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The human dimensions of co-management in Chilean coastal fisheries

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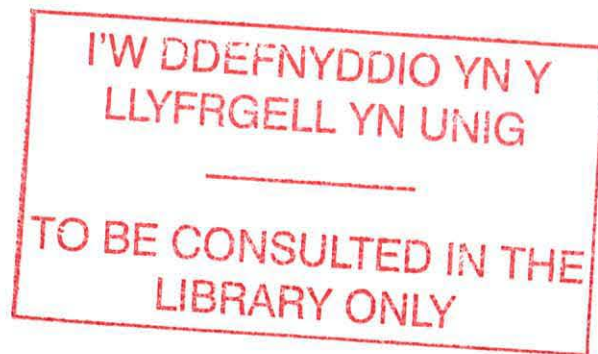
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The human dimensions of co-management in Chilean coastal fisheries

A thesis presented to the University of Wales-Bangor for the degree of Doctor of
Philosophy

by

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Abstract

The Chilean government has introduced a co-management policy that grants territorial user rights to organised groups of artisanal fishers with the goal of achieving sustainable coastal fisheries. This management measure aims to encourage a positive change in fishers' behavioural patterns and to transform fishing operations into small business enterprises managed by fishers. This study analyses the human dimensions of the policy with special emphasis on the social, cultural and economic variability of participating artisanal fishers.

Fishers' attitudes towards conservation and co-management vary significantly between individuals. Fishers also respond in different ways to the financial challenge of managing resources under territorial user rights policies. These differences indicated the existence of different worldviews that structure fishers' behaviour toward the marine environment and its management. Fishers' attitudes and financial adaptation strategies correlated best with fishers' livelihood characteristics. Additionally fishers' specific attitudes towards environmental quality seemed to be shaped favourably by fishers being engaged with co-management, as these aspects would be related to quality control operating within international markets.

Results also suggest that a simple review of co-management application statistics and the accompanying official documentation does not identify the problems with the policy. Historical fishing sites are becoming scarce, conflict between fishers is rising and the costs of enforcing territorial user rights increments. Under these circumstances, fishers' engagement with co-management relate to power struggles between fishing groups, which acquire specific story-lines to legitimize claims when adapting to conditions generated by the policy. Power inequalities between fishers could jeopardize the use of territorial user rights and therefore must be considered in co-managements future developments.

The thesis also highlights the importance of understanding the impact of implementing co-management over traditionally managed ecosystems. In doing so the study advocates for the need to include derogations in policies for systems that offer similar benefits to those achievable by co-management.

The human dimension is an important aspect of co-management implementation. It offers a way to understand fishers who engage in the activities to be regulated, including their motivations, attitudes, culture and social and economic situations. In view of this knowledge policy makers gain new insights into the problems that arise while attempting to co-manage resources and therefore might consider new mechanisms for consultation, better adaptation of the policy to local realities and eventually a move towards an adaptive form of co-management.

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"Nosotros los de entonces ya no somos los mismos"

(Pablo Neruda)



eStefan

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Acronyms and Abbreviations

CBNRM	Community Based Natural Resource Management
CFQ	Community fishing cuota
CPUE	Capture per unit of effort
FAL	Fisheries and Aquaculture law
MEABRs	Management and exploitation areas for benthic resources (Areas de manejo y explotacion de recursos bentonicos).
Sernap	Servicio Nacional de Pesca, Chile (National Fisheries Service)
Subpesca	Subsecretaria de pesca, Chile (Undersecretary of fisheries equivalent to a fisheries ministry)
TAC	Total allowable catch
TURFs	Territorial User Rights to Fishers
TRA	Theory of reasoned action

Chapter 1: General Introduction

General Introduction

1.0. General Background

Marine fisheries are globally important for the provision of food and economic resources to fishing communities, particularly in developing countries and those with traditional artisanal fisheries. In addition, many of the World's major fisheries have undergone severe declines and many are officially listed as over-exploited (Pauly *et al.* 2002; 2003; Myers and Worm 2003). In view of these interacting factors, the major policy response to mitigating further declines, while simultaneously maintaining some level of harvest, revolves around achieving the goal of sustainable exploitation¹ (Bene 2003). Traditional top-down natural resource management approaches based on centralized government intervention and single species stock evaluations have proven to be inadequate in achieving this goal (Sandersen and Koester 2000). As a consequence, during the last decade, researchers and development agencies have promoted a shift towards bottom-up governance of local resources and the sharing of responsibility between governments and fishers through the use of co-management policy frameworks (Castilla and Defeo 2001; Pauly *et al.* 2003).

Co-management is intended to be a meeting point between government concern for efficient resource utilisation and local concern for equal opportunities, self-determination and self-control (Fanning 2000). A fundamental character of such a strategy is that governments provide the general legal framework for the user organisation, while user organisations must be able to regulate the actions of their members (Pomeroy and Berkes 1997; Sen and Nielsen 1996). Co-management is considered to represent a more democratic governance system as it implies increased involvement of users (Jentoft *et al.* 1998). It is also expected to increase the efficiency of fisheries management as compliance and self-regulation are assumed to

¹ The term sustainable is contested. In this thesis a broad definition provided by Bruntland (1987, p. 43) will be adopted: "Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

be better than in top-down approaches (Jentoft 1989). While many authors believe that co-management in general can meet these aims, there is no single definition of co-management, and several authors describe different levels of devolution of power to local communities according to specific situations².

One common approach, used by governments attempting to introduce co-management in coastal waters is rooted in granting territorial user rights to fishers (TURFs). The rationale behind territorial user rights is based on a common property approach, which proposes that a well-established rights-based system provides access, withdrawal and management security for individuals and groups of individuals (Ostrom & Schlager, 1996). With such assurance, fishers would make credible commitments to one another and develop long-term plans for investing in and harvesting from a common-pool resource in a sustainable manner (Ostrom 1990).

The recent adoption by national governments of co-management as an integral part of their fisheries policies is supporting the shift towards bottom-up governance, as well as giving insightful case-studies which have broadened the development of theory and empirical research regarding co-management (Nielsen *et al.* 2004). Despite the energy which has been devoted to the generation and implementation of these policy models for fisheries management and the worldwide growing interest in social science information as a means of managing the fishery rather than managing the fish stocks there has been little attention paid to the relationships between co-management implementation and the socio-economic and cultural characteristics of fisher communities (Wiber *et al.* 2004).

Concurrently there has recently been a call in the academic world to study the relationships between management policies and the social, cultural and economic aspects of people being managed (Kaplan and McCay 2004; FAO 2005, Gelcich personal observation IV World fisheries Congress). Nevertheless, to date, these

² Sen and Nielsen (1996) describe a spectrum of co-management arrangements which ranges from instructive, where the state creates mechanisms of dialogue and informs of management decisions to informative where user groups inform government of decisions made at the local level. Typically co-management policy arrangements are thought of as somewhere in between where state and resource users cooperate as equal partners (cooperative co-management).

‘human dimensions’ of fisheries management may still not have received the attention they deserve. This is unfortunate, as such considerations are important as they should inform an understanding of fishers’ long-term willingness to participate in, and compromise with, the co-management of resources.

This thesis addresses the human dimensions of an artisanal benthic resource³ fishery in Chile, which has been co-managed through TURFs since 1997. Special emphasis will be placed on trying to understand the socio-cultural and economic heterogeneity in the fisheries sector, and how this might become a critical determinant for the long term success of co-management policy. Throughout the different chapters the thesis will focus on aspects of fishers’ attitudes (Chapter 3, Chapter 4), financial decisions when managing resources through territorial user rights (Chapter 5), power struggles involved in the uptake of the policy (Chapter 6) and the consequences co-management might have over traditional management institutions (Chapter 7).

Studies that explore human dimensions of natural resource management strategies have increasingly used social science models as frameworks to understand how stakeholders and the public respond to the natural environmental policies. In order to explore these human dimensions of fishers engaging with co-management in Chile, social science models which allow a better understanding of individual behavioural responses are used throughout the different chapters.

Behavioural scientists have proposed a number of theories regarding what pre-disposes an individual to certain behaviour. Ajzen and Fishbein’s (1980) theory of reasoned action (TRA), is one of these models which has been applied extensively to resource management, (e.g. Bright and Manfredo 1995), recreation and leisure behaviour (Ajzen and Driver 1991), and consumer behaviour (Olli *et al.* 2001). The essence of the theory is that behaviour can be predicted by cognitive factors such as beliefs, subjective norms, attitudes and intentions (Ajzen 1988). Prior to an actual acting out of behaviour, an individual, would consider cognitively his or her willingness (or intentions) to support an act being implemented (Vogt *et al.* 2005). Socio-demographic variables have been correlated with environmentally friendly

³ Benthic resources are those that live on the ocean floor (i.e. snails, crabs, sea urchins).

behaviours. These have variously been reported as education and income (Hines *et al.* 1987; Olli *et al.* 2001), age (Hallin 1999; Olli *et al.* 2001) and activity levels in environmental groups (Olli *et al.* 2001). Although TRA is still widely used, it does have its critics (e.g. Bender and Speckart 1981; Oliver and Bearden 1985; Valerand *et al.* 1992), however alternative models to TRA, like the transactional model of behaviour (Lazarus and Folkman 1984; Deary *et al.* 1996) still place importance on attitudes as important elements influencing behaviour. In a meta-analysis of over 80 studies, Sheppard *et al.* (1988) estimated an average correlation for the intention-behaviour relationship of 0.53 suggesting intentions and attitudes predict some but not all behaviours. Specific research to study additional variables which add greater predictive modelling power to understand human behaviour is an ongoing challenge. This is a rich area for academic study within the marine management and conservation domain, and would offer the potential for real practical benefits for conservation and development.

Fishers' livelihoods are directly derived from the environment. Therefore, the determinants of their environmental behaviour will probably include some element of financial gain. Because of this financial relationship with the environment we suspect that in addition to socio-demographic and attitudinal information, including approaches from the behavioural economics literature will increase our understanding of different stakeholders' willingness to participate and response decisions respect to marine management.

Prospect Theory (Kahneman and Tversky 1981), and Cumulative Prospect Theory (Tversky and Kahneman 1992), are a theory of decision making under conditions of risk and uncertainty, which have had a broad impact on a number of fields (McDermott 2004). Prospect theory shows that people evaluate outcomes with respect to deviations from a reference point and not with respect to net asset levels as expected utility theory assumes. Outcomes that exceed the reference point are seen as gains, whereas outcomes that fall below the reference points are perceived as losses (Fanis 2004). The reference point is usually the current position in which people find themselves, but can also be an aspiration level, or some other point (Kahneman and Tversky 1981). Whether people (i.e. stakeholders, fishers) perceive the available options as gains or a loss has different implications for the choices they make

(Kahneman and Tversky 1981; Fanis 2004). Thus understanding fishers financial choices and the way they depart (or not) from Prospect Theory adds an important factor towards understanding fishers response decisions respect to marine management policy.

In addition to financial considerations, socio-demographic variables and attitudes, fishers' behavioural responses to management policy will be related to their social structures and worldviews. It is in this domain that the role of institutions (North 1990) and discourses (Hajer 1995) can also provide useful insights into understanding fishers heterogeneity and behaviour towards marine management policy.

1.1. Thesis Structure

This thesis specifically draws on the theory of reasoned action to explore fishers' attitudes towards co-management and conservation of resources and search for factors which might determine and shape attitudes (Chapter 3; Chapter 4). It uses Prospect Theory (Chapter 5) to identify factors which might influence fishers' response decisions and risk preferences respect to co-management and TURFs. It also draws on discourse analysis (Chapter 6) to assess the importance of agency in structuring fishers' perceptions towards marine management. It finally looks at institutions as a way (Chapter 7) to explore the implications of management policy to changes in access and control over resources.

The information gathered in the different chapters will ideally enable policymakers and academics to consider better ways of adapting the policy and its future perspectives to local realities. It also intends to show how social/behavioural frameworks can be operationalized in order to understand the motivations, culture and socio-economic situations of the fishers which are being expected to co-manage resources alongside governments and researchers. In this way the thesis is driven by a desire to understand fishers' behaviour towards resource management policy through an interdisciplinary approach rather than to link different theoretical frameworks together into an integrated framework.

The thesis begins in Chapter 2 by introducing the Chilean TURFs case study and highlighting the need for studies on the human dimensions of the fishers involved with this policy. Chapter 3 explores fishers' attitudinal heterogeneity with respect to co-management and conservation and relates these to livelihood characteristics. Chapter 4 takes the study of fishers' environmental attitudes a step further and analyses the possibility that these might have been shaped through the experience of co-managing resources. Chapter 5 examines fishers' financial decisions when managing resources under a TURFs regime, and relates these to risk preferences and livelihood characteristics. Chapter 6 tries to understand why fishers might have different opinions towards the Chilean co-management policy and explores the role of power and positioning in co-management implementation. Chapter 7 is a case-study in which the impact of co-management on existing management institutions is assessed (Table 1.1). The thesis is concluded by discussing ways forward and challenges for co-management to become the policy instrument it has been proclaimed, and not just another development narrative.

In writing this thesis it was intended that each chapter (Chapters 2-7) should be capable of standing alone in a format suitable for publication. As such, some repetition of concepts and ideas has inevitably occurred because of the need to introduce the Chilean TURFs policy and the importance of looking at the human dimensions of the process in each prospective publication.

Table 1.1 Summary of the main objectives of each Chapter and its publication status*.

Chapter Title	Objective	Publication Status
2: Experience from managing marine invertebrate artisanal fisheries in Chile.	Describe the Chilean co-management policy process highlighting lessons and the need to understand human dimensions.	Submitted to Castilla and McClanahan (ed.) <i>Successes in world fisheries</i> .
3: Importance of attitudinal differences among artisanal fishers towards co-management and conservation of marine resources.	Understand fishers attitudes towards the Chilean co-management policy and its implications for management	2005. <i>Conservation Biology</i> 19(3): 865-875
4: Do fishers turn green under co-management policy?	To understand the implications of co-management policy over fishers environmental attitudes	Submitted to <i>Nature</i>
5: Prospect Theory explains fishers harvesting behaviour under territorial user right policy.	Understand fishers financial decisions when managing resources through territorial user rights	Submitted to <i>Ecological Economics</i>
6: Using discourses for policy evaluation: the case of marine common property rights in Chile.	Understand the reasons that underpin fishers engagement with the Chilean co-management policy	2005. <i>Society and Natural resources</i> 18(4): 377-391
7: Co-management policy can reduce resilience in traditionally managed ecosystems.	Understand the effects of introducing TURFs policy over existing management institutions	Submitted to <i>Ecosystems</i>

* The co-authors of the papers are mainly the supervisors of the PhD project, their contribution to the papers and chapters is restricted to structural, editing of English and discussion of ideas, concepts and approaches to achieve the goals of the papers.

1.2 General Methodology

1.2.1 Research sites and syndicates

In order to understand the determinants of fishers' response towards co-management policy, which are developed in the different chapters, the study uses multiple case studies selected with the purpose of ruling out rival hypothesis (Yin 1994). The study analyses a total of 11 fishing syndicates (Fig. 1.1) in regions IV, V, VI and X of Chile. These regions were chosen as:

- Region IV is composed mainly of divers, it is the first region where MEABR have been widely implemented and most syndicates here have harvested from one at least 4 times.

- Region V is the region where the MEABR movement originated, syndicate El Quisco was used as a pilot study for the implementation of the policy.
- Region VI: Last region to engage with MEABR system even though regulations were put into place in 1997.
- Region X: Region with most number of artisanal fishers registered in Chile. MEABR regulation was approved here 2 years latter than in the rest of the country. Since then an explosive amount of MEABR applications put into place.

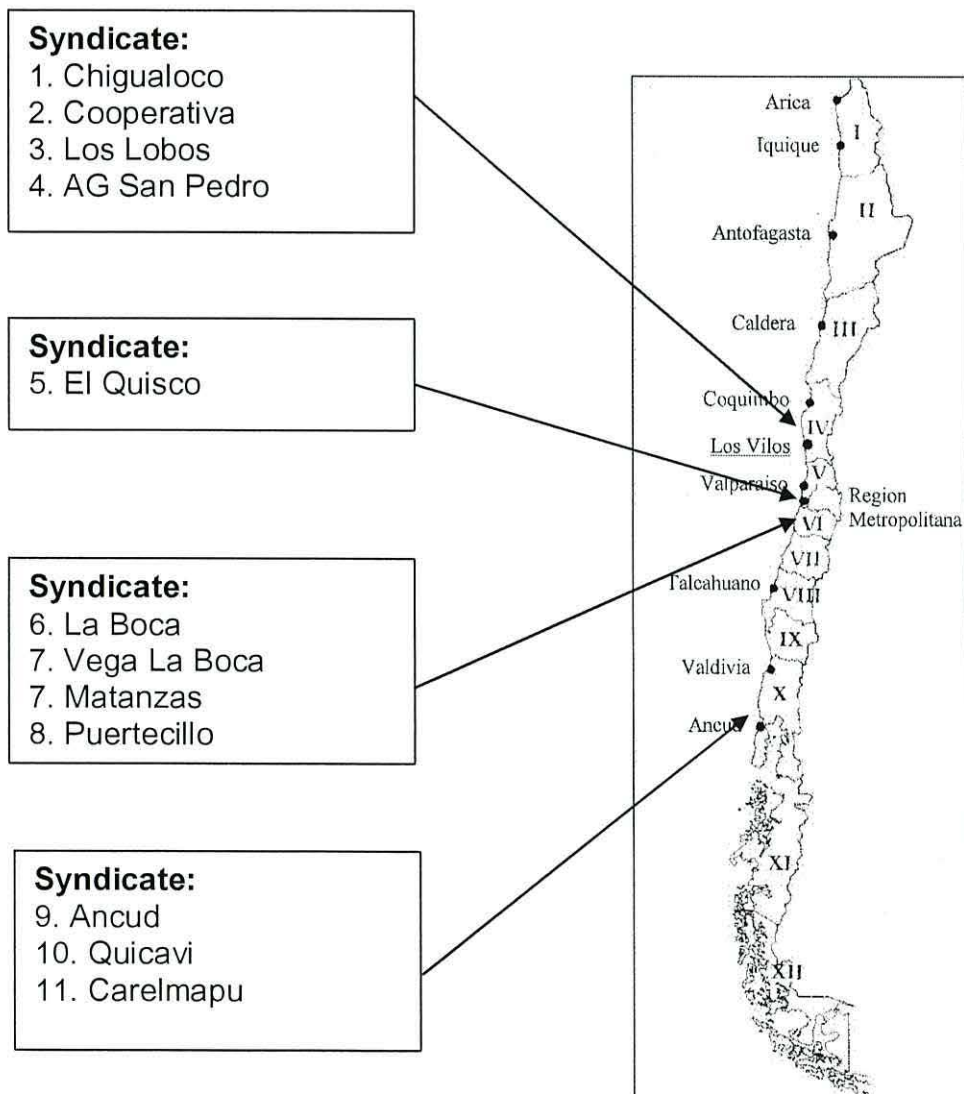


Figure 1.1. Name and location of the studied sites.

1.2.2 Participants

The general methodological approach used to achieve the objectives of each chapter was based on participatory observation and informal interviews which were carried out during various field visits (detailed methods are included in each chapter). The information gathered through these techniques was then used to generate questionnaires in order to provide a quantitative base over which statistical analysis could be performed to provide further proof (or not) of the qualitative observations. In this way, qualitative and quantitative methods in tandem (triangulation of methods) offered new aspects that neither provides on its own (Flowerdew & Martin, 1997).

Questionnaires included a section on basic social and economic information and a section on livelihood strategies as well as the questions/statements concerned with the different chapter objectives. Five different questionnaires were used (Appendix 1). Questionnaires consisted mainly of Likert type statements which had anchor points 1= strongly disagree and 5= strongly agree. An exception to this was the questionnaire used for chapter 5 which consisted of a bidding game (discussed in detail within the chapter). It is important to highlight that not all syndicates were part of the data set for every chapter, detail of participating syndicates is found within the chapter methods and a summery can be found in Table 2.1.

In general, the selection of participants for the questionnaires included the directorate group of the syndicate (president, vise-president, secretary and treasurer), members from the MEABR management commissions (mainly 4 or 5 fishers) and a random sample of around 18-20 fishers. Ten out of the 11 syndicates sampled throughout this study have less than 50 individual fishers; therefore we sampled over 50% of the syndicate members. The remaining syndicate was composed by 180 members, nevertheless there is no information regarding how may of these are still active fishers.

Table 1.2. Summary of the general methods used in the study

Chapter title	Syndicates studied	Research activity		Period undertaken
		Qualitative	Quantitative	
Experience from managing marine invertebrate artisanal fisheries in Chile.		Interviews with fisheries departments officials	Various government secondary sources.	12/2002 – 01/2004
Importance of attitudinal differences among artisanal fishers towards co-management and conservation of marine resources.	Los Lobos Matanzas La Boca Puertecillo Ancud Quicavi	Participant observation	64 face to face questionnaires of 46 likert type statements each.	12/2002 – 03/2003
		18 semi-structured interviews		
		6 group meetings 6 group mapping sessions		
Do fishers turn green under co-management policy?	Chigualoco Cooperativa El Quisco La Boca Matanzas Puertecillo Ancud Carelmapu Quicavi	Participant observation	226 face to face likert scale questionnaires of 84 statements each.	10/ 2003 – 07/2004
Prospect Theory explains fishers harvesting behaviour under territorial user right policy.	Cooperativa El Quisco La Boca Vega la Boca Carelmapu Ancud	54 interviews	54 bidding game questionnaires.	01/2004 – 07/2004
Using discourses for policy evaluation: the case of marine common property rights in Chile.	AG San Pedro Cooperativa Los Lobos	Participant observation 24 interviews	36 questionnaires.	05/2002 – 07/2002 and 01/2003 – 02/2003
Co-management policy can reduce resilience in traditionally managed ecosystems.	Puertecillo	Participant observation 43 interviews 2 group meetings	32 questionnaires (27 questions are the same as the ones asked in chapter 2).	12/ 2002 – 02/ 2003 and 10/2003 – 04/2004

1.2.3 Overview of general methodology

In order to gain a good understanding of fishers' attitudes and perceptions the field study was approached independently. There was no logistic support or affiliation with the Chilean fisheries department, consultants or NGOs. This is a main strength of the research methodology as it allowed fishers to engage in conversations, without the pressure of 'acting out' responses, tailored to achieve support, additional finances or development funds.

The process of building up the necessary rapport with fishers was not easy and required months⁴ in the different fishing *caletas* before fishers had the necessary incentives (mainly confidence) to engage in interviews and group meetings. Spending the initial months in the field gathering little quantifiable data is quite stressful, and would not fit in with many development or research funds. Nevertheless, this is a critical point when working with interview and questionnaire data. It reduces bias and gives scope for participation of fishers who would not normally attend to meetings or focus groups.

1.3 Limitations of the methodology

In recent years the scientific community has become aware that participatory research in which researcher and local people collaborate is a good way of obtaining information on communities (Chambers 1994). Nevertheless there are risks involved in this approach. When carrying out this type of research attention must be paid to the way differences in groups, ages, occupations and gender might have been overlooked while working with the communities (Chambers 1994). There is a need to understand the non-fishery nature of people's lives, the complex livelihood interlinkages and the potentials for unintended results arising from research.

By approaching the field work over a one year time period, and as an independent entity, this study has tried to reduce these constraints, although there is still an

⁴ The time necessary to build confidence with different fisher syndicate members was reduced as I had worked (in non fishery related issues) and lived at three of the fishing villages prior to being registered for a Phd.

important point this study was unable to address which is related to gender. Although women were interviewed and surveyed, no clear relationship between gender and fishers environmental attitudes, MEABR perceptions or financial response decisions was found. This gender issue must be considered in greater detail as the syndicates studied here were mainly formed by men. In Chile there are some fishing syndicates (i.e. La Vega de Pupuya, Chorillos) who are formed in more than 50% by women, and whose directorates are composed of women (Gelcich personal observation). Thus if we are to understand gender issues immersed within the Chilean co-management experience we must study what happens within these groups in greater detail.

Questionnaires are a traditional and widely used methodology to gain insight into determined realities. Nevertheless, although they are regarded as objective (when compared to qualitative approaches), they do entail interpersonal relations of power and distort realities by fitting them into pre-set framework (Inglis 1992). This study attempted to avoid the constraints associated with questionnaires, by focusing on these quantitative tools late in the research process, once rapport was built between the researcher and the fisher.

Many of the questions or statements used within the questionnaires were related with behavioural intentions. As discussed in the general background, the extent to which behavioural intentions reveal actual intentions has been a matter of physiological research and debate, nevertheless all theories which have attempted to explain human behaviour have behavioural intentions as an important component. Thus again, the degree of confidence between the researcher and the fisher is the critical component of this work.

Questionnaires used throughout this study validate the preferences and opinions given by members of 11 different fishing syndicates. Chile has 354 fishing syndicates and clearly the results of 11 cannot be easily assumed as representative to the whole of a country. Nevertheless, throughout the different chapters we have tried to include syndicates which could be incorporated into a loose taxonomy of "syndicate type", according to attitudinal, livelihood and discursive characteristics. Further research to further validate these types of fishers would allow government to

better understand and consider fishers response to management options. This seems to be the most practical way forward as extensive survey questionnaires (which could be statistically meaningful for the whole of Chile) will surely not be well received by fisher communities or their national leaders (Gelcich, personal observation).

As mentioned above, the level of rapport built by the researcher and the fishing communities is a key issue for the successful participation of fishers. However there is the risk that the researcher becomes too involved within this world and therefore loses objectivity. This research has tried to consciously mitigate this problem. Also field sites were visited on repeated occasions, trying to build friendship with different actors every time, which allowed a less biased view.

Chapter 2: Experience from Managing Marine Benthic Invertebrate Artisanal Fisheries in Chile



Artisanal fishers preparing to dive near Las Cruces, Chile

A modified version of this chapter has been submitted as:

Castilla JC, Gelcich S, Defeo O. Successes, Lessons, and Projections from Experience in Marine Benthic Invertebrate Artisanal Fisheries in Chile in JC Castilla and T McClanahan (ed.) Successes in world fisheries.

O. Defeo and JC Castilla contributed mainly with the section of the Chapter which deals with the proposed perspectives for the future (points 2.2.3.1 and 2.2.3.2).

Experience from Managing Marine Benthic Invertebrate Artisanal Fisheries in Chile

2.0 Abstract

Artisanal fisheries in Chile supply a significant proportion of high valued fin-fish, benthic invertebrate and algal resources. These fisheries provide a livelihood for thousands of artisanal divers and their families, and fuel a significant export-oriented industry. This chapter describes the developments, in the past 50 years, of the marine benthic invertebrate artisanal fisheries in Chile. It introduces small-scale artisanal fishery for benthic resources and describes open access scenarios, new legislation introduced in the early 1990's based on granting territorial user rights to fishers, and the co-management strategies that developed as a result. Emphasis is put on the lessons we can learn from this fishery policy process. It also presents what scholars and the government have proposed as the policy perspectives for the future, which includes an ecosystem management approach and the creation of networks of limited access areas. The chapter concludes by advocating research on the human dimensions of the policy process as a critical determinant of the policy's long term success.

2.1. Introduction

There is a crisis in the worlds' oceans. Marine fisheries are in trouble (Botsford *et al.* 1997, Pauly *et al.* 2003, Pew Oceans Commission 2003). This is occurring in the context of what many fishery scientists, national, regional and international organizations thought was a well developed "fisheries science-management scenario". The crisis refers not only to the depletion of oceanic and coastal resources, but also has rippled into modifications of natural ecosystems (Myers and Worm, 2003). There has been a series of reviews focusing on the cause and solutions for the crisis. For instance, Pauly *et al.* (2002) indicated that fisheries have rarely been sustainable and that the serial depletion of fisheries have long been masked by improved technology, geographic expansion and exploitation of previously spurned species low in the food web. Further, that the solution lies in reducing fishing capacity to appropriate levels and on the reduction of subsidies. Also, that zoning the oceans into un-fished marine reserves (also see Roberts and Polunin 1993, Castilla 1999, Roberts *et al.* 2000, 2001, Palumbi 2003) and areas with limited/controlled levels of fishing effort (Castilla and Defeo 2001) would allow sustainable fisheries for the future.

The fishery crisis is more multifaceted than the way it has been portrayed and key elements such as the role of social sciences, specifically the role of fishers management perceptions and the use of property/user rights, have not been duly highlighted in the proposed solutions. For instance, small-scale coastal inshore fisheries, mainly composed of artisanal fishers, have their own challenges and can not be accounted for in the same way as highly industrialized fisheries, trans-boundary highly migratory fisheries, or bottom-trawling fisheries. These complexities of the fishery crisis and its multifaceted nature need to be recognized if specific scientific management orientated advice on resource sustainability are to be given.

This chapter introduces the small-scale artisanal fishery for benthic resources in Chile and describes open access scenarios, new legislation introduced in the early 1990's based on granting Territorial User Rights for Fishers (TURFs), and the co-management strategies that developed as a result. Emphasis is put on the lessons we

can learn from this fishery policy process. It also presents what scholars and the government have proposed as the policy perspectives for the future, which includes an ecosystem management approach and the creation of networks of limited access areas. The chapter concludes by advocating in favour of research on the human dimensions of the policy process as a critical determinant of the policy's long term success.

2.2. The Chilean Benthic Artisanal Fisheries

Artisanal fisheries in Chile supply a significant proportion of high value fin-fish, benthic invertebrate, and algal resources, much of which is exported. For instance, in 2000, 110,000 tonnes of shellfish were landed, worth approximate US\$ 50 million in export revenues (SERNAP 2004). This activity is also important from a social and employment perspective, as there has been an explosive increase in the artisanal fisheries work force over recent years, from approximately 17,000 registered fishers in 1975 to over 48,000 in 2000 (San Martin 2001). Out of these, 22,600 fishers are registered as divers or coastal intertidal and shallow subtidal food-gatherers, which exploit benthic shellfish as part of their livelihood.

Benthic artisanal fishers extract most species of shellfish through manual collection during low tides, through skin diving and using semi-autonomous or "hooka" diving gears (Bustamante and Castilla 1987, Castilla and Defeo 2001). Hooka gear (known in Chile as "material"), includes: a 5-9 m wooden or fibre glass boat; a 10-45 hp outboard motor; air compressor and hoses and a crew of 3-4, including a boatman; one assistant; and one or two divers (Fig. 2.1). Diving trips are normally run during the day, usually less than 25 km from the base port and diving occurs no deeper than 25-30 m (Castilla and Defeo 2001).



Figure 2.1 Diver with hooka equipment preparing to extract key-hole limpets (*lapas*) at El Quisco, Central Chile.

At least 60 benthic species of invertebrates are exploited in Chile, including crustaceans, mollusks, sea urchins and tunicates (Bustamante and Castilla 1987). Economically the most important benthic Chilean artisanal resources, are the murcid snail *loco* (*Concholepas concholepas*), the *erizo*, red sea urchin (*Loxechinus albus*) and *lapas* or key-hole limpets (several species of genus *Fissurella*; Fig. 2.2). The ‘loco’ is currently the most important economic shellfish in Chile⁵, while ‘erizo’ and ‘lapa’ are relatively important in terms of landings in southern and northern regions respectively (Sernapesca 2004).

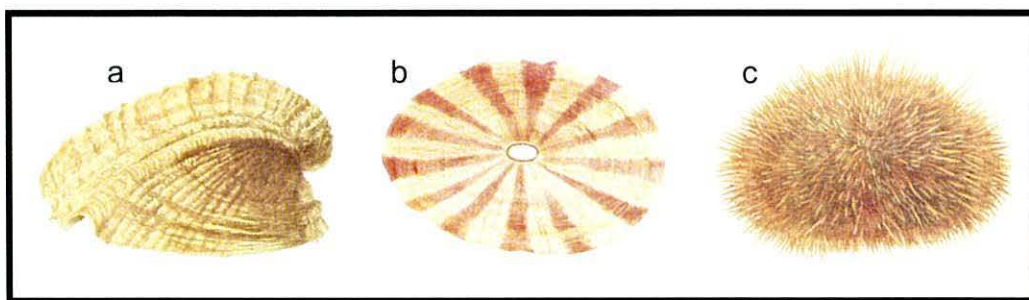


Figure 2.2 Drawing of the main benthic species extracted in Chile. a) *Loco* (*Concholepas concholepas*) b) *Lapa* (*Fissurella ssp*) c) *Erizo* (*Loxechinus albus*) (source: Acuario de Los Vilos 2001).

⁵ King crab (*Lithodes antarcticus*) and crayfish (*Jasus frontalis*) are more valuable per unit but are restricted to very local geographical areas and therefore do not have such a big influence on a national scale.

As loco is the single most economically important shellfish in Chile we will refer to its fishery, throughout this chapter, as a basic case study to illustrate the implementation of changes in Chilean fishery legislation. We divide this fishery in two main stages; a pre-policy and policy process stage (Fig. 2.3).

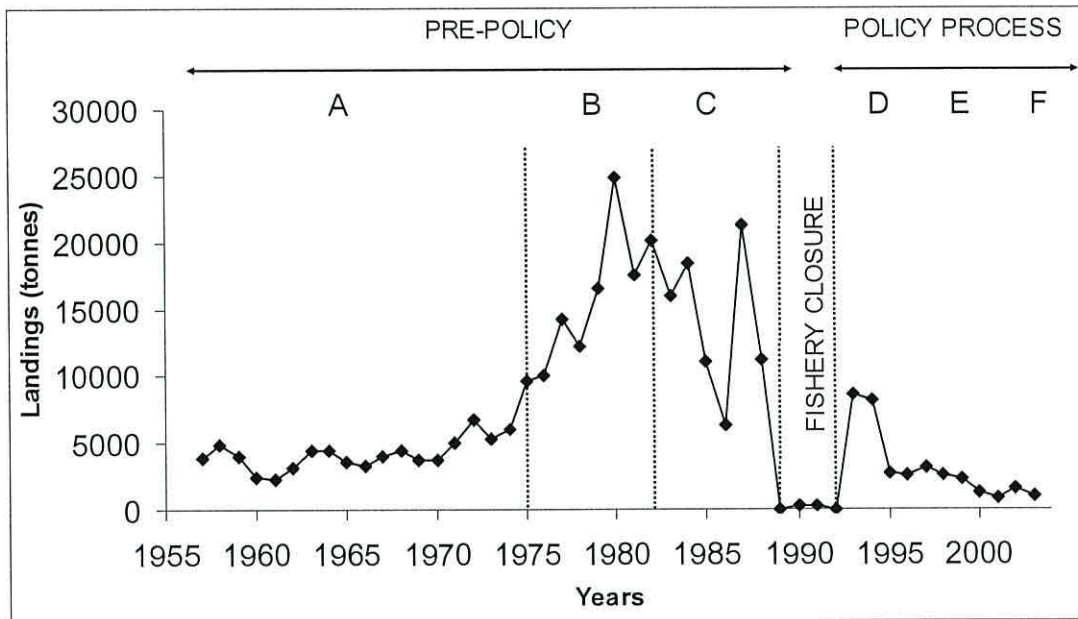


Figure 2.3 *Loco* landings for the period 1957-2003. Three pre-policy and three policy process phases of the fishery are identified. These are (a) domestic consumption phase, (b) the export phase, (c) regulation problem phase, (d) the pre-development policy phase, (e) the development policy phase, and (f) the maturation phase (source: Various government reports).

The pre-policy stage includes an initial period of landings exclusively for domestic consumption, followed by the rise in mid 1970's of landings due to the fact that *loco* became a major export product mainly to Asian countries (Castilla and Defeo 2001, Leiva and Castilla 2002). Due to the rise in fishing effort, the *loco* experienced over-exploitation and was the source of strong conflict in the late 1980's (reviewed in the next section). These conflicts have been important factors in bringing about change in Chilean fishery legislation related to benthic resources, which were institutionalized in the 1991 Fisheries and Aquaculture Law (FAL). This legislation is reviewed in the policy process section of the chapter.

2.2.1. Pre-Policy Stage

During the pre-policy stage the *loco* fishery showed three phases. The first (1960-1975) characterised by small landings of around 2,000-6,000 tonnes, used mainly for domestic consumption (Fig. 2.3a). Then, Chile adopted a neo-liberal policy framework⁶; this, together with the implementation of an aggressive exchange rate policy in 1974/75, substantially improved fishing export earnings⁷, and produced the necessary incentives for Chile to become the region's leading fish and shellfish exporter (Thorpe *et al.* 1999). For instance, between 1976 and 1981 *loco* landings abruptly increased reaching a peak of 24,800 tonnes in 1980 (Fig. 2.3b). According to Vial (1991), fisheries were the fastest growing economic sector in Chile during the 1980's.

Demand for shellfish (mainly *locos* and sea urchins) were constantly increasing from Asian markets and local credit programs created by the government meant favourable investment opportunities for new boats, diving gear, and processing plants, thereby stimulating even further product demand (Schurman 1996). At that time, most fisheries in Chile operated under an open access policy and small-scale artisanal fishers, although based at specific artisanal coves or *caletas* (Castilla *et al.* 1998), used to migrate along the country. As the new export markets grew fishers intensified their migrations to take advantage of the new opportunities. Buyers began recruiting groups of divers from *caletas* and transporting them to distant fishing grounds targeting high valued species such as the *loco* (Meltzoff *et al.* 2002). Thousands of divers moved around Chile, mainly to the southern regions, sparking fights between locals and outsiders in what was named at the time the '*loco* war' or '*loco* fever' (Reyes 1988, Meltzoff *et al.* 2002). From 1982 to 1988 *loco* landings decreased (Fig. 2.3c), probably due to overexploitation, resulting in a complex series of management steps (Castilla and Fernández 1998). The Governmental Fisheries Service could not prevent clandestine catches and smuggling. Reyes (1991, cited in Meltzoff *et al.* 2001) stated that smuggling efforts even included labelling *loco* as frozen strawberries for export purposes.

⁶ Neoliberal policies were implemented shortly after A. Pinochet came to power in 1973.

⁷ "The deregulation of the domestic capital market and the creation of the quasi-governmental Pro-Chile (Instituto de Promoción de Exportadores de Chile) in 1974 to promote exports, further encouraged trade expansion. The fisheries sector was the major beneficiary" (Thorpe *et al.*, 1999).

According to a Fisheries department official, the open-access state of benthic resource fishing in Chile, and the newly opened export markets, were enough to lead to a ‘tragedy of the commons’⁸ (Interview 2002, San Martin). Consequently the *loco* fishery was completely closed between 1989 and 1992 (Fig. 2.3) until subsequently the government developed a new regulatory framework: the Fisheries and Aquaculture Law N° 18.892 (Decreto 430, approved in September 1991).

2.2.2. Policy Process

The 1991 Fisheries and Aquaculture Law (FAL) included the allocation of TURFs to artisanal fishers in what are known as management and exploitation areas for benthic resources (MEABR). This process was not straightforward. In the following sections we describe three main phases of the policy process: pre-development, development, and maturation (Fig. 2.3 d,e,f).

2.2.2.1. Pre-development phase

This early phase in the policy process began in 1988 with the implementation of experimental no-take zones undertaken jointly by marine ecologists and fisher syndicates, and christened as “natural shellfish re-stocking via rotational exploited areas” (Castilla 1988). At this time there was no formal policy and fishers themselves established regulations for the management of these informal management areas. The basic ecological and fishery concepts pertaining to shellfish re-stocking, came from the experience of a single and small 5 ha of intertidal and subtidal system at a University No-take Coastal Reserve (Estación Costera de Investigaciones Marinas (ECIM), Las Cruces, 33° 33’S, 71° 36’W) in central Chile. Research at this Station between 1982-1988 showed that if shellfish extraction was prevented, then benthic resources such as the *loco*, sea-urchin, key-hole limpets, and large algae, may be restored via ‘natural seeding’, over a period of about 3-5 years (Castilla 1988, 1989, 1990). Inside the reserve the commercial resources reached greater abundances (up to 10 times) and sizes compared with nearby exploited fishery grounds (Castilla and Durán 1985, Castilla 1989, 1990, Durán and Castilla 1989, Castilla 1999).

⁸ Original article Hardin (1967), review of the concept in Feeney et al. (1991).

It is important to highlight that Castilla *et al.* (1998) showed that the number of *loco* caught per hour of diving as a measure of catch per unit effort (CPUE) was significantly higher in the 1993 winter season harvest within the caleta El Quisco experimental natural re-stocking area than in historical fishing grounds in the nearby caleta of Algarrobo and Las Cruces (Table 2.1). The mean size of the individuals was also higher in El Quisco, and therefore prices were higher. Searching and traveling time for diving were significantly reduced within the re-stocking area as compared to historical fishing grounds (Castilla *et al.* 1998).

Table 2.1 Catch per unit effort (CPUE), size range, and prices of *loco* from an experimental no take zone (El Quisco) and historical fishery grounds (Algarrobo and Las Cruces) in central Chile during the winter of 1993.

Locality (Caleta)	Mean CPUE (<i>locos</i> /hour)	Size (cm)	Unit Price (US\$)
El Quisco (Experimental re-stocking zone)	148.3 ± 40.7	10.7 – 11.8	1.39 – 1.94
Algarrobo	64.89 ± 25.83	10.3 – 10.8	0.91 – 1.17
Las Cruces	30.93 ± 10.17	10.3 – 10.8	0.86 – 1.84

Source: Castilla *et al.* (1998)

These successful pilot natural restocking experiments were used as models for the implementation of TURFs in the 1991 FAL. Nevertheless detail as to how marine tenure was going to be given to fishers was lacking until 1997, when the decrees for legalising TURFs in the form of MEABRs were approved. Between the publication of the FAL in 1991 and the development of enabling regulations in 1997, fisher syndicates, who wished to engage with MEABR policy, could only do so in an informal basis. During these years of informality, any fishery syndicate or

cooperative wishing to conserve and manage there resources was helped and supported by teams of university linked biologists and marine technicians.

2.2.2.2. Development phase

During the ‘Development’ phase the policy gained support from the Fisheries Undersecretary and was officially implemented. TURFs for benthic fisheries were finally legalized and given to artisanal fisher syndicates in the form of MEABRs. This stage began in 1997 with the governments’ approval of the regulations, which established the proceedings and technical criteria for managing MEABRs. It leads up to the year 2000 when MEABRs were already being legally harvested and more than 230 MEABRs decrees were being established (Subpesca 2004).

The co-management arrangements behind MEABR policy, in place since 1997, establish that in order to be awarded a MEABR, a fisher syndicate/association must finance a baseline study for their MEABR from which resource catch quotas (typically between 10-25% of exploitable stock) and a management plans are created. These are non-transferable syndicate and not individual quotas. The arrangement also establishes that fishers must pay for yearly follow up assessments to certified consultants in order to determine changes in the total allowable catches and the evolution of the management extractive plan. The annual assessments of the natural resources extracted from the MEABR must be declared to the fisheries department which supervises compliance of the management plan (Gelcich *et al.* 2005a). In addition to this, a yearly management area permit must be paid once the area has been harvested for four years (Subpesca 2002).

During the ‘Development’ phase the state committed to promote, popularize, and co-finance the implementation of MEABRs pushing to formalize them for every fishery syndicate in the country. Up until the year 2000 approximately US\$ 1 million had been spent on co-financing MEABR studies (Subpesca 2002). As a government official stated: “*MEABRs were to be the basis for managing benthic fisheries with special emphasis on the lucrative loco*” (Interview with G. San Martin, 2002). The governments’ MEABR approach during this stage aimed at generating an increased sense of exclusive use and ownership among fishers (Meltzoff *et al.* 2002). This created large expectations among fishers as their perception was that they were

receiving the equivalent of a ‘land grant’, which in this case had the form of a highly productive subtidal area (Bernal *et al.* 1999). Additional strategies that favoured the success in implementation of government-supported co-management included publicizing the government’s desire to collaborate, concentrating efforts on cohesive localities (Jentoft 1989), and a decision to declare a ban on *loco* extraction, apart from MEABRs with approved management plans.

During these ‘Development’ years, 206 MEABR decrees were processed, 93 of them during 1997, which were mainly submitted by fisher communities who had been working with universities and experts on managing areas during the “Pre-development” phase, and who were eager to get formal property rights. The National Fishing Service and private consultants supported the remaining ones.

MEABRs which are applied for in Chile vary in size and species composition. Fifty five percent of MEABRs are less than 100 hectares in size and only 8% measure more than 500 hectares (Fig. 2.4). Species that are included in the MEABR plans vary between fishery communities but mainly include *loco*, sea urchin and key-hole limpets (Fig. 2.5).

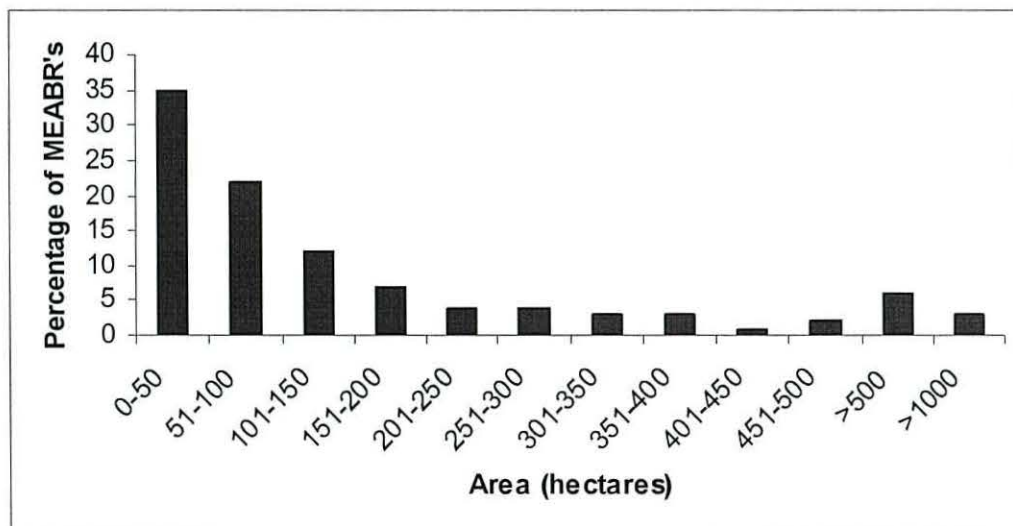


Figure 2.4 Percentage of MEABRs which correspond to different size classes (source: San Martin 2001).

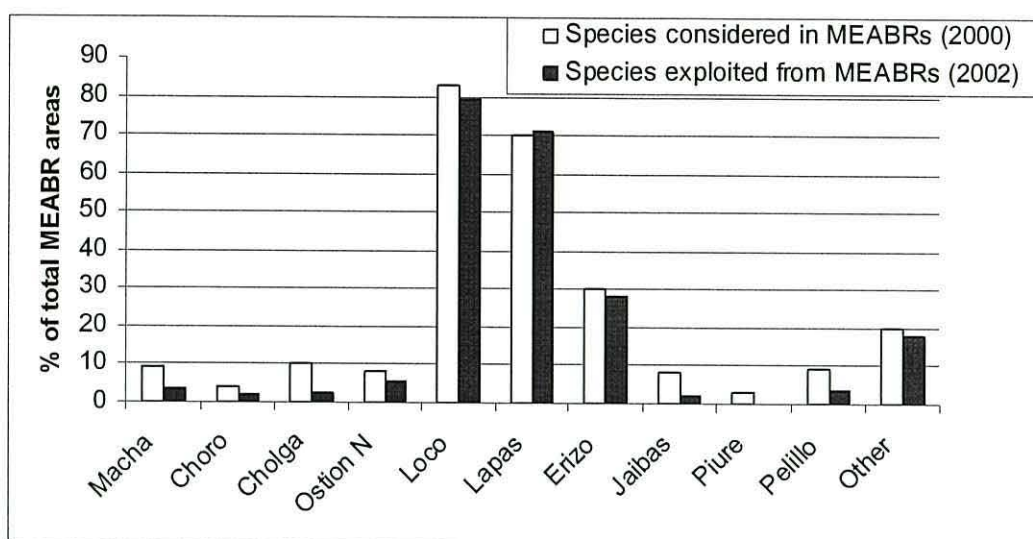


Figure 2.5 Percentage of MEABR (out of 206 areas) that included different benthic species as part of their management plan in year 2000 (white columns). The black columns represent the percentage of areas (out of 107) that harvested different species out of their MEABRs until year 2002. *Macha* (*Mesodesma donacium*), *choro* (*Choromytilus chorus*), *cholga* (*Aulacomya ater*), *osti6n del norte* (*Argopecten purpuratus*), *loco* (*Concholepas concholepas*), *lapas* (*Fissurella* spp.), *erizo* (*Loxechinus albus*), *jaibas* (*Homalaspis plana*; *Cancer* spp.), *piure* (*Pyura chilensis*), and *pelillo* (*Gracilaria* sp) (source: Various government reports).

It is important to highlight that the Fisheries Undersecretary sees these years as a great success for benthic resource management. Fisher communities were self-organizing in syndicates and applying for MEABRs, creating partnership with the government, universities and consultants. In this way, artisanal fishing coves were being consolidated responding to government incentives. There was a reinforcement of syndicates / associations and a strengthening of leadership which led to the implementation, by fishers themselves, of surveillance procedures to stop poaching within MEABRs and to establish participatory and regulatory rules within the communities. A sense of ownership, responsibility, pride, and hope for sustainability arose among fishers engaging with the policy (Castilla and Defeo 2001). The biological and economic success of MEABRs were proclaimed through government documents. These studies showed a significant increase in abundance and individual size of resources within MEABRs in comparison with open-access sites (Subpesca 2000). International prices of *loco* also increased after the implementation of MEABRs following an inverse relationship with respect to landings (Fig. 2.5). Thus, global markets showed a willingness to pay higher prices for *loco*.

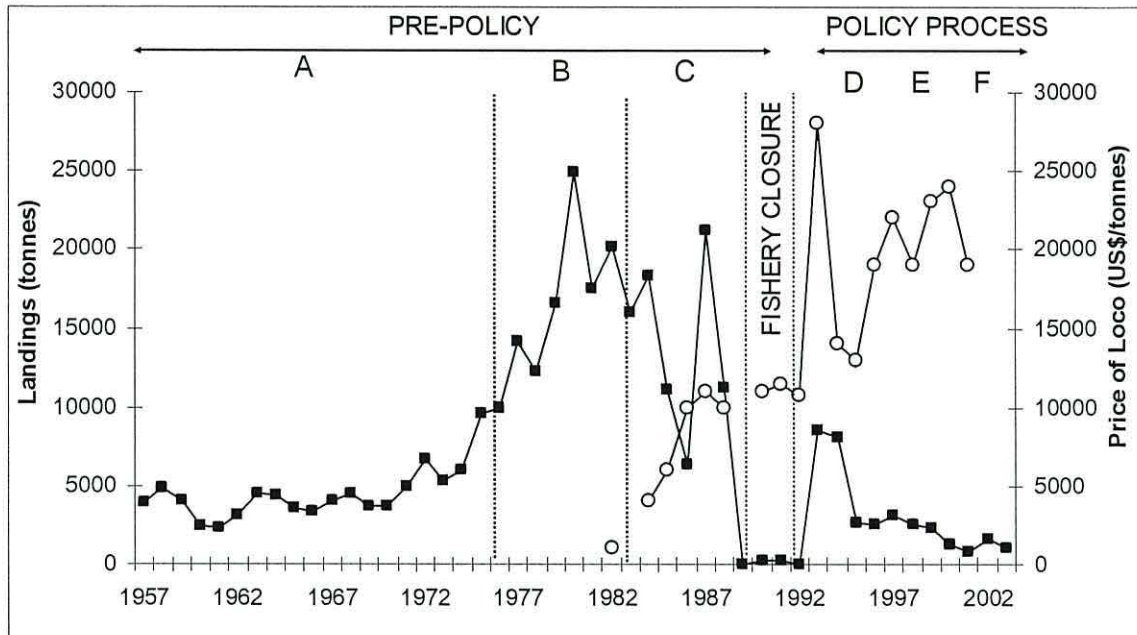


Figure 2.6 Landing (tonnes) and price (US\$/tonnes) of *loco*. The squares represent landings and the circles the price paid for *loco* (source: Various government reports).

During this stage, fishers were effectively encouraged to become non-migrating, small businessmen, who could earn a living through the sale of self-managed resources and co-management was promoted as the innovative change that helped this process by sharing power between the government and fishing communities. During this ‘Development’ phase two main issues were resolved: (1) the consolidation of the ‘pre-development’ stage through the formalization of property rights, thus changing a *de facto* into a *de jure* measures based on biological assessments and (2) the definition and expansion of the property rights policy concept (MEABRs) with the support and commitment of the Fisheries Undersecretary and the positive response of artisanal fisher associations.

2.2.2.3. Maturation phase

From the year 2001 to the present, fisher associations have gradually been adapting to their new lifestyle as non-migrating businessmen. By the end of 2003 MEABRs were consolidated throughout many regions of Chile: 1031 applications had been processed and 481 MEABRs had been approved, 157 management plans had been implemented (Fig. 2.6), five areas were entering their fifth follow up assessment, and these were due to pay a management area permit for the first time (Subpesca 2004).

Differences between the policy uptake speeds from different regions were observed mainly due to variation in the government's support which began in central Chile and then extended towards other more geographically extreme regions. For instance MEABRs in regions IV and V in central Chile, prove to be quite advanced with most of its MEABRs implemented and in full extraction. Nevertheless, many associations of Region X in southern Chile are still in the application processes stage (Fig. 2.6).

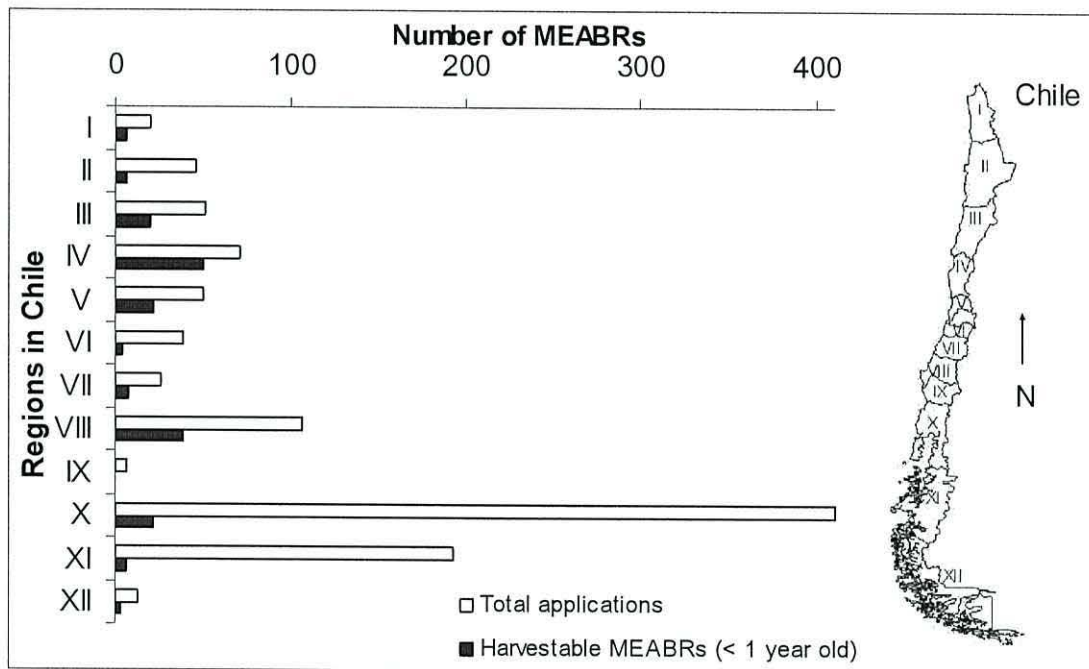


Figure 2.7 Number of MEABR applications in Chile until November 2003 separated by region. The black columns represent the number of areas that have been officially decreed for more than a year (source: Various government reports).

During the policy Maturation phase, some fisher association leaders and small-scale fishers started to view the MEABRs as more than a marine tenure. Now they saw them as a way to organize and facilitate fisheries and non-fisheries related business activities, such as tourism and seafood restaurants. An important driving force for this was the fact that MEABR resource quotas were given to the community organised as syndicates. These community fishery quotas (CFQ) gave incentives for cooperation instead of negotiation between fishers, as may have occurred had individual quotas been awarded.

Fishers have also attached other important non-economic values to the existence and ownership of MEABRs, such as pride and accountability (Gelcich personal observation, 2003). As part of MEABR consolidation, innovative strategies that account for fishers' entrepreneurship include an attempt to sell management area resources collectively between associations in the form of a 'selling cooperative', named 'Pacíficoop' in the V Region (Gelcich, personal observation 2004). This cooperative was formed exclusively by fishers', engaging 15 organizations from central Chile that represented 1170 artisanal fishers. In 2003 the associated syndicates had offered about 50% of their MEABRs production to the cooperative, resulting in approximately 650,000 *loco* and 50,000 kg of *lapa* for sale. "*The ultimate objective behind this association is to consolidate MEABRs and form strategic alliances with shellfish exporters in order to get a fare price for our products*" (Interview with Pacíficoop Cooperative Director, 2004).

It is important to highlight that decisions within the fishers' cooperative are taken at three levels: (1) the assembly, which is formed by members of all the syndicates and has the power to resolve and sanction decisions; (2) the directorates, who are trusted by the assembly to take administrative decisions; and (3) the commissioners, who take operational decisions concerning discipline, commercialization, and are accountable to the directorates and the assembly. This initiative, although so far unique in the country, shows how the MEABR policy has opened new ways for fishers' long-term engagement as resource stewards and how it has encouraged self-empowerment to solve fishery problems. In this particular case, the avoidance of the competition that associations were experiencing between themselves to sell resources produced price reductions at the *caletas* level.

In addition to self-organization and empowerment, another specific point of interest, maturing during this stage, relates to the change of attitudes of fishers with respect to management and conservation of resources. Research in the fishing cove of Los Vilos, which included three syndicates, evidenced that 94% of surveyed fishers agreed or strongly agreed to the statement "*Fishers have a duty to conserve marine resources for the next generation*" and all agreed with the statement of "*Improving earnings from resources by improving quality*" (Gelcich *et al* 2005a). In this way, fishers have a perception of their role in marine conservation, which had been

generated through the experience with co-management. Despite these encouraging results, it is important to be cautious because the positive attitude towards conservation might be related to recent memories of intervention when conservation affinity was synonymous with gaining donor projects. This took place especially during the ‘Development’ phase when, community based development and conservation projects of MEABRs, were greatly supported and fishers learnt that cooperation could bring status and also additional sources of income from eager national or international NGOs or agencies (Gelcich *et al* 2005a).

During these last three years the MEABR policy process has matured and self-management has proved to be effective in many *caletas*. Achievements concerning policy, sustainability, fishers’ knowledge, and inter-sector collaboration have encouraged stakeholders to think that the exclusive use associated with territorial user rights has generated the necessary incentives and institutions.

2.2.3. Perspectives for the Future

MEABRs policy has incorporated many of the classic common-property regime design principles such as those developed by Ostrom (1990). In this section we discuss two ideas, which have been mentioned by academics and are beginning to be part of government officials’ discourses when faced with questions relating to the long-term sustainability of benthic resource management through MEABRs. The first includes the need for a multi-species ecosystem approach within MEABRs and the second considers the need for marine protected areas within the MEABR network.

2.2.3.1. An ecosystem approach

Scales for the implementation of operational and institutional fisheries management arrangements should correspond with the scales of the population movements and dynamics of the benthic stocks. In Chile, the boundaries selected for each MEABR are generally based on the physical structure of the coastline. Moreover, former MEABRs were designed by giving high priority to the *loco*. Even though fishers, managers, and scientists could easily observe and understand the limits of *caletas*, these are not the boundaries defined by the life-history habits of benthic

invertebrates, particularly those mobile species mentioned above (Fernández and Castilla 1997, 2000). Mobile species offer a new challenge to design and implement area-specific management tools. A hierarchical approach would contribute in the criteria for MEABR implementation, on the basis of the life history of the highest valued species for the society. This implies a trade-off between the scale of implementation of a MEABR and the biology of the species involved, specifically the probability of response of the benthic species to fishing pressure (Castilla and Defeo 2001).

An ecosystem approach incorporating interspecific interactions and physical environmental influences should be used to manage MEABRs (Botsford *et al.* 1997). This holistic approach to restoring populations within MEABRs is difficult to implement when fishing effort becomes more heterogeneous and therefore more difficult to link to specific stocks. However, it becomes more realistic than single-stock management in the sense that it considers competitive release or a diminution of predation effects on species with the highest value in the market. It should be highlighted however that manipulation of species abundance should be prohibited or only conducted with close scientific advice, because the complex dynamics in multispecies assemblages precludes a synthetic forecast of the ecological outcome of these manipulations (Castilla 2000).

Regular control of the availability of suitable habitat for critical life-history stages would also be advisable. Limitations of habitat may be important bottlenecks for some invertebrate populations (Caddy and Defeo 2003), and experience suggests that benthic organisms of a wide range of taxonomic groups and species often pass through primary and secondary habitats in the course of their life histories, as is the case for the high-valued *loco*. In this case, the extent of critical juvenile habitats may be the bottleneck limiting overall production, given that habitat and food supplies available to older stages may not be limiting.

2.2.3.2. Marine protected area network

Castilla (2000) suggested that spatial linkages, promoting cross-fertilization between permanently closed, managed, and unmanaged areas may represent an excellent example of the joint achievement of conservation and management goals. This

spatial model, enhancing connectivity between different locations and environments along the Chilean coastline, is presently being developed. For instance, the first Chilean Marine Park has recently been established in far Southern Chile (Parque Francisco Coloane, Fernandez and Castilla, in press) and the inauguration of two new Parks will soon follow in northern and southern Chile (Conama 2004). Their locations will be necessarily flanked by several MEABRs, already established and in operation. Therefore a natural connectivity between areas, for management and conservation purposes, should occur. It has already been demonstrated for northern and central Chile (Castilla and Rho 1997; Manríquez and Castilla 2001) that marine reserves and no-take areas act to replenish benthic resources, leading to increased larval production, and they also act as 'seeding-grounds' for nearby overexploited fishing grounds. This novel strategy is being proposed in order to abolish the traditional confrontations between conservation and management measures (Castilla 2000).

Policy has been implemented throughout the country and there has been a planning process for its future. Nevertheless as one might expect, there is few win-win situations in management, and problems are emerging. This is discussed in the following section.

2.2.4. Problems with MEABR Policy

The problems associated with open access and the traditional command and control approach to fisheries, stimulated the search for MEABRs as a management alternative. To date, perceptions of the success of the MEABR policy have been largely dependent on biological studies of resource restoration within MEABRs (Castilla 1990), and the official statistics on MEABR adoption. The large number of MEABR applications has been taken as evidence that fishers are organizing and adopting livelihoods as non-migrating businessmen, which was one of the original policy aims. However, a review of MEABR application statistics and the accompanying official documentation does not reflect the current and future problems associated with the policy.

There is a need to have a better understanding of the effect of management decisions on the social, cultural, and economic pressures on the people being managed (Kaplan and McCay 2004). These human dimensions of the management process have not been given the attention they deserve and no studies have examined social consequences of the policy. This is unfortunate, as the attitudes and perceptions of key stakeholders influence their engagement with policy and consequently should increasingly be fed into policy developments (Aipanjiguly *et al.* 2003).

Interviews with fishers (detailed throughout this study) show the existence of important sources of conflict with the MEABR implementation. Many of them deal with the fact that open-access fishing sites are becoming scarce and overexploited. This has important consequences depending on the type of fisher engaged in MEABR. For example, one fisher stated *“This law didn’t analyze the secondary effects. There is an indiscriminate extension of the areas. They [fisheries department] say that the sea cannot all be used by MEABR. But there is nearly nowhere to go and dive, everything is asked for and the little historical zones [open-access] left have collapsed... Divers have nowhere to dive....”* (Diver of Los Vilos 2002). Fishers as the one quoted above define themselves as divers, and as such, are reticent to adopt a livelihood as fin-fishers during the periods when MEABRs are closed for extractions. They therefore seek an optimization of MEABRs by including multi-species management plans. Additionally, due to the lack of open-access diving grounds conflict between divers is rising, notably as a result of illegal poaching within the MEABRs. This is weakening social bonds between fishers and raises costs of enforcing rights over MEABRs.

Ultimately it is important to highlight that experience with MEABR shows that the financial returns from MEABRs is lower than the initial expectations fishers had. Thus it is practically impossible for fishers to make a living exclusively from MEABRs, making open access diving sectors and fin-fishing important income strategies. MEABRs in Region IV of Chile during the 2000-2001 extraction period only showed an average income equivalent to 5.26 minimal monthly wages per diver per year (≈ 1000 US\$ diver/year). The value for the harvesting period 2001-2002, 2002-2003 followed a similar pattern (Sernapesca, 2004). In 2003-2004 income values from MEABRs declined mainly due to the incorporation of new MEABRs in

the South of Chile (Region X, see Fig. 2.6) which supply large quantities of good quality *locos*.

We must be aware that a fine-tuning period for the policy may last several years and could be accompanied by conflict and low or negative financial returns due to poaching of fishers within MEABRS and market adjustments due to supply and demand adjustments. This transition could have stronger effects in syndicates where occupational mobility of fishers is restricted to diving and to regions where *loco* sizes and abundances are historically lower. It is under these circumstances that, research on the human dimensions of the policy, regarding fishers' attitudes, objectives, economic decisions, will prove valuable to understand how different fishers will adapt to the new policy and if they are willing to continue participating in MEABR and its proposed future directions.

2.3. Conclusion

The rationale for introducing the co-management arrangement in the form of MEABR in Chile, was the fact that these fisheries were almost overexploited. In this respect, co-management is a form of crisis management, which seeks as an anticipated outcome that the sustainability, efficiency and equity of the resources and its users will be improved. There is evidence that MEABRs have had several positive repercussions for marine benthic fisheries in Chile:

- MEABRs have increased bio-economic fishery indicators (stock abundance and CPUE levels, unit prices, and individual sizes of targeted stocks) when compared with either past values during the declining phase of the fisheries or with open-access grounds (Castilla 1994; Castilla and Fernández 1998; Castilla *et al.* 1998).
- Restricting access to the stocks, together with legislation to protect rights to fish of those fishers that participate in the management plan were successfully implemented and applied (Castilla 1994; 1997). The assignment of fishing grounds to well-defined groups of fishers also represents recognition of the role of small-scale communities in conservation and management (Castilla and Defeo

2001) and has given incentives for fishers' engagement in non-fisheries business activities such as tourism and seafood restaurants.

- The cross-linkage between experimental management protocols (natural seeding experiments) and the active participation of fishers was successful in improving knowledge of fishery indicators.
- Considerations of the future of MEABR policy have proposed the inclusion of ecosystem management within the MEABRs. It has also managed to propose and currently begin to implement a network where the combination of coastal MEABRs and no-take areas, including reserves and parks, may lead to a strategy where management and conservation practices can be merged, resulting in a novel and sustainable fishery conservation approach.

Despite the above, the increasing adoption of co-management in Chile is no cause for complacency. There is still an unknown level of socio-cultural heterogeneity in the fisheries sector, and uncertainty as to how the policy will impact different fishers. These are critical determinants for the long term success of the policy and highlight the need to understand aspects of fishers' attitudes, response decisions and perceptions. This information may guide policymakers and academics to consider better ways of adapting the policy and its future perspectives to local realities. It also shifts coastal fisheries development away from a linear development trajectory towards one based on fishers' skills livelihoods and motivations.

Chapter 3: Importance of attitudinal differences among artisanal fishers towards co-management and conservation of marine resources



Returning from a day's fishing at Matanzas, Chile

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Importance of attitudinal differences among artisanal fishers towards co-management and conservation of marine resources

3.0. Abstract

The Chilean government has introduced a policy that gives formal user rights over defined areas of seabed to organized groups of artisanal fishers with the goal of achieving sustainable exploitation of natural resources. We assessed differences in the attitudes of participating artisanal fishers toward this form of management to understand their importance in the design and implementation of fisheries management. We used questionnaires and participatory rural appraisal techniques to survey members of six fishing management committees. Fishers' attitudes varied significantly among syndicates in three main domains: attitudes toward the environment, unresolved aspects behind the management area policy, and perceived benefits derived from adoption of the policy. These differences indicated the existence of distinct world views that structure fishers' behaviour toward the marine environment and its management. In addition, the responses made by fishers correlated best with the degree of off-sector pluriactivity and their dependence on diving as a source of income. This suggested that a livelihood approach to the development of Chilean artisanal fisheries that considers the multiple economic niches of the fishers will be most effective in the implementation of dual conservation/management measures.

3.1. Introduction

Marine fisheries are important as providers of food and economic resources to fishing communities around the globe, they are also in global decline (Pauly *et al.* 2002; 2003; Myers and Worm 2003). In view of these interacting factors, the major policy response to mitigating further declines, while simultaneously maintaining some level of harvest, revolves around achieving the goal of sustainable exploitation (Bene 2003). Several instruments show potential in achieving both conservation and sustainable use of marine resources, including the use of Marine Protected Areas (MPAs) and no-take zones (Gell and Roberts 2003; Agardy *et al.* 2003). However, the success of such management systems that limit or restrict access to marine resources depends upon the extent to which fishers are willing to participate in these systems (Jentoft and McCay 1995; Jentoft *et al.* 1998; Zanetell and Knuth 2004).

In general, examples of limited access fisheries tend to be isolated and do not necessarily reflect national policy (e.g. Acheson 1990; Blyth *et al.* 2002). The adoption of a national policy in Chile that restricts access to many areas of the seabed to achieve sustainable exploitation is therefore an exception. This policy has arisen due to the social and economic importance of the artisanal fisheries that are restricted to coastal waters (Castilla and Defeo 2001). As a result, the management of benthic (bottom dwelling) resources is a specific component of the Chilean 1991 Fisheries and Aquaculture Law (FAL). The FAL redefines artisanal fishers and incorporates new regulations that affect their user rights through three management steps. First, exclusive fishing rights within a zone that extends to 5 nautical miles (9 km) from the shoreline are assigned to artisanal fishers. Second, artisanal fishers are restricted to working (diving) within the coastal zone adjacent to their area of residence (regionalisation). Third, the FAL assigns exclusive diving rights to given areas of seabed to registered artisanal fishing syndicates, under what have been termed management and exploitation areas for benthic resources (hereafter referred to as MEABR). The rationale behind these territorial user rights is based on common property and co-management approaches (Ostrom and Schlager 1996). These propose that formal property rights will create sustainable institutional arrangements among fishers, who will manage and harvest collectively (Ostrom 1990; Bromley 1992). In addition, this form of co-management should contribute to more effective

enforcement of regulations by increasing the likelihood of compliance (Jentoft *et al.* 1998).

The MEABR policy was first formulated in the early 1990s and is viewed as an innovative management instrument which is consistent in approach with the current global policy agenda of combining neoclassical economics with liberal democratic theory. The first actual MEABR was formally established in 1997. Since August 2003, 188 MEABR have management plans in place, and 649 are at various stages of the application procedure (Subpesca 2003). These include MEABRs for which applications have just begun, those whose applications are being modified, those with a decree for future establishment. Thus the Chilean network of MEABRs comprises a large number of management areas, established by numerous groups of fishers over a wide geographical range under one policy instrument. This network provides a useful resource for research in the allocation of territorial user rights and co-management, and the results should have relevance to other countries considering similar policies.

To date, research on MEABR has described the genesis of the policy (Bernal *et al.* 1999; Meltzoff *et al.* 2002) and has investigated biological sustainability and stock recovery within management areas (Castilla 2000; San Martin 2001). However, few studies have examined the social aspects and fishers' perception of the policy (Meltzoff *et al.* 2002). Such considerations of attitudes to the environment are becoming more important as conservation activity, increasingly depends on the actions of interested groups of people, be they local communities or the general populace. In theory, understanding the perceptions and attitudes of such groups could help predict their likely responses to a new policy or management activity prior to its implementation and/or help understand their responses to existing policies or activities. This interaction is reflected in the Theory of Reasoned Action or TRA (Fishbein and Ajzen 1975; Ajzen 1988) which is an important theory that has underpinned much social and psychological work over recent years. This theory argues that behaviour is best predicted by a person's intentions, which are in turn affected by his/her attitudes and the influences of significant others (e.g. family or community members) on their intention to act. Although TRA is still widely used it, does have its critics (eg Bender and Speckart 1981; Oliver and Bearden 1985;

Valerand *et al.* 1992), however alternative models to TRA, like the transactional model of behaviour (Lazarus and Folkman 1984; Deary *et al.* 1996) still place importance on attitudes as important elements influencing behaviour.

Partly in response to theories like TRA empirical work has sought to investigate the importance of attitudes and other factors in determining the environmental behaviour of different groups of people. Foremost amongst these groups have been the general public and farmers. The general public can engage in environmental behaviours such as ecological friendly consumerism, waste and energy reduction and recycling activities, and several studies have identified the socio-demographic variables which are correlated with such behaviours in the general public. These have variously been reported as education and income (Hines *et al.* 1987, Olli *et al.* 2001), age (Hallin 1999; Olli *et al.* 2001) and activity levels in environmental groups (Olli *et al.* 2001). The importance of individuals' attitudes in determining environmental behaviour has also been identified (Dunlap and Van Liere 1978; Hines *et al.* 1987; Vining and Ebreo 1992). However, it is probably incorrect to totally disconnect an individual's attitudes and behaviour from its social context, and both may be modified by social constructs such as institutions and local culture (Rayner 1991; Olli *et al.* 2001).

In contrast to the general public, farmers can undertake a range of environmentally related behaviours while undertaking their normal business. These behaviours may relate to issues such as the use of agro-chemicals, good nutrient management and water efficiency. In many countries farmers can also choose to adopt so-called agri-environment schemes which seek to enhance biodiversity on the farm in return for some form of payment from Government (Whitby 1994; Kleijn and Sutherland 2004). The adoption process of these agri-environment schemes is basically similar to that of any other new technology (see Rogers and Shoemaker 1971), and surveys of farmers have identified a series of farmer characteristics that impinge on the adoption decision. These include age, education, gender, attitude to risk and personality (Jones 1963; Bowler 1979; Brotherton 1991; Edwards-Jones *et al.* 1998; Vanslebrouck *et al.* 2002; Sheikh *et al.* 2003). In addition the wider social context influences their decision in terms of their farm household characteristics, such as stage in family cycle and level of pluriactivity (i.e. multiple job holding; Potter and Gasson 1988), and other social influences such as information flows, local culture,

social capital, attitude of trusted friends, the policy environment and the structure and impact of a range of institutions (Guerin and Guerin 1994; Neupane *et al.* 2002; Mathijs 2003). In addition to the above, the role of the farmers' attitudes in determining their environmental behaviour has been shown empirically in several studies (Carr and Tait 1991; Wilson 1997; Willock *et al.* 1999a; 1999b; Beedell and Rehman 2000).

Fishers are similar to farmers in that their livelihood is directly derived from the environment. Therefore, the determinants of their environmental behaviour will probably include some element of financial gain, a factor which is largely absent from the determinants of environmental behaviour of the general public. Because of this financial relationship with the environment we may expect many of the determinants of environmental behaviour in fishers to be similar in broad terms to that of farmers. Unfortunately, while there have been calls to investigate factors that might encourage or impede the adoption of new fishing strategies or policies (Jacobson *et al.* 2003), to date the attitude of fishers toward such strategies has often been over-looked (Kaplan and McCay 2004). We suspect that as with farmers, this is a rich area for academic study and offers the potential for real practical benefits to conservation. Thus understanding fishers' attitudes is an important aspect of the successful implementation of management policies, both in the general case of MPAs and in the specific case of the Chilean MEABR.

3.2. Background of MEABR policy

Co-management arrangements in the form of management and exploitation areas for benthic resources were introduced “*to find mechanisms that would reverse the generalised over-exploitation of benthic resources in Chile*” (San Martin 2003 personal communication, MEABR Department, Undersecretary of Fisheries). This overexploitation resulted from neoliberal policies in the mid-1970s and the aggressive exchange-rate policy in 1974/1975, which substantially improved fishing export earnings. As a result Chile became the leading exporter of fish and shellfish in South America (Thorpe *et al.*, 1999). The rapidly expanding fleets and associated fishing effort quickly depleted resources such as the clam *Venus antiqua* (Schurman

1996) and the gastropod *Concholepas concholepas*, known locally as *loco* (Fernandez and Castilla 2000; Bernal *et al.* 2001).

The harvest of *loco* increased from approximately 6000 tonnes in 1974 to 24800 tonnes in 1980 driven by the high demand from Asian markets (Castilla and Fernandez 1998; Castilla and Defeo 2001). From 1982 to 1988, landings decreased, probably due to overexploitation, while export revenues doubled (Castilla and Fernandez, 1998). From 1989 to 1992 the fishery was officially closed for the first time. Since then revenues from the export of *loco* have contributed up to 50% of the Chilean export revenues from small-scale shellfisheries, and accounted for US\$64 million in 1993 (Castilla and Fernandez 1998). *Loco* is the single most economically important benthic resource in Chile, as such it has been used to drive policy development, and the MEABR management system was first introduced in Chile aimed at the management and conservation of the *loco* fishery (Meltzoff *et al.* 2001; San Martin 2001).

The creation of MEABR arose from a combination of drivers that included (1) results of biological studies of the benefits of protection of benthic resources from human exploitation (Castilla and Duran 1985; Castilla and Bustamante 1989), (2) the theoretical and empirical consequences of open access and the evidence of successful common property regimes (Dahl 1998; personal communication San Martin 2003), and (3) the desire of some fishing syndicates to manage resources in defined geographical zones (Meltzoff *et al.* 2002; Subpesca 2002).

According to the Chilean Fisheries Undersecretary the creation of management and exploitation areas for benthic resources promotes and increases the productivity of benthic resources and thereby maximises the socioeconomic benefits derived from their exploitation (Subpesca 2002). The establishment of marine management areas through MEABRs leads to a consolidation of fishing activities into fishing coves (small ports). This process changes the historical migratory behaviour of fishers, who are instead effectively encouraged to become non-migrating business people organized into syndicates that earn a living through the sale of self-managed resources (Subpesca 2002).

The MEABR policy process began in 1988 with the implementation of experimental no-take zones undertaken jointly by marine biologists and fisher syndicates (Castilla and Duran 1985). This was taken as a model for the implementation of territorial user rights in the 1991 fisheries and Aquaculture Law. Nevertheless detail as to how marine tenure was going to be given to fishers was lacking until 1997, when decrees for legalising management and exploitation areas for benthic resources were approved. Therefore, six years after the implementation of the management and exploitation areas for benthic resources policy, the first area to be granted under this system was decreed in 1997. Since then, the formalization of MEABRs throughout Chile has been promoted positively (Meltzoff *et al.* 2002). The state is committed to promote, popularise, and co-finance the implementation of MEABR. Until 1999 approximately US\$1,000,000 had been spent on co-financing MEABR studies (Montesinos 2000 in Subpesca 2002). These additional finances are critical to the implementation of the policy because the MEABR application procedures include an initial baseline study and a management plan with subsequent monitoring performed by universities or registered consultants. This activity is financed by both fishers and the government (Subpesca 2002).

The first syndicates that adopted MEABR were those that had worked closely with ecologists and academics, holding joint meetings, where they shared scientific and monitoring data, modified their resource extraction strategies, and planned how to run the MEABR. The issue of the trade-off between fishers' ancestral migratory behaviour and the move toward a life-style as non-migrating business people meant that ecologists were more likely to work with syndicates and thereby provided access to government funded projects, training and studies that helped initiate these first MEABRs (Meltzoff *et al.* 2002).

Understanding the attitude and beliefs of fishers with respect to management and exploitation areas for benthic resources is important if we are to understand MEABR policy. At present 64% of MEABR applications are under consideration at different levels of the application and management plan process (Subpesca 2003); hence, our study coincides with a critical period in the adoption of MEABR policy in Chile.

3.3. Study Areas

We examined six fishing syndicates that were each in the process of applying for a single management and exploitation areas for benthic resources. For administrative purposes Chile is divided into 12 regions, our research considered syndicates in three of these regions (IV, VI and X). Syndicate Los Lobos was in the initial phase of applying for a MEABR in region IV ($31^{\circ} 55'S$; $71^{\circ} 00'W$). The MEABR policy process has been established in region IV for 5 years; hence, most fishing syndicates already have been through the application process. Syndicates La Boca ($33^{\circ} 55'S$; $71^{\circ} 50'W$), Matanzas ($33^{\circ} 57'S$; $71^{\circ} 52'W$), and Puertecillo ($34^{\circ} 17'S$; $71^{\circ} 58'W$) are all in region VI. They had also applied for MEABR and were at the final stage of formulating management plans. This was typical of the situation in region VI as it was one of the last in Chile to incorporate the MEABR policy. The syndicates El Muelle-Ancud (hereafter referred to as Ancud) ($41^{\circ} 51'S$; $73^{\circ} 49'W$) and Quicavi ($42^{\circ} 18'S$; $73^{\circ} 35'W$) are both in region X. This region had its first MEABR management plans approved in 2001, but since then there have been a large number of applications which accounted for 39% of the current applications across Chile (By August 2003). In keeping with this trend Ancud had just applied for a MEABR whereas Quicavi was at the initial phase of planning to present an application. The members of these six artisanal fishing syndicates use benthic resources in different ways. Puertecillo is composed mainly of algae gatherers, who also are regular intertidal food gatherers. They tend to operate during low tides and calm sea conditions. Ancud is formed exclusively of professional Hookah divers (a hookah diver involves the use of pressurised air supplied directly from a support vessel as opposed to SCUBA or skin diving) (Castilla and Defeo 2001). These Hookah divers in general do not have other sources of income. They operate with a crew of three or four people (boat operator, assistant, one or two divers). Los Lobos has mainly intertidal food gatherers and skin divers, who operate in shallow waters (Castilla and Defeo 2001). They dive to depths of around 1-16 m to extract *loco*. La Boca, Quicavi, and Matanzas are syndicates formed by fishers who depend on fishing for fin-fish, diving for benthic resources, and gathering algae for their livelihoods. Thus the diversity of fishing activities varies markedly among syndicates.

3.4. Methods

We conducted fieldwork between December 2002 and March 2003. Primary data were collected using a range of different methods, including (1) participant observation; (2) 64, face to face 5-point questionnaires with anchor points: 1, strongly disagree and 5, strongly agree; (3) 18 semistructured open-ended interviews; and (4) six group meetings and six group mapping sessions.

The interviews and PRA techniques enabled us to discriminate among different attitudes with respect to MEABR and conservation. The questionnaires were designed to test whether dominant features with respect to MEABRs occurred among different syndicates. These questionnaires also sampled fishers' socio-demographic characteristics. We used the statistical software P.R.I.M.E.R. (Plymouth Routines in Multivariate Environmental Research) (Clarke and Warwick 2001), to perform multivariate analysis on questionnaire responses. We undertook a cluster analysis of the attitudinal questionnaire data using the Bray-Curtis index of similarity on untransformed data. The group average linkage technique was used to form clusters of similar individuals that gave similar responses. Subsequently, the similarity matrix derived from the questionnaire data was used to generate a multidimensional scaling (MDS) ordination plot that represented in two dimensions the similarity between the questionnaire responses made by each respondent. Differences in the responses made by fishers from different syndicates were tested *a priori* for significance with the ANOSIM procedure (one-way analysis of similarity) (Clarke 1993). This test assesses significant differences between groups of fishers' (syndicates) responses to the questionnaire, against a series of random simulations, resulting in the calculation of a test static (R).

We used similarity percentages analysis (SIMPER) to identify those questions that accounted for the largest differences in responses made by members of different syndicates (Clarke and Warwick 2001). The questions selected with the SIMPER procedure were also tested for differences using Kruskal-Wallis and Dunns tests or one way ANOVAS and Tukey tests depending on the distribution of the data.

The relationship between the similarity among fishers' responses and socio-demographic variables was examined with the BIOENV procedure. BIOENV is a program that tests sequentially for the combination of variables or a single variable that correlates best with the similarity among the responses of different fishers. The socio-demographic variables selected for the BIOENV analysis were age; number of generations fishing; days spent at sea per month; on and off-sector fishery pluriactivity (having multiple sources of income and / or job holding); ownership of a boat; number of people who live in the household; past and/or present role in the syndicate; and the relative importance of fishing, algae gathering, and diving in terms of income generation.

At the time of this study none of the syndicates in the study had a functioning MEABR. Hence, it is the expectations of the syndicates and their objectives for applying to MEABRs that are represented in the responses reported herein. It is important to understand the expectations of fishers because these are the goals against which they will presumably assess the success or failure of MEABR.

3.5. Results

Multivariate analysis of questionnaires and PRA techniques identified attitudinal differences and subsets of questions (key issues) that accounted for differences in the fishers' world views. The multidimensional scaling ordination plot based on the similarity between the responses made by different individuals (Fig. 3.1) and subsequent ANOSIM tests ($n=64$) revealed significant differences ($R= 0.63$, $p < 0.01$) among different syndicates. This indicates that members of each syndicate had similar views to each other but had distinctly different views from members of other syndicates. Pairwise comparisons among different syndicates revealed that these differences occurred between all syndicates (all pair-wise tests $p < 0.05$).

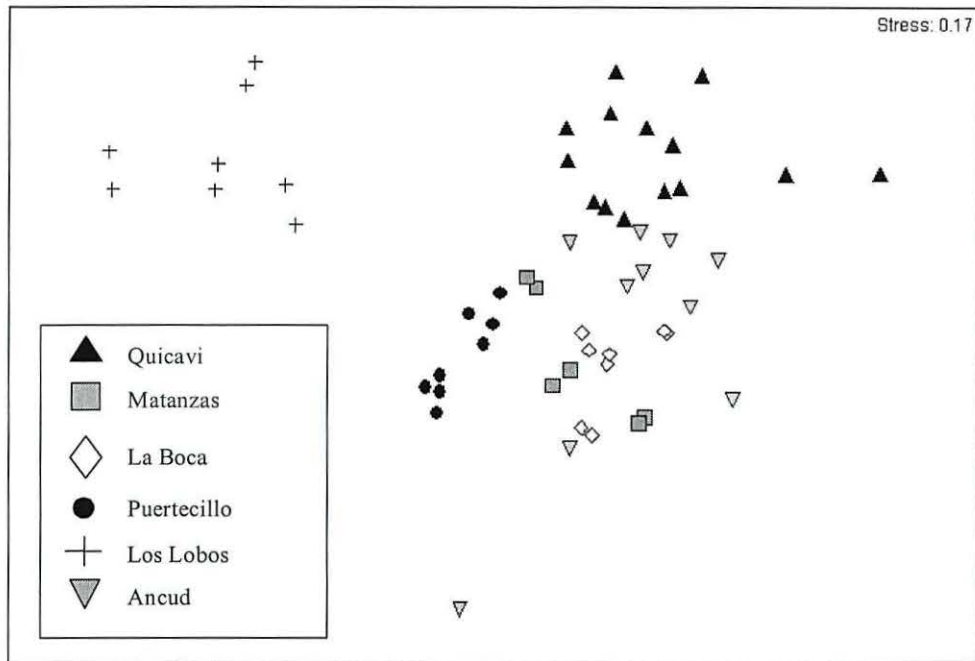


Figure 3.1 Multidimensional scaling ordination plot of the degree of similarity between fishers' responses to the attitudinal questionnaire. Each fisher is represented by a symbol according to the fishing syndicate in which they are members. The distance between the symbols represents the percent similarity between the respondent's answers to the whole set of questions.

The SIMPER analysis revealed that out of a total of 60 questions, 19 contributed most to the dissimilarity among the different syndicates. These 19 questions fell into three subsets of fishers' attitudes according to the main themes they represented. Those respect to the environment, unresolved issues with the MEABR process, and benefits and effectiveness of MEABR.

3.5.1. Attitudes to the Environment

The first group of questions that accounted for the differences among syndicates were concerned with the use and value of the environment (Table 3.1).

Members of Los Lobos and Puertecillo had a strong positive attitude toward conservation and the intrinsic value of natural resources. This was reflected in the low mean score of the responses of these two groups with respect to questions that attributed lower importance to conservation goals compared with financial stability. This attitude was strikingly different from that of the members of the syndicate La

Boca, who perceived that natural resources are primarily a source of income. Fishers from Los Lobos saw natural resources as something that are “there to be used, not overexploited, but used” (fisher from Los Lobos). In contrast, members of the syndicates Puertecillo, Matanzas, and even La Boca agreed that natural resources should be used as little as possible (Table 3.1).

Additional differences occurred with respect to fishers’ attitude toward the statement “Enough is being done to protect and enhance marine environments” (Table 3.1), with which both Quicavi and La Boca agreed. These syndicates perceived that fishing activities were already highly regulated and therefore did not desire the further imposition of regulations (e.g., quotas and size restrictions). The other syndicates seemed willing to accept new regulations and approaches to management as long as they were introduced through participatory consultation.

Table 3.1 Questions and their average score that related to fishers’ attitudes toward the environment and accounted for the largest differences between Chilean fisher syndicates*.

Question	Syndicate					
	Quicavi	Ancud	Matanza	Boca	Puertecillo	Lobos
Natural things must only be valued for what humans get out of them.	2.7 a-b (0.8)	3.8 b (0.9)	3.8 b (0.7)	4.2 b (0.8)	1.5 a (0.5)	1.6 a (0.5)
Conservation should only be considered once you have reached your financial objectives.	2.7 a-b (1.2)	3.1 b (1.3)	3.0 a-b (1.5)	4.5 b (0.9)	1.2 a (0.4)	1.7 a (0.4)
Enough is being done to protect and enhance marine environments already.	3.9 a (1.0)	2.9 a-b (1.5)	1.3 b (0.5)	3.5 a (1.6)	1.3 b (0.7)	1.2 b (0.4)
Chile’s seas are in better state now than 10 years ago.	3.5 a (1.0)	1.2 b (0.4)	3.6 a (1.0)	1.7 a-b (0.8)	1.3 b (0.5)	1.0 b (0)
The earth’s resources, such as minerals, forests and fisheries should be used as little as possible.	2.5 b (0.9)	2.9 b (1.1)	5.0 a (0)	4.0 a-b (1.0)	4.8 a (0.3)	2.6 b (0.9)

*Numbers represent the average response (\pm S.D). All syndicate responses showed differences ($p < 0.001$) in a Kruskal-Wallis analysis. Pairwise differences were tested using Dunns test, those syndicates that are not significantly different share the same letter.

Although fishers from different syndicates had distinct attitudes, all fishers surveyed agreed or strongly agreed that “MEABR act as reserves for resources”. Seventy-eight percent strongly agreed that “Fishermen should seek to improve earnings from resources by improving the quality of the resources”. Thus, fishers shared the belief that MEABRs could work as reserves to increase the quality of resources, and in this way, help to conserve benthic habitats for future generation, even though their individual attitudes to the environment and its value or use are structured in different ways.

3.5.2. Unresolved issues with MEABR

The second group of questions which accounted for differences between syndicates concerned with unresolved issues with MEABR policy (Table 3.2). Differences occurred between syndicates with respect to their opinions toward historical fishing rights and the lack of open access areas where diving was possible. Only the respondents of La Boca and Puertecillo syndicates disagreed with the fact that historical rights over resources are lost with the implementation of MEABR (Table 3.2). This may be explained by the fact that neither of these syndicates had a history of diving which could be interrupted by MEABRs. Similar differences in history may explain why members of three syndicates (Los Lobos, Puertecillo, La Boca) had strong opinions with respect to the conflict and the problems that could result from an excessive number of MEABRs. Specifically Los Lobos and Puertecillo strongly agreed with the fact that MEABR generate conflict, mainly due to issues surrounding access rights and poaching. Fishers of Quicavi, Ancud, and Matanzas did not have strong opinions about MEABR as an extra cause of conflict between syndicates and therefore did not understand why limiting the number of management areas that are given throughout Chile could have positive consequences (Table 3.2).

Table 3.2 Questions that accounted for the largest differences between fishing syndicate respondents and related to unresolved issues with management and exploitation areas for benthic resource policy (MEABR)*.

Question	Syndicates					
	Quicavi	Ancud	Matanza	Boca	Puertecillo	Lobos
Historical rights over resources are broken with the implementation of MEABR.	4.4 a (0.6)	4.0 a-b (1.2)	5.0 a (0)	2.5 b (1.9)	2.8 b (1.0)	5.0 a (0)
Syndicates have taken resources from open access sites in order to re-populate their MEABR.	3.8 b-c (1.4)	4.0 b-c (1.3)	2.3 a-b (1.0)	3.2 a-b-c (1.9)	1.5 a (0.5)	5.0 c (0)
MEABR create conflict with other syndicates for access to resources.	3.0 a (1.0)	2.5 a (1.6)	2.6 a (1.8)	4.7 b (0.4)	5.0 b (0)	5.0 b (0)
There should be a limit to the number of MEABR that are given.	2.2 a (1.1)	3.7 a-b (0.8)	2.0 a (1.5)	4.5 b (0.5)	5.0 b (0)	4.5 b (0.9)
Under current MEABR policy divers have to change their livelihoods toward fishing.	2.1 a (0.8)	4.6 b (0.5)	4.1 a-b (0.9)	3.7 a-b (0.8)	5.0 b (0)	5.0 b (0)
There will soon be no open access sites left where to dive.	3.3 a-b (1.5)	3.8 a-b (0.4)	5.0 b (0)	3.0 a (0)	4.8 b (0.3)	5.0 b (0)

*Numbers represent the average response (\pm S.D). Differences were tested with Kruskal-Wallis. Pairwise differences were tested using Dunns test, those syndicates that are not significantly different share the same superscript letter.

Ninety percent of fishers agreed with the statement that “MEABR have increased the exploitation of resources at historical sites”, although there was discrepancy in opinion regarding the future of diving on open access sites. Fishers from Ancud and Los Lobos perceived that this lack of open-access diving grounds was a threat to their livelihood. The fishers of Los Lobos state that they have historical rights over resources which have been stolen from them by syndicates who have repopulated their MEABRs with *locos* from open-access sites. Because of this they believe that poaching from other management areas becomes a valid way of reclaiming what is rightfully theirs.

3.5.3. Perception of Benefits from MEABR

Questions that accounted for the largest differences between syndicates were related to the perceived benefits and effectiveness of MEABRs (Table 3.3). Syndicate members had different attitudes with respect to the potential economic success of MEABRs. Only Matanzas and la Boca agreed strongly that “MEABR are

economically successful” (Table 3.3). Fishers from Ancud also had high expectations of the economic success of their own area as expressed in a group meeting “*we have all our hopes on MEABRs.....we need them to work*”, nevertheless the mean score of their responses was low. Los Lobos respondents thought that without Government subsidies, MEABR were not economically viable because of the high cost of environmental and stock assessments required by legislation.

Syndicate members that had low economic expectations of MEABRs, strongly agreed with questions that referred to the importance of the support received from the government (i.e. financial, political) once a MEABR is in place. Despite fishers’ different attitudes with respect to the economic success of MEABRs, all were concerned about having to pay tax per hectare of their MEABR which became payable once they had harvested for 4 years.

Table 3.3 Questions which accounted for the heterogeneity in fishers’ attitudes toward the perceived benefits of management and exploitation areas for benthic resources (MEABR)*.

Question	Syndicates					
	Quicavi	Ancud	Matanza	Boca	Puertecillo	Lobos
MEABR are economically successful	3.7 a-b (0.6)	3.8 a-b (0.7)	4.8 a (0.4)	4.8 a (0.3)	3.5 b (0.5)	2.3 b (0.7)
An important aspect of having a MEABR is the support you get from government	2.0a (0.8)	2.6a (0.9)	2.6a (0.8)	3.0 a-b (0.6)	5.0 b (0)	3.5 a-b (0.6)
Gaining political power and accountability are important factors of applying for a MEABR.	2.0 a (0.8)	2.6 a (1.0)	2.6 a (0.8)	3.5 a-b (0.5)	5.0 b (0)	4.8 b (0.3)
MEABR are working well under the current policy.	3.2 b (0.9)	3.0 b (0.9)	4.0 b (0.8)	3.5 b (0.9)	2.2 a (1.3)	1.1 a (0.3)
MEABR are beneficial to the whole fisheries sector (divers, fishermen, gatherers). ^b	4.5 a (0.6)	3.0 b (1.0)	4.3 a (0.5)	4.6 a (0.5)	4.8 a (0.3)	1.2 c (0.4)
The fisheries department should mainly help to stop encroaching on MEABRs.	2.5 a (0.5)	4.7 b (0.4)	4.8 b (0.4)	4.5 b (0.5)	5.0 b (0)	1.0 a (0)
MEABR are the only alternative for benthic resource sustainability	3.8 b-c (0.3)	3.9 b-c (1.1)	5.0 c (0)	5.0 c (0)	1.6 a (0.7)	2.8 a-b (0.3)

*The numbers represent the average response (\pm S.D). Pairwise differences were tested using Dunns test, those syndicates that are not significantly different share the same superscript letter. ^b Analysed by ANOVA and a Tukey pairwise test.

3.5.4. Socio-demographic relationships

The BIOENV analysis revealed that off-sector pluriactivity (i.e. multiple job holding) and the exclusive use of diving to achieve a livelihood provided the best rank correlation ($\rho = 0.38$) with the responses made by fishers to the attitudinal section of the questionnaire (Table 3.4). Fishers' environmental attitudes, historical rights attitudes and objectives for applying to the policy were each tested separately against the socio-demographic variables and yielded significant relationships for all subsets apart from the one concerned with environmental attitudes (Table 3.4). In all cases off-sector pluriactivity was related to the responses made by fishers and was the factor that had the greatest influence on the attitudes expressed in the questionnaires.

Table 3.4 Socio-Demographic variable or variables that had the best correlations with fishers' specific and overall attitudes towards the identified domains.

Fishers responses	Socio-demographic variables that best correlated to fishers' responses	Spearman correlation (ρ)	p
Environmental subset	off-sector pluriactivity exclusiveness of diving for livelihood owning a boat	0.25	not significant
Historical rights and Conflict	off-sector pluriactivity	0.45	<0.05
Benefits and objectives MEABR*	off-sector pluriactivity exclusiveness of diving for livelihood	0.32	<0.05
Overall responses	off-sector pluriactivity exclusiveness of diving for livelihood	0.383	<0.05

*Management and exploitation areas for benthic resources

3.6. Discussion

Significant differences in resource use, world views and attitudes exist within the broad category of artisanal fishers in Chile, as in many other countries (Sandersen and Koester 2000; Perez-Sanchez and Muir 2003; Hampshire *et al.* 2004). These differences must be identified and understood if co-management and conservation are to be more inclusive and participatory, and thus more effective (Sandersen and Koester 2000; Sittert 2003). Current policies assume fishers will respond homogeneously and deterministically to a given policy, e.g. policy X will produce response Y across all fishers. However, our results suggest that the response of fishers to a policy will be affected by their attitudes, personalities, and livelihoods. Hence, the policy response may still be deterministic (if you understand the system well enough), but it will be variable both among groups, and between individuals within any group. Understanding this variability is important in order to determine the likely success of any given conservation measure.

In view of this we believe that policy makers should have a broad idea of the sorts of policy responses different groups will make to a given policy. While at one level, as emphasised throughout this paper, individual differences in circumstance may make different people respond differently to the same policy, it is clearly unrealistic for policy makers to consider all individual responses separately. So to aid understanding of these differences some sort of loose taxonomy of 'response type', as determined by attitudes, objectives and other socio-economic variables, may be helpful.

Based on the current understanding of the Chilean situation it seems that different syndicates of fishers that currently participate in MEABR policy have different attitudes and perceive different barriers toward the use of MEABRs as a dual conservation/development policy instrument. For the situation studied here we postulate that fishers may be grouped into one of three domains of attitude, while four types of objectives illustrate their adoption of co-management through MEABRs.

The three attitudinal groups are environmentalists, livelihood advocates, and commodity conservationists. (1) Environmentalists value nature for what it is and not for what humans get out of it, and fishers holding these attitudes would apply for MEABR due to the conservation status that they provide to benthic habitats. (2) Livelihood advocates value nature for economic reasons and for the lifestyle it provides. (3) Commodity conservationists are more business orientated than the other groups, who nevertheless also consider environmental issues important but rank these lower than financial considerations (Davies and Hodge 2002).

Fishers could have four objectives that provide the incentive for participation in MEABR: (1) achieve an economically stable livelihood that could support their families (e.g. Ancud); (2) secure an additional source of income (e.g. La Boca, Quicavi, Matanzas); (3) attain government support and the social status fostered by participation (e.g. Puertecillo) and (4) attain access to restricted resources (e.g. Los Lobos). Further research is required to formally investigate the existence of these categories and their associated behavioural responses to management and conservation policy.

The main causes of attitudinal heterogeneity among fishers of different syndicates are related to their attitude toward the environment, traditional access rights (unresolved issues with the policy), and the objectives for participation in MEABR. The differences in fishers' attitudes toward these key issues become especially important as human behaviour is determined by specific attitudes and the beliefs that people hold (Ajzen 1988; Bedell and Rehman 1999). Consequently, these underlying attitudes would lead to future observable differences in management style and commitment to MEABR policy. These attitudes thereby influence the voluntary participation by fishers in enforcing the regulations of MEABR, and through this, its wider impact on benthic resources (Defeo and Perez-Castaneda 2003).

Potential influences on the observed attitudinal differences were ascertained from socio-demographic variables. Of these, off-sector pluriactivity and the level of dependency on diving to maintain an income correlated best with fishers' overall responses. This indicates that it is crucial to understand the complexities in livelihoods of artisanal fishers in order to understand the driving forces behind

fishers' behaviour. This may be advanced by adopting a livelihoods approach to fisheries (Scoones 1998; Allison and Ellis 2001). The livelihoods approach seeks to improve rural development policy and practice by recognising the seasonal complexity of livelihood strategies. It considers the conditions that create economic niches for coastal residents and that relate to specific lifestyles (Allison and Ellis 2001). Central to the framework is the analysis of institutional arrangements (informal and formal rules and regulations) that influence livelihood outcomes and the notions of livelihood resources such as natural capital, financial capital, human capital and social capital (Scoones 1998). Validation of a livelihoods approach to fisheries also fits with the shift away from management of a fishery or fish stock in isolation toward management of the ecosystem within which the fishery exists (Jorgensen and Muller 2000). A consideration of livelihoods extends this management concept further to take cognisance of local socioeconomic factors.

Fisher attitudes toward historical rights and the benefits of MEABR correlated significantly with off-sector pluriactivity and the level of dependency on diving to maintain an income. Nevertheless no combination of socio-demographic variables correlated significantly with the environmental subset of questions (Table 3.4), which indicated this attitudinal domain was determined primarily by other factors, such as, social norms (Aipanjiguly *et al.* 2003), and/or ethical considerations or personality as has been found for farmers (Willock *et al.* 1999b). In this way, the actual adoption and future behaviour of fishers with respect to MEABRs and conservation will be based on a complex set of factors that include fishers' economic niches (livelihoods) and past experiences in addition to their existing values, personality, and social norms (Fig 3.2).

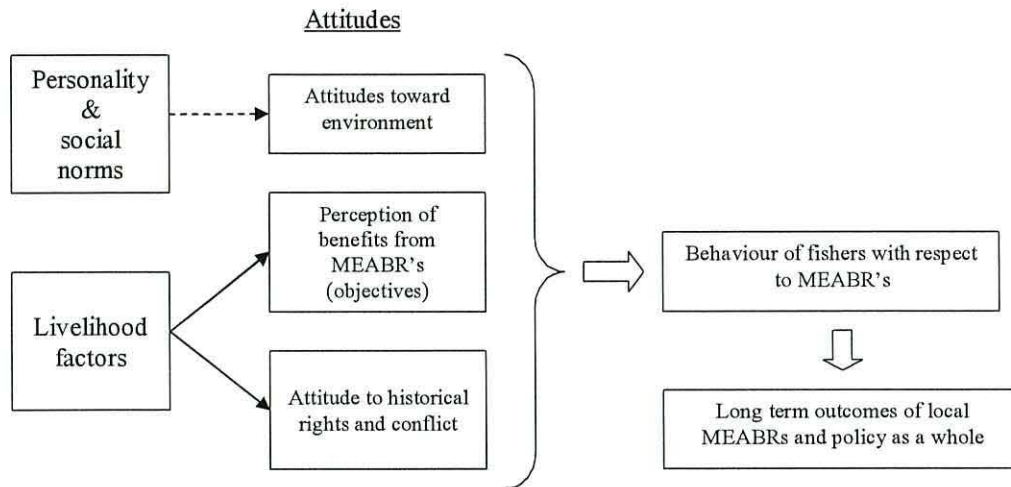


Figure 3.2 Conceptual relationships among factors that structure differences in responses of fishers' syndicate committees (arrows represent relations that were tested statistically. The dashed arrow represents a relationship that was not tested statistically).

The importance of individual attitudes in determining behaviour raises the possibility that while a new policy or incentive may change fishers' short-term behaviour, if the policy is not accompanied by any changes in fishers' perception and social norms, then when that policy finishes, or even in times of crisis, fishers will probably revert to their traditional behavioural patterns thereby compromising long term environmental conservation and protection (Pretty 2003).

It is important that managers obtain an awareness of actors' environmental attitudes with respect to natural resources, through an approach that highlights the importance of marine conservation to which MEABR contribute. This is a long-term approach that involves education of fishers and carries benefits with respect to fishers' behavioural intentions. In addition, MEABRs should be analysed in accordance with livelihood strategies of fishers in which differences in local economies (Scoones 1998), skills (Gelcich unpublished data), flexibility (Huhmarniemi and Salmi 1999), and interests of fisher communities are developed. In this way, development programmes can target the specific needs of high and low pluriactivity syndicates that have different objectives and attitudes. This research has shown that stakeholder attitudes are significantly different between groups of actor and are dependent on

livelihoods. This heterogeneity must be considered when providing incentives for fishers to respond to dual conservation and development policy.

Postscript

Further research on fishers' attitudes towards co-management and conservation was undertaken through surveying 226 artisanal fishers at various stages of the MEABR policy process. The general conclusions of the present study were supported. Fishers' attitudes related to historical access rights and to the benefits and objectives of MEABRs. These also correlated significantly with fishers livelihood characteristics (Appendix 2, found in page 199). Fishers' environmental attitudes were surveyed in greater detail in this new sample and results are reported in Chapter 4.

Chapter 4: Do fishers turn 'green' under co-management policy?



Loco harvest at 'caleta' El Quisco, Chile

A modified version of this Chapter has been submitted as:

Gelcich S, Edwards-Jones G, Kaiser M. Do fishers turn green under co-management policy? *Nature*

Do fishers turn ‘green’ under co-management policy?

4.0. Abstract

The bottom-up governance of marine resources through co-management frameworks has been promoted as an essential process in the alleviation of mis-management of marine fisheries. Such policies are designed to encourage changes in fishers’ practices, but do not guarantee long-lasting positive changes in their attitudes towards the environment. Therefore, if policy incentives are withdrawn, fishers might revert to previous destructive behavioural patterns. We show that fishers’ attitudes towards environmental issues alter favourably through participation in co-management regimes, although the rates of change are dependent upon different subsets of environmental concerns. Favourable attitudes towards conservation of natural resources of commercial value were held by all fishers irrespective of the length of time of engagement with co-management policy, while attitudes towards biodiversity conservation in relation to financial considerations changed more slowly. Concerns about environmental and resource quality increased with the length of time that fishers had been engaged with co-management policy. The impact of co-management on different components of fishers’ environmental attitudes will be an important determinant of the long term success of such initiatives.

4.1. Introduction

Human dependence on marine resources is increasing (Payne 2000) despite the global over-exploitation and unsustainable management of many marine fisheries (Pauly *et al.* 2002; 2003; Myers and Worm 2003). In addition, aquaculture has not yet fulfilled the demand for a cheap and reliable source of protein for the world's growing population (Naylor *et al.* 2000). In light of these chronic failures, approaches to manage and govern marine resources are undergoing important modifications and are moving away from traditional single-stock and species based management and towards adaptive ecosystem-based management (Castilla 1999; Olsson *et al.* 2004). Concurrently, governance is shifting towards community-based and co-management approaches that emphasize fisher participation and decentralization of management authority and responsibility (Berkes *et al.* 2001; Pauly *et al.* 2002). The recent adoption by some national governments of co-management as an integral part of their fisheries policies has supported this change, and has provided an important basis to broaden the development of theory and empirical studies of these policy models (Nielsen 2004).

Despite the emphasis on the generation and implementation of these policy models, the relationships between co-management and the emerging practices or attitudes that the policy is expected to promulgate are unknown (Kaplan and McCay 2004; Aswani and Hamilton 2004). Such considerations of attitudes are important in a co-management framework as conservation increasingly depends upon the resultant actions of different stakeholder groups (Gelcich *et al.* 2005b). As with any one of a range of intervention, (such as aid or development funds), a new policy, or a co-management regime may change fishers' short-term behaviour. However, if the policy is not accompanied by a change in fishers' perceptions and broader environmental attitudes, there is a risk that fishers might revert to previous behavioural patterns upon withdrawal of policy incentives or in the event of financial/environmental crisis. The absence of such attitudinal changes would undermine the success of implemented policies and long term environmental conservation (Pretty 2003; Gelcich *et al.* 2005b). Given the large paradigm shift in our current approach to the global management of fisheries, it is timely to look into the effects of co-management on fishers' environmental attitudes and behavioural

intentions if co-management is to become a sustainable policy instrument, rather than simply another development narrative (Adams 2001).

The adoption of a national co-management policy in Chile, as a specific component of the 1991 Fisheries and Aquaculture Law (FAL), has provided a unique opportunity to examine the effects of co-management policy on fishers' environmental attitudes. Co-management related to artisanal fishers in the FAL takes the form of management and exploitation areas for benthic resources (MEABR). Through MEABR policy, temporal territorial user rights are assigned to artisanal fisher unions (syndicates) in defined coastal areas. This includes the right to deny non-members access to the same area of seabed. The rationale behind these territorial user rights is based on a common property approach, which proposes that user rights will create institutional arrangements among fishers that promulgate sustainable resource use (Ostrom 1990; Castilla and Defeo 2001).

Between MEABR policy inception in 1997 and 2003, 188 management plans were put in place, while a further 649 are at various stages of the application procedure (Gelcich *et al.* 2005a). These range from unions that are just starting to engage with the co-management process to those fishing in their fifth consecutive year under an official co-management framework. Fiscal subsidies have been critical to the implementation of the policy and by 2000 over US\$ 1,000,000 had been spent in co-financing MEABR studies (Montesinos 2000 in Subpesca 2002). These subsidies have been spent in different regions in different years. In this way, fishers' innovation or environmental attitudes have not been as important in defining fishers' initial engagement with MEABR as the desire of the government to promote the policy (Gelcich *et al.* 2005a). Accordingly, empirical evidence shows how fishers with different attitudes adopt the MEABR policy at similar time periods (Gelcich *et al.* 2005b).

A key limitation for research attempting to understand the effects of co-management on fishers' attitudes is the absence of base line information about fishers' perceptions

prior to the implementation of the given policy⁹. The fact that the Chilean government controlled the policy process makes it unlikely that early adopters of MEABR would do so due to a positive attitude towards the environment. Therefore by analysing fishers' environmental attitudes and their relationship with socio-demographic characteristics, livelihoods and co-management variables which include time of engagement with MEABR, we may gain some indication of the degree to which each of these independent factors might drive fishers' perceptions towards the marine environment. Information which is crucial, in order to help managers target the right incentives for sustainable bottom-up governance of resources in Chile and in other countries considering similar policies.

4.2. Methods

This study surveyed the environmental attitudes of fishers from 10 different fishing unions (syndicates) that represent the full range of time involved with the co-management process. For administrative purposes Chile is divided into 12 regions, our research considered syndicates in four of these regions (IV, V, VI and X; Fig. 4.1). Regions IV and V were the first ones who had government support and initiated MEABR policy implementation in Chile. Hence, most fishing syndicates in these regions have already been through the application process and are between their 3rd and 5th official extraction of resources from the MEABRs. Regions VI and X have been the last regions in Chile to incorporate the MEABR policy. Syndicates in these regions would typically range from being in the initial application phases of MEABR to being at a 3rd official harvest.

⁹ This is an important constraint worldwide; this type of information must begin to be gathered in order to revert this trend in the future if we are ever to fully understand the effects of natural resource management policies.

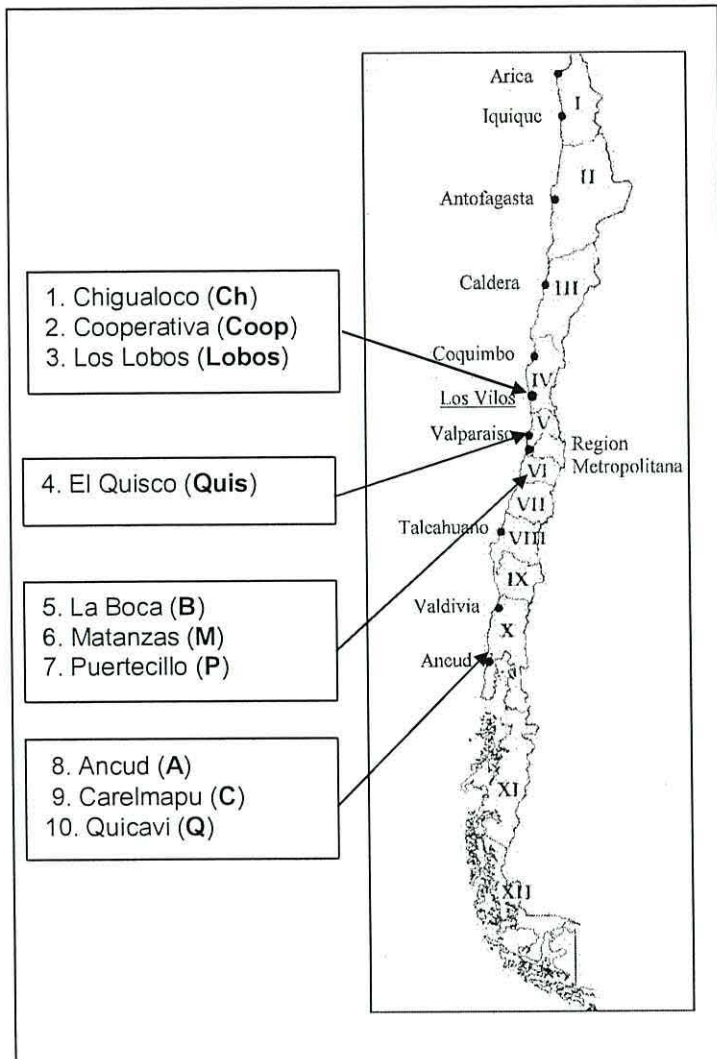


Figure 4.1 Map of Chile showing the regions, the location of the studied syndicates, and the symbols used to represent them in the analysis.

Syndicates Cooperativa (Coop; 31° 55'S; 71° 00'W), Chigualoco (Ch; 31° 45'S; 71° 30'W) and Los Lobos (Lobos; 31° 55'S; 71° 00'W) are all in region IV. Cooperativa and Chigualoco were in their fifth official harvest from the MEABR. Los Lobos on the other hand was in the initial phase of applying for a MEABR in the region. Syndicate el Quisco (Quis; 33° 24'S; 71° 41'W) is in region V, they had their quota approved for their fourth official harvest from a MEABR, el Quisco was also one of the syndicates who pioneered with informal MEABR during the early 1990s. Syndicates La Boca (B; 33° 55'S; 71° 50'W), Matanzas (M; 33° 57'S; 71° 52'W) and Puertecillo (P; 34° 17'S; 71° 58'W) are all in region VI and have already harvested once from the MEABR. Syndicates Carelmapu (C; 41° 44'S; 73° 43'W),

El Muelle-Ancud (hereafter referred to as Ancud) (A; 41° 51'S; 73° 49'W) and Quicavi (Q; 42° 18'S; 73° 35'W) are in region X. This region had its first MEABR management plans approved in 2001, but since then there have been a large number of applications which accounted for 39% of the current applications across Chile (at the time of writing). In keeping with this trend Ancud is preparing to have their second official harvest. Carelmapu was beginning to plan its third year extraction and Quicavi was at a planning stage to present an application.

Fieldwork was conducted between October 2003 and July 2004. Data were collected using 226, face to face 5 point questionnaires with anchor points: 1, strongly disagree and 5, strongly agree, additional information given by respondents was also recorded. Questionnaires were designed to test whether dominant features with respect to environmental issues occurred among individual fishers from different syndicates. The statistical software package P.R.I.M.E.R. (Plymouth Routines in Multivariate Environmental Research) (Clarke 1993; Clarke and Warwick 2001) was used to undertake multivariate analysis of the questionnaire data. We undertook cluster analysis using the Bray-Curtis index of similarity on untransformed data and clusters were formed using the group average linkage technique. Differences in responses among syndicates were tested *a priori* for significance with the ANOSIM procedure (randomized permutation test; Clarke and Warwick 2001). This test assesses significant differences between groups of fishers' (syndicates) responses to the questionnaire, against a series of random simulations, resulting in the calculation of a test static (R).

Similarity percentages analysis (SIMPER) identified those questions or statements that accounted for the largest differences in responses made by members of different syndicates (Clarke and Warwick 2001). The SIMPER programme analyses dissimilarity between different groups of fishers' responses and calculates the contribution of each question/statement towards that dissimilarity. This information indicates which questions/statements are most important in terms of the observed differences between syndicates.

To distinguish if attitudinal differences were attributed to isolated questions or a systematic worldview we calculated the reliability of statements within each set of

concerns by using Cronbachs' alpha. In order to do this we grouped the questions which were aimed at understanding the different sets of concerns. In this analysis, the Cronbachs' alpha coefficient will be equal to zero if there is no true score but only error between the items and therefore statements are uncorrelated across subjects. If all items are perfectly reliable and measure the same thing (true score), then the coefficient alpha is equal to 1.

The relationship between the sets of questions which represent a specific attitudinal domain for an individual fisher, and his livelihood, socio-demographic and MEABR variables, were examined with BIOENV (Clarke and Warwick 2001). BIOENV is a program that tests sequentially for the combination of variables that correlate best with the similarity among the responses of different fishers. The test performs a rank correlation of two similarity matrices, one of the attitudinal aspects and one of the socio-demographic and livelihood data. It then successively tests for every possible combination of socio-demographic and livelihood parameters which best explain the observed attitudinal patterns. A full list of the livelihood and socio-demographic variables selected for the BIOENV analysis can be found in Table 4.4 and Table 4.5 of the results section. MEABR and syndicate variables were also included in the BIOENV analysis (Table 4.1). Of these it is important to state that we included the time fishers had been engaged in co-management policy and the official stage at which the MEABR was found during the survey as 2 different variables. The first one includes any informal commitment with co-management prior to having the actual legal territorial user rights.

Table 4.1 Syndicate variables used to correlate with attitudinal characteristics in the multivariate stage of the study.

Syndicate Variables	Mean	SD	Range	Syndicate order
People in syndicate	49.54	20.1	20-94	C>Quis>A>Coop>P>Ch>B>M, Lobos>Q
Boats in syndicate	26.81	34.57	1-120	C>Quis>Ch, Coop>A>Q>B>M>P, Lobos
Number of fishing associations the syndicate is part of	1.76	0.812	0-3	A>C, Ch, A, Quis, B, M, P>Lobos, Coop
MEABR monitoring costs (million Pesos)	6.30	3.73	1.80-13.0	C, Coop> Ch, A> Quis> B, M, P> Lobos, Q
MEABR TAC (total allowable catch) as numbers of loco	172777	311579	0 - 1000000	C > Coop> Chi, Quis > A > B, M> P > Lobos>Q
Number of MEABRs applied for?	2.2	0.67	1-3	C, Coop, Quis, M, > P, B, Ch, A > Lobos, Q
Stage of MEABR (official stages)	4.4	2.504	0-8	Coop, Ch, Quis> C > A> B, M, P> Lobos> Q
Time engaged in co-management policy (years)	4.1	2.3	0-8	Quis> Coop> C, Ch> A> B, M, P > Lobos > Q

For univariate analysis, the groups of statements which represented each set of environmental attitudes were summed (after reversing coding for some questions), resulting in an overall score for each fisher with respect to the different attitudinal domains. These scores were compared between syndicates using Kruskal-Wallis and Dunns pairwise tests. Scores were also used to calculate Spearman rank order correlations between the environmental attitude scores and the variables: a) time engaged with the policy and b) fishers dependence on diving for their livelihood.

4.3. Results

Multivariate analysis of responses to the questionnaires (n=226) revealed significant differences among fishers from each syndicate ($R=0.685$ $P<0.001$). This indicates that environmental attitudes are an important source of heterogeneity in fishers with respect to policy implementation. The SIMPER analysis revealed that 11 of the 36 statements accounted for the 1st and 2nd largest differences between any pair of syndicates (Table 4.2). The statements that accounted for the largest difference

between any pair of syndicates were always related to one of three topics: 1) conservation and financial considerations; 2) concern about environmental and resource quality; and, 3) conservation of iconic species. The questions that accounted for the principal similarities (> 90%) among groups were related to the importance of stock conservation. For example 97% of interviewed fishers agreed with the statement *“it is important for artisanal fisher communities to participate in protecting marine resources”*.

Table 4.2 Statements which accounted for the 1st and 2nd largest differences among fisher syndicates in the SIMPER analysis*.

Statement	DF	H	P
-Species conservation outside management areas is as important as within these areas.	9	44.26	<0.001
-Natural resources must only be valued for what humans get out of them.	9	64.53	<0.001
-Conservation should only be considered once you have reached your financial objectives.	9	63.45	<0.001
-Enough is being done to protect and enhance marine environments already.	9	98.71	<0.001
-Do you agree with the fact that artisanal fisheries are the source of great ecological problems and need important modifications	9	68.3	<0.001
-I would spend money to avoid or mitigate the effects of a outfall pipe near my MEABR	9	170.6	<0.001
- I would spend money to keep my MEABR free from pollution	9	170.6	<0.001
-Do you agree with the fact that sea lions and other species are a problem and do not deserve the conservation attention put on them.	9	178.4	<0.001
- The future for MEABRs is dependent on increasing coastal zone environmental quality	9	44.26	<0.001
- Marine mammals should be managed as any other natural resource	9	151.5	<0.001
-The earth's resources, such as minerals, forests and fisheries should be used as little as possible.	9	55.67	<0.001

* Univariate differences between syndicates were tested with Kruskal-Wallis tests. DF are the degrees of freedom, H is the Kruskal-Wallis statistic and P is the significance.

The different responses to specific statements within each of the main topics were reliable as shown by Cronbachs' alpha values (n=226) (Table 4.3). Therefore, they may be attributed to a specific environmental concern and not to variability with respect to one specific statement. This provides further evidence that the attitudes towards the environment were effectively composed of the four distinct domains.

Fishers' socio-demographic, livelihood and MEABR variables differed significantly between syndicates for all aspects measured except education, gender, children in household, number of directorates sampled and the ownership of fishing gear (Table 4.4 and Table 4.5).

Table 4.3 Cronbach's alpha values for different environmental subsets

Fishers responses	Number of Statements	Cronbachs alpha
Conservation and financial considerations subset	8	0.69
Environment and resource quality subset	5	0.81
Conservation of emblematic species subset	5	0.54
Conservation of stocks subset	6	0.84

Table 4.4 Socio-demographic variables used to correlate with attitudinal characteristics in the multivariate stage of the study.

Socio-demographic Variables	Whole Sample (n=226)			Differences between syndicates	
	Mean	SD	Range	P	Syndicate order
Age**	3.05	1.156	1-5	<0.01*	Quis, Coop, B, M, P, A, Ch > Q, Lobos, C
Education (1=primary)	1.28	0.5	1-3	>0.05*	No Difference
Sex (1=Male)	0.97	0.16	0-1	>0.05*	No Difference
Income (Pesos)	168070	77868	70000-410000	<0.01*	Ch> M, Quis, Coop, C > B, Lobos, Q, P, A
Number of generations fishing	2.82	1.26	0-5	<0.01*	B>Coop, Quis, C, A, P, Q, M, Ch> Lobos
Ownership of house (yes=1)	0.76	0.41	0-1	<0.01*	B, Coop, Quis, C, A, P, Q, Ch, M > Lobos
Size of household (number people)	4.01	1.46	1-8	<0.01*	Ch, A, Q, Coop, P, Lobos, B > C, Quis, M
Children in household	1.44	1.00	0-4	>0.05*	No Difference
Membership to other organisations (yes=1)	0.35	0.48	0-1	<0.01*	Lobos, P, C, Q, M, B> Coop, Quis, Ch, A
Membership to other organisations (number)	1.33	0.77	0-3	<0.05*	Q, C, B, M, P, Lobos > Quis, Coop, Ch, A

** : 1=18-27; 2=28-37; 3=38-47; 4=48-57; 5=57+ years of age

* : Differences using Kruskal-Wallis and Dunns pairwise comparisons.

Table 4.5. Livelihood variables used to correlate with attitudinal characteristics in the multivariate stage of the study.

Livelihood Variables	Whole Sample (n=226)			Differences between syndicates	
	Mean	SD	Range	P	Syndicate order
On-sector puriactivity (number activities)	2.1	0.8	1-3	<0.01*	B, P, Q> Coop, M, Quis, Ch, Lobos > A, C
Off-sector pluriactivity (number of activities)	0.71	0.98	0-4	<0.01*	M, Lobos, B > P > Quis, C, A, Coop, Ch, Q
Ownership of a boat (yes=1)	0.31	0.46	0-1	<0.01*	Q, Ch, A, C, Quis> Coop> P, M, B, Lobos
Directorates (yes=1)	0.35	0.47	0-1	>0.1	No Difference
Ownership of fishing gear (yes=1)	0.49	0.50	0-1	>0.1	No Difference
Fin-fisher? (yes=1)	0.63	0.48	0-1	<0.01*	B, M, Quis, Q > Coop, Ch, P > A, C, Lobos
Algae gatherer? (yes=1)	0.45	0.49	0-1	<0.01*	P, Q, B > M, Lobos, Quis, C, A, Coop, Ch
Diver? (yes=1)	0.58	0.49	0-1	<0.01*	Lobos, Coop, Q, A, C, Ch> P, M, B, Quis
Exclusiveness of diving (yes=1)	0.40	0.40	0-1	<0.01*	A, C, Coop, > Ch, Lobos, Quis, P, M, B, Q
How important is artisanal fishing for your income during the year? (100%=1)	0.80	0.27	0.05 – 1	<0.01*	Ch, Coop, Q, C, Quis, A > M, B, Lobos, P
How important is artisanal fishing for your income during the summer? (100%=1)	0.83	0.25	0.1-1	<0.01*	Ch, Coop, Q, C, Quis, A, P, M > B, Lobos
Income from diving (100% = 1)	0.62	0.49	0-1	<0.01*	A, C, Coop, > Ch>Lobos, Quis, Q> P, M, B
Income from MEABR (number of times monthly income)	3.34	3.3	0-13	<0.01*	Coop, Ch, Quis, C > P, M, B, , A > Q, Lobos

*: Differences using Kruskal-Wallis and Dunns pairwise comparisons.

The BIOENV analysis used to relate the socio-demographic, livelihood and syndicate variables to attitudinal concerns identifies that the concern over the ‘environmental and resource quality’ domain related significantly with a combination of variables which included the length of time a fisher had been engaged in the policy, the stage at which the MEABR was found and off-sector pluriactivity (Table 4.6). The ‘conservation of iconic species’ domain was related mainly to dependence on diving and the role of algae gathering as a measure of on-sector pluriactivity. No individual variable or set of variables significantly explained the fishers’ ‘conservation and financial concern’ attitudinal domain (Table 4.6). The lack of

significance related to this domain is consistent to the environmental attitude and contextual variable relationship reported by Gelcich *et al.* (2005b; Chapter 3).

Table 4.6 Combination of contextual variables that had the best correlations with fishers' specific attitudes towards the environment.

Fishers responses	Contextual variables that best correlated to fishers' responses*	Spearman correlation (ρ)	p
Conservation and financial considerations domain	a) age b) exclusiveness of diving for livelihood c) owning a boat	0.15	not significant
Environment and resource quality domain	a) off-sector pluriactivity b) time engaged in the policy c) Stage of MEABR	0.56	<0.05
Conservation of iconic species domain	a) Exclusiveness of diving for livelihood b) Role of algae gathering for livelihood	0.29	<0.05

* More than one variable is presented for each correlation coefficient as the BIOENV programme selected a set of variables which best explained attitudinal characteristics.

When statements in each domain were summed, resulting in an overall score for each respondent, univariate Kruskal-Wallis analysis showed significant differences between syndicates for the 'conservation and financial considerations' domain, the 'environment and resource quality' domain and the 'conservation of iconic species' domain. No differences were observed for the 'stock conservation' domain (Table 4.7). In general syndicate Coop had the most favourable attitudes towards every set of environmental concern. No single syndicate consistently appeared as being the least concerned with environmental issues.

Table 4.7 Differences between the scores for different environmental domains between studied syndicates

Environmental Attitude Domain	H	D.F	P	Pairwise (Dunns)
Conservation and financial considerations domain	68.69	9	<0.001	Coop > Ch > Quis, Q > M > Lobos, C, P, A, B
Environment and resource quality domain	186.59	9	<0.001	Coop, Quis > C, Ch, Lobos, B, M, A > Q, P
Conservation of iconic species domain	100.60	9	<0.001	Lobos, Coop, C, Q, A > Quis, Ch, P, M, B
Stock Conservation domain	14	9	>0.1	No difference

Correlations between fishers individual overall scores for each domain and the time they had been engaged with the co-management policy, as well as their dependence on diving, provided further evidence that fishers' increasing awareness of environmental and resource quality is directly related to the duration of co-management engagement (Table 4.8). There was also a weak relationship of this factor with the 'conservation and financial considerations' domain (Table 4.8). Attitudes towards 'iconic species' seemed to correlate with fishers' dependence on diving as these species (i.e. mainly sea lions), seem to have a disproportionately negative effect on the livelihoods of fishers that are dependent on fin-fish as opposed to those dependent on diving for shellfish.

Table 4.8 Correlation coefficients (ρ) between fishers' (n=226) overall environmental attitude score for each domain and a) time engaged with co-management b) dependence on diving to maintain a livelihood.

Environmental Attitude domain	Time engaged in policy		Dependence on Diving	
	Spearman (ρ)	p	Spearman (ρ)	p
Conservation and financial considerations domain	0.29	<0.01	0.07	Not significant
Environment and resource quality domain	0.80	<0.01	0.01	Not significant
Conservation of iconic species domain	0.19	Not significant	0.31	P<0.05

In summary, the results suggest that fishers' environmental attitudes are composed of four domains; those related to stock conservation, environmental and resource quality, conservation and financial considerations and conservation of iconic species. Of these, the 'environment and resource quality' domain seems to be the one which has a stronger relationship with the time fishers have been engaged with co-management (Figure 4.2). A positive attitude towards 'stock conservation' seemed to be present despite differences in socio-demographic, livelihood and co-management variables. The 'conservation of iconic species' domain relates mainly to livelihood characteristics, while the 'conservation and financial considerations' domain showed no relationship with any socio-demographic or livelihood variables studied in the multivariate analysis, and only showed a weak relationship with time engaged in co-management in the univariate correlations.

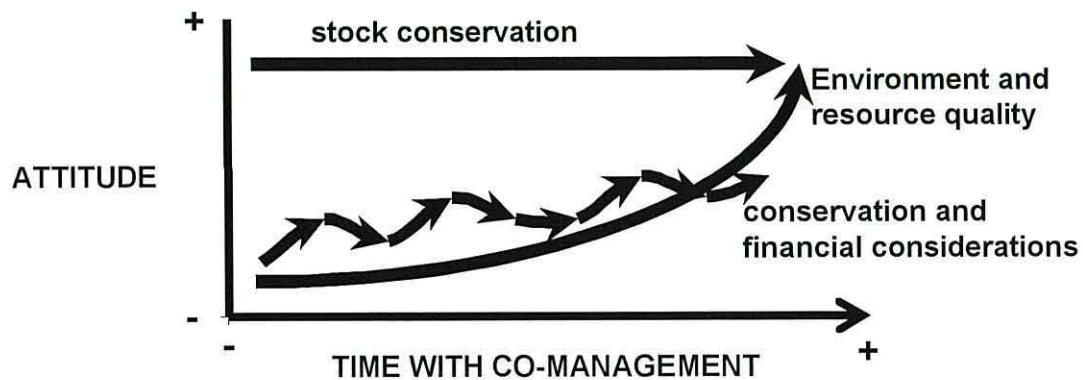


Figure 4.2 Conceptual relationships among time engaged with co-management and fishers' environmental attitude domains

4.4. Discussion

Without doubt fishers' behaviour with respect to co-management and natural resources is structured by more factors than just their environmental attitudes. Previous studies have identified livelihoods, past histories and sense of community as important contributors to changes in fishers' behaviour (Aipanjiguly *et al.* 2003; Zanetell and Kunth 2004; Gelcich *et al.* 2005b). However, in all cases, environmental attitudes were an important component to fishers' behavioural intentions. In this sense, the extent to which co-management has influenced attitudes towards marine resource stock conservation can be seen as positive through the close adherence of fishers to statements within questionnaires such as *"It is important to conserve resources for future generations"* and *"Fishers must increase their income by increasing the quality of resources rather than the catch"*. An alternative interpretation is that these attitudes represent an environmentally friendly discourse, that does not reflect changing attitudes, but enables fishers to appear 'green' such that they qualify for development funds and territorial user rights (Morris and Potter 1995; Gelcich *et al.* 2005a).

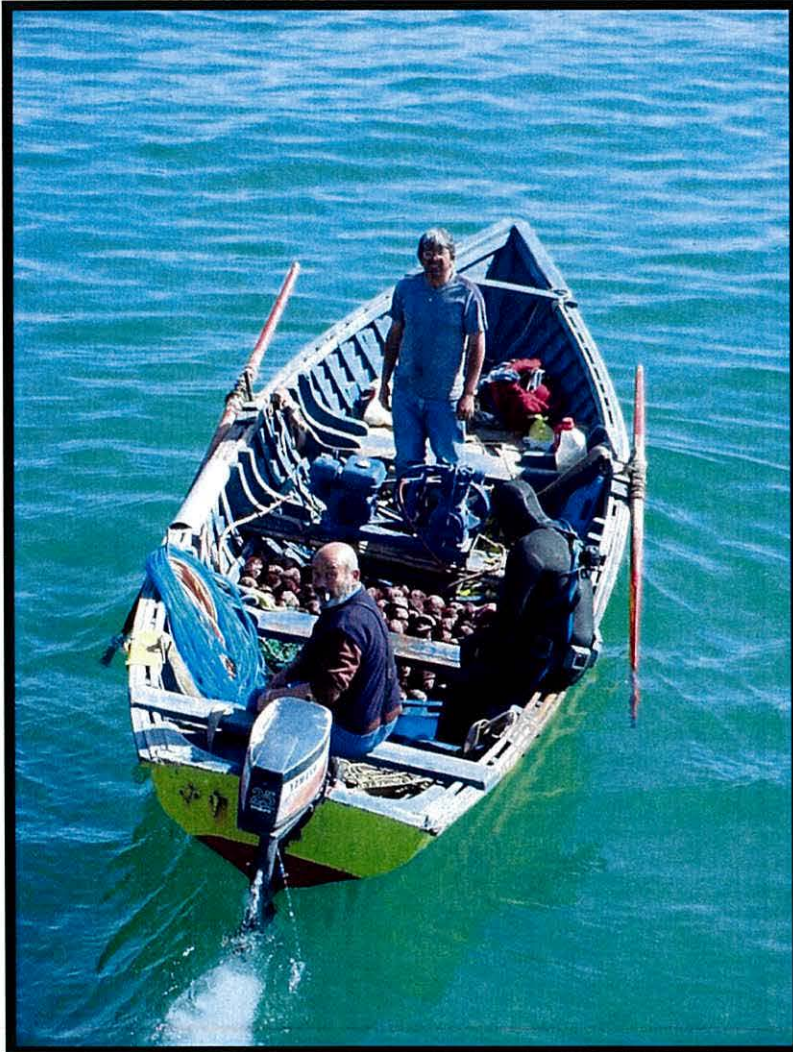
If fishers are in effect, passively enrolled in 'green' policy, greater attention should be placed on providing incentives to change their attitudes with respect to the relationships between conservation and financial considerations. This aspect showed little relationship with the time fishers were engaged with co-management or any

socio-demographic variable, therefore we believe it is mainly dependent on fishers' personality traits and social norms (Gelcich *et al.* 2005b; Chapter 3). The latter implies a need to approach this issue through education and participatory research (Wiber *et al.* 2004). This approach is well situated as small scale coastal artisanal fisheries with well-demarcated fishing grounds provide ideal situations for experimental management research (Castilla 2000; Johannes 2002). It also implies further changes in the devolution of power to these communities with the objective of achieving adaptive co-management (Olsson *et al.* 2004) and thereby moves towards adaptive governance (Dietz *et al.* 2003).

Co-management has helped to develop new norms with respect to perceived acceptable levels of environmental quality (i.e. acceptable levels of pollution), probably related to the fact that markets for co-managed fishery products increasingly operate within an international domain. This is helping unite fishers under a specific concern. In this sense, national co-management policies that attempt to achieve sustainability by including market forces, such as those developed in Chile, are more likely to encourage environmental protection and law enforcement in respect of local pollution or water-treatment related issues as these issues can influence access to markets in developed countries such as the EU. This has important implications especially in developing countries where conflict between local fishers and large commercial enterprises (i.e. mining, salmon aquaculture, sewage plants) will probably be exacerbated. As a result, conflict resolution may become as important as resource management in the design and direction of new co-management institutions.

It can be argued that one of the most important, although least tangible, objectives of co-management policies should be to bring about a shift in attitudes of fishers with respect to resource use that should outlast the schemes from which they originated (Morris and Potter 1995). Co-management seems to be the best currently available method to achieve these goals, although this must be an active struggle that needs support from educational programmes that target fishers' social norms. By understanding attitude shifts and intentions we increase our ability to guide governance-society interactions and direct incentives along sustainable trajectories in coastal zones.

Chapter 5: Prospect Theory explains fishers' harvesting behaviour under a territorial user rights policy.



Loco harvesting in central Chile

This Chapter has been submitted as:

Gelcich S, Edwards-Jones G, Kaiser M. Prospect Theory explains fishers harvesting behaviour under territorial user right policy. Ecological Economics

Prospect Theory explains fishers' harvesting behaviour under a territorial user rights policy.

5.0. Abstract

A suggested method to arrest the world's fishery crisis lies in granting coastal fisher communities territorial user rights to encourage bottom-up governance of resources. These management measures aim to encourage a positive change in fishers' behavioural patterns and to transform fishing operations into small enterprises. In this study we assess the financial decision-making behaviour of fishers when managing resources under a territorial user rights policy implemented by the Chilean government. We used questionnaires, which took the form of bidding games, and semi-structured interviews to assess fishers' financial understanding and risk preferences. We defined risk preferences with respect to the amount of catch fishers are willing to leave un-harvested for a potential future increase in income from resource growth, compared to the income which they would perceive from current bank interest rates.

Our results suggest that fishers behave in accordance to the predictions of Prospect Theory. Thus they modify their risk preferences when they perceive themselves facing gains or losses respect to a personal expectation level. When facing losses fishers become risk acceptant and when perceiving gains they become risk averse. Fishers' expectation level is dependent mainly on their livelihood characteristics. These reflect two major financial adaptation strategies; a) Divers would become risk acceptant when confronted with a small size catch structure scenario and willing to invest in leaving benthic (bottom dwelling) resources un-harvested and b) Fin-fishers would be less inclined in risking on benthic resources and prefer having the money to invest in a more familiar alternative like fishing nets.

Understanding fishers' response decisions under hypothetical scenarios has allowed us to understand fishers' risk preferences. This has implications for the future development of the policy and the inclusion of other territorial based approaches such as marine protected areas.

5.1. Introduction

Fisheries management approaches based on centralized government intervention have proven to be inadequate, contributing to the existence of a crisis in the world's fisheries (Pauly *et al.* 2003; Myers and Worm 2003). As a consequence, in recent years, researchers have promoted the expansion of co-management as an important alternative to top-down natural resource management policies (Sandersen and Koester 2000; Castilla and Defeo 2001; Pauly *et al.* 2003).

One approach, used by governments that have attempted to introduce co-management in coastal waters is to grant territorial user rights to fishers (TURFs). The rationale behind territorial user rights is based on a common property approach, which proposes that a well-established rights-based system provides access, withdrawal and management security for individuals and groups of individuals (Ostrom and Schlager 1996). With such assurance, fishers would make credible commitments to one another and develop long-term plans for investing in and harvesting from a common-pool resource in a sustainable manner. Accordingly, TURFs change the nature of resource extraction. Hunting is transformed into harvesting, as a degree of predictability is introduced, and fisher's skills (as hunters) become less important (Jenoff *et al.* 1998; Gelcich *et al.* 2005a). New abilities associated with management and negotiation gain importance as fishing operations become small enterprises, and markets for fisheries' products increasingly operate within an international domain (FAO 2005; Gelcich *et al.* 2005a). Under these new circumstances, it becomes important to direct attention to fishers' financial decisions when confronted with the responsibility of managing resources within the territorial user rights framework. Understanding risk preferences of fishers is a key element to developing this knowledge (Eggert and Martinson 2004). However, despite the importance of understanding fishers' risk preferences there are still few empirical studies in this area, and these tend to focus on open access regime fisheries (Bockstael and Opaluch 1983; Eggert and Martinson 2004; Eggert and Tveteras 2004).

Studies that have explored economic decision making preferences under uncertainty and risk have followed two general tracks. One traditional approach, introduced by

economists, has focused on expected-utility maximisation theory (Taliaferro 2004). Under this theory individuals are thought to make decisions which maximize their utility. In other words they would weigh the utility of particular outcomes by the subjective probability of their occurrence and chose the option with the highest weighted summed outcome (Taliaferro 2004). In the past few years however, it has become quite acceptable to challenge the notion of human rationality that is displayed by the theory of maximization of expected utility (Tversky and Kahneman 1992; Thaler 2000). Most of these critiques put its descriptive power into doubt, based on a lack of empirical support, and indicate decision-making must take into account the psychological capabilities, social norms, extrinsic variability of decision-makers and in particular, their limited abilities to envision 'all possible' decision alternatives (Kahneman and Tversky 1979; Glimcher and Rustichini 2004; Van den Burg *et al.* 2000; Caplin and Leahy 2001). Alternatives for expected utility models come from behavioural economics, which have found satisfactory explanations for phenomena and decisions which were inexplicable with standard approaches from mainstream economics (Stracca 2004). Nevertheless before neoclassical models can be replaced by something that bears a closer resemblance to reality, a theory must come into existence that is based firmly on knowledge about the actual decision making process of real human beings. The extent to which behavioural methodologies will achieve this challenge, and come to dominate economic research is a matter of current debate and research (Stracca 2004; Thaler 2000).

Prospect Theory (Tversky and Kahneman 1981), and Cumulative Prospect Theory (Tversky and Kahneman 1992), are psychological theories of decision making under conditions of risk and uncertainty, which have had a broad impact on a number of fields (McDermott 2004). Its supporters suggest they could represent an alternative theory of behaviour to that of expected utility ¹⁰ (Stracca 2004). Prospect Theory introduces a two stage decision making process, which consists of framing and valuation. Framing refers to a number of mental operations that simplify the subsequent evaluation and choice of options. These operations consist of the selection of reference points and the framing of outcomes as deviations from the reference point. In the valuation phase, the decision maker assesses the value of each

¹⁰ Prospect theory's increasing popularity in a number of different fields is confirmed by the award of the 2002 Nobel prize to Daniel Kahneman.

prospect and chooses accordingly (Tversky and Kahneman 1981; Tversky and Kahneman 1992). Consequently, Prospect Theory shows that people evaluate outcomes with respect to deviations from a reference point and not with respect to net asset levels as assumed by expected utility theory. Outcomes that exceed the reference point are seen as gains, whereas outcomes that fall below the reference points are perceived as losses (Fanis 2004). The reference point is usually the current position in which people find themselves, but can also be an aspiration level, or some other point (Tversky and Kahneman 1981).

Whether or not people perceive the available options as gains or a loss has different implications for the choices they make (Kahneman and Tversky 1979; Fanis 2004). Prospect Theory predicts that when people perceive their situation as one that will lead to losses, they are more likely to adopt a risk-prone behaviour or are risk-acceptant with respect to losses. When individuals perceive they will acquire gains, they tend to adopt a behaviour that avoids risk, thus people become risk-averse with respect to gains (Kahneman and Tversky 1979).

So, when people are in their domain of gains they will be risk-averse and prefer a high probability event even if it yields a smaller utility. When in the domain of losses they will be risk-acceptant and choose an option which has a lower probability of occurring and may generate a higher loss than the option which would yield a certain but smaller loss. In addition to the above, Prospect Theory predicts that losses hurt more than equal gains please, as McDermott (2004) explains “*losing \$10 hurts more than finding \$10 pleases*”. This phenomenon is called loss aversion (Tversky and Kahneman 1981; 1992). Cumulative Prospect Theory extends these findings towards a distinctive fourfold pattern of risk attitudes: risk aversion for gains and risk seeking for losses of medium and high probability events and risk seeking for gains and risk aversion for losses of low probability (Tversky and Kahneman 1992).

It is important to highlight that Prospect Theory is an individual choice model and in TURFs decision making normally occurs in group settings, where groups may comprise all or a subset of participating fishers. Nevertheless, there is increasing experimental and empirical evidence that Prospect Theory provides a descriptive model for organizational and group decision making (Qualls 1989; Taliaferro 2004).

Thus, groups would also tend to evaluate risk in terms of deviations around a common expectation level and the framing of decisions in terms of gains and losses, influences the overall direction of the groups risk propensity (Qualls 1989).

Some models of rational choice may also allow risk-averse and risk-acceptant decisions (Kuznar and Frederick 2003; Tuthill and Frechette 2004). Nevertheless, classic expected utility models assume that risk-aversion should dominate rational decision making at all times, therefore all choices take place in the gains domain as identified in Prospect Theory, these models also make no accommodations for loss aversion (McDermontt 2004).

Due to the widespread acceptance of expected utility models, fishers mainly have been described as a risk-averse group (Bockstael and Opaluch 1983; Dupont 1993; Mistiaen and Strand 2000) and only a few exceptions to this position have been proposed (Eggert and Tveteras 2004; Eggert and Martinsson 2004). In this study we will research fishers' financial decisions and therefore risk preferences under a TURFs management regime. In doing so, we also wish to explore the use of Prospect Theory as a descriptive framework for understanding fishers behaviour under user right management scenarios.

The current study was undertaken in Chile where the adoption of co-management as a component of the 1991 Fisheries and Aquaculture law (FAL) provides a good opportunity to understand fishers' financial decisions under a TURFs framework. Territorial user rights related to artisanal fishers in the FAL take the form of management and exploitation areas for benthic¹¹ Resources (MEABR). Through these the Chilean Undersecretary of Fisheries assigns community territorial user rights to artisanal fisher syndicates in defined geographical coastal areas (Gelcich *et al.* 2005b).

The first official MEABR was established in 1997 and by August 2003, 188 MEABR had management plans in place, and another 649 were at various stages of the application procedure (Gelcich *et al.* 2005b). To date, research on MEABR has

¹¹ Benthic organisms are those who live on the ocean floor. (i.e. snails, crabs, clams)

described the genesis of the policy (Bernal *et al.* 1999; Meltzoff *et al.* 2002), investigated biological sustainability and stock recovery within management areas (Castilla 2000; San Martin 2001) and investigated attitudinal heterogeneity of participating fishers (Gelcich *et al.* 2005a; 2005b). However, there is a lack of knowledge on fishers' financial decisions with respect to quality and prices of co-managed resources. Such understanding would ideally aid any future evaluation of fishers' financial adaptive strategies, and thereby enable any necessary future refinements of the policy. Thus this type of information raises relevant issues for both the Chilean co-management experience and also for other countries considering similar policies.

5.2. Research setting

Under the co-management arrangements of MEABR policy, syndicates wishing to obtain territorial user rights must identify an area of seabed over which they wish to make a claim, and then co-finance a baseline study of this area, from which resource catch quotas (typically between 10-25 % of exploitable stock) and a management plan are established. These are syndicate and not individual quotas. Syndicates are also required to contract external consultants to undertake yearly follow up assessments of stock in the management area, and to determine changes in the total allowable catches (TAC). The Annual assessments of the natural resources must be presented to the Undersecretary of Fisheries and all resources extracted from the MEABR must be declared to the fisheries department which supervises compliance of the management plan (Subpesca 2004; Gelcich *et al.* 2005b). Resource stocks in MEABR may be enhanced, by bringing resources from other sectors, only once at the beginning of the MEABR process, after this stocks must be maintained by 'natural seeding' (*sensu* Castilla 1990).

In Chile the gastropod *Concholepas concholepas*, known locally as *loco* is the most economically important shellfish and therefore 90% of existing MEABRs have *loco* as their main target species. Such has been the importance of *loco* that it has been used to guide policy developments towards an MEABR approach and currently all the *loco* gathered in Chile come exclusively from MEABRs. During the last five years, around 3000 tonnes of *loco*/year have been landed; with this amount rising as

new syndicates' apply for MEABRs (see Gelcich *et al.* 2005b and Castilla *et al.* in press).

The minimum catch size for *loco* is 10cm in length, and they are mainly bought by marine-resource exporting companies, or middle-men working for them, and exported to Asian markets. When bought by these companies *loco* price is related to a quality grading of the resources. For example a kilogram of very large *loco* (4 per kilo) can be worth twice the amount of a kilogram of smaller ones (15 per kilo).

Effectively, fishers' harvesting decisions within MEABRs are constrained to four main issues: a) The amount of TAC to be gathered and the timing of this harvest, within the officially designated harvest season; b) the price fishers will accept for their resources; c) the number of buyers to whom fishers sell and; d) how income is distributed within the syndicate. This study explores fishers' financial decisions with respect to the first three aspects, as these are more directly related with fisher syndicate selling decisions.

5.3. Study Areas

For administrative purposes Chile is divided into 12 regions, our research considered syndicates in three of these regions (IV, VI and X). Syndicate Cooperativa (CO) is located in region IV (31° 55'S; 71° 00'W). The MEABR policy process has been established in region IV for 7 years; hence, this syndicate has been managing a MEABR for most of this time and in 2004 was preparing to extract resources for its fifth year. Syndicate El Quisco (Q) is located in region V, and was one of the first to engage with MEABR policy, this syndicate is on its fifth official harvest although it was looking after their subtidal habitat, with help of university scientists, well before the MEABR policy was implemented in 1997 (Gelcich *et al.* 2005b). Syndicate Union La Boca (L) (33° 55'S; 71° 50'W), Vega La Boca (LB) (33° 55'S; 71° 50'W) and Union Matanzas (M) (33° 57'S; 71° 52'W), are all in region VI. They applied for a MEABR in 2001, and got their management plan approved in 2003. These three syndicates were in their first formal extraction in 2004. The situation of these syndicates was typical of the general situation in region VI as it was one of the last in Chile to incorporate the MEABR policy. The syndicates El Muelle-Ancud (A) (41°

51°S; 73° 49'W) and Carelmapu (C) (41° 51'S; 73° 35'W) are both in region X. This region had its first MEABR management plans approved in 2001, but since then there have been a large number of applications from within the region. These accounted for 39% of the current applications across Chile (at the time of writing). In keeping with this trend Ancud was in its first harvest from a MEABR, after undergoing a year without harvesting and Carelmapu was waiting for the resolution for their third official year of harvest. Nevertheless these two syndicates had been allowed to extract *loco* in the form of an experimental fishing quota in 2002. It is important to mention that fishers from Carelmapu are from 5 syndicates, but have come together to confront the changes imposed by the MEABR, so in terms of the management and selling process they act as one.

The members of these seven artisanal fishing syndicates depend on benthic resources in different ways. Ancud and Carelmapu are formed exclusively of professional Hookah divers (a hookah diver involves the use of pressurised air supplied directly from a support vessel as opposed to SCUBA or skin diving) (Castilla and Defeo 2001). These Hookah divers in general do not have other sources of income and operate with a crew of three or four people (boat operator, assistant, one or two divers). Cooperativa, is mainly formed by hookah divers (75% of landings are benthic resources) who also might fish for fin-fish or have off-sector jobs for a portion of their livelihood. For syndicates El Quisco, Union La Boca, Vega La Boca and Union Matanzas benthic resources represent only about 15, 30, 15, and 9 percent of the syndicate landings respectively (Sernap 2000). Their main sources of income are from fishing for fin-fish, gathering algae or other off-sector activities.

5.4. Methods

We conducted our fieldwork between January and July 2004 and collected information from 54 fishers' on their financial decisions under two hypothetical size distributions of *loco*, which represent a potentially good and relatively bad harvest. The three aspects of financial decision making related to: a) selling prices; b) amount harvested; and, c) number of buyers. It is important to note that this information was collected as part of a larger research programme and other surveys, group meetings and participatory observation had been carried out for some time at the different

syndicates (Gelcich *et al.* 2005a; Gelcich *et al.* 2005b). Because of this ongoing activity a good level of rapport had been built up between the interviewer (SG) and the fishers.

5.4.1. Selling prices

Data were collected using a questionnaire which took the form of a bidding game. The basic question was ‘If the price of *loco* today was x, would you harvest?’. This question was posed under 2 different hypothetical catch-distributions (or scenarios). In scenario 1 size distribution was skewed towards small *loco* (low in weight) and in scenario 2 it was skewed towards large-sized *locos* (heavy in weight), therefore the potential earnings from the catch is also skewed (large size *loco* are worth proportionally more than smaller *loco*; Table 5.1). A supplementary question asked if fishers would maintain the selling price at the end of the harvesting season. Questions were asked face to face in Spanish following this preamble:

‘Imagine that a buyer comes to see you on the first day of the *loco* harvesting season and offers you a price for *loco*. I will tell you what price the buyer is offering for each size of *loco*, and I will also tell you the size distribution of the *loco* catch within your MEABR. You have to tell me if, given that size distribution you would sell at that price. Remember this is a game, so do not worry if the size distribution I show you is different to the current size distributions in your MEABR, just pretend it is real. Apart from this, I’d like you to assume that everything else is as in real life. So even though this is a game, try and be as honest as you can in your decisions.’

After giving this preamble, the interviewer would explain the catch size distributions. These were similar to those used to grade *loco* by the buying companies and therefore fishers were quite familiar with the process. Initially we offered a bid price for scenario 1. The starting price was chosen at random for each bid, from a given range of 400-2000 Chilean pesos¹². If fishers were not willing to sell at that determined price, we increased the bid price by one increment and ask if they would sell at this new price. We kept iterating the price in this manner until the fisher

¹² The US\$/Chilean peso exchange rate is 1US\$ = 602 pesos (El Mercurio, July 2005).

agreed to sell. If they agreed to sell at the first price offered, we followed the same procedure in an inverse manner. At the end of bidding we would review the data and then ask ‘If it was the last day of the season, would you stick to the same prices or would you sell at different prices, if ‘Yes’ a what price would you sell?’. We would then repeat the whole bidding game for the other scenario.

We tested for starting point bias that might affect the responses through correlation analysis. Differences in expected prices between syndicates and within syndicates for the two scenarios were analyzed using Kruskal-Wallis and Mann-Whitney tests or t-tests depending on the distribution of the data. Real market values for the different *loco* size classes were obtained from Pasificoop, a selling cooperative (Table 5.1). We used this data to calculate the average value of an individual *loco* under scenario 1 and scenario 2. The price ratio between these two values represented the theoretically optimum increase in price for a *loco*, produced by a shift in catch size distribution, from scenario 1 to scenario 2.

Table 5.1 Hypothetical catch distributions and price relationships for different size class *loco*.

Number of <i>locos</i> (in a kilo)	Weight of <i>locos</i> (gr.)	Scenario 1	Scenario 2	Price relationships
4 – 6	250 – 166	5%	10%	1.18
6.1 – 7	165 – 125	10%	30%	1.06
7.1 – 10	124 – 100	20%	35%	1
10.1 – 12	99 – 83	30%	20%	0.78
12.1 – 15	82 – 66	35%	5%	0.71

5.4.2. Amount to be harvested:

Once selling prices had been established fishers were asked: ‘Given that selling price, how much of your TAC would you harvest and why?’

This question was asked under the same two scenarios and it was explained again that the total income from the harvest would be dependent on the grading of the

resources, as occurs in reality. We also asked what proportion of the size classes they would consider selling (i.e. the large or small *loco*).

The amount of TAC to be harvested was registered as a percentage for each scenario. This information represents the extent to which fishers are willing to accept different levels of risk, by leaving resources unharvested, under the expected financial returns of the 2 scenarios. Implicit in the decision of leaving x amount unharvested is the belief that the growth of *loco* in a year would yield a higher income than that obtained through bank interest rates¹³.

In order to gain some idea of fishers' expected revenues with respect to the investment of leaving x amount of resources un-harvested, we estimated *loco* growth in a year and made the following two assumptions: a) the proportion of prices paid for *loco* remained constant; b) no losses occurred in that portion of stock. *Loco* growth for a 10 cm individual was calculated for a period of 12 months using a Gompertz growth curve (Rodriguez *et al.* 2001) and a Von Bertalanffy growth curve (Geaghan and Castilla 1988) which coincided in a growth rate of approximately 0.025 mm peristomal length a day. This was transformed to weight values following the length/weight relationship ($a=0.0001$ and $b=3.1036$) used by Estudios Marinos (2003). Having completed this calculation we estimated the growth of the unharvested portion of TAC. Growth rates proved high enough for *loco* to achieve a better price after a year, therefore we estimated fishers percentage increase of income from this growth for each one of the scenarios.

As the main objective of understanding how much TAC will be left unharvested is to understand how fishers relate to risk, we developed a risk threshold by calculating the amount of *loco* (% of TAC) which must be left unharvested, to provide similar expected returns from investing sales revenues in the bank, at Chilean standard interest rates. The risk threshold identifies a theoretical limit between fishers being risk adverse, preferring a sure outcome, which yields equivalent to having the money in the bank, or risk acceptant, in which they are willing to confront the uncertainty of leaving *locos* un-harvested to increase their income in the future. We used current

¹³This is the form of saving fishers would normally have access to.

bank interest rates to define the risk threshold value because they represent a non-risky investment alternative accessible to fishers. This risk threshold was calculated separately for both scenarios.

Qualitative responses as to why fishers decide to harvest a certain amount of TAC underwent thematic-coding. Additionally the fishers' role in the selling decision was recorded as a high probability or a low probability of making the actual selling decision. Typically the directorate which is the administrative body of the syndicate whose members include the President, Vice-President, Secretary, Treasurer and one or two advisors or influential fishers, are the most likely to make such decisions.

5.4.3. Number of buyers

As a way of understanding fishers' rationale behind selling *loco* we asked fishers "When you consider a good price is being offered, would you sell all your resources exclusively to one buyer?"

If respondents said 'No', we asked what would be the number of buyers to whom you would consider selling your *loco* TAC. This information was analysed using Kruskal-Wallis and a *posteriori* Dunns test.

5.4.4. Contextual variables

After completing the formal part of the interview we collected information about the role of benthic resources and off sector activities in the livelihood of the fisher. Additionally we gathered some socio-demographic data on wealth (monthly income), age, gender, education and the number of people in household. Data on MEABR total allowable catches, overall income generated by the MEABR and the length of time the MEABR was in operation were compiled from secondary sources, typically the case specific follow-up studies made by consultants. These data represent the context within which each of the decisions is taken. Contextual data were related to fishers' risk preferences, estimated from fishers being above or below the risk threshold, by using a logistic regression model with the programme SPSS 9.0 (Statistical Package for the Social Sciences).

5.5. Results

No significant correlation was found between starting bidding price and respondents chosen selling value ($n=108$, correlation coefficient of 0.14, $p>0.05$) which suggests that there was no starting point bias.

5.5.1. Price

The price at which fishers would sell *loco* varied between syndicates for scenario 1 ($H=33.49$, $DF=6$, $p<0.01$) and scenario 2 ($H=41.49$, $DF=6$, $p<0.01$), with syndicate C and Co demanding higher prices and L accepting the lowest (Fig 5.1).

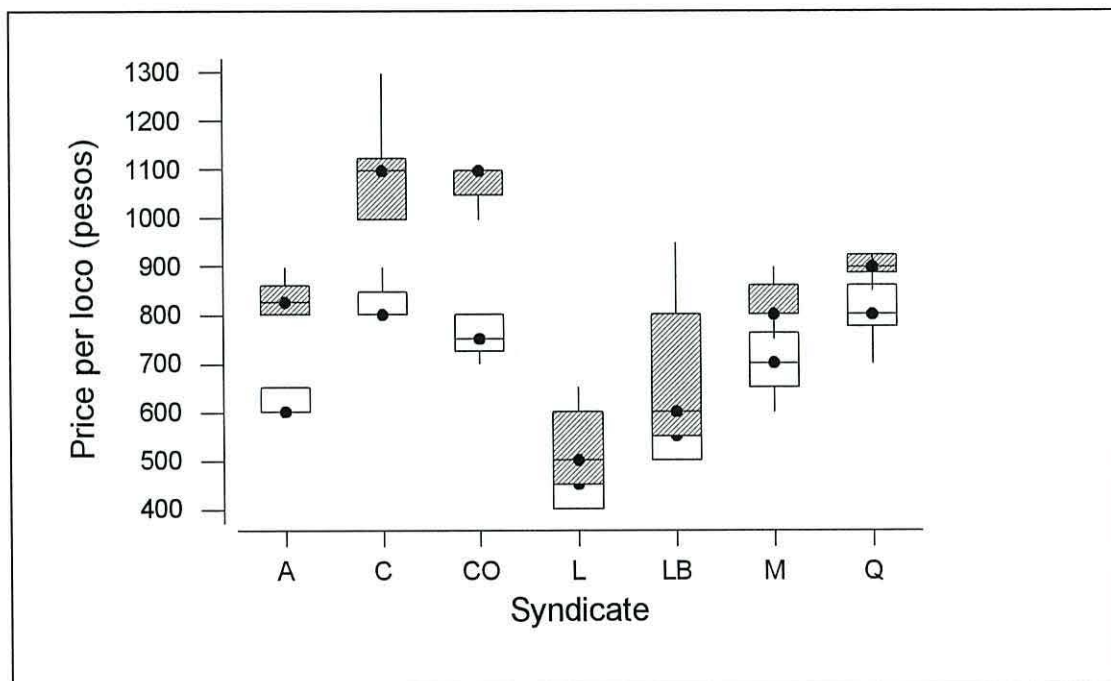


Figure 5.1 Price at which fishers would sell *loco* (pesos). Filled blocks represent scenario 2 (skewed to large *loco*). Empty blocks represent scenario 1 (skewed to small *loco*). In the box plots; median is represented by line and dot, the box represents the interquartile range, the whiskers represent the data range. Letters represent different syndicates where A, C and CO are syndicates comprised of divers who obtain most of their income from benthic resources and L, LB, M and Q generally have more diversified income streams comprising fin fishing, diving and off sector activities.

The price at which fishers were prepared to sell *loco* varied significantly between scenario 1 and scenario 2 for syndicates C ($T=55$, $n=10$, $p<0.01$), Q ($T=69$, $n=10$, $p<0.01$), CO ($T=21$, $n=6$, $p<0.01$), A ($T=21$, $n=6$, $p<0.01$) and M ($t=-4.44$, $DF=8$, $p<0.01$) (Fig 5.1).

No significant differences were observed for either scenario or syndicate when comparing the price fishers were willing to accept for *locos* early and late in the season (Wilcoxon signed rank tests, $p>0.05$). However 25% and 31% of respondents would reduce the price of *loco* for each scenario respectively when sold late in the season. These reductions imply a change in median price of *loco* of 50 Chilean pesos. Only 5% of all respondents, all from syndicate A, would increase the price of *loco* late in the season. Using the Pasificoop data, the price ratio for a *loco* between scenario 1 and scenario 2 was estimated to be 1.38 (theoretical value). The perceived price ratio calculated from fishers responses in the studied syndicates, regardless of the price at which fishers would sell their *loco*, ranged between a median price ratio of 1.43 in syndicate CO to a median price ratio of 1.1 in syndicate LB (Fig 5.2).

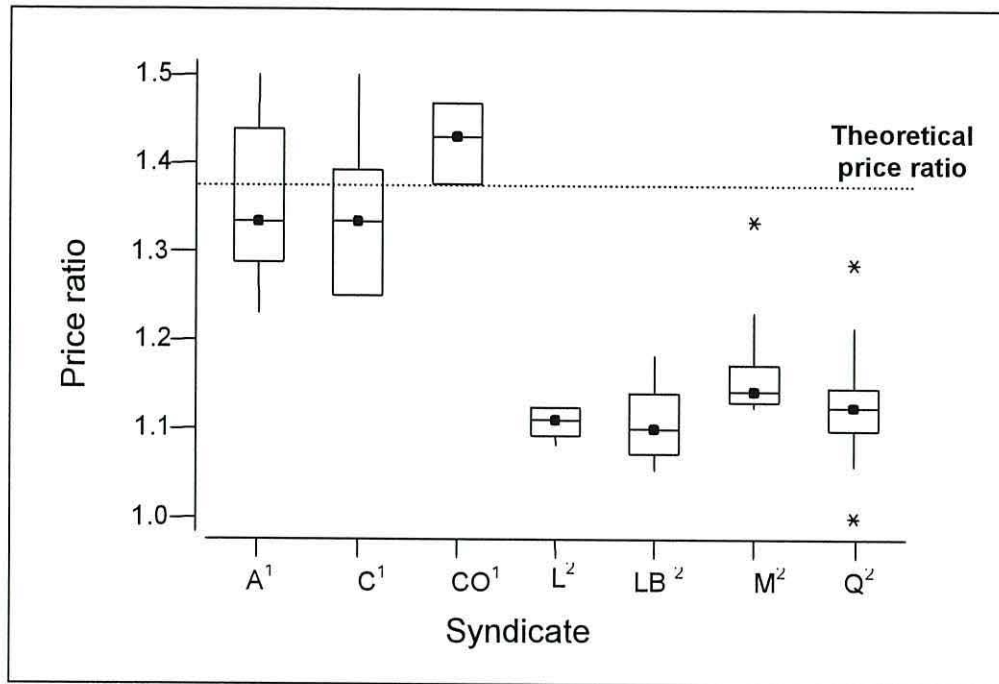


Figure 5.2 Fishers' price ratio (price sold at scenario 2/ price sold at scenario 1) for the studied syndicates. The dotted line represents the theoretical price ratio. Responses showed differences in a Kruskal-Wallis analysis ($H= 38.657$, $DF= 6$, $p< 0.001$). Those syndicates that are not significantly different share the same superscript number. In the box plots; median is represented by line and dot, the box represents the interquartile range, the whiskers represent the data range and the * the outliers. Letters represent different syndicates where A, C and CO are syndicates comprised of divers and L, LB, M and Q are mainly composed of fin-fishers.

Significant differences were found for price ratio between syndicates ($H= 38.657$, $DF= 6$, $p< 0.001$). Only syndicates A, C and CO (syndicates mainly composed of divers) did not deviate significantly from the theoretical price ratio value (Fig. 5.2). This indicates that these fishers (divers) understand the complexities of the price grading system in an efficient way.

5.5.2. Amount to be harvested

Fishers from syndicates L, LB and M would sell 100% of their TAC despite the size distributions (grading) of their catch in both scenarios. Fishers from syndicates A, C, CO and Q would leave portions of their TAC unharvested and would therefore accept certain levels of risk. Typically fishers from these syndicates would sell a higher portion of their TAC in scenario 2 (skewed to large *loco*) than in scenario 1 (skewed to small *loco*). Therefore the level of risk they are willing to accept is

related to the quality of *loco* and their perceived overall income. Disaggregating the responses to only include fishers more likely to make the actual harvesting decision follows a similar trend to that of the whole sample, except for syndicate C (Fig. 5.3). All fishers stated that they would sell their large *loco* first.

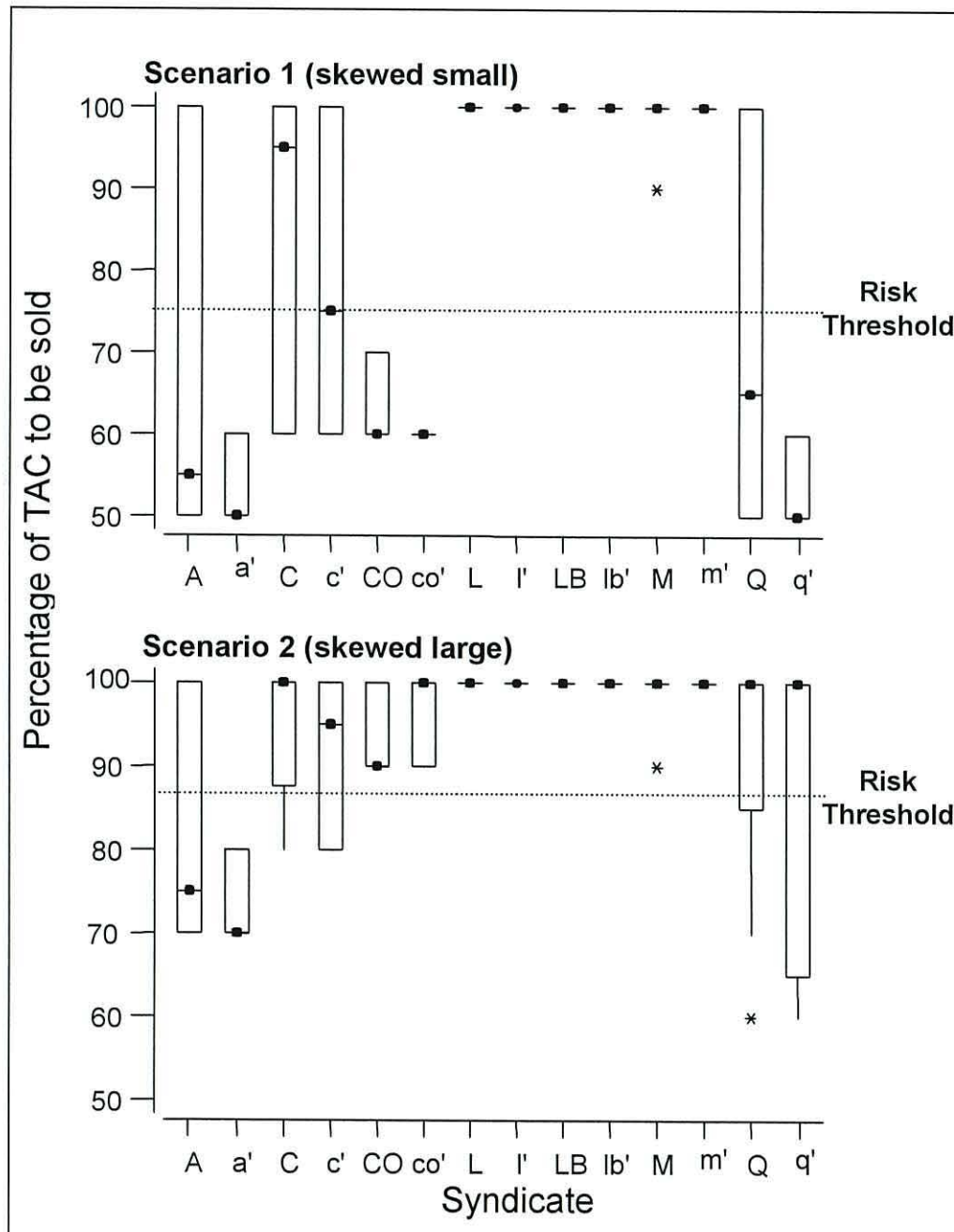


Figure 5.3 Percentage of total allowable catch fishers from the different syndicates were willing to sell under the bidding game conditions for two scenarios. Lower case letters represent the portion of the whole sample more likely to make the decision. The dotted line represents the risk threshold. In the box plots; median is represented by line and dot, the box represents the inter-quartile range, the whiskers represent the data range and the * the outliers.

The growth rate of *loco* (50 grams in a year for a 10 cm individual) meant that they could increase in size sufficiently in one year to fall within a higher grade class, thus changing from one price grading category to another. Fishers' expected revenues derived from this growth, in relation to the amount of unharvested TAC is presented in Table 5.2. These values were obtained by calculating the income from the portion of TAC extracted under the current *loco* size distribution and the expected income from that same portion of TAC extracted after a year's growth.

The risk threshold consisted of the amount of *loco* (% of TAC) which must be left unharvested, in each of the scenarios, for its growth to compare with the expected returns from investing sales revenues at an interest rate of 1.8%¹⁴ (Banco Central 2005).

Table 5.2 Percentage of unsold catch and the expected gains of income which could be attained from the growth of un-extracted *loco* *.

Scenario	Syndicate	% unsold TAC	Financial gains from <i>loco</i> growth
Scenario 1			
Risk Threshold		26%	1.8%
	A	45%	5.0%
	Directorates A	50%	6.3%
	CO	40%	3.7%
	Directorates CO	40%	3.7%
	Q	35%	2.4%
	Directorates Q	50%	6.3%
Scenario 2			
Risk Threshold		14%	1.8%
	A	25%	4.9%
	Directorates A	30%	5.1%

* Syndicates who would sell 100% of the TAC are not presented in the table. Their gains would be 1.8% from investing the money equivalent to any amount of TAC in the bank.

In scenario 1 (skewed to small *loco*) the risk threshold value would require 26% of *loco* TAC to remain un-harvested to achieve the 1.8% gain. For scenario 2 the figure was 14% (Table 5.2; Fig 5.3). The risk thresholds would represent the limit between fishers being risk averse or risk acceptant. It also shows that it would be more

¹⁴ These interest rates are adjusted for inflation and are typical of the savings account fishers would normally have access to.

convenient to harvest the full TAC and put the equivalent amount of money in the bank, than to extract any amount between the risk threshold value and the full TAC.

Qualitative responses suggest that in scenario 1 fishers' decisions to harvest 100% of their TAC is related to the social pressure of the syndicate members to gain income from the MEABR. It is interesting to note that fishers in syndicate C, B and LB also stated that low grade low weight *locos* will never become high quality, and will consume limited food supplies, thus jeopardizing the success of the entire MEABR area. Fishers who decide not to extract 100% of the TAC all agreed with the fact that some *loco* has to be extracted to pay for the management costs but that leaving *locos* unexploited could increase their income in future extraction seasons (Table 5.3).

Table 5.3 Qualitative responses to the question 'why would you sell that amount of your TAC?' *

Syndicate	Reason for selling all TAC	Reason for selling part of TAC
A	- We would lose them due to theft	- We could increase income from thin ones next year.
C	- They would only eat up food for new / juvenile <i>loco</i> . - Only 2-3 months of harvest a year.	- We could increase income from thin ones next year.
CO		- We have the best quality in the region and must maintain our standards.
L	- Social pressure is high - To justify the sacrifices made by associates of the syndicate	
LB	- Social pressure is high. - Avoid selling in black market. - They would only eat up food for new <i>loco</i> .	
M	- Social pressure is high - They would only eat up food for new <i>loco</i> .	
Q	- To validate the sacrifices made by associates of the syndicate	- We could increase income from thin ones next year. - Important to keep <i>loco</i> for our local markets (restaurants).

* Responses made for scenario 1

For scenario 2 fishers who agreed to sell 100% of their TAC for *loco* agreed that the revenue generated from the sale of large size classes would be good enough to compensate for the low revenue from the sale of the small-grade classes. Fishers who would not sell 100% of the TAC shared the thought that small-grade *locos* will grow and provide further benefit.

5.5.3. Number of buyers

The minimum numbers of buyers' to which fishers from different syndicates consider selling their *loco*, ranged from a median value of 1 in syndicates A, L and LB to a median value of 3.5 in syndicate Q (Fig 5.4). Syndicate responses showed significant differences ($H= 37.048$, $DF= 6$, $p< 0.001$).

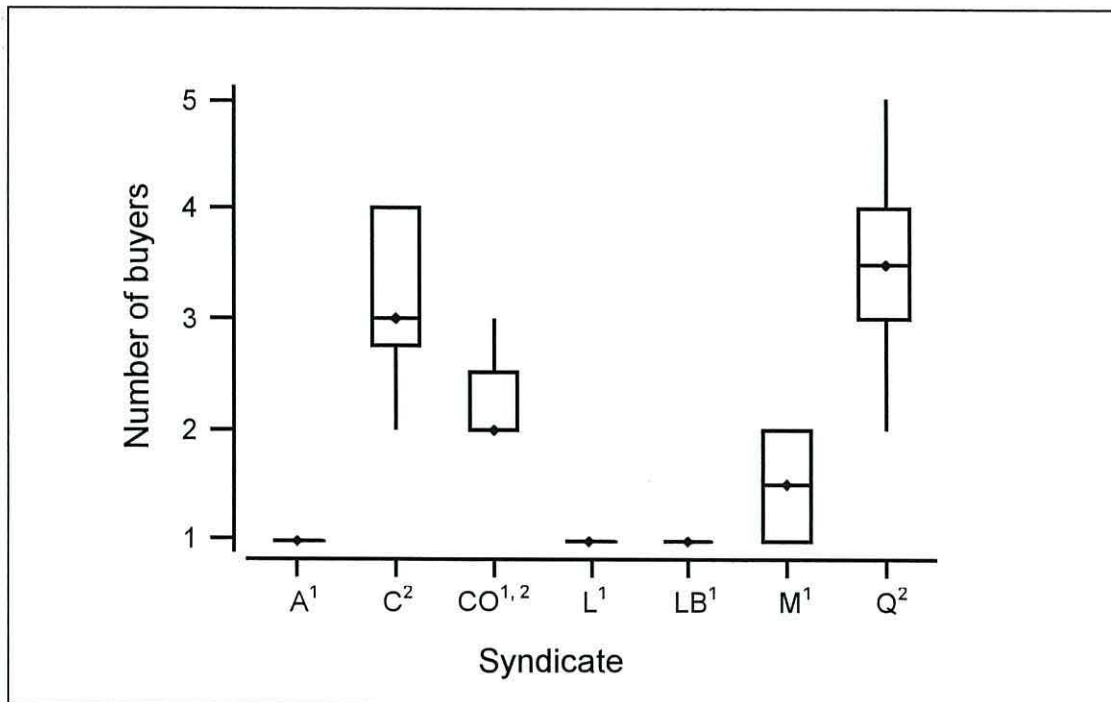


Figure 5.4 Minimum numbers of buyers' fishers from different syndicates consider selling their *loco* TAC to. Syndicate responses showed differences in a Kruskal-Wallis analysis ($H= 37.048$, $DF= 6$, $p< 0.001$). Pairwise differences were tested using Dunns test, those syndicates that are not significantly different share the same superscript number. In the box plots; median is represented by line and dot, the box represents the inter-quartile range, the whiskers represent the data range.

5.5.4. Contextual Variables

Logistic regression results between contextual variables and risk preferences are reported in Table 4. The overall model has a Nagelkerke R^2 value of 0.8. The coefficient for the variable, dependence on benthic resources as a source of income, is positive and significant, indicating that fishers which tend to have a higher proportion of their income from benthic resources (diving), become risk-acceptant under circumstances as those from scenario 1 (skewed small). We also find that those fishers more likely to take the actual harvesting decision (typically the directorates) were significantly more willing to engage in risk-acceptant behaviour. The level of education also showed a positive relationship with risk-acceptance although this was only significant at a $p < 0.1$ level (Table 5.4).

Table 5.4 Logistic regression showing the relationship between contextual variables and risk-acceptant attitudes towards selling *loco* *.

Variable	B	SE	Wald	P	R
Gender (female)	1.113	2.732	.166	.684	.00
Age (older)	1.556	.971	2.566	.109	.09
Education (higher)	3.835	2.302	2.776	.096	.10
People in household	-.516	.924	.313	.576	.00
Proportion of income from benthic resources	.082	.031	6.973	.008	.27
Number of off-sector activities	-.676	.581	1.355	.244	.00
Average monthly income (wealthier)	.000	.000	.953	.329	.00
Stage of MEABR	.679	.791	.736	.391	.00
Income from MEABR	2.340	6.129	.146	.703	.00
Directorate (yes)	4.268	1.928	4.900	.027	.20

* Responses for hypothetical scenario 1 where $n=51$, B=logistic regression coefficient, SE=standard error, W=Wald statistic (has a chi-square distribution and $DF=1$), P=significance, R= R static, indicating the relative contribution of variable to the model).

From the results it seems that a wealth effect on risk is absent, where this variable is measured in terms of individual monthly average cash income. We note this would not be expected from expected utility theory. Variables concerning the time the syndicate had been engaged with the policy and the importance of MEABR income on overall annual income were not significant predictors of risk attitudes. Tests for correlations between the 10 contextual variables found no correlation coefficient over 0.6 thus discarding multicorrelarity as an important aspect that could have

affected these results. For scenario 2, no set of contextual variables had a significant relationship with risk preferences as most fishers sold all of their TAC.

5.6. Discussion

As the race to extract resources is broken through the implementation of territorial user rights, fishers have new management responsibilities and need to respond to global market conditions. This change of responsibility has brought new challenges with respect to fishers' financial understanding of the system. In the case of Chilean MEABR, fishers seem to have learnt to deal with the new responsibilities associated with management and commercialisation of resources, by adopting an array of preferences in their decision making that relate to price and risk.

Risk-preferences are one of the major determinants of fishers' responses to a range of changes, whether in regulatory, biological or economic terms (Mistiaen and Strand 2000). Previous studies of risk-preferences have dealt mainly with open access fisheries and find that fishers are a risk-averse group (Bockstael and Opaluch 1983; Dupont 1993) with only a few exceptions being reported (Eggert and Martinson, 2004; Holland and Sutinen, 1999). Responses of Chilean fishers under a TURFs management regime imply they have risk-averse and risk-acceptant preferences. In four of the syndicates studied, a change in the composition of the catch in terms of the body size distribution of animals available for harvest would be enough to cause a shift from risk-averse to risk-acceptant behaviour. Our results suggest fishers would be modifying their risk preferences when they perceive themselves as facing gains or losses relative to some personal reference point or expectation level. The direction of change in their risk-preferences shows that when lower income will be obtained, in other words when fishers are in the losses domain (scenario 1), they adopt a strategy that is risk-acceptant, by leaving *loco* to grow on and hopefully achieve higher value. On the other hand, when fishers feel they are making a gain (scenario 2) with respect to their reference point they become risk-averse and extract all *loco* permitted by the TAC. This behaviour is as predicted by Cumulative Prospect Theory for medium or high probability events (Kahneman and Tversky 1979; Tversky and Kahneman 1981; 1992).

The fact that not all fishers or syndicates act in a similar way under the two scenarios, underlies the importance of contextual factors in creating individual reference points. Prospect Theory does not include a theory of reference point choice, maintenance or change, which has been a strong critique of the 'real life' applicability of the theory (Taliaferro 2004). For the fishers in this study, we found that the dependence on benthic resources as a source of income, and therefore livelihood strategies, appears to be one of the main factors that influence the framing of fishers' harvesting decisions. With this in mind, we will describe how differences between being risk acceptant and risk averse relate to preferences among a particular financial adaptation strategy.

The results of the present study suggest that the higher the proportion of a fishers income that is derived from benthic resources the more risk-acceptant the fisher becomes under conditions with a small sized skewed distribution of *loco* (scenario 1). A similar type of behaviour has been described for Swedish commercial fishers for which a higher dependence on fishing was associated with a less risk-averse attitude (Eggert and Martinsson 2004).

Explanations for the differences in risk preference between fishers who depend more or less on the managed resources may come from the fact that divers who engage in MEABR have more experience of benthic resources and would feel that a reduction in earnings (below their reference point) could be reversed by their own initiative, work and knowledge of the system. On the contrary, fishers who are less dependent upon diving are less inclined to risk resources from MEABRs. One could say a fisher prefers the investment alternative with which they are most familiar, this is similar to the situation reported for forest owners (Lonnstedt and Svensson 2000). This idea is further emphasized by a comment made by a fisher from syndicate M who catches mainly fin-fish for a livelihood: '*we need the money [from the loco TAC] to buy new nets and fix our boats*'. In this way, he was more willing to accept the risks of fishing under an open access regime, than to accept the risk of leaving a portion of the *loco* TAC unharvested. Thus his reference point between what a gain and loss is at the moment of taking the harvest decision is different to that of a diver.

The idea that fishers are willing to invest in benthic resources or other alternative income (i.e. fishing, off-sector activities) is also reflected in the way they perceive the grading system used to price *loco*. Fishers that are dependent on benthic resources for their livelihoods understand the complexities of the grading system, in a precise way. Whereas fishers that do not depend on diving as a main source of income, seem to place more emphasis on achieving a minimum price. In this way, fishers' pricing behaviour seems to be guided by a set of routines or repeated habits and fisher syndicates would tend to imitate the ones that yield a satisfying level of effort and profits (Noailly *et al.* 2003).

So, fishers followed two main financial selling strategies, and are willing to make risky decisions within these. Divers generally wish to get the best of their resources, to do so they are willing to become risk-acceptant and adapt efficiently to selling strategies. Fin-fishers on the other hand, are risk-averse with respect to benthic resources and have a minimal requirement for the sale of their *loco* TAC, which can then be invested on other on-sector or off-sector activities.

It is important to highlight that these strategies are based on a normal selling season in the previous year. It was made quite clear by many respondents, mainly from the diving sector, that if they perceive losses for more than two years (i.e. the perceived probability of gains becomes very low), social pressure, debt and the need to see returns will modify their decisions towards one in which the total TAC would be sold independent of price and grading, as predicted by the four fold pattern of cumulative Prospect Theory (Tversky and Kahneman 1992). This behaviour reduces the chance that fishers will persist with failing courses of action when in the losses domain.

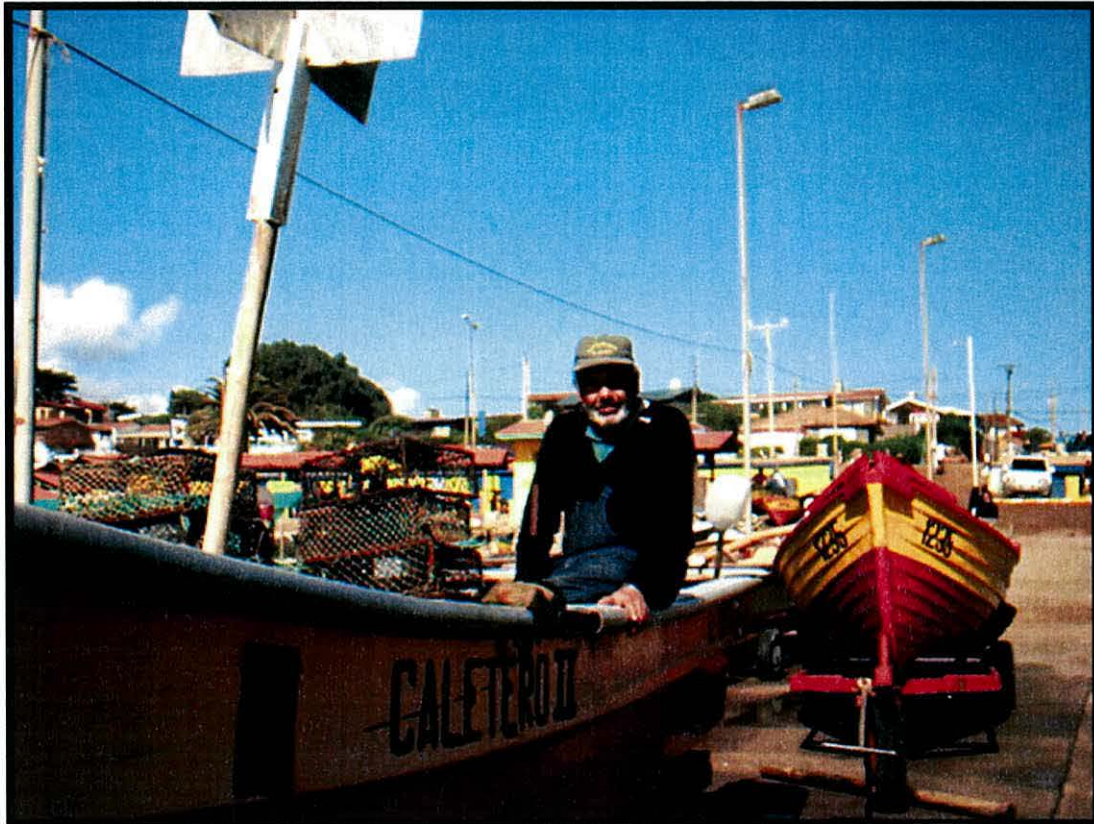
Many fishers' would prefer to sell their catch to more than one buyer in a season. We perceive this preference occurs mainly due to a sense of loyalty between the fisher and the buyer (Seixas and Trout 2003). Fishers who have large TAC or sell at local markets would typically have loyalty to more than one buyer. Nevertheless '*this tendency is diminishing and will probably continue to do so as fishers increasingly feel they own the resource and value the reduction in transaction costs*' (From interview with Lizana 2004; fishers' advisor Carelmapu Syndicates).

Understanding fishers heterogeneous risk preferences poses interesting questions for the future development of TURFs policy and the inclusion of other rights based approaches as marine protected areas. Fishers' willingness to 'invest' in benthic or other resources will become critical as fishers' and managers try to develop MEABRs into successful enterprises, increasingly demanding higher levels of commitment associated with collective commercialization between syndicates, certification schemes, ecosystem management and improving resource recruitment (Manriquez *et al.* 2004). Identifying risk preferences and response decisions could prove to be a good guideline to direction development initiatives in these arenas.

5.7. Conclusion

From the results we perceive fishers have adapted to the financial challenges imposed to them by a territorial user rights policy. Understanding fishers' response decisions aided by Prospect Theory allowed us to have some idea of fishers' risk-preferences and some indication of the economic hardship acceptable to fishers in return for increased revenues. This is an important factor, when seeking to understand fishers' local management strategies and thus define effective management tools. It may also prove a good instrument to guide the implementation of further territorial based management approaches such as the insertion of marine protected areas within networks of locally managed resources.

Chapter 6: Using discourses for policy evaluation: the case of marine common property rights in Chile.



Fisher telling his story about the *loco* fishery

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Using discourses for policy evaluation: the case of marine common property rights in Chile.

6.0. Abstract

In an attempt to combine marine conservation and economic development, the Chilean Government introduced a policy which gives territorial user rights over defined areas of seabed to organised artisanal fishers. This study used discourse analysis to understand the impacts and consequences of this policy.

Story-lines based on sustainability, livelihood maintenance and historical right claims, are mechanisms by which three different groups of fishers adopted postures towards the policy and each other. These act as a means of legitimizing claims when adapting to conditions generated by the policy and also vindicate poaching between syndicates, thereby jeopardizing the whole system.

Results show the fishing groups studied adopt the policy for different reasons than those espoused by Government during its development. Discourse analysis assists the understanding of actors' policy responses and provides an insightful tool to investigate incentives and dominance of particular sets of ideas in a co-management framework.

6.1. Introduction

Policies that ensure sustainable exploitation of marine resources can help achieve food security, protect natural resources and preserve the social and economic status of dependant communities (Bene 2003). In Chile, due to the social and economic importance of artisanal benthic¹⁵ shellfisheries, there is a political desire to achieve sustainable exploitation in these fisheries (Castilla and Defeo 2001). This is reflected in their being one specific component of the Chilean 1991 Fisheries and Aquaculture Law (FAL) being exclusively concerned with the management of benthic resources. Perhaps the most innovative management instrument in this component of the FAL seeks to assign property rights to benthic fishers. This is attempted through the assignation of exclusive harvesting rights to registered artisanal fishing syndicates, under what have been termed management and exploitation areas for benthic resources (hereafter referred to as MEABR).

Through this policy, the Undersecretary of Fisheries gives formal property rights over natural resources in defined geographical areas of seabed to registered syndicates. This includes the right to exclude non-members from exploiting that area of seabed. The rationale behind these territorial user rights is based on a common property approach (Ostrom and Schlager 1996), which proposes that these property rights will create institutional arrangements among fishers, who will then manage and harvest collectively and sustainably (Ostrom 1990).

The first MEABR was formally established in 1997. By August 2003, 188 fishing syndicates had MEABRs with management plans in place, and another 649 were at various stages of the application procedure¹⁶ (Subpesca 2003). Research on MEABR has described the genesis of the policy (Bernal *et al.* 1999; Meltzoff *et al.* 2002), and has investigated biological sustainability and stock recovery within management areas (Castilla 2000; San Martin 2001). However, to date no studies have examined social aspects of the policy, such as its impacts on fishers' livelihoods, and / or their

¹⁵ Benthic organisms are those who live on the ocean floor. (i.e. snails, crabs, clams, mussels).

¹⁶ This number includes syndicates who have just begun their application process, those applications that are being modified, those with a decree for the future development of a MEABR and those that are undertaking base-line studies in order to develop management plans immediately prior to the formal adoption of a MEABR.

perceptions of the MEABR policy. This is unfortunate, as the attitudes and beliefs of key stakeholders may impact the level and type of their engagement with a policy, and consequently consideration of stakeholder attitudes is increasingly informing policy development (e.g. Agra-CEAS 2003).

This study relates to the role of discourses in enabling an understanding of fishers' engagement with MEABR policy. According to Dryzek (1997 p.8) a discourse is *"...a shared way of apprehending the world. Embedded in language, it enables those who subscribe to it to interpret bits of information and put them together into coherent stories or accounts. Each discourse rests on assumptions, judgements and contentions that provide the basic terms for analysis, debates, agreements and disagreements"*. Proponents of using discourse as an analytic construct in the natural resource field have reported their importance as they frame and create understanding, validate actions, and empower and encourage participation of local communities (Fortmann 1995; McHenry 1996; Rose 1990). When considering property rights, local discourses have been recognised as important as a way of legitimising claims for access rights (Rose 1990; Fortmann 1995).

The present study wishes to explore whether these functions of discourse are evidenced in the marine management situation in Chile. This may help understand why particular groups behave in determined ways, and also explain the dominance of particular sets of ideas held by fishers about the MEABR policy. Ideally such understanding would aid any future evaluation of the policy's success, and thereby enable any necessary future refinements of the policy.

6.2. Discourses and story-lines: definitions and theory

While Dryzek (1997) provides a clear but broad definition of a discourse (see above), the term 'discourse' has come to mean many different things to different people (Ockwell 2001). Nevertheless a principal reference point in the study of discourses is Foucault (1979; 1980), who was interested in studying those rules that lie behind the expressions that are accepted as meaningful in a specific historical context. He followed a tradition of social constructivism and states that the truth is a discursive

construction, and that certain regimes of knowledge point out what is true or false¹⁷. In this sense most of current discourse analytic perspectives have Foucauldian elements in terms of viewing discourses as something that defines what is meaningful and how power is exercised.

This study draws mainly on Martin Hajer's social constructivist approach to discourses called "social interactive discourse theory" (Davies and Harré 1990; Hajer 1995). Hajer (1995) sees discourses as products of institutional practices and individual activities that reflect types of knowledge. Actors are considered to be actively involved in the production and transformation of discourses, which are then drawn upon to give a meaning to social or environmental phenomena (Fortmann 1990; Hajer 1995). Thus, in the context of this study, fishers would be involved in the production of discourses which give different meanings to MEABR policy.

Hajer (1995) introduces the notion of "story-lines" to describe the common adoption of narratives through which elements from many different domains are combined to provide actors with symbolic references that suggest a common understanding (Hajer 1995; Ockwell 2001). *"The underlying assumption is that actors don't draw on a comprehensive discursive system, instead these are evoked through story-lines"* (Hajer 1995 p. 56). In this way story-lines act to create social order within a given domain. They are devices through which actors are positioned and ideas of blame, responsibility and urgency are attributed. The widespread adoption of a story-line results in the formation of discourse coalitions; groups of actors drawn to specific story-lines as they reflect their common interests (Hajer 1995).

It has been suggested that story-lines have at least three kinds of missions; to create meaning and validate action, to mobilise action and to define alternatives. Thus in their telling they develop a meaning out of a set of events or experiences (Fortmann 1995). While they have been shown to be used to justify uses of power (Rose 1990), empirical evidence suggests that they are also told by those who do not possess power, in order to try to alter the balance of power relations, and remind their tellers of the worthiness of their cause (Moore 1994; Fortmann 1990; Scott 1985).

¹⁷ It is beyond the scope of this study to review Foucault's specific notions of discourse and the power/knowledge relationships.

Fortmann (1990) arguing for the importance of moral appeals in the mobilisation of communities, states that an “*interpretation of events is one way of creating space for action, of reconstructing reality in such a way that people can be moved to act*”. The story-line that is told, then becomes a vehicle for transmitting and making accessible a framework of meanings through which people are reminded both about what they deserve, and about their ability to act (Hajer and Fischer 1999). When considering discourses and story-lines from this perspective, fishers would not only be trying to make others see the problems according to their views, but also seek to position others in a specific way. Hence, it is not as if they do not have an intuitive idea about discourse theory, in fact they constantly practice it.

6.3. Research setting

Artisanal fisheries in Chile supply a significant proportion of the country’s exports of high value fin-fish, and the totality of benthic resource exports. The majority of the benthic resources are exported to markets in Taiwan and Japan, and in the year 2000, 110,050 tonnes of shellfish were landed from artisanal fisheries in Chile, with an export value of US\$50,000,000 (Sernap 2002).

Chilean artisanal fisheries were subjected to two important policy changes by the 1991 Fisheries and Aquaculture Law: regionalisation and MEABR. The political drivers for these policy initiatives included increases in the number of participants in artisanal fisheries occurring simultaneously with observed over-exploitation of benthic resources (Schurman 1996; Fernandez and Castilla 2000). Biological impacts of over-exploitation were particularly clear for species such as the *Venus antiqua* or “clam” (Schurman 1996), and the predatory gastropod *Concholepas concholepas*, or *loco* (Castilla and Fernandez 1998). A contributory factor in the overexploitation, and a reason for both the regionalisation and MEABR policy initiatives related to the structure of the fishing industry pre-1991. Under this system there was open access to resources and individual artisanal fishers, who usually collected benthic resources through diving, were managed by ‘businessmen’ who provided financial capital for fishing gear, transported groups of divers to new fishing grounds and sold the resultant harvest to exporters. Within this structure

divers were free to work with any 'businessman', and to dive in any region they wished. This system resulted in local over-exploitation and significant social tensions, hence the drive for policy change. However, it is important to note that simultaneous to these developments was the implementation of neo-liberal economic models in Chile and growing export earnings across several sectors¹⁸.

The policy of 'regionalisation' sought to prevent the previously observed mass-migration of divers to areas of high resource value. For administrative purposes Chile is divided into 12 regions, and the 'regionalisation' policy confined the activities of fishers to only one region, usually that region containing their home port (Meltzoff *et al.* 2002). The MEABR policy enabled fishers to form registered groups, here called 'syndicates', and to acquire property rights over a subtidal area of sea bed. Under the co-management¹⁹ arrangements of MEABR policy, syndicates must identify an area of seabed over which they wish to make a claim, and then co-finance a baseline study of this area, from which resource catch quotas and a management plan is established. Syndicates are also required to contract external consultants to undertake yearly follow up assessments of stock in the management area, and to determine changes in the total allowable catches. Further, after the fourth such assessment, syndicates are required to pay an annual fee to Government for the right to maintain the management area. This fee is fixed per hectare of sea bed, and as such is not related to catch or revenue obtained from the management area.

Within Chile, certain areas of coastal land are officially designated as 'coves' ('*caleta*' in Spanish). These are strips of land above the high tide mark which provide certain rights to users. These include the right to have access to the sea, land a boat, remove catch and erect certain buildings. Currently there are 425 such 'coves' in Chile (Subpesca 2002), and this study is concerned with fishers working out of one such cove: Los Vilos (31° 55' S 71° 00' W) located in region IV (Fig. 6.1).

¹⁸ "The deregulation of the domestic capital market and the creation of the quasi-governmental Pro-Chile (Instituto de Promocion de Exportadores de Chile) in 1974 to promote exports, further encouraged trade expansion. The fisheries sector was the major beneficiary" (Thorpe *et al.* 1999).

¹⁹ Co-management is the shared responsibility for managing the biological resource between the State and the fishing community.

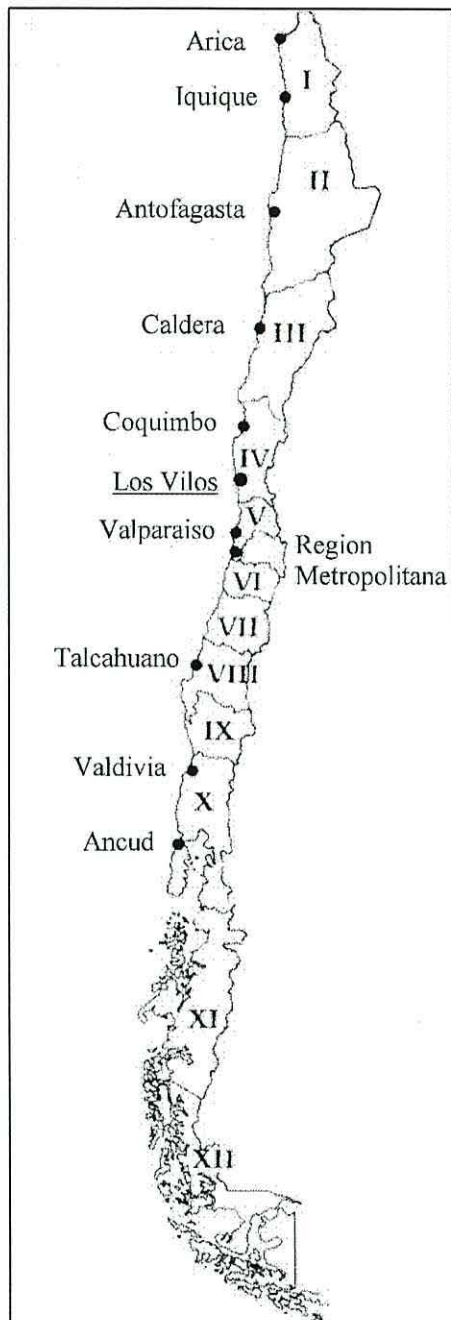


Figure 6.1 Map of Chile showing the location of Los Vilos, the regions and some important landing ports.

The vast majority of fishers of Los Vilos belong to one of three fishing syndicates. Prior to the implementation of the MEABR policy many fishers in Los Vilos belonged to a single institution, comparable to 'trade union', called 'AG San Pedro'. This 'union' initially formed the basis of the syndicate that applied for MEABRs, however in 1999 tensions over MEABR administration resulted in the formation of

two separate syndicates: “AG San Pedro” and “Cooperativa Los Vilos”. Both these syndicates subsequently applied for separate MEABR areas. At the time of this study these two syndicates had operated MEABRs for four years, and taken harvests in 3 of these 4 years. A third group, the syndicate “Los Lobos”, was formed in 2001 by the fishermen who had never belonged to the original ‘AG San Pedro’ union. The “Los Lobos” syndicate submitted an application for an MEABR in 2001 (Sernap 2002).

The main benthic resources harvested from the Los Vilos MEABRs are the murcid gastropod *Concholepas concholepas* known locally as *loco* or barnacle rock shell (Zagal *et al.* 2001) and keyhole limpets (*Fissurella spp*) known locally as *lapa*. Both *loco* and *lapa* are hand collected by divers using semi-autonomous or *hooka* diving (Bustamante and Castilla 1987). *Hooka* gear includes a wooden or glass fibre boat (5-9m long), an outboard motor (10-45 hp), an air compressor (*hooka*) and a crew of 3-4 (a boatman, an assistant and one or two divers). Divers breathe through a long tube attached to the air compressor on the boat, and normally work in water no deeper than 25-30 m, up to 15 miles from the home port (Castilla and Defeo 2001). *Loco* is currently the most economically important shellfish in Los Vilos and Chile. Since 1999 there has been a national ban on *loco* extraction from outside designated MEABRs.

6.4. Research methodology

The first phase of fieldwork was conducted in May-July 2002. Initially all members of the three syndicate directorates were interviewed in a semi-structured, open-ended manner. The directorate is the administrative body of the syndicate and its members include the President, Vice-President, Secretary and Treasurer. In total 11 such interviews were undertaken, and their purpose was to identify perceived advantages and disadvantages of the MEABR policy. Similar semi-structured interviews were undertaken with some members of the syndicate’s Commission (n=9). The Commission is concerned with the practical management of the MEABR, and is normally made up of 5-7 active fishers. In addition, all Commission members participated in group meetings. Two such meetings were held for each syndicate.

As a result of these interviews 3 distinct story-lines were tentatively identified. Each syndicate seemed to be identified with a separate story-line. However, it was uncertain if the story-lines communicated by the members of the directorate and Commission were representative of the syndicate members, and also if the apparent separation of story-line by syndicate was justified.

In an attempt to provide reassurance on these issues a second phase of field work was carried out in January-February 2003. Interviews with the directorate were repeated. This work also surveyed 12 randomly selected members of each syndicate ($n=36$) using a 50 question, 5 point Likert scale questionnaire with anchor points: 1=strongly disagree; 5=strongly agree. Questions were related to 6 main domains that had been identified in the earlier field work. These domains were MEABR policy, historical rights, marine conservation, role of regionalisation, regional development policy and lack of open access areas. Questionnaires were completed face to face in Spanish at the *caleta*. Unfortunately there is no database characterising all members of the syndicates, so it is impossible to test the representativeness of the randomly selected respondents to the entire syndicate.

In addition secondary sources, such as archives in the local fisheries service office provided information on quotas, landings and income, and helped understand which interests lay behind the story-lines. Finally an unstructured interview was held with the Head of the MEABR Policy Section in the Chilean Fisheries Department. The purpose of this interview was to obtain their view on the policy process and implementation.

Multivariate analysis was used to test if the responses to the survey were coherent within a syndicate. This analysis was undertaken with the software package PRIMER (Clarke and Warwick 2001), and the responses to questionnaires were subject to cluster analysis using the Bray-Curtis index of similarity on untransformed data. Subsequently, the similarity matrix derived from the questionnaire data was used to generate a multidimensional scaling (MDS) plot which represents the similarity between each respondent's answers to the questionnaire. Respondents from different syndicates were grouped *a priori* and differences in the responses given among syndicates tested for significant differences using the ANOSIM (one

way analysis of similarity) permutations tests. The latter is analogous to an ANOVA (analysis of variance) as used in parametric statistics (Clarke 1993).

6.5. Results

Each of the data points in the MDS ordination plot represents the responses of an individual member of a syndicate to the questionnaire (Fig. 6.2). The literal distance between two adjacent points represents the degree of similarity between the answers given by two different individuals. The greater the difference between two points in the ordination plot, the greater the dissimilarity between the answers to the questionnaire.

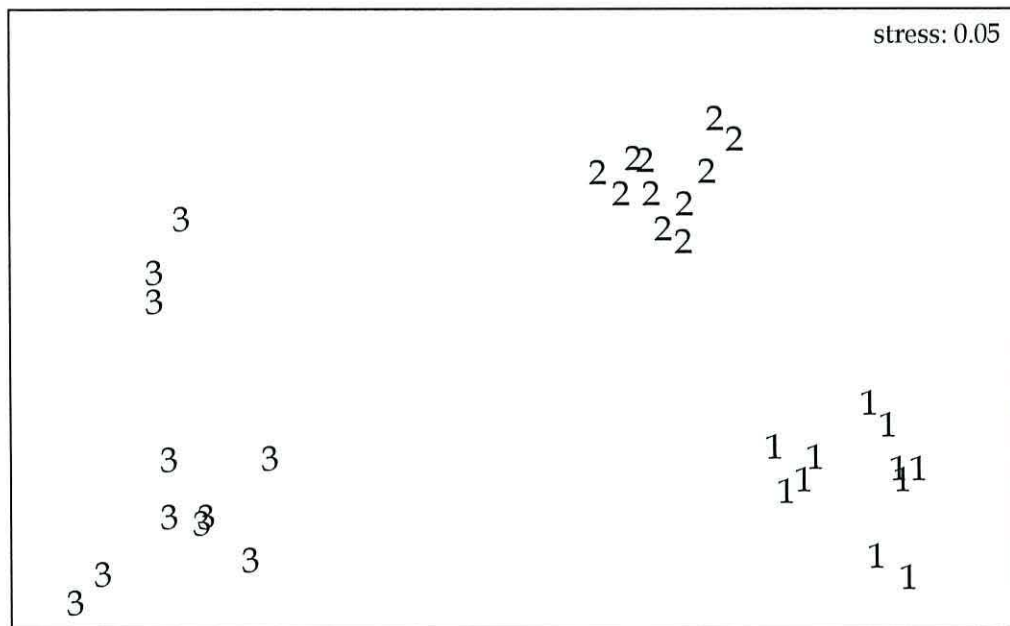


Figure 6.2 Multidimensional scaling plot showing the degree of similarity between fishers responses to the questionnaire generated from the identified discourses. The distance between the numbers represents the similarity between the respondent's answers. In the plot, '1' represents fishermen from AG San Pedro, '2' fishers from Cooperativa and '3' from Los Lobos.

The ANOSIM permutation test revealed significant differences between the questionnaires answered by fishers from each of the syndicates ($R=0.99$ $P<0.001$). This provides statistical support for the assertion that the three story-lines identified from the qualitative interviews are shared in a consistent manner by different syndicate members. We labelled these story-lines 'sustainability', 'livelihood

maintenance' and 'claims of historical rights' according to their main focus. These story-lines support a discourse with respect to MEABR policy and a reason for engaging with it. Each of these story-lines is described in detail below, but prior to this the Chilean Fisheries' Under-secretary view of the MEABR policy is described in order to provide further context.

6.5.1. The Chilean Fisheries Under-secretary view of MEABR.

The Government view is framed in terms of property rights and a transfer of control within certain regulations to local users. They subscribe to a pro-MEABR discourse taking a development and conservation approach. Two principal story-lines are promoted; a story-line of MEABR as maximising bio-economic benefits and a story-line in which MEABR consolidates small fishing ports and changes fishers' previous free-riding migratory behaviour towards creating sustainable institutional arrangements to manage and harvest collectively. The government perceive MEABRs as a great success; fishers have self-organized in syndicates and applied for MEABRs in a steadily increasing way, creating partnership with the government and private sector and fishing coves were being consolidated. There was a reinforcement of syndicates and a strengthening of leadership which led to the implementation, by fishers themselves, of surveillance procedures to stop poaching within MEABRs and establish participatory rules within the communities.

6.5.2. Story-line "Sustainability"

The fishers of "AG San Pedro" subscribe to a pro-MEABR discourse through a story-line which is based on seeking sustainable development through MEABR. They argue that after the regionalisation of fishers, which occurred as part of the 1991 Fisheries and Aquaculture Law, something had to be done to stop local over-exploitation. They felt it was important to know how to exploit the potential benefits offered by the new policy, and they present themselves as pioneers in MEABR adoption and administration:

"We have been looking after our sectors here since 1991, before the MEABR regulation was put into place, we had a MEABR commission. This is why we were ready in 1995 to engage

immediately with MEABR policy...It's the only way forward."(President 'AG San Pedro')

The fishers within the syndicate assumed the role of non-migrating businessmen, who must make a livelihood (or a portion of it) from selling resources from their MEABR area. Their story-line is congruent with the one of the Under-secretary of Fisheries' officials, and in this sense is a good means of promoting government policy towards MEABR.

Despite the fact that the organisation adopted a strong discursive affinity towards MEABR, their experience has not been a great success financially. The members of the organisation have never received more than 358110 Chilean pesos (approx. \$US 511) per person per year from their MEABR, which is equivalent to 3.2 times the minimum monthly wage in Chile, and significantly less than that earned by the six surrounding syndicates over the same timescale (T-test, $t = 3.01$ $p < 0.05$). This relatively poor individual income is partly due to the syndicate's large number of members (180). The syndicate is attempting to address this situation by applying for an area extension and a new MEABR, while holding membership constant. So this group wishes to achieve development by engaging with the policy to a greater extent, largely through increasing the area of MEABR area per syndicate member.

6.5.3. Story-line "Livelihood as a diver"

The second story-line is that espoused by fishers from "Cooperativa Los Vilos". It is formed mainly by older divers (45- 70 years old), who initially decided to forego a year's harvest from their MEABR in order to enable the biological resources to recover. This group subscribes to an anti-MEABR discourse and has adopted a story-line in which they express a desire to maintain their livelihoods as divers. They have a negative attitude towards the MEABR policy which is reflected in the words of one of its members and ex- president:

"This law didn't analyse the secondary [social] effects. There is an indiscriminate extension of the areas. They [the fisheries department] say that all the sea cannot be used by MEABR, but there is nearly no where to go and dive, everything is asked for and

the little historical zones [open-access] left have collapsed... Not only did they limit us to dive in one region, but they are also dividing diving grounds in it.... Divers have no where to dive."

The members of this syndicate present themselves exclusively as divers, and as such, are reticent about adopting a livelihood as fishers during the periods when harvesting is not permitted within the MEABR. They see that diving is declining as a livelihood strategy, and with it their way of living. In spite of this negative attitude towards MEABR, the "Cooperativa" receive a good financial return from their management areas. In the year 2000 each member earned 1200000 Chilean pesos (approx. \$US 1714), equivalent to 10.7 minimum monthly wages, and more than three times greater than members of the "AG San Pedro" syndicate received (Sernap 2002).

The syndicate has sought to optimise its return from the MEABR by targeting new species and negotiating better financial arrangements with merchants and sales agents, as opposed to increasing the MEABR area. This approach concurs with their opposition to unlimited extension of MEABR which threatens the existence of commercial divers, their livelihoods and even their equipment which deteriorates through lack of use (personal communication, 2002. artisanal fisher of "Cooperativa"). This in turn influences the extent to which this group will be prepared to fulfil the demands made by any future developments of the MEABR policy.

6.5.4. Story-line about "Historical rights"

The third story-line is presented by fishers from "Los Lobos", which has 46 members all of whom are forced to dive exclusively in regional open-access sites, which have become smaller and less productive as more organisations apply for and extend MEABRs. Now that the syndicate has been formed, it has applied for its own MEABR and the application was under consideration by the authorities at the time of the study.

This group present themselves as historical right claimants. These divers understood the purpose of the MEABR policy but decided not to engage in it, they just wanted to

dive without constraint, and to avoid the commitment required to maintain a MEABR. These fishers express a willingness to avoid the “voluntary” MEABR process. Within their story-line the problem has related to the exploitation of the historical sites, as one diver from this syndicate explained

“So, we knew we were not going to be able to work in MEABR, but the problem is that they [other syndicates] have their own area and work in historical sites as well... They not only compete with us in the historical areas but they started extracting resources from these sites to re-populate their own management areas, it was like putting things in a bag, every organisation did this, and exploited historical sites. Therefore we stayed empty handed... we had to go and get what was ours inside their areas; a thief who steals from a thief has 100 years of forgiveness²⁰”.

In addition to this, the ban on fishing for *Locos* from open-access waters has left them with little alternative but to apply for a MEABR. This group present an anti-MEABR discursive strategy through a story-line in which historical rights over the resources have been taken away. This then vindicates the use of theft to secure these ‘lost’ resources. Their perception is that MEABRs are a fraud and historical rights over resources have been usurped at their expense, but in the current policy environment they have no option but to adopt an MEABR, even if this is no more than a façade which simply lets them market resources harvested (stolen) from other areas.

6.6. Discussion

It is easy to understand from fishers’ oral histories that the MEABR management system has altered the nature of diving, as hunting is transformed into harvesting (Jentoft *et al.* 1998) a degree of predictability has been introduced, and diver’s skills (as hunters) have become less important. New roles and abilities (e.g. management and negotiation) have gained importance, and therefore a shift in interests and values between fishers is evident through the story-lines that they advocate.

²⁰ In Chile this is a popular saying “Landron que roba a ladron tiene 100 años de perdon”

The story-lines lead us to recognise that fishers' views on MEABR policy are polarised between two main discourses of pro and anti MEABR (Table 6.1). The government and Syndicate "AG San Pedro" are pro-MEABR, while "Cooperativa" and "Los Lobos" are anti-MEABR. The two opposing discourses pose obvious conflicts of interest, "AG San Pedro" seeks extensions of MEABR areas, and "Cooperativa" and "Los Lobos" seek a restriction of these in favour of conserving regional "open-access" diving grounds.

Table 6.1 Principal Stakeholders, their discourse and basic story-line

Interest Group / Stakeholder	Discourse	Story-line
Government Officials	PRO-MEABR	Bio-Economic benefits and transfer of control.
"AG San Pedro"	PRO-MEABR	Sustainability
"Cooperativa"	ANTI-MEABR	Traditional livelihoods lost
"Los Lobos"	ANTI-MEABR	Historical rights broken

The government is unaware of these different perspectives and perceives the success (or otherwise) of the MEABRs applications largely through the number of applications for management areas it receives. These are then taken as evidence that the fishers are becoming more organised, and adopting livelihoods as non-migrating businessmen – which was one of the original policy aims. However, a simple review of MEABR application statistics and the accompanying official documentation does not show that historical fishing sites are becoming scarce and conflict between fishers is raising dramatically, thereby weakening their social bonds (Sittert 2003) and raising the costs of enforcing rights over MEABRs.

The different perceptions and impacts of the MEABR policy may be hard for policy makers, and managers, to identify as currently the ideologically effective discourse, which is dominating policy, is the pro-MEABR discourse. This discourse has

become widely accepted in Government and non-governmental circles, and has established a certain understanding of what MEABRs are achieving, both socially and biologically. In so doing it has silenced other discourses at the policy level. This is unfortunate, and it would seem important to communicate the heterogeneity of relevant discourses, and to explore the interests which lie behind such a dominating understanding of the policy process.

For example, an examination of the pro-MEABR discourse and the economic performance of “AG San Pedro” reveals an important issue outside that of managing biological resources. A well-organised fishing syndicate with 180 members which promotes sustainable management through local participation is an excellent focus for national and international aid organisations who wish to support sustainable development. As a result, the syndicate has been successful in attracting numerous development project grants, and these provide an important source of income for the syndicate and its associates (Fig 6.3).

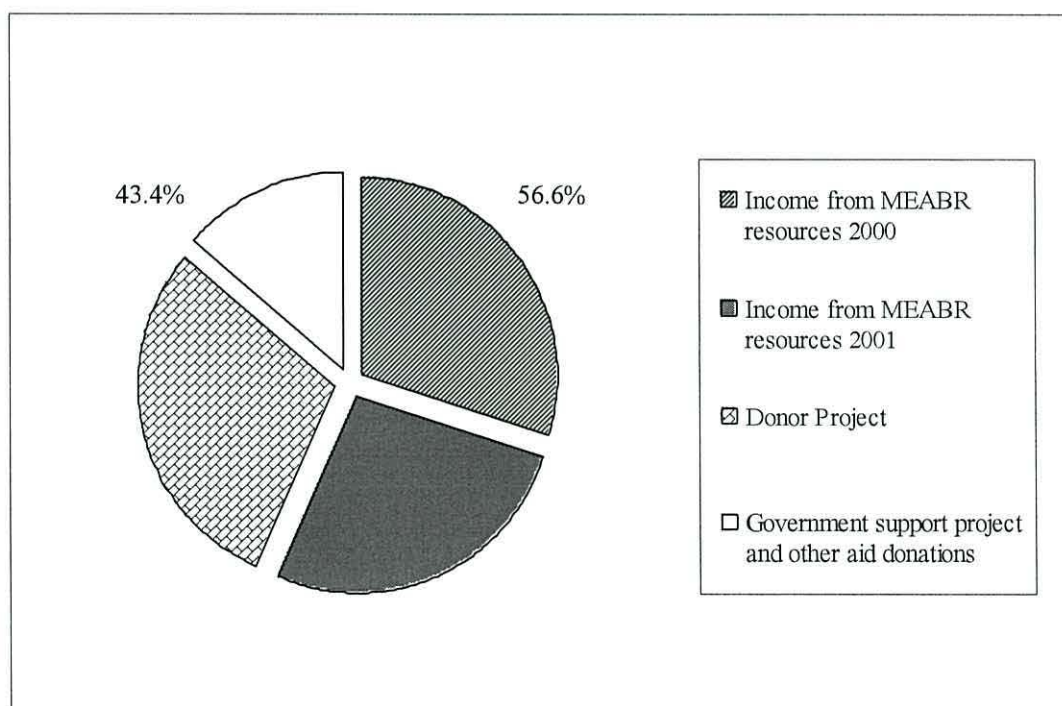


Figure 6.3 Sources of income to the syndicate “AG San Pedro”. The dark shades represent income from MEABR (56.6%) and the light shade is income from aid and government agencies (43.4%) during the period 2000-2001²¹.

²¹ Proportions of income followed a similar pattern in years 2001-2002 and 2002-2003 (Subpesca 2004).

The “sustainability” story-line which supports pro-MEABR discourse may therefore, be related to memories of intervention from a period when MEABR was in a developmental phase, which taught the syndicate that volunteering for development projects brings status and wealth. From the perspective of the syndicate, participation in the MEABR may have little to do with self-reliance or the maintenance of sustainable fisheries. Instead, the discursive strategy of aspiring to be good managers who seek sustainability is an opportunity to gain political status and extract financial resources from eager agencies.

Another important point to consider is strategic and has to do with the need of big syndicates to have more than one MEABR in order to increase the earnings of individual syndicate members. AG San Pedro advocates, using the sustainability of MEABRs story-line in favour of policy which will enable them to do this. Government being strongly pro-MEABR has also made this perspective their own, and in 2003 approved that syndicates could have three MEABRs, while also considering how syndicates could extend the area of their MEABRs. So the pro-MEABR discourse adopted by AG San Pedro has been predominant in influencing policy developments towards their particular needs, and against those supported by the other fishing syndicates.

“Cooperativa Los Vilos” in contrast advocate the importance of maintaining a lifestyle as divers and their anti-MEABR discourse is based mainly on the lack of regional open access sites where diving is possible. They have attempted to advocate for a decrease in number of MEABRs and their extensions, but have not been successful in getting their story-line into the wider societal discourse in order to strengthen their position. Despite this some NGO’s are beginning to work with this group and help advocate in favour of historical diving grounds.

“Los Lobos”, on the other hand has adopted an anti-MEABR discourse through a story-line based on historical access rights. This is used to remind themselves and others of their legitimate claim over benthic resources from which they are excluded. These fishers are actively using this story-line to validate their theft actions as a way of resistance against the powerful government and “AG San Pedro”.

As authors writing about other natural resource domains have suggested, discourses create understanding, encourage participation and validate action (Rose 1990; Fortmann 1995; McHenry 1996). Identification of different story-lines has allowed us to understand that fishers' interests and realities are not homogenous, and that power struggles in the implementation of MEABR policy are an important factor to consider in its future development. This importance rests on the possibility of the different story-lines developing into larger issues which may somehow threaten the successful implementation of, and compliance with, the policy in the future. So in the short term we may expect Government to be primarily concerned about reaching targets relating to policy uptake, and not be overly concerned about the heterogeneous story-lines which the adopters of the policy may hold. However, when considering the long term future of the policy they may benefit from understanding the different story-lines which supported original adoption of the policy. In view of this policy makers might consider new mechanisms for consultation, better adaptation of the policy to local realities, and local ways to support conflict-resolution mechanisms. Such an approach might prevent the occurrence of unequal support to fishing syndicates according to their discursive affinities (which contributes to power inequalities) and would encourage development strategies focused on differences in fishers' skills, livelihood flexibility and motivations. In this sense discourse analysis does have potential to be developed as a strategic resource to aid policy evaluation and implementation by helping override powerful economic and political interests.

6.7. Conclusion

Story-lines are important for the different groups of fishers as they serve to establish claims, strengthen the legibility of their claims, validate actions and/or make claims part of wider societal discourses, which then strengthens the position of those that hold them. It is possible for a certain story-line to become dominant, particularly if the ideology of its proponents agree with that of officialdom. Widespread acceptance of such a story-line can mask other story-lines, which offer different insights into the situation. Understanding these different story-lines, and the reasons they are held, should help policy-makers gain a deeper understanding of the various

responses stakeholders have to a policy, and thereby enable more effective policy development.

Chapter 7: Co-management policy can reduce resilience in traditionally managed ecosystems



Fisherman carrying kelp at Puertecillo, Chile

This Chapter has been submitted as:

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Co-management policy can reduce resilience in traditionally managed ecosystems

7.0. Abstract

Best practice environmental policy often suggests co-management of natural resources as a means of achieving sustainable development. Here we consider the impacts of introducing co-management policy in the form of territorial user rights over an existing traditional community based natural resource management system in Chile. We used participatory rural appraisal techniques and questionnaires to understand the traditional management system for the bull-kelp ‘cochayuyo’ (*Durvillaea antarctica*). Traditional management was based on the allocation of informal access rights through a lottery system. This was controlled by a complex net of traditional institutions which was shown to be successful in terms of equity and resilience. Using a similar approach we analysed the effects of introducing a government led co-management policy on this traditional system. Two major effects of the new policy were encountered a) Traditional institutions were weakened, which had negative effects on levels of trust within the community and intensified conflict. b) The management system’s adaptive capacity was reduced thereby jeopardizing the system’s resilience. Our results suggest that derogations must be made for traditionally managed ecosystems that offer benefits comparable to those pursued by policy. Additionally, by understanding the interactions between co-management and traditional institutions, we can identify ways to promote resilience and facilitate equal access, mitigating and informing policy implementation procedures.

7.1. Introduction

Throughout the world, over many decades, artisanal fishing communities have developed local tenure arrangements that govern coastal resources based on traditional knowledge (Olsson and Folke 2001; Johannes 2002; Pinto da Silva 2004; Lobe and Berkes 2004). These communities are characterised by a wide assortment of local management institutions (Johnson 2001) and have been widely acknowledged as providing both locally relevant and environmentally sustainable solutions for resource management (Lobe and Berkes 2004). Concomitantly, the solution to the global fishery crisis is perceived to lie in management through the bottom-up governance of local resources, and the sharing of responsibility between governments and fishers through the use of co-management policy frameworks (Castilla 2000; Pauly *et al.* 2003). Despite the energy devoted to generate these policy models for fisheries management, there has been little attention paid to the relationship between these and the practices they are expected to promulgate or legitimize in particular contexts (Mosse 2004, but see Aswani *et al.* 2004). Accordingly, the practical implications of introducing co-management policy on existing traditional management systems is a crucial issue that must be addressed, if these policies are to help achieve the goal of sustainable development.

In Chile, the inshore fishery system provides an opportunity to examine the outcome of implementing co-management policy upon a traditional management system. The so called 'parcela' system is an informal traditional natural resource management system that is used for managing the bull-kelp 'cochayuyo' (*Durvillaea antarctica*) through site designation and rotation. The system gives access rights to eligible members of a particular community, to undertake harvesting activities in designated grounds along the coast (each of which is termed a parcela). These are customary property rights legitimized by social norms and codes of behaviour and have not been legitimised in state legislation. The parcela system has survived for at least a century and is used by many artisanal fisher unions and indigenous Araucanian²² families in the two main geographical regions where cochayuyo extraction is an important livelihood activity (Castilla and Fernandez 1998). These regions land

²² Araucanos are the biggest indigenous community in Chile. They inhabit the southern regions of Chile (VIII – XI).

around 80% of Chile's cochayuyo (2000 tonnes/year) which is sold for human consumption at a national scale. Nevertheless it is important to highlight that cochayuyo distribution is localised to these areas and its extraction represents 1-2% of Chile's overall algal species landings (Sernap 2003).

In addition to this traditional management system Chile's coastal benthic (bottom dwelling) resources have been co-managed under the Fisheries and Aquaculture Law (FAL) since 1991. Co-management related to artisanal fishers in the FAL takes the form of management and exploitation areas for benthic resources (MEABR). Through MEABR the Chilean Undersecretary of Fisheries assigns temporal property rights to artisanal fisher syndicates in defined geographical coastal areas. This includes the right to exclude non-members from exploiting the same area of seabed. The rationale behind these territorial user rights is based on a common property approach, which proposes that property rights will create institutional arrangements among fishers, who will then manage and extract resources in a sustainable way (Ostrom 1990).

The MEABR policy was first formulated in the early 1990s "to find mechanisms that would reverse the generalised over-exploitation of benthic resources in Chile" (G. San Martin 2003 personal communication, MEABR Department, Undersecretary of Fisheries). This overexploitation resulted from the open-access nature of the fisheries and the inclusion of neo-liberal policies in the mid-1970s which substantially improved small-scale fishing earnings. As a result, Chile became the leading exporter of fish and shellfish in South America but overexploitation of resources was becoming evident (Castilla and Fernandez 1998).

The MEABR policy is viewed as an innovative management instrument (Castilla and Fernandez 1998), which is consistent with participatory approaches and the shift towards bottom-up development (Agrawal and Gibson 1999). Policy outcomes suggest a sense of ownership, responsibility, pride, and hope for sustainability arose among fishers (Castilla and Defeo 2001). Biological and economic success of MEABR policy has been proclaimed through government documents which show a significant increase in abundance and individual size of resources within MEABRs in comparison with open-access sites (Subpesca 2000).

Since August 2003, 188 MEABR have management plans in place, and 649 are at various stages of the application procedure (Gelcich *et al.* 2005a). This uptake of MEABR policy is highly dependant upon the commitment of the state to promote, popularize and co-finance the implementation of these management areas, with the aim of formalizing a MEABR for every fisher syndicate in Chile (Meltzoff 2002). In line with this trend, MEABR policy is currently being implemented in many areas where traditional and informal management practices, such as the parcela system, have been the norm for decades and centuries.

Co-management has intended to be a positive change from decades of intrusive resource management strategies and planned development. It should be a meeting point between government concern for efficient resource utilisation and local concerns for equal opportunities, self-determination and self-control (Fanning 2000). A fundamental factor within this strategy is that governments provide the general legal framework for the user organisation, while user organisations must be able to regulate the actions of their members (Pomeroy and Berkes 1997). Ostrom (1990) identified characteristics that appeared to be essential design elements for managing common-property regimes. These include the clarity of boundaries, the application of graduated sanctions and the recognition of rights to self-organize. The MEABR policy, in common with many other forms of co-management elsewhere, was designed to incorporate these basic principals. Despite these good intentions, other important aspects such as policy impacts on existing institutions and its effects over ecosystem resilience have not been fully considered to date.

Resilience is a concept which has been introduced as a way to integrate the social/ecological dichotomy that occurs in resource management. This concept was first introduced in the ecological literature to understand non-linear dynamics, such as the processes by which ecosystems maintain themselves through perturbations and change (Gunderson 2000). Resilience was then used to explain both social and ecological systems referring to the magnitude of disturbance that can be absorbed by a system without it undergoing fundamental changes in its functional characteristics (Berkes *et al.* 2003). Resilience in a social perspective then becomes “*an important element of how societies adapt to externally imposed change*”, the greater the

resilience the greater the ability to adapt to change (Berkes *et al.* 2003). According to Berkes *et al.* (2003) a resilient social-ecological system that provides an effective buffer against disturbance would provide social, economic and ecological sustainability. Consequently, many scholars advocate the management of resources to promote the maintenance of resilience of the social-ecological systems (i.e. Olsson and Folke 2001; Carlsson 2003; Colding *et al.* 2003).

In the context of traditional management practices resilience is a concept which is closely linked to local institutions. Institutions in this study are defined as the ‘rules of the game in society’ (North 1990), and mediate between people and the environment by determining who has access to natural resources, to what extent, when, and what use they make of them (Leach *et al.* 1999; Watson 2003). The aim of viewing institutions in this way is to understand what institutions do to promote sustainability and facilitate access and how co-management policy can build or at least maintain effective institutions (Watson 2003). Thus it is fundamental that the design of new policy interventions adequately recognise institutions as the foundations of resilience.

In Chile, the implementation of MEABR policy has focused on areas where there has been no traditional institutions for resource management. Nevertheless, this is currently changing and MEABR are being implemented over existing natural resource management institutions (i.e. parcela). The process of implementing policy on these management systems lacks knowledge about these traditional institutions, and consequently the outcomes of the policy are uncertain. Co-management could have positive implications if traditional institutions work to organize fishers within the MEABR framework which gives them legal rights. Alternatively it could have a negative influence if it affected trust relations, resource access or structuring economic variables, thereby weakening social bonds. Studying co-management implications on traditional institutions gains importance given that co-management is an approach evident in policies of many national governments and donor agencies across the world.

7.2. Research Setting

Within Chile, certain areas of coastline are officially designated as ‘coves’ (*‘caleta’* in Spanish). These are strips of land above the high tide mark that provide certain rights to users. These include the right of access to the sea, land a boat, land natural resources and erect certain buildings. Currently there are 425 *caletas* in Chile (Gelcich *et al.* 2005b). Some *caletas* are well equipped as artisanal landing ports for fin-fish and/or shellfish, in urban or holiday destination towns. Other *caletas* are rural and relatively isolated. Their infrastructure is limited and the selling of resources is dependent on few middle-men who travel to buy direct from the fishers. It is important to highlight that most of the *caletas* which extract cochayuyo fall within this category.

This study is concerned with fishers that operate out of one of these rural *caletas*: Puertecillo (34° 17’S; 71° 58’W) located in Region VI of Chile. Most of the inhabitants of Puertecillo are in part dependant on the fisher syndicate which is composed of 38 men and 13 women. The syndicate is composed of algae and shellfish gatherers who do not own boats or practice diving. Bull-kelp is harvested and sold during the summer months (November-March) and its income used to buy basic food supplies for the winter. According to official statistics, Region VI accounts for 30% of the cochayuyo landings in Chile and Puertecillo fishers call themselves the ‘cochayuyo capital of Chile’, reaching official values of approximately 250 tonnes in the village a year. Cochayuyo takes the form of a cultural key-stone species and plays a role in shaping the identity of fishers (Garibaldi and Turner 2004).

Under the new MEABR co-management arrangements, Puertecillo fishers have had to apply for a MEABR in order to establish property rights over their bull-kelp harvesting zones, and prevent other syndicates applying for those rights. In order to apply for these formal rights, the syndicate is required to contract external consultants to undertake a stock-assessment and to generate a five year management plan for the MEABR. Annual assessments of the natural resources must also be presented to the Undersecretary of Fisheries and all resources extracted from the

MEABR must be declared to the fisheries department which supervises compliance of the management plan (Subpesca 2004; Gelcich *et al* 2005a).

In Chile 90% of existing MEABRs have the lucrative gastropod *Concholepas concholepas* (*loco*) as their main target species. Such has been the importance of *loco* that it has been used to guide policy developments towards an MEABR approach (Castilla and Defeo 2001; Gelcich *et al.* 2005a). In Puertecillo, *loco* and cochayuyo are the main species to be managed. According to the external consultants' management plan cochayuyo should account for approximately 50% of the income from the MEABR, the other 50% would come from subtidal and intertidal extraction of *loco* (Estudios Marinos 2003).

7.3. Research Methodology

Field work was conducted from December 2002 to February 2003 before the Puertecillo MEABR was officially recognised by the Government. During this field work phase we interviewed the directorate of the syndicate (President, Vice-President, Secretary and Treasurer) in a semi-structured, open-ended manner. These same interviews were held with five other associates of the syndicate (2 divers, 1 widowed woman, 1 woman, 1 elderly man). The main focus of the interviews was: a) to understand the extraction process; and, b) to identify the institutions which regulate the access and control over natural resources in the parcela management system. This focus on access and control is based on the extended environmental entitlement framework proposed by Leach *et al.* (1999). During this field work phase 12 questionnaires were administered orally in Spanish to fishers from the syndicate. Questionnaires were mainly concerned with attitudes towards MEABRs, historical access rights to resources, conservation and livelihoods.

In order to provide confirmation of the institutions governing resource management and also to understand the impacts of MEABR policy on these institutions a second phase of field work was carried out from October 2003 to May 2004. During this period we visited Puertecillo every month, staying at the village for 3-5 days on each occasion. During this phase we re-interviewed the directorate and collected 15 in-depth interviews about harvesting and functioning of the syndicate under the parcela

system, interviewees were contacted using a snowball technique. Three interviews were administered to elderly women, three to elderly men, six to men, two to women and one to a widowed woman. Two group meetings with around eight participants were held to further understand the impacts of establishing MEABR policy on the local pre-existing management institutions, these involved men and women as they are both involved in harvesting activities.

To provide further information on fishers' perceptions of MEABR implementation, we surveyed 25 randomly selected members of the syndicate (some of these interviewees had also taken part in the first field work phase survey). Interviews were undertaken orally in Spanish and the survey included 27 Linkert scale questions which were common with the first field phase. We used the statistical software P.R.I.M.E.R. (Plymouth Routines in Multivariate Environmental Research) (Clarke and Warwick 2001) to perform multivariate analysis on the responses to these 27 questions. We undertook a cluster analysis of the data using the Bray-Curtis index of similarity on untransformed data. The group average linkage technique was used to form a similarity matrix between individual fishers' responses. Subsequently, this similarity matrix derived from the questionnaire data was used to generate a multidimensional scaling (MDS) ordination plot that represented in two dimensions the similarity between the questionnaire responses made by each respondent. Differences in the responses made by fishers before and after the MEABR were tested *a priori* for significance with the ANOSIM procedure (one-way analysis of similarity) (Clarke 1993). This procedure is analogous with a parametric ANOVA, but tests if the similarity among replicates is different to those between them (i.e. if similarity of responses between the pre-MEABR and post-MEABR implementation are different). We used the similarity percentages analysis (SIMPER) function from P.R.I.M.E.R. to identify those questions that accounted for the largest differences in responses (lowest similarity) made by fishers in the two time periods (Clarke and Warwick 2001).

We tested the relationship between the similarity among fishers' responses and other contextual, livelihood and socio-demographic variables (hereafter referred to only as socio-demographic variables) with the BIOENV procedure. BIOENV is a program that tests sequentially for the combination of variables or a single variable that

correlate best with the similarity among the responses of different fishers. The socio-demographic variables selected for the BIOENV analysis were age; education level; sex; income level; number of generations fishing; days spent at sea per month; on- and off-sector fishery pluriactivity (having multiple sources of income and / or job holding); ownership of a boat; number of people who live in the household; past and/or present role in the syndicate; number and type of communal organisations the fisher is part of; ownership of fishing gear; type of fishing gear; ownership of house; size of household and the relative importance of fishing, algae gathering, diving or wage labour in terms of income generation.

Additionally we tested for heterogeneity in fishers' responses as a measure of MEABR impact using an Index of multivariate dispersal (IMD). The IMD has a maximum and minimum value of 1 and -1 respectively, depending on variable groupings, when all similarities among one group are lower than any similarity of the other group. The middle value, 0 would represent no difference in similarities (no heterogeneity) between responses prior to and after MEABR implementation (Clarke 2001). The objective of IMD was to check if a shared world view was changing towards a heterogeneous one, which may be suggestive of the formation of distinct attitudinal groups within the community.

7.4. Results

7.4.1. *The cochayuyo extraction*

We were able to distinguish five major stages in the extraction process for cochayuyo:

- 1) Extraction of the cochayuyo from the intertidal and shallow subtidal (1-2 m depth) zone. The cochayuyo harvester (diver) cuts the algae at the base of the stipe during low tides and lets them drift to be washed ashore (Fig 7.1A).
- 2) Once the cochayuyo have drifted to the shore they are gathered (Fig 7.1B). Unlike the previous stage which depended primarily on the cochayuo extractor, this stage is a group effort.
- 3) The cochayuyo is then laid on the sides of the cliffs in order to dry (Fig 7.1C). Drying takes approximately 17-25 days, depending on weather conditions.

4) Carrying the cochayuyo up cliff paths to the houses or storage sheds (Fig 7.1D). The distance varies from 0.4 to 2 km and adults carry between 25-35 kg of cochayuyo while children carry up to 15 kg.



Figure 7.1 Cochayuyo harvesting process; **A** shows how cochayuyo is extracted, **B** how it is laid, **C** how it is dried on cliffs, **D** how it is carried, **E** shows a marketable bundle or ‘maleta’ of cochayuyo and **F** a ‘rodela’ composed of 25 maleta which is the unit sold to middle-men (photos by S Gelcich and G Edwards-Jones).

5) Packing the cochayuyo into bundles of marketable units. The bundle making process takes approximately 45-60 seconds per unit. The diameter of each unit is based on the measurement of an adults forearm, including the length of the hand. The plant is folded back and forth until the overlapping layers form a bundle. The thin ends of the stipes are used to tie the bundle (Fig 7.1E). Bundles are packed together in groups of 25 which form a ‘rodela’ that weighs about 8 kg (Fig 7.1F) and is the unit sold to middle-men for around 3000-4500 pesos (US\$ 5-7). Middle-men will sell

a rodela for around 7000 pesos, which are then separated again into bundles and sold in supermarkets for 400 – 700 pesos each (10000 – 17500 pesos per rodela).

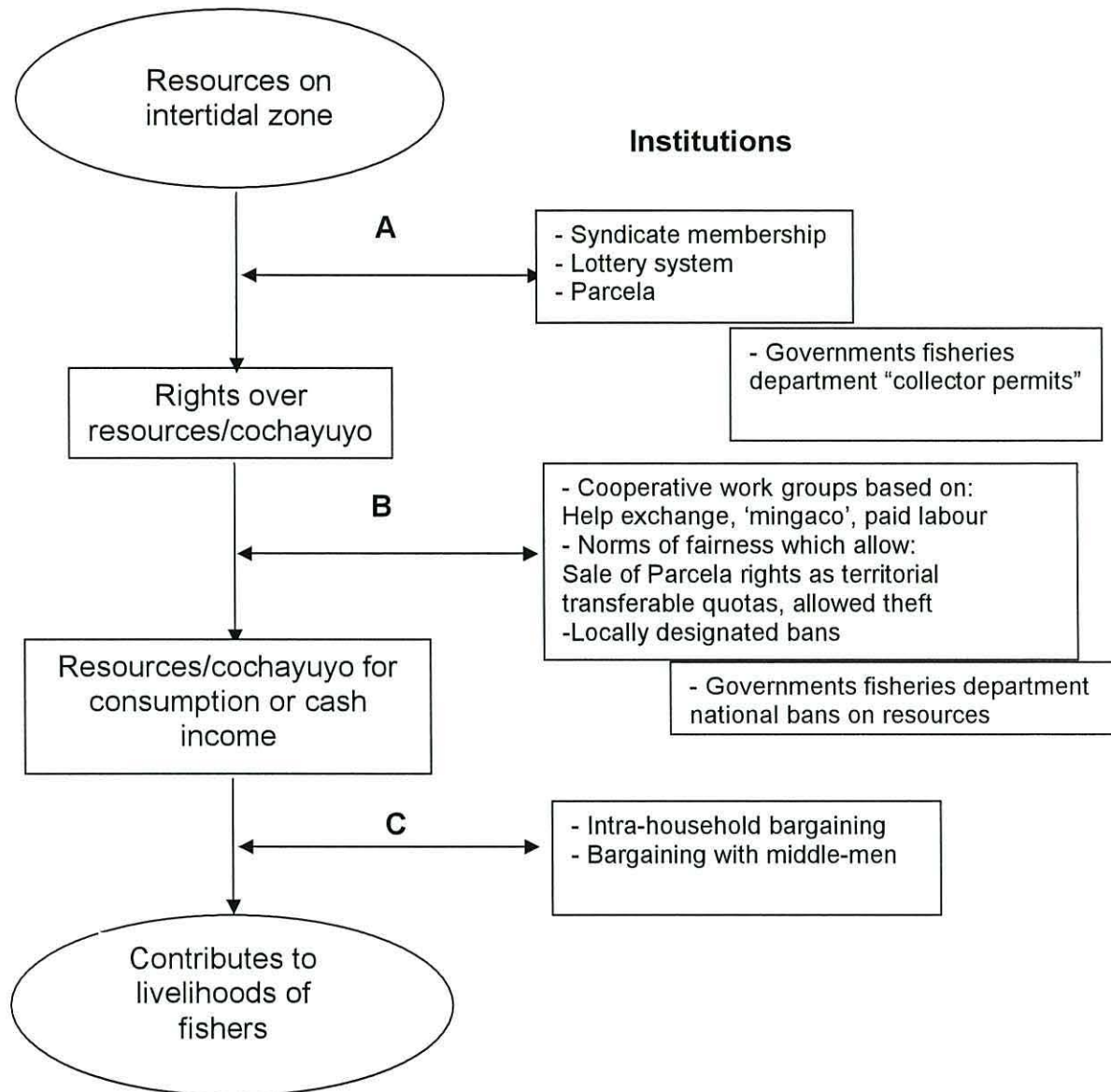
7.4.2. Cochayuyo management: the parcela system

By using the interviews and observations of the system we identified key institutions which govern access and control over resources as well as ecological aspects of the parcela system.

7.4.2.1. Access and control over resources.

Fishers from Puertecillo extract cochayuyo following well defined rules, which are voluntarily agreed upon. These rules can be classified into two main groups: those providing the access rights over the cochayuyo and those providing the effective control or use of cochayuyo as a resource (Fig 7.2 A-B).

Access rights (Fig 7.2A) to cochayuyo are given to each fisher in the form of a small harvesting area or parcela (approximately 150 meters of coastline) which accounts for approximately 6 to 8 large rocks onto which holdfasts are attached. In general a parcela will produce around 1200-1800 kg of dry cochayuyo per season (worth 5-7 Chilean minimum monthly wages). It is important to highlight that each parcela is created and divided on the basis of approximate production and not size. Parcelas are allocated to syndicate members in August every year through a lottery system that produces annual rotational access to harvesting grounds. The lottery is supervised by the syndicate directorates and is attended by almost all fishers, although this is not a condition. Two factors distinguish the quality of a parcela: a) how far it is from a selling point, in other words how far does the fisher has to carry the kelp; and, b) the physical space which is associated with the parcela for drying the cochayuyo. It is important to highlight that a parcela is a customary property right legitimized by social norms and codes of behaviour, and therefore illegitimate in the eyes of the state. The only government institution that grants access to cochayuyo is a “coastal collector permit’ that is issued by the Fisheries Department.



(Based on Leach *et al.* 1999)

Figure 7.2 Schematic representation of the institutions affecting cochayuyo harvest under the parcela management system in Puertecillo. **A** represents Institutions which determine access; **B** the ones determining the control over resources and **C** the ones determining wellbeing derived from cochayuyo. The second square associated to (A) and (B) identifies the existing formal institutions.

All fishers have equal rights at the time of receiving access rights to the parcela, nevertheless differences occur in the way fishers control or harvest their cochayuyo (Fig 7.2B) according to their individual capabilities.

Male fishers, especially divers, will generally harvest their parcela on their own or with their family group. However, 20% of interviewees obtain help to harvest simply by requesting it from others. This form of cooperation for a possible favour sometime in the future, is informal and uncertain in that the help may or may not be repaid. In such a small community, those who reciprocate are well known. Interviews made it clear that if the person asking for a favour is a diver or good at cutting cochayuyo, then the potential donor is more likely to agree.

Those associated with the syndicate that do not qualify for this informal exchange, (e.g. women and older men), use a process called 'Mingaco' in which the owner of a parcela gives food and drink to the helpers in return for their assistance. In addition to these mechanisms, it is now common for someone with finances earned working in the forestry sector, to pay for help from other fishers.

Other methods that are used to obtain benefits from use rights include the sale for one season of the parcela to other associates as a territorial based individual transferable quota. This system is mainly used by fishers whose physical capabilities or livelihoods make it extremely difficult for them to manage their own resources.

Theft is another way of obtaining cochayuyo. At Puertecillo this is not widespread and is sanctioned formally by exclusion from the syndicate for a year. However, not all forms of theft are considered anti-social or illegal and widows obtain algae by this means. Widows do not extract or cut algae, they collect what is washed ashore naturally by waves (this is normally collected by parcela owners). In this way, the algae in the widows' parcela remain un-extracted and no assistance for extraction needs to be found.

In conclusion, institutions that provide access rights over the cochayuyo (Fig 7.2A), and those that provide the effective control or use of cochayuyo as a resource (Fig 7.2B), maintain a minimal conflict system in which collective choice arrangements are secured through individual transferable quota ownership rights. Income, livelihood or capability heterogeneity is accounted for through a range of

institutional arrangements, which seem fair to fishers and therefore do not seem to affect compliance.

In addition when comparing the parcela management system to Ostrom's (1990) design principals for common property right regimes this traditional system seems to comply with most of the basic elements, except for those related to legally endorsed recognition (Table 7.1).

Table 7.1 Design principals for common property right regimes and their presence under the parcela and MEABR management scenarios in Puertecillo.

Design Principal	Description	Parcela	MEABR
Clearly defined boundaries	Rights to withdraw units from the CPR must be clearly defined, as must the boundaries of the CPR itself.	YES	YES but rights are now controlled by government officials.
Congruence	Rules restricting access should be related to local conditions and to provision rules requiring labor, material, and/ or money.	YES	NO, provision rules have been transformed and local control over resources is uncertain.
Collective choice arrangement	Most individuals affected by the operational rules can participate in modifying these rules.	YES	NO, top down modification of rules
Monitoring	Monitors are accountable to the appropriators or are the appropriators themselves.	YES	YES, although accountability has driven towards state institutions.
Graduated sanctions	Appropriators who violate operational rules are likely to receive graduated sanctions depending on the severity of the offence.	YES	YES
Conflicts resolution mechanisms	Rapid access to low-cost conflict resolution areas	YES	NO, it has shifted to some extent to the distant fisheries department
Recognition of rights to organize	The rights of appropriators to devise their own institutions are legally endorsed by external government authorities	NO	YES, as long as they are within MEABR framework
Nested enterprises	For CPR institutions that are part of larger organisations, appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities organised in multiple layers of nested enterprises.	NO	YES, but it is problematic as it has given much scope for the creation of vertical social capital for a select few.

(source: Ostrom 1990)

7.4.2.2. Ecological aspects of the parcela management system

Once each parcela has been allocated it is up to that fisher how the parcela is managed and regulated. Nevertheless no cochayuyo extraction is permitted between 01 April and 30 September. This is a voluntary measure which is related to the biology of the algae. Local knowledge perceived the period outside the closed season as the time in which algae grew faster, and therefore one or two harvests could be attained. This compares well with current scientific knowledge of algae biology (Santelices *et al.* 1980).

In addition to selecting the harvesting times, many fishers, particularly men, extract other kelp species (e.g. *Lessonia nigrecens*), during August to promote better recruitment of cochayuyo spores, thereby enabling an increased production of cochayuyo from their parcela. This selective species removal imitates the natural disturbance caused by storms (pers. com Puertecillo diver) and concurs with studies that demonstrate that cochayuyo persists as a result of its high rate of settlement and rapid growth (Santelices *et al.* 1980). These communities have realised that disturbance is a necessary part of the process that promotes ecosystem services and have developed management practices that mimic disturbance regimes in nature. Management that behaves like disturbance is one of a series of practices that generates resilience (Folke *et al.* 2003).

Although widows are allocated a parcela in the lottery system they do not harvest them which means they act as small reserves or buffer zones (Castilla and Bustamante 1989; Bustamante and Castilla 1990). Fishers regard these as useful, in the words of a Puertecillo diver (2004) these parcelas are “*important to maintain areas that have not been touched in order to see what happens and recuperate other sectors*”.

Finally the parcela system includes monitoring of the yearly biomass yields from each individual parcela in the event that some produce too little and therefore the sizes or layouts may require alterations. By doing this fishers are including monitoring and local understanding of ecosystem conditions and dynamics within their management institutions. Thus, local knowledge and practices in Puertecillo

have developed continuously through a combination of local monitoring and trail and error processes (adaptive management).

7.4.3. Effects of MEABR on the existing system

It is in this arena of local institutions for resource management that social, economic and tenure changes associated to MEABR are influencing the Puertecillo bull-kelp management system. All Puertecillo fishers interviewed agreed with the statement “*MEABR are changing fishers’ lifestyle*”. These impacts affect the access rights, the control over and the way wellbeing is derived from resources (Fig 7.3 A,B,C). It also influences the way local knowledge helps to plan harvesting strategies.

7.4.3.1. Effects on access and control over resources: the weakening of social bonds

Under the MEABR, rights of access to cochayuyo are based on the membership of the syndicate. Nevertheless the future of the lottery system is now uncertain as the requirements for MEABR policy dictate access to resources/cochayuyo. Rights of access are now formally recognised but fishers must respect MEABR regulations, hire consultants and pay fees (Fig 7.3A). The system is controlled by State institutions and in accepting these conditions fishers from Puertecillo must effectively become small-scale businessmen that earn an income through self-managed resources.

Control over resources has also undergone major changes (Fig 7.3B). The parcela system was effectively converting a common property system into a private property one through the parcela lottery. The MEABR policy advocates for community based natural resource management through scientifically established community quotas. It advocates for group work and the sharing of responsibility between users in the form of a small cooperative business. This change in control over resources has highlighted differences in fishers’ livelihoods and capabilities, thereby weakening traditional institutions and encouraging conflict due to uncertainty about the future. The main division among fishers is limited to the weighting of the different roles associated with MEABR. In other words, how much income should a diver, old man or widow receive if no informal exchange of labour or selling of endowments exists?

In the words of a Puertecillo diver (2004):

“We are starting to have lots of arguments. People are confused by the management areas. Some think we have to share everything from MEABR [including cochayuyo] but this implies that only some will end up doing all the work. It is not the same to dive or to look after the area. ...some members are so old they cannot do anything [and still want their share of income].”

These problems have reached a critical point as the Puertecillo MEABR has not been a financial success during the first two years. With hardly any income from *locos*, most of fishers' income derived from kelp has been used to pay for consultants and administration. Fishers' expectations of MEABR have also decreased, due to the inability to monitor the areas for compliance. The latter is due to a lack of government agency support, as reflected by fishers: *‘we are too isolated and fisheries department officials do not come. We cannot catch poachers’* (Group meeting March 2004). Poachers steal the *loco* the syndicate has looked after. Thus access rights are legally recognized but are unenforceable. As a result MEABRs have become an extra burden which has led some fishers within the syndicate to steal *locos* from their own MEABR, thereby affecting trust among the group.

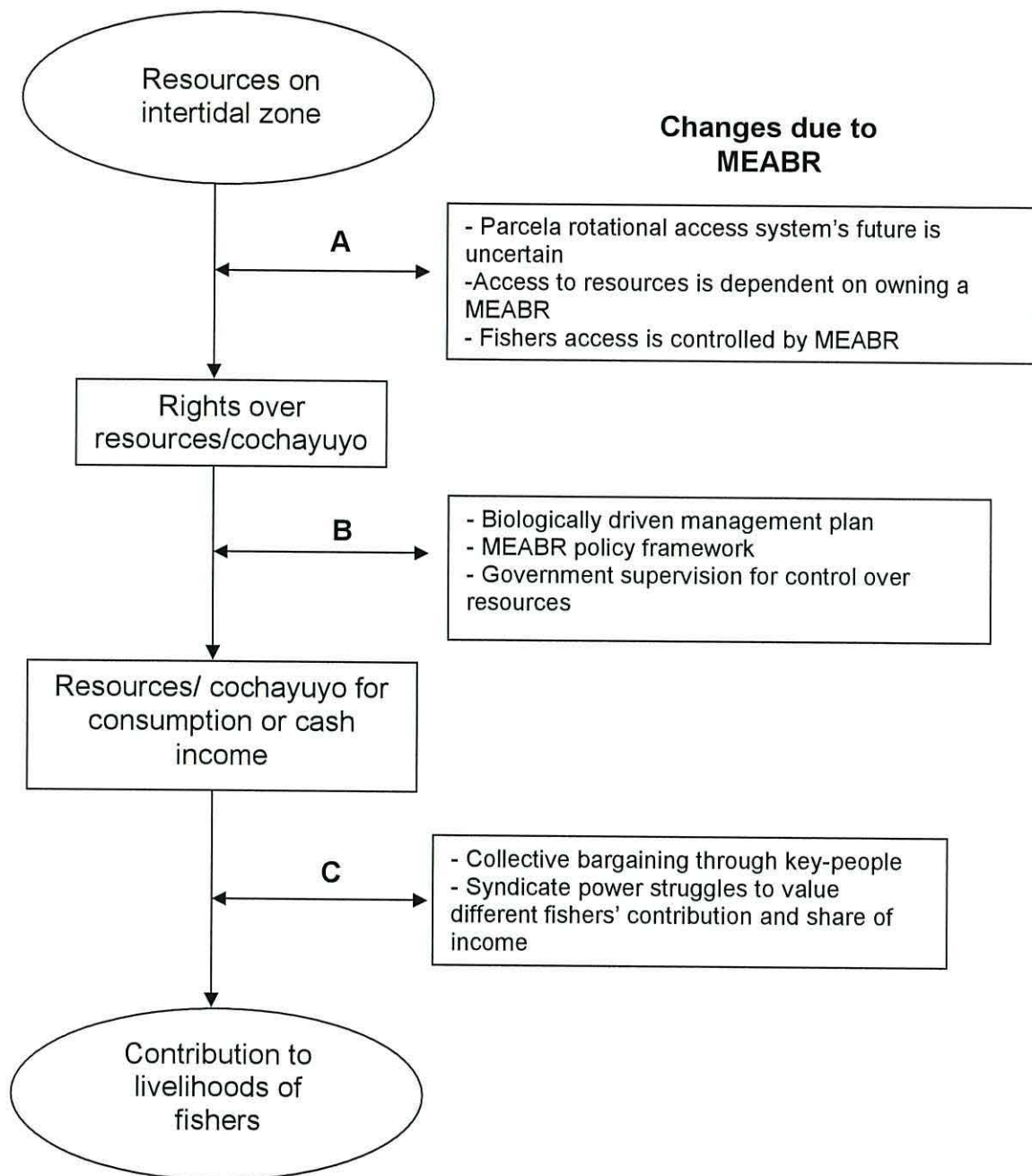


Figure 7.3 Schematic representation of the changes over the parcela management system related to MEABR policy implementation in Puertecillo. **A** represent changes over access rights, **B** represent changes over resource control and **C** describes changes over the wellbeing derived from harvests.

The mechanism to sell resources has changed (Fig 7.3C), from individual bargaining with middle-men to collective bargaining. This has brought its own problems. It changes the power relations in the syndicate as some members have the power to

take crucial bargaining decisions. This creates new vertical social relations between a few fishers and consultants and middle-men. These relations have been used to serve individual interests, affecting trust relations within the syndicate.

The weakening of local institutions affected the social bonds within the Puertecillo syndicate. We have tried to provide statistical support for this from the quantitative survey of fishers' attitudes. Multivariate analysis of all responses prior to and after MEABR implementation revealed significant differences in fishers attitudes (ANOSIM, $R = 0.377$ $p < 0.01$) during these time periods. As expected, the questions which accounted for the largest differences in these time periods (SIMPER analysis) were related to the increase of conflict within the syndicate and the decrease in the expectations of MEABR as a policy that promotes income generation (Table 7.2).

Table 7.2 Average response to questions which accounted for largest differences before and after the MEABR implementation. Numbers represent the average response (\pm S.D). Where 1=Strongly disagree; 2= Disagree; 3= Neither agree or disagree; 4= Agree; 5= Strongly agree*.

QUESTION	FISHERS RESPONSE	
	PRE-MEABR	POST-MEABR
Resources are distributed fairly within my syndicate	5 (0)	1.92 (0.76)
MEABR generates cooperation within the syndicate	5 (0)	2.24 (1.39)
Gaining political power and accountability are important factors of applying for a MEABR	5 (0)	2.68 (1.06)
MEABR is economically successful	3.5 (0.5)	1.88 (1.50)

*All responses showed differences ($p < 0.05$) in Mann-Whitney tests.

Fishers' responses for the post-MEABR implementation stage were significantly more heterogeneous than those made prior to the implementation (IMD of -0.935 and Figure 7.4).

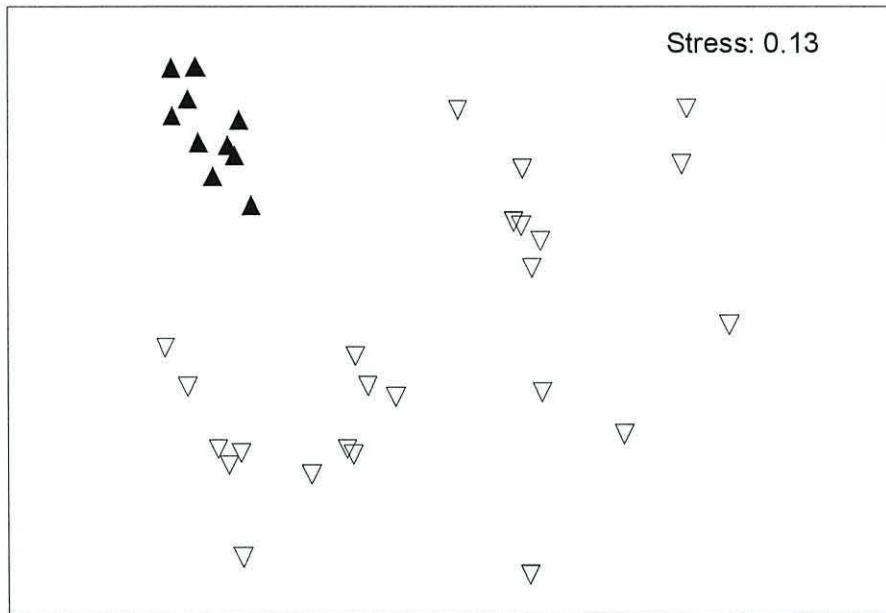


Figure 7.4 Multi-dimensional scaling plot which represents fishers' responses to the questionnaires before (▲) and after (▽) the implementation of the MEABR policy. Distance between points represents the degree of similarity between these.

Additionally the rank correlations between socio-demographic data and fishers attitudes only showed a significant relationship for the second field work phase (Table 7.3). The BIOENV procedure revealed that in the period after MEABR implementation attitudes are correlated with aspects of fishers' livelihoods strategies and membership of other communal institutions (Table 7.3).

Table 7.3 Combination of socio-demographic and contextual variables that had the best correlations with fishers' overall responses for each field phase.

Fishers responses	Combination of variables that best correlated to fishers' responses*	Spearman correlation (ρ)	p
Responses first field phase (pre-MEABR)	a) Dependence on diving as a source of income b) number of generations of fishers in family c) days at sea spent in a month d) If they have been director of the syndicate	0.082	Not significant
Responses second field phase (post-MEABR)	a) Dependence of diving as a source of income. b) Dependence of algae as a source of income. c) Main fisheries activity which you feel represented by. d) off-sector pluriactivity. e) Other local organisations you are part of.	0.509	<0.05

* More than one variable is presented for each correlation coefficient as the BIOENV programme selected a set of variables which best explained attitudinal characteristics.

This suggests that interest groups have been formed within the community. These groups are related to livelihoods and highlight differences in fishers' capabilities. An example of how this process is beginning to emerge is related to fishers' responses to the statement 'Income from MEABR should be distributed equitably within the syndicate' which has changed from a situation of unanimous attitudes pre-MEABR to conflicting attitudes post-MEABR (Fig 7.5).

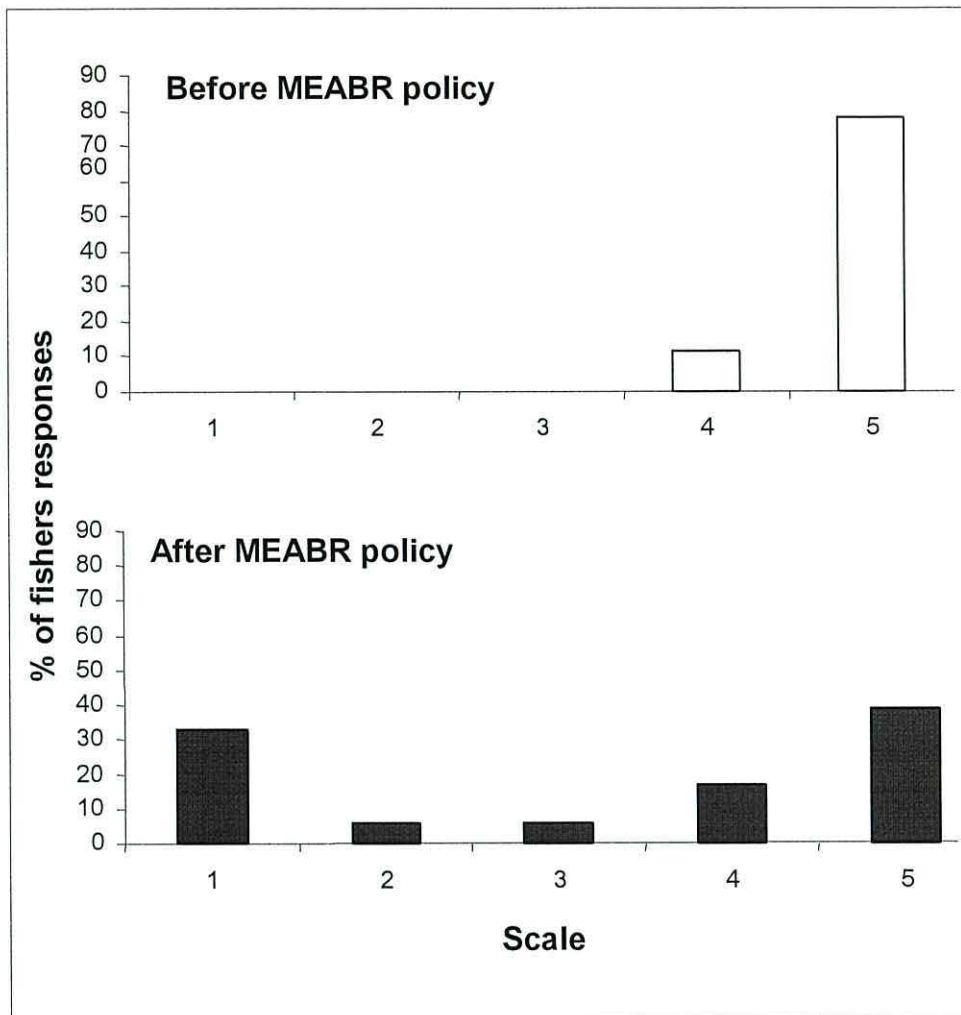


Figure 7.5 Fishers attitude towards the statement “Income from MEABR should be distributed equitably within the syndicate”, before and after MEABR policy implementation. 1=Strongly disagree; 2= Disagree; 3= Neither agree or disagree; 4= Agree; 5= Strongly agree. Frequency distributions are significantly different ($p < 0.05$) using a Kolmogorov-Smirnov analysis.

The changes in traditional institutions have been such that they have also affected Ostrom’s (1990) design principals for the access of common pool resources in Puertecillo. MEABRs have had negative effects mainly over congruence of rules to local conditions and over levels of participation on collective choice arrangements (Table 7.1) which again provides evidence of how MEABRs strongly affect the equity and social cohesion of the system.

7.4.3.2. Effects on ecological adaptations: the weakening of resilience

Another effect of MEABR implementation on the parcela system has to do with how duties associated with having a MEABR are discouraging fishers from maintaining

an adaptive capacity and effectively use their knowledge for the management of coastal resources (i.e. the buffer or small reserves are being lost due to the fact that the entire intertidal zone will be harvested).

The MEABR policy implicitly establishes that the fisheries undersecretary sets and controls the management objectives. It also determines that research based biological knowledge is the basic knowledge to include in the MEABR process and evaluation. In doing this the irony is that the MEABR might be reducing the capacity of systems to buffer change, therefore affecting the ability to cope with, adapt to, and shape change without losing options for future adaptability.

Basic restrictions on the type and amount of species to be extracted, affect adaptation strategies. Legally, extraction of other kelp species must be within the management plan and informed to the fisheries department (which is 5 hours travel time away). These species are not included in the plan and distance makes it logistically difficult to have an observer present every time a non-economically important species is to be removed, therefore the extraction of other kelp species in August, imitating natural disturbance, will end. Additionally as fishers must let the fisheries department officials know in advance every time resources are going to be extracted, an event that is mainly dependent on the uncertainty of the sea conditions, the rituals and learning processes involved in harvesting are lost in favour of a one day frenetic harvest every month.

7.5. Discussion

As other forms of traditional natural resource management elsewhere (e.g. Olsson and Folke 2001; Seixas and Berkes 2003), the parcela system is embedded in local management institutions and seems to build social capital in the community through the harvesting ritual (Pretty and Ward 2001). The system also complies with Ostrom's (1990) widely accepted principals for common pool resource management. Despite this, engagement with co-management rules that were devised to fit a different set of socio-ecological conditions is beginning to erode this unique example of bottom-up governance of resources.

MEABR policy is a 'one size fits all policy' in which government officials have not introduced more democratic principals into fisheries management, but have used co-management as an instrument to reach management principles more efficiently through the involvement of fishing communities in the implementation process. To date, there has been little consideration of what local fisher organisations can offer to enhance governance or will lose during the transition to co-management. In Puertecillo this has eroded institutions which built the adaptive cycle that was leading to sustainability. Erosion of these institutions has had consequences related to 1) internal disputes among members arising as a result of highlighted differences in livelihoods and capabilities, 2) the fisher organisation becoming susceptible to the influence of key and powerful members within the organisation (Mosse 1994), 3) rising costs associated with decision making, implementation and application of permits (Heltberg 2001). Additionally MEABRs are based on production targets that make the management process a static quota based system, which in turn makes fishers vulnerable to disturbances that cannot be anticipated in advance (Holling and Sanderson 1996) as well as destroying the incentives to maintain adaptation.

The present study provides evidence that communities of fishers may face costs associated with the responsibility of co-management that exceed their expected benefits (Guillotreau and Cunningham 1994). Nevertheless, we are aware that co-management was introduced as a form of crisis management, and therefore expecting a national policy to take areas as Puertecillo into account is impractical, but there should be some form of derogation, for management systems that offer similar benefits to those pursued by the policy. Such derogations are especially important as the policy is now extending to include heterogeneous groups of fishers in Chile (Gelcich *et al.* 2005b) and therefore, successful policy responses will depend on the capacity of the MEABR model to adapt (evolve) to local conditions. Derogations could be incorporated within the same policy framework through an advisory or informative form of co-management, where user groups inform government of decisions made at the local level (Sen and Neilsen 1996). In this way fishers have the chance to control the resources on which they depend in a formal way but under local rules and hence maintain their local institutions (Johannes 2002, Gelcich *et al.* 2005b).

An examination of the institutions that underpin the parcela system have enabled us to identify the ‘right institutions’ (Cleaver 2000), that promote resilience and facilitate equal access. This is important if derogations are to be made and indicate guidelines to reduce the unwanted effects of policy. Aspects such as the individual transferable territorial rights in use within the parcela, should be conserved and strengthened. This management strategy could even have wider applications acknowledging the complexities of doing this (Watson 2003).

7.5.1. Institutional learning: hope for traditional institutions?

Institutional learning (Ostrom 1990) was an effective and influential component of the parcela system. Through institutional learning, fishers developed a memory of cochayuyo management and adapted management procedures to their local conditions. We have tried to present evidence of how MEABR policy may threaten this process. Nevertheless it is important to consider that institutional learning also provides the foundation for modifying rules and typically refers to decadal time scales as opposed to months or years (Olsson and Folke 2001). In this sense Johannes (2002), described how his “*pessimism was unwarranted*”, when describing how the centuries-old Pacific Island practices of marine community-based natural resource management were in decline victim to the various impacts of westernization in 1978. He acknowledged how Pacific Island local communities during a period of 25 years rose to the resource management challenge by adapting their traditional practices to fit contemporary circumstances.

Will this be possible in Puertecillo if no action is taken to conserve the traditional management practices? It will depend on the ability of the social-ecological system to adapt. Despite this potential capacity, from our experience in Puertecillo we think that if no derogations are taken for traditional management institutions within the current worldwide co-management policy advocacy, we are going to lose important institutional arrangements which can teach us many management lessons.

Chapter 8: General Discussion

General Discussion

8.0 General Discussion

Throughout this thesis, I have examined different aspects of the manner in which fishers respond to a territorial user rights policy. I have explored fishers' attitudes, objectives, harvesting decisions, discourses and traditional institutions when faced with a change in the means by which resources are accessed and controlled. I have also discussed the importance of understanding fishers' heterogeneity in terms of their livelihoods in order to assist managers target fishers own skills, interests and aspirations. I have discussed the extent to which co-management may shape fishers attitudes and have drawn upon different theoretical frameworks from the social sciences to show how these might prove useful to explore human dimensions of fishery policy implementation and management.

I have indicated how contributions from different disciplines can lead to a better understanding of resource management. Different methodologies provided important insights into understanding fishers' social, cultural and economic heterogeneity and its consequences for co-managing marine resources. I advocate for a multidisciplinary approach to management in which problems are identified and targeted from a number of disciplinary directions. In this thesis I have not attempted to advocate synthesis or link individual theoretical frameworks into an integrated one (see Lockwood 1999 for an example of integrating frameworks). This is not to say, that generating an integrated framework which includes TRA, Prospect Theory, discourse analysis and entitlements and its relationships could prove an interesting challenge for the future, which could bring practical benefits for the management of coastal resources.

This general discussion will specifically draw on my own experience of researching the human dimensions of territorial user right policy implementation in Chile and discuss ways forward in the development of co-management policy. This discussion will focus on the need to include knowledge generated from the resource management experience, explicitly within future management practices, as an ever

evolving feedback process. I wish to highlight ways in which we could facilitate a shift from the current co-management approach used in Chile towards an adaptive co-management approach.

Folke *et al.* (2002), defined adaptive co-management as ‘the process by which institutional arrangements and ecological knowledge are revised in a dynamic, ongoing process of learning by doing’. Adaptive co-management combines the ‘dynamic learning’ characteristic of adaptive management (e.g. Holling 2001), with the ‘linkage’ characteristic of cooperative management (e.g. Jentoft 2000), and collaborative management (Osslon *et al.* 2004). The adaptive co-management approach treats policies as hypotheses, and management as experiments from which managers can learn (Gunderson 2000). Most importantly, adaptive co-management proposes that management practices should be adjusted by the monitoring of feedback signals of social-ecological change (Berkes *et al.* 2003).

One characteristic of the adaptive co-management literature is that both case-specific studies and much of the theory have focused on the identification of key elements that contribute to adaptive responses of natural resource management, analysing how adaptive co-management originates, and identifying factors that promote socio-ecological resilience. To date, there has been a lack of focus on how policies might initiate feedback and therefore the process of learning through implementation.

Here, I propose a dialogue framework and the need to include derogations in MEABR policy for participatory research²³ as key elements for the successful adaptation of MEABR (or any co-management policy) to local realities. These would serve as basic elements to kick-start learning-by-doing feedback links for policymakers and fishers.

²³ In the context of this discussion, I refer to participatory research as the research which is done by fishers or guided by fishers. I exclude passive forms of fisher participation as completing questionnaires or participating in focus groups from this definition.

8.1. Dialogue framework

The Chilean fisheries department assumed their role as crucial partners in the move to achieve co-management, and addressed the issues of government legislation to support legal rights as recommended by much of the co-management and common-property research literature (Ostrom 1990; Pomeroy and Berkes 1997). They have also been shown to be satisfied with the evolution of MEABR. Policy uptake statistics, and the fact that currently the ideologically effective discourse which dominates policy is in favour of MEABRs have served to encourage a sense of complacency in the policy. This complacency has resulted in little questioning of the problems and future directions required to maintain and improve policy implementation (Gelcich *et al.* 2005a).

Fisher syndicates on the other hand, have had to implement the MEABRs at local scales and have faced different problems. As fishers are not homogenous (Hampshire *et al.* 2004; Chapter 3, 4, 6) we cannot assume that they share a common understanding of the problems that confront them (Chapter 6). Recent policy debates over natural resource management have revealed the unexpected consequences of the assumption that problems are evident and present themselves (Adams *et al.* 2003). Therefore careful and transparent consideration of the ways different fishers understand management problems is essential to guide effective dialogue and policy adaptation.

A good starting point to develop feedback between the realities of local experience and the policy process is through dialogue. Using this logic a dialogue framework is proposed (adapted from Adams *et al.* 2003), that can help guide dialogue within fisher syndicates and between fishers and government. Thereby enabling more effective policy development (Fig. 8.1).

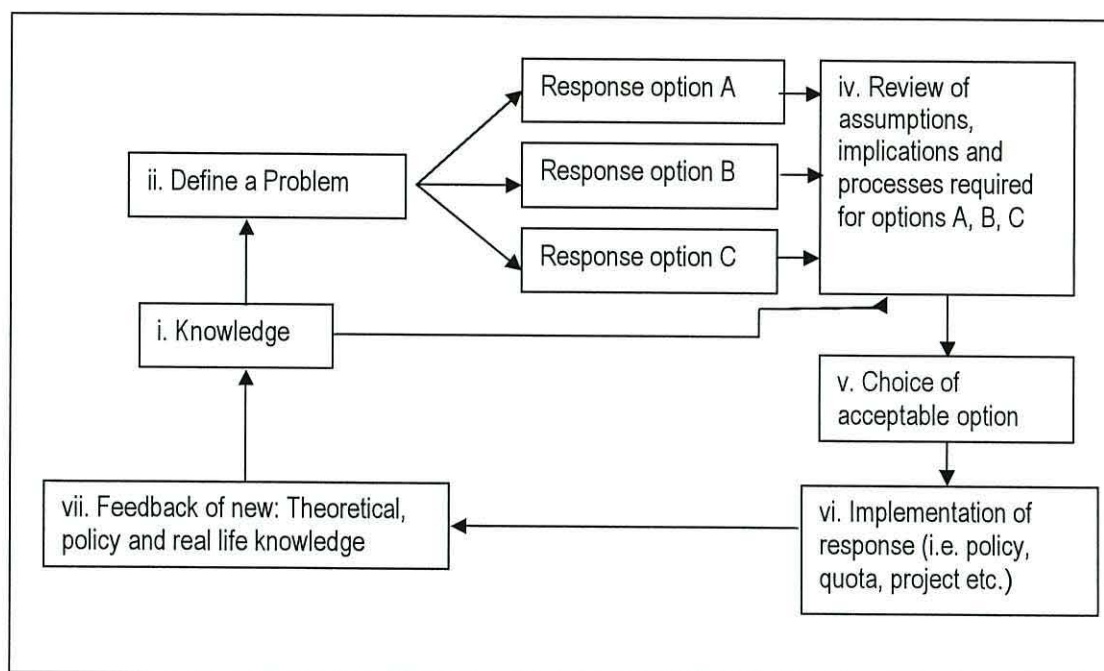


Figure 8.1 Framework for dialog and advancement of policy related to MEABRs and common pool resources in general (adapted from Adams *et al.* 2003).

The framework includes the means by which current knowledge (i) of the environment, theory and policy help to define a problem (ii) that stimulates a series of response options (iii). These response options are then tested (iv) with respect to current knowledge, assumptions, implications and theory. Once a feasible option can be found (v) and implemented (vi), the most important aspect is to incorporate this experience into redefining our current knowledge (vii), that ultimately helps to define new problems, that feed into the cycle again.

As shown in Chapter 2, the rationale behind steps i-vi of the framework have been implemented in the Chilean Benthic shellfishery policy. Nevertheless in light of the knowledge gained through research on the human dimensions of MEABR policy (Chapters 3-7) it is apparent that there is a gap in the process by which experience should help redefine knowledge and the new policy problems (stage vii).

This framework becomes important at local scales as it is simple to follow and builds on people's own knowledge. Fishers involved in MEABRs can follow this framework using their own knowledge, assumptions and experiences to define new problems and build on responses at every "caleta". By making problems and possible

responses explicit, it will become clear that fishers actively respond and adapt to the challenges imposed by the policy. This does not mean that the framework will solve the problems or reconcile irreconcilable interests, however it does clarify the costs of compromising and/or advancing MEABR policy developments (Adams *et al.* 2003; Hampshire *et al.* 2004).

8.2. Policy derogations for experimentation

Understanding fishers' problems and the heterogeneous solutions they identify provides interesting challenges to the fisheries management authorities. Specific solutions to adapt MEABRs to local realities will probably include some form of manipulation or experimentation within fishers' geographical user right boundaries. In this sense, the development of these initiatives will not only depend on the difficulty of finding funding, but on the constraints of the present legal structure of the policy.

Currently the management procedures within MEABR policy implicitly establish that the fisheries undersecretary sets and controls management objectives. It also determines that research based biological knowledge is the basic knowledge to include in the MEABR process and evaluation of this fishery. In doing this the irony is that the MEABR reduces the capacity of social and ecological systems to buffer change, therefore affecting the ability to cope with, adapt to, and shape change without losing options for future adaptability (Folke *et al.* 2003).

The lack of management options and flexibility within MEABRs has already begun to generate discontent among artisanal fishers. Through the open ended interviews and participatory methodologies that I used while carrying out this study it became clear that some fisher syndicates wished to develop MEABRs into successful enterprises. They identified several potential mechanisms to improve yield and conservation which include: feeding *locos* in ponds, rescuing juveniles from harvested shells, rescuing *loco* from sand embankments, re-population experiments with sea urchins and other species, feeding *loco* in mesh bags with different diets and multi-species ecosystem approach towards their MEABR as possible ways forward. All of these alternatives involve some degree of experimentation and moving

resources around within their MEABRs. This is not accounted for in the policy and is therefore currently illegal.

This is quite ironic as small scale coastal artisanal fisheries with well-demarcated fishing grounds provide ideal situations for experimental management research (Castilla 2000; Johannes 2002). In addition, if MEABRs are going to adapt successfully, managers should encourage local communities (syndicates) to experiment and continuously adapt to changes (social or ecological). However, at present the MEABR policy has left few legal alternatives for community experiments and their subsequent adaptations. This is unfortunate as participatory research in support of adaptive management has become almost commonplace in many developing countries (Edwards-Jones 2001), under the premise that the participation of resource users and other stakeholders is important not only in the management of resources, but also in research orientated toward the generation of information and innovations that shape how resources are understood and exploited (Johnson *et al* 2004).

Under this same perspective, and in order to facilitate the future improvement of MEABRs, I advocate for a system by which research derogations in MEABR policy can be made. Derogations could be supervised by the fisheries undersecretary in partnership with private consultants who already work with fishers. Learning from these experimental approaches will provide valuable information for local management and research interests. As suggested for other natural resources domains, research and development can no longer be the exclusive domain of scientists (Olsson and Folke 2001). Fishers would be able to adapt policy to their own conditions through experimentation. Researchers (social and natural scientists) and managers would gain from fisher experimentation because they will observe the results of numerous experiments over a wide range of conditions between and within years, allowing them to generalize about outcomes of experiments (i.e. meta-analysis), and to develop or amend theory accordingly (Edwards-Jones 2001; Johannes 2002).

In summary, feedback in the policy process is especially important as the MEABR policy extends to include heterogeneous groups of fishers in Chile (Chapter 3,

Chapter 4, Chapter 5, Chapter 6). Successful policy responses will depend on the capacity of the MEABR model to adapt (evolve) to local conditions. If fishers' feedback could be incorporated within the policy framework, derogations and support could be incorporated into local-based fisheries development. This would allow co-management and conservation to be more inclusive and participatory, and thus more effective.

8.3. Future research

There is a growing interest worldwide in social science information as a means of managing the fishery rather than managing the fish stocks (Wiber *et al.* 2004) and of addressing more focused social objectives such as livelihood needs (Allison and Ellis 2001). In this thesis I have addressed some of these issues for coastal fisheries managed through territorial user rights. It has proved to be a rewarding experience (Fig. 8.2) which has shown that understanding the human dimensions of fisheries management effectively provides a rich area of academic study that can have important practical implications for coastal resource sustainability.



Figure 8.2 Informal meeting between the author and Luis (Toto) Catalan, a local fisher at Matanzas, Chile.

While there is scope for much work on the human dimensions of fisheries policies around the world I personally feel that there are three important aspects which must be dealt with in the future:

a) Understanding the role fishers' leaders play in adopting and adapting to new policy frameworks. Evidence suggests that fisher Unions declined in productivity and organisation when ineffective leaders replaced a good one (J.C. Castilla, Personal Communication; Osslon *et al.* 2004). However, the process works both ways and strong leadership seems the way to rejuvenate the development of fisheries policies towards new horizons.

b) To understand the importance of social capital for well-being in fisher communities and how this relates to marine resource management initiatives. Evidence suggests that groups which generate vertical social capital relations with university scientists and NGOs have greater access to development resources. But to what extent this wellbeing is maintained once universities and development/conservation funds have been removed remains unknown.

c) Using scenarios research within an adaptive co-management context to understand fishers' response options. Adaptive co-management relies on iterative social learning and the on-going adjustment of management decisions to be acceptable for different stakeholders. Most attention on this type of research has been placed on past actions. Using scenarios as a tool for anticipating responses for the implementation of regulations as marine protected areas would allow adaptive co-management to be taken a step into the future.

In order to finish, I wish to highlight that by gathering data in the form of interviews, questionnaires and observations, I also became part of the study. I have been affected by what different fishers have told me. They allowed me into their different worlds and this seduced me. Thus I declare this thesis has an author with thoughts and emotions that might affect to some extent what you have read throughout the different chapters.

8.4. Conclusion

In this study I have shown that understanding the human dimensions of marine management provides new insights into problems and ways to confront coastal fishery management through co-management. Perhaps the most important lesson to be drawn from this study is that governments that attempt to shift from traditional top-down systems of resource management towards co-management approaches must be aware that this is an ongoing process that demands commitment and flexibility if it is to be successful. Co-management as a form of governance is much like having a child, the implementation and early years are only the beginning!

References

- Acheson J 1990. The lobster fiefs revisited: economic and ecological effects of territoriality in Maine lobster fishing. Pages 37-65 in B. McCay and J. Acheson editors. *The question of the commons: the culture and ecology of communal resources*. The University of Arizona Press, Tuscon.
- Adams WM 2001. *Green Development: Environment and sustainability in the Third world*. Routledge, London.
- Adams W, Brockington D, Dyson J & Vira B 2003. Managing tragedies: understanding conflict over common pool resources. *Science* **302**: 1915-1916
- Agardy T, Bridgewater P, Crosby M, Day J, Dayton P, Kenchington R, Laffoley D, McConney P, Murray P, Parks J & Peau L 2003. Dangerous targets? Unresolved issues and ideological clashes around marine protected areas. *Aquatic Conservation-Marine and Freshwater Ecosystems* **13**: 353-367
- Agra CEAS. 2003. *Mid-term evaluation of the Rural Development Plan for Wales*. Final Report for Welsh European Funding Office, Imperial College at Wye, Ashford UK.
- Agrawal A & Gibson CC 1999. 'Enchantment and disenchantment: the role of community in natural resource conservation', *World Development* **27**: 629-649
- Aipanjiguly S, Jacobson S & Flamm R 2003. Conserving Manatees: Knowledge, Attitudes, and Intentions of Boaters in Tampa Bay, Florida. *Conservation Biology* **17**: 1098-1105
- Ajzen I 1988. *Attitudes, personality, and behaviour*. Open University Press, Milton Keynes, UK.
- Allison E & Ellis F 2001. The Livelihoods approach and management of small scale fisheries. *Marine Policy* **25**: 377-388
- Aswani S & Hamilton R 2004. Integrating indigenous knowledge and customary sea tenure with marine and social science for conservation of bumphead parrotfish (*Bolbometopon muricatum*) in the Roviana Lagoon, Solomon Islands. *Environmental Conservation* **31**: 69-83
- Beedell J & Rehman T 1999. Explaining farmers' conservation behaviour: Why do farmers behave the way they do? *Journal of Environmental Management* **57**: 165-176
- Bender P & Speckart G 1981. Attitudes "cause" behaviours: a structural equation analysis. *Journal of Personality and Social Psychology* **11**: 271-278
- Bene C 2003. When fishery rhymes with poverty: a first step beyond the old paradigm on poverty in small-scale fisheries. *World Development* **31**: 949-975
- Berkes F, Mahon R, McConney P, Pollnac R & Pomeroy R 2001. *Managing Small-scale fisheries: Alternative directions and methods*. International development research centre. Canada, 250pp (accessed on line at http://www.idrc.ca/en/ev-23582-201-1-DO_TOPIC.html)
- Berkes F, Colding J & Folke C 2003. Introduction. Berkes F, J. Colding and C. Folke editors. *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Cambridge: Cambridge University Press.
- Bernal P, Oliva D, Aliaga B & Morales C 1999. New regulations in Chilean Fisheries and Aquaculture: ITQ's and Territorial user rights. *Ocean and Coastal Management* **42**: 119-142
- Blyth R, Kaiser M, Edwards-Jones G & Hart P 2002. Voluntary management in an inshore fishery has conservation benefits. *Environmental Conservation* **29**: 493-508

- Bockstael N & Opaluch, J 1983. Discrete modelling of supply response under uncertainty: The case of the fishery. *Journal of Environmental Economics and Management* **10**(2): 125-137
- Botsford LW, Castilla JC & Peterson CH 1997. The management of fisheries and marine ecosystems. *Science* **277**: 509-515
- Bowler I. 1979. *Government and agriculture: a spatial perspective*. Longman. London.
- Brotherton I 1991. What limits participation in ESAs? *Journal of Environmental Management*. **32**: 241-249
- Bromley D 1992. *Making the commons work: Theory, Practice and Policy*. Institute for contemporary studies Press, San Francisco.
- Bruntland H 1987. *Our common future*. Oxford University Press, Oxford UK.
- Bustamante R & Castilla JC 1987. The shellfishery in Chile: An analysis of 26 years of landings (1960-1985). *Biología Pesquera* (Chile) **16**:79-97
- Caddy JF & Defeo O 2003. Enhancing or restoring the productivity of natural populations of shellfish and other marine invertebrate resources: a review. *FAO Fisheries Technical Paper*. No. **448**. Rome, FAO. 159 p.
- Caplin A & Leahy J 2001. Psychological expected utility theory and anticipatory feelings. *The quarterly journal of economics*. **2**: 55-79
- Carlsson L 2003. The strategy of the commons: history and property rights in central Sweden. Berkes F, Colding J, Folke C editors. *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Cambridge: Cambridge University Press.
- Carr S & Tait J 1991. Differences in the attitudes of farmers and conservationists and their implications. *Journal of Environmental Management* **32**: 281-294
- Castilla JC & Bustamante R 1989. Human exclusion from rocky intertidal of Las Cruces, central Chile: effects on *Durvillaea antarctica* (Phaeophyta, Durvilleales). *Marine Ecology Progress Series*. **50**:203-214
- Castilla JC & Durán L 1985. Human exclusion from the rocky intertidal zone of central Chile: The effects on *Concholepas concholepas* (Gastropoda). *Oikos* **45**: 391-399
- Castilla JC 1988. Earthquake-caused coastal uplift and its effects on rocky intertidal kelp communities. *Science* **242**: 440-443
- Castilla JC 1989. Un seguimiento de la actividad pesquera artesanal en dos caletas de Chile central. Memorias del Simposio Internacional de los Recursos Vivos y las Pesquerías en el Pacífico Sudeste, Chile. Viña del Mar, Chile, 9-13 May, pp. 543-553
- Castilla JC 1990. Clase magistral: importancia y proyección de la investigación de ciencias del mar en Chile. *Revista Biología Marina* (Chile) **25**: 1-18
- Castilla JC 1994. The Chilean Small scale benthic shellfisheries and the institutionalization of new management practices. *Ecological International Bulletin* **21**: 47-63
- Castilla JC & Rho E 1997. Conservación y repoblamiento en el litoral del norte de Chile: El caso de Minera Escondida en Punta Coloso, Antofagasta, Chile. *Estudios Oceanológicos* (Chile) **16**: 51-66
- Castilla JC & Defeo O 2001. Latin American benthic shellfisheries: emphasis on co-management and experimental practices. *Reviews in Fish Biology and Fisheries* **11**: 1-30

- Castilla JC 1997. Environmental regulations and the hazards of risk assessment: Attitudes in developing countries. *Human and Ecological Risk Assessment* **3**: 659-664
- Castilla JC & Fernández M 1998. Small-scale benthic fisheries in Chile: On co-management and sustainable use of benthic invertebrates. *Ecological Applications* **8**: S124-S132
- Castilla JC, Manríquez P, Alvarado J, Rosson A, Pino C, Espóz C, Soto R, Oliva D & Defeo O 1998. Artisanal "Caletas" as units of production and co-managers of benthic invertebrates in Chile. In Proceedings of the North Pacific Symposium on Invertebrate Stock Assessment and Management. Edited by G.S. Jaimieson and A. Campbell. *Can. Special Publication in Fisheries and Aquatic Science* **125**: pp. 407-413
- Castilla JC 1999. Coastal marine communities: trends and perspectives from human-exclusion experiments. *Trends in Ecology and Evolution* **14**: 280-283
- Castilla JC 2000. Roles of experimental marine ecology in coastal management and conservation. *Journal of Experimental Marine Biology and Ecology* **250**: 3-21
- Castilla JC, Gelcich S & Defeo O. Twenty year management experience with marine benthic invertebrate artisanal fisheries in Chile: successes, lessons and projections. In T.R. McClanahan and J.C. Castilla Editors. Successes in coastal resource management (in press)
- Chambers R 1994. Participatory rural appraisal (PRA): Challenges, potentials and paradigm. *World Development* **22**: 1437-1454
- Clarke K 1993. Non-parametric multivariate analysis of changes in community structure. *Australian Journal of Ecology* **18**: 117-143
- Clarke K & Warwick R 2001. *Change in marine communities: An approach to statistical analysis and interpretation*. 2nd edition. PRIMER-E, Plymouth, United Kingdom
- Colding J, Elmqvist T & Osslon P 2003. Living with disturbance: building resilience in social-ecological systems. Berkes F, Colding J, Folke C editors. *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Cambridge: Cambridge University Press.
- Curtis JA 2002. Estimates of fishermen's personal discount rate. *Applied Economics Letters*. **9**:775-778
- Davies B & Harré R 1990. Positioning: The discursive production of selves. *Journal for the Theory of Social Behaviour*, **20**(1):43-63
- Davies B & Hodge I 2002. Assessing the role of 'stewardship norms' in environmental decision making on farms. Paper presented at the Agricultural Economics Society Annual Conference, April 8-11, University of Wales, Aberystwyth, UK.
- Dahl C 1998. Traditional marine tenure: a basis for artisanal fisheries management. *Marine Policy* **54**: 40-48
- Deary I, Blenkin H, Agius R, Endler N, Zealley H & Wood R 1996. Models of job-related stress and personal achievement among consultant doctors. *British Journal of Psychology* **87**: 3-29
- Defeo O & Perez-Castaneda R 2003. Misuse of marine protected areas for fisheries management: The case of Mexico. *Fisheries* **28**: 35-36
- Dietz T, Ostrom E & Stern P 2003. The struggle to govern the commons. *Science* **302**: 1907-1912
- Dryzek J 1997. *The politics of the earth: Environmental discourses*. Oxford, United Kingdom: Oxford University press.

- Dunlap R & Van Liere K 1978. The New 'Environmental Paradigm': a proposed measuring instrument and preliminary results. *Journal of Environmental Education*. **9** : 10-19
- Dupont D 1993. Price uncertainty, expectations formation and fishers' location choices. *Marine Resource Economics* **8**(3): 219-247
- Durán LR & Castilla JC 1989. Variation and persistence of the middle rocky intertidal community of central Chile, with and without human harvesting. *Marine Biology* **103**: 555-562.
- Edwards-Jones G, Deary I & Willock J 1998. Modelling farmer decision-making: what can psychology do for agricultural policy assessment models? *Etudes et Reserches sur les Systemes Agraires et le Development* **31**:153-173
- Edwards-Jones G 2001. Should we engage in farmer-participatory research in the UK? *Outlook on Agriculture* **30**(2):129-136
- Eggert H & Tveteras R 2004. Stochastic production and heterogeneous risk preferences: Commercial fishers gear choices. *American Journal of Agricultural Economics* **86** (1): 199-212
- Eggert H & Martinsson P 2004. Are commercial fishers risk lovers? *Land Economics* **80** (4): 550-560
- Estudios Marinos 2003. Estudio de Situacion Base y Plan de manejo y explotacion para el area Puertecillo, VI region.
- Fanis M 2004. Collective action meets Prospect Theory: An application to coalition building in Chile, 1973-75. *Political Psychology* **25**(3):363-388
- Fanning L 2000. The co-management paradigm: Examining criteria for meaningful public Involvement in Sustainable marine resource management. Mann E, Chircop A, McConnell M, Morgan J editors. Ocean Yearbook 14. Chicago: University Chicago Press
- FAO 2005. Fishing statistics. [Http: www.fao.org](http://www.fao.org) (accessed January 2005)
- Fernández M & Castilla JC 1997. The Chilean artisanal Stone crab (*Homalaspis plana*) fishery: Catch trends in open access zones and the effect of management areas in Central Chile. *Journal of Shellfish Research* **16**: 371-377
- Fernández M & Castilla JC 2000. Recruitment of *Homalaspis plana* in intertidal habitats of central Chile and implications for the current use of management and marine protected areas. *Marine Ecology Progress Series* **208**: 157-170
- Fernández M & Castilla JC. Marine Conservation in Chile: Historical perspective, lessons and the future. *Conservation Biology* (in press).
- Fisheries and Aquaculture law (FAL) 1991. Ley de Pesca y Acuicultura. Ley 18892 D.S 430. Ministerio de Economia Fomento y Reconstruccion, Santiago, Chile.
- Flowerdew R & Martin D 1997. Methods in human geography: a guide for students doing a research project. Addison Wesley Longmann ltd.
- Folke C, Holding J & Birkes F 2003. Synthesis: building resilience and adaptive capacity in social-ecological systems. Berkes F, Colding J, Folke C editors. Navigating Social-Ecological Systems: Building Resilience for Complexity and Change. Cambridge: Cambridge University Press.
- Fortmann L 1990. Locality and custom: Non-aboriginal claims to customary usufructuary rights as a source of rural protest. *Journal of Rural Studies* **6**(2): 195-208
- Fortmann L 1995. Talking Claims: Discursive Strategies in Contesting Property. *World Development* **23**(6): 1053-1063
- Foucault M 1979. *Discipline and Punish: the birth of the prison*. (translation Sheridan, A) New York, USA: Vintage.

- Foucault M 1980. *Power/Knowledge. Selected interviews and other writings 1972-1977*. Edited by C. Gordon. Brighton, United Kingdom: Harvester.
- Garibaldi A & Turner N 2004. Cultural key-stone species: Implications for ecological conservation and restoration. *Ecology and Society* **9** (3):1
- Gelcich S, Edwards-Jones G, Kaiser MJ & Watson E 2005a. Using discourses for policy evaluation: the case of marine common property rights in Chile. *Society and Natural resources* **18** (4): 377-391
- Gelcich S, Edwards-Jones G & Kaiser MJ 2005b. Importance of attitudinal differences among artisanal fishers towards co-management and conservation of marine resources. *Conservation Biology* **19** (3): 865-875
- Gell F & Roberts C 2003. Benefits beyond boundaries: the fishery effects of marine reserves. *Trends in Ecology and Evolution* **18**: 448-455
- Glimcher P & Rustichini A 2004. Neuroeconomics: The consilience of brain and decision. *Science* **306**:447-452
- Guerin L & Guerin T 1994. Constraints to the adoption of innovations in agricultural research and environmental management: a review. *Australian Journal of Experimental Agriculture* **34**: 549-571
- Gunderson LH 2000. Ecological resilience-in theory and application. *Annual Review of Ecology and Systematics* **31**:425-439
- Guillotreau P & Cunningham S 1994. The management implications of overlapping property rights: The case of the Solent oyster fishery. Research Paper 71 Cemare, Portsmouth: University of Portsmouth.
- Hajer M 1995. *The Politics of Environmental Discourse: Ecological modernization and the policy process*. Oxford, United Kingdom: Calderon Press.
- Hajer M & Fischer F 1999. Beyond Global Discourse: The rediscovery of Culture in Environmental Politics. In *Living with Nature: Environmental politics as cultural discourse*. Edited by M. Hajer and F. Fischer. Oxford, United Kingdom: Oxford University Press.
- Hallin P 1995. Environmental concern and behaviour in Foley, a small town in Minnesota. *Environment & Behavior* **27**: 558-578
- Hampshire K, Bell S, Wallace G & Stepukonis F 2004. Real" poachers and predators: Shades of meaning in local understandings of threats to fisheries. *Society and Natural Resources* **17**: 305-318.
- Heltberg R 2001. Determinants and impact of local institutions for common resource management. *Environment and Development Economics* **6**: 183-208.
- Hines J, Hungerford H & Tomera A 1987. Analysis and synthesis of research on responsible environmental behaviour. *Journal of Environmental Education* **18**: 1-8
- Holland D & Sutinen J 1999. An empirical model of fleet dynamics in New England Trawl Fisheries. *Canadian Journal of Fisheries and Aquatic Sciences* **56**: 253-264
- Holling CS & Sanderson S 1996. Dynamics of (dis)harmony in ecological and social systems. Hanna S, Folke C, Maler K editors. *Rights to nature: ecological, cultural, and political principals of institutions for the environment*. Washington: Island Press.
- Holling CS 2001. Understanding the complexity of economic, ecological and social systems. *Ecosystems* **4**(5):390-405
- Huhmarniemi A & Salmi J 1999. Attitudes and opinions of commercial fishermen on whitefish management in the Gulf of Bothnia, Finland. *Fisheries Management and Ecology* **6**: 221-232

- Inglis A 1992. A tale of two approaches: conventional questionnaire survey vs PRA. Rural development forestry network paper 14c, ODI London.
- Jacobson S, Sieving K, Jones G & Van Doorn A 2003. Assessment of farmer attitudes and behavioural intentions toward bird conservation on organic and conventional Florida farms. *Conservation Biology* **17**: 595-606
- Jentoft S 1989. Fisheries Co-management: Delegating government responsibility to fishermen's organisations. *Marine Policy* **13**: 137-154
- Jentoft S & McCay B 1995. User Participation in fisheries management. Lessons drawn from international experiences. *Marine Policy* **19**: 227-246
- Jentoft S, McCay B & Wilson D 1998. Social theory and fisheries co-management. *Marine Policy* **22**: 423-436
- Jentoft S 2000. Co-managing the coastal zone: is the task too complex. *Ocean and coastal management* **43**: 527-535
- Johannes RE 2002. The renaissance of community-based marine resource management in Oceania. *Annual reviews in Ecology and Systematics* **33**: 317-340
- Johnson C 2001. Community formation and fisheries conservation in Southern Thailand. *Development and Change* **32**: 951-974
- Johnson N, Lilja N, Ashby J & Garcia J 2004. The practice of participatory research and gender analysis in natural resource management. *Natural Resource forum* **28**: 189-200
- Jones G 1963. The diffusion of agricultural innovations. *Journal of Agricultural Economics* **15**: 387-409
- Jorgensen S & Muller F 2000 Ecosystems as complex systems. Pages 2-16 in S. Jorgensen and F. Muller, editors. *Handbook of ecosystem theories and management*. Chemical Rubber Company Press, US.
- Jul-Larsen E, Kolding J, Overå R, Nielsen JR & Zwieten P 2003. Management, co-management or no management? Major dilemmas in southern African freshwater fisheries. 1. Synthesis report. FAO Fisheries Technical Paper. No. 426/1. Rome, FAO. 127p.
- Kahneman D & Tversky A 1979. Prospect theory: an analysis of decision under risk. *Econometrica* **47**(2): 263-292
- Kaplan I.M & McCay B 2004. Cooperative research, co-management and the social dimension of fisheries science and management. *Marine Policy* **28**: 257-258.
- Kleijn D & Sutherland W 2004. How effective are European agri-environment schemes in conserving and promoting biodiversity? *Journal of Applied Ecology* **40**: 947-969
- Kuznar LA & Frederick WG 2003. Environmental constraints and sigmoid utility: implications for value, risk sensitivity and social status. *Ecological Economics* **46** (2): 293-306
- Lazarus R, Folkman A 1984. *Stress, Appraisal and Coping*. Springer, New York.
- Leach M, Mearns R & Scoons I 1999. Environmental entitlements: dynamics and institutions in community-based natural resource management. *World Development* **27** (2): 225-247
- Ley de Pesca y Acuicultura 1991. Ministerio de Economía Fomento y Reconstrucción, Gobierno de Chile. Ley N°18892 D.S N°430.
- Lobe K & Berkes F 2004. The padu system of community-based fisheries management: change and local institutional innovation in south India. *Marine Policy* **28**: 271-281

- Lockwood M 1999. Humans valuing nature: Synthesising insights from philosophy, psychology and economics. *Environmental values* **8**: 381-401
- Lonnstedt L & Svensson J 2000. Non-industrial private forest owners' risk preferences. *Scandinavian Journal of Forest Research* **15**: 651-660
- Mahon R, Almerigia S, McConney P, Parker C & Brewster L 2003. Participatory methodology used for sea urchin co-management in Barbados. *Ocean and Coastal Management* **46**: 1-25
- Manríquez PH & Castilla JC 2001. Significance of marine protected areas in central Chile as seeding grounds for the gastropod *Concholepas concholepas*. *Marine Ecology Progress Series* **215**: 201-211
- Manriquez PH, Navarrete SA, Rosson A & Castilla JC 2004. Settlement of the gastropod *Concholepas concholepas* on shells of conspecific adults. *Journal of the Marine biology association UK*. **84** :651-658
- Mathijs E 2003. Social capital and farmers' willingness to adopt countryside stewardship schemes. *Outlook on Agriculture* **32**: 13-16
- McDermott R 2004. Editor's introduction. *Political Psychology* **25**(2):147-162
- McHenry H 1996. Farming and environmental discourses: a study of the deception of environmental issues in a German farming newspaper. *Journal of Rural Studies* **12**(4):375-386
- Meltzoff S, Lichtensztajn Y & Stotz W 2002. Competing visions for marine tenure and co-management: Genesis of a marine management area system in Chile. *Coastal Management* **30**:85-99
- Mistiaen J & Strand I 2000. Location choices of commercial fishermen with heterogeneous risk preferences. *American journal of agricultural economics* **82**: 1184-1190
- Moore D 1994. Contesting terrain in Zimbabwe Eastern Highlands: Political ecology and peasant resource struggles. *Economic geography* **69** (4): 380-401
- Morris C & Potter C 1995. Recruiting the new conservationists: Farmers adoption of agri-environmental schemes in the UK. *Journal of Rural Studies* **11**: 51-62
- Mosse D 1994. Authority, Gender and Knowledge: Theoretical reflections on the practice of participatory and rural appraisal. *Development and Change* **25**:497-526
- Mosse D 2004. Is good policy unimplementable? Reflections on the ethnography of aid policy and practice. *Development and Change* **35**:639-671
- Myers RA & Worm B 2003. Rapid worldwide depletion of predatory fish communities. *Nature* **423**: 280-283
- Naylor R *et al.* 2000. Effect of aquaculture on world fish supplies. *Nature* **405**: 1017-1023
- Neupane R, Sharma K & Thapa G 2002. Adoption of agroforestry in the hills of Nepal: a logistic regression analysis. *Agricultural Systems* **72** (3): 177-196
- Nielsen JR, Degnbol P, Viswanathan K, Ahmed M, Hara M & Raja N 2004. Fisheries co-management - an institutional innovation? lessons from South East Asia and Southern Africa. *Marine Policy* **28**: 151-160
- North D 1990. *Institutions, institutional change and economic performance*. Cambridge: Cambridge University Press
- Ockwell D 2001. Fire in the Wet-Dry Tropics of Australia: A Comparative study of Alternate Approaches to Discourse analysis. Centre for Ecology, Law and Policy Working paper, University of York, UK
- Oliver R & Bearden W 1985. Crossover effects in the Theory of Reasoned Action: a moderating influence attempt. *Journal of Consumer Research* **12**: 324-340

- Olli E, Grendstad G & Wollebaek D 2001. Correlates of environmental behaviors - bringing back social context, *Environment and Behavior* **33**: 181-208
- Olsson P & Folke C 2001. Local ecological knowledge and institutional dynamics for ecosystem management: A study of lake Racken Watershed, Sweden. *Ecosystems* **4**: 85-104
- Olsson P, Folke C & Berkes F 2004. Adaptive comanagement for building resilience in social-ecological systems. *Environmental Management* **34**: 75-90
- Ostrom E 1990. *Governing the Commons: The evolution of institutions for collective action*. Cambridge, University Press.
- Ostrom E & Schlager E 1996. The formation of property rights. Pages 127-157 in *Rights to nature: ecological, economic, cultural and political principals of institutions for the environment* editors S. Hanna, C. Folke, and K. Maler. Island Press, Washington.
- Palumbi S 2003. Population genetics, demographic connectivity, and the design of marine reserves. *Ecological Applications* **13**: S146-S158.
- Pauly D, Christensen V, Dalsgaard J, Froese R & Torres F 1998. Fishing down marine food webs. *Science* **279**: 860-863
- Pauly D, Alder J, Bennett E, Christensen V, Tyedmers P & Watson R 2003. The future for fisheries. *Science* **302**: 1359-1361
- Pauly D, Christensen V, Guenette S, Pitcher T, Sumaila U, Walters J, Watson R & Zeller D 2002. Towards sustainability in world fisheries. *Nature* **418**: 689-695.
- Payne I 2000. The Changing role of fisheries in development policy. Overseas development institute. *Natural Resource Perspectives* **59**:1-4.
www.odi.org.uk/nrp/ (accessed Feb 2005).
- Perez-Sanchez E. & Muir J 2003. Fishermen perception on resource management and aquaculture development in Mecoacan estuary, Tabasco, Mexico. *Ocean and Coastal Management* **46**: 681-700
- Potter C & Gasson R. 1988. Farmer participation in voluntary land diversion schemes: some predictions from a survey. *Journal of Rural Studies* **4**: 365-375.
- Pretty J & Ward H 2001. Social Capital and the environment. *World Development* **29**(2): 209-227.
- Pretty J 2003. Social capital and the collective management of resources. *Science* **302**: 1912-1914.
- Pomeroy R & Berkes F 1997. Two to Tango: the role of government in fisheries co-management. *Marine Policy* **21**: 465-480.
- Pinto da Silva P 2004. From common property to co-management: lessons from Brazil's first maritime extractive reserve. *Marine Policy* **28**:419-428.
- Qualls W 1989. Organizational climate and decision framing: An integrated approach to analyzing industrial buying decisions. *Journal of marketing research* **26**: 179-192.
- Rayner S 1991. A cultural-perspective on the structure and implementation of global environmental agreements. *Evaluation Review* **15**: 75-102
- Reyes E 1988. Nuevo Colapso de la pesquería del Loco. *Chile Pesquero* **47**: 41-44.
- Roberts C & Pollunin N 1993. Simple solutions to managing complex fisheries. *Ambio* **22**: 363-368.
- Roberts C, Bohnsack J, Gell F, Hawkins J & Goodridge R 2001. Effects of marine reserves on adjacent fisheries. *Science* **294**: 1920-1923.
- Roberts C, McClean C, Veron J, Hawkins J, Allen G, McAllister D, Mittermeier C, Schueler W, Spalding M, Wells F, Vynne C & Werner T 2002. Marine

- biodiversity hotspots and conservation priorities for tropical reefs. *Science* **295**: 1280-1284.
- Rodriguez L, Daneri G, Torres C, Leon M & Bravo L 2001. Modelling the growth of the Chilean loco, *Concholepas concholepas* (Bruguiera, 1789) using a modified Gompertz-type function. *Journal of shellfish research*. **20** (1): 309-315
- Rogers E & Shoemaker F 1971. *Communication of innovations: a cross-cultural approach*. The Free Press, New York.
- Rogers E 2003. *Diffusion of innovations*. The Free Press, New York
- Rose C 1990. Property as storytelling: Perspectives from game theory, narrative theory, feminist theory. *Yale Journal of Law and the Humanities* **2**: 37-57.
- Sandersen H & Koester S 2000. Comanagement of tropical coastal zones: the case of the Soufriere marine management area, St. Lucia, WI. *Coastal Management* **28**: 87-97.
- San Martin G 2001. Áreas Marinas Costeras con Derechos de uso Exclusivo Destinadas al Manejo y Explotación de Recursos Bentónicos en Chile. Taller Áreas de Manejo: Experiencias y Proyecciones, Puerto Montt 16,17 Agosto.
- Santelices B, Castilla JC, Cancino J & Schmiede P 1980. Comparative ecology of *Lessonia nigrescens* and *Durvillaea antarctica* (Pheophyta) in central Chile. *Marine Biology* **59**: 119-132.
- Schurman R 1996. Snails, Southern Hake and Sustainability: Neo-liberalism and Natural Resource Exports in Chile. *World Development* **24**: 1695-1709.
- Scoones I 1998. Sustainable rural livelihoods: a framework for analysis. Institute of Development Studies working paper 72. University of Sussex, Brighton.
- Scott JC 1985. *Weapons of the weak. Every day forms of peasant resistance*. Yale, USA: Yale University Press.
- Seijo JC, Defeo O & Salas S 1998. Fisheries Bioeconomics. Theory, Modelling and Management. FAO Fisheries Technical Paper. No. 368. Rome, FAO. 108 p.
- Sen S & Neilsen R 1996. Fisheries co-management: a comparative analysis. *Marine Policy* **20**: 405-418
- Seixas C & Birkes F 2003. Dynamics of social-ecological changes in a lagoon fishery in southern Brazil. Berkes F, Colding J, Folke C editors. *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Cambridge: Cambridge University Press.
- Seixas C & Troutt E 2003. Evolution of a local Brazilian shrimp market. *Ecological Economics* **46** : 399-417
- Sernap 2000. Estadísticas de desembarque artesanal por caleta. (accessed April 2005 : www.sernapesca.cl)
- Sernapesca 2004. Servicio Nacional de Pesca. <http://www.sernap.cl>
- Sheikh A, Rehman T & Yates C 2003. Logit models for identifying the factors that influence the uptake of new 'no-tillage' technologies by farmers in the rice-wheat and cotton-wheat farming systems of Pakistan's Punjab. *Agricultural Systems*. **75**: 79-95
- Sittert L 2003. The tyranny of the past: why local histories matter in South African fisheries. *Ocean and Coastal Management* **46**: 199-219
- Stracca L 2004. Behavioural finance and asset prices : Where do we stand ? *Journal of Economic Psychology* **25** : 373-405
- Subpesca 2000. Áreas de manejo y explotación de recursos bentónicos. Documento de difusión N° 3. Subsecretaría de Pesca. <http://www.subpesca.cl>.
- Subpesca 2002. Concepto de áreas de manejo y recursos bentónicos. Documento de difusión N° 1. Subsecretaría de Pesca. <http://www.subpesca.cl>.

- Subpesca 2003. Estado de situacion de areas de manejo por region. Subsecretaria de Pesca, Valparaíso, Chile. Available from <http://www.subpesca.cl>. (accessed August 2003)
- Subpesca 2004. Estadísticas áreas de manejo. <http://www.subpesca.cl>
- Subpesca 2005. Estadísticas áreas de manejo. Subsecretaria de pesca. www.subpesca.cl (accessed January 2005).
- Taliaferro JW 2004. Power politics and the balance of risk: Hypotheses on great power intervention in the periphery. *Political Psychology* **25**(2): 177-211
- Thaler RH 2000. From Homo economicus to Homo sapiens. *Journal of economic perspectives* **14** (1): 133-141
- Thorpe A, Ibarra A & Reid C 1999. The new economic model and fisheries development in Latin America. CEMARE research paper 141 U. of Portsmouth. 20pp
- Tuthill J & Frechette D 2004. Optimism and pessimism in commodity price hedging. *European Review of Agricultural Economics* **31**(3):289-307
- Tversky A & Kahneman D 1981. The framing of decision and the psychology of choice. *Science* **211**: 453-458
- Tversky A & Kahneman D 1992. Advances in Prospect Theory: Cumulative Representation of Uncertainty. *Journal of Risk and Uncertainty* **5**: 297-323
- Valerand R, Deshaies P, Currier J, Pelletier L & Mongeau C 1992. Ajzen and Fishbein's Theory of Reasoned Action as applied to moral behaviour: a confirmatory analysis. *Journal of Personality and Social Psychology* **62**:98-109
- Van den Bergh J, Ferrer-i-Carbonell A & Muda G 2000. Alternative models of individual behaviour and implications for environmental policy. *Ecological Economics* **32** : 43-61
- Vanslembouck I, Van Huylenbroeck G & Verbeke W 2002. Determinants of the willingness of Belgian farmers to participate in agri-environmental measures. *Journal of Agricultural Economics* **53**: 489-511
- Vial J 1991. Reflexiones en torno a la Ley de Pesca. Colección estudios CIEPLAN, CIEPLAN Santiago de Chile.
- Vining J & Ebreo A 1992. Predicting recycling behavior from global and specific environmental attitudes and changes in recycling opportunities. *Journal of Applied Social Psychology* **22**: 1580-1607
- Watson EE 2003. Examining the potential of indigenous institutions for development: a perspective from Borana, Ethiopia. *Development and Change* **34**: 287-309
- Whitby M 1994. *Incentives for countryside management. The case of environmentally sensitive areas*. CAB International, Oxon UK
- Wiber M, Berkes F, Charles A & Kearney J 2004. Participatory research supporting community-based fishery management. *Marine Policy* **28**: 459-468
- Willock J, Deary I, Edwards-Jones G, McGregor M, Sutherland A, Dent J, Gibson G, Morgan O & Grieve R 1999a. The role of attitudes and objectives in farmer decision-making: business and environmentally oriented behaviour in Scotland. *Journal of Agricultural Economics* **50**: 286-303
- Willock J, Deary I, McGregor J, Sutherland A, Edwards-Jones G, Morgan O, Dent J, Grieve R, Gibson G & Austin E 1999b. Farmers' attitudes, objectives, behaviours and personality traits. The Edinburgh study of decision making on farms. *Journal of Vocational Behaviour* **54**: 5-36

- Wilson G 1997. Factors influencing farmer participation in the environmentally sensitive areas scheme. *Journal of Environmental Management* **50**: 67-93.
- Yin RK 1994. Case study resaerch: Desighn and methods. Thousand Oaks, CA:Sage
- Zagal C, Hermosilla C & Riedemann A 2001. *Guide to marine invertebrates of Valdivia*. Santiago, Chile: Quebecor World Chile S.A.
- Zanetell B & Knuth B 2004. Participation rhetoric or community-based management reality? influences on willingness to participate in a Venezuelan freshwater fishery. *World Development* **32**: 793-807

Appendix

Appendix 1

This appendix presents the 5 different questionnaires used in the thesis (note that formatting may be different due to the margins of a thesis). They are named in relation to chapter they were used to generate results. All questionnaires were administered face to face in Spanish and were introduced by a formal letter.

Cover Letter

Estudio sobre factores socio-económicos que determinan estrategias de manejo artesanal sobre recursos marinos en Chile

El cuestionario que se adjunta es parte de un estudio de la Universidad de Bangor en el Reino Unido, que pretende conocer mejor las actividades e ingresos de los sindicatos de pescadores artesanales en Chile.

Este estudio pretende dar a conocer lo diversa que es la pesca artesanal a lo largo de la costa, y como los diferentes grupos de pescadores evalúan las áreas de manejo como medida de administración. En este sentido su participación es de extrema importancia.

Los resultados recopilados por el estudio serán entregados a las directivas de los sindicatos, así como a la Subsecretaría de pesca y el servicio nacional de pesca.

Para completar los siguientes cuestionarios lea atentamente cada afirmación. Luego de cada una de estas afirmaciones se encontrara con un recuadro donde se le pregunta si esta de acuerdo o en desacuerdo con lo que se dice.

Para completar los recuadros marque:

- 1: si esta en desacuerdo con la afirmación
- 2: si esta en desacuerdo, pero no en un 100%, con la afirmación
- 3: si le da lo mismo la afirmación
- 4: si esta de acuerdo, pero no en un 100%, con la afirmación
- 5: si esta en acuerdo con la afirmación

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

Los cuestionarios serán complementados con historias orales de algunos miembros del sindicato así como por entrevistas y datos de las especies que se extraen, para conocer de mejor forma las opiniones de ustedes.

Desde ya agradecemos su colaboración y tiempo, sin el cual este trabajo no se puede llevar a cabo.

Se despide atentamente

Stefan Gelcich, Jefe de Estudio

QUESTIONNAIRE CHAPTER 3

“Información básica”.

1. Nombre
2. Edad
3. Sindicato
4. Dónde vive actualmente?
5. Dónde nació?
6. Cuanto tiempo ha vivido acá?
7. Cuantas personas componen su hogar, incluyéndolo a usted?
 - Hombres:
 - Niños:
 - Mujeres
8. Es miembro de la directiva del sindicato?
9. Ha postulado o sido miembro de la directiva del sindicato?
10. N° de personas que componen el sindicato
11. Que recursos (peses, mariscos, algas, leña ect) extrae?
12. Quien mas en su familia esta involucrado con el trabajo en el mar?
13. Si hay alguien mas, a que se dedican?
14. Es dueño de una embarcación?
15. Cuantos días al mes pasa usted en el mar?
16. Como vende los recursos que extrae?
17. Cuantos días al mes pasa usted cuidando el área de manejo?
18. Ha notado algún cambio en la abundancia o tipo de especies que pesca?
Si es así a que atribuye usted este cambio?

19. Como se describiría usted mismo? (marque cuantas alternativas estime convenientes)

- | | |
|------------------|-----------------------|
| -Buzo | -Pescador |
| -Recolector | -Pescador esporadico |
| -Buzo esporadico | -Ex -pescador |
| - o Ex -Buzo | -Dueño de embarcacion |
| -Dirigente | - Empresario pesquero |

20. Que otras actividades realiza para aumentar sus ingresos?

21. Cuales son sus prioridades /preocupaciones en lo que a administración pesquera concierne?

22. Cuales son sus ingresos anuales provenientes de áreas de manejo?

23. Cuales son los costos para usted de tener un área de manejo durante un año?

Actitudes frente al manejo y conservación”

1. Deberían haber mas rutas de acceso a las zonas costeras en Chile

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

2. Los pescadores tienen el deber de conservar los recursos naturales para las próximas generaciones, independiente del impacto sobre las ganancias.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

3. Los recursos naturales solo deben ser valorados por su valor comercial.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

4. Mas allá de los ingresos, la mayor alegría del pescador/buzo es el estilo de vida.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

5. No es importante ayudar a sindicatos pequeños y pobres a mantenerse en la pesca.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

6. La conservación de recursos debe considerarse solo cuando Los objetivos económicos (de ingreso) han sido alcanzados.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

7. Mientras mas grande el sindicato mas apoyo tiene para implementar un área de manejo

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

8. Se esta haciendo suficiente para proteger y mejorar los ambientes marinos

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

9. Los pescadores artesanales deben tener el derecho de manejar el área de manejo como mejor estimen conveniente.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

10. Las áreas de manejo están cambiando el estilo de vida de Los pescadores.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

11. Derechos históricos sobre recursos son quebrados muchas veces al implementar áreas de manejo.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

12. Las tradiciones pesqueras y su cultura están obsoletas y no tienen lugar en las políticas pesqueras modernas.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

13. Sindicatos con áreas de manejo han sacado recursos de áreas históricas para repoblar sus propias áreas.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

14. Los pescadores que roban de las áreas de manejo deben ser castigados más severamente.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

15. Los mares de Chile están en mejores condiciones ambientales que hace 10 años.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

16. Los pescadores artesanales deben aumentar sus ganancias mejorando la calidad de sus recursos.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

17. Los recursos como minerales, bosques, combustibles y pesquerías deberían usarse lo menos posible.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

18. Tener altas ganancias de áreas de manejo es una señal de un buen sindicato.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

19. Mientras mas chico el sindicato la ganancia de áreas de manejo es mayor.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

20. Las áreas de manejo son una buena medida de administración pesquera.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

21. La regionalización ha ayudado a que los pescadores se organicen en sindicatos.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

22. Pronto no quedaran sitios históricos donde se pueda bucear

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

23. Bajo la legislación referente a áreas de manejo actual, los buzos mariscadores están siendo obligados a cambiar su oficio hacia la pesca.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

24. La ganancia de poder político frente a las autoridades son importantes ganancias de poseer un área de manejo.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

23. La regionalización favoreció a los pescadores y buzos artesanales de su localidad

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

“Áreas de Manejo”

1. Las áreas de manejo constituyen un mejor sistema que el régimen de libre acceso que existía antes.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

2. Las áreas de manejo funcionan bien bajo el marco legal actual.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

3. Las áreas de manejo traen beneficios a aquellos grupos que las adoptan.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

4. Las áreas de manejo traen beneficios a todo el sector pesquero artesanal (buzos, pescadores, recolectores).

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

5. Las áreas de manejo protegen Los recursos y ecosistemas bentónicos.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

6. Las áreas de manejo actúan como reservas y refugios para recursos.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

7. Las áreas de manejo han fomentado una mayor explotación de las zonas históricas.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

8. Las áreas de manejo funcionan mejor en organizaciones con pocos socios.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

9. La autoridad marítima debería involucrarse más en el control de las áreas de manejo

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

10. Los ingresos de las áreas de manejo son repartidos con equidad dentro del sindicato al que pertenezco.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

11. Las áreas de manejo crean conflictos con otros sindicatos por el acceso a recursos.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

12. Las áreas de manejo generan cooperación dentro de Los integrantes de un mismo sindicato.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

13. El gobierno ve a las áreas de manejo como la forma de administrar Los recursos bentonicos en el futuro.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

14. Debería existir un limite al numero de áreas de manejo que son entregadas dentro de una misma región.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

15. Las áreas de manejo han limitado el trabajo de Los Buzos.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

16. Un factor importante de poseer una área de manejo es el apoyo que se recibe de organizaciones de gobierno (Subpesca, Sernapesca, Corfo, Sercotec ect.)

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

17. Es positivo que un sindicato y sus miembros tengan un área de manejo.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

18. Las áreas de manejo son económicamente exitosas.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

19. Las áreas de manejo son la única alternativa para el manejo sustentable de recursos bentónicos.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

20. Los programas de financiamiento que ha proporcionado el gobierno han sido fundamentales para implementar las áreas de manejo en Chile.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

21. Las Areas de manejo son la única forma de acceder al recurso Loco.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

Tiene algún comentario o pregunta acerca del presente estudio?

Muchas Gracias por Su Colaboración sin la cual este estudio no se puede llevar a cabo.

eStefan Gelcich

Questionnaire Chapter 4



Actitudes de los pescadores artesanales sobre las áreas de manejo en Chile

El cuestionario que se adjunta es parte de un estudio de la Universidad de Bangor en el Reino Unido, que pretende conocer mejor las actividades de los pescadores artesanales en Chile.

Este estudio pretende dar a conocer lo diversa que es la pesca artesanal a lo largo de la costa, y como los diferentes grupos de pescadores evalúan las áreas de manejo como medida de administración. En este sentido su participación es de extrema importancia.

Los resultados recopilados por el estudio, serán publicados y entregados a las directivas de los sindicatos, así como a la Subsecretaría de pesca y el Servicio nacional de pesca.

Agradeciendo su cooperación, se despide atentamente

Stefan Gelcich

Cuestionario Areas de Manejo

1. Nombre:

2. Edad:

3. Sindicato:
caleta?

4. Hace cuanto vive en esta

5. ¿Que recursos naturales extrae?

()Pescado () Mariscos () Algas () Madera () Otro _____

6. ¿Quien mas de su casa esta involucrado con el trabajo en el mar?

7. ¿Es dueño de sus propios artes de pesca?

Si ☐ No ☐

8. ¿Es algún miembro del sindicato parte de alguna federación provincial o nacional de pescadores (cuantas)?

Si ☐ No ☐

9. ¿Ha postulado o sido dirigente del sindicato al que pertenece?

Si ☐ No ☐

10. ¿Ha asistido a cursos de capacitación?

Si ☐ No ☐ Sobre que tema ? _____

11. ¿Es miembro de alguna otra organización comunal?

Si ☐ No ☐ De cual o cuales: _____

12. ¿Es dueño de un auto o camión?

Si ☐ No ☐ Si lo es, lo ocupa como fuente de trabajo? _____

13. ¿Cuantos días al mes pasa usted en el mar? _____

14. ¿Como ve el futuro de la pesca artesanal en Chile? _____

Ingreso por mes

INGRESOS (% o bruto)								
MES	Pesc a	Buceo	Recolecció n	Contrato	Agricultura	Animales	A. MANEJO	TOTAL
ENERO								
FEBRERO								
MARZO								
ABRIL								
MAYO								
JUNIO								
JULIO								
AGOSTO								
SEPT.								
OCTUBR E								
NOV.								
DIC.								

Que alternativa mejor lo identifica.

1. Se esta haciendo lo suficiente para proteger y mejorar los ambientes marinos.

☐ Si ☐ En la mayoría de las regiones ☐ No se ☐ Solo en lugares específicos
☐ No

2. El mar de Chile está en mejores condiciones que hace 10 años.

☐ Si ☐ En la mayoría de las regiones ☐ No se ☐ Solo en lugares específicos
☐ No

3. Los recursos de la tierra, como minerales, bosques y pesquerías deberían usarse lo menos posibles.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

4. Los recursos naturales deben ser valorados solo por su valor comercial.

☐ Si ☐ La mayoría de las veces ☐ No se ☐ Solo en casos especiales ☐ No

5. La conservación debe considerarse una vez que se hayan alcanzado los objetivos financieros.

☐ Si ☐ La mayoría de las veces ☐ No se ☐ Solo en casos especiales ☐ No

6. La mayoría de las especies que les preocupan a los conservacionistas y ecólogos, no son las más importantes.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

7. Las pesquerías artesanales son la fuente de grandes problemas ecológicos y necesita modificaciones importantes.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

8. La explotación de zonas de libre acceso es un elemento vital de la vida de los pescadores de mi caleta.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

9. La explotación de zonas de libre acceso siempre será importante para la mayoría de los pescadores en Chile.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

10. Los pescadores que causan daño ambiental deberían ser castigados más severamente.

☐ Si ☐ La mayoría de las veces ☐ No se ☐ Solo en casos especiales ☐ No

11. Los pescadores tienen el deber de conservar los recursos independientes del impacto sobre las ganancias.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

12. Los grupos de conservación y las ONG son útiles para los pescadores artesanales.

☐ Si ☐ La mayoría de las veces ☐ No se ☐ Solo en casos específicos ☐ No

13. La factibilidad económica tiene que ser el factor determinante de cualquier decisión

☐ Siempre ☐ La mayoría de las veces ☐ No se ☐ Solo en casos específicos
☐ Nunca

14. La planificación y el manejo financiero son los aspectos mas importantes para poseer un área de manejo.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

15. Para mi, más allá del ingreso la mayor alegría del pescador es el estilo de vida

☐ Siempre ☐ La mayoría de las veces ☐ No se ☐ Solo a veces ☐ Nunca

16. Áreas de manejo exitosas son el resultado de estudios ESBA bien hechos.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

17. Áreas de manejo exitosas son el resultado de los sacrificios de los pescadores.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

18. Es importante saber como otros sindicatos están manejando su área de manejo.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

19. Es importante para mi poner atención en los precios de mercado de los recursos

☐ Siempre ☐ La mayoría de las veces ☐ No se ☐ Solo en casos específicos
☐ Nunca

20. ¿Que tan importantes son los pescadores económicamente en su localidad?.

☐ Muy importantes ☐ Importantes ☐ No se ☐ Normales ☐ Poco importantes

21. Las áreas de manejo actúan como reservas para los recursos bentónicos

☐ Siempre ☐ La mayoría de las veces ☐ No se ☐ Solo en casos específicos
☐ Nunca

22. Las áreas de manejo actúan como reservas para peces

☐ Si ☐ Para la mayoría ☐ No se ☐ Solo para algunos ☐ No

23. Derechos históricos sobre recursos son quebrados muchas veces al implementar áreas de manejo.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

24. Algunos sindicatos han sacado recursos de sitios de libre acceso para repoblar sus áreas en mas de una oportunidad.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

25. Las áreas de manejo han generado conflicto con otros sindicatos por el acceso a recursos.

☐ Si ☐ La mayoría de las veces ☐ No se ☐ Solo en algunos casos ☐ No

26. Debería haber un límite al número de áreas que son entregadas a los pescadores.

☐ Si ☐ En muchas regiones ☐ No se ☐ Solo en algunas regiones ☐ No

27. Bajo la legislación actual, los buzos están obligados a cambiar su oficio hacia la pesca.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

28. Las áreas de manejo han generado desigualdad entre sindicatos de buzos y pescadores o algueros.

☐ Si ☐ En muchas regiones ☐ No se ☐ Solo en algunas regiones ☐ No

29. Pronto no quedaran sitios de libre acceso o históricos donde se pueda bucear en Chile

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

30. Es importante ayudar a los pescadores jóvenes a mantenerse en el sector pesquero.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

31. Los pescadores artesanales deberían transformarse en micro empresarios que ganan su ingreso de la venta de recursos manejados por ellos mismos.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

32. Quienes no han sido históricamente buzo, debería permitírseles que tuvieran área de manejo

☐ Muy de acuerdo ☐ En acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

33. Los pescadores son actores sociales importantes en mi comunidad

☐ Si ☐ No se ☐ No

34. Es importante monitorear los niveles de producción de las áreas de manejo.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

35. Es importante mantener la actividad de buzo artesanal

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

36. Debería haber un límite al número de áreas de manejo que son entregadas en Chile.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

37. Los Buzos deberían tener preferencia al solicitar un área de manejo, por sobre los pescadores.

☐ Si ☐ La mayoría de las veces ☐ No se ☐ Solo en casos especiales ☐ No

38. Las áreas de manejo han limitado el trabajo de los buzos

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

39. Me gustaría renunciar a la pesca/ buceo / recolección de algas.

☐ Si ☐ No se ☐ No

40. Se debería incentivar a los jóvenes a entrar en la pesca artesanal

☐ Si ☐ No se ☐ No

41. Las áreas de manejo han hecho que los jóvenes encuentren más difícil la entrada a los sindicatos.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

42. Los pescadores en general disfrutamos del trabajo que hacemos

☐ Si ☐ No se ☐ No

43. Yo disfruto de la pesca artesanal

☐ Si ☐ No se ☐ No

44. Me gustaría trabajar en algo fuera del sector pesquero artesanal

☐ Si ☐ No se ☐ No

45. Me gustaría que mi hijo/ hija fuese también pescador artesanal

☐ Si ☐ No se ☐ No

46. Es importante para mi tener destrezas y habilidades para hacer cosas fuera del sector pesquero artesanal

☐ Si ☐ No se ☐ No

47. Los pescadores exitosos toman riesgos financieros

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

48. Al solicitar un área de manejo, el pescador debe estar dispuesto a pedir un préstamo para conseguir el capital necesario.

☐ Si ☐ La mayoría de las veces ☐ No se ☐ Solo en casos especiales ☐ No

49. El apoyo financiero del gobierno juega un papel crucial en el proceso de postulación a áreas de manejo en Chile.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

50. Estoy de acuerdo con la toma de riesgos en la pesca artesanal

☐ Si ☐ La mayoría de las veces ☐ No se ☐ Solo en casos especiales ☐ No

51. Las áreas de manejo son económicamente exitosas.

☐ Si ☐ La mayoría de las veces ☐ No se ☐ Solo en casos especiales ☐ No

52. Yo aumente mis ingresos significativamente desde la implementación de las áreas de manejo.

☐ Si ☐ No se ☐ No

53. Un aspecto importante, a la hora de poseer un área de manejo, es el apoyo que se recibe de organizaciones de gobierno.

☐ Si ☐ La mayoría de las áreas ☐ No se ☐ Solo en áreas especiales ☐ No

54. Los sindicatos que tienen áreas de manejo son envidiados por aquellos sin áreas.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

55. Un aspecto importante al tener un área de manejo, es la ganancia de poder político

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

56. Al poseer áreas de manejo, el sindicato incrementa su credibilidad frente a las autoridades.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

57. Las áreas de manejo funcionan bien bajo el marco legal actual

☐ Si ☐ La mayoría de las veces ☐ No se ☐ Solo en casos especiales ☐ No

58. Las áreas de manejo favorecen a todo el sector pesquero artesanal por igual, sean buzos, algueros o pescadores.

☐ Si ☐ La mayoría de las regiones ☐ No se ☐ Solo en regiones especiales ☐ No

59. Sernap debería ayudar más activamente a detener el ingreso ilegal a las áreas de manejo

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

60. Las áreas de manejo son la única alternativa para el manejo sustentable de recursos bentónicos

☐ Si ☐ La mayoría de las veces ☐ No se ☐ Solo en casos especiales ☐
No

61. Las áreas de manejo deberían considerarse solo como una fuente de ingreso adicional

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

62. Es preferible que se le entreguen préstamos a los pescadores artesanales, a que se le den subvenciones

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

63. Las áreas de manejo serian más exitosas si se pudiese hacer cultivos en ellas

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

64. La acuicultura debería permitirse en las áreas de manejo

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

65. Tener un área de manejo con una diversidad de recursos, es importante

☐ Si ☐ La mayoría de las veces ☐ No se ☐ Solo en casos especiales ☐
No

66. La ley contempla demasiados trámites para conseguir un área de manejo

☐ Si ☐ No se ☐ No

67. Las etapas a seguir para conseguir un área de manejo son fáciles de entender

☐ Si ☐ No se ☐ No

68. Actualmente hay mucho papeleo y burocracia en la pesca artesanal

☐ Si ☐ No se ☐ No

69. El reglamento de áreas de manejo no es muy claro

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

70. Es fácil postular a fondos y conseguir apoyo para hacer los ESBA

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

71. Es fácil postular a fondos y conseguir apoyo para hacer los estudios de seguimiento

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

72. La ley de pesca favorece a los pescadores industriales por sobre los artesanales

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

73. No hay una estrategia clara acerca de áreas de manejo en Chile.

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

74. Ni siquiera los consultores saben bien la cantidad de reglamentos de áreas de manejo

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

75. Las áreas de manejo han incrementado la explotación de las zonas de libre acceso

☐ Muy en acuerdo ☐ En Acuerdo ☐ No se ☐ En Desacuerdo ☐ Muy en Desacuerdo

76. ¿Discute el futuro de la pesca y las áreas de manejo con su familia?

☐ Siempre ☐ A veces ☐ Casi Nunca ☐ Nunca

77. Es importante respetar la opinión de otros pescadores de mi sindicato

☐ Siempre ☐ A veces ☐ Casi Nunca ☐ Nunca

78. La gente que me importa (hijos, familia) piensa que es importante que siga las reglas que impone mi sindicato y respete las fechas de cosecha.

☐ Siempre ☐ A veces ☐ Casi Nunca ☐ Nunca

79. La gente que me importa (hijos, familia) piensa que es importante que yo este involucrado en las áreas de manejo.

☐ Si ☐ No se ☐ No

80. Yo coopero con el área de manejo al igual que todos en mi sindicato

☐ Siempre ☐ A veces ☐ Casi Nunca ☐ Nunca

81. Pretendo seguir las regulaciones que impone mi sindicato

☐ Siempre ☐ A veces ☐ Casi Nunca ☐ Nunca

82. ¿Ha tomado medidas de conservación adicionales en su área de manejo?

☐ Si ☐ No se ☐ No

83. Creo que las regulaciones que impone mi sindicato son validas

☐ Siempre ☐ A veces ☐ Casi Nunca ☐ Nunca

84. ¿Es su ingreso suficiente para tener ahorros?

Si ☐ No ☐

Questionnaire Chapter 5**VENTA DE LOCOS**

Cargo en sindicato: _____

CASO

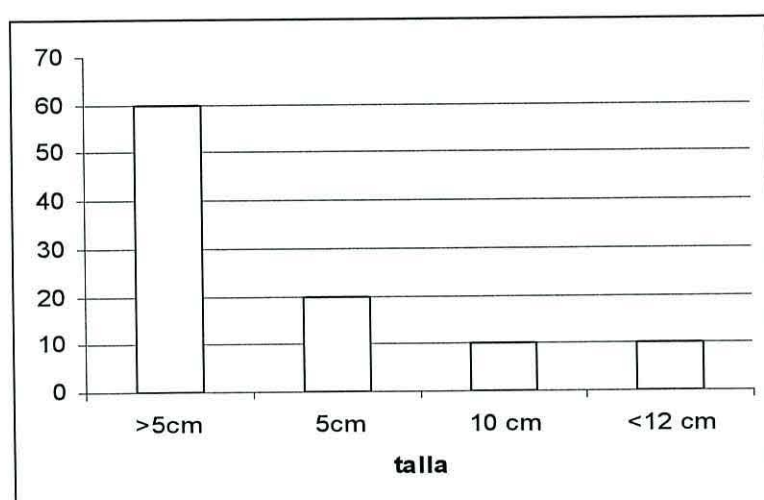
'Imagine que un comprador viene a verlo el primer día de la época de cosecha y le ofrece un precio por sus locos. Yo le diré el precio que el comprador le esta ofreciendo, también le diré la estructura de calibres de su área de manejo. Usted debe decirme si vendería a los precios que le ofrezco. Recuerde esto es solo un juego, pero trate de asumir que los otros factores son reales para tomar una decisión.

Cuota del Área de Manejo: _____

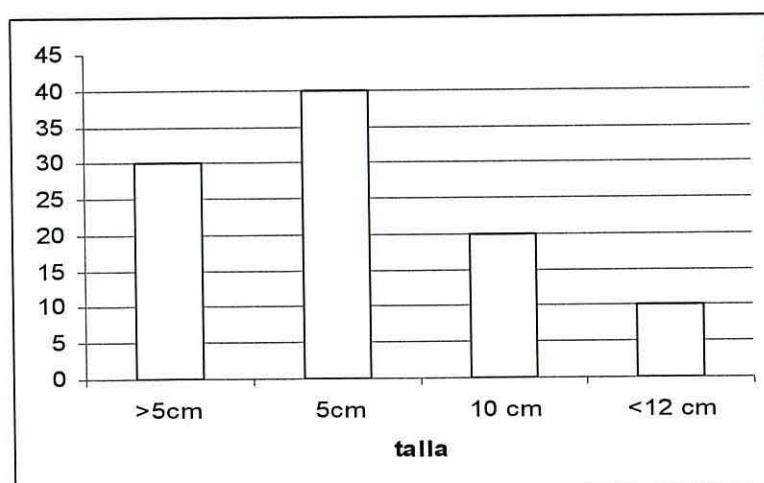
Numero de locos por kilo	Porcentaje de abundancia	Precio al que vendería el primer día.	¿Cuántos vendería?	Precio al que se comenzó la apuesta	Precio al que vendería el ultimo día	Cuántos vendería el ultimo día?
4-6	5%					
6.1-7	10%					
7.1-10	20%					
10.1-12	30%					
12.1-15	35%					

Numero de locos por kilo	Porcentaje de abundancia	Precio al que vendería el primer día.	¿Cuántos vendería?	Precio al que se comenzó la apuesta	Precio al que vendería el último día	Cuántos vendería el último día?
4-6	10%					
6.1-7	30%					
7.1-10	35%					
10.1-12	20%					
12.1-15	5%					

TALLAS POBLACION

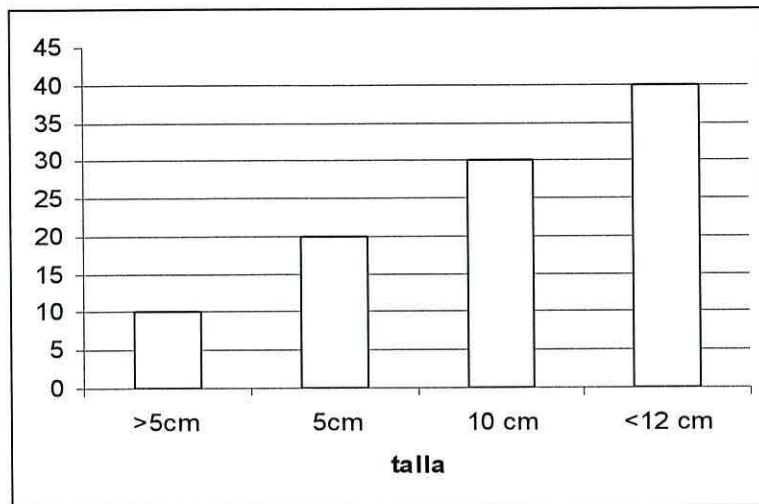


¿Que porcentaje de los Locos vendería?
 ¿A que precio?



¿Que porcentaje de los Locos vendería?

¿A que precio?



¿Que porcentaje de los Locos vendería?

¿A que precio?

Cuestionario: "Información básica".

1. Nombre
2. Edad
3. Sindicato
4. Dónde vive actualmente?
5. Dónde nació?
6. Cuanto tiempo ha vivido acá?
7. Cuantas personas componen su hogar, incluyéndolo a usted?
 - Hombres:
 - Niños:
 - Mujeres
8. Es miembro de la directiva del sindicato?
9. Ha postulado o sido miembro de la directiva del sindicato?
10. N° de personas que componen el sindicato
11. Que recursos (peses, mariscos, algas, leña ect) extrae?
12. Quien mas en su familia esta involucrado con el trabajo en el mar?

13. Si hay alguien mas, a que se dedican?

14. Es dueño de una embarcación?

15. Nivel de educación?

16. Cuantos días al mes pasa usted en el mar?

17. Como vende los recursos que extrae?

17. Cuantos días al mes pasa usted cuidando el área de manejo?

18. Que tan importante son los recursos bentonicos para su ingreso?

19. Como se describiría usted mismo? (marque cuantas alternativas estime convenientes)

-Buzo

-Pescador

-Recolector

-Pescador esporadico

-Buzo esporadico

-Ex -pescador

- o Ex -Buzo

-Dueño de embarcacion

-Dirigente

- Empresario pesquero

20. Que otras actividades realiza para aumentar sus ingresos?

21. Cuales son sus prioridades /preocupaciones en lo que a administración pesquera concierne?

22. Cuales son sus ingresos anuales provenientes de áreas de manejo?

23. Cuales son los costos para usted de tener un área de manejo durante un año?

24. En que etapa se encuentra el area?

Questionnaire Chapter 6

1. Deberían haber mas rutas de acceso a las zonas costeras en Chile

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

2. Los pescadores tienen el deber de conservar los recursos naturales para las próximas generaciones, independiente del impacto sobre las ganancias.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

3. Los recursos naturales solo deben ser valorados por su valor comercial.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

4. Mas allá de los ingresos, la mayor alegría del pescador/buzo es el estilo de vida.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

5. No es importante ayudar a sindicatos pequeños y pobres a mantenerse en la pesca.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

6. La conservación de recursos debe considerarse solo cuando Los objetivos económicos (de ingreso) han sido alcanzados.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

7. Mientras mas grande el sindicato mas apoyo tiene para implementar un área de manejo

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

8. Se esta haciendo suficiente para proteger y mejorar los ambientes marinos

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

9. Los pescadores artesanales deben tener el derecho de manejar el área de manejo como mejor estimen conveniente.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

10. Las áreas de manejo están cambiando el estilo de vida de Los pescadores.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

11. Derechos históricos sobre recursos son quebrados muchas veces al implementar áreas de manejo.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

12. Las tradiciones pesqueras y su cultura están obsoletas y no tienen lugar en las políticas pesqueras modernas.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

13. Sindicatos con áreas de manejo han sacado recursos de áreas históricas para repoblar sus propias áreas.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

14. Los pescadores que roban de las áreas de manejo deben ser castigados más severamente.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

15. Los mares de Chile están en mejores condiciones ambientales que hace 10 años.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

16. Los pescadores artesanales deben aumentar sus ganancias mejorando la calidad de sus recursos.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

17. Los recursos como minerales, bosques, combustibles y pesquerías deberían usarse lo menos posible.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

18. Tener altas ganancias de áreas de manejo es una señal de un buen sindicato.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

19. Mientras mas chico el sindicato la ganancia de áreas de manejo es mayor.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

20. Las áreas de manejo son una buena medida de administración pesquera.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

21. La regionalización ha ayudado a que los pescadores se organicen en sindicatos.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

22. Pronto no quedaran sitios históricos donde se pueda bucear

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

23. Bajo la legislación referente a áreas de manejo actual, los buzos mariscadores están siendo obligados a cambiar su oficio hacia la pesca.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

24. La ganancia de poder político frente a las autoridades son importantes ganancias de poseer un área de manejo.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

25. La regionalización favoreció a los pescadores y buzos artesanales de su localidad

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

Tiene algún comentario, pregunta acerca del cuestionario, o cree que algo importante no fue incluido?

Questionnaire Chapter 7

1. Las áreas de manejo funcionan bien bajo el marco legal actual.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

2. Las áreas de manejo traen beneficios a todo el sector pesquero artesanal (buzos, pescadores, recolectores).

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

3. Las áreas de manejo protegen Los recursos y ecosistemas bentónicos.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

4. Las áreas de manejo actúan como reservas y refugios para recursos.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

5. Las áreas de manejo han fomentado una mayor explotación de las zonas históricas.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

6. Debería existir un límite al número de áreas de manejo que son entregadas dentro de una misma región.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

7. Un factor importante de poseer una área de manejo es el apoyo que se recibe de organizaciones de gobierno (Subpesca, Sernapesca, Corfo, Sercotec ect.)

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

8. Es positivo que un sindicato y sus miembros tengan un área de manejo.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

9. L

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

10. Las áreas de manejo son la única alternativa para el manejo sustentable de recursos bentónicos.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

11. Los programas de financiamiento que ha proporcionado el gobierno han sido fundamentales para implementar las áreas de manejo en Chile.

En desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

12. Los pescadores tienen el deber de conservar los recursos naturales para las próximas generaciones, independiente del impacto sobre las ganancias.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

13. Los recursos naturales solo deben ser valorados por su valor comercial.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

14. Mas allá de los ingresos, la mayor alegría del pescador/buzo es el estilo de vida.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

15. La conservación de recursos debe considerarse solo cuando Los objetivos económicos (de ingreso) han sido alcanzados.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

16. Se esta haciendo suficiente para proteger y mejorar los ambientes marinos

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

17. Los pescadores artesanales deben tener el derecho de manejar el área de manejo como mejor estimen conveniente.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

18. Las áreas de manejo están cambiando el estilo de vida de Los pescadores.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

19. Derechos históricos sobre recursos son quebrados muchas veces al implementar áreas de manejo.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

20. Los mares de Chile están en mejores condiciones ambientales que hace 10 años.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

21. Los pescadores artesanales deben aumentar sus ganancias mejorando la calidad de sus recursos.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

22. Los recursos como minerales, bosques, combustibles y pesquerías deberían usarse lo menos posible.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

23. Income from MEABR should be distributed equitably within the syndicate.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

24. Pronto no quedaran sitios históricos donde se pueda bucear

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

25. La ganancia de poder político frente a las autoridades son importantes ganancias de poseer un área de manejo.

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

26. Los ingresos de areas de manejo se reparten equitativamente en mi sindicato

En Desacuerdo	1	2	3	4	5	En Acuerdo
---------------	---	---	---	---	---	------------

Preguntas Generales

Es Buzo?

¿Ha sido dirigente del sindicato?

Sexo:

Rango de edad

su nivel de estudios

¿Cuanta gente vive en su hogar?

Adultos

Niños

Cuántas generaciones de pescadores ha habido en su familia?

¿Es dueño de la casa en que vive?

¿Cual es su ingreso mensual promedio?

¿Cual es la principal actividad que realiza para mantener a su familia día a día?

Cual es la principal actividad pesquera suya?

¿Que otras actividades, fuera de la pesca artesanal, realiza para aumentar sus ingresos?

Cuántas otras actividades realiza?

Que tan importante es la pesca artesanal para sus ingresos durante el año?

Que tan importante es la pesca artesanal para sus ingresos durante el VERANO?

Es dueño de sus artes de pesca?

¿Pertenece a alguna otra organización comunal?

A cuántas otras organizaciones pertenece?

Como se definiría?

Cree que las parcelas son un buen sistema?

Cree que las AMERB estan cambiando el estilo de vida de los pescadores?

INGRESOS (% o bruto)								
MES	Pesc a	Buceo	Recolecció n	Contrato	Agricultura	Animales	A. MANEJO	TOTAL
ENERO								
FEBRERO								
MARZO								
ABRIL								
MAYO								
JUNIO								
JULIO								
AGOSTO								
SEPT.								
OCTUBR E								
NOV.								
DIC.								

Appendix 2

This appendix shows that the results of 226 face to face questionnaires with fishers from 10 different fishing syndicates in Chile follow a similar trend to those described in Chapter 3. Differences in attitudes between syndicates were observed ($R = 0.45$, $p < 0.05$) and the questions which accounted for this difference can be attributed to 2 sets of concern; a) those related to co-management policy benefits and b) those related to conflict and problems with the policy (Table A1).

Table A1. Statements which accounted for the largest differences between syndicates*.

Statement	Subset of concern
- Gaining political power and accountability are important factors of applying for a MEABR.	Co-management policy benefits
- An important aspect of having a MEABR is the support you get from government	Co-management policy benefits
- I am generally satisfied with the fact that my syndicate has a MEABR	Co-management policy benefits
- It is important for me to have a MEABR	Co-management policy benefits
- The main reason for having a MEABR is to increase my income	Co-management policy benefits
- MEABRs are economically successful	Co-management policy benefits
- Historical rights over resources are broken with the implementation of MEABR.	Conflict and Problems with policy
- MEABR creates conflict with other syndicates for access to resources.	Conflict and Problems with policy
- I think the harvesting regulations imposed by my syndicate are valid/fair	Conflict and Problems with policy
- I would like to work in something other than artisanal fisheries to increase my income	Conflict and Problems with policy
- I am worried about the fact that there will soon be no open access sites left where to dive.	Conflict and Problems with policy

* Questions were identified using SIMPER function in P.R.I.M.E.R

Subsets of concern were correlated to socio-demographic and MEABR variables through the BIOENV programme. The results of this analysis revealed that both subsets of concern related significantly to variables which represent aspects of fishers' livelihoods (Table A2).

Table A2. Variables that had the best correlation with fishers' specific attitudes towards identified sets of concern (n=226).

Fishers responses	Contextual variables that best correlated to fishers' responses	Spearman correlation (ρ)	P
Co-management and MEABR benefits	Exclusiveness of diving for livelihoods On-sector pluriactivity	0.30	<0.05
Conflict and problems with the policy	Ownership of boat Off-sector pluriactivity	0.411	<0.05

These results support the conclusions espoused in Chapter 3 concerning the 'co-management and MEABR benefits' and 'conflicts and problems with the policy' subsets of concern. Detailed results concerning the environmental subset of concerns which was proposed in Chapter 3 are not presented in this appendix but have been written up as Chapter 4.