

**Networks and Co-management in Small-scale Fisheries in Chile**

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A Thesis

Submitted to the Faculty of Graduate Studies

In Partial Fulfilment of the Requirements

For the Degree of

**Master of Natural Resources Management**

Clayton H. Riddell Faculty of Environment Earth and Resources

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**By**

**Andrés Marín Ricke**

A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University  
of

Manitoba in partial fulfillment of the requirement of the degree

Of Master of Natural Resources Management (M.N.R.M)

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## Abstract

Some recent studies of co-management have focused on social networks among local resource users but only a few have attempted to include other decision-makers in these networks. The Chilean Management and Exploitation Areas for Benthic Resources (MEABR) system provides a good opportunity to study co-management networks. The MEABR applies to the small-scale benthic fishery sector and it has not been studied from a network approach. The MEABR system has attracted a great deal of international attention as a model of co-management. However, there are various critiques of the system. Novel and on-going challenges suggest there is room for adaptation and fine-tuning given that co-management is not an end-point but a process and is always changing.

The purpose of my research was to explore the organizational networks of actors and interactions that comprise the small-scale fisheries co-management system in Chile. Further, the thesis looks at existing adaptive capacities of these networks and its members that could affect the long-term sustainability of the Chilean fishery co-management policy. Using mixed methods, this study is based on one detailed case. Drawing from this case, the study expands to cover 38 small-scale fisher organizations from two administrative regions. Information from these organizations was used to investigate (1) the key actors and relationships of Chile's fisheries co-management system, (2) the relevant governance networks of the system, and (3) the implications of individual networks for the functioning of co-management. The analysis is based on a *two-mode* network centrality analysis. The focus is placed in the linkages between fisher organizations and other co-management counterparts (including fisher and non fisher actors).

The overall MEABR system is mostly supported by facilitating relationships among fisher organizations and their counterparts. However, decision-making seems to be highly centralized, and power is concentrated in state institutions. There is little horizontal exchange and cooperation among local fisher organizations. Nonetheless, other self-organized networks have emerged to respond to growing drivers of change. Some of these are long-standing regional and national fisher associations, which play key political and bridging functions. Others represent novel partnerships with the goal of increasing resource

productivity. In some cases these alliances are hampered by the rigidity of the policy structure. For example, there have been experimentation initiatives involving universities and fishers. Conflictive linkages between fishers and other sectors, such as large development projects, were identified and require conflict resolution mechanisms.

Findings suggest that the presence of broad and strong social networks, as an expression of linking social capital (i.e., between local organizations and actors at other scales), are positively correlated with external prestige of fisher co-managers. These networks are also correlated with fishers' pride in their management areas and with the current results obtained from these areas. Preliminary conclusions are: (1) social networks are relevant and associated with perceived success of co-management; and, (2) networks are actively established by fishers over time to cope with difficulties or to take advantage of opportunities. Social capital and networks are certainly not only the only predictors of co-management success. There are multiple conditions that can lead to better functioning and performance of management areas.

The findings have several policy implications. To achieve the goal of increased resilience and better governance we need a way to transform organizations that are relatively poor in social and natural capital, into organizations that are relatively rich. To do this may require greater flexibility to experiment and innovate and greater autonomy to carry out such experimentation independent of top-down government management. The “engines” for innovation in the MEABR system are those organizations which are already rich in social and natural capital. Flexibility can be introduced step-wise, gradually reducing fishers' dependence on external actors. For example, reducing the amount of money spent on resource inventory, by fishers themselves taking over that function, may allow fisher organizations to invest more in services in other areas, such as marketing, processing, and infrastructure.

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## Glossary of terms, acronyms, and abbreviations

<i>Caleta</i>	Literally “cove”: Fisher landing sites, organizations, or/and communities
<i>Loco</i>	Gastropoda Muricidae - <i>Concholepas concholepas</i> (marketed as “Chilean abalone”)
ESBA	Baseline Study
MA(s)	Management Area(s)
MEABR	Management and Exploitation Areas for Benthic Resources
PMEA	Management and Exploitation Plan
SUBPESCA	Subsecretaria de Pesca – Fisheries Undersecretary
SERNAPESCA	Servicio Nacional de Pesca – Fisheries National Service
TAC	Total Allowable Catch
TURF	Territorial Use Rights in Fisheries

Note: for additional acronyms of organizations, see Table 4.1.

# **Networks and Co-management in Small-scale Fisheries in Chile**

## **Chapter 1: Introduction**

This thesis is about networks in co-management and is based on a study of the coastal co-management system for small-scale benthic fisheries in Chile. The idea that social networks and connectivity are important for social-ecological system performance has been increasingly emphasized in the literature on adaptive co-management (Armitage et al. 2007) and fisheries governance (Kooiman et al. 2005). Moreover, authors have stressed the need to advance the empirical study of those networks (Kooiman et al. 2005; Carlsson and Berkes 2005). In this research, the main argument is that co-management is essentially a relational institution. Therefore, the understanding of complex networks of relationships among the multiple actors involved can illuminate how co-management systems work and adapt to changes. The Social Network Analysis approach (Scott 2000) is used here to describe co-management networks and to explore the ways in which they shape and determine the functioning of co-management. My findings depict Chilean coastal co-management system as comprised of complex governance networks characterized by various central actors (within and beyond the small-scale fishery sector and the State) playing both facilitating and hindering roles with respect of co-management. The breadth and strength of facilitating networks of trust relationships established by fisher organization represent a key condition for co-management, and a basis for adaptation. In this chapter, I first review the management and policy context of co-management in Chile and also provide a description of the artisanal fisheries sector. Then, the research problem is defined, and the purpose and objectives of the study are presented. Next, the methods employed in the research are introduced and the contributions of the study are outlined. Finally, I explain the organization of the remaining of the document.

In the late 1980s, the small-scale or artisanal<sup>1</sup> fishery sector in Chile went through a profound sustainability crisis. The rapid expansion of fisheries, triggered by de-regulating

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<sup>1</sup> “Artisanal” is the label employed in Chile for designating the diverse realities of fishing people who are not industrial. In strict terms the label is misleading as technology (for example, hookah diving, fiberglass motorboats and GPS) has been increasingly adopted by most fishers, and a majority employs gear developed

processes (i.e., open-access regimes), led to the over-fishing of the main pelagic (Aguilar et al. 2000) and benthic species (Castilla 1994). In particular, the main shellfish resource upon which an important subset of fishers and divers depended, namely the Chilean *loco*, showed alarming symptoms of overexploitation (Fernandez and Castilla 2005; Castilla and Gelcich 2006). The problem was characterized by social and economic instability, the emergence of a black market, and the implicit risk of the species extinction (Castilla and Defeo 2001; Castilla and Gelcich 2006). The rationality behind natural resource depletion is well described by the notion of the “tragedy of the commons” (Hardin 1968; Ostrom et al. 1999). Individual self-interest compels users to increase resource use as long as individual gains are higher than individual costs. However, as resources are depleted, social costs increase to such a point where none makes individual gains and the resource itself is degraded. According to one of Hardin’s (1968) responses, the solution is government-imposed regulations.

In fact, in the Chilean case, the “tragedy of the commons” and then the imposition of government regulations was exactly what happened. Government authorities imposed sanctions and established a four-year total harvesting ban between 1989 and 1992 (Castilla 1994). But this measure only increased the overall socio-economic unrest without solving the resource depletion problem (Castilla and Defeo 2001). As it turned out, in fact, the solution required a mix of government regulations and controls developed by local social institutions.

During the following decade, a notable pilot project was put in place involving the government, the scientific community, and the fishers and their organizations, building the pillars of an innovative collaborative management policy for coastal zones (Payne and Castilla 1994). In 1991, the Fisheries and Aquaculture Law (FAL) provided the overall framework for the establishment of Management and Exploitation Areas for Benthic Resources (Gelcich et al. 2006). Three important administrative measures were implemented for the sector. First, the law defined a five-mile limit exclusively for the small-scale fishers’ exploitation (Payne and Castilla 1994). This five nautical mile (10 km)

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elsewhere and purchased in the market. However, in this paper artisanal and small-scale are used as synonyms.

strip extending 2,500 km encloses an area of ca. 27,000 sq km in which the artisanal pelagic fishery takes place<sup>2</sup> (Castilla 1994, 2010). As Bernal and others suggest (1999), by granting priority access to all artisanal fishers to a band of territorial sea (e.g., the five-mile limit) an *Artisanal Reserve* was established.

Second, with respect to the benthic fishery, the law recognized the right of artisanal fisher organizations to regulate common-property territorial use rights within the *Artisanal Reserve*. These territorial user rights for fisheries (TURFs) apply to delimited management areas (MAs) of coastal border, the water column, and the resources contained within (Payne and Castilla 1994; Gelcich et al. 2006). MAs represent a collection of small and scattered dots along the Chilean shoreline inside the five-mile-wide strand, as illustrated by Castilla (2010)<sup>3</sup>. Third, to gain a higher control over the sector, the Law included the creation of the Artisanal Fishery Register and the regionalization of the activity. Thereby, earlier seasonal migrations of fishers and divers were halted and the restriction to operate in one single region (commonly the one of residence) was imposed (Castilla and Gelcich 2006).

In general, *co-management* policies like these have emerged to counterbalance ineffective command-and-control resources management measures, such as the closure of the *loco* fishery, by fostering the sharing of power among the government and the resource users in a more participatory fashion (Armitage et al. 2007). Under the Management and Exploitation Areas for Benthic Resources (MEABR) system, the fisher organizations — unions, cooperatives, associations, and indigenous communities (SERNAPESCA 2005) — sign a four-year renewable agreement with the authority, grounded on a resource base-line assessment, a resource management plan, and annual monitoring reports (SUBPESCA 2000). These studies must be developed by qualified biologist consultants hired by fisher organizations. A number of economically valuable benthic species (Table 1.1) are presently regulated under this system involving fisher organizations' rights, *caletas*, and co-management.

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<sup>2</sup> Small-scale pelagic vessels are also allowed to fish outside the five-mile limit. Industrial vessels, however, cannot operate inside the exclusive area.

<sup>3</sup> Castilla (2010) reports a total of 301 management areas in 2009, representing a total estimate of 1,100 square kilometers.

The Chilean coastal fishery co-management system emerged and developed as part of a broad fisheries management response. In the new law of 1991, the government implemented a mix of measures (Bernal et al. 1999), as summarized in Table 1.2. As reported by Bernal and co-authors (1999), who were involved in the Chilean fishery as decision-makers in the mid 1990s, the newly-elected government tried to counterbalance the market-oriented system inherited from the military dictatorship (1973-1990). This was done by instituting some community-based approaches for the benthic fishery and by adapting the quota system designed earlier for the pelagic fishery. As a consequence, the Chilean model consists of both neo-liberal inspired mechanisms<sup>4</sup> (e.g., quotas) and community-based measures (e.g., co-management). The purpose was to protect, govern, and integrate the traditional-artisanal sector into Chile's growing export-oriented market economy.

#### *Social geography of small-scale fisheries in Chile*

Chile has the third largest capture fisheries in the world, with 5.5 % of the total global catch. Chile's fishery exports, including aquaculture, represent 3.4 % of the global trade of marine resources (FAO 2005). The Chilean fishery sector is usually considered as three sub-sectors: industrial, small-scale (artisanal), and aquaculture. In terms of contribution to the total Chilean capture fishery, the artisanal sector represented 44 % of the national fishery in 2006 (Castilla 2010)<sup>5</sup>.

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<sup>4</sup> Some authors though (Casilla 2010) have argued that the quota system in Chile is rather different from the traditional concept of full marketable individual transferable quotas (ITQs).

<sup>5</sup> This contribution represents a substantial increase of the artisanal catch, which in 1992 was only 8 % (Castilla 2010).



Table 1.1: Some *key* benthic resources under the co-management system in Chile.

	Species	Reference
Chilean abalone - “Loco”	<i>Concholepas concholepas</i>	Payne and Castilla 1994
Key-hole limpets - “Lapa”	<i>Fissurella spp.</i>	Pino and Castilla 1995
Sea urchin - “Erizo”	<i>Loxechinus albus</i>	Castilla and Pino 1996; Schumann 2007
Crab - “Jaiba”	<i>Homalaspis plana</i>	Fernandez and Castilla 1997
Magellan mussel - “Cholga”	<i>Aulacomya ater</i>	
Red sea squirt - “Piure”	<i>Pyura chilensis</i>	
Wedge clam - “Macha”	<i>Mesodesma donacium</i>	Schumann 2007
Scallop - “Ostion”	<i>Agropecten purpuratus</i>	
Bull-kelp - “Cochayuyo”	<i>Durvillaea Antarctica</i>	Gelcich et al. 2006
“Huiro negro” (seaweed)	<i>Lessonia nigrescens</i>	

Table 1.2: Management tools adopted in the Fisheries and Aquaculture Law, 1991.

Instrument	Resource	Area	Holder of rights
Individual Transferable Quotas (ITQs)	Pelagic	Exclusive Economic Zone and Artisanal Reserve	Vessel
Individual Fishing Non-transferable Quotas (IFQs)	Benthic	Within Artisanal Reserve: Historical harvesting sites	Diver
Territorial Use Rights in Fisheries (TURFs)	Benthic	Within Artisanal Reserve: Co-management areas	Associates of artisanal fishers organizations

Source: Bernal et al. 1999.

The small-scale sub-sector is heterogeneous in terms of activity and fleet. More than 65,000 fisherfolk were involved in the artisanal sector in 2007, as fishers, shellfish divers, inshore gatherers, and boat owners. They operate around 15,000 small-scale vessels including non-mechanized vessels (row and sailing boats), motorboats and minor launches (up to 12 meters long), medium launches (from 12.1 to 15 meters long), and major launches (from 15.1 to 18 meters long). Artisanal fishers exploit a variety of marine resources. Pelagic species are of great importance, in addition the benthic resources exploited under the

MEABR system (Table 1.1). In 2006, the artisanal catch reached a maximum of 1.89 million metric tons: 43% small pelagic species (e.g., sardines), 22.5% other fishes (demersal species or bottom fish), 16% seaweed (e.g., bull-kelp) and 18.5% shellfishes (Castilla 2010). To put the MEABR system in context, from the total shellfish catch only 2 % are benthic resources managed in management areas; that is, only 2% of the total of 18.5% shellfish come under co-management. Although the benthic fishery under co-management is relatively small in terms of the total national harvest, it has high social and economic importance at local and regional levels.

The benthic fishery covered in this study is a particular subset of the small-scale fishery sector. This subset can be described by the species targeted, the fishing territories, the fisher categories involved, and the gear employed. As indicated before, Chilean co-management is about benthic species (e.g., shellfish, crustaceans, and seaweed) that show relatively low mobility and dwell in the nearshore (where MAs are established). Highly prized species, such as *loco*, were emblematic in the design and early implementation of the MEABR system, but in practice, many other resources have been progressively incorporated into co-management (Table 1.1). Therefore, a wider perspective of co-management in Chile should consider a range of species, including bull-kelp (Gelcich et al. 2006), and not only *loco*.

Initially, divers and gatherers of inshore and intertidal resources were the main harvesters of benthic resources (Castilla 1994). With the FAL, however, also pelagic and demersal fishers and other categories were incorporated into the artisanal fishery. Certainly, the establishment of fisher organizations (and not individuals) under FAL as the only potential holders of fishing rights, led divers to join these right-holding organizations. As a result, fisher organizations participating in co-management range from those that include mostly divers to those in which members are primarily pelagic fishers<sup>6</sup>. This heterogeneity also defines mixed livelihood strategies of fishers nationwide (Castilla and Gelcich 2006). Varied and elaborate share systems have been put in place to establish how benefits from MAs are distributed among divers, boat assistants, boat owners, and the general

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<sup>6</sup> It is important to note, first, that not all the resources currently exploited under the MEABR system are exploited by diving (e.g., seaweed and bivalves); and second, in many cases professional divers are specifically hired by fin fisher organizations to exploit their MAs.

membership of each organization. Finally, with respect to vessels and gear used, the co-managed benthic fishery is mostly associated with hookah diving equipment and small motorboats and minor launches equipped with air compressors (Castilla 1994).

Artisanal fishers also vary in terms of geographical distribution as shown in Figure 1.1<sup>7</sup>. The fishery is traditionally organized around coves (*caletas* in Spanish) established along the coast. The use of the term *caleta* more broadly covers fishers' landing sites, organizations, or communities. The wide heterogeneity in latitudinal distribution of fisheries correlates with cultural diversity as well. Even though Chilean fishers share common identity and concerns about the future of the activity<sup>8</sup>, regional and local sociocultural contexts may be as varied as the species they exploit, as well as the climate and landscapes. For example, within a particular region, *caletas* differ enormously depending on whether they are located next to urban or rural areas (Gelcich et al. 2006). Similarly, among regions, fishing settlements are considerably different in the south (for example, the rainy and cold Chiloe Island and fiords) than in the north (for example, the arid and hot Atacama Desert with its steep coasts).

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<sup>7</sup> Chile is a unitary State with its central government located in the capital, Santiago, in the central and landlocked Metropolitan Region. The rest of the territory is divided into 14 administrative regions, all of which have access to the Pacific Ocean and fishery activity. These regions are ordered from North to South, from I (in the border with Peru) to XII (including the Chilean Antarctic territory). The recently created XIV and XV regions were inserted in between and do not follow the same geographical criteria.

<sup>8</sup> The cultural dimension of the implementation of co-management in the artisanal fishery sector is not addressed in this research. Concurrent modernization and liberalization processes have deeply affected small-scale fisheries, challenging fishing people's identities and cultural adaptive capacities. These concerns are the focus of an in-progress manuscript the author and Dr. Derek Johnson are elaborating. The purpose of that paper is to investigate the introduction of the 'hunter-gatherers' concept in Chilean fisheries that took place in concurrence with profound policy reforms in the early 1990s and to assess its effects on fishers' identities.

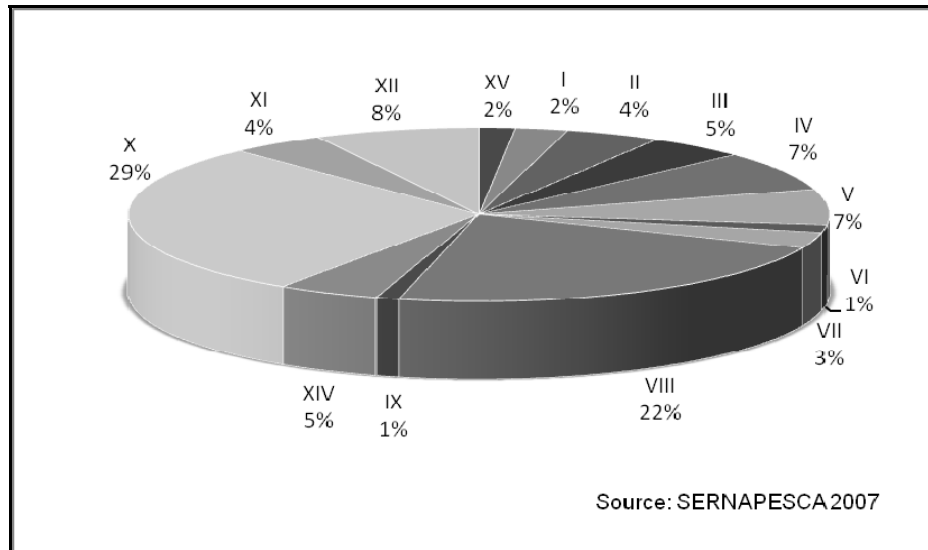


Figure 1.1: Regional distribution of small-scale fishers in Chile.

### 1.1 Problem statement

The implementation of Management and Exploitation Areas for Benthic Resources (MEABR) as a formal public policy started in 1997. After having overcome the initial resource crisis with the implementation of the co-management arrangement, the fishery entered a stabilization phase and eventually reached a consolidation stage (Castilla and Defeo 2001). Nowadays, more than 320 co-management areas for marine benthic resources exploitation have been established along Chile's 4,329 km national coast (see Figure 1.2), involving approximately 280 artisanal fisher organizations (SERNAPESCA 2005).

The Chilean MEABR system has been extensively studied and documented. In particular, the social dimension of co-management has attracted the attention of a number of authors (Castilla 1994; Payne and Castilla 1994; Gelcich et al. 2005; Castilla and Gelcich 2006; Gelcich et al. 2007). Empirical studies have shed light, from different perspectives, on various conditions and effects of co-management on fishers. For example, Payne and Castilla (1994) stressed the importance of fisher self-organization for the adoption of and better harvesting achievements from pioneer MAs. Also, Gelcich and co-authors (2005)

found that fishers involved in co-management tend to develop more favourable attitudes towards marine resource conservation.

Based on the preliminary social, economic, and environmental outcomes, which were judged to be positive, the MEABR system has become well-known as a promising model of natural resources management (Payne and Castilla 1994; Hilborn et al. 2005; Fernandez and Castilla 2005; Castilla and Gelcich 2006; Schumann 2007). In addition, co-management areas have been considered as potential building-blocks for a national-scale marine conservation network, along with other conservation mechanisms (Fernandez and Castilla 2005; Castilla and Gelcich 2006).

Nonetheless, various studies have also revealed at least four kinds of shortcomings of the system. First, Meltzoff and co-authors (2002) identified the problem of competing visions of stakeholders. The fishers have productivity objectives, whereas the state and biologists hold conservation objectives. Second, Gelcich and co-authors (2006) identified the failure of the policy to integrate and respect existing local and traditional management institutions. Third, Castilla and Gelcich (2006), Gonzalez and co-authors (2006), and Schumann (2007) reported unsatisfactory economic outcomes from managed harvests. Fourth, there have been complaints concerning the continued top-down nature of the policy (Castilla and Gelcich 2006; Schumann 2007).

These and other issues suggest that there are always challenges in the relationships among stakeholders and the governance of the co-management institution. Judging from international experience this is not surprising. Co-management is a process, and not an endpoint, as Carlsson and Berkes (2005) and Berkes (2007a) have argued. A useful approach may be to accept the idea that co-management is going to change in time through successive rounds of learning and experience. Such an approach is called *adaptive management*. Armitage and colleagues (2007, p.4) describe *adaptive management* as “A learning approach focusing on improving policy and practice in the face of uncertainty”. In theory and practice, *adaptive management* has sought to build an integrative understanding

of the dynamics, feedbacks, and thresholds that can weaken the resilience or adapting capacity of the social-ecological system.

Recently, the collaborative and adaptive strands of complex systems approaches to natural resources management have reached common ground. Both on-going learning and power-sharing have become fundamental ingredients of environmental governance and sustainability (Armitage et al. 2007). *Adaptive co-management* – the result of combining these two aspects – is “A process whereby institutional arrangements and ecological knowledge are tested and revised in an on-going, self-organized, and dynamic process of learning-by-doing” (Armitage et al. 2007, p.328). A number of issues have emerged in adaptive co-management. Among them, the complexity of decision-making processes can be a problem, when multiple and diverse actors are involved (Armitage et al. 2007). The challenge is how to implement adaptive management, in combination with co-management, for example in a complex arrangement such as that found in Chile.

Most of the research on the Chilean co-management experience has focused on individual (e.g., attitudes and discourses) and organizational (e.g., rules and cohesion) variables to understand co-management. More recently, Schumann (2007; 2010) studied the MEABR system using a relational approach. The author defined the Chilean experience as a tripartite system involving fishers, state, and consultants, and focused on the new relationships established between fishers and independent consultants in co-management. She concluded that, although the latter group has contributed as an intermediary between fishers and the state, this tripartite arrangement has failed in the transfer of knowledge and in the empowerment of users.

In general, studies have identified the participation of a large number of individuals within each community and organization (e.g., fisher associations, the state at the national and regional levels, scientists and consultants, and middlemen) around co-management initiatives (Payne and Castilla 1994; Gelcich et al. 2006). Thus, there is a network of participants; however, the existence of such complex networks in Chilean co-management has not been studied in depth. A simplified image of these networks, as represented by the

National Fisheries Service (SERNAPESCA), is shown in Figure 1.3. In this thesis, I attempt to provide a relational view of co-management. The adoption of a formal network approach offers the possibility to expand the understanding of the MEABR system and to point out novel aspects of co-management as an ongoing adaptation process.

## **1.2 Purpose**

Given that there has been little attention given to networks in the study of co-management in general, and of the Chilean case in particular, there is a need and opportunity to develop this approach further. The purpose of my research, therefore, was to explore the networks of actors and interactions that comprise the small-scale fisheries co-management system in Chile. Further, the thesis looks at existing adaptive capacities of these networks and its members that could affect the long-term sustainability of the Chilean fishery co-management policy.

## **1.3 Objectives**

Given this purpose, the objectives of my research are the following: (1) To identify key actors and relationships of Chile's fisheries co-management system; (2) To analyze the relevant governance networks of the system; and (3) To explore the role of social networks in the functioning of coastal benthic co-management. Guiding questions that underlie these objectives are included in Appendix 1. The textile metaphor of the *network*, as the underlying fabric or structure of everything, has extensively permeated various scientific disciplines, including environmental and natural resource thinking. This idea inspires the assumption for my research: that the livelihood and sustainability of many fisher communities in Chile are increasingly reliant on their integration in the social-institutional context and on fishers' capacity to knit *networks* of co-management.

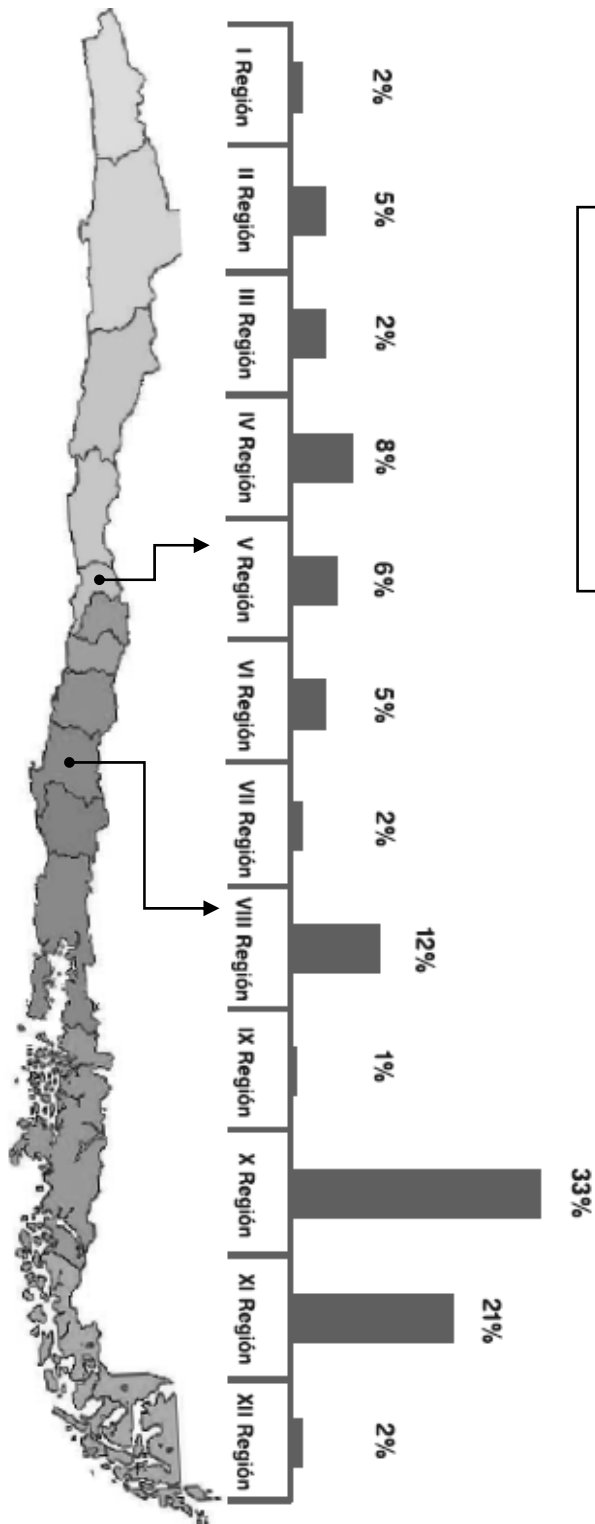


Figure 1.2: Regional distribution of co-management areas in Chile (and the two study regions). Source: SERNAPESCA 2005.

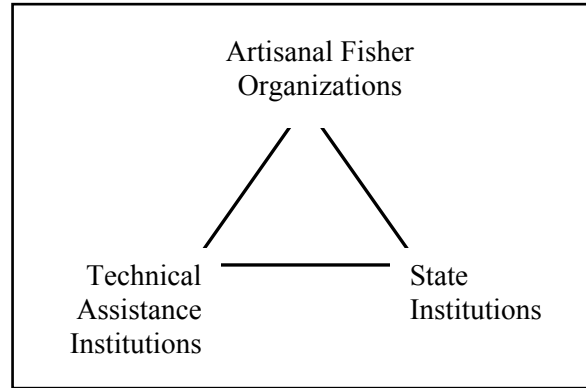


Figure 1.3: Participants of the co-management and exploitation system. Source: SERNAPESCA 2005.



## 1.4 Methods

The study builds upon one in-depth case study, one particular fisher organization, that helped ground the questions and guided the collection of data. Then, the study extends its scope to cover a larger set of co-management cases in two coastal management regions of Chile. The methods used were adaptive. Fieldwork conditions and the receptiveness of the community towards the study were uncertain at the outset; thus a flexible methodology was the appropriate strategy. Relevant questions and topics to be investigated were refined in the field according to the setting and the conditions observed. Also, different research tools (with diverse level of involvement and participation of the informants) were designed and applied to accommodate spatial and time constraints.

Second, the methods used were mixed. That is, information was collected combining qualitative and quantitative research tools (Creswell 2003). Participatory and Rapid Rural Appraisal techniques, such as interviews, focus groups, and observation were employed to gather rich and detailed qualitative information. My informants were fishers, fishers' representatives, scientists, consultants, and public sector officers. The aim of using qualitative methods was 1) to learn at the grass-roots level how the individuals describe the networks within which they operate and evaluate their linkages with other stakeholders, and to permanently receive feedback from the community members; and, 2) to contribute to the capacity building of resource users and learning processes within the community.

Quantitative tools, namely structured questionnaires, were also applied in order to have a broad collection of informants and fisher organizations. The questionnaire allowed them to numerically express or value (e.g., using Likert Scale) the quality and strength of multiple connections with other actors of co-management. Social Network Analysis (SNA), by definition, requires a particular kind of data that has been called *relational data* (Scott 2000). Rather than collecting data that describe different characteristics from the individuals (e.g., sex, gender, and age from individuals A, B, and C) SNA is based on data about the relationships that tie those individuals together (e.g., A and B are brothers, and both are acquaintances of C. But B also trades with C). These relations are traditionally

expressed and analyzed in a quantitative fashion—basically using matrices that allow graph representations (Hanneman and Riddle 2005)—but the way they are collected can vary.

### **1.5 Contributions of the research**

The results of my research contribute, first, in a practical sense to fishery co-management policy-making. Present-day Chile, with its long coast, has naturally been a land of fishers since early times<sup>9</sup>. Although small-scale fisheries have a relatively low share of the GDP—much lower than industrial fisheries indeed—the sector has an important significance in social terms. More than 16,500 fishers—including an increasing number of women fishers and collectors—and their families heavily depend on the future of the marine resource management system. With this group in mind, I attempt to provide policy-relevant findings and to reflect on their likely implications.

Second, this research provides methodological contributions in the use of the networks for understanding social-ecological systems (SES, defined as integrated systems of humans and environment, Berkes and Folke 1998). A *two-mode* network design is employed to capture the complexity of multi-stakeholder involvement in fisheries. It also produces insights in the use of the resilience approach. The resilience notion and the associated concept of adaptive co-management challenge the traditional assumptions of scientific certainty and ecosystem stability (Gunderson and Holling 2002). The understanding of the resilience of these SES becomes, therefore, a possible path towards sustainability.

An example is provided by Berkes and Seixas (2005), who identified and discussed a set of factors that can build (or reduce) resilience of SES at the local level. For example, cross-scale institutional interactions can help build resilience, but institutional instability can reduce resilience. The authors grouped mutually reinforcing clusters of factors for resilience building, following the categorization proposed by Folke and others (2003). This

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<sup>9</sup> There is considerable archaeological research about coastal prehistoric inhabitants of present-day Chile. Early populations inhabited the coasts of Chile from circa 10,000 B.P. developing an extremely wide variety of adaptation strategies to equal diversity of environments (Llagostera 1979; Santoro et al. 2005; Quiroz and Sanchez 2004; Méndez 2002; Standen and Santoro 2004).

approach is consistent with Capra's (2002) idea that it is important to understand the 'hidden connections' between social-organizational and ecological systems, and between the case and its context.

Finally, I applied a mixed approach to explore networks. Various approaches used in social sciences informed this attempt, as indicated above. As some authors have argued (Knox et al. 2006), innovative integrations (e.g., of qualitative and quantitative methods) would contribute to overcoming some of their individual limitations. The tension between social structure and human agency, and the involvement of nonhuman actors—such as species—in the network is indirectly addressed. Thereby, a contribution to network studies is presented in a particular case study of SES.

## **1.6 Organization of the thesis**

In the second chapter of this document I present the literature review. This review starts with an examination of social-ecological systems theory and the converging developments in the fields of co-management and adaptive management of natural resources. Then it turns into a description and discussion of the Social Network Analysis.

The third chapter exposes in detail the methods that I used to undertake the research. The activities and timeline of the fieldwork are also described. Chapters 4 and 5 present and discuss the findings of the study. Finally, Chapter 6 contains conclusions and policy implications of the main findings.



## Chapter 2: Literature Review

### 2.1 Humans in nature: complex systems for complex problems

Systems thinking has long influenced the way resources managers and scientists understand the natural realm. Conventional perspectives—based on the exploitation of single valuable resources—have been ineffective in coping with our rapid-changing and complex environment (Capra 1996; Berkes et al. 2003). By fragmenting the reality into independent parts, mechanistic views hindered the capacity to understand the drivers that affect the functioning of larger systems, and the inherent connections between natural and social systems.

In response to the ineffectiveness of conventional approaches to cope with old and new environmental challenges, such as resource depletion and global warming, the concept of social-ecological systems (SES) emerged as an interdisciplinary framework towards sustainability (Berkes and Folke 1998). As opposed to ecology and social sciences that have traditionally addressed the relationship between humans and nature either by paying little attention to the social or the natural domains, the novelty of SES is the notion of integrated systems. The authors propose that social and ecological systems are actually linked and are interdependent (i.e., humans-in-nature, Berkes and Folke 1998), and that the conventional division between them is artificial and arbitrary. The aim of the SES framework is “to *relate* management practices based on ecological understanding *to* the social mechanisms behind these practices...” (Berkes and Folke 1998, p.4).

A key characteristic of resource and environmental problems is that higher complexity emerges from the interactions between natural and social systems. The challenge of SES when facing complex problems is to have the capacity to adapt to change. In other terms, sustainability is a dynamic process that necessitates adaptive capacity for societies to live and cope with change (Berkes et al. 2003). Change is a natural condition of both complex social and natural systems, and therefore, the focus of inquiry is “the phenomenon of

change and how to respond to change in a manner that does not lead to loss of future options” (Berkes et al. 2003).

Expanding the basic notions of connectedness, context and feedback postulated by the general systems theory, science of complexity provides more precise concepts to describe the inherent characteristics of complex systems, namely: nonlinearity, uncertainty, emergence, scale, and self-organization. Berkes and others (2003) used the complex systems vocabulary to bridge social and biophysical sciences in the quest towards the understanding SES. As social and ecological systems are depicted as complex, the authors have proposed that these features apply to both and to their linkages.

Complex systems are primarily defined as having the following qualities:

- **Nonlinearity:** complex systems face inherent uncertainty, and they organize around one of several possible equilibrium states or attractors.
- **Uncertainty:** surprise is an essential quality of complex processes, which determines the difficulty to discover universal laws and to establish infallible scientific predictions.
- **Emergence:** certain properties of complex systems emerge at higher levels of complexity and they cannot be observed in the individual parts. Resilience—as an emergent property—is the capacity of a system to absorb change and perturbation, and to adapt to new contextual conditions.
- **Scale:** reflects the nested nature of systems within systems. Complex systems are composed of multiple subsystems, commonly ordered in a hierarchical fashion. Each subsystem has different levels of complexity and emergent properties; and, as they tend to be coupled, they need to be simultaneously observed.
- **Self-organization:** based on feedback mechanisms, complex systems have the inherent capacity to spontaneously reorganize at critical points of instability.

Source: Berkes et al. (2003).

The new systemic paradigm has contested the modern outlook towards the natural world. Environmental and resource practices based on conventional prescriptions are not resulting in sustainability of SES. In response to that, systems thinking calls for a new generation of

natural resources management policies focused on developing adaptive capacities rather than on maximized productivity. Under this scope, resources cannot be isolated from ecosystems and from the social system (Berkes et al. 2003).

## **2.2 Co-management as a social-ecological system**

*What is it about?*

Co-management—cooperative or collaborative management—refers primarily to the joint management of the commons, or common pool resources. The commons are those resources for which exclusion of undesired users is not feasible, and for which joint use involves subtractability (Berkes and Farvar 1989; Fenny et al. 1990; Ostrom et al. 1994). Common pool resources tend to appear as public goods or as open-access resources, and therefore they are likely to suffer overexploitation as described in “the tragedy of the commons” (Hardin 1968).

The tragedy of the commons is not, however, a universal pattern. Ostrom and colleagues (1999) and many others have shown that, even though Hardin’s prediction tends to be true in many instances, people have historically overcome this dilemma by self-organizing and designing long-standing institutions to govern the commons. These responses are based on collective action and reciprocity (Ostrom et al. 1999). Co-management of natural resources is one of those mechanisms.

Co-management is not a new invention to manage the exploitation of scarce natural resources. These kind of institutions “are as old as human cultures, exist in all countries of the world and concern all types of territories and natural resources” (Borrini- Feyerabend et al. 2004, p.70). Historical forms of joint management remain successful and are documented in administrating fisheries, forestry and grazing lands in all continents (Borrini-Feyerabend et al. 2004).

Co-management agreements represent a particular case of people striving to sustain their well-being, and concurrently the capacity of ecosystems to provide ecosystem services

(MA 2003). The management of common-property natural resources has been regarded as SES, since they reflect the particular notion of humans embedded in nature (Berkes and Folke 1998; Berkes et al. 2003), and provide the basis for relevant research on resources, ecosystems, and communities (Payne and Castilla 1994).

With the purpose of sustaining the availability and renewal of natural resources, the focus of co-management has usually followed two options. It can either regulate the exploitation of specific set of resources (e.g., a valuable species) or it can be established over a delimited geographical area (e.g., protected area) (Borrini-Feyerabend et al. 2004).

#### *Who is involved?*

Co-management systems involve more than one social actor, and more than one single interest. These actors agree to collaborate in the management of resources. Even though collaborative management originally emerged as an arrangement between users (e.g., in Norway and Japan), more recently the concept and practice of co-management has involved necessarily the participation of the state (Berkes 2007a). This is so because co-management has become a formal and legal management institution implemented by governments to respond to growing demands of local resource users over the right to access and to decide on the exploitation of key resources. For co-management to exist and succeed, the enthusiasm of the community is necessary but not sufficient, and the government is required to play a relevant complementary role. As in dance, Pomeroy and Berkes (1997) suggest that one needs ‘two-to-tango’.

Co-management was initially conceptualized in the literature as responsibility and power sharing among the government and local resource users (Berkes et al. 1991). But, in practice co-management has evolved showing higher complexity (Carlsson and Berkes 2005), and definitions have had to expand the scope of actors engaged to give account for real co-management. Gradually, definitions of co-management characterizations have included broader terms, such as ‘stakeholders’ (The World Bank 1999), to reflect the multiple involvements in these systems.



Carlsson and Berkes (2005) stressed the variety of actors involved in co-management, as opposed to conventional ideas of a monolithic state and a unitary community. Certainly, many public agencies have a stake in the administration of the same resource or area. Similarly, users' communities are far from being simple, homogeneous and static groups of people. Communities have been depicted as complex social systems (Connell 2001; Connell unpublished).

Mikalsen and Jentoft (2001), for example, identified and analyzed the wide spectrum of stakeholders (e.g., definitive, expectant, and latent) and their interests in Norwegian fisheries, as summarized in Table 2.2. This multiplicity challenges conventional conceptions of co-management as various groups claim different interests over the use of resources with different levels of urgency, power and legitimacy (Mikalsen and Jentoft 2001). Accordingly, co-management theory has evolved from a dyadic conception (e.g., state and community) to a complex network of social actors (e.g., multi-stakeholders) to give account for co-management in the real world (Carlsson and Berkes 2005).

Table 2.2: Fisheries management stakeholders in Norway (Mikalsen and Jentoft 2001).

<i>Definitive</i>	<i>Expectant</i>	<i>Latent</i>
Fishers	Indigenous peoples	Citizens
Fish-processors	Environmental groups	The media
Bureaucrats	Local communities	Municipal authorities
Enforcement agencies		Future generations
Scientists		Banks
Fish workers		Consumers
		Equipment suppliers
		Tourist industries
		Sport fishers

*What are the conditions for, and the elements and outcomes from, co-management?*

From the early views of co-management as involving the state and a community of users, one may conclude that the right way to create a successful management system is to establish a well-thought out legal body that clearly defines each party's rights and duties. If

more than two interests are at stake, a more sophisticated legal design would be required, but the challenge is still what configuration is built. From this perspective, the implementation should flow through the hierarchical structure of ministries and agencies *down* to the users at the local scale. The result would be a “one-size-fits-all” system.

But international experiences have shown that blueprint solutions do not work in natural resources management (Berkes 2007b). This is because both the ecosystems that resources are part of and social systems that users, managers and regulators are members of are complex and face high levels of uncertainty. Managing complexity and reducing uncertainty calls for more flexible and adaptive policies and institutions. Consequently, to isolate the requirements, the components, and the outcomes from co-management appears as a complicated task. Even more difficult is to define a checklist of best practices for sustainable co-management. In reality in each co-management system the different ingredients are combined on a case-specific basis.

Different authors have emphasized distinct elements of co-management. These various descriptions arise from the multitude of cases investigated all over the world. Borrini-Feyerabend and co-authors (2004), for instance, listed 36 concepts and terms adopted to characterize collaborative natural resources management. Berkes (2007a) discussed the ‘many faces of co-management’ drawing on the main subjects stressed in the literature during the last 20 years. According to the author, co-management has been described as: power sharing, institution building, trust building, process, social learning, problem solving, and governance. Each of these facets poses specific challenges to be addressed and alternatives to be balanced by the actors engaged (see Table 2.3).

This milieu of dimensions that managers and users must deal with in co-management agreements reflects nothing other than the complex and dynamic nature of SES. Commons resource management responds to key properties of complex systems, such as non-linearity, uncertainty, emergence, scales, and self-organization (Berkes et al. 2003). At the same time, the existence of a large number of social actors with interests over the resource, operating at different organizational levels, configures a complex system of governance.

The possibilities of simultaneous interaction and communication among all actors become increasingly limited, defining a high level of social complexity.

Table 2.3: The seven faces of co-management and their challenges (Berkes 2007a).

**Power sharing** (i.e., decision making and responsibilities)a

The state devolves power to users over natural resources and involves them in decision making.

- The actual degree of power shared by partners can vary considerably.

**Institution building** (i.e., maturity of platform for collaboration)

Working in partnership requires capacity and will, both in the civil society and within the state.

- Institutional traditions and the spirit of the policy define distinct platforms.

**Trust building** (i.e., requisite for cooperation)

Trust enables collaborative working relationships.

- Possible cultural differences (e.g., worldviews, systems of knowledge, cultures) among parties require mutual respect and integration.

**Process** (i.e., temporal dimension)

Evolution and development: collaboration among parties requires time to stabilize.

- Co-management can be the result of a long-term deliberative process of negotiation.

**Social learning** (i.e., adaptation and resilience)

Uncertain social and natural environments require social memory to respond and adapt to changes; direct practice and participation is key.

- Use of multiple kinds of knowledge and perspectives can enhance social learning.

**Problem solving** (i.e., functional dimension)

Building consensus and generating alternatives to cope with change and complexity.

- Co-management relies not only on legal structures but on effective social-ecological functions.

**Governance** (i.e., authority distribution)

Participatory and flexible people-centred management systems involve networks and partnerships among state, private, and civil society actors.

- Coordinating between multiple levels of decision making and involvement (e.g., centralization vs. decentralization).

Several cross-cutting themes can be highlighted for the purposes of this research. First, the notion of co-management as an adaptive process (see also Pomeroy and Rivera-Guieb 2006), which suggests that the joint management of natural resources tends to be more a result than a starting point for the actors involved (Carlsson and Berkes 2005). Social relationships, as natural systems, are essentially characterized as evolving and delicate processes. Thus, time plays an important role in such cases. While Pomeroy and Rivera-Guieb (2006) suggested between three and five years as necessary to organize coordinated activities and interventions, Berkes (2007a) estimated ten years for a co-management system to mature.

In some cases, however, arriving at a co-management agreement can be the last resort (Borrini-Feyerabend et al. 2004) when a history of conflict exists among users and the state, such as seen in the Chilean case (Bernal et al. 1999). Co-management can also be, after a crisis, a first step for a long-term negotiation process. As pointed out by Borrini-Feyerabend and others (2004) the most important result of any co-management attempt is reaching a partnership agreement rather than a management plan.

Second, the coexistence of structural and functional, and formal and informal aspects of co-management indicates important points for the discussion. Since present forms of co-management were born under the domain of the state, they still contain the flavour of technocratic top-down approaches (Berkes 2007b). In this sense, legal and policy structures tend to be overestimated as the cornerstone for successful co-management. Pomeroy and Rivera-Guieb (2006) remark that, even though regulations are used in co-management policies, co-management itself is not a regulatory technique.

Legal structures, therefore, should be understood as a means and not as an end. Usually, there is a schism between co-management policy (*de jure*) and co-management in practice (*de facto*); moreover, in many cases practice goes ahead of policy (Borrini-Feyerabend et al. 2004). Sometimes, imposed policies can undermine traditional practices of co-management (Gelcich et al. 2006). Concurrently, co-management as a governance system (e.g., social networks) develop far beyond the limits and rules established in the policy. A

critical comparison between formal structures and informal processes offers an interesting source of lessons for policy improvement. The functioning of Chilean co-management as established by law is presented in Box 2.1.

A third aspect that calls for attention is concerned with the multi-scale nature of co-management systems. Among the multiple challenges that communities face when managing natural resources, one may stress those that arise when dealing with other organizations and institutions that operate at different scales (i.e., local, national, and global) (Berkes 2006; Cash et al. 2006). Scale, as a property of complex systems, implies the existence of multiple subsystems nested at various levels of complexity (Berkes et al. 2003; Berkes 2006). Not only can ecosystems be understood as being nested within larger systems, but also “institutions may be considered hierarchically, as a nested set of systems from the local level, through regional and national, to the international” (Berkes et al. 2003, p.6).

These linkages between scales have been traditionally defined as vertical, following the notion of vertical integration within hierarchical organizations. But these are not the only relationships that affect local resource management. Communities engage other communities and groups establish linkages with other groups, and so forth, and exchange relevant information and resources. Following the organizational image, these have been regarded as horizontal linkages.

Cash and others (2006), have discussed the persistent and complicated cross-scale and cross-level interactions in natural resources management, and argued that these dynamic interactions are affected by multi-level institutional interplays. A better understanding of complex linkages within and among scales is required for improved adaptive management systems and environmental policies. These designs and policies shall consider emergent properties, feedback couplings at each scale (Berkes et al. 2003) and also mediation and negotiation among organizations that operate across scales (Cash et al. 2006).

Two hypothetical polarized visions of co-management can be inferred from Carlsson and Berkes (2005) for the purpose of assessing particular cases. In Table 2.4, both images are sketched: one uncovers a simplistic and static view; the other captures key ideas of co-management as a complex adaptive SES.

**Box 2.1: The functioning of the MEABR coastal co-management system**

The Chilean MEABR co-management system is a national-scale policy for the small-scale fisheries sector. In 2007, 204 MA were operating, accounting for more than 6,700 tons of shellfish and algae landings (SUBPESCA 2007). At present, more than 1000 areas are at some stage of the formal application process. Based on official policy documents (SUBPESCA 2000, 2005), three main phases can be identified within the formal process that enables co-management:

- (1) *The establishment of the area for management and exploitation purposes.* Any interested artisanal fisher organization is allowed to present an application over a delimited coastal area to SUBPESCA (the Undersecretary of Fisheries). The fisheries authority is in charge of consulting with a number of public agencies (i.e., Zonal Coastal Council, Undersecretary of Marine, and internally the Aquaculture Department) whether the requested area is available and not already assigned for other purposes. Once the area is approved by all these institutions, a decree is signed by the Ministry of Economy and officially publicized. From that moment, any fisher organization can request the area (i.e., not necessarily the original proponent) by presenting a formal application (see next phase).
- (2) *The application for the area and the enactment of the co-management contract.* Once the area is declared available, the interested fisher organization presents to SUBPESCA a Management and Exploitation Project for it, which includes first a Base-line Assessment (ESBA) and later a Management Plan (PMEA) developed by an authorized technical assistantship institution. These documents incorporate biophysical and socioeconomic dimensions of the area and the users, respectively. Once this proposal is accepted both by SUBPESCA and the National Fishery Service (SERNAPESCA), the

latter requests the destination approval by the Ministry of Defense. At that moment SERNAPESCA is entitled to sign a four-year renewable Use Agreement with the fisher organization, and co-management is permitted to begin.

- (3) *The functioning of co-management.* Once the Use Agreement is sanctioned, the fisher organization is entitled to extract from the assigned area the species included in the studies and the amounts approved by the authority. The exploitation is controlled and operates on the basis of annual capture quotas which correspond to the technical term Total Allowable Catch (TAC)<sup>10</sup>. These quotas are expressed in units and kilograms depending on the species. The compliance of these quotas is directly supervised in landing sites by SERNAPESCA officials. Besides, the policing function to prevent and penalize illegal resource extractions from management areas is embodied primarily by the Marine Police (Capitania de Puerto) and also by SERNAPESCA<sup>11</sup>.

Fisher organizations are responsible for submitting annual Follow-up Reports to SUBPESCA, certified by a technical assistant institution. These reports allow the authority to monitor the adherence to the management goals, to evaluate the performance of proposed activities, and to identify required corrective measures. Core elements here are the species stock assessment and the proposal of the quota, for each target species, for the upcoming year. The study is reviewed, modified and approved by public managers. Non-compliance with the annual report is considered a severe fault of the organization, which may lose the use rights over the area.

The renewal of the Use Agreement (after four years<sup>12</sup>) initiates the payment of a permanent management area annual fee to hold use rights. The fee is calculated by the number of hectares exploited by the organization<sup>13</sup> and is paid to the National Treasury. The non-compliance with this payment can lead to the expiration of the management area.

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<sup>10</sup> The TAC consists in a fraction of the total available mature individuals of a species, and is defined according with sustainability and conservation criteria.

<sup>11</sup> The Police can also intervene when poachers are ashore.

<sup>12</sup> The fee must be paid after two years for those Use Agreements issued after 2002.

<sup>13</sup> The fee was initially 1 UTM by hectare (UTM= \$37.614) that is equivalent to some 74 Canadian dollars. In 2004 the fee was reduced to 0.25 UTM by hectare or fraction.

The completion of the two first phases can take normally more than one year if no major troubles are met. For the sake of simplicity, the description presented avoids the event of likely objections (e.g., in the form and substance) from the authorities in any of the application steps. In such cases the applicants have to correct or add information and re-submit the request, extending the application period. The third phase is an annual iterative co-management cycle from the standpoint of the policy, as illustrated in Figure 2.1.

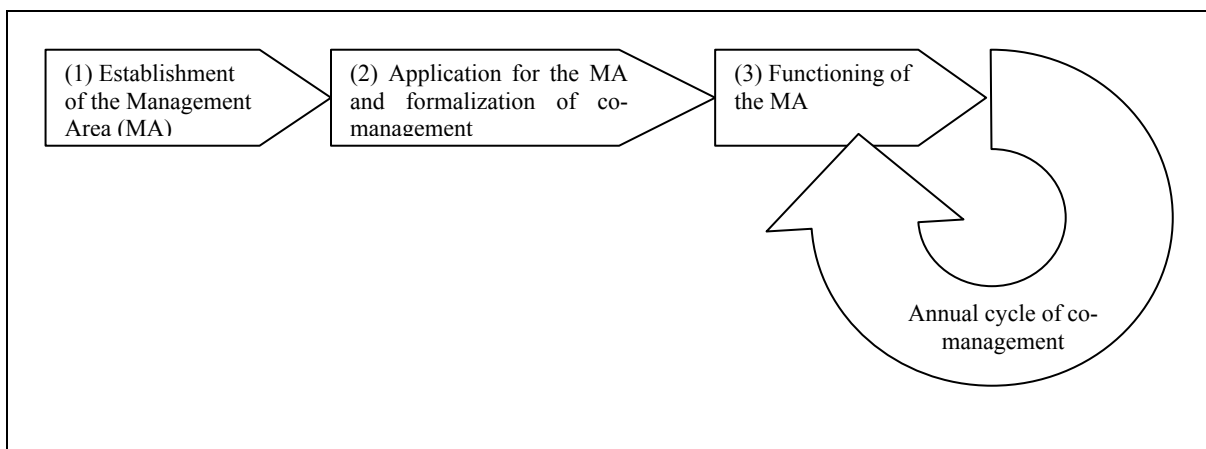


Figure 2.1: The process of the Chilean coastal benthic co-management

Table 2.4: Two contrasting visions of co-management (Carlsson and Berkes 2005)

	Conventional approach to co-management	Co-management as complex adaptive system
Core institution/actor	State-centric Government	Society-centred Governance
Implementation mechanisms	Political administration Hierarchy	Coordination and self-governance Networks and partnerships
Policy focus	Decision making Formal	Problem solving Formal and informal
Management focus	Structure Fixed	Functions of co-management Process and continuum
Determinants of success	Political and institutional capacity to steer	Trial- error Test- evaluation Reconstructed and rebuilt
Research focus	How the policy is structured	How different management tasks are organized and distributed



Finally, if co-management is case-specific, shaped by local social, political and cultural contexts and evolving, one may question how to evaluate a particular initiative without falling into a contingent description. Carlsson and Berkes (2005) suggested focusing on how the system copes with responding to key functions of co-management. This suggestion is congruent with the definition of co-management as a problem-solving process rather than a solution-implementing mechanism. The authors presented a set of functions that each co-management case should be concerned to satisfy (see Table 2.5).

Table 2.5: Functions of natural resource co-management systems (Carlsson and Berkes 2005).

- 
1. Allocation of tasks
  2. Exchange of resources
  3. Linking different types and levels of organizations
  4. Reduction of transaction costs
  5. Risk sharing
  6. Conflict resolution and power sharing mechanisms
- 

### **2.3 Towards social-ecological networks**

The understanding of environmental problems and the challenge of sustainability as complex issues, and the application of integrated SES to the study and design of sustainable resource management systems call for interdisciplinary approaches. Ecosystems sciences and social sciences need to be bridged to find adaptive ways of dealing with natural and social complexity, change and uncertainty. As described above in this chapter, systems thinking offers a common language to link not only isolated scientific traditions, but also to integrate the multiple and contrasted perspectives that experts, managers and users have about social and natural realms.

The systemic notion of networks—an interconnected and interdependent reality—offers particular potentials to explore, describe, and explain the complexities of SES. Systems thinking has been widely embraced by ecosystems ecology and also within social sciences.

In the remainder of this chapter, I will review the development of network theories and approaches that provide insights to the study of complex co-management systems.

### **2.3.1 Social Networks**

*What is it about?*

The study of social networks is dedicated to the understanding of the social structure, or the structure of social action (Scott 2000). There is a well known tradition of thought in social sciences that explains the social life as shaped by underlying structures. Karl Marx, Talcott Parsons, and Claude Lévi-Strauss are the most influential structuralist thinkers (Blau 1982). They analyzed and explained the functioning of society as constrained by structural features, either the structure of property, the structure of social values, or the structures of kinship and language, respectively. The notion of social structure, as characterized in the social network tradition, however, is different from that captured by conventional structuralism.

The structural approach developed under the notion of network is based on the idea that the structure of social action is constituted entirely by social relations (Scott 2000). Although Parsons ends up developing a cultural theory (i.e., structure as determined by values and norms), the network approach is consistent with his definition of social system: “Parsons defines a social system as a process of *interaction* between actors; the structure of the social system is a network of relationships between the actors involved in the interactive process” (Connell 2001, p.12). The social network standpoint, according to Blau (1982, p.275), “Assumes that social life [...] is rooted in the structure of social positions and relations and must be explained by analyzing these patterns or distributions of positions and these networks [...] of relations in groups and societies”.

The bases of network thinking in social science were developed between 1930 and 1970, and recognize three contributing branches: 1) Gestalt theory and the sociometric analysis (i.e., group dynamics and graph theory); 2) Harvard social psychology (i.e., patterns of interpersonal relations and the formation of cliques; and the use of sociograms); and 3)

Manchester social anthropology (i.e., built on the previous to investigate the structure of tribal communities) (Scott 2000). These strands, notably influenced by systems thinking and also particularly by the work of Radcliffe-Brown, converged during the 1960s and 1970s in a group of sociologists at Harvard. Through the work of authors such as Mark Granovetter (1973, 1982), who advanced the early network legacy, the contemporary institutionalized field of Social Network Analysis (SNA) was forged.

SNA is based on a rather simple notion, namely that “A social network is a set of actors (or points, or nodes, or agents) that may have relationships (or edges, or ties) with one another. Networks can have few or many actors, and one or more kinds of relations between pairs of actors” (Hanneman and Riddle 2005, no page). The analysis proceeds by rigorously describing the patterns of social relations using formal methods and concepts to inform the understanding of networks.

The study of social networks has been motivated by the argument that the various positions occupied by actors within the social structure are related to their access to opportunities and resources. Aldrich (1982, p.281) argued that “Social structures have a pervasive effect on almost all phenomena of interests to sociologists, affecting the social distribution of resources and the terms on which they are available”. According with Mitchell (1969, in Scott 2000) networks embody flows of relevant information and also transfer valuable resources and services among individuals. Granovetter (1973), for example, demonstrated how the confluence of certain social positions and relationships (e.g., particularly the ‘weak ties’) provide individuals with mobilizing job opportunities. Conversely, other positions within the network can entail limited access to social goods and resources (Scott 2000), and even the undesired access to social ‘bads’, such as the spread of diseases (Buchanan 2002).

Social network scholars have permanently struggled with a lack of theoretical foundations for their postulates. Certainly, SNA has been criticized as being a simple set of tools and methods to describe the structure of social relationships with no convincing explanatory propositions (Scott 2000; Blau 1982; Aldrich 1982). The critique has been echoed by SNA proponents. Many authors have explored novel frameworks of sociological theory or

updated old models pursuing more integrative theoretical grounds (Scott 2000). For instance, Aldrich (1982) discussed a number of studies in the field and shows how the use of a more solid theory—such as the ecology of populations and the transaction costs model—can fill some of the gaps in SNA.

Network scholars, such as Scott (2000), recognize that there is no single substantial theory that can be regarded as embodying the essence of this approach. The author's position is that SNA "is an orientation towards the social world that inheres in a particular set of *methods*" (p.37). Nonetheless, many authors (Aldrich 1982; Scott 2000; Hanneman and Riddle 2005) stressed that network studies with its particular orientation towards the structure of social world have shown the analytical power of even the most simple of its tools. The potential of SNA has been shown when applied to particular fields of study (Hanneman and Riddle 2005).

Although a unitary sociological narrative seems not to be a realistic pretension for SNA, the challenge of advancing beyond description has constantly concerned social network researchers (Granovetter 1973; Scott 2000; Aldrich 1982). The task for network scholars has been to move from treating the network as the dependent variable (i.e., the result) to dealing with it as the independent variable (i.e., the driver). Granovetter (1973) suggests "as a sharper analytical tool, examination of the network of ties comprising a community to see whether aspects of its structure might facilitate or block organization" (Granovetter 1973). In Granovetter's proposition, the question of how the network structure affects the organization's performance is evident.

Following the same line of argument, Aldrich (1982) claims that the existence of structures of relationships should not be taken as given. Therefore, he argues, analysts must give account for the origin and persistence of networks. By applying the population ecology model, the author stresses the relevance of considering the frequency of linkages, the level of uncertainty in the social environment, and the costs of transaction-specific investments; also the genesis of key network roles (e.g., brokers) needs special attention.

Aldrich's point raises another relevant issue in structural analysis, namely the need and the capacity to capture social dynamics and change. While social reality is intrinsically dynamic, the analysis of its structure based on the relationships in a given moment can appear as a static snapshot. "To understand the dynamics of social structure requires knowledge of the social processes involved in implementing social change. Social structures change if the distribution of resources or that of people changes, and both of these altered distributions are the result of social processes" (Blau 1982, p.275). While SNA scholars have proven proficient in describing structures, the advance towards explanatory network theories must integrate change processes and the dynamic aspect of network development (Granovetter 1973; Aldrich 1982).

### **Formal methods: matrices, concepts and algorithms.**

SNA has proven to provide a solid set of tools to describe and analyze social structures of relationships. The power of SNA as a formal method in sociology is supported by the use of a notable technical and mathematical language (Scott 2000). Besides, SNA is based on the use of a special kind of data, namely 'relational data' (Scott 2000; Hanneman and Riddle 2005).

SNA consists of both the use of matrices and graphs to analyze relational data and represent networks. Representing networks as matrices is based on matrix algebra, while the use of graphs is inspired in graph theory. The latter offers a translation of matrix data into formal concepts and theorems that can be directly related to the substantive features of social networks (see Table 2.6). The power of graph representations of social structures has been discussed by Davies (2003) and Freeman (2000).

Table 2.6: Some concepts and measures in SNA (Scott 2000).

Concept / algorithm	Description
Degree (of connections)	The total number of points in the neighbourhood of a particular point; Indegree: Total number of points that have lines directed towards a particular point (sink); Outdegree: Total number of points to which a point (source) directs lines.
Density	Number of lines in a graph, expressed as a proportion of the maximum number of lines. General level of linkage among the points in a graph; measure of how far the network is from being a complete graph; Complete graph: all the points are adjacent.
Centrality	Local centrality: concerned with the relative prominence of a focal point in its neighbourhood; Global centrality: concerns prominence within the whole network; Betweenness: measures the extent to which an agent can play the part of a 'broker' or 'gatekeeper' with a potential control over others.

### 2.3.2 Organizational networks: from the micro to the meso-level

The level of analysis has been an important issue along the development of network thinking in sociology. SNA is rooted in studies of interpersonal relations and small groups or community internal linkages (e.g., friendship and kinship). However, some of the earlier contributors to the field have constantly reflected on the interplays between small and large scales of inquiry (Scott 2000). Granovetter (1973) explored the potential of interpersonal networks analysis to link micro and macro social theory. His hypothesis is that the strength of interpersonal ties at the small scale affects large scale processes such as information diffusion, political organization, and social cohesion (Granovetter 1973, 1983).

The nodes or points represented in a network can represent entities other than individuals. As pointed out by Hanneman and Riddle (2005), "A network analyst might examine all of the nouns and objects occurring in a text, all of the persons at a birthday party, all members of a kinship group, of an organization, neighbourhood, or social class (e.g., landowners in a

region, or royalty)” (no page). In keeping with the units selected as the nodes of a network—e.g., individual, group, organization, community, institution, society—the level of analysis will vary—e.g., micro, meso, and macro levels. As explained by Hanneman and Riddle (2005) “One advantage of network thinking and method is that it naturally predisposes the analyst to focus on multiple levels of analysis simultaneously” (no page). That is, because the focus is to uncover how the actors are embedded within larger networks and how the structure emerges from the lower level relations between individual parts.

When the focus of analysis is posed at the level of linkages among organizations, i.e., organizational networks, the discussion is framed within the field of organizational studies. The idea is that the position of the organization within the larger social structure may determine constraints and chances to mobilize resources at the organizational level. The notion of organizational environment that influenced organizational studies from the 1960s is a direct inheritance from the systems thinking. Katz and Kahn (1966) understand organizations as open systems that have interdependent relationships with the environment. In other words, organizations are constituted and influenced by the environment, and vice versa.

The network approach to the study of organizations is usually conversant with other organizational narratives (Aldrich 1982; Scott 2004; Hanneman and Riddle 2005; Williams 2005). The formal study of linkages among organizations can be enriched by these various theories about dynamics of exchange, power, and dependence. They offer arguments for why some linkages arise, what linkages remain stable, and what kinds of organizations are more likely to succeed in certain environments.

Table 2.7: Systemic organizational theories: the network approach in context (Scott 2004).

Theory	Focus of argument
Contingency	Organizational structures are contingent in response to environmental complexity; performance is a result of adaptive capacity.
Costs of transaction	Organizations emerge and change as governance structures to reduce the high costs of key uncertain exchanges not controlled by the market.
Resource dependency	Dependence on resources held by other organizations creates power differences; organizations will struggle to reach political arrangements searching for strategic advantages.
Population ecology	Individual organizations have limited capacity to change; the focus is on organizations in the same niche that compete for same resources (e.g., populations); different types of organizations emerge, compete and decay.
Networks	The position of the organization within the larger social structure may determine constraints and chances to mobilize resources for survival.
Institutional	Organizational structures and behaviours are influenced by cultural forces in the environment that lead to homogeneous (isomorphic) types of organizations that search for integration and trust.

Studies on organizational networks have paid attention to particular features of organizational interactions. Tichy and others (1979), for example, defined three dimensions of inquiry, namely the content of the relationship, the nature of the links, and structural characteristics of the network. Even though the author studied intra-organizational linkages, the same set of indicators could be applied between organizations.



One of the potentials of network analysis is to empirically relate characteristics of individuals' distribution and measures of network structure to key social phenomena. Williams (2005) for example, assessed the effect of inter-organizational network features (e.g., formalization, density, intensity, centrality, and stability) on cooperative relationships among organizations. The author found that "high formalization, centrality and intensity are problematic for network cooperation, while density and stability positively affect cooperation" (p.1). Also, Crowe (2007) explored the correlation between network density and two kinds of social capital, namely bridging and bonding, and proposes a typology of network structures (see Figure 2.1). The author demonstrated that the structure of inter-organizational networks influence community economic development strategies.

### **2.3.3 Social networks and natural resource management**

There has been increasing interest in applying the network perspective to bridge social and natural sciences and to search for sustainable and more resilient forms of natural resource management. Recent literature on co-management and adaptive management has specifically adopted the social network approach as a novel analysis for understanding governance and resilience within management systems (Bodin 2006; Carlsson and Sandström 2008).

Examples of studies incorporating network thinking have been provided by Bodin and others (2006), Janssen and others (2006), Olsson and others (2006), and Gunderson and others (2006). My thesis project follows this path, searching for ways to unpack rich webs of social and ecological relationships.



## Chapter 3: Research methods

### 3.1 Methods

The core methodological option I have chosen is the Social Network Analysis (SNA) approach. SNA consists of a particular outlook on social reality—a large social whole formed by interrelated and interdependent parts—and an accompanying formal set of methods to discern, describe and analyze complex social networks. There has been extensive debate on the status of network analysis in social and political sciences within conventional approaches to research (Breiger 2004; Börzel 1997). While some authors have researched networks using large size quantitative data sets, and some have mainly relied on ethnographic information, others have combined both (Scott 2000). Thus, SNA methods do not necessarily correspond with conventional statistical methods normally labelled as quantitative (Breiger 2004; Scott 2000; Hanneman and Riddle 2005). As Breiger (2004, p.512) claims, “the very distinction between “quantitative” and “qualitative” approaches to data analysis is called into question by network analysis...”.

Accordingly, the second perspective informing this study consists in the mixed methods approach. Mixed methods refer to the class of inquiry where quantitative and qualitative research techniques, methods, approaches, concepts or language are combined into a single study (Johnson and Onwuegbuzie 2004). This approach provides “a more complete picture by noting trends and generalizations as well as in-depth knowledge of participants’ perspectives” (Creswell and Plano 2007, p.33).

The analysis of social networks relies more on a particular kind of data, called *relational data*, than on a conventional methodological standpoint (Scott 2000). According to this approach, “Relational data (...) are the contacts, ties and connections, the group attachments and meetings, which relate one agent to another and so cannot be reduced to the properties on the individual agents themselves” (Scott 2000, p.3). The sources or methods used to collect the data do not determine the type of analysis that is undertaken. It is the type of data that is more or less appropriate for different types of analyses, as

presented in Table 3.1. Traditionally, social network scholars have used both qualitative ethnographic and quantitative methods to collect empirical information (Scott 2000; Breiger 2004).

Table 3.1: Types of data and analysis (Scott 2000).

Style of research	Source of evidence	Type of data	Type of analysis
Survey research	Questionnaires, interviews	Attribute	← Variable analysis
Ethnographic research		Ideational	← Typological analysis
Documentary research	Observations	↓	← Network analysis
	Texts	Relational	

Finally, my research design included adaptation and flexibility as key pillars (Yin 2003). Unexpected situations faced in the field represented opportunities for the research rather than threats. Thus, it was important to be responsive to particular conditions found on the fieldwork. The scope of the research, the study cases, the size of the sample, and the geographical settings were relevant aspects that I had to define in the field and addressed flexibly. Adaptation in this sense is understood not only as having had a set of different instruments to choose from but also as being sensitive to reorient my objectives and research design.

### 3.2 Selection of cases, informants and study areas

The study is based on the Chilean national-scale MEABR coastal co-management system. The fieldwork was focused on two coastal regions of Chile, one artisanal fisher *caleta* case-study, and a larger set of other fisher organizations. Also a number of relevant stakeholders were interviewed. The description of the regional contexts and the selection criteria for the case study, the interviewees, and the organizations is presented as follows.

### *Study areas*

Chile, with its 4,300 kilometre long coastline, presents great environmental and socio-cultural heterogeneity among its fifteen political-administrative regions<sup>14</sup>. The setting of this study corresponds to two regions in central and central-south Chile: Valparaiso and Bio-bio (see Figure 1.2). I briefly explain here the criteria that led to this selection and describe both regional contexts.

The V Region of Valparaiso was selected primarily based on convenience. This was the closest potential site to the researcher's base of operations. Besides, in this Region, some of the first management experiments involving fishers and benthic resources were implemented (Fernandez and Castilla 2005). Also the MEABR system was formally initiated there (Gelcich et al. 2008). On the other hand, the Bio-bio Region was chosen with the purpose of comparison. Bio-bio is one of the most important regions in terms of coastal co-management activity. As it will be explained next, Bio-bio has more MAs, more divers, and more intensive benthic resource exploitation than Valparaiso.

Valparaiso is Chile's third most important region in economic terms. Main economic activities are manufacturing industry, port industry, and tourism. In political-administrative terms the city of Valparaiso (33°3'47"S, 71°38'22"O), the regional capital, is also relevant as it hosts the National Congress. In addition, a relevant fact for this study is that Valparaiso is the centre of national fishery policy-making (SUBPESCA's headquarters are located there). On the other hand, the VIII Region of Bio-bio has the second highest regional product of Chile, with fisheries and forestry as its main economic activities. The capital is the city of Concepción (36°46'22"S, 73°3'47"O), which together with its extended conurbation, represents the largest urban centre of the region. The distance between both study regions is about 600 kilometres.

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<sup>14</sup> Chile is a unitary State with its central government located in the capital, Santiago, in the central and landlocked Metropolitan Region. The rest of the territory is divided into 14 administrative regions, all of which have access to the Pacific Ocean and fishery activity. These regions are ordered from North to South, from the I (in the border with Peru) to the XII (including the Chilean Antarctic territory). The recently created XIV and XV regions were inserted in between and do not follow the same geographical criteria.

With regards to the small-scale fishery sector the two regions show remarkable contrasts. The Bio-bio region significantly exceeds Valparaiso's total artisanal catch. While the former represents 44 % of national artisanal landings in 2008 (ca. 854,000 tons), the latter accounts only for 2 % of the total (ca. 38,400 tons; SERNAPESCA 2008). Also in terms of number of fishers (i.e., 20,426) and divers (i.e., 2,105), Bio-bio is more labour-extensive than Valparaiso (with 5,890 and 588, respectively).

With regards to the MEABR system, in particular, Bio-bio counts with 139 established MAs and Valparaiso with 58 (SERNAPESCA 2008)<sup>15</sup>. The total extractions of resources in these regions also reflect the above-mentioned trends (see Table 3.2). The total catch in Valparaiso represents 1.1 % of national landings in year 2008, whereas Bio-bio's represents 14.7 %.

Table 3.2: Landings from Management Areas by type of species in 2008 (SRNAPESCA)

	Tons of catch		
	Valparaiso	Bio-bio	National total
Algae	17	94	2,603
Molluscs	65	1,069	4,872
Crustaceans	0	0	0
Other species	3	0	458
Total	85	1,163	7,933

### *The case study*

My original intention was to study a successful case of co-management. According to the literature on the Chilean fisheries, a successful case of co-management could be preliminarily defined by economic, social, and ecosystem variables, and characterized by: 1) satisfactory economic revenues from the fisheries; 2) absence of disruptive internal and external conflicts in the community, and 3) which exploitation of the resource base is carried on with concern for sustaining ecosystem integrity.

<sup>15</sup> It is important to clarify that the number of areas, also denominated sectors, is likely to be different from the number of fisher organizations involved in the system. Many of these organizations have more than one MA or sector.

In the field, however, I realized that defining any given fisher organization as successful at the outset was a misleading option<sup>16</sup>. First, because organizations in co-management are highly heterogeneous; hence, there are no typical cases and success is relative. Second, because interesting lessons do not come necessarily from the most flourishing cases. These perceptions became key elements for the findings and discussion presented in Chapter 5.

The selection of Caleta Montemar can be defined as opportunistic (e.g., taking advantage of particular beneficial situations, such as proximity and accessibility). The facts and criteria considered were the following:

- Early contact established with Montemar leaders (through an acquaintance) and their soon approval of the research plan.
- Located close by the place where the researcher was based in Chile, and reasonably close to Santiago (where Dr. Castilla is based).
- Represents an interesting and undocumented case, where there is spatial overlap between fishers and a marine sciences faculty.

The in-depth study of this case helped to ground the research and guided the data collection. Main aspects of co-management learnt from the Montemar are presented in Box 4.1).

#### *The interviewees*

The selection of interviewees responded to a purposive sampling: subjects were chosen because of who they are and what they know, rather than by chance. Most of the times, new informants were identified and contacted following early informants' suggestions (i.e., snowball sampling). The aim was to:

- Cover stakeholders from the different sectors (e.g., public, private, and civil society).
- Collect information from people with large experience of the MEABR system.
- Cover informants from the two regions studied.

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<sup>16</sup> With this respect, conversations with Dr. Castilla and his team were highly enlightening.

### *The broad set of fisher organizations*

The selection of cases for the application of the questionnaire was done based on extensiveness criteria. That is, rather than taking a random sample of fisher organizations in each region, the goal was to cover as many cases as possible in the available time. As such, we have not a sample but a *set* of fisher organizations. In SNA the ideal is to have a census of the target population to cover the whole network; if that is not possible, is preferable to consider that the cases study *are* the desired population (Hanneman and Riddle 2005). In this case a major proportion of fisher organizations in each region was covered, as shown in Table 3.3. The criteria used to select the fisher organizations were:

- Being involved in the MEABR system: organizations with functioning MAs or applications in-process.
- Availability of the formally elected president to respond the questionnaire. As a second option, if the president was not available, other members of the directorate were accepted (e.g., vice-president, secretary, or treasurer)<sup>17</sup>.

TABLE 3.3: Coverage of fisher organizations in two coastal regions of Chile

	V Region of Valparaiso	VIII Region of Bio-bio
Total No. of organizations with MAs	25 <sup>b</sup>	44 <sup>c</sup>
No. of surveyed organizations	16	22
Coverage <sup>d</sup>	64%	50%

<sup>a</sup> SERNAPESCA, 2008; <sup>b</sup> SERNAPESCA Bio-bio, Regional data base.

The selection of the president as the “qualified informant” to respond to the questionnaire needs to be explained and justified. Other authors that have studied Chilean small-scale fisheries have frequently targeted the president as a key informant, but have also included other members (Gelcich et al. 2005; Schumann 2007). Leaders have been regarded as central players, activating potential latent social connections to produce flows of benefits for communities (Bodin and Crona 2008).

<sup>17</sup> Only in one case the respondent of the questionnaire was the treasurer and not the actual president, as the latter was out of the region for the season.



What is the rationale for assuming that the president is *the* valid representative?

- The co-management system is highly formalized: to be part of the system, organizations have to elect leaders – a board of directors, in which the president is the chief. Therefore, the president, by definition, is the spokesperson for the group.
- The government authorities must be periodically informed about who the elected leaders are.
- The president has a key role in decision making: the president is required to sign any document that is concerned with the organization's decisions about co-management (e.g., declaration of catch and harvest size, and project application submissions). As reported by Gelcich and co-authors (2007), the president is amongst the few members who make selling decisions.

Two examples from fieldwork on the role of the president are offered: First, my access to fisher organizations, as an external actor, was always required to be established through the presidents. Second, in Montemar, the President was ironically called “*El Burócrata*” (i.e., the Bureaucrat). The nickname signifies that he is the one who handles the formal aspects of the fisher organization directly and the relationships with state agencies.

Chilean co-management is a highly formalized system. The study of formal relationships established by the fisher organizations with external institutions and actors with respect to co-management requires the opinion of the most knowledgeable individuals. It is the president who handles most of those interactions. For example, Meltzoff and others (2002) highlighted fisher leaders' role in operating within the institutional system. Also Meltzoff and co-authors (2001) reported a case where the leaders were the only likely liaison between the *caleta* and the government.

My assumption is that the president of each organization may not be the *only* legitimate informant, as there are other leaders that form the directorate, but is likely the *best*. Leaders are elected by majority and work for, and respond to, the assembly (i.e., all the members). The president, in most cases, can be expected to have a broad vision and to be a well-informed spokesperson about the functioning of the MA. It is important here, however, to

keep in mind that the unit of analysis of this research is the fisher organization. The level of the analysis is *meso* (as opposed to *micro* and *macro*). Thus, the results are meant to be valid at the organizational (and not the individual) level.

### 3.3 Data collection tools

A mix of tools or instruments was employed to collect data. Different techniques proved to be more suitable for particular stakeholder groups (e.g., according with time availability and interest). Also different instruments showed to be more effective and efficient for particular aims pursued (e.g., the questionnaire allowed covering more fisher organizations in short time). The employment of specific sets of instruments was associated with the different informants' groups as summarized in Table 3.4.

Table 3.4: Informant groups and data collection tools employed

	Interviews	Workshop/ focus group	Participant observation	Questionnaire
- Case study: Caleta Montemar	•	•	•	•
- Relevant stakeholders	•		•	
- 37 fisher organizations				•

These groups also correspond to different levels of analysis. The investigation at Caleta Montemar provided an in-depth understanding of fishers' everyday life and problems, and of co-management in practice. The consultation with various stakeholders allowed an overall comprehension of the functioning, challenges and trends in the MEABR policy and its institutional and organizational environments. Finally, addressing 38 fisher organizations (i.e., including Montemar) provided enough information for contrasting refined research questions in a larger number of cases.

The way the different levels, tools, and sources of information were integrated in the research process is explained in section 3.4 of this chapter. Next, I present the guiding

questions of my fieldwork and explain the data collection instruments used. Then, I discuss secondary sources that were consulted as well.

### *Guiding questions*

The core questions I looked to respond to, from the various perspectives of actors involved were:

- Who are the co-management actors (e.g., individuals, organizations, agencies)?
  - Role played in co-management (e.g., by law, informal).
  - Mission or mandate (e.g., agenda, purpose).
  - Location (e.g., national capital, regional capital, localities).
  - Size (e.g., number of individuals playing a role in the system).
  - Experience (e.g., years of existence, years of involvement in the system).
- What and how are the relationships with each other?
  - Content (e.g., partnership, cooperation, trade, obedience, control).
  - Frequency (e.g., weekly, monthly, yearly).
  - Valuation (e.g., positive/ negative, strong/ weak, important/ secondary).
  - Potentiality (e.g., what is expected from relationships and other actors).

These questions above were addressed by using semi-structured interviews, workshops, questionnaires, and field observation.

### *Interviews*

Semi-structured interviews are a core source of information for my research. This tool is characterized as being open-ended, informal and conversational, and as being guided only by a list of questions or topics to be addressed (Chambers 1998). This allows conversations to flow and to give space for emerging issues and concerns not considered by the researcher from the outset. Moreover, one of the strengths of this tool is that allows literate and semi-literate participants to express themselves in their own terms about any topic.

Sixteen interviews were conducted with fishers and divers, fisher leaders, researchers, government representatives, and fisheries consultants (see Table 3.6) throughout the

fieldwork as summarized in Table 3.5. Also permanent informal conversations and discussion meetings were held with Dr. Castilla and his team, research counterparts of this project. Later personal communications were established via e-mail and telephone with some of the same and new informants as indicated in Table 3.6 (i.e., PC). In most cases, interviews and conversations were digitally recorded. But, when the context was inappropriate (e.g., a too noisy place or during an informal dinner) I took written notes of the most important ideas expressed.

Table 3.5: Timetable of the fieldwork in Chile, year 2008.

	June				July				August			
Case study: Caleta Montemar					W		w					w
Interviews												
Questionnaire design / application									q	q	q	
Policy documents collection												
Secondary information												

Legend: w= workshops; q= questionnaire application

### *Focus groups and workshops*

Focus group interviewing is a strategy that aims at generating discussion and interaction within small groups of local people (Berg 2004). Normally, these groups range in size from six to twelve individuals. The researcher attempts to learn through discussion about conscious, semiconscious, and unconscious psychological and socio-cultural characteristics and processes within groups (Basch 1987). In other words, focus groups are collective semi-structured interviews that provide substantive information that emerges in an interactive and dynamic setting.

When the dynamic of the discussion goes beyond the interaction between the participants and the researcher and is led by certain frames (e.g., problem tree or stakeholder analysis) and tools (e.g., blackboard or flipcharts) to achieve more specific collective tasks (e.g., definition of a problem or description of actors) one may conceive the method to be a workshop. A workshop is more participatory than a focus group as participants play a more active and relevant role.

The idea of having workshops was positively received by fishers at my case study in Montemar. Three meetings were arranged with Montemar members (see Table 3.5), each one with a different purpose: 1) to learn about the story of Montemar and to identify key actors of co-management and the kind of relationships established; 2) to validate my qualitative network analysis (see Figure 3.1) and to discuss about co-management and their other livelihoods; and 3) to carry on a strategic planning & SWOT<sup>18</sup> analysis of the fisher organization. An executive summary in Spanish with the results of the latter was submitted later on to the President (Appendix 4).

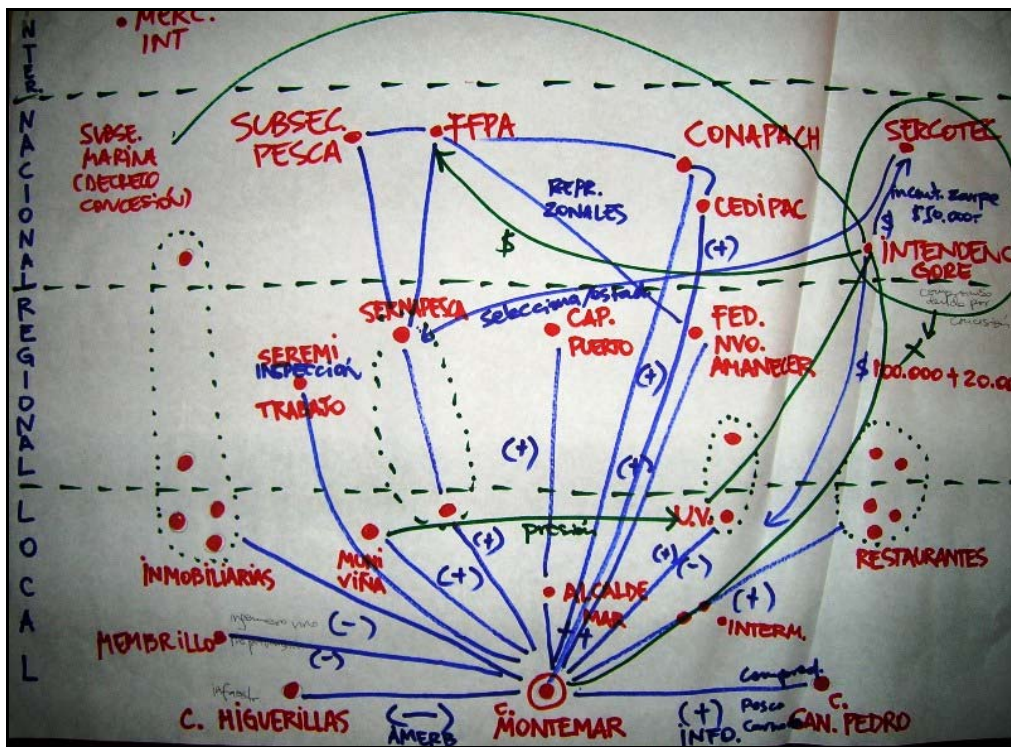


Figure 3.1: Participatory stakeholder and network analysis at Montemar.

Information and ideas elaborated during the workshops were registered by means of flipcharts and notes taken during and after the meetings. Workshops took place in a classroom facilitated by the Universidad de Valparaiso to the fisher union. Also a data projector was borrowed from the University to support the sessions.

<sup>18</sup> SWOT is an analysis scheme including the identification of strengths, weaknesses, opportunities and threats of a focal organization.

Table 3.6: Stakeholders interviewed and other key informants

Name	Initials	Background / Affiliation	Date
1. Hernán Villarroel	HV	Diver and President, Caleta Montemar	June 13; July 5; PC
2. Oscar Santis	OS	Sociologist, CEDIPAC Bio-bio	June 25; PC
3. Yuri Carrillo	YC	Diver and President, Caleta Cocholgüe	June 26; August 11
4. Antonio Morales	AM	Shellfish and seaweed exporter	July 3
5. Hugo Arancibia	HA	President of FEREPa and CONFEPACH	July 3
6. Max Montoya	MM	Innovation and Development Unit, SUBPESCA	July 9
7. Gonzalo Araya	GA	Biologist, CEDIPAC Valparaíso	July 9; PC
8. Juan Carlos Salas	JCS	Artisanal Fishery Department, SERNAPESCA Bio-bio	July 22
9. Eugenio Medina	EM	Fisher and President, Caleta Dichato	July 22
10. Cristóbal Herrera	CH	Technical Assistant, SODEPAR	July 24
11. Giovanni Daneri	GD	Oceanographer, CIEP	July 28
12. Andres Camaño	AC	Environmental and Community Manager, ARAUCO	July 28
13. Raúl Ortiz	RO	Biologist, Univ. del Mar	July 29
14. Cosme Caracciolo	CC	Fisher and General Secretary CONAPACH	July 29
15. Ricardo Silva	RS	Fisher and President, Caleta Maitencillo	July 30
16. Luis Fuentes	LF	Technical Assistant, Independent	August 22
1. Juan Carlos Castilla	JCC	Univ. Católica de Chile	June 10, 20; July 31; August 26
2. Stefan Gelcich	SG	Univ. Católica de Chile	June 10, 11, 12, 20; July 31; August 26; PC
3. Karina Vergara*	KV	Biologist, Univ. Católica de Chile	PC
4. Matías Frugone*	MF	Biologist, Univ. Católica de Chile	PC
5. Felipe Marchant*	FM	Sociologist, Univ. de Chile	PC
6. Patricio López	PL	Anthropologist, Univ. de Chile	PC
7. Oliver Alarcón	OA	Aquiculture and Fishery Engineer, Univ. de Concepción	PC

Legend: PC= personal communications after fieldwork completion; \*= assistant of this research.

### *Questionnaires*

A questionnaire was applied to collect data from 38 fisher organizations (Appendix 2) scattered along the coastline in two non-adjacent regions of Chile (see next section). The instrument (see Appendix 3) was designed based on early findings obtained from the interviews, workshops and observation. Structured and open-ended questions were included, covering three mayor issues: 1) Identification and description of the fisher organization, the Management Area (MA) and its resources; 2) Co-management relationships established with actors and institutions presented in a roster; and 3) Perceptions about co-management policy and evaluation of the experience with co-management. Likert scales were used in several survey items, for example, for respondents to assign numerical weight to different relationships with actors or to express their level of agreement with multiple propositions presented.

A draft version of the instrument was pre-tested and revised by the researcher. The application of the questionnaire was implemented during the last three weeks of fieldwork (see 3.5). Three undergraduate students with early experience with interviews and surveys assisted this phase (see KV, MF, and FM in Table 3.6). Briefing meetings were held to familiarize them with the purposes of the study, the selection of cases and the approach to fishers, and especially with the questionnaire. Also de-briefing meetings with the assistants were had learn about their experiences and perceptions. Their help was invaluable to gather the required data within scant available time.

Responded questionnaires were stored in hard copy format (e.g., paper) and also codified and digitalized in Excel spreadsheets to facilitate the processing and analysis of data.

### *Field observation*

The researcher has been considered the primary instrument for data collection in qualitative studies (Creswell 2003). Participant field observation was included as a formal tool (Bernard 1988) of my research. I took the opportunity to register what I saw, heard and perceived during the fieldwork. My field observations can be labelled as semi-structured: even though I knew what kind of information I was looking at (see guiding question

above), I was receptive to anything that appeared as interesting or unexpected. I maintained a fieldwork journal to document daily experiences, thoughts and feelings that occurred throughout the data collection process.

The level of my participation was heterogeneous. I got actively involved with one community (i.e., Caleta Montemar, see next section), participating in: 1) the traditional artisanal fishers' San Pedro feast; 2) a harvest from the co-managed area; 3) formal and informal meetings; and 4) informal dining encounters (e.g., *asados*) with them and some their families. This involvement helped in the establishment of rapport with this particular group (see Bernard 1988). On the other hand, with other fisher organizations, the level of participation was moderate to low. In some cases I met fisher leaders twice, first to interview them and then to apply the questionnaire (e.g., Maitencillo, Cocholgüe, and Dichato). In many other cases, I did only short visits to the *caletas* to apply the questionnaire (e.g., most of the fisher organizations in the Bio-bio region) or to be introduced to the leaders (e.g., Caleta Cantera, see Figure3.X).



Figure 3.2: Loco harvest and commercialization at Caleta Cantera, Bio-bio Region.



### *Policy Analysis*

In addition to the latter tools, policy analysis and secondary information analysis were used to investigate the broader context of the co-management system and the particular regional settings. The state and its policies play a relevant role in my study as they frame and intervene on the co-management system in general and the specific management areas in particular. Therefore, I collected and analyzed institutional documentation and the legal framework concerned with the small-scale fisheries. This activity continued on the Internet long after fieldwork completion. In general, these sources provided the formal setting of the policy and how the system is designed to function.

### *Secondary information including media*

Different organizations are involved in the small-scale co-management system in Chile and some of them maintain records of their members, their history, harvests, and copies of management plans, MA base-line studies and other documents. Some of those materials were collected to inform the description of my case study and the two regional settings. For example, a brief documentary on Caleta Montemar was exhibited on TV, covering one of their harvests in their MA and alternative livelihoods. That happened while I had just come to a preliminary agreement about their participation in my research. I arranged the recording of the video and used it to introduce the first workshop. Also, a number of digital copies were given to them.

## **3.4 Data processing and analysis**

### *Qualitative information*

Recorded interviews were selectively transcribed into text (in English). Also flipcharts (from workshops) and fieldwork notes were transcribed into digital formats. Ultimately, only few direct quotations of informants were employed in this document, as the research process led to a more quantitative-centred analysis. Nonetheless, qualitative data played a key role in the interpretation of quantitative results, as illustrated in Figure 3.X.

Photographs taken by the researcher throughout the fieldwork are employed in this document to illustrate and backup specific facts about the study settings<sup>19</sup>.

### *Quantitative information*

With respect to quantitative data, two kinds of matrices were created, according to the kind of variables studied. For relational variables (i.e., containing data about relationships among actors) *two-mode* or *incidence* network matrices were constructed (Hanneman and Riddle 2005). Two-mode networks represent the relationships between two different sets of actors. In this case the first set corresponds to fishers (in the rows) and the second to co-management counterparts (in the columns). Table 4.2 is an example of the matrices constructed.

Relational data contained in these matrices are by definition directed (Scott 2000). In other words, relationships studied in this investigation are not reciprocal. That is, they describe only the perception of fisher leaders about their connections with other actors (and not inversely). In addition, relational data elaborated here are either binary (e.g., 1 and 0), to express the existence or non-existence of relationships, or valued (e.g., nominal values) to express the weight assigned to particular linkages (Scott 2000).

The processing of relational data was carried on using Excel (e.g., recoding and merging of variables), whereas the calculation of network measures (e.g., actors' *degree*, see Freeman 1979 and Hanneman and Riddle 2005) was done in UCINET (Borgatti et al. 1999). Finally, for the development and design of network diagrams the NetDraw software (Borgatti 2002) was employed.

On the other hand, attribute variables of fisher organizations (e.g., describing organizational characteristics or leaders' perceptions) were expressed as conventional cases-by-variables data sets (Scott 2000). Nominal and numeral scales of measurement were employed. Basic statistics (e.g., frequencies, modes, and means) and correlation coefficients were calculated using Excel.

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<sup>19</sup> However, unlike originally planned, photography was not employed as a formal method. The achievement of objectives demanded the focusing on the other tools identified in the proposal.

### *The integration of mixed methods*

This study took a mixed methods approach. Indeed, various instruments and tools were used, and also secondary information was consulted. Figure 3.T summarizes the way in which these different sources were integrated into the research process. In brief, the case study, the interviews and the observation informed the design and application of a questionnaire. This instrument also included inputs from secondary sources and from policy documents. The findings emerge mostly from the analysis of the questionnaire results, and from the interpretation of those results based on qualitative information gathered and secondary sources.

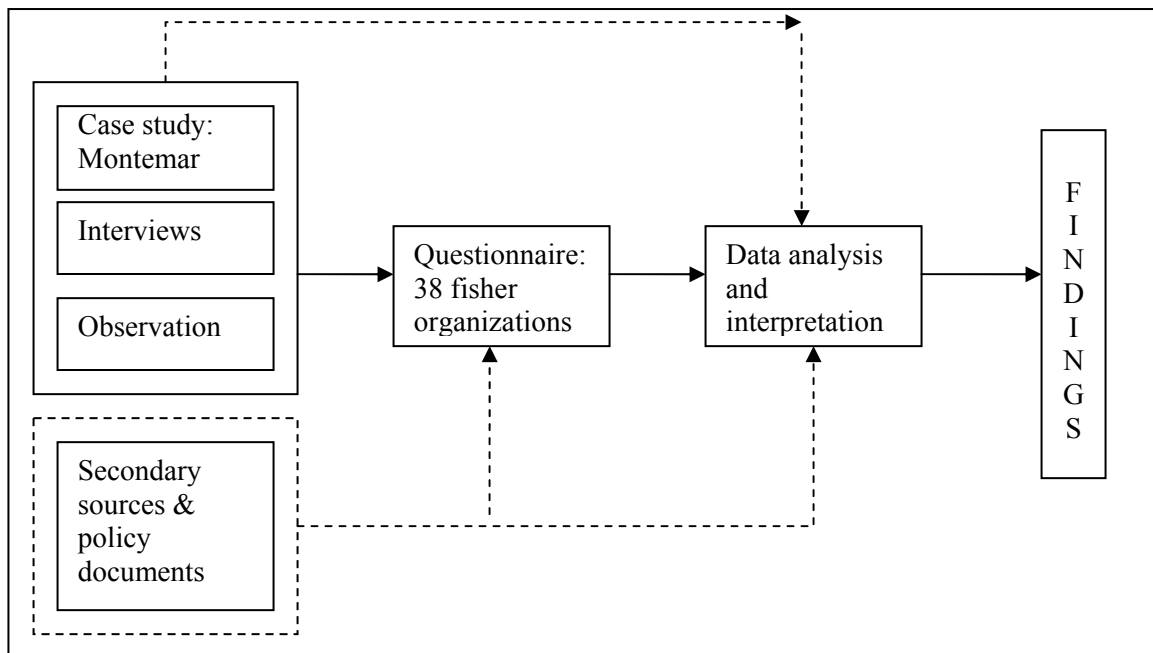


Figure 3.3: Mixed methods and the research process



## **Chapter 4: The MEABR co-management system as a complex governance network**

### **4.1 Introduction**

This chapter provides a description and appraisal of Chilean coastal co-management as a governance network. By drawing on local users' perspectives and highlighting the functional dimensions of co-management, rather than concentrating on the formal structure of co-management policy, a more comprehensive understanding of the system is possible. The chapter addresses two of the research objectives presented in Chapter 1. The first is to identify key actors and relationships in Chile's fisheries co-management system and the second is to analyze the relevant governance networks of the system.

Recent approaches to co-management (Carlsson and Berkes 2005), to adaptive co-management (Armitage et al. 2007), and to fisheries governance (Kooiman et al. 2005) have increasingly emphasized the interactions among individuals and organizations that underlie social ecological systems. Expanding upon this idea, my assumption is that co-management systems can be regarded as a form of governance and that, in turn, governance systems are formed by multiple social relationships that extend beyond the realms of the State. Consequently, the study of social networks would appear to provide a better understanding and design of sustainable co-management systems.

The elected leaders or representatives of 38 fisher organizations in two regions of Chile were surveyed to learn about the linkages they have to other actors with respect to co-management. A roster of 28 actors was used in the questionnaire (see Table 4.1) including: (1) actual co-managers (e.g., fisheries authorities and fisher organizations), (2) other public and private institutions (e.g., public agencies, consultancies, and businesses), and (3) fisher associations at higher scales (e.g., federations and confederations). The survey also allowed for respondents to put forward the names and details of other actors not explicitly included in the original roster. Strictly speaking, these co-management actors are not all individual entities but social roles or categories that I previously identified as being involved in the co-management system.

Table 4.1: Roster of co-management counterparts

Actors	Full name (single organizations)	Description (collective categories)
REG. FISH FEDER.	-	Regional fisher federations
UNIVER.	-	Universities
SERCOTEC	Servicio de Cooperación Técnica – Technical Cooperation Service	-
FFPA	Fondo de Fomento de la Pesca Artesanal – Artisanal Fisheries Promotion Fund	-
SUBPESCA	Subsecretaria de Pesca – Fisheries Undersecretary	-
MARINE POLICE	Capitanía de Puerto	-
SERNAPESCA	Servicio Nacional de Pesca – Fisheries National Service	-
NAT. FISH CONFED.	-	National fisher confederations
INDEP. PROF.	-	Independent professionals
FISHER CONSULT.	-	Fisher association’s consultant teams
MUNICIP.	-	Municipalities
RESTAUR.	-	Restaurants
PRIV. CONSULT.	-	Private consultants
CORFO	Corporación de Fomento de la Producción – Economic Development Agency	-
IFOP	Instituto de Fomento Pesquero – Fisheries Promotion Institute	-
EXPORT.	-	Fish and shellfish exporters
INTEND.	-	Intendancies (Regional Governments)
ZONAL COUNC.	-	Fisheries Zonal Council
BANKS	-	Public and private banks
FOSIS*	Fondo Solidario de Inversión Social – Social Investment and Solidarity Fund	-
PORT INFR.*	Dirección de Obras Portuarias – Port Infrastructure Agency	-
TOURISM	-	Tourism enterprises
INT. ORGS.	-	International organizations
INTERM.	-	Market intermediaries
SERNATUR*	Servicio Nacional de Turismo – National Tourism Service	-
SENCE*	Servicio Nacional de Capacitación y Empleo – National Service of Training and Employment	-
PRODEMU*	Fundación para la Promoción y Desarrollo de la Mujer – Women’s Promotion and Development Foundation	-
MEDIA*	-	The media
INNOVA*	InnovaChile – Entrepreneurial Innovation Promotion Agency	-
CONADI*	Corporación Nacional de Desarrollo Indígena – National Corporation for Indigenous Development	-
NEAR CALETAS	-	Nearby fisher organizations
NGOs	-	Non-governmental organizations
CONAMA	Comisión Nacional del Medio Ambiente – Environmental National Commission	-
PARLIAMENT.	-	Parliamentarians: senators /deputies
FAR CALETAS	-	Far-away fisher organizations
LARGE COMP.	-	Large development companies (e.g., mining, pulp, or real estate)

Legend: \*= actors that were not in the original roster but were added by the informants.

Note: Actors are ordered as they appear in Figure 4.4.

The study variable was defined as the attributes of co-management relationships between fisher organizations and other actors. It was measured in terms of the valence of relationships, namely whether relationships were regarded as positive or negative to the development of co-management. In the survey, these attributes were conceptualized as *facilitating* and *hindering* relationships, respectively. The selection of the variable and its dimension was based on a detailed examination of the case of Caleta Montemar (see Box 4.1), in addition to exploratory interviews with qualified informants.

For the purpose of the network analysis, the type of data collected consists of a *two-mode* or *incidence* matrix (Borgatti and Everett 1997; Scott 2000), as presented in Table 4.2. It is important to highlight that based on the research design and the structure of my data, the analysis is limited to linkages *between* fisher organizations *and* other actors. No detailed information was collected about relationships *among* particular local fisher organizations or about relationships *among* these other actors. To overcome the former, the roster of actors in the questionnaire included collective categories of near and distant *caletas*, so as to capture horizontal linkages among fisher organizations. Also, regional federations and national confederations were included as generic categories to cover the linkages between local fisher organizations' and these umbrella associations. With regards the latter, at least within the public sector, formal linkages between public institutions are defined by law and can be easily identified as and when required. Besides the quantitative data that provide the basis for the SNA, qualitative information –collected by means of participant observation and in-depth interviews— also informs the analysis.

Table 4.2: Two-mode matrix of fisher organizations and co-management counterparts

		Co-management counterparts				
		A	B	C	... N=28	Others:
Fisher Organizations	FO1	1	1	0	1	0
	FO2	0	1	1	0	0
	FO3	0	0	0	1	1
	...	1	0	1	0	1
	N=38	0	1	1	0	0

Legend: valence of linkages a) Positive: 1= facilitating relationship, 0= non-existent relationship; b) Negative: 1= hindering relationship, 0= non-existent relationship.

#### **BOX 4.1 Case study: Benthic co-managers at Caleta Montemar**

The case of Caleta Montemar was explored in depth to inform my understanding of the co-management system and the design of data collection instruments for the study of social networks. Montemar is located in central Chile, in the V Region of Valparaiso (Figure 1.2), in the Municipality of Viña del Mar. The *caleta* is located near an urban upper-middle class sector that attracts mass tourism during the summer season and is home to a small permanent population and weekend visitors for the rest of the year.

The fisher organization is made up of 42 members, from which only 18 are active fishers at the time of the survey. Montemar was legally registered as a *fisher union* in 2000, but fisher re-organizing efforts began earlier in 1992 motivated by the opportunity of becoming right-holders to a MA. Former and acquainted fishers and divers scattered elsewhere in the region were recruited to join this venture.

Caleta Montemar is vested with territorial use rights over one sector of 40.4 hectares which has been formally co-managed since 2003. They target only one species in the MA: the ‘Loco’ (see Figure 4.1). Fishers have had so far three legal harvests and SUBPESCA has recently approved a fourth follow-up report. Montemar has experienced an increasing trend in their annual harvests from the area. This is illustrated in the evolution of the state-sanctioned Total Allowable Catch (TAC). Between 2006 and 2009, their TAC increased from 5,000 to 25,000 units of Loco<sup>20</sup>. This trend reflects good resource regeneration, fishers’ self-organizing capacity, organizational stability, and growing income opportunities.

Normally, fishers from Montemar spend annually only between five and seven days harvesting ‘Loco’ from the Management Area (MA) to complete their TAC. Hence, besides the co-management activity, for much of the time fishers also catch pelagic and demersal fish and crustaceans from open access areas. Most fishers also have other activities to supplement their income (e.g., lifeguard, tradesman, and artisan).

In terms of the relationships established by Caleta Montemar with other actors with respect to co-management, interesting insights included:

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<sup>20</sup> The weight of each unit is highly variable. On average, Locos from Montemar weight 300 grams with their shell.



- The poor collaboration with the Faculty of Marine Sciences (Universidad de Valparaíso) despite sharing the same shoreline. Even though the university was initially involved in the base-line studies and the process to solicit and register the MA, now there is no cooperation in this respect. Mistrust and conflict of interests regarding use rights over the coastal border has impeded more fruitful relationships.
- The conflicts with nearby *caletas* on restricted access to the MA and the participation of larger scale fisher associations. Within the artisanal fisheries sector, they depicted near and some distant *caletas* as representing threats to co-management. Fishers and divers from other places are constantly and illegally extracting resources from their MA. At a higher level, they are affiliated to CONAPACH, which provides political support and also lower cost and more committed technical assistantship by means of CEDIPAC, their technical consultancy. Montemar is also member of “Nuevo Amanecer”, a regional federation which is more concerned about defending pelagic fishing rights than about benthic resources co-management.
- Development impacts and threats to co-management. Large real estate developments over the coastal dunes nearby their MA are considered a great hazard for the sustainability of the co-management initiative. A storm sewer outlet was installed over Montemar’s MA (Figure4.3), which either by altering natural ground water streams (important for mussels settlement) or by discharging polluted water over the area is threatening the ecosystem health of their managed area.
- The selective engagement of fishers in differentiated market chains. Unlike other *caletas*, Montemar sells their products directly to several restaurants in the city. They are proud of having cut out the middlemen.
- The participation of a number of public agencies as defined by policy. Fishers at Montemar identified SERNAPESCA, SUBPESCA, and the Marine Police as key players in co-management. Also SERCOTEC was mentioned as the funding agency that supported early technical studies in their MA. Other State institutions, such as territorial authorities, were also mentioned but play less important or indirect roles in co-management.



Figure 4.1: Hookah diving for Loco at Montemar

Based on Table 4.2, there are two possible entry points for the analysis<sup>21</sup>. One is the examination of rows (e.g., the differences and similarities among individual networks of fisher organizations). The other is the investigation of the columns (e.g., the differences and similarities among the other actors in the network). The focus of this chapter is the latter, which places the emphasis on identifying key positions of co-management counterparts based on aggregated valence and the strength of linkages expressed across fisher organizations. Centrality network analyses underlie this work.

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<sup>21</sup> In fact, there are more than two possible analyses. *Affiliation* network analysis can be performed by converting the two-mode matrix into two different one-mode matrices (Faust 1997). This would consist of clustering fisher organizations into types based on how similar their patterns of ties with co-managers are. Complementarily to classify or cluster co-manager counterparts into types based on the similarity of their patterns of ties with fisher organizations. However, the fundamental assumption of such analyses is the linking function of actors in both sets with respect to actors in the other set. For example, in an individuals-by-events network, individuals are assumed to be linked through events and events are connected by attending people. In my research design this is not the case most of the time. Private consultants do have direct linkages with fisher organizations, but this does not mean that fisher organizations are linked through or meet because of consultants. At the same time, fishery authorities deal with fisher organizations, but it is not through them that they engage with other co-management stakeholders. The linking function of actors in the two sets is only potential, limiting the possibilities for further analysis.

## 4.2 Key co-management actors: *facilitating* and *hindering* roles

Drawing on the valence of relationships, two networks can be derived, namely the network of **facilitating** and the network of **hindering** relationships. The assumption is that real life co-management, involving dynamic power-sharing and problem-solving processes, implies interplaying collaborative and conflictive networks with multiple actors from different sectors operating at different scales. Figures 4.2a and 4.2b represent these two networks of Chilean co-management based on empirical data I collected. The examples show that the network of facilitating relationships is much denser than that of hindering<sup>22</sup>. Note that the latter has a number of isolated actors on the top left side, including fisher organizations that did not identify any hindering counterparts and counterparts that were not indicated as hindering parties by any fisher leader. As a consequence, even though both facilitating and hindering actors are present, these results suggest an overall prominence of facilitating relationships in the MEABR co-management system.

However, in terms of the individual co-management counterparts, a number of actors were depicted by different fisher leaders as representing at the same time facilitating and hindering parties. This ambivalence is in no way a contradiction, as it reflects the complexity of social relationships in general and of co-management in particular. Nonetheless, it requires a more careful examination as it might have relevant implications for the functioning of the system. To do this, a centrality analysis is proposed based on the *degree* measure.

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<sup>22</sup> The facilitating network counts with 410 relationships, whereas the hindering network has only 130.

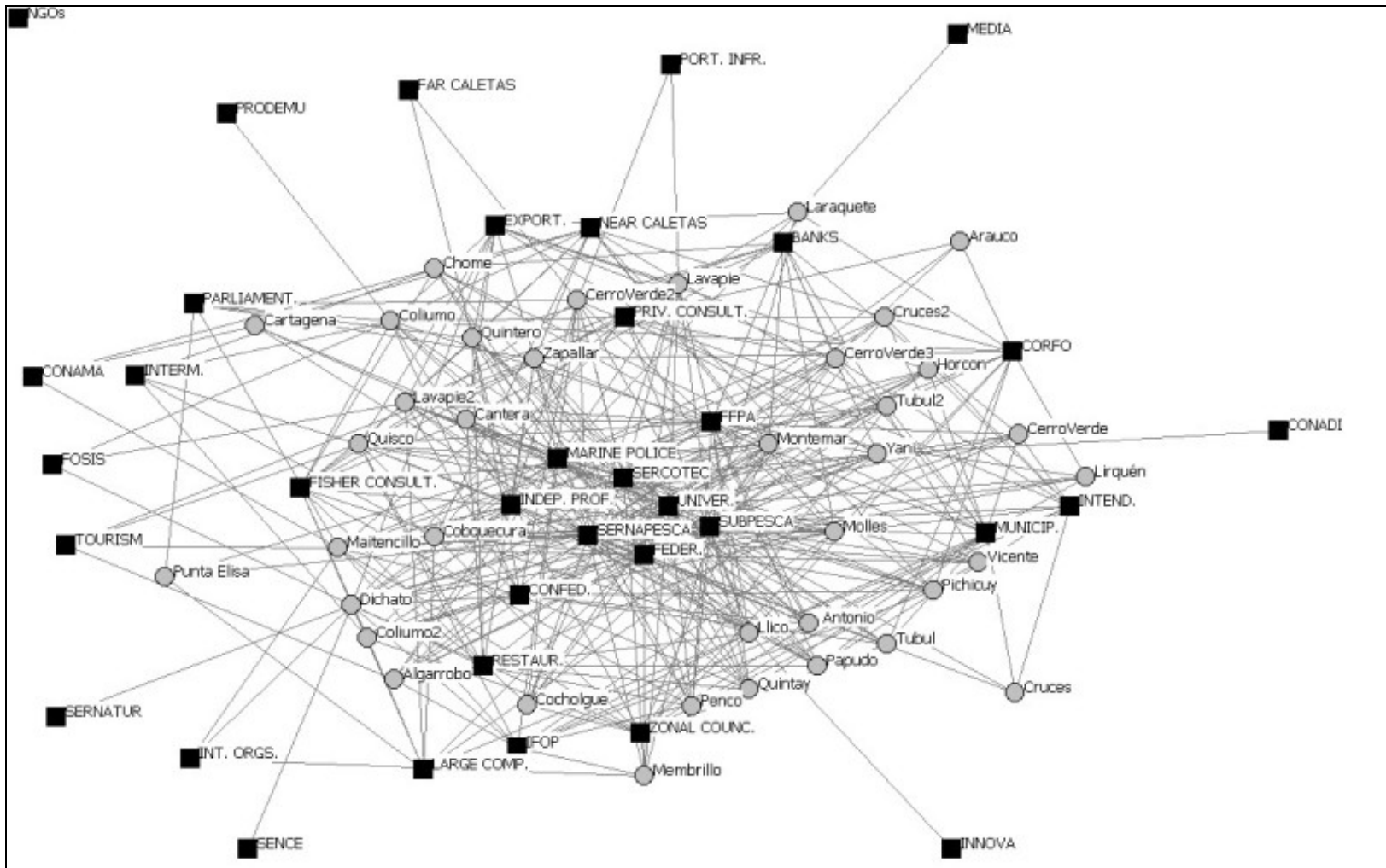


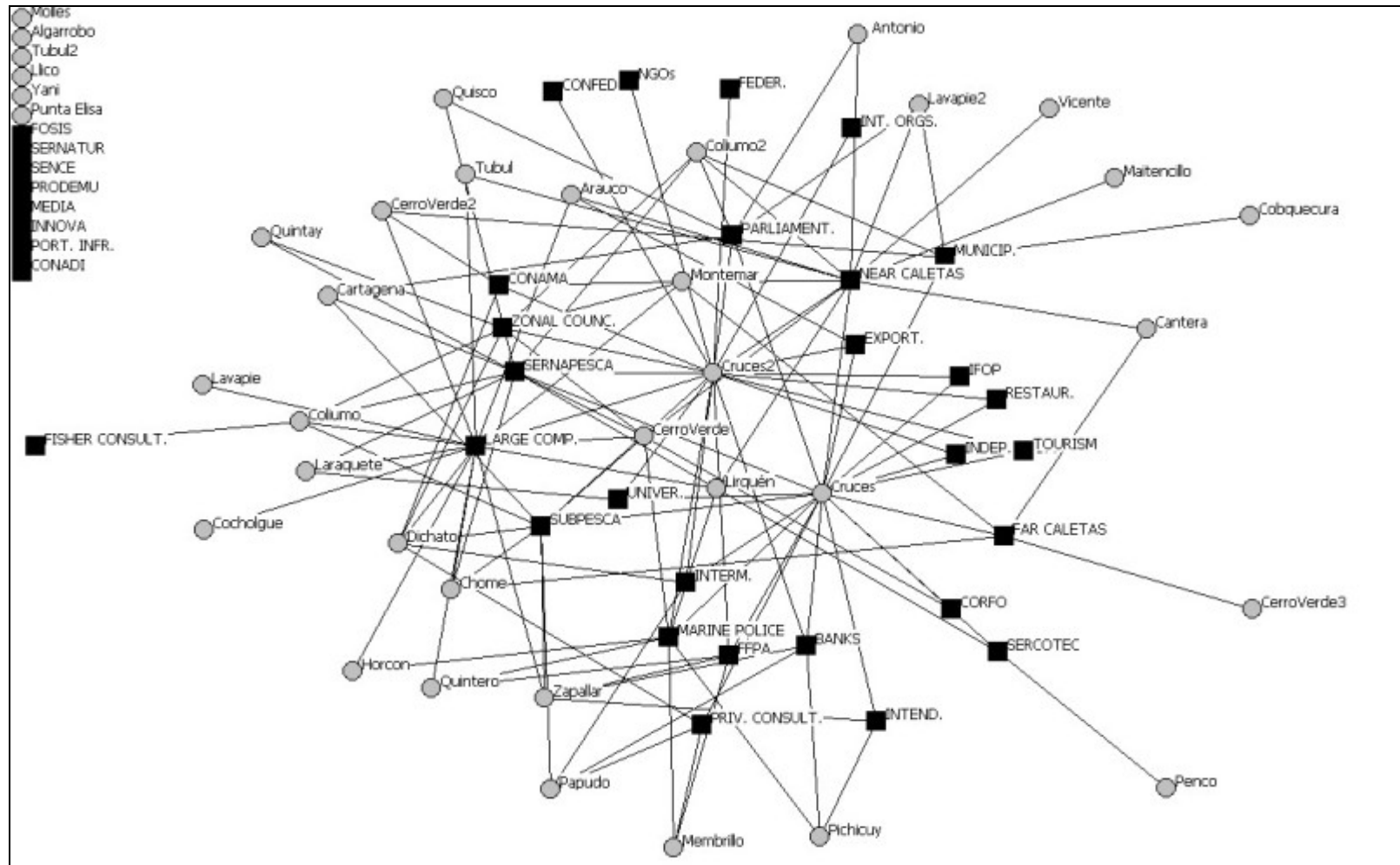
Figure 4.2a: Facilitating relationships network of Chilean co-management

Legend:

○ Fisher organizations

■ Other actors

Layout: Spring embedding with node repulsion and equal edge length bias



Figures 4.2b: Hindering relationships network of Chilean co-management

Legend: ● Fisher organizations  
 ■ Other actors

Layout: Spring embedding with node repulsion and equal edge length bias

The *degree* is a measure of network centrality and reflects the relative prominence of focal points within the network, based on the level of connecting activity (Faust 1997; Hanneman and Riddle 2005). In this case, variation in *degree* indicates which co-management counterparts are more connected and thus play more central roles in the system, from the overall standpoint of fisher leaders. For two-mode networks, *degree* refers to each actor's total number of linkages, expressed as a fraction of the maximum number of possible linkages (Borgatti and Everett 1997; Faust 1997). For example, the *degrees* of observed actors in the network of facilitating relationships vary significantly, ranging from 0.789, in the case of fisher federations, to 0.026, in the case of the media. In this way, *degree* becomes an attribute of the actors involved in the network that is based on the relationships among them. A general description of *degree* centrality distribution is presented in Table 4.3.

Table 4.3: Descriptive statistics of *degree* centrality distribution among co-management counterparts

	(a) Facilitating	(b) Hindering	(a) – (b) Net facilitating
Maximum	0.789	0.421	0.763
Minimum	0.026	0.026	-0.211
Isolated nodes (degree = 0.00)	1	8	-
Mean	0.308	0.122	0.205
Std. Dev.	0.255	0.101	0.237

My understanding of real-life MEABR system is that of simultaneously facilitating and hindering relationships. As both facilitating and hindering data sets have the same actors and the *degree* measure is normalized (i.e., as a percentage of the maximum number of possible linkages), *degree* indices are equivalent and can be compared. This fact provides the basis for integrating the positive and negative faces of the system. Figure 4.3 presents facilitating and hindering centrality *degree* indices of co-management counterparts. Also, the triangles in the figure represent the difference between both measures, expressing an indicator of what I call the 'net facilitating' *degree* centrality of each actor. Actors are ranked according with the latter.

The rationale behind the net facilitating *degree* indicator is that the overall participation of any given counterpart equals the difference between its facilitating and hindering involvement. For example, regional federations compute the highest net facilitating *degree* (i.e., 0.763) as a result of its facilitating *degree* being high and its hindering *degree* being considerably lower; by contrast, large companies compute the lowest net facilitating *degree* (i.e., -0.211) as its hindering *degree* significantly overpasses its facilitating *degree*. Finally, the case of near *caletas* is worthwhile mentioning, where facilitating and hindering degrees are equal, and consequently their net facilitating *degree* is neutralized (i.e., 0.000). As a consequence, the position of actors in the ranking changes from where they would have stood if only facilitating relationships were considered (e.g., see the case of SERNAPESCA).



Figure 4.3: Real estate developments and the storm sewer outlet (on the left) discharging over Montemar's MA.

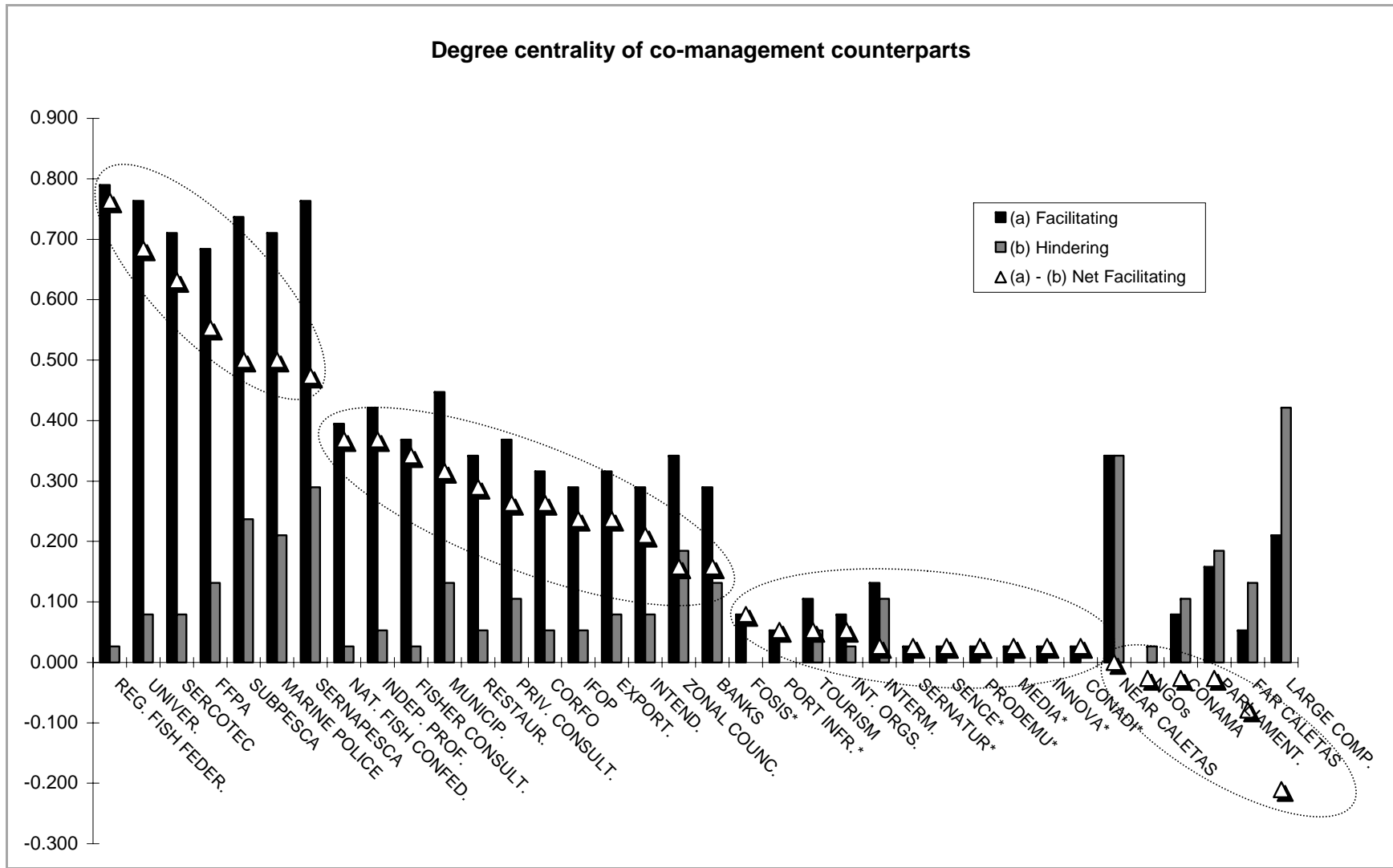


Figure 4.4: Degree centrality of co-management counterparts from fishers' perspective

Legend: \*= actors added by fisher leaders that were not in the original roster.



The graph shows three major breakpoints in the rank, indicating the existence of four groups of actors in the network with close net facilitating *degree* centrality. The group on the left shows the highest levels of net facilitating *degree* ( $\geq 0.474$ ), and includes: regional federations, universities, SERCOTEC, FFPA, SUBPESCA, the Marine Police, and SERNAPESCA. The second group has lesser net facilitating centrality ( $\leq 0.368, \geq 0.158$ ) but includes a larger number of agents, such as national confederations, municipalities, CORFO, and banks. The third group of actors has decreasing net facilitating centrality ( $\leq 0.079$ ) and presumably much lower prominence in the co-management system as a whole, such as FOSIS, international organizations, and the media.

Finally, at the right side of the graph, six actors have zero or negative balance of *degree* centrality, namely near *caletas*, NGOs, CONAMA, parliamentarians, far *caletas*, and large companies. In other words, according to aggregated fisher leaders' perceptions, their overall contribution to co-management is neutralized or exceeded by the obstacles they represent. In these cases, I consider the actors involved as hampering counterparts of co-management.

Two analytical consequences follow the overall distribution of net facilitating *degree* centrality of co-management counterparts in the observed network. First, the four centrality groups detailed in Table 4.4 provide a reference for further examinations as they reflect the potential weight or power of actors in the network and the net valence of their involvement. The analysis will be primarily focused on, but not limited to, the “High” and “Negative” net facilitating centrality groups.

Table 4.4: Net facilitating centrality groups of co-management counterparts.

	Net degree range	No. of actors
High	$\geq 0.474$	7
Mid	$0.158 \geq x \leq 0.368$	12
Low	$0.026 > x \leq 0.079$	11
Negative	$\leq 0$	6

Second, even though the four groups are defined as sharing similar net facilitating centrality, they show considerable internal heterogeneity. The diverse kinds of institutions within each group (e.g., State, civil society, and private sector) and the variety of functions they play in co-management (e.g., rights allocation, expert knowledge, and trading) suggest that no single sector dominates the entire network of co-management. Actors are different and they facilitate or hinder the development of co-management in different ways, and consequently the connections with those actors are also qualitatively different. The question arises as to whether different groupings of actors would highlight more refined trends in centrality distribution. The chapter now proceeds to look at co-management tasks or functions to understand the complexities of co-management governance.

### **4.3 Power and centrality in multiple interplaying governance networks**

The webs of relationships presented in Figs. 4.1a and 4.1b are rather unelaborated images of MEABR networks captured in this study. In order to refine and clarify this image, a first step is to distinguish between the various management tasks or functions and to group co-management counterparts by sector and in accordance with those tasks. In other words, to input actors' attributes into the analysis to understand the multiple flows and processes therein. The new image of the MEABR network is presented in Figure 4.5.

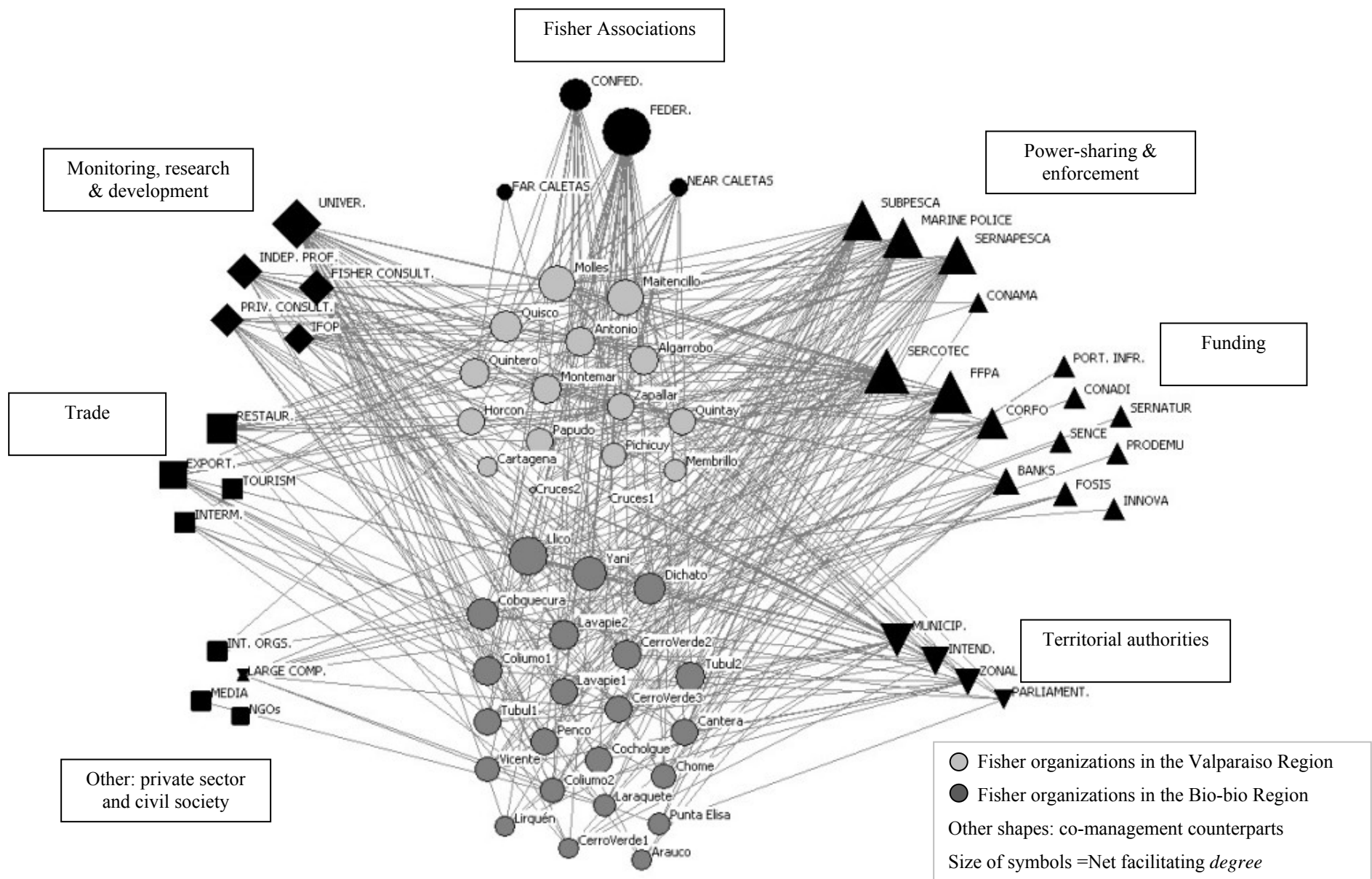


Figure 4.5: Interplay of functional networks of the MEABR co-management system, from fishers' perspective

An overall observation of the figure shows that:

- a. The web of connections tends to be much denser on the right-hand side where all the various State institutions are situated. This highlights the high centrality of, and power held by, the State in the MEABR co-management network.
- b. On the left-hand side of the figure, predominantly involving private and civil society sectors, the thicker web of collaborative bounds is directed towards the technical assistant institutions or knowledge producers. The latter stresses the centrality of expert knowledge for the functioning of the system as established by policy.
- c. In the centre column of the figure, the black circles express internal cross-scale linkages within the small-scale fisheries sector. On top, a thick set of linkages is directed towards regional federations, followed by linkages with national confederations. The centrality of these fisher associations indicates the importance of self-organizing efforts to represent fishers' interests and to counterbalance the influence of other fisheries actors, other private users of coastal ecosystems, and the power of the State.
- d. Lower yet still significant frequencies of contributing ties can be observed with private actors operating in the market of marine resources, such as restaurants and exporters. Finally, at the bottom left-hand side of the diagram, lowest centrality describes the involvement of other actors from the private sector and civil society, such as large companies, international organizations, and the media.

The next step is to conduct a more detailed examination of each functional network and the actors involved. Social network diagrams present synchronic images of social phenomena and thus tend to appear as rather static. A common challenge for network analysts has been to integrate dynamic and evolving dimensions of social structures into the analyses. In the next section the rationale and dynamics behind the various interplaying networks is presented.

#### 4.4 Characterization of co-management key actors and functional networks

A more focused examination of the interplaying functional groups and networks in Figure 4.5 provides more specific distributions of network centrality, and the basis for intra-group analysis. Drawing on the network diagram presented (Figure 4.5) and adding qualitative information gathered in the field, this section explores: 1) the reasons that explain contrasts between facilitating and hindering *degrees* of key actors, 2) the rationale for the net facilitating centrality distribution, and 3) two characteristics of the functional networks, namely whether or not there is substitutability of involved actors, and whether network formation is driven by policy (top-down) or by self-organization (bottom-up) processes. Substitutability refers to whether a particular function can be handled by more than one actor. The presence of substitutability or redundancy and self-organization in co-management networks is important as they are connected to the flexibility or resilience and sustainability of social-ecological systems (Berkes et al. 2003; Ostrom 2009).

##### a. The multiple roles of the State

The State is a complex and multifaceted institution and with respect to co-management tasks, several subgroups can be identified. Co-management relationships between fisher organizations and the various public agencies are presented in Figure 4.6. State agencies with the highest net facilitating degree of centrality are fisheries and coastal authorities in charge of power-sharing and policy enforcement tasks, namely SUBPESCA, the Marine Police, and SERNAPESCA. Most of the formal aspects enabling the MEABR policy rely on these institutions and this is consistent with their high facilitating *degrees*. However, the three of them also show considerable levels of hindering *degrees*. In the case of SUBPESCA, most fisher leaders criticized the high level of bureaucracy shown by the main fisheries authority, particularly with respect to the issuing of the annual resolutions to harvest. They complain, for instance, that the pace of these procedures rarely matches the speed and requirement of the market, leading them to lose out on selling opportunities.

With respect to SERNAPESCA and the Marine Police, relationships described as hindering are explained primarily as a discontent with existing enforcement and policing mechanisms. In this respect, fishers usually consider that the policy is highly restrictive for those who observe the rules and very lax with those who operate illegally. State agencies' capacity to implement opportune surveillance of MAs is completely overwhelmed and fisher organizations themselves are in charge of preventing non-members from extracting resources from their areas. According to leaders, the latter is both costly and ineffective, as responses to poaching denunciations tend to come too late - once there is no evidence of infringement. Even worse, there have been cases of serious violence and even homicide between poachers and appointed vigilantes of MAs.

Ultimately, as fisher organizations are not the legal owners of the resource areas but rather temporary users, fishers' decision-making rights and legal protection are limited. In response, their attitude tends to be critical about the policy and the authorities in charge, exercising pressure through their representative bodies for extending current power-devolution levels. Fishers seek to have more autonomy in their MAs with respect to managing resources and seek more effective control mechanisms. In political terms, these bottom-up struggles represent important drivers of co-management policy change.

A special case within this group is CONAMA (with a different colour in the graph), the National Environmental Commission. Although the agency may be primarily regarded as a funding provider<sup>23</sup>, its involvement in co-management is not limited to this function. CONAMA is not an environmental enforcement authority in the strict sense, but is the coordinating institution of national environmental policy, including the Environmental Impact Assessment System (SEIA). The majority of fishers are increasingly concerned about the impacts of large private developments on the health of marine ecosystems and the resources in their MAs. Many of them disapprove of current environmental policies due to the lack of protection they afford their interests and livelihoods. Consequently,

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<sup>23</sup> In fact, most of CONAMA's facilitating degree can be explained by its small-scale project funding program that has benefited several fisher organizations.

CONAMA was largely regarded as a hindering actor of co-management and its resulting net facilitating *degree* is negative.

A significant characteristic of the power-sharing and policy enforcement subgroup is the total absence of substitutability of co-management counterparts. Fisher organizations cannot select alternative authorities to rely on. Fisheries authorities issuing co-management permits are highly specialized and represent a single window to enter and to participate in the MEABR system. This fact also highlights the high centrality of policy-driven relationships of co-management between the State and user communities. State institutions enable co-management and retain control over annual permits for harvesting, define what kinds of players are legitimate technical assistants, and set the pace of policy adjustments. Moreover, as will be explained later in this chapter, the non-intervention over markets is central form of public policy. Finally, funding mechanisms and research grants defined by the state also frame the scenario of experimentation and development in the artisanal fishery sector, as presented next.

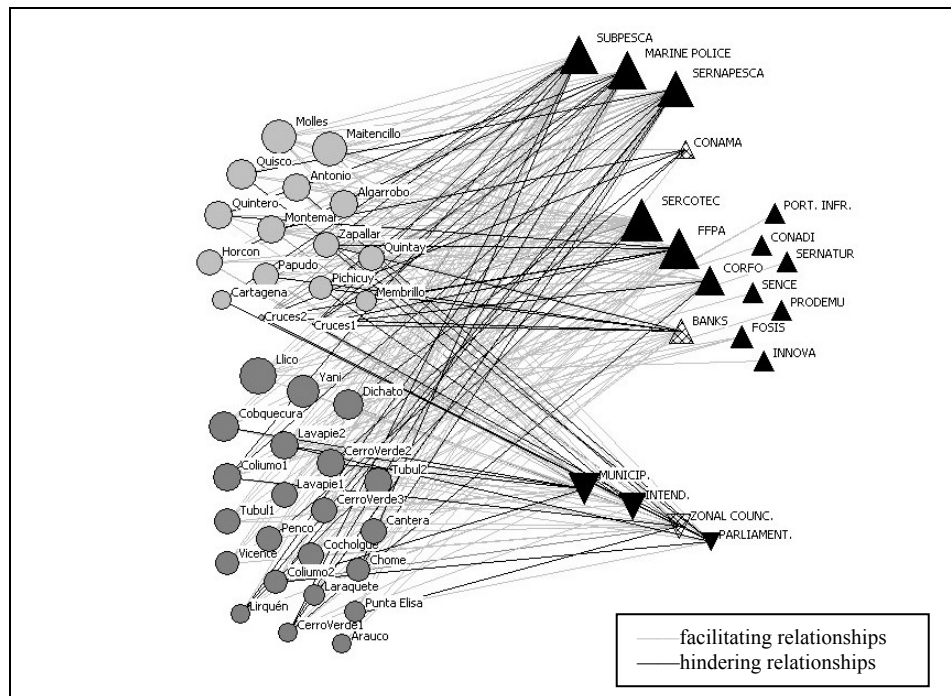


Figure 4.6: The many faces of the State

Also as part of the State, specialized funding institutions and mechanisms follow as a core functional group, with actors showing high facilitating *degrees* such as SERCOTEC and FFPA. Interestingly, they show very low hindering *degrees*, reflecting clearly the positive perception of fisher leaders about their participation. These institutions operate under subsidizing and/or co-funding schemes that are supported by specific project proposals. The general critique of my informants was to do with the requirements and the formal barriers they establish to making funds available to fishers.

In the same subgroup, but with a different colour (in the grid) in Figure 4.6, public and private banks are included as they represent a more recent source of financial resources for fisher organizations; in this case, however, based on fishers' credit capacity. The tail of the subgroup is occupied by a number of sectoral agencies providing less frequent financial and capacity-building support, usually based on particular fishers' characteristics (e.g., gender, ethnicity, or level of impoverishment) or specific endeavours (e.g., tourism, processing infrastructure, or training). These less commonly involved actors were added by informants in the Bio-bio Region to the original roster, and this is why their overall centrality is considerably lower. Nonetheless, their involvement in fishers' development represents an attempt at, and opportunity for livelihood diversification.

A common attribute of funding networks is a substantial degree of substitutability. Fisher organizations have the option to raise funds from any or several of these agencies. In this way, although several policy-driven funding mechanisms exist, a bottom-up initiative is an important factor underpinning these relationships. Also, the centrality of the funding subgroup points out a key aspect of the coastal co-management system, namely the economic dimension. Ultimately, the extraction of marine resources under co-management is a business requiring capital and investment to succeed. With this respect, a novel driver of change in co-management networks are the partnerships identified between fisher organizations and large aquaculture and marine resource processing firms, such as that in Dichato and Llico. These private-private joint ventures consist of aquaculture projects (e.g., mussels) in which fishers contribute with their MAs and



labour, and firms with the investment, technical knowledge and operational costs. Interestingly, these initiatives represent potential opportunities to increase the productivity of resource systems and fishers' livelihood sources. At the same time, they also challenge fisher leaders' capacities to negotiate and establish equitable agreements about the distribution of revenues with more powerful counterparts.

Finally, territorial authorities represent a rather eclectic subgroup with an overall low centrality. This is so both because its members are heterogeneous—including elected (e.g., municipality) and non-elected authorities (e.g., intendancies or regional governments), personal positions (e.g., parliamentarians) and collegiate bodies (e.g., Fishery Zonal Council) - and because there is no specific task performed by or assigned to them in co-management. The higher centrality of municipalities within this subgroup likely reflects either the increasing concern of local authorities for fishing communities' activities (e.g., some municipalities have recently created coastal border offices) or a relative preference by fishers for the lowest levels of decision-making (i.e., subsidiary principle; see Stern et al. 2002; Ballet et al. 2007). Basically, municipalities are responsible for providing a broad set of public services that may have indirect impacts on co-management but direct impacts on fishers' well-being. In turn, intendancies have direct influence over the allocation of public funds for regional development priorities, with likely benefits small-scale fisheries and particular projects focused on MAs. On the opposite side, parliamentarians appear as net hindering actors among territorial authorities. My interpretation of the data is that fishers, like many people in Chile, criticize deputies and senators for unaccomplished promises and for legislating in favour of the most powerful economic groups. In a few cases, however, these politicians were regarded as facilitating actors of co-management. For example when they have mediated conflicts between *caletas* (e.g., Coliumo) or when they, as local cottagers, have longstanding and close relations with fishers (e.g., Maitencillo<sup>24</sup>).

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<sup>24</sup> In the example, fishers expressed that politicians have facilitated their access to high hierarchical authorities or have supported particular specific claims.

A special case within this subgroup is the Fishery Zonal Council. It is included in this subgroup (with a different colour in Figure 4.6) as a territorial advisory and decision-making multi-stakeholder body. Councils do have a say in the early stages of Management Areas (MAs) establishment but not in the regular functioning process. It includes three representatives of the small-scale fishery sector from a total of around 15 seats.

Given the internal heterogeneity of the territorial authorities' subgroup, no clear trend in terms of substitutability and the nature of network formation can be deduced. However, as I have observed, there is room here for bottom-up initiatives and networking by fisher organizations (e.g., Montemar sought for the Intendancy's support and Cocholgue for the Municipality's).

#### b. Monitoring, research and development

A number of actors play the role of technical assistants or expert knowledge producers for co-management. As presented in Figure 4.7, within this group, universities show the highest net facilitating centrality. This fact can be explained by the range of information, resources, and opportunities that they provide to the development of co-management as compared to other actors in the group. Several universities not only provide assistance in the preparation of PMEs, ESBAs, and follow-up studies (as most private consultants do), but they carry on basic and applied studies, and resource enhancement experimental initiatives in MAs (see Figure 4.8). In this sense, universities represent an opportunity for fisher organizations to access, at least indirectly, other sources of funding (exclusive for research and development purposes) for more specialized interventions in the MAs with likely positive outcomes for co-management. Fishers' interaction with the ecosystem may become more adaptive as a consequence of long-term social relationships with universities.

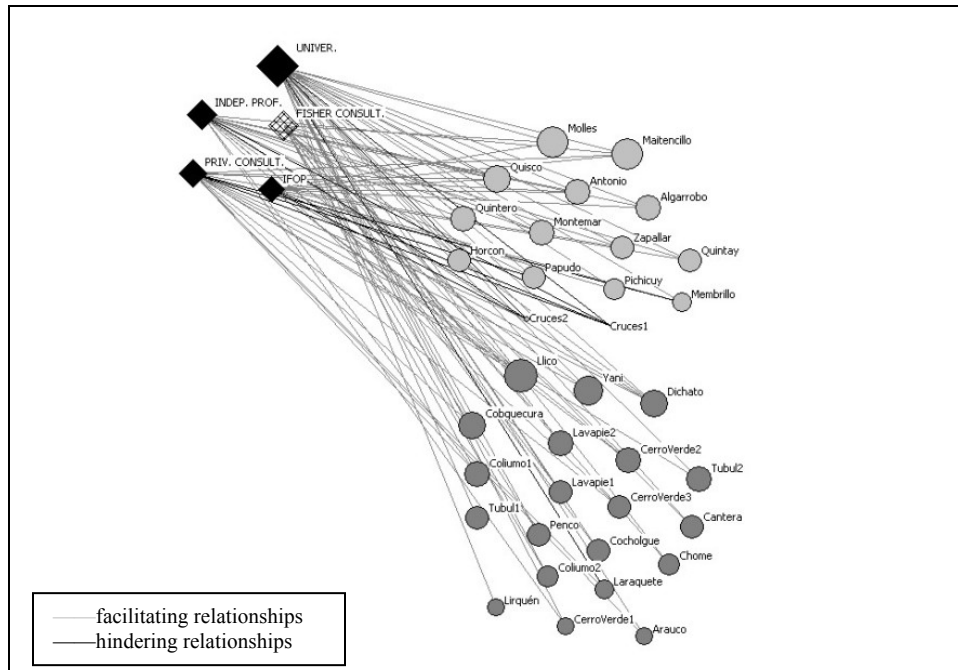


Figure 4.7: Monitoring, research and development institutions

Technical assistantship institutions also vary in terms of cost, which is also reflected in their varied centrality. From fishery professionals and technicians' perspective, the MEABR system opened a new market niche for specialization and profit-making. Many universities became involved and numerous consultancies were created across the country to provide fisher organizations with these initially subsidized services. But the cost of studies has become a driver for fishers when engaging and replacing assistantship institutions, since lower costs increase the net income of production. Because subsidies are currently low, fisher organizations have had to increasingly internalize the costs of monitoring studies of their MAs, which are in many cases unaffordable. In response, confederations and federations created their own teams of consultants (e.g., FEREPAC, CEDIPAC). These arrangements (included in Figure 4.7 using a different colour) represent an emerging actor in the system implying: lower or fairer prices, self-funding of fisher associations, stronger linkages with more 'familiar' experts. To some extent, technical assistance institutions formed by fisher associations are also examples of self-organization efforts of the small-scale fishery sector. In this case, the aim is to provide alternatives to consultancy services provided in the market.

In the case of knowledge production and monitoring tasks in co-management, there is a high level of substitutability of relationships and actors with respect to the development of basic studies<sup>25</sup>. However, the range of recognized institutions that can undertake these reports is defined by law<sup>26</sup>. Other connections between fisher organizations and knowledge producers beyond basic studies are either framed by research grants policies or independently according with the interests of the parties in a more bottom-up or horizontal fashion. These partnerships are certainly limited and probably the number of *caletas* exceeds the assistance capacity of universities. In summary, policy-driven, self-organizational and market drivers converge to impact the network of monitoring, research and development relationships.



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<sup>25</sup> From the 38 fisher organizations studied, 23 declared that they had changed their technical assistance providers. Fifteen of those changes were explained by the high costs of the services.

<sup>26</sup> Nonetheless, MM, policy-maker at SUBPESCA, indicated that one idea that has been discussed is to change these criteria and to allow individual professionals to carry on these studies. This measure would seek to benefit fishers by reducing the operational costs of consultancies and studies being conducted.

Figure 4.8: Experimental laboratory and hatchery (a partnership between Universidad Viña del Mar and Caleta Maitencillo).

c. Fisher associations

The small-scale fisheries sector in Chile comprises fisher associations at local, regional and national levels. Figure 4.9 stresses the role of regional federations as key actors of the co-management system with the highest net facilitating *degree* in the network. Less centrality is conferred to national confederations as fishers' representative bodies. Both entities represent bridges between fishers and the Government at the regional and national levels. From the grassroots to the decision-making levels, these institutions channel demands, interests and concerns. From decision-making spheres to the grassroots, they negotiate policy modifications, funding for projects, and specific permits. For instance, the co-management policy has been changed several times in response to fishers' pressure and lobbying done by federations and confederations<sup>27</sup>. It should be noted, however, that in responding to the complexity of small-scale fisheries, these associations address multiple topics affecting the sector and not only those concerning the MEABR system. In fact, many fisher and non-fisher informants perceived that some of the federations are barely concerned about MAs.

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<sup>27</sup> These changes include a reduction in user fees, the introduction of a permit to carry out aquaculture within MAs, and the consent of joint management of MAs by two or more organizations.

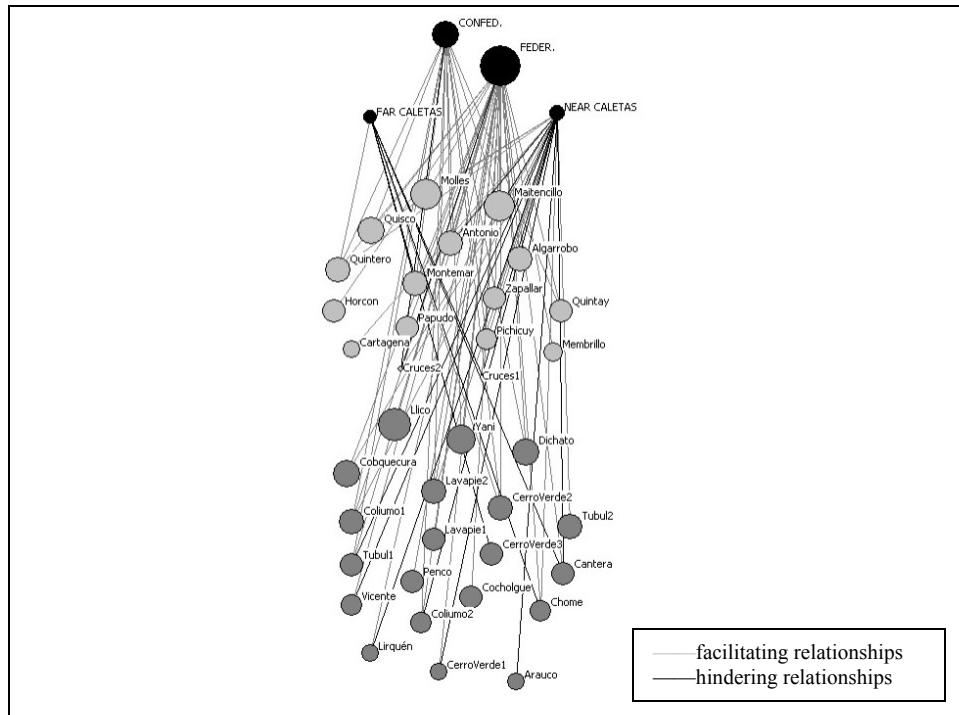


Figure 4.9: Multi-level fisher associations

As mentioned before, federations and confederations have played an important role in providing technical assistantship to their members; thereby negating in many cases the intervention of private consultancies and universities. These umbrella organizations represent bottom-up organizational initiatives *par excellence*. As such, different interests and political visions among fishers determine the existence of distinct and sometimes competing associations, both at the regional and national levels. Therefore, although substitutability is a distinctive feature of this group of actors it can be eventually regarded as a weakness also. Indeed, if representative bodies are too fragmented their relative power is reduced.

At the local level, fisher organizations also establish connections with other user groups and fishers involved in co-management. By contrast, in this case their overall centrality is negative. Near and far *caletas* are very often regarded as hindering the development of co-management. In general, horizontal linkages at the local level are weak with respect to co-management and constant rivalry and antagonism makes cooperation fairly difficult. This may explain why regional umbrella associations in particular are regarded as key

players in the system, providing the necessary mediation between grassroots organizations. Few cases of inter-organizational alliance or exchange were recorded in the field though, accounting for the facilitating degree of the category of near *caletas*. For example, in the Bio-bio Region, two neighbouring organizations in Caleta Cerro Verde were initiating the joint management of their MAs and joint commercialization of their resources. While in the Valparaíso Region, Maitencillo fishers indicated how they had been taught by Caleta Pichicuy to cultivate and harvest seaweed.

#### d. The market

Market relationships have an overall low centrality in the network of net facilitating relationships. Fishers seem to conceive trade relationships as being different from those defined by collaboration. Nonetheless, the trend in the subgroup illustrated in Figure 4.10 is consistent with fishers' basic economic interests: restaurants in the first place, exporters in the second place and intermediaries in last place. In general, the shorter the chain between fishers and the final consumer, the higher the revenues for primary producers. For example, the highest price I observed for loco was found in Maitencillo, where the fishers sell shellfish directly to cottagers and summer visitors. While at Montemar, fishers proudly described their marketing strategy to cut out the middlemen by selling directly to local restaurants.

A special case here is represented by tourist enterprises. Tourism is broadly presented as a promising opportunity for fishers to diversify their livelihoods and to add value to their daily activities. Certainly, more than a few fisher organizations included in this study are involved in various kinds of tourism services (e.g., restaurants, sea trips, and diving courses). In addition, small-scale fisheries and *caletas* normally represent tourism attractions due to the cultural value they embody. However, the low centrality of tourist operators in the network of net facilitating relationships describes a weak integration between fisher organizations and the tourism industry.

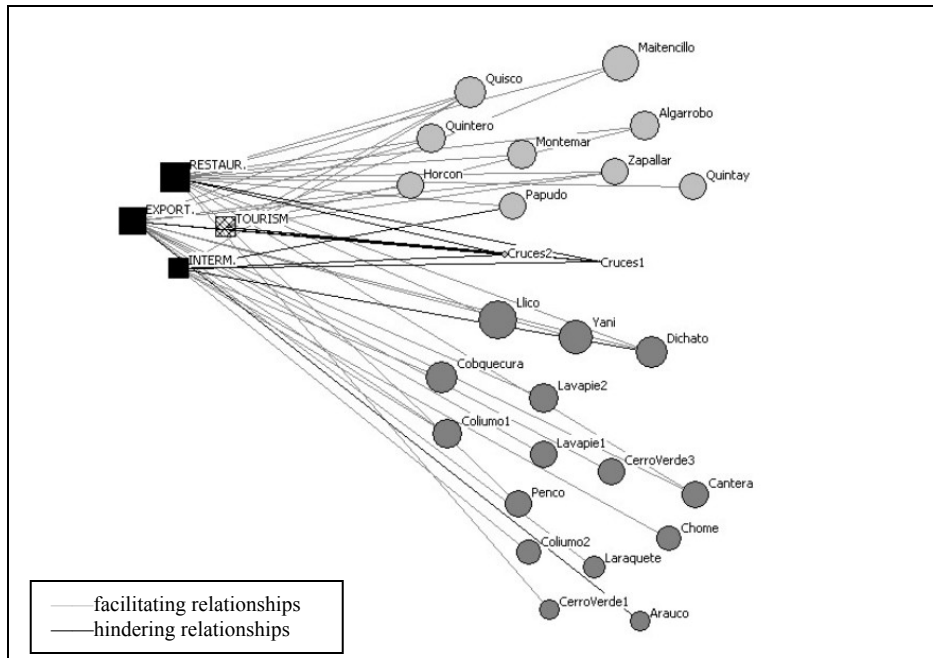


Figure 4.10: Actors in the market

e. Other actors from the private sector and the civil society

With respect to other private sector actors (see Figure 4.11), particularly with large companies, it is important to note that fishers have contrasting relationships with them. A frequent trend observed in the field was the tension between fishers involved in co-management and large development projects. Fishers are increasingly concerned about environmental impacts on their MAs. They claim that marine resources are threatened by different sources of water pollution (e.g., pulp industry discharges, storm sewer outlets of large developments, and urban sewage water), risking the loss of the produce or reducing the chance to export their products to high-standard markets. In many cases, use rights over MAs have been adopted by fisher organizations as a negotiating tool to demand advanced compensation from businesses. In strict terms, these companies are not directly involved in co-management but they affect its development as competing ecosystem users.



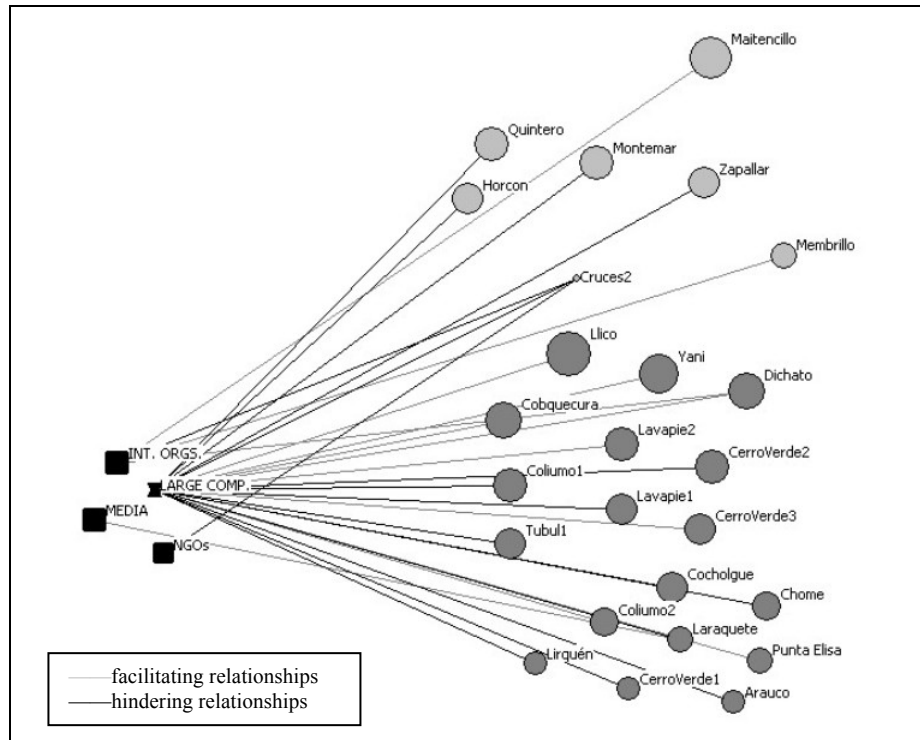


Figure 4.11: Actors from the private sector and the civil society

The positive connections with large companies represent the particular case of a pulp industry in the Bio-bio Region that is involved in a multiparty negotiation—including the company, regional authorities, fisher representatives, and a university—where a proactive approach towards environmental impacts on fisheries is exercised (e.g., monitoring, compensatory fund, and investment; see National Research Council et al. 2008). However, not all fisher organizations in the area participate in this agreement, since industry is regarded by many as posing the greatest threat to co-management. In other cases, however, such as Montemar and the conflict with real estate companies, there are no precautionary schemes in place. The only alternative fishers have in this case is to wait until severe damage is caused and evidence can be presented to demand compensation. In any case, these interactions with large companies are the result of specific situations of overlapping interests over ecosystem uses and are not deliberately sought by the parties. There is no substitutability of actors and such networks are commonly driven by contingency.

Finally, it is interesting to note the low involvement of international organizations in Chilean small-scale fisheries co-management (i.e., *degree* of 0.079). International cooperation directed to Chile has decreased during recent decades, along with the country's economic growth. On the other hand, NGOs were deliberately included in the roster of actors as they represent key capacity-builders and bridging organizations in many community-based resource management systems worldwide. Unlike other sectors and other resource management fields in Chile where NGOs have a strong presence, none of the fisher organizations reported their contribution to co-management (i.e., facilitating *degree* of 0.00). On the contrary, one *caleta* described NGO involvement in co-management as hindering, explaining the negative net *degree* obtained. Unfortunately, the reason behind that particular case is missing from the questionnaire.

A detailed interpretation and analysis of the dynamics of the multiple functional networks of co-management was provided above. Table 4.5 summarizes examples of both the positive/facilitating and negative/hindering faces of co-management. Table 4.6 summarizes the examination of co-management networks with regards to substitutability and drivers of network formation and provides, as reference, the mean net facilitating *degree* of each group. Higher substitutability of actors within networks is more likely related to the greater resilience of SES. Self-organized relationships satisfying co-management functions indicate a more flexible and socially-embedded system, as opposed to a fixed and hierarchically structured top-down policy.

Table 4.5: Examples of facilitating and hindering relationships/actors of the MEABR co-management system

Facilitating actors/relationships provide key resources for co-management
<ul style="list-style-type: none"> <li>• SUBPESCA and SERNAPESCA, the fishery authorities, are in charge of entitling fisher organizations with use rights over MAs, ensuring their access to benthic resources and increasing their asset base.</li> <li>• The Marine Police provides legitimate enforcement to the MEABR system, limiting illegal intrusions into the areas.</li> <li>• Regional Federations are representative bodies channelling the voice of fishers from the grassroots to the State and administrating the allocation of public resources.</li> <li>• Universities input expert knowledge into the system, fostering resource enhancement opportunities and capacity building among fishers.</li> <li>• The FFPA provides fisher organizations with co-funding opportunities to improve their working conditions and increase the benefits they derive from their activities.</li> </ul>
Hindering actors/relationships represent challenges for co-management
<ul style="list-style-type: none"> <li>• Neighbouring <i>caletas</i> and faraway fishers frequently poach from others' MAs, generating constant rivalry among users and jeopardizing the sustainability of the system.</li> <li>• Large companies with other interests over the coasts and the ecosystems represent latent risks for the health of resources, provoking environmental conflicts between developers and fishers.</li> <li>• CONAMA, the representative agency of the environmental policy, is criticized by fishers as providing insufficient legal protection of MAs.</li> </ul>

Table 4.6: Mean centrality and important characteristics of co-management functional networks

	Mean Net Facilitating Degree <sup>28</sup>	Substitutability of actors	Driver of network formation
Fisher associations	0.566	Yes	Self-organized
Funding	0.401	Yes	Policy, market & self-organized
Monitoring R&D	0.379	Yes/ Limited	Policy, self-organized & market
Power-sharing & enforcement	0.362	No	Policy
Territorial authorities	0.164	Yes	Unclear & self-organized
Trade	0.151	Yes/ Limited	Supply & demand
Near and far <i>caletas</i>	-0.039	Yes/No	Contingency, self-organized
Private sector & civil society	-0.061	Yes/No	Contingency, self-organized

A remarkable characteristic of Chilean co-management policy, as a projection of the national development model, is its high rigidity and the concentration of decision-making power and total flexibility in the market for marine products. State intervention on export amounts, market prices or centralized/coordinated buyers is completely contrary to the idea of an open-market economy. This explains, for instance, why the success of the MEABR system is also the reason for its present weakness. The international price of Loco has fallen as a consequence of a sustained increase in supply, which is a result of the species' recovery. Such forces are completely beyond the control of local users.

<sup>28</sup> For a more valid representation of mean *degrees*, only the figures of actors included in the original roster are computed. Also fisher associations were separated from near and far *caletas*.

## 4.5 Chapter discussion: Adaptive capacities of MEABR networks

### *Strengths*

Empirical evidence suggests that the MEABR co-management system is mostly supported by facilitating relationships among fisher organizations and their counterparts. In responding to a conflictive episode in Chilean small-scale fisheries, namely the overexploitation crisis, or the ‘loco fever’, in the late 1980s and early 1990s, the MEABR system has built a collaborative platform for the governance of benthic fisheries.

The MEABR system can be seen as consisting of multiple and diversified networks. Co-management networks are formed to satisfy multiple functions of co-management, such as power-sharing, funding, monitoring and the coordination of trade<sup>29</sup>. Furthermore, in terms of the sectors involved, my results show that co-management includes much more than a monolithic State and a group of homogeneous users. On the contrary, the Chilean MEABR system includes a broad set of public agencies, private organizations, fisher associations and civil society organizations. All of these actors define the organizational environment of fisher organizations carrying out co-management. In fact, the extended list of actors, who play different roles in the system, presents a much more complex set of relationships than suggested by formal policy.

A remarkable process of fisher self-organization was identified, particularly at the regional level. Fisher regional federations appeared as the most central actor in the network of co-management and the most influential fisher association among the small-scale fisheries’ sector. As umbrella organizations, federations represent potential meeting points for the many individual fisher organizations involved in co-management, which

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<sup>29</sup> Trading has not been usually regarded as one of the functions of co-management. In this case, however, the fishery is primarily export-market-oriented, and therefore the level of coordination of market agents plays an important role. Trade is the direct target of the activity for fishers as the source of paybacks, hence, more collaborative ventures –both among fishers and with the traders— are potential opportunities to gain more control of prices and to get access to better markets.

are scattered along the coastline. As bridging organizations, federations represent the connection between the local level and regional and national fisheries authorities. They stand out as key players in the overall small-scale sector, linking local demands of fishers with the action of national confederations. The role of these self-organized actors in the MEABR system is to counterbalance the pervasive power of the State and the influence of other resource and ecosystem users. In doing so, they represent a fundamental driver of policy change.

The analysis showed fisher recognition of the role played by institutions providing expert knowledge to the management system, but also highlighted the differences among them. The MEABR policy established the requirement that the exploitation of fisher resources had to be monitored and guaranteed by technical assistance institutions. But the current pressure on fishers to enhance the productivity of MAs is reflected in the overall inclination towards institutions providing more wide-ranging resources and support, such as universities or consultancies established by fisher associations. The question here is not whether technical assistance institutions should or should not participate in the functioning of MAs, but rather what kind of assistance is provided, and at what price. Experts fostering resource enhancement measures and more active management schemes are regarded as more positive participants of co-management. They potentially represent bridging organizations in the system.

### *Weaknesses*

Even though the system appeared mostly collaborative with a high level of facilitating relationships, conflicts among involved actors still exist. Conflicts or hindering relationships were identified by fisher leaders with many organizations from different sectors. Among them, two important aspects can be highlighted. First, the high level of hindering relationships among near and far *caletas* can be stressed as a weakness of the

system, mainly explained by presumably mutual poaching from MAs<sup>30</sup>. Illegal extraction from MAs still exists and has been regarded as one of the main obstacles to co-management in Chile. Questions arise about the effectiveness of enforcement and policing mechanisms and the kind of punishments established, but also the scale of co-management and the implicit incentives or disincentives for fishers to implement more effective social control mechanisms.

Second, there are ongoing problems between fishers and the private sector, mainly large companies, with respect to co-management. The main driver of conflict is the externalization of pollution costs by commercial development projects representing environmental threats to marine resources within and outside MAs. Major and minor instances of pollution have affected fishers co-management initiatives in both regions studied. According to fisher perceptions, these problems also include CONAMA, the environmental agency, as they feel insufficient protection by the environmental policy. Questions arise here about the legal status of MAs in the national legal framework and particularly in the SEIA, and about the environmental requirements and standards that companies must respond to and implement before and after spilling industrial waste into water courses and the sea.

An extension of conflicts over poaching is the low existence of positive horizontal linkages among fisher organizations with regards to co-management. This situation has hampering consequences for social processes that may improve the functioning and enhance the outcomes of co-management. For example, social learning about resource management and enhancement, joint trading and investment, and adaptation to environmental changes are less likely if relationships deteriorate. At the local level, bridging social capital among fisher organizations is considerably lower than at regional and national levels.

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<sup>30</sup> Fishers also poach from their own MAs. For example, when they extract resources during the biological ban or contravene the harvesting planning of the group and the TAC. In such cases, it is the organization that has to sanction poachers in accordance with its own statutes.

Results also stressed the high centrality of State institutions in co-management. On the one hand, this can be seen as positive for co-management, as the stable functioning of the State and the rule of law provide a solid base for actors and the management system to rely on. On the other hand, however, when considering the specific functions performed by fisheries authorities, then some weaknesses of the system emerge. Indeed, the annual cycle of co-management and the underlying key enabling decisions are centred on public managers. The combination of bureaucracy and the rigidity of the law define a fixed State-driven system with little room for bottom-up adaptation and learning with respect to a complex and uncertain ecosystem.

Finally, the broad spectrum of actors directly and indirectly involved in the MEABR co-management system has a negative side when looked at from the perspective of fisher development. The analysis showed a remarkably complex architecture of actors, relationships and resources that nourish the functioning of co-management. But for many fisher leaders there are too many intermediaries in the system between the sources of resources and information and the fishers themselves (as the actual beneficiaries). Middlemen and exporters mediate between fishers and final consumers with respect of trading; technical assistance institutions and SERNAPESCA technicians mediate between fishers and SUBPESCA with respect to permits and financial mechanisms; universities and scientists mediate between fishers and funding with respect to research and development opportunities. In fact, networks seem to connect local communities with broader existing opportunities and to make those opportunities more inaccessible at the same time.

The question here is not about eliminating development agents from the system but about the kind of relationships that are established. Excessive interactions that imply a higher dependence of fisher organizations from their counterparts can be regarded as a system weakness. Multiple interactions can be negative when fisher possibilities of becoming the protagonists of their own development are reduced. Fisheries and development policies need to pay more attention to the proportion of financial, social and human resources that



actually reach the grassroots. In addition, incentives and market conditions should be provided for better participation of fishers in the commercialization of marine products.

#### **4.6 The network approach and the governance of small-scale fisheries**

The two-mode network research design I applied is a powerful tool to better understand complex social-ecological systems. In particular, this chapter presented a detailed and empirically-based image of fisher co-management connections with external agents. A partial picture of the nature of the macro-structure of relationships providing resources to a complex co-management system such as the Chilean MEABR case was then constructed. Following Carlsson and Berkes (2005), the analysis supports the notion that real-life co-management engages multiple stakeholders, and that co-management is comprised by a complex web of connections. This image suggests that all of these actors and linkages need to be taken into account when addressing sustainability and governance issues. Even though not all social relationships can be governed through policy and many develop as self-organization, institutional frameworks and incentive systems that foster interactions need to be sensitive to multiple changes in ecosystems, markets and society.

As an extension of its descriptive power, the network methodology also has the potential to make comparisons among different geographical regions, countries, and/or management systems. In my research, however, in which two non-adjacent administrative regions of Chile with rather distinct contextual characteristics were studied, no significant differences were found with respect to the network centrality analysis. The latter may signify that the MEABR system, as a national scale policy, has been evenly implemented and undertaken a similar regional evolution with respect to social relations.

This chapter dealt exclusively with the assessment of positions and functions of co-management counterparts, according with the perceptions offered by various fisher

leaders. A different perspective of the studied system emerges from the fine-grained observation of co-management networks established by the individual fisher organizations with external institutions. This outlook extends the analysis to the study of fisher organizations' linking and bridging social capital (Pretty 2003; Grafton 2005). Expanding upon this perspective is the purpose of Chapter 5.

## **Chapter 5: Co-management networks and fisher linking social capital**

### **5.1 Introduction**

In this chapter the patterns in co-management relationships across fisher organizations participating in the Management and Exploitation Areas for Benthic Resources (MEABR) system are analyzed. The objective is to explore the role of social networks in the functioning of coastal benthic co-management. Guiding questions are: to what extent are individual co-management networks different among fisher organizations? Can these differences help explain the mixed performance of co-management cases? Unlike Chapter 4, which has a descriptive focus, this chapter explores the explanatory power of social networks.

My working hypothesis is that fisher organizations with more elaborate networks and/or stronger partnerships are more likely to be associated with the perceived success of co-management. Although there is no set recipe for co-management, there are various factors associated with commons or co-management success (Ostrom 1999). Accordingly, social networks are not the only explanation, but I argue that they are one of the likely conditions that affect the functioning of co-management.

The scope of this chapter converges with the social capital approach. Authors have theoretically and empirically emphasized the importance of social capital for the management of natural resources in general (Pretty and Ward 2001; Ballet et al. 2007) and for fisheries co-management in particular (Jentoft et al. 1998; Plummer and FitzGibbon 2006). The concept of social capital refers to the resources that are embedded in the social structure and which are differentially accessed and/or mobilized in purposive actions by social actors (Lin 2001). Therefore, connectedness of actors in networks and groups is fundamental to access those resources. Other authors (e.g., Pretty 2003) have extended the definition to include 1) common rules, norms and sanctions, 2) reciprocity and exchanges, and 3) relations of trust as components of social capital. In this research, I

adopted a definition that integrates the network approach and the value of trust in social relationships as core elements of social capital.

There are three types of social capital: bonding, bridging and linking (Pretty 2003). Bonding social capital is about interpersonal relationships within a group or community and internal cohesiveness. Bridging social capital refers to the relationships among groups or communities at the same level. And linking social capital refers to linkages of people and organizations beyond the community level and to their ability to engage with external agencies either to influence their policies or to access useful resources (Pretty 2003). The three kinds of social capital have been discussed and presented as affecting the governance of small-scale fisheries (Grafton 2005). According to that categorization, my research focused mostly on fishers' linking relationships with external institutions, but includes also among them bridging connections among *caletas*. Because the latter are extremely weak and predominantly conflictual, as discussed in the previous chapter, I have opted not to treat them here as a separate kind of network. Instead I will use the linking social capital concept (i.e., the most encompassing in this case) to refer to relationships of fisher organizations with all the external agencies involved in co-management, including both horizontal and vertical linkages.

In my research, the elected leaders/representatives of 38 fisher organizations (Appendix 2) in two regions of Chile were surveyed to capture a comprehensive description of their organizational environment with respect to co-management. An open-ended roster of 28 actors was used in the questionnaire (see Table 4.1) and included (1) co-managers (e.g., fisheries authorities and fisher organizations), (2) other public and private institutions (e.g., public agencies, consultancies, and businesses), and (3) fisher associations at higher scales (e.g., federations and confederations). Strictly speaking, these co-management actors represent social roles or categories that I previously identified as being involved in the co-management system and not individual entities.

The kind of networks studied consists of *two-mode* or *incidence* networks (Borgatti and Everett 1997; Scott 2000). More specifically, these are fisher organization-by-counterpart matrices in which the values in the cells indicate the existence (or non-existence) of

linkages *between* actors in the different sets (see example in Table 4.2). The study variable was defined as the characteristics of co-management relationships between fisher organizations and other actors involved in the MEABR system. Two dimensions of these relationships were investigated: 1) the valence of relationships, namely whether involved actors are considered by fisher leaders as facilitating or hindering counterparts for the development of co-management<sup>31</sup>; and 2) the strength of facilitating relationships, defined here as levels of trust perceived towards counterparts. Trust level was measured in a 1-to-4<sup>32</sup> Likert scale that was later dichotomized to equate it with the facilitating and hindering indicators.

As a result, four binary (i.e., 1= existing relationship, 0= no relationship) matrices were constructed: facilitating, hindering, trustworthy, and untrustworthy relationships. The operationalization of the study variable and an overall description of obtained data are presented in Table 5.1. The mathematical-based network analysis and interpretation is complemented with other questions of the survey about co-management functioning/performance and qualitative information gathered through participant observation and interviews.

Table 5.1: Dimensions and attributes of observed co-management social relationships

Dimension	Attributes	Observed linkages	Maximum*	Minimum*	Mean	Missing responses
Valence	Facilitating	410	19	4	10.8	-
	Hindering	130	21	0	3.4	-
Strength of facilitating relationships	Trustworthy	333	18	2	9.3	15
	Untrustworthy	62	5	1	2.4	15

<sup>31</sup> In consequence, interviewed fisher leaders could have declared theoretically a minimum of zero and a maximum of 28+n *facilitating* or *hindering* connections.

<sup>32</sup> Trust scale in the survey: 1=No trust at all; 2=Little trust; 3=Enough trust; and 4=A lot of trust.

Legend: \*= maximum and minimum number of linkages observed among fisher organizations.

To achieve the objectives of this chapter I will: 1) develop an index and rank of fisher co-management social networks (as an indicator of social capital); 2) discuss what co-management functioning and performance is and present preliminary indicators of co-management perceived success; 3) crosscheck correlations to explore social capital and networks as independent and dependent variables; and, 4) propose a framework to understand multiple conditions for co-management success and to diagnose strengths and weaknesses of studied fisher organizations.

## **5.2 Co-management networks of the fisher organizations: Measurement of social capital**

Each fisher organization participating in co-management establishes a number of varied relationships with multiple stakeholders. Some of these connections represent channels through which fishers acquire valuable social resources and information that are positive for co-management. Moreover, according to the definition of social capital, when there is trust between actors more fruitful interactions are likely to occur. On the other hand, hindering interactions signify conflicts and obstacles that can jeopardize the functioning of co-management. Hence, the characteristics of individual networks can be expected to determine different conditions for fishers participating in the co-management system. In this section I describe general trends in these networks and develop an indicator of network size and strength to synthesize the differences and similarities among fisher organizations. As in Chapter 4, the exploration will be based on network centrality analysis.

The *degree* is a measure of network centrality that describes the relative prominence of focal points within the network (Freeman 1979; Faust 1997; Hanneman and Riddle 2005). In this case, variation in *degree* indicates which fisher organizations are more connected to sources of resources (and less connected to sources of conflicts) and thus are more actively involved in co-management networks. For two-mode networks, *degree*

refers to each actor's total number of linkages, expressed as a fraction of the maximum number of possible linkages (Borgatti and Everett 1997; Faust 1997). For example, the *degrees* of fisher organizations with respect of facilitating relationships varies more than fourfold, ranging from 0.528, in the case of Dichato, to 0.111, in the case of Arauco, as graphically illustrated in Figure 5.1. Degrees of hindering, trustworthy and untrustworthy relationships also vary significantly (see Table 5.2).

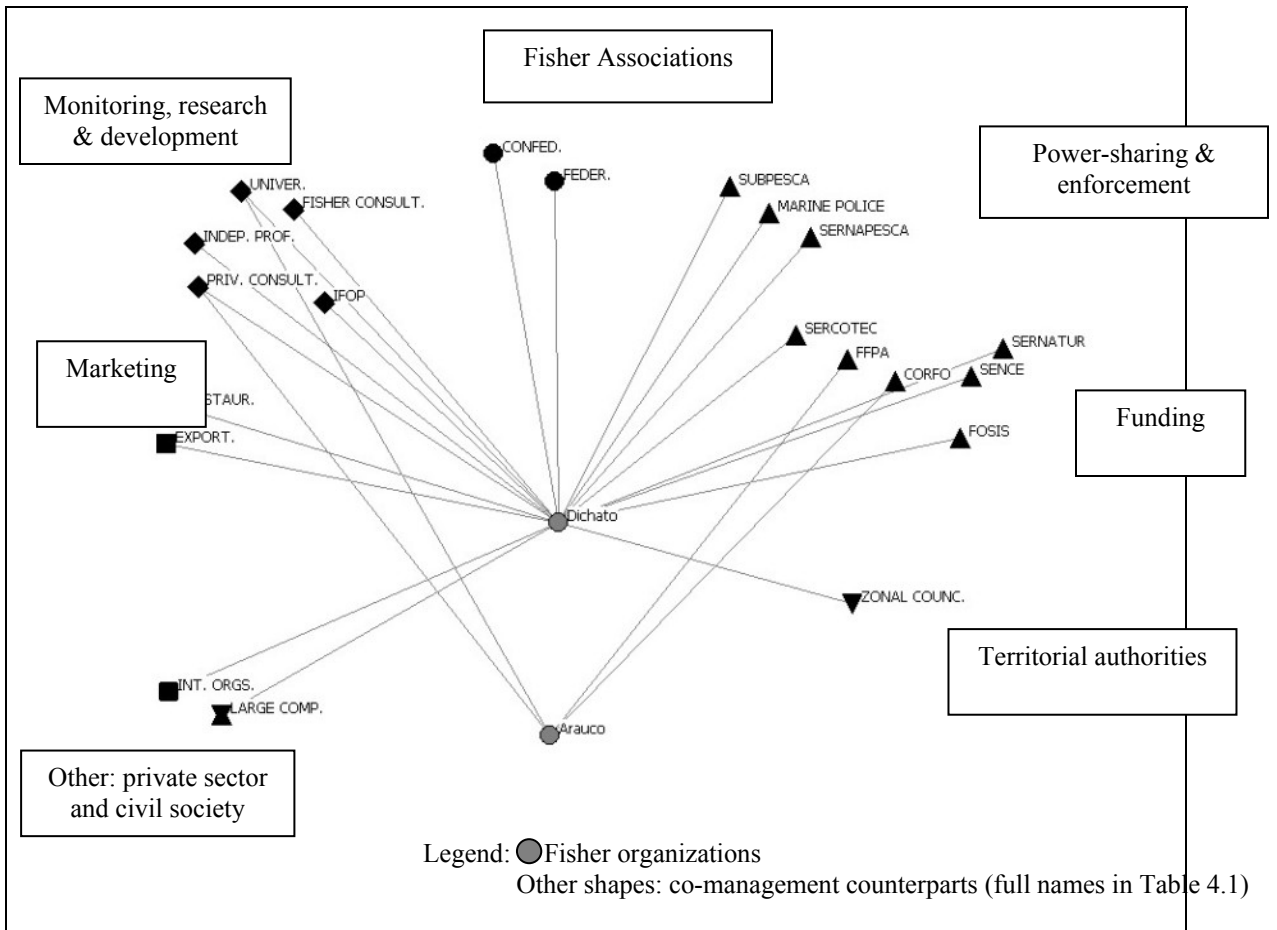


Figure 5.1: Example of two contrasting fisher facilitating networks

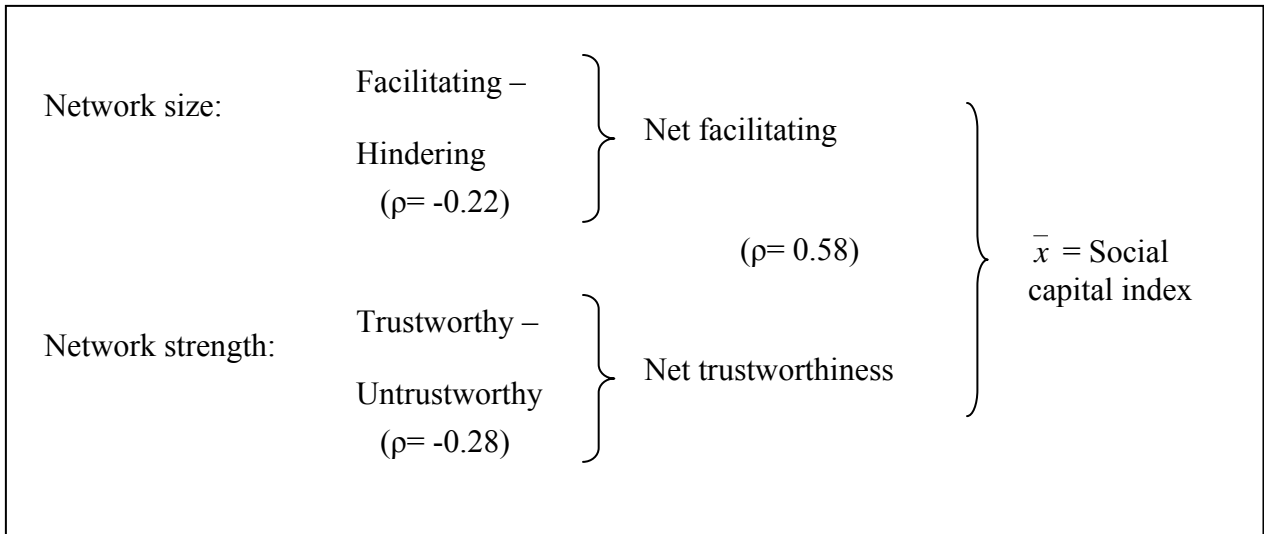


Figure 5.2: Social capital index construction based on two dimensions and four *degree* centrality measurements.

A network measurement, termed here social capital index, is constructed based on empirical data on the four attributes of co-management relationships. The first important feature of fisher social networks is the size, namely the number of linkages that ultimately contribute to the development of co-management. As in the previous chapter, the overall number of facilitating relationships of any given fisher organization equals the difference between facilitating and hindering relationships. The result is what I termed the net facilitating *degree*. Similarly, for the strength of relationships, the net trustworthiness *degree* consists of the difference between trustworthy and untrustworthy relationships. Correlation coefficients ( $\rho$ ) were calculated to test construction validity of net facilitating and net trustworthiness measurements. In both cases, internal opposed components (i.e., measurements that should theoretically be *unrelated* to each other) show negative correlation ( $\rho = -0.22$  and  $\rho = -0.28$ , respectively). This fact suggests discriminant validity of the net facilitating and net trustworthiness constructs.

To integrate both the size and the strength dimensions of networks in one social capital index, the standard average between net facilitating and net trustworthiness *degrees* is computed as presented in Figure 5.2. Convergent validity was tested, showing high and positive correlation ( $\rho = 0.58$ ) between the two similar components (i.e., measurements that should theoretically be *related* to each other). The resulting ranks of fisher



organizations according with the social capital index are presented in Figures 5.3 and 5.4. Social capital can be considered context-dependent and therefore the ranks in the two regions are presented separately.

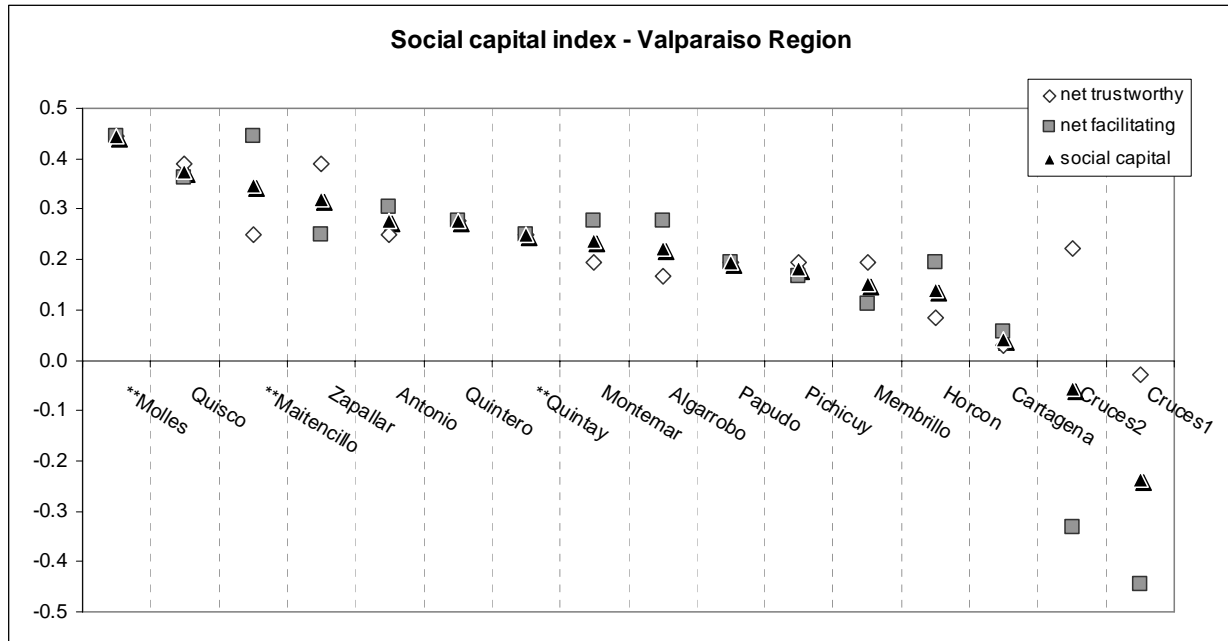


Figure 5.3: Fisher organizations' social capital index in the Valparaiso Region

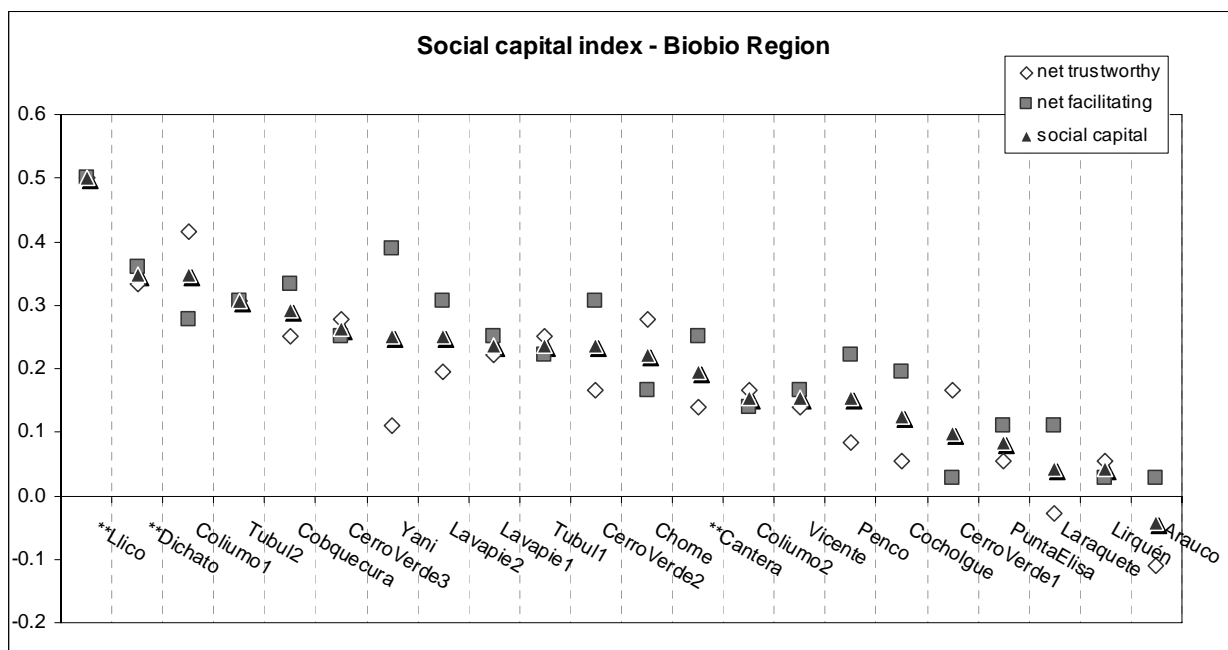


Figure 5.4: Fisher organizations' social capital index in the Bio-bio Region

As expected, in both Figures 5.3 and 5.4 the social capital index offers a more moderate measurement of fisher organizations' network centrality, levelling the cases with dissimilar net facilitating and net trust scores, and those with lower degrees. Table 5.3 presents basic statistics on the composition and distribution of the social capital index and its components in both regions.

Table 5.2: Basic statistics of *degree* centrality distribution among fisher organizations

	(a) Net facilitating		(b) Net trustworthiness		$\bar{x}(a, b) =$ Social capital index	
	Valparaiso	Bio-bio	Valparaiso	Bio-bio	Valparaiso	Bio-bio
Maximum	0.444	0.500	0.444	0.500	0.444	0.500
Minimum	-0.444	0.028	-0.028	-0.111	-0.236	-0.042
Mean	0.177	0.204	0.219	0.183	0.198	0.204
SD <sup>33</sup>	0.245	0.122	0.125	0.142	0.169	0.122

The effects of social networks, expressed in the social capital index, will be tested among other variables that can be considered important in the overall functioning and performance of the Chilean co-management system. This line of inquiry corresponds with Granovetter's (1973) inquiry about how network structures affect organizational performance. As presented in Figure 5.5, the analysis will include prestige, satisfaction, natural capital, and time in co-management. These variables and their indicators are explained as follows.

<sup>33</sup> SD: standard deviation.

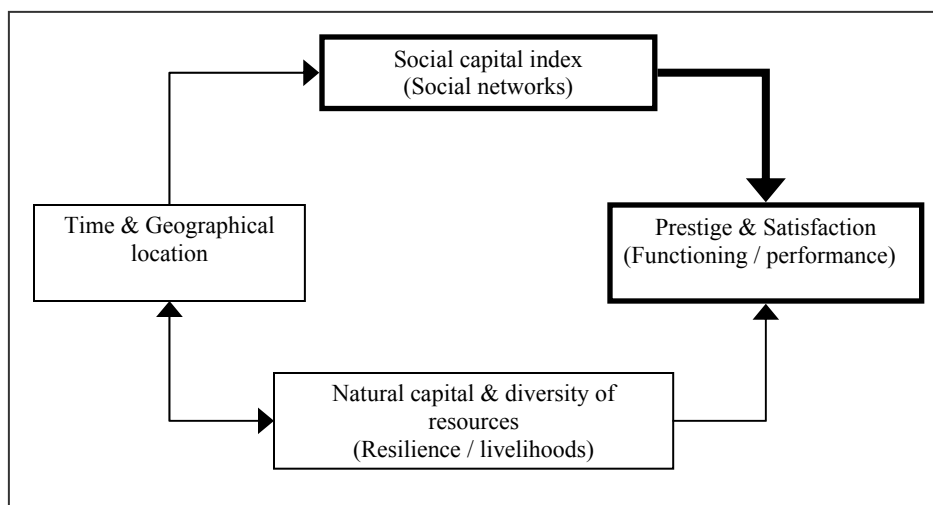


Figure 5.5: Logic for the analysis in Chapter 5

### 5.3 MEABR functioning and performance indicators

The MEABR system has shown a positive evolution in terms of national implementation and overall functioning (Fernandez and Castilla 2005; Castilla and Gelcich 2006; Schumann 2007). However, at the micro level, fisher organizations have had (and are having) manifold experiences. As of December 2008, available data on the status of Management Areas (MAs) in the two studied regions presents multiple and dynamic scenarios. Figure 5.6 shows that from a total of 196 management areas<sup>34</sup> reported by SERNAPESCA<sup>35</sup> that are in various phases of the MEABR formal process only 30% are actively functioning, plus 4% of areas that are being reallocated to a different organization. Twenty-four percent of the areas were renounced<sup>36</sup> by fishers (9%) or are risking being lost due to non-compliance of legal deadlines (16%). Moreover, a large portion of new areas is trying to enter the system (41%). From the latter, 21% are just in the application process and 20% were refused by any of the relevant authorities (but fisher organizations may reapply with a revised proposal).

<sup>34</sup> It is important not to confound areas with organizations. The figure represents the total number of areas or sectors under the MEABR system. Many fisher organizations hold more than one area.

<sup>35</sup> Servicio Nacional de Pesca (Fisheries National Service).

<sup>36</sup> Renouncing refers here to those cases in which fisher organizations submit a request to the State to cancel their use and exploitation rights over a formerly co-managed area.

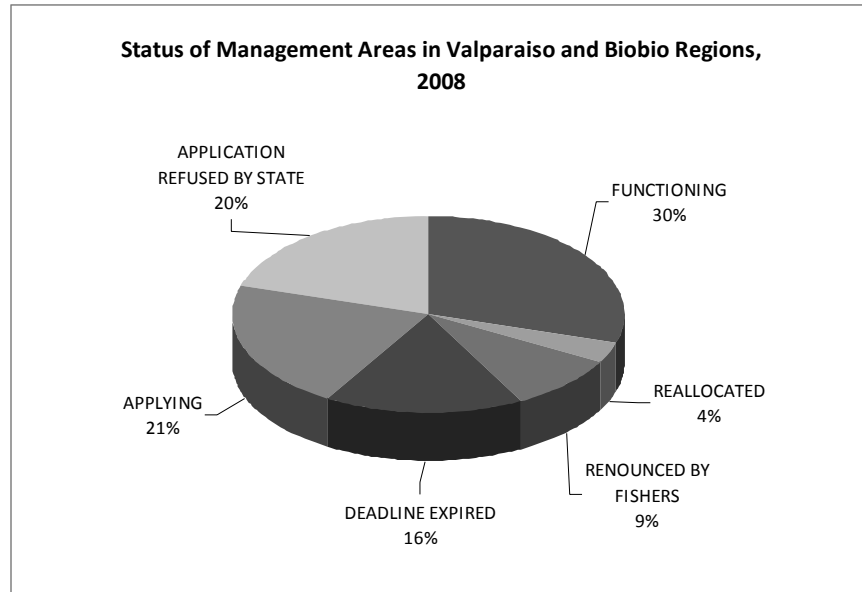


Figure 5.6: Status of Management Areas in studied Regions, December 2008 (Author's elaboration based on SERNAPESCA 2008).

In this context it is valid to ask: *What is a successful fisher organization carrying on co-management? Or what factors determine the success or failure of co-management?* These questions are not only relevant for the areas that are currently functioning but also for the large number of newcomer fishers who are applying for new MAs. My interpretation is that the bottom-line for a successful co-management case is fishers' capacity and keenness of 'staying in the game'. By contrast, those who abandon their areas or do not fulfil the formal requirements are no longer in co-management and thus, represent cases of failure.

Beyond the bottom-line of cases 'in the game' there is a wide range of relatively successful situations. The outcomes or benefits of the MEABR system are multiple and multidimensional. As I suggested in Chapter 1, based on existing literature, a successful co-management case in Chile could be preliminarily defined as having satisfactory economic revenues for the fishers, harmonious social relations within the community and its environment, and as performing sustainable management and exploitation of the resource base. Thus, no single indicator can account for the whole system; economic, social and ecological dimensions need to be integrated. Furthermore, outcomes and

success are not absolute as co-management can face reversals and is always dynamic. A comprehensive evaluation of co-management should include both objective and subjective indicators. A detailed assessment of MEABR outcome and benefits indicators is beyond the reach of this study.

However, based on secondary and primary data, a preliminary approach to co-management success that meets the needs of this study is possible. The aim is to differentiate and rank the various fisher organizations according to common indicators. Three sets of performance and functioning indicators are considered in the following analysis (see Figure 5.5) as indirect indicators of success: 1) Prestige, defined as external perception of co-management performance; 2) Satisfaction, defined as fisher leaders' evaluation of their co-management experience and the MEABR policy; and 3) Natural capital and resource diversity, defined as the state and trend of the ecosystem under management and exploitation.

### ***Prestige***

Prestige is the perception of external stakeholders about which fisher organizations perform better. It is included here as an indirect indicator of co-management success as a consequence of empirical findings. During fieldwork scientists, technicians, policy makers, and fisher leaders frequently mentioned *caletas* that are considered models of co-management. These *caletas* represent ideal examples of how the MEABR system should work and presumably they also drive the arguments that lead to policy changes and programs. Paraphrasing MM, a policy-maker at SBPESCA, these are the “star *caletas*” of the system:

“The best *caletas*? Quintay and Los Molles [in Valparaiso Region]... But the *star caleta* is Punta de Choros, and second Los Vilos [both in Coquimbo Region]. In Punta de Choros, they receive almost \$900 million<sup>37</sup> annually as net income for their harvest. Fishers have a consultancy team, a

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<sup>37</sup> Nine hundred million Chilean pesos are equivalent to some 1,750,000 Canadian dollars.

working team, there's labour division... they're impressive. In (...) Los Vilos, they have a small processing plant, they have a vending store, they have presented small-scale business projects, and everything is based on harvests [from MAs]" (italics are mine).

The above-quoted informant's approach is mostly centred on fisher productivity, adding that these are the "areas that are models in terms of management... the optimum models that you would wish for all MAs in Chile" (MM). The existence of "star *caletas*" is not limited to the Valparaiso and Coquimbo Regions though. Knowledgeable informants in the Bio-bio Region also remarked on several cases as being exemplary. Among the 38 fisher organizations covered in my study, there were six cases that can be classified as "star *caletas*"<sup>38</sup>. In Table 5.3 these six fisher organizations are identified along with the features justifying their inclusion. The prestige variable consists of binary data in which the value 1 represents the quality of being prestigious.

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<sup>38</sup> There are probably other potential "star *caletas*" in the studied regions. But those would be fisher organizations that were not covered in the sample, for example, Isla Santa Maria in the Bio-bio Region.

Table 5.3: The “star *caletas*” (prestigious fisher organizations) in the co-management of two coastal regions

Fisher orgs.	Features	Sources
<i>Valparaiso</i>		
Maitencillo	-Restocking and aquaculture experimentation -Organizational robustness and a wealth of projects funded -Tourism services: e.g., diving school & underwater trail, parking lots and vending store (livelihood diversification) -Fishers trained and involved in MA monitoring team (with university biologists)	GD, Oceanographer RC, Diver RO, Engineer Observation
Los Molles	-High productivity and organizational stability -Equitable distribution of benefits among members -Tourism services: recreational diving project -Stable harvests from MA and good resource stock -Algae exploitation	MM, Policy-maker PL, Anthropologist SG, Biologist KV, Biologist
Quintay	-Aquaculture and experimentation initiatives -Well organized group and a wealth of projects funded -National pioneering case: Influence on, and recognition from, <i>caletas</i> elsewhere	MM, Policy-maker RC, Diver JCC, Biologist
<i>Bio-bio</i>		
Dichato	-High productivity of their MA -Well organized group, independent and good fundraising capacities -Tourism services and preliminary aquaculture project (livelihood diversification) -Pioneers in partnering with private processing companies	HA, FEREP JS, SERNAPESCA Observation
Llico	-Among the most productive MAs -Tourism services: museum and restaurant (livelihood diversification) -Consolidated in productive, social and cultural terms	HA, FEREP CH, SODEPAR JS, SERNAPESCA Observation
Cantera	-Highly productive MA with many target species -Good marketing strategies	HA, FEREP CH, SODEPAR Observation

### *Satisfaction*

Fishers' own satisfaction is an indirect indicator of success. Here, it refers to fisher leaders' perception and evaluation of the overall functioning of their co-management experience. In that sense, it blends social, economic, and ecological factors as assessed by the informants. The measurement of satisfaction, as asked in the survey, includes five components: 1) Pride in the MA; 2) Evaluation of past results obtained from the MA; 3) Evaluation of current results; 4) Future expectations about MA results; and, 5) Evaluation of the MEABR policy as a whole. The results of satisfaction indicators are presented in Table 5.4.

Table 5.4: Fisher satisfaction with co-management

Component	Survey question item	Scale	Mode (Mean)	SD
Pride	"In our organization we are proud of our MA"	4 (Highly agree) to 1 (Highly disagree)	4 (3.3)	1.0
Past results	"How do you regard the results obtained from the MA in the past?"	4 (Very good) to 1 (Very bad)	4 (3.3)	1.1
Current results	"And MA results obtained presently?"	4 (Very good) to 1 (Very bad)	4 (2.9)	0.9
Future expectations	"How do you think MA results will be in the future?"	3 (Improve) to 1 (Decrease)	3 (2.4)	0.9
MEABR evaluation	"What mark would you give (like at school) to the MEABR policy"	7 (Excellent) to 1 (Very poor)	5 (4.6)	1.4

### *Natural capital and resource diversity*

This variable captures the fact that coastal ecosystems are highly variable and vulnerable in terms of species distribution and abundance. In other words, every MA is unique and to some extent its conditions can be expected to naturally limit fisher exploitation capacity. Fishers know that there are areas that are simply better in terms of productivity than others. Thus, the first indicator used here is the number of species targeted within the areas. This indicator reflects resilience potential (i.e., more species offer more alternatives in case of unexpected changes) and opportunities for livelihood sustainability of fishers (i.e., more species, with different lifecycles, allow for more continuous



exploitation). The number of species was obtained from a secondary source (SERNAPESCA 2008). Table 5.5 presents the data of the indicator developed.

Table 5.5: Relevant characteristics of studied fisher organizations and their MAs

	Valparaiso	Bio-bio	Overall (%)
Number of species targeted			
Maximum*	7	10	10
Minimum*	1	1	1
Mean	4.3	3.5	3.9
SD <sup>39</sup>	1.6	2.3	2.0
Trend in TAC			
Increased	4	7	11 (29)
Maintained	4	3	7 (18)
Decreased	6	7	13 (34)
Other <sup>40</sup>	2	5	7 (16)
Years in co-management			
Maximum*	10	9	10
Minimum*	0	0	0
Mean	7.5	6.6	7.0
SD	2.7	2.6	2.7
Geographical location/ isolation (Km) <sup>41</sup>			
Maximum*	121	124	-
Minimum*	0	12	-
Mean	60	53	-
SD	31.8	38.4	35.5

Legend: \*= refers to the range of values observed in the set of fisher organizations studied.

<sup>39</sup> Standard deviation

<sup>40</sup> The category includes those cases that have no TAC yet, only one TAC, and those that did not know.

<sup>41</sup> The indicator expresses the distance from the *caleta* to the regional capital city.

The second natural capital indicator is the trend in the Total Allowable Catch<sup>42</sup> (TAC) of MA's main resource. The TAC indicates the quantity of resources that can be extracted per species each year, based on scientific-based stock assessment of MAs. Thus, the trend in the TAC indicates the evolution of population recovery and also the resulting variation in fishers' income. Data were collected by means of the survey and show that fisher organizations have faced diverse tendencies with respect of co-management harvests. These are illustrated in Table 5.5. It is important to mention that more than a few informants who said that their TAC was maintained added that this is a deliberate consequence of management decisions to conserve resources. That was not the case for any of the decreasing TACs.

### *Time*

Co-management is a process and not an endpoint and therefore it takes time for parties to accommodate to new regulations, to learn how co-management functions and to solve ongoing conflicts (Carlsson and Berkes 2005; Armitage et al. 2007). Empirical studies have indicated that time is among the best predictors of co-management success (Napier et al. 2005; Armitage et al. 2007). In the Chilean case, co-management was gradually implemented in the various administrative regions (Gelcich et al. 2008). The system started in the Valparaiso Region in 1999 and one year later in Bio-bio. Fisher leaders, particularly those who first started in their regions, underline the experience they have had in co-management and emphasize that they were pioneers and the number of harvests under co-management they have had.

The temporal variable is defined here as the number of years since the management and exploitation plan (PMEA) was approved for each organization<sup>43</sup>. Cases included in this study cover mostly the whole age range since co-management policy was established. The oldest MAs were formalized in 1999 and the newest in 2009 (see Table 5.5).

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<sup>42</sup> The TAC consists in a fraction of the total available mature individuals of a species, and is defined according with sustainability and conservation criteria (see Beddington and Rettig 1983; Charles 2001).

<sup>43</sup> In those cases where fisher organizations have more than one MA, the earliest PMEAs were considered; also, for those cases that during data collection were about to receive the first PMEAs approval, year 2009 was considered.

### ***Geographical location***

Fisher *caletas* are scattered along the lengthy Chilean coast. Some are located in highly populated and urban areas, while others are rural and isolated from economic and administrative centres. As found in the field, some leaders in rural areas complained about their isolation and the low access to benefits and better opportunities, whereas others in urban areas highlight the fact that in isolated settings MAs work better as poaching is less likely to occur. In terms of social networks, one may anticipate that geographically isolated fisher organizations will have more difficulties in establishing trustworthy relationships with external agencies than those in the cities. The location here is computed as the distance in kilometres from the *caleta* or village to the regional capital (see table 5.5).

### **5.4 Social networks as the independent variable**

Correlation coefficients were tested between the social capital index and prestige and satisfaction, the independent and dependent variables respectively (see Table 5.6). The overall highest correlations can be observed in the cases of prestige and pride ( $>0.4$ ). In other words, higher scores in the social capital index tend to be positively associated with external perceptions about the better functioning cases and with fisher pride about their MAs. Lower but still medium correlation coefficients ( $>0.3$ ) appear with respect of perceived current results of MAs and the overall evaluation of the MEABR policy. Having larger and stronger social networks (i.e., high social capital index) appears as linked with better evaluations of current results of co-management experiences and with better marks given to the whole co-management system.

Table 5.6: Correlations between the social capital index and prestige, and satisfaction

Relationship	Correlation coefficient $\rho$			Comments
	Valpo.	Bio-bio	Total	
SCI – Prestige	0.44	0.48	0.45	Medium Overall
SCI – Satisfaction				
Pride	0.35	0.48	0.41	Medium Overall
Past results	0.46	0.00	0.24	Medium in Valpo.
Current results	0.46	0.29	0.37	Medium Overall and in Valpo.
Future expectations	0.25	0.09	0.18	Not significant
MEABR evaluation	0.53	0.31	0.35	Medium Overall, High in Valpo.

Legend: SCI= Social capital index; Valpo.= Valparaiso

In the latter two cases, however, there is some difference between figures in the two regions. The correlation between social capital and current results and between social capital and MEABR evaluation is stronger in the Valparaiso Region. Particularly with respect to MEABR evaluation, in Valparaiso the correlation is high (0.53), suggesting that stronger connections in that region are significantly related with higher satisfaction with the co-management policy.

On the other hand, there is medium correlation between the social capital index and the quality of results obtained in the past in the Bio-bio Region (>4.0). Fisher organizations with a higher social capital score tend to be those that obtained better results from co-management in the past. This positive correlation raises the question about the directionality of the relation. Did social capital contribute to those positive past results or did those results drive the construction of a better social network? Co-management policy is relatively young in Chile. In addition, during the early years, the role of actors was unlikely to be stable enough to have concrete positive effects. I tend to subscribe more to the latter interpretation. Nonetheless, this question mark leads to the analysis of social capital as a dependent variable that is presented in the next section.

Finally, it is worthwhile to note the low overall correlation between social capital and expectations about MAs' future results (0.18). Apparently, in both regions, social

networks do not reduce uncertainty of fishers about the ecosystem and its resources (particularly in the face of increasing sources of pollution and weak environmental legislation).

### 5.5 Social networks as the dependent variable

Critics to the social capital framework argue that it leads to a circular logic: groups with high social capital tend to succeed; whereas their high social capital is caused by their own success (Lin 1999). Indeed, social capital can be seen as explaining improved social performance or as resulting from dynamic long-term processes. This critique could also be extended for social networks (Scott 2000; Blau 1982; and Aldrich 1982), and this is so because there are two-way feedbacks. Both social capital and networks can be seen as dependent variables as well as independent variables. If that is the case, what factors lie beneath fisher organizations' social capital and co-management networks? Natural capital, time in co-management, and geographical location of *caletas* as likely triggers or hindrances of higher social relationships of fishers are investigated here. Table 5.7 presents the correlations between the social capital index and those variables.

Table 5.7: Correlations between the social capital index, natural capital, time and geographical location

Relationship	Correlation coefficient $\rho$			Comments
	Valpo.	Bio-bio	Total	
SCI – Natural capital				
Number of species	0.57	0.13	0.28	High in Valpo
Trend in TAC	0.34	0.01	0.17	Medium in Valpo
SCI – Time	-0.01	0.66	0.32	Medium Overall, High in Bio-bio
SCI – Geographical location/ isolation	0.38	0.40	0.37	Mid Overall

Legend: SCI= Social capital index; Valpo.= Valparaiso

The Table shows a sharp contrast between regions in the first three relationships analyzed. In Valparaiso, the highest correlation (0.57) is between the number of species in MAs and the social capital index. This data suggests that fisher organizations in Valparaiso with rights over areas with larger number of species tend to have higher levels of social capital. This result, together with the medium correlation observed before between past results from the MA and current social capital (0.46), may support the argument that in the Valparaiso Region some fisher organizations have built social capital as an adaptive response to protect and to take advantage of their rich resource bases. Lower, but still medium, correlation is observed for the Region between social capital and the trend in the TAC (0.34).

By contrast, in Bio-bio, a high correlation with social capital is observed for the temporal variable (0.66). Fisher organizations with longer time in co-management tend to have higher levels of social capital or more and more trustworthy social relationships with external actors. This is a trend that could have been expected for all cases but is only significant in the case of this region.

However, in both regions the geographical location shows a positive correlation with the social capital index ( $>0.37$ ). Differently than expected, distance and isolation tend to be associated with higher scores in social capital, as measured here. Again, if the measurement is valid, this can be interpreted as signs of adaptive responses to cope with the obstacles of distance and isolation.

## **5.6 Multidimensional conditions for successful co-management**

There is one fact about the co-management system that does not show up clearly in the analysis of correlations among the social capital index and the other variables studied. Co-management does not have a fixed formula (Berkes 2009); rather it relies on varied conditions to be sustained and succeed (Napier et al. 2005). Certainly, conditions do not operate equally for all fisher organizations. There seem to be sets of correlated features or conditions that jointly help explain differentials in co-management performance and

functioning. In that sense, when looking in more detail into the linkages among ranked variables and the particular cases leading the ranks, some groupings of characteristics come to the forefront. I suggest that these concurrent conditions provide the basis for a typology of fisher organizations in accordance with their adaptive strategies and capacities.

Interestingly, the prestigious cases of co-management (i.e., the star *caletas* marked “\*\*\*” in the figures and tables) are among the ones with longer time in the system (see Figure 5.7a). With two exceptions, these cases are also amongst those that possess the most species-diverse MAs (see Figure 5.7b). The exceptions, however, are also meaningful as both Maitencillo and Llico are part of the few identified cases of fishers carrying on innovative restocking and resource enhancements experiments. In Figure 5.7c the tendency of “star *caletas*” on the right side of the chart shows again, this time towards expressing a better overall satisfaction with co-management<sup>44</sup>. The low score of Dichato can be explained based on the interview with its president. Their MA has worked well in terms of harvests, but the large membership results in a very low annual per capita income. That is why they are increasingly involved in tourism and initiating a pioneer partnership with a private company to jointly implement aquaculture.

These prestigious fisher organizations also happen to rank particularly highly in the social capital index within their own regions as can be observed in Figures 5.3 and 5.4. Once again this trend has two thought-provoking exceptions: Quintay and Cantera. Quintay does not have a very large and strong social network, but it is a well-known case of fisher-university partnership that may be replacing (or hindering) a broader and more diverse social interaction. Cantera, on the other hand, as emphasized by my informants (see Table 5.3) and ratified with secondary information (see Figure 5.7b), is the co-management case with the richest MA in terms of diversity of target species. This allows them to exploit the area throughout the year and have a more stable livelihood. Therefore,

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<sup>44</sup> The overall satisfaction score was computed based on the three indicators with higher internal construct correlation: present results of MAs, pride in the MA, and MEABR evaluation. The latter was recoded from the 7 to 1 scale into a 4 to 1 scale to match the others. Then the three indicators were added to obtain a synthetic score (12 to 1).

networking has probably not come to their attention as a priority. And finally, when looking at the trend in the TACs of “star *caletas*” (see Table 5.8) one can see that they have either increased or kept stable, but never decreased.

Table 5.8: Fisher organizations’ trend in the TAC

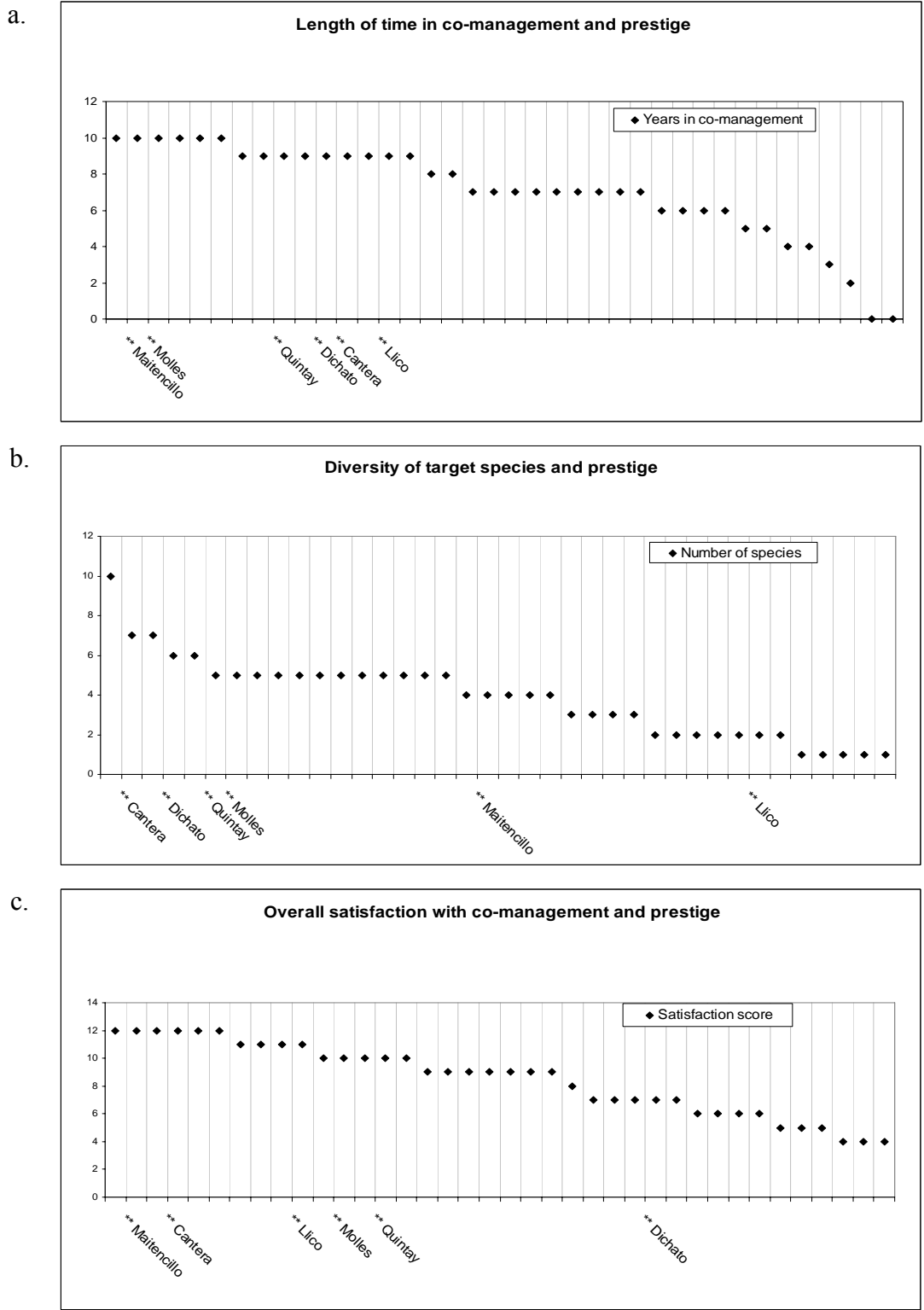
Trend in the TAC <sup>45</sup>		
Increased	Maintained	Decreased
** Maitencillo	** Quintay	Zapallar
** Molles	** Dichato	Papudo
** Cantera	** Llico	Cruces1
Horcon	Algarrobo	Quisco
Cobquecura	Quintero	Cartagena
Cochohgüe	Coliumo1	Antonio
Tubul1	Pichicuy	Arauco
Coliumo2		Lavapie1
Penco		Lavapie2
Lirquén		Yani
Montemar		Chome
		Vicente
		CerroVerde1

Legend: \*\*= “star *caletas*”

<sup>45</sup> The table does not include cases with only one TAC (i.e., Cerro Verde2, Punta Elisa, and Cerro Verde3) and cases with their first TAC in process of being issued (i.e., Cruces2, Laraquete, and Tubul2).



Figures 5.7 a, b, c:



In sum, when examining in depth the six influential co-management cases, available information suggests that the concurrence of time, natural capital, and social networks are likely to be associated with increased or sustained TACs, with fisher satisfaction about co-management, and certainly with prestige. Whereas resource enhancements, the number of members, and single strong linkages may function as intervening factors in the relationship. Figure 5.8 presents the resulting interpretative framework of my findings.

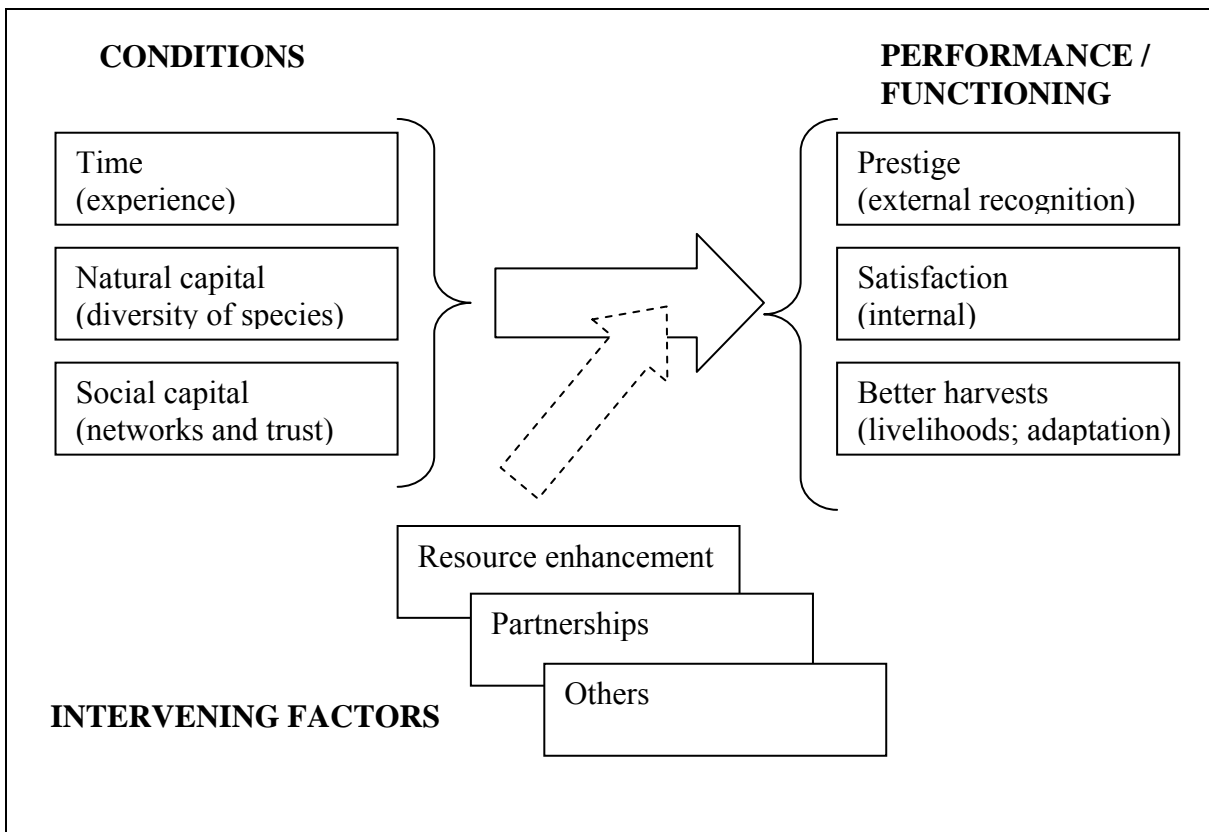


Figure 5.8: Possible concurrent conditions and intervening factors of co-management performance and functioning.

The latter argument, however, draws from the experience of the “star *caletas*” and may not be useful to understand the present conditions of the other organizations. Hence, based on the variables analyzed an overall image of the 38 fisher organizations with respect to identified conditions for better functioning can be obtained. The cases were ranked according to every variable and then each data range was divided into three

groups: High, Medium, and Low as summarized in Table 5.9. Cases are grouped and ranked according with a reference score indicating the sum of dots. The Table shows that:

- The “star *caletas*” hold again the first positions with high scores in all dimensions. *Caleta* El Quisco appears as an interesting case that occupies the first position in the Valparaiso Region, but that was not identified as a prestigious *caleta*.
- The largest number of organizations occupy intermediate positions (i.e., combined scores of 6 and 7).
- For most non-star organizations, time, natural capital and social capital appear as independent factors in relation to each other. For example:
  - Cartagena and Arauco have been involved in co-management for a long time but have not generated high levels of social capital; their natural capital is also low.
  - Cerro Verde 3 and Cobquecura, despite having relatively low-productive MAs, appear as having built high levels of social capital. Cerro Verde 3 has longer experience than Cobquecura.
  - Tubul 2 and San Antonio are relatively new in the system but show high levels of social capital. The former has lower natural capital than the latter.

Table 5.9 allows the identification, for each organization, of the strongest and weakest aspects when compared with the rest. Further, the analysis suggests that the strengths and weaknesses of each fisher organization are highly specific. Taking into account the national scale of the Chilean co-management policy, these findings may well imply that the enhancement of the system depends on differentiated and tailored development strategies. Adaptability would appear then as a key function for the improvement and sustainability of the various participants of the MEABR system.

Table 5.9: The multiple conditions for co-management functioning and performance

	Rank groups (••• = High; •• = Medium; • = Low)				
	Prestige	Time in co- management	Natural capital	Social capital	Combined Score
<i>Valparaiso</i>					
Quisco		•••	•••	•••	9
Molles	**	•••	••	•••	8
Maitencillo	**	•••	••	•••	8
Zapallar		•••	••	•••	8
Quintay	**	•••	••	••	7
Algarrobo		•••	••	••	7
Papudo		•••	••	••	7
Pichicuy		•••	••	••	7
Horcon		•••	••	••	7
Antonio		••	••	•••	7
Quintero		••	••	•••	7
Cartagena		•••	•	••	6
Montemar		••	•	••	5
Membrillo		••	•	••	5
Cruces 1		••	•	•	4
Cruces 2		•	•	•	3
<i>Bio-bio</i>					
Dichato	**	•••	•••	•••	9
Cantera	**	•••	•••	••	8
Llico	**	•••	•	•••	7
Coliumo 1		••	••	•••	7
CerroVerde 3		•••	•	•••	7
Yani		•••	••	••	7
Lavapie 2		•••	••	••	7
Lavapie 1		•••	••	••	7
CerroVerde 2		•••	••	••	7
Chome		•••	••	••	7
Cocholegüe		•••	••	••	7
CerroVerde 1		•••	••	••	7
Cobquecura		••	•	•••	6
Coliumo 2		•••	•	••	6
Vicente		•••	•	••	6
Penco		••	••	••	6
Punta Elisa		•••	•	••	6
Lirquén		•••	•	••	6
Tubul 2		•	•	•••	5
Arauco		•••	•	•	5
Tubul 1		•	•	••	4
Laraquete		•	•	••	4

## 5.7 Discussion and conclusions

Fisher organizations, represented by their formal leaders, have shown differences in size and strength of their co-management social networks. This is regarded here as different levels of linking social capital of benthic co-managers. If co-management is essentially relational, as suggested by Carlsson and Berkes (2005), then the quality of fisher relationships would have something to do with the functioning and performance of co-management. A social capital index integrating size and strength of co-management relationships was elaborated and tested for its correlation with satisfaction and prestige measurements. These represent here indicators of perceived success of co-management.

Significant correlations were found for the overall set of cases between the index and external prestige of fisher co-managers, and with fishers' pride in their MA. In addition, social capital showed overall middle correlation with fisher evaluations of current results of co-management and with their judgment about the national MEABR policy. However, remarkable differences between regions indicate that the influence of networks and social capital is relative. Context-dependent factors and the history of co-management implementation need to be taken into account for a more comprehensive understanding.

Likely explanations for differential social capital scores among fisher organizations were also explored. Social capital and networks do affect performance but they are results of broader processes as well. An overall positive correlation was found between the distance of *caletas* from the closest urban centre and social capital. Therefore, networking can be seen as an adaptive strategy of isolated organizations to gain access to valuable social resources and information. Other possible factors explaining social capital show dissimilar influence in each region. A larger number of species in Valparaiso and time in co-management in Bio-bio appear as strong positive indicators. Behind both cases though one could interpret that higher current social capital has resulted in response to, or in concurrence with, richer resource bases. Fishing grounds with more valuable species tend to be also the first that were established as MA ( $\rho = 0.46$ ).

Although correlations are not robust enough to establish definitive explanations, the analysis allows a preliminary conclusion. First, social networks are a relevant factor that is associated with perceived success of co-management. Second, those networks are actively established by fishers in time to cope with difficulties or to take advantage of opportunities. Small-scale fishers in Chile are mostly part of the poorest rural and urban social groups. Poor people commonly face the risk of being excluded and marginalized from the centres where key decisions are made affecting their welfare and livelihoods (World Bank 2000). Linking social capital, as conceptualized here, consists of the vertical connections between poor people and people in positions of influence in formal organizations (e.g., banks, government ministries, and the police). In this sense, social capital is a key asset of communities that helps reduce the gap between people and the encompassing society.

Social capital and networks are certainly not the only predictors of co-management success. There are multiple conditions that can lead to better functioning and performance of MAs, and probably also that help prevent particular co-management cases from failure. In section 5.5 a cluster of conditions was identified, following the features and stories of six cases commonly regarded as successful and exemplar. These cases have in common high levels of social capital, species rich MAs, and longer experiences in co-management. Besides being prestigious, they also score highly in terms of internal satisfaction with the overall results of their MAs and the underlying policy. However, as illustrated with the exceptions to the previously presented trend, models or recipes for co-management are unlikely to work. Even “star *caletas*” have stronger and weaker facets. In terms of the resilience and sustainability of the fisheries though, the goal would be for organizations to be able to adapt, enhancing their strengths and minimizing their weaknesses. Studied cases were clustered according with their overall strengths, factoring time in co-management, natural capital and social capital. As time is the only absolutely independent variable, a typology of fisher co-managers should consider natural and social capitals as structuring axes. The policy-implications of these findings are manifold.

## Chapter 6: Conclusions and policy implications

This final chapter reflects upon the methodological, theoretical, and practical implications of main research findings. First, the contributions of the study to Social Networks Analysis (SNA) are addressed. Second, the insights to the adaptive co-management and fisheries governance literature are discussed. Third, a set of policy-relevant implications for the Chilean fisheries coastal co-management policy are presented. In each section, potential future research questions are also outlined.

### 6.1 Contribution to social network methods

A *two-mode* network centrality analysis underlies the design and development of the research. It is the opinion of the author that the contribution of this study to that particular subset of methods in SNA is narrow. As announced in Chapter 5 (footnote No. 21), due to the nature of most of the co-management counterparts (i.e., the second set of actors) the implementation of additional analyses – commonly used with *affiliation* networks (e.g., equivalence analysis) – was limited. With few exceptions, most of the actors involved in co-management as counterparts do not play a clear linking role for fisher organizations. Fisher organizations hardly interact among each other as a consequence of interacting to state institutions, traders, or technical assistants.

Most of the interactions between fisher organizations and counterparts represent occasional and specific dyadic relationships; hence, the linking function (in the context of *affiliation* networks; see Faust 1997) is potential and not factual. For the same reason, the use of other centrality measures (e.g., *betweenness* and *closeness*) was also considered inappropriate. The data set was conceived as a *two-mode* type of network and to remain as such (Borgatti and Everett 1997). In a nutshell, measurements and analytical operations applied were relatively simple but appropriate to the purpose of the study and the researchers' understanding of the study setting.

However, the exceptions mentioned above highlight possible future research questions and designs. The relationships between fisher organizations and regional federations and national confederations do satisfy the linking function of *affiliation* networks. Federations and confederations represent actual umbrella and bridging organizations for the small-scale fishery sector, as discussed in Chapter 4. They were included in this study as generic categories, but in fact multiple federations in each region exist. At the same time, local organizations and/or federations are members of one of the two national confederations (i.e., CONAPACH and CONFEPACH). Thus, two general structures of representation or affiliation exist. The leaders of both subsets expressed very different visions about the identity and development of the artisanal sector. Therefore it could be hypothesized that their internal and external networks would also differ. A more detailed examination of these two different *affiliation* networks could be pursued to test and compare, for instance, internal cohesion among their members, or the disposition or rejection to interactions with certain competing sectors (e.g., large industries).

With regards to the collection and processing of information and the use of network tools, this research represents an original network analysis case. First, adaptive mixed methods were used to gather data from the field, integrating qualitative and quantitative information along the research process. Second, a network formal measurement (e.g., *degree*) was used as the basis to the construction of specific indicators (e.g., net facilitating *degree*, and a social capital index) to account for and integrate particular characteristics of the social system studied (e.g., conflict and collaboration, trust and mistrust). Finally, the study also employs in Chapter 5 a fair amount of secondary information in the creation of variables (e.g., number of species, years in co-management) to correlate the core index elaborated (e.g., social capital index). In sum, the research has several innovative and creative methodological and analytical components.



## 6.2 Social networks, adaptive co-management, and fisheries governance

The findings presented in Chapter 4 show an empirically-based image of co-management as a complex governance network (Carlsson and Berkes 2005). Drawing on fisher leaders' descriptions of their organizational relationships with external actors involved in co-management, the approach allowed to: 1) map the breadth of actors involved in co-management and the complex web of relationships that underpin co-management; 2) identify the more central and emerging counterparts that facilitate co-management, and the players that represent hindrances and conflicts to its development; and 3) cluster the actors according to the multiple functions of co-management and to qualitatively explore the dynamics and the drivers of change in each functional network. Also, the description provided a basis for the discussion on the strengths and weaknesses of the governance system. The chapter represents a contribution towards a more sophisticated stakeholder analysis framework, a gap identified by Kooiman and co-authors (2005).

Theoretical implications from the approach in Chapter 4 include first the provision of evidence supporting and expanding the notion of co-management as a **complex relational institution**. With this respect, it is clear that the case of co-management studied here goes far beyond the “two to tango” metaphor (Pomeroy and Berkes 1997) and the tripartite relationship (Schumann 2010). Even though the state plays a fundamental role together with the communities of resource users, there are plenty of other emerging players intervening in the real-life process of co-management. These include various kinds of technical assistants and knowledge providers, fisher umbrella and bridging organizations, actors in the market, private partners, and territorial authorities. This multiple collection of actors with distinct interests over ecosystems, natural resources, and fishing communities converge in the development of the co-management project.

Second, the study underlined the fact that co-management, as a form of governance, appears as a **dynamic equilibrium** between opposing forces: facilitation or collaboration and hindrance or conflict (also trust and mistrust in Chapter 5). While the former is expressed for example as devolution of power, knowledge transfer, political

representation, and revenue or livelihoods, the latter includes lack of enforcement and support, poaching, and environmental threats. Mostly, these forces involve dissimilar actors and asymmetric power relationships, where fishers occupy the most disadvantageous place – when compared with the state, private industry, and traders and exporters. But, the research revealed also horizontal disputes among fisher organizations with similar positions of power at the local level. Indeed, co-management has a mixed relationship with social conflict and power imbalances: it can be a solution for ongoing conflicts, it can change the focus of conflicts, or it can become a trigger of conflict in itself.

The MEABR system can be considered a successful institutional response to a pre-existing conflict and crisis (in the late 1980s and early 1990s). Co-management, and the overall fisheries policy change, transformed the nature of earlier conflicts, from a the-law-of-the-jungle kind of scenario to the institutionalization of continuing tensions. For example, at present, overexploitation of resources and uncontrolled migration is not part of the discussion, and the conflict between users and the state is mostly under control. But surveillance and enforcement of rules by users themselves, environmental and resources health, investment in and productivity of MAs, and access to markets are among the new challenges and drivers.

Third, the approach pursued and the findings obtained in Chapter 4 push forward the notion of co-management as a **multifunctional resource management system**. By expanding the scope to the whole fish-chain (see Kooiman et al. 2005) a number of functions that are commonly overlooked came to the forefront. Indeed, co-management is much more than a legal contract and a hierarchical structure of governance. As a complex system, co-management is a process that is legally enabled but involves a number of horizontal and vertical linkages that channel varied social resources. These include knowledge and experimentation, investment and infrastructure, and certainly also commodities and returns. In an increasingly market-oriented world fishery the integration of local producers into more just and transparent market-chains is a fundamental matter of justice and equity.

Every functional co-management network was described as having its own dynamics and factors driving changes. Whereas some are highly state-dependent and fixed, others depend more on fishers' networking and self-organization capacities, bargaining, or contingency, and offer more flexibility in terms of its participants. In addition, problems and challenges for the functioning of co-management emerge from the interplay between different functional networks. For example: bureaucratic processing of reports and permits may affect selling opportunities; limited power-devolution and autonomy can hamper experimental and enhancement initiatives; and lack of horizontal collaboration and fragmentation of associations are likely to reduce artisanal fisher sector lobbying capacity and delay policy modifications and adaptation.

Chapter 5 presents a complementary facet of the same phenomenon. Whereas the focus of Chapter 4 was on the overall structure of co-management as source of opportunities and oppositions – revealing likely general strengths and weaknesses of the system as a whole – here the attention is placed at how those sources are differentially reached by each fisher organization and the effects on co-management performance. The analysis suggested that those involved in individual co-management experiences do not approach collaboration and conflict relationships equally. Besides, the building of trustworthy connections is also different in each case. These differences influence fishers' satisfaction with co-management and stakeholders' perceptions about successful cases.

Social networks analyzed in this research, and measured as linking social capital (Pretty 2003), are valuable for fisher organizations. Connections with agents and institutions at different levels can make a difference in terms of the well functioning of co-management. Moreover, as pointed out by Grafton (2005), linking social capital is also related with good governance of small-scale fisheries. Conflict resolution, flexibility to change, and management options with uncertainty are some of the governance aspects that are enhanced by wide and trustworthy relationships. In Grafton's words:

Better fisheries outcomes, at lower overall management cost, require explicit consideration of social capital and social networks within and across

fishery stakeholders. It also demands a redirection in priorities and funding away from 'top-down' fisheries management towards 'co-management' where fishers have both rights and responsibilities to be effective partners in ensuring sustainable fisheries (Grafton 2005, p.764).

But social capital is a necessary but not sufficient condition for ensuring co-management success. Natural capital and the length of experience with co-management, and other intervening conditions, such as size of the membership and strong two-party partnerships, may also maximize or reduce outcomes.

### **6.3 Governance and resilience of co-management in Chile**

There are some implications of this research for benthic coastal co-management in the artisanal fisheries in Chile. I will synthesize these by trying to respond to two key interrelated questions. The first is about the governance of the system and the second is about resilience. Together they attempt to address, from the perspective of this study, the issue of the sustainability of Chilean co-management.

*Who and what is driving the MEABR system?*

It is implicitly assumed in this research that co-management is primarily driven by fishers through their organizations. Without them, there is no co-management and no fishery. Having said that, the network centrality analysis presented then the State and its multiple agencies as concentrating the major part of the relationships that facilitate the functioning of co-management. By having more connectivity, the State plays a core role in the system and has the greatest influence on the rest of the actors. This assertion is supported by the functions that are exclusive of the public sector: temporary allocation of rights and devolution of power, policy enforcement and control, and funding. Thereby the fisheries authorities determine who the formal players of co-management should be, and what they can do within the MAs and with the resources. The State specifies a fairly detailed framework on the co-management arrangement in the MEABR system, and thus

“control” and “careful development” are the State’s mottos in co-management. However, it is not entirely a top-down system and other relationships exist.

Fisher associations at the regional and national levels also play a fundamental role. They channel the voice of local fisher organizations and participate in policy-making and changing. Confederations and federations were involved in the early demand for a management solution for the benthic crisis, and in the formulation and implementation of current co-management framework. Although the driver in this case is mostly political, some of these associations have intervened in other dimensions, crating technical teams to support co-management in the field. The positive and strong regard of these actors by fisher leaders raises the question as to whether they could formally handle more specific issues. In particular, those issues in which conflicts and rivalry exist among local organizations hamper solutions. For example, federations could coordinate and implement initiatives such as poaching and theft reduction programs, enforcement and penalty mechanisms, and regional-scale resources stock monitoring. But they cannot do this, unless power is devolved in a way that enables them to play such a role.

Actors bringing in technical and scientific knowledge are also among the principal drivers of the system. However, there are pressures coming from the users for a revised involvement of these actors, and for more fisher participation. Fishers and divers realize that the basic work of private consultant teams is “counting *locos*” (or whatever other species) and processing that information with their computers. They foresee that they could do that job on their own, cut out the contractor, and considerably reduce their operational costs, as suggested by Schumann (2010). What they are less capable of performing by themselves is generating applied knowledge and technology to carry on resource enhancement projects, such as restocking and aquaculture.

In light of these fisher demands, there are substantial differences among technical institutions but many authors have not recognized these differences (Schumann 2007, 2010). *Independent* biologists, in Schumann’s terms, are in fact independent from fishers and from the State, but they are not free from their own interests and limitations. Most of

private consultancies have their own agenda, and may lack the commitment and capacity to satisfy those functions. This is not surprising considering that their involvement responds to an economic rationale of a small enterprise (they do what they are paid for). However, my results are not in support of Schumann's conclusion. My findings suggest that fishers expect more and enhanced participation of universities in the development of applied research and experimentation to improve the productivity of MAs. In the case of universities, however, basic science research interests may also conflict with productivity objectives. In sum, a continuing challenge to be addressed is the alignment among three kinds of objectives (see Meltzoff et al. 2002): fishers' production related objectives, government's conservation objectives, and scientific objectives for basic research.

Undoubtedly, co-management reversed overexploitation, and resources have recovered since 1998 and are now rationally exploited (Castilla and Defeo 2001). But a persistent driver in the system, in my opinion, is the fact the "basic recipe of MAs"<sup>46</sup> and the MAs as a single activity are insufficient to sustain fisher livelihoods. As a consequence, growing pressures exist for productivity enhancement of MAs. This goal is seen by fishers and other actors as inevitably associated with higher autonomy of direct users. Emerging actors and relationships appear in response to these pressures. In addition to the lobby of fisher associations and the greater involvement of universities, the private sector is also showing early signals of becoming a more important actor. The law allows the implementation of aquaculture in up to 40 % of the area in each MA<sup>47</sup>. Because the investment required is far beyond fishers' means, some organizations are beginning to partner with large companies to explore further this opportunity.

In MEABR's 12 years of existence, an impressive architecture of relationships linking fisher organizations to the public, social, and economic systems has been built around the system. This extensive network goes far beyond the original two-party relationship between the government and fishers to halt overfishing and to ensure the survival of the

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<sup>46</sup> The "basic recipe of MAs" is an expression coined by CH (see Table 3.4) to refer to the carrying of the area, the observation of size and biological closures, and to respect the quota.

<sup>47</sup> The figure represents a modification introduced at the time of the writing of this document. Originally, only 20% of each area was permitted for aquaculture.

fishery. This level of embeddedness of co-management networks in other social and policy networks poses the question of whether the right time has come for a more flexible approach to MEABR administration. Responding to some of the drivers highlighted above, this would imply opening up the system for more actors, devolving more power to users, and fostering more locally-based initiatives.

Supported by the evidence provided in this study, my impression is that flexibility would be highly positive for the system. But, at the same time, it requires well-thought out, gradual, and adaptive implementation. This is so, first, because of the various latent threats to co-management that were identified in this study, such as poaching and water pollution. The existence of opposing forces and power asymmetries demands further development of complementary protective institutions to ensure the continuity of co-management. Transparent conflict prevention, resolution, and compensation mechanisms (formal and semi-formal, depending on the severity of events) among fisher organizations and between these and other actors may serve the purpose. Second, a gradual approach is needed because not every fisher organization has the capacity and support for more autonomous management of resources. This aspect is addressed under the next question.

*How to make the system more flexible, adaptive and resilient?*

Making the system more flexible should not be a one-step change. Instead, a gradual and adaptive process seems to be appropriate. Some *caletas* or organizations are more prepared for that, as they have stronger bases to respond to unexpected events and to innovate: more and more diverse resources, healthy ecosystems, and more and more trustworthy connections to actors in the state, the market, the academic sector and their own fisher associations. The analysis presented in Chapter 5 provides the basis for a typology of fisher organizations involved in co-management that captures the diverse stages where they are currently and their relative adaptive capacity. Hypothetically, fisher organizations range between those with high or rich social and natural capitals (quadrant I in Figure 6.1) and those with low or poor social and natural capitals (quadrant IV); and in the middle, two cases with dissimilar combinations of both assets appear (quadrants II

and III). Every quadrant can be associated with likely strategies or emphases according to the specific development needs of fisher organizations.

In the proposed scenario for increased flexibility, the main priority would be to elevate fisher co-managers out of quadrant IV into quadrant II, or from quadrant IV to quadrant III. This can be done either by increasing and strengthening fisher networks or by enhancing the resource base (where possible), or ultimately by diversifying their livelihoods. Capacity building and organizational development instances would help to overcome likely internal conflicts and discontent. Those organizations situated in quadrant III would require special attention in the improvement of their MAs and the creation of value added to existing resources, taking advantage of their good social connections. Livelihood diversification can complement these initiatives when interventions within the MAs are less feasible or if results are ineffective.

		Social Capital	
		High / rich	Low / poor
Natural capital	High / rich	<p><b>I.</b></p> <p>Obtain support from government to experiment and exercise autonomy</p> <p>Act as leaders for others and build horizontal linkages</p>	<p><b>II.</b></p> <p>Social &amp; technical capacity building</p> <p>Build horizontal linkages</p> <p>Experimentation &amp; aquaculture</p>
	Low / poor	<p><b>III.</b></p> <p>Resource enhancement initiatives</p> <p>Livelihood diversification</p> <p>Capacity building in marketing</p>	<p><b>IV.</b></p> <p>Social and technical capacity building</p> <p>Internal conflict resolution</p> <p>Livelihood diversification</p> <p>Build vertical &amp; horizontal linkages</p>

Figure 6.1: Typology of fisher organizations and some possible strategies



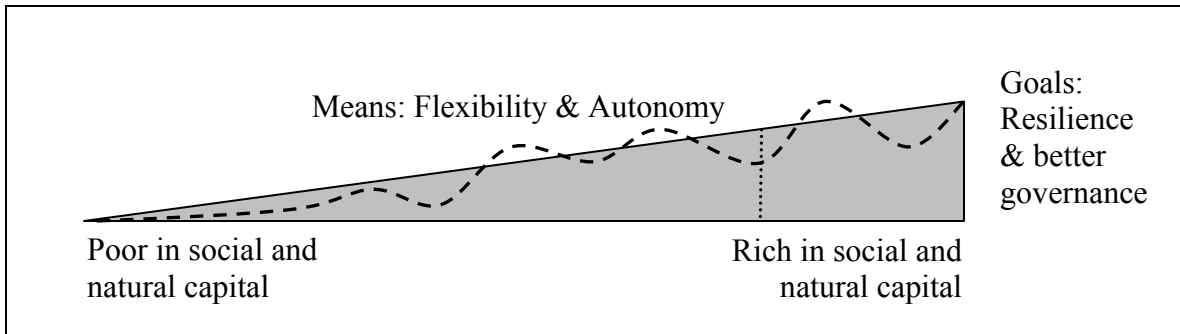


Figure 6.2: The potentials for adaptive co-management of combined social and natural capitals

The way out of quadrant II would certainly require improvements of fishers’ connections, building social capacity and fostering learning from, and collaboration with, other similar and more advanced fisher organizations. Pilot experimentation and aquaculture initiatives with external support and follow-up would provide fertile ground for trust and self-confidence building. Finally, fisher organizations that are in quadrant I are likely the ones that can act as the “engine” for further MEABR adaptation. However, to be able to experiment, these organizations would require extended permits to manage and experiment in their own areas. They would need special support from the government as well, to disseminate their learning (success or failure), and to assist other organizations in the adaptive process. Learning and experimentation are the basis of adaptive co-management, and fishers with long experience in co-management, who have recovered and increased their resources, and who have knitted ample and trustworthy co-management networks are the ones best prepared for taking the lead. Current and prospective “*star caletas*” would provide feedback to be monitored and incorporated in the formal policy, and knowledge to be systematized and transferred to others.

Figure 6.2 summarizes the policy implications of my findings. To achieve the goal of increased resilience and better governance, we need a way to transform organizations that are relatively poor in social and natural capital, into organizations that are relatively rich. The means to do this are greater flexibility to experiment and innovate and greater autonomy to carry out such experimentation independent of top-down government management. The “engines” for such innovation in the MEABR system are those

organizations which are already rich in social and natural capital. Nonetheless, social and natural enhancement processes are unlikely to be straightforward and uniform in progression. Rather, such processes can be expected to experience ups and downs with success and failure (see dashed curve in the figure). Furthermore, some fisher organizations may end up facing their own limits in term of natural and/or social capitals (see dotted line in the figure).

A step-wise flexibility with respect to technical assistance and an increased participation of fishers and divers might be a positive strategy. Such an approach would gradually reduce their dependence on external actors. Reducing the amount of money spent on resource inventory may allow fishers to invest more in services in other areas, such as marketing, processing, and infrastructure.

The assessment of horizontal relationships among fisher organizations presented in this research deserves a special reflection. Horizontal relationships in the MEABR system were identified as being in general weak. In other words, bridging social capital among fisher groups is particularly low. With the development of the MEABR system, poaching between adjacent groups became a problem. Illegal harvesting turned from being a problem between the contraveners and the state, to be a matter between the thieves and the right-holders of MAs. As a consequence, even the most basic information exchange between different organizations – for example about the abundance or diversity of resources within MAs – becomes a risk factor for them.

The lack of cooperation and horizontal relationships is a problem in the MEABR system. Grafton (2005), Bodin and Crona (2008), and Ramirez-Sanchez and Pinkerton (2009) have stressed the importance of bridging social capital for the governance and resilience of small-scale fisheries. These inter-fisher networks transmit and enable learning processes, knowledge transfer, and may increase rule observation. Accordingly, there are grounds for suggesting that the low bridging social capital situation observed in Chile is an impediment to system adaptation and improvement.

What options exist to change this condition and to foster more horizontal collaboration? There is little evidence for asserting that fishers and divers in Chile are intrinsically selfish and individualistic profit-seekers. An evidence of this might well be the massive organization process triggered after the FAL (1992) (Payne and Castilla 1994; Castilla and Gelcich 2006). This phenomenon responded in part to pre-existing informal self-organization (Castilla and Gelcich 2006) and in part to the definition of policy incentives. Organizations became the “landlords” of MAs, encouraging fishers to associate at the local level; any chance for formal management institutions at higher scales were indirectly eliminated. As expressed by several informants (e.g., RO), local organizations became co-management *fiefs*.

The question remains whether formal power devolution to the provincial or regional levels of organization would promote higher coordination within the sector, and provide overall synergy for co-management. Certainly, MAs are arbitrary enclosures of multiple and broader ecosystems. Although benthic resources are not highly mobile, large-scale ecosystem processes may affect marine populations and local productivity of specific areas. The idea of framing the management of individual areas within a broader seascape planning based on ecological knowledge has been already explored (UCN 2008). This view would imply that fishers already know their success depends on the success of their neighbours. Therefore, the effects of poaching would affect the areas used by the thieves themselves. If co-management policy could incorporate measures along this line of thought, eventually more effective social controls would develop among users.

The Chilean MEABR system has been considered a model for fisheries elsewhere<sup>48</sup>. Certainly, the experience in Chile is innovative, successful so far, and also ambitious (it is national in scale). The functioning of Chilean co-management highlights one aspect I would like to stress here that might be considered by policy-makers in other countries. The design, implementation, and takeoff of the system have been possible to great extent because of the legitimacy and well-functioning of the State and the rule of law. However,

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<sup>48</sup> I had the chance to talk to a South African scholar at the MARE 2009 Conference, who was organizing a workshop with Chilean colleagues to learn from the MEABR system.

it can be improved further through increased flexibility and power devolution to fishers. It has been extensively argued that recipes do not exist for co-management, but there are certainly some ingredients that can make the difference (Berkes 2007b; Ostrom 2007).

On the other hand, the evolution of co-management in Chile is also interpreted as following a free-market approach in which government does not intervene much. This fact may bring strengths and weaknesses for its future. International markets value Chilean benthic resources more than the national markets. But in the period prior to 1991, the international demand caused the stock collapse under an open-access regime. The recovery of the Chilean supply of *loco* and other benthic resources under co-management after 1991 has caused the opposite problem: a reduction in international market prices. Fishers complain that their costs steadily increase, while the revenues only decrease. In the meantime, one of the problems that has not been solved is the black market (see Gonzalez et al. 2006). Illegal commercialization of shellfish and/or non-legal informal trade is one of the remaining problems that jeopardize the maturing of the system. A lack of legal local and national markets mostly for *loco* is of concern. Most of the household consumption of *loco*, as observed by the researcher, is based on illegal harvest and trade, reminiscent of the time of the total ban, pre 1991. There is a need to organize local and national markets where people can buy legally harvested *loco*, as this may eliminate much of the illegal trade.

The MEABR system is a web of relations. It is a form of fisheries governance based on complex social networks (Carlsson and Sandström 2008). As suggested by Natcher and co-authors (2005), co-management is more about managing relationships than resources. Ultimately, co-management and co-managers do not exist on their own; rather they *become* in reference to others. If those *others* are not there, or they are there for opposing purposes, the foundations of co-management weaken. This is the main argument brought forward in this research. Thus, the more co-management actors are aligned with comprehensive visions of learning and adaptation, the more likely the Chilean system is to be on the right path to sustainability.

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## Appendix 1: Linking objectives, research questions and methods

Objectives	Research questions	Main Methods
1. To identify key actors and relationships of Chile's fisheries co-management system	<ul style="list-style-type: none"> <li>• Who are its members? What levels/scales can be identified?</li> <li>• What relevant resources and information do they channel?</li> <li>• What obstacles exist?</li> </ul>	<ul style="list-style-type: none"> <li>• Stakeholder analysis</li> <li>• Interviews</li> <li>• Focus group/workshop</li> <li>• Questionnaire</li> <li>• Secondary information</li> </ul>
2. To analyze the relevant governance networks of the system.	<ul style="list-style-type: none"> <li>• Which linkages provide the co-m system with key resources and functions? Are those connections considered in the formal policy structure? How strong or healthy is the co-management arrangement?</li> <li>• To what extent is the formal structure of the co-m institution established by public policy integrated with other relevant formal and informal networks of which the fishers are part?</li> </ul>	<ul style="list-style-type: none"> <li>• Questionnaire</li> <li>• Interviews</li> <li>• Social Network Analysis</li> </ul>
3. To explore the role of social networks in the functioning of coastal benthic co-management.	<ul style="list-style-type: none"> <li>• What role does fishers networking play in filling the gaps, contesting and challenging the formal structure of the policy?</li> <li>• What are the social and ecological networks that sustain the co-m system?</li> <li>• What structural and dynamic conditions of these networks can enhance adaptive capacities of co-m systems?</li> <li>• What are the challenges?</li> </ul>	<ul style="list-style-type: none"> <li>• Social Network Analysis</li> <li>• Questionnaire</li> <li>• Interviews</li> <li>• Secondary information</li> </ul>

## Appendix 2: Participating small-scale fisher organizations in two coastal regions

Label	Full name
<i>Valparaiso</i>	
Molles	STI de Buzos y Pescadores de Caleta Los Molles
Pichicuy	STI, Buzos y Pescadores de Caleta Pichicuy
Papudo	STI de Pescadores Caleta Papudo
Zapallar	STI Pescadores Caleta Zapallar
Maitencillo	Asociación Gremial de Pescadores Artesanales de La Caleta Maitencillo
Horcon	Sindicato Pescadores Artes Buzos Mariscadores y Ramos Similares de Caleta Horcón
Quintero	Sindicato de Pescadores Artesanales Independientes Embarcadero de Quintero
Montemar	Sindicato Independiente del Buceo y la Pesca Artesanal de Caleta Montemar
Membrillo	STI Pescadores Caleta El Membrillo
Quintay	STI Pescadores Artesanales de Caleta Quintay
Algarrobo	STI de Pescadores Artesanales Algarrobo
Quisco	STI "Narciso Aguirre" de Pescadores Artesanales Comuna El Quisco
Cruces 1	STI de Buzos y Pescadores Artesanales de La Caleta Las Cruces "Dr. Alfredo Cea"
Cruces 2	Cooperativa de Mujeres Mariscadoras Puesta de Sol Las Cruces
Cartagena	STI de Buzos Mariscadores Semiautónomos; y Pescadores Artesanales de Cartagena y Las Cruces
Antonio	Sindicato de Buzos Mariscadores Embarcados Puertecito San Antonio
<i>Bio-bio</i>	
Cobquecura	STI de La Pesca Artesanal, Buzos Mariscadores y Actividades Conexas de La Caleta Cobquecura
Dichato	STI del Mar y Acuicultores de La Pesca Artesanal Caleta Dichato
Coliumo 1	STI Pescadoras Artesanales Recolectoras de Algas Coliumo
Coliumo 2	STI Pescadores Caleta Coliumo
Cochohgüe	Sindicato de Buzos Mariscadores y Algueros de Cochohgüe
Lirquén	STI Buzos Mariscadores de Lirquen
Punta Elisa	STI de La Pesca A Artesanal, Buzos Mariscadores y Actividades Conexas de La Caleta Cerro Verde
CerroVerde 1	Sindicato de Pescadores El Refugio
CerroVerde 2	Sindicato Cerro Verde (Miguel Ponce)
CerroVerde 3	STI, Pescadores y Buzos Artesanales Carlos Condell
Penco	Sindicato de Pescadores Artesanales Penco Playa Negra
Cantera	STI Pescadores Artesanales Buzos Mariscadores Caleta Cantera
Vicente	STI Pescadores Artesanales, Buzos Mariscadores, Algueros Acuicultores y Actividades Conexas de San Antonio
Chome	Asociación Gremial de Pescadores Artesanales, Buzos, Mariscadores y Algueros de Caleta Chome
Laraquete	STI, Buzos Mariscadores Caleta Laraquete
Arauco	Sindicato de Trabajadores Pescadores Independientes de Caleta Arauco
Tubul 1	Asociación Gremial de Pescadores Artesanales Buzos Mariscadores y Algueros de Tubul
Tubul 2	Sindicato Independiente Dueños de Equipos Buceo y Armadores Caleta Tubul
Llico	STI Pescadores Artesanales, Buzos Mariscadores y Actividades Conexas de Caleta Llico
Lavapie 1	STI, Pescadores Artesanales, Buzos Mariscadores y Recolectores de Algas Marinas Puerto Viejo Punta Lavapie
Lavapie 2	STI Pescadores Artesanales, Buzos Mariscadores y Actividades Conexas de La Caleta Punta Lavapie Sector Puerto Nuevo
Yani	Asociación Indígena Yani Lafquen

Legend: STI= Sindicato de Trabajadores Independientes (Independent Worker Union or Syndicate)

Note: Fisher organizations are ordered as they are geographically located, from north to south.

### Appendix 3: Questionnaire for fisher organizations <sup>49</sup>

NAME OF THE ORGANIZATION: \_\_\_\_\_  
 NAME OF THE CALETA: \_\_\_\_\_ REGION: V \_\_\_ VIII \_\_\_  
 You are: PRESIDENT \_\_\_ REPRESENTATIVE \_\_\_ EX-REPRESENT. \_\_\_ AMERB COMMISSION \_\_\_  
 You are registered as DIVER \_\_\_ FISHER \_\_\_ OWNER \_\_\_ GATHERER \_\_\_  
 Syndicate affiliated to which National Confederation? CONAPACH \_\_\_ CONFEPACH \_\_\_  
 And to what Regional Federation?: \_\_\_\_\_

1. What resources do you extract from your MA? Which one is the main resource? (Underline)

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2. What is the current annual quota (TAC) for the main resource and how has it varied in time?

1	Increased	2	Decreased	3	Maintained	4	Only one quota	5	No quota yet
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3. Who is your main buyer? Tourist (final consumer) \_\_\_ Restaurant \_\_\_ Intermediary \_\_\_ Factory \_\_\_ Other: \_\_\_  
 What was the price obtained in the last sale? \$ \_\_\_\_\_ unit: \_\_\_ kilo: \_\_\_ dozen \_\_\_

4. Have you incorporated new resources (species) in your management plan that were not initially considered?  
 YES \_\_\_ Which ones? \_\_\_\_\_ NO \_\_\_

-With which institution do you carry on the follow-up studies? \_\_\_\_\_

-Have you always worked with this institution or have you changed? ALWAYS \_\_\_ CHANGED \_\_\_

-Why have you changed? \_\_\_\_\_

5. How many members compose the organizations? \_\_\_\_\_ Are there inactive members (how many)? \_\_\_\_\_

- How many divers?: \_\_\_\_\_ How many boats operate in the MA? \_\_\_\_\_

-Do you have an MA Commission? YES \_\_\_ NO \_\_\_

-How do you distribute the earnings from the MA (Shares system)? By boat \_\_\_ Over the total extraction \_\_\_

	Indicate measure (% or share)
Diver:	
Boat and gear owner:	
Assistant:	
Member:	
For the syndicate:	

6. Do you perform other economic activities as a fisher organization? (e.g. processing, tourism)

--	--

7. Have you obtained funding for projects within the MA? Which ones? Jointly with which institutions? NO \_\_\_  
 YES \_\_\_

Name of Fund or Project	Associate institutions

8. What is the relevance of the MA within all the activities of your organization? Please respond according to **card No. 1**<sup>50</sup>

1	VERY IMPORTANT	3	SLIGHTLY IMPORTANT
2	IMPORTANT	4	UNIMPORTANT

<sup>49</sup> This version of the questionnaire was translated from Spanish and its format modified to fit in this document.

<sup>50</sup> Cards were passed on to the interviewees, containing the same alternatives as in the questionnaire but without the codes.

9. Please, a) rank by relevance the different activities performed by your organization (**READ ALTERNATIVES**),  
 b) And now, please express the latter in percentages: what percentage of annual income corresponds to “resources extracted from the MA”? etc. **READ**

	a) Ranking 1-4	b) %
Resources extracted from MA		
Resources extracted with fishing net (finfish, crustaceous)		
Other activities related with the sea (shore gathering, tourism)		
Other activities not related with the sea		

**READ:** The following questions are centred in the ACTIVITIES WITHIN MAs. Please think in the administration of MAs to responds the next sections **ATTENTION:** mark items 10 to 14 in the responses sheet at the end of the questionnaire.

10. I will read a list of institutions somehow related with the functioning of MAs in Chile. Please tell me, according with Card No. 2, what participation have they had in the development of your MA here at NAME OF CALETA.:

1	HAS FACILITATED	2	HAS HINDERED	3	NO PARTICIPATION
---	-----------------	---	--------------	---	------------------

-Is there another actor that has had directly or indirectly participated that I haven't mentioned? \_\_\_\_\_

11. Please indicate, according with card No. 3, what level of importance have had the following institutions I will read for the development of your MA. **READ ONLY THOSE MARKED AS “1” IN LAST QUESTION.**

1	VERY IMPORTANT	3	SLIGHTLY IMPORTANT
2	IMPORTANT	4	UNIMPORTANT

12. Now, please, according with card No. 4, which degree of trust do you feel with respect to each of the organizations and institutions I will read as follows, in regards with the administration of the MA. **READ ONLY THOSE MARKED AS “1” and “2” IN QUESTION No. 10.**

1	A LOT OF TRUST	3	LITTLE TRUST
2	ENOUGH TRUST	4	NO TRUST AT ALL

13. Please indicate, according to your vision, which of the organizations listed in card No. 5 should play a different role to contribute to the administration of MAs. **FOR EACH ORGANIZATION MENTIONED ASK:** NN should play a different role in terms of what?

14. Please indicate, according with your experience, which of the organizations listed in card No. 5 have carried on actions or defended interests that prevent or put at risk the success of your MA. **FOR EACH ORGANIZATION MENTIONED ASK:** XX has been an obstacle in terms of what?

15. How does the organization get the information about important changes in the MEABR system? (e.g., changes in bylaws, in the fees, new funding sources)

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16. What communication channels do you use to let the authorities know about your concerns, requirements or complaints about the MAs? (e.g., letter, through the Mayor, through SERNAPESCA or the Federation, etc.)

--

17. Which persons or institutions have been important to solve internal conflicts of the organization with regard to the MAs?

--

18. Which persons or institutions have been important when conflicts emerge with other caletas or syndicates because of the MAs? (e.g., poaching, fishing inside the MA, etc)

--

19. Which persons or institutions have been important to learn about the administration of the area? (e.g., about the organization or how to maximize the benefits and productivity in the MA).

--

20. Does the syndicate have allied (permanent cooperation) persons or institutions with respect to the MA?

--



21. Do you experiment different ways of managing resources within the MA to increase productivity? Which ones? (e.g., *raleo*, moving resources, feeding, etc)


22. As follows, I will read some statements about topics that might be relevant for the success of MAs. Please, tell me based on your experience to what extent you agree or disagree with those statements, according with card No. 6.

	STRONGLY DISAGREE	DISAGREE	AGREE	STRONGLY AGREE	DK/NR
The law that rules MEABR has been improving	1	2	3	4	5
Individualism in our organization is a problem for a better management of the area	1	2	3	4	5
We believe that SERNAPESCA does trust us sufficiently as resource managers.	1	2	3	4	5
Our internal management agreement is observed to the letter.	1	2	3	4	5
Internal communication of the syndicate is very good with respect to decisions affecting the MA.	1	2	3	4	5
In our organization we are proud of our MA	1	2	3	4	5
Conflicts among caletas or fisher organizations have increased as a consequence of MAs.	1	2	3	4	5
Fishers in my organization are more integrated since we have the MA.	1	2	3	4	5
In our syndicate we have expectations of making our lives only from the MA.	1	2	3	4	5
We believe that SUBPESCA does trust us sufficiently as benthic resource managers.	1	2	3	4	5
We have learnt from other caletas how to improve the management of the MA.	1	2	3	4	5
Our relationships with the authorities have improved since we have the MA.	1	2	3	4	5
Without external support and follow-up it is unlikely that the MA will succeed.	1	2	3	4	5
Other non-benthic species that dwell in the MAs should be included in the management plan.	1	2	3	4	5
The current crisis in fisheries has increased our pressure on the resources in the MA.	1	2	3	4	5

23. Have you carried on aquaculture projects within the MA? YES \_\_\_ NO \_\_\_

\*\*With what results? POSITIVE \_\_\_ NEGATIVE \_\_\_ TOO EARLY \_\_\_

-What obstacles have you encountered? (e.g., funding, knowledge, infrastructure, permits)


24. Have you carried on restocking projects within the MA? YES \_\_\_ NO \_\_\_

\*\*With what results? POSITIVE \_\_\_ NEGATIVE \_\_\_ TOO EARLY \_\_\_

-What obstacles have you encountered? (e.g., funding, knowledge, infrastructure, permits)


25. Have you carried on inland aquaculture projects within the MA? YES \_\_\_ NO \_\_\_

\*\*With what results? POSITIVE \_\_\_ NEGATIVE \_\_\_ TOO EARLY \_\_\_

-What obstacles have you encountered? (e.g., funding, knowledge, infrastructure, permits)


26. If you had to move to another region and joint another fisher organization, and you had to choose among various organizations, which one would you choose in the first place... **read alternatives and mark with an x.** And in the second place?

	1 <sup>st</sup> place	2 <sup>nd</sup> place	Comments...
An AMERB full or resources...			
One with a strong internal organization...			
One with good contacts and alliances...			

27. According with card No. 7:	VERY GOOD	GOOD	BAD	VERY BAD	Comments...
How do you consider the results obtained from the AMERB in the past? (previous years)	4	3	2	1	
And how do you consider the results obtained currently? (2008 harvest)	4	3	2	1	

And according with card No. 8:	WILL IMPROVE	WILL BE MAINTAINED	WILL DECREASE
How do you think results will be in the forthcoming years?	3	2	1

Why? \_\_\_\_\_

28. In summary, from 1 to 7 (like at school) what grade would you give to the policy of management areas in Chile?  
 1      2      3      4      5      6      7

Would you prefer to return to an open-access system? YES    NO

Why?

THANK YOU VERY MUCH FOR YOUR TIME. WOULD YOU BE INTERESTED IN THE RESULTS OF THIS STUDY?

ADDRESS OR EMAIL \_\_\_\_\_

**COMMENTS FROM THE INTERVIEWER:**


INITIALS \_\_\_\_\_

DATE August \_\_\_\_\_





## Appendix 4: Strategic planning workshop at Caleta Montemar - Executive summary

### TALLER DE PLANIFICACIÓN ESTRATÉGICA S.T.I. DE LA PESCA ARTESANAL DE LA CALETA MONTEMAR

En el marco del proyecto de investigación “Redes sociales y co-manejo en la pesca artesanal en Chile”<sup>51</sup> surgió la iniciativa de realizar un taller de planificación estratégica participativo para la organización de pescadores artesanales de Caleta Montemar. El propósito de este taller fue *contribuir al proceso de fortalecimiento organizacional* que el sindicato venía experimentando desde su constitución en 1992 y en particular desde la adjudicación de su Área de Manejo y Explotación de Recursos Bentónicos en 2003. El presente documento entrega una síntesis de los resultados del taller realizado el 23 de agosto de 2008<sup>52</sup>.

#### VISIÓN

La visión de una organización constituye el estado ideal hacia el cual esta desea dirigirse. Es la descripción de cómo la organización desea ser y ser vista en el futuro. Los pescadores de Montemar reflexionaron en torno a la pregunta *¿Cómo me gustaría ver a mi sindicato en el futuro?* Primero lo hicieron de manera individual y luego compartieron sus aspiraciones en plenario. El resultado fue el siguiente:

**La visión que tenemos es ser un sindicato unido y fuerte, con capacidad de desarrollar una diversidad de actividades económicas y culturales en un espacio físico adecuado, integrando a nuestras familias, y siendo reconocidos y respetados por las autoridades y toda la Comunidad.**

#### MISIÓN

La misión es la declaración de la razón de ser de una organización, su propósito básico y el ámbito de trabajo esencial para sus integrantes al cual han de enfocar sus energías de manera permanente. Siguiendo la misma metodología (reflexión personal seguida de plenario), los pescadores abordaron la pregunta *¿Qué es lo que la organización no puede dejar de hacer?*, llegando conjuntamente a la siguiente declaración:

**La misión de nuestro sindicato es proveer a nuestros clientes de productos del mar de la mejor calidad, de manera de asegurar un sustento económico estable y equitativo para los socios; la organización debe también canalizar oportunidades de desarrollo cultural y de capacitación para los miembros y sus familias, en un marco de relaciones de integración con instituciones, autoridades, y vecinos, y promoviendo el trabajo conjunto con otras caletas de la Región.**

#### ANÁLISIS SITUACIONAL: FODA

La realización de la visión y el cumplimiento de la misión de una organización estarán determinados por el modo como esta logre trabajar internamente así como por las condiciones externas que enfrente. El éxito, por lo tanto, dependerá del balance de fuerzas tanto internas como externas al grupo humano, algunas de las cuales son factibles de manejar y planificar. El análisis situacional, o FODA, entrega un diagnóstico sintético de cómo la organización se ve a sí misma en el presente (*fortalezas y debilidades*), y cómo esta ve el contexto en que se encuentra (*oportunidades y amenazas*). A continuación se presenta el FODA desarrollado por los pescadores:

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<sup>51</sup> Este proyecto corresponde a la investigación desarrollada por Andrés Marín, sociólogo, para optar al título de Máster en Manejo de Recursos Naturales de la Universidad de Manitoba, Canadá. La moderación del taller y preparación de este documento estuvieron bajo la responsabilidad del profesional. E-mail: [andres.marin.r@gmail.com](mailto:andres.marin.r@gmail.com)

<sup>52</sup> El taller fue realizado en las dependencias de la Facultad de Ciencias del Mar de la U. de Valparaíso.

## **FORTALEZAS**

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El Área de Manejo	El sindicato se siente orgulloso por los logros alcanzados con respecto a su Área de Manejo y la explotación del recurso “Loco”: el aumento sostenido en las cuotas de extracción anuales, y los buenos canales de comercialización que han establecido (venta directa a prestigiosos restaurantes de la zona).
Experiencia de mejoramiento	Los socios reconocen el lento y difícil proceso que han vivido: experiencias con líderes negativos y directivas poco transparentes, que retrasaron el avance del grupo, han tenido que enfrentarse y superarse. Actualmente los pescadores deshonestos fueron expulsados, la directiva actual fue reelecta por segundo año, y se valora la organización y el trabajo conjunto.
Lealtad de los socios	Lazos directos de parentesco (y con los pescadores originales de Montemar) y amistad mantienen unido al grupo.
Buena comunicación	Los miembros del sindicato dicen tener una buena y abierta comunicación entre ellos.
Buenas relaciones de apoyo	La directiva actual ha logrado reestablecer una red de respaldo y contactos tanto a nivel de autoridades, de los servicios públicos y con asociaciones del sector pesquero artesanal. Además se ha promovido el diálogo y la negociación con la Universidad de Valparaíso, cambiando la actitud confrontacional que existió en el pasado (con otros dirigentes).
La tradicional Fiesta de San Pedro	Los pescadores se sienten portadores de este valioso patrimonio cultural y sienten orgullo de ser la única caleta de Viña del Mar. También dicen haber demostrado capacidad de gestión en las últimas celebraciones de la Fiesta.

## **DEBILIDADES**

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Desunión e individualismo	Cuando no existe una amenaza externa fuerte el grupo tiende a debilitarse. Así también hay miembros que se acercan al sindicato solamente cuando hay ganancias y reparto de beneficios.
Falta de voluntad	La energía con que han luchado por salir adelante suele decaer ante el paso del tiempo y los lentos avances y resultados, particularmente con respecto al tema de obtener la concesión de uso de borde costero.
Abuso del alcohol	Este es un problema que afecta a algunos integrantes de manera intermitente y que puede tener efectos negativos sobre el trabajo y el funcionamiento de la organización. Los socios son concientes de esta dificultad e intentan mantenerla bajo control, apoyando a los afectados.

## **OPORTUNIDADES**

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Actividad turística	La ubicación privilegiada de la caleta les permitiría agregar valor a sus productos y diversificar su fuente de ingresos generando negocios vinculados al turismo (mirador de la lobera, puestos de venta, etc.). En las condiciones actuales de infraestructura es imposible aprovechar esta oportunidad.
Desarrollo de proyectos	Postulación a financiamiento para mejorar situación actual y potenciar sus capacidades, como el Fondo de Fomento a la Pesca Artesanal, y de Obras Portuarias. Requisito para muchos fondos es contar con la concesión costera.
Políticas para el sector pesquero	En particular mencionan el proyecto de explotación y exportación directa del recurso Jibia en colaboración con el Estado.

## **AMENAZAS**

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Robo de locos desde el Área de Manejo	El fácil acceso que tiene por tierra el Área (incluyendo sector Roca Oceánica), la hace presa fácil de extracciones ilegales de Locos.
Eventual negación de la concesión de uso de borde costero	El reconocimiento de su derecho histórico y el traspaso de los derechos sobre un paño en la franja costera dependen de una serie de instituciones, partiendo por la Universidad de Valparaíso. Esto genera una situación incierta que escapa a su control, y ante la cual se encuentran en evidente desventaja de poder.
Conflictos con caleta vecina	Hacen mención a conflictos pasados con caleta Higuierillas en torno a las Áreas de Manejo (contiguas) y episodios puntuales de agresión por parte de sus vecinos: el material de trabajo les fue destruido y las vidas de los buzos fueron puestas en peligro. Actualmente no existen buenas relaciones con Higuierillas.
Contaminación de las aguas	El grupo teme por los efectos que pueda tener sobre el ecosistema y su Área de Manejo la descarga directa de aguas lluvias y residuos líquidos -desde el conjunto de edificios sobre el sector de Cochoa- a través del ducto construido recientemente. Reclaman la falta de apoyo precautorio que han recibido de parte de las autoridades.

## **LINEAMIENTOS ESTRATÉGICOS**

Los Lineamientos Estratégicos representan las líneas de acción concretas en las que la organización se focalizará para alcanzar sus objetivos. En base al FODA, la organización definirá estos lineamientos buscando, por un lado, potenciar sus fortalezas y aprovechar las oportunidades, y superar sus debilidades y hacer frente a la amenazas, por el otro. Por restricciones de tiempo, no se alcanzaron a discutir y elaborar en el taller los Lineamientos Estratégicos para Montemar. Es una tarea que quedó en manos de los interesados. No obstante, a continuación se ofrece un comentario final de parte del moderador de la actividad.

## **COMENTARIO**

A partir del taller aquí resumido, y del acompañamiento realizado a la organización durante tres meses, es posible realizar las siguientes observaciones:

- Ante la compleja situación respecto de la concesión costera, la actitud de negociación adoptada hasta el momento parece la más adecuada. La búsqueda de respaldos institucionales externos también es positiva. Pero lo más importante para el grupo es concentrar sus fuerzas en fortalecerse internamente, trabajando para superar en conjunto cualquier fuente de división.
- Hasta ahora el sindicato ha enfrentado situaciones relativamente simples desde el punto de vista de la administración de recursos financieros (por ejemplo, la venta en conjunto de los recursos del mar o el manejo de aportes públicos municipales). No obstante, estas exigencias han generado algunas dificultades y conflictos internos. Es muy importante desarrollar capacidades administrativas, especialmente si el sindicato tiene aspiraciones mayores en el desarrollo de proyectos y negocios. En este sentido, por ejemplo, no mezclar las cuentas personales con los asuntos de la organización es crucial.
- Existen frecuentes tensiones entre la autoridad de los representantes electos por la asamblea (la directiva) y las opiniones de líderes informales (por antigüedad) dentro del grupo que generan inestabilidad. Es importante que el grupo demuestre mayor confianza y respeto por sus dirigentes, para permitirles hacer su trabajo. La directiva, a su vez, debe perseverar en un trabajo transparente hacia y con las bases. Los dos elementos en conjunto fortalecerán las capacidades del sindicato para lograr sus metas a la vez que mejorará el clima de trabajo.

## Appendix 5: Research Approval Certificate



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### APPROVAL CERTIFICATE

17 June 2008

**TO:** **Andrés Marín Ricke** (Advisor F. Berkes)  
Principal Investigator

**FROM:** **Wayne Taylor, Chair**  
Joint-Faculty Research Ethics Board (JFREB)

**Re:** **Protocol #J2008:072**  
**"Networks and Co-management in Small-scale Fisheries in Chile"**

Please be advised that your above-referenced protocol has received human ethics approval by the **Joint-Faculty Research Ethics Board**, which is organized and operates according to the Tri-Council Policy Statement. This approval is valid for one year only.

Any significant changes of the protocol and/or informed consent form should be reported to the Human Ethics Secretariat in advance of implementation of such changes.

**Please note:**

- if you have funds pending human ethics approval, the auditor requires that you submit a copy of this Approval Certificate to Kathryn Bartmanovich, Research Grants & Contract Services (fax 261-0325), including the Sponsor name, before your account can be opened.
- if you have received multi-year funding for this research, responsibility lies with you to apply for and obtain Renewal Approval at the expiry of the initial one-year approval; otherwise the account will be locked.

The Research Ethics Board requests a final report for your study (available at: [http://umanitoba.ca/research/ors/ethics/ors\\_ethics\\_human\\_REB\\_forms\\_guidelines.html](http://umanitoba.ca/research/ors/ethics/ors_ethics_human_REB_forms_guidelines.html)) in order to be in compliance with Tri-Council Guidelines.