# A SOCIAL RELATIONAL APPROACH TO THE CONSERVATION AND MANAGEMENT OF FISHERIES: THE RURAL COMMUNITIES OF THE LORETO BAY NATIONAL MARINE PARK, BCS, MEXICO

by

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# ABSTRACT

This dissertation uses a social relational approach to investigate the conditions under which resource users from seven rural coastal communities cooperate to access fish resources within and outside the limits of the Loreto Bay National Marine Park, Baja California Sur, Mexico. I use social network analysis methods to quantify the extent to which socially diverse and geographically distant individuals share information on the state/location of fish resources and fisheries regulations. The main findings are as follows:

(1) Information sharing is widespread within communities and, to a lesser extent, among communities, despite the over-exploited condition of fish resources.

(2) Information sharing is embedded in kinship, friendship, and acquaintance relations, which ensure the social integration of fishery resource users across social categories (e.g., locality and occupation) and geographically distant localities. However, these categories reflected different degrees of social stratification.

(3) Occupation, years of fishing experience, and years of residence account for the importance of resource users in the network of information sharing. However, these three variables do not always predict the most important resource users within each community.

(4) The social networks of information sharing have manifest (access to fishery resources) and latent (social integration) functions. These networks also have logically related functions: the internal function ($F_1$) is social and emotional support; the external function ($F_2$) or role is social integration; and the total function ($F_3 = F_1 + F_2$) is achieving

group tasks (i.e., accessing fishery resources). From a local perspective (perceived by network members) social networks are valuable ($F_4$) but from a global perspective (perceived by management authorities) they may be regarded as dysfunctional (i.e., the cause of overfishing).

I argue that the inherent social and emotional condition of individuals on which social networks of information sharing are based, is a powerful resource often neglected by the most influential theories and participatory policies for conservation and management of fishery resources. Thus, effectively tapping into these social networks for conservation and sustainable management of fishery resources in the Loreto Bay National Marine Park may require managers with long-term commitments to their conservation areas and socially and emotionally engaged managers.

**Keywords:** Social relational approach; Loreto Marine Park; Social networks; People-oriented conservation; Fisheries; Human cooperation.

**Subject Terms:** Protected areas -- Management; Protected areas -- Planning; Fisheries management -- Political participation; Fisheries management -- Social aspects

*To Wendy, Emi and Nico*

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# PREFACE

Fisheries are notoriously competitive, or so they seem because fish resources are often heterogeneously distributed and their abundance is hard to forecast, effectively defying their exclusive use, conservation, and management. Fisher folk, however, often cooperate with each other by sharing information on the location of fish resources to deal with the uncertainties and risks inherent in the use of these resources. Fisher folk derive mutual benefit from information sharing, which an economic framework based on rational self-interest seems capable of explaining. Information sharing, however, is not homogeneous and rational self-interest cannot explain why fisher folk would share information on a resource that has been extensively over-exploited. Such is the case with the fisheries system of the Loreto area that has been characterized by a weak regulatory regime, high resource-dependent livelihoods, weak development of social organization, extreme poverty, and signs of over-exploitation of extensive fishery resources. Paradoxically, fisher folk from the Loreto area rely on social networks of information sharing for accessing fishery resources beyond any reasonable account based on rational self-interest alone.

This dissertation is an inquiry into the conditions under which fishery resource users from seven rural coastal communities share information to access fishery resources inside and outside the limits of the Loreto Bay National Marine Park, Baja California Sur, Mexico. My particular interest in the Loreto Bay National Marine Park began in 1999 with the possibility of developing my PhD dissertation as part of a major multi-disciplinary project to study the social and ecological conditions affecting the use and conservation of marine resources in the park. For a better or for worse the project did not

secure the necessary funding but the case of the Loreto Park caught my attention because it had been portrayed as a model for community-based conservation. Yet the local communities have not developed their own institutions to control the access and use of fishery resources, and government fisheries institutions have failed to prevent resource degradation – the familiar tragedy of open-access situation that many scholars have used to describe the degradation of fishery resources by fishers competing to extract the last fish from the oceans. Paradoxically, cooperation rather than competition seems to characterize the access to fishery resources in the Loreto area. Why would fisher folk cooperate rather than compete as the open-access model would predict? Under what conditions are fishers more likely to engage in information sharing with others? What mechanism(s) underpins such cooperative behaviour? Would it be possible to use the same mechanisms driving this cooperative behaviour to address collective-action problems such as the conservation and management of fishery resources in the Loreto area? Of course, while I consider these important questions, others interested parties could not quite understand, or were suspicious of, my interest in the fishing communities of the Loreto area. During the first visit of my research, a federal resource manager who wondered about my interest in the area asked me, "Why do you want to study fisheries in Loreto that have low production and economic impact? In the North Pacific we have the most productive and highest economic value fisheries in the state". A fisher commented, "Are you one of those who want to change the world?"

I had my own reservations too, not so much about my personal motivations to focus my research on the fishing communities of Loreto, but for a conception of human cooperation as individuals whose interests have been brought in line by institutionalized incentives. Instead, I found a social relational view that conceives the nature and constitution of human cooperation as socially embedded to be more persuasive. In many

ways, a philosophical tension between individualism and social relationalism about the nature and constitution of social systems is a theme that runs throughout my dissertation. To be sure, the social relational approach I used to develop my dissertation cannot answer the fundamental question of what motivates people to cooperate. However, no single scientific discipline can provide all the answers. Social neuroscientists and cognitive neuropsychologists have found that our brains are attuned to read our social world not as an isolated computer-like processor of information but as an organ that has evolved to read and support human emotions. Ironically, the most influential models of human cooperation for conservation and management of natural resources have notoriously neglected human emotions. Indeed, the question is not under what conditions self-interested individuals find it rational to cooperate, but rather under what conditions inherently cooperative human beings decide to follow their self-interest.

Fernando Jordán's 1951 biographical book "The Other Mexico. Biography of Baja California" begins: [T]here are disconcerted books, and books that disconcert you. This is not the former nor pretends to be the latter. However, I can assure you without shame that it originated in a disconcerting feeling. In a disconcerting feeling and…in a feeling of love. No more, no less" (Jordán 2001: 63). My interest in the Loreto area evolved amidst mixed feelings about the coastal communities of the Loreto area. Today, I do not have regrets that I decided to conduct my research in an area considered unimportant from an economic perspective, or feel troubled by my hope to elicit change with my dissertation. Indeed, I hope that my dissertation brings credit to the cooperative capacity of the fishers from the Loreto area and underscores the potential contribution that fisher folk could make to reconcile conservation and sustainable use of fishery resources.

Saudiel Ramirez-Sanchez
Ottawa, Ontario, February 2007

# CHAPTER 1
# INTRODUCTION

Finding cooperative solutions for the protection and sustainable use of marine resources through people-oriented parks are both a necessity and a frustration in the developing world. The record of people-oriented parks in developing countries has been mixed and many in the international conservation community tend to regard their performance as a failure, given that the decline in biological diversity continues (see reviews by Adams et al. 2004, Brechin et al. 2002, Wilshusen et al. 2002). While Wilshusen et al. (2002: 28) acknowledge this failure in the so-called "Integrated Conservation and Development Projects", they indicate that this is because such programs rely on a number of tenuous assumptions about human behaviour – e.g., individuals respond mainly to economic incentives. Empirical evidence from community-based conservation and decentralized resource management suggests that economic, cultural, and political processes are interconnected rather than being separate realms in the conservation and use of natural resources (Ghimire and Pimbert 1997, Guénette et al. 2000, Logan and Moseley 2002, Singleton 1998, Wells et al. 1992). The understanding of these processes as interconnected has existed in anthropology since the seminal work of Malinowski in the 1920s. Thus, a better understanding of how diverse and interconnected economic, political, and cultural processes constrain and enable people's livelihoods and conservation efforts may stimulate more comprehensive approaches to ensure effective people-oriented parks.

This dissertation uses the social relational approach as developed in sociology (Emirbayer 1997) to investigate the conditions under which resource users from seven rural coastal communities access and use fishery resources within and outside the limits of the Loreto Bay National Marine Park, Baja California Sur, Mexico. In particular, I focus on the extent to which socially diverse and geographically distant individuals cooperate by sharing information on the state/location of fishery resources and institutional context. The main assumption of my research is that sharing of information is an important form of cooperation in which resource users seek trustworthy information to help them decide where and when to fish. My thesis is that the access and use of fish resources occurs as part of social networks that transcend social affiliations (economic, political, and cultural) and geographical boundaries.

The Loreto Bay National Marine Park was conceived as a people-oriented park where protection and sustainable use of marine resources were to be achieved collaboratively with local communities. There have been advancements towards these goals since the park was created, but the fisheries management system in the Loreto area is still characterized by a weak regulatory regime, high resource-dependent livelihoods, weak development of social organization, extreme poverty, and signs of over-exploitation of extensive fishery resources. These conditions characterize some of the most challenging situations for biological conservation and represent some of the major issues taken up by the social global development agenda articulated after World War II (Escobar 1995, Esteva 1992, Ghimire and Pimbert 1997, Kellert et al. 2000).

## 1.1 Implementing a People-Oriented Approach in the Loreto Bay National Marine Park

A widespread perception in academic and practitioner circles interested in people-oriented approaches to conservation was that the Loreto Bay National Marine Park was a community-based conservation initiative (Breunig 2006, Hyun 2005). Such condensed account simplifies the multiple factors involved in the park's creation such as Mexican policies and networks of local, national and international actors (Breunig 2006). My findings were consistent with those of Breunig that this is a misperception of the origins of the park. For instance, during my first visit to the area in 2001 I found that many commercial fishers became aware of the existence of the park until researchers from the Universidad Autónoma de Baja California Sur conducted research on fishers' ecological knowledge to draft the management plan of the park. When fishers discover that their knowledge had been used to propose strict conservation areas or "no-take zones" for the zoning of the park, many fishermen felt betrayed and suspicious of researchers, park managers, and in general the idea of conservation.

I had to conceive the focus and scope of my research in this context of distrust of researchers and suspicion about anything that had to do with conservation. For this reason, I decided to concentrate on the conditions under which resource users cooperate by sharing information for accessing and using fish resources inside and outside of the limits of the park. This seemingly unimportant topic for fisheries conservation is a powerful indicator for investigating the conditions under which fisher folk cooperate to achieve supra-individual goals. In general, the conditions under which humans decide to engage in cooperation remains controversial but their identification remains critical for implementing a people-oriented approach to conservation.

## 1.2 The Challenge of Cooperation: Models of Human Behaviour

What motivates people to engage in cooperative behaviour? Under the rubric of social dilemmas, cooperative behaviour has been framed as a conflict between the private interests of individuals and the interests of the collective (Van Vugt et al. 2000). There is, however, no consensus among social scientists on the mechanisms and conditions that turn this basic conflict into cooperative outcomes. Biel (2000: 25) suggests that "at the heart of research on social dilemmas lies the question of human nature: are we selfish creatures or do we act for the benefit of the common good?" The quest for the *true* human nature can be traced back to the writings of moral and political philosophers of the 17th and 18th centuries (Hirschman 1977). Nowadays, the rational-choice and norm-following models of human behaviour appear to be the main contrasting views in the social sciences (Checkel 2001, Emirbayer 1997). Seemingly representing opposite views, these models converge in one important aspect: their neglect of the ongoing structures of social relations in human action (Granovetter 1985). In particular, Granovetter (1985) characterizes the rational-choice model as an "under-socialized" or an atomized-actor conception and the norm-following model as an "over-socialized" one.

On the one hand, in the under-socialized view individuals are detached from their social relations, for example, as a necessary condition for perfectly competitive markets. On the other hand, in the over-socialized view individuals acquire cultural habits, customs, and norms that are followed automatically or mechanically as some sort of "latent variable" (DiMaggio 1997, Granovetter 1985). In the final analysis, ironically, both "have in common a conception of action and decision carried out by atomized actors"; either individuals act in pursuit of their self-interest or they enact internalized

behavioural patterns (Granovetter 1985: 485). The fact that both forms converge by focusing on individuals attests to the various shades that ontological and methodological individualism can take despite the seemingly apparent differences (Bunge 2003, Udehn 2002). It is also this convergence that directs Emirbayer (1997) to conceive rational-choice and norm-following models of human behaviour as essentially the same and separate them from relational forms of thinking in the social sciences.

## 1.3 A Relational Conception of Human Action

The relational conception of human action and social life has recently been articulated in the theoretical movement called relational sociology (Emirbayer 1997). Relational sociology's main thesis is that human action unfolds through, and, as part of, relations among actors and not by independent self-contained interacting individuals. Such a conception resembles the more familiar phenomenon of social embedding, which focuses on how human action is channelled (constrained or enabled) and constituted by social relations (Emirbayer 1997, Schweizer 1997).

How social relations channel human affairs is one of the classic questions in social science, but it is broadly believed that the level of social embedding is strong in non-market societies and has significantly decreased with modernization (Coleman 1993, Polanyi 1967, Scott 1976). The social embedded/dis-embedded characterization has been shown to be untenable and unhelpful when trying to explain, for instance, economic action using standard economic theories that neglect social relations (Granovetter 1974, 1985). One way to systemically analyze the enabling and constraining effect of social relations in human affairs is through the application of methods developed by social network analysts (Burt 1980, Freeman et al. 1978, Wasserman and Faust 1999, Wolfe

1978). The methods of social network analysis are diverse in their methodological assumptions and do not follow a unitary theory or a single definition of a social network, yet the emphasis of all methods is on relational attributes (Burt 1980, Emirbayer and Goodwin 1994, Tindall and Wellman 2001). Social network analysis focuses not only on the immediate effect of social relations in human action but also on the structural emergent properties grounded in such relations (Schweizer 1997). The applications of the research on social networks are increasing and, in general, the idea of networks as an organizing principle of human affairs is obtaining recognition (Benz and Furst 2002, Henry et al. 2004, Podolny and Page 1998, Tindall and Wellman 2001).

How social relations and human agency interrelate has been a far less prominent aspect by network analysts (Emirbayer 1997, Emirbayer and Goodwin 1994). And yet its most important implication is that if social relations are constitutive of *all* social behaviour, it is not necessary to adopt an oppositional view to elucidate individual-collective, agency-structure linkages. The methodological implication of a relational view is that social facts cannot be analyzed or explained through human actions independent of the structure of social relations[1]. This philosophical principle can produce diametrically different economic, political, and cultural theories that not only could enrich our understanding of social facts but also may suggest different moral principles guiding the policies for addressing socio-technological problems such as the protection and management of natural resources.

[1] A social fact is a state or a change of state of a social system. Thus, there ere are no social facts outside or above social systems (Bunge 1996).

## 1.4 Protecting and Managing the Commons: The Distinction between Self-Governance and Open Access

Based on the concept of individual rationality, Garret Hardin's tragedy of the commons model demonstrated that if individuals use the commons following their individual rational self-interest, then the commons inevitably are degraded (Hardin 1968). Hardin explained that in a commons, greater benefits accrue only to individuals who increase their takings, while all individuals share the costs. In the absence of external or communally-imposed constraints, self-interested individuals degrade the commons. According to Hardin's model, privatizing the commons or state control are the most effective mechanisms to solve this dilemma. The tragedy of the commons is a simple yet powerful model of resource degradation that in the past 30 years has inspired a plethora of studies by a diverse collection of scholars (Fenny et al. 1990, Fenny et al. 1996, Klooster 2000). These studies have documented a large number of cases in which local groups have adopted social practices that successfully conserve and manage common-pool resources such as fisheries, forests, rangelands, and irrigation systems (Acheson 1981, Dyer and McGoodwin 1994, Fenny et al. 1990, Ostrom 1990, Pinkerton and Weinstein 1995)[2]. Although, local groups have not always succeeded in conserving and managing the commons, neither have private or state ownership as suggested by Hardin (Dietz et al. 2003).

Indeed, elucidating the conditions that promote social cooperation to protect and manage common-pool resources (CPRs) or the commons has been one of the most challenging and controversial issues in environmental and natural resource management

[2] A common-pool resource is broadly defined as "a valued natural or human-made resource or facility that is available to more than one person and subject to degradation as a result of over-use" (Dietz et al. 2002: 18).

(Dietz et al. 2002). Currently, the institutional choice school of thought is the most influential view on the evolution and survival of the social systems of common-pool resources (Dietz et al. 2002, Klooster 2000, Ostrom 1990). Adopting a model of individual rationality, institutional choice scholars indicate that unless common-pool resource users develop social institutions or rules to regulate access and exclude others, individuals will find it rational to over-use common-pool resources because they have no incentives for investing in their conservation and management (Ostrom 1990, Dietz et al. 2002). Thus, these scholars make the distinction between self-governing and open-access regimes. In the former, internally enforced rules harness individual rationality to the collective good. In the latter, the degradation of common-pool resources is likely to occur as predicted by Garret Hardin's model (Ostrom et al. 1994).

The distinction between self-governing and open-access regimes of the institutional choice school focuses primarily on individual interests and social institutions or rules. Thus, Agrawal and Gibson (1999: 636) argue that human communities and their interactions with their natural resources could be better understood if greater attention was given to "the multiple actors with multiple interests that make up communities, the processes through which these actors interrelate, and, especially, the institutional arrangements that structure their interactions". The institutional choice school has been criticized because this school reduces political, cultural, and economic issues to a calculus of costs and benefits by rational individuals (Jentoft 2000a, Klooster 2000, Mansfield 2001, McCay and Jentoft 1998). In spite of this objection raised by social scientists, the distinction between self-governing and open-access regimes has become a widely accepted framework for researchers, policy makers, and practitioners to

understand the current ecological and social crisis of common-pool resources (Dietz et al. 2003).

### 1.4.1 The Crisis in the World's Small-Scale Fisheries

Some estimates indicate that of the more than 51 million fishers in the world, over 99 % are small-scale fishers, of which 95% live in the so-called developing countries (Berkes et al. 2001). Furthermore, approximately a billion people, mostly in developing countries, depend on fish for their prime source of protein (WRI 2001), and some 150 million people in developing countries are associated with the fishery sector in marketing, boat building, gear making, and bait (Berkes et al. 2001). These estimates highlight the important role that small-scale fisheries have as source of food, income, and livelihood, especially in developing countries. Yet, many of the coastal fishing communities around the world are increasingly in social, economic, and political distress (Charles 2001, Durrenberger and King 2000, WRI 2001). Above all, it is hard to sustain fishing communities without healthy fish stocks. Many of the world's marine fisheries (60%) have reached their maximum exploitation level (mature) or are showing declining yields (senescent) as noted by the Food and Agricultural Organization in 1997 (Charles 2001). There appears to be also a global tendency for a composition shift away from top predators toward smaller pelagic species – the "fishing down the food web" idea (Pauly et al. 1998). Habitat destruction and pollution have also contributed to the decline of fish stocks worldwide (Duda and Sherman 2002). Global warming will affect oceanic environmental conditions that are known to affect the resilience of fish stocks (Gewin 2004).

There are also other important factors that have contributed to the crisis of the small-scale fisheries, some of these include: (1) inadequate scientific models for tropical multi-specific fish stocks (Berkes et al. 2001); (2) poorly formulated policies for developing and modernizing small-scale fisheries (Davis 1991 ); (3) a persistent neglect in favour of high economic value and industrial fisheries (Pinkerton and Weinstein 1995); (4) inter-sectoral conflicts and competition such as small-scale vs. industrial fisheries and sport vs. commercial fisheries (Pinkerton and Weinstein 1995); and more recently, (5) displacement of traditional fishing areas and landing sites by tourism/recreation, residential and industrial development, and creation of marine protected areas (Berkes et al. 2001).

Despite the list of contributory factors to the ecological and social crisis in the small-scale fisheries, it is the dominant view that the root of the current crisis in the world's fisheries is that many fisheries are or have become "open access" (Aguilar-Ibarra et al. 2000, Caddy and Cochrane 2001, Garcia et al. 1999, Mansfield 2001, Thorpe et al. 2000). Indeed, the distinction between self-governing and open-access regimes has been a powerful framework for researchers, policy makers, and practitioners to understand the current ecological and social crisis in the world fisheries at local, regional, and global scales.

### 1.4.2 Addressing the Crisis: Policies for Conservation and Sustainable Resource Use

It is now widely accepted that conservation and resource management policies are distinctively social and should not be independent of sound social and ecological scientific knowledge if they are to be effective (Brechin et al. 2002, Gewin 2004, Mascia

et al. 2003). However, scientific and expert advice often fails to recognize the moral and ideological underpinnings of their recommendations (Ludwig 2001). Yet these moral and ideological principles not only determine the direction of such policies, they reflect what we want to become as individuals and society.

The distinction between self-governing and open-access regimes has been the most influential conceptual framework in the policy debate on the protection and management of fishery resources. In this framework, the state, market and self-governance regimes are the main institutional options (Durrenberger and King 2000). The poor record of the state in managing natural resources, however, continues to re-define its role from an all-powerful management institution to a partner or a more or less enabling agent of market and self-governance institutional frameworks. Currently, thus, the market and self-governance regimes are the most important contrasting policies under debate (Christy 1996, Durrenberger and King 2000, Ostrom 1999).

Ironically, the individualism inherent in the self-governing and open-access regimes equally supports the market and self-governance institutional frameworks. On the one hand, scholars of the commons argue that local groups have developed or are capable of crafting rules to promote cooperative solutions to the exclusion/access and subtractability/use problems of the commons (Ostrom 1990, 1992, 1999). On the other hand, the increasing number of over-exploited fisheries worldwide has been interpreted as tragedies of open access caused by self-interested individuals whose destructive economic rationality can be positively channelled by instituting the right market incentives – especially clear property rights (Christy 1996). Thus, in the commons part of the dichotomy it is the individuals coordinated through the *right* rules of the game that

find it rational to cooperate to address the exclusion and subtractability problems. In the open-access counterpart, the individuals' rationality can lead to conservation and sustainable resource use through well-defined property rights where the commons become private property.

Consistent with their focus on individuals, both the market and dominant self-governance policy recommendations converged by adopting an individualistic moral principle as articulated in social and political pluralism of modern democracies – i.e., the affirmation of the diversity of interests and beliefs of individuals. Pluralists construct the social order as an aggregate of individual values and preferences, and they believe that the solution to social problems should focus on the role of individuals and their values (Sunderlin 1995). In natural resource management and conservation the adoption of political pluralism articulates the social as an aggregate of individuals, their beliefs and interests.

### 1.4.3 Social Perspectives in Fisheries Management

I have so far argued that the fisheries theoretical and policy views have been dominated by the institutional choice school of thought and its distinction between self-governing and open-access regimes. Yet, the commons scholarship has also been carried out by social scientists who emphasize the socially embedded nature of individuals (Acheson 1981, Clay and McGoodwin 1995, Jentoft 2000a, Klooster 2000, Malinowski 1922, McCay and Jentoft 1998, Pinkerton and Weinstein 1995, Symes 1996). Importantly, these scholars reject, or at least suspect, the reducibility of greater wholes to individual properties. For instance, institutional choice theorists find their model of rationality superior to Hardin's individual rationality model because it incorporates moral and

cultural factors (Ostrom 1999). Yet other social scientists have criticized this rationality model not because it incorporates cultural and moral issues in individual choices but because it reduces these issues to a calculation of costs and benefits (Jentoft 2000a, Klooster 2000, Mansfield 2001, McCay and Jentoft 1998).

Therefore, these scholars argue that social institutions, conflict, cooperation, and legitimacy are key emergent properties of social systems involving common-pool resources that cannot be reduced to individual attributes (Jentoft 2000a, Klooster 2000, McCay and Jentoft 1998). This view rejects the idea that aggregating individual choices amounts to an emergent property, let alone a social system. This is what is known as the fallacy of composition or the idea that what holds for the part is true for the whole (Bunge 2003). In other words, "an aggregation of private virtues can result in a state that is everything but virtuous" (Hirschman 1977: 119). This is not a methodological paradox but an ontological condition. This much was demonstrated by Garret Hardin's (1968) tragedy of the commons model: i.e., aggregating choices of self-interested individuals do not amount to the common good.

Furthermore, social scientists have argued that sustainable fisheries depend not only on abundant fish stocks but also on viable and socially integrated communities (Dyer and McGoodwin 1994, Jentoft 2000a, McCay 2000). The social scientists' argument about the socially embedded nature of individuals and irreducible nature of social facts has in part been less prominent in policies for the conservation and management of fishery resources because social scientists conceptions fail to explain the cause of emergent social features or effectively articulate their effect on natural resource use (Agrawal and Gibson 1999). Using a social relational approach, my discussion of

how the structure of social relations affects the access and use of fishery resources attempts to strengthen the arguments made by social scientists on the socially embedded nature of individuals and irreducible ontological condition of social facts.

## 1.5 The Contrasting Conceptual Systems

My conceptual objective is to bring to the fore a social relational perspective for analyzing the access and use of fishery resources as an effort to unite micro (individual) and macro (structure) concerns. I contrast the social relation view with the institutional choice school of thought because, as I have explained, it is the most popular view in the protection and management of the commons or commonly held extensive resources such as fisheries.

Therefore, at the heart of my dissertation there are two contrasting conceptual views on the nature of and proper way to study society and social cooperation for the conservation and management of CPRs: institutional individualism and social relationalism. Furthermore, each of these *isms* entails moral principles that are key features of the social policies that each would prescribe.

Institutional individualism is the philosophical view adopted by the institutional school to articulate the distinction between the self-governing and open-access regimes. The implicit principles adopted by institutional individualists in the study of society and social cooperation for the conservation and management of CPRs can be summarized as follows.

1. **Ontological** – social groups (from society to communities) are an aggregate of persons and social cooperation is a by-product of mutually agreed upon conventions ruling individual behaviour.

2. **Epistemological** – the proper topic of the commons and social cooperation is the interaction of multiple actors and their interests as structured by institutional arrangements.
3. **Moral** – individuals are maximally valuable and an institution's legitimate function is the reconciliation of the plurality of individual interests and beliefs.

In my dissertation, I take a social relational philosophical view (Bunge 1996, Emirbayer 1997), which can be summarized in the following principles.

1. **Ontological** – society is a dynamic system composed of cultural, economic, and political subsystems with resultant and emergent properties. Social facts such as cooperation are relational, although grounded in individual actions.
2. **Epistemological** – social facts are to be accounted for in terms of social systems and their individual components in their natural and social environment. Individual behaviour is to be accounted for in terms of all relevant features, biological, psychological, and social or the individual-in-society: i.e., individuals are connected *parts* rather than just *elements* of higher level entities or social systems.
3. **Moral** – All individuals can be valuable, but the more valuable ones are the ones who give useful service to others. The only legitimate function of any social system is to promote the well-being of its members or those of other social systems.

From this social relational perspective I submit that the study of the commons refers to the shared use of valued resources by at least two individuals embedded in social systems that consist of political, cultural, and economic sub-systems. Accordingly, I propose the following programmatic hypothesis for the study of the two fundamental problems in the conservation and management of the commons, exclusion/access and subtractability/use: the shared access and use of valued resources is a subset of the social, political, and cultural relations among individuals who comprise social systems.

## 1.6 Thesis and Research Agenda

My thesis is that resource users engage in multiple communicative social networks for accessing and using extensive fishery resources inside and outside the Loreto Bay National Marine Park. These social networks transcend social affiliations (economic,

political, and cultural) and geopolitical boundaries, supporting the contention that social life is organized through social categories but motivated by the social relations in which actors are embedded. The social networks of information sharing have manifest (access to fishery resources) and latent (social integration) functions. These networks also have logically related functions: the internal function ($F_1$) is social and emotional support; the external function ($F_2$) or role is social integration; and the total function ($F_3 = F_1 + F_2$) is achieving group tasks (i.e., accessing fishery resources). From a local perspective (perceived by network members) social networks are valuable ($F_4$) but from a global perspective (perceived by management authorities) they may be regarded as dysfunctional (i.e., the cause of overfishing).

The empirical content of my investigation is derived from fieldwork in 2002, 2003-2004, and 2005. I analyze various individual attributes (e.g., fishing experience, occupation, etc.) to determine the degree of social diversity within and among resource users from seven rural coastal communities adjacent to the Loreto Bay National Marine Park. I use as an indicator of cooperation the sharing of information about resources where resource users seek trustworthy information to help them decide where and when to fish. I also include, where relevant, my personal observations and informal interviews with resource users, park managers, and government officials during my visits to the area. The two contrasting conceptual systems, programmatic hypothesis, thesis and hypotheses delimit the scope of my research, which explores the social conditions under which heterogeneous groups and geographically distant resource users from seven rural coastal communities cooperate for accessing and using fishery resources within and outside the Loreto Bay National Marine Park, Baja California Sur, Mexico (Figure 1.1).

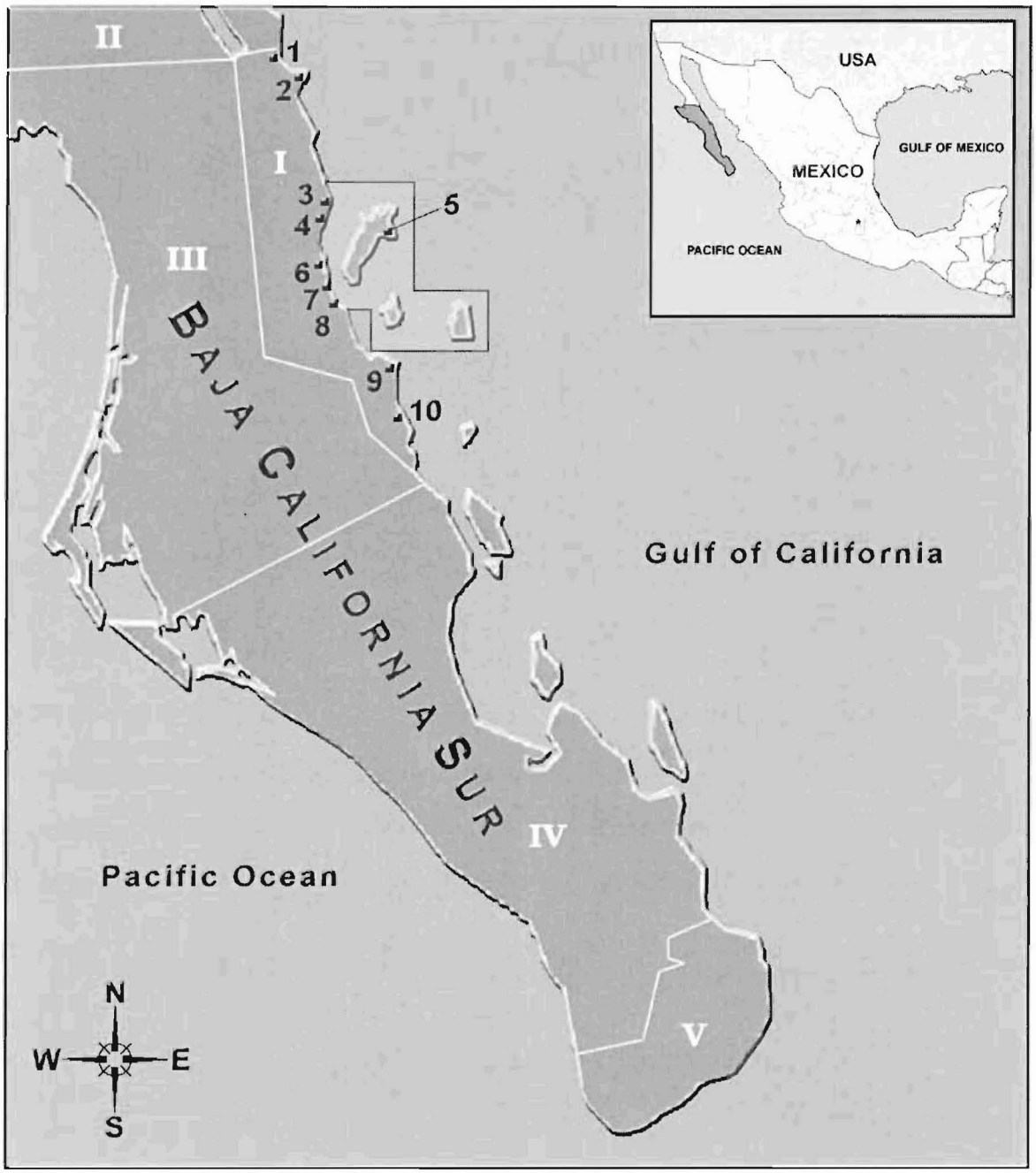


**Figure 1.1** The Loreto Bay National Marine Park boundaries are shown with a solid line. Localities of the Loreto Municipality: 1. Ramadita (RM); 2. San Nicolás (SN); 3. Loreto (LT); 4. Colonia Zaragoza (CZ); 5. Isla del Carmén (IC); 6. Juncalito (JC); 7. Ligüí (LG); 8. Ensenada Blanca (EB); 9. Agua Verde (AV); and 10. Tembabiche (TB). Municipalities in the state of Baja California Sur: I. Loreto; II. Mulegé; III. Comondú; IV. La Paz; and V. Los Cabos.

The park comprises part of the waters adjacent to the Loreto municipality where the primary users of the park reside. I describe the social and ecological context of the Loreto municipality before introducing the marine park.

## 1.7 The Social and Ecological Context of the Loreto Municipality

Mexico is a republic that is politically organized in states and municipalities. In the state of Baja California Sur there are five municipalities (Figure 1.1). The Loreto municipality is the smallest, covering an area of approximately 73,475 $Km^2$ (approximately 5% of the total area of the state of Baja California Sur), and the youngest, created in 1994, in Baja California Sur. In 2000, the national census registered 11,812 inhabitants with 84 % of all the population residing in the town of Loreto and the rest in rural communities and ranches (INEGI 2001). This makes the town of Loreto the most important political and economic centre in the municipality. Overall, there are limited economic options in the Municipality of Loreto, largely because of its desert or semi-desert climate, scarce fresh water, and limited infrastructure relative to others part of Mexico (INEGI 2001, Roberts 1989).

The minimum average temperature registered in Loreto between 1983 and 2004 was 18 Celsius (December-January) and the maximum average 32 Celsius in June-August (INEGI 2001). Indeed, locals often divide the year in two seasons, cold and hot ("frío y calor") and in the case of local fisheries these two seasons correspond to the windy conditions of the cold winter months and the calm, warm waters during the summer months. There is hardly any commercial agriculture in the Loreto municipality although horticulture is widespread and many urban and rural homes have citrus trees and

small vegetable gardens. Some households in the rural localities have also received help through federal programmes to diversify the rural economies particularly through grants to construct corals for goats that are maintained largely by extensive grazing.

The only road connecting Loreto to the rest of the peninsula is a two-lane trans-peninsular road finished in the 1970s. Eight of the localities considered in my study (3-8 in Figure 1.1) are located adjacent to or within five minutes of this highway. Other localities are connected only through back roads that tend to get severely damaged during the rainy season (late summer, early fall) particularly during tropical storms and hurricanes. There is a one-runway airport with passenger-only commercial flights to a limited number of national and international locations. The town of Loreto does not have a commercial dock; however, international tourist cruise ships anchor offshore for the day as part of their regular trips in the Gulf of California.

Loreto is the least populated (circa 12,000 people) of the five municipalities of Baja California Sur (INEGI 2001). The municipality of Mulegé, north of the Loreto Municipality, has almost four times as many people (approximately 46,000). Comondú has approximately 64,000, Los Cabos 106,000, and La Paz 197,000 people as registered in the national census of 2000 (INEGI 2001). Such numbers reflect the historical economic development tendencies in Baja California Sur, mostly driven by federal policies and programmes aimed at populating Baja California Sur. For instance, in the 19$^{th}$ Century a French mining company, El Boleo, successfully promoted the colonization of what is now the Municipality of Mulegé, particularly through the creation of the town of Santa Rosalía. This company brought people mostly from the Mexican states of Sonora, Sinaloa, Nayarit, Colima, Guerrero, and Jalisco, but there were also people from

China, and France. Comondú was largely populated during the past century as the result of an agrarian program that brought people from Mainland Mexico. Although it was in Loreto where the first successful missionary settlement was established in the 16th century, it lost its political and economic clout when in the 19th century the capital of the territory of Baja California was moved to La Paz (now the capital of Baja California Sur). The hopes for revival of the Loreto municipality through the promotion of large-scale tourism in a coastal area (Nopoló) and a natural harbour (Puerto Escondido) south of the town of Loreto in the late 1970s were frustrated when a grant by the National Fund for the Promotion of Tourism (FONATUR) was redirected to Cabo San Lucas in Los Cabos municipality[3]. However, some tourist infrastructure has been constructed in the Loreto municipality, including hotels (mainly in the town of Loreto), a hotel and gulf course complex and a half-finished marina at Puerto Escondido (15 and 20 minutes by car from the town of Loreto respectively).

In 2003, however, a two billion dollar foreign residential project, The Loreto Bay development, which includes 6,000 vacation and retirement residences plus restaurants, shops, business, etc, was approved. This project is institutionally supported by FONATUR which, among other functions, awards sustainability certificates to tourist development projects in Mexico. How this project will affect the local population of the town of Loreto and the coastal communities of the municipality have not been investigated. Evidence from similar developments, however, indicates that coastal mega-projects are likely to displace fishing families, lead to large appropriation of land and water rights, change the local economy, and induce cultural replacement such as changes

[3] FONATUR is a federal trust fund. The fund was created in 1956 under the name of FOGATUR (Fondo para la Garantía y Fomento al Turismo). Currently FONATUR coordinates its actions under the Secretariat of Tourism (SECTUR) according to the national plan of development and national program of tourism.

in people's way of living, values, and traditions (McGoodwin 1986, Noronha et al. 2002, Rivera-Arriaga and Villalobos 2001).

Despite this, the local population of Loreto is accustomed to interaction with nationals from the USA, and some of these visitors have established agreements with residents of the local rural communities to construct vacation residences, which are used mostly during the winter months. Another large section of USA visitors come to the area in their motor homes to winter and others come exclusively to do sport fishing. The largest portion of these visitors concentrates in the town of Loreto and rural communities tend to have less frequent contact with foreign nationals. The community of Juncalito is the exception in this respect and USA and Canadian nationals have built vacation houses all along the coast and in the winter months the adjacent beach south of the community is literally packed with Recreational Vehicles.

### 1.7.1 Coastal Land Ownership

Before the Mexican Revolution (1910-1917), most land in Baja California Sur had been given in concessions to international companies or had been acquired as private property. After the Mexican Revolution, land was re-distributed in the form of ejidos or communal land holdings based on usufruct tenure as legislated in the constitution of 1917. The implementation of ejidos had two objectives (de Janvry et al. 2001): 1) political control and containment of peasant demands by incorporating peasants as clients of the ruling party (PRI – Partido Revolucionario Institucional) through corporatist organizations such as National Confederation of Peasants; and 2) economic efficiency in food production (particularly for the delivery of staple foods to the urban sector). The state or ruling party (PRI) exercised a strong control over communities that were economically organized as

ejidos. The main characteristic of the ejido communal system in terms of rights and restrictions were as follows (de Janvry et al. 2001): 1) ejidatarios had to work the land and were not allowed to hire wage labour, 2) they could transfer their use rights to no more than one heir, and 3) access to credit and marketing of crops had to be done through state-led institutions. As part of the structural adjustment reforms pursuing economic liberalization, the Constitution of 1917 was amended in 1992 to relax some of restrictions imposed on ejidatarios and to limit state control. The reforms consisted in allowing the division of ejido land into private individual plots, the right to manage the land by ejido members as they see fit, and the right to associate with private interests outside the ejido in pursuit of profitable business (de Janvry et al. 2001).

Before the land reforms of 1992, the coastal lands of ejidos in Loreto had practically no economic value because commercial farming is not possible and selling or renting the land was not possible[4]. After the federal reforms of 1992, the political and economic dynamics of the Loreto municipality changed. In particular, reforms have allowed the booming of a real state industry and the emergence of conflicts over land in cases of overlapping titles of private and ejido ownership. Most of the residents of the coastal communities of Loreto, however, are composed of squatters. This is in part because these most of the coastal communities emerged from temporary fishing camps (see section 1.6.3). Currently, most if not all of the coastal land in the municipality of Loreto has been sold to foreign nationals or is in the hands of speculators who bought the land at very low prices in hope of re-selling the land at inflated prices.

[4] The Mexican Constitution does not allow any foreigner to own land within 100 kilometres of the Mexican borders or 50 kilometres from the coast. The Mexican Foreign Investment Law passed in 1973, amended in 1993, allows foreigners to obtain rights of ownership through fiduciary trust or the equivalent of a beneficiary trust in the USA.

These social and ecological characteristics of the Loreto Municipality are the general context under which the Loreto Bay National Marine Park operates. I now turn to describing the marine park and the general characteristics of the coastal rural communities that depend on the natural resources the park seeks to regulate.

## 1.8 The Loreto Bay National Marine Park

The Loreto Bay National Marine Park (LBNMP) is located on the western side of the Gulf of California, Mexico and covers an area of about 2065 $km^2$ (Figure 1.1). The park is located within the Municipality of Loreto and was created in 1996 after an influential group of local entrepreneurs directly requested the Mexican President to help them protect their marine resources from poachers and non-resident shrimp trawling fleets. The creation of the park strengthened the right of local groups to participate in the management of local marine resources.

### 1.8.1 Provisions and Restrictions in the Marine Park

The first draft of the park's management plan was produced in 1998 but it took three years for consensus to be reached by park resource users. The management plan was finally published in 2002. The overarching goal set out by the management plan is to protect and restore the natural resources of the park and, at the same time, promote the social development of the communities adjacent to the park (CONANP 2002). Thus, the LBNMP was conceived as a people-oriented park where protection and sustainable use of natural resources should be reconciled (Wilshusen et al. 2002). There are three specific objectives of the park: 1) regulate consumptive and non-consumptive activities within the park that are compatible with conservation; 2) promote scientific research in support of

resource management, identification of alternative uses, and evaluation of management actions; 3) develop programs of environmental education and diffusion to encourage community participation in the conservation of the park; and 4) encourage community monitoring and enforcement of current legislation and provisions of the park (CONANP 2002). Park managers are committed to involving resource users in the management of the park, and so far, community involvement has been formally attempted through the formation of a Technical Advisory Committee.

Zoning is the main instrument for managing the park. There are three zoning categories: 1) protection, 2) restricted use, and 3) sustainable use. Protection areas include those with low human impact and high ecological values (e.g., biodiversity) with no extractive activities allowed. The other two zones vary in their emphasis on protection and impact of human activities. Thus, for example, small-scale commercial fisheries that use low-impact gear types (e.g., hook and line) are allowed in restricted use zones. The zoning of the park was the most contentions issue of the drafting of the management plan, particular the extent and location of protected and restricted use zones. The park does not include the terrestrial coastal areas but has some influence on how a narrow stretch of coastal land (20 meters from the low water mark towards land) is used since it is under federal jurisdiction. Indeed, the management plan explicitly recognizes that the social and economic dynamics in the coastal area and adjacent waters affect the effectiveness of the park and its management actions. The process of reaching consensus on the zoning of the park ended with most of the waters comprising the marine park being managed mostly under the category of sustainable use zones, and some activities originally excluded in the

first draft of the management plan (e.g., use of gill nets) being allowed although not unregulated (i.e., not all mesh sizes are permitted).

Protected areas in Mexico, including the Loreto Bay National Marine Park, fit within a federal environmental policy, most strongly pursued in the 1990s, aimed at including environmental concerns in national development. In particular, the Ley General del Equilibrio Ecológico y la Protección al Ambiente (LGEEPA) passed in 1988 and amended in 1996 sets the overarching legal framework which specifies the types of instruments that may be used in environmental administration, including the establishment of protected areas (Rivera-Arriaga and Villalobos 2001). An important provision of LGEEPA is that it distributes environmental responsibilities among federal, state, and municipal levels of administration. The administration of marine and terrestrial protected areas is given to SEMARNAT (Secretaría del Medio Ambiente y Recursos Naturales), which has as its specific mandate to reconcile the sustainable use and protection of the environment and natural resources of Mexico. CONANP or Comisión Nacional de Areas Naturales Protegidas is the agency responsible for implementing SEMARNAT's mandate of protection and sustainable use of terrestrial and marine resources through the creation, and management of protected areas. Yet, the management and conservation of fishery resources falls under another secretariat (SAGARPA or Secretaría de Acuacultura, Desarrollo Rural, Pesca y Alimentación) created in 2000 during the administration of President Vicente Fox Quezada. This organizational reform weakened the capacity of SEMARNAT and CONANP to effectively carry out their mandate of protection and sustainable development of fishery resources within the context of marine parks. In the case of the Loreto Bay National Marine Park, the federal

division of responsibilities complicates the control of fishing activities, one of the most important economic activities for most of the rural coastal communities in the Loreto municipality.

## 1.9 The Rural Coastal Communities Adjacent to the LBNMP

Tourism and fisheries (sport and commercial) are the main economic activities in the park. Small-scale fisheries, however, are a main concern of local authorities and park managers for their provision of livelihoods to the town of Loreto and several rural coastal communities (Figure 1.1). The number of commercial fishers operating in the park is not known precisely, but a survey a few years ago by park staff estimated 326 fishers, some of which were organized into fishing cooperatives (Gutiérrez-Barreras 2001). Commercial fisheries target multiple species and may include several species of clam, conch, octopus, squid, crustaceans, shark, and finfish. Despite the rapid growth of tourism and the service sector in the Municipality of Loreto, fishing continues to be the main, and often only, economic activity available in most of the rural coastal communities (Gutiérrez-Barreras 2001). In particular, the communities of Ramadita, San Nicolás, Colonia Zaragoza, Juncalito, Ligüí, Ensenada Blanca, and Agua Verde have been frequently approached by Loreto Marine park managers with the aim of involving them in conservation and management of the park's marine resources (Gutiérrez-Barreras 2001).

### 1.9.1 Settlement Histories and Some General Characteristics of Seven Rural Coastal Communities Adjacent to the LBNMP

Although Loreto was the first capital of the Californias, it never became an important

economic and political center in Baja California Sur. The town of Loreto is the oldest human settlement in the area and most of the seven rural coastal communities started as small coastal ranches or temporary fishing camps. The first settlers of what now is the Loreto area were the Guaycuras, an indigenous group found by the first European visitors. It was not until the 19th century when Loreto's population significantly increased that immigration restrictions imposed by the missionary system ceased to exist (Morales-Polo 1994). Most of these newcomers were from mainland Mexico, Europe, and North America. The hard living conditions (biophysical and economic) acted as a filter for migration into the area and only a few families were able to survive. Morales-Polo (1994) reported that 23 families had immigrated into the area since the 1800s. Indeed, within most of the rural communities, individuals are related through consanguine and affine ties.

To the North of the LBNMP, San Nicolás started with a family from a ranch located about 50 km west. The presence of an underwater spring facilitated a permanent settlement in the 1950s and other families followed after that. Currently, San Nicolás has less than 100 inhabitants and some members also have a residence in the town of Loreto. A few families have also allowed foreign nationals to construct vacation residences. San Nicolás is located on ejido land. However, all except for two families are not ejido members. There is also a fishing camp with fishers from El Sargento, a locality south west from La Paz. These fishers have set up an arrangement with the only local fishing cooperative to fish in the adjacent waters. Ramadita is located about 15 minutes north of San Nicolás. It started as a fishing camp used mainly by some San Nicolás residents and

in the 1990s a few families moved permanently there. There are no more than 15 residents but often there are fishers from other communities temporarily fishing there.

Colonia Zaragoza is separated only by a fluvial canal from the town of Loreto. It is the second largest settlement in Loreto (circa 1,000 inhabitants). Described in the 1980s as a settlement of fishermen, now Colonia Zaragoza has a large portion of its members working in the service, tourist, and construction industries. Many residents benefited in the 1970s when the ejido Loreto, created in the 1920s, was expanded from 761 ha to 42,000 ha, including a large portion of coastal land (approximately 15 km North of Colonia Zaragoza to Juncalito). The expansion of the ejido Loreto benefited mostly fishers. To the south the ejido extends to the Juncalito community. A large portion of these coastal lands were expropriated to create the Loreto airport and to promote tourist developments by FONATUR. The land expropriated by FONATUR is where most of the Loreto Bay development will be constructed. Although Juncalito was settled on land belonging to the ejido Loreto, no dispute exists between the ejido Loreto and the Juncalito community over the ownership of the land. Juncalito started with a family from a nearby ranch, rancho Tripui, in the 1940s. Many residents in Juncalito have made arrangements with foreign nationals to have a winter vacation residence (often an RV pad with a rustic roof made of palm tree materials) and others have changed from commercial fishing to sport fishing or work in the tourist industry. There are no more than 75 permanent inhabitants in Juncalito and some families have moved to Loreto and spend time in Juncalito only during the weekends.

Ligüí is located a few kilometres before the freeway turns away from the coast towards Ciudad Constitución in the municipality of Comondú. Ligüí also started with

only one family in the 1940s, although they were not landowners in the area. Originally, the land belonged to the federal government but was bought by the administrator of a salt mine located in Isla del Carmén. The greatest growth in the community occurred in the mid 1970s when people from Ciudad Constitución, Comondú, moved to the coast where fishing was abundant at the time. There are about 130 residents and, although most families were squatters, they are now receiving a land title where they have constructed their houses. Ensenada Blanca is located south and east from Ligüí, five minutes by car. It also started with one family temporarily visiting the area to fish in the 1960s. In the late 1970s many families arrive from adjacent ranches and the Agua Verde community. A few years ago, a small hotel was constructed along the coast of Ensenada Blanca, which gives work to some community members, especially women who are employed to cook and clean. The number of inhabitants in Ensenada Blanca is of similar proportion to that of Ligüí, approximately 130.

Finally, Agua Verde is located 100 km south of Loreto by land (60 km south on Highway 1 and 40 Km through back roads) in ejido San Juan de la Noria. The first families arrived in Agua Verde early in the 1910s; however, most of the population arrived in the late 1970s. Currently, there are about 170 people living in Agua Verde, of which about 70 are children. Residents also supplement their fishing livelihoods by raising cattle, goats, and chickens. Tourism is practically absent but a new tourist development in San Cosme (25 minutes north) has provided work to some men from Agua Verde in the construction sector in the recent years.

In sum, most of the rural coastal communities are relatively small with most of their members having consanguineal or affinal relationships. The most important

population growth of these communities occurred in the 1970s. Indeed, the 1970s seem to be a watershed in the demographics of the coastal communities of Loreto. Small-scale fisheries have been the most important activity but in recent years tourism has also become important in the economies of most of these communities. Yet, small-scale fisheries in these communities have been in crisis for some time now, and their viability as an economic activity and way of life is now at risk. Most long-time fishers in the Loreto area agree that there has been a significant decrease in the abundance of finfish, sea turtles, and sharks in the past 20 to 30 years. The contributing causes of the decline in fisheries resources are multiple, but in the final analysis academics and managing institutions attribute such declines to the tragedy of open access (Aguilar-Ibarra et al. 2000, Hernandez and Kempton 2003, Thorpe et al. 2000). Hence, analysis of all political, cultural, and economic issues associated with the decrease in fishery resources has been reduced to calculation of costs and benefits by self-interested individuals. This view prevents an appreciation of the contribution that a study of the social conditions under which the access and use of fish resources inside and outside the marine park can provide to improve the conservation and management of fisheries in the area. The empirical findings of my research will allow a more sophisticated understanding of fishing behaviour by considering how the structure of social relations affects the access and use of fishery resources within and outside the limits of the Loreto Bay National Marine Park, BCS, Mexico.

## 1.10 Structure of Dissertation

My dissertation is organized as follows. I begin in Chapter 2 with a discussion of how the institutional choice school of thought conceptualizes the access and use of the commons

and social cooperation for the conservation and management of the commons or common-pool resources. In particular, I highlight the individualism inherent in this school, which collapses all cultural, economic, and political issues into an economic calculation of costs and benefits by individuals. The individualism adopted by this school creates a fundamental tension with a social relational view, which recognizes that social systems of common-pool resources have emergent properties irreducible to individual choices.

In Chapter 3, I articulate a social relational approach as an alternative framework for studying the access and use of the commons. I link this approach to the systemic approach and the Composition/Environment/Structure/Mechanism (CESM) model, and highlight the role of social network analysis which has developed methods to systematically study social relations. Based on the ideas articulated in the social relational approach, I contextualize its potential in the study of the commons and justify a programmatic hypothesis for the study of the commons. At the end of this section, I describe my fieldwork, data and analysis, and discuss my methodological and fieldwork challenges.

In Chapter 4, I focus on the past and present political ecology of natural resources in the peninsula of Baja California. From this brief historical account of the struggle to access natural resources, it becomes clear that the over-use of natural resources has been the result of diverse cultural, economic, and political interconnected processes, often orchestrated by the Mexican government. Similarly, an account of how the Loreto Bay National Marine Park was created suggests multiple cultural, economic, and political processes operating at local, regional, and national levels.

To analyze the cooperative ties for accessing fishery resources, I follow the distinction between actor and network-level of analysis made in social network analysis. In Chapter 5, I focus on a network level of analysis to account for how cooperative ties are affected by social heterogeneity of resource users in terms of social and demographic factors (e.g., locality, place of birth). I use the property of network density to index the extent to which resource users cooperate. The central question I address is this: under what conditions is information sharing more likely to occur among resource users with similar social and demographic characteristics? In other words, to what extent is information sharing structured through social categories? Moreover, is information sharing more prominent and frequent among resource users that are kin related or through other social relations like friendship and acquaintance relations? I interpret these results as indicators of social fragmentation and social integration and reflect on their effects on collective action. I suggest that the social network of information sharing has latent (social integration) and manifest (accessing fishery resources) functions. Finally, I discuss the implications of the extent of cooperation among resource users despite the social diversity or heterogeneity in composition of the resource users from the seven rural coastal communities. In particular, I propose that focusing on social relations provides a fruitful conceptualization of human communities as open, nested systems, characterized by pro-social behaviours.

In Chapter 6, I use an actor level of analysis to examine the contribution of individuals to the emergent structure of the social network of sharing of information. I explore occupational categories, years of fishing experience, and years of residence as indicators of how important an individual is in the network of information sharing. I use

two actor centrality properties (Freeman's degree and betweeness centrality) to index the importance of resource users in the network of information sharing. The three variables are robust in terms of reflecting the differences in resource users' centrality in the network of information sharing. However, when the network is divided by community and social relations, these three variables are less reliable. I conclude this chapter by proposing five logically related concepts of the functions of social networks as a framework to understand the potential contribution of social networks to the conservation and management of fishery resources. I argue that the internal function of social networks is social and emotional support but that such a function cannot be demonstrated with my structural analysis of cooperative ties to access fishery resources or even observing overt behaviour of individuals sharing or not sharing information.

In Chapter 7 I take a conceptual step "downward" and discuss the evidence from social neuroscience and cognitive psychology on finding a plausible hypothesis for what neural processes serve our capacity to engage in cooperative ties. The evidence so far produced indicates that humans are inherently social and emotional beings. My assertion that the internal function of social networks is social and emotional support is consistent with this literature. Thus, managing social networks for participatory conservation and management of fishery resources may be better served using a social relational view than the individualism inherent in the institutional choice school.

In Chapter 8, I look into people-oriented approaches to conservation and management of natural resources in modern democracies. I argue that such an approach places the individual and his/her interests at the center, producing political processes in conservation and management that are characteristically adversarial rather than

cooperative. I suggest that, at best, such a political process produces unstable results and, at worst, entrenches conflicts. I propose that a relational principle rather than an individualistic one should guide participatory policies for conservation and management of natural resources. I summarize the main topics discussed and findings of my dissertation in Chapter 9. The most important implication of adopting a social relational approach to the conservation and management of fisheries is a rejection of any form of individualism to conceptualize and promote social human cooperation.

# CHAPTER 2
# COOPERATION IN COMMON-POOL RESOURCE DILEMMAS

Cooperation is a ubiquitous feature of all social human systems that has equally puzzled natural scientists (Sober and Wilson 1998, Rilling et al. 2002, Sterelny 2003) and social scientists (Axerold 1984, Frank 2001, Pinkerton 1989, Van Vugt et al. 2000). In the social sciences, two of the most prominent problems addressed by the literature on human cooperation are those posed by the under-provision of common goods (Olson 1965) and over-exploitation of shared resources commonly known as the tragedy of the commons (Hardin 1968). Since the publication of Olson (1965) and Hardin's (1968) seminal works, a large number of theoretical, experimental, and field studies have advanced various explanations and conditions that are more conducive to cooperation (Biel 2000, Van Vught et al. 2000, Frank 2001, Pinkerton 1989). In the conservation and management of common-pool resources, the most influential view on cooperation is that of the institutional choice school of thought (Bromley 1999, Ostrom 1990, Ostrom et al. 1994, Singleton 1998). The basic starting point, implicitly or explicitly, used in this scholarship is that of social dilemmas, which are generically viewed as an inherent conflict between the individual and the collective interests. From this viewpoint, the problem of cooperation is one of creating institutions-as-rules that reconcile these divergent interests.

In this chapter, I do a critical appraisal of the key features of the institutional choice school of thought, which has articulated the most accepted theoretical framework

of how such divergent interests are brought in line in the conservation and management of common-pool resources. I begin by discussing the foundational concepts and continue with the underlying premises used to build these theoretical explanations. I argue that in these theoretical explanations social cooperation is conceived as an aggregate of individual choices structured by institutionalized incentives, or what has been referred in the literature as institutional individualism (Udehn 2002) or choice-within-constraints (Ingram and Clay 2000). Constructed in this way, one theoretical consequence is that the lack or failure of institutionalized incentives leads to over-exploitation of common-pool resources by rational self-interested individuals. Moreover, institutional choice scholars neglect social relations and the emergent character of social institutions in their main theoretical constructions (Klooster 2000). When social relations are considered, they are over-socialized (e.g., internalized as norms) or conceived as conditions more conducive to solving the primordial conflict between the individual and the collective. Emergent social institutions are nothing but agreed upon contracts among individuals. Moreover, scholars of the institutional choice school argue that the increasing social diversity associated with the protection and management of the commons renders more challenging social cooperation or collective action for the protection and management of the commons (Dietz et al. 2002).

## 2.1 The Study of the Commons

### 2.1.1 Foundational Concepts

Common property theorists have taken the important task of clarifying key concepts to strengthen the analytical progress of their scholarship, particularly after the Annapolis

meeting on the Study of Common Property Resource Management in 1985 (Dietz et al. 2002)[5]. The central concern has been to create a clear conceptual framework that reconciles ideas across disciplinary traditions. Currently, there is relative general agreement across disciplines on some basic distinctions and definitions in the commons scholarship, and some have called for conceptual consistency and clarity in other concepts relevant to the study of the commons such as community and participation (Poteete 2004, Ribot 2004, Roth 2004). However, there is still confusion about what concepts are, their definitions, and relationship to theories (Common Property Resource Digest 2004). I briefly discuss these issues (an extensive philosophical treatment can be found in Bunge (1996)) before taking a closer look at the foundational concepts widely accepted in the commons literature.

### 2.1.2 Concepts, Definitions, and Theories

Concepts are the basic units of meaning used in rational discourse: we use concepts to form propositions and the latter to form systems such as theories. Only propositions can be tested for truth whereas concepts can only be exact or fuzzy, applicable or inapplicable, fruitful or barren. One way of clarifying a concept is to define it. Definitions are stipulations, or conventions, but not assumptions, and they only impinge on concepts not on facts. A common misconception is that definitions proper "connect theory to observation and observation back to theory" (Ribot 2004: 4). Such is the role of indicators commonly known as "operational definitions". However, such indicators are

[5] The initial collection of papers from this founding meeting, originally published in 1986, was selectively republished in 1992 as Daniel Bromley (ed.) *Making the Commons work: Theory, Practice and Policy*. Significantly, the contributors to the 1992 volume are almost all institutional economists, political scientists, and other social scientists focused on rural developmental issues in developing countries.

not conventions or definitions but the hypotheses that often refer to un-observables such as democracy, scarcity, social structure and so on. In sum, clarity of concepts or elucidation of concepts through definitions is an important first step to enhance accuracy and prepare the ground for theorizing. Yet some definitions can be narrowly constructed, limiting the scope of a field of inquiry. I argue that such is the case of the common-pool resource definition put forward by the institutional choice school (ICS).

## 2.2 The Economic Conception of Common-Pool Resources

ICS scholars conceptualize the commons by explicitly distinguishing between the resource and the institutions or regime governing its use (Ostrom 1990, Schlager and Ostrom 1992). ICS scholars use two key foundational sets of definitions, those of the resources and those of governing regimes. The most salient definition in the former set is that of common-pool resources (CPRs). On the other hand, the institutional dimension focuses on distinguishing between property regimes, typically, open access, common, state, and private. This distinction forms the main substance along which the ICS scholarship and most of the popular understanding of the commons has been predicated.

However, the conception of CPR by scholars of the ICS narrows the scope of the concept to economic concerns. Thus, although ICS scholars broadly conceptualize a CPR as "a valued natural or human-made resource or facility that is available to more than one person and subject to degradation as a result of overuse", the CPR concept is further refined (Dietz et al. 2002: 18). By definition "common-pool resources are ones for which exclusion from the resource is costly and one person's use subtracts from what is available to others" (Dietz et al. 2002: 18). The conventional name was introduced by Ostrom (1990) but the definition is based on the standard typology found in neoclassical-

inspired resource economics where *all* resources are defined according to the degree of costs of exclusion and rivalry in use (Vatn 2001). By narrowly defining CPRs in terms of the costs of exclusion, political and cultural factors are collapsed into the one dimension of economic costs. In other words, the value of a resource and thus the degree of difficulty of excluding others from accessing a resource are inextricably linked to social processes that cannot be collapsed into one dimension, namely economic costs. Value is multidimensional and often incommensurable. For instance, some subjects involved in environmental contingent valuation surveys often show resistance or reject a cost-benefit analysis of trade-offs between health, safety, or environmental quality and economic growth (Sagoff 1988). In addition to the commensurability issue, a cost-benefit approach may conflict with social constructions of democracy and political deliberation (Sagoff 1988).

I submit that the definition of common-pool resource advanced by the ICS is a persuasive one whose function is to give unwarranted prominence to economic concerns and assumes that all social factors can be conveyed via an economic value. Moreover, and more relevant to my argument, while having a clear conceptual framework may lead to analytical progress, it may also privilege certain views at the expense of others, which in the multidisciplinary field of the study the commons may slow rather than advance analytical progress. I believe that the broader definition of CPR as "a valued natural or human-made resource or facility that is available to more than one person and subject to degradation as a result of overuse" is more in line with the broad concerns of the multidisciplinary field of the study of the commons. The second set of definitions, property regimes, is also dominated by a "thin" conceptualization by ICS scholars. In

particular, the open-access regime or "no-regime regime" reduces all social concerns in the over-use of common-pool resources to the lack/failure of institutions-as-rules.

### 2.2.1 Open-Access "Regime"

The definition of open-access regime raises two objections, one logical and the other substantive. The logical issue is straightforward. By definition "common-pool resources that do not have institutions governing their use are called open-access regimes" (Dietz et al. 2002: 21). Rephrasing: open-access is a regime that has no institutions governing its use. This is a logical falsity because it violates the principle of non-contradiction (Bennett 2004). In other words, open access cannot, *be* and *not-be* a regime at the same time. A regime is by definition a system of rights and duties, the do's and don'ts, the conventions regarding human behaviour. This logical contradiction may be just the result of an omission and should perhaps be understood as absence or failure of institutions-as-rules (Ostrom 1990).

However, this "thin" conception of open access predicated on the absence/failure of institutions-as-rules as the cause of over-use leads ICS scholars to accept Hardin's thesis that the over-exploitation of shared resources is carried out by isolated rational individuals (Mansfield 2001). Indeed, the ICS theorists of the commons concede that "the evidence supports Hardin's argument concerning degradation due to inability to regulate access to resources held as open access" (Fenny et al. 1990: 6). To convey this idea and reconcile Hardin's powerful argument in the commons scholarship, the term "the tragedy of open-access" is becoming more conventional. Ironically, to be consistent with a strong commitment to a view of individuals only structured by institutionalized incentives, ICS theorists have no choice but to accept Hardin's thesis predicated on a problematic rational

self-interested conception of human behaviour. Scholars of the ICS apply the same paradigm to distil an explanation of cooperation for the conservation of common-pool resources; i.e., by neglecting or collapsing social concerns to costs and benefits assessed by rational individuals who interact through institutionalized incentives.

## 2.3 Human Nature and Cooperation

The most powerful form of reasoning in science is deductive. Deductive reasoning starts from a set of premises or assumptions and yields conclusions in conformity with rules of inference (Bunge 1996). In the context of a theory the basic or initial premises are axioms or postulates and together with other assumptions and data, they entail a number of theorems. A great advantage of axiomatization is that it exhibits *all* its premises, thus facilitating their critical examination. Such is the case of the economic analyses of social phenomena, of which its most controversial premise has been that of the nature of human behaviour (Barry 1970). Such axiomatization is characteristic of the ICS scholars who have provided the most compelling explanations of the constitution and emergence of social cooperation for the conservation of common-pool resources (Ostrom 1990, Ostrom et al. 1994, Singleton 1998).

### 2.3.1 Social Cooperation and the Commons

The main argument for the emergence of cooperation for the conservation of common-pool resources is constructed negatively by ICS scholars. That is, cooperation emerges from the need to solve problems derived from the inherent qualities of common-pool resources, costs of exclusion and subtractability. The benchmark situation is this. Over-use of common-pool resources results from a lack or failure of access barriers (exclusion)

to individuals who face strong incentives to continuously take units of a free resource and will continue to do so until individual marginal costs of taking an additional unit equals the individual's marginal benefit (Singleton 1998). From this scenario, studies of cooperation for conserving and managing common-pool resources have been highly aggregated (Ostrom 1990, Singleton 1998) or highly individualised (Ostrom et al. 1994, Ostrom 1999). But in both cases, the benchmark is rational individuals competing for units of a free resource.

### 2.3.2 Aggregated and Individualised Approaches to Social Human Cooperation

In the case of the highly aggregated studies, the focus is on how institutions assist essentially competing individuals to cooperate with each other for mutual gain, in particular by solving collective action problems or situations where individuals face incentives to take actions that, collectively, result in sub-optimal outcomes (Singleton 1998). In other words, in the absence of institutions "individuals may face incentives to continue extracting additional units [of the resource] beyond the optimal point, since the costs of such excess takings are spread across the group, but the benefits go directly to the individual user" (Singleton 1998: 2). More succinctly, when private and social costs diverge, there is over-exploitation. In this economic conception, human cooperation boils down to aggregate individual actions institutionally coordinated to achieve mutual gain. As institutions are the key element and cooperation just a "by-product", at the macro level institutions receive most of the attention in this conception, although it is unclear how individuals assess the costs and benefits of different rules and how individual choices of preferred rules amount to more effective conservation and management of common-pool resources.

To be sure, there is a plethora of studies documenting cases in which local groups have adopted particular rules to effectively control the access and use of common-pool resources such as fisheries, forests, rangelands, and irrigation systems (Fenny et al. 1990, Ostrom 1990). But the idea that institutions cause these effective controls by bringing in line individual and social costs is assumed. Individualized approaches to human cooperation are used to argue that such assumption is robust and to argue that all humans are norm-following rational self-interested individuals.

In the individualized approaches, scholars of the ICS use game theory (GT) as a theoretical framework to study human cooperation in the context of common-pool resource dilemmas. Game theory clings also to methodological individualism and consists in individuals playing strategic games. The main thesis of GT is that every individual action depends on what the player believes others (partners or adversaries) are likely to do. In the game, participants are free to choose between outcomes (payoffs) that are interdependent of participant's choices (Bunge 1999). As such, game theory provides a framework to study individual strategic choices that reflect preferences between personal high pay-offs (defection of one person), less but equally beneficial outcomes (both persons chose to cooperate) and poor outcomes (both people defect). Among the array of game theoretic models, ICS scholars have found that iterated N-person prisoner dilemma games appear to better reflect real-life choice situations than one-shot N-person games (Ostrom et al. 1994).

The benchmark situation in N-person prisoner dilemma games is that of non-cooperative games, from which changes in conditions can be tested, particularly institutional rules (Ostrom 1999). The overall pattern from the scholarship on games is

that when the game is played repeatedly, where there is no predefined endpoint, and where communication is possible, cooperation rather than defection is the rational strategy by players (Axerold 1984)[6]. Moreover, from her laboratory iterative game experiments, Ostrom (1999) concludes that humans are fallible, rationally bounded, and norm using, who will cooperate to overcome the commons dilemmas: that is, Ostrom rejects the idea that humans are norm-free maximizers of immediate gain as conceptualized by Hardin (1968) and Olson (1965). Interestingly, Ostrom et al. (1994) assert that "predictions of suboptimal use of the resource are likely to be correct" as predicted by G. Hardin's tragedy of the commons (1968) and Olson's logic of collective action (1965), who assume a norm-free maximizer model of human behaviour. In any event, the experiments on human cooperation within the framework of GT tell us two things: if individuals follow their self-interest then they will over-use a resource (the well-known thesis of Garret Hardin); and if people interact repeatedly, then it is likely they will cooperate rather than defect.

However, it does not follow that every time we observe over-use, it happens because rational individuals following their self-interest have chosen to defect because rules are absent or have failed. Moreover, if local groups have designed rules to control access and use of CPRs, it does not follow that it was rational individuals who crafted them to bring individual costs in line with social costs. Perhaps inadvertently, ICS scholars commit the error or fallacy of logical conversion. That is to say, if ***a*** is true (individuals have used a resource following their self-interest), then ***b*** is true (the resource has been depleted); ***b*** is true (the resource has been depleted); conclusion, there is none!

[6] Boyd and Loberbaum (1987) have demonstrated mathematically that no pure strategy is evolutionarily stable in repeated Prisoner's Dilemma games as argued by Axerold (1984).

We cannot affirm the antecedent based on the premise that affirms the consequent. To conclude "individuals have used the resource following their self-interest" would be fallacious. The only necessity involved in the if/then statement involves what necessarily happens if individuals have used a resource following their self-interest. The same is true, *mutatis mutandis*, for the case when rules are found in successful cases of local groups managing and conserving common-pool resources. A second fallacy may be committed by denying the antecedent and, incorrectly, denying the consequent. That is to say, if ***a*** is true (rational individuals have used a resource following commonly agreed upon rules), then ***b*** is true (resources have been conserved); if ***a*** is not true; it would be fallacious to conclude "***b*** is not true". In sum, the experiments on cooperation conducted by ICS scholars explain one scenario for over-use and conservation of common-pool resources. However, the same outcome (conservation and over-use of common-pool resources) may be caused by multiple social conditions, including embedded individuals rather than rational self-interested individuals (Jentoft 2000b, Klooster 2000, McCay and Jentoft 1998).

### 2.3.3 Over-Socialized Cooperation

It must be admitted that although there is consideration of social relations in the highly aggregated and individualized approaches to human cooperation, they are part of core theoretical views in so far as they are internalized or rather collapsed in the norm-following rationally self-interested individual. Therefore, Ostrom (1999) talks about a norm-following individual, and Singleton (1998) acknowledges the critical role of trust in cooperative outcomes in joint production between government organizations. Ostrom et al. (1994) go a step further and acknowledge the importance of social relations in the

form of social capital. However, social capital relations are seen only as an instrumental condition more conducive to solve the fundamental problems in the conservation of common-pool resources: creating rules (Ostrom 1992, Ostrom et al. 1994). Thus, in the last chapter of "rules, games, and common-pool resources", Ostrom et al. (1994: 329) highlight that those who have developed mutual trust and social capital "can utilize these assets to craft institutions that avert the CPR [common-pool resource] dilemma and arrive at reasonable outcomes". Yet it is not social relations that structure such outcomes but the rules or conventions individuals holding social capital and trust are able to produce by rationally assessing costs and benefits. Despite their acknowledged significance in CPR dilemmas, trust, social values, social norms, and social capital remain unanalyzed factors that, again, only facilitate individuals' choices and actions to craft or abide by mutually agreed upon rules.

## 2.4 Concluding Remarks

The ICS boils down social facts to an aggregate result of incentive-driven individuals who interact strategically through conventional means or institutions enabling mutual benefit. As such, institutional individualists exaggerate the role of contracts and conventions as the prime source of social interaction and explanation. Indeed, social structure is equated with the institutionalized or conventional structure of incentives. Contracts and conventions are part of, but are not the only glue that holds together social systems, nor are they the source of legitimacy of a management system (Jentoft 2000b) or necessary to achieve regularity in action (Clemens and Cook 1999).

Assuming a model of norm-following rational self-interested individuals, the ICS scholarship reaffirms Garret Hardin's (1968) thesis of resources overused by self-

interested individuals and that repeated interaction is likely to lead to cooperative outcomes. But it is fallacious to conclude the converse. Indeed, if a common-pool resource has been over-used, it does not follow that rational self-interested individuals are responsible for this outcome. It is in the context of this critique that I propose investigating how social relations affect the extent to which socially diverse and geographically distant resource users may cooperate to have access to fishery resources. In the next chapter, I propose using a social relational approach to carry out such investigation.

# CHAPTER 3
# A SOCIAL RELATIONAL APPROACH TO THE STUDY OF THE COMMONS

In this Chapter I develop the elements of a social relational approach to the study of the commons. I link this approach to the systemic approach and Composition Environment Structure Mechanism (CESM) model, and justify the need for such approach in the study of the commons. I propose that the methods developed under the rubric of social network analysis are suitable for implementing a social relational approach. Finally, I describe my fieldwork, data and analysis as well as a discussion of my methodological and fieldwork challenges in implementing a social relational approach.

## 3.1 The Debate of Part-Whole Relations in the Social Sciences

An old debate in the social sciences has been the part-whole relations, or individual agency and social structure linkages. In the social sciences the study of such connections has more or less adopted one of two philosophical views, individualism or holism. The former puts less emphasis on the social constraints on agency and attempts to analyze and account for social facts in a bottom-up fashion. The latter adopts a top-down approach to the analysis and account of social facts, putting less emphasis on individual interests and initiative (Bunge 1999). Since each strategy is incomplete, a more comprehensive analysis and explanation of micro-macro relations should adopt a mixed strategy. The institutional choice school I discussed in the previous chapter uses a mixed strategy,

which I argued limits its scope by focusing on rational individuals and rules. I submit that what is required is a merger rather than simply a mix or aggregation of both strategies. The merger requires a referent that is neither isolated individuals (rational self-interested individuals) nor organic wholes but embedded individuals, and a clear concept of emergence or qualitative novelty.

## 3.2 The Systemic Approach

The systemic approach, not to be confused with what is loosely called "systems theory", is hyper-general and consists in the ontological principle that every concrete thing is either a system or a component of such. Systems have resultant and emergent properties, which none of its constituents have. Its epistemological counterpart is that every system must be studied at its own level and analyzed in its interacting components (Bunge 1996). To make the systemic approach operational, systems can be conceptualized as a quadruple model "composition, environment, structure, and mechanism", or CESM for short (Bunge 2003). It is important to mention that the CESM model, developed by Mario Bunge, only points to the elements that should be brought to bear when adopting a systemic view. To my knowledge, the CESM model has not explicitly been used to define the focal analytical elements when studying social systems, yet scholars focusing on social systems may use similar analytical elements as the CESM model.

## 3.3 The CESM Model

As it applies to social sciences, the CESM model can use different units of analysis from individuals, the family, the firm, the nation, etc. It also acknowledges that social wholes or social systems possess (emergent) properties that their parts lack. In particular, the

CESM model breaks down systems into its (i) components (collection of all parts of the system), (ii) environment (the collection of items, other than those in the system that act on or are acted upon by some or all components of the system), (iii) structure (collection of bonds among components of the system, endo-structure, or among these and items of its environment, exo-structure), and (i) mechanisms (collection of items in the system that make the system behave the way it does). It is important to notice that the analysis of systems through the CEMS model employs analytical distinction but not separation or detachment.

The CESM model, however, is so general that it does not contain any prescription regarding the level of analysis of (social) systems. Level of analysis refers to real levels of organization, and since there are different levels of organization, one cannot speak of one, absolutely appropriate level of analysis. The absence of an appropriate level of analysis is unproblematic if we adopt the ontological principle that every unit of analysis (individuals, families, community, nation, etc.), except for the universe, is part of a higher-level system. Hence, when describing the former, we must not overlook the latter. In the context of the CESM model, this translates into a characterization of the selected level of organization into its composition and structure, and its external relations with its environment.

The final component of the CESM analytic framework is mechanisms. Mechanisms refer to the *modus operandi* of the fact to be understood rather than simply a subsumption or account (Mahner and Bunge 2001). Thus to say that an individual in a Prisoner's Dilemma game defected because he/she is self-interested is not an explanation proper. Rather, it is self-interested behaviour that calls for an explanation. I adopt

Bunge's (1996: 138) following general distinctions regarding mechanisms. First, mechanisms can be physical, chemical, biological, social, or mixed. Second, mechanisms may be natural or artificial; causal or stochastic (chance), or a combination of the two; pervasive or idiosyncratic. Third, a valid mechanism must be concrete (rather than immaterial), lawful (rather than miraculous) and suitable to scrutiny (rather than obscure or dogmatic).

In sum, the CESM model is in accordance with the systemic approach. However, the generality of both requires the use of a more specific approach and methods whose only requirement is for them to be compatible with the CESM model and, by implication, to the systemic approach. I develop a social relational approach as alternative to the institutional individualistic approach. Most of the ideas I articulate in this social relational approach come from the literature on relational sociology (Emirbayer 1997), systemism (as expounded by Bunge 1996), and qualitative novelty or emergence (Blitz 1992, Bunge 2003, Sawyer 2001).

## 3.4 A Social Relational Approach

Any scientific inquiry starts by identifying a gap or problem in a body of knowledge. The way in which we deal with these problems is what is commonly referred to as an approach. Bunge (1996) proposes that an approach consists of a body *B* of background knowledge, a set *P* of problems, a set *A* of aims, and a set *M* of methods. However, approaches vary in their degree of generality and scope and, if scientific, they are related to each other by virtue of embracing the scientific approach. For instance, the scientific approach consists of (*B*) the bulk of relevant scientific knowledge and its underlying philosophy; (*P*) cognitive (rather than practical or moral) problems; (*A*) gaining objective

knowledge about a domain of facts; and (*M*) the scientific method plus a collection of special techniques subject to scrutiny (Bunge 1996: 79). As will become apparent, the social relational approach I am proposing is scientific and it coincides in many respects with the systemic approach, although the latter is more general than the social relational approach.

### 3.4.1 Body of Background Knowledge

A social relational approach is based on two main philosophical ideas. First, it conceives cultural, political, and economic facts as relational in nature rather than individual actions or an aggregate thereof. Second, it acknowledges that from these relations greater wholes are formed that display emergent or novel properties, above all, social structure. From these two principles, a social relational approach rejects all basic forms of individualism and holism, but it takes the best aspects of both. That is to say, a social relational approach acknowledges the individual, although relational, materiality of social facts and the existence of materially based wholes but with qualitatively irreducible or emergent properties (Blitz 1992, Sawyer 2001, Schweizer 1997).

More recently, these two philosophical notions have been articulated in a theoretical movement in sociology called "relational sociology", which stipulates that the structure of relations among actors and the location of individual actors in this structure have important behavioural, perceptual, and attitudinal consequences for the individual actors and the entire social system (Emirbayer and Goodwin 1994). Relational sociology stipulates that social relations are not completely random, but that they show patterns or particular configurations, which are important features of the lives of the individuals who display them. Therefore, how an individual lives depends in large part on how that

individual is tied into the larger web of social connections. Furthermore, relational sociology notices that categorical models (e.g., race, social status, and social class) alone rarely partition people in a way that confirms with observed action. Thus, these analysts argue that human action in the world is organized through categorical affiliations (e.g., race or social class), but motivated by the structure of tangible social relations in which persons are embedded (Emirbayer 1997).

Admittedly, there is still confusion by some relational sociologists, and scepticism by individualists with reference to the philosophical status of the so-called social relations. Social relations are unproblematic if understood as referring to two interrelated philosophical concepts: relational property and binding relation. A relational property is one that a thing possesses by virtue of its relation to other things (e.g., being friends). In addition, relations can be binding and non-binding, and only binding relations make a difference to the entities it connects as in the case of relational properties (Bunge 1996: 245-246). Social relations are of the binding kind and only these ones qualify as members of the structure of a social system.

### 3.4.2 Problems Addressed

A social relational approach can deal with some aspects of all social cognitive problems (economic, cultural, and political) given one condition. The cognitive social problem has to be formulated in relational terms (Emirbayer 1997, Emirbayer and Goodwin 1994). For example, social institutions have been conceptualized as the emergent patterns of social activity generated by actors embedded in the structure of social networks (Schweizer 1997), and power emerges out of the pattern and operation of socio-cultural and socio-psychological relationships among members of a social system (Emirbayer

1997) rather than being an entity or a possession to be "sized" or "held" as conceived by substantialist theorists.

A social relational approach can deal with practical problems, but in an indirect way, i.e., by scientifically uncovering the role of political, cultural, and economic relations in social systems and providing this information for designing social policies. In this sense, a social relational approach distinguishes between science and technology.

### 3.4.3 Aims

A social relational approach seeks to explain, at least in part, the behaviour of human actors (composition) and of the system as a whole by appeal to specific features of the connections (structure) among the elements. More specifically, it investigates how patterned relationships among actors within a system enable and constrain human action. Conceiving human actors as part of, rather than just as elements of, social systems acknowledges the social embedded condition of human actors and avoids the problems of micro-reduction (which focuses on individuals) and macro-reduction (which focuses on the larger structure) approaches to explain the behaviour of systems: it eschews the individualist and holist pitfalls.

### 3.4.4 Methods

One of the best-developed sociological methods for studying social relations is organized under the rubric of social network analysis (Emirbayer 1994). Social network analysis focuses on "relationships among entities, and on the patterns and implications of these relations" (Wasserman and Faust 1999: 3). Social network analysis comprises diverse methods for the study of how resources, goods, and information flow through particular

configurations of social ties (Wasserman and Faust 1999). From the outset, the network methods of studying human behaviour involve two commitments: (1) they are guided by formal theory organized in mathematical terms[7], and (2) they are grounded in the systematic analysis of empirical data. Thus, fuzzy concepts such as social cohesiveness and social prestige can be formalized and quantified, allowing systematic quantification and comparative studies. However, a logical or mathematical formula cannot capture the full sense of a scientific construct because formalization does not provide the reference class of the construct in question, which means that it supplies only part of its meaning. For example, that the density of a network equals 0.4 is mathematically exact but not enlightening unless accompanied by a proposition telling us what kind of relation it represents; i.e., its context. The context in this case is given by a factual theory. In other words, the methods of the social network analysis are not a substitute for substantive social theories. However, the social network approach can serve as scaffolding for the construction of theories.

Social network data consist of at least one structural variable measured for a set of actors (Wasserman and Faust 1999). Structural variables refer to the social relations (measured on pairs of actors) of interest, and are the primary concern of network analysis. However, attributes of individuals such as age, education, work position, place of residence, and so on, can also be used creating a composition-structure framework of explanation. The relations among actors define the ***structural*** data, while the attributes of individuals refer to the ***composition*** of the social network. The tools for obtaining social network data are similar to the traditional methods used in the social sciences (e.g.,

[7] These methods are based on graph theory, statistical and probability theory, and algebraic models (Wasserman and Faust 1999).

interviews, surveys, participant observation, and archival records). There are two major emphases in social network analysis (Hanneman and Riddle 2005). On the one hand, the analysis can focus on the individual and his/her contribution to the structure of a social network by virtue of his/her position in the web of social relations – actor level of analysis. Focusing on the overall structure, on the other hand, an analysis concentrates on emergent properties of social networks: that is to say, properties that none of the members of the social network has – global level of analysis. My analysis of how social relations affect the access to fishery resources in the Loreto area follows this analytical distinction. In Chapter 5 I use a global level of analysis and in Chapter 6 I use an actor level of analysis.

The structural approach as developed by social network analysts also has theoretical and methodological limitations. For instance, network analysts have restricted their theoretical concerns to elucidating basic concepts, methods, and synthesis of research findings, neglecting the theorizing of the role of culture (ideas, beliefs and values) in the determination of social action (Emirbayer and Goodwin 1994). In other words, the structural approach "fails to show exactly how it is that intentional, creative human action serves in part to constitute those very social networks that so powerfully constrain actors in turn" (Emirbayer and Goodwin 1994: 1413). Methodologically, social network analysts cannot accommodate the notion of exo-structure in the sense used in the CESM model, because once the population of interest has been defined, the methods of social network analysis have to assume the network to be a closed system. Of course the obvious solution is to expand the boundaries of our population but this strategy ultimately faces the constraints imposed by the limited financial resources of any scientific

empirical inquiry. However, it is possible, at a minimum, to graphically describe the exo-structure of a social network. Notice, however, the neglect of exo-structure is a methodological necessity and not an ontological commitment of social network analysts who explicitly acknowledge the multiplicity of relations and nested nature of social systems (Wasserman and Faust 1999). Finally, it is necessary to make some conceptual distinctions between (social) system and (social) network and between network analysis and social network analysis, if only because they are often used interchangeably.

The similarity and difference between (social) system and (social) network are these: every social network is a social system, but the converse is not true. There are two reasons for this, one conceptual and the other of substance. Conceptually, all (social) networks and all (social) systems can be represented as a graph; i.e., a collection of nodes (e.g., representing individuals, firms, organizations, nations) connected (fully or partially) by lines (social relations). Substantially, however, a social network is held together by pro-social behaviours (e.g., solidarity, friendship, acts of reciprocity), and it is informal and not hierarchical (Bunge 1996)[8]. Thus, a formal organization and a market are social systems but not social networks, yet both can be represented as graphs (Poldony and Page 1998). To be sure, every human is a member of at least one social network, and often we deal and participate through our networks in social systems such as the market (Granovetter 1985); hence, the relevance of social networks to all social systems, despite the contention that contemporary societies are characteristically structured by impersonal institutions (Coleman 1993, Polanyi 1967, Scott 1976).

[8] It is important to note that not all social network analysts may share this definition of social network. In fact, network analysts often leave the concept of social network undefined and use structural properties to characterize social networks.

Another important distinction should also be made between network and social network analysis. While both may use the same mathematical algorithms, network analysis is used to model and analyze practically any kind of system. Again, this is because systems can be represented as graphs. Thus, there are applications of network analysis to a wide range of systems. For example, network analysis has been used to study food webs (Ray et al. 2000) and neuro-physiological systems (Smith et al. 1999). Clearly, by definition none of them is a social network.

Overall, I have sketched the main components of the social relational approach and its connections with and difference from the systemic approach and the CESM model. I have also made basic conceptual distinctions between system and network and between network and social network analysis. Based on this theoretical framework and conceptual distinctions, I advance a programmatic hypothesis for the study of the commons.

## 3.5 The Study of the Commons: A Social Relational Programmatic Hypothesis

The conditions under which local resource users are able to govern the use and protection of the commons have been amply documented since the publication of the Tragedy of the Commons (Acheson 1981, Dyer and McGoodwin 1994, Fenny et al. 1996, McCay 2000). The most important efforts to systematize some of the extensive work on the commons in the past 30 years has resulted in empirical generalizations (conditions) that have served to produce middle range theories (e.g., Ostrom 1990, Pinkerton 1989) and institutional design principles (Ostrom 1992). Recently, Agrawal (2002) has suggested that to move forward in theory building it is necessary to hypothesize about the possible relationships

among these conditions. Agrawal (2002) has discussed some of the constraints and methodological issues that need to be addressed for advancing in this direction. There are, however, philosophical issues that are also paramount in moving forward in the study of the commons, particularly given the diversity of perspectives that have characterized the field in the past 25 years (Singleton 1998).

It should come as no surprise that many scholars in the study of the commons have resisted unification of the field through reductionism that favours a particular view (See "Design Principles and Social Construction in CPR Theory" and "Game Theory and CPR Research" in, The Common Property Resource Digest 2000a, 2000b). Unification and diversity seem to be at odds. But unification does not always entail reductionism, such as *psychologism*, *physicalism*, and *economicism* to mention the most popular radical reductionist strategies for achieving the unity of science (Bunge 1996). I submit that the social relational approach can provide the framework for such unification because it stresses interconnectedness by implicitly adopting the systemic principle that "every object (whether concrete, conceptual, or symbolic) is either a system or a component of one or more systems" (Bunge 1996: 195). The fundamental ontological principle of interconnectedness as the most fundamental organizing principle of reality can not be over-stated, and despite resistance by some to explicitly embrace it, it is hard to find a scientific discipline that does not make use of it (Bunge 2001, 2003).

It is in using this general principle that I submit what I believe the study of the commons entails. The study of the commons is a scientific field that refers to the shared access and use of valued resources by at least two individuals embedded in social systems that consists of political, cultural, and economic sub-systems. Three aspects of this

general idea are worthy of note. First, value is not attributed to only economic value, but certainly allows for it. Second, it uses sharing instead of ownership to allow for a broader range of patterns of use (including private, state, and common regimes); indeed, sharing precedes owning[9]. And third, it assumes that shared use is not exercised by individuals but by embedded individuals or individuals-in-society, thus eschewing any forms of individualisms or holisms. More importantly, the generality of this idea suggests the following programmatic hypothesis: the shared access and use of valued resources is a subset of the social, political, and cultural relations among individuals who comprise social systems. This programmatic hypothesis allows for more breadth and depth for theorizing the commons. That is, this programmatic hypothesis is in need of substantive theories regarding the cultural, political, and economic relations among users of the commons. It is within this programmatic hypothesis that I analyze the conditions under which socially diverse and geographically distant individuals from seven rural coastal communities adjacent to the Loreto Bay National Marine Park, share the access and use of fishery resources.

## 3.6 Empirical Work: Informed Consent, Assumptions, and Survey Questionnaire

I conducted the empirical component of my research during three visits (in 2001, 2003-2004, and 2005) to seven rural communities adjacent to the Loreto Bay National Marine Park, BCS, Mexico. The main component of my empirical work included informal interviews and application of a survey questionnaire. Before visiting the area in those

[9] Vatn (2001) points out that even in cases of private ownership such as by a corporate firm, it is reasonable to talk about a group of co-owners.

years, I obtained ethics approval of my research from Simon Fraser University to conduct informal interviews and application of my survey questionnaire.

### 3.6.1 Informed Consent for Interviews and Surveyed Questionnaire

I did not obtain written consent from my research participants because people in Mexico often do not feel comfortable signing forms, and many of my research participants were illiterate. Instead, I obtained verbal consent from all my subjects before I commenced any interview or application of my surveyed questionnaire using a standard statement (Appendix 1). Typically, I first approached potential research subjects to explain who I was and what I was doing, and then I would ask for an interview or for help to complete my survey questionnaire for my research. If an individual declined, I did not approach the person again with the aim of having an interview or filling out my questionnaire. I did not have a pre-determined place to conduct my interviews or filling out my survey questionnaire but often I conducted them at the work place of participants or in their homes. I did not tape any of my interviews but took notes during and immediately after my interviews and application of my survey questionnaire.

In 2001 I was based in the town of Loreto and spent time (one to two weeks) in each of five (Ramadita, San Nicolás, Juncalito, Ensenada Blanca, Agua Verde) of the seven rural coastal communities adjacent to the Loreto Bay National Marine Park. I visited Ligüí in several occasions but did stay overnight in this locality and I did not visit Colonia Zaragoza because of its transitional nature from rural to a more urban locality due to its close proximity to the town of Loreto. In subsequent visits I decided that Colonia Zaragoza was an important locality that I needed to include in my research because it is one of the oldest localities and has one of the largest number of resource

users in the area. Managers of the Loreto Bay National Marine Park have repeatedly approached these seven coastal rural communities with the aim of involving them in the conservation and management of the park's marine resources.

During my 2001 visit I also conducted informal interviews with resource users from the coastal rural communities of Loreto, academics from the Autonomous University of Baja California Sur, managers of the Loreto Marine Park (director and staff) and natural and fisheries resource managers from federal (SEMARNAP) and state agencies (State Fisheries Promotion Agency of Baja California Sur). During these informal interviews I dealt with the viewpoints and opinions each informant had regarding constraints and opportunities in the conservation and management of natural and fisheries resources in Baja California Sur and particularly in the Loreto Area. I conducted my interviews with park staff in the town of Loreto and with federal and state resource managers and academics in the city of La Paz, the capital of Baja California Sur. The interviews together with my personal observations helped me articulate my dissertation topic.

In the 2003-2004 and 2005 visits, I mostly applied a survey questionnaire to fishery resource users who voluntarily accepted to participate in my research and participated in community activities such as fishing and daily life of the seven fishing communities adjacent to the park. I also visited the city of La Paz to conduct literature reviews, particularly at the Autonomous University of Baja California Sur and CICIMAR, a local branch of the Instituto Politécnico Nacional (The National Polytechnic Institute).

### 3.6.2 Assumptions

The main assumption used in developing Chapters 5 and 6 is that sharing of information among fishery resource users on the state of fishery resources and regulations is a key form of cooperation where resource users seek trustworthy information to help them decide where and when to fish. Information sharing for accessing fishery resources among fishers has been already documented in the maritime anthropology literature and has also been conceptualized as a form of cooperation (Acheson 1981, Andersen 1972, Forman 1967, Gatewood 1984, Stiles 1972). While fishers share information for accessing fishery resources, information does not flow freely and is often kept secret. Information for accessing fishery resources is a scarce resource; thus, it is of value to fishery resource users. In the case of the fishery resource users from the Loreto Bay National Marine Park, information on the state of fishery resources and the regulations is a valued resource that does not flow indiscriminately.

During my first visit in 2001, I often witnessed fishery resource users consulting one another on the state of fishery resources. In my subsequent visits to the area in 2003-2004, several fishers told me stories about deciding to temporarily leave their communities to fish in other parts of BCS after a fellow fisher had informed them about a good fishing opportunity elsewhere. In this sense, I interpret this sharing of information as an important form of cooperation that can be more precisely articulated using Bunge's (1980) assertions regarding cooperation: (1) Let *a* and *b* be actors, then, *a* and *b* cooperate with one another if the social behaviour of each is valuable to the other or to a third actor; and (2) when cooperation concerns "goods" of some kind it is called sharing and called participation when it concerns activities. Sharing of information is a "good"

that allows access to fishery resources that are often variably distributed, or as fishermen would describe it, "fish move". A patchy distribution of fishery resources is also likely to make sharing of information critical for resource users to continue their participation in fisheries.

### 3.6.3 Survey Questionnaire

I designed my survey questionnaire in conjunction with my committee members and refined its content after pre-testing it in the field in 2004. In particular, I included, and when necessary adapted, some of the socio-economic questions used by Dr. Duncan Knowler in his community-based conservation research project in Nepal. I pre-tested my survey questionnaire with three male residents born and raised in Colonia Zaragoza, 23, 45 and 55 years of age, and a fourth male of 50 years of age who I met in 2001 while visiting the San Nicolás community. I decided to test my questionnaire with these four individuals because of my rapport with these four individuals and their interest in my research.

My survey questionnaire included two types of variables, individual and relational attributes (Appendix 2). The individual attributes included variables on social and demographic characteristics, fishing practice, and work satisfaction. These questions were intended to characterize resource users or the composition of my population of interest, the fishery resource users from the seven rural coastal communities adjacent to the Loreto Bay National Marine Park.

The relational data included questions on the personal contacts that resource users draw upon for finding out the state and location of fisheries resources and the regulatory context. Three questions were used to identify the individuals consulted to find out about

the state and location of fishery resources: Whom do you consult to obtain trustworthy information regarding abundant fishing areas in (1) your community, (2) the other fishing communities of Loreto Municipality, and (3) other parts of BCS? A fourth question was used to assess the contacts used to find out about the fisheries regulatory support for accessing fisheries resources: (4) whom do you consult to obtain trustworthy information regarding fishery regulations such as fishing permits and closed and open areas for fishing? During the preliminary testing of these questions it became apparent that adding the qualifier "trustworthy" (*de confianza*) was necessary to embed each question within the idiosyncratic schema of knowledge representation and information-processing mechanisms of resource users[10]. For instance, during the pre-testing of my survey questionnaire, I found that without the qualifier "trustworthy" the question about personal contacts seemed almost unintelligible to resource users and resulted in answers such as "anybody in the community will provide you with information". The qualifier "trustworthy" made the question intelligible to resource users and often prompted discussions on resource users who were untrustworthy. Because of the importance of this qualifier, I always reiterated to participants the condition of trustworthiness for them to identify the individuals they consult.

The four questions on personal contacts attempt to capture the different social relations available to resource users for accessing fishery resources, and it is assumed that the informant's consultation with trustworthy personal contacts indicate cooperative behaviour whether or not this behaviour is reciprocated. The relational data were

[10] Recent studies in cognitive psychology and social cognition use the concept of schema to explain human cognitive performance and patterns. Schema refers to schematic structures that organize information (DiMaggio 1997). One general finding is that cognitive performance (e.g., recalling) improves when information is schematically embedded.

complemented by asking the individual respondent about the relationship (e.g., father, cousin, friend, acquaintance, etc.) with each of the personal contacts mentioned in each of the four questions. I always emphasized to participants in my research that personal contacts could not be both kin related and friend at the same time.

Finally, in 2004 after four months of fieldwork collecting data from Colonia Zaragoza, I became seriously ill and had to postpone my fieldwork until 2005 when I went back to the field for four more months. The collection of data took significantly longer in Colonia Zaragoza for two reasons. Colonia Zaragoza has one of the largest rural populations of fishery resource users in the area and that reduced the speed at which I was able to approach potential participants given both my previous lack of experience with the resource users from this locality during my first visit in 2001, and the absence of a complete list of all fishery resource users from Colonia Zaragoza. A complicated factor was the relative longer time to find and arrange interviews with resource users from this locality, and the refusal of some resource users to participate in my research. These factors as well as the intrinsic methodological challenges of implementing a social relational approach had implications on how I collected my data in 2004 and my subsequent visit in 2005.

## 3.7 Methodological and Fieldwork Challenges in the Collection of Data

I faced two methodological challenges for collecting my data. The first one was the cognitive assumptions made about informants answering autobiographical questions and the second one the delimitation of my population of interest.

### 3.7.1 Dealing with Cognitive Limitations

One of the main assumptions in a social network analysis and, in general, of survey questionnaires is that respondents will recall *all* information accurately, for instance, the individuals with whom they have a social tie of a certain kind (Bradburn et al. 1987, Brewer 2000). If this assumption is not entirely accurate, the robustness of the results produced by the social network analysis will decrease. Thus, respondent's forgetting of social ties during the interview can be a significant problem for the assessment of social networks. Indeed, a review of the literature on respondent's forgetting of social ties suggest that forgetting poses a potentially significant problem for the collection of complete network data and may bias measurement of network characteristics and properties (Brewer 2000). While this literature shows that forgetting in free recall of social ties is always present, people are more likely to forget weak than strong ties (e.g., measured as closeness of relationship, reciprocity of friendship choices, duration and frequency of contact). A more accurate statement, given the important discovery of the "strength of weak ties" (Granovetter 1983) is that social network analysts are interested in identifying patterned relations and their dynamics and not ephemeral encounters (Wasserman and Faust 1999). Despite the clarification on the scope of social network analysis, people's memory is fallible (Bradburn et al. 1987). Brewer (2000) identifies several collection methods that have shown to increase, from slight to moderate, the respondent's recall in survey questionnaires. These methods include recognition or objective records of social interactions, non-specific prompting and cueing, multiple elicitation questions (if appropriate) and re-interviewing.

In light of this recall or forgetting problem, I planned to collect my relational data using a "recognition data collection technique" in 2004. In this technique respondents are presented with a list of all members of the group, and are asked to estimate the strength of their relationships with each listed person (Ferligoj and Hlebec 1999). In 2004, there were two unforeseen situations that did not allow me to use this technique: a complete list of *all* fishermen prior to the collection of the data was not available, and the relatively large number of resource users from the seven rural communities would have made it rather impractical to go through a complete list with each respondent.

To deal with the issue of forgetting, I disaggregated the question on the personal contacts used by fishermen into four questions, and added the qualifier "trustworthy" (*de confianza*) to each question (see section 3.6.1.). Disaggregating the question on the personal contacts prompts respondents to concentrate their attention on specific situation and reduces the demand on respondent's cognitive effort to recall names[11]. Furthermore, the subjective qualifier trustworthy may have had the additional effect of focusing attention on associated emotional events or important personal experiences (e.g., whose information has proven to be trustworthy) that seem to enhance an individual's facility for re-calling past information (Bradburn et al. 1987).

To collect my relational data in 2003-2004, I used a free-choice design because of the lack of a complete list of resource users (Wasserman and Faust 1998). In a free-choice design there is no constraint on the number of people that an individual respondent can choose. I used a snowball network sampling technique to continue identifying other

[11] Psychological research suggests that people shift into deliberate modes of thought relatively easily when their attention is attracted to a problem (DiMaggio 1997).

fishery resource users from Colonia Zaragoza[12]. I stopped applying my survey questionnaire when no more resource users from Colonia Zaragoza could be identified with the snow-ball technique and no more potential respondents would accept to be part of my research. While some simply refused to be interviewed, others would point out that their answers would be the same as the answers of a previous member of the household I had interviewed. The consequence of this condition was that I would always end up interviewing one household member, often the skipper or the one responsible for fishing trips, which did not always coincide with the oldest member of the family. Of course, as I discovered, in those cases where one household member would decline to be part of my research, it was certain no other potential member of the household would agree to be part of my research.

These methodological and fieldwork challenges had important implications on how my population was defined, and how I collected my data in my subsequent visit to the area in 2005.

### 3.7.2 Boundary Specification of Population

An important consequence of the snowball network sampling technique I used in 2004 was that it allowed the resource users themselves to define the membership and limits of the population, in this case, fishery resource users from Colonia Zaragoza. As such the implicit assumption in defining my population of interest is that resource users have to be regarded as such by their peers rather than being selected using a researcher's theoretical

[12] The snowball network sample begins with a set of actors and reported actors with whom s/he has ties of a particular kind. All the actors reported by the first set of interviewees are interviewed to identify a second set of actors. The snowball network sampling continues in this way until all members of a network have been interviewed.

categories such as occupation (e.g., sport and commercial fisher), years living in community, alternative sources of income, etc. The approach of identifying boundaries as perceived by the actors themselves is referred to in the literature as the realist approach, while a nominal approach is based on the theoretical concerns of the researcher (Wasserman and Faust 1998).

For my subsequent visit in 2005 I decided to apply a different technique to collect my relational data. Rather than using a snowball network sampling technique to identify resource users from any particular locality, I created a list of community resource users based on data from my previous visits and input from two to three members from each community with whom I had built rapport from previous visits. The only condition I imposed on the identification of fishery resource users by my informants was that they should regard the resource users as members of the community. My previous rapport with some community members facilitated this process. To be consistent I re-interviewed (only for the relational data) most of the resource users from Colonia Zaragoza (41 of 50)[13].

In 2005, then, I collected my relational data by presenting a respondent with a roster of resource users from his community and using a free-choice design to elicit contacts from the other six communities, localities within the Loreto municipality (e.g., the town of Loreto), and other localities in Baja California Sur. I attempted to interview at least one household member. It is important to point out that this strategy does not represent nor was intended to draw a random sample. Indeed, one important characteristic of relational data is that observations are not independent in a statistical sense (Hanneman

[13] The individuals I did not re-interview were old and young fishers who had definitely left the fishing activity or associated activities.

and Riddle 2005). The reason is that network data is about social relations, not individual attributes. Thus, traditional survey methods treat each individual as a representative or replication interchangeable with any other (Hanneman and Riddle 2005). In sum, my population consisted of members (all males) of households who agreed to participate in my research from the seven fishing coastal communities.

## 3.8 Data and Statistical Approach to Relational Data

I applied my research questionnaire to 123 individuals from the seven rural communities. The relative number these 123 individuals represent in relation to the number of households I identified to be involved in fishing are presented in Table 3.1. In addition, the 123 individuals interviewed identified 106 fishery resource users from other localities I did not survey the town of Loreto, Isla del Carmén, Tembabiche and three municipalities Comondú, Mulegé, and La Paz. These 106 resource users represent in the CESM model the exo-structure. Unfortunately, the social network analysis methods are not designed to include individuals who are just mentioned by interviewed subjects. A formal social network analysis of the exo-structure would be biased by including them. Once the population of interest has been defined, it is assumed that the system is closed, even when most social network analysts are aware this is rarely the case (Robert Hanneman, personal communication, 2006). Yet, such relations describe important connections of resource users from the seven rural communities to the other localities and their social integration with the larger polity.

**Table 3.1** Number of surveyed individuals and number of households involved in fishing I identified in each of the seven coastal communities

| COMMUNITY | SURVEYED INDIVIDUALS | NUMBER OF HOUSEHOLDS |
|---|---|---|
| Agua Verde | 19 | 23 |
| Colonia Zaragoza | 41 | 50 |
| Ensenada Blanca | 20 | 30 |
| Juncalito | 6 | 10 |
| Ligüí | 20 | 28 |
| San Nicolás | 12 | 16 |
| Ramadita | 5 | 5 |
| Total | 123 | 162 |

### 3.8.1 Statistical Approach to Relational Data

In modern science, the discovery of chance as a natural, objective, and intrinsic constituent of physical and natural phenomena led to an intuition of reality that is not deterministic but probabilistic (Scardovi 1988). Network researchers have come to recognize the contingent nature of social relations and thus to apply descriptive and inferential statistics in their work (Hanneman and Riddle 2005). Therefore, observations of relational data are interpreted as stochastic, rather than deterministic outcomes of social processes.

In particular, I used inferential statistics to analyze my relational data in Chapters 5 and 6. While standard inferential statistical methods can be applied to network data, Hanneman and Riddle (2005) indicate that there are two distinctive aspects to consider when using statistical methods for analyzing network data. The first difference is that

social network data refers to relations among actors and not relations among variables. The second difference, and perhaps most critical, is that the standard tools of inferential statistics do not apply directly to network data. The reason is that observations in network data are not independent: i.e., the independence postulate of standard statistics is violated. Thus, estimating standard errors, computing test statistics, and assessing the probability of null hypotheses can produce "false positive" answers more often than "false negative" ones (Hanneman and Riddle 2005). Alternative numeric methods such as "boot-strapping" and permutation approaches are used to calculate distributions of statistics directly from observed networks as implemented in specialized software for social network analysis (Borgatti et al. 2002, Hanneman and Riddle 2005). I used these specialized inferential statistical methods in Chapters 5 and 6.

## 3.9 Concluding Remarks

The hallmark of the social relational approach I have described lies in its focus on socially related individuals, who form greater wholes that display emergent properties. I proposed that this approach and the specific methods of social network analysis are potentially fruitful alternatives for investigating the conditions under which actors access and use common-pool resources, such as fisheries. In the next chapter, I begin by describing how natural resources have been accessed and used in the Baja California Peninsula, particularly in the southern portion of the peninsula before and after the arrival of Spaniards.

# CHAPTER 4
# ACCESS AND USE OF NATURAL RESOURCES IN BAJA CALIFORNIA: PAST AND PRESENT

What has been the interaction between society and nature in Baja California? Political ecology addresses this type of question by focusing on power relations and material and symbolic struggles to access natural resources but also how the natural environment affects socially organized behaviours (Goldman and Schurman 2000). As such, the ultimate emphasis of political ecology is on conflict and competition among unequal agents and how through these struggles the social constitutes nature and vice-versa (Goldman and Schurman 2000).

In this Chapter, I describe some of these political struggles and environmental constraints on the access and use of natural resources before and after the arrival of Spaniards in the Baja California Peninsula. I also describe the main fisheries federal policies and their effect on the state of fishery resources in the Gulf of California. The over-exploited condition of multiple marine resources can, in part, explain the creation of the Loreto Bay National Marine Park, but the social processes of its creation occur amidst a mixture of cooperation and conflict.

## 4.1 California: The Land West of the Indies

Hernán Cortés conquered Tenochtitlán or what is now Mexico City in 1521 and by 1527 he had already ordered the construction of ships to explore the oceans west of the Indies.

However, it was not until 1533 when Fortún Jiménez discovered an extensive land far west of the Indies in what is now known as the Pacific Ocean but at the time was known as *Mar del Sur,* "Sea of the South". This land was described by Jiménez and his crew as a rich island because of large banks of oyster pearls found along its coasts. Soon this island became known as California[14].

After learning about the *Island of the Pearls*, Cortés organized his own expedition to establish a colony. His expedition arrived in what now is known as the bay of La Paz in 1535, but less than a year after, the new colony had to be abandoned because the climatic conditions (lack of abundant water and excessive heat) did not allow a permanent settlement. After Cortés, other expeditions followed, some to recognize and map the coast of the new land and others to extract pearls, but a permanent colony was not possible until 1697 when Jesuit missionaries established the first mission that subsisted, in part, due to the financial support provided by Jesuit groups from mainland Mexico (del Río and Altable-Fernández 2000).

During the first 150 years of its known existence, California was an enigma floating between the fiction of a legend (Las Sergas de Esplandián) and its geographic reality; it oscillated between one and the other depending on the objectivity or imagination of the describers of this land. Fernando Jordán (2001: 72) describes California in this century and a half as a land of paradoxes:

> "For those who only saw its arid mountains and dangerous coasts, it [California] was portrayed as an inaccessible and miserable land; those who knew of its pearls and saw its rich ores of gold inland found it immensely rich. Some believed it to be densely populated, others horrifically lonely. California was, and continues to be, rich and poor, beautiful and unpleasant, inaccessible and embracing" (Jordán 2001: 72).

[14] The word California seemed to have originated in an ancient Greek novel, and was popularized by Garcí Ordoñez de Montalvo in his epilogue of *Las Sergas de Esplandián* to describe the land imagined by Christopher Columbus (Rosales-López and Fujita, 2000).

These paradoxes seem to continue well into the 21th century, many of which have been the result of seeking to populate an inhospitable land and create a viable social order for accessing and using California's natural wealth. In the next sections, I describe how natural resources have been accessed and used in the Peninsula of Baja California before and after the establishment of the first Missionary Colony until recent times. The historical account, necessarily condensed, tells a story of repeated efforts to regulate access to natural resources and create a productive Baja California. Paradoxically, these efforts have resulted in over-exploitation of natural resources. The actual tragedy has been the opposite of the one imagined by Hardin (1968).

### 4.1.1 The First Californians

Indigenous groups are thought to have migrated along the Peninsula at late as 9,000 years BC and possibly as long ago as 18,000 years BC (Rosales-López and Fujita 2000). Immigrants to the peninsula appear to have originated from what is presently known as southeast USA. The success of the first migrations to the California Peninsula appeared to have been facilitated by a more humid and benign climate than the prevalent current desert or semi-desert climate[15]. The indigenous population at the time of contact was estimated to have been between 40,000 and 50,000 individuals (Rosales-López and Fujita 2000). Given the harsh conditions under which these indigenous groups lived, many have suggested that over the years, their cultural practices reflected to a great extent the biological, physical, and climatic conditions of the California Peninsula (del Río and Altable-Fernández 2000).

[15] The California peninsula covers an area of approximately 143,600 square km and about 89% of this land is considered desert or semi-desert. The California peninsula is the second-longest north-south peninsula in the world (Roberts 1989).

The first Californians were semi-nomadic, and never developed or practiced agriculture nor domesticated any animals. Their nomadic practices were closely coupled with the abundance and location of water and food resources within some more or less defined territories. Food included insects, reptiles, fruits and roots, mammals, fish, and molluscs. Food gathering and hunting was divided among men and women. When fishing was carried out collectively, fish was equally distributed and although there were individual practices such as gathering of foods, most activities seem to be carried out cooperatively within the context of egalitarian practices (Rodríguez-Tomp and Altable 2002, Rosales-López and Fujita 2000).

At the time of contact, missionaries noticed that the indigenous societies were organized into bands that could include as many as 250 individuals. There was social differentiation within groups but these divisions were more prominent during festivities and extraordinary situations such as conflict with other tribes (del Río and Altable Fernández 2000). Language was another cultural trait that differentiated indigenous groups in the California peninsula. Jesuits missionaries recognized three languages of extensive use in the Peninsula: Cochimí, Guaycura, and Pericú. However, a more detailed assessment of language suggested that there were many dialects within these three main languages to the point that at times some non-neighbouring tribes within a particular language may have difficulties communicating. Indigenous groups adopted some form of sedentary life, believed in supernatural beings, and had complex burial practices despite their apparent unsophisticated way of life (Rosales-López and Fujita 2000). Indeed, the spiritual belief system of indigenous groups was polytheistic, and appears to have clashed with the Christian monotheistic belief system of the first missionaries.

In sum, the first Californians were semi-nomadic, hunter-gathers, with a rather simple social organization and polytheistic belief systems that are likely to have guided their practices and ways of life. Their knowledge of this land and its resources was, however, a key factor in their organizational structure and cultural practices. A rapid transformation, however, occurred after the creation of the first missionary colony.

### 4.1.2 The Conquest of California: the Missionary Epoch

In October 26, 1697, almost 200 years after the conquest of Tenochtitlán, the first successful project for colonization started in what now is known as the town of Loreto. It was in Loreto, the first capital of the Californias, where the Jesuit missionary Juan María de Salvatierra along with a crew of less than 20 men successfully established the first mission in California. Many factors helped in the success of Salvatierra in establishing the first mission in California, but perhaps a key factor was the unconditional help from the Jesuit, Eusebio Francisco Kino, who constantly sent basic supplies to Salvatierra from mainland Mexico. Salvatierra and many other religious ministers were used as the primary agents to implement Spain's main policy for the American colonies: concentrate the indigenous groups in towns to facilitate their religious conversion to Christianity (evangelization), enhance political control, and, in time, ensure the economic integration (exploitation) of the indigenous groups as a labour force (del Río and Altable Fernández 2000). Thus, in frontier areas of the Spanish colonies, where Spanish control was weak, the main administrative unit used to implement this policy was the mission. Missions became widespread throughout northern Mexico and at its peak in Baja California there were as many as 14 Jesuit missions in 1767.

The economic system of the missions was based on communal principles and oriented towards subsistence. There was a clear division of labour between sexes and age groups, but these would vary depending on the needs of the mission (Rodríguez-Tomp and Altable 2002). The most important impact of the missionary practices on indigenous groups was a partial disruption of the hunting-gathering practices by typically sedentary religious and economic practices of the European missionaries. There were many drastic cultural changes during the conversion of the first Californians to Christianity, but nothing could have been more drastic than the disappearance of all indigenous groups in the southern part of the Peninsula by the beginning of the 1800s. Important causes that led to the rapid decrease in the indigenous population were illnesses such as syphilis and chicken pox.

It is widely accepted that the missions were only a stepping stone to an integration of the peninsula and its inhabitants into the tributary Spanish system. This integrating process began with the secularization of the missions where the most important goal was the development of private economic activities.

### 4.1.3 Secularization of the Missions

Before the decline of the missionary regime, the soldiers and other non-indigenous groups associated with the missions were interested in the fishery of pearls and mining. Manuel Ocio, a soldier associated with the mission of Loreto, is recognized as the first permanent resident to start an enterprise for profit after the first mission was established. After quitting his position as a soldier, Ocio became rich from selling pearls in Guadalajara (a city in mainland Mexico), and then became a cacique or local political boss after creating a profitable mining enterprise in the southern part of the Baja

California peninsula. In the absence of a large work force, a recurrent constraint for the economic growth of Baja California, Ocio had to bring workers from mainland Mexico. By the end of the 18th century, there were around 400 people living in the southern mining region of California. Soon, the missionary system of self-support through subsistence which was the governing arrangement of the Californias began to encounter conflicts over the fertile land as the new mining settlements became profitable. Disputes were often resolved in favour of the missionary system but the Spanish Crown began to see the missionary system as a barrier to economic expansion, not to mention the fact that the Jesuit missions of the Californias had become an expensive enterprise to the Spanish crown. Not the least of the problems facing the missionary regime was the fact that its original reason for existence, the conversion of Indians to Christianity, became irrelevant given the rapid decrease of indigenous groups[16]. The activities for profit, however, can be traced back to the very discovery of Baja California in the 16th century when seasonal expeditions by *armadores*, or pearl fishing fleet entrepreneurs, were a common practice (Rodríguez-Tomp and Altable 2002). These fishing expeditions had to be approved by the Crown and five percent of the pearls fished had to be given to the Crown.

The formal step towards the secularization of the missions of California was taken in 1767 by Royal Decree, where all the governing and economic privileges of the Jesuit missionaries were withdrawn. A need for re-organization of economic and political life was necessary to speed up the process of economic integration of Baja California. The Spanish Crown assigned José Gálvez to visit Baja California as part of a commission to evaluate the performance of all the colonies of the Spanish Crown and recommend

[16] Estimates indicate that the indigenous population, in 1697 when Salvatierra arrived in Loreto, was around 41,500. By 1728 it had been reduced 20% to 30,500, and by 1742 to 25,000; 1762 to 10,000 and in 1768 to 7,149 (del Río and Altable Fernández 2000).

reforms. His recommendations for reforms to socially and economically re-organize the remaining indigenous and new settlers of California were unrealistic and excessive (e.g., Galvéz was bold enough to indicate the number of rooms, windows, and fruit trees for the houses to be built). Years later, some recommendations, in particular those dealing with land tenure were eventually implemented.

The social order envisioned by the Spanish Crown was to convert the self-support through subsistence regime of the missions to a profitable system that would allow market integration and use of the indigenous working force. Key to this project was the re-allocation of land, in particular, the few fertile lands once monopolized by the missionary regime. Galvéz, through legal reforms, promoted the privatization of several portions of land in the southern part of the peninsula, where mining was already operating. Indeed, mining in southern California facilitated the economic integration into markets in mainland Mexico and also the economic integration of local economies composed of mining towns and dispersed farm producers of poultry, meat, milk, fruit, vegetables, etc., necessary for the mining towns to survive.

Baja California initiated a process of political and economic reform at the end of the 18$^{th}$ century in which a governing system integrated by governors and commissaries or deputies for the most important human settlements (in particular the mining ones found in the southern part of California) were implemented. Also relevant was the substitution of the subsistence economic system of the missions for a capitalist economy in the permanent settlements of Baja California. While Galvéz's reforms to the economy and political system were key conditions facilitating human immigration into Baja California, other conditions continued to slow down the flow of new immigrants to Baja

California: the cultural, social, and economic isolation of Baja California from mainland Mexico and harsh climatic conditions. Although slow, the colonization and replacement of the indigenous groups of Baja California continued, in particular in southern Baja California where, in addition to a "thriving" mining industry, merchants en route to Asia, in particular to the Philippines, stopped to re-supply in La Paz and San Jose del Cabo ports. This change in the structure of the population spread south to north in Baja California from the end of the 18th throughout the beginning of the 19th centuries. More changes were to come after Mexico became an independent nation.

### 4.1.4 Mexican Independence and Baja California

Baja California seemed to have been unaware of and disconnected from the signs of conspiracy and insurrection for independence taking place in mainland Mexico. No great battles took place in Baja California Sur related to the independence of Mexico. In 1822 Baja California pledged allegiance to Mexico as an independent nation. Once the political leaders of California had pledged allegiance to an independent Mexico, the already recognized Alta (or upper) and Baja (or lower) California were constituted as one federal territory with one political chief based in San Diego, California, and a political delegate located in Loreto. It was not until 1829 that Baja California acquired its own political chief. Moreover, in 1837 the capital of the territory of Baja California was moved to La Paz, apparently because of La Paz's larger population and economic activities.

There were multiple changes required in the political and administrative structures to make the Baja California territory operational. Among the most important ones was the creation of municipalities, whose general functions were to keep peace, provide for basic education, health, promote economic activities, and also ensure the political participation

of Baja Californians. Out of its legal mandate, municipal authorities in the Baja California Territory assigned concession rights for land uses. This policy further facilitated the colonization of Baja California. In approximately 50 years from 1800 to 1850, the population of the whole peninsula had more than doubled from 4 500 to 12 500 (this did not include the 3,000 Indians dispersed in Alta California). For the four extant municipalities of Baja California, there were circa 7,366 individuals mostly concentrated in the southern part of Baja California (del Río and Altable-Fernández 2000). Baja Californians of that time were mostly occupied in basic economic activities such as mining; raising cattle; and production of cattle products such as cheese, dry meat, and leather products. Indeed, these socio-economic conditions allowed for a *sui generis* culture, mostly articulated through small ranches for raising cattle, and small-scale agriculture that persists today in areas of BCS (Cariño and Alameda 1998). For instance, towards the mid 1800s, it was estimated that there were about 88,000 cows in Baja California, raised mostly through a customary system of extensive grazing (del Río and Altable-Fernández 2000).

Agriculture became more important once civil society had access to missionary land, which often was the most productive. Other, no less important, increasing economic activities were the mining of silver, gold, gypsum, salt, and extraction of pearls and fishing. At the beginning, internal economic activity in Baja California operated via a system of barter (exchange) and credit. Rancheros would exchange some of their surpluses for wheat, corn, coffee, utensils, fabrics, but normally would enter into a system of credit where merchants would fix the prices and interests for their goods. The barter and credit system led small producers to be permanently in debt to merchants. This

practice of credit by word of honour remains active today in most rural communities. It was also during the mid 19th century that the population started to concentrate in areas that are now the major cities in BCS. For instance, merchants and other entrepreneurs tended to concentrate in the ports of La Paz and San Jose del Cabo, where cow skins, salt, cheese, butter, dry meat, molasses, dry fish, sea turtles, copper, gold, silver, and pearls were shipped out of BCS. However, the population throughout the peninsula was extremely sparse and this became a serious concern, particularly with the growing interest from the USA in accessing this frontier.

### 4.1.5 Baja California Peninsula: Land of Foreign Ambition and Concessions

While BCS was slowly changing, the Mexico-USA war in 1846 almost converted it into US territory. Indeed, it was after this war when the USA first expressed its interests in acquiring Baja California, through sale or given in concession. Up to this point, and well into the 20th century, the cultural, political and economic isolation of Baja California from the rest of Mexico was never more apparent. As a result, the Mexican government made explicit to the appointed governor of Baja California the need to be more vigilant and implement the necessary policies to achieve a broader and more definitive integration of Baja California with the rest of Mexico. The main policy for colonization, however, was particularized in terms of massive concessions, mainly to foreign capital.

Since the 1850s and more importantly during the administration of President Porfirio Díaz (end of 19th beginning of 20th century) a series of concessions were given to Mexicans and foreigners with the aim of developing Baja California and, more importantly, to colonize the sparsely populated region. Concessions were issued in Mexico City and by the end of the 19th century concessions comprised about two thirds of

the whole peninsula. Concessions included the use of practically all natural resources, in particular salt, moss for dying fabrics, pearls, marine mammals and metals. As colonizing projects, most concessions were a failure in Baja California. Instead, concessions often led to evictions of Baja Californians who had no titles to land. A French mining company, El Boleo, was the only concession that successfully promoted the colonization of Baja California, eventually creating one of the largest cities, Santa Rosalía, in the southern territory of Baja California. The new settlers that came to work for El Boleo came mostly from the Mexican states of Sonora, Sinaloa, Nayarit, Colima, Guerrero, and Jalisco, but there were also people from China, and France (the latter were the executives of the company and their families). This mining company, however, also had a terrible record regarding human rights abuses of workers. Other concessions were more oriented towards economic development such as a pearl concession to an English company that included practically all the eastern coastal waters of Baja California, from the Colorado River to Cabo San Lucas. This concession brought almost to extinction the banks of mother of pearls and also came into conflict with the local groups already profiting from the exploitation of pearls. Most concessions came to an end after the Mexican Revolution. However, foreign interest in the Baja California Peninsula, particularly by the USA continued[17].

Overall, it was through concessions that many conflicts were created around the access to land and other natural resources in Baja California. It has been argued that from

[17] For instance, Jordán (2001) reports that in the United States' Senate, during the penultimate of Roosevelts' mandates, the following was expressed: "Baja California is only a luxury for Mexico, but for us (the US) it is a necessity". Unfortunately, Jordán (2001) does not specify the source of his quote. However, the interest of the US in acquiring the Baja California Peninsula was articulated in *The Mother of California* (1908) by Arthur W. North, who asserted that the Peninsula was a burden to Mexico, but it could be of great benefit to the US. He wondered: would it not be of benefit to both countries for Mexico to sell the Peninsula of Baja California to the US?

this dynamic, a culture revolving around politics and economic benefits developed strongly in Baja California. The endorsement of the revolutionary movement by the elite groups in Baja California seems to have been fuelled by a hope to exclude foreign interests.

### 4.1.6 The Mexican Revolution and Agrarian Reform

The main consequence of the concessions and the isolation of Baja California from mainland Mexico was the creation of social and economic inequalities through the accumulation of wealth in few hands. The revolutionary movement at the national level was a response to these inequalities, particularly in the agricultural sector. The revolutionary movement in Baja California, however, was mostly promoted by local elites who feared losing their possessions and any economic power to large foreign capital that continued its incursion into Baja California through the use of concessions. There were no great battles in Baja California during the Mexican Revolution, but the Mexican Revolution would bring another wave of drastic changes for Baja California particularly in the shape of land reform.

After the Revolution war (1910-1917) all concessions were eventually cancelled except for one, El Boleo, the copper mining company that continued operating well into the 1950s when it decided to close due to recurrent losses. It was also after the Revolution that the federal government put more emphasis on developing the fisheries sector nationally. The premise was that the poor development of the fisheries sector was due to the excessive accumulation of fishing rights in a few hands, who accumulated wealth through the exploitation of fishermen and tax evasion rather than investing in improving the fishing sector. This led President Venustiano Carranza (1917-1920) to

cancel most fishing concessions, among others, those of Gastón Vives and Antonio Ruffo for the exploitation of marine mammals in the Pacific Ocean and Gulf of California (González-Méndez 1986). It was during the post-revolutionary era that a populist policy in the fisheries sector was adopted but, unfortunately, often with perverse results such as: (1) over-capitalization of high economic value fisheries such as lobster, abalone, shrimp, and high-volume fisheries such as sardine/anchovy and tuna fisheries; and (2) the neglect of most small-scale fisheries (González-Méndez 1986).

Despite this substantial change, the Mexican Revolution did not favour the political empowerment of local groups. On the contrary, the previously implemented municipalities were replaced by political delegations until 1972 when municipalities were re-integrated into the political system of Baja California Sur. On the positive side, the revolutionary promise of land reform was implemented in Baja California through the redistribution of land via the implementation of *ejidos* or land to be used under communal ownership (de Janvry et al. 2001). After most concessions were revoked, land previously used by concessions turned into federal land susceptible to be distributed among peasants. Unlike other parts of Mexico, in the southern part of Baja California available land to be re-distributed among peasants for farming was not the issue. The limiting factor was rather the dispersed character of human populations and scarce water resources for irrigation: ejidos were intended for communal farming.

Beginning in 1930s and in light of the low population densities in Baja California and most of northern Mexico, the federal government adopted again a policy of

colonization but now through the creation of farming colonies[18]. Of significance in Baja California Sur was the creation of the farming colonies in the Santo Domingo Valley which started with 85 families formed of 400 people from mainland Mexico. In the 1950s, a national policy for industrialization and economic growth triggered a Mexican study on the natural resources and economic potential for industrial exploitation in Baja California (del Río and Altable-Fernández 2000). Mining and fishing ranked high in this study, but lack of infrastructure such as roads and human resources were a barrier to any plans for industrial development. These two constraints seemed relatively easy to solve, but the lack of sources for energy production, such as rivers to produce hydroelectric power and oil were not. In light of these conditions, the southern territory of Baja California continued to have only modest support from the federal government. Some important infrastructure was created such as the 10-year-long construction of Highway 1, which was finished in 1974 and runs the length of the peninsula. Highway 1 is in fact a two-lane road with no shoulders. Ferry services from mainland Mexico to Santa Rosalía, La Paz and Cabo San Lucas helped the commercial and tourism activities to develop further in the southern territory of Baja California. Despite this, southern Baja California continued to be isolated from the rapid cultural, economic, and political changes in the rest of Mexico.

### 4.1.7 The Birth of a New State

The isolated condition of Baja California Sur from the rest of Mexico and its political dependence on the federal government supported a culture of regionalism wherein local

[18] President Cardenas (1934-1940) initiated a federal policy of colonization and development of farming activities, which in the case of Baja California Sur included bringing people from mainland Mexico and providing them with free land, credits, and various supports for farming (Martínez de la Torre 1998).

groups constantly lobbied the federal government in search of political independence. Finally in 1974 Baja California Sur became the 30th state of Mexico. It was after Baja California Sur became a state that many federal programs were created with the aim of promoting economic development. For example, a Trust was created for the promotion of tourism in Cabo San Lucas, which helped to create the tourist empire that Cabo San Lucas enjoys today. The increase in commercial and tourism activities had important consequences for the distribution of the population. In 1960, of the 80,000 inhabitants in BCS 36% were urban dwellers and the rest lived in rural areas. A decade later, the population increased to 130,000 of which 54% were in urban centers and the rest lived in rural areas. By 1980, 90,000 more people were added to the 130,000 counted in the 1970s (del Río and Altable-Fernández 2000). Overall, economic production in sectors such as fishing, agriculture, and manufacturing increased very rapidly; however, comparatively speaking, the service sector of the economy of Baja California Sur was the only one with a real tendency to increase, while the others experienced a decrease.

## 4.2 The Current State of Natural Resources in Baja California Sur

The consensus appears to be that since the arrival of the Spaniards in the area, the use of natural resources in BCS have been characterized by everything except order, fairness, or rationality in spite of the many efforts to create laws for instantiating these goals (Cariño and Alameda 1998, Dedina and Young 1995). From colonial times through the independence era (1810-1917) up to the post-Revolutionary times, the use and access of natural resources in BCS have been subject to various policies, laws, concessions, and programs. Indeed, contrary to common belief, it has not been the lack of legislation and institutions regarding restriction for access and use that has led to the over-exploitation of

many natural resources in Baja California. History clearly shows that the access and use of natural resources in Baja California has never occurred in a void of governing institutions and political interventions. The envisioned social order of prosperity predicated on private economic activities since colonial times has failed and continues to fail to create order, fairness, and rationality in use. Paradoxically, the enclosure of the commons through concessions and private enterprise for creating social order has produced Hardin's (1968) tragedy of the commons. This supports the contention I made in section 2.3.2 that the tragedy of open access is not caused only by self-interested individuals, but it can also be caused by actions of socially embedded individuals in political struggles. Other historical accounts of over-exploitation of common-pool resources also indicate that political interventions are always shaping access and use, even in situations broadly classified as open access (Mansfield 2001). The current over-exploitation of many fishery resources in Mexico and in the Gulf of California has, in part, been created by the mismanagement of fisheries management agencies.

### 4.2.1 Fisheries Management in Mexico

The management of fisheries in contemporary Mexico or in the post-Revolution era can be traced back to 1930s when cooperatives were awarded fishing concessions to exploit some of the most economically important inshore and shellfish fisheries, including shrimp, lobster, oysters, squid, mullet, octopus and totoaba fish (Ibarra et al. 2000). These concessions were converted into exclusive rights in the first Fishing Law passed in 1947. Yet, the fishing sector remained marginal in the development of federal policies until the 1970s when President Luis Echeverría created the Sub-secretariat of Fisheries and promoted the Federal Law for the Promotion of Fisheries, approved in 1972. The aim of

President Echeverría was to boost fisheries production from 200 thousand metric tonnes to at least 500 thousand metric tonnes. The efforts by the federal government to increase fisheries production was mostly aimed at developing high-value and high-volume fisheries such as shrimp, tuna, sardine and pilchard sardine (Hernandez and Kempton 2003). However, the fishery development policy also increased the number of small-scale fishers and their fishing production. Total landings reached 1.6 million metric tones in 1980 and have not surpassed this value since (Hernandez and Kempton 2003). The balance sheet of federal fishery development policy was fleet overcapitalization and depletion of multiple fish stocks (Aguilar-Ibarra et al. 2000, Hernandez and Kempton 2003, Thorpe et al. 2000).

The 1990s marked a change in fisheries policy direction despite a lack of a coherent assessment of the status of fishery resources (Hernandez and Kempton 2003). The emphasis of this change in direction in the early 1990s was to re-structure the sector in line with a national neo-liberal development strategy championed by President Carlos Salinas de Gortari (Aguilar-Ibarra et al. 2000, Thorpe et al. 2000). The succeeding administration of President Ernesto Zedillo added concerns such as halting environmental degradation, reversing processes of over-exploitation, and promotion of responsible fishing practices (Hernandez and Kempton 2003). Indeed, President Zedillo's administration brought together all environmental issues and natural resource management (except for oil and gas) under one secretariat, SEMARNAP (Hernandez and Kempton 2003). SEMARNAP's relevant achievements in fisheries management included the creation of management plans for 15 fisheries and a "Carta Nacional Pesquera" or national inventory of fishery species, which establishes guidelines for conservation and

use of fishery resources, biological indicators, and the maximum allowable effort for each fishery (Hernandez and Kempton 2003, Rivera-Arriaga and Villalobos 2001)[19].

Currently, fisheries are managed by regulating entry through a system of transferable permits/concessions as conceived in the Fisheries Law of 1992. Under the direction of SAGARPA (Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación), CONAPESCA (Comisión Nacional de Pesca y Acuacultura), supported by the INP (Instituto Nacional de Pesca), drafts the national fisheries policies. Surveillance and enforcement correspond to PROFEPA (Procuraduría Federal de Protección al Ambiente). These three federal institutions have state offices to implement fisheries policies and enforce legislation. CONAPESCA issues all fishing permits, some of which may allow a vessel to fish in the whole Mexican Pacific (Danemann 2002). However, the Carta Nacional Pesquera appears to have reduced the discretionary power of the central fishery management offices by setting the maximum allowable effort (Hernandez and Kempton 2003). Moreover, national and local fisheries committees have been created to improve scientific input and public participation although with mixed results (Danemann 2002, Hernandez and Kempton 2003).

Despite those changes introduced during the late 1990s, there is scepticism among researchers regarding the effective management of fisheries in Mexico, among other reasons, because fisheries management institutions and policies have lacked continuity and consistency between federal administrations (Aguilar-Ibarra et al. 2000, Hernandez and Kempton 2003). In particular, the re-assignation of the conservation and management

[19] The 15 species for which management plans were drafted are the following: shrimp, shark and tuna (for the Gulf of Mexico); lobster, octopus, purple stone crab, and grouper in the Yucatán Peninsula); shrimp and shark (for the Pacific region); sardine and sword fish (for the North Pacific); and lobster, abalone, and sea-urchin (for the west coast of Baja California Peninsula).

of fishery resources from SEMARNAP to SAGARPA makes challenging, and often frustrating, fisheries management in marine protected areas (Danemann 2002).

### 4.2.2 The State of Fishery Resources in the Gulf of California

The marine ecosystem of the Gulf of California is considered one of most productive and biodiverse in the world (Enriquez-Andrade et al. 2005). The Gulf of California accounts for almost a third of the annual fish production in Mexico (circa 500 thousand metric tons), including shrimp, sardine, tuna, squid and other species every year, worth 300 million dollars (Enriquez-Andrade et al. 2005). Despite this, multiple fishery resources have been over-exploited, show signs of over-exploitation or are under increasing stress due to habitat destruction, pollution, and fishing pressure (Hyun 2005). Technological changes from hook and line to gill nets, trawls, and long-lines have also contributed to the decline in fishery resources. Environmental fluctuations are also known to contribute to the changes in the abundance and structure of fish communities (Hyun 2005, Rivera-Arriaga and Villalobos 2001, Sala et al. 2004). The cases of the totoaba, shrimp, and sardine fisheries illustrate the complex interplay between environmental and anthropogenic factors[20].

The totoaba (a long-lived fish that was recorded to reach up to two meters in length) is an endemic fish species of the upper Gulf of California that supported important commercial and sport fisheries in the 1930s and 1940s (Cudney-Bueno and Turk-Boyd 1998). The commercial fishery of totoaba in the first half of the 20th century included only the air bladder, an essential ingredient in a traditional Chinese soup

[20] Other species are recognized to be over-exploited in the Gulf of California such as sharks, oyster pearls and sea turtles (Hyun 2005).

(Arvizu-Martinez 1987). During the 1930s the damming and diversion of the Colorado River also decreased freshwater input to the upper Gulf of California, arguably affecting the recruitment of the totoaba (Hyun 2005). By the 1970s, the abundance of the totoaba had drastically decreased leading to a total closure of the fishery in 1975 (Cudney-Bueno and Turk-Boyd 1998). Yet, every year in the mid-1980s approximately 120,000 totoaba juveniles died in the shrimp fishery and 6,200 adults died because of poaching (Arvizu-Martinez 1987, Hyun 2005).

The shrimp fishery in the Gulf of California also started early in the past century, particularly in the state of Sinaloa (McGoodwin 1987). The shrimp fishery comprises a lagoon fishery, that supports the most fishers, and an off-shore fishery (Magallon-Barajas 1987, Diario Oficial 2006). Both were intensely developed during the 1970s as part of the national fisheries development strategy. For instance, all the shrimp fishing fleet grew from 800 boats in 1971 to 1,700 by 1981, without any important increase in the catch (Magallon-Barajas 1987). The offshore shrimp fishery is more controversial because of its bottom-trawling method which catches also important volumes of juveniles of other fishery species (e.g., groupers and totoaba) and in general for its impact on the marine bottom. Indeed, the Mexican secretariat of the environment (SEMARNAT) reports that the shrimp trawling in the Mexican Pacific discarded circa 175,798 tons of fauna and trawled approximately 549, 689 square kilometres in 2000 (SEMARNAT 2003). Currently, the fishery itself is considered at its maximum capacity and, in general, it is recommended that 15% of the fishing fleet to be decommissioned (Diario Oficial 2006). The high export value of the fishery and provision of jobs creates political and economic

pressures that overwhelm the ecological and conservation issues surrounding the fishery, particularly in the Gulf of California (McGoodwin 1987, Thorpe et al. 2000).

The fishery of the sardine parallels that of the shrimp fishery in its rapid development in the 1970s but is not contentiously associated with political, economic, and social issues as in the case of the shrimp fishery. However, sardines and, in general small pelagics (e.g., anchovy), are an interesting case because they seem to be an important link between production and top predators such as other fish (many of commercial importance), birds, and marine mammals (Cury et al. 2000, Jennings and Kaiser 1998). Sardines display high natural inter-annual variability even in the absence of fishing pressure (Baxter and Hunter 1982, Beverton 1990, Cisneros-Mata et al. 1995). However, sardine fisheries are likely to increase this natural variability. In the Gulf of California the sardine fishery began in the 1960s, developed during the 1970s, stabilized in the 1980s, and declined in 1989/1990 (Cisneros-Mata 1995). Although the fishery of sardines has been relatively well studied, the effects that environmental and fishery-induced fluctuations in sardine stocks may have on small-scale fisheries has been neglected. Some fishers in the Loreto area have observed that fisheries have declined in the area since 1980s which they attribute to a decrease in the abundance of sardines (Hollister 1996). Interestingly, other small pelagics, and possibly sardines too, also may have an important affect on the recruitment of commercially important species by consuming their eggs (see for example Köster and Möllmann 2000, Swain and Sinclair 2000).

These three examples illustrate the complexity of three "single-species" fisheries. The multiple species targeted by most small-scale fisheries in the Gulf of California

increases the degree of complexity in understanding the dynamics of these fisheries and producing reliable data to establish their current status (Berkes et al. 2001, Pauly 1994). Indeed, scientific and official reports considered the status of most small-scale finfish stocks (commonly referred to as *Escama*) in the Loreto area and in the Mexican Pacific to be uncertain (Casas-Valdez and Ponce-Díaz 1996, Diario Oficial 2006). Nationally, the Carta Nacional Pesquera recommends no further increase in fishing effort of the more than 200 finfish species that comprise the *escama* group (Diario Oficial 2006). Indeed, most long-time fishers in the Loreto area agree that there has been a decrease in abundance of finfish, sea turtles, and sharks in the past 20 to 30 years, and in other areas of the Gulf of California small-scale fishers report perceiving a decline of fish stocks as far back as 60 years ago (Saénz-Arrollo et al. 2005).

In sum, the fishery resources and ecological systems of the Gulf of California have been undeniably impacted. Again, this has not been caused by self-interested individuals but by actions of individuals embedded in political struggles set in motion by federal fisheries development policies. The Loreto Bay National Marine Park was in part created as a collective effort to deal with the decline in fishery resources. But this collective effort emerged amidst political alliances and struggles by socially embedded individuals.

## 4.3 The Creation of the Loreto Bay National Marine Park

The short account regarding the creation of the park is that "in 1996, the lower Gulf established the Parque Marino Nacional Bahía de Loreto (Loreto Bay National Marine Park) because of local small-scale fishermen concerns with collapsing fisheries" (Hyun 2005). Indeed, this account of the creation of the Loreto Bay National Marine Park has

credited the park as a model for community-based conservation. From my interviews with local fishermen from the rural communities of the Loreto Municipality, it appears that most fishermen were not even aware of the intention to create a park and were informed about its existence years after its creation. Moreover, a historical account by one of the park's most dedicated promoters describes the multiple actors involved and the political struggles that preceded the creation of the park (Morales-Polo 2000). This does not diminish the important impact the creation of the park has had in promoting a more rational use of marine resources and their conservation through efforts to involve resource users. However, a simplistic account of the creation of the park underplays the economic and political processes in which conservation initiatives are implemented (e.g., the creation of protected areas). Moreover, simple accounts tend to homogenize social groups to the point of idealizing them and creating a problematic sense of what human communities are like (Agrawal and Gibson 1999). At the same time, we should not exaggerate the role of conflict and difference; after all, the Loreto Bay National Marine Park was indeed created from a collective effort by some community groups.

Loreto, the first capital of the Californias, has an important place in the annals of Baja California history. When the political powers of the Californias and the important industry of pearl fishing were transferred to La Paz, the present capital of Baja California Sur, Loreto lost clout in the history of the Californias (Jordán 2001). Little is known about Loreto and its inhabitants after it was stripped of its title of capital of the Californias. It was not until very recently (1994) that Loreto was officially recognized as the 5$^{th}$ municipality in Baja California Sur. In Jordán's (2001) description of his epic trans-peninsular trip in the 1950s to re-discover what he referred to as "the other

Mexico", the most important remarks about Loreto refer to its historical importance as the first capital of the Californias and its peaceful, yet precarious economic situation. Loreto was not connected to the main trans-peninsular road until Highway 1 was finished in 1974, finally linking Loreto to the rest of Baja California. It was not until the 1980s, as part of a nation-wide survey on the fishing communities of Mexico carried out under the auspicious of the National Institute of Anthropology, that Loreto was mentioned as a fishing town (Chenaut 1985, Gatti 1986). Chenaut (1985) writes a couple of paragraphs describing Loreto mostly as a town dedicated to sport fishing. She adds that most commercial fishers were found in the Colonia Zaragoza, practically adjacent to the town of Loreto but clearly separated from it. Most commercial fishers were described as working for one permit holder and only a handful were part of the only cooperative in the area, the cooperative California (Chenaut 1985)[21].

Sergio Morales-Polo, administrator of the salt-works in Isla del Carmén in the 1960s, describes extremely abundant and diverse marine natural resources, and beautiful marine and coastal ecological surroundings. A crisis started to brew in the 1970s and 1980s. Some residents of the town of Loreto blamed a decrease in abundance of fish resources on foreign Japanese Fleets of long liners, and Mexican shrimp trawlers and sardine purse net boats (Morales-Polo 2000). It is not clear how some people from the town of Loreto came to accept those actors as the cause of the depletion of marine resources. However, it is interesting to note that, now that many shrimp trawlers have been excluded from the area, gill nets and illegal diving are being blamed for the low abundance of some fishery resources. In the 1990s, after almost 30 years of absence from

[21]Many fishers in Mexico have no fishing permits and to overcome this problem fishers work for those who have a permit. Such an arrangement is not legal and fishers without a permit are often subject to exploitation by fish buyers.

the area, Sergio Morales-Polo returned to Loreto and started a strong campaign to create a park through newspaper articles and letters to President Salinas de Gortari indicating the need to create a marine park. It becomes clear that it was the people from the local tourism sector, what Morales-Polo (2000: 17) refers to a Loretanos in his chronicle, which eventually supported the initiative of the park:

> "I started to promote the idea [of the park] but many in the tourism sector had fears that sport fishing would be limited, the main source of income in the town [Loreto]...However, the idea was adopted and a year latter, in 1993, the Loretanos did not see as problematic the idea of a park".

It appears that Sergio Morales-Polo himself was the one who conceived the idea of creating a marine park to deal with the perceived marine crisis in Loreto. In March 2001, I interviewed the late Alfredo Ramírez, an immigrant from mainland Mexico and one of the pioneers in the sport fishing in Loreto, who claimed that he and a government official from FONATUR came up with the idea of a marine park.

In any case, an enthusiastic group from the town of Loreto created the non-governmental organization, Grupo Ecologista Antares GEA (Ecological Group Anatares), in Loreto with the explicit purpose of establishing a marine park in Loreto. Many formal petitions to federal government officials (e.g., in 1994 to Jesús Silva Herzog, the Minister of Tourism) to establish a park were promoted by GEA and supported by the municipal government, and other leaders of civic associations such as the Chamber of Commerce, and Association of Hotels, Motels, and Trailer Parks (Morales-Polo 2000). The state governor at the time (Mercado Romero) always opposed the initiative of the park, apparently because he had economic interests in the area and feared that a park would stop coastal development. In a visit to Baja California Sur in March 1996 by the then-Mexican President Ernesto Zedillo, the Municipal President of Loreto, García Green,

asked Sergio Morales Polo to prepare a file with the priorities of the municipality, including the need to create a park. In an unprecedented second visit less than a month later, the Mexican President returned to Baja California Sur with the aim of presenting his National Program of the Environment 1995-2000. The Minister of the Environment, Julia Carabias, invited the director of GEA to sit at the podium for the President's presentation of the National Program of the Environment 1995-2000. The park was not announced by the President of Mexico as GEA members expected. The decision to establish a park in Loreto was made during President Zedillo's bus ride to the airport. Sergio Morales-Polo (2000: 25) vividly describes the event:

> "García Green (in his last 15 days as Municipal President) escorted the President aboard the bus along with Mercado Romero and Julia Carabias; the latter mentioned the project of a park to the President and immediately the Governor of BCS intervened saying that a park was not a wise idea because the Loretanos wanted to use the sea and the park was going to prohibit all economic activities. Immediately, Garcia Green intervened and said that the community still wanted to carry out economic activities, but in an orderly fashion to avoid marine environment deterioration by prohibiting large scale boats in the area. Then, President Zedillo addressed Julia Carabias and said that if that was the case she must expedite the process of drafting the official decree to institute the park".

In July 15, 1996, less than three months after the memorable bus ride, the Congress approved the presidential initiative to create the Loreto Bay National Marine Park. There are two interesting technical aspects in the creation of the park. The area covered by the park had to be defined as a bay because shrimp trawlers are not allowed to operate in bay waters. Clearly, the sea area is anything but a bay. Second, the shape of the park is rather awkward, particularly in its southbound limits that, instead of continuing from east to west all the way to the coast turn north two kilometres before reaching the coast (See Figure 1.1). Morales-Polo (2000) explains that Mercado Romero required such

limits to exclude the coastal areas of Bahía Agua Verde, where he had already made development deals.

There is little doubt that the creation of the Marine Park in Loreto has been a complex economic, political, and cultural process, and its creation shows the social complexity under which conservation initiatives are implemented. It also casts doubts on accounts based on homogenous social groups, especially in terms of how social change and innovations often originate. The idea of the park originated in one person's head (although not in a social void), it was promoted and adopted by some (many influential leaders in the tourist sector) to address a tangible problem. A shift in federal environmental policy facilitated the declaration of the park where all Loretanos were required to accept (willingly or by coercion) the creation of the park and its eventual dispositions and restrictions regarding the use and conservation of marine resources. Accepting the new conditions brought about by the park has not been without resistance from local groups. The latter can be seen in the multiple obstacles that park managers have been facing to make the park operational – e.g., it took them from December of 1998 to 2002 to achieve interest groups' approval of the management plan. Indeed, the conflict between conservation and development creates dilemmas that the international conservation community has tried to reconcile through the "stretching" of the concept of protected areas.

### 4.3.1 The Creation of the LBNMP in the Context of International Conservation

The creation of the Loreto Bay National Marine Park exemplifies a trend in international conservation through protected areas, which are being used as a means of combining social justice (e.g., exercising local control over natural resources) and biodiversity

conservation (Locke and Dearden 2005). Protected areas as a means for local groups to voice political claims over natural resources may be the result of the lack of state recognition of the capacity of local groups to regulate access and use of natural resources. Both lack of recognition of local institutions and enabling state legislation have been well-documented in the common's scholarship as important barriers to community-based natural resource management (Berkes 2002). In Mexico, for instance, there is a growing discourse about community involvement in economic development and management of natural resources but there is no formal recognition of alternative governing regimes such as community-based natural resource management (Barkin 2000). Internationally, however, the creation of the IUCN category VI at the 1992 World Parks Congress has given political leverage and legitimacy to the creation of protected areas that seek to link conservation and development, particularly within development countries (Phillips 1999). The international recognition of people-centred protected areas has its critics.

Locke and Dearden (2005) have argued that expanding the idea of protected areas to accommodating development concerns does a disservice to the international efforts to protect the world's biological diversity. They suggest that protected areas as a means to achieve social justice and biological conservation seem to have "stretched too thin" the idea of protected areas and may provide a false sense of increasing protection of biological diversity through people-centred protected areas. For instance, Locke and Dearden (2005) point out that in practically 10 years (1992-2003) 47.9 % of new protected areas fall under the IUCN's categories V and VI, which these authors do not consider are effective at protecting biological diversity[22]. In light of this controversy,

[22] This 47.9% corresponds to IUCN's protected areas categories VI (23.3 %), V (5.6%), and without category (19%).

Locke and Dearden (2005) propose that instituting ideas such as Sustainable Development Areas could resolve the controversy[23]. In the mean time, people-oriented protected areas will continue to proliferate, most likely to fill a political gap with the potential of addressing biological conservation.

## 4.4 Concluding Remarks

Focusing on political struggles, as emphasized by the political ecology perspective, shows that social conflict has been a key driver in the relationship between human societies and nature in the Baja California Peninsula. However, social conflict has not been between individuals but among socially embedded individuals. This distinction is not trivial and points to a fundamental difference between explaining social facts as an aggregate of actions by individuals competing for access to a resource, and as actions by socially embedded individuals in political struggles. This distinction again highlights the philosophical tension between a social relational approach and the institutional choice school.

The struggles over accessing resources in the Baja California Peninsula and the creation of the Loreto Bay National Marine Park have been characterized by socially embedded individuals in dynamic cultural, political and economic contexts. The overall result of social conflict and political struggles has been the overuse of many natural resources, including multiple fishery resources in the Gulf of California. The creation of the Park was in part a response to the depleted condition of fishery resources in the Loreto area, arguably caused by non-local fishing fleets. Indeed, the Park was conceived

[23] Locke and Dearden (2005) propose that IUCN protected areas categories V and VI should be reclassified as Sustainable Development Areas (SDAs). SDAs central focus will be to pursue people's development interests in the context of sustainability.

mostly as a means of political control over marine resources rather than as a conduit for biological conservation; an increasing trend in the creation of protected areas world-wide.

To what extent has this larger context of social conflict, over-use and mismanagement of fishery resources and creation of a marine park affected the fishing activity in the Loreto area? In particular, is the access and use of fishery resources among these resource users characterized by social conflict and competition? In the next chapter, I address this question by analyzing the extent to which resource users from seven rural communities engage in cooperative ties of information sharing for accessing fishery resources within and outside the limits of the Loreto Bay National Marine Park.

# CHAPTER 5

# COOPERATION FOR ACCESSING FISHERY RESOURCES AND SOCIAL HETEROGENEITY

Fishing is an uncertain and risky activity (Acheson 1981). This is because fishing occurs in a very dynamic and uncertain environment, which affects the abundance and distribution of fishery resources in highly complex ways that defy their exclusive use, management, and conservation (Acheson 1981, Gewin 2004, Hilborn 1987, McGoodwin 1990). The uncertain and complex dynamics of fishery resources create a very competitive context in which the fishing activity unfolds (Gatewood 1984, Gordon 1954, Ostrom 1990). Yet under the same competitive context, cooperation among resource users can emerge (Acheson 1981, Gatewood 1984, McGoodwin 1980, Salas and Gaertner 2004, Stiles 1972).

In particular, fishery resource users may engage in information exchanges to reduce the uncertainties and financial risks involved in the decisions about where and when to fish (Acheson 1981, Andersen and Wadel 1972, Gatewood 1984, Salas and Gaertner 2004). Moreover, this form of cooperation creates benefits, which have been characterized as being synergistic in that the final effect appears greater than the sum of the independent actions (Gatewood 1984, Salas and Gaertner 2004). Despite the manifest instrumental function that information exchange can have, this form of cooperation is not homogenous and sometimes this exchange may be intentionally deceptive (Andersen 1972, Forman 1967, Gatewood 1984, Stiles 1972). There is no consensus about the

conditions that structure information exchanges. However, some of the biophysical, technological and social contextual variables commonly reported include mobility of the resource; alternative sources of information (e.g., pure observation of other vessels' behaviour, equipment to locate fish, two-way marine-band radios); the regulatory structure of a fishery; and long-term relations of kinship and friendship, trust, and solidarity (Andersen 1972, Forman 1967, Gatewood 1984, Stiles 1972).

The role that these contextual variables have in explaining information exchanges appears to follow two views. Some scholars, on the one hand, reduce these variables to individuals' decisions aimed at predicting future states of the system with conditional probabilities (Gatewood 1984). On the other hand, some prefer a systemic form of explanation that takes into account the system as a whole instead of reducing explanations to the effects of certain variables on particular actors or particular roles (Stiles 1972). This, indeed, resembles the philosophical tension I have highlighted between an individualistic and a social relational approach.

Following the distinction between actor and network level of analysis (see section 3.4.4), in this chapter I focus on the network level of analysis to account for how cooperative ties are affected by social heterogeneity of resource users in terms of social and demographic factors (e.g., locality, place of birth). I use the property of network density to index the extent to which resource users share information and the degree of social integration. The central question I address is this: under what conditions is information sharing more likely to occur among resource users with similar social and demographic characteristics? In other words, to what extent is information sharing structured by social categories? Moreover, is information sharing more prominent and

frequent among resource users that are kin related or through other social relations like friendship and acquaintance relations? I also interpret these results as indicators of the effects that social heterogeneity has on the social integration of the coastal communities and reflect on implications of this integration for collective action (Marsden 1988).

How social and demographic factors structure different kinds of social relationships has been addressed in the social networks literature as an issue of social inbreeding or homophily, where individuals have a tendency to interact with socially and demographic similar persons (Marsden 1988, McPherson et al. 2001). The patterning of social relationships by social and demographic factors has important implications for the stratification of social systems beyond what would be expected on the basis of chance alone (Marsden 1988, McPherson et al. 2001). The other side of social stratification is social integration. Marsden (1988) argues that "because homophily tendencies reflect the density of relationships among persons sharing an attribute, they are at once indicators of decreased global and increased local integration". Thus, local homophily may enable a set of similar people to coordinate their actions more effectively; however, strong tendencies toward homophily and the lack of ties to outsiders may lead to social fragmentation and compromise collective action (Granovetter 1973). For instance, Crona and Bodin (2006) have suggested that strong homophily of groups with different knowledge about the ecological condition of fishery resources may account for the lack of collective action in fisheries management and conservation in a rural fishing community in Kenya.

After analysing and discussing the degree of homophily in cooperative behaviour for selected individual attributes, I describe the connections beyond the relations among

communities or exo-structure (see CESM model in Chapter 4). I only describe the exo-structure because a formal social network analysis requires all network members to report their social ties. This is a constraint of the current state of social network analysis but exploring the exo-structure may suggest important patterns on the extent to which resource users from the seven rural communities are connected to the larger polity.

Finally, I discuss the implications of the extent to which resource users cooperate despite the social diversity or heterogeneity in the composition of the resource users from the seven rural coastal communities. In particular, I conclude by reflecting on current concerns about the role of social diversity of human communities in the management and conservation of the commons (Agrawal and Gibson 1999, Allison and Ellis 2001).

## 5.1 Methods and Hypotheses

To address how social and demographic factors affect association among resource users, I use an analysis of variance (ANOVA) of density under a model of variable homophily. The key concepts are homophily and group density. Homophily refers to the idea that if two actors are similar in some way (e.g., having the same age) it is more likely that there will be network ties between them than between those who do not share a particular attribute (McPherson et al. 2001). The conceptual importance of homophily can be appreciated with Blau's (1977) contention that a tendency to homophily is a cardinal indicator that an attribute is a meaningful dimension of social structure. This tendency can be interpreted as a statistical propensity. Thus, a model of variable homophily tests the likelihood that tie density within each group (defined by an individual attribute, for example, age) differs from all ties that are not within groups (Hanneman and Riddle 2005). In other words, the hypothesis is that the density within groups (i.e., density of

groups pre-defined by an attribute such as age) differs from what would be expected if an equal number of ties were distributed at random across the network.

The most basic network relational property (in graph theoretical terms) is that of node degree or number of ties adjacent to a particular node. In other words, node degree refers to the number of social ties of a particular type in which an individual is involved. This basic relational property can be analyzed from the actor or global perspectives. From a global perspective, node degree is generalized to the whole network to assess the density of a network of a particular kind; i.e., the proportion of possible ties in a network as a whole that are actually present in a network. Network density ranges from 0, if there are no ties present, to 1, if all possible ties among network actors are present. I interpret network density of information sharing as the extent of cooperation for accessing fishery resources.

The ANOVA density model of variable homophily tests were determined using the UCINET suite of social network programs (Borgatti et al. 2002). In this program the statistical significance is established by running a large number of random networks of the same size using the same total density as the original data. The program then applies a predefined partition (according to an individual attribute) to each run and calculates the block densities for the random data. The procedure is repeated for a large number of random trials; thus, providing the proportion of random networks that have block densities higher and lower than the observed data. I also use bar-graphs (using the Microsoft Excel program) to depict some of the individual attributes, and create network visualizations using Netdraw (a network drawing program distributed along with UCINET). I tested for significant differences in some of the individual attributes by

communities using the statistical procedures of the SPSS program (Version 13.0 for Windows). Finally, the data set I use is the individual and relational attributes I collected from the 123 people I interviewed, and to describe the exo-structure I include the people identified by my 123 respondents; i.e., 106 individuals from localities I did not survey: the town of Loreto; Isla del Carmén; Tembabiche; and the municipalities of Comondú, Mulegé, and La Paz (see Figure 1.1 in page 17 for details).

### 5.1.1 Generic Hypotheses

Multiple sociodemographic (e.g., race, ethnicity, sex, age) and acquired characteristics (e.g., occupation, intra-personal values) have consistently been found to induce homophily across many different types of relationships (McPherson et al. 2001). Moreover, family ties appear to be homophilous for most characteristics and can induce heterophily in other characteristics (McPherson et al. 2001). This appears to be the case because of family ties' strong affective bonds and slow decay as opposed to more voluntary, easier to dissolve relationships (e.g., friendship relations). In this context, I proposed the following two generic hypotheses:

**1)** Actors who share a sociodemographic or acquired characteristic are more likely to cooperate than resource users who do not share the same characteristic; thus, tie density within groups defined by a particular characteristic will be greater than tie density among groups that would be expected by chance alone.

**2)** Homophily is more likely to occur in kinship as opposed to friendship and acquaintance relations in most sociodemographic and acquired characteristics and tie density of groups for a particular type characteristic will conform to the following hierarchical pattern: kinship > friendship > acquaintance relationships.

I use a network that includes all the ties reported by the 123 individuals to test hypothesis 1, and partition this network into three networks by type of social relation (kinship, friendship, and acquaintance) to test hypothesis 2. All the networks used in my

analysis are symmetric (i.e., network ties are not directional), and dichotomous (i.e., a network tie between two actors is coded as 1 and the absence between two actors is coded as 0). For expositional convenience, all density values were transformed to percentages from the original values that run between 0, for no ties are present, to 1, when all possible ties between actors are present.

## 5.2 Cooperation Within and Between Communities

It is a common assumption in human community studies that sharing a physical place increases the formation of close-knit groups of people because of an increased likelihood of direct and continued face-to-face interactions that facilitate negotiation, communication, and coordination in the course of a social practice (Aswani 2002, Brown and Duguid 2000). Indeed, place is an important structural factor in successful community-based fisheries management and tendencies to share information on the location of fishery resources (Agrawal 2002, Aswani 2002, Forman 1967, Pinkerton and Weinstein 1995, Stiles 1972). How does living close together reflect the extent to which resource users form cooperative ties of information sharing?

Table 5.1 shows the density of cooperative ties within and between communities. Because all cooperative ties are assumed symmetric all values above and below the density values within communities (i.e., the values in the diagonal) are the same. Thus, in Table 5.1 I omit all the density values above the diagonal. The order of the columns in Table 5.1 corresponds to the location of each community relative to one another. Finally, significantly larger density values within than among communities using the ANOVA density model of variable homophily are indicated in bold and with an asterisk.

**Table 5.1** Density of cooperative ties among resource users by community (all values are expressed in percentages and statistically significant values are in bold and marked with an asterisk; $\alpha \leq 0.05$. Appendix 3 shows statistical values)

| | NORTH → | | | | | | SOUTH |
|---|---|---|---|---|---|---|---|
| | COMMUNITY (Number of Resource Users Interviewed) | | | | | | |
| | **Ramadita (5)** | **San Nicolás (12)** | **Colonia Zaragoza (41)** | **Juncalito (6)** | **Ligüí (20)** | **Ensenada Blanca (20)** | **Agua Verde (19)** |
| **Ramadita** | **90.00*** | | | | | | |
| **San Nicolás** | 35.00 | **34.80*** | | | | | |
| **Colonia Zaragoza** | 15.60 | 2.40 | **14.9*** | | | | |
| **Juncalito** | 6.70 | 4.20 | 4.10 | **33.30*** | | | |
| **Ligüí** | 1.00 | 1.20 | 1.70 | 7.90 | **52.10*** | | |
| **Ensenada Blanca** | 0.00 | 0.40 | 0.70 | 3.30 | 8.60 | **55.8*** | |
| **Agua Verde** | 0.00 | 0.00 | 3.30 | 0.90 | 2.60 | 4.70 | **43.5*** |

The ANOVA density model of variable homophily indicates that resource users have a significant tendency to cooperate with resource users who reside in the same community, supporting the general idea that location is an important structuring factor. However, location alone cannot explain why cooperative ties are more prevalent in some communities than in others, nor the different extent with which resource users from each community have cooperative ties with resource users from other communities. I explore scarcity of fishery resources and geographical proximity to account for the patterns of cooperative ties within and between localities.

### 5.2.1 Resource Scarcity

The difficulty of exclusive use that characterizes fishery resources makes these resources vulnerable to overuse, particularly in the absence or failure of institutionalized rules regulating access (Ostrom 1990, Fenny et al. 1996). Fisheries overuse enhances resource scarcity, which is the most immediate and, arguably, the strongest incentive motivating resource users to fish out the oceans. Resource scarcity should operate as a strong incentive for fishery resource users to keep rather than share information with other users in the absence or failure of rules, when assuming norm-following self-interested individuals (Ostrom 1999). The fisheries system in the Loreto area is characterized by a weak regulatory regime, high resource-dependence livelihoods, weak development of social organizations, extreme poverty, and signs of over-exploitation of extensive fishery resources. Given these conditions, the extent to which resource users from the Loreto area share information within their communities is puzzling, particularly if we assume that individuals should be pursuing their self-interest by hoarding information. Two conditions may explain this paradoxical result.

It is possible that a generalized effect of resource scarcity on the extent of cooperative ties is being confounded by the number of resource users considered in each community. This could be the case if, and only if, the number of ties in which an actor is involved (actor degrees) is similar across all community networks. A one-way analysis of variance shows actor degrees are significantly different among communities ($F=5.0476$; 6 d.f.; $p=0.0002$). This indicates that the differences in cooperative ties within each community cannot be attributed to the size of the community networks. Alternatively, it is still possible that resource scarcity is different along the coast of the municipality of

Loreto, creating different tendencies towards cooperation of resource users within communities. However, resource users from Ligüí and Ensenada Blanca claim to have noticed a significant decrease in their fish catches in the past 15-20 years (Leal-Jiménez et al. 2003), yet cooperative ties within these two localities are relatively high (Table 5.1). This suggests two things. Resource scarcity is an ambiguous indicator of the extent to which resource users may cooperate for accessing fishery resources and the presupposition that individuals are self-interested is doubtful. To be sure, it is likely that how resource scarcity is experienced on a daily basis affects the tendency of resource users to share information. For instance, in 2005 a resource user from Ligüí once commented "when I find abundant fish I share their location with others but when the fish is not that abundant I share this information only with a few".

### 5.2.2 Physical Proximity

Extending the idea that locality favours cooperative ties because of the increased rate of face-to-face interactions, we should expect geographically close communities to have greater cooperative ties than geographically distant communities. Ramadita, Ligüí, and Ensenada Blanca communities fit the geographical proximity hypothesis, but not San Nicolás, Colonia Zaragoza, Juncalito, and Agua Verde communities (Table 5.1). For example, the density of cooperative ties between Ramadita (the northernmost community) and the other six communities decreases with geographical distance (values in the column under the Ramadita community, Table 5.1). In contrast, the density of cooperative ties between Colonia Zaragoza and the four communities located to the south of Colonia Zaragoza tend to decrease except for the southernmost community of Agua Verde (values in the column under the Colonia Zaragoza community, Table 5.1). The

density of cooperative ties between Colonia Zaragoza and the two communities located to the north of Colonia Zaragoza also do not support the geographical proximity hypothesis (values in the Colonia Zaragoza row, Table 5.1). Indeed, it may be better to think about social rather than physical distance in social systems. A visualization of the whole social network should help to appreciate this idea.

Figure 5.1 shows the relations of information sharing for all resource users. This network visualization was created using a built-in-algorithm in Netdraw called "spring embedding", which locates actors in a such a way as to put those with smallest path lengths (i.e., direct ties) to one another closest in the network depiction (Hanneman and Riddle 2005). Thus, the closer actors appear in Figure 5.1, the more socially close they are. Two structural patterns already suggested can be recognized. On the one hand, actors from Ligüí, Ensenada Blanca and Agua Verde appear in a "cluster" on the left-top right corner, while Colonia Zaragoza, Ramadita, Juncalito and San Nicolás appear in a cluster in the right-bottom corner of the figure. In the latter cluster, it is also worth noting that members of Ramadita lie between Colonia Zaragoza and San Nicolás members. On the one hand, we can also visually confirm that actors living in the same community tend to be socially closer as the ANOVA model of variable homophily indicated. There is a third pattern much easily appreciated through the network visualization. Community members from Ensenada Blanca, Ligüí, and Agua Verde form more closely-knit clusters than those clusters formed by Colonia Zaragoza, Juncalito, and San Nicolás community members. This is particularly noticeable in the cluster formed by Colonia Zaragoza members.

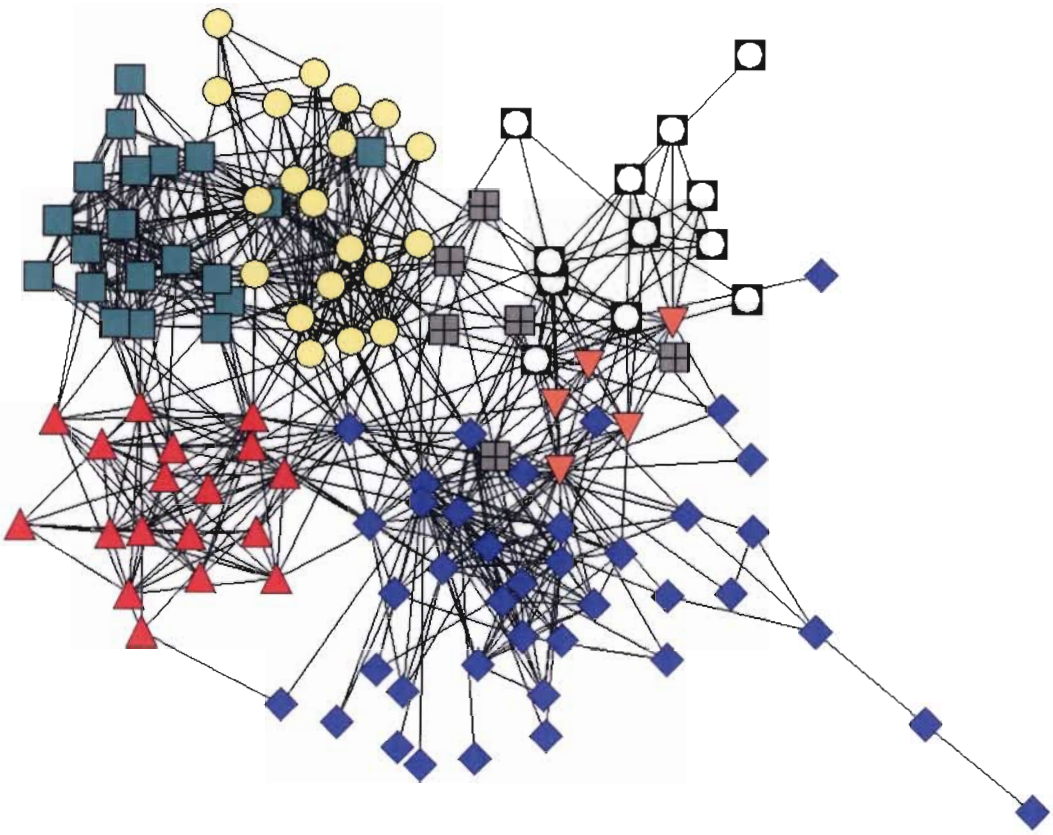

**Figure 5.1** Visualization of the social network of information sharing. Community network members are shown with different colours and shapes: Agua Verde (red up-triangle), Colonia Zaragoza (blue diamond), Ensenada Blanca (blue-green square), Juncalito (gray box), Ligüí (yellow circle), San Nicolás (white circle-in-box), and Ramadita (orange down-triangle)

The density of cooperative ties between communities and network visualization based on social distance suggest that spatial proximity, which favours recurrent face-to-face interactions, is necessary but not sufficient to explain social cooperation within communities and between geographically close communities, at least in the context of sharing of information for accessing fishery resources. In other words, physical proximity facilitates face-to-face interactions but does not alone determine the formation of social relations. This could also help explain why spatial or geographical proximity often fails as a criterion to define human communities and the significance of this attribute for

policy making (Agrawal and Gibson 1999). It also supports the contention that human systems are held together by virtue of binding social relations (Bunge 1996). Thus, we could more effectively talk about social rather than physical distance as a factor in human cooperation.

In sum, scarcity of resources and geographical proximity are ambiguous in explaining the extent of cooperative ties within and between communities. Moreover, the presupposition that individuals are self-interested is doubtful, especially since self-interest should manifest most strongly under conditions of resource scarcity and lack/failure of fishery regulations as in the case of the Loreto area. Thus, not only may other factors be affecting the different tendencies towards cooperation within and between communities, but a logical explanation may require a different presupposition regarding human behaviour. The strength of social relations in which cooperation is embedded and internal conflict may explain the extent to which resource users cooperate within and between communities.

## 5.3 Embedded Cooperation

Studies of social networks and the commons, including information exchanges, suggest a hierarchy of importance of social relations in the extent to which individuals are more likely to cooperate and exchange information; kinship > friendship > acquaintance relations (Aswani 2002, McPherson et al. 2001, Gatewood 1984, Taylor and Singleton 1993, Stiles 1972). Overall, the fact that social activity occurs through and, as part of, social relations suggests that human behaviour is socially embedded. In Mexico, most aspects of social life unfold through family relationships (Otero 1999, Smith 1984). The state of Baja California Sur is not an exception, and family relationships appear to be

even more important because of the relatively small and sparse population, particularly in rural communities of the Loreto municipality (INEGI 2001, Morales-Polo 1994).

The relative importance of kinship, friendship, and acquaintance relations within and between communities are shown in Table 5.2, which has the same arrangement as Table 5.1, except that the density of cooperative ties in each cell is disaggregated by the type of social relation. During my fieldwork, I distinguished three types of kinship relations (Truex 1981): consanguineal ties (grandfather, grandson, father, son, brother, uncle, nephew, cousin), affinal ties (father-in-law, son-in-law, and brother-in-law), and fictive ties (co-parent or "*compadre*"). In the following analysis, I reduced all these types into the general type of kinship relations to make the analysis more tractable.

Within communities cooperative ties occur mostly through kinship relations, except for San Nicolás and Colonia Zaragoza where friendship relations are more important (Table 5.2). Indeed, resource users are more likely to share information within their communities through kinship ties. They are also likely to share through friendship ties in all localities except for Juncalito (where all resource users interviewed were kin related), and through acquaintance relations only in Ensenada Blanca and Ligüí (Table 5.2). Of the 18 cases of between-communities cooperation, 16 cases do not show a hierarchy of importance of the type of social relations (i.e., kinship > friendship > acquaintance relations). In fact, friendship and acquaintance relations are often more important at connecting communities.

**Table 5.2** Density of cooperative ties among resource users by kinship, friendship, and acquaintance relations (all values expressed in percentages and statistically significant groups are in bold and indicated with an asterisk; $\alpha \leq 0.05$. Appendix 3 shows statistical values)

| | North → | | | | | | South |
|---|---|---|---|---|---|---|---|
| | Community (Kinship, Friendship, Acquaintance) | | | | | | |
| | Ramadita | San Nicolás | Colonia Zaragoza | Juncalito | Ligüí | Ensenada Blanca | Agua Verde |
| Ramadita | **50.0*** > **40.0*** > 0.0 | | | | | | |
| San Nicolás | 16.7 < 18.3 > 0.0 | **9.1*** < **25.8*** > 0.0 | | | | | |
| Colonia Zaragoza | 2.4 < 6.3 < 6.8 | 0.2 < 0.6 < 1.6 | **4.5*** < **9.0*** > 1.3 | | | | |
| Juncalito | 0.0 < 3..3 = 3.3 | 1.4 < 2.8 < 0.0 | 0.8 < 1.6 = 1.6 | **33.3*** > 0.0 = 0.0 | | | |
| Ligüí | 0.0 < 1.0 > 0.0 | 0.0 < 1.2 > 0.0 | 0.2 < 1.3 > 0.2 | 3.2 < 4.0 > 0.8 | **29.0*** > **18.6*** > **2.9*** | | |
| Ensenada Blanca | 0.0 = 0.0 = 0.0 | 0.0 < 0.4 > 0.0 | 0.1 < 0.5 > 0.1 | 0.0 < 3.3 > 0.0 | 3.1 < 5.0 > 0.5 | **32.6*** > **19.5*** > **3.7*** | |
| Agua Verde | 0.0 = 0.0 = 0.0 | 0.0 = 0.0 = 0.0 | 0.8 < 2.0 >0.4 | 0.9 > 0.0 > 0.0 | 0.0 < 1.3 = 1.3 | 2.8 > 1.4 > 0.6 | **26.8*** > **18.3*** > 0.0 |

Network visualizations of each type of social relation for all resource users also show emergent structural differences. Figures 5.2, 5.3 and 5.4 show the networks of information sharing for each type of social relation, kinship, friendship, and acquaintance relations respectively. These figures were generated also using the Netdraw program and its built-in algorithm called "spring embedding". Thus actors are located according to their social distance.

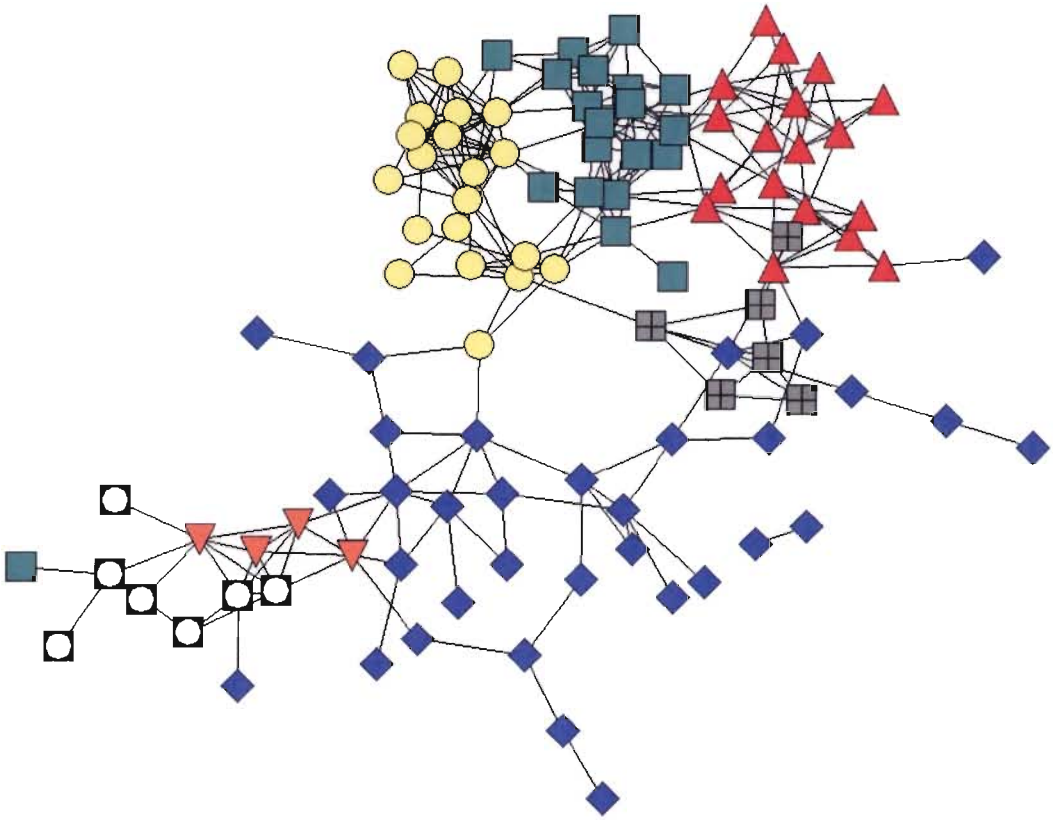

**Figure 5.2** Visualization of the kinship network of information sharing. Community network members are shown with different colours and shapes: Agua Verde (red up-triangle), Colonia Zaragoza (blue diamond), Ensenada Blanca (blue-green square), Juncalito (gray box), Ligüí (yellow circle), San Nicolás (white circle-in-box), and Ramadita (orange down-triangle)

Focusing on the structural pattern that emerges from the kinship relations, the

distinction between the two major clusters from Figure 5.1 appear again, but the separation is more evident. Interestingly, the emergent structure of kinship relations resembles a bee-waist pattern where by virtue of only one actor from Colonia Zaragoza and one from Ligüí the two major clusters are connected. Also, while most actors who live in the same community cluster close to one another, Colonia Zaragoza and San Nicolás community members cluster in a much looser way through kinship relations.

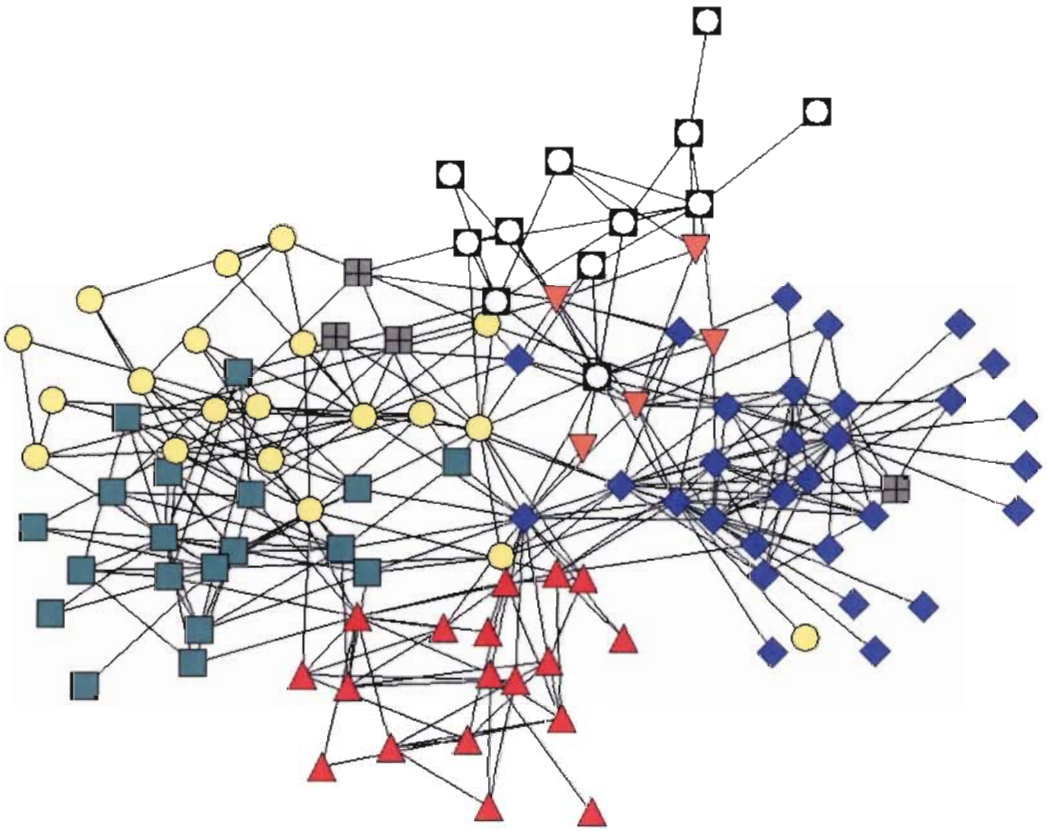

**Figure 5.3** Visualization of the friendship network of information sharing. Community network members are shown with different colours and shapes: Agua Verde (red up-triangle), Colonia Zaragoza (blue diamond), Ensenada Blanca (blue-green square), Juncalito (gray box), Ligüí (yellow circle), San Nicolás (white circle-in-box), and Ramadita (orange down-triangle).

The emergent structural patterns in friendship shows a much looser social arrangement than the kinship network. Although the clusters by community can be still easily discerned, most communities "loosen up" in their social distance. It is worth noting that several members of Colonia Zaragoza are now much more socially close through friendship relations than in the kinship network visualization. Overall, social distance between communities is reduced in the friendship network.

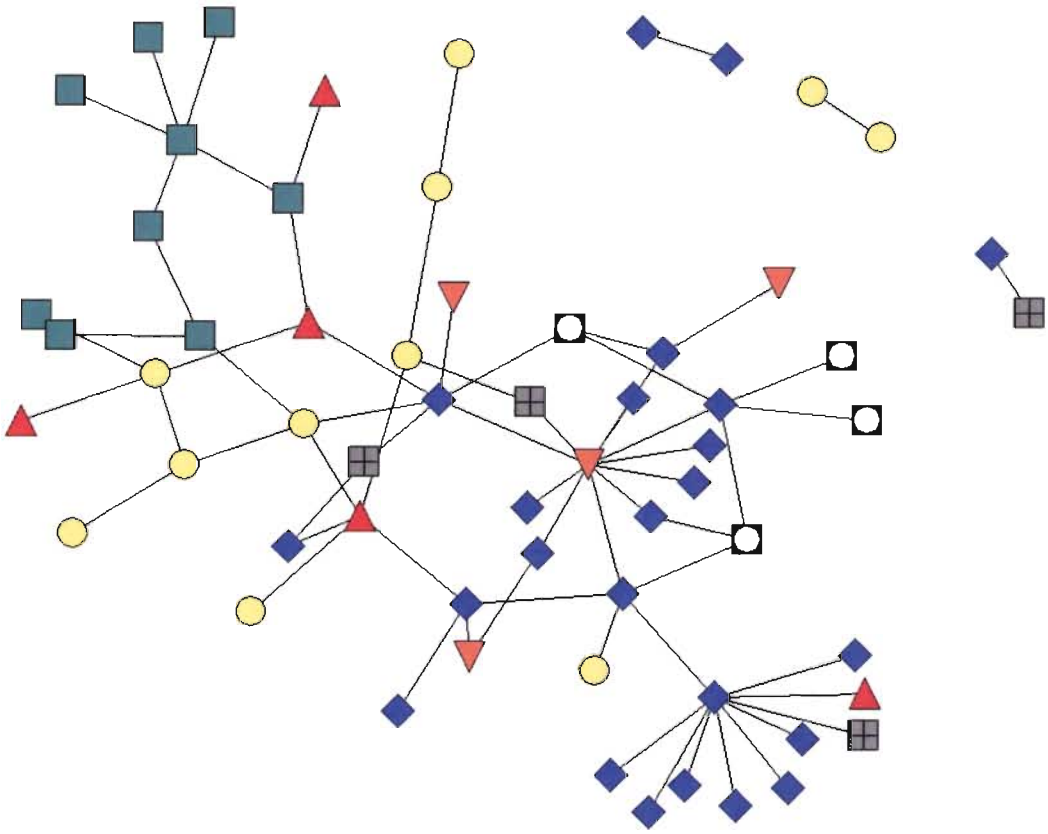

**Figure 5.4** Visualization of the acquaintance network of information sharing. Community network members are shown with different colours and shapes: Agua Verde (red up-triangle), Colonia Zaragoza (blue diamond), Ensenada Blanca (blue-green square), Juncalito (gray box), Ligüí (yellow circle), San Nicolás (white circle-in-box), and Ramadita (orange down-triangle)

Last but not least, the acquaintance network also has an interesting emergent structure. This network is much socially looser than the kinship and friendship networks and it also shows a greater social mix among resource users from different communities. In the whole structure of the acquaintance network it is also possible to discern many sub-structures that resemble star-like networks. As I will discuss in the next chapter, star-like network structures are of particular important for understanding the contribution and centrality of actors in the structure of social networks. At this juncture, I simply want to point out the obvious occurrence of this kind of sub-structure in the acquaintance network of two apparent distinct kinds, one occurring in communities and the other between communities. Of the first kind, there are two salient star-like sub-structures, one in the left-top corner and another in the right-bottom corner by members of Ligüí and Colonia Zaragoza, respectively. Of the second kind, the more distinct one is formed practically in the middle of the acquaintance network visualization by one member of Ramadita, located at the center of the star-like sub-structure, and in the periphery eight members from Colonia Zaragoza and one from Juncalito. Indeed, once we focus on finding star-like sub-structures, they seem widespread throughout the whole acquaintance network, in many cases connecting members from different communities, visually confirming the observation made from Table 5.2 that acquaintance relations are more important between than within most communities.

In sum, and reflecting on the hypothesis that kinship relations are more likely to form homophilic groups, we can conclude the following. A hierarchy of importance of type of social relations (kinship > friendship > acquaintance) exists in the sense of structural social distance but not necessarily in the sense of structural density of ties. How do we explain these patterns? The strength of social relations in terms of their availability and utility can explain these patterns.

### 5.3.1 The Strength of Social Ties

Family ties have a strong affective component and slow decay in comparison to other social relations (McPherson et al. 2001). Yet, the seemingly "weak" acquaintance relations may have a "strong" role in bringing social integration to social groups. Mark Granovetter's (1983) theory on the "strength of weak ties" proposes that, under certain conditions, weak relations (i.e., acquaintance relations) may be more critical than strong ties in bridging social groups and avoiding, for instance, redundant information and social fragmentation. That is to say, weak ties may provide individuals with access to information and resources beyond those available in their own social circles. Yet "strong ties provide greater motivation to be of assistance and are typically more easily available", especially for people who are economically insecure or poor (Granovetter 1983: 209). The conditions under which strong and weak ties operate can explain the extent to which resource users cooperate within and between communities and the structural emergent patterns of kinship, friendship, and acquaintance networks.

### 5.3.2 Family Ties and Conflict within Communities

Most fishery resource users from the coastal communities of Loreto have kinship and affinal relations. Clearly, the significant kinship homophily in information sharing within most communities supports this condition, which can be explained by the settlement history of Loreto by a few families and its low population density (INEGI 2001, Morales-Polo 1994). In addition, most fishery resource users in the Loreto area live in precarious economic conditions because of the low value of most small-scale fishery resources and lack of sufficient alternative economic activities. These conditions may explain the

greater cooperative ties through family relations within communities, as suggested by Granovetter's (1983) theory on the strength of weak ties. Yet there are exceptions. Worth noting is the case of Colonia Zaragoza, where a second-generation resident once assured me, "here, we are all family", yet sharing of information in this location occurs mostly through friendship relations. Internal conflict may explain the low density of cooperative ties in the Colonia Zaragoza network, particularly the anomalous low occurrence of kinship relations and their loosely structural pattern observed in Figure 5.2.

Klooster (2000) has shown that conflict and corruption are important factors for explaining changes in social systems of common-pool resources. In particular, Klooster (2000) argues that conflict and corruption may fragment already-stratified communities and disrupt a sense of community based on fairness and legitimacy. During the time I spent in the Colonia Zaragoza community, I often came across extended family feuds. While there are divisions among extended families during political elections in all seven coastal rural communities, conflicts over the management of ejido Loreto land are salient in Colonia Zaragoza. Ejido is land that was re-distributed to peasants for use under communal ownership after the Mexican Revolution (see section 1.6.1). The ejido Loreto comprises 42,000 hectares, including a large portion of the coastal land (approximately 15 km North of Colonia Zaragoza to Juncalito). After the constitutional land reforms of 1992 most of the waterfront land of the ejido Loreto was subdivided, individually titled and sold in part because this coastal land is unsuitable for farming, as is most of the land in Baja California Sur. The subdivision and titling of land has been a source of conflict and corruption leading to divisions within the community, even among families. Such political and economic conflicts over land may have undermined kinship relationships

and overall tendency of cooperation between fishery resource users from Colonia Zaragoza. That is to say, a sense of community has been undermined (Klooster 2000). Indeed, older fishers from Colonia Zaragoza asserted that 20 to 30 years ago most fishers in the community would share information on abundant fishing areas, but now only a handful can provide trustworthy information. Moreover, older fishers also affirm that many fishers would send inquirers in the opposite direction from where abundant fish have been found with the purpose of deceiving them. Structurally, social distance in family ties seems to have widened by this conflict in Colonia Zaragoza as well (Figure 5.2). Resource users from the San Nicolás community also tend to share information mostly through friendship relations. Although there is internal conflict during political elections in this community, the history of settlement may explain the sharing of information mostly occurring through friendship relations. In particular, San Nicolás originated with a few families but many other families have arrived in recent times from the Mulegé and Comondú municipalities.

In sum, internal conflict and settlement history seem to explain the particular patterns of the anomalous cases of Colonia Zaragoza and San Nicolás. Of all the seven fishing communities, Colonia Zaragoza appears to be the most contrasting one and thus I will use it to illustrate differences among communities. Information sharing between communities and in some cases within communities may be explained by the strength of weak ties.

### 5.3.3 The Strength of "Weak" Ties

Most resource users share information with resource users from other communities through friendship and acquaintance relations (Table 5.2). These seemingly weaker ties

may have the important function of allowing resource users to have access to information on the state of distant fishery resources. That is to say, if these weak ties were absent, most resource users from different social groups may not be able to access fishery resources from other areas and, possibly, off-set the impacts of natural or human-induced fluctuations in local fishery resources. Thus, sharing of information may operate like a "good" that allows access to fishery resources that are often variably distributed, or as fishermen would describe it, "fish move".

The much looser social structures of the friendship and acquaintance networks suggest that friendship and acquaintance relations may also be serving the function of socially integrating distant communities in the Loreto area and countering the strong homophilic effect observed for kinship relations. For instance, friendship relations seem to strengthen the weak bee-waist form of the kinship network. Particularly interesting were the rather obvious star-like sub-structures in the acquaintance network. The theory of the strength of weak ties does not mention star-like sub-structures as characteristic of acquaintance networks, but the theory seems to logically imply them since weak ties connect relatively isolated groups (Granovetter 1983). Finally, the strong homophily in acquaintance relations within the Ensenada Blanca and Ligüí communities may be explained by the relatively recent formation and influx of newcomers, mostly during the late 1970s, in these two communities (Hollister 1996, Leal-Jiménez et al. 2003).

In sum, most communities have a greater tendency to cooperate through family ties, although internal conflict may undermine such tendencies. Strong (kinship) relations are important in accessing fisheries resources but weaker friendship and acquaintance relations may play an important role in how resource users access resources from distant

localities and also maintain social integration. One important implication is that communities are not necessarily confined to a fixed territory, a condition most likely observed in all human communities, yet neglected by many community scholars in conservation and resource management as indicated by Agrawal and Gibson (1999). Despite the variability in the importance of the type of social relations within and between communities, in the aggregate (i.e., all resource users combined), the relative importance of the type of social relation in information sharing and social integration is friendship (4.1%), kinship (3.64 %), and acquaintance (0.89%) relations, a pattern that still remains anomalous given the historical settlements in Loreto by relatively few families and its low population density. What, then, is the function of these social relations in terms of the social networks that emerge from them?

### 5.3.4 The Latent and Manifest Function of Social Relations and Social Networks: An Initial Distinction

So far I have argued that the three different types of social relations and the networks that emerge support the exchange of information for accessing fishery resources and also ensure the social integration of the communities, despite internal conflicts. To be sure, in the context of information exchange, social relations and the social networks that emerge serve the manifest function of enabling access to fishery resources – social relations and the networks that emerge from them have a particular purpose. Yet, social relations and the networks that emerge from them may also be fulfilling the latent function of social integration – social relations are not purposefully used to bring about social integration.

The distinction between latent and manifest function of social systems was first proposed by Merton (1957) and adopted by Mahner and Bunge (2001) to distinguish between manifest or recognized (intended) and latent or unrecognized (unintended) social functions. In the rest of my analysis of the social and demographic factors affecting information sharing and social integration I use this distinction to highlight the manifest, sharing of information, and latent, social integration, functions of social relations and the social networks that emerge from them. I will elaborate further this ontological distinction to understand collective action at the end of this chapter, and will introduce other logical distinctions regarding the function of social networks after I discuss the contribution of individuals to the social networks (actor-level of analysis) at the end of Chapter 6.

## 5.4 Sociodemographic Characteristics, Information Sharing, and Social Integration

The literature on social integration based on the idea of homophily distinguishes two types of sociodemographic characteristics: ascribed (e.g., race, ethnicity, and age) and acquired (e.g., education, occupation, and religion). These sociodemographic characteristics define status homophily, while internal states presumed to share orientation toward future behaviour is referred to as value homophily (McPherson et al. 2001). Although this distinction is important, I use three categories to analyze the sociodemographic characteristics: sense of place, fishing practice, and livelihood diversity. In the sense of place category, I analyze place of birth and years living in the current locality. For fishing practice I focus on gear types and species targeted, seasonal migration, type of resource user, and years of fishing experience. For livelihood diversity,

I analyze alternative economic activities and job satisfaction. Finally, I mainly focus on the patterns of information sharing among all resource users by each sociodemographic characteristic as indicated by the ANOVA model of variable homophily because my interest is to examine the extent to which sociodemographic characteristics are a meaningful dimension of social structure (Blau 1977). However, I use conventional statistical analyses, in a secondary manner, to test for significant differences in these variables among communities. The reason is that in a social relational approach the focus is not on relations among variables (conventional statistics) but on relations between actors (see section 3.8.1).

### 5.4.1 Homophily in Social Networks of Information Sharing

In a recent review of homophily in social networks, McPherson et al. (2001) identifies consistent homophilic patterns across social networks of different kinds, including, but not exclusively, marriage, friendship, work, advice, support, and information transfer. Race and ethnicity appear to be the strongest factors followed by age, religion, education, occupation, and gender. The literature that has specifically studied information sharing in fishing communities for findings about the state/location of fishery resources has not been as comprehensive in studying sociodemographic characteristics (Andersen 1972, Forman 1967, Gatewood 1984, Stiles 1972). A recent study of communication networks among fishery resource users suggests that occupational and fishing gear type homophily is an important variable structuring information exchanges regarding ecological knowledge and the effects of the social network structure for collective action (Crona and Bodin 2006). In this context, I intend to contribute to the knowledge so far produced by this literature and expand it by analyzing the type of social relation through which information flows.

### 5.4.2 Sense of Place

Within the broad social category of fisher folk, there is often a strong sense of identity and pride, both of which are part of the complex fishing practice that is often learned at a young age (Acheson 1981, Gatti 1986, McGoodwin 1990). Moreover, fisher folk often developed a strong sense of place and territory often created by more face-to-face interactions (Pinkerton and Weinstein 1995, Smith and Hanna 1993). A sense of place, however, emerges over time and frequently over generations (Acheson 1981, Aswani 2002, Dyer and McGoodwin 1994, McCay 2000, Pinkerton and Weinstein 1995). Indeed, time is of the essence for cooperation to emerge, including information sharing (Biel 2000, Berkes 2004, Gatewood 1984, Pinkerton 1989, Singleton 1993, Stiles 1972). However, fishing communities all over the world are more often than not composed of fisher folk with different sociodemographic backgrounds – fishing communities are not homogenous (Breton et al. 2006, Clay and McGoodwin 1995, Davis 1991, Pinkerton and Weinstein 1995, Smith and Hanna 1993).

The lower Baja California Peninsula has been characterized by high influxes of people relative to their local population, often facilitated by federal policies aimed at populating these low density areas as I explained in the previous chapter. As pointed out in the introductory chapter, rural coastal communities of the Loreto municipality have been recently populated by migrants from within and outside the state of Baja California Sur, especially during the late 1970s. To what extent do place of birth and years living in a current locality reflect the structure of information sharing of the resource users from the seven communities?

### 5.4.3 Place of Birth

Most resource users interviewed from the seven rural communities were born in the Municipality of Loreto (69%), a quarter in other municipalities of BCS (24%), and the rest outside of BCS (7%). Such a tendency is not significantly different among resource users by community (Kruskal-Wallis, $\alpha \leq 0.05$, p=0.439). However, there is a significant tendency for more cooperative ties among those born within the municipality of Loreto than those born outside of the Loreto municipality or outside of BCS. Table 5.3 shows the density of cooperative ties among resource users when partitioned according to four categories of place of birth.

**Table 5.3** Density of cooperative ties among resource users by place of birth (all values expressed in percentages and statistically significant groups are indicated with an asterisk; $\alpha \leq 0.05$. Appendix 3 shows statistical values)

| | PLACE OF BIRTH CATEGORY (Number of Observations) | | | |
|---|---|---|---|---|
| | MUNICIPALITY OF LORETO | | | |
| | Community (12) | Ranch (20) | Town of Loreto (54) | Outside Loreto/BCS (37) |
| **Community** | **25.00*** | | | |
| **Ranch** | 17.1 | **20.3*** | | |
| **Town of Loreto** | 5.6 | 5.3 | **12.5*** | |
| **Outside Loreto/BCS** | 10.1 | 13.0 | 4.4 | 8.0 |

All three categories of place of birth within the municipality of Loreto show a significant tendency to homophily but not so for those who were born outside of the

municipality of Loreto or outside of BCS (ANOVA density model of variable homophily, $\alpha \leq 0.05$). The density of cooperative ties appears to decrease the further away a resource user was born from the community: community (25 %), ranch (20.3 %), town of Loreto (12.5 %), and outside of Loreto/BCS category (8.0 %). However, density of cooperative ties between these categories does not follow this pattern. For instance, cooperative ties do not decrease uniformly between those born in the community and the other three categories (first column of Table 5.3): community-ranch (17.1%) > community-town of Loreto (5.6%) < community-outside Loreto/BCS (10.1%). Worth noting is that the density of cooperative ties is the lowest between those born in the town of Loreto and all other categories (row and column of the town of Loreto category, Table 5.3).

Focusing on the type of social relations, all categories show significant homophily for all types of social relations, except for the "outside of Loreto/BCS" category (Table 5.4). There is not a consistent pattern of hierarchy of social relations within each category or between categories. However, comparing the density of the type of social relation across the four categories, it appears that the farther resource users were born from the community the more they rely on friendship relations.

These patterns suggest that the ethnic-like characteristic of place of birth may have important consequence for the extent to which individuals share information. Why is place of birth a structuring factor in how resource users share information? During my informal interviews with some resource users who were not from the area (outside of BCS) or just recently arrived from other communities (within the municipality of Loreto) there was often a perception of less fellowship when it came to sharing information. In 2004, I interviewed an individual from Agua Verde who had recently arrived to Colonia

Zaragoza after marrying a woman from this community. The way he felt about other members of Colonia Zaragoza sharing information with him was summed up as "All here are *chivas* [goats]" suggesting that the local community members would shy away or ignore you before trying to help you out.

**Table 5.4** Density of cooperative ties among resource users by place of birth and by type of social relation (all values expressed in percentages and statistically significant groups are indicated with an asterisk; $\alpha \leq 0.05$. Appendix 3 shows statistical values)

| | PLACE OF BIRTH CATEGORY (Kinship, Friendship, Acquaintance) | | | |
|---|---|---|---|---|
| | MUNICIPALITY OF LORETO | | | |
| | **Community** | **Nearby Ranch** | **Town of Loreto** | **Outside of Loreto/BCS** |
| **Community** | **10.6* = 10.6* > 4.5*** | | | |
| **Nearby Ranch** | 7.5 < 10.8 > 2.1 | **8.4* > 7.9* > 2.6*** | | |
| **Town of Loreto** | 2.9 > 2.3 > 0.5 | 2.8 > 1.9 > 0.3 | **4.8* < 5.9* > 1.8*** | |
| **Outside of Loreto/BCS** | 5.0 = 5.0 > 0.9 | 5.9 > 5.5 > 0.5 | 1.3 < 2.6 > 0.6 | 3.6 < 3.9 > 0.5 |

Another important pattern is that resource users born in the town of Loreto tend to engage less in cooperative ties with all other resource users. This particular pattern may be attributed not to the place of birth of these resource users exclusively but rather more to the internal dynamics of communities where most of these resource users reside now. Of all the resource users who reported having born in the town of Loreto, 61% are residents of the Colonia Zaragoza community. Indeed, it was in this community where I proposed internal conflict over ejido land may have undermined the extent of cooperative

ties among resource users from this community (see section 5.3.2). Thus, while place of birth may be an important factor in how resource users cooperate, how long resource users have interacted with each other and the quality of this interaction may be more relevant.

If time is of the essence in developing cooperation, we can expect to observe more cooperation among resource users with longer times of residence at their current location than those with relative shorter times of residence. I explore this hypothesis using the years living at the current locality.

### 5.4.4 Number of Years Living in the Current Locality

Using 10-year intervals to construct year classes of periods of time residing in the current location, we find that those with longer periods of time living in their community have a greater tendency for homophily in cooperation; i.e., comparing density values across categories of years residing at the current locality (Table 5.5). Indeed, the ANOVA density model of variable homophily shows that resource users with at least 21-30 years residing in a place have a tendency to form more cohesive groups; i.e., a stronger tendency to homophily than those who have recently arrived to a community. This supports the general finding that time is of essence in the tendency for individuals to cooperate, including sharing information, and certainly to form more closely-knit groups. Notwithstanding, resource users of all ages tend to share information for accessing fishery resources as shown by the density values between the "years living at the current locality" categories.

**Table 5.5** Density of cooperative ties among resource users by years living in the current locality (all values expressed in percentages and statistically significant groups are indicated with an asterisk; $\alpha \leq 0.05$. Appendix 3 shows statistical values)

| | NUMBER OF YEARS LIVING IN CURRENT LOCALITY (n) | | | | |
|---|---|---|---|---|---|
| | **1-10 (14)** | **11-20 (26)** | **21-30 (31)** | **31-40 (33)** | **41+ (19)** |
| **1-10** | 6.6 | | | | |
| **11-20** | 6.0 | 10.3 | | | |
| **21-30** | 2.1 | 9.9 | **17.8*** | | |
| **31-40** | 3.9 | 8.0 | 6.2 | **16.9*** | |
| **41+** | 4.5 | 6.7 | 5.4 | 12.9 | **14.0*** |

Focusing on the type of social relations we find that only in two categories, 21-30 and 31-40, is there a significant tendency toward homophily in kinship relations (Table 5.6). Friendship relations show homophily in all cases, except for the 1-10 years category and in acquaintance relations only for those with 41+ years of residence. There is not a clear hierarchical pattern of importance for the type of social relation. How does the time living in the current community affect the cooperative tendencies within communities?

The class distribution of years of residence of all resource users interviewed is shown in Figure 5.5. The most common class or modal class is 31-40 years. Below this "years of residence" class, in the aggregate, most resource users have resided in their communities between one and 30 years.

**Table 5.6** Density of cooperative ties among resource users by years living in current location and by type of social relation (all values expressed in percentages and statistically significant groups are indicated with an asterisk; $\alpha \leq 0.05$. Appendix 3 shows statistical values)

| | NUMBER OF YEARS LIVING IN CURRENT LOCATION | | | | |
|---|---|---|---|---|---|
| | **0-10** | **11-20** | **21-30** | **31-40** | **41+** |
| **0-10** | 1.1 < 4.4 > 1.1 | | | | |
| **11-20** | 1.4 < 4.4 > 0.3 | 4.0 < **6.5*** > 0.00 | | | |
| **21-30** | 1.2 > 0.7 > 0.2 | 4.7 > 4.1 > 0.9 | **11.6*** > **5.8*** > 0.6 | | |
| **31-40** | 1.3 < 1.9 > 0.6 | 2.4 < 3.0 > 1.7 | 2.4 < 3.2 > 0.6 | **7.0*** < **8.9*** > 0.9 | |
| **41+** | 1.9 = 1.9 > 0.8 | 2.4 < 3.0 > 1.0 | 2.5 > 2.4 > 0.7 | 4.9 < 6.7 > 1.3 | 2.9 < **7.6*** > **3.5*** |

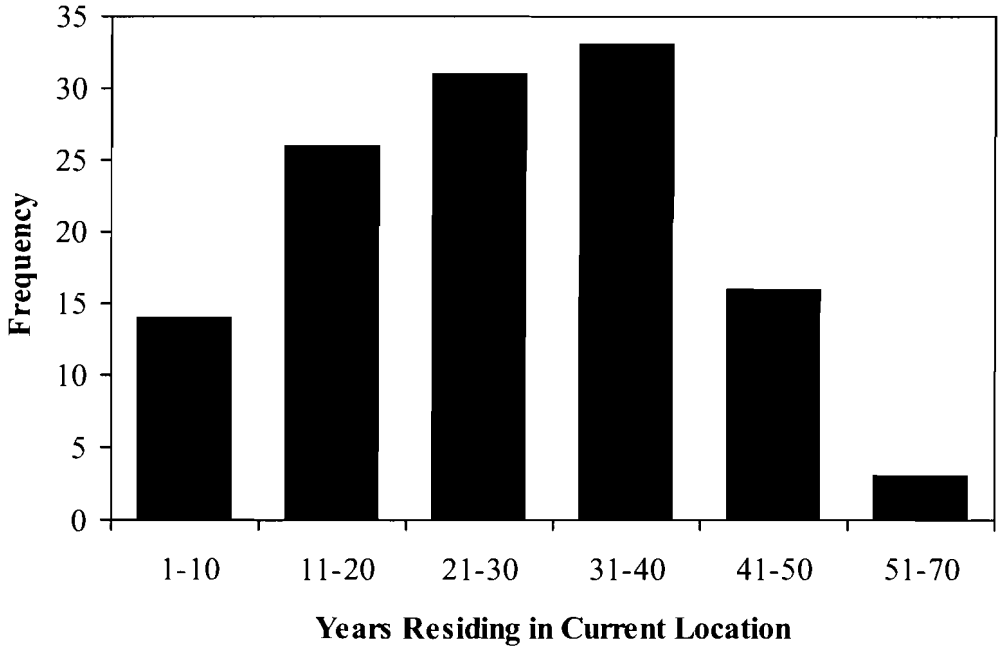


**Figure 5.5** Years residing in the current location of all resource users

This becomes apparent when looking at the proportion of resource users according to three-year classes (the modal class of 31-40 years of residence and remaining cases of less than, and more than this modal class) by community (Figure 5.6). The number of years living in the current locality is significantly different among communities (Kruskal-Wallis, p= 0.000).

The intuitive expectation that the density of cooperative ties should be high in communities with long-time residents is not always the case. Ramadita and Ensenada Blanca with the highest number of cooperative ties (90 and 55.8 % respectively; see Table 5.1) have the most cases of recent arrivals, and Colonia Zaragoza with the lowest density of group ties (14.9 %) has the greatest cases of resource users with higher number of years living in the community than the modal value.

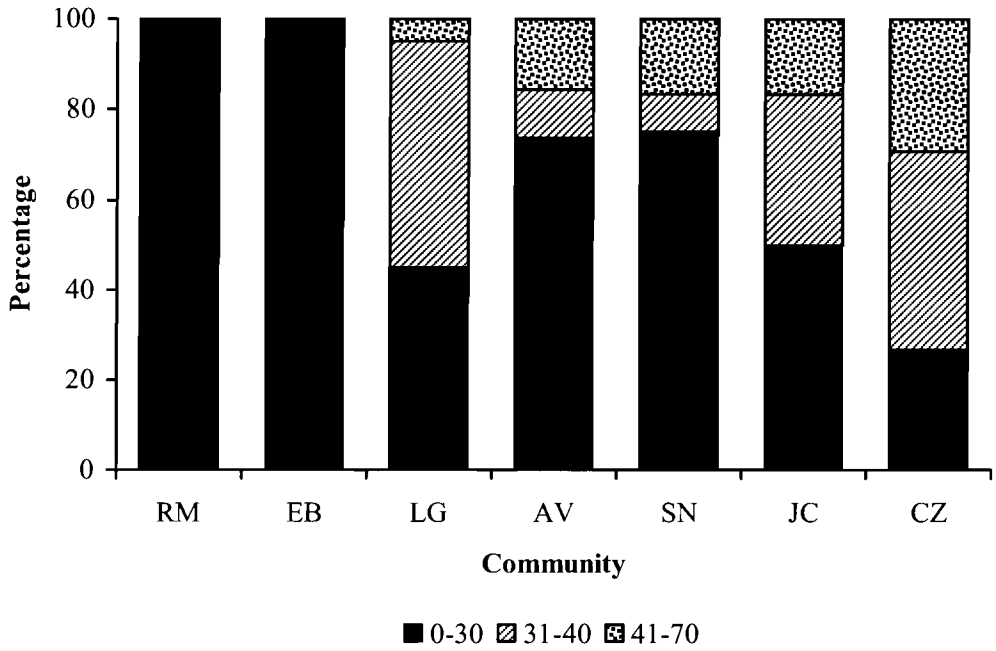


**Figure 5.6** Proportion of three classes of years of residence by community

This suggest that time may be necessary but insufficient for cooperation to emerge. In particular, the Colonia Zaragoza epitomizes this possibility given the internal conflicts in this community. Thus, the quality of these interactions and the context in which they develop may be more important than years living in the current locality may suggest. To be sure, one of the most trustworthy resource users, as reported by resource users from the Colonia Zaragoza community, is a non-resident individual who arrived from a nearby ranch to the community about 30 years ago. To further qualify this case, this individual is not an ejido member and tends to be less involved in politics than expected giving his apparent popularity as a trustworthy source of information.

In sum, place of birth and number of years living at the current locality do work as structuring factors in how resource users share information and form cohesive groups as indicated by tendencies to homophily. Yet, even those individuals with tendencies

toward homophily have cooperative ties with individuals from other categories. Thus, individuals who have a tendency toward homophily do not form completely isolated groups. In some cases, however, the density of cooperative ties does not seem to follow the expected pattern. For example, Colonia Zaragoza with one of the highest proportion of long-time residents has one of the lowest densities of cooperative ties among communities. A more robust understanding of how place of birth and years living at the current locality affect tendencies to engage in cooperative ties requires looking into contextual factors such as conflict and quality of interaction among individuals. How do the particularities of the fishing practice in the Loreto area affect information sharing?

### 5.4.5 The Fishing Activity and Information Sharing

The fishing practice is unique in many respects. It not only develops in a dynamic and uncertain environment that involves high financial risks; fishery resources are often distributed unevenly and the equipment necessary to carry out fishing is very specialized (Acheson 1981). One of the important contributions of maritime anthropologists has been documenting and providing possible explanations of the adaptations shown by fisher folk in carrying out their fishing activity more effectively (Acheson 1981, McGoodwin 1990). Despite this, resource users may adopt different strategies and practices, even within the same fishery. In this section, I look into three characteristics of fishery resources from the Loreto area that may have the effect of structuring the tendencies of resource users to share information. In particular, I look into seasonal migration, occupational diversity, and fishing experience as potential structuring factors. Fishery resource users from the Loreto area also share important characteristics such as species targeted and gears used.

Indeed, most fishery resource users know how to use various fishing gear types and seldom target just one fish species.

### 5.4.6 Fishing Gear Types

Most resource users were first introduced to fishing between 11 and 15 years of age, although many were introduced at a younger age and a small proportion learned fishing at a mature age (Figure 5.7). The age at which resource users first learned to fish is not significantly different among communities (Kruskal-Wallis, p= 0.803), indicating the homogeneity of fishing as a social practice in this regard.

The first fishing gear that resource users learned to use was hook and line (59%) most likely because of its simplicity and economy, 17% fishing nets, 7% long lines for sharks, 2 % diving, 7% other gear like harpoon, and 8% a combination of two gear types. Interestingly, diving, which is the current practice commonly blamed by managers and resource users alike for most of the decrease in abundance of certain fish stocks, was not a commonly first-learned practice among resource users. Most resource users, however, rely on more than one fishing gear to make a living during the year (Figure 5.8).

The majority of resource users I interviewed employ more than one type of fishing gear (87%), 10% use only hook an line, 2% only sport fishing gear, 1% snorkelling gear, and 2% none since they are currently fish buyers/permit holders. The number of fishing gear types used is significantly different among communities (Kruskal-Wallis, p= 0.025). Figure 5.9 shows the proportion of number of fishing gear types used during the year by community.

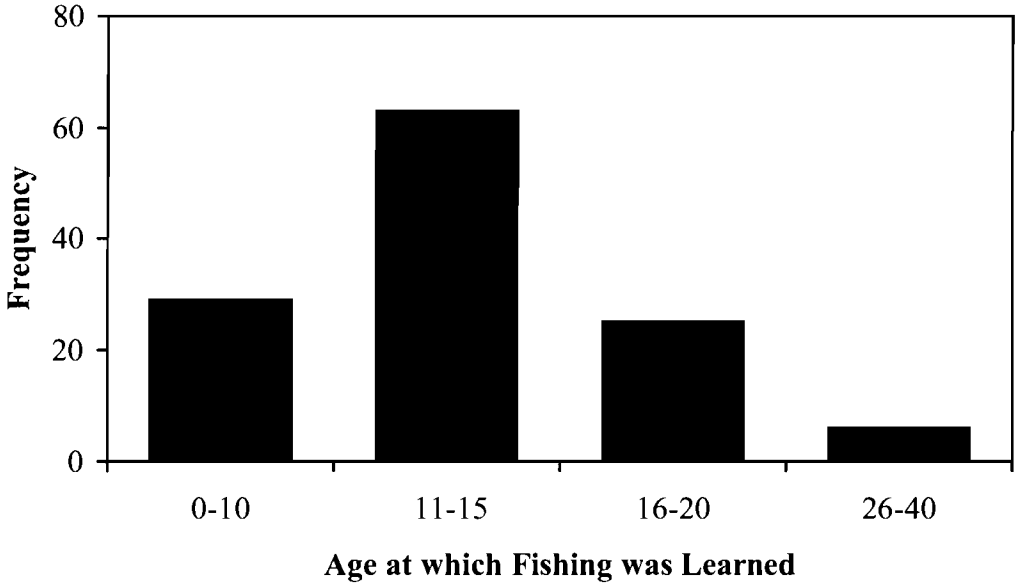


**Figure 5.7** Frequencies of age at which fishing was first learned

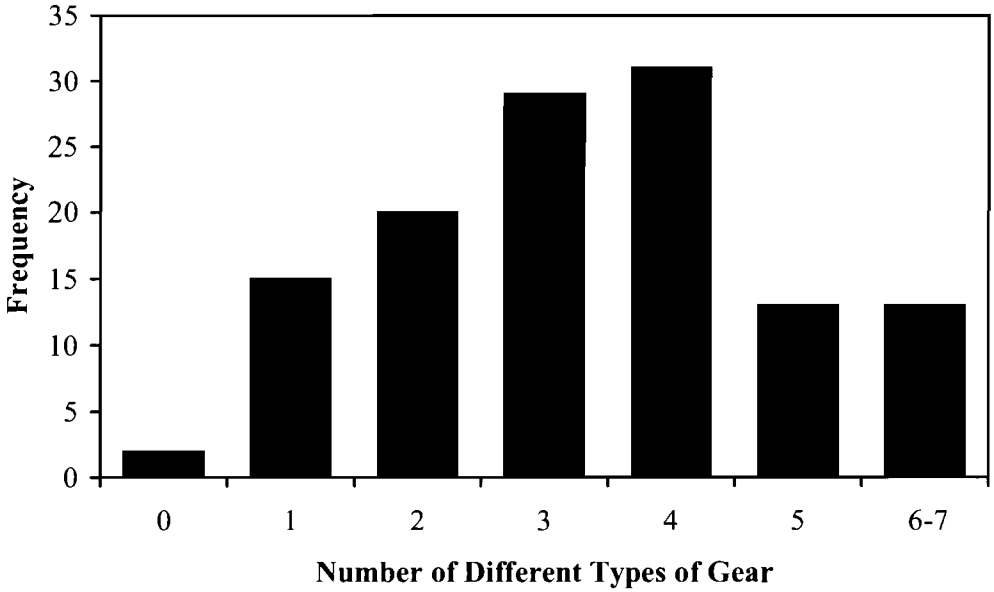


**Figure 5.8** Frequency of number of different types of gear used by resource users during the year

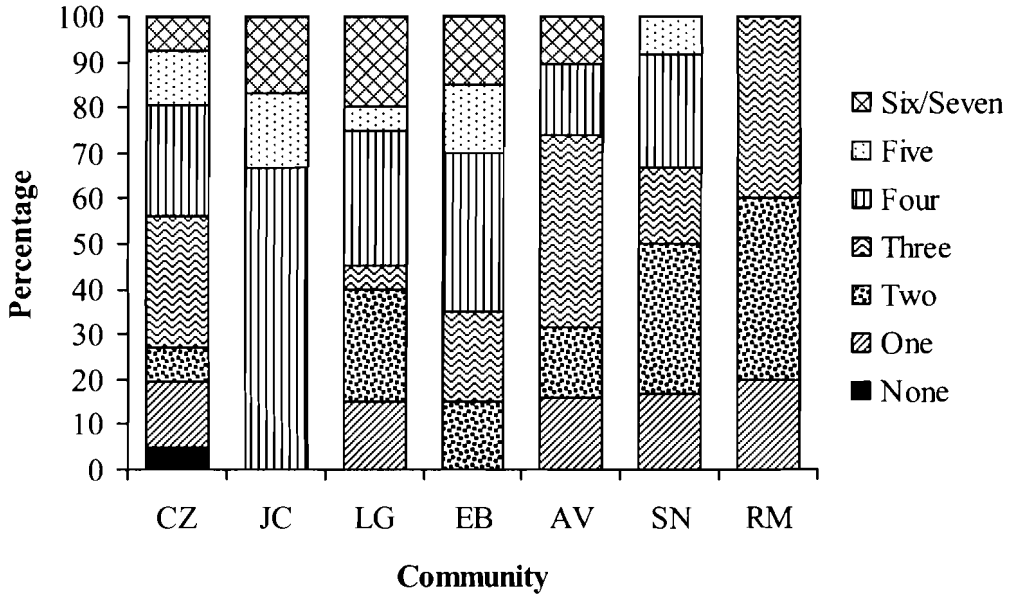


**Figure 5.9** Proportion of number of fishing gear types used during the year by community

The trends are different in terms of the proportion and composition of types of fishing gear when assessing the gear types that resource users know how to use but don't use during the year (Figure 5.10). While most resource users (68%) know how to use two to seven gear types, 21% know only one other gear and 11% do not know other gear besides the ones they use during the year. This suggests that many resource users may have stopped using other known gear types because of other factors such as regulations (e.g., prohibition of certain nets), physical impairment (e.g., damaged joints because of diving), and decrease in targeted species (e.g., long-line and hooks for sharks and turtles). Despite the decrease in fishing species in the Loreto area, most resource users target various species during the year.

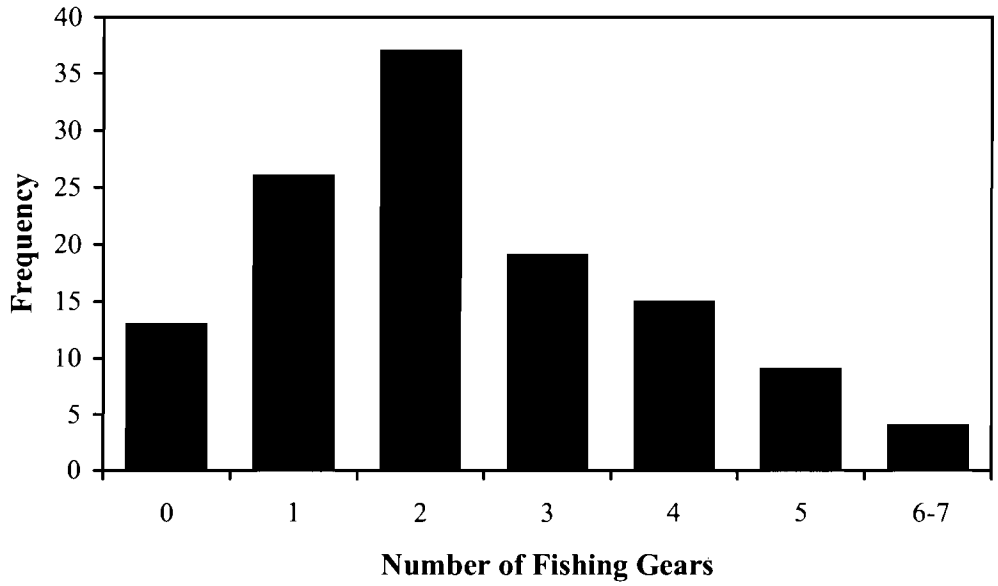


**Figure 5.10** Frequency of the number of fishing gear types known but not used by resource users during the year

### 5.4.7 Fishery Groups Targeted by Resource Users

In their local waters, the majority of resource users (94 %) target from two up to six different fishery species groupings, 4% only finfish species and 2% none – the latter represent the fish buyers/permit holders (Figure 5.11). Figure 5.12 depicts the proportions of the number of fishery species groupings targeted by community.

It is clear, and not a new finding, that fisheries are multi-specific in all communities (Gutiérrez-Barreras 2001). However, little is known about the number of groups targeted by resource users and the most important groups during the two fishing seasons (cold or winter and warm or summer).

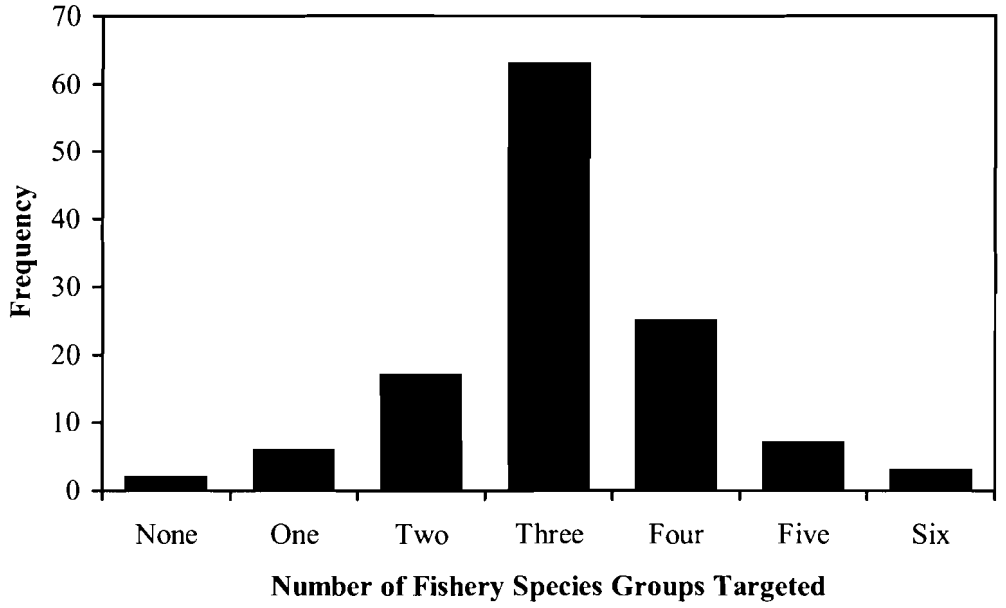


**Figure 5.11** Number of fishery species groupings targeted by resource users in their adjacent waters

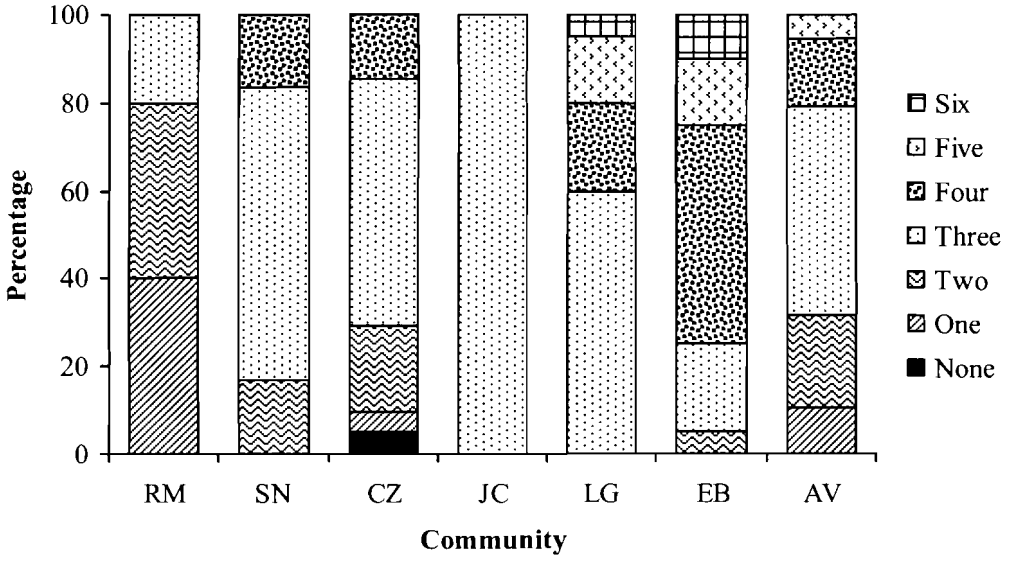


**Figure 5.12** Proportion of fishery groups targeted by community

According to the two socially accepted seasons among fishery resource users, during the cold months the relative importance, as perceived by resource users, of species targeted is as follows: sharks (39%), finfish (32%), none (7%), ornamental fish, squid, molluscs and invertebrates (4%), and two to three different groups (17%). These tendencies change during the warmer months, when most fishers considered finfish species to be the most important (63%), followed by squid (9%), molluscs and sport species (4 and 5% respectively), ornamental species (less than 1%), and two different groups (18%).

Despite the multi-specific nature of the fisheries in the Loreto area, during the summer months there is a greater tendency to concentrate on finfish species than in the winter months (Figures 5.13 and 5.14). Interestingly, some resource users do not consider the winter season important for fishing (i.e., some do not fish during the winter months). Most resource users (51%) who temporarily leave their communities for accessing fish resources target only one group of species, 32 % more than one group, and 17 % three up to seven different groups. Among single groups of species targeted, squid attracts most resource users (51%), followed by finfish species (30%), molluscs (16%), and sharks (3%). Although squid is the most important group targeted by seasonal migrants, squid abundance is such that permit holders have to bring people from outside of the municipality to work in this fishery. As a park staff member indicated to me during an interview, this often creates serious environmental degradation of coastal areas where resource users establish temporary camps. Given the high abundance of squid, it is unlikely that resource users have a need for information about their location, yet people still rely on their personal contacts to determine with which permit holder they can work.

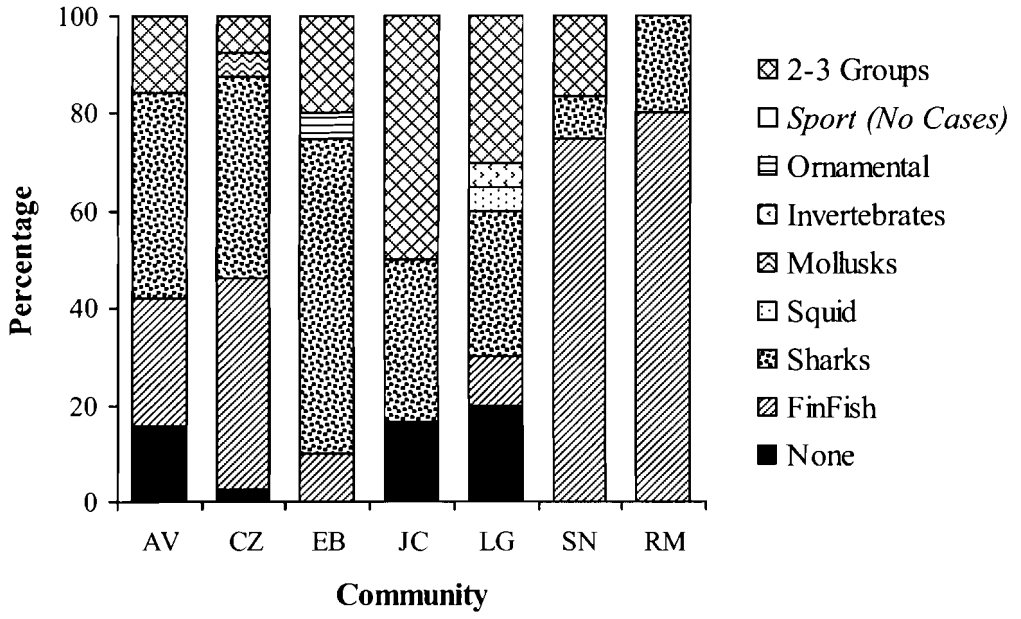


**Figure 5.13** Proportion of fishery species groupings in the winter season by community

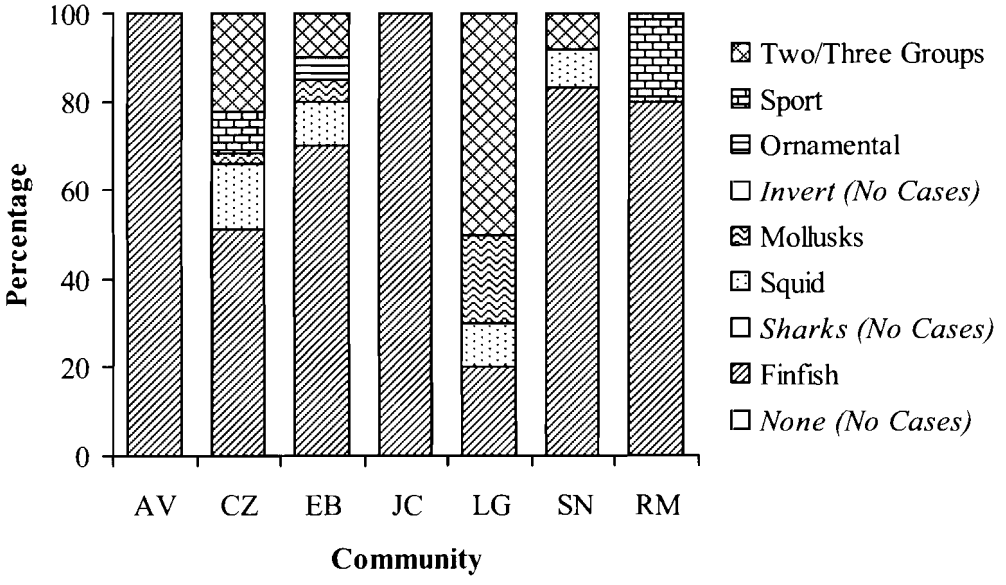


**Figure 5.14** Proportion of fishery species groupings targeted in the warm season by community

The changing abundance and location of the other fishery groups may require more detailed information through personal contacts. Indeed, fishery resource users have different strategies for coping with the uncertain distribution and abundance of fishery resources, including seasonal migration, fishing experience, and occupational diversity. The diversity of strategies taken, however, creates social heterogeneity. It is in this sense that I look into these three characteristics of the fishing practice in the Loreto area.

### 5.4.8 Seasonal Migration

Human migration with the purpose of accessing and using natural resources has and still is a widespread practice, particularly, although not exclusively, in developing countries (Curran and Agardy 2002, Curran et al. 2002, Piddington 1965). In the context of the commons, the pressure that migration imposes on consumption rates of commonly held resources is far from direct. In particular, there is evidence that open access is not a direct result of more people chasing less fish resulting from migration (Aswani 2002, Curran and Agardy 2002). Seasonal migration operates within economic, political and cultural systems that mediate its impact on the resources and the environment (Curran and Agardy 2002). I hypothesize that resource users with seasonal migratory tendencies for accessing fishery resources outside of their communities are more likely to have cooperative ties and form a homophilic group.

Considering all resource users, it is clear that resource users practicing seasonal migration have a significant tendency for homophily (Table 5.7). Cooperative ties between migrants and non-migrants are far from small (6.3%). However, this value is half of that occurring within the migrant category. Indeed, the fact that migrants engage

in more information sharing among them suggest that this type of migration is socially embedded.

**Table 5.7** Density of cooperative ties between migrants and non-migrants (all values expressed in percentages and statistically significant groups are indicated with an asterisk; $\alpha \leq 0.05$. Appendix 3 shows statistical values)

| | Type of Resource User | |
|---|---|---|
| | **Non-Migrants (50)** | **Migrants (73)** |
| **Non-Migrants** | 6.9 | |
| **Migrants** | 6.3 | **12.9*** |

Table 5.8 shows the type of social relation through which resource users with migratory practices share information. The ANOVA density model of variable homophily shows that only those with migratory practices significantly relate among themselves through kinship and friendship relations but not through acquaintance relations.

**Table 5.8** Density of cooperative ties within and between migrants and non-migrants by type of social relation (all values expressed in percentages and statistically significant groups are indicated with an asterisk; $\alpha \leq 0.05$. Appendix 3 shows statistical values)

| | TYPE OF RESOURCE USER\| (Kinship, Friendship, Acquaintance) | |
|---|---|---|
| | **Non-Migrant** | **Migrant** |
| **Non-Migrant** | 3.2 < 3.3 > 0.5 | |
| **Migrant** | 2.6 = 2.6 > 0.9 | **5.3*** < **6.5*** > 1.0 |

Although there is not a hierarchy of importance of the type of social relation within and between the migratory and non-migratory categories, the density of cooperative ties across these two categories increase from the non-migratory to the migratory category for kinship, friendship, and acquaintance relations. How does migration affect cooperative patterns within communities? In particular, do communities with a larger number of migrants tend to show greater cooperative ties?

As much as 59% of all resource users reported leaving temporarily their communities to access fishery resources. The proportions of resource users that occasionally leave their communities are shown in Figure 5.15. The hypothesis of higher cooperative ties within localities with a large number of migrants is partially confirmed when comparing communities.

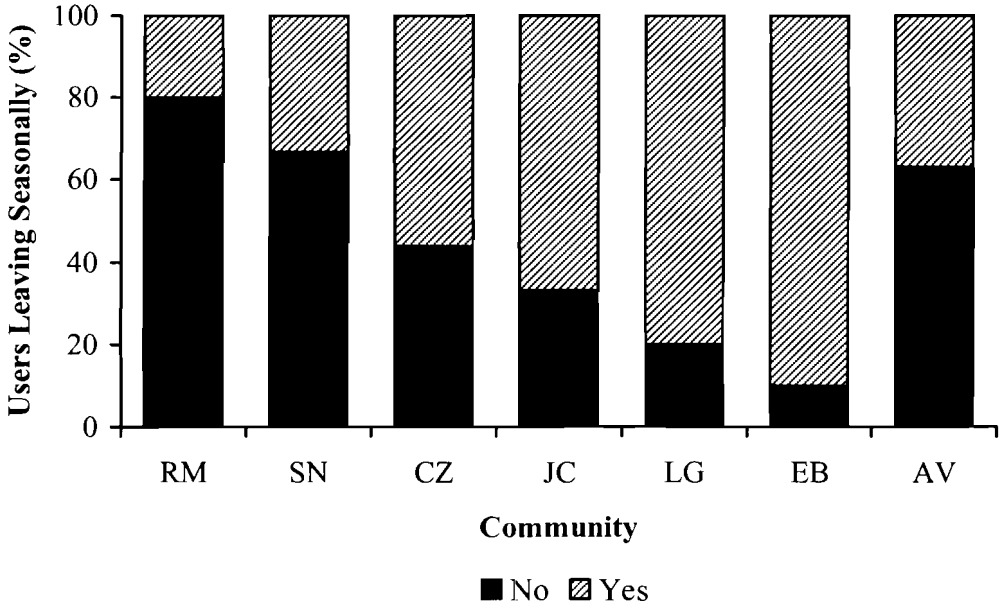


**Figure 5.15** Proportion of resource users that temporarily leave their communities for accessing fish resources

For instance, Ensenada Blanca and Ligüí have two of the highest densities of cooperative ties (55.8% and 52.10% respectively; see Table 5.1) and also have the largest proportion of seasonal migratory resource users. Colonia Zaragoza, however, with a relatively high number of migrants, does not show high levels of cooperative ties of information sharing (14.9%; see Table 5.1).

It appears that the relative location of a community in relation to the Park correlates with the tendency to engage in migratory practices and also accounts for the cooperative ties between localities adjacent to the Park. Communities that are not adjacent to the park (Ramadita and San Nicolás to the North, and Agua Verde to the South), have smaller proportions of resource users that temporarily leave their communities. One interpretation of this pattern is that fisheries resources are more depleted within the park than in waters adjacent to communities that are more difficult to access such as Agua Verde, San Nicolás, and Ramadita. Thus, members of these latter communities may have less pressure to migrate than members from communities adjacent to the Park. Yet some of the individuals from San Nicolás, Ramadita, and to a lesser extent Agua Verde, who temporarily leave their communities to access fisheries resources, do so to the waters of the marine park, partially undermining (i.e., they are few in absolute numbers) the hypothesis of more depleted resources inside the park. In addition, most of the individuals from the four communities (Colonia Zaragoza, Juncalito, Ligüí, and Ensenada Blanca) located adjacent to the park, temporarily leave their communities to access resources outside the Park or outside the municipality of Loreto (Figure 5.16). The greater tendency of fishery resource users to search for

resources outside of the park or outside of the municipality of Loreto is consistent with the relative low density of cooperative ties among most of the communities located adjacent to the park (Table 5.1).

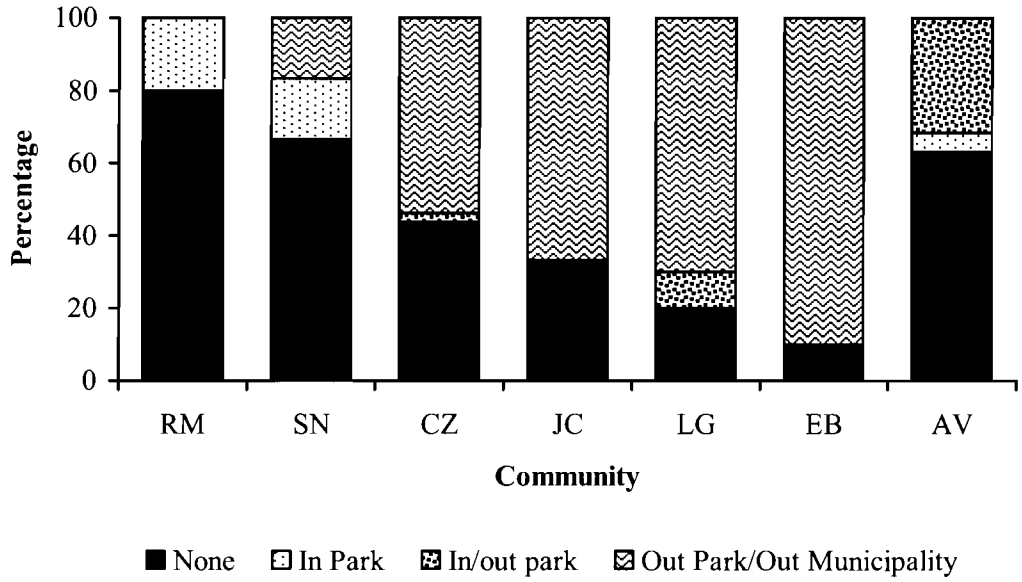


**Figure 5.16** Proportion of areas visited by resource users who leave their communities for accessing fishery resources

Migration for accessing natural resources is a widespread social practice in BCS (Young 1995), and the resource users from the seven rural communities are not the exception. In the case of the fishery resource users from the Loreto area, the proportion of resource users practicing seasonal migration seems to correspond to the degree of cooperation within communities. Furthermore, migratory destination and relative location in relation to the Park appear to describe the relative low cooperation between communities adjacent to the Park, suggesting that areas adjacent to the Park may be more depleted than waters outside the park where localities are relatively less accessible. The hypothesis that seasonal migrants may have a greater density of cooperative ties than

non-migrants to access fishery resources was confirmed and so far has provided the strongest case of homophily (Table 5.7). However, cooperative ties between migrants and non-migrants were still relatively strong. Seasonal migration appears to require more cooperative ties in terms of sharing of information in part because of the uncertainty involved, difficult conditions encountered in the migratory destinations, and investment required. During my interviews, many resource users indicated that they were less prone to migrate because of the expenses involved, the difficulty of being away from the family, and harsh living conditions (mostly limited basic services such as food, shelter, and washrooms). An alternative strategy to cope with the uncertainty of the fishing practice is for fisher folk to diversify their occupation. This seems to be an important alternative for fishery resource users in the Loreto area.

### 5.4.9 Type of Resource User

In the modern practice of fisheries management, resource users are categorized according to social categories that reflect common interests and practices arguably making them homogenous groups (Maurstad 2000). This political reduction to produce a manageable number of social categories used in politics, law, and official statistics is characteristic of modern liberal democracies (Scott 1998, Starr 1992). In the Loreto area fishery resource users self-defined themselves to a specific fishing occupational category (e.g., commercial or sport fisher). Yet most resource users seldom limit their fishing activity to one occupational type. To what extent do occupational categories structure information sharing for accessing fishery resources?

The occupational categories of resource user from the seven rural coastal communities are self explanatory. However, the distinction between Sport/Commercial

and Commercial/Sport Fisher requires clarification. Sport/commercial fishers are mostly dedicated to sport fishing, but they fish commercially during the low season of sport fishing (winter months) or when few anglers visit the area during the summer months. Commercial/sport fishers are mainly commercial fishers who are hired as skippers of sport fishing boats during periods when high numbers of anglers visit the area (summer months).

The extent of information sharing within and between resource users by occupational categories is shown in Table 5.9. An ANOVA density model of variable homophily shows that most resource users, except for those in the diver/commercial fisher category, are not significantly more likely to share information within occupational categories.

**Table 5.9** Density of cooperative ties among resource users by occupational categories (all values expressed in percentages and statistically significant groups are indicated with an asterisk; $\alpha \leq 0.05$. Appendix 3 shows statistical values)

| | RESOURCE USER CATEGORIES | | | | |
|---|---|---|---|---|---|
| | Commercial Fisher (75) | Diver/Commercial Fisher (24) | Sport/Commercial Fisher (7) | Commercial/Sport Fisher (15) | Fish Buyer/Permit holder (2) |
| **Commercial Fisher** | 9.20 | | | | |
| **Diver/Commercial Fisher** | 10.40 | **16.10*** | | | |
| **Sport/Commercial Fisher** | 4.00 | 2.80 | 11.40 | | |
| **Commercial/Sport Fisher** | 7.80 | 7.10 | 18.10 | 14.30 | |
| **Fish Buyer/Permit Holder** | 8.00 | 2.10 | 10.0 | 21.4 | 0.00 |

Within social categories the absence of sharing of information between fish buyers is interesting. Although I was able to interview only two of them and both resided in Colonia Zaragoza, one of them informed me that he broke off relations with his *compadre* (the other fish buyer), because many of his *compadre's* workers decided to sell their fish to him, who was paying a better price. It is not warranted to conclude that all fish buyers would compete rather than cooperate but it is informative that the *compadre* fictive social relation does not necessarily imply cooperative tendencies.

Fish buyers also have a high density of ties with the commercial/sport fishing category. Indeed, it appears that the information that fish buyers/permit holders can obtain through their particular activity allows them to have privileged information. Fish buyers/permit holders are normally involved in transporting the fish to a third party to be sold. In these commercial centers, many fish buyers/permit holders connect and tend to exchange information among themselves or with a third party buying the fish. This allows fish buyers/permit holders to have rich sources of information from multiple locations that the average fisher cannot easily obtain. As a fisher once told me "If you want to know where the good fishing is, just ask the fish buyers". The weak occupational homophily found among fishery resources users from the Loreto area contrasts with the pattern of strong occupational homophily reported by Crona and Bodin (2006) in their case study of communicative networks of local knowledge. The occupational diversity seems to explain this pattern, which in the case of Crona and Bodin (2006) was not present.

Overall, we can say that occupational categories are not a structuring factor in the way fishery resources users share information in the Loreto area. Because of its weak structuring effect, I do not analyze the type of social relation by occupational categories. The final structuring characteristic I analyze is fishing experience.

### 5.4.10 Fishing Experience

Perhaps one of the most important acquired characteristics of local resource users, and of great interest in recent years in fisheries management, is that of local ecological knowledge (Crona and Bodin 2006, Holm 2003). Undoubtedly, such knowledge is culturally transmitted and it is enhanced and possibly refined with experience (Forman 1967). Knowledge on fish abundant areas can be very effective at exploiting fishery resources without much help from others. Yet, in cases where fish are mobile, fishery resource users seldom have continuous information on its exact location (Acheson 1981, Andersen and Wadel 1972). Indeed, decisions in fishing are rarely taken on the basis of detailed, predetermined, or programmed information. The day to day information acquired in fishing and accumulated knowledge by fishery resource users form a pool of very valuable information, although not available to everybody. To what extent do the number of years fishing structure information sharing among resource users?

The density of ties within and between four categories of years of experience is shown in Table 5.10. An ANOVA test of variable homophily shows that only the 31-40 years of experience category shows significant homophily.

**Table 5.10** Density of cooperative ties among resource users by years of fishing experience (all values expressed in percentages and statistically significant groups are indicated with an asterisk; $\alpha \leq 0.05$. Appendix 3 shows statistical values)

| | CATEGORIES OF YEARS OF FISHING EXPERIENCE (n) | | | |
|---|---|---|---|---|
| | **1 - 20 (43)** | **21 - 30 (35)** | **31 - 40 (32)** | **40 + (13)** |
| **1 - 20** | 8.7 | | | |
| **21 - 30** | 6.8 | 8.7 | | |
| **31 - 40** | 8.6 | 9.0 | **13.8*** | |
| **40 +** | 7.3 | 8.1 | 11.8 | 11.5 |

Interestingly, those having 31 – 40 years of experience are not only most likely to interact with each other but also have the highest density of connections with the other three categories. Also worth noting is that, comparing across categories of years of fishing experience, there is an increase from less experience up to the 31-40 category after which, there is a tendency for a decrease in the degree of homophily. Focusing on the degree of homophily by type of social relation, the same category (31 - 40) is the only one showing significant friendship and acquaintance homophily (Table 5.11). In particular, friendship relations seem to account for the increasing tendency for homophily from less to more experience.

Years of fishing experience is a weak structuring factor in information sharing, especially since there is a relatively high density of ties between the 31 - 40 years of fishing experience category and the other three categories. This suggests that information sharing, in the case of resource users from the Loreto area, is less a function of accumulated knowledge than up to date information.

**Table 5.11** Density of cooperative ties among resource users by years of fishing experience and by type of social relation (all values expressed in percentages and statistically significant groups are indicated with an asterisk; $\alpha \leq 0.05$. Appendix 3 shows statistical values)

| | CATEGORIES OF YEARS OF FISHING EXPERIENCE (Kinship, Friendship, Acquaintance) | | | |
|---|---|---|---|---|
| | **1 - 20 (43)** | **21 - 30 (35)** | **31 - 40 (32)** | **40 + (13)** |
| **1 - 20** | 4.0 > 3.7 > 0.7 | | | |
| **21 - 30** | 3.5 > 2.9 > 0.5 | 2.9 < 5.2 > 0.7 | | |
| **31 - 40** | 3.9 = 3.9 > 0.7 | 3.6 < 4.6 > 0.8 | 4.2 < **6.9*** > **2.7*** | |
| **40 +** | 2.9 < 3.8 > 0.9 | 3.3 = 3.3 > 1.5 | 4.1 < 5.3 > 2.2 | 5.1 > 3.8 > 2.6 |

In sum, the very diverse and dynamic nature of the fishing activity seems to defy the potential homophilic effect of fishing characteristics such as fishing experience, occupational categories, and even the relative strong homophilic effect produced by migratory practices. This diversity also seems to permeate the livelihood strategies of fishery resource users and perceptions regarding fishing as a socio-economic activity.

### 5.4.11 Livelihood Diversity

Allison and Ellis (2001) define a livelihood as the access (mediated by institutions and social relations) to assets (different forms of capital) and activities that together determine the living gained by the individual or household. It has been widely documented that poor rural families tend to be engaged in multiple activities that cut across orthodox economic sectors and transcend the rural-urban divide (Allison and Ellis 2001, Ellis 2000). Ellis (2000) argues that the more diverse the economic activities of an individual or a

household the more resilient a livelihood will be. It is reasonable to hypothesize that those better off (with more diverse economic activities) may rely less on critical information to access fishery resources than those involved only in fishing. This is because diversity of activities gives an individual the possibility of substitution between activities, a hallmark of resilient livelihoods (Ellis 2000). That is, the less financially secure resource users will engage in more cooperative ties such as sharing of information and most likely through "strong" ties (Granovetter 1983). What kind of alternative economic activities do resource users engage in, and to what extent does diversity of economic activities reflect homophily of cooperation?

### 5.3.12 Alternative Economic Activities

The overall household size of fishery resource users interviewed is clearly dominated by 3-6 members, with bigger family sizes (7 or more) being rather infrequent (Figure 5.17). This is similar to the Mexican national statistical values (4.7 in average in 1995) which have tended to decrease since 1970 (5.8 in average), arguably because of changed socio-economic conditions (e.g., increased cost of living, better access to education and health services).

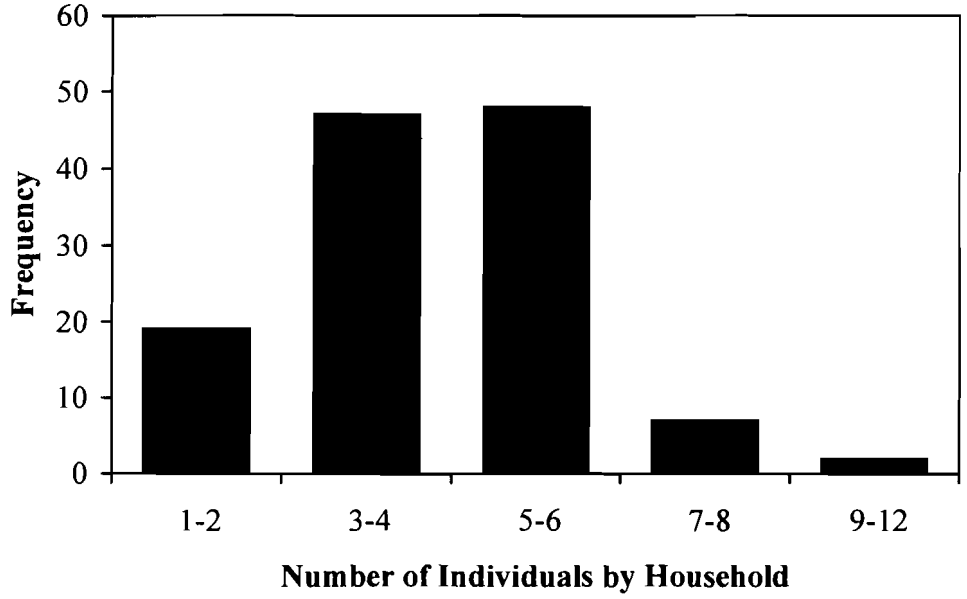


**Figure 5.17** Household size distribution

Less than half of the households (46.34%) depend solely on the remunerating activities of the fishery resource users, almost as many households have another member working (44.72%), and a small proportion have up to two members working (8.94%). However, most resource users (72%) carry out alternative economic activities. The most frequent alternative economic activity among resource users is tourism (32%), followed by construction (26%), ranching (14%), other activities (8%), farming (5%), and a combination of two or three of these activities (15%). The proportion of such activities is not homogenous among communities (Figure 5.18). It is worth noting that tourism was an economic activity absent in past working experience of resource users. Now, it is present practically in all communities. It does not appear that communities with resource users involved only in fisheries tend to have more cooperative ties. For example, Colonia Zaragoza and Agua Verde with similar proportion of individuals dedicated only to fishing

have very different tendencies to cooperation (14.9% and 43.50 % respectively). An ANOVA test of variable homophily shows no tendency for social stratification when resource users are grouped by number of economic activities, giving no support to the hypothesis that economic diversity (as number of activities) structures sharing of information (Table 5.12). While there is no evidence that individuals with alternative activities may need to engage less in cooperative ties, it is still possible that their alternative activities are just not secured enough or available all year round. Indeed, it is more likely that resource users pursue alternative economic activities when fishing is not good rather than having a portfolio of activities from which to choose.

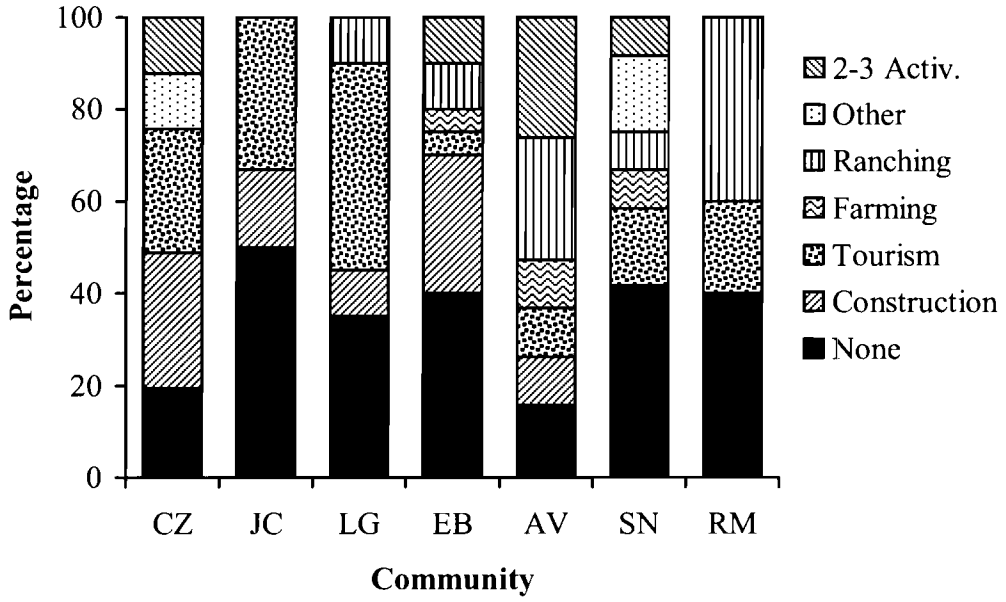


**Figure 5.18** Type of alternative economic activity other than fishing of resource users by community

**Table 5.12** Density of cooperative ties among resource users by number of economic activities (all values expressed in percentages and statistically significant groups are indicated with an asterisk; $\alpha \leq 0.05$. Appendix 3 shows statistical values)

| | NUMBER OF ECONOMIC ACTIVITIES (n) | | |
|---|---|---|---|
| | **None (36)** | **One (74)** | **Two-Three (13)** |
| **None** | 10.6 | | |
| **One** | 9.0 | 8.6 | |
| **Two-Three** | 7.7 | 7.3 | 9.0 |

Alternative economic activities may be used on a more opportunistic basis as has already been reported in small-scale fisheries in Mexico (Gatti 1986). Focusing on the idea that resilient livelihoods are based on the possibility of substitution of different activities implies that an individual would simply move from one activity to another based only on economic considerations (Ellis 2000). This view neglects the fact that an individual may derive other benefits from a particular activity. Indeed, resource users derive more from their activity than just economic benefits (Acheson 1981, Gatti 1986, McGoodwin 1990).

### 5.4.13 Job Satisfaction

Small-scale fisheries are a primary sector that supports a large proportion of the world's population in coastal areas (Berkes et al. 2001). Yet, it has been socially in crisis for some time now, in part due to the collapse of multiple fisheries stocks and because it has been systematically neglected (Berkes et al. 2001, González-Méndez 1986). Indeed, small-scale fisheries in many parts of the world are in social, economic, and political distress (Charles 2001, Durrenberger and King 2000, McGoodwin 1990, WRI 2001). It

seems logical that most small-scale fishers would prefer to leave the fishing activity at the first sight of any alternative economic activity. The perceptions on the benefits derived from fishing as a way of life may be stronger than the prospects of an alternative less uncertain economic activity.

Under a hypothetical situation of an alternative occupation providing equal remuneration to the one received in the fisheries sector, most fishery resource users would not leave the fishery sector (61%). It is plausible that job preference is a function of age and the number of years fishing. Job preference, however, is not significantly correlated with age (Spearman's Coefficient = 0.133, $\alpha \leq 0.05$) nor with number of years fishing (Spearman's Coefficient = 0.106, $\alpha \leq 0.05$).

The preference of resource users under the hypothetical situation has no effect on the degree to which they engage in cooperative ties. An ANOVA test of variable homophily shows no significant tendency by job preference (Table 5.13).

**Table 5.13** Density of cooperative ties among resource users by job preference (all values expressed in percentages and statistically significant groups are indicated with an asterisk; $\alpha \leq 0.05$. Appendix 3 shows statistical values)

| | **OCCUPATIONAL PREFERENCE (Number of Observations)** | |
|---|---|---|
| | **Would Not Change (75)** | **Would Change (48)** |
| **Would Not Change** | 9.0 | |
| **Would Change** | 8.7 | 7.8 |

For those who provided a reason for preferring an alternative job over the one they have in the fishing sector (only 24% of all 123 interviewed), financial security

(83%), less work (10%), and security/less work (7%) were the main reasons. The insecurity and uncertainty in small-scale fishing is inherent in the appropriation part of fishing (Acheson 1981, Gonález-Méndez 1986, McGoodwin 1990), and appear as logical reasons for preferring a less risky job. It is also common for small-scale fishers in Mexico to be exploited by middlemen (Gatti 1986, González-Méndez 1986), which may add to a sense of insecurity. However, when resource users were asked "why are fisheries important for you?", most resource users perceive fishing as a way of life or lifestyle characterized by good and bad days, an activity with which most have been raised, and an activity in which one is his own boss (Figure 5.19).

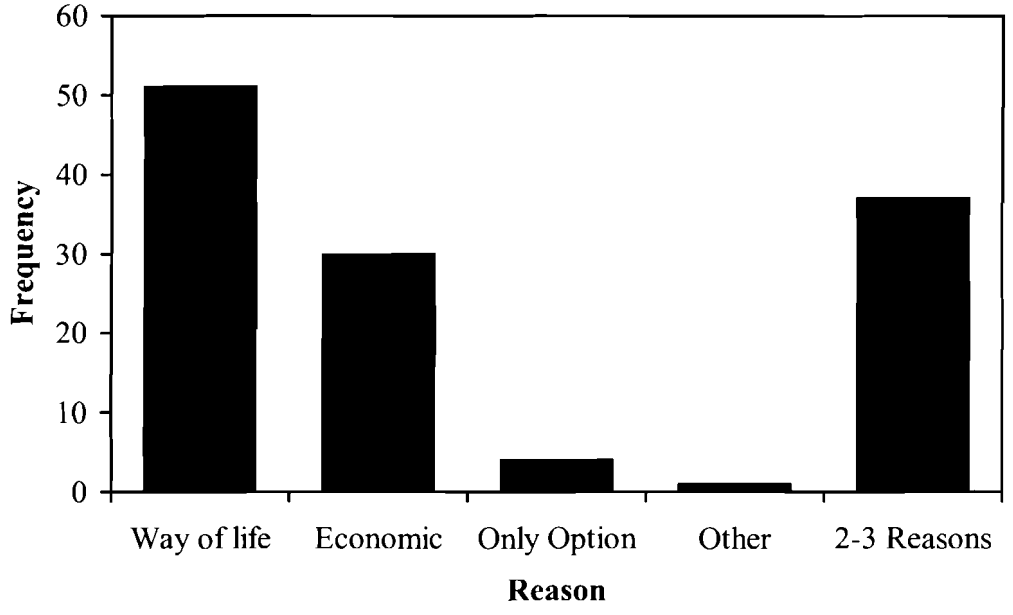


**Figure 5.19** Perception on the importance of fishing

Moreover, when more than two reasons were provided, in all cases, way of life was mentioned, substantially increasing the importance of such a perception. The literature addressing job satisfaction in fisheries, irrespective of culture and region, has

consistently demonstrated that fisheries resource users derive intrinsic non-monetary satisfaction from fishing such as independence, self-reliance, and enjoyment of working outdoors (McGoodwin 1990, Gatewood and McCay 1990, Gatti 1986, Pollnac et al. 2001). Fishing is more than a source of income. The apparent incommensurability of fishing with alternative employment places barriers on substitution between activities on economic grounds and suggests that fisheries policies such as reduction of fishing effort through provision of alternative employment are likely to fail as has already been suggested (Pollnac et al. 2001). Yet, scholars promoting sustainable livelihoods continue to advocate resilient livelihoods as a matter of an increased portfolio of assets and activities and substitution according to a benefit-cost analysis by individuals/households (Ellis 2000). To be sure, the issue I am pointing to is not that economic diversity is an important approach to sustainability but the presumption that all social, political, cultural, and economic concerns can be reduced to choices by rational individuals on the extent of substitution between his/her assets and activities. As I have stressed before, that is an important tension between an individualistic and a social relational approach.

To conclude the analysis of cooperative ties, I describe the exo-structure or the connections of the seven rural communities with other localities within the Loreto municipality and the state of Baja California Sur. This analysis is just descriptive because it lacks the potentially existing social relations among individuals from the localities that were not surveyed. As discussed in section 3.4.4, the methods of social networks cannot accommodate the notion of exo-structure in the sense used in the CESM model, because once the population of interest has been defined, the methods of social network analysis have to assume the network to be a closed system. Notice, however, the neglect of exo-

structure is a methodological necessity and not an ontological commitment of social network analysts who explicitly acknowledge the multiplicity of relations and nested nature of social systems (Wasserman and Faust 1999).

## 5.5 Social Relations beyond the Seven Rural Communities

Once the boundaries of the network have been defined, the system is assumed closed for analytical purposes in the formal methods of social network analysis. Network analysts are well aware of this assumption and recognize that systems are not closed. To be sure, it is only social ties beyond the system of interest that cannot be included. Here, I report and describe the social connections outside of my defined system (the seven rural coastal communities) to illustrate the potential importance of such ties to connect the resource users to the larger polity.

The 123 individuals interviewed reported to consult individuals from six other localities when seeking information for accessing fishery resources. Three are located within the municipality of Loreto (the town of Loreto, Isla del Carmén, and Tembabiche) and the other three represent municipalities in Baja California Sur (Comondú, Mulegé, and La Paz, see Figure 1.1 for details). The number of individuals from these localities and occupation as reported by the 123 individuals is summarized in Table 5.14. The locality and occupation are the only two sociodemographic characteristics known for the 106 individuals mentioned by the 123 resource users interviewed.

**Table 5.14** Individuals from other localities and their occupations as reported by resource users from the seven rural communities

| RESOURCE USER CATEGORY | MUNICIPALITY OF LORETO | | | OTHER MUNICIPALITIES IN BCS | | | TOTAL |
|---|---|---|---|---|---|---|---|
| | Loreto | Temba-biche | Isla del Carmén | Comon-dú | Mulegé | La Paz | |
| Fish Buyer/Permit Holder | 13 | 0 | 0 | 10 | 9 | 3 | 35 |
| Commercial Fisher | 5 | 11 | 2 | 2 | 4 | 0 | 24 |
| Sport Fisher | 21 | 0 | 0 | 0 | 0 | 0 | 21 |
| Sport/Commercial Fisher | 13 | 0 | 0 | 0 | 0 | 0 | 13 |
| Resource Manager | 7 | 0 | 0 | 0 | 0 | 0 | 7 |
| Diver/Commercial Fisher | 0 | 0 | 0 | 4 | 2 | 0 | 6 |
| TOTAL | 59 | 11 | 2 | 16 | 15 | 3 | 106 |

The town of Loreto is by and large the most important locality in terms of individuals contributing to the composition of the exo-structure. This is not surprising since it is the largest and most important economic and political centre in the municipality of Loreto. Comondú and Mulegé, the two adjacent municipalities, are practically equally important (16 and 15 individuals respectively) and individuals from La Paz municipality are less important in terms of numbers.

In terms of occupations, sport fisher and resource manager are new categories. The sport fisher category is somewhat obvious, but the resource manager requires further explanation. This latter category includes individuals from federal and municipal organizations with a mandate in fisheries management and social development. The federal and municipal organizations include: the Loreto Bay National Marine Park, the Federal Fisheries Department, Federal Ministry of Protection to the Natural Environment, and the Municipal Department of Community Development. These two occupational categories are found only in Loreto town. Beyond the municipality of Loreto, the most important category is that of Fish Buyer/Permit Holder, which overall represents the most important type of contact with 35 individuals. This, at least in terms of relative numbers, further supports the remark by one of the resource users mentioned before regarding the privileged position of fish buyers/permit holders because of the information from multiple locations that they are able to access but that the average fisher cannot easily obtain. It is also interesting to see the relatively high number of sport fishers mentioned, further suggesting a weak occupation homophilic effect discussed in section 5.4.9.

To describe the connections between localities and occupational categories, I use Netdraw to generate network visualizations using the built-in algorithm of spring

embedding. As mentioned before spring embedding is one approach to visualize social distance, but because 106 individuals were not interviewed I simply use these visualizations to see general connections among resource users. I also limit the analysis to the type of social relation. Figure 5.20 and 5.21 show the kinship networks by location and occupational categories, respectively. Two aspects seem relevant in the kinship network by location (Figure 5.20).

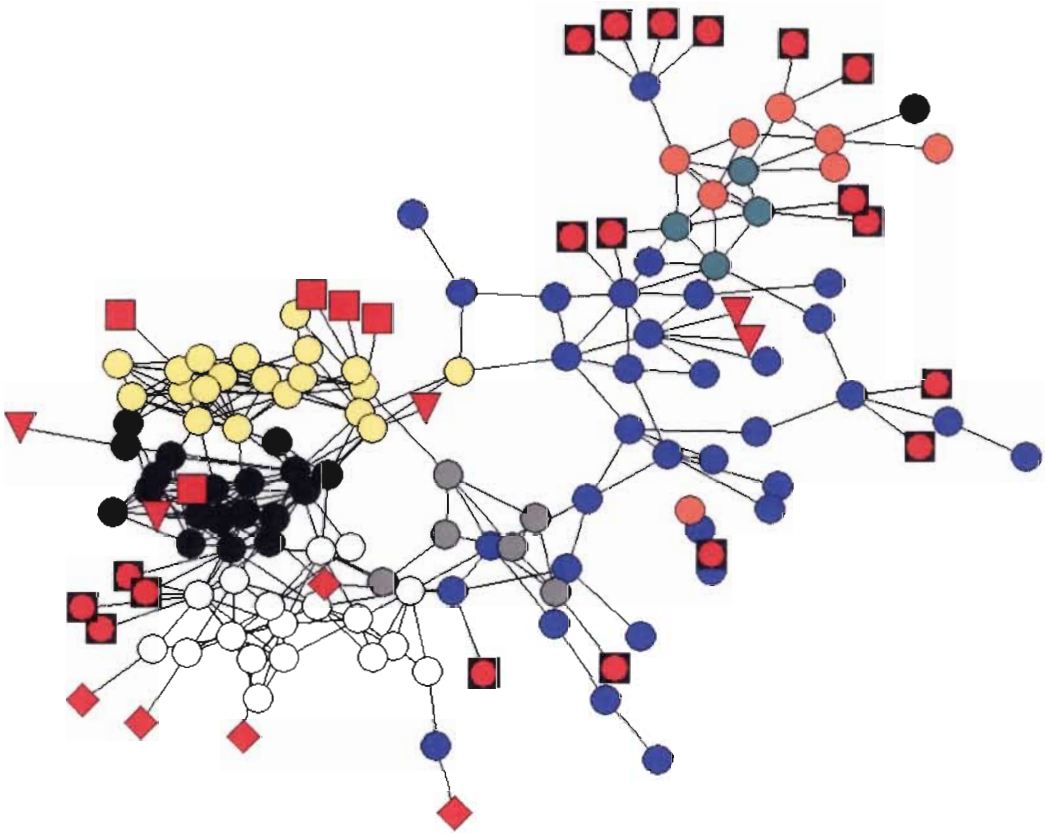

**Figure 5.20** Visualization of the kinship network of information sharing by community. Resource users from the seven communities are circles with different colours: Agua Verde (white), Colonia Zaragoza (blue), Ensenada Blanca (black), Juncalito (gray), Ligüí (yellow), San Nicolás (orange), and Ramadita (blue-green). Resource users from the other localities are all in red, but with different shapes: Comondú (square), Mulegé (down triangle), town of Loreto (circle-in-box), Tembabiche (diamond).

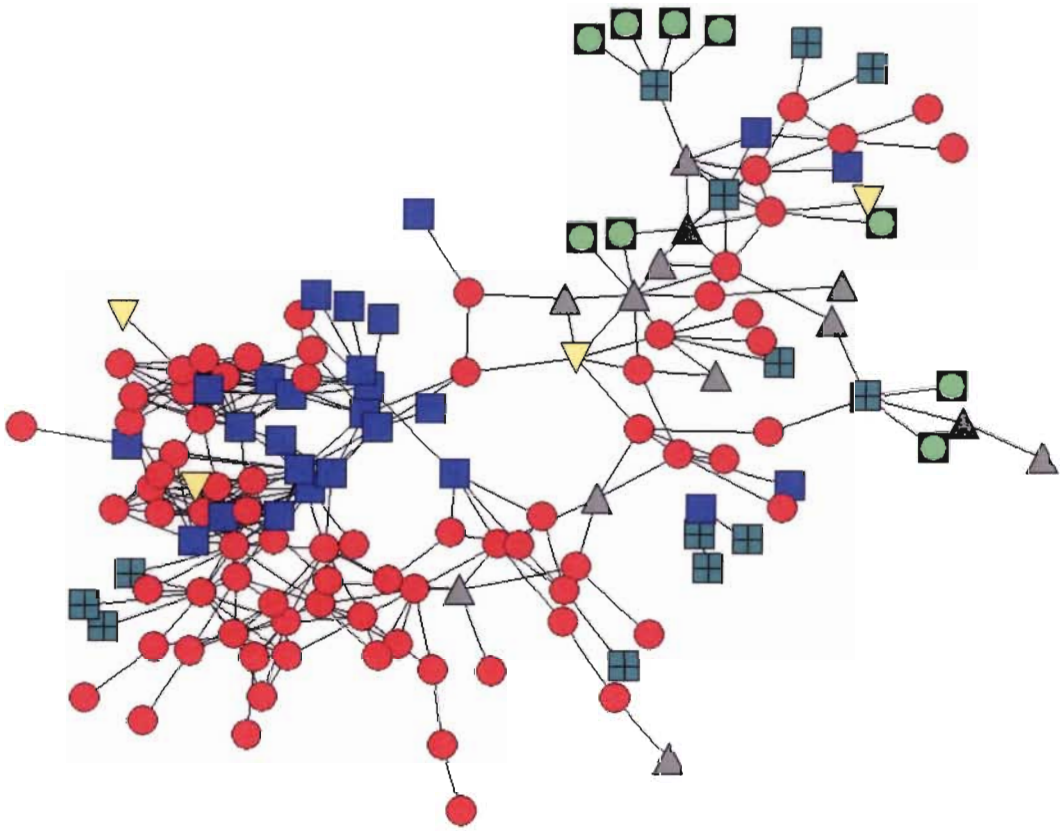

**Figure 5.21** Visualization of the kinship network of information sharing by occupation. Occupations are in different colours and shapes: commercial fisher (red circle), diver/commercial fisher (blue square), sport/commercial fisher (blue-green box), commercial/sport fisher (gray up-triangle), fish buyer/permit holder (yellow down-triangle), and sport fisher (bright green circle-in-box).

La Paz municipality and Isla del Carmén are not represented in this network, the former most likely because of the geographical distance and the latter because there is not a fishing community in Isla del Carmén but only temporary fishing camps. Resource users from the Comondú municipality are clearly associated only to Ligüí and Ensenada Blanca mostly because many of its residents have come from this municipality.

The relatively geographical proximity between Agua Verde and Tembabiche can explain the kinship connections between these two localities (white circles and red diamonds). Finally, we can see that most resource users from the different communities consult kin-related individuals from the town of Loreto, except for Ligüí and Ensenada Blanca, again, most likely because resource users from these two communities have recently come from the neighbouring municipality of Comondú.

Focusing on how resource users with different occupations relate, we observe that the resource users located in the top-right corner are much diverse in their occupational connections than resource users from the bottom-left corner. Moreover, the top-right cluster of resource users is more loosely arranged than the bottom-left corner cluster in terms of social distance. Interestingly, the bottom-left corner is composed mainly by commercial fishers and diver/commercial fishers but not by sport fishers.

Figures 5.22 and 5.23 show the friendship network by location and occupation, respectively. The most important pattern in this network is that most resource users from all the other localities, except Isla del Carmén, are present, and that the relative number of these resource users is greater than in the kinship network. Also it is worth noting that through friendship relations resource users from other localities (all red nodes with different shapes) appear more evenly distributed in the whole network structure. In relation to the friendship network by occupation (Figure 5.23), a couple of resource managers (who are only from the town of Loreto), absent in the kinship network, now appear. Also important to notice is the high occurrence of fish buyers throughout the network, most of them from the town of Loreto and other localities. This, again, suggests

the importance of fish buyers/permit holders in connecting resource users because of their broad information on the state of fishery resources from different localities.

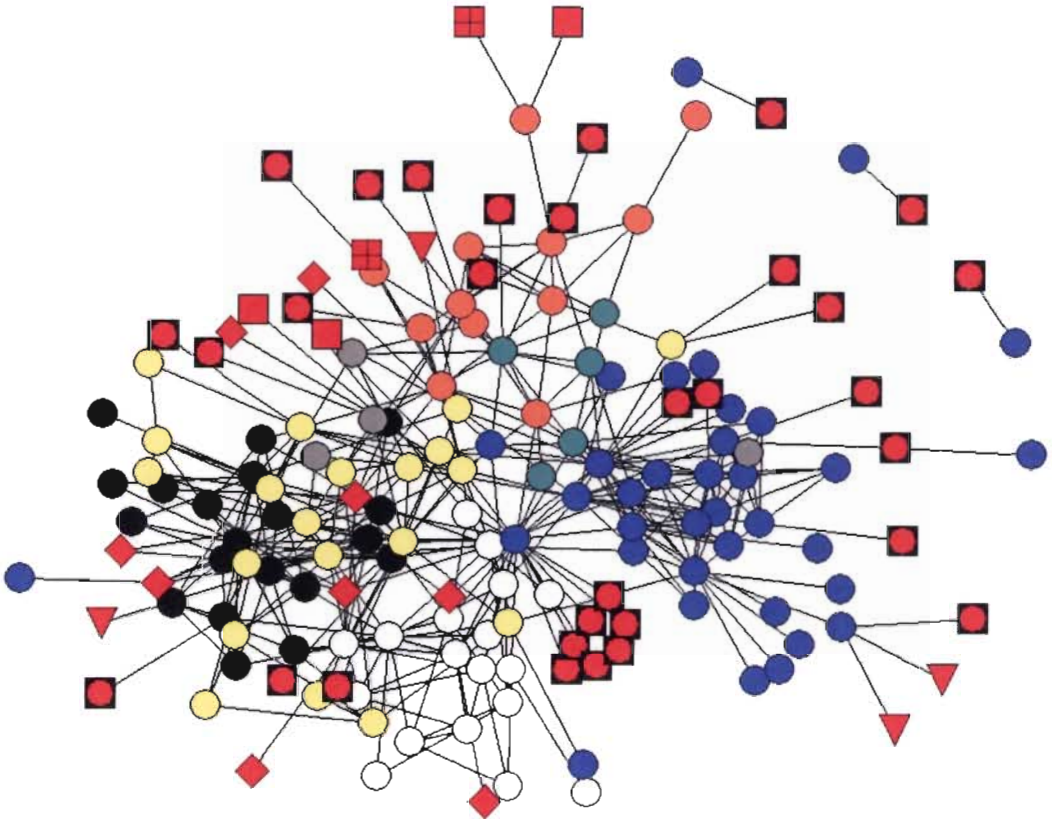

**Figure 5.22** Visualization of the friendship network of information sharing by community. Resource users from the seven communities are circles with different colours: Agua Verde (white), Colonia Zaragoza (blue), Ensenada Blanca (black), Juncalito (gray), Ligüí (yellow), San Nicolás (orange), and Ramadita (blue-green). Resource users from the other localities are all in red, but with different shapes: Comondú (square), Mulegé (down triangle), town of Loreto (circle-in-box), Tembabiche (diamond), and La Paz (box).

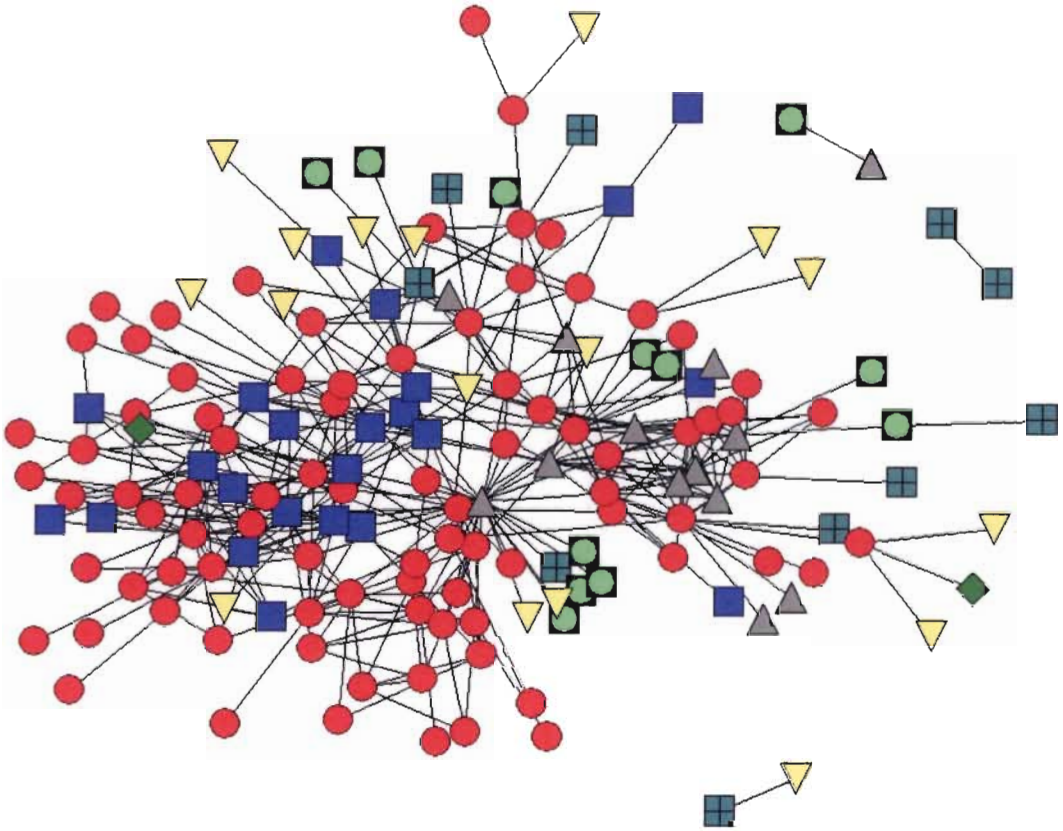

**Figure 5.23** Visualization of the friendship network of information sharing by occupation. Occupations are in different colours and shapes: commercial fisher (red circle), diver/commercial fisher (blue square), sport/commercial fisher (blue-green box), commercial/sport fisher (gay up-triangle), fish buyer/permit holder (yellow down-triangle), sport fisher (bright green circle-in-box), resource manager (olive green diamond).

The acquaintance networks by locality and occupation are shown in Figures 5.24 and 5.25. The most important pattern in the acquaintance network by locality is that some individuals from Loreto are more embedded in this network than individuals from the other localities, despite the fact that none of these individuals were interviewed. In other words, these individuals were mentioned by more than one of the 123 resource users interviewed. The three most embedded individuals are resource managers from Loreto.

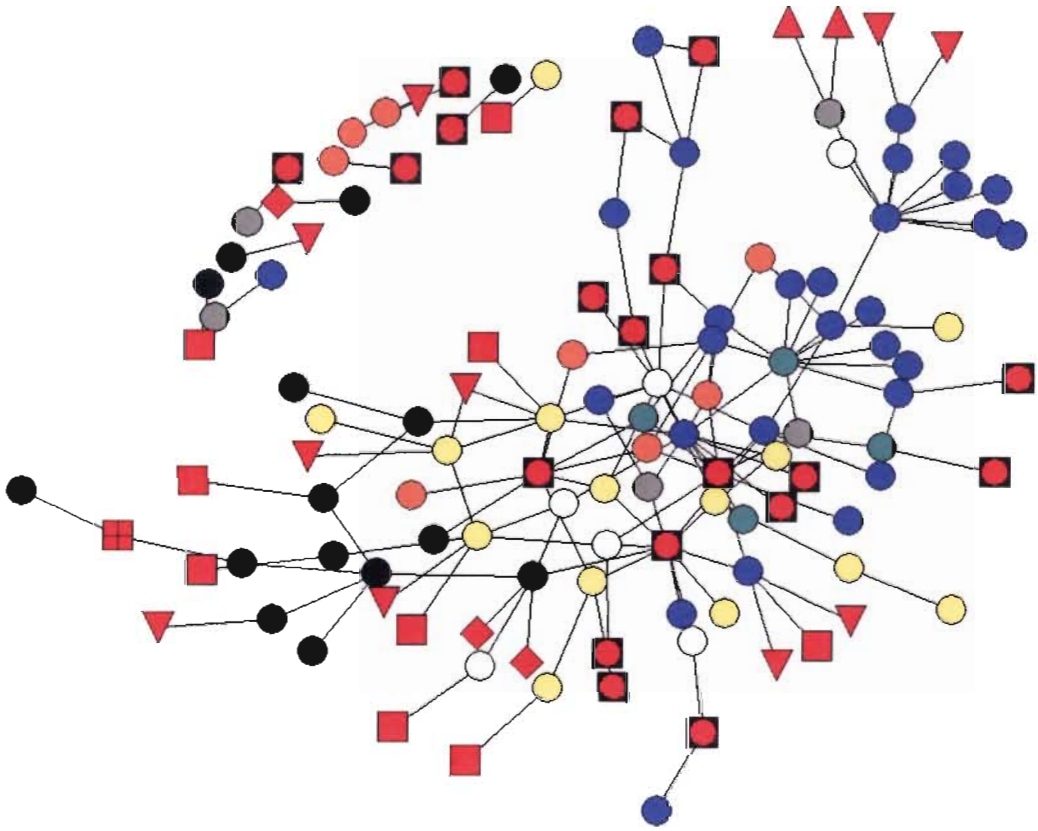

**Figure 5.24** Visualization of the acquaintance network of information sharing by community. Resource users from the seven communities are circles with different colours: Agua Verde (white), Colonia Zaragoza (blue), Ensenada Blanca (black), Juncalito (gray), Ligüí (yellow), San Nicolás (orange), and Ramadita (blue-green). Resource users from the other localities are all in red, but with different shapes: Comondú (square), Mulegé (down triangle), town of Loreto (circle-in-box), Tembabiche (diamond), and Isla del Carmén (up triangle).

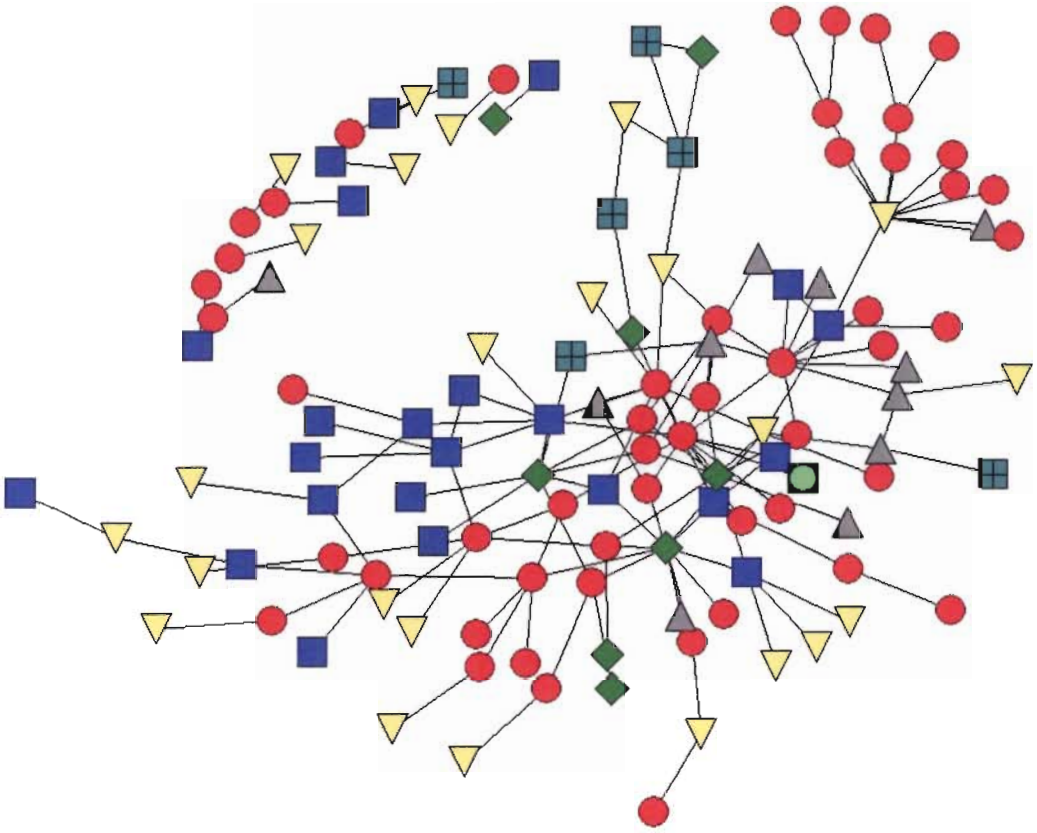

**Figure 5.25** Visualization of the acquaintance network of information sharing by occupation. Occupations are in different colours and shapes: commercial fisher (red circle), diver/commercial fisher (blue square), sport/commercial fisher (blue-green box), commercial/sport fisher (gray up-triangle), fish buyer/permit holder (yellow down-triangle), sport fisher (bright green circle-in-box), resource manager (olive green diamond).

Last, many resource users use impersonal relations when consulting resource managers from Loreto (Figures 5.26 and 5.27). Indeed, impersonal relations are used only to communicate with resource managers, and only when seeking information regarding fisheries regulations. There are also no members from Ramadita in this network.

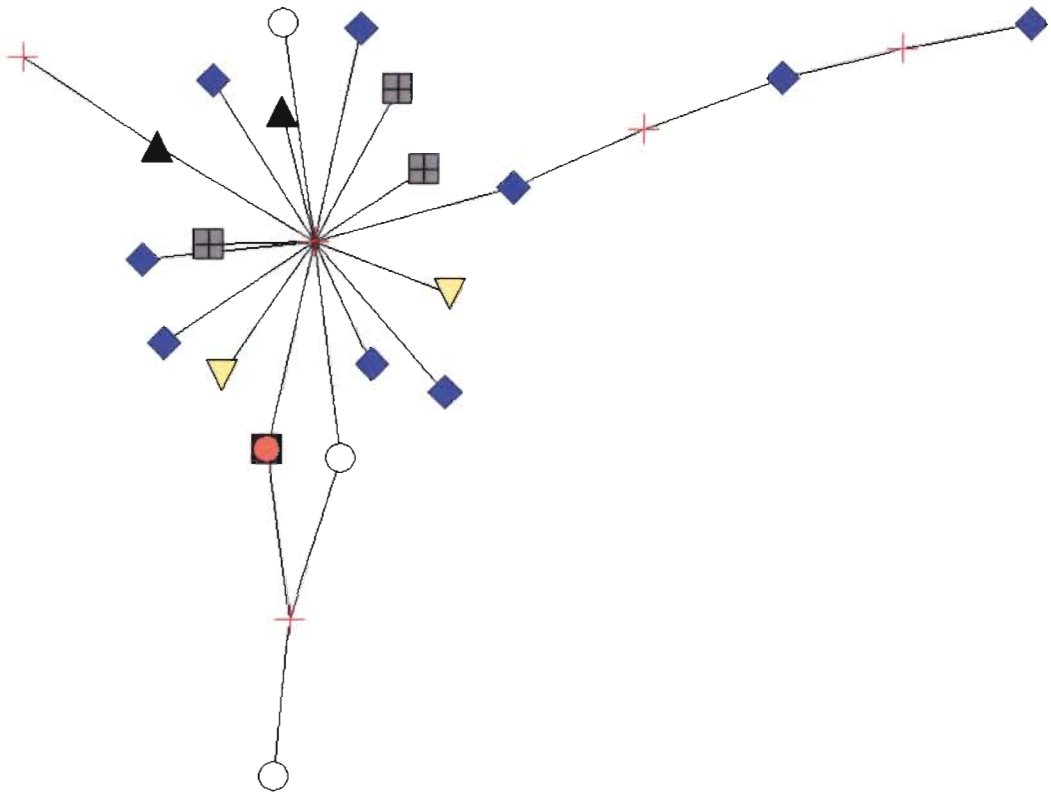

**Figure 5.26** Visualization of the impersonal network of information sharing by community. Actors are highlighted with different colours and shapes: Agua Verde (white circle), Colonia Zaragoza (blue diamond), Ensenada Blanca (black up-triangle), Juncalito (gray box), Ligüí (yellow square), San Nicolás (orange circle-in-box), and the Town of Loreto (red plus).

Despite the overall low number of ties to other localities, particularly those outside of the Loreto municipality, they may have an important function in connecting individuals from the seven rural coastal communities to the larger polity of Baja California Sur, where the likelihood of accessing different information is greater than within the municipality of Loreto. Accessing such information appears to occur mostly through information exchanges with fish buyers/permit holders, particularly through friendship relations and acquaintance relations.

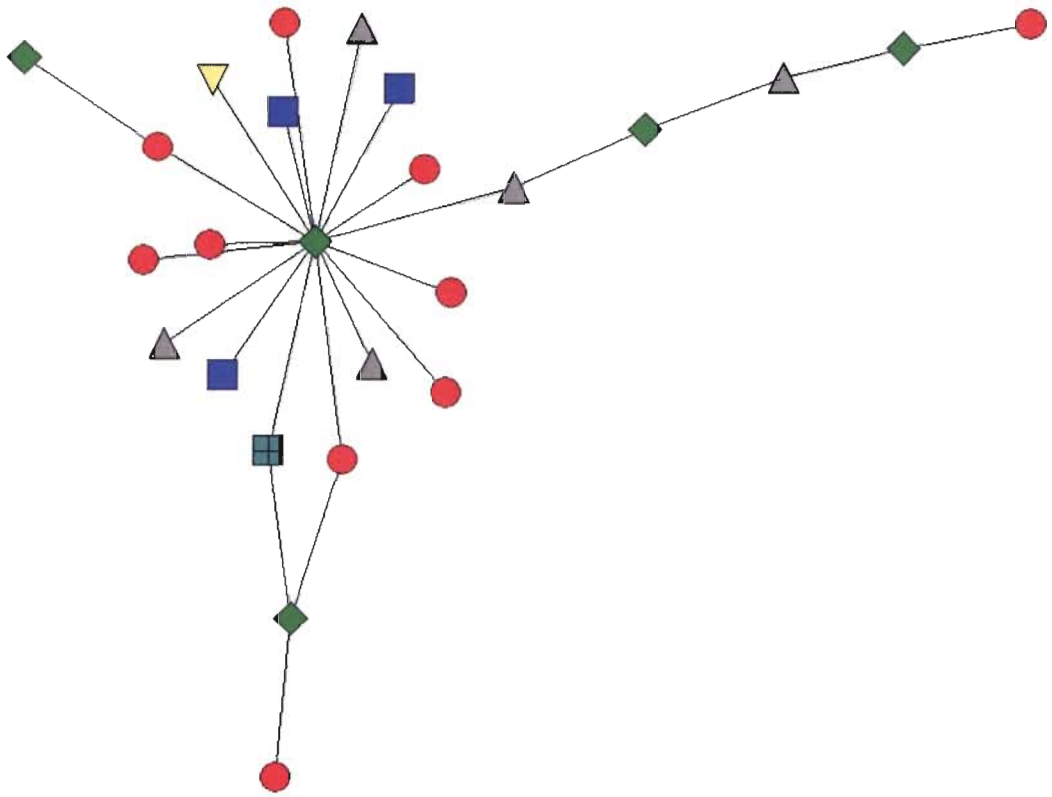

**Figure 5.27** Visualization of the impersonal network of information sharing by occupation. Occupations are in different colours and shapes: commercial fisher (red circle), diver/commercial fisher (blue square), commercial/sport fisher (gray up-triangle), fish buyer/permit holder (yellow down-triangle), and resource manager (olive green diamond).

It is important to indicate again that these tendencies are provisional because the individuals from these other localities were not interviewed. Yet it is clear that the social networks of the rural communities extend beyond the political borders of the municipality of Loreto connecting actors with diverse occupations. What have we learned about the sharing of information for accessing fishery resources by members from the seven coastal rural communities adjacent to the Loreto Bay National Marine Park using a social relational approach?

## 5.6 The Social Context of Information Sharing for Accessing Fishery Resources

The unpredictability on fish stocks and difficulty of their exclusive use creates, arguably, a very competitive context in which the fishing activity unfolds. Paradoxically, this very condition calls for cooperation rather than competition, at least when it comes to finding out about the location/state of fishery resources. Stiles (1972: 162) eloquently states "the competitors need each other" to contribute to each other's success. Under what conditions is this more likely to occur? Resource scarcity cannot account for the extent to which resource users share information within and between communities, despite the general context under which the fisheries system in Loreto operates, namely a weak regulatory regime, high resource-dependence livelihoods, weak development of social organizations, extreme poverty, and signs of over-exploitation of extensive fishery resources. Physical proximity was ambiguous in accounting for the significant community homophily of information sharing and information sharing between communities. A network visualization based on the idea of social distance provided a better sense of how resource users share information within and between their communities. Indeed, the strength of three types of social relations in which sharing of information is embedded provided a better explanation than resource scarcity and physical proximity. Information sharing occurs importantly within and between communities through kinship relations but their relative importance does not always fit a hierarchy of importance when compare to the density of friendship and acquaintance relations. Yet, structural social distance seems to fit a hierarchical pattern, at least at the level of the whole network. It appears that kinship relations may be undermined by

internal conflict, particularly in the Colonia Zaragoza community. Interestingly while kinship relations tend to form closely-knit communities, friendship and acquaintance relations seem to counter act the potential social fragmentation of these communities.

The analysis of how other sociodemographic characteristics may be structuring the information sharing showed that social relations defy a potential strong homophilic effect by any of these characteristics. Despite this, how long individuals have known each other is an important factor that may also affect the quality of the relationship and thus the tendency to exchange information. The diverse nature of the fishing activity and livelihood trajectories of resource users seems to prevent clear cut divisions of information sharing by occupation, years of fishing experience, seasonal migration practices, and alternative economic activities. Finally, and with the understanding that such patterns are provisional, the connections of the resource users from the seven coastal communities to the larger polity may allow them not only to access resources from locations outside of the Loreto municipality but also to socially integrate with the rest of Baja California Sur.

In sum, and considering the multiple caveats discuss in each of the past sections in this chapter, we can say that focusing on a global level of analysis of the social networks, information sharing is more widespread than we would expect given the social heterogeneity of resource users and over-exploited condition of fishery resources in the area. If cooperation is so widespread, why have not resource users engaged in other forms of collective action to tackle key problems of their livelihoods, such as the over-exploited condition of fishery resources? Some of the scholars who have studied sharing of information in the context of fisheries have raised this question, providing various

possible reasons (Crona and Bodin 2006, Gatewood 1984). I propose that the distinction I made earlier between latent and manifest function of cooperative social networks of information sharing may help us sort out this question.

## 5.7 Latent and Manifest Collective Action

Cooperation among fishery resource users through information exchanges is a particular kind of cooperation that is puzzling, given the competitive context in which it emerges. This kind of cooperation provides an interesting setting to understand the extent to which biophysical and social conditions affect human cooperation in the access and use of fishery resources. However, most studies on human cooperation for the conservation and management of common-pool resources, including fish, have disproportionally focused on building institutions to control access and use. Undeniably, collective action for building institutions is a necessary task for conserving and managing common-pool resources (Ostrom 1990). Yet how and under what conditions people decide to cooperate is still unclear. The goal or manifest function of both forms of cooperation is obviously different (Gatewood 1984). However, others have argued that communicative networks of ecological knowledge could lead to collective action for addressing the over-use of fishery resources and degradation of the marine environment (Crona and Bodin 2006).

In a study of information-sharing groups among Southeast Alaskan salmon seiners, Gatewood (1984: 366) concludes that unless "fundamental economic and political structures are changed, or the fishery as a whole is threatened by severe and precipitous declines, seiners will be likely to cooperate in more organized and enduring fashions". Moreover, Gatewood (1984: 367) hypothesized that people will share information whenever it is used as data to "predict future states of the system with

conditional probabilities". Clearly, Gatewood (1984) adopts a form of institutional individualism where cooperation is irrational unless the structure of incentives make it rational to cooperate. Interestingly, Gatewood (1984: 357) indicates, "the information-sharing cliques are very small, exclusive, temporary groups whose membership is based on close kinship and friendship ties". The latter, however, has no relevance to why resource users cooperate, even if we consider that this cooperation happens in small, exclusive and temporary groups. Indeed, Gatewood's (1984) focus on the instrumental manifest function of information sharing, leads this scholar to reduce everything to a benefit-cost analysis by individuals.

In a network conceptual framework, Crona and Bodin (2006) have recently hypothesized that occupational and fishing gear homophily does not allow for generalized collective action for conservation and management. In other words, when individuals tend to form closely-knit groups by occupational and fishing gear categories and these groups have different perceptions of resource degradation and are weakly connected, collective action is unlikely to emerge. In particular, they argue that the configuration of the social networks that emerges from this homophilic effect has not allowed collective action to occur, especially since the most central groups are migrant deep-sea fishers who appear to be less motivated to initiate collective action. Crona and Bodin's (2006) hypothesis does not seem to be supported by my empirical evidence where heterophily rather than homophily seem to characterize the sharing of information. Indeed, the heterophily of the fishery resource users from the Loreto area should have a high potential for collective action (Granovetter 1973). It seems that they do.

The account of one of the resource users involved in the protest against the no-take fishing zones proposed in the first version of the management plan for the Loreto Bay National Marine Park suggested that communicative networks indeed have an important impact on collective action. In 2002, I had an informal interview with a fisher from Juncalito who seemed to have initiated a mass movement by commercial fishers in light of the provisions and restrictions in the first management plan of the Loreto Bay National Marine Park, drafted two years after the park was created in 1994:

> "My nephews, who are engineers in fishery sciences, came with the news that the marine park's management plan was going to prohibit most human activity, particularly fishing in the most productive areas used by fishermen, but that the presidential decree required approval by local communities within a time frame of one and a half years. After reading the first version of the management plan it became clear that they were going to exclude most commercial fishing and almost prohibit use of the beaches. We went to visit people from Ligüí and Ensenada Blanca to convince them to reject the management plan. Initially there was slow involvement but in not too long there was a large involvement of resource users to protest against the management plan"

The overall effect was such that it took several years for the management plan to be approved by fish resource users. It is not clear what the role of the communicative social networks was precisely but in the absence of other forms of communication among communities it is possible that they had an important role in disseminating information to support this form of collective action. Moreover, and similar to how the Park was created, leadership seems to be of the essence.

In light of this evidence, I submit that the social networks have purposeful or manifest and non-instrumental or latent functions. The former narrows the scope of a social network to accomplish a particular task (e.g., sharing information for accessing fishery resources) while the latter non-committed function (e.g., social integration) can

potentially support all forms of collective action. How this potential of social networks could help improve the conservation and management of natural resources is the topic of Chapter 8.

To conclude this chapter I discuss one of the consequences of the latent social integration function of social networks for how we may conceptualize human communities. I do this by reflecting on the conceptual proposal by some institutional choice scholars that we should replace the notion of community predicated on concepts of territory, social structure and shared values in favour of individuals and their interests structured by institutions (Agrawal and Gibson 1999, Allison and Ellis 2001). In other words, it is argued that advocates of community-based resource management and conservation tend to emphasize homogenous communities and neglect their political divisions, interests of actors, and the internal and external institutions that shape the decision-making process (Agrawal and Gibson 1999).

## 5.8 Finding Community in Human Groups

Agrawal and Gibson (1999) make an important contribution in analyzing the shortcomings of conceiving communities as territorially fixed, small, and homogenous. Moreover, they point out that "these characteristics supposedly foster the interaction among members that promote desirable collective decisions" in conservation and resource management (Agrawal and Gibson 1999: 636). These authors suggest that to be more accurate in our efforts to depict communities and their interactions with adjacent natural resources greater attention should be given to "the multiple actors with multiple interests that make up communities, the processes through which these actors interrelate, and, especially, the institutional arrangements that structure their interactions" (Agawal

and Gibson 1999: 636). My results with respect to the relationship among individual attributes and cooperation do not support a view of homogeneity among fishery resource users or even within communities. I think the critique of Agrawal and Gibson (1999) of communities conceptualized as territorially fixed, small, and homogenous is well founded. Even though I agree that it is important to consider actors' interests and institutional arrangements, I disagree that such a shift in emphasis can provide a better picture of communities and their role in resource management and conservation. It is the case that traditional depictions of communities often used in conservation and resource management may have failed to articulate a viable definition of human communities or simply assumed it away. This, however, does not invalidate the intuitively obvious idea that social groups are wholes with emergent properties and pro-social behaviours such as relations of trust and reciprocity.

### 5.8.1 The Glue of Social Groups

According to Coleman (1993) the distinction between traditional communities and modern societies was first made by Ferdinand Toennies in 1887. Characteristically, traditional communities are local, with frequent face-to-face interactions, relatively small, with a stable set of persons, and relatively fixed institutions. By contrast, social relations in modern societies are no longer face-to-face nor confined to locality, and institutions become impersonal rather than personal. Similarly, Coleman (1993) concurs by indicating that the most dramatic change that the modernization process brought with it was the decline of primordial institutions such as kinship relations that have been substituted by purposely intended designs of organizations, institutions and social environments. Many social scientists agree on this process and believe that the level of

social embedding was strong in non-market societies and it has significantly decreased with modernization (Polanyi 1967, Scott 1976). Agrawal and Gibson (1999: 633) equate Toennies' view of traditional communities with those used by advocates of community-based conservation and resource management who employ the concept of community as small, integrated groups "using locally-evolved norms and rules to manage resources sustainably and equitably".

There are two alternatives to this dichotomy: (1) to argue that social life, even in modern societies is socially embedded; or (2) simply to render irrelevant social relations in all human groups or collapse all social structural concerns into individual choices (Granovetter 1985). Institutional individualists, such as Agrawal and Gibson (1999), prefer to choose the latter, particularly because they find obscure the causality of social structure. In short, these scholars adopt the institutional individualism I reviewed in section 2, leading them to conceive of human communities as an aggregate: i.e., communities are seen as individuals pursuing their own interests and their decisions and actions as being structured by institutional incentives. This view is not problematic if we accept that contemporary social groups are mostly structured by impersonal institutions (Coleman 1993). However, this is not the case. For instance, Granovetter (1985) has thoroughly demonstrated that human economic action is embedded in social relations in modern market societies, and despite the long history of European cultural intrusion in Latin America and the Caribbean, most social life is still embedded in kinship relations (Smith 1984). There is also a growing recognition that explanations of human behaviour using methodological individualism needs to use some irreducible social principles and concepts, and that strategic action is insufficient to explain social phenomena that is

emergent in nature (Arrow 1994). Indeed, two decades earlier Kenneth Arrow (1974) recognized that it is hard to imagine the survival of any society without certain kinds of regard for others. Other authors have suggested that while institutions such as exchange markets depend on the supportive legal institutions and states' coercive power to enforce them, they are inconceivable without antecedent patterns and norms of social trust, reciprocity, and co-operation (Fukuyama 1995, Scott 1998, Singer 2000).

The embedded character of human communities and in general of social life articulated in terms of homogenous internalized norms and values are problematic (DiMaggio 1997, Granovetter 1985), and easily interpreted as a romantic organic whole (Agrawal and Gibson 1999). I propose that human communities are neither organic wholes nor aggregates but social systems characterized by dynamic pro-social behaviours. It is true that the institutional individualism promoted by Agrawal and Gibson (1999) is closer to conceiving human communities as social systems but fails to acknowledge the existent of emergence or qualitative novelty, the most important aspect highlighted by holism. Moreover, Agrawal and Gibson (1999) exaggerated emphasis on individual interests coordinated by institutional arrangements neglect the fact that any social institutional arrangement requires a minimum of pro-social behaviours to be operational (e.g., trust).

I submit that a conception of human communities must be predicated on pro-social behaviours and in relational terms. The former emphasizes the human tendency for attachment (Brothers 1997) that holds together social systems through a sense of fellowship, acts of reciprocity, and, above all, sharing. Indeed, it is only in this sense that speaking of the "commons" has any meaning from a social human perspective. The latter

(i.e., a relational view) avoids totalizing or unifying social groups through cultural, political, or economic social categories and focuses on the intrinsic relational character of pro-social behaviours; i.e., it transcends totalizing categories. Moreover, we avoid confining communities to a fixed territory by defining communities in relational terms. Focusing on pro-social relations also allow for understanding social integration as a matter of degree, thus making room for internal fractures, divisions, disconnections, or social fragmentation, as I have shown in my network-level of analysis of information sharing among socially diverse actors. Pro-social behaviours are dynamic and not static, thus, human communities are always evolving.

Conceptualizing communities as essentially pro-social in character does not undermine the need to study internal politics, individual interests and power relations that clearly contribute to their dynamics. Indeed, the concern of institutional individualists with individual agency is important in understanding the dynamics of social systems. However, we can also study the role of individuals in the dynamics of social systems within the social relational framework used by social network analysts, whereby the contribution of individuals to this dynamic is conceptualized as his/her degree of involvement in the web of social relations. In the next chapter I investigate the extent to which individuals contribute to the network of information sharing.

# CHAPTER 6
# THE CONTRIBUTION OF INDIVIDUALS TO THE STRUCTURE OF NETWORKS OF INFORMATION SHARING

In the previous chapter, I investigated the extent to which socially diverse and geographically distant resource users cooperate by sharing information for accessing fish resources. I used network density as a substantive indicator to analyze the overall structure of the social networks of information sharing. In so doing, I adopted a global-level of analysis that focuses on the emergent structure of the social networks (Hanemann and Riddle 2005). In that sense, I did not focus on the specific contribution or involvement that each member has in the networks of information sharing. Yet, a simple exploration of the network visualizations from the previous chapter clearly suggests that not every actor is equally involved in the network of information sharing. Indeed, a social network analysis would be incomplete without an actor-level of analysis that focuses on how individuals contribute to the structure of a social network (Hanemann and Riddle 2005).

In the context of information exchanges on their fishing activity, actors display different tendencies toward participation depending on their socio-demographic characteristics and social roles (Crona and Bodin 2006, Gatewood 1984, Maiolo and Johnson 1988, Stiles 1972). There is no consensus among scholars on what attributes may explain the importance of individuals in exchanges of information in the context of

the fishing activity. Moreover, the power of individual attributes to explain the importance of resource users in information exchanges may vary considerably among similar fisheries (Maiolo and Johnson 1988). This evidence indicates that we cannot produce a general protocol based on individual attributes to identify important individuals in a social network. Instead we should approach the issue of importance of individuals in a network as an empirical question (Maiolo and Johnson 1988).

What does it mean to be important in a social network? Under the rubric of network centrality, social network analysts have developed various measures of such importance (Borgatti and Everett 2006, Freeman 1979). Centrality measures have been diversely interpreted but substantive research tend to use either the actor or the organization as the unit of analysis. Thus, centrality has been used to index power, prestige, brokerage, influence, and advantage (Borgatti and Everett 2006). The substantive diversity with which the centrality idea has been used has the common feature that they all assess a node's involvement in the walk structure of a network (Borgatti and Everett 2006)[24]. In other words, an individual's contribution to the structure of a social network depends on his/her position in the web of social relations. Choosing among the various concepts developed to index centrality depends on the substantive interest of the research and graph-theoretic differences among these concepts (Borgatti and Everett 2006). I use Freeman's degree and betweeness centrality measures, which represent two complementary concepts and together can deliver a complete picture of an individual's contribution to a social network (Borgatti and Everett 2006).

[24] In graph theory terms, "A walk is a sequence of nodes and lines, starting and ending with nodes, in which each node is incident with the lines following and preceding in the sequence" (Wasserman and Faust 1999: 105).

On the one hand, Freeman's "actor degree centrality" refers to the ties adjacent to each actor. Thus, it indicates how important each actor is in a network by the "volume" or number of direct ties in which an actor is involved. In this measure, important actors have a large number of direct ties. In communication networks, an actor with a high "degree centrality" value can be said to be in the "thick of things" and likely to be a major channel of information – actors with high "degree centrality" values are "focal points of communication, at least with respect to the others with whom he [the actor] is in contact" (Freeman 1979: 219-220). On the other hand, Freeman's betweeness centrality also indicates how important each actor is in a network, but it represents a different way of theorizing such importance. The "betweeness centrality" measure is based upon the "frequency with which a point falls between pairs of other points on the shortest or geodesic paths connecting them" (Freeman 1979: 221)[25]. Thus, an actor's betweeness centrality value can be seen as an indicator of his/her importance as gatekeeper between an actor and other actors. In communication networks, an actor who falls on the communication paths of others exhibits the potential for control of their communication (Freeman 1979: 221). Freeman's degree and betweeness centrality of actors can be generalized to the whole network as, on the one hand, Freeman's Degree Centralization and, on the other hand, Betweeness Centralization. Both measures express the extent of variation in the degree and betweeness centrality values of actors in a network as a percentage of that in a star-like network of the same size (Hanneman and Riddle 2005)[26]. Thus, the greater the value of either of these two global centralization measures, the more

[25] The shortest path between a pair of nodes is referred to as a geodesic.
[26] In a star network, all network members are connected through only one member, the one in the centre, making the star-like network the most centralized or most unequal possible network for any number of actors (Hanneman and Riddle 2005).

centralized activity is in a few individuals. To summarize, Freeman's degree and betweeness centrality measures index the importance of each individual while Freeman's degree and betweeness centralization are measures that index the distribution of the actors' degree and betweeness centrality values for the whole network.

In this Chapter I adopt an actor-level of analysis to determine the extent to which occupation, number of years of fishing experience, and years of residence explain the importance of resource users (indexed as Freeman's degree and betweeness centrality measures) in the social networks of information sharing as a whole and within each community. In other words, how well does each of these variables explain the variation in network centrality measures of resource users in the networks of information sharing? Moreover, is this variation the same for the kinship, friendship and acquaintance relations? Finally, how uneven is the distribution of centrality measures (Freeman's degree and betweeness centralization measures) among resource users? In light of the results from the previous chapter and my results from this chapter, I conclude this chapter by using the logically related concepts of functions proposed by Mahner and Bunge (2001) to identify the functions of social networks and advance a rationale for policy and management recommendations.

## 6.1 Methods and Hypotheses

To evaluate whether individual attributes explain the variation in actors' degree and betweeness centrality values in the social network, I use one-way ANOVA (analysis of variance) for multiple groups and regression analysis (Hanneman and Riddle 2005). I use the former to evaluate the nominal variables of occupation and community. The one-way ANOVA statistical method tests the hypothesis that the mean values of multiple groups

(defined by an individual attribute such as occupation) are different by comparing sources of variation among and within groups. In my analysis, these mean values are the average degree and betweeness centrality values of resource users. I use regression analysis to evaluate whether years of residence and years of fishing experience can predict the degree and betweeness centrality of resource users.

The degree and betweeness centrality measures, the one-way ANOVA tests and regression analyses were determined using the UCINET suite of social networks program (Borgatti et al. 2002). In this program, statistical significance is established by running a large number of trials (e.g., 10,000) to create a permutation-based sampling distribution of the difference between the means of each group. For each of these trials, the scores on a centrality measure are randomly permuted (i.e., randomly assigned to each group and proportional to the number of each group). The standard deviation of this distribution based on random trials becomes the estimated standard error to test for significance (Hanneman and Riddle 2005). In the regression procedure, UCINET estimates standard errors and significance using the random permutations method for constructing sampling distributions of R-squared and slope coefficients (Hanneman and Riddle 2005). To illustrate the differences in degree and betweeness centrality among resource users, I create network visualizations using Netdraw (a network drawing program distributed along with UCINET). In the analysis I use the information from the 123 individuals I interviewed.

The basic hypothesis is that occupation, community, years of fishing experience, and years of residence are meaningful indicators of the actors' centrality in the network of information sharing. In the case of the nominal variables of community and

occupation, the hypothesis is that actors' centrality is significantly different among occupations and communities. For years of fishing experience and years of residence the hypothesis is that, on the one hand, years of residence and, on the other hand, years of fishing experience predict the centrality of resource users.

## 6.2 Occupation and Focal Points of Network Activity

In the previous chapter I identified five occupational categories and found that occupation produces a weak homophilic effect, most likely because all resource users, independent of occupation, use similar fishery resources. On average, however, resource users from each occupational category have different degrees of involvement in the social network of information sharing (Table 6.1). The mean degree centralities by occupation are significantly different (F=2.9056; 4 d.f.; p=0.0234).

**Table 6.1** Average and standard deviation values of degree centrality for occupation and seasonal migration

| ATTRIBUTE | DEGREE CENTRALITY | |
|---|---|---|
| **Occupation** | **Mean** | **Standard Deviation** |
| Commercial/Sport Fisher | 6.73 | 4.99 |
| Fish Buyer/Permit Holder | 9.50 | 2.12 |
| Commercial Fisher | 10.76 | 6.51 |
| Sport/Commercial Fisher | 11.57 | 9.85 |
| Commercial Diver/Fisher | 13.63 | 7.74 |
| **Seasonal Migration** | | |
| No | 8.1 | 6.02 |
| Yes | 13 | 6.88 |

Resource users categorized as diver/commercial fishers are the ones with the greatest degree centrality values or the most prominent occupational category in the network in terms of number of ties in which they are involved. What seems to be peculiar about the diver/commercial fishers is that they tend to migrate to neighbouring municipalities to access fishery resources. This may be contributing to their increased tendency to be focal points in the network of information sharing. Indeed, on average, those practicing seasonal migration have higher degree centrality values than none-migrants (Table 6.1). This difference is statistically significant ($F=1.7215$; 4 d.f.; $p= 0.0414$).

A visualization of the network of information sharing by occupation and community generated using Netdraw's spring embedding algorithm is shown in Figure 6.1. This figure allows us to see what some of the important centrality patterns are, simultaneously considering occupational categories and the seven fishing communities. First, the diver/commercial fisher category (square nodes) is not only the most frequent in Ligüí (square orange nodes) and Ensenada Blanca (square white nodes) but individuals in this category also have the greatest degree centrality values (indicated by the size of the node). Although, there are diver/commercial fishers in Colonia Zaragoza (square blue nodes) and San Nicolás (square yellow nodes), the degree centrality values of these individuals is rather small. This suggests that the occupation is not a consistent factor across all communities. Indeed, on average, the degree centrality values of individuals by community is significantly different ($F=4.5964$; 6 d.f.; $p=0.0010$).

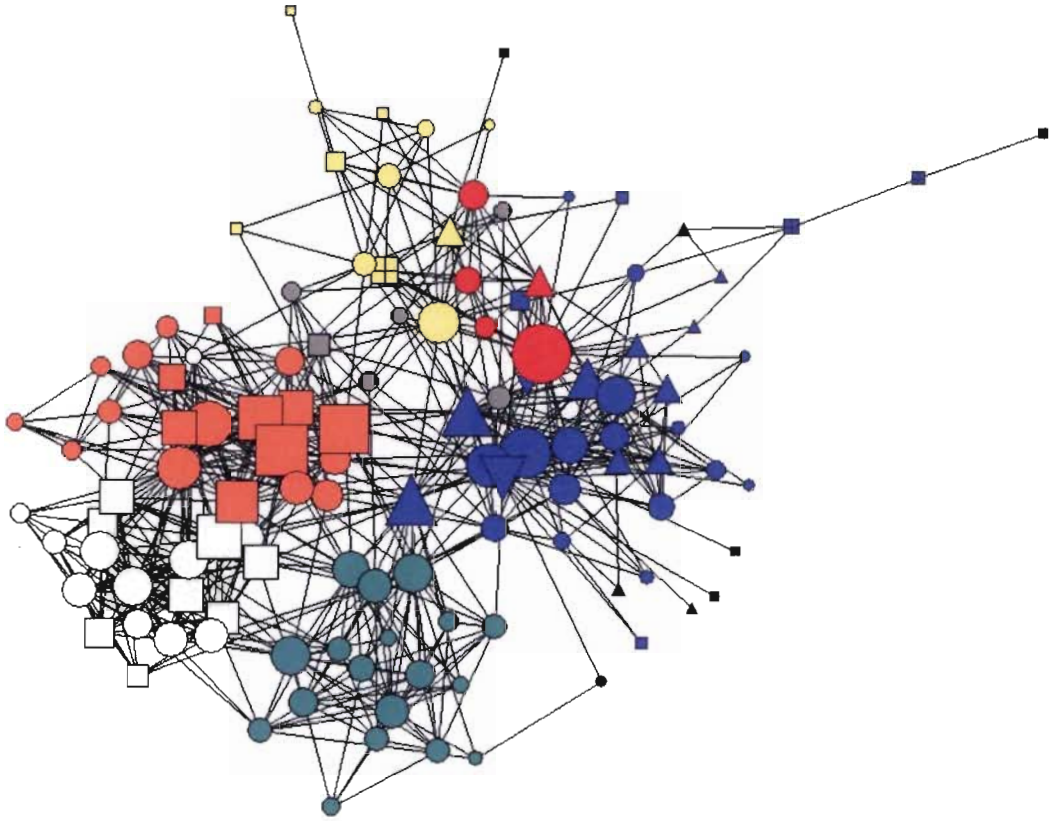

**Figure 6.1** Visualization of the social network of information sharing. The size of the nodes is proportional to their degree centrality values. Occupations are shown with different shapes: commercial fisher (circle), commercial/sport fisher (up triangle), sport/commercial fisher (box), diver/commercial fisher (square), and fish buyer/permit holder (down triangle). Communities are highlighted with different colours: Agua Verde (blue-green), Colonia Zaragoza (blue), Ensenada Blanca (white), Juncalito (gray), Ligüí (orange), San Nicolás (yellow), and Ramadita (red)

Another important characteristic is that although the individuals with highest degree centrality values (largest nodes in Figure 6.1) do not belong to only one occupation, the distribution of network activity as a whole is slightly unequal. Freeman's "degree centralization" measure for the whole network is 16.19% (a value of zero would be the case if all actors had the same degree centrality values). At the community level, Freeman's "degree centralization" measure increases in most communities (Table 6.2).

**Table 6.2** Freeman's "degree centralization" measure for each community

| COMMUNITY | DEGREE CENTRALIZATION (%) |
|---|---|
| Agua Verde | 49.67 |
| Juncalito | 40.00 |
| Ligüí | 37.43 |
| Colonia Zaragoza | 31.67 |
| San Nicolás | 34.55 |
| Ensenada Blanca | 29.24 |
| Ramadita | 16.67 |

To put these network degree centralization measures in perspective, Maiolo and Johnson (1988) report degree centralization values of 10 % and 11 % for network sizes of 120 and 75 respectively in their study of communication networks in the mackerel fishery in North Carolina. These authors regard those values as high for the size of their networks. Interestingly, the authors also report values close to zero in network degree centralization for the same type of communication network and type of fishery but this network was in Florida where the communication network size was 205. The degree centralization value reported by Maiolo and Johnson (1988) in the mackerel fishery in North Carolina is similar to the one I found for the 123 individuals. Yet in their study degree centralization for a similar fishery can radically change to be almost zero. Maiolo and Johnson's (1988: 276) research purpose was to identify "specific opinion leaders and centrally located players" to enhance the communication between resource users and management councils. A key finding of these authors in their case studies is that individual centrality is a function of organizational affiliations and subscriptions or periodicals read.

In contrast, Schweizer (1997) reports a 45 % degree centralization for an exchange network of gift giving among 73 actors from the !Kung group of Botswana in south-western Africa. Schweizer's (1997) reported value of network degree centralization is more in accordance with my results of network degree centralization for the different communities despite the substantive difference in the kind of social relation and type of social network. The !Kung of Botswana, however, are a nomadic and hunter/gatherer society, which to a certain extent resembles the social context of the fishing practices in the small-scale fisheries in Loreto. The wide range of values that degree centralization can take between similar social networks (Maiolo and Johnson 1988) and similarities between different social networks highlights the importance of context in determining network structures. Indeed, it has been already pointed out that structural analyses (in network snapshots and networks monitored over time) cannot alone answer the important question about the extent to which network patterns are created by selective tie formation or selective dissolution (Emirbayer and Goodwin 1994, McPherson et al. 2001). In other words, what motivates individuals to engage in cooperative social relations? I search for an answer to this question in Chapter 7. At this juncture I address the question of how actors' degree centrality values changes for each type of social relation.

## 6.3 Occupation and Focal Points of Network Activity by Type of Social Relation

Table 6.3 shows the results of the one-way ANOVA tests for actors' degree centrality values and occupational categories for each type of social relation. Only in the friendship network are actors' degree centrality values not significantly different among

occupational categories. Visualizations of the networks for each type of social relation highlight important patterns of differences among occupational categories and communities (Figures 6.2 to 6.4). These visualizations were also created using the spring embedding algorithm of the Netdraw program.

**Table 6.3** One-way ANOVA tests for actor's degree centrality values by occupational categories for each type of social relation

| SOCIAL NETWORK BY TYPE OF SOCIAL RELATION | DEGREE CENTRALITY (F-Statistic; Degrees of Freedom; P-value) |
|---|---|
| **Kinship Network** | F=2.8506; 4 d.f.; p=0.0248 |
| **Friendship Network** | F=2.0659; 4 d.f.; p=0.0920 |
| **Acquaintance Network** | F=6.7510; 4 d.f.; p=0.0040 |

The visualization of the kinship network of information sharing (Figure 6.2) clearly shows that the greatest number of focal points of network activity are commercial fishers and diver/commercial fishers, particularly in the Ligüí (squares and circles in orange) and Ensenada Blanca (square and circles in white) networks. In the case of Agua Verde (blue-green nodes), with only commercial fishers, there is also a relatively high concentration of network activity among a few actors. In contrast, differences in actors' degree centrality values in Colonia Zaragoza (blue nodes), San Nicolás (red nodes), Ramadita (yellow nodes) and Juncalito (gray nodes) are not as large as in Ligüí and Ensenada Blanca. Also, the most important actors or focal points of network activity are not monopolized by one or two occupational categories. Again, the effect of occupational categories in actors' degree centrality values or number of ties in which an actor is involved breaks down at the community level. Indeed, actors' degree centrality values in

the kinship network are significantly different between communities (F=14.6967; 6 d.f.; p=0.0002).

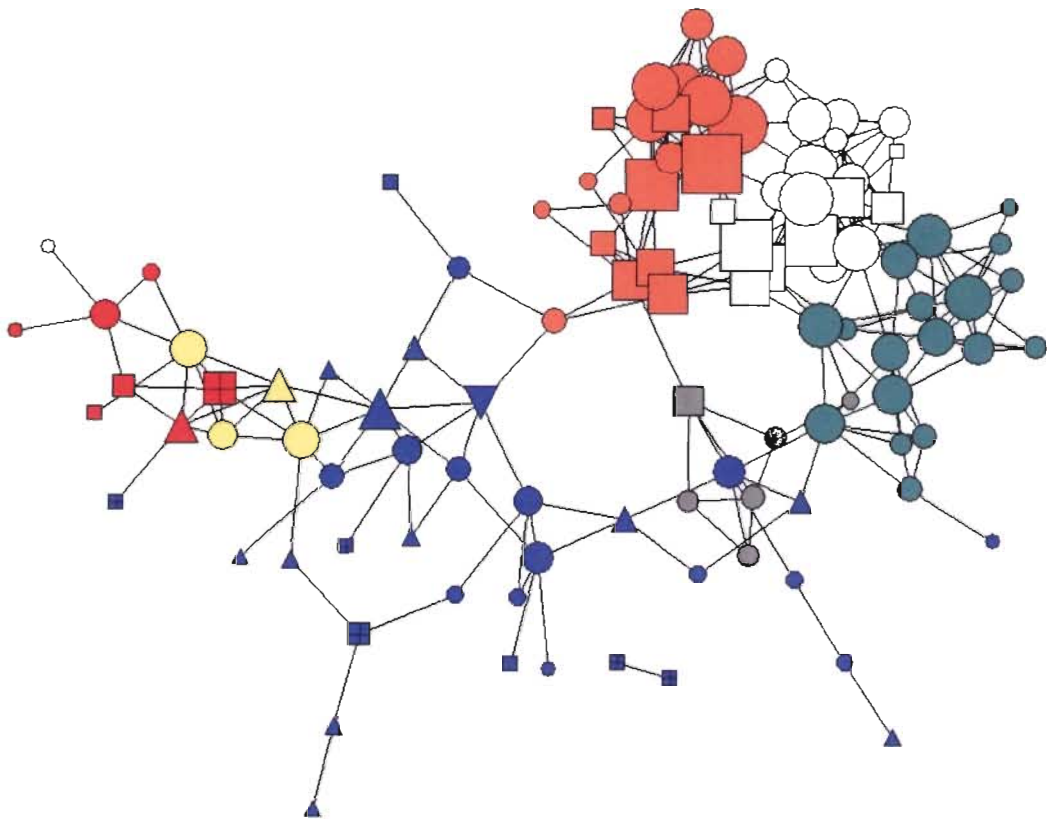

**Figure 6.2** Visualization of the kinship network of information sharing. The size of the nodes is proportional to their degree centrality values. Occupations are shown with different shapes: commercial fisher (circle), commercial/sport fisher (up triangle), sport/commercial fisher (box), diver/commercial fisher (square), and fish buyer/permit holder (down triangle). Communities are highlighted with different colours: Agua Verde (blue-green), Colonia Zaragoza (blue), Ensenada Blanca (white), Juncalito (gray), Ligüí (orange), San Nicolás (red), and Ramadita (yellow)

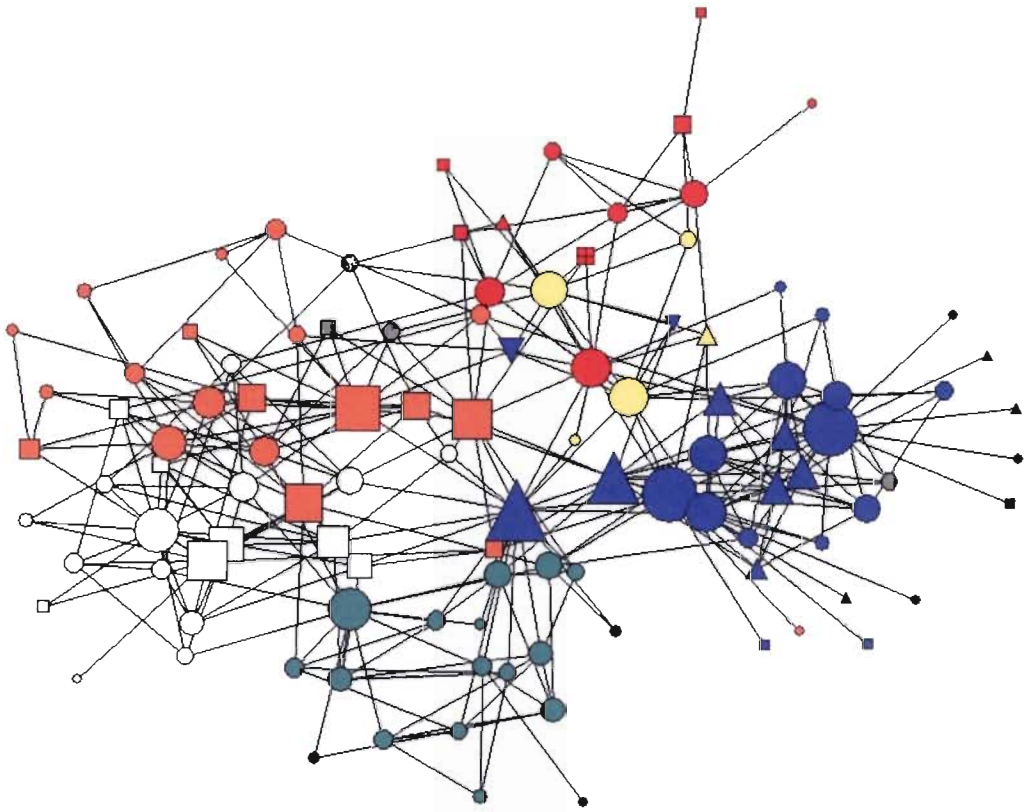

**Figure 6.3** Visualization of the friendship network of information sharing. The size of the nodes is proportional to their degree centrality values. Occupations are shown with different shapes: commercial fisher (circle), commercial/sport fisher (up triangle), sport/commercial fisher (box), diver/commercial fisher (square), and fish buyer/permit holder (down triangle). Communities are highlighted with different colours: Agua Verde (blue-green), Colonia Zaragoza (blue), Ensenada Blanca (white), Juncalito (gray), Ligüí (orange), San Nicolás (red), and Ramadita (yellow)

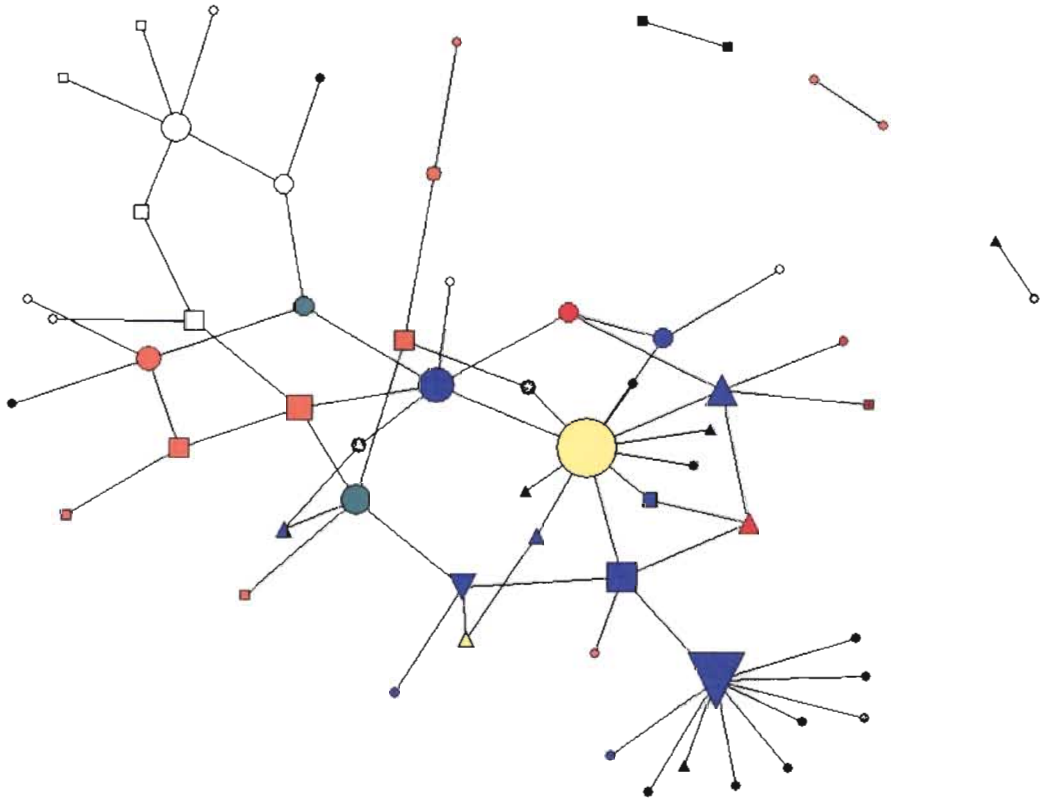

**Figure 6.4** Visualization of the acquaintance network of information sharing. The size of the nodes is proportional to their degree centrality values. Occupations are shown with different shapes: commercial fisher (circle), commercial/sport fisher (up triangle), sport/commercial fisher (box), diver/commercial fisher (square), and fish buyer/permit holder (down triangle). Communities are highlighted with different colours: Agua Verde (blue-green), Colonia Zaragoza (blue), Ensenada Blanca (white), Juncalito (gray), Ligüí (orange), San Nicolás (red), and Ramadita (yellow)

In the friendship network visualization (Figure 6.3), the occupational diversity of focal points of activity remains but, overall, the differences in actors' degree centrality values or contributions to the social network are not as large as in the kinship network. Indeed, actors' degree centrality values are not significantly different among occupational categories (Table 6.3) or among communities (F=0.8842; 6 d.f.; p=0.5041). The statistical propensity of actors to become involved in a similar number of friendship

relations across communities suggests the important role that friendship has in bridging social groups and supporting social integration. Clearly, the friendship network is denser than the kinship and acquaintance networks.

In the acquaintance network, actors' degree centrality values among occupations are significantly different (Table 6.3). It is in this network that the idea of degree centrality stands out the most. In the visualization of this network (Figure 6.4) we can see that for almost every occupation, there is an individual located at the centre of a star-like sub-structure in the acquaintance network. The centres of these star-like sub-networks or focal points of network activity connect different occupational categories and members from different communities. Indeed, actors' degree centrality values in the acquaintance network are not significantly different among communities ($F=1.4765$; 6 d.f.; $p=0.1742$). These patterns also highlight the importance of acquaintance relations at bridging different occupations and localities in the network of information sharing as I suggested in the previous chapter.

In sum, occupation is an important factor in defining focal points of activity in the network of information sharing but the effects of occupations break down across communities. Moreover, important patterns emerge when we disaggregate the network of information sharing by type of social relation, where the star-like sub-structures of acquaintance relations seem to epitomize the essence of Freeman's (1979) concept of degree centrality as actors who are focal points of network activity. Indeed, and despite their conceptual difference, Freeman's degree and betweeness centrality measures have their maximum values in a star-like network. Yet, in more complex network structures,

the same actors are seldom important as focal points and controllers of information in the same network.

## 6.4 Occupation and Control of Information

While the focal points of information sharing (actors with high degree centrality values) are in part explained by occupation, none of the occupational categories is significantly different in terms of betweeness centrality values of resource users (F=0.9557; 4 d.f.; p=0.3907). In other words, none of the occupational categories have a greater control of information flow over others in the whole network. Actors' betweeness centrality values by community are not significantly different either (F=0.9172; 6 d.f.; p=0.4751). A visualization of the network of information sharing by occupation and community (Figure 6.5) shows that the differences in actors' betweeness centrality values (difference in node size) is not as large as in the case of the same network where actors are depicted by their relative degree centrality values (Figure 6.1). It is also clear from looking at Figure 6.1 and Figure 6.5 that an actor's degree centrality or importance as focal point does not always coincide with his betweeness centrality or importance as controller of information. In particular, four resource users located in the middle of Figure 6.5 representing four communities and three different types of occupations (Ligüí orange square, Colonia Zaragoza blue up-triangle, Ramadita bright-green circle, and San Nicolás red circle) have relatively high betweeness centrality values. The location of these four individuals in the centre of the figure also indicates that they are important controllers of information between different communities.

The extent to which the betweeness centrality of the most central actors exceeds the centrality of other actors in the whole network is relatively low (Freeman's

betweeness centralization = 10.09 %). This indicates that the potential control over information by the actors with highest betweeness centrality values in the whole network is not too strong. Yet, within communities Freeman's betweeness centralization values are more variable (Table 6.4).

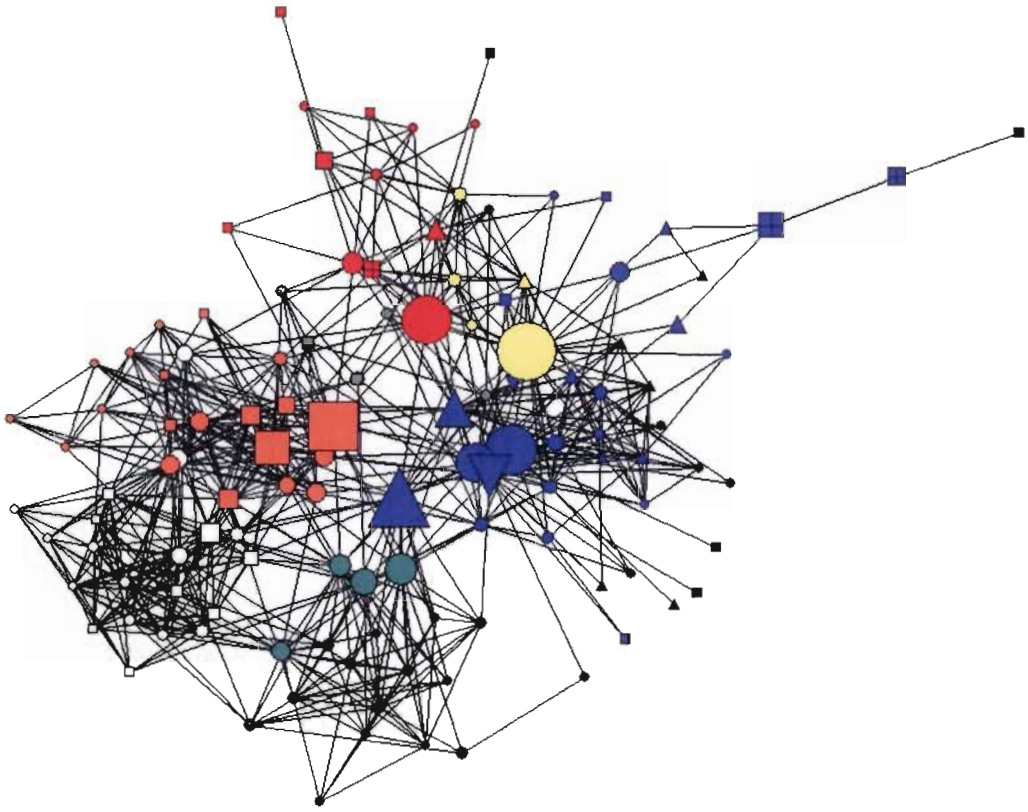

**Figure 6.5** Visualization of the network of information sharing. The size of the nodes is proportional to their betweeness centrality values. Occupations are shown with different shapes: commercial fisher (circle), commercial/sport fisher (up triangle), sport/commercial fisher (box), diver/commercial fisher (square), and fish buyer/permit holder (down triangle). Communities are highlighted with different colours: Agua Verde (blue-green), Colonia Zaragoza (blue), Ensenada Blanca (white), Juncalito (gray), Ligüí (orange), San Nicolás (red), and Ramadita (yellow)

**Table 6.4** Freeman's betweeness centralization measure for each community

| COMMUNITY | BETWEENESS CENTRALIZATION (%) |
|---|---|
| Agua Verde | 14.50 |
| Juncalito | 30.00 |
| Ligüí | 5.91 |
| Colonia Zaragoza | 19.35 |
| San Nicolás | 17.85 |
| Ensenada Blanca | 4.22 |
| Ramadita | 2.78 |

The greater variation in betweeness centralization (Table 6.4) than in degree centralization (Table 6.2) across communities indicates that control of information by a relatively small number of individuals may be a more important structuring factor within some communities. Thus, focusing on the differences among communities reflect important centrality patterns that may be masked in the whole network of information sharing. Moreover, the changes in structural patterns from the whole network to community networks of information sharing suggest a scale effect. How do these patterns in betweeness centrality change by the type of social relation?

## 6.5 Occupation and Control of Information by Type of Social Relation

The networks of information sharing by occupation and community for each type of social relation are shown in Figures 6.6, 6.7, and 6.8. The actors' betweeness centrality values are not significantly different across occupational categories (F=1.4391; 4 d.f.;

p=0.2004). In contrast, actors' betweeness centrality values are significantly different among communities (F=3.0704; 6 d.f.; p=0.0148).

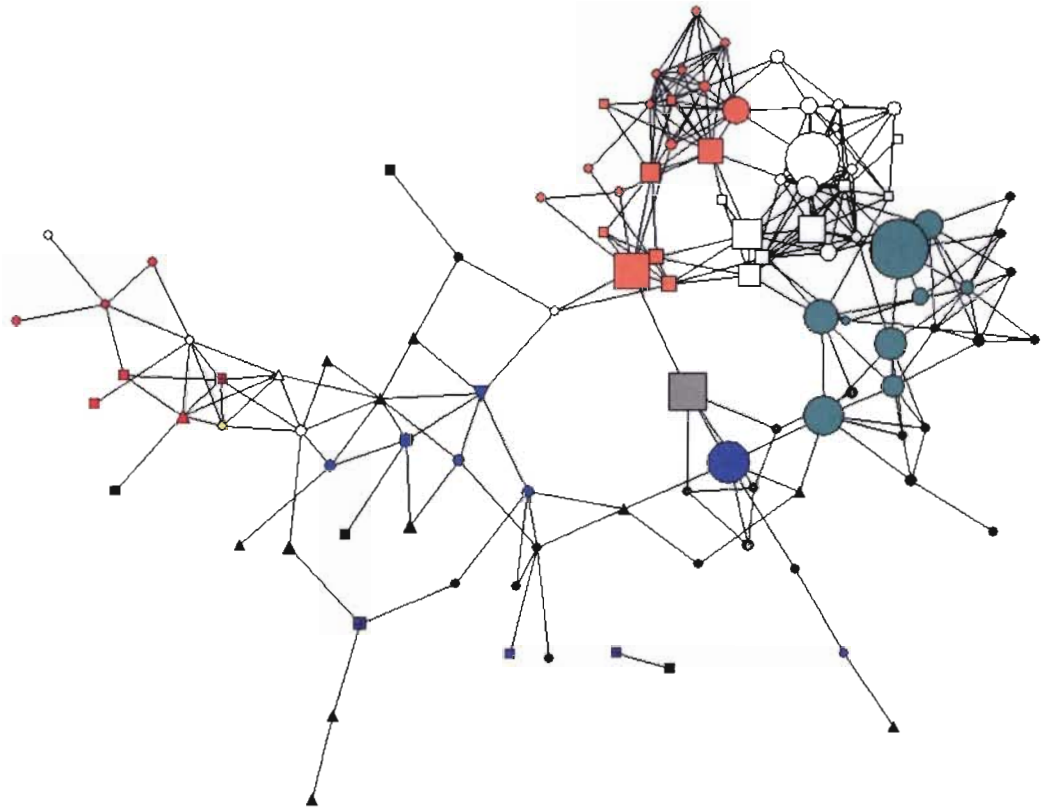

**Figure 6.6** Visualization of the kinship network of information sharing. The size of the nodes is proportional to their betweeness centrality values. Occupations are shown with different shapes: commercial fisher (circle), commercial/sport fisher (up triangle), sport/commercial fisher (box), diver/commercial fisher (square), and fish buyer/permit holder (down triangle). Communities are highlighted with different colours: Agua Verde (blue-green), Colonia Zaragoza (blue), Ensenada Blanca (white), Juncalito (gray), Ligüí (orange), San Nicolás (red), and Ramadita (yellow)

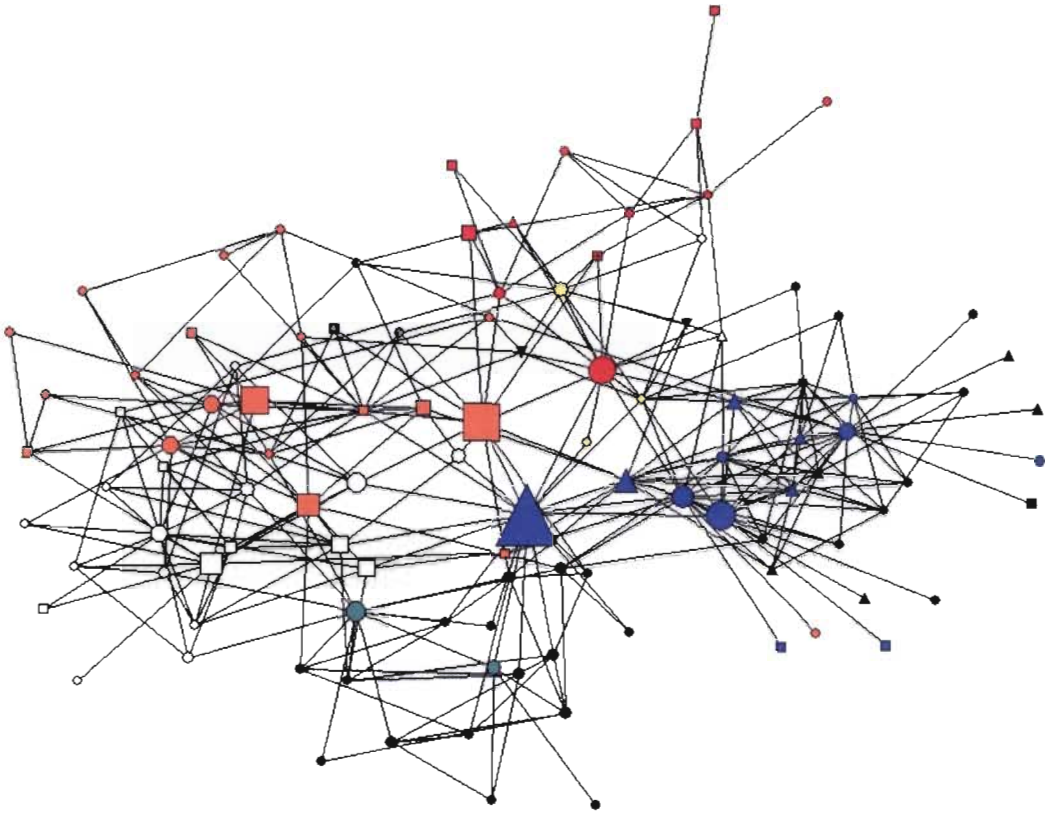

**Figure 6.7** Visualization of the friendship network of information sharing. The size of the nodes is proportional to their betweeness centrality values. Occupations are shown with different shapes: commercial fisher (circle), commercial/sport fisher (up triangle), sport/commercial fisher (box), diver/commercial fisher (square), and fish buyer/permit holder (down triangle). Communities are highlighted with different colours: Agua Verde (blue-green), Colonia Zaragoza (blue), Ensenada Blanca (white), Juncalito (gray), Ligüí (orange), San Nicolás (red), and Ramadita (yellow)

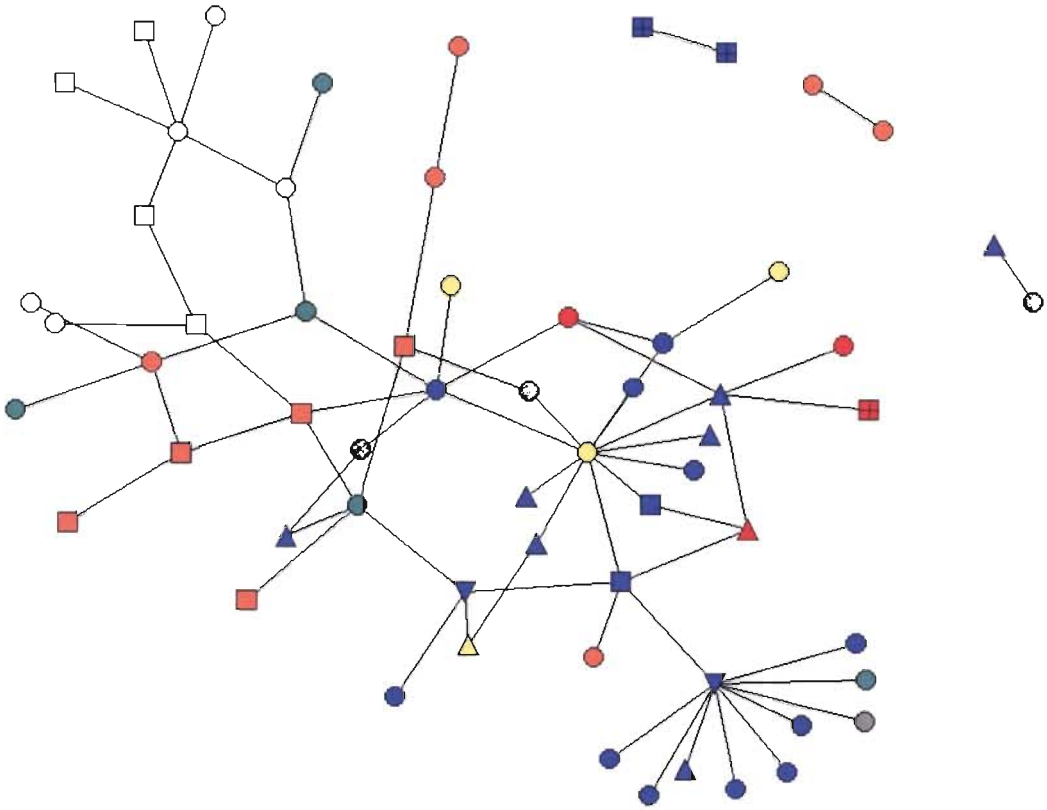

**Figure 6.8** Visualization of the acquaintance network of information sharing. The size of the nodes is proportional to their betweeness centrality values. Occupations are shown with different shapes: commercial fisher (circle), commercial/sport fisher (up triangle), sport/commercial fisher (box), diver/commercial fisher (square), and fish buyer/permit holder (down triangle). Communities are highlighted with different colours: Agua Verde (blue-green), Colonia Zaragoza (blue), Ensenada Blanca (white), Juncalito (gray), Ligüí (orange), San Nicolás (red), and Ramadita (yellow)

In particular, Ligüí (orange nodes), Ensenada Blanca (white nodes) and Agua Verde (blue-green nodes) show the greatest difference in betweeness centrality values as shown by the size of the nodes in Figure 6.6. It is in these three communities where differences in actors' betweeness centrality values are more evident. In the case of the friendship network, actors' betweeness centrality values are not significantly different across occupations (F=1.2314; 4 d.f.; p=0.235) or communities (F=0.433; 6 d.f.;

p=0.8468). In contrast, the betweeness centrality values of actors across occupations are significantly different in the acquaintance network (F=3.7293; 4 d.f.; p=0.0332). This is not surprising because, as indicated for the case of actors' degree centrality values in the acquaintance network, betweeness centrality values are also maximal in star-like sub-structures (Figure 6.8). Indeed, comparing the acquaintance network where actors are depicted by their degree centrality values (Figures 6.4) and their betweeness centrality values (Figure 6.8), we can see that they are practically identical in their size in both figures. Interestingly, actors' betweeness centrality values are not significantly different across communities in the acquaintance relations (F=0.9967; 6 d.f.; p=0.3971). This suggests that, as in the case of the lack of statistical differences across communities for the friendship relation, acquaintance relations are also important in connecting different localities and supporting social integration.

In sum, betweeness centrality or the extent to which control over information may be exercised by any occupation in the whole network of information sharing is only statistically significant for the acquaintance relationships. Central actors in the acquaintance network may serve as important bridges because actors located in star-like sub-structures connect different localities and occupations. Among communities, however, actors' betweeness centrality values are significantly different only for kinship relations, perhaps not a surprising pattern given the settlement history of the fishing communities by a few families. Overall, there are important variations in how well occupation and locality can explain actors' degree and betweeness centrality values. In the next section, I explore two plausible factors that may forecast actors' degree and betweeness centrality values in the network of information sharing.

## 6.6 Forecasting Actors' Centrality Values in the Network of Information Sharing: Fishing Experience and Time of Residence

Because fishery resource users from the seven fishing communities seek information on the state of fishery resources, it is likely that the more experienced a fisher is, the more likely he will be consulted by others. To evaluate this hypothetical relationship, I use years of fishing experience to determine the extent to which this variable explains actors' degree and betweeness centrality values. Time of residence may also be a good predictor of actors' degree and betweeness centrality values. All personal contacts reported by fishery resource users were perceived as trustworthy, which is a characteristic most likely developed over time. It is possible that a fisher who has lived longer in a community may be more trustworthy than one that has just recently arrived in a community. To explore this hypothetical relationship, I use years of residence to determine the extent to which this variable explains actors' degree and betweeness centrality values.

### 6.6.1 Fishing Experience

Is the centrality of an individual in the network of information sharing a function of his years of fishing experience? A regression analysis indicates that the number of years of fishing experience is significantly correlated to users' degree ($P=0.05$; $\alpha \leq 0.05$) and users' betweeness centrality values ($P=0.004$; $\alpha \leq 0.05$). Within communities, however, years of fishing experience seldom correlate with users' degree and betweeness centrality values (Table 6.5). In fact, Agua Verde is the only community in which years of fishing experience correlate with both actors' degree and betweeness centrality values, and

Ensenada Blanca is the only one in which they correlate with betweeness centrality values.

**Table 6.5** Significant values of regression analyses for years of fishing experience with actors' degree and betweeness centrality values for each community. Statistically significant values in bold ($\alpha \leq 0.05$)

| | YEARS OF FISHING EXPERIENCE | |
|---|---|---|
| **COMMUNITY** | **Degree Centrality** | **Betweeness Centrality** |
| **Agua Verde** | **0.034** | **0.047** |
| **Colonia Zaragoza** | 0.595 | 0.620 |
| **Ensenada Blanca** | 0.182 | **0.029** |
| **Juncalito** | 0.861 | 0.786 |
| **Ligüí** | 0.262 | 0.507 |
| **San Nicolás** | 0.464 | 0.580 |
| **Ramadita** | 0.303 | 0.269 |

Visualizations of the network of information sharing by community using four classes of years of fishing experience for actors' degree (Figure 6.9) and betweeness (Figure 6.10) centrality values help to understand these patterns. Focusing only on the actors from Agua Verde (circles), we noticed that there is one large red circle (representing a member of the 41+ years of fishing experience category), followed by smaller yellow circles of the 31-40 category and blue-green circles of the 21-30 category.

**Figure 6.9** Visualization of the network of information sharing. The size of the nodes is proportional to their degree centrality values. Classes of years of fishing experience are highlighted with different colours: 10-20 (gray), 21-30 (blue-green), 31-40 (yellow), and 41+ (red). Communities are shown with different shapes: Agua Verde (circle), Colonia Zaragoza (square), Ensenada Blanca (up triangle), Juncalito (box), Ligüí (down triangle), San Nicolás (circle-in-box), and Ramadita (diamond)

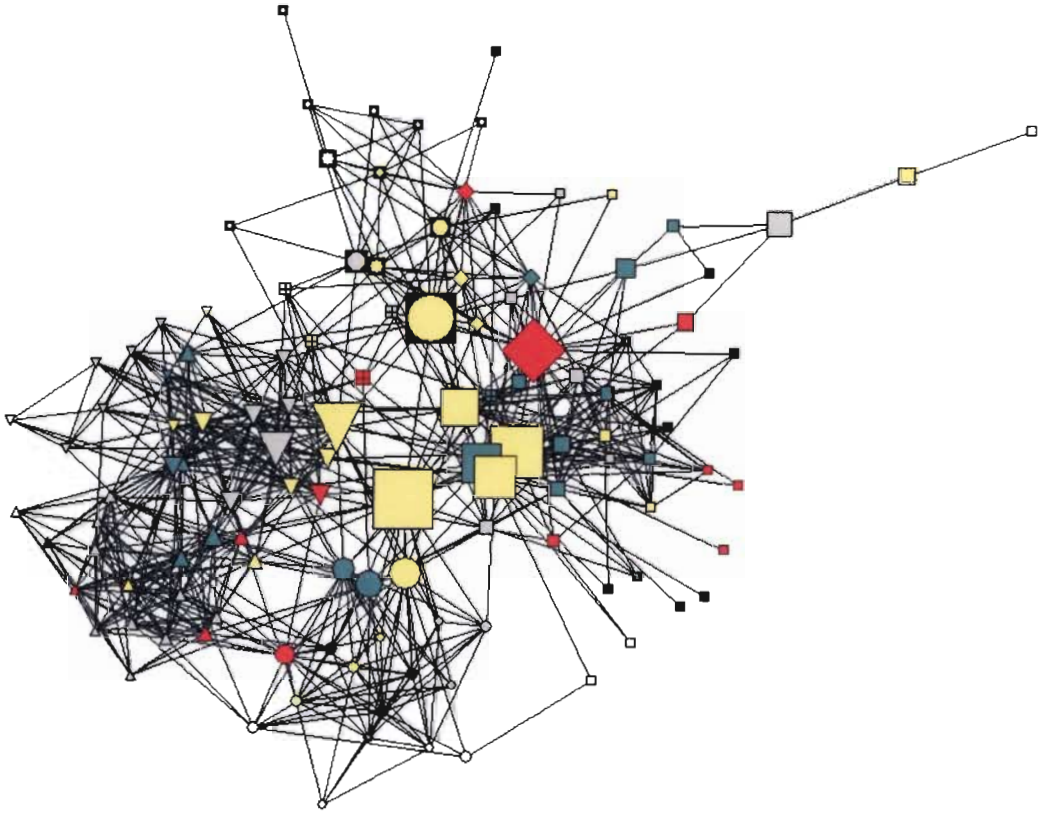

**Figure 6.10** Visualization of the network of information sharing. The size of the nodes is proportional to their betweeness centrality values. Classes of years of fishing experience are highlighted with different colours: 10-20 (gray), 21-30 (blue-green), 31-40 (yellow), and 41+ (Red). Communities are shown with different shapes: Agua Verde (circle), Colonia Zaragoza (square), Ensenada Blanca (up triangle), Juncalito (box), Ligüí (down triangle), San Nicolás (circle-in-box), and Ramadita (diamond).

The 10-20 category (gray circles) has the smallest degree values in the Agua Verde community. In contrast, Colonia Zaragoza's members with the highest number of years of fishing experience (red squares) have some of the smallest degree values. In Figure 6.10, we can find similar patterns where the red nodes representing the fishers with the most years of fishing experience are not always the ones with some of the highest betweeness centrality values, except for Agua Verde and Ensenada Blanca. Thus, years of fishing experience is a good predictor of actors' degree and betweeness

centrality values at the level of the whole network but seldom at the community level. This is similar to what we observed in the previous analysis of occupation as a centrality factor. Partitioning the network of information sharing by community, years of fishing experience becomes a weaker predictor of an actor's degree and betweeness centrality values. This could be the case because in the process of partitioning the network of information sharing, we eliminate all the relations outside of the community. Yet, it remains the case that resource users share information most prominently within their own communities as shown in the previous chapter.

Interestingly, when partitioning the social network of information sharing by type of social relation, years of fishing experience is a good predictor of actors' degree centrality only for acquaintance relations (Table 6.6). This pattern may be explained by the function that acquaintance relations have in bridging groups with information not available in each groups' own social circle.

**Table 6.6** Significant values of regression analyses for years of fishing experience with actors' degree and betweeness centrality values for each type of social network. Statistically significant values in bold ($\alpha \leq 0.05$)

| | YEARS OF FISHING EXPERIENCE | |
|---|---|---|
| **TYPE OF NETWORK** | **Degree Centrality** | **Betweeness Centrality** |
| **Kinship Network** | P=0.439 | P=0.158 |
| **Friendship Network** | P=0.148 | P=0.268 |
| **Acquaintance Network** | **P=0.001** | **P=0.011** |

### 6.6.2 Time of Residence

A regression analysis shows that the years a resource user has lived in the community is a good predictor of actors' degree and betweeness centrality values when focusing in the whole network. This variable, however, does not forecast the importance of individuals in the network of information sharing when the network is analyzed by type of social relation (Table 6.7).

**Table 6.7** Significant values of regression analyses of years of residence for actors' degrees and betweeness centrality values of the whole social network of information sharing and by type of social relation. Statistically significant values in bold ($\alpha \leq 0.05$)

| | YEARS OF RESIDENCE | |
|---|---|---|
| TYPE OF NETWORK | DEGREE CENTRALITY | BETWEENESS CENTRALITY |
| **Whole Network** | **P=0.013** | **P=0.009** |
| **Kinship Network** | P=0.073 | P=0.234 |
| **Friendship Network** | P=0.10 | P=0.068 |
| **Acquaintance Network** | P=0.055 | P=0.184 |

At the community level, the number of years of residence is a good predictor of actors' degree and betweeness centrality values for Colonia Zaragoza and Ligüí, and for actors' betweeness centrality values only for the Ligüí community (Table 6.8). Interestingly, the number of years of residence is only a good predictor of actors' centrality when all social relations are aggregated to form the whole network for both actors' degree and betweeness centrality values. This has been a recurrent pattern in the examination so far produced of actors' degree and betweeness centrality values.

**Table 6.8** Significant values of regression analyses of years of residence for actors' degrees and betweeness centrality values of the network of information sharing for each community. Statistically significant values in bold ($\alpha \leq 0.05$)

| | YEARS OF RESIDENCE | |
|---|---|---|
| **COMMUNITY** | **Degree Centrality** | **Betweeness Centrality** |
| **Agua Verde** | 0.075 | 0.238 |
| **Colonia Zaragoza** | **0.030** | 0.281 |
| **Ensenada Blanca** | 0.241 | 0.508 |
| **Juncalito** | 0.902 | 0.684 |
| **Ligüí** | **0.001** | **0.039** |
| **San Nicolás** | 0.092 | 0.288 |
| **Ramadita** | 0.100 | 0.098 |

The capacity of time of residence to explain the centrality of individuals illustrates the concept of emergence whereby the components of a system, in this case the kinship, friendship, and acquaintance networks, together produce a qualitatively different network with properties of its own. This is why the properties of the components of a system do not always amount to the properties of the system (fallacy of composition). Conversely, assuming that what holds for the whole system is true for its parts is likely to commit the fallacy of division, especially when we know that heterogeneity rather than homogeneity in social systems appears to be the rule. In the case of years of residence and years of fishing experience, we have observed both processes. The practical implication is that neither holism (fallacy of division) nor individualism (fallacy of composition) may serve us well in designing or managing social systems.

The factor of time as years lived in a community was rather a weak predictor of actors' degree centrality values in a study of communication networks in the mackerel fishery in South and North Carolina (Maiolo and Johnson 1988). Moreover, these authors found that individual attributes were not stable by location (state) or across fisheries (mackerel and shrimp). These variations in centrality measures across types of relations and social context suggest that socio-economic variables should be empirically investigated rather than taken as all-encompassing indicators of the social importance of individuals (Maiolo and Johnson 1988), and more so given the existence of emergence and heterogeneous nature of most social systems. What have we learned about the seven fishing communities from studying network centrality?

## 6.7 Centrality at Different Levels of Aggregation

The central question I have addressed in this chapter was this: to what extent is an actor's importance in the social network of information sharing determined by his occupation and predicted by years of fishing experience and years of residence? Assuming that an individual can be important as a focal point of activity in the network of information sharing (actor's degree centrality) and controller of information (actor's betweeness centrality), the three variables analyzed were more robust at explaining both an actor's degree and betweeness centrality in the whole network of information sharing. Disaggregating this network by type of social relation and community decreases the power of these variables to explain an individual's role as a focal point of network activity and controller of information. The varying capacity of the socio-economic variables for indicating social importance of individuals in communication networks seems to be the rule rather than the exception (Maiolo and Johnson 1988). In the context

of my study, I have interpreted the varying capacity of the three variables analyzed as an issue of emergence and level of aggregation. The type of social relation and internal dynamics of each community are likely to be important contextual factors shaping the emergent form that centrality structural patterns take at different levels of aggregation.

In short, community and type of social relations matter. However, we cannot micro-reduce (individualism) or macro-reduce (holism) these two factors, and commit the fallacies of composition and division respectively. If only for this reason, systemism and a social relational approach seem more adequate to deal with social systems and allow a more comprehensive course of action for policy and management. What are the policy and management implications from knowledge generated about the social networks of information to access fishery resource? In other words, what can we accomplish by focusing on related individuals and their social networks that emerge for the management and conservation of fishery resources?

## 6.8 The Functions of Social Networks: A Logical Framework for Management and Policy

Although there is relative consensus that marine protected areas could serve an important role in long-term conservation and sustainable use of marine resources and biodiversity, there are different views regarding their implementation and scope (Agardy et al. 2003. Locke and Dearden 2005). In particular, the Loreto Bay National Marine Park and federal fisheries managers face the challenge of how to engage resource users to regulate the access and use of fishery resources. Maiolo and Johnson (1988) provide one option.

Maiolo and Johnson (1988: 274) identified the problem of communication between managers and their constituency in the context of what they refer to as "upward

aggregation of responsibility and authority" in fisheries management in the United States (US), particularly with the passage of the Magnuson Fishery Conservation and Management Act[27]. To address this problem in the king mackerel fishery in the Southeast US, the authors assume that the effectiveness of this communication could be improved by identifying key leaders or central members in the communication networks who could then be appointed as representatives of the industry in key advisory committees. In particular, these authors sought to produce a series of protocols for identifying central figures. While they found variations in the socioeconomic characteristics that predict actors' degree centrality values by state (Florida, North and South Carolina) and type of fishery (mackerel and shrimp), they tentatively concluded that in their case studies, organizational affiliation and subscriptions to information outlets are good proxies for selecting advisors. Yet, they acknowledged that it is advisable to carry out a full scale network study rather than simplifying the identification of central figures by assuming socio-economic characteristics identified in one study will hold everywhere.

The results produced in my research could be used with the same objective, i.e., making more effective the diffusion of information via social networks by involving in management boards central individuals from the social network of sharing of information. However, I would argue that a more powerful approach to tap into social networks for the conservation and management of fishery resources could emerge from an understanding of what the function(s) of social networks are and, more importantly,

[27] One of the purposes of this act is, "To establish Regional Fishery Management Councils to exercise sound judgment in the stewardship of fishery resources through the preparation, monitoring, and revision of such plans under circumstances (A) which will enable the States, the fishing industry, consumer and environmental organizations, and other interested persons to participate in, and advise on, the establishment and administration of such plans, and (B) which take into account the social and economic needs of the States" (Government of the United States of America, 1996, Public Law 94-265).

from the identification of the mechanisms that produce the functions of social networks. After all, anyone seeking to draft a social policy or management strategy must identify the underlying mechanisms if s/he wishes to control them and improve their performance (Bunge 1996, Mahner and Bunge 2001).

### 6.8.1 The Logical Related Functions of Social Networks

Based on Mahner and Bunge's (2001) analytical work on the different conceptions of function used in biology and the social sciences, I propose that social networks have five functions (Table 6.9). The relationship between these five functional concepts is that of implication. In other words, F5 logically presupposes F4, which in turn presupposes that of either F1, F2, or F3 (Mahner and Bunge 2001).

**Table 6.9** Five logically related functions of social networks using the framework proposed by Mahner and Bunge (2001)

| TYPE OF FUNCTION | SOCIAL NETWORKS |
|---|---|
| F1 = Internal Activity | Social and emotional support |
| F2 = External Activity | Social integration |
| F3 = F1 + F2 | Achieve supra-individual tasks from the dyad to the triad and larger groups |
| F4 = Value of F3 | F3 can be valuable (*aptation*) or *dis-valuable* (*mal-aptation*) |
| F5 | A valuable function F4 can be socially selected |

Moreover, the corresponding processes associated with each are also historically prior to each other. For example, Mahner and Bunge (2001: 78) provide the following example, "A new mutation may establish a new internal (F1) or external activity (F2) of

some organ, which may turn out to be an aptation, natural selection may start to spread this aptation in the population, perhaps imposing in addition a direction on the subsequent evolutionary process"[28].

In biology, the synthetic theory of natural selection provides the key mechanism in the previous example. We, however, do not have a counterpart to this theory in the social sciences, particularly for a key feature of social systems, namely cooperation. The complication in producing such theory comes in part from the fact that social systems involve purposive actions by human individuals. In the previous chapter I made the distinction between latent (unintended) and manifest (intended) function of the social network of information sharing. I propose that the social network of information sharing has the latent function of social integration (F2) and the manifest function of obtaining information for accessing fishery resources (F3). Is the network of information sharing for accessing fishery resources (F3) a function of value (aptation) or unfavourableness (mal-aptation)?

### 6.8.2 The Value of Social Networks of Information Sharing for Accessing Fishery Resources

The idea of social networks as an organizing principle of human affairs is obtaining recognition because they appear to achieve tasks more effectively and efficiently than formal forms of organization (Benz and Furst 2002, Henry et al. 2004, Krackhardt and Hanson 1993, Podolny and Page 1998). In particular, social networks as social capital have gained increasing importance as a key ingredient for community development,

[28] An *aptation* is a function that may be valuable (aptation) or *dis-valuable* (mal-aptation) to the organism or system. An *aptation* nautrally selected becomes an adaptation. By definition, a mal-aptation cannot become an adaption in the context of the synthetic theory of natural selection (Mahner and Bunge 2001).

management and conservation of common-pool resources (Barry 2001, Kadushin 2004, Portes 1998, Pretty and Smith 2004, Pretty and Ward 2001). However, the so-called social capital does not always discharge a valuable social function (Barry 2001, Granovetter 1985, Kadushin 2004, Portes 1998). A large portion of the literature has been critical of the idea of social capital, saliently because the word capital lends the term a misplaced sense of scientific precision and unwarranted one sided emphasis on benefits (Barry 2001). Some economists have readily pointed out that for social capital to be a form of capital and not just a buzzword, there needs to be an identifiable process of "investment" that adds to the stock, and possibly a process of "depreciation" that subtracts from it (Arrow 2000, Solow 1995). Leaving aside for the moment the controversies surrounding the concept of social capital, my point is that social networks, for example, as social capital are ambiguous in their value.

For instance, illegal fishing in the Loreto area is embedded in social networks. In an interview with a fisherman who admitted to having practiced illegal spear fishing with tanks (among the most repudiated illegal fishing practices) I was not surprised to hear that corrupt authorities collude with fish buyers/permit holders in carrying out illegal fishing. It was more revealing to hear how effective the network of illegal fishing was at keeping their activity protected:

> "If you refuse to conform and to be discrete about it [illegal fishing], your name is rapidly known [in the network of illegal fishing] and then no patron [fish buyer/permit holder] will give you work and you will get no protection or concessions from authorities".

Indeed, "force and fraud are most efficiently pursued by teams, and the structure of these teams requires a level of internal trust – "honour among thieves" – that usually

follows pre-existing lines of relationships" (Granovetter 1985: 492). Thus, social networks seem to have both valuable and *dis-valuable* functions.

In the case of the social networks of information sharing in the Loreto area, it is possible that the widespread cooperation as sharing of information among fishery resource users may have, in part, caused the over-use of fishery resources. In this regard, and perhaps in a more obvious way for a network of illegal fishing, social networks appear *dis-valuable*. Yet, these social networks are clearly of value to those who participate in it. Thus, the tasks achieved by social networks are valuable to those involved in it, but they may be perceived unfavourably by those outside of the network. The value of the function (F4) that social networks discharge has an idiosyncratic element, which is likely to cause conflict.

Regarding functions F2 and F1, the fact that the social networks of information sharing are embedded in kinship, friendship, and acquaintance relations attests to their latent function (F2) of social integration and social support (F1). It is my suggestion -- perhaps a controversial one -- that F1 also involves emotional support. In fact, the logical conclusion is that cooperation as information sharing in social networks is possible because of function F1 (social and emotional support). This is a logical conclusion because all conceptual functions in Table 6.6 are logically related by the relation of implication. That social and emotional support is the function of social networks that elicit cooperation stands at odds with conceptions of human cooperation based on individuals who are motivated by self-interest and who make choices and decisions through information processing using some form of expected-utility model. Using overt behaviour and carefully controlled experiments to settle this issue is problematic because

two outwardly identical actions can be elicited by different internal mechanisms (Bernston 2006). Inferring that a particular behaviour in a controlled experiment indicates individuals are processing information to cooperate or defect may be unwarranted because these are inverse problems. That is, the behaviour-motivation relation is one-to-many. Thus, when dealing with inverse problems, if A then B, it does not necessarily follow, B then A. Moreover, the precision gained, for instance, in strategic game experiments is off-set by the loss in scope of using asocial conditions where individuals are separated from the social systems to which they belong (Bunge 1996). To be sure, social structural explanations cannot tell us either why an individual decides to share or keep information from others: i.e., to engage or not in cooperation.

In light of these methodological barriers, looking at evidence generated by other disciplines also interested in the basic question of the mechanisms that produce social human behaviour is justified. In the next chapter, I revisit social cooperation in light of current evidence from brain research and social cognitive psychology to support the contention that individuals are inherently social and emotional beings.

# CHAPTER 7
# THE CONSTITUTION AND EMERGENCE OF HUMAN COOPERATION

The main philosophical principle I have endorsed to construct my dissertation has been that "everything is a system or part of a system". I have also argued for the constitution and emergence of social facts such as cooperation from a relational perspective. However, it can still be argued from the empirical evidence of my research that it is institutionalized social relations that constrain or enable the individual. Thus, we can still talk about the fundamental conflict between the individual and the collective, where social relations are also part of the sources that channel or condition the individual's decision to engage in cooperative behaviour. Indeed, although this is a plausible account, I argue that it involves two problematic assumptions regarding human action: that individuals are pre-constituted agents whose aggregate interaction creates larger social phenomena, and that human agents' key attribute for the production of larger social phenomena is humans' reasoning capacity for decision making.

In this section I address these two assumptions. I argue for the inherent social nature and systemic constitution of individuals, and I also propose the hypothesis that decisions for engaging in cooperative ties reported by resource users in my research are likely to be promoted and sustained by a cognitive-emotional mechanisms that serve what some neuroscientists and social cognitive psychologists are calling emotional and social intelligence (Bechara and Bar-On 2006). I pursue this task through a multilevel,

integrative approach used by emerging inter-disciplines that seek to connect different levels of reality (i.e., from the biological through the psychological to the social) to explain the constitution of human behaviour and emergence of social phenomena (Cacioppo and Bernston 1992, Cacciopo and Visser 2003).

## 7.1 The Systemic Constitution of Individuals

The human cooperation for sustainable use and conservation of natural resources discussed in Chapter 2 uses as a starting point a pre-constituted individual, cognizant of his/her preferences. The pre-constituted individual not yet involved in social interaction is the one that faces a dilemma between his/her universal positive self-regarding tendencies (i.e., individuals are naturally motivated to posses, enhance, and maintain positive self-views) and the collective good. It is individuals with their particular attributes already given, in particular their natural sense of positive self-regard, that come into interaction with others. This conception of the positive self-regarding and cognizant individual makes necessary the creation of conventions or institutions through social contracts to make social cooperation possible. This under-socialized view competes with an over-socialized one held by some social psychologists. The competing view, however, is not less individualistic and over-intellectualized. It adopts a notion that individuals not only have self-interested motivations but also possesses other-regarding preferences or social value orientations (Van Vugt et al. 2000).

The human actor as a pre-constituted and self-contained entity increasingly has been shown to be an untenable conception. From studies on the human brain to understand mental functions and subjective experience to studies on how self-regarding mental states are culturally constructed, it is increasingly clear that the individual human

actor is in relation to, rather than an isolated pre-constituted component of, social groups. This is evident from both biological and cultural perspectives. On the one hand, the human brain has evolved to be attuned to develop and thrive in social situations; thus while the brain is the material engine of human behaviour, the brain is inseparable from its relations to the mental and social levels of reality (Brothers 1997, Smith and Franks 1999). In turn, the form or content of the individual's subjective experience is dictated by particular cultural understandings; thus subjects find the meaning of what it is to be a person or an individual in relation to others, and more generally, it is in social practices that meaning or purpose is established in social life (Brothers 1997, Heine et al. 1999, Schatzki 1997, 2002).

### 7.1.1 The Social Brain

Neuroscientists aim at understanding how the brain produces behaviour. In particular, they are interested in determining the neural basis or neural correlates of the various mental functions (Bunge and Ardila 1987, Cacioppo and Tassinary 1990, Sarter et al. 1996)[29]. The neurophysiological research on brain functions, however, was largely dominated by a metaphor of an isolated brain visually grasping an external reality. In this particular view, visual perceptions by the isolated brain were the central focus of inquiry for brain functions in which social stimuli were excluded in order to avoid confounding

[29] Neuroscientists adopt a localizationalism view that comes in two strengths. A strong form adopts a hypothesis that every behaviour or mental function is discharged by a distinct anatomically concentrated neural system with well-defined borders. The weak form has the programmatic hypothesis that every behaviour or mental state is performed by some neural system that may be concentrated or distributed (Bunge and Ardila 1987:162-163). There is evidence in favour of each form (LeDoux 1996, Kanwisher 2006) but the first hypothesis implies the second one.

results (Brothers 1997)[30]. Probing the brain under asocial conditions was not so much wrong as limited in scope. Such limitations became more apparent with the discovery by neurophysiologists of hand and face-responsive brain cells in the infero-temporal cortex of the macaque (Gross et al. 1972) and the relatively recent, accidental, discovery of "mirror neurons" (di Pellegrino et al. 1992) in the cortex of monkeys. These discoveries shed new light into how brain structure and functions work together with the social context.

### 7.1.2 Interpreting Others and Human Imitation

The distinctive attention paid to facial gestures and gaze direction by newborn human babies and during face-to-face conversational interactions by adults suggests that facial expression provide key social cues through which we are able to comprehend our social environment (in particular, others' intentions) and how to proceed intelligibly toward others (Brothers 1997). Infants and adults alike have extensive experience with the appearances and actions of other humans which the human brain encodes, extraordinarily well, as social events. The highly localized and specialized neural structures responsible for face recognition support the idea that facial perception is a crucial socio-environmental cue in human cognition (Kanwisher 2006, Tsao et al. 2006). It appears that sometime during the evolution of humans, certain brain areas evolving in a highly social environment not only became specialized for responding to social signals of all kinds

[30] The original approach of brain research resembles the approach of some behavioral economists who research human altruism and claim that "[A]ltruistic behavior in real-life circumstances can almost always be attributed to different motives...sound knowledge about the specific motives behind altruistic acts predominantly stems from laboratory experiments...[S]ubjects [in the authors' experiments] never knew the personal identities of those with whom they interacted and they had full knowledge about the structure of the experiment – the available sequence of actions and the prevailing information conditions" (Fehr and Fischbacher 2003: 785).

(e.g., face expression and body movements) but also work systemically to allow us to attribute subjective experiences or mental states to others such as beliefs, goals, desires and intentions – what is hypothesized by some neuroscientists as a Theory of Mind (Brothers 1997, Samson et al. 2004, Saxe et al. 2004). Indeed, innate brain disorders (e.g., autism) and focal brain lesions (e.g., misidentification syndromes) in brain structures serving the mechanisms of emotions and conscious feelings can produce impairment in basic tasks such as assigning mental life or personhood to others, lack of capacity to show empathy and incapacity to observe social conventions or rules (Bechara and Bar-On 2006, Brothers 1997, Damasio 1995).

Humans also have an impressive capacity for imitation practically from birth, and this capacity for imitation continues throughout individuals' lives. Such imitation is critical not only for early social development and the possibility for inter-subjective interaction but imitation also appears to have been critical for the evolution of the human species through the creation of knowledge-rich environments that facilitate cultural evolution (Brothers 1997, Ramachandran 2000, Sterelny 2003).

The social neural condition to support the acute capacity of humans to imitate others started with the recent discovery of action recognition neural cells in the macaque (di Pellegrino et al. 1992). Unexpectedly, neurophysiologists studying the firing of individual cells in the pre-motor cortex of macaque's brain while giving the monkey different things to handle, discovered that the same neurons that fired when the macaque handle an object were also activated when the monkey watched the same action being performed by someone else. Interestingly, these neurons were activated specifically for

particular actions and not for others. Such neurons were termed "mirror cells" (di Pellegrino et al. 1992, Gallese et al. 1996).

Finding mirror neuron cells in the human brain has not been possible because of the intrusive technique used on monkeys – inserting electrodes in the subject's brain. However, using non-intrusive techniques such as fMRI (functional Magnetic Resonance Imaging) neurophysiologists have produced evidence that such mirror neurons are likely to exist in the human brain where specific neural networks activate when an individual performs and watches others performing the same action (Iacoboni et al. 1999). Humans, however, not only imitate, they also assign meaning to actions and are capable of perceiving instinctively others' thoughts, feelings, and intentions. Neuroscientists have found that perceiving other's emotions, sensations, and intentions are brain functions in part supported by mirror neural systems that are involuntary and automatic (Wicker et al. 2003, Iacoboni et al. 2005).

So far, I have explored the neural basis of individual experience and argued that it is inherently social. Yet it can be argued that, once socially constituted, the individual engages in social interaction in which the person expresses his/her particular preferences. This is true to a certain extent. However, the subjective experience of self occurs as part of a cultural system, unthinkable in terms of isolated individuals even in cultures where individualistic value systems are part of many social practices.

### 7.1.3 The Culturally-determined Self

A key element in the study of human behaviour and social interaction is the individual subjective experience of the self. The predominance of individual self apart from society, however, has been challenged as far back as the writings of the late George Herbert Mead

(1934). The concept of the self is ambiguous. It designates, on the one hand, the culturally constructed notion of person and, on the other hand, trans-cultural processes of role taking (Franks 1999). Of particular interest to my discussion on cooperation is the assumed notion that there is a universal motivation in humankind to possess, enhance, and maintain positive self-regarding views. Such a notion is adopted uncritically in theoretical constructions of social human cooperation that logically support an inherent conflict between individuals' universal need for positive self-regarding views and the collective good. It follows that contributing (as in the case of public goods) and restraining our behaviour (as in the conservation of common-pool resources) represents a disutility to any normal individual; thus leading to a personal dilemma. While there is no doubt that the self as subjective experience has neural enablers from the individual's brain (Brothers 1997, Damasio 1995), a universal content of the self for all humankind is not a settled matter (Heine et al. 1999).

In a comprehensive review, Heine et al. (1999) highlight how research on the self has been constructed on an assumption of a universal need for individuals to regard themselves positively, which their study on self-regarding views between Japanese and North American cultures finds unwarranted. Heine et al. (1999:769) highlight that a culturally constructed positive self-regarding view in North America is supported by practices and institutions that promote individualistic subjective experiences such as independence, choice, freedom, ability, individual control, and individual responsibility, while in Japanese culture there is an emphasis on self-criticism, self-discipline, effort, perseverance, the importance of others or interdependence, shame and apologies, and balance and emotional restrain. Salient in the culturally constructed individual in

Japanese culture is a cultural sense of interdependence. The self is "not considered to be separate and autonomous; rather it is within the contextual fabric of individuals' social relationships, roles, and duties that the interdependent self most securely gains a sense of meaning...the self gains meaning by being firmly suspended and supported within a web of mutually biding social relationships" (Heine et al. 1999: 770). The differences observed between North American and Japanese cultures do not lie on a presence/absence of the subjective experiences of the self per se (e.g., interdependence, which occurs in both cultures), but in the emphasis or pervasive social expressions (carried in everyday social practices and institutions) of particular subjective experiences in each culture. In other words, the constitution of the self is a complex social process enabled by a cultural system that ensures the reproduction of particular ways of being, feeling, and thinking (Heine et al. 1999). Indeed, this cultural reproduction takes place most importantly during the cross-cultural process of role taking where we signal bodily states, mostly subconsciously, that are intelligible to others (Narayan 1993, Turner 1999). In the case of language, this occurs by expressing a common understanding of an "organized set of attitudes common to all members of a community" (Brothers 1997:101). Interestingly, by noticing the many elements that sustain a cultural system (e.g., social practices and institutions) the difficulties of steering cultural practices to promote, for instance, conservation and sustainable resource use should come as no surprise.

With this brief review on the cultural construction of the self and the previous sections on the social brain I have sought to provide support for a conception of individuals as being systemically constituted – we are part of and not only interacting

elements of social systems. We know that although the human brain's basic organization is genetically determined, the brain is incapable of developing normally in the absence of social stimuli (Adolphs 2006). Moreover, different social and natural environments will dictate how the brain develops and the kind of subjective experiences that will be meaningful (Heine et al. 1999, TenHouten 1999). However, my argument about the social brain has not rejected the possibility that individual's decision-making is served by brain structures (frontal cortical lobes of the brain) associated with executive tasks such as reasoning. The fact that the frontal cortical lobes of the brain, primarily identified in executive tasks such as reasoning for decision making, are inherently connected to subcortical areas of the brain serving affective experiences such as drives, emotions, and feelings, suggests that affect and cognition are mutually complementary rather than exclusive brain processes (Bunge and Ardila 1987, Damasio 1995, LeDoux 1996, Schwarz 1998, Turner 1999).

## 7.2 The Primacy of Emotions in Reasoning for Decision Making

The intellectual capacities of humans for reasoning have been hailed as the hallmark of humankind – Descartes' human spirit. Modern decision-making and action theories rely on a decider who is cognizant of the situation that calls for a decision (i.e., the initial conditions, the different options of actions, and consequences of each option), and who possess some logical strategy for producing valid inferences (Damasio 1995). Not only have such cognitive abilities repeatedly been disproved, but also studies on patients with brain lesions indicate that affective mechanisms are inherently necessary for making personal and socially related decisions (See Bechara and Bar-On (2006) for a concise summary).

Damasio (1995) has studied the intriguing cases of patients with lesions to the ventromedial pre-frontal brain cortex who are capable of performing well in intelligence-quotient and memory tests and yet when faced with real-life decisions they make unwise decisions. Also characteristic of such patients is their impairment at expressing emotions. This led to the hypothesis that emotionally biased experiences rather than factual memories may be the missing element for such patients to make wise decisions. In a simple yet elegant experiment Bechara et al. (1997) generated supporting evidence for this hypothesis.

Bechara et al. (1997) tested the contention that deciding advantageously requires overt reasoning and explicit knowledge of facts pertaining to premises, options, and outcomes of actions, which are part of an individual's past experiences. Such is the common assumption made in mainstream decision and action theories, including the models used by institutional individualists to explain the emergence of social cooperation. The experiment of Bechara et al. (1997) consisted in comparing normal individuals and patients with bilateral damage to the ventromedial prefrontal brain cortex in a gambling game that involves decision making with built-in uncertainty, rewards, and penalties. The game consisted of four decks of cards with rewards and penalties (decks A and B had higher rewards and penalties than decks B and C) from which a player could choose. Each player was also given a base amount of money at the beginning of the game with the objective of losing the least amount of money by selecting from any of the four decks of cards. Three indicators were used to compare normal individuals with patients: behavioural performance (number of cards selected in each deck), emotional arousal (skin conductance responses) before selecting a card, and the subject's account of how

they conceptualized the game and strategy they were using. Bechara et al. (1997) found that in normal individuals non-conscious biases guide behaviour before conscious knowledge does. Surprisingly, such non-conscious emotional biasing effects help normal individuals to make advantageous choices even in cases where, after having played the game for some time, some normal individuals did not reach a conceptual phase or conscious knowledge of the hidden pattern of the game. A more striking finding was that none of the patients registered emotional arousal (as skin conductance responses) before selecting a card, and despite the fact that some patients reach a conceptual awareness of the decks leading to bad choices, such patients continued to select the bad decks – "the patients failed to act accordingly to their correct conceptual knowledge" (Bechara et al. 1997: 1294). The researchers propose that such biases in normal individuals work together to achieve efficient processing of knowledge and conscious decisions. This evidence on decision making indicates the importance of emotional processes not only as a source of behaviour but also as a necessary element for advantageous decisions in situations with real-life characteristics such as uncertainty, rewards, and punishments.

Building on this evidence and accumulated knowledge from studies of cognitive performance in patients with focal brain lesions, Bechara and Bar-On (2006) use tests developed to distinguish between information processing or cognitive intelligence (e.g., cognition, perception, memory, and executive functioning) and social competence or emotional and social intelligence (e.g., intrapersonal, interpersonal, stress management, adaptability, and general mood). The results from their tests suggest that both forms of intelligence are distinctive in the neural systems that support them. The implication of the evidence from patients with focal brain lesions is that "to perform well and be successful

in one's personal and professional life apparently requires the ability to make emotionally and socially intelligent decisions more than simply a high IQ" (Bechara and Bar-On 2006: 36). To be sure, the distinction between these two forms of intelligence is that socially intelligent decisions require cognitive-emotional mechanisms, but not all cognition requires emotional input. Moreover, we should not give exclusivity of attribution to neural processes for emotional and social intelligence. Instead, emotional and social cognition emerges from "a complex interplay among many structures, in the context of development of a particular culture, and considering the brain as a system that generates behaviour only through its interaction with the body and the social environment" (Adolphs 2006: 281). In other words, the human brain is plastic and intrinsically constituted through its social and environmental connections, and mental states emerge from such relations rather than being the creation of isolated brains (Franks and Smith 1999, TenHouten 1999). The multilevel analysis adopted by emerging inter-disciplines such as social neuroscience demonstrates that more fruitful insights are generated from studying the multiple connections that link different levels of reality to explain human behaviour.

With such elements in mind I hypothesize that the decisions of resource users from the Loreto area to engage in human social cooperative ties are part of a multi-factorial array of emotional and social processes served by neural and body systems that converge for the emergence of interpersonal human relations.

## 7.3 Human Cooperation: From Social and Emotional Individuals through Social Relations to Social Systems

Many scholars agree that cooperative behaviour early in the history of human evolution was a necessary condition for the current success of the human species (Fehr and Fischbacher 2003, Nesse 2001, Sober and Wilson 1998, Sterelny 2003). Yet what mechanisms elicited and continue to support social human cooperation is a topic of recurrent debate. The issue of the nature of human behaviour continues to permeate this debate, which persists in neglecting emotions and constructing large-scale cooperation as an aggregate of individuals' decisions that emerge from "cold" cognition.

From an evolutionarily viewpoint we know that humans developed a significantly larger limbic system or neural supersystem serving affective experience (e.g., drives and feelings) than our cousins the apes. This important anatomical difference leads Turner (2000) to hypothesize that such areas expanded the human's ability for processing, interpreting, and signalling a variety of emotional dispositions early in human evolution and created the necessary mechanisms for the emergence of social bonding and solidarity. Other evidence seems to support Turner's hypothesis. Compared to our cousins the chimpanzees, human children (linguistic and pre-linguistic) show a stronger tendency for altruistic helping toward non-kin, even without prompting (Silk 2006, Warneken and Tomasello 2006). We also have an innate drive for attachment and contact, characteristic of the child-caregiver pair where neuroactive peptides produced in the brain work to soothe and create feelings of comfort. Such substances remain active in everyone throughout life (Franks and Smith 1999). Interestingly, it appears that the necessity for purposeful imitation as a requirement for being part of a group is only

experienced by humans, and the unpleasant feeling of being an outsider can be generated by electrical stimulation of the human brain (Brothers 1997).

This evidence suggests that we are adapted for cooperation, most likely enabled by our social and emotional nature. Indeed, it has been argued that genuine human cooperation in "social dilemmas" is based on the emotion of sympathy (Sally 2000), and that the cooperation motivated by threat of punishment or ordinary material incentives as explained in repeated Prisoner's Dilemma games is more aptly called prudence than cooperation (Frank 2001). Authentic cooperation, Frank (2001) argues, is more likely to be based on emotions. To Franks' (2001) argument we can add that social cooperation is more likely to involve emotional and social intelligence (Bechara and Bar-On 2006).

That people may commit to cooperation out of emotional bonds does not exclude the fact that people may choose to defect rather than cooperate. But even defection can be explained by decisions aided by a cognitive-emotional mechanism rather than by over-intellectualized conceptions of human behaviour. For instance, people assign an initial valence (positive or negative) in response to practically every category of stimulus including persons (Damasio 1995, Frank 2001, Franks and Smith 1999). Attraction to similar-seemingly people, certainly enabled by our social and emotional brain, may play a key role in how we make judgments about other people and the likelihood that we may engage in transactions with people that we hardly know. It is possible then that people choose to defect because a person is associated with a negative emotional valence from previous interactions and associated negative experiences, or because of the lack of an emotional bond, as in the case with perfect strangers (Frank 2001). Using neuro-imaging

techniques on people playing Prisoner's Dilemma games, Rilling et al. (2002) have shown that we feel rewarded when behaving cooperatively toward strangers.

Despite this, we should also recognize that interests, beliefs, intentions, doubts, and other mental processes influence human action as well, and thus have a bearing on social facts (Bunge 1996). For example, in testing the hypothesis that repeated exposure to a behavioural model that assumes pure interests in the narrow sense tends to inhibit co-operation, Frank et al. (1993) found that training in mainstream micro-economics makes people more likely to defect than non-economists in experimental Prisoner's Dilemma games. Reason is causally effective in human action, but not all behaviour is caused by conceptual knowledge as demonstrated by Bechara et al. (1997), and reason without emotion is socially ineffective (Bechara and Bar-On 2006). Indeed, there is intriguing evidence showing that the average person perceives herself to be worse off when engaging in thorough conscious deliberation before choosing in complex matters (Dijksterhuis et al. 2006), and deliberative, rational thought falls short of expectations for producing political tolerance (Kuklinshki et al. 1991). While I am far from suggesting that rational thinking should be abandoned, such evidence indicates that deciding for one's welfare on personal and social matters could be less amenable to abstract reasoning, which in principle leads to personal optimal choices, than gut feelings or what "feels right to do". Indeed, this evidence is consistent with the distinction between cold and emotional and social cognition (Bechara and Bar-On 2006).

The evidence discussed supports the idea that decisions to engage or not in social human cooperation is served by a cognitive-emotional mechanism. The emotional mechanisms are likely to operate as biasing effects as reported by Bechara et al. (1997) or

as subjective pro-social feelings of solidarity, altruism, trust, and empathy (Damasio 1995). For instance, the strong effect of pro-social feelings in cooperative ties became apparent from the testing of my questionnaire when the qualifier "trustworthy" screened out sources of unreliable information, even for impersonal sources of information as in the case of management institutions.

At a more molar level, the socially and affectively related individual allows us to move away from the paradoxes that an oppositional view creates when conceptualizing individual-collective and agency-structure linkages. In particular, related individuals display positional and structural emergent properties capable of accounting for large-scale social effects as argued in Chapter 6. It is then related rather than just interacting individuals from which large social phenomena emerges.

The direction and form that macro social effects can take will largely depend on the cultural understandings or social practices and particular supporting institutions influencing social relations (Emirbayer and Goodwin 1994). The outcome, as I see it, is that our concerns with the role of communities in management and conservation are largely misplaced when focusing on the plurality of interests, and narrowly-scoped when prescribing mainly institutional building (Agrawal and Gibson 1999). To indulge in a metaphor, we must put the social and emotional cart before the institutional horse, but once in motion both become interdependent or characterized by causal cycles. Thus, a participatory approach to conservation and management of common-pool resources that prescribes institutional building as the most important condition for effective community-based conservation and natural resource management without concern for the emotional

processes that underpin social relations and pro-social feelings and behaviours is likely to fail.

In this chapter I have reviewed the literature from brain research and cognitive neuropsychology to support my contention that social life and, in particular, human cooperation is based on our inherent social and emotional nature. My claim that the internal function (F1) of social networks is social and emotional support is also consistent with the empirical findings from this research. If we accept the view that social networks' internal activity (F1) is social and emotional support and that cognitive-emotional mechanisms serve our social and emotional engagement, then managing social networks implies finding out what they can do (F3), what value F3 they can have, and their structural characteristics (Chapters 5 and 6). It also implies controlling the very social and emotional mechanisms that cause social networks to emerge or become undermined. In short, participatory policies in conservation and natural resource management that wish to tap into social networks must be guided by a social and emotional relational view. In the next and final chapter, I discuss the implications of a relational view for participatory policies in conservation and natural resource management and recommendations for the Loreto Bay National Marine Park.

# CHAPTER 8
# A SOCIAL RELATIONAL APPROACH TO PARTICIPATORY POLICIES IN CONSERVATION AND MANAGEMENT

Modern natural resource management and biological conservation were initially conceived as the application of biophysical scientific knowledge to the rational use and protection of biodiversity (Ewert et al. 2004, Mascia et al. 2003). In the 1970s a series of scientific journals and academic programmes emerged regarding conservation, and natural resource and environmental management (Brosius 1999, DeSanto 1977, Harkins 1977). Although it is unquestionable that scientific knowledge of the biophysical conditions sets limits on the possibilities for managing and conserving biological diversity, environmental policies are social (Brechin et al. 2002, Mascia et al. 2003). Yet, providing policy recommendations is especially challenging in protected areas that have been established with the dual purpose of protecting biological diversity and promoting development of local communities through sustainable natural resource use (Adams et al. 2004, Berkes 2004, Brechin et al. 2002, Locke and Dearden 2005, Songorwa et al. 2000, Wilshusen et al. 2002). However, it is widely accepted that one of the guiding principles for managing people-oriented protected areas is the effective involvement of local groups in the decision-making process. Indeed, participatory approaches to conservation and natural resource management are becoming increasingly prominent (Ashby 2003, Pahl-Wostl and Hare 2004).

In this Chapter, I propose a social relational approach as the underlying principle for promoting cooperative solutions to resource use and conservation of fisheries resources for the Loreto Bay National Marine Park. My recommended principle is based on the results and theoretical arguments on the function(s) of social networks made in my dissertation. I recognize that social policies can be drawn only from scientific knowledge jointly with value judgements, general principles, and goals (Bunge 1999). The latter three are distinctively moral and ideological, and are seldom acknowledged by scientific disciplines having practical implications (Ludwig 2001). I argue that the people-oriented approaches currently promoted in social policies for conservation and natural resource management are based solely on a pre-occupation with how we organize social life, assuming a pluralistic worldview. That is to say, it is commonly assumed that finding cooperative solutions for sustainable resource use and conservation mostly implies accommodating a diversity of perspectives of individuals or interest-based groups, particularly through the design of institutions (Berkes 2004, Brechin et al. 2002, Ostrom 1990, Pretty and Smith 2004). Such view reflects a political pluralistic view that characteristically endorses moral individualism. I suggest that such a view, at best, produces unstable outcomes and, at worst, entrenched conflicts. I argue that building social relations, based on social and emotional engagement, and promoting a new practical understanding within current social practices should be a primary objective in participatory approaches. Such processes for social change require visionary cosmopolitan leaders embedded in social networks.

## 8.1 Social Policy in People-Oriented Parks

Social policy in people-oriented parks seeks to "increase the development options of resource-dependent rural communities as a means of increasing nature protection" (Brechin et al. 2002: 44). This particular policy emerged from fields that advocate sustainable use, participation of rural populations in research and development, and inclusion of local perspectives and knowledge in environmental management (Ashby 2003, Berkes 2004).

Conceived under diverse circumstances, multiple programmes have been guided and implemented in alternative ways under the people-oriented parks policy (e.g., Community-based Natural Resource Management and Integrated Conservation Development Projects, Brechin et al. 2002; and Community-based Wildlife Management, Songorwa et al. 2002). It has been difficult to establish why such programmes sometimes work and other times fail, but the advocates of people-oriented conservation agree that failure or success lies in the design of institutions and social organizations created to implement such programmes (Berkes 2004, Brechin et al. 2002, Mansuri and Rao 2004, Pretty and Smith 2004). Recommendations of advocates of people-oriented parks are diverse and they may range from more effective inclusion of resource users in the decision-making process through partnerships between local groups and government to investments in social capital. The challenge, eloquently stated by Berkes (2004: 628), is one of "accommodating a diversity of perspectives and developing a pluralistic cross-cultural conservation ethic". Indeed, Berkes' (2004) remark points to the implicit meta-policy norm or principle guiding the democratization of the environment and development agenda: political pluralism. I argue that political pluralism as a meta-policy

principle permeates the design of modern organizations, institutions, and participatory approaches associated with the environment and development agenda that has influenced the direction of people-oriented parks. Political pluralism is an individualistic project for social order that goes against a relational sense of community and pro-social behaviours such as trust, reciprocity, and solidarity because it is inherently adversarial rather than cooperative in nature. Yet, even in the adversarial context promoted by political pluralism, cooperation emerges. The very complex co-management of salmon fisheries in Washington State characterized by multiple stakeholders and marked cultural differences among these stakeholders illustrates the human capacity for cooperation, even in the context of political pluralism (Singleton 1998). Why sometimes cooperation flourishes and other times it fails to emerge remains a contentious issue, but it has never been examined as an issue of political pluralism. To be sure, a distinction should be made. Pluralism as diversity of views or cultures is an essential element of the human experience. But a cultural trait of political pluralism that glorifies the individual and his/her interests is socially corrosive.

## 8.2 Political Pluralism in Institutional Building for Conservation and Development

One of the most important features of modern democracy is the affirmation of the diversity of interests and beliefs of the citizenry. Indeed, contemporary liberal democracy is associated with the extension of the franchise and the consolidation of social and political pluralism (McGrew 1995). Political pluralism assumes that there is inherent conflict of interests, convictions, and lifestyles of individuals or groups, and claims that negotiation and dialogue can resolve this conflict by accommodating the existent

diversity of demands (Mansbridge 1981). Therefore, pluralists construct the social order as an aggregate of individual values and preferences, and they believe that the solution to social problems should focus on the role of individuals and their values (Sunderlin 1995).

Demands, interest groups, stakeholders, multi-stakeholder, multiple-parties, negotiation, coexistence, win-win outcomes are some examples of the environment and development language that implicitly acknowledges an inherent conflict of interests among individuals and groups. This is not to deny that there are often conflicts between individuals and groups. What is problematic is the normative view advanced by political pluralists that the only legitimate function of institutions is to safeguard individual liberties and interests (Bunge 1996, Heine et al. 1999).

This normative view underpins the institutional choice school that has become the most influential view in participatory approaches to the conservation and management of common-pool resources (Agrawal and Gibson 1999, Berkes 2004, Ostrom 1990, Pretty and Smith 2004). Unfortunately, this individualistic moral principle is inconsistent with the creation of a sense of community, building of social trust, and acts of reciprocity and solidarity, which are relational qualities of social human systems. Moreover, organizations, institutions and political processes built on a pluralistic view and rationality tend to be ephemeral and evanescent (Earle and Cvetkovich 1995, Vandergeest 2006). For instance, Pretty and Smith (2004: 637), implicitly embracing a pluralistic view for conservation through investments in social capital, acknowledge that "promising programs may falter if individuals start to burn out, believing that investments in social capital are no longer paying off". Participation in social life is seen as a disutility only offset by the benefits the individual may obtain.

Because pluralist organizations, institutions, and political processes are assumed to be driven by conflict, and social order is seen as nothing but compromises among "rational" individuals, distrust rather social trust transpires in these processes. That is to say, "rules and sanctions give individuals the confidence to invest in the collective good, knowing that others will also do so, and sanctions ensure that those who break the rules know they will be punished" (Pretty and Smith 2004: 633). In this conception, rules and sanctions are a functional substitute and not a producer of social trust (Granovetter 1985). Basing cooperation and social trust on an assessment of a number of attributes related to other individuals or institutions requires the individual to engage in various processes of information acquisition and integration, contrary to contemporary psychology that depicts individuals as normally seeking cognitive simplicity (Earle and Cvetkovich 1995). If participatory political processes are conceived and practiced on individualistic principles, how do we explain the various successful cases of multi-party resource management?

## 8.3 Social Learning and Resource Management

While institutional individualists adopt a "rationalist" approach that emphasizes coercion, cost/benefit calculations and material incentives as the basis for compliance, constructivist theorists emphasize learning and social interaction as an important source of agent compliance with normative prescriptions (Checkel 2001). In this sense, the concept of social learning has evolved from "passive" individuals observing and modelling the behaviours, attitudes, and emotional reactions of others to inform his/her own behaviour (Bandura 1977), to social learning as engaged individuals in social practices (Pahl-Wostl and Hare 2004). Indeed, social learning has gained increased advocates in resource management, by those who believe that management is not "a

search for optimal solutions to one problem but an ongoing learning and negotiation process where a high priority is given to questions of communication, perspective sharing and development of adaptive group strategies for problem solving" (Pahl-Wostl and Hare 2004: 193-194). These authors argue that in the process of resource management, "social involvement (e.g., the generation of social capital, the development of new social practices) is as important as content management (e.g., the development and communication of knowledge...)" (Pahl-Wostl and Hare 2004: 194). The hallmark of the social learning being advocated in resource management is that of double-loop learning, "in which the learner becomes aware of the assumptions and values on which it is based and is capable of major shifts of reference" (Milbrath 1989: 94)[31].

In fisheries management, Pinkerton (1994) has argued that individuals and groups cannot move from conflict and unsustainable resource use without realizing the possibility of a new social order. Such possibility is more likely to be achieved through social learning when "parties learn to redefine situations in terms of what they can achieve collaboratively" (Pinkerton 1994: 2374). Not only must participants restructure their perceptions, but they must also develop social relations and trust, in many cases, with previously considered unknown and/or untrustworthy individuals (Pahl-Wostl and Hare 2004).

Thus, it appears that the essential contribution of social learning processes for participatory approaches in resource management is the emergence of a new understanding of being part of a social group or "feeling of group identity" (Checkel 2001: 563). Thus, social learning can overcome the individualistic ethic of political pluralism. However, it is not the case that social learning is necessary because humans

[31] Single loop learning is experientially based incremental learning (Milbrath 1989).

are inherently individualistic. Indeed, the current pluralistic condition of most modern societies can be traced back to 17th century ideology that identified aggregated individual interests with the common good (Hirschman 1977). Individualism and positive self-regarding are not universal traits of humans, they are culturally constructed and expressed by individuals in response to particular practices: i.e., they are learned and contextual (Heine et al. 1999, McGoodwin 1980, Schatzki 1996, 1997, 2002).

If a new practical understanding based on the perception of social identity is a necessary condition for cooperative solutions to conservation and natural resource management, how can such understanding become a social innovation? I submit that such a social innovation has a practical understanding which is relational and characterized by double-loop learning. I argue that social innovation is more likely to occur through social networks in conjunction with visionary cosmopolitan leaders. To better understand my proposal, I draw a distinction but not separation between the organization and structure of social life.

## 8.4 Organization and Structure of Social Life

A key contention by relational sociologists is that human action in the world is organized through categorical affiliations (e.g., race, social class, religion), but motivated by the structure of tangible social relations in which persons are embedded (Emirbayer 1997). However, organized social life and the structure of social relations are not detached. Organized social life can change the structure of social relations, although indirectly: i.e., through the practical understanding characteristic of particular social practices (Schatzki 1997). For instance, Vatn (2001) indicates that although we may expect common property regimes to foster common values and interests to a greater extent than private

property regimes, wider cultural and social systems may be of greater importance than those invoked by the property-based regime. Thus, "badly working common property regimes may even foster less community identification than well working markets based on individualized private enterprises" (Vatn 2001: 676). These remarks suggest that it is practical understandings and not directly our organized social world that affect the structure of social relations and nourish particular values. Moreover, the relationship is not a linear causal chain but rather a causal cycle where "societies strongly supporting individualistic values will institute private property regimes as much as possible" (Vatn 2001: 676). The emergent structure of social relations associated with a social practice would enable and constrain the dynamics of individual actions and the social system as a whole: this much I have argued from my analysis of social networks of sharing of information in Chapters 5 and 6.

Indeed, organized social life is largely ineffectual or ephemeral in the absence of social relations and pro-social behaviours of trust, reciprocity and solidarity (Fukuyama 1995, Granovetter 1985, Lomnitz 1988, Putnam 1993, Scott 1998, Singer 2000, Wallis and Dollery 2000). This is acknowledged by scholars who endorse institutional individualism. Thus, Ostrom et al. (1994: 329) remind us that those who have developed trust and social capital "can utilize these assets to craft institutions that avert the CPR [common-pool resource] dilemma and arrive at reasonable outcomes". The implication is that the policy issue is not so much creating institutions "as rules of the game" to deal with conservation, management and development issues, but the often taken-for-granted social relations and pro-social behaviours and cultural understandings that are necessary to make such institutions viable. Moreover, because social relations and pro-social

behaviours underpin organized social life, the role of formal hierarchies is less important in bringing order to social life, as has already been argued by Granovetter (1985) regarding the role of social relations in bringing order to economic life. A case in point is the Mondragón Cooperative Corporation network, an apparent contradiction in terms for theoretical economic standards.

## 8.5 The Relational Understanding of the Mondragón Network

The Mondragón network in the Basque Country has derived its success from its fidelity to communitarian principles guiding its organization (McLeod 1997). The communitarian visionary principle to create a new economic order can be traced back to Don José María Arrizmendiarrieta (1915-1976), who was a guiding light and mentor of the founders of the Mondragón network (McLeod 1997, Whyte and Whyte 1988). Don José María Arrizmendiarrieta was a visionary leader who adopted universal principles about moral behaviour in our social relations, but was extremely opposed to dogmatic judgements about institutions in the world; he believed that we should respond to the world as it actually is but with a view to changing it to a "new order" (McLeod 1997). The Mondragón network, which has been judged as highly successful, is instructive not only because it shows that a humanistic cooperative business corporation can thrive in a capitalist society but also that visionary leadership is necessary to transform social systems into dynamic innovative communities. I submit that such visionary leadership is necessary to transform our practical understanding for the building of institutions and organizations supporting conservation and management. I argue that such visionary leadership is effective because it is cosmopolitan in nature; it carries a cultural understanding of community interdependence as concern and respect for others; and it

achieves enhanced dissemination of cultural understandings through social networks. My policy recommendation for conservation and management of fishery resources by the rural communities in the Loreto Bay National Marine Park consists of these elements.

## 8.6 The Role of Leadership and Cosmopolitanism in Participatory Conservation and Development

Earle and Cvetkovich (1995) contend that social trust is an extension of man, whose message is community – the meaning of community being social cohesion through value equivalence and sharing. But there is a paradox: social trust based on shared cultural values is necessary for community, which is also based on shared cultural values. Earle and Cvetkovich (1995) suggest that leadership is the key to this paradox because it helps to create innovative communities by making people aware of possible communities, and possible values they could share. Leaders create a context in which people can critically evaluate and revise what they believe by providing them with alternative visions of what is desirable and possible – leaders provoke a re-examination of premises and values and stimulate deliberation: i.e., double-loop learning. This visionary leadership is cosmopolitan because it is about creating common cultural values to conceive alternative futures (Earle and Cvetkovich 1995). This stands in opposition to a populist leadership that endeavours to determine existing public values and design actions.

Earle and Cvetkovich (1995) propose that a cosmopolitan leader should encourage acknowledgement of four principles: 1) one's personal limitations – belief in self-sufficiency is harmful to oneself and a barrier to social trust; 2) the contributions of one's community to one's life – without communities, human life and accomplishments are impossible; 3) knowledge as a product of social interaction – the purpose of

knowledge is to cope with reality; and 4) create commonalities with persons from other communities and cultures. All these principles are in essence relational and coincide with the view that we should not encourage the creation of dependent citizens. However, these principles stand in sharp contrast to the idea that we should create "entrepreneurial citizens" or "group-based programmes for environmental improvements" (Ostrom 1998 in Pretty and Ward 2001: 221). The latter two are characteristic of a pluralistic view based on the singular and independent and it is the main point of a liberal society; i.e., the aim of a pluralistic liberal society is not to invent or create anything, but simply to make it as easy as possible for people to achieve their widely different private ends without hurting one another (Earle and Cvetkovich 1995, Bunge 1999).

The creative cosmopolitan leader is undermined by a pluralistic public participation based on diversely separated individuals, favouring narrow, tight, separate communities, a unitary self and fixity within traditional cultural limits. Public participation requires cosmopolitan leaders and individuals diversely related, with a view that favours overlapping communities, multiple selves and change (Earle and Cvetkovich 1995: 150-151). A cosmopolitan view seeks to transcend essentialisms as social categories and over-socialized forms of human action such as norm-following models. It encourages division of labour and acknowledges human limitations – e.g., not everybody can be a policy analyst or resource manager. Thus, science and technology have an important role in expanding the social and ecological context under which common understandings can emerge to deal with increasingly complex social and ecological systems. For instance, in the Mondragón economic network, there is a priority on social and moral concerns with a strong appreciation of technology (McLeod 1997). This hardly

suggests that, for instance, conservation should be rated second over, say, jobs or incomes, if only because no social system is viable without healthy and diverse ecosystems. The converse appears likely to be true too: healthy and viable ecosystems depend on viable human communities (Jentoft 2000a). Any ecosystem will be overwhelmed by competing demands if there are not advocates fighting of its health and actively monitoring and protecting it. This is particularly relevant in modern times with fast disappearing resources and an exploding human population. The days when ecosystems could be healthy if just left alone are gone.

In sum, cosmopolitan creative leaders and public participation are necessary to create social change. However, how do cosmopolitan creative leaders and public participation translate into social innovations and durable collective action for sustainable development and conservation? I submit that innovation and collection action occur primarily through social networks.

## 8.7 Community Innovation and Collective Action through Social Networks

While creativity is grounded in visionary leadership, social innovation involves the widespread adoption of transformed practices. The diffusion, spread, or generalization of practices is a social phenomena grounded in embedded individuals in a milieu of social relations. Notice that the content, or direction of such practices, is culturally determined through practical understandings but structurally constrained and enabled (Schatzki 1996). Moreover, individual agency is not entirely conditioned by the structure of social networks; an individual's position can change the efficiency with which social networks operate (Chapter 5 and 6). To be sure, an individual's network position may serve

intentionally strategic purposes and provide the better positioned individual with some advantage. However, the fluidity of social relations is likely to produce only temporary advantage and cognitive limitations on the structure of social networks also places an important constraint on such strategic agency (Kossinets and Watts 2006, Granovetter 2003).

More importantly, social networks operate along the lines of a cosmopolitan public participation, where individuals are interconnected in diverse and dynamic ways, communities overlap, and social relations transcend the boundaries of social and political categories (Chapters 5 and 6). It is through social interaction and shared affiliation (e.g., common spaces of interaction such as attending the same church, sport activities, etc.) that social networks emerge and evolve over time (Kossinets and Watts 2006). One of the key practical aspects of social networks is that they can achieve tasks that individuals alone cannot (Chapters 5 and 6). In that sense, social networks are more effective and more efficient than an individualistically-based collective action. Because social networks are grounded in related individuals, it does not make sense to conceive of networks as the collective action of independent individuals. Such inconsistency is evident in Carlsson (2000) who equates a relational phenomenon (policy networks) with an individualistic conception of cooperation (collective action). What does my argument for a social relational view imply for how the Loreto Bay National Marine Park managers may reconcile biological conservation and sustainable use of natural resources through a participatory approach?

## 8.8 Tapping into Social Networks for Conservation and Management of Fishery Resources of the Loreto Bay National Marine Park

In Chapter 6 when I discussed the functions of social networks, I indicated that the social network data I have collected could be used with the objective of making more effective the diffusion of information via social networks by involving central individuals from the social network of sharing of information in the park's technical advisory committee. In light of the argument I have made in the present chapter, "creating" cosmopolitan leaders embedded in social networks should facilitate social change. However, there is a broader practical implication for park managers suggested by the fact that cooperative ties for accessing fishery resources occur as part of social relations. Managers could become leaders or central figures in the networks of social relations of the resource users s/he is trying to engage in conservation and management. Indeed, formal arrangements in hierarchical organizations often become secondary in practice, and individuals engage in information exchanges and collaborations that do not correspond to formal channels (Brass 1984, Brown and Duguid 2000, Granovetter 1985). Institutionalized rules cannot capture this social phenomenon, but in a figure of speech, they piggyback on such informal practices to achieve its goals.

Interestingly, the relevance of informal channels and practical understanding to achieve participation has been recognized by park managers. In 2001 the director, at the time, of the LBNMP commented that the progress they were making in involving fishermen in the management process was the result of one staff member's efforts to establish social relations with resource users: "you always see him having coffee or interacting with resource users in informal settings". Becoming proficient at "reading"

social networks is a critical aspect for accomplishing key organizational functions (Goleman 1998, Krackhardt and Hanson 1993). If we add a more systematic study of the social networks in which resource users interact, a park manager should be in a good position to tap into these social networks. There is a caveat, however. For an individual to mobilize a social network, s/he must be a central and legitimate figure in a network. In my study of personal contacts, a condition of trustworthiness characterizes all the personal contacts used by resource users. Thus, a resource manager who wishes to tap into the power of social networks needs first to become a central and legitimate figure in social networks. A resource manager embedded in social networks requires long-term commitments to a conservation area and, perhaps more importantly, an understanding of what it means to be socially embedded in social networks. The experts (social scientists, neuroscientists, social psychologists, and social network analysts) tell us that this implies becoming socially and emotionally engaged (Bechara and Bar-On 2006, Goleman 1998, Krackhardt and Hanson 1993).

Emphasizing the management of social networks as a primary strategy for participatory conservation and management of natural resources does not imply that building institutions-as-rules does not play an important role. It does. It does imply, however, that institutions-as-rules are necessary but insufficient for understanding the dynamics of social systems using common-pool resources. Thus, rules cannot be the only or primary policy concern to ensure the conservation and sustainable use of common-pool resources. This much may be conceded by the advocates of the institutional choice school (Dietz et al. 2003). Yet the most important theoretical implication of a social relational approach is the rejection of the individualism inherent in this school (Klooster

2000, McCay and Jentoft 1998). That is to say, a social relational approach is based on the view that social facts are produced by related individuals and the existence of materially based wholes that display qualitatively irreducible or emergent properties. Social institutions, conflict, cooperation, legitimacy, access, and exclusion are key emergent properties of social systems using common-pool resources that cannot be reduced to individual attributes (Jentoft 2000a, Klooster 2000, McCay and Jentoft 1998). Aggregating individual choices does not amount to an emergent property, let alone a social system (Chapter 6). In other words, "an aggregation of private virtues can result in a state that is everything but virtuous" (Hirschman 1977: 119). This is not a methodological paradox but an ontological condition.

In sum, implementing a relational policy for conservation and development requires visionary leaders promoting a cosmopolitan practical understanding that effectively becomes an innovation through participation of individuals embedded in social networks. The relational social policy I am advocating can be said to rest on one moral principle: concern and respect for others. The eminent economist, Kenneth J. Arrow, has provided an eloquent reason for this:

> "Concern without respect is at best paternalism and can lead to tyranny. Respect without concern is the cold world of extreme individualism, a denial of the intrinsic social nature of humanity" (Arrow 1992: 45).

The challenge of participatory approaches to conservation and natural resource management is not to accommodate the diversity of individual and group interests but to promote social innovation by envisioning possible futures grounded in a moral principle of concern and respect for others, including the environment. To my knowledge, the most powerful instrument for social innovations is to be found in our inherent social and

emotional nature expressed through affective social relations and pro-social behaviours that underpin our social networks.

# CONCLUDING REMARKS

Promoting cooperative solutions to the conservation and development of rural communities in the context of protected areas is still a controversial issue, to a large extent, because there is still no consensus on what motivates people to cooperate. On the one hand, we have an individualistic model of human behaviour or an under-socialized view that detaches individuals from their social relations. On the other hand, the apparent rival of this individualistic model is the norm-following model of human behaviour. This model, however, also neglects social relations because it over-socializes individuals by invoking acquired cultural habits, customs, and norms that are followed automatically or mechanically. I argued that both models are used by institutional choice scholars to describe self-governing and open-access regimes of common-pool resources.

To account for how social relations affect the access to fishery resources, I investigated how resource users from seven rural coastal communities access and use fishery resources within and outside the waters of the Loreto Bay National Marine Park. The fisheries in the Loreto area have been characterized by a weak regulatory regime, high resource-dependence livelihoods, poor development of social organizations, extreme poverty, and signs of over-exploitation of extensive fishery resources. The latter indexes the most important feature of the tragedy of open-access model in which individuals following their self-interest lead to the over-use of fishery resources, as first articulated by Garret Hardin in 1968.

A review of the conditions under which natural resources have been used and accessed before and after the arrival of the Spanish in Baja California and contemporary history indicates that the over-use of multiple terrestrial, coastal, and marine resources have been the result of purposeful policies and programs aimed at bringing order and rationality to the use of these resources: the tragedy has been the opposite of the one imagined by Garret Hardin. The creation of the Loreto Bay National Marine Park was the result of a collaborative political movement to exclude non-local shrimp trawler boats rather than emerging from a community concern for biological conservation. To be sure, the park has produced important improvements in the way natural resources are being used, although not without complications. A limited understanding of the social dynamics underpinning the access to fishery resources by park managers has hindered the process of implementing a participatory policy for conservation and community development. To fill this gap, I looked into the cooperative ties that link resource users from seven rural coastal communities that have been approached by park managers to implement the park's participatory policy. I framed this research within a social relational view and contrasted it with institutional individualism, the most widely accepted view on how common-pool resources such as fisheries are accessed and used.

I proposed the thesis that resource users from these rural communities engage in cooperative ties of information sharing for accessing fishery resources that enable and constrain their participation and the benefits they derive from social networks. I further contended that these cooperative ties transcend social categories and geopolitical boundaries, and that it was by virtue of social relations that social life is motivated and organized through social categories.

In Chapter 5, I adopted a global-level of analysis to explore the relationship between cooperative ties and social categories and its implications for collective action and conceptualization of the important concept of community. In that chapter I made a basic distinction between latent and manifest functions of social networks to demonstrate that networking activities could be activated initially to serve a psychological need for emotional connection, but could secondarily be continued and reinforced by their positive effect on mutual aid and its resultant social solidarity. I concluded that despite the nuanced patterns in the degree to which social relations were explained by social categories, social human communities are glued together by social relations and pro-social behaviours (e.g., trust, reciprocity) rather than being just an aggregate of individuals differentiated only by their interests as structured by institutions. Yet, I acknowledged the important role of individuals in the production of networks. Thus, in Chapter 6 I adopted an actor-level of analysis to explore some factors that may explain the prominence of an individual in the network of information sharing. How important an individual is in the network of information sharing as focal point and controller of information was found to be a function of the occupation, years of fishing experience and years of residence. However, the effect of these factors did not always hold across types of social relations and communities. In Chapter 6 I expanded the distinction I made in Chapter 5 between latent and manifest functions of social networks by proposing five logically related concepts of functions of social networks. I argued that this functional framework provides the basis for how social networks can be tapped for crafting participatory policies for conservation and management of fishery resources. My most contentious assertion in this framework is that the internal function of social networks is

social and emotional support, and by implication such internal function is responsible for how effective and efficient social networks are at achieving supra-individual tasks.

To support my contention about the internal function of social networks, I reviewed the literature from brain research and social cognitive psychology to propose the hypothesis that individuals' choices are served by cognitive-emotional mechanisms rather than just being elicited by "cold" cognition. I proposed that these mechanisms also served the cooperative ties reported by resource users in the Loreto area. In sum, my empirical work and evidence from other disciplines support the philosophical view that everything is a system or part of a system. Social life is relational.

In light of this important conclusion, I criticized political pluralism as the meta-policy guiding principle of participatory policies for conservation and natural resource management because this principle is individualistic. I proposed that a participatory policy for conservation and natural resource management should move away from this principle that is adversarial rather than cooperative. In other words, the challenge of participatory approaches to conservation and natural resource management is not to accommodate the diversity of individual and group interests but to promote a cosmopolitan cultural view through social learning spearheaded by leaders embedded in social networks. In particular, I proposed that our meta-policy principle guiding this cosmopolitan cultural view should be respect and concern for others, including the environment. If the Loreto Bay National Marine Park managers wish to tap into the social network of information sharing or any other social network, they may need to have a long-term commitment to their conservation areas but, more importantly, to become socially and emotionally engaged in social networks.

The most important implication of a social relational view is a rejection of the individualism inherent in the institutional choice school. Interestingly, the late Garret Hardin (1968: 1244), perhaps inadvertently, hinted at this when he noted, "we can make little progress in working toward optimum population size until we explicitly exorcize the spirit of Adam Smith in the field of practical demography". The spirit of Adam Smith is individualism: a radical ontological, epistemological, and moral philosophical view that has not been completely exorcized.

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# APPENDICES

## Appendix 1

Statement used to obtained verbal consent from all research participants informally interviewed or responding to my survey questionnaire. I translated the statement into Spanish.

> "The purpose of this study is to understand the role of social networks in the access to, and use of, fish resources in the Loreto National Marine Park. This study is sponsored by the International Development Research Center of Canada and the Canon National Parks Science Program for the Americas. I am conducting this study as part of my graduate studies at Simon Fraser University, British Columbia, Canada. Your participation in this study is voluntary and you may choose to keep all the information that you provide confidential. You can also choose not to answer any of the questions and you can withdraw your participation at any time during the interview. You will be asked to answer some questions about yourself and relations with fishermen and other people with whom you go to for advice regarding the state of the fisheries in the park. You will be also asked about your relations of friendship and kinship with fishermen and other people".

If the respondent agreed to participate in the study, I provided him/her with the following information.

> "Regarding the information that you are providing during this interview, how would you like to be cited in this study – by your name, your organization, or as a respondent?
>
> If you have any complaints about this interview, you should contact Dr. Frank Gobas, Director of the School of Resources and Environmental Management, Simon Fraser University, at: School of Resource and Environmental Management, Simon Faser University, 8888 University Drive, Burnaby, B.C., V5A 1S6. Tel: (604) 291-3103.
>
> Should you wish to obtain a copy of the results of this study, upon its completion, you can contact me at the School of Resource and Environmental Management, Simon Faser University, 8888 University Drive, Burnaby, B.C., V5A 1S6. Tel: (604) 216-0566".

A hard copy was offered to all participants.

## Appendix 2

Survey questionnaire used to evaluate individual and relational attributes of fisheries resource users from the seven coastal rural communities, Municipality of Loreto, BCS, Mexico.

Name: _____ Date: _____

Community: _____

**SECTION A. PROFILE OF THE RESPONDENT**

A1. How old are you?

A2. Where were you born?

A3. What is your religion?

A4. What is the highest level of schooling you have attended?

A5. How many years have you lived in this community?

A6. Do you live all year round in this community?

*If yes, go to A8, if no, proceed to next question*

A7. Where else do you live during the rest of the year and for how long?

A8. Have you live in other places within or outside BCS, and if so, for how long?

A9. How many people live in your house, including your self and what is your relation with them?

A10. Besides you, who else works in a remunerated activity in your house, and in what activity?

**SECTION B. SKILLS, KNOWLEDGE AND FISHING PRACTICE**

B1. When did you start and who taught you how to fish?

B2. What was the first type of gear you learned to use?

B3. Which of the following fishing gear types do you use, do not use anymore but knows how to use, and who taught you how to use each of them?

| GEAR TYPE | USE | KNOWS HOW TO USE | WHO TAUGHT HIM |
|---|---|---|---|
| Hook and line | | | |
| Long lines for sharks | | | |
| Fishing nets | | | |
| Scuba Diving | | | |
| Snorkelling | | | |
| Sport Fishing | | | |
| Other (e.g., harpoon) | | | |

B4. Do you own a boat and fishing gear?
*If yes, go to B6, if no, proceed to next question*

B5. Who owns the boat and fishing gear?

B5. Who do you go fishing with?

B7. What are the northern most and southern most places where you go fishing during the year?

B8. What fish species do you fish, when and with what gear?

**SECTION C. PARTICIPATION IN FORMAL ORGANIZATIONS**

C1. Are you, or have you been, a member of a fishing cooperative or union?
If yes, proceed to the next question, if no, go to C3

C2. What year(s)? What was the name of the organization? Were you only a member or did you have an executive position such as president? Do you think that your participation in each of these organizations was positive, negative, or neither?

C3. Have you worked for the government? If yes, when and doing what?

**SECTION D. PARTICIPATION IN OTHER ECONOMIC ACTIVITIES**

D1. Do you do other activities besides fishing to make a living? If yes, where?

D2. What is the most important fishery in which you participate during the year during the cold and warm seasons?

D3. Do you go to other places in BCS to fish? If yes, what species?

## SECTION E: INFORMATION ON SOCIAL RELATIONS

### Local fisheries

E1. You have been involved in fisheries so some time now, but there are times when knowing where fishing is good is hard to assess. When you are in need of knowing about abundant fishing areas, Who, in your community, do you consult to obtain trustworthy information regarding abundant fishing areas in the municipality of Loreto? What is your relationship (e.g., acquaintance, brother, etc.) with each of those you consult?

E2. Who, from the other communities of the municipality of Loreto, do you consult to obtain trustworthy information regarding abundant fishing areas in the municipality of Loreto? What is your relationship with each of those you consult?

### Foreign Fisheries

E3. Sometimes it is necessary to go to others part in Baja California Sur where fishing opportunities are better. Who, in your community, do you consult to obtain trustworthy information regarding good fishing areas outside the municipality of Loreto? What is your relationship with each of those you consult?

E4. Who, from other communities or locations, do you consult to obtain trustworthy information regarding good fishing areas outside the municipality of Loreto? What is your relationship with each of those you consult?

### Fisheries Institutional Support

E5. Sometimes is difficult to be up to date on how fisheries are being regulated. For instance, regulations such as fishing permits, closed and open areas for fishing, etc. Who, from your community, can provide you with trustworthy information regarding fishing regulations? What is relation with each of those you consult?

E6. Who, from other localities, can provide you with trustworthy information regarding fishing regulations? What is your relationship with those you consult?

## SECTION F. JOB SATISFACTION

F1. If you could earn the same amount of money you make fishing doing other job, would you change your work as fisher for this other job and why?

F2. If you could do other type of work, what would this be?

F3. Why is fishing important for you?

## Appendix 3

ANOVA test of variable homophily for selected attributes and type of social relation (significant values in bold)

| COMMUNITY | P VALUE |
|---|---|
| Agua Verde (AV) | **0.000** |
| Colonia Zaragoza | **0.000** |
| Ensenada Blanca | **0.000** |
| Juncalito | **0.004** |
| Ligüí | **0.000** |
| San Nicolás | **0.000** |
| Ramadita | **0.000** |

| TYPE OF RELATION | COMMUNITY | P VALUE |
|---|---|---|
| Kinship | Agua Verde | **0.0000** |
| | Colonia Zaragoza | **0.0012** |
| | Ensenada Blanca | **0.0000** |
| | Juncalito | **0.0004** |
| | Ligüí | **0.0000** |
| | San Nicolás | **0.0108** |
| | Ramadita | **0.0002** |
| Friendship | Agua Verde | **0.0000** |
| | Colonia Zaragoza | **0.0000** |
| | Ensenada Blanca | **0.0000** |
| | Juncalito | 0.5490 |
| | Ligüí | **0.0000** |
| | San Nicolás | **0.0000** |
| | Ramadita | **0.0002** |

| TYPE OF RELATION | COMMUNITY | P VALUE |
|---|---|---|
| Acquaintance | Agua Verde | 0.3316 |
| | Colonia Zaragoza | 0.1102 |
| | Ensenada Blanca | **0.0040** |
| | Juncalito | 0.8798 |
| | Ligüí | **0.0156** |
| | San Nicolás | 0.6092 |
| | Ramadita | 0.9088 |

| PLACE OF BIRTH | P VALUE |
|---|---|
| Community | **0.0008** |
| Nearby Ranch | **0.0000** |
| Town of Loreto | **0.0002** |
| Outside of Loreto/BCS | 0.2922 |

| TYPE OF RELATION | PLACE OF BIRTH | P VALUE |
|---|---|---|
| Kinship | Community | **0.0100** |
| | Nearby Ranch | **0.0052** |
| | Town of Loreto | **0.0216** |
| | Outside of Loreto/BCS | 0.2746 |
| Friendship | Community | **0.0144** |
| | Nearby Ranch | **0.0186** |
| | Town of Loreto | **0.0048** |
| | Outside of Loreto/BCS | 0.3140 |

| TYPE OF RELATION | PLACE OF BIRTH | P VALUE |
|---|---|---|
| Acquaintance | Community | **0.0122** |
| | Nearby Ranch | **0.0252** |
| | Town of Loreto | **0.0028** |
| | Outside of Loreto/BCS | 0.4270 |

| YEARS LIVING IN CURRENT LOCALITY | P VALUE |
|---|---|
| 1-10 | 0.5062 |
| 11-20 | 0.0886 |
| 21-30 | **0.0000** |
| 31-40 | **0.0000** |
| 41+ | **0.0194** |

| RELATION | YEARS LIVING IN CURRENT LOCALITY | P VALUE |
|---|---|---|
| Kinship | 1-10 | 0.1956 |
| | 11-20 | 0.1692 |
| | 21-30 | **0.0000** |
| | 31-40 | **0.0014** |
| | 41+ | 0.4222 |
| Friendship | 1-10 | 0.3348 |
| | 11-20 | **0.0292** |
| | 21-30 | **0.0392** |
| | 31-40 | **0.0002** |
| | 41+ | **0.0256** |

| RELATION | YEARS LIVING IN CURRENT LOCALITY | P VALUE |
|---|---|---|
| Acquaintance | 1-10 | 0.3396 |
| | 11-20 | 0.0806 |
| | 21-30 | 0.4106 |
| | 31-40 | 0.4164 |
| | 41+ | **0.0162** |

| SEASONAL MIGRATION | P VALUE |
|---|---|
| Non-migrant | 0.2966 |
| Migrant | **0.0000** |

| RELATION | SEASONAL MIGRATION | P VALUE |
|---|---|---|
| Kinship | Non-migrant | 0.2006 |
| | Migrant | **0.000** |
| Friendship | Non-migrant | 0.2362 |
| | Migrant | **0.000** |
| Acquaintance | Non-migrant | 0.1228 |
| | Migrant | 0.3890 |

| NUMBER OF ALTERNATIVE ECONOMIC ACTIVITIES | P VALUE |
|---|---|
| None | 0.1010 |
| One | 0.4204 |
| Two-Three | 0.3866 |

| JOB SATISFACTION | P VALUE |
|---|---|
| Would not change | 0.3732 |
| Would Change | 0.7298 |

| TYPE OF RESOURCE USER | P VALUE |
|---|---|
| Commercial Fisher | 0.1340 |
| Diver/Commercial Fisher | **0.0024** |
| Sport/Commercial Fisher | 0.1400 |
| Commercial/Sport Fisher | 0.1364 |
| Fish Buyer/Permit Holder | 0.1144 |

| YEARS OF FISHING EXPERIENCE | P VALUE |
|---|---|
| 1 - 20 | 0.3318 |
| 21 - 30 | 0.3576 |
| 31 - 40 | **0.0052** |
| 40 + | 0.1760 |

| RELATION | YEARS OF FISHING EXPERIENCE | P VALUE |
|---|---|---|
| Kinship | 1 - 20 | 0.2992 |
| | 21 - 30 | 0.2656 |
| | 31 - 40 | 0.2690 |
| | 40+ | 0.2270 |
| Friendship | 1 - 20 | 0.4530 |
| | 21 - 30 | 0.1324 |
| | 31 - 40 | **0.0162** |
| | 40+ | 0.3836 |

| RELATION | YEARS OF FISHING EXPERIENCE | P VALUE |
|---|---|---|
| Acquaintance | 1 - 20 | 0.4328 |
| | 21 - 30 | 0.4514 |
| | 31 - 40 | **0.0048** |
| | 40+ | **0.0606** |