thais-stromatita-chocolata*	18		73	58	85	143	193	31	68		669
				Pulpo	Octopus	*Octupus mimus*	71	9					2	7	3	1	93
							TOTAL										**5,884**

REGION		N° TURFs (2013)	Area (Ha) (2013)	SPANISH NAME	ENGLISH NAME	SCIENTIFIC NAME	LANDINGS (mt)										
							2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	TOTAL
II	Antofagasta	36	5,172	Almeja	Taca clam	*Protothaca thaca*						8					8
				Erizo	Sea urchin	*Loxechinus albus*	12	5		53	102	47	205	128	22	25	599
				Huiro (pito o canutillo / flotador)	Kelp	*Macrocystis spp. / M. integrifolia*		28	2								30
				Huiro negro o Chascón	Kelp	*Lessonia nigrescens*	49	101	5	102							257
				Huiro palo	Kelp	*Lessonia trabeculata*	332	62	18	100							512
				Loco	Chilean abalone	*Concholepas concholepas*	15	53	81	74	22	132	16	24	53	3	473
				Lapa	Keyhole limpet	*Fissurella spp., Fissurella bridgessi*	13	13	12	121	11	4	7	1			182
				Lapa negra	Keyhole limpet	*Fissurella latimarginata*					3		19		2	2	26
				Lapa reina	Giant keyhole limpet	*Fissurella maxima*					1						1
				Lapa rosada	Keyhole limpet	*Fissurella cumingi*										1	1
				Locate (caracol)	Rock snail	*Thais-stromatita-chocolata*					59	20	22				102
				Pulpo	Octopus	*Octupus mimus*	25	4	18	238	1	13	6				305
							TOTAL										**2,495**

REGION		N° TURFs (2013)	Area (Ha) (2013)	SPANISH NAME	ENGLISH NAME	SCIENTIFIC NAME	LANDINGS (mt)										
							2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	TOTAL
III	Atacama	39	4,021	Erizo	Chilean sea urchin	*Loxechinus albus*	22	13	7	38	21	31	36	47	47	17	279
				Huiro (pito o canutillo)	Kelp	*Macrocystis spp.*				86	12	74					172
				Huiro negro o Chascón	Kelp	*Lessonia nigrescens*	273	524	493	506	819	155	130	393	816		4,109
				Huiro palo	Kelp	*Lessonia trabeculata*	332	158	288	83					39		900
				Loco	Chilean abalone	*Concholepas concholepas*	128	191	124	28	28	13	2	52	89	46	701
				Lapa / Lapa bonete / Lapa reina	Keyhole limpet / Costate keyhole limpet / Giant keyhole limpet	*Fissurella spp. / Fissurella costata / Fissurella maxima and Fissurella crassa*	7	15	2	17	66	6	4	4	9	10	140
				Lapa negra	Keyhole limpet	*Fissurella latimarginata*	1	19	42	17	3		1	14	79	43	219
				Lapa rosada	Keyhole limpet	*Fissurella cumingi*	5	12	9					5	4	2	37
							TOTAL										**6,557**
IV	Coquimbo	80	13,568	Almeja	Taca clam	*Protothaca thaca*			7	13	39						20
				Caracol rubio	Sea snail	*Xanthochorus cassidiformis*											39
				Chicorea de mar	Seaweed	*Chondracanthus chamissoi*	35										35
				Chocha (lapa)	Limpet	*Calyptrea trochyformis*									1	2	3
				Culengue	Clam	*Gari solida*	5	51									56
				Huiro (pito o canutillo / flotador)	Kelp	*Macrocystis spp. / M. integrifolia*	78	279	101								458
				Huiro negro o Chascón	Kelp	*Lessonia nigrescens*	1,645	1,628	468	98				12			3,851

REGION		N° TURFs (2013)	Area (Ha) (2013)	SPANISH NAME	ENGLISH NAME	SCIENTIFIC NAME	LANDINGS (mt)										
							2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	TOTAL
IV	Coquimbo	80	13,568	Huiro palo	Kelp	*Lessonia trabeculata*	897	4,076	9,195								14,168
				Loco	Chilean abalone	*Concholepas concholepas*	323	694	1,150	241	498	594	669	797	373	580	5,919
				Lapa / Lapa bonete	Keyhole limpet / Costate keyhole limpet	*Fissurella spp. / Fissurella costata*	23		7			1		2	2	1	36
				Lapa negra	Keyhole limpet	*Fissurella latimarginata*	17	36	66	35	44	48	37	48	44	47	422
				Lapa reina	Giant keyhole limpet	*Fissurella maxima*						2				1	3
				Lapa rosada	Keyhole limpet	*Fissurella cumingi*	13	13	19	20	38	39	36	30	49	49	306
				Macha	Surf clam	*Mesodesma donacium*	897	417	406	600	1,925	1,209	324	437	1,017	72	7,304
				Ostión del Norte	Scallop	*Argopecten purpuratus*			189				43	120	20	8	380
				Pelillo	Seaweed	*Gracilaria chilensis*	1,259	455	389	562	335	42	450	381	1,020	2,024	6,917
TOTAL																	**39,917**
V	Valparaiso	42	5,251	Chasca	Seaweed	*Gelidium spp.*			1	7			1				9
				Erizo	Chilean sea urchin	*Loxechinus albus*	7	2	14	3	6	19	1		8	4	64
				Huiro negro o Chascón	Kelp	*Lessonia nigrescens*		33				30	152				215
				Huiro palo	Kelp	*Lessonia trabeculata*	428	1,447	489				93				2,364
				Loco	Chilean abalone	*Concholepas concholepas*	21	18	24	49	71	48		134	49	254	761
				Lapa / Lapa bonete	Keyhole limpet / Costate keyhole limpet	*Fissurella spp./ Fissurella costata*	2	6		4	2	5		7			26
				Lapa negra	Keyhole limpet	*Fissurella latimarginata*	2	16	1	6	5	6	3	24	29	21	113
				Lapa reina	Giant keyhole limpet	*Fissurella maxima*		4	1	1	4			2	8	3	23

REGION		N° TURFs (2013)	Area (Ha) (2013)	SPANISH NAME	ENGLISH NAME	SCIENTIFIC NAME	LANDINGS (mt)										
							2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	TOTAL
				Lapa rosada	Keyhole limpet	*Fissurella cumingi*	6	8		5	2	5	2	14	20	8	70
				Luga cuchara o corta	Seaweed	*Mazzaella laminarioides*							1				1
				Luga negra o crespa	Seaweed	*Sarcothalia crispata*				10							10
							TOTAL										**3,656**
VI	Libertador Bernardo O'Higgins	35	1,949	Chasca	Seaweed	*Gelidium spp.*	2	1	19	34	63	125	3	37			284
				Cochayuyo	Kelp	*Durvillaea antarctica*	18	15	97	105	213	466	54	663			1,631
				Loco	Chilean abalone	*Concholepas concholepas*	1	1			3	1	7	1			14
				Luga, Luga cuchara o corta	Seaweed	*Mazzaella laminarioides*	2	3	41	93	80	207	9	87			522
				Luga negra o crespa	Seaweed	*Sarcothalia crispata*						24					24
				Luga Roja	Seaweed	*Gigartina skottsbergii*							10				10
				Piure	Red sea aquirt	*Pyura chilensis*	2			2							6
							TOTAL										**3,491**
VII	Maulé	19	2,799	Almeja	Clam	*Euromalea sp.*				2							2
				Choro zapato	Giant mussel	*Choromytilus chorus*					5	2	1	5	4		17
				Cochayuyo	Kelp	*Durvillaea antarctica*				2							2
				Loco	Chilean abalone	*Concholepas concholepas*	5	5	9	24	30	52	55	28	28	52	288
				Luga, Luga cuchara o corta	Seaweed	*Mazzaella laminarioides*				1							1
				Macha	Surf clam	*Mesodesma donacium*			11	157	23	20	10	13	12	6	252
							TOTAL										**562**

REGION		N° TURFs (2013)	Area (Ha) (2013)	SPANISH NAME	ENGLISH NAME	SCIENTIFIC NAME	LANDINGS (mt)										
							2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	TOTAL
VIII	Bio Bio	76	26,397	Almeja	Taca clam	*Protothaca thaca*		8		3	38	78	23	35	21	6	204
				Chicorea de mar	Seaweed	*Chondracanthus chamissoi*	54	53	168	87	22	34					418
				Cholga	Cholga mussel	*Aulacomya atra*			6			2	2	2			12
				Culengue	Clam	*Gari solida*			9	127	397	104	77	35	47	35	831
				Disco o Tumbao	Chilean semele clam	*Semele solida*					164	88	68	105	97		522
				Erizo	Chilean sea urchin	*Loxechinus albus*					1						1
				Loco	Chilean abalone	*Concholepas concholepas*	262	182	51	279	250	412	148	94	232	122	2,032
				Lapa / Lapa reina	Keyhole limpet / Giant keyhole limpet	*Fissurella spp. / Fissurella máxima*	3		1			2	3	2	3	4	18
				Lapa negra	Keyhole limpet	*Fissurella latimarginata*			1		69	2	1	6	4	2	85
				Lapa rosada	Keyhole limpet	*Fissurella cumingi*									1	3	4
				Luga negra o crespa	Seaweed	*Sarcothalia crispata*		48	48	48							144
				Luga, Luga cuchara o corta	Seaweed	*Mazzaella laminarioides*						24					24
				Macha	Surf clam	*Mesodesma donacium*					2		9	277	566	598	1,452
				Navaja o Huepo	Razor clam	*Ensis macha*	13	10	28		33	35	36				155
				Navajuela	Small razor clam	*Tagelus dombeii*			17		3	10		4			34
				Pelillo	Seaweed	*Gracilaria chilensis*	52	42	113	103	65	172	136	28			711
							TOTAL										**6,647**

REGION		N° TURFs (2013)	Area (Ha) (2013)	SPANISH NAME	ENGLISH NAME	SCIENTIFIC NAME	LANDINGS (mt)										
							2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	TOTAL
XIV	Los Ríos	45	3,673	Choro zapato	Giat mussel	*Choromytilus chorus*	63	76	33								172
				Erizo	Chilean sea urchin	*Loxechinus albus*		4	6								10
				Loco	Chilean abalone	*Concholepas concholepas*	133	153	83	232	20						621
				Lapa / Lapa bonete / Lapa picta	Keyhole limpet / Costate keyhole limpet / Painted keyhole limpet	*Fissurella spp., Fissurella nigra, Fissurella pulchra / Fissurella costata / Fissurella picta*	2		7	46							55
				Lapa negra	Keyhole limpet	*Fissurella latimarginata*	2										2
				Lapa rosada	Keyhole limpet	*Fissurella cumingi*					8						8
TOTAL																	**868**
X	Los Lagos	290	32,691	Almeja	Taca clam	*Protothaca thaca*	179	189	278	154	33	57					890
				Caracol palo palo	Triton	*Argobuccinum spp.*					2						2
				Cholga	Cholga mussel	*Aulacomya atra*	16						2				18
				Chorito	Chilean mussel	*Mytilus chilensis*	1	185	80								266
				Choro zapato	Giant mussel	*Choromytilus chorus*	23	42	9	27	6	11		4	5		127
				Erizo	Chilean sea urchin	*Loxechinus albus*	48	13	78	149	39	57	22	36	13	8	463
				Loco	Chilean abalone	*Concholepas concholepas*	979	1,558	1,858	2,026	1,867	2,307	2,026	1,731	1,140	37	15,529

REGION		N° TURFs (2013)	Area (Ha) (2013)	SPANISH NAME	ENGLISH NAME	SCIENTIFIC NAME	LANDINGS (mt)										
							2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	TOTAL
X	Los Lagos	290	32,691	Lapa / Lapa bonete / Lapa picta	Keyhole limpet / Costate keyhole limpet / Painted keyhole limpet	*Fissurella sp., Fissurella bridgessi / Fissurella costata / Fissurella picta*					3			7	3		13
				Lapa negra	Keyhole limpet	*Fissurella latimarginata*					4						4
				Lapa rosada	Keyhole limpet	*Fissurella cumingi*					10						10
				Luga negra o crespa	Seaweed	*Sarcothalia crispata*	100	130	149	146	157	60					742
				Luga roja	Seaweed	*Gigartina skottsbergii*	65	70	140	58	6	39					378
				Macha	Surf clam	*Mesodesma donacium*	1,555	1,438	2								2,993
				Ostra chilena	Chilean oyster	*Ostrea chilensis*			2								2
				Picoroco	Giant barnacle	*Austramegaba-lanus psittacus*						8					8
				Picuyo (caracol)	Sea snail	*Odontocymbiola magallanica*	18						14				32
				Piure	Red sea squirt	*Pyura chilensis*					42	15					57
				Pulpo del Sur	Southern red octopus	*Enteroctopus megalocyathus*	19	24	1						5		49
							TOTAL										**21,583**
XI	Aysén del General Carlos Ibáñez del Campo	75	16,777	Culengue	Clam	*Gari solida*										7	7
				Loco	Chilean abalone	*Concholepas concholepas*	27	17		27	84	256	87		100	11	609
				Luga roja	Seaweed	*Gigartina skottsbergii*					51						1
				Treri o Almeja	Clam	*Venus antiqua*						13	1				14
							TOTAL										**681**

REGION		N° TURFs (2013)	Area (Ha) (2013)	SPANISH NAME	ENGLISH NAME	SCIENTIFIC NAME	LANDINGS (mt)										
							2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	TOTAL
XII	Magallanes y Antártica Chilena	9	1,330	Ostión del Sur	Scallop	*Chlamis vytrea*									21		21
							TOTAL										**21**
TOTAL		**768**	**119,264**			**TOTAL BY YEAR**	**10,928**	**15,919**	**18,066**	**7,933**	**8,300**	**7,581**	**5,510**	**6,561**	**6,452**	**4,180**	**80,502**

Source: Based on data from SERNAPESCA (SERNAPESCA 2011g, 2013b).

Notes: A) TURFs from Region IX have no registered landings, thus it is not included in the table. B) The number of TURFs and the hectares correspond to TURFs designated by July 2013. C) Between 2002 and 2006, Region XV was part of Region I and Region XIV was part of Region X. D) Landings correspond to species that have registered landings in SERNAPESCA's Statistics annuaries. In many cases, the data from SERNAPESCA do not distinguish landings by species: 1) In Region I, figures corresponding to Keyhole limpet (*Fissurella spp.*) may include Giant keyhole limpet (*Fissurella maxima*); figures corresponding to *Huiro* may include *Macrocystis integrifolia* and other *Macrocystis spp.* of kelp, 2) In Region II, figures corresponding to Keyhole limpet (*Fisurella spp.*) may include *Fissurella bridgessi* keyhole limpet; figures corresponding to Huiro may include *Macrocystis integrifolia* and other *Macrocystis spp.* of kelp, 3) In Region III, figures corresponding to Keyhole limpet (*Fissurella spp.*) may include Costate keyhole limpet (*Fissurella costata*) and Giant keyhole limpet (*Fissurella* maxima and F*issurella crassa*); figures corresponding to the Sea urchin (*Loxechinus albus*) may include *Tetrapygus niger sea urchin*; figures corresponding to *Huiro* may include *Macrocystis integrifolia* and other *Macrocystis spp*. of kelp, 4) In Regions IV and V, figures corresponding to Keyhole limpet (*Fissurella spp.*) may include Costate keyhole limpet (*Fissurella costata*), 5) In Region IV, figures corresponding to Huiro may inlcude *Macrocystis integrifolia* and other *Macrocystis spp.* of kelp, 6) In Region VIII, figures corresponding to Clam may include *Protothaca thaca* and *Euromalea spp*. clams, 7) In Region X, figures corresponding to Keyhole limpet (*Fissurella spp*.) may include Costate keyhole limpet (*Fissurella costata*), Painted keyhole limpet (*Fissurella picta*) and *Fissurella bridgessi* keyhole limpet. Blank spaces for some of the species do not necessarily imply no catch; only the non-existence of data.

ACRONYMS AND ABREVIATIONS

AMERB (*Áreas de Manejo y Explotación de Recursos Bentónicos*). Management and Exploitation Areas for Benthic Resources (Territorial Use Rights in Fisheries - TURFs in English).

Art. Specific article in a law.

CLP Chilean Pesos.

CONFEPACH (*Confederación Nacional de Federaciones de Pescadores Artesanales de Chile)*. Chilean National Confederation of Federations of Artisanal Fishermen.

CONAPACH (*Confederación Nacional de Pescadores Artesanales de Chile*). National Confederation of Artisanal Fishermen of Chile.

CONICYT (*Comisión Nacional de Investigación Científica y Tecnológica de Chile*). National Scientific and Technological Research Commission of Chile.

CORFO (*Corporación de Fomento de la Producción*). Corporation for the Promotion of Production.

CPUE Catch-Per-Unit-Effort

D.S. (*Decreto Supremo*). Supreme decree.

D. (*Decreto*) Decree.

FAL Fishery and Aquaculture Law.

FIP (*Fondo de Investigación Pesquera*). Fisheries Research Fund.

FAO Food and Agriculture Organization of the United Nations.

FFPA (*Fondo de Fomento para la Pesca Artesanal*). Development Fund for Artisanal Fisheries.

IFOP (*Instituto de Fomento Pesquero*). Institute for Fisheries Development.

IQ Individual Quota

INE (*Instituto Nacional de Estadística*). National Statistics Institute of Chile.

ICSED (*Centro Interamericano para el Desarrollo de Ecosistemas Sustentables*). Interamerican Center for the Development of Sustainable Ecosystems.

MPA(s) Marine Protected Area(s).

NTZ(s) No-Take Zone(s).

RAP (*Registro Artesanal de Pescadores*). Registry of Artisanal Fishermen.

SUBPESCA (*Subsecretaría de Pesca*). Undersecretariat of Fisheries.

SERNAPESCA (*Servicio Nacional de Pesca*). National Fisheries Service.

TURF Territorial Use Rights in Fisheries.

TAC Total Allowable Catch.

UCN (*Universidad Católica del Norte*). Catholic University of the North, Chile.

UCV (*Universidad Católica de Valparaíso*). Catholic University of Valparaíso, Chile.

The Nature Conservancy
Protecting nature. Preserving life.

THE ROCKEFELLER FOUNDATION

the David & Lucile Packard FOUNDATION

BECAS ARGO GLOBAL