EXCLUSIVE FISHING ZONE AS A STRATEGY FOR MANAGING FISHERY RESOURCES BY THE SERI INDIANS, GULF OF CALIFORNIA, MEXICO

by

Luis Bourillón-Moreno

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Artist representation of Seri spearing of *caguama* (sea turtle) at night, possibly inside the Infiernillo Channel with Tiburón Island off in the distance, the hearth of the Seri marine territory.

Para Marisol e Isabella; Gracias por darme el tiempo para terminar, ahora hay que recuperarlo! Las adoro....

Guaymas, Sonora, 13 de Abril de 2002.
TABLE OF CONTENTS

LIST OF FIGURES ................................................................. 12

LIST OF TABLES ................................................................. 14

ABSTRACT ............................................................................. 15

CHAPTER 1 THE SERI PEOPLE AND THEIR USE OF MARINE
NATURAL RESOURCES ......................................................... 17

A. SERI TERRITORY ............................................................... 17
   Historical Occupation of the Coastal Region ....................... 17
   Present extension of the Seri territory .................................. 21

B. SERI SOCIO-CULTURAL SETTING AND USE OF
   MARINE NATURAL RESOURCES ........................................ 23
   The Use of Marine Natural Resources by the Seri ................. 23
   Past Relationships of Seri with Neighbouring Communities
   1600-1930 ........................................................................ 25
      1. Seventeenth and Eighteenth Centuries ....................... 27
      2. Nineteenth Century .................................................. 29
      3. Twentieth Century, until 1930s ................................. 30
   Modern Developments from 1940s to 2000 ......................... 35
      1. Developments from 1940s to 1960s ......................... 35
      2. Developments from the 1970s to 2000 ....................... 51

C. SERI SOCIAL ORGANIZATION AND CHANGES
   PROMPTED BY EXTERNAL ORGANIZATION
   STRUCTURES .................................................................... 61
   Historical Accounts on Seri Social Organizations ............... 61
   Changes in Social Organization caused by external institutional
   structures, from 1940s to 1990s ........................................... 62
      1. Seri Fishing Cooperative ........................................... 63
      2. Ejido of Desemboque and Punta Chueca ................. 63
      3. Tiburón Island Comunal Property .............................. 64
      4. The Council of the Elders ......................................... 64
TABLE OF CONTENTS - Continued

CHAPTER 2 OVERVIEW OF THE CONSERVATION PROBLEM, OBJECTIVES AND STUDY AREA 66

A. MARINE TENURE AND PROPERTY RIGHTS IN FISHERIES MANAGEMENT 66
   Influence of the Tragedy of the Commons Model 66
   Common Property and Natural Resources 70
   Territorial Use Rights in Fisheries (TURFs) 73

B. FOLK MANAGEMENT AND CO-MANAGEMENT OF FISHERIES 76

C. FISHERIES MANAGEMENT IN MEXICO 78
   The bias towards large-scale fisheries 79
   Centralized Bureaucracy and Influence of the Private Sector in Fisheries Management 80
   Mexican Fishing Law: Administration through Entry Controls 82
   Social organization of Fishing 83

D. THE SERI EXCLUSIVE FISHING ZONE 86
   Rights Granted to Seri fishermen 86
   Intrinsic limitations of the Seri EFZ 87

E. OBJECTIVES OF THE STUDY 89

F. STUDY AREA 91
   Infiernillo Channel 91
   Biological Characteristics 91

CHAPTER 3 THE EFFECTS OF THE SERI EXCLUSIVE FISHING ZONE ON FISHERIES MANAGEMENT 94

A. INTRODUCTION 94

B. OBJECTIVES 95

C. METHODS 96
   Ethnographic work 96
   Review of legal documents 99
   History of conflicts over the Seri EFZ 99
TABLE OF CONTENTS - *Continued*

**D. RESULTS** ................................................................. 100
Fisheries Resource Use Patterns in the Region .......................... 100
Interpretation of the limits of the Seri EFZ ........................... 100
Recent Conflicts over Marine Resources between Seris and Mexican Fishermen ........................................... 105
  Conflict One: the “El Perro” conflict .............................. 105
    Description of the conflict ...................................... 105
    Outcomes and Perceptions ...................................... 109
    Role of governments .......................................... 111
  Conflict Two: the “shrimp tax conflict” ........................... 112
    Description of the conflict ...................................... 112
    Outcomes and Perceptions ...................................... 114
    Role of governments .......................................... 116
  Conflict Three: the “Bahía Kino reserve” conflict ............... 119
    Description of the conflict ...................................... 119
    Outcomes and Perceptions ...................................... 122
    Role of governments .......................................... 122
  Conflict Four: the “sierra” conflict ............................... 123
    Description of the conflict ...................................... 123
    Outcomes and Perceptions ...................................... 125
    Role of governments .......................................... 126

**E) DISCUSSION** .......................................................... 127
The limits of the Seri EFZ in the light of resource use patterns .......................... 127
Interpretation of the limits of the Seri EFZ ........................... 131
Conflicts over Competition for Marine Resources and their Outcomes ........................................... 132

**F) CONCLUSIONS AND RECOMMENDATIONS** ................. 146

**CHAPTER 4  THE JAIBA FISHERY INSIDE THE SERI EFZ:**
**COMMON PROPERTY REGIME AND ROLE OF TRADITIONAL ECOLOGICAL KNOWLEDGE IN ITS MANAGEMENT** ........................................... 150

**A. INTRODUCTION** ..................................................... 150
Traditional knowledge of small-scale fishermen and Management ........................................... 151
Seri Traditional Ecological Knowledge ........................................... 152
# TABLE OF CONTENTS - Continued

## B. OBJECTIVES

<table>
<thead>
<tr>
<th>153</th>
</tr>
</thead>
</table>

## C. METHODS

<table>
<thead>
<tr>
<th>154</th>
</tr>
</thead>
</table>

- Biological Aspects of the *jaiba* Fishery
  - (1) Monitoring of the commercial catch
  - (2) Computerized mapping of *jaiba* fishing areas

## Analysis of *jaiba* as a Resource under a Common Property Regime

<table>
<thead>
<tr>
<th>158</th>
</tr>
</thead>
</table>

## Traditional Ecological Knowledge of *jaiba*

<table>
<thead>
<tr>
<th>159</th>
</tr>
</thead>
</table>

## D. RESULTS

<table>
<thead>
<tr>
<th>160</th>
</tr>
</thead>
</table>

- The *jaiba* fishery in Seri waters
  - (1) History of the fishery
  - (2) Fishing methods
  - (3) Fishing areas
  - (4) Historical trends in the catch
  - (5) Descriptive statistics of the catch
  - (6) Federal management regulations

## Analysis of the *jaiba* Resource under Seri Common Property

<table>
<thead>
<tr>
<th>179</th>
</tr>
</thead>
</table>

- (a) Natural and Technical Attributes of the Resource
  - i) Subtractability
  - ii) Exclusion
    - (a) Resource Piracy
    - (b) Illegal Buying
    - (c) Arrangements with Seri authorities
    - (d) Becoming Seri labor
    - (e) Becoming part of the Seri community
  - iii) Indivisibility

- (b) Decision Making Arrangements
  - i) Operational Rules
  - ii) Conditions of collective choice
  - iii) External arrangements

- (c) Patterns of Interaction
  - i) Individualistic behavior and reciprocity
    - within the household
  - ii) Individual vs. community interests
  - iii) Respect or mutual control in fishing areas
  - iv) Interaction between villages
  - v) Community cohesion facing external threats
TABLE OF CONTENTS – Continued

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>(d) Outcomes</td>
<td>210</td>
</tr>
<tr>
<td>Characteristics of Traditional Ecological Knowledge of Jaiba and the Infiernillo Channel</td>
<td>214</td>
</tr>
<tr>
<td>E. DISCUSSION</td>
<td>218</td>
</tr>
<tr>
<td>The jaiba fishery in Seri waters</td>
<td>218</td>
</tr>
<tr>
<td>Federal Management Regulations</td>
<td>227</td>
</tr>
<tr>
<td>Common-property ownership and management of jaiba inside the Seri EFZ</td>
<td>228</td>
</tr>
<tr>
<td>Natural and Technical Attributes of the Resource</td>
<td>228</td>
</tr>
<tr>
<td>Decision-making arrangements</td>
<td>232</td>
</tr>
<tr>
<td>Patterns of interaction</td>
<td>233</td>
</tr>
<tr>
<td>Outcomes</td>
<td>240</td>
</tr>
<tr>
<td>Role of Jaiba Traditional Ecological Knowledge</td>
<td>244</td>
</tr>
<tr>
<td>F. CONCLUSIONS AND RECOMMENDATIONS</td>
<td>245</td>
</tr>
<tr>
<td>APPENDIX 1. LIST OF MOST COMMON MARINE SPECIES CONSUMED BY THE SERI HISTORICALLY, SOME OF WHICH ARE STILL CONSUMED. BASED ON FELGER AND MOSER 1985, AND TORRE ET AL. 2000, COMPLEMENTED WITH ENGLISH COMMON NAMES FROM BRUSCA 1980</td>
<td>250</td>
</tr>
<tr>
<td>APPENDIX 2. LIST OF ACRONYMS AND ABBREVIATIONS USED</td>
<td>252</td>
</tr>
<tr>
<td>APPENDIX 4. RESEARCHERS WORKING IN SERI TERRITORY DURING THE PERIOD OF STUDY</td>
<td>257</td>
</tr>
</tbody>
</table>
TABLE OF CONTENTS - Continued

APPENDIX 5. FISHING PATTERNS IN THE AREAS ADJACENT TO THE SERI EFZ ................................................................. 258


APPENDIX 8. QUESTIONNAIRE USED TO SURVEY THE SERI TRADITIONAL ECOLOGICAL KNOWLEDGE ABOUT JAIBA ................................................................. 266

APPENDIX 9. LIST OF SERI TRADITIONAL GOVERNORS IN THE 1990S AND PERIOD OF THEIR ADMINISTRATION .... 271

APPENDIX 10. LIST OF INTERNAL AND EXTERNAL AUTHORITIES IN THE SERI COMMUNITIES ........................................ 272

REFERENCES ................................................................................. 275
LIST OF FIGURES

Figure 1.1. Map of the historical and present extension of the Seri territory. Modified from Bowen (1983) ................................................................. 18

Figure 1.2. Map of the territory occupied by the different Seri bands. Modified from Moser (1963), and Bahre (1980) .......................... 20

Figure 2.1. Map of the names and main geographical features of the study area, and its locations in the Midriff Islands Region of the Gulf of California ................................................................. 93

Figure 3.1. Map of the different interpretations of the limits of the Seri EFZ 103

Figure 4.1. Location of fishing areas for jaiba in the Infiernillo Channel. Grey polygons represent areas where jaiba traps were placed during fishing seasons of 1997, 1998, and 2001 .......................... 164

Figure 4.2. Trends in the catch in tons of jaiba landed in Sonora and the Bahía Kino region from SP data. Also the trend in catch from all fisheries in the Infiernillo Channel landed at the SP office in Bahía Kino. Data from official records reported from Sonora catch in Molina-Ocampo (2000b), Bahía Kino catch in Pérez-Ríos (2001), and Canal de Infiernillo catch in Bracamonte (2001) ................................................................. 166

Figure 4.3. Trends in the catch (kg) of jaiba landed in the Bahía Kino region, and from catch coming from all small-scale fisheries in Canal de Infiernillo (CDI) and Bahía Kino (BK). All from official SP data, as reported in Pérez-Ríos (2001) for BK-jaiba, in Bracamonte (2001) for CDI-All, and in Bourillón et al. (1999) for BK-All ................................................................. 166

Figure 4.4. Daily production in kg of jaiba landed by three selected Seri fishermen from Punta Chueca .................................................... 169

Figure 4.5. Fluctuation in the variance with increasing sample size for the catch sampled on July 30, 1998 ................................................................. 171

Figure 4.6. Fluctuations in the percentage of males and females in the monthly catch of jaiba per fishing season. Fishing is interrupted in late December and early January for holidays and low production 171
LIST OF FIGURES - Continued

Figure 4.7. Size-frequency distribution of CL in mm for all crabs collected… 173

Figure 4.8. Monthly size-frequency distribution for both years combined. Left histogram is for males. Right is for females, immature females are in gray…………………………………………………… 174

Figure 4.9. Monthly size-frequency distribution for both years combined. Left histogram is for males. Right is for females, immature females are in gray…………………………………………………… 175

Figure 4.10. Monthly fluctuations of mean size per fishing season for all individuals, for male, and female jaiba……………………………… 176
LIST OF TABLES

Table 3.1. Motives, causes, solutions of four conflicts over the Seris EFZ originated in the decade of 1990, and the changes needed in the Seri EFZ for a definite solution………………………………….. 135

Table 4.1. Carapace lengths for jaiba caught in the Infiernillo Channel in 1998-2000 ($\alpha = 0.05$ for confidence intervals)……………………… 172

Table 4.2. Characteristics of the fishermen population, cooperative affiliation, and fishing gear available for the jaiba fishery in Punta Chueca during 1997-1998…………………………………….. 188

Table 4.3. Fishing cooperatives in operation inside Seri territory during 1997-1998………………………………………………………… 201

Table 4.4. Price paid per kilo of fresh jaiba on the beach to the Seri fishermen. 213
ABSTRACT

I analyzed the Seri Exclusive Fishing Zone (SEFZ) in the Gulf of California, to assess its efficiency in solving common fisheries management problems related to open access resources. A review of the major historical changes in the socio-cultural context of marine natural resource use in the region showed the SEFZ has allowed the Seri to successfully keep and improve control of access to the Infiernillo Channel, as well as reduce competition with fishers from Bahía Kino in a region with increasing competition for marine resources. However, the SEFZ showed severe limitations that produced conflicts of variable intensity. The most important were lack of: clear geographic limits to SEFZ, clear systems to transfer fishing rights, and rights to defend with armed guards the integrity of their marine territory. The role of Seri and Federal Government authorities in conflict creation and resolution and the perception of the outcomes of these conflicts for Seri and Bahía Kino fishers are analyzed on four recent conflict events. Several potential opportunities to promote co-management of fisheries by the federal government and local fisheries management authorities emerged from the SEFZ. However, none of these opportunities, in the form of informal arrangements, succeeded in creating better relationships between Seri and Bahía Kino communities of fishers.

I used the jaiba (*Callinectes bellicosus*) crab fishery inside the SEFZ to assess dynamics of marine resources under Seri common property ownership. I found that inside the SEFZ fishing effort is controlled, the fishing ban is honored, fishing areas are rotated throughout the season, and no-fishing zones are functional. I used data from *jaiba* buyers,
and extensive catch sampling during two fishing seasons, to determine yearly production in Punta Chueca, as well as average daily catch and other descriptive catch statistics. 

*Jaiba* is an important resource in the economy of Punta Chueca, and its local management has been facilitated by the SEFZ to produce a fishery that, to date, appears to be sustainable. However, the long-term viability of this fishery inside the SEFZ is vulnerable to outside harvesting patterns and to political and economic influences over which the Seri have no control.
CHAPTER 1

THE SERI PEOPLE AND THEIR USE OF MARINE NATURAL RESOURCES

A. SERI TERRITORY

Historical Occupation of the Coastal Region

The Seri Indians\(^1\) have lived in the Northwest corner of what is today the State of Sonora, in Northwest México since prehispanic times (Figure 1.1). Archeological records date their presence in this region for at least 2,000 yr (Felger and Moser 1985). In the seventeenth century their coastal territory extended from the coast of the Gulf of California to an average of 40 km inland, and from drainage of the Río de la Concepción north of Puerto Libertad, to the south as far as Guaymas (Sheridan 1999). Seri territory also included the islands of Tiburón, San Esteban, Patos, and Alcatraz\(^2\).

The Seri range inland extended considerably three centuries ago. In the north, the limits are reported in what is now the town of Magdalena, to the east to where Ures, Baviácora and Banmichi Missions were built, and to the south as far as the Río Yaqui (Sheridan 1999). Their range shared boundaries with several other indigenous groups: the Yaqui tribe on the south and the Pima and Pápago (Tohono O’odham) tribes on the

\(^{1}\) Seri call themselves *Comcáac* in their language, which literally translates as “the people.” For writing convenience in this dissertation I will use the terms, Seri Indians, Seris and Comcáac, as synonyms to refer to the same ethnic group.

\(^{2}\) There is historical evidence that the Seri maintained a fairly large population on Tiburón Island (Felger and Moser 1985) and a small one on San Esteban (Villalpando 1989). On Alcatraz they frequently hunted pelicans and sea lions (Bahre 1983).
east and north respectively (Bowen 1983). There are accounts of Seri using boats made

made of native reeds called balsas, to cross the gulf to reach the Baja California Peninsular coast and travel as far south as the Mission Santa Gertrudis (near modern Loreto) (Sheridan 1999). Undoubtedly the Seri had contact with the Cochimi Indians and

Figure 1.1. Map of the historical and present extension of the Seri territory. Modified from Bowen 1983.
other people that inhabited Baja California at the time of first contact with Europeans (Felger and Moser 1985).

Scholars have reported that in this vast territory the Seri were divided into groups, each distributed in a different region of the territory, and therefore living from a different natural resource base within coastal desert areas. Sheridan (1999) summarizes current views about the nature of these subdivisions among the Comcáac, groups recognized since the seventeenth century by Spaniard accounts (Figure 1.2). The Tepocas occupied the Sonoran coast north of Tiburón Island as far inland as the Bacoachi River drainage; the Salineros ranged from the Infiernillo Channel to modern Bahía Kino and to the west of San Miguel River; the Tiburones occupied Tiburón Island; and the Guaymas and Upanguaymas lived south of Bahía Kino to Guaymas. Linguist Ed Moser reported the existence of six Seri bands, based on the accounts of modern Seris: (1) the Xica Hai Ic Coii (‘they who live toward the true wind’), lived from Cerro Tepopa northward to Puerto Lobos; (2) the Xica Xnai Ic Coii (‘they who live toward the south wind’), from Bahía Kino to Guaymas coast; (3) the Tahéojc Comcáac (‘Tiburón Island people’), inhabitants of the north, east and west coast of the island and the mainland opposite to the island; (4) the Heno Comcáac (‘desert people’), lived in the interior of Tiburón Island; (5) the Xnaa Motat (‘they who came from the direction of the south wind’), who surrounded the mangrove estuaries of Punta Sargento and were said to come from around Guaymas; and (6) the Xica Hast Ano Coii (‘they who live in the mountains’), who went back and forth between San Esteban and Tiburon’s south coast (Moser 1963).
Sheridan (1999) proposed a correspondence of the Seri bands presented by Moser (1963) with Seri subdivisions encountered by Spaniards. According to Sheridan (1999), the Xica Hai Ic Coii may have been the Tepocas; the Xica Xnai Ic Coii the Guaymas and Upanguaymas; the Taheojc Comcáac the Salineros; the Heno Comcáac the Tiburones; the Xnaa Motat the Guaymas or Upanguaymas who had taken refuge at Estero Sargento during the wars with Spaniards; and the Xica Hast
Ano Coii were perhaps the people in the “ranchería on the west side of Tiburón Island,” in Father Nicolás Perera’s accounts from 1729.

**Present Extension of the Seri Territory**

The present Seri territory, although still large, is just a fraction of the land occupied by the Comcáac in the seventeenth and eighteenth centuries. The general causes of the drastic reduction in range were warfare and competition for land with Spanish and Mexican settlers. These causes are analyzed in detail in Section B of this chapter.

Current coastal Seri territory is roughly one third of the historic stronghold (Figure 1.1). The areas lost by the Comcáac extend from Guaymas to the north passing Bahia Kino up to Santa Rosa Estuary, and from the San Ignacio River’s drainage next to the Río Concepción’s mouth going south passing Puerto Libertad to Las Cuevitas. They also were exterminated from San Esteban Island. However, Seri people were always present on the mainland region surrounding Tiburón Island, across the Infiernillo Channel, and on the Island itself. This region has been the core of Seri territory, and also may have had a relevant position in their world vision, if we consider the role of Tiburón Island in the Seri creation myth.

Today the Seri territory includes Tiburón Island and the mainland coast across the Infiernillo Channel, extending inland for variable distances from the mainland coast. The width of the mainland part ranges from less that 1 km just north of Punta Chueca, one of

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3 In approximately 1860s the Mexican military extirpated the Seri living in San Esteban (Felger and Moser 1985). For an excellent book on this subject see Bowen (2000).

4 Although there are many versions of the origin myth, in many of the versions Tiburón Island is either the place were gods created the Seri people, or the site where important personages of the mythology appeared and taught the Seri many important things for survival, see Felger and Moser (1985).
the two Seri permanent villages, to almost 15 km in its widest part near Punta Tepopa. Large private ranches surround Seri land. The total extension of the mainland portion of the territory is 91,322 ha (about 226,000 A). El Desemboque, the second Seri village, is located at the edge of the northern border. Seri territory includes the totality of Tiburón Island, the largest island in México, with 120,756 ha (about 524,000 A). Punta Chueca is located 28 km north of Bahía Kino and has approximately 350 people; Desemboque is 98 km north of Punta Chueca and has roughly the same population.

Seri territory also includes a marine component, extending offshore along 100 km of coastline, including the Infiernillo Channel and waters adjacent to Tiburón Island. The area of the marine portion is impossible to calculate, because the limits of the marine territory are not as clear as their terrestrial counterparts. There are different interpretations of these limits. However, all interpretations include the entire Infiernillo Channel. The difficulties in establishing the limits of the marine territory constitute critical issues analyzed in this dissertation.

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5 In the reminder of the document El Desemboque will be referred as Desemboque, not to be confused with Desemboque de Caborca, which is a Mexican town, located several kilometers to the north.
B. SERI SOCIO-CULTURAL SETTING AND USE OF MARINE NATURAL RESOURCES

The Use of Marine Natural Resources by the Seri

Agriculture is not feasible in the region occupied by the Seris due to the scarcity of fresh water (Felger and Moser 1976). To survive with this paucity of food and water, the Seri Indians had to assume a nomadic lifestyle based, until very recent times, on hunting, collecting wild plant foods, fishing, and shellfish gathering (Bowen 1983). Their population was small compared to the large region they occupied (Felger and Moser 1985).

The maritime orientation of the Seri was noted since the first contacts with Europeans. The first account that refers to Seri presence, written by Father Andrés Pérez de Ribas in 1619, mentioned indigenous inhabitants of this portion of the New World living along the coast and using fish and other marine life, including seagrass seeds (Sheridan 1999). The consumption of seagrass grain as a food staple by Seri is unique in the world (Felger and Moser 1973, Sheridan and Felger 1977).

Seri lived in an inhospitable environment, but food supply probably was not as strong a limiting factor as was the supply of fresh water on the size of the Seri population (Sheridan 1999). Using traditional fishing technology, Seri fishermen probably were capable of some large or regular catches. In addition, shellfish were readily available in Seri territory, although shellfish probably were unsatisfactory as the only staple. Food

---

6 The seagrass *Zostera marina* was the only marine plant consumed by the Seri. During their extensive research, Felger and Moser (1985) found no evidence of consumption of other marine plants.
from the sea was in precarious supply despite the rich resources of the Gulf of California because limitations in fishing technology (Bowen 1983). Seri survival as hunters and gatherers focused on the extraction of several marine resources. For a list of marine species consumed today by the Seris see Appendix 1.

The most important resources, before the beginning of commercial fishing and the introduction of modern fish technology, were the sea turtle (Felger and Moser 1987) and fish species like the cabrilla (*Paralabrax* spp.), groupers (*Mycteroperca* spp.), and sea bass (*Cynoscion* spp.) (Felger and Moser 1985). Fish and sea turtles ranked first and second as food items in the earliest study of the Seri diet made by Boris Malkin in the 1950s (Malkin 1962). According to Felger and Moser (1985), bivalves and crustaceans were also consumed, and had more importance in the diet during difficult periods when turtles or preferred fish species were not present in the Seri territory due to their migratory movements. The Seri harvested molluscs and crustaceans along the shore, in shallow waters and inside several coastal lagoons along the coast. The Infiernillo Channel was especially important as a source of these resources. Shell middens in the area have revealed that the most important invertebrates harvested where oysters (*Ostrea* spp.), swimming crabs (*Callinectes* spp.) and several species of clams (Bowen 1976).

With the advent of modern fishing technology, Seri extended their use of marine resources to other species. Today the most important commercial fish are: mullet (*Mugil cephalus, Mugil curema*), sea bass (*Hoplopagrus guntheri, Lutjanus* spp.), cabrilla (*Paralabrax maculatofasciatus*), triggerfish (*Balistes polylepis*), corvina (*Cynoscion* spp.), pompano (*Trachinotus* spp), many species of small sharks (*Rhizoprionodon* **
longuro, Squatina californica, Mustelus spp.), and manta rays (Dasyatis brevis, Gymnura marmorata, Mylobatis californica, Narcine entemedor, Rhinobatos productus, Urolophus spp.). Important molluscs include pen shells (Atrina tuberculosa and Pinna rugossa), mussels (Modiolus capax), snail (Hexaplex spp.), and octopuses (Octopus spp.).

Crustaceans harvested are limited to swimming crabs (Callinectes bellicosus). For several years in the 1990s, the echinoderm sea cucumber (Isostichopus fuscus) was exploited in the Infiernillo Channel, but it was not consumed locally.

Seri today still base an important part of their economy on fishing, and protein from the ocean is an important part of their diet. In the seventeenth, eighteenth and nineteenth centuries, the nature of Seri relationships with neighboring communities was affected more by use of terrestrial resources. Changes in use of the marine environment were affected by their relationships with other human communities in the twentieth century. The relationships of Seri communities with outsiders related to the use of marine resources had a powerful effect on future Seri relationships with non-Indian groups.

**Past Relationships of Seri with Neighboring Communities 1600-1930**

Seri were in continuous warfare, or tense relationships, not only against adverse environmental conditions but also with neighboring tribes and even among their own bands. The first accounts by Spaniards analysed by Sheridan (1999) point out that in 1700 Alférez Juan Bautista de Escalante, reported that Tepocas and Salineros where hostile to one another because of “ancient passions and wars.”
This same author discusses accounts by Capitán Juan de Encinas in 1685 of the southern group of Seri, the Guaymas and Upanguaymas group, that apparently had better relationships with their neighbors, the Yaqui, the Lower Pima, and the Ópata, and even lived together in the multi-ethnic town of Belén. Sheridan (1999) also describes movements of Seri back and forth between desert regions in the eastern portion of their territory, to coastal areas in the west. According to historical accounts, the purpose of such movements was to trade with riverine communities of central Sonora of Ópata, Eudeve and Lower Pima Indians. Thus not all relationships between Seri and other tribes were hostile.

With the arrival of the first Spaniards to the land that is now northern México, the contacts of Seri with non-Indian people started. These contacts were primarily with Jesuit Fathers on their missionizing movement north from Sinaloa, and with military scouts on reconnaissance trips. A detailed history of this interaction has been presented and meticulously analyzed by the ethnohistorian Thomas Sheridan (1979, 1992, 1999). Bowen (1983) and Felger and Moser (1985) have presented a short outline of the main events from which I have extracted the following information. My goal here is to describe Seri relationships with foreign groups in the last three centuries, in order to evaluate the current nature of these relationships in the light of changes in the historical context.
1. Seventeenth and Eighteenth Centuries

One common denominator in the literature describing the nature of the Seri people is opportunism. As a nomadic hunting, fishing and gathering society, the ability to adapt to new opportunities to exploit resources has obvious value. However, neighboring groups competing for resources did not see this Seri trait in a beneficial light. In the desert, natural resources must be used immediately and as efficiently as possible, and usually under strong time constraints due to the short duration of natural cycles such as plant blooming, game movements and fresh water availability. The arrival of foreign settlers to the Seri territory meant the arrival of new natural resources. Accordingly by the year 1600, groups of Seri had adopted a pattern of petty livestock raiding. For a Seri hunter, a cow must have been perceived as a big, slow mule deer (Felger and Moser 1985). Retaliation of settlers soon followed these acts of pillage. In 1622 several hundred Seri were killed west of Ures (Spicer 1962).

By the second half of the seventeenth-century (1679), some Seri attracted by the Mission of Santa María del Pópulo along the San Miguel River had adopted agricultural mission life under Father Juan Fernández. When Father Fernández was transferred (1683), the mission was devastated by an epidemic and Seri survivors fled to the coastal desert. Father Adamo Gilg reestablished the mission (1688)\textsuperscript{7}. During that period, Jesuit missionaries and Spanish complained of “wild Seri, who drifted in and out of the missions to steal food and material goods.” Father Gilg claimed that Seris were attracted to the missions to raid the communities of newly missionized Lower Pimas.

\textsuperscript{7} A letter of Adamo Gilg has the earliest known illustration of the Seri people (see Felger and Moser 1985, page 13).
In 1748, movement of the Presidio of Pitic (in what is now modern Hermosillo, the Capital City of Sonora) to a location with better farming land in San Miguel de Horcasitas, started almost two decades of brutal guerrilla warfare between the Seri and Spaniards. This conflict arose because Seri Indians at the Pópulo and Los Angeles Missions had previously farmed the land distributed among relocated Spanish residents in San Miguel with moderate success. The results of Seri protests for taking away their farming land were the arrest of women and their deportation to Guatemala and elsewhere. In retaliation, Seris attacked Spanish settlers throughout central Sonora. This conflict escalated into open war from 1750s to 1770s, a war that included several military campaigns to exterminate the Seri. These campaigns included the famous and largely unsuccessful invasion of Tiburón Island by General Diego Ortiz Parrilla (1750), and further more successful attempts by Colonel Domingo Elizondo in the 1760s and 1770s. During the worst times of persecution, Tiburón Island’s rough mountains and secret waterholes were the last refuge to escape from the “white people.”

During these decades, as Felger and Moser (1985) state, “no decisive battles were fought, but increasing Spanish pressure, old world diseases and the weariness of several decades of unrelenting warfare gradually wore down Seri resolve.” In spite of progressive reductions in their numbers and strength, the conversion of Seri to agricultural European lifestyle was not accomplished by the time Jesuit missionaries were expelled from New Spain at the end of the eighteenth-century.
2. Nineteenth Century

At the beginning of this century, Seri had been pacified or driven into their desert refuges, mostly in the Tiburón Island region and the Cerro Prieto Mountains between Bahía Kino and Guaymas. During the turmoil of Mexican Independence (1810), the government authority and its presence weakened in Sonora and elsewhere, and Seri raiding started again. From the 1830s on, Seri and Apache raiders harassed Mexican ranches and settlements in the northwest portion of the new and independent Republic. Mexicans who had settled in the margins of the reduced Seri range attempted to curtail attacks by rounding up Seri and bringing them to Pitic where they were forced to settle at Villa de Seris. However, most of them escaped and returned to the desert.

The bloodiest time of this century started soon after Pascual Encinas established his ranch in the Costa Rica area (1844). His initial attempts to improve relationships with Seri by paying them wages to work for him soon failed. Encinas’s livestock was soon part of the Seri diet and Indians engaged in petty-thievery at the ranch. Encinas declared war in 1855, and during the next 10 years he decimated the Seri population. This time was known as the Encinas War. With his armed and mounted cowboys, Encinas killed about half of the Seri living in the territory. In 1850 the Sonoran Congress offered a reward of 150 pesos for each dead male Seri and 50 for each female Seri (Cuéllar 1980). By the 1860s an isolated group of Seri living on San Esteban Island was exterminated, presumably by the Mexican Military. The remaining Seri population held out on Tiburón Island and the adjacent Sonoran coast. After about 300 years since the first contacts with
Spaniards at the end of the nineteenth-century, the Seri resistance had finally been broken.

3. Twentieth Century, until 1930s

By the beginning of the twentieth century only a couple hundred Seri existed. They slowly started to settle on the mainland coast in front of Tiburón Island. Their battles against the Mexican army and ranchers diminished and disappeared totally around the 1920’s (Bowen 1983).

Seri life at the beginning of the twentieth century was still primarily based on hunting, fishing and gathering. In spite of strong persecution, their basic social structure and economic system had not changed radically. Probably the most acute changes in the social structure of the Seri were disruption and restructuring of the geographic distribution of Seri subdivisions, after the assimilation of some groups into the mestizo society (probably the Guaymas and Upanuaymas), or disappearance of some groups due to warfare (like the Xica Hast Ano Coii). The remainder of the Seri population probably included representatives of most of the different groups. This is reflected in variations of the Comcáac language detected by linguists (Felger and Moser 1985).

Strong distrust and exaggerated prejudice marked interactions between Seri and Mexicans during the first decades of the twentieth century. Sporadic killings on both sides,\(^8\) plus the murder of some American adventurers on Tiburón Island, fuelled

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\(^8\) Probably the earliest account of Seris killing Mexican fishermen is found on the field notes of William N. Smith. Based on his interview of Guadalupe Astorga, a Seri man, who remembered that around 1920 Seri burned the sailboat of Mr. Bermúdez and his party of 5 fishermen killing four or five people. This event happened between Campo Dólar and Punta Tepopa in the north end of the Infiernillo Channel.
sensational accounts in Mexican and U.S. magazines and newspapers of encounters with or attacks by “savage Indians” that still lived in the “stone age” just a few kilometers south from the booming cities of Los Angeles, San Diego, Tucson and Phoenix. During this time, the myth of Seri cannibalism developed, along with beliefs that Seris engaged in other immoral and degenerate practices (i.e., polygyny, incestuous behavior, prostitution, consumption of raw decomposing meat, no personal hygiene). As Sheridan (1999) pointed out, modern popular accounts instead of historical ones demonized the Seri. “Nowhere in the Spanish colonial record are Seris referred to as cannibals, a vicious myth that apparently appeared in the U.S. magazines and newspapers in the late nineteenth century.” “Ironically Spaniards and missionaries portrayed Seris more humanely and with less distortion than writers and even scientists two centuries or more latter” (Sheridan 1999).

Two important elements marked a new phase of interaction between the Seri and “white people” in these years: (1) establishment of the Kino Bay Sportsman’s Club, and (2) the beginning of Seri participation in commercial fishing. The Kino Bay Club was established in 1926 by an American promoter named Yates Holmes, and through its short life brought large numbers of American tourists to Bahía Kino (Spicer 1962). The

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9 To better understand these two elements I relied heavily on unpublished manuscripts, notes, logs, booklets and newspaper clips from that time collected and written by the anthropologist William N. Smith II, on file at the Special Collections Library of the University of Arizona, Tucson. William N. Smith II made extended ethnographical field trips to Desemboque and Tiburón island region from 1945 to 1967 to study the influence of outsiders in Seri culture.

10 Holmes started looking for a place in 1925, in 1926 he built a dozen wooden rooms, and in 1929 a two story cement and adobe building, according to notes in the files of William N. Smith.
club had more popularity after prohibition of alcohol in the United States, since it offered unparalleled hunting, fishing, exploring (and most likely drinking) opportunities. The club owned a plane that flew clients, mostly businessmen from southern Arizona, from Nogales in a trip lasting an hour and a half. A picture in the club’s brochure seems to present the nature of Seri relations with the club’s guests. It shows four members of the club posing on the beach in front of a wooden boat, with two old Seri women with their naked torso, one old Seri man and one Seri child. The caption of the photo reads: “closed season on our Seri Indian friends! Some Kino members go visiting to Tiburon Island.” The Kino Bay Club marked the advancement of the “white” frontier into Seri territory. The club was the first permanent settlement on the Bahía Kino coast (Smith 1954).

By 1927-28 approximately two thirds of the Seri population who already had become accustomed to establishing their winter camps at Bahía Kino (Smith 1954), moved near the hunting and fishing lodge to take advantage of handouts from visitors, and to barter artifacts for clothing, tools, materials, or to earn money by posing for pictures (Coolidge and Coolidge 1939). The opportunistic Seri rapidly took advantage of this convenient arrangement, until the economic depression beginning in 1929 caused the Kino Bay Club to fail in 1932 (Smith 1954).11

A second important aspect of Seri interactions with outside groups was Seri participation in commercial fisheries. This relationship had a strong and more lasting influence on the relations of Seri with outsiders. The following information is entirely based on Smith (1954), who wrote the only detailed account available about the early

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11 Present day Kino Bay Club re-started in the 1950s, with the boom of Kino as a tourist destination for American tourists.
years of Seri involvement in commercial fishing. Due to the importance of this unpublished information as foundation to understand the historical context of Seri participation in commercial fishing, detailed quotation is provided.

In 1918, Roberto Thomson Encinas, the nephew of Pascual Encinas, along with his brother Luis, encountered the Seri and started to build a friendly relationship over a period that lasted until 1926. According to Smith, Thomson was quick to perceive the richness of the fish resources in the Bahía Kino area, and the natural adaptability of the Seri culture to the fishing economy. As a result, sometime between 1926 and 28 he began trucking small quantities of fish into Hermosillo, which he bought from the Seri Indians in Bahía Kino in exchange for food supplies and clothing. “This proved to be the beginning…of the marine-based Seri fishing economy. For the first time, these Indians were able to make efficient use of their native environment in establishing a monetarily sound, buying and selling relationship with the Mexicans. It greatly improved the Seri living standards as time went on; and it considerably altered the Mexican attitude toward these Indians” (Smith 1954)\textsuperscript{12}. The beginning of Seri participation in commercial fishing was part of the development, in the north part of the Gulf of California, of the commercial fishing for totoaba (\textit{Totoaba macdonaldi}), the largest species of the seabass family whose commercial catches started in the region south of Guaymas in 1910 (Chute 1928). The eventual assimilation of Seri into Mexican culture occurred largely because they began living for long periods of time each year in fishing camps on the Sonoran

\textsuperscript{12} It is ironic that Pascual Encinas almost extirpated the Seri people while his nephew introduced them into a new relationship with outsiders based on economic interchanges, that made their survival today possible.
coast of their territory, and were influenced by Mexican fishers and fish buyers (Bahre et al. 2001).

Roberto Thomson was not the only Mexican doing business in the area in the late 1920s. Between 1926 and 1939, the fishing settlement of Kino expanded rapidly, as the number of Mexican fishermen and fish truckers increased and several Mexican-run stores were established. According to Smith’s writings, in 1928 Roberto Thomson was influential in obtaining support from the State of Sonora government for the development of commercial fishing among the Seri. This was a period of governmental sympathy toward the Indians, and the government provided the Seri with dug-out canoes, lumber for boat construction, food supplies, clothing, a small 12-ton vessel for use in fishing and wood-hauling operations, and a truck for hauling fish from Bahía Kino to Hermosillo. Roberto Thomson also was responsible for establishment in 1928 of the first Federal School in Kino, primarily for the benefit of Seri Indians.

Seri participation in the fishery was limited to the capture of fish at sea using hand lines and dugout canoes, and the initial cleaning of fish on the beach (Bahre et al. 2001). The Mexican fish buyers often paid for the fish caught by Seri with mescal and

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13 In notes obtained by Alberto Dawson communicated to William Smith in 1954, there is an account of a plane owned by an American company in partnership with the Hoefffer brothers from Hermosillo that landed in 1932 on an airstrip at Teconate on the north of Tiburón Island. The plane was flying fish out from Kino and Tiburón. The operation lasted a few months until the airplane was damaged landing in Kino.

14 In 1935 Bahía Kino and San Felipe in Baja California were the two most important commercial fishing camps for totoaba, supplying fish to the markets in southern California and Arizona (Huey 1953).

15 According to Smith’s notes in a field journal from 1956, the Seri school was established in November-December of 1932 in one room of the Club Kino Hotel and lasted approximately 5 months. Roberto Thompson, Ignacio Romero, and a Seri girl known as Ramona among others learned to read and write in this school.
marihuana (Bernal 1950, Smith 1954). The consequences were frequent violent drunken brawls between Seri and Mexicans, and even among Seri.\(^\text{16}\) Addiction to both drugs became a problem for fishermen from both cultures.

Modern Developments from 1930s to 2000

1. Developments from 1940s to 1960s

William N. Smith’s writings tell us that from 1932, the Mexican population in Bahía Kino continued to grow, resulting in an imbalance with the Seri residing there. By 1939 the Mexicans outnumbered the Seri 8 to 1, and bad influences from the outside culture started to impose a heavy toll on Seri culture and on the nature of contacts between the two groups. According to Smith (1954) Seri cultural and ethnic identity began to show signs of serious disintegration, evidenced by the consumption of drugs and alcohol. In addition, prostitution lead to the production of small numbers of illegitimate half-breed children. Venereal diseases were introduced to the Seri population this way, and, as a result, Seri men refused to have any relationship with the prostitutes. These women lost their opportunity for marriage to Seri men, broke away completely from the tribe, and became common-law wives of Mexican fishermen. Other signs of cultural disintegration were evident in young Seri men who were shamed into cutting their long hair, and abandoning their native kilt for modern clothes.\(^\text{17}\) They also adopted a

\(^{16}\) Modern Seri refer to all foreigners as Cósar that means outsider. They do not consider themselves as Mexicans, but as Seri living in a territory inside México.

\(^{17}\) Seri men used to wear a piece of fabric around their waist as seen in numerous old photographs published in Felger and Moser (1985) see for example photos in pages 2, 137, 151.
subservient attitude towards Mexicans nearly supplanting their native sense of independence and pride that had always helped their group to survive.

Two events in the last years of the 1930s produced changes for the Seri socio-cultural setting: 1) a series of epidemics of measles and influenza that frightened the already depleted population, and 2) creation of the Seri fishing Cooperative. The second event is the most relevant to my study.

In 1935 the Mexican Government ordered that all fishing commerce should be carried out through organized Cooperatives, following the post revolutionary constitutional policies that created a system of Cooperatives beginning in the 1920s. Jesús Solórzano, an indigenous man from Colima, who combined the necessary personality characteristics to gain the confidence of the Seri, with the vision to materialize a very difficult economic enterprise, organized the Seri fishing Cooperative. In the fall of 1938, on November 29, the Seri fishing Cooperative was established in the town of Bahía Kino under the name of “Sociedad Cooperativa de Pescadores de la Tribu Seri, S.C.L.”

According to the original act and bylaws, it had 59 members including, at least three non-Seri men: Roberto Thompson, Jesús Solórzano, and Encarnación López. López was the owner of the house in Bahía Kino where the members gathered to form the Cooperative. The Cooperative was legalised by President Lázaro Cárdenas the following

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18 See Appendix 2 for a complete list of acronyms and abbreviations used.
19 A copy of the original act and bylaws is stored in the box # 20 of the files (MS 316) of William N. Smith at the Special Collections Library of the University of Arizona, Tucson.
According to Smith (1954) after one year of trying to manage the Seri Cooperative in Bahía Kino, it was evident to Jesús Solórzano that it was impossible to maintain a united Seri labor pool in the face of the existing competition with other fish buyers in the area.\footnote{An official notice of the Secretaría de la Economía Nacional dated February 2, 1939 that states the cooperative has authorization to exploit totoaba, corvina, cabrilla, and sea lion, sea turtles, and sharks from Puerto Lobos to Guaymas. William N. Smith files Box # 20 at the Special Collections Library of the University of Arizona, Tucson.} In the winter of 1940-41\footnote{According to Davis and Dawson (1945) in 1945 Kino had 400-500 people living in 50 or more wattle and daub houses. Refrigerated trucks carrying from 15 to 25 tons of fish left daily during the height of the fishing season, mostly with totoaba.} Jesús Solórzano made the bold decision to move the Cooperative base nearly 70 miles up the coast from Bahía Kino to an old camp at the Delta of the Río San Ignacio, called Desemboque. This place was the old Seri camp *Haxöl Ihoom* occupied as a Japanese fishing camp in the 1930s. It was very isolated, roughly 100 miles from either Hermosillo or Pitiquito, the nearest municipalities. Solórzano’s selfish interests in exclusive exploitation of the Seri labor pool fueled this relocation. However it was also motivated by the serious situation that threatened imminent extinction of Seris through armed battle with the overwhelming Mexican population in Kino. The only attraction keeping Seri in the Kino area was the desire to maintain their economic advances from the fishing economy\footnote{Information from Alberto Dawson communicated to William Smith in 1954 tell us that by 1939 Solórzano had part of the tribe working for him. They worked at Kino until the season on totoaba closed on March 20, 1939 and then moved to Tecomate. Solórzano received their fish at Campo Almond in the Infiernillo Channel.} After Solórzano

\footnote{According to Dawson (1954), in 1939 approximately 75% of the Seri tribe lived at Kino and 25% at Tiburón. He moved the Seri in two trucks to Desemboque. Then with Seri cooperative funds, bought wood and 20 Seri conoes were built. He said fishing began in November on 1939.}
provided these same opportunities in Desemboque, Seris abandoned Kino where they faced cultural and ethnic extinction.\textsuperscript{25}

The following years until 1947 witnessed the boom of Desemboque as a model community. Good quality food and mercantile products were available to be purchased in Solórzano’s store with the money Seris earned from the sale of fish. The ratio of Seri to Mexicans was 2:1 and the sale of mescal and marihuana was prohibited.\textsuperscript{26} The town even had an icehouse, an office for the Seri Cooperative, and a Federal School for the Seri. Solórzano reinvested a great percentage of his profits in development of the town, planning to reap big returns in the long term by maintaining his control over commercialization of Seri fishing. Looking for further cash to invest, he invited General Abelardo Rodríguez, Governor of the State of Sonora and former Mexican President, to visit Desemboque. The four-day visit took place in April of 1943 and the group was impressed with the progress achieved. But on the last day several Seri men making aggressive demands for several 8 to 12-ton fishing boats confronted the Governor.\textsuperscript{27} The

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\textsuperscript{25} In an unpublished (Anonymous 1944) manuscript stored at the William Smith collection, there is a copy of a report of a visit to Tiburón Island by a researcher affiliated with the Smithsonian Institution in September of 1944. In that report the author reported Seri lived in Tiburón Island on a permanent basis at Campo Tecomate, on the north end of the island, and maintained camps at Bahía Santa Rosa (on what is today Punta San Miguel) on the mainland coast. Punta Chueca camp was not being used at the time of the visit.

\textsuperscript{26} Between 1939-1943 Mexicans started to settle in Desemboque (Davis and Dawson 1954).

\textsuperscript{27} Smith (1954) said that this group of Seris were influenced by Solórzano’s competitors, among them was Topete, which wanted an end to his control. They convinced the Seris
Governor refused to provide any large boats, remembering the fate of a large 12-ton boat already wrecked by Seri in the late 1920s. This angered the Seri and they vociferously attacked Solórzano accusing him of exploitation, and thoroughly insulted the Governor and his party. Governor Rodríguez left immediately after, cutting short his visit, vowing never to provide the Seri with any form of assistance and washing his hands of all further interests in the Seris. According to Smith writing in 1954, “the unfortunate consequences of this event persisted for more than a decade and are reflected down in the attitude towards the Seris still taken by most officials in the Sonoran Government.”

After this incident, the town of Desemboque ceased to expand. The competitive fish buyers took advantage of Solórzano’s loss of face and started disputing the control of Desemboque. Sellers of mescal and marihuana appeared and benefited from the hands-off policy of the Government. Disputes and brawls started and by 1947 the Seri fishing Cooperative disintegrated\(^\text{28, 29}\). Bankrupt, Solórzano left the area in 1948.

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\(^{28}\) The problem with the fishing cooperative caused the splitting of the tribe, according to an anonymous report (1944). The disagreement as to the fishing syndicate caused Chico Romero, the head of the tribe, to move to Santa Rosa with seven other men, five women and 5 children. The fishing syndicate reported the reason for the splitting as exploitation of the tribe. In October however, the whole tribe intended to reassemble at Desemboque for totoaba fishing. This same report cited data from the Mexican military authorities that Desemboque had 20 piraguas 18-20 ft in length, beam 5-6 feet equipped with sails two paddles and two oars. Normally each boat carried 3 men, with the following fishing gear: 3 house lines of 50 fathoms, from 6 to 9 hooks, a “macana,” and a knife.\(^{29}\) In 1952 the offices of the Seri Fishing Cooperative were destroyed by a fire, and according to Dawson (1954) were rebuilt with Quaker workers and funds. This would mean that either the Seri cooperative continued to operate at certain level after Solórzano was gone, or that another group used the offices for other purposes.
In the summer and fall of 1947-1948, another element contributed to change the relationships between Seri and fish buyers when Héctor Gallego started to introduce outboard motors to Seri fishermen on a rent-loan basis. Other fish buyers who could not afford to provide motors were either forced to stop dealing with Seri fishermen or reduce considerably their economic interchange. Seri loved the new technology, and learned very quickly to operate the engines and to navigate the powered boats, although they ruined several engines in the process. With outboard motors, Seri gained the capacity to navigate without the hardship of sailing and paddling. Through this strategy, Gallego gained control over the majority of fishermen of the tribe dealing with two thirds of them during the 1952-1953 fishing season. This proved beneficial for Gallego, but was a hardship for Seri that could not afford fuel and oil for their boats.

In the 1940s, world demand for shark oil fuelled rapid growth in the shark fishery in the Gulf of California (Arvizu-Martínez 1987). Shark liver was an important source for vitamin extract producers in the U.S. Seri fishermen soon took advantage of the abundance of sharks in their fishing grounds. Profits from the shark fishery boasted the Seri economy to unprecedented levels. It was calculated that half of their income from

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30 In 1952 Kino had less that 100 people, several bars, no school, no electricity. Seri frequently camped around the village and freely ranged northward to Puerto Libertad and lived on Tiburón Island, Tecomate was a thriving camp then. There was little need for store-bought food, although supplies such as coffee, flour, sugar and outboard motor fuel were eagerly traded or purchased from Mexican storekeepers on the mainland (Felger and Moser 1985).

31 A curious note in William N. Smith’s field journal from 1948, tells the story of a trip by some Seris from Tecomate to Kino to sell shark livers. The livers were sold for $116.50 pesos. After selling their product the Seris got drunk with beer. By midnight Smith had to restrain one Seri from going back to Kino to kill a few Mexicans after a drunken brawl in which his wife and the wife of another Seri were taken away.
fishing derived from shark livers. The abundance of sharks in the Gulf combined with limited access to shark fishing grounds in the Pacific Ocean after the attack of Pearl Harbor provided fishermen in Northwest México with an unforeseen bonanza. Fabulous prices were paid in the U.S. market for shark liver.

During post-war times, the demand from the U.S. for shark liver collapsed due to the discovery of less expensive sources of vitamins and the artificial production of vitamins. In 1947-1948, the demand for shark livers disappeared. This event was combined with increasing scarcity of saleable fish in the Gulf of California due to wartime overfishing, mixed with large-scale use of dynamite in fishing. In post-war years, the Seri economy collapsed, with fishing income declining by 30 to 50% compared with the wartime period. It was during this period also that Seri started to receive aid again from American tourists who began to visit the area.

Smith (1954) described the depth of dislike between Seris and their white neighbors. In June of 1946, a sober exchange of jokes between Seris and Mexican fishermen exploded into an exchange of blows and rifle fire between two camps in Desemboque. One Mexican was shot through the thigh and two Seris were clubbed. Only prudence on part of the whites and Indian satisfaction for wounding the Mexican averted a more serious conflict. In November of 1949, some Seris were discovered at night raiding the fields of a small Mexican ranch near Desemboque. The Seris, who where stealing corn and melons, were fired upon by the ranchers and responded with fire. No one was hurt and the Indians claimed they were taking what was rightfully theirs since they were hungry and the ranch was on land that belonged to them. In March and
May of 1953, two almost fatal fights between Seris and Mexican fishermen occurred in Desemboque. One resulted on a severe beating of a Mexican by a Seri youth. Smith argued that although these kinds of incidents were common in Kino, the situation in Desemboque was different due to Seri numeric superiority by a ratio of 4:1. However, “because of the profits still to be obtained from fish trade with the Seris, as well as because of their isolated situation with its attendant risks due to Seris numerical superiority, the Mexicans are loath to precipitate in any situation which could place them in physical danger and would probably result in their loss of the Seri fish trade. The Seris are not aware of the economic reasons underlying this attitude and, particularly in the case of younger men of the tribe; a feeling of boastful arrogance towards the traders and fish buyers is often quite evident. At all events, an extremely interesting and delicate Indian frontier exists in Desemboque and the Tiburón Island area” (Smith 1954).

Smith’s writings explain that in the decade of the 1950s, an important influence in Seri culture came not from fish buyers but from different missionaries and religions. This phase marked a different socio-cultural context of Seri relations with outsiders who exerted unprecedented pressures in Seri culture.\footnote{This influence was also carefully documented and analyzed by Anthropologist William N. Smith II as several unpublished addenda to his original paper on Seri ethno-history written in 1953.} In 1951, an American missionary couple associated with the Wycliffe Bible Translators operating in Mexico under the name of Summer Institute of Linguistics, settled in a semi-permanent basis in the town of Desemboque, with the purposes of learning the Seri language and translating the new
In a short time, they gained acceptance by Seris through periodic gifts of medicines, clothes, food and other items, a behavior that Seris have come to expect from all American visitors. The relations of these and other missionaries with the Seris were not based on economic interests, and since the sources of support for the Ed and Becky Moser came from the U.S., they were in a unique situation to relate to the Indians.

In 1952 another American religious group arrived to Desemboque: The American Friends Service Committee (A.F.S.C.) operating in México as “Comité de la Sociedad de los Amigos.” Also, in the early 1950s the Pentecostal “Iglesia Apostólica de la Fé en Jesús Cristo” started missionary activities. The A.F.S.C. had the strongest stance and economic support and embarked in the re-establishment of a school in Desemboque to fulfill Seris requests for education to aid them to compete economically with Mexicans. For this job they brought Leo Sandoval, a Federal schoolteacher and his family from central México, whose salary was provided by the Mexican Federal Government. In addition, the A.F.S.C., contributed the majority of the expenses to run the school. According to Smith’s notes, the economic dependency of the school teacher upon religious group clearly limited the desire of the teacher to fully incorporate the Seris into the Mexican way of life, as was encouraged by the integrationist policy of Mexico’s government towards indigenous groups. Smith wrote in 1954: “…American intervention

33 The work of Ed and Mary Becky Moser was not limited to translation of the Bible. They produced several scientific articles about the Seri culture and traditions. Becky Moser coauthored with Richard Felger the book People of the Desert and the Sea: Ethnobotany of the Seri Indians, that is still the most comprehensive and detailed account of Seri knowledge of their natural world.
on an idealistic basis, rather that economically competitive one, has proved increasingly important in the Seri-Mexican culture contact situation during recent years… Since the Americans, for the most part, support Seri individuality and their right of native cultural expression, they are naturally opposed to the demoralizing influences which the Kino period indicate would result from forced destruction of native pride. By taking a sympathetic and friendly attitude towards the Indians and their culture, they have inadvertently augmented Seri nationalism. The Indians feel that, in the event of any important show-down between the Seris and the Mexicans in the area, they could count on American support on their stand.”

Efforts of the three groups of Protestant missionaries severely disrupted Seri native religious beliefs and threatened the cohesive social structure of the group. Two thirds of the tribe were involved in the superficial conversion to Evangelical Christianity that peaked in 1952-1958. The majority of males and females of the tribe, especially young married couples, attended almost nightly revival meetings in Desemboque during the summers of 1953 through 1956. The remaining third of the tribe was unresponsive to the Christian obsession and resolved to move to a semi-permanent camp at Punta Chueca, 45 miles south of Desemboque, and other locations along the mainland coast of the Infiernillo Channel.

The most important event related to the actions of these groups and their effects in the socio-cultural context of the relationships with Mexican fish buyers is related to the A.F.S.C., Quaker “Seri School Project” and its teacher Leo Sandoval. The A.F.S.C. had varied degrees of support from Anti-Catholic elements in the Mexican Federal
Government that they used to lobby for support for their school project. But they lacked support of the Sonora State Government, and of Sonoran merchants dealing with the Seri in their fishing industry. All political matters were addressed directly with Mexico City and without considering local sources of support, a matter that offended the strong regional pride of the Sonoran authorities. In the summer of 1952, the Seri fish buyers in Desemboque received news that Leo Sandoval had circulated adverse reports in Mexico City regarding their conduct of the Seri fishing industry. This bad press was followed by attempts to influence Seris to abandon fishing and change to agriculture for their livelihood. Rumors reached Desemboque of agrarian reforms in other parts of Mexico, and about government support to form ejidos including the provision of tractors to work the land. These rumors were combined with threats of legal intervention to stop the practice of dynamite fishing, and pressures to force Sonoran fish buyers out of Desemboque. In the spring of 1954, a portion of the Sonoran fish buyers appealed directly to the A.F.S.C., for removal of Leo Sandoval to stabilize the fishing economy. In an attempt to gain more political support in February and March of 1955, Leo Sandoval took five Seri on a two-week trip to Mexico City with the objective of having an audience with the President of Mexico. The audience never materialized, but Leo Sandoval took the Seri to the Oficina de Marina (Office of the Navy) were the Seri submissively and candidly signed a denunciation against the Sonora fish buyers. During the trip, the Seri

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34 Considering this tense relationship, the rebuilding of the Seri Cooperative offices destroyed in 1952 by a fire using money and labor from the A.F.S.C., was probably done with the purpose of using the offices with a purpose different than their original function, and maybe also by a group different than the fishing cooperative.

35 Ejido is one form of common property of the land by rural communities.
got measles, showing signs of the disease a few days after their return. By May more than 100 of the tribe were sick in an epidemic that caused eleven deaths and two involuntary abortions. Prompt action taken by the Health Department of Sonora, aided by efforts of William N. Smith and other individuals interested in the survival of the tribe stopped the epidemic. The Seri blamed the schoolteacher for the disease and for not doing anything to cure them, and finally the A.F.S.C., withdrew their moral and economic support for Leo Sandoval. In June of 1956, Sandoval abandoned Desemboque.

In the first half of the 1960s, several other events changed the socio-cultural setting of the Seri fishing economy. These events are explained in an unpublished manuscript by William N. Smith written in 1966, when most of this information was obtained. Fish buyers progressively raised the price per kilo paid to fishermen to compensate them for the inflated cost of living and to minimize the cost of gas and oil. This was done in order to ensure continued production, as the fish supplies became scarce, necessitating traveling to more distant fishing grounds. Also, there were reports that the supply of first grade fish such as *totoaba*, *baya* (*Mycteroperca jordani*) and *pinta* (*Mycteroperca xenarcha*) had become progressively more difficult to obtain. Therefore buyers resorted to buying virtually all grades of fish caught, including many species previously rejected. Emphasis shifted to buying live sea turtles in numbers threatening the existence of this animal in Seri waters. Thus Seri consumed less sea turtle. During the late 1950s and 1960s, commercial hunting for sea turtle boomed. As a result, turtle populations in near-shore waters were over-exploited, forcing fishermen to move to hunting grounds near the islands (Bowen 2000).
Another interesting trend reported by Smith in 1966 referred to the reduction of the pool of Seri fishermen. The smaller number of fishers produced less annual tonnage than in the period prior to the 1950s. However, higher wages were earned for their labor, because of the rise in prices described above. As a result, a larger portion of the tribe benefited from profits earned by fishermen. Although fishermen perceive increased wages as a sign of prosperity, less total income from fishing was available to the tribe compared to the period before 1950. Women, children and older people were still dependant on occasional charity as Smith noted in the 1940s. These discrepancies made the tribe increasingly dependent on income from the relatively small number of youths and younger men.

In 1958 an article published in the magazine Acción Indígena (Muñoz de Alba 1958) noted that the Seri Cooperative, then under Roberto Thomson’s leadership, received capital for operation and equipment from the Banco Nacional de Crédito Cooperativo (National Bank for Cooperatives) and fishing permits from the Secretaría de Marina. This meant that the Cooperative was still functioning after Solórzano left the region.

By 1966 the important fish buyers of the period abandoned Desemboque. Héctor Gallegos stopped operations in 1959. Alfredo Topete maintained marginal buying of fish and turtles at Punta Chueca, and his relative, Antonio Topete, maintained reduced operations in Desemboque. Numerous small-time operators took over, often lasting only

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36 Support consisted in 20 outboards motors (value 80,000 pesos), 20 atarrayas (hand cast nets), 22 oil lamps, hooks, lines, harpoons, and ice-factory (value 100,000 pesos) and 100,000 pesos in cash for operation.
one or two fish seasons. Most fish were purchased from November to Easter with emphasis on the 40-day Lenten period. The incident caused by Leo Sandoval with Sonoran fish buyers in the middle 1950s seriously crippled the operation of the fish economy in the area. “Tired of being blamed for the misery, poverty, and lack of sanitation of the Seri together with continually being pointed out as ‘exploiters’ of Seri ignorance the fishing interests ceased to invest in the economic future of the area and by 1955 had begun to operate on a day to day basis” (Smith 1966).

The effect of the missionary influence during the 1950s is described in a paragraph of Smith’s (1966) manuscript. “Seri culture, once concerned with living in the present and thoroughly optimistic as to the future, has now become chiefly concerned with conforming to virtually impossible Protestant Fundamentalist taboos in order to obtain salvation in the hereafter. A serious and deep-rooted sense of Cultural Inferiority now hampers Seri adaptability to change (a notable characteristic that contributed to their progress from the 1920’s to the 1950’s), and the (sic) Indians appear lost (hopefully for the time being) in a limbo of self-recrimination and apathy.”

In the 1960s an increase in American tourism to the Bahía Kino region helped the Seri with new economic opportunities from the sale of artwork, mainly carvings made of ironwood (*Olneya tesota*) and baskets made from fibbers of the limber-bush (*Jathropa cuneata*). According to Felger and Moser (1985), this shift from an economy based on fishing to incorporate other economic activities helped the Seri to deal with the rapid

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37 In the 1950 the road from Hermosillo to Bahía Kino was paved, and in the 1970s the dirt road from Kino to Punta Chueca and from Puerto Libertad to Desemboque were improved (Felger and Moser 1985).
acculturation patterns and the decreases in earnings from fishing due to diminished turtle and fish catches. It also increased the frequency of encounters and relations with American tourists and art traders. Once again the Seri showed their high level of adaptability to take advantage of new situations.

Ironwood carvings were not traditionally made by Seri nor introduced by outsiders. In 1961 the Seri man José Astorga began carving this hard wood, with encouragement from American tourists. The first pieces (bars, spoons, bowls) had little success until José turned to carving figures of animals of the desert and the sea that lived in Seri territory. By the early 1970s, Seri were famous for their distinctive ironwood carvings. More than half of the adults engaged in carving and it provided a major source of income (Bahre 1983, Felger and Moser 1985). Seri women sold carvings to tourists visiting Seri villages, and to traders of art who bought many pieces at a time. Seri artists were receptive to the suggestions of outsiders to make improvements in their techniques and finishing of carvings and they focused on subjects more eagerly sought by buyers.

Historically baskets were important utensils in the Seri household. Tourists bought baskets as early as the 1930s and later art dealers purchased them. By the 1960s, they were made exclusively for sale and often displayed considerable artistry and skill. Basket weaving is the domain of women, and some artists make baskets that could be ranked among the most expensive in the world, sometimes selling for thousands of dollars in art galleries (Felger and Moser 1985). As the demand for baskets increased in
the 1960s, new shapes and designs of stitching emerged. With the selling of ironwood carvings and baskets along with other handicrafts, the Seri diversified their economy that had previously been dependent on commercial fishing. This diversification also produced the first strong economic links with Americans.

In 1963 the Mexican Federal Government declared Tiburón Island a Nature Reserve and Wildlife Refuge. This action was a response to claims of over-hunting of mule deer on the mainland by poachers. The island was a refuge from illegal hunting. Seri use of the fauna on the island was not considered in the decision. Permanent habitation of the island was also forbidden, as well as visitation and movements in the interior of the island. During 1967, the federal government established their presence on the island and built wildlife management facilities and a military outpost to prevent poaching of wildlife. These wildlife conservation actions mark the beginning of a period of conflicts and tensions between the Seri and wildlife management authorities in the Mexican Federal Government. Conflicts about wildlife use and management are another recurring theme that influenced the socio-cultural context of Seri-Mexican relationships in the next period.

\[38\] In the 1970s and 1980s some enormous baskets 60 cm in height and 50 cm in diameter and much larger were sold for large sums of money, enough to purchase pickup trucks or automobiles.

\[39\] The Presidential Order was published in the Federal Register (Diario Oficial de la Federación) on February 10, 1963.
5. Modern developments from the 1970s to 2000

By the middle 1970s, over-wintering sea turtles were seldom hunted by Seri inside the Infiernillo Channel while Bahía Kino fishermen were decimating over-wintering turtle populations in the Midriff islands (Felger et al. 1976). In 1974 the Infiernillo Channel and Kunkaak Bay were declared by presidential order as fishing reserves to protect the reproduction of shrimp, prohibiting any type of shrimp fishing. This decree recognized the abundance of juvenile shrimp and the vulnerability of small sized shrimp to small-mesh nets (D.O.F. and Federación 1974). This presidential order probably was geared to protect nursing grounds of shrimp inside the Infiernillo Channel from trawlers that fished nearby waters.  

Other events in the 1970s created profound changes in the legal rights of Seri over their homeland and the natural resources they used for survival. The changes were fuelled by the policy of President Luis Echeverría, who took office in 1970, and favored a populist reform in his administration that included greater consideration and attention to issues of indigenous people. Seri had been trying to gain rights over the land they still occupied along the shores of the Infiernillo Channel and over Tiburón Island for many years before the 1970s, helped by concerned individuals from Sonora and elsewhere. Echeverria’s policy to advance development in indigenous communities and return some

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40 I do not have definite data that indicate shrimp fishing by shrimp trawlers was done inside the Infiernillo Channel. According to Dr. Alejandro Villamar, who worked in the area doing species inventories for INP in 1963-1966 shrimpers worked inside the channel (personal communication, INP México City, June 18, 1998). Seris deny that shrimpers have ever worked inside the channel. The presence of many sand bars, shallow waters and swift tide currents may have prevented its use. If this was the case, the Infiernillo Channel is probably one of the few shallow soft bottom areas in the Gulf of California that have been protected from the effects of shrimp trawlers.
control over their future led to recognition of their legal rights over the land and water in their homeland.

As a result, in 1970 the Seri were granted property rights over the portion of mainland coastal desert they occupied since prehispanic times. The *ejido* Desemboque and its annex Punta Chueca were created in November of 1970 by presidential order. The technical study to create this ejido included revision of the limits and status of the private holdings surrounding Seri occupied lands. These limits were used as the boundaries of the Seri ejido. Inside these borders, the Federal Government returned land considered under Federal Government ownership (under the category of *Territorio Nacional*) to Seri communal ownership. This resulted in a total of 91,322 hectares of mainland territory that Seri have today. According to the presidential order, at that time there were no land disputes between the Seri and the owners of the property surrounding the land.

In 1975 all of Tiburón Island was added to the Seri ejido by presidential order. The text of this presidential resolution recognizes the traditional use of the island by Seri, giving them title over the land of the town of Isla Tiburón, in the Municipality of Hermosillo, and adding 120,756 hectares to their communally owned land.

It should be understood that recognition of Seri ownership over the land was not an easy procedure. There was strong opposition from some sectors of the Mexican

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41 The Presidential Decree was published in the Federal Register (Diario Oficial de la Federación) November 28, 1970.
42 The Presidential order was published in the Federal Register (Diario Oficial de la Federación) on February 11, 1975.
In fact the struggle to gain rights over their territory was another facet of the Seri-Mexican conflicts. This time the nature of the warfare was not armed fights, but political and administrative struggles in the tribunals and ministries in Hermosillo and México City. Powerful families from Sonora and the Mexican capital city had strong economic and political interests in Seri territory. The basis of this interest was the use of the land for cattle ranching, tourism, and sport hunting of the wildlife, particularly hunting on Tiburón Island.

It was also in 1975 when the wildlife of Tiburón Island was “enriched” with the introduction of desert bighorn sheep (*Ovis canadensis mexicana*). This project was part of a program of the Federal Government to study and protect bighorn sheep in Sonora (Hernández-Alvidrez and Campoy-Favela 1989) and involved the introduction of 20 sheep captured from the Sierra Seri on the mainland part of the Seri territory (Montoya and Gates 1975). It was thought that the isolation and ruggedness of the island would protect the sheep population that could grow to levels that years later would provide a source for re-introduction to ranges were they had been reduced to very low densities or extirpated by illegal hunting or competition with cattle and goats.

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43 The late Pedro Romero Astorga, former Seri Governor and schoolteacher, told the author that he traveled to Mexico City in 1975 to receive the title over Tiburón Island. On his return to the Hermosillo airport, he had to escape with the help of a group of Mexican lawyers friends of the Seris from a group of Sonoran ranchers and private guards who wanted to kidnap him and take away the title papers. Sanderson (1981) mentions that the fierce independence of the Seri and the anthropological curiosity around them in the 1950s and 1960s make them a perfect symbol for the wave of indigenismo that was blossoming in intellectual and political circles.

44 Sanderson (1981) points out as well that the island was agriculturally worthless, therefore expendable for the Federal Government, although it was under the interest of the State of Sonora Government to be developed as a resort catering for American sportsmen.
The status of Tiburón Island as a game reserve was augmented in 1978 when it was declared, along with all the islands of the Gulf of California, as a wildlife and migratory bird refuge by President López Portillo. Unfortunately creation of this huge reserve was not accompanied by adequate funding. Therefore the Islands of the Gulf of California Reserve were simply additions to Mexico’s “paper parks” since they only exist in the papers that promulgated their creation. Input or involvement of Seris in creation of this new reserve on Tiburón Island was non-existent. Even though Seris were the legal owners of Tiburón since 1975, all matters about island management were carried out by agencies of the Federal Government. But since protected area status was not accompanied with funding to support management, these changes had little influence in the way Seri used natural resources on Tiburón in the 1970s and 1980s. Government wildlife managers worked for a few years in the mid 1960s, and left the island afterwards. The presence of the military on the island, also started in the 1960s, was more or less permanent in the 1970s and 1980s. However, Seri habitation of the island probably stopped sometime in the 1960s and was much affected by the dependence of the Seri economy on tourism, and the convenience of stores, schools, and medical services, present in their permanent settlements of Punta Chueca and Desemboque.

In the middle 1970s, the Federal Government invested to provide the Seri in Punta Chueca and Desemboque with permanent houses and basic public services. Several dozen pre-fabricated houses and blockhouses were built following the blueprint of a village with straight streets, around a central plaza, and a baseball court. With Federal

45 Published in the Diario Oficial de la Federación (Federal Register) on August 2, 1978.
funds, a system to provide water was built, composed of an elevated tank, pumps and cement reservoirs. A diesel generator was installed, and gradually electricity was available to more and more houses.

It was also in 1975 when the Seri Fishing Cooperative and the tribe in general were granted exclusive fishing rights by Presidential Order over the waters they traditionally used.\textsuperscript{46} Land ownership and exclusive use of marine areas was part of a package that included creation of a special multi-agency governmental commission to promote development of the Seri community and its integration into mainstream Mexican society (D.O.F. 1975). This commission was short lived. It operated only for 2 years (1975-1977) before being terminated by president José López Portillo’s administration that believed it had fulfilled its goals (Santillán Mena 1993). This commission facilitated the provision of infrastructure, equipment and economic support to the Seri fishing cooperative.

Considering the importance of this legal document for this dissertation I have made an English translation of the full document that is included in the Appendix 3. The Presidential resolution clearly recognized three issues: 1) the high dependence of Seri on fishing for income, 2) customary use by Seri fishermen of marine areas adjacent to Tiburón Island and their mainland territory, 3) the need to give preferential rights to Seri fishermen over those fishing areas as a strategy to increase the probability of survival of the tribe, minimizing competition with outside fishers.

\textsuperscript{46} On February 11 of 1975 the decree is published in the Federal Register.
Santillán-Mena (1993) argues that from the year of its formation until 1974, the Seri cooperative was practically controlled by fish merchants from outside. According to him, in 1951 its permit to function was withdrawn from the Ministry of Economy of the Federal Government due to reports that fish merchants were paying the Seris with alcohol and marijuana for the fish captured. Even without authorization from the government, merchants continued operating in Seri waters, buying invoices from other Mexican neighboring cooperatives to legalize the catch obtained from Seri waters, until the cooperative recovered its authorization in 1958 again as a result of federal government intervention. The cooperative changed from being run by private interests to being run by the government through INI (Instituto Nacional Indigenista) officials, but just for a few months. In October of 1959, the INI left the cooperative in Seris hands but under control of the Ministry of Industry and Commerce (Anonymous 1959). But problems in commercializing the catches, because of inexperience of the bureaucrats in charge caused the relationship to fail (Anonymous 1959). It is highly possible that the cooperative under INI control started to compete against displaced local fish merchants that had the cooperative controled for several years. Announced control by the Ministry of Industry and Commerce never took place. As a result, soon after INI left the Seri cooperative was soon again under control of fish merchants (Santillán Mena 1993).

Until 1974 the Seri cooperative was considered a cooperativa facturera (a cooperative that just provided invoices or facturas). The federal government intervened again in the Seri land, and president Echeverría gave them ownership over marine resources. Federal funds for a total of 19 million pesos were invested in 1975, the biggest
support to any indigenous group to date (Santillán Mena 1993). In 1978 the Seri cooperative accepted again INI support and with this external advice reduced its dependency on local merchants (Santillán Mena 1993).

During the 1980s, few major changes took place in the economic and social situation of the Seri. There is very little published or unpublished information about this decade. Probably one of the most relevant aspects was the publication of Felger and Moser's comprehensive book on Seri ethnobotany in 1985. This book continues to be the most complete source of information about the Seris. However these authors focused on Seri uses and knowledge of plants and provided little discussion of the general situation of the Seri community in the 1980s. They did comment however that the Seri still conserved a strong cultural identity although much traditional knowledge was gone with the death of older generations.

In the 1990s the list of issues that exerted external pressures for Seri natural resources grew in complexity considerably. In February of 1992, the Seri governor presented the main problems of the tribe in front of a group of 60 researchers and government officials trying to formulate a general plan for conservation of the Midriff Islands (Anonymous 1992). He complained that the marine exclusivity of the tribe was violated constantly by shrimp boats fishing the Infiernillo Channel, and by sardine fishing boats working inside the Agua Dulce Bay, and demanded support to protect their exclusive marine areas. Bahía Kino fishermen present during the same meeting seriously questioned the recognition of the Seri demands for exclusivity of their fishing activity. They also demanded actions to clarify how recognition of Seri rights over Tiburón Island
would affect fishing activity in these waters, expressing that they also have rights to use the resources since they have been residents of the area for over 50 years.

The decade of the 1990s marks the beginning of legal sport hunting operations of bighorn sheep on Tiburón Island. Legal hunting of sheep on Tiburón Island Reserve marked a time of increased efforts by the Seri Community to have more control over their territory and over the natural resources encompassed within. These efforts for self-determination and local control were influenced by the context created towards indigenous peoples rights and autonomy in the aftermath of the rebellion of the Zapatista Army in early 1994. Seris striving for more support with recognition of rights to decide their future caused an abrupt rupture with the INI of the Federal Government.

Indian ownership of wildlife and control of its stream of benefits also have influenced the management of fishing resources. The bighorn sheep project produced for the first time a source of money for operation of the Seri government independent from the Federal or State governments. Some of this money was used to support the Guardia Tradicional (traditional armed Seri guard) to aid in hunting operations. With more wildlife use activities in Tiburón Island, conflicts emerged with federal authorities in charge of wildlife management (SEMARNAP), and in charge of Island patrolling (Secretaría de Marina). The relationship with bighorn sheep researchers from the University of México (UNAM) also became problematic, as access to knowledge of the population’s status to calculate the number of males that could be harvested, became key in the hunting operation. It also gave a new appreciation for the need to manage game animals that can provide important sources of income.
As the majority of the bighorn sheep ranges in Sonora became private, the 1990s was also a decade of intense conflicts for land ownership in the mainland part of the Seri territory, and for the use of wildlife by outsiders. Some of the conflicts caused severe internal political conflicts in which several Seri Traditional Governors were important actors.\textsuperscript{47} This decade also marked a new era of political balance, influenced by the emergence of political power of Seri youth,\textsuperscript{48} and the votes of women to elect internal authorities. For the first time in the 1990s, political power was placed in hands other than the original \textit{comuneros} (see next Section C).

In this decade the \textit{jaiba} (swimming crab, \textit{Callinectes bellicosus}) fishery and the pen shell (\textit{Pinna rugossa} and \textit{Atrina tuberculosa}) fishery developed in the Infiernillo Channel. Other fisheries in the same area rose and collapsed due to overexploitation. Sea cucumber was nearly extirpated from the channel, and sea turtles and sharks became less and less common in Seri waters. Conflicts with outside fishers inside the Seri EFZ continued and escalated during the 1990s. This will be the main focus of Chapter 3 of this dissertation.

The economic and social relationships with Mexican neighboring towns also increased dramatically during the 1990s. With more money from commercial fishing, from sport hunting, and from some illegal activities, Seri speed of acculturation increased. Some manifestations of this are the acquisition and extended use of motor vehicles; the majority of households have at least one. Satellite television sets are found

\textsuperscript{47} More information on the tribal government structure on page 63 and Appendix 10.\textsuperscript{48} The current Seri Traditional Governor is 31 years old.
in virtually every household, and the consumption of marijuana and hard drugs like cocaine appear to be common among Seri youth.

The relationships with Mexican communities have led to the inter-marrying of pure Seri with Mexicans. The presence of more “mixed Seris” has rekindled the internal discussion over whether Indian rights should be linked to the degree of purity of Indian blood. The Seri Indians remain a small group, with a total population that is close to 800 people.

New sources of income like the incipient ecotourism on the island slowly developed during this decade. The production of handicrafts continued to be an important source of income for households. Because of competition with Mexican carvers, ironwood carving is giving way to carvings made of other local materials like soft stone, and palo blanco (Acacia willardiana) wood. Some opportunistic Seris have been seen selling as Seri, ironwood carvings made by Mexican carvers to unaware tourists visiting their villages or in Bahía Kino.

In recent years recuperation of land, invaded by private ranchers for several years, caused a re-emergence of Seri pride.
C. SERI SOCIAL ORGANIZATION AND CHANGES PROMPTED BY EXTERNAL ORGANIZATION STRUCTURES

One key element in the analysis of the Seri Exclusive Fishing Zone (EFZ) relates to the role of Seri institutions and social organization. These elements of Seri society have also changed with time. To set the context of these changes, a historical perspective is used.

Historical accounts of Seri social organization

There is little evidence of the type of social organization that Seri had at the time of the first contacts with Europeans. Knowledge about this culture developed slowly because of the complexity of their language, and the Seri lack of interest in developing close contacts with the first settlers in their range. As a consequence, much of the information on social structure we have from the time before the reduction of the Seri is very limited, and the social structure of this tribe was certainly seriously modified by decades of persecution and killing.

As nomadic people, Seri probably had a social structure similar to that of other nomadic groups in the world. Their total population size was never more than several thousand before warfare and disease reduced them to a few hundred (Bowen 1983). Like most nomadic groups with low population density, Seri had no political organization other than a local and temporary war chief, until the need for leaders or spokespersons emerged in their interactions with outsiders (Felger and Moser 1985). The center of social life is the extended family (Kroeber 1931). Seri moved their camps following the availability of natural resources from the ocean and the desert within limits imposed by
the scarcity of drinking water. There was an obligation to share material goods with other members of the extended family when resources were available.

When the range of the six Seri bands proposed by Moser’s (Moser 1963) was analyzed by geographer Conrad Bahre, he argued that some of the geographic areas were too small to support resident populations, considering water availability and the need for larger territories to survive fluctuating resources (Bahre 1967). Sheridan (1982) proposed later that the territories of Seri bands must have been permeable and band membership itself flexible and fluid. According to Sheridan, this system is more consistent with the model of “open, bilateral, nonterritorial, and flexible composition” of hunter-gatherer societies proposed by Lee (1972) for the !Kung Bushmen of Botswana, and there is no evidence, ethnographic or ethnohistorical, of a patrilineal form of clan organization.

Changes in Social Organization caused by external institutional structures, from 1940s to 1990s

The need for permanent representation to negotiate with State and Federal authorities, as well as other organizations and the private sector, has forced the Seri to have only one outside representative. Nowadays the Seris have one Governor, known by them as the Traditional Governor. The Traditional Governor is supposed to be the maximum authority, but rarely is. The organization of power is divided in four different structures, each has its own members and leaders.
1. Seri Fishing Cooperative

This was the first externally imposed form of organization. For the formation of the Seri cooperative in 1938 there was a need to make a list of Seri men who wanted to join, and to elect a leader to deal with the Mexican Government. In the original acts and bylaws of the cooperative, the list included at least 56 Seri men recognized as members and leaders on November 29, 1938. Nevertheless, this was probably not the first time a Seri leader was elected to negotiate with the Federal or State Government. The first elected president of the Seri cooperative was Alberto Villalobos “Vaquero” then 35 years old, who was also recognized as the Seri chief in those years. Cooperative negotiations with the outside world were still carried out by the Mexican fish buyer Jesús Solórzano.

2. Ejido of Desemboque and Punta Chueca

Unlike the fishing cooperative, which had little influence over Seri internal and external matters aside from fishing, creation of the ejido had a profound impact since it limited the pool of Seri men who could have a position in the administration structures of the ejido system and Tiburón Island communal property for the following 23 years. The list formulated in 1971 contained the names of 75 men, known locally as the comuneros. Some Mexicans were included in this list, like Oscar and Alfonso Topete who were storeowners and fish buyers and had resided in Desemboque since the 1940s. The ejido system had a Comisario Ejidal position, a Secretario, a Tesorero, and a Presidente del Consejo de Vigilancia. Only men recognized as comuneros could vote for or hold those positions.
3. Tiburón Island Comunal Property

The same list of comuneros was used in the paper work to include the land of the island in the Seri territory. As a result, the same cadre of 75 Seri men was eligible for positions as leaders of the communal property of the island. This second structure of representation was not actually used much until the 1990s when the island acquired more economic and political importance. By 1996, a meeting was called by the Procuraduría Agraria (PA) of the Secretaría de la Reforma Agraria (SRA) to elect the Presidente de Bienes Comunales, the Secretario and the Tesorero, as well as a president and two Secretarios of the Consejo de Vigilancia. By 1996 approximately 22 men of the original list of comuneros had died reducing to 41 the number of men eligible for public positions (the Mexicans in the list of comuneros were never proposed). Since not all of these men were either in the best physical or mental state or interested in a political position, the list of possible candidates was reduced even more. Re-elections were possible and some men repeated or just rotated between positions for many years.

The list of comuneros was finally updated in 1998, as 141 new men and for the first time, many women were included as legal owners of Tiburón Island. All of them are now eligible for public positions, and young men and women could vote during elections for the first time in 1999.

4. The Council of the Elders

Today the Seri recognize a fourth type of government structure. I could not find any references to the previous existence of a council formed by Seri elders. This form of Seri internal organization probably did not result directly from influence of external
institutions. More likely it resulted, or re-emerged, from political pressure exerted by
younger leaders to the old Seri, and the need of the latter to keep some political influence
in decision-making. This council consists of three men who are among the oldest of the
tribe and who still have lucid minds.
CHAPTER 2
OVERVIEW OF THE CONSERVATION PROBLEM, OBJECTIVES AND
STUDY AREA

A. MARINE TENURE AND PROPERTY RIGHTS IN FISHERIES
MANAGEMENT

Explanations for fisheries management problems are often based on the common property nature of ocean resources (Hardin 1968, Crutchfield 1973). It is widely believed that when resources are owned collectively, overexploitation is the inevitable outcome, unless those resources are privatized or government regulation of users is instituted (Feeny et al. 1990). These are strong arguments for top-down development planning, which usually ignores local institutions and local participation in management (Berkes 1989). The above arguments also confuse the concepts of common property with those of open access, as well as ignore the self-regulating capabilities of users and their rich understanding of fisheries ecology (Gatti 1985, McCay and Acheson 1987b, Neis 1992, Ruddle 1994). The subjects of: 1) property rights of marine resources, 2) the co-management of fisheries, and 3) the role of traditional ecological knowledge in fisheries management, constitute the theoretical context for my dissertation. I will briefly present and analyze the prevalent issues for the first two subjects presented. Traditional knowledge will be analyzed in Chapter 4.

Influence of the Tragedy of the Commons Model

Among the most important socio-cultural factors in natural resources management is the nature of property rights for resources. This factor is especially relevant in fisheries
management, considering that most fisheries around the world show a persistent and in some cases disastrous tendency towards overexploitation, widely associated in the past and today with uncontrolled access rights to the marine environment (Gordon 1954, Christy and Scott 1965).

In the absence of private ownership, fishermen have no incentives to curtail fishing activities in response to declines in catch or increases in costs, because no property rights guarantees that fish not taken today will be available in larger quantity or at great weight in the future (Acheson 1987). What one fisherman does not catch today goes to other fishermen (Crutchfield 1973:116-17 in Acheson 1987:37).

The ideas that resources held in common are subject to massive degradation was expanded and greatly popularized by the biologist Garret Hardin in a paper published 32 years ago. Hardin’s “tragedy of the commons” became the most widely accepted explanation for overexploitation of resources that are commonly held (Feeny et al. 1990). It was named the tragedy of the commons because it argues that freedom in a commons brings ruin to all, since the maximization of each individual’s benefits does not account for the costs imposed on others. Therefore, “the oceans of the world continue to suffer from the survival of the philosophy of the commons...bring[ing] species after species of fish and whales closer to extinction” (Hardin 1968).

The influence and popularity of this theory has been tremendous. It is used by layman as well as decisions maker to explain the causes of natural resources degradation, and is the dominant framework within which social scientists portray environmental and resource issues (Godwin and Shepard 1979). It is commonly cited as one of the main
reasons for overexploitation of fisheries around the world. The tragedy of the commons has become part of the conventional wisdom in natural resource conservation; Hardin’s tragedy “should be required reading for all students... and if I had my way, for all human beings” (Moore 1985 in Feeny et al. 1990).

To avoid the tragedy, Hardin concluded that the only solutions were the privatization of the resource or control by the government. He “has been widely cited as having said that resource degradation was inevitable unless common property was converted to private property, or government regulation of uses and users was instituted” [italics added] (Feeny et al. 1990). This conclusion “has been used as part of the justification for nationalization, privatization of resources, and the widespread practice of top-down development planning that ignores local institutions” (Berkes et al. 1989).

But the tragedy of the commons model has two important limitations: (1) it fails to distinguish between common property and open access, and (2) it fails to take into account the self-regulating capabilities of users. The inaccurate assumption that common property and open access are synonymous is present in many scholarly texts that span several decades. This assumption has led to arguments that restrictions on access, mainly through privatization, are the only effective means for avoiding over-exploitation of natural resources. However, several authors have questioned whether privatization is a solution and propose other strategies to discourage over-exploitation (McCay and Acheson 1987a).
In true common property situations, right of access or use are shared equally and are exclusive to a defined group of people. Common property is not everybody’s property (Ciriacy-Wantrup and Bishop 1975).

...If open access is the problem, then restricting access to a defined body of people who inhabit or lay claim to a particular territory should lessen or solve the problem... If we can keep others out, it makes sense for us to do something about our own behavior (McCay and Acheson 1987a).

The differences between open access and common property can be further clarified with the taxonomy of the four basic property-rights regimes presented and explained by Berkes et al. (1989): (1) open access is the absence of well-defined property rights (access is free and open to all, and it is the regime implied in Hardin’s model); (2) in private property an individual or a corporation has the right to exclude others from using the resource and to regulate its use; (3) under communal property, the resource is held by an identifiable community of users who can exclude others and regulate use; and finally (4) state property or state governance means that the rights to the resource are vested exclusively on the government, which controls access and levels of exploitation. Resources held under communal property are also called common-pool resources or common property resources (referred in the literature as CPR). Berkes et al. (1989) clarifies that the four property categories mentioned are ideal analytical types, because in practice resources are often held in overlapping combinations of these four with variations within each.

Berkes et al. (1989) propose that we can use the tragedy of the commons model to formulate a more balanced and comprehensive theory for the management of CPR by:
(1) not equating common property resources with open access assuming it leads to overexploitation, and thus equating the commons with overexploitation; (2) not assuming that individual interests are unconstrained by existing institutional arrangements; (3) not assuming that resource users cannot cooperate toward their common interests under certain circumstances, voluntary collective action is feasible, and sustainable outcomes are not unusual; (4) not overlooking the role of local institutions that provide for exclusion and regulation of use; and finally (5) recognizing that the set of solutions offered by the tragedy of the commons model is too limited. In short, privatization or the imposition of government control are not the only viable policy options for assuring sustainable use of CPR.

Common Property and Natural Resources

The work of the economist David Bromley (1992) is very helpful to clarify the concept of common property:

The key concept is property. Property is a claim to a benefit (or income) stream, and a property right is a claim to a benefit stream that some higher body -- usually the state -- will agree to protect through the assignment of duty to others who may covet, or somehow interfere with the benefit stream.

There is no such thing as a common property resource; there are only resources controlled and managed as common property, or as a state property, or as private property. Or -- and this is where confusion persists in the literature – there are resources over which no property rights have been recognized. We call these...‘open-access resources’ (res nullius...Latin for ‘no one’s property’).

Property is not an object but is rather a social relation that defines the property holder with respect to something of value (the benefit stream) against others...Property is a social instrument, and particular property regimes are chosen for particular social purposes.
Rights have no meaning without correlated duties, and the management problem with open-access resources is that there are no duties on aspiring users to refrain from use (Bromley 1992).

Conceptualizing property as a social construction helps to demonstrate how the tragedy of the commons model can be modified to increase social benefits for the majority of stakeholders. According to Feeny and collaborators (1990), during the evolution of the use of a resource held under an open access regime, the tragedy may start as Hardin proposes, but after several years of declining yields, resource users are likely to: (1) control access, and (2) agree upon a set of rules of conduct that effectively limits exploitation. The social capability to construct rules and norms to restrict individual behaviors was vastly underestimated by Hardin. There are many societies and in many situations where the capacity for concerted social action overcomes the divergence between individuals and collective rationality.

“Property -- as applied to natural resources -- is, as a ‘primary’ social institution, a decision system that provides decision rules for adjusting and accommodating...conflicting demands from different interest groups in the society” (Ciriacy-Wantrup 1975). In order to analyze common property regimes, we need first to be clear about the specific property rights that these property regimes entitle.

‘Property’ refers to a bundle of rights in the use and transfer (through selling, leasing, inheritance, etc.) of natural resources...different rights (strands of the bundle) may be distributed in various combinations among persons, groups, and several publics, including the government... Common property refers to a distribution of property rights in resource use in which a number of owners are co-equal in their rights to use the resource.
This means that their rights are not lost through non-use...and does not mean that the co-equal owners are necessarily equal with respect of the quantity of the resource use...[but also] implies that potential resource users who are not members of a group of co-equal owners are excluded (Ciriacy-Wantrup 1975).

A fundamental element in the concept of property is exclusion. Property has no meaning without this feature. Everybody but the owners themselves or those who have some arrangement with owners to use the resource in question, must be excluded. To describe un-owned resources (res nullius) as common property (res communes), as many economists have done for years, is a contradiction according to Ciriacy-Wantrup (1975). The cliché ‘everybody’s property is nobody’s property,’ should instead say ‘everybody’s access is nobody’s property’ (Bromley 1989).

If we want to formulate a list of world resources held under common property regimes the list will be long and diverse including commons with a fixed location (i.e., a woodlot), or ‘fugitive’ resources (e.g., fish and wildlife), renewable resources (e.g., grasslands), or non renewable resources (e.g., oil deposits). In some cases these resources exist over large areas (i.e., oceans, the atmosphere) that cannot feasibly be divided and organized as separate parcels of private property, or in other cases resources are organized as commons by social preference (e.g., pastures) (Oakerson 1992). This diversity of common property resources can be confusing in an analysis of their characteristics. Feeny et al. (1990) suggest that resources held under common property share two key characteristics: (1) due to the physical nature of the resource, the exclusion (or control of access, excludability) of potential users is problematic, being in many cases a costly process and in some other cases virtually impossible to achieve; and (2) are
resources subjected to subtractability, which means that each person using the resource is capable of subtracting from the present or future welfare of other users or owners.

The level of excludability and subtractability are largely determined by two variables: (1) the nature of the resource in question, and (2) the characteristics of the common-property regime. Both parameters can be located along a continuum whose limits are determined by those same variables. Plasticity in excludability and subtractability levels is considered in the detailed framework provided by Oakerson (1992) to explore variations in common-property regimes. This framework is helpful since it distinguishes four sets of attributes or variables that can be used to describe the commons: (1) physical attributes of the resource and the technology used to appropriate its yield, (2) decision-making arrangements (e.g., organization and rules) that govern relationships among users, (3) mutual choice of strategies and patterns of interaction among decision-makers, and (4) outcomes or consequences. In Chapter 4 this framework is used to analyze in detail the Seri marine CPR.

Territorial Use Rights in Fisheries (TURF)

TURF are a kind of sea tenure institution. They are interesting because of: (1) their influence in preventing open access to the world’s fisheries (the Extended Economic Zone-EEZ is a form of worldwide TURF), and (2) their provision at the local level offers an important opportunity for improving or maintaining the welfare of small-scale fishing communities in developing countries (Christy 1982).

TURF have been known to exist for centuries, generally associated with sedentary resources such as oysters, mussels and seaweed. Enclosed bodies of freshwater ponds,
lakes, floodplains have also been subject to exclusive use rights. TURF emerged as well in areas or situations where ease of acquisition and defense of an exclusive right is not apparent, such as marine areas, lagoons, beaches, coral reefs and, recently, in association with fish aggregation devices (Christy 1982).

The bundle of rights associated with TURF include the right of exclusion, right to determine patterns of use of resources within the territory, and right to extract benefits from the use of those resources (Siar et al. 1992). Christy (1982) proposes that it should also include the right to future returns from the use of a territory.

The following are the main elements in Christy’s characterization of TURF. The territory governed by TURF could be the surface, the bottom or entire column of water of the marine portion encompassed. The size of TURF could vary with the use of their resource, the resources being harvested and their geographical characteristics, but their boundaries should be clearly demarcated and identifiable, using natural or artificial features. The territory does not necessarily have to fully enclose the whole stock of fish or other resource, since a TURF is not so much resource specific as it is site specific. The degree to which there is a value associated with the territory is the significant element, especially since in most cases the movement of natural resources cannot be interrupted (Christy 1982).

Among the most important characteristics of TURF is territoriality. “The importance of territoriality is that it can be the basis for the development of more restrictive common property institutions” (McCay and Acheson 1987).
The nature of ownership of TURF is in part a matter of effectiveness and in part a matter of equity. In the case of communal TURF held in perpetuity, ensuring the flow of future income streams from the territory has a value that can only be approximated in economic terms, since it may have significantly greater importance to the welfare of the community. For example, the owner of a TURF can be a private individual, a private individual enterprise, a group of individuals such as a cooperative, an association or a community, a town, a nation or even a multinational agency, with the objective of improving the welfare of small-scale fishing communities (Christy 1982).

The creation and maintenance of TURF are affected by the following conditions: the natural resources attributes, the degree to which the boundaries can be readily defined and defended, the types of fishing devices used, the cultural feasibility of permitting extension of land rights to the sea, effective distribution of wealth among users, and legal and institutional support received. The distribution of wealth produced by effective TURF typically involves a strong political dimension entailng government support for the distribution of resource use rights. Without a deliberate decision about the distribution of wealth and full government support for enforcement and protection, the efficacy of TURF is likely to become very difficult (Christy 1982).

The benefits of TURF reside primarily in the empowerment of local users to control and administer their own resources. TURF promote conservation practices that may not rely totally on external enforcement and management.
B. FOLK MANAGEMENT AND CO-MANAGEMENT OF FISHERIES

We know that territoriality can be the mechanism for restricting use patterns of common property resources. Individual voluntary modifications of behavior or participation in the creation of rules for coordinating resource use have been documented in what is called “folk management” (Pinkerton 1994). “Formally defined, folk management is any localized behavior originating outside the state control that facilitates the sustainable utilization of renewable natural resources” (Dyer and McGoodwin 1994). Territoriality is one of the foundations for folk management of fisheries resources since it provides a system to control access to the fishery.

Few examples of folk management systems have been documented in México. This is due to the lack of studies of this subject, and the fact that these systems are probably obscured or have been eradicated by the fishery control performed by the Federal Government. Fisheries management in Mexico is a responsibility of the Federal Government. One of the few documented examples is the lobster fishery on the southern coast of the state of Quintana Roo in the Yucatán Peninsula (Leslie 2000). Here folk management is totally independent of governmental control and the system has proved to be successful over the years. A common-property regime based on territorial use rights is used to manage lobster fishing. Using small artificial structures placed on the sea floor to attract and concentrate spiny lobsters (*Panulirus argus*), the fishers from the communities of Bahía Asunción have divided most of their fishing grounds granted under concession to their cooperatives into individually owned parcels or *campos*. This sea tenure system seems to provide incentives to maintain a sustained harvest, increase working hours,
invest more and actively participate in the regulation of their fishery. Furthermore, by
limiting access the community is able to prevent free riders (from outside or within the
community) who do not contribute to management from exploiting the common property
resource (Miller 1989).

Community-based restrictions independent of governmental control usually
facilitate implementation of co-management (also known as cooperative management)
regimes, where local communities share different management responsibilities and duties
with authorities (Pinkerton 1989, Dyer and McGoodwin 1994, Sen and Raakjaer Nilsen
1996). Co-management is one of the most popular paradigms in fisheries management
today, and is particularly appropriate for small communities that depend on small-scale
fisheries, since these people mostly exploit local fishing grounds and should benefit from
local-level management decisions. Nevertheless, emergence of co-management systems
is not automatic, and the conditions necessary for co-management to arise and function
successfully are not clear (Pinkerton 1994). Co-management offers new ways to
integrate local management in subsistence indigenous fishing communities into federal
management systems (Jentoft and McCay 1995).
C. FISHERIES MANAGEMENT IN MEXICO

Fisheries management is the responsibility of the Secretaría de Pesca (SEPESCA), that is part of SEMARNAP. Management is based entirely on regulations to control entry to the fishery, via fishing permits and fishing concessions. Fishing permits are the most important and widely used management tools, since concessions are limited to a few marine benthic and sessile species in few areas of the coast (e.g., abalone Haliotis spp., sea urchin Echinometra vanbrunti, and lobster Panulirus spp. in the west coast of the Baja California Peninsula, and in the Caribbean Sea for spiny lobster). The fishing concession granted to the Seri Indian community over an extensive marine territory in 1975 is uncommon in the Gulf of California and elsewhere in México. Its distinctiveness lies in the fact that other fishing concessions are specific to one species or groups of similar species (i.e., the concession of the lobster inside Bahía Asunción, Q. Roo, or to abalone in Isla Cedros, B.C.). The Seri concession includes all the marine species commercially exploitable inside their territory. Another difference is that the primary reason for the creation of the Seri exclusive fishing zone (EFZ) was not economic but social -- to ensure survival of the Seri population, depleted after many decades of war and struggle against Spaniards and Mexicans. Since the Seri have always been very dependent on marine resources, it was decided that granting legal sea tenure was the best strategy to ensure survival of Seri culture and minimize competition with outside mestizo fishing fleets (D.O.F. 1975).
The bias toward large-scale fisheries

Fisheries development efforts by the Mexican government started in the 1920s intensified considerably in 1976 with the declaration of the 200-nautical mile Economic Exclusive Zone (EEZ). From 1977 to 1982, during the López Portillo Administration, a plan for fisheries development was adopted that included modernization and expansion of the fleet, diversification of the fishing effort, development of basic infrastructure, and technical training of the fishing force (Cicin-Sain et al. 1986). The government goals for the fishery in 1983 were: (1) food production, (2) creation of jobs, (3) contribution to enhancement of the standard of living of the population, and (4) improvement of the balance of trade and capture of foreign exchange (Cicin-Sain et al. 1986). While these goals are relevant for both small and large-scale fishing sectors, the last goal has been the primary emphasis of the government for two decades. At the beginning of the 1980s, Mexican fisheries were of two types: (1) a modern shrimp fishing industry aimed at the export market, and (2) an artisanal (or small-scale) fishery aimed primarily at local consumption49 (Cicin-Sain et al. 1986). In the late 1980s, the shrimp fishery was the most important Mexican fishery in terms of foreign exchange and employment (Magallón-Barajas 1987), and continues to have tremendous socio-economic importance. As a result, management actions and research programs of the government have, for the past 20 years, been almost limited to the large-scale shrimp fisheries, and to the sardine and tuna fisheries developed in the 1980s and 1990s.

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49 Shrimping from small-scale boats is for export.
Centralized Bureaucracy and Influence of the Private Sector in Fisheries Management

The fast rate of development of the fishery-oriented bureaucracy in México resulted from government efforts in the 1970s-1980s. It catapulted the country into a first-world fishing power (Cicin-Sain et al. 1986). A major actor in this development was Secretaria de Pesca (SEPESCA), consolidated after many years of organizational transformations during the López Portillo Administration. SEPESCA was responsible for evaluation, management and development of Mexico’s fisheries resources. It had Delegaciones in all coastal states, and in those states with extensive coastline, one or more Oficina Regional de Pesca exists in strategic small coastal towns. Landed catch must be registered in the Oficina Regional de Pesca. Fisheries research is the responsibility of regional Centro de Investigaciones Pesqueras (CRIP), coordinated under the Instituto Nacional de Pesca (INP) in Mexico City. SEPESCA staff is concentrated in central offices in Mexico City and in large state capitals.

The centralized nature of decision-making in SEPESCA has changed little since the 1970s. Major decisions still emanate from the President and presidential cabinet in

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50 SEPESCA was transformed in 1994. The basic structure was maintained when it was transformed.
51 To give an idea of SEPESCA bureaucracy dimensions in the 1980s, Cicin-Sain et al. (1986) compare it with its counterpart in the United States, the National Marine Fisheries Service (NMFS). In 1981 SEPESCA had 18,385 permanent employees, this was almost ten times the number of NMFS employees. However, this was before Mexico economic crisis of the early 1980s that prompted a reduction in bureaucracy and the privatization of several para-State entities that further reduced the number of employees.
52 The Seri territory is part of the jurisdiction of the Oficina Regional de Pesca in Bahía Kino. An important part of marine resources harvested inside the Seri territory is commercialized in Bahía Kino.
53 Regional offices are usually understaffed, have very small operating budgets, and almost no logistic resources as cars, boats.
México City. The executive authority of the President in México extends much farther than in the United States, using a strong and centralized bureaucracy in which strong bonds of personal relationships and political patronage are very common. In this system, political/bureaucratic leaders are not technical experts but generalists who may have held appointments in various agencies during their political career (Cicin-Sain et al. 1986).

The participation of natural resource interest groups in fisheries decision-making also has been the emphasis of the large-scale fishing sector whose interests are represented by the Cámara Nacional de la Industria Pesquera (CANAIPES). This is by far the strongest fisheries interest group in Mexico. The other interest group is the Sección de Cooperativas Pesqueras de la Confederación Nacional de Cooperativas Pesqueras that involves all fishing cooperatives in México. The political influence of this latter group was debilitated in 1988 when the government decided to change the federal fishing law that restricted the harvest of the most important commercial species such as lobster, abalone, pismo clam, cabrilla, shrimp, oyster, sea turtle and totoaba to government licensed co-operatives. The new Fisheries Law opens these fisheries to participation of the private sector. As a result, many of Mexico’s fishing cooperatives have disintegrated, leaving more political room and power for the private sector, through CANAIPES, to influence fishing policy. So far CANAIPES investments and interests are concentrated on supporting large-scale fisheries, with increasing and expanding interests

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54 The last two species are now banned because their endangered status and protected by law.
in aquaculture and in acquisition and operation of fleets of pangas for small-scale fisheries.

At the beginning of President Ernesto Zedillo’s administration, the creation of the SEMARNAP lowered the status of SEPESCA ministry to a sub-secretariat. The explicit purpose of the creation of SEMARNAP, under the leadership of the trained ecologist Julia Carabias, was the coordination of management efforts for terrestrial and marine natural resources. However, the new status has not changed the former structure of SEPESCA. Fisheries officials stated by that the new arrangement was designed to force the environmental section of SEMARNAP to coordinate with the fisheries managers and administrators, not the opposite. Thus the merge was more physical -- the sharing of one building -- than operational. The powerful Sub-secretary of Fisheries, Lic. Carlos Camacho Gaos, in office for almost 12 years, continually opposed initiatives for sustainable fisheries proposed by Carabias.

Mexican Fishing Law: Administration through Entry Controls

In Mexico all marine resources are held as federal property. With a concession, permit, or authorization granted by the federal government through the SEPESCA, anybody who fulfils the administrative requirements can practice commercial fishing, and

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55 Pangas is the local name used for the fibreglass skiffs used by small-scale fishermen.
56 The basic structure of SEPESCA was maintained when it was transformed.
57 With President Vicente Fox Administration, SEPESCA was moved again from SEMARNAP into a new Ministry of Agriculture, Cattle Ranching, Regional Development and Fisheries-SAGARPA. In June of 2002 the National Commission of Aquaculture and Fisheries was created to deal with the administration of all fisheries in México. It is headed by Dr. Jerónimo Ramos, the second in command when Dr. Gaos was in charge of SEPESCA.
therefore have the property right to enter a physically defined area (access right to a fishing ground), and to obtain products from it (withdrawal right or fishing right).

The Mexican Federal Fishing Law of 1992 also states that for “subsistence fishing” no rights from the government are needed. This means that no permits are needed to fish to feed yourself or your family.58

The control mechanism used to attempt fisheries regulation is entry limitation. In theory any commercial fisher must have a fishing permit, authorization, or concession. However, this system relies heavily on enforcement in the fishing grounds. The almost complete lack of enforcement of the fishing law in Mexico makes it impossible to control the fishing effort through this method. Enforcement of environmental laws is the responsibility of the Procuraduría Federal de Protección al Ambiente (PROFEPA), also under SEMARNAP. While fishing permits do not limit access to the resource, due basically to lack of enforcement, they strongly influence the social organization of fishing.

Social Organization of Fishing

There are three main types of social organization for fishing in the small-scale sector: (1) the permisionarios or fishing permit holders, (2) the pescadores cooperativistas or those who work under a cooperative system, and (3) the pescadores libres or free fishers. Permisionarios are individuals that hold a fishing permit issued from SEPESCA, thus are entitled to legally extract and commercialize specific marine

products. The cost of permits varies. They are usually valid for 2 years and are non-transferable. Permisionarios are local entrepreneurs who usually own the means of production -- fiberglass boats, outboard motors, nets, traps, hooka air compressors, semi-trucks, and refrigerated storages. They hire free fishers or those belonging to cooperatives to go out and catch fish that the permisionarios commercialize. The fishing permit covers a specific number of pangas, referred as número de espacios. However, this limitation on number of boats is never respected and not enforced by PROFEPA. Permit holders are the only ones who can land catch in the Oficinas Regionales, and can provide legal invoices (or facturas) for the catch. The facturas prove legal ownership, and are necessary to transport the catch to regional or international markets. However, illegal facturas are sold and bought to shelter catch bought from illegal sources. Consequently, although not enforced on the fishing grounds, fishing permits are needed to legally commercialize the landed catch, to register this capture in federal offices, and to issue the needed papers for catch to be transported and legally commercialized by others intermediaries. Some permisionarios do not own a single boat but have several fishing permits. Others have a permit that is limited to 3 or 4 boats, but

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59 The permit is valid for particular species, or group of species, and only allows the catch of that resource (i.e., octopus permit, lobster permit). One organization can hold many permits to catch several commercial species. Permits specify the authorized fishing area. Fishing areas are usually very large. Their geographical extension is based on administrative rather than biological units. For some fisheries of pelagic species, like sharks, authorized fishing areas could be the waters of the Mexican Pacific Ocean.

60 Usually the permisionarios provide the gasoline, food and sometimes even the necessary equipment and gear to go fishing. In most instances the fishermen get a share of the catch, instead of a salary.
the holder of this permit may buy the catch of 20 or more boats owned by him or by others. Fishing permits only control access to legally commercialize the catch.

Fishing cooperatives seem to be the most convenient form of organization for fishermen. The fishing cooperative system was introduced in the 1930s in Mexico, intended not only to manage access to fishing but also provide the means of production for a group of fishermen through access to monetary credits, loans or grants from government banks and other financial institutions. In general, the cooperative system has failed to provide those benefits, and fishermen find it more advantageous to be free to move to a more convenient working arrangement.

A major blow to the cooperative systems were the changes in 1992 of the Federal Fishing Law that took away the exclusive right fishing cooperatives had to withdraw the most valuable species, and opened these fisheries to the private sector. At the same time governmental support for cooperatives dwindled, and credit from banks stopped. The majority of the fishing cooperatives got deeply in debt, went bankrupt, and were soon dismantled.

_Pescadores libres_ are “free” since they do not belong to fishing co-operative or any other group. They usually do not own fishing equipment, but some have vast fishing experience. In order to engage in legal commercial fishing, they have two options: either to work for a permisionario or enroll in fishing cooperatives. In the

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61 During President Carlos Salinas’ administration other types of groups for fishers were promoted like _Sociedad de Solidaridad Social_ (S.S.S.), and _Grupo Solidarios_ (G.S.). But by the end of his administration fishermen were again required to group only in fishing co-operatives.
former option they must operate under the fishing arrangements and be part of the labor force of the permisionario.

**D. THE SERI EXCLUSIVE FISHING ZONE**

**Rights Granted to Seri Fishermen**

The Presidential resolution that created the Seri Exclusive Fishing Zone (EFZ) recognized three issues: 1) the high degree of economic dependence of Seri upon fishing, 2) the use by these fishermen of marine areas adjacent to Tiburón Island and their mainland territory for many years, and 3) the need to give preferential rights to Seri fishermen to minimize competition with outside fishers. This legal document gave the Seri exclusive withdrawal rights within this marine territory. The right of access for people who do not belong to the community was not given to the Seri. This is specifically addressed in the Presidential Decree. Seri marine territory its legally considered part of the Mexican territory and all Mexicans always have free access. Therefore, Seris were conferred only exclusive withdrawal rights but not exclusive access rights. Seris also have *de jure* rights of exclusion, since they can legally exclude non-Seri fishers from fishing inside their territory. The two most relevant operational-level property rights are access and withdrawal (Schlager and Ostrom 1992). Even though Seris do not have exclusive access rights, the nature of their relationships with fishermen from other communities has resulted in *de facto* exclusive access rights, as I have showed in Chapter 1.
Intrinsic Limitations of the Seri EFZ

The presidential decree published in 1975 was conceived as a general legislative tool to outline the assignation of rights to the Seri. As with other presidential decrees, it certainly needed further documents to specify and clarify the important elements included in it. The text of the decree called directly for a process to define these elements.

The most important aspects of the decree are limits of the area under concession. In the original text of the decree, the last paragraph of the section entitled “considering” said: “…To avoid the take away, invasions, illegal fishing acts and any other acts that could affect them in their patrimony, and on those recognized directly to the members of the Seri community and to the Cooperative of Fishing Production organized by them, it should be precisely determined the waters in which the cited community could operate, and in particular the Sociedad Cooperativa de Producción Pesquera “Comunidad Seri,” Seri”…[italics added] (see Appendix 3). Unfortunately further efforts to precisely determine these limits never happened, leaving an ambiguously defined Seri fishing territory.

Different groups have interpreted the limits of the Seri EFZ in different ways and have formed different subareas within this zone. Each interpretation of the external boundaries gives substantial competitive benefits to the group who is using it during fishing operations. The Seri interpret the limits of their exclusive waters in the most generous possible way. They include areas where they have little or no presence in recent times, but which were part of their historical stronghold, like waters adjacent to the west and south coast of Tiburón island and San Esteban Island waters. Non-Seri groups
do the opposite, recognizing under Seri ownership just a portion of the waters within the Infiernillo Channel, inside “the core” of the Seri territory, in front of Seri villages. Non-Seri recognizes only areas where Seri fishermen have a numerical superiority. In practical terms, this is the functional Seri EFZ, and will be the territory under common property analyzed in my study. The rest of the territory is functioning _de facto_ as an open access territory to all fishermen. Some non-Seri fishers contest all Seri exclusive use of the ocean in the region. Whether this is related to their lack of awareness of the existence of the presidential decree of 1975, or simply opposition to ownership in the sea it is unknown.

The lack of clarity in boundaries creates fertile ground for conflicts. Seri fishermen compete with non-Seri fishermen inside the Infiernillo Channel. Outside the Infiernillo Channel there is no competition. Conflicts arise when Seri attempt to exercise their _de jure_ rights in their interpretation of the Seri EFZ boundaries, and either try to expel non-Seri fishermen from these waters, or benefit from their fishing activity charging a user fee to allow them to fish.

The question of whether Seri have the right to transfer withdrawal rights to users that are non-Seri is an important issue in the relationship of Seri with large-scale fleets, mostly shrimp trawlers. Enforcement rights and capabilities of Seris as owners are essential to maintain their exclusive rights. In this aspect the Seri _Guardia Tradicional_ (traditional guard) plays an important role, both in creation and resolution of conflicts.

Some strategies used by non-Seri fishers to enter the Infiernillo Channel are more complex since they involve being part of the Seri community. For analysis of these
strategies, it is critical to draw on the current context of socio-cultural relationships between Seris and Mexicans, internal conflicts related to Indian blood mixing, and dynamics of Seri authorities, and community representation in decision-making processes. This is the focus of the analysis of the Seri EFZ presented Chapter 3.

E. OBJECTIVES OF THE STUDY

This study addressed fundamental questions pertaining to the management of small-scale fisheries under common property of an indigenous group with exclusive withdrawal rights over the marine resources. The goal of my dissertation was to understand the underlying social, political and biological issues of this management system in order to suggest strategies to promote more sustainable and equitable fisheries inside the Seri EFZ. In addition, I evaluated the extent to which the Seri fishing scenario offers insights for the use of exclusive fishing zones as a resource management tool for the neighboring fishing communities of Bahía Kino.

I focuses on four broad, interconnected research questions:

1) To what extent do Seri control access to their EFZ, and what is the level of competition for marine resources within this area with fishers from adjacent regions?

2) What is the historical and current social, political and economic context of the Seri EFZ, and what are indicators to assess the efficacy of this management tool for sustainable fisheries in this portion of the Gulf of California?

3) What are the characteristics and the roles of traditional ecological knowledge (TEK) utilized by Seri fishers inside the EFZ?

4) What is the applicability of the EFZ model to the fishing area of Bahía Kino?
The main goal of the dissertation is achieved by accomplishing the following objectives:

1) To describe the prevalent issues and theoretical contexts of common property ownership and community participation in natural resources management, and the role of sea tenure and traditional ecological knowledge in marine fisheries management and conservation.

2) To describe the role of Seri and federal and state institutions over the control of access to Seri exclusive waters, and the arrangements under which non-Seri fishermen gain access.

3) To identify sources of conflicts between beneficiaries of the marine territorial concessions and fishers from adjacent communities, and assess these issues in terms of basic conservation and equity standards, the balance of social relations between different resource users, and the possibilities for co-management.

4) To develop an understanding of the spatial and temporal fishing patterns and production trends between Seri and non-Seri fishermen in Seri EFZ.

5) To assess whether *jaiba* (swimming crab) fishing inside Seri exclusive waters is carried out following general sustainable fishing standards and whether these fishing practices use traditional ecological knowledge.

6) To develop recommendations for analyzing the socioeconomic and biological context of exclusive fishing zones and their contribution to sustainable fisheries. Also, to evaluate exclusive fishing zones as a strategy for sustainable fisheries management.
and develop recommendations of key elements to consider for creation of exclusive fishing zones in other areas of the Gulf of California.

**F. STUDY AREA**

**Infiernillo Channel**

Infiernillo Channel or *Canal de Infiernillo* is located between Tiburón Island and the mainland coast of Sonora, in the Midriff Islands Region (MIR) of the Gulf of California (Figure 2.1). For information on the ecological, oceanographic, and social characteristics and conservation issues of the MIR see Zeitzchel 1969, Case and Cody 1983, Bahre 1983, Bourillón 1996, and Bowen 2000.

This natural channel is long (37 km), narrow (2.7 to 11 km), and shallow (average depth of 5.5 m). For this study, an imaginary line extending from Punta Sargento to Punta Mala marked the northern limit of the channel. A similar line extending from Punta Santa Rosa to Punta San Miguel is the limit of the southern boundary. The north end of the Infiernillo Channel connects to Agua Dulce Bay, and the south end to Kunkaak Bay. The names of the main Seri fishing camps, and of the most important geographic features inside the Infiernillo Channel are presented in Figure 2.1.

**Biological Characteristics**

The shallow waters of Infiernillo Channel give refuge to a rich marine ecosystem. The coastline has nine coastal lagoons. Three species of mangrove trees live along the edges; red (*Rhizophora mangle*), black (*Avicennia germinans*), and white (*Laguncularia racemosa*) mangrove forest provide feeding and nursery areas for fish, crustaceans, and
migratory or resident aquatic birds. Inside the Infiernillo Channel extensive seagrass beds grow. The bottom of the channel is covered by large patches of eelgrass (*Zostera marina*), and ditch grass (*Ruppia maritima*), and by about 200 species of marine algae. Mangrove forests and seagrasses are critical nursery and feeding areas for marine life, and are near zones with continuous up-welling around Tiburón Island that maintain high levels of primary productivity year round. As a result, the Infiernillo Channel and the waters adjacent to Tiburón Island are extremely rich in marine life, and maintain important fisheries. See Torre (n.d.) for a detailed description of the ecological attributes of this channel.

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62 These are probably the last portions of shallow and soft ocean bottoms in the Midriff Islands Region, and perhaps even in the entire Gulf of California that have not been disturbed by the action of shrimp trawling nets.
Figure 2.1. Map of the names and main geographical features of the study area, and its locations in the Midriff Islands Region of the Gulf of California.
CHAPTER 3

THE EFFECTS OF THE SERI EXCLUSIVE FISHING ZONE ON FISHERIES MANAGEMENT

A. INTRODUCTION

Twenty-five years ago the Mexican Federal Government granted exclusive fishing rights to Seri Indians over a large marine area, based on the premise that by avoiding competition with outside fishermen their likelihood of survival would improve. The Seri EFZ has had a strong influence in the fisheries of this area. It has not precluded competition among fishermen, and exclusion of outsiders from the zone has proved difficult, and in some situations, not beneficial for the Seris. The fishing concession granted to the Seris came with important deficiencies, without any external form of support to enforce it. However, exclusion of outsiders, needed to fulfill the social goals of the Seri EFZ, was partially achieved because the Seri de jure territory was placed over their de facto territory. The Seri EFZ has worked well in areas where Seri fishers have always had numerical supremacy. The Seri EFZ was adjacent to important and rapidly growing Mexican fishing communities. Levels of Seri competition with Mexican fishermen, important enough in the 1970s to motivate the political need for a Seri concession, have grown in the last two decades. By the time Seris received the fishing concession they had entered into a cash economy. Broadening linkages, combined with the peculiarities of Seri organization, institutions and long history of mistrust of outsiders and resentment of the government, have all contributed to make resource use rights a
source of conflicts, but as well as of alliances with Bahía Kino fishers. I present and discuss my results that deal with the inner workings of Seri control of access of Mexican fishermen to the marine territory, the conflicts that developed, their outcomes, and the changes needed to improve the utility of the EFZ.

B. OBJECTIVES

My goals for this chapter are to understand the influence that the Seri EFZ has on local fishing patterns, and on relationships among resource owners and between resource users. In addition, I want to analyze the conflicts produced by this common property regime, and to assess outcomes in terms of fisheries conservation and sustainability. To achieve these goals, I address the following objectives.

1) Understand spatial fishing patterns and production trends in the Seri EFZ and the influence they have on resource use conflicts.

2) Describe the types of arrangements under which Mexican fishermen gain access to the Seri EFZ.

3) Analyze the development and outcomes of recent conflicts between Seri and Mexican fishermen caused by access rights to the Seri EFZ, and the roles that Seri, federal, and state institutions have over access control.

4) Assess those outcomes in terms of basic conservation and equity standards, and the balance of relationships among different users.
C. METHODS

Ethnographic work

I used a combination of social and biological science techniques to obtain qualitative and quantitative information. My study was restricted to fishermen living in the Seri community of Punta Chueca, thus references to Seri fishermen in my study refer to these people unless otherwise specified. These fishermen extract resources in the southern half of the Infiernillo Channel. Research was concentrated on the *jaiba* fishery that was the main fishery inside the Infiernillo Channel. Due to the small size of the village and the time spent in the field, eventually the ethnographic work covered practically all fishers from Punta Chueca.

My field research drew on previous experience and contacts in the region obtained during a research project carried out between 1992 and 1994 (Bourillón 1996). During those years, I participated in several fishing trips to Tiburón Island with a dozen expert fishermen from Bahía Kino, and spent considerable time doing informal interviews (Bernard 1994). I developed a good understanding of spatial fishing patterns in the waters adjacent to the island, gained some perspectives from Bahía Kino fishermen on their relationships with Seris and their marine territory, and started my interest in the Seri EFZ. I then made some visits to Punta Chueca, was introduced to Seris by researchers and photographers who have worked with them and knew many individuals and families. Between 1994 and 1997, I returned on several occasions and gained some
level of confidence and acceptance from a few of them, including the Seri traditional governor in those years.

My field research relied heavily on participant observation techniques (Spradley 1980). I lived permanently in Bahía Kino, located 30 km from Punta Chueca, for over 2 years from August 1997 to December 1999. Living next to my study area allowed numerous trips to Punta Chueca and to Seri temporary fishing camps. Over time, I developed a good relationship with key members of the community, including present and past Seri authorities, expert fishers, and other influential people in Punta Chueca. High levels of suspicion of foreigners are still present among most Seris. To overcome this as much as possible, I had to invest considerable time at the beginning of my field research, to gain necessary rapport with Seris to engage in productive conversations and exchange useful information. To build rapport, during the first 6 months of my study I visited the Seri community at least four times a week, and spent all day in town. In those trips, my objective was to meet as many people as possible, following the snowball technique (Bernard 1994). I bought or traded many Seri handicrafts and used polarized sunglasses, mechanical tools, medicines, camping equipment, outboard engine parts, and diving equipment for exchange. I gave numerous rides, participated in trips to pick up raw materials for basket weaving, participated in traditional fiestas and other community activities, and helped people in despair. In short, I tried to be a good neighbor and make friends. All this was necessary before attempting to do specific questioning and get honest answers, or being allowed to participate in fishing trips, or to be present at community meetings and other important events. During all my trips and visits I
engaged, as frequently as possible, in open conversations to develop a general idea of the current social issues, that usually gravitate around the problems in marine natural resources management and conservation faced by the Seris. Some times conversations took place in my home in Bahía Kino, during frequent visits of Seri families to sell handicrafts or just to drink coffee. Towards the end of my study, I taught basic computer skills to a couple of bright and progressive young Seri men in exchange for bits of information that would be hard to obtain otherwise.

I maintained contact and exchanged information and opinions with other researchers doing various research projects at the same time in the study area (Appendix 4). During my participation in fishing trips on board Seri boats, I worked as much as possible or as much as allowed, just like another member of the crew. I participated in all activities prior to, during and after the trip when the catch was unloaded and sold. I participated in fishing trips during the season of harvest of \textit{jaiba}, the main species captured inside the Infiernillo Channel. During the trips, I made detailed observations of fishing practices, and of interactions among crewmembers, and with other boats in the vicinity. I questioned fishermen about specific aspects of their operation that were unclear, elicited their opinions and perceptions of various issues pertinent to the study. It was also prudent to engage in recreational activities, and practical jokes, to gain rapport. During all my participation in community activities, I was always careful in maintaining the appropriate personal distance needed to carry out professional ethnographic research.

Participation in fishing trips allowed me to describe where and when Seri fishermen obtain their catch and establish their fishing patterns inside the Infiernillo
Channel. This information was complementary to that obtained in previous work for areas adjacent to the channel (Bourillón 1996). To assess how Mexican fishermen obtain access to the most important fishery resources in the Infiernillo Channel, data were obtained during participant observation in fishing trips and during informal and formal in-depth interviews with Seri and Mexican fishermen and fish buyers in Punta Chueca or in their fishing camps in the Infiernillo Channel. This was done while I visited the camps to obtain biological samples of the *jaiba* catch (see Chapter 4). I maintained regular conversations with the leaders of local institutions: the traditional governor, presidents of the Seri fishing cooperatives, and members of the council of elders. I conducted in-depth interviews with representatives of federal authorities from INP and INI in Bahía Kino, Guaymas and Mexico City. These interviews dealt with the importance of exclusive fishing zones as a tool for fisheries management, opinions about the performance of the Seri EFZ, and about indigenous people’s rights over natural resources in Mexico.

**Review of legal documents**

In order to understand the legal framework and law enforcement tools and mechanisms for fishing concessions in Mexico, I analyzed the *Ley Federal de Pesca* of 1976 and 1992, the presidential decree of 1975 that gave exclusive fishing rights to the Seri people, the *Ley General de Sociedades Cooperativas* from 1993, as well as other legal documents pertinent to small-scale fisheries management in the area.

**History of conflicts over the Seri EFZ**

I reviewed articles published during the 1990s about Seri fishing and territorial issues that appeared in the main local newspaper *El Imparcial*, and other national
newspapers like La Jornada. I also used my field journals and documents filed in my personal archives to reconstruct some of the conflicts that occurred in the early 1990s.

D. RESULTS

Fisheries Resources Use Patterns in the Region

The productive waters in the Infiernillo Channel and adjacent to Tiburón Island are fished by fleets using a wide variety of fishing gear to capture over 50 species of fish, crustaceans, mollusks, and echinoderms (Appendix 5).

Inside the Infiernillo Channel, Seri fishermen from Punta Chueca engage primarily in two small-scale fisheries: the jaiba trap fishery and the pen shell scallop diving fishery, combining them with several other secondary fisheries. There are no large-scale fisheries inside the Infiernillo Channel. Seri fishermen do not participate directly in any large-scale fishery of the area.

Interpretation of the limits of the Seri EFZ

The majority of the fisheries described in Appendix 5 were being exploited in the area during 1975, when the Seri EFZ was established. This exclusive fishing zone was placed on areas used heavily by Mexican fishermen. Unfortunately, the wording used in the presidential order to establish the limits of the Seri EFZ was not precise, thus creating problems in the interpretation of its limits and conflicts for property rights over fishing
grounds. However, all different interpretations agree in considering the Infiernillo Channel, from Punta San Miguel to Punta Sargento, under full Seri ownership.

The original text of the Presidential Order was published in the Federal Register in February 11, 1975. It grants exclusivity to the Seris for their fishing activities:

“on the waters of the littorals of the State of Sonora and particularly in those comprehended on the presidential resolution that definitively gave them 91,322-00-00 ha. of land, situated in the littorals of the Gulf of California and with approximately 100 km of beaches; and the littorals that form Tiburón Island, localized in the Gulf of California.”

Another section of the Presidential Order mandates that precise limits must be defined:

“…to avoid destruction, invasion, illegal fishing acts and any other acts that could affect them in their patrimony, and on those recognized directly to the members of the Seri community and to the Cooperative of Fishing Production organized by them, it should be precisely determined the waters in which the cited community could operate, and in particular the Sociedad Cooperativa de Producción Pesquera “Comunidad Seri.” [italics added].”

The required definition of limits was never done. One result of this omission is that there are two general interpretations of the limits of the Seri EFZ (Figure 3.1). Each interpretation, favors the interests of a different sector of users of the marine resources in the region.

The Seri interpretation is the most extensive geographically. It includes the water from Desemboque, the Agua Dulce Bay and west coast of Tiburón, the Kunkaak Bay,

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63 See Appendix 3 for the full text.
and the Infiernillo Channel. During the rest of this dissertation, the Seri EFZ will refer to the Seri interpretation of the limits of the Presidential Order of 1975.

A variation of this Seri interpretation adds the water adjacent to San Esteban Island and the San Esteban Channel. This extended Seri interpretation is based on the Seri reading of the first draft management plan for Tiburón and San Esteban islands, produced in 1993-1994. The draft management plan included a map of the management area with a line encompassing the area north of Desemboque to San Esteban Island to the south end of Tiburón Island, and the entire Infiernillo Channel, including the Seri ejido on the mainland. Since no official map of the Seri EFZ exists, this map has been misinterpreted by some of the Seris involved in the planning exercise as the official representation of the extension of the Seri marine and terrestrial territory.

The Mexican interpretation of the boundaries of the Seri EFZ restricts it entirely to the Infiernillo Channel, Agua Dulce Bay, and the waters adjacent to Desemboque. Under this interpretation, the waters adjacent to the west coast of Tiburón Island, Kunkaak Bay,
Figure 3.1. Map of the different interpretations of the limits of the Seri EFZ.

Patos and San Esteban Islands would be open to any fishermen. This is the interpretation used by Bahía Kino fishermen, which recognizes exclusive Seri use of the Infiernillo Channel, but denies any Seri rights beyond this area. The beaches and interior of Tiburón Island are recognized as Seri property. The Mexican definition has also been influenced by the fact that Seri fishermen from Punta Chueca almost entirely restrict their activities
to the Infiernillo Channel, and Seri fishers from Desemboque seldom venture south of Agua Dulce Bay. The Seris simply lack the numbers and the capacity to patrol the entire area they consider their EFZ. This has lead Mexican fishermen to believe that the west and south coast of Tiburón are not Seri territories, since they do not patrol these areas.

To the contrary, Seri control and patrolling activity inside the Infiernillo Channel, Agua Dulce Bay and Desemboque, although informal, is very effective. The narrowness of the Infiernillo Channel in some areas makes it possible to have visual control over all maritime traffic from many places on the beach, including Punta Chueca. Seris do not restrict Mexican boat traffic through the channel, although this is not a common route for the large-scale fleet, which uses the San Esteban Channel to sail north. Similarly the *pangas* used by Mexican small-scale fishers have better access to the fishing grounds off Tiburón Island’s west coast using that same external route.

The fishing patterns of Seri and Mexican fishermen result in a form of competitive exclusion, which reduces conflicts over marine resources in spite of differing definitions of the Seri EFZ limits. Exceptions to this largely peaceful co-existence occur occasionally when Mexican fishermen attempt to fish inside the core of the Infiernillo Channel, or when Seris patrol their entire EFZ. Another source of conflict occurs when Seri transfer withdrawal rights to Mexican fishers, and subsequently modify these rights. The strategies that Mexican fishermen use to gain access to the Infiernillo Channel will be presented and discussed in Chapter 4. The conflicts emerging by Seri patrolling the extended EFZ and by the transfer of rights will be analyzed in the light of the following conflicts.
Recent Conflicts over Marine Resources between Seris and Mexican Fishermen

In order to describe and analyze the roles that governmental institutions have over control of access in the channel and elsewhere, I will present four recent conflicts caused by competition for marine resources. These four cases show differences in types of conflicts, the solutions achieved, and durability of the solution. Results are presented starting with a detailed description of the events that originated the conflict, with the purpose of understanding the socio-political context. Next the most evident outcomes and the perceptions of both Seris and Mexicans of these outcomes are discussed. I conclude each case with an analysis of the roles played by Seri and Federal government institutions.

Conflict One: the “El Perro” conflict

*Description of the conflict* 64

In 1995, 17 years after all islands of the Gulf of California were established as protected areas, the first management actions started. The *Instituto Nacional de Ecologia* (INE) drafted an “emergency plan” for the federal wildlife reserve of the islands, while a general and definitive management plan was elaborated. Money for protected area management was available for the first time in 1993, when the Mexican government used a 25 million U.S. dollar grant from the World Bank through its Global Environmental Facility (GEF) to support 10 selected protected areas. The emergency plan included

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64 Based on personal notes and Anonymous (1996b).
management actions directed at Tiburón Island. It was designed by INE staff biologists with input from the Seri governor and the head of the Seri ejido. One of the specific elements of the plan involved financial support to the Seri Guardias Tradicionales (tribal guards) to police Tiburón Island and prevent wildlife poaching, blamed on Mexican fishermen. Funds were assigned to pay for patrolling expenses so regular trips around the island could be performed.

The first of such trips occurred in March of 1995. According to accounts by eyewitnesses from the Bahía Kino fishing community, one panga with seven Seris, including the governor, traveled directly from Punta Chueca to the El Perro cove, situated in the southern end of Tiburón Island. Fishers from Bahía Kino have used this cove for the last 30 to 50 years to camp during fishing trips, and escape from wind and waves. Temporary wood and tarpaper huts had been built; Mexican fishers can be found almost year round here. Upon arrival, the Seri party searched all huts and checked all personal belongings of the fishers. The Seri governor lead the search while members of the Guardias Tradicionales, automatic weapons in hand, remained nearby on the boat. Since the search was during mid-morning, the majority of the fishers were at sea working and just a few fishers were present. The search concluded without violence. If the Seri visit had happened later in the day, when everybody was back from fishing, the outcome would probably had been very different. A much respected member of the fishing cooperative that camped frequently on El Perro told me that Seris had no right to do what they did. He had built one of the huts in El Perro, and was very angry to find that “some Indians” searched his house and belongings with no reason and without a legal search
order. He added: “That is considered trespassing in Bahía Kino and is also on the island!” Once the search was completed the Seris left, but not before warning they would be back, and as legal owners of the island, they requested fishers to stop camping there.

After the incident, the Mexican fishers complained in Bahía Kino to the local office of Secretaría de Pesca about the event. A couple of days latter, I visited Bahía Kino and interviewed Mexican fishers, the Seri governor, and the head of the Seri ejido. During those days Seris were planning a second patrolling trip. Bahía Kino fishers knew about it, and started to get prepared. Some said they would not leave the beach of El Perro to go out fishing, but wait for the Seris, this time armed. The conflict seemed to be escalating.

On the second patrol trip, Seris did not stop at El Perro. Their boat just passed by, without even reducing speed according to a witness (personal communication, Amy H. Weaver, student, Prescott College Station in Bahía Kino, July 1995). Seri women could be seen onboard. Anticipating no further harassment, Mexican fishermen resumed fishing. Money from INE ran out fast, and was increasingly difficult to get because of bureaucratic processes of the federal government and GEF. As a result, only a few patrol trips took place. In one of them, on February of 1996, a group of Seris with support from inspectors from PROFEPA removed fishermen from El Perro and Corralitos camps and issued fines to several of them. This happened after Seris presented a written petition to federal authorities to remove those fishers, since they found evidence of illegal hunting of mule deer and bighorn sheep in their camps, and complained fishers were also littering Tiburón Island Wildlife Reserve.
Between February and April of that year, Bahía Kino fishermen complained that the Seris were allowing fishermen from Guaymas to fish near the island and charging a fee. Rumors started in Bahía Kino that Seris would no longer allow fishing near the island. Bahía Kino fishermen decided to persuade the Seris to sign a formal agreement to use the island for fishing camps and continue fishing.

Outcomes and Perceptions

In the middle of April 1996, a meeting in the office of SEPESCA in Bahía Kino took place. Seris and Bahía Kino fishermen negotiated and signed a “working agreement” (Appendix 6), in the presence of officials representing the Sonoran Government, the director of the INI office in Bahía Kino, the director of SEPESCA office in Bahía Kino, the Port Captain of Bahía Kino, the Seri Governor, presidents of five fishing cooperatives from Bahía Kino, and local representative from a human rights organization. This agreement established that Bahía Kino fishermen organized in cooperatives could work in the waters adjacent to Tiburón Island, excluding Canal de Infiernillo, by paying a fee of $1,000 Mexican pesos/month per group. Mexican fishermen would be involved in patrolling Tiburón Island in coordination with the Guardias Tradicionales to stop poaching and illegal fishing from outside boats. For that purpose, the Seri Governor issued identification documents to 12 Bahía Kino fishermen, and gave them authority to stop pangas not from Bahía Kino, and take them to Punta Chueca.

The working agreement functioned for a few weeks until one party started abusing it. Boats from outside areas continued to arrive, and the Seri governor simply

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65 The equivalent of about $140 US dlls.
started selling permits to all of them, charging each boat $500 pesos/week. When the 12 Bahía Kino fishermen appointed to assist the traditional guards stopped those boats, the fishermen showed them permits signed by the Seri governor. As one of the Bahía Kino fishermen involved said, “The Seri governor’s concern was not the overexploitation of resources, but his personal benefit.” Bahía Kino abandoned the agreement, and during the rest of 1996, all fishermen could buy a permit from the Seri governor for approximately $500 pesos/month. This permit even allowed some access to the Infiernillo Channel. According to some accounts, the Seri governor himself advertised openly the availability of those permits in the streets of Bahía Kino. He even had permit forms ready to be completed.

Because the situation was out of control, another meeting was held in February of 1997, this time between officials and representatives from all agencies and organizations that were present in the meeting of April 1996, except for the Seris. It was then agreed that Bahía Kino fishermen would no longer have to pay fees to the Seris in order to fish the waters off Tiburón. During that meeting, officials from Secretaría de Gobernación (SEGOB) offered to act as mediators in the solution of this conflict, something that was never done. The Seri Governor continued selling permits and Guaymas fishermen took advantage of this opportunity. However, soon Seris gave free access to Bahía Kino fishermen in exchange for some patrolling, to prevent the arrival of more Guaymas fishermen. This action lowered the influence and arrival of Guaymas fishermen and slowly fishing patterns off Tiburón Island returned to those that existed before this incident.
The general perceptions of Bahía Kino fishermen after this conflict was that Seri could not be trusted. This experience demonstrated to them once again the impossibility of making agreements without being abused by Seris. The fishermen also expressed the sentiment that Seris were protected by federal institutions, to the point that virtually no accountability existed for their acts. They could abuse the rights of non-Indians. Another perception reflected a reaction of Bahía Kino fishermen to concerns expressed by Seri authorities about damage fishermen caused to the island and to fisheries. The Seris were perceived as “hypocritical, only moved by greed, and the pursuit of monetary gain.”

From the Seri standpoint, the outcome was provoked by Bahía Kino fishermen who broke the agreement by not protecting the island from Guaymas fishermen. This episode showed Seris that it was not possible to collaborate with Bahía Kino fishermen to protect the island. Another perception was that all Mexican fishermen should pay to fish in Seri waters, since these waters are part of Seri territory. However, internally the Seri community was well aware of the abuse of power that people invested in their governor. In May of 1996, the governor received minor injuries in a fistfight with a group of Bahía Kino fishermen, when arguing about fishing inside the Seri EFZ (Alvarado 1996). After this dispute, the governor threatened the Mexican fishermen, saying he would use 50 members of the Guardia Tradicional, armed with semiautomatic rifles to defend their territory. He stated: “Seri patience is over, with bullets all will have to leave our territory” (Alvarado 1996). The governor was involved in another incident in June of 1996, this time when he was arrested in Punta Chueca for carrying a semiautomatic AK-47 rifle. This model of gun is restricted to the use of the Mexican army. The governor
was protesting his loss in the election for new governor, elections called by the community after inappropriate use of the government funds was detected (Arciniega and Padilla 1996). The Seri governor was arrested by the Mexican police, and spent a couple of months in jail until he was bailed out by INI lawyers. A few months later, he got into yet another incident and was arrested again - this time in Bahía Kino, after crashing his truck into an electricity pole. The Mexican municipal police reported that he was under the influence of alcohol and cocaine. They found an AK-47 in his car, and he was accompanied by a Mexican prostitute. He was released a few months later after INI lawyers interceded again. For many months, until his death, he did not leave Punta Chueca. He stopped his substance dependence and maintained an influential role as member of the Elders Council.

Role of governments

The participation of federal and state management officials in this conflict was limited to being witnesses during meetings and as signatories of the local agreement. They did not intervene when agreements were violated, always maintaining a “neutral” position. When the common law was broken, other government institutions acted (e.g., the local police and the Procuraduría de Justicia del Estado de Sonora or PJES). Since fishing is under federal jurisdiction, state governments can only participate in fisheries promotion. However, SEPESCA and SEMAR had no presence in the sea, and no capacity to oversee fishing activities. SEGOB, the agency in charge of domestic security, did not keep their promises to participate as conflict mediator.
The role of the Seri government in this incident showed little control and accountability. The community acted slowly to prevent abuse by the governor and eventually removed him from office. The Seri fishing cooperative did not participate in the signing of the working agreement. The cooperative had little participation in controlling the outcome of this conflict, and probably received little benefit from the sale of permits.

Conflict Two: the “shrimp tax” conflict

Description of the conflict

One night in early November of 1996, four young Seri men from Punta Chueca, members of the Guardia Tradicional, left the beach and traveled in one panga to get la cuota or what is called the “shrimp tax” (a certain amount of shrimp) from the Mexican shrimp trawlers working inside the Kunkaak Bay. This quota is requested from boats to allow them access into the Seri EFZ. After 40 minutes of navigation, they approached several ships, but crews said they had already given some shrimp to other members of the Guardia Tradicional. The party of Seris decided to go even farther away, to a boat that was fishing close to the shore of Tiburón Island. Upon arrival, one of the Seris explained to the captain of the shrimper the reason for their visit, and the captain agreed to give them some shrimp, once they had recovered the net. The crew of the shrimper recovered

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66 Based on the detailed description in Morales Astorga (1997), complemented with information on Anonymous (1996a). Names of the Seris involved in the incidents are not presented.

67 The average amount of this payment is two baskets of shrimp, approximately 50 kg; one shrimper can get 700 kg per each night (de Velasco R. 1997).
the net, and emptied the catch on deck. The captain asked them to wait for the crew to select the shrimp from the by-catch. Some minutes later, a strong spot light was directed on the ship from a Navy Patrol Boat that was approaching. The Seris had enough time to leave the ship but decided to stay, since they had no reason to flee, and thought the Navy personnel would support their patrolling actions. It was clear later that the shrimp captain had radioed the Navy boat asking for help.

When the Navy personnel boarded the shrimper, they asked the Seris to separate from the crew of the boat. The Seris explained that they were collecting the quota to which the soldiers replied: “Your are not supposed to be charging fees, there is no owner of the sea, stay away from the ship’s crew.” The four Seris were apprehended under the charges of piracy and possession of restricted guns, transferred into the Navy boat and kept locked for 8 hours in one of the aft cabins. After sailing all night, they arrived at Bahía Kino. The four Seris were presented as the “robbers of the shrimp boat” to a high ranking official in charge of a platoon of 20 soldiers. The Seris protested the accusation but the soldiers replied that such accusations had to be reviewed by the authorities of the Ministerio Público. The official version said they were caught in the act of assaulting the boat.

From Bahía Kino they were transported in a Navy truck, laying face down with their hands in the back of their heads for 2 hours, to the Navy Base in Guaymas, and from there to the office of the PGR. Two days later, two of the four Seris were prisoners in Hermosillo under the charges of possession of arms reserved for the use of the army. The other two were released free of charges; one was carrying a .22 caliber gun without
registration. The arms in possession of the two imprisoned Seris were an old 30-30 rifle, without bullets, and an automatic 7.62 caliber rifle.

A few days later a Seri man in charge of ecotourism activities on Tiburón Island protested at INI offices in Hermosillo that navy soldiers stationed at the outpost in Punta Tormenta, on the island, were not allowing Seris access to the interior.

Outcomes and Perceptions

The two captured Seris remained at the Hermosillo prison for 6 months until released in April 1997 (Burckhalter 1999). This event has been recalled by Seris as one of the most hideous and offensive acts of the Mexican government against Seris in their recent history. During the weeks following the detention, regional and national press published articles protesting the decision, calling for respect of Seri customs, traditions and rights, included the right of Seris to defend their territory using their Guardia Tradicional, and to get compensation from the use of their resources by Mexican fishermen.

Three weeks after the detention, a meeting between representatives of INI and PROFEPA was organized. The objective was to formalize a promise made by PROFEPA back in 1995 to give official credentials to the Seri members of the Guardia Tradicional, appointing them as Vigilantes Comunitarios (community wardens). The promise was part of Seri formal collaboration with Instituto Nacional de Ecología (INE) in order to give more control to the Seris over Tiburón Island Wildlife Reserve. During the meeting, PROFEPA representatives showed no willingness to make clear commitments about when credentials will be issued, and only proposed a series of workshops to train the
Guardia Tradicional. The Seri delegation, deeply concerned about their members in jail, abandoned the meeting, expressing their total distrust towards all governmental institutions. The following day another meeting was held between INI and PROFEPA, without Seri participation. PROFEPA agreed to give credentials to the Seri Guardia Tradicional as Vigilantes Comunitarios, and to start a program with Seri participation for inspection of fisheries inside Seri territory. Again, this agreement was not honored.

In the second meeting, INI and PROFEPA agreed to start an analysis of the legal status of the Seri territory and its natural resources, and to organize workshops to analyze the results with the Seris, and to reach consensus about this diagnosis. This analysis never took place. According to a report in a local newspaper, in September of 1997 the Seris complained formally to SEMAR and SEMARNAP that Navy personnel stationed in Punta Tormenta were not allowing access to Tiburón Island, and that Navy ships were escorting shrimpers into Seri exclusive waters. They also complained that PROFEPA had not issued the promised identifications as community wardens, and was not performing patrolling activities in the island and waters to prevent the entrance of foreign fishing boats into Seri waters (Anonymous 1997).

This was not the first time conflicts emerged in opposition to Seri charging quotas for fishing inside their territory. In 1995, the local press reported complaints of crew and owners of shrimp boats, about patrolling activities by Seris and about charges of 40 to 50 kg of shrimp per boat to fish inside Seri territory. The newspaper article also referred to the informal agreement between small-scale fishermen and Seris to allow small-scale fishers access to the coast of Tiburón Island and establish temporary camps during their
fishing activities (Rodríguez 1995). In 1998 another local newspaper article cited declarations of the leader of the federation of small-scale fishing cooperatives in Bahía Kino that complained that the Seri tribe charged from $500 to $1,000 Mexican pesos/panga for a permit to fish inside Seri territory (Rodríguez 1998).\footnote{Between $55 and $110 US Dlls.} The leader said: “we pay because this is an area where you can get good catches, but the problem is that the tribe is divided, and one part recognizes the agreement while the other does not, and they also want money. If they respect their own agreements things will be fine, but the Seris sell the same kind of permits to fishermen from other areas, causing unfair competition with the locals.”

**Role of Governments**

Patrolling of Kunkaak Bay by Seri Guardia Tradicional does not depend on money from the federal government as in the first conflict; it relies exclusively on Seri funds. The Guardia Tradicional is a loosely structured and controlled organization. All adult Seri males above 15 years old are members (Córdova-Casas 1993). Only recently, because of the needs of the bighorn sheep trophy hunting project, the Guardia Tradicional acquired a more organized structure. Today each Guardia Tradicional carries a personal identification with their photograph and name, issued by the traditional government. Nevertheless, Guardia Tradicional has no operational budget, no communication equipment, and no vehicles. Nonetheless, mostly young members of the Guardia Tradicional participate in collecting the shrimp tax. Seris organize the order of boats that can go each night to collect the shrimp tax. For the shrimp season of 2000,
about 15 youngsters were present in the meeting to organize this order (personal communication Xavier Basurto, Masters student, School of Renewable Natural Resources, The University of Arizona, Tucson, January 2001). The Seri governor has little control over these missions to collect the quota; it falls more under the jurisdiction of the president of the Seri cooperative that buys the collected shrimp.

During the shrimp fishing season in the Gulf of California of 1998, regional press reported several attacks by real pirates on shrimpers off the coast of Sinaloa (Mendoza-Martínez 2000). The burglars used pangas to approach the boats, and high-power weapons to steal shrimp and cash from the crew. The Mexican Navy was under political pressure from the fishing industry to curb these assaults. Spokesperson from CANAIPES were asking for more protection and control over Mexican territorial waters.

The Seri and the Navy had another point of contact that further complicated this conflict. The Navy has maintained a permanent outpost in Punta Tormenta since the early 1960s, when the island was designated a federal wildlife refuge. This outpost is located directly across the channel from Punta Chueca. During the time of my study, relationships between the approximately 6-10 Navy marines and Seris oscillated from confrontation to avoidance.69 Usually contact is kept to a minimum, with the exception of Marines buying food and getting drinking water in Punta Chueca. Before the marines got their own boat, Seri fishermen were asked by the Navy to help transport soldiers, water and supplies every 2 weeks. The outpost has no trucks on the island.

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69 Córdova-Casas (1993) narrates one incident in 1990 between some drunken marines and all Seri men in Punta Chueca that nearly ended in an armed confrontation.
SEMAR is the only institution of the federal government that has permanent physical presence in Seri territory. Their missions on the island are reportedly to protect national security in the largest island of Mexico, protect wildlife, and prevent drug trafficking. Nevertheless, the marines are perceived more as foes than as friends. For Seris, the outpost’s main reason for existence is to harass them. The reasons for this belief is the limited efficiency of the Marines in controlling poaching on the island and preventing drug trafficking. Both tasks were difficult since the Marines had neither a truck nor a boat for patrolling. The defense of national security on an island so close to the mainland and inside territorial waters, and the only island in the Gulf of California with permanent military presence, is understood as the defense against Seri invasion of the island. The role of SEMAR in this conflict was manifested when they prevented access to the interior of Tiburón Island by Seris.

The role of the Federal Government in this conflict was definitively influenced by the war against the Zapatista Army in Chiapas. National governmental aversion towards armed Indians, and against their attempts to gain self-determination rights and the recognition of self-governing structures, was running high in those years. In light of the political climate of generalized suspicion that supported the use of governmental force in Indian territories, a general tendency to see Indians as criminals was fueled (personal communication Pablo Yanes, Director de Antropología Jurídica INI, Mexico City, June 1998). These volatile issues in Mexico kept the Sonoran government distant, and federal authorities cautious and reluctant to interfere in the solution of the conflict.
Conflict Three: the “Bahía Kino reserve” conflict

Description of the conflict

On May of 1999, the leader of the federation of fishing cooperatives of the small-scale sector in Bahía Kino personally delivered a letter to the head of SEMARNAP. In this letter, his organization proposed the creation of a new biosphere reserve in the area of Bahía Kino. The creation of a biosphere reserve was motivated by concern over protection of commercially important species from the “devastation caused by trawlers in the region” and by their desire to get an exclusive exploitation concession for the local cooperatives over those resources. Fishermen recognized the only feasible way to gain exclusivity was through a marine protected area. This proposal called for an explicit assignment of property rights to benefit local fishermen and the local economy, as well as to eliminate conflicts with the Seri Tribe. The area proposed was established in a detailed map attached to the letter. It encompassed 682 km$^2$ of water inside Kunkaak Bay. The northern boundary of the proposed reserve was established by a line contiguous to the Seri EFZ. However, the definition of the limits of the Seri EFZ was based on the Mexican interpretation, popular among small-scale fisherman from Bahía Kino.

A couple of weeks later a copy of this proposal reached the hand of the Seri Traditional Governor. The Seri perceived this proposal as a new attempt to erode their territory, and called the leader of the federation for a meeting to discuss the issue. This meeting took place on May 24 in the office of the Seri Government in Bahía Kino. The Seris explained their opposition to the proposal to 24 leaders of the small-scale fishermen

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70 Based on personal notes.
of Bahía Kino. The Seri governor stated the strong conviction of the Seri people to
defend the integrity of their territory against any form of intervention. The Seri
delegation accepted that the proposal for the creation of a new reserve was good, but it
should respect Seri rights and territory. The leader from Bahía Kino, who proposed the
creation of the reserve, gave his apologies for the wrong interpretation made of the limits
of the Seri EFZ. He explained that he tried to seize the opportunity to give the proposal
to the head of the environmental agency, and “plant the seed” of a movement with the
goal of getting more local control for Bahía Kino fishermen against trawlers and
fishermen from outside. The apologies were accepted by the Seri, and the meeting
continued discussing competition for fishing areas of Bahía Kino fishers against
fishermen from Bahía Lobos in southern Sonora, from Sinaloa and even from Chiapas.
After 2 hours of conversation, all people attending the meeting agreed that they were
facing similar problems, and it was good time to join forces for the protection and control
of fisheries in the Bahía Kino and Seri territory. Because of the meeting, they drafted the
nine points of collaboration and agreements included in Appendix 7, and formed the
“Alliance for the Protection of Marine Resources in the Region of Bahia Kino-Marine
Comcáac Territory” (Anonymous 1999). They then decided to use the opportunity of a
visit of the Sub-delegate of SEPESCA in a few days and called for a larger meeting with
representatives from all fishing cooperatives to present to the authorities the agreement
reached, and ratify the creation of the alliance.

Five days later this meeting was held at the Seri Government Offices, it was
attended by 28 fishers and fish merchants from Bahía Kino, federal, state and local
authorities. The meeting was attended by the sub-delegate of SEMARNAP, the director of the INI office in Bahía Kino, the sub director of the Islands of the Gulf of California Wildlife Reserve Office, the local inspector of PROFEPA and the local office director of SEPESCA. Also was present one representative from the Sub direction of the Government of Sonora.

This meeting started with the Seri Governor calling for respect of their territory, and the support they have from federal laws, international agreements and indigenous rights to have control over their resources. As in the previous meeting, this was followed by apologies of the leader who made the proposal of a new biosphere reserve, and called for collaboration to make a common front against the real invaders. During the meeting, several verbal requests were made from fishers from Bahía Kino to define with precision the limits of the Seri territory, and the willingness to reach agreements with Seris. The sub-delegate of SEMARNAP recalled previous agreements in past Seri administrations that were not respected, and mentioned the actions of some members of the Seri community that were taking advantage of the confusion over limits to abuse and assault Mexican fishers. Regarding the desire to control access of fishermen from the southern parts of the state, he said that further analysis is needed, but he would respect their decisions. He recalled the recent installation of the State Committees of Management of Fisheries and Natural Resources as the right forum to channel their suggestions.

The Seri delegation presented their need to have more local participation in conservation and management of natural resources even when they are not part of a protected area. They used the meeting to voice the need to get governmental recognition
of the *Guardia Tradicional* as their body to protect their resources. They also condemned recent events of harassment of Seri fishermen from the Navy outpost in Punta Tormenta looking for drugs in Seri pangas fishing inside the Infiernillo Channel.

*Outcomes and Perceptions*

This conflict over the Seri EFZ had a positive outcome, although it was a very short-lived one. No more meetings of the alliance took place. The main reason was the refusal of the Seri governor to negotiate with two leaders of different federations of fishing cooperatives in Bahía Kino. He explicitly asked the fishermen to form a united front, and then negotiate before uniting forces to lobby the government. Since this never happened, the alliance never materialized. To the Seri, this was perceived as just another sign that there was little real interest by the Bahía Kino fishermen in forming alliances with them. To the Bahía Kino fishermen, this was perceived as the reluctance of the Seri to use their political position to aid other marginalized groups to gain exclusive fishing areas like the one they had.

No further efforts were made by federal or state authorities. In the letter by INE in response to the proposal to create a new biosphere reserve, the official format to make a formal request was appended. A formal proposal was never formulated.

*Role of Governments*

The typical roles of the different levels of the governments are clear in this conflict. The Seri governor had been recently appointed and voiced strong opposition to any form of intervention on Seri territory, and the willingness to deal with a united representation of the Bahía Kino fishermen. As in other cases during these meetings,
there were no representatives of the Seri fishing co-operatives, although they were invited.

In the eyes of both the Seris and the Bahía Kino fishermen, the role of the Sub-Delegate of SEPESCA, representative from the Federal Government agency in charge of fisheries administration, showed lack of commitment to and authority to solve the problem. It was clear his interest leaned towards the policy of administering fisheries through open access to small-scale fishermen over all fishing areas. The inaction by SEPESCA was perceived as lack of any real support for local initiatives, recognizing that lacking external support, these initiatives will surely die rapidly. The representative from the state government had no jurisdiction and little participation, other than expressing that an alliance was “seen with good eyes” by the Sonoran government.

Conflict Four: the “sierra” conflict

Description of the conflict

In a local newspaper, the title of a note published on November of 2000 read: “Seris attack fishermen.” It was a report of a group of 10 armed Seris that assaulted four pangas of fishermen from Guaymas capturing sierra mackerel inside waters that belong to the Seris (Rodríguez and Sánchez-Lizaso 1996). The Seris, residents of the community of Desemboque, “seized outboard motors, gill-nets and 3,700 kg of sierra, and held all 14 Mexican fishermen for several hours, using their high power automatic rifles and violence to force the fishermen to give them their product and equipment”
According to the report, the Mexican fishermen received death threats from the Seri saying they would be killed if found fishing inside Seri zone again. The Mexican fishermen recognized that in order to fish inside the Seri waters a permit must be purchased from the Seri government. Although the fishers had a Seri permit, it had expired. The Mexican fishermen later filed a formal complaint at PROFEPA and Procuraduría General de la República (PGR) offices against the Seris for the assault. The complaint was filed for robbery only and not for kidnapping. They also complained that the Seri requested $2,500 pesos (approximately $250 US) to release them. The fishermen said their federal fishing permits were valid.

The newspaper also mentioned that after this incident the fishermen from Puerto Libertad (some captured fishers lived in this town located north of Desemboque) were not working because of fear. One fishermen interviewed said this was not the first time something like this happened, and they feel unprotected because of the type of weapons the Seri have. He related that during the previous year, a similar formal complaint was filed, but no actions had taken place. Fishers from Puerto Libertad did not know if they should get armed to face the Seris and go out fishing. Backlash from the action was already showing when a truck full of Seri was nearly burned the week after the incident in Puerto Libertad.

One of the fishermen interviewed said: “Authorities must intervene to stop a clash between fishermen and the Seris, they must define the zones in which we can work, although legally no more restrictions to work must exist, other than the ones from
existing regulatory instances and not those imposed by a group of people” (Rodríguez 2000).

**Outcomes and Perceptions**

Only two notes appeared in the local newspapers about this incident. However, I had the chance to follow-up the outcome. After the complaint was filed, an arrest order was issued against two Seris. Agents from PGR travel to Desemboque but could not find those people. In a meeting in the office of the Seri Government in Bahía Kino, PGR and officials from the *Ministerio Público*, 71 asked Seri authorities to cooperate with the investigation. In this meeting, accusations were clarified, and after some discussion, one official of the Seri Government drove to Desemboque and brought the accused men, who appeared voluntarily. All discussions were private, but later I learned from the people present that it was centered on the legal rights of the Seris over the waters where Mexicans were caught fishing. It was discovered that they were fishing at night in the waters in front of Desemboque. It was also discovered that the federal permit had expired. The Seris then asked: who was stealing from whom? The officials requested a copy of the presidential decree of 1975, and the arrest warrant was cancelled. No further legal actions took place. It should be mentioned that the leader of the Seris who stopped the Guaymas fishermen was recognized by the Seri authorities as a troublemaker, with a

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71 *Ministerio Público*, federal or state agency in charge of the investigation of criminal acts.
long history of felonies. He had been involved in other violent incidents before, and he is a Seri mestizo (son of a Seri father and Mexican mother).

*Role of Governments*

In this case, the role of the Federal government was limited to representing the accusing party, and investigating the incident. After it was clear that the Seris had uncontested legal rights over resources in the water where the incident took place, charges were dropped. No confusion of the limits of the Seri EFZ existed in the place were the incident took place.

The Seri government showed a firm conviction and interest in clarifying the issue. They believed this conflict resulted in a victory for external recognition of Seri ownership. They even collaborated to bring the accused Seri men to justice.

This conflict more than any other left the Seris with the positive perception of having the power to defend their rights in uncontested fishing areas. However, it also made clear to outsiders the lack of control that Seri authorities have on the behavior of some problematic individuals in the community. Internally there is little capacity to punish outlaws, and virtually no accountability exists for criminal acts brandished in defense of Seri sovereignty.
E) DISCUSSION

The limits of the Seri EFZ in the light of resource use patterns

The two foundations for territorial resource control in the Seri EFZ are the clear geographical definition of the limits of the territory, and the rights to exercise control over potential users. Neither of these were fully given to the Seris by the Mexican government. The presidential decree stipulated that a precise definition must be made to prevent conflicts over marine resources use, but such an exercise was never done. The underlying reasons are not known, but lack of interest from the government, pressure from the offshore fleet to keep ambiguous borders, and absence of Seri pressure to complete the process, could have contributed to failure. The granting of rights to Seri Indians over land and sea was a top-down decision by populist President Echeverría, to give back to the Seris some of what was taken from them during centuries of conflict with the Mexican state. Land ownership and exclusive use of marine areas were part of a package that included the creation of a special multi-agency governmental commission to promote the development of the Seri community and its integration into mainstream Mexican society (D.O.F. 1975). But the termination of this commission 2 years after its creation suggests that the commitment to support Seri autonomy and development was not widely held; or there was a radical change in government priorities with the new president López-Portillo administration (Santillán Mena 1993). This commission provided infrastructure, equipment and economic support to the Seri fishing cooperative, built houses, improved roads and provided basic public services. But its termination on the premise it has fulfilled its goals was a clear symbol of the simplistic idea of the
government to develop small Seri coastal fishing communities, only by providing legal rights, housing, boats and fishing gear.

The exact definition may not have been accomplished due to the lack of Seri fishing pressure outside the Infiernillo Channel. Minimal competition in fishing areas that today are extremely contested can explain why neither Seris nor Mexicans pressured for a precise definitions of the EFZ. During the late 1950s and 1960s, commercial hunting for sea turtle boomed, and over-hunting in near-shore waters forced fishermen to move to hunting grounds on the islands (Bowen 2000). By the middle 1970s, overwintering sea turtles were seldom hunted by Seri inside the Infiernillo Channel, while Bahía Kino fishermen were decimating overwintering turtle populations in the Midriff Islands (Felger et al. 1976). No fishing competition for sharks was taking place in the Infiernillo Channel in those days since the fishery was still devastated by intense fishing pressure in the 1940s. There probably was a little overlap inside the Infiernillo Channel and along the south and west coasts of Tiburón Island between Seri and non-Seri fishing activities. Moreover, according to some authors, most fishing inside Seri waters was done by Mexican fishermen in late 1960s and early 1970s. Therefore, the main practical goal for creation of the EFZ may have been to aid Seri fishermen, commercially defeated in competition against Mexican fishermen, and help them regain fishing control mainly of the Infiernillo Channel.

Another possibility for the lack of definition of the borders of the Seri EFZ may have been development of the offshore shrimp fishery. Since the 1960s, the number of offshore trawlers grew, exercising more political pressure to restrict the fishing activities
of inshore shrimp fisherman in offshore waters of the Gulf of California (McGoodwin 1987). In 1974 the Infiernillo Channel was declared by presidential order as a fishing reserve for reproduction of shrimp, prohibiting any type of shrimp fishing (D.O.F. 1974). Seri have never fished for shrimp, neither for subsistence nor commercially. Therefore, this presidential order probably was geared more to protect nursing grounds of shrimp inside the Infiernillo Channel from trawlers that fished nearby waters. A clear definition of the Seri EFZ could have created problems of access for trawlers to the productive and popular shrimping grounds of Kunkaak Bay.

Increased interaction with outside fishermen created more instances of conflict. As Seris gained more control over their territory, these conflicts intensified. The roots of the conflicts that are documented in this chapter, which occurred in the 1990s, probably developed under similar scenarios in the 1980s.

The decade after creation of the Seri EFZ was marked by rapid development of the industrial fishing sector of the sardine fishery (Cisneros-Mata et al. 1995). The offshore shrimp fleet was in decline, but still in 1985 the Guaymas fleet had 377 boats and Mazatlán 420 (Magallón-Barajas 1987). Guaymas small-scale fishermen were active participants in exploitation of marine species inside Seri territory in the late 1970s and

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72 I do not have data that indicated shrimp fishing by trawlers inside the Infiernillo Channel. According to Dr. Alejandro Villamar, who worked in the area doing species inventories for INP in 1963-1966 shrimpers worked inside the channel (personal communication, INP Mexico City, June 18, 1998). Seris deny that shrimpers have ever worked inside the channel, although one Seri fisherman mentioned that one boat was trawling in front of Punta Onah in the 1970, but was soon expelled. The presence of many sand bars, shallow waters and swift tide currents may have prevented this. If this was the case, the Infiernillo Channel is probably one of the last shallow soft bottom areas in the Gulf of California that have been protected from the effects of shrimp trawlers.
The rate of growth in fishing power was higher in Bahía Kino that in Punta Chueca, the former having greater accessibility to fish merchants, the main providers of boats and fishing equipment. In the middle 1980s, the population of Bahía Kino was further augmented with the arrival of migrants looking for better opportunities in the light of Mexico’s economic crisis (Doode and Delgado 1999).

**Interpretation of the limits of the Seri EFZ**

Current interpretations of the limits of the Seri EFZ respond to three different patterns of use of marine resources. Two of these patterns are commercial fishing fleets established in the 1950s and with little change since. Neither the existence of the protected area for nursing shrimp nor the Seri EFZ have stopped trawlers from working inside Kunkaak Bay. In addition, the small-scale fishing fleet has increased its areas of operation, but continues to use the west and south coast of Tiburón Island as it has done for many decades.

With a precise definition of the southern and northern limits of the Seri EFZ following the Seri interpretation, legal fishing by Mexicans inside these areas can only be done by transferring withdrawal rights. The precise delimitation of the southern limit of the Seri EFZ, including a small portion of the Kunkaak Bay, will reinforce the current *de facto* perception of the Seri limits, and support the practice of “shrimp taxing” trawlers working in this area. This local system has been in place for many years, and has been informally approved by the trawlers and by governmental authorities on several
occasions. This could be an excellent foundation to formalize the transfer of rights, and to legitimize the southern border of the Seri EFZ.

It is surprising that years of interaction between Guardias Tradicionales and the crews of trawlers have not resulted in more aggressive encounters or even casualties. Two possible explanations for this are the overall acceptance by the majority of the trawler captains of this arrangement since the tax was low compared to the average nightly catch; or that aggressive encounters are more common than I detected especially when they are not reported to authorities and do not reach the newspapers.\textsuperscript{73}

The need to develop a stable and equitable system for allowing access to Seri water is evident. If access permits are formalized, there should be a mechanism for ensuring that the benefits of the “shrimp tax” are distributed equitably among the Seris.

The implications of the strict application of the Seri interpretation of the EFZ to Bahía Kino fishing activity are obvious: the majority of their fishing areas will be inside Seri waters. Moreover, the inclusion of the San Esteban Channel waters into the Seri EFZ is an indication of the inter-connections between management efforts directed towards the land portion of Seri territory, and their strong influences in marine areas. It is also an example of poor handling of local participation in the design of management strategies. A draft map from a management plan for Tiburón and San Esteban Islands, that was never approved by the federal authorities and had little or any influence in the management of those islands, includes San Esteban in the management area. This map

\textsuperscript{73} In 1998, a boat of Seris attempting to collect the quota was reportedly repelled by a shrimp boat with gunfire; Seris were later preparing homemade bombs to use on aggressive shrimpers.
has had a strong influence on Seri perception of the marine area they are entitled to control. The historical presence of one Seri Band on San Esteban Island until they were extirpated in the nineteenth-century (Bowen 2000) justifies modern Seri belief that they must retain rights based on cultural connections with this island. Nevertheless, recognition of their historical rights over this island does not necessarily mean exclusivity, and the practicality of recognizing rights over the entire historical extension of the Seri range is questionable, especially over areas they seldom use or have been absent from for decades. On Tiburón Island, Seris have always maintained control, unless prevented by the government. Even though fishing areas in the west coast of Tiburón have not been used during at least two or three decades, Seris are clear in their position to defend them as Seri waters. An official map with precise coordinates of the limits of the Seri EFZ is urgently needed.

Conflicts over Competition for Marine Resources and their Outcomes

As a strategy to deal with the uncertainty in boundaries, informal mechanisms have developed not only to transfer withdrawal rights but also to control access of Mexican fishermen. These arrangements work even in areas of the Seri EFZ that function as de facto open access when the Guardia Tradicional is not patrolling. Limitations and pitfalls of these mechanisms can be best discussed using elements of the four conflicts that are summarized in Table 1.1. Each conflict element is useful in showing the roles of government. This framework also is useful to define changes needed in the Seri EFZ for fisheries conservation and sustainability.
Conflict one shows the strong links between the marine and land portions of the territory among the Seris. The Seri would like to have Tiburón Island totally off-limits to outsiders. However, Bahía Kino fishermen need to continue using the island for camping in order to exploit fishing grounds adjacent to the island. As a result, all actions by Seris to patrol the Tiburón Island coast will have direct repercussions on the fishing pattern by Mexicans. It is important to realize that it is impossible to limit Seri patrolling so that it deals only with impacts on beaches, without having seeing evidence of illegal fishing (e.g., sea turtle remains, sea cucumber rendering equipment). Patrolling to protect marine resources from illegal fishing was one of the objectives in the “emergency plan” of INE (Anonymous 1995). Therefore, it is highly advisable for INE to clarify its current management jurisdiction to Seris, and in the future to take necessary actions to extend the limits of the protected area into the marine waters adjacent to Tiburón Island, and coordinate with Seris about patrolling of marine activities.

The participation of INE in fisheries conservation within protected areas has proved more conducive to local control of marine resource management in marine protected areas of the Gulf of California, like the Loreto Bay Marine Park and even recently in the Upper Gulf of California Biosphere Reserve. In contrast, local control under SEPESCA jurisdiction is very difficult to achieve in areas that are not under any category of protection.

Seri interest in patrolling their waters is based on their perception that their territory is only one entity. The territory is not divided into pieces (e.g., island, channel and mainland) as federal management agencies have partitioned. Moreover, Seri have a
profound “sense of territory;” one in which their territory starts in the sea and continues inland. This conception differs substantially from other coastal indigenous groups in Mexico, in which their territory ends at the coast (personal communication Pablo Yanes, Director de Antropología Jurídica INI, Mexico City, June 1998). For the Seri, their territory starts at the coast. Patrolling the island is among the few opportunities the Seri have to act against invaders of their territory.
Table 3.1. Motives, causes, solutions of four conflicts over the Seris EFZ originated in the decade of 1990, and the changes needed in the Seri EFZ for a definite solution.

<table>
<thead>
<tr>
<th>Conflict motive</th>
<th>Conflict underlying cause</th>
<th>Permanent solution to the conflict</th>
<th>Changes needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfer of withdrawal rights to Mexican fishermen</td>
<td>No recognition of Seri rights to transfer their rights to other users. Organizational problems of Seri institutions. Lack of internal and external accountability of the <em>Guardia Tradicional</em></td>
<td>Legal recognition of transfer rights. Transparent procedures for transfer. Democratic and egalitarian distribution of benefits among Seris.</td>
<td>Precise definition of limits of Seri EFZ. Formalized procedures and accountability of <em>Guardia Tradicional</em>. Legal recognition of Seri transfer rights. Support from federal govnmt</td>
</tr>
<tr>
<td>Overlapping of limits with conservation proposal by Bahía Kino fishermen</td>
<td>No clear definition of southern limits of Seri EFZ.</td>
<td>Precise definition of limits of Seri EFZ. Support of local agreements directed to conservation and improved fisheries management.</td>
<td>Precise definition of limits of Seri EFZ. Implement and support local conservation alliances between all stakeholders</td>
</tr>
</tbody>
</table>

In contrast, there is little they can do to repel the politically and economically powerful landowners, which own the surrounding private ranches that were invading from 8% to 44% of their mainland territory.⁷⁴

⁷⁴ According to figures published in 1993 by (Romero Moreno 1993), and (Covarrubias Baldenebro 1994).
Wildlife management on Tiburón Island also has had direct influences on the Seri EFZ in two ways. Firstly, monitoring and patrolling actions of the Guardia Tradicional to prevent big-game poaching are directed towards the fishing camps utilized by Bahía Kino fishermen. In addition, patrolling is not restricted to poaching but also fishing activities of the Mexican fishers. Detection of illegal activities moves the Seris to restrict use of Tiburón Island by outsiders. This is one of the main issues where perceptions of an issue are radically different. Although Seris would like Tiburón Island to be strictly off-limits to outside use, this is highly unlikely politically. Bahía Kino fishers need to use the island for camping grounds and will continue to exercise political pressure to maintain their access to the coast.

Secondly, the recent development of active wildlife management programs on the island have increased recognition by the community of the need to have sovereignty and control over the entire Seri territory. The bighorn sheep project also has demonstrated the need to have management actions supported by scientific research. The bighorn sheep hunting project not only gave the Seris more political visibility with SEMARNAP, but also monetary resources for the Seri governor’s office to operate. For the first time, money from other sources than the federal government was entering directly to support internal government structures. One result of this has been that the Seri governor had fast and direct access to the highest-level federal and state authorities. This is a political resource that Bahía Kino fishing organizations do not have, which can be used in case of problems related to natural resource management.
Some conflicts over Seri patrolling by the *Guardia Tradicional* triggered formal negotiations between Seris and Bahía Kino fishermen. For Bahía Kino fishermen, negotiation is perceived as the only productive strategy to maintain their use rights of the Tiburón Island area. However, these negotiations also constitute recognition of the Seri precedence over the west coast of Tiburón Island. Signed agreements regulating access to “exclusive Seri waters” in exchange for monthly fees, undersigned by authorities from state and federal agencies, also constitute explicit recognition by the government that Seris are entitled to transfer withdrawal rights to a third party. In fact, the Federal Fishing Law recognizes that transfer of withdrawal rights between concessionaries without authorization of the SEPESCA is illegal and can cause termination of the fishing concession (D.O.F. 1992).

Putting aside a long history of mistrust and conflicts, alliances have formed between Seris and Bahía Kino fishermen over control of access to Tiburón Island. These alliances have different motives for each group, but their overall outcome potentially can be used to improve fisheries management and marine conservation. Until now, those outcomes have only had indirect effects on fisheries conservation, like the reduction of fishing effort. Alliances for the Seris are convenient ways to reap economic benefits from exploitation of natural resources in marine areas not used by Seris. These alliances also serve the Seris by establishing a presence in these waters by cooperating fishers who will report incursions by unauthorized fishers.

For Bahía Kino fishers the benefits are greater. By preventing access to Tiburón Island for fishermen from Guaymas and Puerto Peñasco, they gain exclusive fishing
rights. For a small cost they can continue benefiting from the rich fishing grounds, without competition from other Mexican fishermen. Coalition formation between otherwise competing groups to control access is an excellent foundation for co-management of fisheries. A Seri-Bahía Kino coalition is based on pre-existing patterns of resource use in which competition is minimal. This grassroots alliance has an interest in stopping indiscriminate fishing activities by shrimp trawlers and other destructive fishing practices like spearfishing and collection diving at night. Stopping these destructive practices would definitely have a direct positive effect in marine conservation in the area.

Territoriality in fishing exists in other portions of the Gulf of California, like the Midriff Islands Region, where de facto territories exist for the fishermen from Bahía de los Ángeles (BDLA). They defend the bay and a stretch of coastline and islands off the Baja California Peninsula as their exclusive fishing areas (Bourillón 1996). This de facto territory is recognized by fishermen from Bahía Kino. BDLA fishermen have successfully expelled trawlers fishing inside the bay. Anyone caught fishing without a permit from BDLA fishing cooperatives can be subjected to fines or equipment confiscation. In the Upper Gulf of California, commercial divers from Puerto Peñasco, Sonora, and gill-net fishermen from El Golfo de Santa Clara, Sonora, have made public to federal authorities, their interest in having exclusive fishing zones on their traditional grounds (Cudney-Bueno 1997, Cudney-Bueno 2000, personal communication, María de los Ángeles Carvajal, Director Gulf of California Program for Conservation International,
1999). Recognizing and strengthening this territoriality in certain areas of the Gulf of California, can make fisheries management feasible based on control of access.  

Unfortunately, informal and quasi-formal agreements between Seris and Bahía Kino fishermen soon dissolved. The events that lead to their rupture gave clear indications of the weaknesses of local institutions. To begin with, the Seri fishing cooperative has never been based on signed agreements. Another Seri institution, the governor, was accused of abusing his power and keeping rather than distributing revenues from selling fishing permits. A subsequent Seri governor recognized the importance of a strong alliance with Bahía Kino but failed to negotiate. In general, a long history of animosity towards Mexicans must be overcome to create working alliances. In addition to this, participation in and acceptance of the alliance by the majority of the Seri community is an important element. Information flow inside the Seri community is restricted and often distorted by feuds, family and intra-community antagonisms and disputes. This causes internal challenges to initiatives by Seri officials, and frequent political impasses.

The use of double standards by Seris and by Mexicans was common. Being opportunistic is still a trademark of the Seri culture, and in agreements with Mexican fishermen, there is no moral obligation to restrain from trying to benefit as much as possible. The problem with this behavior is that it fuels a general perception by Mexicans that: “you can not make deals with Seris.”

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75 In 2001 fishers and conservation NGOs started efforts to create the BDLA Marine Park.
The Seris are caught in a dilemma. On one hand, they are eager to vehemently defend their territory and make anyone pay for use of their resources. On the other hand, they need to establish working arrangements and alliances with outsiders to reap benefits from resources they do not use and prevent access by more outsiders to their waters.

In the viability of the informal and quasi-formal agreements between Seris and Bahía Kino fishermen, the role of the federal and state authorities is critical, but in practice was ambiguous and lacking commitment. All government officials, under their different levels of jurisdiction, limited their participation to being witnesses over agreements between sectors of the society. They have not provided the minimal political and administrative conditions needed for the agreements to be workable. There was an absolute lack of explicit political definition on critical issues, for example the rights Seris have to patrol Tiburón Island waters or the conditions under which they can transfer those rights to Mexicans. They failed to take a clear stand recognizing the authority of the Guardia Tradicional Seri, and their right, as well as practical need to be armed to be taken seriously by fishers. Government officials failed to provide basic support to the Vigilantes Comunitarios, by giving minimal assurance that as a result of patrolling they would not end up in jail for piracy.

These are complicated political issues, and deal with significant aspects of the relationship between the state and indigenous groups. The right of indigenous groups to get legal recognition of their traditions and customs, and the right for self-determination have been at the center of political discussions in Mexico during the late 1990s. To understand Mexican Government policies with the Seris, we should consider the socio-
political context in the middle 1990s. Indigenous rights were brought to the attention of
the Mexican government, and the whole country in general, by the uprising of the
February of 1996, the Federal Government under President Zedillo administration signed
the *Acuerdos de San Andrés Larrainzar*, that later were transformed into the initiative to
make modifications to the Mexican Constitution. This initiative was worded between
EZLN and representatives from the Mexican Government that formed the *Comisión de
Concordia y Pacificación* (COCOPA). After 6 years of short periods of negotiations and
resistance of low-intensity war against the Mexican army, the fight of the Zapatistas
entered the new millennium. In January of 2001, under the new administration of
President Fox, the COCOPA Initiative was submitted to the Congress for analysis.
Among other points, the demands of the EZLN, if approved, will be transformed into
constitutional modifications of Article 4th regarding self-determination, usufruct rights
over natural resources inside indigenous territories, and respect and recognition to
indigenous authorities. All of this will have strong repercussions on future issues related
to the Seri EFZ and resource management inside their territory.

The SEMAR Marines stationed at Punta Tormenta are critical elements of the
federal government in Seri land. SEMAR is the only federal government institution that
has permanent physical presence in Seri territory. Their actions and efficiency to stop
illegal activities on the island and in the Infiernillo Channel are strongly questioned. The
presence of marines on Tiburón Island is a permanent element of contention, that is
hightened when they stop access to Seris to the interior of the island, or stop Seri fishing
boats looking for drugs. Relationships between Seris and SEMAR had evolved into an undeclared power struggle. In 1998 the Seri governor had a personal interview with the Secretary of the SEMAR in which a formal agreement was signed that enabled Seri free access to Tiburón Island and committed participation of SEMAR marines to cooperation with the *Guardia Tradicional* in inspection and patrolling of Seri territory (Anonymous 1998). This meeting was granted after the Seri government sued the SEMAR for not granting an audience after a formal request was made. The portion of the agreement related to collaboration in patrolling has not been honored. Unless a more productive relationship is developed with the SEMAR, the Seri EFZ will be undermined by SEMAR’s lack of participation, and in some cases obstruction of marine resources management. If not tempered and carefully planned, actions by the Marines may fuel Seri desire for retaliation against Mexican armed forces, and worsen the already tense relationships between indigenous groups and the Mexican army.

A clear definition of the participation by federal authorities in Seri resource management is desperately needed. Authorities only act when the law is broken, and not in shaping and implementation of local management arrangements and practices that would prevent violations. When federal policies are not clear, resource users who do not agree with local agreements have more weight to challenge them. The incident with the *Guardias Tradicionales* collecting the “shrimp tax” is illustrative. It is understandable that shrimp captains are not happy with paying an entrance fee to areas assumed open, and when *Guardias Tradicionales* are accused of piracy, shrimpers reinforce their view of open-access, with support from the Marines.
The survivorship of initiatives for local management and alliances to collaborate is limited to the time and the money participants are willing to invest in them, and to their lobbying capacity to get external support for better management practices. For small-scale fishermen, time to lobby and money are limited. However, during the time of my study, no provisions were made by the federal government to include local proposals, arrangements and public participation in the improvement of management practices. Most if not all local proposals never materialized into something more than a poorly written and submissive letter to some public authority. Politicians in charge of fisheries administration did virtually nothing to improve the workings of the Seri EFZ, demonstrating a lack of foresight to engage in productive relationships with stakeholders. An alternative reasoning as to why there is no definite action from SEPESCA and SEMARNAP is that they are simply not prepared to take the challenge, or not interested in changing the status quo. In the rhetoric of our natural resource administration officers, words like local participation, responsible fisheries, precautory approaches in management, adaptive management, decentralization of management, are commonly used in political discourse, but rarely used in practice. The limitations that are intrinsic and endemic to our political system, after decades of paternalistic governments and a strong history of conflicts between Seris and Mexicans, are limiting factors that have severely hindered the potential for fisheries management in the Seri EFZ.

It was clear that increased formal involvement from all local institutions is needed, but especially from the Seri government and the Seri cooperative, who need to show a commitment for responsible actions and accept accountability from their
performance. This can also apply to the two federations representing Bahía Kino fishing cooperatives; both organizations are profoundly divided by political and economic interests and still very self-centered in the personal interests of their leaders. A big portion of why alliances between Seris and Bahía Kino have not worked out is related to problems of representation and control of fishing organizations.

Among Bahía Kino fishermen, there is a common perception that Seris have been pampered by the government since the middle 1970s. In their eyes, the exclusive fishing right over the Infiernillo Channel is the perfect example of paternalistic treatment. For them, Seris are underexploiting the rich marine resources inside the channel, and blocking the access of other fishermen who have needs and means to exploit those resources. It is paradoxical that Bahía Kino fishermen dream of an exclusive fishing zone for their own, recognizing the importance of controlling access of fishermen coming from southern portions of the gulf, but at the same time perceive the Seri marine territory as a waste, benefiting just a few families. They perceive the EFZ as evidence of favoritism towards Indians. Fueled by emotions, discussions of the procedures for the transfer of withdrawal rights often degenerate into accusations of one party stealing from the other.

There is a delicate balance in the socio-economic relationships between Seris and their neighboring communities, a balance that is rapidly disturbed by conflicts. Seri villages depend increasingly upon goods and services bought in Bahía Kino and Puerto Libertad (e.g., food, gasoline, medicines, health and elementary education services, markets for fish products, labor, trucks repairs, and recreation). During severe conflicts,
Seris are always facing the risk of direct or indirect retaliation against them that will escalate violence in towns or at sea.

This potentially explosive atmosphere is aggravated by problems generated by a few Seris who commit serious criminal acts inside the Seri EFZ, and are shielded by their affiliation with Guardias Tradicionales. The behavior of these few individuals is hurting the reputation of the entire Seri community. The Seri Government attempted to bring some of them to Mexican justice by allowing access to judicial police to look for criminals in villages. However, the problem is complicated by severe limitations and corruption in the internal and external judicial system. Furthermore there is a deeply rooted sense among some radicals that all actions of abusive Guardias Tradicionales against Mexicans are justified in light of centuries of persecution and crimes against Seri people. The result is the total lack of accountability inside Seri territory for these problematic individuals Guardias Tradicionales need to be formalized as an internal police, with structure, norms and procedures visible to outside review and comparable or better than the standards of any local police. Again, in this area the federal government, with its passivity, ambiguity, fear of commitment and extreme bureaucracy has directly or indirectly blocked all efforts at reform. Apparently, a working document for recognition of the Guardia Tradicional as the official internal security force at the municipality level never went beyond the desks of INI officials.\footnote{Municipio is the equivalent of county in the USA.}
**F) CONCLUSIONS AND RECOMMENDATIONS**

1. Exclusive use rights given to the Seris in 1975 have been advantageous to control access and to face competition against Mexican fishermen, but only inside the Infiernillo Channel. It has been successful in promoting survival of the Seri people and their maritime culture.

2. Lack of definition of the borders of the Seri EFZ, coupled with limited patrolling capacity of Seris, hampered its effectiveness in the majority of the area apparently under exclusivity. Inside the marine areas, which before 1975 functioned as *de facto* exclusive Seri waters, the presidential decree strengthened exclusivity.

3. The presidential decree of 1975 is not a finished piece of legislation. The lack of legal delimitation of clear limits of the Seri EFZ have caused conflicting interpretations, and is the main source of conflicts among resource users. The precise definition of borders, through a participatory process based on local consensus, is urgently needed.

4. Exclusive use rights in Seri EFZ had more viability because they had been influenced by the historical context of social relationships between Seris and Mexicans, in which Seris had actively defended their territories.

5. Conflicts for resource use are increasingly important over time because the Seri EFZ includes areas with rich fishing grounds that fuel local and regional economies. In adjacent fishing grounds, open-access fisheries management policies have been ineffective in controlling overfishing. There is a strong and growing outside pressure
to gain access to the Seri EFZ, which includes productive grounds of benthic and
demersal species that are overexploited elsewhere.

6. The low operational capacity of the Seri *Guardia Tradicional* has kept conflicts
at a minimum. Increased capacity of the Seri guards to patrol, under current
circumstances, results in rapid emergence and escalation of conflicts.

7. There is no clear system for transfer of withdrawal rights from the Seri to
Mexican fishers. This is another major source of conflicts.

8. Informal and quasi-formal agreements and local alliances have been used to
transfer withdrawal rights, but lack of organization and mistrust between Seris and
Mexicans, coupled with the weakness of local and federal government institutions
have caused agreements to be short-lived.

9. An important element in the failure of agreements has been lack of transparency
and equitable distribution among Seris of the economic benefits of the sale of fishing
permits. Another factor is the lack of commitment from government institutions to
support local alliances conducive to better management and sustainable resource use
practices.

10. The status of Tiburón Island as a wildlife reserve under federal jurisdiction has
complicated fisheries management issues inside the EFZ. Island management
policies have blocked local control, discouraged collaboration, and promoted
confrontation with the federal government. The role of SEMAR in the area is critical
in the emergence or avoidance of conflicts.
11. The status of Tiburón Island as a wildlife reserve also has facilitated issues of natural resources management, since it has reaffirmed to the Seris the importance and viability of local control over natural resources, and the need for scientific research about natural resources for better management.

12. For Seris, it is virtually impossible to envision partitioning of their territory into management units as has been promoted by non-Seri agencies. There is a strong sense of territory among Seris that interlinks terrestrial and marine territories.

13. The government has been ambiguous in its position on Seri use of the Guardia Tradicional to defend the integrity of their territory. The fear of an enclave of Indian autonomy from the State, with armed Indians defending their rights over natural resource ownership was influenced by unresolved issues elsewhere in the country. The connections between the Seri EFZ and the Zapatista uprising in Chiapas in 1994 reside in the San Andres Accords, and the COCOPA initiative to modify the Mexican Constitution. These modifications will definitely empower Seri control over their fishing areas. However, for reforms to be successful, Guardias Tradicionales must be structured and formalized with strong internal controls and external accountability.

14. Fishermen from Bahía Kino recognize the advantages of property rights over fishing areas. They wish to have similar areas adjacent to the Seri territory. Other instances of territoriality in the region can serve as a foundation for a change in fisheries policy from open access to regionally-based common property.

15. The outcomes of some conflicts have been costly to Seris. But some conflict resolutions have demonstrated the potential to defend their EFZ using only legal
documents. It is likely possible that the outcome of some conflicts were influenced by the prevailing political context around Indigenous rights and local autonomy.

16. Mexican fishermen perceived the Seri EFZ as part of the paternalistic attitude of the federal government towards Seris. Mexican fishermen feel marginalized from government support, lacking ownership over their fishing grounds. Perception of an uneven distribution of natural resources, supports arguments in favor of transferring withdrawal rights from the Seris to Mexican small-scale fishers. This is a strong pressure for Mexican fishers to carefully manage their use of natural resources inside the Seri EFZ, since unsustainable fishing patterns could serve as an argument to lose ownership or withdraw rights.
CHAPTER 4
THE JAIBA FISHERY INSIDE THE SERI EFZ:
COMMON PROPERTY REGIME AND ROLE OF TRADITIONAL
ECOLOGICAL KNOWLEDGE IN ITS MANAGEMENT

A. INTRODUCTION

The jaiba crab (*Callinectes bellicosus*) is currently the target species for the most important fishery for the Seris living in Punta Chueca. In order to understand the role that the Seri EFZ has in fisheries management, I studied the inner workings of this fishery from three different perspectives. To begin, I described the fishery characteristics and extraction patterns from the perspective of fisheries biology, and reviewed existing federal regulations. Secondly, I used the framework proposed by Oakerson (1992) for analysis of the jaiba resource as a common property natural resource. And lastly, I researched the existence of traditional ecological knowledge about jaiba and assessed its role in current fishing practices and local management strategies inside the Infiernillo Channel. These analyses complement previous information provided in Chapter 3 on the effects of property rights in waters adjacent to the Seri EFZ, and provide a more complete perspective on the usefulness and challenges for the Seri fishing community of having exclusive fishing rights in management and conservation of the jaiba fishery.
Traditional knowledge of small-scale fishermen and management

Since the early 1980s, several studies have shown the existence of deep and rich local knowledge systems, which serve as the basis for folk management of agriculture, forestry and agroforestry, ethnomedicine, animal husbandry, and fishing (Ruddle 1994). Local knowledge has been described in maritime communities, although not usually assessed in management terms, for Oceania, Australia, Brazil, the Virgin Islands and India through the seminal work of eminent social and biological scientists such as Robert Johannes, Bernard Nietschmann and John Cordell, among others (Nietschmann 1973, Johannes 1981, Cordell 1989).

It has been argued by some that local knowledge ensures sustainable utilization of aquatic resources and “is therefore an important cultural resource that guides and sustains the operation of folk-management systems...its of fundamental sociocultural importance to any society because it provides for the maintenance of social institutions and traditional norms of behavior” (Ruddle 1994).

Mexico is one of the world’s regions where there has been much research accomplished on the use of traditional knowledge in natural resources management by rural communities. At least one study has been performed in 28 of the approximately 50 indigenous groups of México. Among Latin American countries the ethnobotany of México is the best known (Toledo 1990). Most of these indigenous groups have knowledge linked to subsistence economies, that depend on primitive agriculture, collection of wild plants, hunting, and fishing (Fekes 1991). Although traditional knowledge has been studied among agricultural-systems, very little interest has been
shown in subsistence hunting and fishing (Gatti 1985). As a result, most of the information about the use of traditional ecological knowledge (TEK) in natural resources management is related to terrestrial resources.

If studies of marine resources traditional management systems have been neglected in México, the subject of small-scale fisheries has been virtually forgotten. This is probably one of the consequences of the bias in scientific research, management policies, and bureaucracy apparatus directed toward supporting and controlling large-scale fisheries. Only a few studies exist that touch directly or indirectly on aspects of ethnobiology and its applicability in natural resource management of Mexican small-scale fishermen: Alcalá describes the shark and shrimp fishermen from the Soconusco Region in Chiapas (Alcalá-Moya 1999); Breton focused on the small-scale fishermen from Colima (Breton and Doyon 1998); McGoodwin worked with shrimp and shark fishermen from southern Sinaloa (McGoodwin 1980a and b); Pomeroy studied a lake fishery (Pomeroy 1994); Vázquez-León analyzed the shrimp fishers in southern Sonora (Vázquez-León 1994), and more recently Cudney-Bueno (2000) studied a snail fishery in the Upper-Gulf of California, and Basurto (2001) the sea pen shell fisheries in the Seri territory.

Seri Traditional Ecological Knowledge

The comprehensive studies of Felger and Moser (1985) documented a detailed knowledge of the biology and ecology of desert plants by Seris. Seri have names for
most plants and animals in their territory. Felger and Moser (1985) recorded 427 Seri
names for plants (ethno-taxa) representing 411 botanical species.

Studies of Seri ethnozoology have not been as comprehensive. Felger and Moser
(1985) present data on some species of invertebrates and vertebrates used by Seri,
following the pioneer work of Malkin (1962). Moser and Marlett give some information
on names of animals in their Seri Dictionary (Moser and Marlett 1998). More recently
Nabhan (2000) has done research on Seri ethnoecology, and Torre et al. (2000) have
studied Seri ethnoichthyology. All these studies have revealed a detailed knowledge of
species and areas by Seri. However, as in other research on ethnobiology and
ethnoecology, few studies have explored connections between Seri TEK and local
traditional marine resource management practices. In this chapter, I present and discuss
the role of traditional knowledge in the sustainability of fishing for jaiba inside the Seri
EFZ.

B. OBJECTIVES

My goals for this chapter are to present a basic understanding of the jaiba fishery
biological characteristics and extraction dynamics in order to analyze its intrinsic
characteristics as a natural resource under a common property regime by the Seris. In
addition I want to assess the outcomes in terms of fisheries management and marine
conservation. Finally, I want to determine whether current jaiba fishing patterns inside
Seri EFZ use TEK, and if fishing practices are following general sustainable fishing
standards. To achieve these goals I accomplished the following objectives:
1. Describe the general characteristics of the *jaiba* fishery; history of the fishery, fishing methods, fishing areas, trends in the catch and federal regulations.

2. Analyze characteristics of the *jaiba* fishery under Seri common property ownership and determine if this property rights regime is leading to better management and marine conservation of this resource.

3. Describe the TEK Seris have about *jaiba* and its environment, and analyze the level of its use in the *jaiba* fishery management.

4. Determine whether current fishing practices follow sustainable fishing standards.

**C. METHODS**

I used a combination of social and biological sciences techniques to obtain qualitative and qualitative information. The study was restricted to the Seri community of Punta Chueca, and reflects *jaiba* fishing patterns in the fishing grounds inside the Seri EFZ of Canal de Infiernillo.

**Biological Aspects of the *jaiba* Fishery**

(1) Monitoring commercial catch

I regularly sampled the commercial catch of *jaiba* landed either in Punta Chueca or the fishing camp of El Egipto, in order to analyze fluctuations in size classes, proportion of sexes, proportion of sexually immature females, and volume of the catch. I
obtained *jaiba* data from random samples of the catch of Seri fishers during the fishing seasons of 1998-1999 and 1999-2000. Samples were obtained every other week at beach landing points, where crabs are weighted before being transported to processing plants in Bahía Kino. The sample was obtained from the first *panga* that arrived at the landing point after we arrived at the site. Upon arrival, the fishers and helpers shovel the catch from the bottom of the boat into large plastic crates for transport. From each panga selected, I separated the first or last crate that was weighed, with about 30 kg of crabs. All individual *jaiba* in the crate (approximately 120-150 individuals) were measured. The appropriateness of this sample size was also confirmed by analyzing fluctuation in the variances of measurements. A t-test was used to check for differences in carapace measurements between *jaiba* sampled from the top of the boat with *jaiba* from the bottom, to ensure that my samples represented the population of harvested crabs accurately.

Depending on the time and help available to me when taking data, the catches from two pangas were sampled some days. Sampling each crate took approximately 1 hour. The time available to sample depended to a great extent on the time of arrival of the boats to the beach. Occasionally boats arrived almost simultaneously, and the buyer was unwilling to allow us to finish the sample before leaving to take the catch to the processing plant. However, usually the time between the arrival of the first and last boat was 2 to 3 hours, allowing time to finish the sample, and also to talk to fishers and buyers, and observe their interactions providing data for the other objectives of my dissertation. I used a plastic caliper graduated in millimeters with a precision of 0.1 mm
to measure carapace length (CL). The high correlation obtained comparing carapace length measurements with carapace width measurements (P>0.9) made it possible to calculate carapace width (CW) when needed by multiplying by 2 the carapace length (Molina-Ocampo 2000a). Taking only one carapace measurement (CL) reduced sampling time considerably. Moreover CL is the measure used by government fisheries biologists from the Centro Regional de Investigación Pesquera (CRIP), it is easier and faster to measure, and has less error due to the relatively high incidence of broken carapace spines that introduce error in width measurements. During sampling, I always had helpers. While one helper measured crabs the other recorded data. The sex of the crab was easily obtained because jaiba show sexual dimorphism. The apron of sexually immature females is different than for mature females; therefore sexual maturity could also be easily determined visually. Additional data obtained were the price in Mexican pesos/kg paid to fishermen, general geographic location of fishing traps in the channel, and number of traps that crew was using. Data were later entered into formats designed specifically by CRIP fishery biologists, using Excel 2000 and JMP IN (ver. 3.2.1.) software for data and statistical analysis. Statistical methods included t-test to compare means, hypothesis testing to compare proportions and inferences on the mean to calculate sample size (Milton 1992).

I analyzed, in official public records, the fluctuations and trends of the catch from the Bahía Kino and Canal de Infiernillo region from 1988 to 1999. I used personal records from a crab buyer in Punta Chueca, in order to have more detailed and accurate information of these fluctuation, and to get an idea of the productivity, and continuity of
work for individual fishers. Regulatory measures of the fishery were obtained from the *Diario Oficial de la Federación* (D.O.F. or Federal Register), CRIP’s internal reports, copies of *jaiba* fishing permits, and at the annual meetings of the *jaiba* State Fishing Management Committee, that take place before the beginning of the fishing season.

(2) Computerized mapping of *jaiba* fishing areas

I used computerized mapping and a simple geographic information system (GIS) database of the Infiernillo Channel to follow changes in the location of jaiba fishing areas during 1998-1999. I mapped the general location of crab traps during two 9-month fishing seasons. Mapping was done using GeoLink (ver. 4.1d) software and Motorola GPS 8-channel Workhorse units connected to a laptop computer powered by 12-v batteries. I used differential GPS correcting positions with Post Point (ver. 3.3) software. Corrections where not done in real time but with positions collected by a GPS base station, using the same type of GPS unit and software, installed at Bahía Kino. This station was programmed to collect positions during all of the time we were mapping in the channel. The GPS unit and the portable computer were used on board a Seri *panga*, rented from Seri fishermen for special trips focused only on mapping. Locations of clusters of jaiba traps were found by searching for buoys floating on the surface of the ocean. Once a group of traps was located, one researcher directed the boat, pointing out the direction and speed to the boat captain, who was also our Seri guide and an experienced fisherman. We followed the outer contour of the group of traps, trying to map the polygon that contained all of the buoys. The GPS calculated one position per second, and the software drew the shape of the polygon. Placing the GPS antenna over a
flat metal base on the tip of a metal pole approximately 1 m above sea level minimized multipath error. Once the polygon was completed, it was saved using individual and progressive files, named after the Julian date. A simple database was related to each polygon, with information on the total number of traps inside it, the type and color of buoys, and the name of the fisherman who owned the traps, if known. The total number of traps was counted by two crewmembers with the aid of a manual counter, during the time mapping was taking place. The average of both counts was used as the total number of traps. Computer files collected on the boat (rover files) were corrected with the base station files that same night, or as soon as possible to eliminate the dilution of precision error (DOP) inherent to civil GPS units. Corrected files were then imported into ArcView (ver.3.2) software to produce and print maps of *jaiba* fishing areas.

Since there were no digital maps of the coastline of Tiburón Island and the mainland of the Infiernillo Channel in a small scale (e.g., 1:10,000), I had to map both coastlines for the GIS database. This was done using the same procedure for mapping traps, but following the coastline as close as possible, 30 m or less, to the edge of the waterline depending on the depth. This was done on days with very high tides.

**Analysis of *jaiba* as a Resource under a Common Property Regime**

For this analysis I used the framework and terminology proposed by Oakerson (1992). I analyzed the basic elements related to four sets of attributes or variables: (1) the physical attributes of the *jaiba* resource and the fishing technology used, (2) the decision-making arrangements (e.g., organization and rules) that govern relationships among *jaiba*
fishers, (3) the mutual choice of strategies and patterns of interaction among decision-makers in the fishery, and (4) the outcomes or consequences of the fishery. For this analysis I considered only the inside of the Infiernillo Channel, under a common property regime by the Seri community.

Traditional Ecological Knowledge of _jaiba_

Research relied on participant observation during fishing trips (Spradley 1980), and the use of a questionnaire-based survey to qualitatively assess Seri fishers level of TEK about _jaiba_. This questionnaire was designed with biological and ecological information from species of the genus _Callinectes_ as a base. It was applied to a random sample of 30 fishermen, selected from a list of active fishermen made for this study.\textsuperscript{77} The questionnaire consisted of 42 open-ended questions, covering the areas of species recognition and sexual dimorphism, reproduction and breeding, feeding, local movements, fishing patterns, ecosystem concepts, and conservation concepts. Questions were designed after the categories for TEK proposed by Ruddle (1994), see Appendix 8. Fishermen were interviewed individually, in the afternoon, at their homes and after daily fishing activity was completed.

\textsuperscript{77} I updated and completed the census of families in Punta Chueca done by Santillán Mena (1993) and drew a map with all households in the village. These proved very useful in understanding and remembering kin-based groups of fishers.
D. RESULTS

The jaiba fishery in Seri waters

(1) History of the fishery

Seris have fished jaiba for subsistence fishing long before it was a commercial fishery in the area. There is evidence of abundant claws and carapaces in house refuse reported since the earliest encounters with explorers (McGee 1898, in Felger and Moser 1985). The extensive use of Callinectes bellicosus, captured by hand harpoons named hacáaiz, in shallow waters along the shore and inside mangrove lagoons, is reported by Felger and Moser (1985): “these crabs, esteemed for their sweet-tasting meat, were eaten in substantial quantities.”

The commercial fishery for jaiba in the Seri territory started in the early 1990s, about the same time it developed at Bahía Kino (Molina-Ocampo 2000b). Therefore, with 10 years of existence, the jaiba fishery is a young commercial fishery that has a long history as a subsistence fishery for the Seri and probably for other indigenous groups in Sonora and Baja California.

(2) Fishing methods

According to some Seri fishermen, when commercial fishing for jaiba started in the Infiernillo Channel, gill nets were used to catch crabs. This capture method was soon abandoned, because it was difficult and slow to disentangle the crabs, with fishermen having to break or even smash the animals. The capture of jaibas using metal traps is today the only method used to appropriate the resource. Although other methods to catch
jaiba (e.g., rings, hand harpoons, nets) are lawful, they are not used in the region. Metal traps were introduced to the area in the early 1990s, and are a smaller version of the Chesapeake Bay blue crab (*Callinectes sapidus*) pot design. Local fishermen build traps at the jaiba processing plants or in the facilities of buyers in Bahía Kino. They use an imported metallic mesh that is coated with plastic to prevent corrosion. A detailed description of the characteristics of the *jaiba* trap can be found in Molina-Ocampo (2000b). Seris are not involved in trap construction, just in repairs of damaged traps at the beginning of the season.

Fishing consists in placing groups of baited traps on the bottom of the Infiernillo Channel. Traps are passive fishing devices that are baited to attract crabs that enter through one of four funnel-shaped entrances and get trapped. Fishing crews leave every morning on board their *pangas* carrying fresh bait to check their fishing traps. Buoys at the surface indicate the location of traps. One member of the crew pulls each the trap out of the water by hand, using the nylon line attached to the buoy. The top end of the trap is opened, and crabs emptied into the boat. Old bait is removed and replaced with fresh bait, and the trap is then thrown back into the water. This is repeated until all traps, about 100 per boat, are checked in a process that takes about 2 hours with good ocean conditions. *Jaiba* traps are usually placed in lines parallel to the coastline. Each line is composed of about 20 traps. This facilitates control of the crew over the location of their traps and ensures all traps are checked. Location of these lines parallel to the coast facilitates piloting the boat against and in favor of the prevailing tidal currents.
Once all traps are checked, the boat returns directly to the landing point on the beach. No grading, selection, or special handling of the *jaiba* is made on board. Immediately upon arrival, the catch is shoveled into plastic crates and carried to the buyer, who weighs each crate with a dynamometer scale hanged from a pole. Then, the *jaiba* are submerged in cold water (during summer months), loaded into a truck, covered with chopped ice, and transported to processing plants.

(3) Fishing areas

Traps are left in the water for the entire length of the fishing season, although they are regularly moved. Traps are placed on sandy bottoms of areas with water depths ranging from 1 to 15 m. Traps can be placed just a few meters from the coastline, or at the center of the Infiernillo Channel. The general locations of traps mapped during the fishing seasons of 1998 and 1999, and completed with interviews in 2001 are presented in Figure 4.1. A detailed description of the physical and biological characteristics of the ocean bottom in the jaiba fishing areas in the Infiernillo Channel can be found in Torre (n.d.).

The location of traps is not fixed. Seris move their traps to maintain catches throughout the season. When catch diminishes considerably over a period of time, or when the captain wishes to try his luck at another spot, traps are picked up and moved to another location inside the Infiernillo Channel.

This frequent movement indirectly causes a rotation of fishing zones. At the beginning of the season, in August, most traps are placed in fishing grounds close to Punta Chueca. They are slowly moved north, month after month, until virtually all are
located near Campo El Egipto, on the north end of the Infiernillo Channel, by the end of the fishing season in March. In winter months, some Seri fishermen and their families move their residence to Campo Egipto to be closer to the northern fishing grounds to reduce the use of gasoline. The movements of traps by the fishers from Desemboque was not analyzed.

(4) Historical trends in the catch

It is difficult to know precisely how much *jaiba* is captured inside the Seri territory. All catch data from the region between Puerto Libertad and El Cholludo (between Bahía Kino and Guaymas) is lumped in the official records of the *Secretaría de Pesca* (SEPESCA) office in Bahía Kino. In addition, official catch data are highly unreliable. The main problem is underestimation of landings. This is caused by the extended illegal practice of buying and transporting the catch without invoices, from landing areas to processing centers and markets outside the Bahía Kino area, and by lack of enforcement in registering landed catch at the SEPESCA office. As a result, an unknown but apparently large proportion of the catch is never recorded by SEPESCA statistics. A conservative estimate, calculated by buyers, is that 50% of the catch is never registered. The underlying reason reported is tax evasion, although fishing without permits is also a reason.
Figure 4.1. Location of fishing areas for *jaiba* in the Infiernillo Channel. Grey polygons represent areas where *jaiba* traps were placed during fishing seasons of 1997, 1998, and 2001.
In spite of this, I assumed that even with large errors, official records portray general trends in production. Figure 4.2 shows official records of the catch in Sonora starting in 1988, and gradually increasing in catch until a peak of 4,183 t in 1996. A similar trend is observed in the official data set for the Bahía Kino region, with a maximum of 1,658 t in 1996. Although the fishery started later in the Bahía Kino region than in southern Sonora, it peaked in 1994, and went from a fishery with little importance to the most important fishery in the area in just 3 years (Montemayor-López 2001).

*Jaiba* captured in the Bahía Kino region represented between 20-57% of the jaiba captured in Sonora in the period 1991-1995. After 1995 the importance of *jaiba* captured in Bahía Kino dropped to less than 10% of the state total. In 1997 the catch from Bahía Kino represented 17% of the jaiba captured in all of the Gulf of California (Sonora, Sinaloa, Baja California, Baja California Sur and Nayarit) and has never reached a greater percentage after that year.

Looking at the official records for the overall catch from all small-scale fisheries in the Infiernillo Channel, we can see a decreasing tendency, reaching zero, in total catch landed (Figure 4.3). This is extreme example of the bias caused by under-reporting. I knew from the personal records of the buyers, that at least 173 tons of *jaiba* were caught in the Infiernillo Channel during 1999-2000.
Figure 4.2. Trends in the catch in tons of jaiba landed in Sonora and the Bahía Kino region from SEPESCA data. Also the trend in catch from all fisheries in the Infiernillo Channel landed at the SEPESCA office in Bahía Kino. Data from official records reported from Sonora catch in Molina-Ocampo (2000b), Bahía Kino catch in Pérez-Ríos (2001), and Canal de Infiernillo catch in Bracamonte (2001).

Figure 4.3. Trends in the catch of jaiba (kg) landed in the Bahía Kino region, and from catch coming from all small-scale fisheries in Canal de Infiernillo (CDI) and Bahía Kino (BK). All from official SEPESCA data, as reported in Pérez-Ríos (2001) for BK-jaiba, in Bracamonte (2001) for CDI-All, and in Bourillón et al. (1999) for BK-All.
The most accurate and detailed sources of catch data are the personal records of buyers. These records are usually kept in regular school notebooks in which buyers daily write the kg captured by each boat, along with the kg of bait provided, liters of gasoline and two-cycle oil provided, if the fishermen owed money to the buyer or vice versa. Unfortunately, over time these notebooks are commonly lost. Most buyers are very reluctant to share these important data for fear that it may reach the authorities.

I only have access to data from one of the two active *jaiba* buyers in Punta Chueca, however it was the main buyer in the region. A total of 10 small notebooks were recovered, and the data were transcribed into a computer spreadsheet. From the notebooks, 1 year of continuous data could be recovered. This data set ranged from September 21, 1999 to September 28, 2000, and contains information from 248 total fishing days of 20 boats, with crews of 2-3 fishers. Only five of these crews have catch data that shows they fished for more than 120 days. The rest have less than 60 days of fishing recorded, which means highly irregular activity. Some crews have data just from one fishing day; the captains of those crews were holding official positions in the Seri fishing cooperative during this time.

Assuming that all crews sold their entire seasons’ catch to one buyer, the 20 fishers captured a total of 173,671 kg of *jaiba* in 1 year. The average volume brought daily to this buyer was 700 kg (95% CI = 633, 767). Fishermen who caught the most *jaiba*, landed 33,374 kg in 180 days of work during the year, and had an average daily catch of 185 kg (95% CI = 171, 199). The average annual individual daily catch was 144 kg (95% CI = 120, 168). This average can be considered the average CPUE (catch per
unit of effort) for this period, since individuals only made one fishing trip per day. However, the average calculated only with data of individuals who fished more than 60 days in the year was 146 kg (95% CI = 123, 169). The average annual CPUE calculated using trap as the unit of fishing effort was 87 kg/trap for all crews. This is considering a total of 2,000 traps in the study area, or 20 boats with 100 traps each.

The average number of days fished by each crew was 56 (95% CI = 28, 84). However, due to variability introduced in this average by the crews who worked less than 20 days a more representative calculation is 90 days (95% CI = 54, 126). The crews with the highest number of days worked have 169, 173, 180 days respectively.

The daily production for three fishermen selected from the group of 20 is presented in Figure 4.4. These three fishers were selected based on the different patterns shown in their catch fluctuations, different ages and experience and reputation in the community. Fisherman “A” was the most productive of the group of 20 fishers. He and his crew landed over 33 tons of jaiba, and worked 180 days of the year. His catch was higher than all other 19 fishers, with the exception of fisherman “B” during the last months of 1999. Fisherman “A” is 35 yr old. In comparison, fisherman “C” is 68 yr old, and landed 22,042 kg in 173 days of work. Fishermen “B” is 48 yr old and landed 10,497 kg in only 44 days of work in 1999, and only worked with the buyer who provided the records during 2000. Figure 4.4 shows the high variability in the catches of these three fishers over small periods of time.
Figure 4.4. Daily production in kg of *jaiba* landed by three selected Seri fishermen from Punta Chueca.
(5) Descriptive statistics of the catch

Data on carapace length and sex were obtained from 5,087 individual crabs during 2 years of sampling in the Infiernillo Channel. Minimum sample size (n = 120-150 animals) was confirmed first by using the visual method of fluctuation of variances in the measurements (Figure 4.5). The estimation of the required sample size to capture 95% of the variability resulted in a minimum sample size close to 1,000 individuals per sampling episode. This was impossible to achieve, therefore the sample size was 120 animals which captures 75% of the variability. Larger sample sizes were impossible due to the limited time we had to sample jaiba without interfering excessively with the commercial activities, and not damaging the catch due to desiccation by extended exposure to air and heat. The sample size used was also convenient since it is the average number contained in a crate used to transport the crabs to the processing plant. No significant differences were found comparing a sub-sample from the top of the boat to a sub-sample from the bottom (t = -1.458, P = 0.1474).

The sexual composition of the catch showed a large bias towards males. During the 1998-1999 fishing season the average ratio of males to females was 79.9:20.1 (n = 3,714), and 90.3:9.7 (n = 1,373) during the fishing season of 1999-2000, overall average was 84% males. About half of females captured were sexually immature, 48.2% in the season 1998-99 (n = 450), and 46.7% (n = 60) in the season 1999-00. Figure 4.6 shows monthly changes in the percentages of males, mature females and immature females.
Figure 4.5. Fluctuation in the variance with increasing sample size for the catch sampled on July 30, 1998.

Figure 4.6. Fluctuations in the percentage of males and females in the monthly catch of *jaiba* per fishing season. Fishing is interrupted in late December and early January for holidays and low production.
The proportions of male to female between fishing seasons for the month of August was significantly different ($Z = 3.00, P = 0.0013$), with more males in 1999. The same was true for comparison for March ($Z = 5.97, P = 0.0002$), with more males in 2000. The sex ratios for August of 1998 and February of 1999 showed significant differences ($Z = 14.41, P = 0.0002$), with more females in February.

Table 4.5 shows a summary of the extreme measurements and averages in the carapace length (CL) for both sexes during the sampled period.

Table 4.1. Carapace lengths for jaiba caught in the Infiernillo Channel in 1998-2000 ($\alpha = 0.05$ for confidence intervals).

<table>
<thead>
<tr>
<th></th>
<th>CL in mm</th>
<th>CI 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Largest male</td>
<td>94.0*</td>
<td></td>
</tr>
<tr>
<td>Smallest male</td>
<td>20.0*</td>
<td></td>
</tr>
<tr>
<td>Largest female</td>
<td>70.9</td>
<td></td>
</tr>
<tr>
<td>Smallest female</td>
<td>29.9</td>
<td></td>
</tr>
<tr>
<td>Largest immature female</td>
<td>62.5</td>
<td></td>
</tr>
<tr>
<td>Smallest immature female</td>
<td>29.9</td>
<td></td>
</tr>
<tr>
<td>Smallest mature female</td>
<td>46.4</td>
<td></td>
</tr>
<tr>
<td>Overall mean</td>
<td>63.8</td>
<td>63.53</td>
</tr>
<tr>
<td>Overall mean male</td>
<td>65.6</td>
<td>65.32</td>
</tr>
<tr>
<td>Overall mean female</td>
<td>53.8</td>
<td>53.36</td>
</tr>
<tr>
<td>Overall mean mature female</td>
<td>59.9</td>
<td>59.39</td>
</tr>
<tr>
<td>Overall mean immature female</td>
<td>50.6</td>
<td>50.30</td>
</tr>
</tbody>
</table>

- Probably error measurements, more precise range estimates are 35.5-88.6 mm.
Figure 4.7 show the size-frequency distribution for all crabs collected during two seasons. The majority of *jaiba* harvested are distributed between the modal classes of 50-70 mm of CL.

The monthly size-frequency distribution for both years combined is shown in Figures 4.8 and 4.9. These figures show presence of large males (modal length 75 mm) at the beginning of the fishing season and recruitment of juvenile males (modal length 55-60 mm) in February and March. For mature females a similar tendency than is observed, with large mature females (modal length 65 mm) at the beginning of the season, and their disappearance, probably due to fishing, towards the end of the season. The recruitment of immature females (modal length 50-55 mm) is evident in December to March.
Figure 4.8. Monthly size-frequency distribution of CL in mm for both years combined. Left histogram is for males. Right is for females, mature females are in gray.
Figure 4.9. Monthly size-frequency distribution of CL in mm for both years combined. Left histogram is for males. Right is for females, mature females are in gray.
Figure 4.10. Monthly mean size per fishing season for all individuals, for male, and female jaiba.

The summary of monthly fluctuations of mean CL per fishing season for all individuals, for males, and for females is shown in Figure 4.10. Comparing the mean size for all individuals, I found significant differences between August 1998 and August 1999 ($t = 4.916, P<0.001$), jaiba was bigger in the first year. The same comparison of mean size among March 1999 and March 2000 data resulted also in significant differences ($t = 5.952, P<0.001$) but this time the average size in the second year was bigger.
Similar trends were observed among average sizes of males and of females. Significant differences were found in the average size of males between August of 1998 and August of 1999 (t = 6.105, P<0.0001). Also between March of 1999 and March 2000, being bigger the second year (t = 4.395, P<0.0001). For females significant differences were found between average size in August of 1998 and August of 1999 (t = 2.1, P = 0.0379), with larger females in the first year. Between March of 1999 and March 2000 there were no significant differences (t = -1.517, P = 0.1319) for average size. The overall mean size for the fishing season 1998-99 (64.11 mm) was different from the overall mean size (62.92 mm) for the season 1999-2000 (t = 3.943, P<0.0001).

Monthly fluctuations in CL for all individuals per fishing season for both years showed catch dominated by larger individuals at the beginning of the fishing season (July and August), followed by transitional months (September to December) when the modal length shifts gradually towards smaller sizes, and the catch is dominated by smaller individuals the last months of the season (February and March).

(6) Federal management regulations

The specific administrative and management regulations of a fishery are included in one or several Norma Oficial Mexicana (NOM or Mexican Official Norm), published in the federal register (DOF). In México fisheries are not managed through management plans, but through official norms. Only a few fisheries have NOM, the jaiba fishery is
not one of them. However, the fishery in Sonora is regulated through an administrative agreement; the rest of the states that bound the Gulf of California does not have any regulation other than the Federal fishing permit. The State of Sonora is thus a pioneer in the design of regulations for this fishery. The administrative agreement between the federal government, producers, and processors and exporters, is based on a technical opinion that is formulated by Federal Government fisheries scientists working at CRIP. During my study, the specific *jaiba* regulations in the agreement were: a) a closed season that starts the first day of April, and ends in the middle of July, depending on advice from CRIP scientists and consensus with the fishing sector, b) minimal legal landing (catch) and commercialization size of 10 cm CW (carapace width), b) a maximum of 70 traps per boat, c) at least two culling rings of 2 inches (53 mm) in inside diameter installed in each trap, c) no capture allowed of egg-bearing females, d) no placing of traps inside estuaries along the coast or inside the Colorado River Delta, fishing is restricted to bays and littoral waters, e) no capture allowed with trawling nets, although rings and hand harpoons are allowed, and f) all traps must be removed from the water at the end of the fishing season. The regulation also include the following recommendations: f) extract and commercialize only males due to the higher yield due to weight and to diminish the risk of recruitment overfishing (Molina-Ocampo 2001).

By the end of my study, another regulation for fisheries management was established, the *Carta Nacional Pesquera* (CNP or National Fishing Chart). Published on August 17, 2000, the CNP is the written and graphic representation of availability, and conservation indicators for all Mexican fisheries resources. The CNP has one chapter for
the *jaiba* fishery in the Pacific Coast. This chapter includes essentially the same information that the administrative agreement in Sonora, but calls for an annual CPUE of 0.2 kg/trap for the Gulf of California. The chart does not recommend increasing fishing effort in the Gulf of California, recommends an evaluation of the formal implementation of a fixed closed season for Sinaloa and Sonora, and proposes to implement a quota system (D.O.F. 2000).

In addition to these two regulatory instruments, fishing permits issued to catch *jaiba* include the authorized number of boats and traps that the permit holder is allowed to use, as well as the general geographic fishing area marked by coastal landmarks.

**Analysis of the *jaiba* Resource under Seri Common Property**

a) **Natural and Technical Attributes of the Resource**

The constraints that communities have to face to use a natural resource are part of the nature of the resource in question, or are inherent to the technology available to extract it. In the following analysis subtractability refers to the relative capacity of the resource base to support multiple users without diminishing the aggregate yield of the resource. Exclusion refers to the degree to which common property resources permit exclusion of individual users and thereby limiting access to the resource. Finally, indivisibility deals with the physical boundaries of the common property resources.
i) Subtractability

The capacity of a resource to support multiple users is largely based on the capacity for natural replenishment and maintenance of populations under exploitation. Limiting conditions for natural replenishment of the *jaiba* resource are habitat quality or modification, changes in population structure due to fishing pressure, and changes in recruitment patterns. Indirect measurements of these factors can be obtained analyzing the current fishing and aquaculture practices outside and inside the Infiernillo Channel, determining if they disturb nursing and feeding habitats or produce growth and/or recruitment overfishing.

High reliance on estuaries and coastal lagoons in the life cycle of *Callinectes* crabs is well known (Orth and Montfrans 1990). The largest estuary in the study area, La Cruz Estuary adjacent to Bahía Kino, is being disturbed in two different ways. Firstly, by a private shrimp aquaculture farm that is pumping large volumes of seawater directly from the estuary to fill hectares of ponds. Some people believe that this farm is killing large numbers of larvae and juvenile *jaiba* in the pump filters used to move this water, or when juveniles are moved to shrimp ponds were they are preyed upon or die after the shrimp are harvested and ponds are dried (personal communication Javier Carrillo, fishermen from Bahía Kino, Sonora, October 2000). The shrimp farm also has a negative impact by releasing its discharge waters directly into the estuary (Villa-Escárciga 2000). Secondly, the mouth of the estuary was obstructed by sedimentation caused by the installation of hundreds of modules for oyster farming years ago (personal communication Jesús Vázquez, fishermen from Bahía Kino, Sonora, February 1994).
This may be decreasing the amount and quality of water exchange with the bay and is probably affecting local *jaiba* recruitment.

Large-scale fishing practices by shrimp trawlers in the areas may also be impacting local *jaiba* populations. During 9 months each year, an average of 20-30 shrimp boats drag their nets every night in the waters of Kunkaak Bay. This fishing activity has been widely documented for its impacts on benthic communities (Watling and Norse 1998). The fleet catches variable amounts of *jaiba* among other benthic fauna in their operations targeting shrimp. Boats also return to the ocean large volumes of dead animals captured as by-catch. However, some sources propose that discarded animals that reach the bottom may become new sources of food for crabs (Hill and Wassenberg 1992), thus may be boosting local crab populations.

There are no aquaculture operations inside the Infiernillo Channel. Nine small mangrove lagoons that border the Infiernillo Channel have remained largely undisturbed by human activities. Shrimpers do not trawl inside the channel; therefore the only apparent source of damage to benthic communities inside the Channel is the physical impact *jaiba* traps have on eelgrass (*Zostera marina*) beds (Torren d.). These aquatic plants apparently are critical nursing and feeding areas for *jaiba* (Orth and Montfrans 1990).

Fishing extraction patterns have an impact on future yield if they produce overfishing. A high percentage of *jaiba* females in the catch will introduce the risk of recruitment overfishing. However, Seri fishing *jaiba* inside the Infiernillo Channel capture small percentages of immature crabs and of egg-bearing females. In the
Infiernillo Channel, on average over 78% of the catch, during the two fishing seasons sampled, was composed of males. Percentages of males was between 80% and 100% were as well recorded in samples from Bahía Kino collected from November 1999 to September 2000 by other researchers (Montemayor-López 2001). Capture of immature females and egg-bearing females is common in areas south of Bahía Kino, according to sampling by Federal government researchers. For example the capture of large numbers of immature females and egg-bearing females, up to 40% of the animals sampled, has been recorded in fishing areas from Sahuimaro to Cholludo distant 39 and 78 km south of Bahia Kino respectively (personal communication, Raúl Molina, CRIP-Guaymas, March 2000).

ii) Exclusion

Exclusion from the Infiernillo Channel of potential jaiba users is done by controlling access to the channel. Fishers who are not part of the Seri community are actively excluded. However, exclusion of outsiders is not absolute. The strategies used by Mexican fishers to gain access to fishing resources inside the Infiernillo Channel that I recorded were: (a) resource piracy, (b) illegal buying or guaterismo, (c) informal or formal arrangements with Seri authorities, (d) becoming Seri labor, and (e) becoming part of the Seri community. Outside the Infiernillo Channel, none of these arrangements are necessary most of the time. The complete absence of Seri patrolling outside the channel makes these open-access areas for Mexican fishers, with some exceptions like the shrimping grounds inside Kunkaak Bay, where withdrawal rights are transferred (Chapter 3).
(a) Resource Piracy

All fishing activities adjacent to the Coast of Tiburón Island by Mexican fishermen are considered by the Seris to be resource piracy. Fishers from Bahía Kino and other areas sometimes venture into the outer limits of the Infiernillo Channel. They know the high risks involved, but fishing in some areas and during certain times of the day entails a low possibility of being caught. For example, fishing off Patos Island, and along the western and north shore of Tiburón Island is not considered very risky. Patos Island is a popular diving destination for Bahía Kino commercial hookah divers during the octopus season in the summer. Mexican fishers also consider it relatively safe to navigate in Kunkaak Bay to catch schooling fish as far north as Punta San Miguel, located just a few kilometers south of Punta Chueca but blocked visually by the point. No resource piracy events for *jaiba* were recorded inside the Infiernillo Channel, where the likelihood of being caught is very high, with consequences of losing gear, boat and product. *Jaiba* are regularly fished south of Punta San Miguel by Bahía Kino fishers.

(b) Illegal Buying

Illegal buying or *güaterismo* is defined by Seris as buying from Seri fishers without providing them with the means of production (e.g., fishing gear, gasoline, boats), or having any arrangement with Seri authorities to do so. In this strategy, Mexicans buyers are taking advantage of the fishing resources provided to the Seris by other Mexicans. Seri fishermen sell to *güateros*, a term also used for those fishing during the closed fishing season, because they pay in cash, at delivery. By doing these transactions in secrecy, they avoid the risk of losing equipment provided by their formal buyers.
However, güaterismo is usually done in low volumes. During the two years of my study, at least one güatero was engaged in illegal buying of jaiba on the beach and transporting the catch to Bahía Kino for processing. Some of the fishermen selling jaiba to güateros owned their equipment and gear. In this case a fishermen is free to sell his catch to the best buyer.

(c) Arrangements with Seri authorities

The Seri Governor or the President of the Seri fishing cooperative can negotiate arrangements with outside fishermen, and allow them to enter the Seri EFZ to engage in fishing operations. Depending on the terms of the arrangements negotiated, Mexican fishers accept one, all, or a combination of the following conditions: a) allow the Seri cooperative to register all catch and must buy an invoice (factura) issued by the Seri cooperative, in which case the price of the factura is a fixed amount of pesos per kilo of product, b) pay the Seri cooperative a fixed amount per kilo of product captured without buying a factura (that may be obtained elsewhere), c) allow at least one fisherman of the Seri community to work as local guide and/or crew in each of the boats, (these Seri get paid a fixed share of the daily catch as regular crewmembers), d) pay for the use of the land where a truck used to transport the catch is parked, this is known as derecho de piso, or the right over using the ground, e) pay for a general blanket permit that will allow them to fish and transport all catch without hiring, registering or paying any other fees.

Only one Mexican panga with an entire Mexican crew was fishing for jaiba inside the Seri EFZ just for a few weeks in 2 years of my study. This boat was working under an arrangement with one Seri fishing cooperative leader.
(d) Becoming Seri labor

Some Mexican fishers are hired to work for Seri patrons. This strategy for access is more common in the pen shell fishery where divers work for Seri patrons that own *pangas*, motors and hookah diving compressors. In the *jaiba* fishery, I found only two Mexican fishers participating in the fishery that were not part of the Seri community. Working for a Seri patron does not differ from working from a Mexican patron. Seri patrons actively recruit fishers in Bahía Kino on occasions, particularly divers (personal communication Amy H. Weaver, Master Student, School of Marine Affairs, University of Washington, January 2001). I recorded one instance of a diver living in Bahía Kino who traveled daily to Punta Chueca to work.

(e) Becoming part of the Seri community

A few Mexican fishermen have established formal relationships with Seri women and established permanent residence in Punta Chueca. Inter-ethnic marriages of Seri women with Mexican fishermen are less common in Punta Chueca than in Desemboque. Once a Mexican fisherman marries a Seri woman, he gains access to the Seri territory resources. The issue of “mixing with outsiders” was a major topic for internal conflicts during the time of my study. The incidence of inter-ethnic marriages is still very low, with even fewer instances of Seri men marrying Mexican women. I recorded only one marriage of a Mexican fishermen with a Seri teen. In this case the families forced the marriage since the girl became pregnant. The number of Seri single mothers resulting from affairs with Mexicans is large. Seri women are shy and reserved but very attractive. In a small village like Punta Chueca, female curiosity about male outsiders is evident.
The product of a marriage between a Seri and a Mexican is locally referred as *mestizo* or *cruzado*. Mexican fishermen who have married Seri women and *mestizo* fishermen sometimes bring members of their extended Mexican family to live with them in the Seri villages and some of these family members may also be fishers.

For older Seris, particularly to the members of the Council of Elders, mixing with “Mexican blood” is wrong. They are very outspoken and radical opponents of interbreeding. One time a former governor said to me: “We should expel all *mestizos*, if we are not careful in 15 more years they (*mestizos*) will clean us, and step on us.”

 Relationships between *mestizos* and some traditionalist full-blooded Seris are either harsh and aggressive, or based on total avoidance.

The general context of relationships between Seris and Mexicans influences relationships between Seris and *mestizos*, and between Seris and Mexicans. In times of conflicts triggered by private landlords invading the Seri territory, or by the Mexican Navy restricting Seris access to Tiburón Island, a backlash was felt by Mexican fishermen living in Punta Chueca and by Mexican fishermen attempting to gain access rights. During my study, a family of Mexican fishers who were married to Seris was expelled from Punta Chueca along with their Mexican relatives in two instances.

Although exclusion is possible within members of the Seri community, it is not exercised. No exclusion events of Seri fishers were observed or reported to me. All members of the community, regardless of current or past affiliation with a fishing cooperative, or lack of affiliation with one, were allowed to enter the fishery. The ethnic status of a fishermen within the Seri group, pure Seri or Seri *mestizo*, was not a factor of
exclusion. The only type of indirect internal exclusion of individuals recorded in this study was related to the ability or willingness by some individuals to gain access to jaiba fishing equipment (e.g., panga, engine and traps). Several individuals reported that fishing equipment was not available (see Table 4.2), but some of these complaints came from individuals with a known reputation of not working at all. Private companies that buy and export crab into U.S. markets, own the majority of the jaiba fishing equipment. Seri cooperatives and a few individuals from the community own some of the boats, engines, and traps.\footnote{During my study crab was bought by Alta Sonora, S.A. de C.V., and by Expasa, S.A. de C.V.}
Table 4.2. Characteristics of the fishermen population, cooperative affiliation, and fishing gear available for the *jaiba* fishery in Punta Chueca during 1997-1998.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximate population of adult men</td>
<td>124</td>
</tr>
<tr>
<td>Average age of adult male population</td>
<td>36 yr</td>
</tr>
<tr>
<td>Mode of adult male population</td>
<td>38 yr</td>
</tr>
<tr>
<td>Active fishermen</td>
<td>46</td>
</tr>
<tr>
<td>Percentage of adult male population involved in fishing activities</td>
<td>57%</td>
</tr>
<tr>
<td>Average number of active <em>pangas</em></td>
<td>24</td>
</tr>
<tr>
<td>Active <em>pangas</em> fishing <em>jaiba</em></td>
<td>18</td>
</tr>
<tr>
<td><em>Pangas</em> fishing <em>jaiba</em> owned by private companies</td>
<td>13</td>
</tr>
<tr>
<td><em>Pangas</em> fishing <em>jaiba</em> owned by Seris</td>
<td>5</td>
</tr>
<tr>
<td>Fishermen members of the SCPP Seri, SCL.</td>
<td>141</td>
</tr>
<tr>
<td>Fishermen members of the SCPP Canal de Infiernillo, SCL.</td>
<td>8-12</td>
</tr>
<tr>
<td>Fishermen members of the SCPP Coyote Iguana, SCL.</td>
<td>~5</td>
</tr>
<tr>
<td>Fishermen members of the SCPP Grupo Romero Punta Chueca, SCL.</td>
<td>9-11</td>
</tr>
</tbody>
</table>

Notes:

a. Adults were considered men over 20 years old in 1997.
b. This number is an approximate since I do not have the ages of 23 men, however based on personal estimates of their ages the average probably does not change much, and remains in the range of 30 to 40 years old.
c. Men that were observed fishing during >80% of the trips I made to Punta Chueca or fishing camps in the Infiernillo Channel.
d. This percentage includes men catalogued as semi-active fishermen, men acting as leaders of fishing organizations, and men helping unload and weight catch on the beach.
e. Includes *pangas* involved mostly in *jaiba* and in pen shell fishery.
f. This number is a minimum. Some of these *pangas* can be involved in another fishery in the afternoon, or during the *jaiba* closed season.
g. Some of this *pangas* were bought with support the federal government gave to co-ops but were appropriated by individuals who now claim ownership.
h. The President of the Seri cooperative gave this number during a general meeting on February 10, 1998. During that meeting some fishers argued that this number included members of other cooperatives. Includes fishermen from Desemboque.
i. These numbers are approximates based on two interviews. It is hard to define membership to a co-op since fishermen move at their convenience.
j. The number of members of this co-operative is perhaps larger. Same as i.
k. The number of members of this co-operative is perhaps larger. Same as i.
Fluctuations in crab harvest derived only from expanded operations within the Seri community of fishermen, and not by an expanded number of users from outside. Inside the Seri fishing territory, demand for *jaiba* was completely regulated by two Mexican buyers who live outside the community. Buyers buy immediately all the *jaiba* Seri fishermen catch. Demand surpassed local production, since buyers have capacity in their plants to process more volume that what is produced by Seris.

**iii) Indivisibility**

Crabs can move in and out the Infiernillo Channel without being impeded by physical barriers. This implies that extractive patterns outside the channel may influence the yield inside and vice versa. The range of the *jaiba* fishery greatly surpasses the limits of the Seri EFZ. *Jaiba* are captured in many places along the coastal waters of Sinaloa and Sonora (Montemayor-López 2001). *Callinectes bellicosus* have a wide distribution throughout and even outside the Gulf of California (Brusca 1980, Hendrickx 1995). Because of the wide distribution of *jaiba*, the Infiernillo Channel is not an appropriate unit for the analysis of the overall management of this resource.

Connections between *jaiba* inside the Seri EFZ and outside may be determined by larval transport, and by the migration of juveniles and adults. The Seri EFZ could be acting as a “source population” or as a “sink population” for other areas outside the channel. For management at the metapopulation level the Seri EFZ is not an appropriate or useful unit.
b) Decision-Making Arrangements

i) Operational Rules

I recorded some internal rules that regulate user behavior in order to maintain the yield of the commons inside the Seri EFZ. These rules were apparently established to maintain the integrity and conservation status of Seri marine territory; therefore they acted more at the ecosystem level rather than at the species level. Highly extractive fishing methods, that also have strong negative impacts, are not used by Seris. They have decided to ban the use of small trawling nets inside the Infiernillo Channel; these same nets are commonly used in catching shrimp in Kunkaak Bay by Mexican fishers. Seris have also forbidden shrimp trawlers from operating inside the Infiernillo Channel. Catching fish using dynamite was abandoned in the 1950s (Bahre et al. 2001). Gillnets, used to catch crabs in the early days of the fishery, were abandoned because of practical problems, not conservation concerns. Today, the only method used to capture jaibas is metal traps.

Other internal operational rules observed relate to the management of the bait used to attract crabs to the trap. Two general types of bait are used: frozen fish that is brought from external sources, or bait fish captured locally by Seri fishermen using hook and line or gillnets. Bait is changed on a daily basis; old bait is removed and replaced with new when the traps are checked. This action increases the fishing efficiency of the trap. Fresh and bloody bait was reported as being more attractive for crabs. Daily change of bait was also reported by fishermen as a strategy to keep the water clean of

79 The small trawling nets, known as *changos*, operated from *panga* are readily accessible to Seri fishermen and to Mexican fishers from Bahía Kino.
fouling meat. This concern to change bait was based on the health of schooling fish. It is a common belief among all small-scale fishermen, Seri and Mexican, that the odor produced by fouling fish repel live fish when detected. Removed old bait was stored on the boat, and discharged on the beach where fishers say it would be eaten by coyotes or seabirds, or in the near shore waters where carrion eaters could get to it at low tide.

No internal rules exist concerning the amount of resource that can be harvested. Since shrimp trawlers are not permitted in the Infiernillo Channel, there was no conflict between *jaiba* and other fishing activities that directly or indirectly target this species. In contrast, there is a competitive interaction between shrimp trawlers and *pangas* from Bahía Kino catching *jaiba* outside the channel. At night trawlers inadvertently destroy *jaiba* traps that are run over by the large, heavy trawling nets when fishing in the same shallow waters. Sometimes pen shell divers complained that their air hoses entangle in the lines attached to buoys of *jaiba* traps, but apparently fishing areas for these two resources have minimal overlap. Some fishers argued that sea turtles entangle with those lines and drown, and they state that overcrowding of traps in areas used by sea turtles have forced turtles to move away.

**ii) Conditions of collective choice**

In Oakerson’s framework (Oakerson 1992), conditions of collective choice are referred to as the rules decided by the group most immediately involved with the resource under common property. I found several aspects of the *jaiba* fishing that seem to be the result of collective choice. All of them are based on traditional ecological knowledge (TEK) of the resource, and on Seri perceptions of the ecological impacts associated with
fishing activities. All aspects are related to restrictions on fishing in certain areas of the Infiernillo Channel, or at certain times during the fishing season.

The Seri fishermen also have decided to avoid setting traps inside mangrove lagoons. These are areas that have crabs all year and could be potentially fished, but are valued as nursery areas. No trap was recorded inside any of the nine mangrove lagoons that border the Infiernillo Channel during this study. By contrast, lagoons outside Seri territory (e.g., Estero La Cruz) are heavily fished for jaiba with hundreds of traps used by Mexican fishers.

Eelgrass beds also are avoided, but the rationale for not fishing inside these beds was more related to the danger of loosing traps than to damage to these aquatic plants. Traps can get entangled with the long leaves of this plant, which can reach almost 3 meters in winter (Felger and Moser 1985). No mention was made by interviewed fishermen of the importance of eelgrass beds for the life cycle of crabs, although biologists propose that these beds are very important in the recruitment of crabs (Orth et al. 1996). To the contrary, some express their concern about the impact of the fishery on eelgrasses, since eelgrass seeds are Seri traditional food (Felger et al. 1980). These concerns were voiced in spite of the fact that Seri no longer harvest hatáam (Seri name for eelgrass). They still consider this plant an important element of their maritime culture. They also acknowledge the importance of eelgrass as food for sea turtles and Brant geese (Branta bernicla).

Even though some areas in the bottom of the Infiernillo Channel are off limits for fishing with traps, either because collective choice or because their physical conditions
make them bad fishing areas, the fishermen’s view is that there is still enough fishing
space available for the current number of fishermen and for the current number of jaiba
traps.

All fishermen interviewed agreed with these restrictions, compliance is voluntary. If one individual decided not to follow some restriction, other fishermen or Seri
authorities took no enforcement actions. Nevertheless, only on one occasion did a Seri
crew decide to set their traps in areas where females congregate. Their catch was almost
entirely composed of females. This happened during the last day of the jaiba fishing
season. When questioned about their behavior they answered that the rest of the fishing
areas were not as productive since they have been exhausted throughout the season, and
they want to finish the season with a good catch.

During March the polypropylene lines used to tie a buoy to the traps are covered
with entangled eelgrass, which is drifting in extensive rafts floating on the surface of the
sea. When the trap is hoisted onboard, some of this eelgrass is also pulled into the boat.
Inside the plant dozens of small jaiba crabs hide (< 25 mm CW). At the end of the day
the water inside the boat is bailed out as well as the crabs in it. Some fishermen made an
extra effort to get all the little crabs back in the water when cleaning their boat on their
way back home.

During the three months of closed jaiba season, buyers from private companies
leave the area, taking away most of the traps. Seri fishermen respect the closed season
even when they have access to some traps. Small groups of traps remained in the water
during the closed season, but those were abandoned, not being attended by fishermen.
No concern was expressed about the potential negative ecological impact those traps could cause. However, all fishermen interviewed expressed their concern over the ecological negative impact in the ocean bottom of the large number of traps that are lost during normal fishing operations. They mentioned that approximately 30-40% of the traps are lost during one season. Efforts recorded by some fishermen to recuperate lost traps were motivated by scarcity in the number of traps available to fishermen, not by ecological concerns about their impact on the bottom of the sea. For a detailed analysis refer to Torre (n.d.).

The general lack of respect by Seri fishers for federal fishing regulations on minimum size, maximum number of traps, and to avoid the capture of egg-bearing females, was also the result of collective choice.

iii) External arrangements

The most important outside decision structure that impinges upon how the Seri jaiba fishery is organized is the presidential decree of 1975. This order gave them the possibility to engage in the collective-choice agreements presented above. The presidential order assumed that Seris will have the capability to manage their territory in order to survive from it. It also assumed that outside competition was a destructive force and the main cause for resources degradation.

External decision makers design all fisheries legislation that applies to the Seri EFZ and to all other fishing areas outside this territory. External rules are not designed with Seri input. Little if any of that regulation is followed by anyone. The maximum number of traps each crew can have is always exceeded, the average number of traps per
crew registered was 100 (the legal limit is 70), but some crews manage to fish with 120 traps.

The legal minimum catch size defined by government biologists for *jaiba* is not followed. Lack of enforcement, and interest of buyers to get all sizes of crab, impedes voluntary control. The mesh size used to make traps allows the escape of small crabs, since culling rings used in some traps to perform this same function, have limited value.

The few disputes I recorded among Seri users were resolved internally, sometimes with intervention of traditional Seri authorities. In disputes between Seri users and Mexican users, third-party arrangements (in the form of Federal Government Authorities) usually take place.

c) Patterns of Interaction

According to Oakerson (1992), “Rules...do not guarantee the emergence of a particular pattern of behavior. Between rules and observed behaviors lie the unobserved mental calculations of individuals who make choices. Individuals choose strategies for relating to one another and to the commons.” In the Seri EFZ, the patterns of interactions between individuals recorded were: individualistic behavior and reciprocity within the household, individual interests vs. community interests, respect or control in fishing areas, interaction between Seri villages, and community cohesion facing external threat.

i) *Individualistic behavior and reciprocity within the household*

Seres are highly individualistic. Individualistic behavior is a characteristic of fishermen’s behavior in general, but in Seri fishermen this aspect is especially strong.
Selfish behavior was not present among crew members since they are generally members of the same household. But when crews include more than one family, they must cooperate during fishing operations to be efficient. Only by functioning as a team can they compete successfully against other fishing crews. In general life, cooperation beyond that found among household members was hard to find. Almost everything is done in exchange for money. There are no loans of boats, equipment or gear between unrelated fishermen, although rental agreements may be made. The same applies for cars, even in emergency situations when a car was needed to transport a sick person to the hospital in Bahía Kino or further away. To the contrary, in situations of maritime distress, help is provided by anyone at sea. For example, when an outboard motor breaks down other fishermen will tow the disabled panga back to shore. But when a search party must be organized after a boat does not come back when it is supposed to, the search effort is usually by members of the household or the extended family.

Relationships among crewmembers are monetary, even between father and son who work for a share. This trait has no apparent influence in the collective choice rules for the use of jaiba mentioned before.

ii) Individual vs. community interests

In a previous section, arrangements allowing access to Mexican fishermen were presented. These arrangements with the leaders of the Seri cooperative or the governor may take several forms. Regardless of the type of arrangement negotiated, the normal outcome was that the Seri official usually keeps for himself most of the money generated by the arrangement. The effect of this new source of income on the lifestyle of these
officials was soon evident. In a small village, it is hard to hide a new car, fancy clothes, or petty cash to spend in town. Others identified these purchases as obvious signs of bad use of the money, favoring personal interests. Seri officials made little effort to conceal the use of this new source of cash income and even bragged about it.

Most of the community, other than a few Seris who were hired by outsiders, saw no direct benefits from allowing entrance of Mexican fishers to the Seri EFZ. As a result, as the number of outsiders grew, community members became more and more hostile towards them, and eventually challenged Seri officials to break the agreement, and throw the Mexican fishermen out. Depending on the seriousness of the situation, public outcry could even cause the Seri official to be removed from his position. In these types of situations, even the Seri who work for the outsiders’ support the expulsion of Mexicans.

Seris expressed several reasons for opposing the entrance of foreign fishermen to the EFZ. Some objected to the outsiders lack of concern over the marine environment and sustainable fishing, lack of respect for local resource use rules, use of different harvest patterns involving more fishing effort, and lack of respect for the Seri people. The idea was that outsiders pose a general threat to Seri security and sovereignty. Seri women from the village expressed similar concerns. Other reasons listed were explained by the fact that Mexican fisherman do not know the Infiernillo Channel. Therefore, some of their fishing practices may take place in areas locally considered off-limits. But I observed that Mexican fishers working inside the Channel closely follow Seri fishers. The second reason was dealing with different extraction practices explained by the reputation of Mexican fishermen as more eager to reap the maximum benefit from
resource extraction in the shortest period of time. They are blamed for working too long during the day without resting, therefore extracting too much of the resource, or continuing extraction when the resource is showing signs of overuse. Seris say foreigners do not show any concern for the future health of the Infiernillo Channel. Seri attribute the interest of outsiders in fishing in the EFZ to the fact that the foreigners have overexploited their own territories and must move somewhere else to continue fishing profitably. The Mexican fishers interviewed acknowledge that they knew how limited in time their presence inside the Infiernillo Channel could be, and therefore they try to maximize their catch.

Another reason to oppose the entrance of outsiders was that newcomers cause internal problems when they relate socially to the Seri community. In general, I saw that Mexican fishermen who enter through temporary arrangements showed very little interaction with the community. The Seri showed the same general avoidance behavior towards them. Mexican fishers prefer to locate their camps in the outskirts of Campo Egipto, 30 km north of Punta Chueca. Once a beach camp of Mexicans was installed in the outskirts of Punta Chueca. Proximity of Bahía Kino allowed some Mexican fishermen to return to Bahía Kino after fishing, and spend little time in the community.

Seri concerns over sovereignty reflect a deeper concern over the long-term ecosystem balance when allowing outside fishermen to work in the Infiernillo Channel. The following concerns were recorded during interviews: “Mexican fishermen are taking away resources that are Seri property, and leaving behind just a small fraction of the price that resource will earn in the market.” “Fishermen are invading our marine territory the
same way, and with the same objectives, ranchers and wildlife poachers invade the mainland and the island to steal our resources.” “Outside fishermen are cheating us, and abusing us, they are polluting our water and eroding our patrimony.”

All the problems described above between individual and community interests are more evident in the pen shell fishery in Punta Chueca, and in the sierra fishery in Desemboque. For a detailed analysis refer to Basurto (2001).

Another result of the patterns of interaction was the splitting of the Seri cooperative and the formation of another four fishing cooperatives (Table 4.3). This rupture was caused when the late Rey Morales Colosio, called “Rey Rojo,” wondered if another fishing cooperative could be formed. He had been president of the Seri cooperative for some years, and knew the convenience of having his own cooperative to continue profiting from arrangements with outside fish buyers, and eventually to have access to government support for fisheries development (personal communication Genaro Herrera Casanova, Punta Chueca, October 1998). Soon, other Seris decided to follow, and the process continues today. This change meant that each cooperative could now engage in contracts with outside buyers, which provided their members with equipment and capital to operate. However, the majority of the Seris continued their membership in the Seri cooperative. New cooperatives initially had members only from the extended family of the founder. Eventually other Seri fishermen asked to be incorporated in order

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80 The SCPP Seri is referred to in this work as the Seri cooperative; any other is mentioned by its name.
81 In 1994 the Ley General de Cooperativas was modified to allow the creation of cooperatives with a minimum of five members (D.O.F. 1994).
to have access to fishing equipment or better prices for their catch. The Seri cooperative started to compete commercially with all the others.

For many years the Seri cooperative was apparently the only cooperative authorized to issue invoices. It was also the only cooperative that had elections to select new authorities. The other fishing cooperatives operate “under the wings” of the Seri Cooperative. By 1998 only the Seri, Canal de Infiernillo, and Estrella Seri Cooperatives had official fishing permits, enabling them to capture jaiba, register their landed catch and issue invoices (personal communication Javier Ramírez, Director, SEPESCA Regional Office, Bahía Kino, Sonora, March 1998). The Seri cooperative is still regarded by many Seris as the only official cooperative, and the only one legally entitled to use the exclusive use rights granted by the government in 1975.
Table 4.3. Fishing cooperatives in operation inside Seri territory during 1997-1998.

<table>
<thead>
<tr>
<th>Official Name</th>
<th>Spanish local name</th>
<th>Year of formation</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCPP Seri, SCL.</td>
<td>Cooperativa Seri</td>
<td>1938</td>
<td>Started by Jesús Solórzano and 56 Seris in Bahía Kino.</td>
</tr>
<tr>
<td>SCPP Canal de Infiernillo, SCL.</td>
<td>Cooperativa Canal de Infiernillo</td>
<td>~1993-1994</td>
<td>Started by the late Rey Morales Colosio (“Rey Rojo”), now leaded by his son Rey Morales Aldino from Punta Chueca</td>
</tr>
<tr>
<td>SCPP Coyote Iguana, SCL.</td>
<td>Cooperativa Coyote Iguana, o</td>
<td>1995</td>
<td>Started and leaded by Rodrigo Moreno Méndez from Punta Chueca</td>
</tr>
<tr>
<td>SCPP Estrella Seri, SCL.</td>
<td>Cooperativa Estrella</td>
<td>~1996-1997?</td>
<td>Started and leaded by Miguel Estrella from Desemboque</td>
</tr>
</tbody>
</table>

Notes:

- This group was formerly called Grupo Solidario de R.L. Canal de Infiernillo and before Grupo Solidario de R.L. Taheójc.
- In November of 1997 I saw paperwork for another cooperative to be called Punta Tormenta, and known as cooperativa de Luis Miguel. In December of 1998 I heard rumors that another cooperative was under formation by Saúl Molina from Desemboque, and Jorge Luis Moreno from Desemboque was also organizing one.
Mixed opinions were recorded concerning the splitting of the Seri cooperative. For some Mexican officials this was perceived as a way to have better distribution of the benefits from fishing, and it was a more appropriate system for the Seri socially, since “family cooperatives” adjusted better to Seri socioeconomic units based on households and extended families (personal communication Francisco Navarro, Director Seri Office of INI, Bahía Kino, Sonora, March 1997 and September 1997).

For others, the new system created more disorder and internal competition for use of the territory, for access to equipment, and for profits, leading to increased robbery of traps. Critics of the proliferation of cooperatives questioned whether this system was more in accordance to the social structure of the Seris. Some felt that splitting was just a trick to increase the total number of jaiba traps authorized to operate in the Infiernillo Channel (personal communication Genaro Herrera C., Punta Chueca, Sonora, October 1998).

iii) Respect or mutual control in fishing areas

Relationships among fishing boats in fishing areas were considered another type of interaction pattern. The following are observations made of interactions and behaviors between fishing boats recorded during normal jaiba fishing operations inside the Infiernillo Channel.

Inside the narrow and relatively small marine space of the Infiernillo Channel, fishermen have good visual control of boat traffic. While fishing or during movements from the village to their fishing grounds, Seris are always looking around, checking for other boats to see if they are involved in fishing activities, the areas they are using, boats
in transit and their probable port of origin. It is not uncommon for a Seri fishing panga to intercept and stop a foreign boat for a check-up. Boats in rapid transit, and particularly those whose characteristics resemble those used in drug running operations, are left alone.

On fishing grounds, *jaiba* traps from one crew are usually placed side by side or even overlapping with those of another crew. This is because crews learn how good the catches of other boats have been during operations to unload and weigh the catch on the beach. As a consequence captains can decide to place their traps in areas that are used by successful crews, or simply use areas in which, by tradition, everybody fishes. Although fishing activities are rotated among fishing sites, there is still a tendency for traps of more than one fisher to be placed in the same general area. Individual exclusive fishing areas do not exist.

When one crew is checking its traps, it refrains from checking traps of other crews. In other words, stealing of crabs from traps was not a common practice. At the beginning of the fishing season crews used buoys of different colors, or marked their buoys with their initials to identify their traps. However, efforts to differentiate their traps are not easy because the traps and buoys provided by buyers are all the same type and color. Regardless of the difficulties, crews are able to find their own traps, and are very careful to keep to their own traps. Since all crews work virtually in the same areas, and check their traps at the same time, they can keep a constant eye on each other. On one occasion I was in a boat mapping the location of traps, and decided to pull out one trap to show to a new student what a crab look like. Immediately, a boat that was
checking traps about 2 km away from us, arrived to check out why we were pulling out one of their traps. This clearly showed that our movements were followed from the distance. The same happens between fishing crews. There is a combination of respect and mutual monitoring and control on fishing areas.

Some crews decide to place their traps away from the rest. In particular, one captain from Punta Chueca was well known for doing this. His boat was usually the last one to leave in the morning, and the last one to return in the evening. This boat was usually more successful in bringing more kilos of *jaiba* than the rest. When questioned the captain explained that their delays in returning were the result of the greater distance they have to travel, added to personal preferences to work slower and stay out longer at sea. Other fishermen said it was because they steal crabs from traps of other crews, and wait for everybody to return so they check traps from others in their way back to shore. This was the only instance a crew was indirectly accused of stealing crabs, but nobody seem to care to do anything about it. Crews take for granted some confusion and mistakes when checking traps in overcrowded areas.

Stealing traps is difficult because they are too bulky, and a few of them are impossible to conceal when they are placed in the open deck of the boats. It is very easy to detect from the distance a boat carrying traps, since the rectangular shape of a pile of traps looks like a miniature freighter carrying containers. Fishermen have a very detailed sense of orientation inside the channel and know with precision where their traps are placed, and the external boundaries of the area their traps are covering. They also can
identify from great distances the boats, and individuals even when they are covered with rain gear, overalls, hooded masks, bandanas and hats.

**iv) Interaction between villages**

The total Seri population is roughly divided in two halves, each one living in one of the two Seri communities. Both communities maintain independence in fishing activities, and have very different fisheries since they exploit resources from different marine environments. Punta Chueca fishermen specialize in *jaiba*, pen shell, mullet, corvina, sierra, and manta rays and other rays. Desemboque fishermen participate in the *jaiba* fishery, but they use fishing areas in the north end of the Infiernillo Channel. They rely comparatively on more open-water species. Large mesh gillnets are used to catch sharks and manta rays, hook and line to catch groupers and snappers, and small gillnets for sierra and corvina.

The 70 km of poor quality dirt road between Punta Chueca and Desemboque have also kept them separated in economic terms. There is far more communication and economic exchange between residents from Desemboque with Puerto Libertad, and between residents from Punta Chueca with Bahía Kino, than among the Seri villages.

One of the practical consequences of this is the need to have political representatives of the Seri authorities in each one of the communities. Punta Chueca is closer to Hermosillo, the capital of the State of Sonora and the center of political power, and therefore is easier for Seris from this community to maintain links with Federal and State authorities. During the decade of the 1990s, the governor has always been a
resident of Punta Chueca (see Appendix 9). This has caused a continual political struggle between influential individuals from both Seri communities during elections of new officials. Although Desemboque politicians have little possibility to be elected as governors, they can occupy the position of president of the Seri fishing cooperative, or be elected as the Comisario Ejidal. The political distances have caused some sort of secondary balance in which a lower ranking official, the secretario (also referred as segundo gobernador), tesorero or presidente de vigilancia is always from a different community than the president the Seri fishing co-operative, the Comisario Ejidal or the governor. One result of this political division and of the limited communication between villages is that little or no coordination exists between officials from the two villages. In practical issues or domestic issues, community officials from Desemboque act as if they were the highest-ranking officials of the Seris.

The Seris have been forced in recent historical times to deal with outsiders through selected representatives. At various times, they must elect 16 officials for the three different representation structures: traditional government, ejido, bienes comunales, and fishing cooperative (Appendix 10). Until very recently the main Seri family groups -- Astorga, Herrera, Romero and López -- were always represented in the Council of Elders and the governor itself was always from one of those families (Santillán Mena 1993) (see Appendix 9).

In 1996 records were filed to expand and update the original list of 75 men who were the official comuneros entitled to rights in 1970, when the ejido was established

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82 In 2001 the first governor from Desemboque was elected.
In two and one half decades, 35 men of that list have died, reducing to 41 the number of men eligible for public positions, since Mexicans comuneros had never been proposed for office. Not all of those 41 men were either interested in politics or physically capable to work, therefore the list of possible candidates was reduced even more.

Re-elections were allowed, thus some names just shifted between power positions for many years. The results resemble an extended plutocracy. The list of comuneros was updated in 1997 with 226 new comuneros (199 new registrants and 27 inherited memberships). The majority of the new comuneros were young, ages ranging from 18 to 34 years, men and women. When this new constituency of youth voted for governor in 1999, a 31 years old man was elected.

In the second half of the 1990s, cars were more available and most Seri families had access to them and the opportunity to ride the dirt road to visit relatives in “the other village.” Today it is common to see cars from Desemboque visiting Punta Chueca, and some people from Punta Chueca travel as often as four times a week between Desemboque and Bahía Kino. But the dirt road is still a major obstacle. Even with new four-wheel drive trucks have a short life due to little maintenance and lack of parts.

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83 There is no public transportation between villages. The origin of these cars is reportedly illegal. According to Seris, these cars have been stolen in USA/Mexico border towns from American Tourists by Mexican police officials, who sell them for a fraction of their original cost. The most popular models are large four wheel drive vehicles. Recent models can be bought for as little as 1/20 of market value. Since Seris only drive these cars between their villages and to Bahía Kino or Poblado Miguel Alemán (~50 Km from Kino, half-way to Hermosillo), they are not confiscated by the police. Seri towns probably have the highest number of cars per capita of any indigenous village in México.
Describing social interactions between members of the two Seri communities was not among the objectives of this study. However, I was able to record some general perceptions and observations that could cast some light on this topic, and its relationship to differential control of access to Seri EFZ by both villages. Most of my interactions were with residents of Punta Chueca. In general, Seri from Punta Chueca refer to Seri from Desemboque as liberal, not as concerned with Seri sovereignty as them, and not concerned with maintaining the purity of the Seri race. In fishing issues Desemboque Seris are considered conformist since they do not fight for better arrangements and working conditions with outside buyers of marine products. They settle for little money when selling their catch, and their local authorities let outsiders work inside Seri territory.

The few opinions about Seri residents of Punta Chueca I heard from people living in El Desemboque are the opposite. Punta Chueca Seris are regarded as conservative, backward and contradictory, dependent upon Bahía Kino and corrupted by problems of drugs and violence that come from Bahía Kino. They are blamed of monopolizing the support from governmental aid programs intended to benefit all Seris. Some expressed even stronger opinions, regarding Seris from Punta Chueca as conflictive and crazy, aggressive and rude with outsiders. In many ways the opinions I heard give me the sense that Punta Chueca is functioning like the Seri capital town, where political power is concentrated. In this sense, it has many of the problems that are common to the capital centers of any country: violence, drugs, fast acculturation rates, and stronger impact of globalization on local economy, monetarization of daily life. In contrast, Desemboque functions as a rural town, with a more relaxed atmosphere. Residents of Desemboque are
more open to outsiders, but have a slower paced living style. They are more concerned with maintenance of Seri traditions, local culture and ethnic identity. There is still no electricity in Desemboque, therefore no access to television.

Seri fishermen from both communities converge in the fishing camp of El Egipto from November until March of each year. They camp in different sections of the beach, but maintain friendly relationships based primarily on avoidance.

Seri fishermen recognize a boundary inside the Infiernillo Channel, between waters that belong to Punta Chueca fishermen and waters that belong to Desemboque fishermen. The dividing point of these sub-territories is the fishing campo of El Almo on the mainland coast, and Punta Mala on the Coast of Tiburón Island. Reportedly this border is permeable, and fishers from both villages can work on either side, although a large majority of their fishing operations take place inside their own internal territorial waters, with little evident desire or need to go beyond.

v) Community cohesion facing external threats

Seri fishermen showed strong cohesion when intrusion of outsiders was perceived as a threat to community interests. For example, during my field research heated conflicts developed with the Federal Government over access to Tiburón island. For several months, soldiers stationed at the outpost in Punta Tormenta did not allow Seri to enter the island. Another major threat involved private ranchers who claim ownership of wildlife on a stretch of land that Seris consider their territory. Both of these conflicts created a general feeling against outside intervention that may have resulted in eviction of
Mexican fishermen, and altered the process of natural resource management planning actions for Tiburón Island with officials from INE and INI.

d. **Outcomes**

To assess sustainability of use of jaiba under a common property regime, I used the four components of sustainability proposed by Charles (1994): ecological, socioeconomic, community and institutional. According to Charles, ecological sustainability involves the maintenance of jaiba stocks at levels that do not foreclose future fishing options. Inherent in this is maintaining or enhancing the capacity and quality of the Infiernillo Channel ecosystem. Modeling of data collected during 1998 and 1999 from the jaiba fishery in the Infiernillo Channel combined with data from Bahía Kino waters showed that the current harvest was at the maximum sustainable yield (MSY) of exploitation (Molina-Ocampo 2000a). This study proposed that the Infiernillo Channel is an area of recruitment, where young jaiba increase in weight until reaching adult sizes, therefore fishing pressure over these juvenile age classes could have a strong effect on recruitment, on future yield, and on future biomass. The fishery is close or at its MSY, despite being a relatively young fishery that started in the early 1990s. Harvest, as recorded in the official data on jaiba landed in Bahía Kino, shows a rapid growth to a maximum in 1997 (Figure 4.3). After 1997, harvest decreased for 2 years and then increased again. Without data on fishing effort, it is impossible to interpret fluctuations in total catch, which may also be a reflection of the addition of the harvest from new fishing grounds in the Upper Gulf of California in northern Sonora and Baja California.
I was not able to track historical harvest in the Infiernillo Channel because I did not have access to past records of buyers. However, anecdotal accounts from Seri suggest that, in the early 1990s, fishers averaged 500-600 kg/day when they started using traps (personal communication Joel Barnett Astorga, Seri fishermen from Punta Chueca, January 1998). In the 1998-1999 fishing season, the average catch per day was 100-150 kg. CPUE may have decreased since the beginning of the fishery, but without detailed information on the fishing effort applied (number of traps), no meaningful comparisons can be established.

The impact of fishing activity on local populations of *jaiba* has been assessed by Márquez-Farías (2001). This preliminary stock assessment found that only 30% of the pre-harvest biomass has been reduced due to fishing. However, he also found a decrement in the age that the biomass is vulnerable to fishing, from 14 months in 1989-1994 to 11 months in 1998.

Bias in the catch towards males in the Infiernillo Channel suggests that fishing practices are not heavily impacting the breeding stock of females. No fishing occurs inside nursery areas or involves use of destructive methods. The only practice undermining sustainability and efficiency in the use of *jaiba*, apart from over-harvest that is very hard to demonstrate with current data, is the capture of sexually immature females. These age classes represent 5 to 15% of the harvest.

Socioeconomic sustainability was measured at the individual level, and is defined as “the maintenance of aggregate welfare generating sustainable net benefits, suitably distributing these benefits amongst participants and maintaining overall viability within
local and global economies” (Charles 1994). This component of sustainability was the hardest to assess. The jaiba fishery is today the main fishing activity for the community of Punta Chueca both in terms of number of Seri fishermen involved and in relation to the economic benefits of the resource. Overall distributional equity in the jaiba fishery seems to be much higher than in other Seri fisheries. Of the total population of adult Seri men, 57% are involved in fishing activities, and 96% of those were involved primarily in the jaiba fishery. This fishery was a major provider of employment and an important source of income for many households.

This high dependence upon the jaiba fishery contrasts dramatically with the limited control Seris have on the means of production. During my research, the jaiba fleet was composed of about 18 boats equipped with 55-hp outboard motors. Of those boats with engines, the private company Alta Sonora owned 10, and another company, Expasa, owned 3, and 5 were owned by Seris. The same pattern occurs with the ownership of jaiba traps. This high dependence on outside capital makes the activity very risky for the Seri, the two companies withdraw their equipment and no other entrepreneur arrives in Punta Chueca to replace them. Since outside companies provide the majority of the fishing equipment, the commercial contract between the Seri fishing cooperatives involves strict control in the price paid to fishermen per kilo of jaiba, and a series of discounts of fixed percentages for rent of equipment (Table 4.4). The price paid to fishers for jaiba fluctuated between $5.80 to $7.50 Mexican pesos/kg during two fishing seasons (1997-1998 and 1998-1999). From this amount, the company subtracted a percentage to pay for rent of traps and engines. The fishermen also must pay for
gasoline and two-cycle oil, and for bait (at a price of ~$3.00 Mexican pesos/kg). Seri
fishers generally purchase bait from the fish buyers unless the company had no bait, or it
was poor quality. In these cases Seri fishers captured their own bait.

Table 4.4. Price paid per kilo of fresh *jaiba* on the beach to the Seri fishermen.

<table>
<thead>
<tr>
<th>Date</th>
<th>Price per Kg. legal buyer, in Mexican pesos</th>
<th>Price per Kg. Illegal buyer</th>
<th>Discount for rent of equipment</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 1997</td>
<td>$5.80</td>
<td>$6.00</td>
<td>Fixed $1.50</td>
<td>Manuelito Flores</td>
</tr>
<tr>
<td>September 1997</td>
<td>$6.50</td>
<td></td>
<td>2% motor, 5% traps</td>
<td>José Fco. Barnett A.</td>
</tr>
<tr>
<td>November 1997</td>
<td>$6.00</td>
<td></td>
<td></td>
<td>Luis Miguel López</td>
</tr>
<tr>
<td>January 1998</td>
<td>$6.00</td>
<td>$8.00</td>
<td></td>
<td>Enrique Robles Barnett</td>
</tr>
<tr>
<td>January 1998</td>
<td>$6.00</td>
<td></td>
<td></td>
<td>Víctor (Alta Sonora)</td>
</tr>
<tr>
<td>February 1998</td>
<td>$7.50</td>
<td></td>
<td>$25/kg traps</td>
<td>Samuel Comito</td>
</tr>
<tr>
<td>February 1998</td>
<td>$7.00</td>
<td></td>
<td>$50/kg for coop</td>
<td>Alfonso Flores</td>
</tr>
<tr>
<td>February 1998</td>
<td>$6.00</td>
<td>$8-00-$9.00</td>
<td>2% traps, 5% motor, 25% of past debts</td>
<td>Enrique Montaño Genaro Herrera C.</td>
</tr>
<tr>
<td>October 1998</td>
<td>$8.00</td>
<td>$15.00</td>
<td></td>
<td>Nereida Martínez</td>
</tr>
</tbody>
</table>

Note:

Percentage discounts are calculated from the total production of the day. For example a 2% discount from a catch of 100 kg paid at $6.00 Mexican pesos/kg will be equal to $12 (= 2% of $600 Mexican pesos).

Seri community sustainability is dependant on the long-term stability of fishing.

Even with the development of new alternative economic activities like bighorn sheep sport hunting operations and ecotourism, income generated from fishing activities
combined with income generated from the production of handicrafts by women constitute the main support of Seri households.

The last component of sustainability, institutional sustainability has not been an outcome of the Seri EFZ. This can be demonstrated by analyzing the extended corruption and abuse of the cooperative leaders in the functioning of their cooperatives.

**Characteristics of Traditional Ecological Knowledge of Jaiba and the Infiernillo Channel**

Seri fishermen have developed an intricate knowledge of the distribution patterns for different sexes and size classes of crabs inside the channel. They know that certain areas are preferred by female *jaiba*, because they consistently get catches with percentages of females higher than usual when placing traps in those areas. However, areas preferred by female *jaiba* generally are avoided.

I also found that fishermen avoid fishing inside areas known locally as *xampt aka* (*xampt* is the Seri name for *jaiba*). According to Seri traditional ecological knowledge (TEK), these are places where crabs bury themselves in the sand during the winter, when the water is coldest. They refer to these places as hibernation areas. Their belief is that fishing should not disturb those areas, because it will severely disturb crabs during an important aspect of their life cycle, and as a result crabs will leave the fishing areas. They believe that even the slightest disturbance caused by discarding a leg or claw of a dead crab in these areas make crabs leave.

The Seri are known for their numerous songs that reflect their spiritual relationship to animals and plants living in their territory.
The Seri *xampt* traditional song is not particularly informative, but refers to the
movements of *jaiba* from shallow to deeper waters, and their preference to remain in
shallow areas.

\[ Haxoj\ an\ oo\ tii\ cogi\ \\
Haxoj\ an\ oo\ tii\ cogi\ \\
Hant\ intaho\ an\ oo\ \\
Xampt\ haxoj\ xoajap\ xoee^{84} \]

The translation of this song into English, by Becky Moser reads:

> It died at the edge of the sea
> "    "    "    "    "    
> You saw the land
> Crab dug into the shore, he said

For Seri *jaiba* have always been a resource that was available during times of
scarcity of other marine resources. It was and still is perceived as a food item to be used
in food emergencies (personal communication Antonio Robles, Seri fishermen and
president of the Elders Council in Punta Chueca, August 2001).

The knowledge Seri have about different aspects of *jaiba* ecology and biology
was reflected in their answers to the questionnaire administered to a random sample of
*jaiba* fishermen (Appendix 8). Results of these interviews also documented extensive
knowledge of the Infiernillo Channel. Older fishermen (50-60 yrs old) showed more
detail in their knowledge compared with middle age fishermen (30-40 yrs old).
However, both groups had generally similar responses, and have similar misconceptions

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^{84} Song by José Juan Moreno, member of the elder’s council on September 24, 1999
during a training course on *jaiba* fishing biology and traditional knowledge directed to
Seri para-ecologists, written in Seri language by David Morales Astorga.
about certain information. All fishermen interviewed recognized that two species are fished:  
\textit{zamt} (\textit{Callinectes bellicosus}) and \textit{zamt tjoil} (jaiba azul = \textit{Callinectes arcuatus}). All fishermen interviewed knew how to differentiate male from female \textit{jaibas} using external morphology of the abdomen. However, 30\% did not know how to distinguish sexually immature females.

For Seri fishermen, the breeding season for \textit{jaiba} extends from April until May with another reproductive peak in August. May was the month named by the majority of fishers as the month when the majority of females are carrying eggs. No scientific studies have been done of the breeding season of \textit{Callinectes bellicosus}; scientists think that the peak of reproduction occurs from April to July.

According to Seri TEK, \textit{jaiba} mating lasts 3 to 5 months, November to February. Some said that copulating pairs bury themselves together during winter months. All fishers interviewed think \textit{jaiba} live more than 5 years, and reproduce once per year. Answers to the question of how many eggs a female produces showed the highest variability in responses, ranging from 150,000 to more than 10 million. Also, for the question regarding the time eggs remained on the female body, responses ranged from 3 to 6 months. According to fishers’ knowledge, all juvenile \textit{jaiba} congregate in shallow waters along the sandy coast and inside coastal lagoons, but some fishers knew places of special concentrations. All fishers answered that eelgrass (\textit{Zostera marina}) has an important role as hiding habitat for juvenile crabs. Main predators named, in order of importance, were puffer fish (\textit{Sphoeroides annulatus}), herons and egrets, and spotted cabrilla (\textit{Paralabrax maculatofasciatus}). Responses about the growth rate of \textit{jaiba} were
also highly variable. To the question of how long it takes for a jaiba to reach commercial size, answers ranged from 3 months to 8 years.

In terms of jaiba feeding habits, Seri knew food preferences for fishing operations but not natural feeding preferences. Some Seris mentioned that crabs prefer to eat mullet (*Mugil cephalus*) than sierra mackerel (*Scomberomorus* sp.) or spotted cabrilla. When asked about local movements of jaiba, respondents invariably mentioned that jaiba bury themselves during winter months, and that their movements depend on the tide cycle. Seris think most jaiba remained buried from January to May. The locations of several places where jaiba like to be buried were described as places with firm sand in the bottom. Some said adults bury themselves in different places than do juveniles. The fishers said that jaiba like to swim a lot more during spring tide nights, when currents are stronger. On days during full moon, they prefer to move along the shore. Jaiba prefer to swim close to the surface when the current in stronger at midday. Answers given to the question regarding the type of substrate jaiba prefer said they avoid muddy waters inside estuaries and prefer places with clean sand, without plant or algae growth.

All fishermen interviewed showed detailed knowledge of the places preferred for placing jaiba traps. They all marked the same areas of the channel on the map provided for the interview. All indicated that traps should never be allowed inside coastal lagoons, and in places where females naturally concentrate (specifically along a sand bar in the northern end of the channel). They all showed concern for the numbers of traps that are lost at sea during fishing operations, but no concern was expressed for reducing the total number of traps that are used in the channel each year.
All fishers expressed concern over the impact of shrimp trawlers on the local fisheries by killing large numbers of juvenile fish. However, no concern was expressed about their impact on the *jaiba* fishery. Most expressed concern about the impact of lost and active traps on water quality of the Infiernillo Channel. Specifically they talked about the water quality impact of corroding traps, and problems of bait fouling the water. According to Seris, these impacts are causing important changes in migrations of schooling fish (corvina, sierra mackerel, small sharks) and sea turtles, that are avoiding use of the Infiernillo Channel.

**E. DISCUSSION**

The *jaiba* fishery in Seri waters

The development of the *jaiba* fishery inside the Seri EFZ has mirrored development of this fishery in the Bahía Kino region. Seri began harvesting *jaiba* just a few years after the industry became established in Bahía Kino. This reflects the strong influence that fishing activity in Bahía Kino has on the evolution of commercial fisheries in the Infiernillo Channel. For the fishermen in Punta Chueca, *jaiba* rapidly changed from a resource that was only exploited in times of hardship to a major commercial commodity. Seri knowledge and experience using this marine resource over centuries prepared them well to respond quickly when the economic demand for this species increased dramatically in the 1990s. Fishing methods used by the Seri are modern, and differ little from the ones used by their neighbors; fishing gear is the same, physical characteristics of fishing areas are similar, and they target the same species of *jaiba*. 
The only differences found between the *jaiba* fishery inside the Infiernillo Channel and off Bahía Kino are the rotation of fishing areas. Areas used at the beginning of the season by Seri fishers from Punta Chueca are different than the ones used at the end of the season. Although this rotation was primarily influenced by the need to maintain yields all through the season, apparently it has a conservation effect by reducing exploitation on individual populations and ensuring adequate survival to repopulate these areas. Rotation of fishing areas was also tied to the fact not the entire bottom of the Infiernillo Channel is used for exploitation of *jaiba*. Areas free from exploitation during regular fishing operations are functioning as *de facto* no-take fishing reserves. These areas include, but are not limited to, eelgrass meadows, mangrove lagoons, and deep-water channels in the center of the Infiernillo Channel. The combination of traditional knowledge and practices plus a relatively small number of fishers has resulted in protection of a portion of the *jaiba* stocks inside the Infiernillo Channel, and ensuring that to date, harvests of *jaiba* in the Channel have not depleted populations significantly.

Using official records of the catch landed in the Infiernillo Channel, it is impossible to accurately determine fluctuations of the *jaiba* harvest over time. There is a strong need to have reliable records of production to assess these trends as well as the relative importance of the Infiernillo Channel to *jaiba* production of the Bahía Kino region. An estimate of this importance, based on informal estimations during conversations with buyers, shows that half of the *jaiba* from the region is harvested inside the Infiernillo Channel. The channel is recognized by buyers as more stable and more attractive economically because of the large proportion of big males in the catch and
because the fishers there distribute their efforts evenly throughout the fishing months. In contrast, in Bahía Kino large numbers of fishers enter the fishery during the first months (July-August) and the majority of them leave the fishery to catch shrimp in September. If the jaiba season was good, some return to the fishery in October but their numbers never equal that of the early part of the season.

Internal records of buyers prove to be the best sources of information about fluctuations in catch. The total catch recorded by the main buyer during 1 year in Punta Chueca (173.7 tons), shows the high biological productivity of the Infiernillo Channel. Considering that the majority of fishers from Punta Chueca work for this buyer, it is safe to assume that we are including the majority of the fishing effort in the study area. The average daily catch documents the importance of this fishery as a stable source of income for Punta Chueca households.

The average annual CPUE calculated for the channel (87 kg/trap/yr) can be used as future reference point for the management of this fishery. This figure is 434 times higher than the CPUE recommended in the National Fishing Chart (Carta Nacional Pesquera) for the jaiba fishery in the Gulf of California (0.2 kg/trap/yr). This latter figure seems to be very low, even more if we consider that approximately 40% of the traps are lost each fishing season in the Infiernillo Channel and perhaps throughout the entire fishing area of jaiba in the Gulf. The majority of those traps are never replaced, therefore the total number of traps used in the study area is lower and the CPUE may be even higher than 87 kg/trap/yr. It is important to review and adjust the CPUE recommended in
the National Fishing Chart for the *jaiba* fishery in order to reflect the current status of the fishery, and keep the precautionary approach of this management document.

Data from the buyer regarding the number of days fishers work in a year contradicts public perception that fishers in general, and Seris in particular, are idle workers. Although data show considerable variability, five crews with the higher production (> 20 tons) worked 77% of the workable days of one fishing season. This calculation was done assuming just 1 day of rest during the week, which was the standard pattern observed in Punta Chueca *jaiba* fishers. The same calculation done for all 20 fishers resulted in 43% days worked of the same total of workable days. Three factors contribute to these high percentages. First is the coastal nature of this fishery, tied with the protected waters inside the Infiernillo Channel that allowed fishing activity even on days with strong winds, which are very common. Second was the provision by the crab buying company of gasoline and bait. And third the scarcity of local demand for other marine products, or the scarcity of fishing gear needed to harvest other fisheries, especially for the pen-shell fishery.

Intensive biological sampling of the catch highlighted important aspects of the *jaiba* inside the Infiernillo Channel. Two hypotheses can explain the large bias towards males detected in the catch. The first is that traps actively select males. This hypothesis is not supported by data from other fishing locations, south of Bahía Kino, which report a large bias towards capturing females, in a fishery that use the same type of traps and fishing methods. Therefore, the most plausible hypothesis is sexual segregation that results in differential availability of the genders in different locations. The ecology and
distribution of *Callinectes bellicosus* have been little studied, however research on sexual segregation for *C. sapidus* in Chesapeake Bay can be used for inference. These studies documented a bias of 60% males, year-round (Hines et al. 1987). Assuming that *C. bellicosus* follows the same well-documented life history paradigm of *C. sapidus*, summarized in Hines et al. (1987), we can hypothesize the following reasons of the bias towards males inside the Infiernillo Channel. In Chesapeake Bay, blue crab populations: “mature females hatch their eggs in high salinities at the mouth of the bay in early summer and fall, and planktonic larval development occurs in the neuston [organisms that live in the surface of the water floating of swimming] on the continental shelf. Newly settled crabs move back into the bay, dispersing throughout the estuary to feed and grow. Mature crabs copulate in late summer and inseminated females migrate several kilometers to high salinities at the mouth of the bay to incubate their eggs. Juveniles and mature males bury in mud to overwinter throughout the estuary” (Hines et al. 1987).

The assumption that sexual segregation in *C. sapidus* may be similar to the one of other species of *Callinectes* is also supported by findings of Norse and Estevez (1977) in *C. toxotes* and *C. arcuatus* from the Southern Pacific waters in front of Colombia. They found a decline seaward in the predominance of males of both species, and an increase of mature and females and females bearing eggs in deeper waters away from shore. In another study, males of *C. arcuatus* were more abundant; 83% of the sample, in nearshore environments in the Colorado River Delta, north of the study area inside the Gulf of California (Villareal-Chávez 1992). Differential distributions between males and
females have been reported also for *C. maracaiboensis*, *C. bocourti*, and *C. latimanus*, although the mechanism by which this differential distribution is maintained is not clear, and sex-associated differences in tolerance to salinity are not sufficient to account for such distributions (Paul 1982).

I hypothesize that the channel itself influences *jaiba* life history inside the Infiernillo Channel. The channel may be ecologically and oceanographically functioning comparable to a massive channel connecting to a series of small and medium estuaries. Males and juveniles inhabit the Infiernillo Channel year-round and overwinter in several areas. Outside the channel in offshore waters south of Tiburón Island, mature females hatch eggs in summer, and in late fall and winter immature females move into the channel in order to mate. Once inseminated, they migrate out of the channel and move to areas south of Bahía Kino or to deeper waters offshore to incubate their eggs and join other mature females.

To the natural higher abundance of males inside the Infiernillo Channel we must add the use of TEK by the Seri fishers, that avoids the harvest in areas were females concentrate. All the patterns described above could explain the high overall average proportion of males in the samples (84.3%). It could also explain the peak of immature females recorded in the late fall and winter months (November to March) when females may be entering the Channel to find males and suitable areas to mate.  

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85 In *C. sapidus* mating occurs in areas selected by pre-pubertal females; usually mash lined banks or beds of submerged vegetation (Guillory n.d.). If *C. bellicosus* behave similarly, the extensive eelgrass beds in the Infiernillo Channel and mangrove lagoons could be important *jaiba* mating areas.
consistent with the finding of Sánchez-Ortiz and Gómez-Gutiérrez (1992) who reported an offshore migration of *C. bellicosus* females, in a reverse order than the inshore migration reported for *C. sapidus* females. In the former species females move to areas with less salinity, that in this part of the world are located in offshore waters, because inside mangrove lagoons salinities are higher than 35%. Estuaries inside the Infiernillo Channel are negative estuaries [with salinities higher than sea water due to evaporation and lack of freshwater influx]. In *C. sapidus* habitat, females found lower salinities in river deltas. Another explanation for the sharp increase of immature females in the catch in December, February and March could be that traps are being placed in areas known to have more females inside the channel. However, the data collected on the location of taps inside the channel do not support this latter hypothesis.

The trap used to catch *jaiba* selects certain sizes. The range of sizes in individuals captured is 20.0-94.0 mm CL. However, low frequencies of the smallest and largest size of male and female (n=1 for each) shows these individual may have been trapped under unusual circumstances, or that they represent measurement errors. By eliminating the extreme numbers we get a more appropriate indicator of the range of sizes for nearly all *jaiba* harvested which is 35.5-88.6 mm CL. The size-frequency distribution of all animals sampled (Figure 4.7) shows a marked increase in frequency of the 50-mm CL modal length, and a sharp decrease in frequency of the 85-mm CL modal length.
This distribution indicates that current design of the trap is efficiently selecting animals between 50-85 mm CL.\footnote{A bell-shaped curve distribution in sizes is observed in studies that use otter trawl to catch juveniles and adults (Hines et al. 1987, Cetta et al. 2000, Hernández-Moreno and Arreola-Lizárraga 2000, and Bayha and Barner 2001).} Traps are not capturing juveniles and perhaps the large adult males beyond 88.6 mm in CL that must exist in the population (personal communication Fernando Márquez, Fisheries Biologist, CRIP-Guaymas, June 2001). This selectivity is convenient for sustainability of the fishery, since juveniles are not targeted, and large males remain in the population to inseminate females. However it also decreases the economic efficiency of the fishery since large males that have the largest weights and better yields in meat are not being captured.

Measurements of the hexagonal mesh used in the construction of jaiba traps are 2.06” in the longest axis by 1.43” wide. The average diameter of the culling rings is also 2.06”. This means that jaibas with less than 50 mm CL are able to escape through the mesh of the trap, and culling rings are not increasing the escapement probability of this size class. The minimum legal size during the study period was 50 mm CL. Trap selectivity is responsible for the small percentage (7%) of animals detected below the legal size in the sampled catch, since no post-harvest selection of individuals was practiced. However, recent research findings show that throughout the Coast of Sonora at 50 mm CL approximately 50% of the females are not sexually mature. Thus there is a high probability of capturing immature females with a minimum legal size of 50 mm CL (Márquez-Farías and Montemayor-López 2001). Trap design can be improved by introducing a culling ring with bigger diameter, or experimenting with mesh size of
different measurements, and finally by introducing post-harvest selection practices among fishers and buyers to separate small individuals and return them to the ocean in good physical conditions. This is especially important for areas outside and south of the Infiernillo Channel where females constitute the majority of the catch, and that maybe represent an important source of recruits for the Infiernillo Channel population or populations.

The fishing patterns shown in Figures 4.8 and 4.9 show the extraction of larger males during the first half of the fishing season, until medium and smaller males dominate the catches at the end of the season (see also Figure 4.10). If the trap design is not allowing the largest males to be captured, their presence may be compensating for the elimination of adult males in the population due to fishing mortality. This “reservoir” of males may be helping to ensure immature females have enough large adult males to mate, and reduce the risk of male depletion.

It has been demonstrated that large annual fluctuations in abundance are characteristic of *C. sapidus* populations apparently as a result of environmentally induced variations in recruitment (Ulanowicz et al. 1982, Tang 1985 in Hines et al. 1987). Pearson (1958, in Williams 1984), used data from 13 generations of crabs found that survival rates during the first year of life are critical, also that size of spawning stocks did not determine size of population surviving to commercial age. He also found no correlation between relative abundance of female crabs and their progeny. The changes found comparing mean sizes of males between years may be a reflection of different composition of the population due to differential growth and recruitment rates from
previous years. This clarifies the importance of leaving enough mature females in the water to ensure reproduction and minimize the mortality of immature females, something that current trap design is not allowing.

Federal Management Regulations

Even though jaiba is not managed through a Norma Oficial Mexicana (NOM or Mexican Official Norm), it can be considered a relatively well-regulated small-scale fishery. The management under an administrative agreement, sanctioned by technical advice from CRIP, and based on the consultation with the representatives from different stakeholders of the fishery, forms the foundation for a co-management arrangement. However, as in many other pieces of regulation in México, there is little enforcement of the fisheries legislation. Enforcement is even more difficult when it is based on an administrative agreement without a legal foundation like in a NOM, which can be eroded easily by those parties that do not agree with it. Federal enforcement of jaiba regulations inside the Infiernillo Channel is absent, with the exception of the duration of the fishing season that is respected. Lack of fishing effort inside the estuaries is more the result of an internal decision than the fulfillment of a legal disposition.

In general, dispositions and recommendations included in the Federal fishing permits are not respected. But within the Channel, jaiba fishing levels appear to be limited to a sustainable level. This ideal situation is the result of several factors, which may be unique to this situation. First, the populations of fishers at Punta Chueca is small. Second, the Seri exercise control over access to the channel by outsiders. And third, although the equipment used is modern the Seri fishers have integrated TEK about the
Jaiba into their practices and the result has been both seasonal and geographic protection of crucial areas for jaiba productivity. Carl Walters, one of the most important fisheries biologists of our time said: “If we look at fisheries that have been successful over the long term, the reason for their success is not to be found in assessment, learning and management models, but in the existence of a spatial accident, something about the spatial structure of population dynamics interacting with regulatory systems, or about the behavior of the species and fishers, that creates a large scale refuge for a substantial segment of the spawning population” (cited in Orensanz et al. 1998). The Infiernillo Channel may be functioning as the spatial accident mentioned by Walters, and apparently is having an important role in the fishery long-term sustainability.

Common-property ownership and management of jaiba inside the Seri EFZ

Natural and Technical Attributes of the Resource

Application of Oakerson’s (1992) framework to the Seri jaiba CPR was a very useful tool to understand relationships and patterns between the four variables used. As most marine resources inside the Infiernillo Channel, jaiba is not physically bounded by Seri ownership. This limits the power of fishers within the EFZ to manage populations for species with long planktonic larvae stages in geographically distant areas or for populations that require recruitment from areas outside the Seri EFZ. This contrasts with benthic and sessile species exploited inside the Channel (e.g., pen shell), where the Seri EFZ is a powerful tool for the local management of entire populations as it was documented by Basurto (2001).
Several kinds of fishing-related activities occurring outside the Seri EFZ may have effects on the *jaiba* yield inside the Infiernillo Channel. For example, although shrimp farming activity in the Estero La Cruz may have little influence in juvenile mortality due to the use of filters in the intake tubes, the discharge of water from the ponds directly to the estuary may be diminishing the quality of this environment for mating. Similarly, the effect of shrimp trawlers in the *jaiba* stocks may be complex, involving a combination of direct fishing mortality and alteration of habitat and distribution patterns of adults in the shelf areas south of Tiburón Island, plus the possible positive influence of trawl discards of by-catch on the diet of benthic scavengers (Hill and Wassenberg 1992).

The level of catch necessary to achieve a sustainable yield has not been calculated in this fishery. This calculation was out of the scope of this study; however efforts to produce the first preliminary quantitative stock assessment of *jaiba* in the Gulf of California have shown optimistic results (personal communication Fernando Márquez, Fisheries Biologist, CRIP-Guaymas, February 2001). This assessment contradicts the only quantitative analysis done with data collected from the fishery inside the Infiernillo Channel which found that current levels of fishing effort are close to the maximum allowable just before the over fishing of the stock (Molina-Ocampo 2000a). However, the assessment is still very preliminary and is based on speculative assumptions.

Quantitative assessments about the responses of *jaiba* populations to alternative management choices are needed to base management decisions (Hilborn and Walters 1992). The use of indirect measures of subtractability for the Oakerson framework, in the
form of habitat deterioration and presence of fishing practices tending towards sustainability, were an alternative path to address this lack of quantitative analysis. Fishing patterns and impacts over mangrove systems and sea-bottom environments outside the Infiernillo Channel are probably affecting the yield inside the Infiernillo Channel. However, the high capture bias toward males, and the existence of areas off-limits to the fishery, inside the Infiernillo Channel, are conducive to a sustainable fishery inside the Seri EFZ. It has been demonstrated that crustacean fisheries directed only at males are very resilient to recruitment overfishing (personal communication Lobo Orensanz, Fisheries Biologist School of Fisheries, University of Washington, June 2000, and (Hilborn 2000). However, at some point depletion of males can influence recruitment due to lack of fertilization of females (Paul 1984, in Orensanz et al. 1998).

Seris have been successful in excluding Mexican fishers from the Infiernillo Channel during the decade of development of the jaiba fishery. They have a controlled fishing effort in the jaiba fishery, not because of an internal management practice, but because a small population of active fishermen and the relative scarcity of fishing equipment. Unfortunately, the combination of controlled access, restricted fishing effort, conservation of critical habitats, and the bias of capture toward males may not be enough to ensure the long term sustainability of their catch. Of special concern is the high percentage of females that are captured in the fishing grounds south of the Seri territory. The Infiernillo Channel may be functioning as a population sink for males, and the areas south as population sinks for females. Therefore the availability of brood stock to recuperate the fishery from current levels of exploitation may be threatened by the
capture of females by Mexican fishermen outside of Seri jurisdiction. Basic biological 
information is needed to answer critical questions about larvae dispersion patterns, larval 
settlement areas, migratory movements of sexually mature females, and the relative 
importance of the Infiernillo Channel area as center for larvae dispersion.

Exclusion of outsiders from Seri exclusive fishing ground proved to be highly 
successful for the jaiba fishery in the study period. Resource piracy was not observed 
and illegal buying was limited to very low volumes. Different arrangements with Seri 
authorities and the permissiveness of Seri government allowed some outsiders to gain 
quasi legal access. In all cases differential benefits to the Seri community were involved 
in the arrangements, with variable distribution of economic benefits among just one or 
several members of the community. The resilience of the arrangement appeared to be 
directly related to the amount of direct beneficiaries in the community at large.

Becoming part of the Seri community is still a strategy with very limited 
ocurrence. Tense relationships between Seris and outsiders permeated the atmosphere 
during the time of my study, influenced by important conflicts with outside interests. 
Deficiencies in the amount of fishing gear available prevented the entrance of the 
majority of fishers into the fishery, although there is a high rate of male occupancy. The 
clear control of outside buyers on the fishing operations does not differ from the patterns 
that Seri fishers experienced since their incursion in commercial fisheries in the late 
1920s.
**Decision-making arrangements**

Internally-decided restrictions to ban the use of highly subtractive fishing methods and the number of spatial restrictions to fishing are indications of the community interest in sustainability of the fishery, and the deeply rooted connection of the Seris and their sense of their marine territory. Although often these practices are not driven by a conservation rationale (e.g., traps are not set on top of eelgrass meadows to avoid the inconvenience of loosing the traps, rather that to avoid damage to eelgrass), they result in conservation benefits. The small population of fishermen and the current fishing effort allows for partitioning of the fishing space and shifting of the efforts along the season. Although this behavior is also not motivated by concerns for conservation the consequences are the effective rotation of fishing areas. This arrangement is impossible in surrounding areas where there is open-access and no control of fishing effort. There, fishing areas left behind because of marginal or sub-marginal profits are used by new arrivals to the fishery and the result is depletion. Although Seris do not respect the minimum size Federal regulation, the proportion of sub-legal *jaiba* in the catch was very low (7%) because of the mesh size of the traps they are given, and the natural distribution of larger *jaiba* size classes inside the channel. Other effective conservation management actions observed included protection of critical recruitment and nursing areas for juvenile crabs.

Even people who own *jaiba* traps strictly respect the closed *jaiba* season. These closures may be the result of the fact that the buyers cannot operate during closed seasons (rather than respect for the law). Nevertheless, this external restriction imposed by the
federal administration combines with internal restrictions to create a system of sustainable fishing patterns. Seris do not participate in the formulation of federal fisheries regulation. Neither did they participate in the yearly meetings of the State Council of Management of *jaiba* so they have no influence in federal fisheries management policy design. The lack of presence of SEPESCA and SEMARNAP enforcement authorities in the area makes the Infiernillo Channel a *de facto* co-management system. The formalization and recognition by federal authorities of the local management arrangements in this fishery is urgent.

*Patterns of interaction*

The social organization of the Seri community has produced a production system in which reciprocity is present within the extended family only. The splitting of the Seri cooperative into five or more units is a reflection of the emphasis on extended family as the operational unit. The patterns of reciprocity mentioned in the Seri literature do not play a role in the *jaiba* fishing activity outside the extended family. If they are still present, their role may be greatly diminished in the present with social interactions based on monetary transactions.

In the interactions between fisherman, rivalry and desire to demonstrate superiority between different crews was evident. However, respect in fishing grounds, probably based more in mutual control and vigilance, was observed. Few instances of conflicts between crews were recorded. This could mean that conflicts are hidden or that there is simply an implicit tolerance to some level of disagreement. Strong disagreements
are often settled in a very short time. Perhaps the social links between certain family
feuds have been affected by important conflicts, but that does not seem to impede
continuing interaction. Being such a small group, increasing social isolation is costly if
conflicts can not be solved or forgotten, at least superficially, to continue having
interaction.

Separation of the two Seri villages is more than geographical. It appeared that
each village has different ethics regarding interactions with outsiders and towards mixing
Seri blood through inter-ethnic marriages. The division of the Infiernillo Channel into
two distinct sub-territories, one for Punta Chueca and one for Desemboque, must be
further investigated in respect to the overall effectiveness of conservation of fisheries
resources. Since my study was limited to Punta Chueca fishers there is little I can
contribute to this issue, other than the observation that each community manages access
by outsiders to the Seri EFZ differently. This is probably a result of their different
fisheries, the physical characteristics of the territory (closed waters vs. open waters), and
their level of social isolation. These factors make Desemboque fishers more prone to
engage in unfair commercial arrangements with outside fishermen and buyers in order to
take advantage of all opportunities.

The origins of Desemboque as the first permanent Seri village, and their history of
friendly contacts with Mexicans and Americans have produced better relationships with
outsiders. To the contrary the history of Punta Chueca resulted from separation of the
more conservative group of Seris, separated when fleeing from the intervention of
religious groups. This and the pervasive influence of governmental paternalism may
have influenced present day characteristics of this community. This early fragmentation of the Seri people should be kept in mind when analyzing the sources of conflicts and describing the role of local institutions in allowing access to the Seri EFZ. In socio-political terms, each community is very different. Splitting of Seri authorities into two portions also may have a strong influence on differential access by outside fisherman to different portions of the Seri territory, and in the perception of the level of threat that allowing access to Mexican fisherman have on Seri sovereignty.

The role of Seri authorities in allowing access to the Infiernillo Channel is particularly important. The lack of clear jurisdiction between the leader of the Seri cooperative and the Seri governor over the issue of transferring withdrawal rights to Mexican fishermen makes control more complicated. From the standpoint of outside fishermen, each authority represents a different “key” to open the “doors” of the Seri EFZ. If one key does not work, it is just a matter of trying another one. The Seri leader who is profiting from allowing access to outside fishermen is easily identified. Internal control mechanisms, based on mistrust towards the leader’s behavior, allow for a certain level of profits to be made before reaching a point of open criticism and protests, that usually generate a change in administration. This community reaction can be exacerbated when general relationships with Mexicans deteriorate due to larger conflicts, for example with the Mexican Navy, or with private landowners neighboring the Seri ejido. In these cases, the expected time for a reaction is shorter, and the outcome is more violent.
Unlike a few notable examples of fishing cooperatives in the pacific coast of the Baja California Peninsula (Vega et al. 1997), fishing cooperatives in the Bahía Kino region, including Seri cooperatives, did not fulfill their social roles (Mendoza-Martínez 1985). None of the objectives of the cooperative system listed in the LGSC (D.O.F. 1994) was present in the Seri cooperatives. There was no sharing of profits, no social funds, no communal capital, no communal ownership of the means of production, no social-benefits, no solidarity, no mutual help, no internal monitoring, no participation in shares. In short, the Seri fishing cooperatives work as private enterprises, in which the authorities in turn profit from the communal effort, sometimes without providing any service at all. As a result there is high “recycling” of authorities, from a small pool of possible candidates, which was even smaller before the admission of new comuneros in 1999. Authorities are like passengers in a “fairy wheel of power” in which leaders in turn squeeze economic benefits from the position as much as possible while their position lasts, while the rest of the potential authorities wait for their turn to be at the top of the wheel. McGuire (1983) attributes the poor performance of fishing cooperatives to “the fact that the Mexican cooperative system is more a tool in national policy than an organizational response to local economic needs.” The same behavior was present in the other two Seri organizations, the ejido and the traditional governor, with the difference that money in the fishing sector was more abundant than money in the ejido and the traditional governor. Therefore positions in the Seri cooperative were more lucrative. This situation changed somewhat when the bighorn sheep hunting project brought important economic resources to the Seri traditional government, and with the splitting of
the Seri cooperative into smaller units. But in the Seri system for fishing cooperatives, few of the social roles of the cooperative systems are accomplished.

Information flowing from the Seri governor to the community is strictly controlled. Recent governors explained that unobstructed flow of information can make the governor’s ability to function very difficult, if not impossible, due to the chronic opposition from “family fiefs” of families that are not in power, against all enterprises of the governor in functions. This was especially critical when the new government had different ideas about social justice and accountability of Seri politicians, or about cooperation with outside agencies in natural resource conservation and management projects. These are ideas that entail a rupture with the views of old-guard Seri politicians.

Among the reasons branded by Seris to block the access of outside fishers is that outsiders use extraction techniques and practices that are not sustainable. It was not possible to assess this claim because of the virtual absence of Mexican crews fishing for jaiba inside the Infiernillo Channel. A study started by Basurto in 2000 attempted to quantify the difference in fishing patterns between Seri and Mexican divers in the pen shell fishery (Basurto 2001).

A couple of Mexican fishermen, married to Seri women and living permanently in Punta Chueca, fish for jaiba. They do not fish differently than Seris. In other fisheries the general trend I observed on this subject is that due to fragility of arrangements with Seri authorities that allow outside fishermen to work inside the Infiernillo Channel, the general tendency is to maximize their harvest. But the approach to outsiders fishing in Seri EFZ also depends on the type of fishery. For fisheries that involve special skills
or high risks (gill-netting in open waters), Seri fishers that own fishing gear prefer the involvement of Mexicans in extraction while they wait in the beach for the product. However, other Seris who do not have the equipment, skills, or desire to participate in those fisheries oppose to involvement of Mexicans, arguing that Seris are being displaced.

The arrival of Mexican fishermen to Seri villages and their social interactions have been generally characterized by violence and mistrust, but friendly encounters have also occurred. Mexican fishermen have merged into the Seri community through inter-ethnic marriages and affairs. Some authors postulate that it was through inter-ethnic marriages that the Seri population was able to pass through the population bottleneck of the early 1940s (Santillán Mena 1993). Although Seri mixing with Mexicans definitely has produced population growth, Seris are still overwhelmingly dominant inside their land. This is one characteristic that is not found in other indigenous groups in México (personal communication Pablo Yanes, Director de Antropología Jurídica INI, México City, June 1998).

This aspect of social interaction has not produced important conflicts, since the Mexican men who agree to live respecting the culture and traditions of the Seris, are accepted into the community. But in recent years conflicts with outside interests for Seri wildlife and fishing resources coupled with the death of old Seris sparked an internal “revolution” of pure Seris vs. mixed Seris. Seri sovereignty over the land and the sea is being interpreted using racial purity as a criterion. The invasion of their lands and their

87 The acceptance does not mean easy living. Several Mexican fishermen interviewed complaint against what the called “Seri racism” in their daily lives.
waters is now happening in their blood and their culture. During the time of my study a couple on incidents of ethnic cleansing occurred, when Mexicans were expelled from Punta Chueca. These incidents were peaceful; Seri authorities simply asked the Mexicans to leave, but the rhetorical arguments used by some vocal leaders to cause the expulsion were violent. Normally the focus of the discussions shifted from outside “whites” living in Punta Chueca to the rights Seris mestizos have over the benefits of Seri resources. Unfortunately, one point of contention was the splitting among community members of the money produced by the bighorn sheep-hunting program. Percentage of Seri blood of the head of household was used as a criterion to define the size of the share to be received by each family. First generation mixed Seris married with Seri men received 50% of the money. First generation mixed Seris married with Mexican women, and household headed by Mexicans did not receive anything. The strongest voices against mixing of Seris with “whites” even proposed the prohibition of inter-ethnic marriages. But the feasibility of this was soon challenged. With more social relationships between Punta Chueca and Bahía Kino, young Seri men are spending more time in Kino interacting with Mexican girls during parties, town-dances, and baseball games. Sons or daughters of some of the strongest opponents to mixing are now married with Mexicans. As one Mexican diver living in Punta Chueca who is married with a Seri woman said to me “sooner or later every family will have a daughter or a son married to a white.” This mixing of Mexican fishermen into the Seri community is expected to continue, and if it does, it will certainly have an effect on the future actions of Seri
authorities and the general community perception towards allowing access to outside fishermen into Seri EFZ.

During important conflicts with Mexicans the community showed a stronger cohesion in their stand for defense against outside interests. This pattern was similar to the observed cohesion of Seri clans in times of warfare against ranchers or the Mexican Army forces in the 17th and 18th centuries.

**Outcomes**

The four aspects of sustainability proposed by Charles (1994) provided a framework for assessing the potentials and limitations of the Seri EFZ. Although all elements of sustainability are very difficult to quantify, my study provide insights into the issues that hinder or support sustainability. Several aspects of the jaiba fishery in the Seri EFZ are contributing to ecological sustainability (e.g., differential exploitation of males, critical habitat protection, closed season, limited fishing effort, limited access). However, sustainability may depend heavily on resource extraction patterns outside their territory, especially in relation of extraction of females. Results of this study suggest that the fishery is close to the maximum levels of exploitation, before overfishing. Anecdotal information shows a decline in CPUE (number of crabs per trap, and mean daily capture per boat), but without accurate data on fishing effort (number of traps and boats) it is difficult to relate this decline to diminishing stocks. A general understanding of the jaiba stock-recruitment relationships in the Gulf of California is needed, and this is a complex issue. For example, in another crustacean fishery in the Gulf of California, McGuire (1983) discussed how little shrimp stock size in one fishing season depends on
exploitation the previous season, in a fishery where wide fluctuations in recruitment can occur from year to year. The shrimp stock size depends apparently more on conditions that foster or preclude spawning and development. In addition strong fluctuations in crab populations abundance have been recorded in other parts of the world.

The extraction of females, the impact of trawlers on the continental shelf, the disturbance of critical habitat in coastal lagoons along the coast of Sonora due to aquaculture development and agriculture run-off, all are important factors in the ecological sustainability of the *jaiba* fishery inside the Seri EFZ.

Socio-economic sustainability can be assessed considering that the *jaiba* fishery is the most important fishery in Punta Chueca, and the most important economic activity in the village. Moreno-Moreno and Bracamonte (2000) calculated that fishing accounted for 77.6% of the Gross Internal Product of Punta Chueca, with hired labor and household labor providing 71% of aggregate value of the Gross Internal Product. They also found that households whose income depended primarily on fishing had the highest level of income; above community average *per capita* income levels. These authors report that 60% of the people in the Punta Chueca are involved in fishing. The Seri EFZ is helping the community to maintain the income generated from *jaiba* fishing inside Punta Chueca, since all fishers are Seri. Unfortunately, the high dependence of Seri fishermen on the fishing equipment of private companies prevented them to exercise pressure to increase the price paid per kilo of jaiba. This outside control is a danger to the socio-economic sustainability of the fishery. The Seri cooperative is reported to have a large and old debt with one of the private companies. But this is doubtful considering the steep price
differential between the price paid to the fisherman on the beach and the price that the
buyers receive from the wholesale distributor, calculated to be 100% more in small-scale
fisheries (Lobato-González 1997). It is reported that when the Seri cooperative split into
four entities, its debt did not split as well; therefore the only fishing cooperative with a
debt is the original Seri cooperative.

The Seri fishing cooperative as an economic organization is not viable, however is deeply rooted in the history of Seri involvement in commercial fishing. The Seri EFZ has not contributed to strengthen the Seri cooperative. It remains to be seen if family cooperatives show better performance and accountability, and provide more benefits to all its members.

Community sustainability depends on the previous two aspects of sustainability:
ecological and socio-economic. Overfishing of *jaiba* will have strong detrimental consequences in the Seri economy. Since the beginning days of Seri participation in commercial fisheries, their options have been narrowing. Their reliance on commercial fishing has gone from totoaba to *jaiba* in 50 years, passing through sharks, sea turtles, groupers, sierra and corvina, sea cucumbers, and manta rays. *Jaiba* and *callo de hacha* (pen shell) are the only species left to fish profitably (personal communication Ignacio Barnett, past Seri Governor, Punta Chueca, March 1998). The dwindling range of resources to support a community that relies very heavily on fishing, and has limited alternative economic options, is cause of concern, and gives a higher relevance to the existence and persistence of the Seri EFZ.
In order to be properly managed inside the Seri EFZ, *jaiba* depend on long-enduring community-based institutions to be sustainable (Ostrom 2001). The structure and operation of the Mexican fishing cooperatives have been extensively criticized for not being able to defend the interests of small-scale fishermen against widespread marginalization, caused by development of open-access policies in the management of fisheries and the growth of the large-scale fishing sector. The Seri EFZ cooperatives show a similar history of internal disorganization, abandonment from governmental support, and control by private interests outside the Seri community. However, the existence of other institutions in the Seri community (the ejido, *bienes comunales*, council of elders), have produced an overall positive outcome to defend the integrity of the Seri marine territory in spite of their own problems of representativity, low accountability, and corruption. Recent developments regarding the growth of the membership of *bienes comunales* are a good sign that will help to open up the possibilities for better institutions. The formalization of the Seri government in recent years with resources from the sport hunting business has also contributed to improve the efficiency of the Seri public policy and the image of Seri institutions towards outside organizations. This profesionalization of Seri institutions has not yet reached the Seri cooperatives that have concentrated in production and not participated in the negotiation of agreements with outside users of the Seri EFZ or in the discussion of management in the few forums of public participation. This must change.
Role of Jaiba Traditional Ecological Knowledge

The life history of *Callinectes* crabs is relatively well known. Thus, it was possible to verify certain elements of Seri TEK, in order to assess their applicability and role in traditional management. One of the most important elements was the Seri knowledge of areas where female concentrate, and these areas are avoided during fishing operations. It was also important to assess the generalized knowledge of sexual dimorphism and the relative high rate of fishers who knew how to identify immature females. However, this knowledge was not used since there was no selection or grading of crabs post-capture.

Extreme variability was found in aspects related to phenomena hard to see with naked eyes, or determined by empirical evidence. For instance the number of microscopic eggs per female, time eggs remained in egg-bearing females, growth rate to commercial size, natural predators in the sea, and natural food preferences show a wide range of responses and very limited knowledge. To the contrary, the interviewed fishers show consistency in data over the number reproductive events in one year, the role of eelgrass as nursing and feeding critical habitat, areas were females concentrate and hibernation spots, as well as the best places to set traps. In general the TEK is being used by Seris avoid critical nursing areas like mangrove lagoons, and areas with female concentration. In practical terms they are using detailed information about the bottom of the Infiernillo Channel to select the best fishing areas but leaving aside spatial refugia for females and juveniles. Other knowledge appears to have little practical use in the current fishing practices for *jaiba*. 
E. CONCLUSIONS AND RECOMMENDATIONS

1. The development of the *jaiba* fishery inside the Infiernillo Channel has mirrored the development of this fishery in the Bahía Kino region. In a few years *jaiba* was transformed from a survival fishery to the most important commodity for the Punta Chueca community. This is yet another evidence of the strong influence and links between Seris and the outside Mexican economy, something that has experienced little change since the beginning of commercial relationships between Seris and Mexicans.

2. Although basic techniques and equipment used for *jaiba* fishing are the same inside and outside the Infiernillo Channel, there are important differences. Inside the Channel, the Seri rotate fishing areas, limit total fishing effort, and have protected areas. The first difference was the result of movements to maintain appropriate yields, the second difference is the product of demographic factors not of internal control, and the third difference is the result of internal agreements and the strong sense of Seri territory.

3. Official records of landing prove strongly biased and useless to assess historical fluctuations in catch. High rates of underreporting ruin official statistics. From private records of buyers, I calculate that 173 tons of *jaiba* were landed during the fishing season of 1999-2000, with an average individual (crew) daily catch of 144 kg.

4. The annual CPUE per crab trap calculated was 217 kg/yr. This figure is 434 times higher than the CPUE recommended in the law as a reference point for this
fishery, suggesting this official reference point must be analyzed in detail to retain its conservation goal.

5. The most productive fishing crews worked 70% of the workable days of the season. This seems to be a high rate of work in a group of fishers, and was facilitated by the protected waters of the Infiernillo channel, the service provided to the fishers by the buyers, and the lack of alternative fisheries. This also produced a high fidelity to the *jaiba* fishery and in turn stability of the catch throughout the season.

6. A strong sex bias of 84.3% males was encountered in the catch sampled. The reason behind this bias seem to be the sexual segregation in this species, in agreement with the life history paradigm of *Callinectes* crabs: mature females living offshore to incubate and hatch their eggs in offshore waters, and immature females in pre-copulatory stages that enter coastal areas to mate with males that are resident of these areas.

7. The entrance of immature females to the Infiernillo Channel from November to March apparently to mate, supports this paradigm.

8. The current model of *jaiba* trap is actively selecting sizes from 35.5-88.6 mm in CL, but more frequently from 50-85 mm in CL. This selection is beneficial since it is not capturing juveniles, and maybe the largest adult males that must exist in the population. Culling rings installed in the traps are the same size of the mesh thus too small to function. Overall, only 7% of the *jaiba* harvest is of sub-legal size; this is a very small percentage. This result is the combination of trap selectivity and natural distribution of sub-legal sizes in the Infiernillo Channel.
9. Fishing patterns of extraction showed that large males are removed by fishing mortality during the first half of the fishing season. Immature females and small males dominate the captures towards the second half of the season. The existence of large males, apparently too large to be captured by the trap, could be compensating the mortality by fishing of large adult males, allowing appropriate sex ratios for ensuring insemination of all receptive females.

10. Sonora is a pioneer state in the design of management regulations for the jaiba fishery. However, this regulation lacks a strong legal foundation if it is not incorporated into a Norma Oficial Mexicana. But even then, lack of enforcement leaves compliance of regulatory mechanisms to the sympathy of fishers and buyers.

11. Fishing patterns for jaiba inside the Seri EFZ appeared to be more sustainable because limited fishing effort, rotation of fishing areas, and spatial reproductive refugia. However, dependence from outside stocks of females mainly makes the fishery inside the channel vulnerable from unsustainable fishing practices outside. The Seri EFZ has not had a role in promoting better integration of fisheries management in areas outside of Seri control.

12. Research is needed to assess and quantify the level of sustainability and the current status of the jaiba populations, but must consider experience from blue crab (Callinectes sapidus) research that have showed the strong limitations for stock assessment imposed by the high inter-annual variability in abundance characteristic of crab fisheries and the problems of finding a stock-recruitment relationship.
13. The Seri EFZ proved to be a successful tool to exclude non-Seri *jaiba* fishers. Access to the Infiernillo Channel is allowed under a series of local arrangements. Internal controls have allowed that arrangements can be monitored and terminated if necessary. Durability of the arrangements seemed to be directly related to the amount of direct monetary beneficiaries in the Seri community at large.

14. Strong differences in the perception of the benefits from allowing access to the Seri EFZ exist between residents from Punta Chueca and Desemboque. Further research is needed to assess the differences in the Desemboque section of the Seri EFZ.

15. The Seri EFZ has been a successful tool to keep outside shrimp trawling, the most important destructive fishing practice in the region. The protection of critical nursing and feeding grounds is probably having a beneficial impact over the health of *jaiba* and other commercial fisheries outside the Infiernillo Channel.

16. Internal fishing patterns, based on collective decisions motivated by efforts to maximize the economic efficiency of fishing, produced conservation outcomes. Nevertheless, although those patterns were not part of external regulation of the fishery, they were conducive to a sustainable fishery.

17. Absence of federal fisheries management authorities combined with local practices and decisions over the compliance of external regulation, results in the *jaiba* fishery inside the Infiernillo Channel that is a *de facto* co-management system. This arrangement is not found in surrounding open-access fishing areas outside the Seri EFZ.
18. The existence of Seri institutions other than the fishing cooperative have allowed increased capacity for community-based discussion and decisions about fishing practices. This diversity of institutions makes the Seri better equipped institutionally for co-management than Mexican fishermen from neighbor communities.

19. Few Mexican fishers are entering the Seri community, mixing with Seri women, to have access to the EFZ. The internal conflicts emerging from the inter-ethnic dimension of limiting access, based in the lack of understanding and agreement about basic rules, is likely to represent the higher social costs for the Seris in the near future.

20. The Seri economy in Punta Chueca is highly dependent from fishing. The range of economically viable fisheries inside the Infiernillo Channel has narrowed severely, therefore eroding the natural capital of the Seris and threatening their survival.

21. Sustainable and stronger Seri institutions have not resulted as a consequence of the Seri EFZ. Problems in definition of property rights, including the limits of the Seri EFZ and the rights to defend its integrity, have not only been detrimental to Seri institutions but have emphasized the often contradictory and ambiguous role of the federal government in local fisheries management in this region of the Gulf of California.

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>English common names</th>
<th>Seri name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Class Pelecypoda</strong></td>
<td>bivalves, such as clams</td>
<td></td>
</tr>
<tr>
<td>Arca pacifica</td>
<td>pacific arc</td>
<td>quiimosim xepe ano</td>
</tr>
<tr>
<td>Atrina tuberculosa</td>
<td>pen shell</td>
<td>yaafé</td>
</tr>
<tr>
<td>Cardita affinis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chama mexicana</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chione californiensis</td>
<td>California chione</td>
<td>sitjquim</td>
</tr>
<tr>
<td>C. fluctifraga</td>
<td>smooth chione</td>
<td>haan</td>
</tr>
<tr>
<td>Dosinia ponderosa</td>
<td>Venus clam</td>
<td>halit cahóoxp</td>
</tr>
<tr>
<td>Glycimeris gigantea</td>
<td>bittersweet shell</td>
<td>xpanóis</td>
</tr>
<tr>
<td>Laevicardium elatum</td>
<td>giant Pacific egg cockle</td>
<td>xtiip</td>
</tr>
<tr>
<td>Modiolus capax</td>
<td>fat horse mussel</td>
<td>satoj</td>
</tr>
<tr>
<td>Ostrea clumbiensis</td>
<td>mangrove oyster</td>
<td>haxt</td>
</tr>
<tr>
<td>O. palmula</td>
<td>oyster</td>
<td>staej</td>
</tr>
<tr>
<td>Pinna rugosa</td>
<td>rugose pen shell</td>
<td>seten ctam</td>
</tr>
<tr>
<td>Pinctada mazatlanica</td>
<td>Mazatlán pearl oyster</td>
<td>copas quictoj</td>
</tr>
<tr>
<td>Protothaca spp.</td>
<td>littleneck clam</td>
<td>haxól</td>
</tr>
<tr>
<td>Spondylus calcifer</td>
<td>spiny oyster, rock scallop</td>
<td>teexoj</td>
</tr>
<tr>
<td><strong>Class Gasteropoda</strong></td>
<td>univalves, such as snails</td>
<td></td>
</tr>
<tr>
<td>Crucibulum scutellatum</td>
<td>cup-and-saucer limpet</td>
<td>caixona</td>
</tr>
<tr>
<td>Hexaplex (Muricanthus) nigritus</td>
<td>black murex</td>
<td>nocat</td>
</tr>
<tr>
<td>Onchidella binneyi</td>
<td></td>
<td>tamax</td>
</tr>
<tr>
<td>Strombus gracilior</td>
<td>conch</td>
<td>xica cotítzicla</td>
</tr>
<tr>
<td>Turbo fluctuosus</td>
<td>turban</td>
<td>cotópis</td>
</tr>
<tr>
<td><strong>Class Cephalopoda</strong></td>
<td>octopuses</td>
<td>hapaj</td>
</tr>
<tr>
<td>Octopus spp.</td>
<td>crabs</td>
<td></td>
</tr>
<tr>
<td><strong>Crustaceans</strong></td>
<td>swimming crab</td>
<td>zamt</td>
</tr>
<tr>
<td>Callinectes bellicosus</td>
<td>blue swimming crab</td>
<td>zamt toijl</td>
</tr>
<tr>
<td>C. arcuatus</td>
<td></td>
<td>oot izámt</td>
</tr>
<tr>
<td>Portunus spp. (?)</td>
<td></td>
<td>inl quixaz</td>
</tr>
<tr>
<td>Eurytium affine (?)</td>
<td></td>
<td>inl quixaz</td>
</tr>
<tr>
<td><strong>Fish</strong></td>
<td>totoaba</td>
<td>zixcáam caucxla</td>
</tr>
<tr>
<td>Totoaba macdonaldi</td>
<td>sea bass</td>
<td>xpatj</td>
</tr>
<tr>
<td>Cynoscion spp.</td>
<td>Gulf grouper</td>
<td>caanj</td>
</tr>
<tr>
<td>Mycterosperca jordani</td>
<td>spotted cabrilla</td>
<td>xnajoj</td>
</tr>
<tr>
<td>Paralabrax</td>
<td>leopard and golden grouper</td>
<td>tate, tate cmasol</td>
</tr>
<tr>
<td>maculofasciatus</td>
<td>sierra mackrel</td>
<td>cpoort</td>
</tr>
<tr>
<td>Mycterosperca rosacea</td>
<td>mullet</td>
<td>ziix coafp</td>
</tr>
<tr>
<td>Scientific name</td>
<td>English common names</td>
<td>Seri name</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------</td>
<td>-----------</td>
</tr>
<tr>
<td><em>Leuresthes sardina</em></td>
<td>gulf grunion</td>
<td>caaha</td>
</tr>
<tr>
<td><em>Sphoeroides annulatus</em></td>
<td>bulls-eye puffer</td>
<td>tzih</td>
</tr>
<tr>
<td><em>Rhinobatos productus</em></td>
<td>Shovlenose guitarfish</td>
<td>coo</td>
</tr>
<tr>
<td><strong>Reptiles</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caretta caretta</td>
<td>loggerhead</td>
<td>xpeyo</td>
</tr>
<tr>
<td><em>Chelonia mydas agazzisi</em></td>
<td>green turtle, black turtle</td>
<td>10 different names depending on size, maturity, and fishing area</td>
</tr>
<tr>
<td><em>Dermochelys coriacea</em></td>
<td>leatherback</td>
<td>moosnípol</td>
</tr>
<tr>
<td><em>Eretmochelys imbricata</em></td>
<td>hawksbill</td>
<td>moosni quipáacalc</td>
</tr>
<tr>
<td><em>Lepidochelys olivacea</em></td>
<td>olive Ridley</td>
<td>moosni sipoj</td>
</tr>
<tr>
<td><strong>Mammals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Zalophus californianus</em></td>
<td>California sea lion</td>
<td>xapôo</td>
</tr>
</tbody>
</table>
### APPENDIX 2. LIST OF ACRONYMS AND ABBREVIATIONS USED

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CES</td>
<td>Centro Ecológico de Sonora. Ecological Center of Sonora</td>
<td></td>
</tr>
<tr>
<td>CRIP</td>
<td>Centro Regional de Investigación Pesquera. Regional Center of Fisheries Research.</td>
<td></td>
</tr>
<tr>
<td>CRIP-Guaymas</td>
<td>Centro Regional de Investigaciones Pesqueras-Guaymas. Regional Center of Fisheries Research in Guaymas, Sonora.</td>
<td></td>
</tr>
<tr>
<td>EFZ</td>
<td>Exclusive fishing zone.</td>
<td></td>
</tr>
<tr>
<td>LGSC</td>
<td>Ley General de Sociedades Cooperativas. General Law of Cooperative Societies.</td>
<td></td>
</tr>
<tr>
<td>MIR</td>
<td>Midriff islands region.</td>
<td></td>
</tr>
<tr>
<td>MSY</td>
<td>Maximum sustainable yield.</td>
<td></td>
</tr>
<tr>
<td>NMFS</td>
<td>National Marine Fisheries Service-U.S. Secretary of Commerce</td>
<td></td>
</tr>
<tr>
<td>PA</td>
<td>Procuraduría Agraria. Agrarian Attorney</td>
<td></td>
</tr>
<tr>
<td>PGR</td>
<td>Procuraduría General de la República. General Attorney of the Republic.</td>
<td></td>
</tr>
<tr>
<td>PIB</td>
<td>Producto Interno Bruto. Gross Internal Product</td>
<td></td>
</tr>
<tr>
<td>SCPP</td>
<td>Sociedad Cooperativa de Producción Pesquera. Cooperative Society of Fishing Production.</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 2 - Continued

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEPESCA</td>
<td>Secretaría de Pesca.</td>
<td>Ministry of Fisheries.</td>
</tr>
<tr>
<td>SEMAR</td>
<td>Secretaría de Marina.</td>
<td>Ministry of the Navy.</td>
</tr>
<tr>
<td>SEPESCA</td>
<td>Subsecretaría de Pesca.</td>
<td>Sub-secretariat of Environment and Fisheries.</td>
</tr>
<tr>
<td>TEK</td>
<td>Traditional ecological knowledge.</td>
<td></td>
</tr>
</tbody>
</table>

Tuesday 11 of February of 1975, pages 11 and 12.

SECRETARY OF INDUSTRY AND COMMERCE

Decree by which it is declared that only and exclusively the members of the Seri tribe and from the Sociedad Cooperativa de Producción Pesquera, S.C.L. (Cooperative Society of Fishing Production, S.C.L.), will be able to carry out fishing acts in the waters of the estuaries and bays, situated in the Gulf of California littorals and on the littorals that form Tiburón Island localized in the Sea of Cortés.

In one margin the seal of the National Shield, that said: Mexican United States-Presidency of the Republic.

LUIS ECHEVERRIA ALVAREZ, Constitutional President of the Mexican United States, in the use of his faculties conferred by Article 89 fraction I of the Political Constitution of the Mexican United States an with fundamont on articles 1, 2, 5, 12, 13 fractions IV and V, 14 of the Federal Law for the Promotion of Fishing that is currently valid, and on the Article 8 fraction XVIII and XX of the Law for Secretariats and State Department, and

CONSIDERING

That in accordance with Article 27 of the Constitution the waters of the territorial seas are the property of the nation under the extension and terms set by the International Law as well as interior marine waters and those of lagoons and estuaries that have permanent communication with the sea;

That the Federal Law for the Promotion of Fishing is regulates Article 27 of the Constitution in regards to regulation, promotion and use of the aquatic flora and fauna, and natural element susceptible of human appropriation, to make and equitable distribution.
APPENDIX 3 - Continued

of the public wealth and to take care of its conservation, therefore being an ordering with
public and social interest;

That Article 34 of the Federal Law for the Promotion of Fishing consider the preference
to organized small-scale fishermen and to Cooperative Societies of Fishing Production to
obtain concessions and permits for commercial fishing;

That, in accordance with the Federal Law of Agrarian Reform communities can carry out
the industrial and commercial exploitation of resources from fishing;

That by Presidential Resolution dated 12 of November of 1970, published in the Federal
Register on 28 of November of 1970 is was granted as ejido donation to the town
denominated El Desemboque and its annex Punta Chueca, Municipality of Pitiquito,
State of Sonora, a surface of 91,322.00-00 Hs. of agostadero [term similar to land apt for
cattle grazing], affecting for that effect land property of the nation, for the purpose of
collective use of 75 people benefited whose names are in the text of the resolution,

That historically the Seri community had exploited the fishing on the waters of the
littorals of the State of Sonora and particularly in those comprehended on the presidential
resolution that definitively gave them 91,322-00-00 ha. of land, situated in the littorals of
the Gulf of California and with approximately 100 km of beaches; and the littorals that
form Tiburón Island, localized in the Gulf of California,

That it is considered convenient, giving attention to the growth of the Seri communities;
their precarious economic situation; that their main source of income is fishing; and that
if the necessary support is not provided it could propitiate their extinction, to give to
those communities the benefit of the exploitation of such resources,

That to avoid the take away, invasions, illegal fishing acts and any other acts that could
affect them in their patrimony, and on those recognized directly to the members of the
Seri community and to the Cooperative of Fishing Production organized by them, it
should be precisely determined the waters in which the cited community could operate,
and in particular the Sociedad Cooperativa de Producción Pesquera “Comunidad Seri,” I
had decided to promote the following

DECREES

FIRST ARTICLE.- Only and exclusively the members of the Seri Tribe and from the
Sociedad Cooperativa de Producción Pesquera, S.C.L., could make fishing acts, those for
species not reserved, and the members of the second also for those reserved, in the waters
APPENDIX 3 - Continued

of the estuaries and bays that are referred in the sixth Considering of this Decree, with the exception of sport fishing,

SECOND ARTICLE.- The Secretariat of Industry and Commerce will give and renovate the permits and concessions for the fishing that in accordance to the Federal Lay for the Promotion of Fishing were solicited or had been issued for the species that are referred in the previous article, to the Seri community and to the Sociedad Cooperativa de Producción Pesquera, S.C.L “Comunidad Seri”.

THIRD ARTICLE.- The Seri community and the Sociedad Cooperativa de Producción Pesquera, S.C.L “Comunidad Seri” are obligated to allow without any limitation, the free transit of vessels, people, animals or things over the water of the estuaries and bays, and to respect all the dispositions related to the regime of Federal Zone of the littorals referred in this Resolution.

TRANSITORY

ONLY ARTICLE.- This Decree will start to be valid three days after it is published in the Federal Register.

Given in the residency of the Executive Federal Power in Mexico City, Federal District, on the 10 days of January of 1975,- Luis Echeverria Alvarez,- Signature,- In absence of the Minister of Industry and Commerce, the under Secretary in charge of the office, Guillermo Becker Arreola,-Signature.
## APPENDIX 4. RESEARCHERS WORKING IN SERI TERRITORY DURING THE PERIOD OF STUDY.

<table>
<thead>
<tr>
<th>Name</th>
<th>Area of research</th>
<th>Academic Institution</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alvaro Bracamontes</td>
<td>Economy of fishing communities</td>
<td>COLSON</td>
<td><a href="mailto:abraca@colson.edu.mx">abraca@colson.edu.mx</a></td>
</tr>
<tr>
<td>Blanca Rebeca Noriega</td>
<td>Anthropology of domestic units</td>
<td>CIAD, Hermosillo</td>
<td><a href="mailto:rebe@cascabel.ciad.mx">rebe@cascabel.ciad.mx</a></td>
</tr>
<tr>
<td>Diana Luque</td>
<td>Seri school for cultural survival</td>
<td>CIAD, Hermosillo</td>
<td><a href="mailto:dluque@cascabel.ciad.mx">dluque@cascabel.ciad.mx</a></td>
</tr>
<tr>
<td>Felipe Rodríguez</td>
<td>Bighorn sheep and mule deer ecology and exploitation</td>
<td>Seri Traditional Government</td>
<td>52 (662) 4-42-00-56</td>
</tr>
<tr>
<td>Gary Nabham</td>
<td>Ethnoecology, local capacity building, herpetology</td>
<td>NAU</td>
<td><a href="mailto:Gary.Nabhan@nau.edu">Gary.Nabhan@nau.edu</a></td>
</tr>
<tr>
<td>Jean-Luc Carton</td>
<td>Osprey breeding ecology</td>
<td>New Mexico Game and Fish</td>
<td><a href="mailto:jlec@unm.edu">jlec@unm.edu</a></td>
</tr>
<tr>
<td>Jeff Seminoff</td>
<td>Sea turtles ecology and conservation, local capacity building</td>
<td>Univ. of Florida</td>
<td><a href="mailto:Seminoff@zoo.ufl.edu">Seminoff@zoo.ufl.edu</a></td>
</tr>
<tr>
<td>Jorge Torre</td>
<td>Long term monitoring of marine biodiversity, local capacity building, seagrass ecology</td>
<td>SRNR-UA, COBI</td>
<td><a href="mailto:jtorre@cobi.org.mx">jtorre@cobi.org.mx</a></td>
</tr>
<tr>
<td>Laurie Monti</td>
<td>Community health, medicinal plants, local capacity building</td>
<td>School of Nursing-UA, NAU</td>
<td><a href="mailto:Laurie.Monti@nau.edu">Laurie.Monti@nau.edu</a></td>
</tr>
<tr>
<td>Mike Oskin</td>
<td>Geology of Tiburón Island</td>
<td>California Technology Institute</td>
<td></td>
</tr>
<tr>
<td>Rodrigo Medellin</td>
<td>Bighorn sheep ecology in Tiburón Island</td>
<td>Institute of Ecology-UNAM</td>
<td><a href="mailto:medellin@miranda.ecologia.unam.mx">medellin@miranda.ecologia.unam.mx</a></td>
</tr>
<tr>
<td>Xavier Basurto</td>
<td>Role of local institutions in marine conservation, pen shell fisheries biology</td>
<td>SRNR-UA, COBI</td>
<td><a href="mailto:xbasurto@u.arizona.edu">xbasurto@u.arizona.edu</a></td>
</tr>
</tbody>
</table>
APPENDIX 5. FISHING PATTERNS IN THE AREAS ADJACENT TO THE SERI EXCLUSIVE FISHING ZONE.

Large-Scale Fleet

Using bottom trawling nets, only operating at night

<table>
<thead>
<tr>
<th>Common name Spanish</th>
<th>Common name English</th>
<th>Species</th>
<th>Fishing Season¹</th>
<th>Main Fishing areas 88,89</th>
<th>Characteristics of fishing areas</th>
<th>Ports of origin of the fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camarón café</td>
<td>Brown shrimp</td>
<td><em>Panaeus californiensis</em></td>
<td>Sep-May</td>
<td>Kunkaak Bay</td>
<td>Soft bottoms on continental shelf</td>
<td>Guaymas, Topolobampo, San Felipe</td>
</tr>
<tr>
<td>Camarón roca</td>
<td>Target shrimp</td>
<td><em>Sicyonia penicillata</em></td>
<td>Sep-May</td>
<td>Kunkaak Bay</td>
<td>Soft bottoms on continental shelf</td>
<td>Guaymas, Topolobampo, San Felipe</td>
</tr>
<tr>
<td>Camarón blanco</td>
<td>White shrimp</td>
<td><em>Panaeus vannamei</em></td>
<td>Sep-May</td>
<td>Kunkaak Bay</td>
<td>Soft bottoms on continental shelf</td>
<td>Guaymas, Topolobampo, San Felipe</td>
</tr>
</tbody>
</table>

Using purse-seine nets, operating at night on new moon nights and sometimes during the day

<table>
<thead>
<tr>
<th>Common name Spanish</th>
<th>Common name English</th>
<th>Species</th>
<th>Fishing Season¹</th>
<th>Main Fishing areas 1,2</th>
<th>Characteristics of fishing areas</th>
<th>Ports of origin of the fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sardina monterrey</td>
<td>Monterey sardine</td>
<td><em>Sardinops sagax caerlea</em></td>
<td>Agua Dulce Bay</td>
<td>n/a</td>
<td>Guaymas</td>
<td></td>
</tr>
<tr>
<td>Sardina crinuda</td>
<td>Pacific thread herring</td>
<td><em>Opisthona libertate</em></td>
<td>Agua Dulce Bay</td>
<td>n/a</td>
<td>Guaymas</td>
<td></td>
</tr>
<tr>
<td>Sardina japonesa</td>
<td></td>
<td><em>Eutremes teres</em></td>
<td>Agua Dulce Bay</td>
<td>n/a</td>
<td>Guaymas</td>
<td></td>
</tr>
<tr>
<td>Anchoveta</td>
<td>Anchovy</td>
<td><em>Engraulis mordax</em></td>
<td>Agua Dulce Bay</td>
<td>n/a</td>
<td>Guaymas</td>
<td></td>
</tr>
<tr>
<td>Sardina bocona</td>
<td></td>
<td><em>Centengraulis mysticus</em></td>
<td>Agua Dulce Bay</td>
<td>n/a</td>
<td>Guaymas</td>
<td></td>
</tr>
<tr>
<td>Macarela</td>
<td>Mackerel</td>
<td><em>Scomber japonicus</em></td>
<td>Agua Dulce Bay</td>
<td>n/a</td>
<td>Guaymas</td>
<td></td>
</tr>
</tbody>
</table>

88 Fishing areas and seasons within or adjacent to the Seri EFZ.
89 Based on Weaver (unpubl.), and Bourillón et al. (2001).
APPENDIX 5. - Continued

Small-Scale Fleet

Using gill nets\(^{90}\)

<table>
<thead>
<tr>
<th>Common name Spanish</th>
<th>Common name English</th>
<th>Target species</th>
<th>Fishing Season</th>
<th>Main Fishing areas</th>
<th>Characteristics of fishing areas</th>
<th>Ports of origin of the fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sierra</td>
<td>Sierra mackerel</td>
<td><em>Scomberomorus sierra</em> and <em>S. Concolor</em></td>
<td>Feb-May, Oct-Dec</td>
<td>In front of Desemboque, Agua Dulce Bay, Kunkaak Bay, west coast of Tiburón island</td>
<td>Near shore waters</td>
<td>Bahía Kino, Guaymas, Bahia Lobos, Sinaloa</td>
</tr>
<tr>
<td>Curvina</td>
<td>Curvina</td>
<td><em>Cynoscion</em> spp.</td>
<td>Oct-Dec</td>
<td>Kunkaak Bay, west coast of Tiburón island</td>
<td>Near shore waters</td>
<td>Bahía Kino</td>
</tr>
<tr>
<td>Lenguado</td>
<td>Cortez halibut</td>
<td><em>Paralychtis aequalis</em></td>
<td>All year</td>
<td>Kunkaak Bay, west coast of Tiburón island</td>
<td>Off-shore waters</td>
<td>Bahía Kino</td>
</tr>
<tr>
<td>Lisa</td>
<td>Striped mullet</td>
<td><em>Mugil cephalus</em></td>
<td>Dec-Mar</td>
<td>Kunkaak Bay, west coast of Tiburón island</td>
<td>Near shore waters</td>
<td>Bahía Kino</td>
</tr>
<tr>
<td>Cazón</td>
<td><em>Mustelus</em> spp. Other species of small sharks</td>
<td>Apr-Aug</td>
<td>In front of Desemboque</td>
<td>Off-shore waters</td>
<td>Bahía Kino, Guaymas, Melchor Ocampo</td>
<td></td>
</tr>
<tr>
<td>Perro</td>
<td>Horn shark</td>
<td><em>Heterodontus francisci</em></td>
<td>Apr-Aug</td>
<td>In front of Desemboque</td>
<td>Off-shore waters</td>
<td>Bahía Kino, Guaymas, Melchor Ocampo</td>
</tr>
<tr>
<td>Manta</td>
<td>Rays</td>
<td>19 species</td>
<td>All year</td>
<td>Kunkaak Bay, west coast of Tiburón Is.</td>
<td>Off-shore waters</td>
<td>Guaymas, Melchor Ocampo</td>
</tr>
</tbody>
</table>

\(^{90}\) Gill nets are known locally as chinchorros. Their dimensions vary widely in length, width, mesh size, as well as their placement in the water column, just below the surface, close to the bottom, or at middle.
### APPENDIX 5. - Continued

#### Using small-trawling nets (changos)

<table>
<thead>
<tr>
<th>Common name Spanish</th>
<th>Common name English</th>
<th>Target species</th>
<th>Fishing Season</th>
<th>Main Fishing areas</th>
<th>Characteristics of fishing areas</th>
<th>Ports of origin of the fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camarón cafés</td>
<td>Brown shrimp</td>
<td>Panamex californiensis</td>
<td>Jul-Dec</td>
<td>Kunkaak Bay</td>
<td>Soft bottoms on continental shelf</td>
<td>Bahía Kino</td>
</tr>
<tr>
<td>Camarón blanco</td>
<td>White shrimp</td>
<td>Panamex vannamei</td>
<td>Jul-Dec</td>
<td>Kunkaak Bay</td>
<td>Soft bottoms on continental shelf</td>
<td>Bahía Kino</td>
</tr>
</tbody>
</table>

#### Using hook and line

<table>
<thead>
<tr>
<th>Common name Spanish</th>
<th>Common name English</th>
<th>Target species</th>
<th>Fishing Season</th>
<th>Main Fishing areas</th>
<th>Characteristics of fishing areas</th>
<th>Ports of origin of the fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extranjero</td>
<td>Golden spotted sand bass</td>
<td>Paralabrax auroguttatus</td>
<td>Nov-Mar</td>
<td>Off-shore waters</td>
<td>Deep waters with soft bottoms</td>
<td>Bahía Kino</td>
</tr>
<tr>
<td>Pargo rojo, huachinango</td>
<td>Red snapper</td>
<td>Lutjanus peru</td>
<td>Nov-Mar</td>
<td>Off-shore waters</td>
<td>Deep waters</td>
<td>Bahía Kino</td>
</tr>
<tr>
<td>Baqueta</td>
<td>Gulf coney</td>
<td>Ephinephelus acanthistius</td>
<td>Nov-Mar</td>
<td>Off-shore waters</td>
<td>Deep waters</td>
<td>Bahía Kino</td>
</tr>
<tr>
<td>Blanquillo Pierna</td>
<td>Blanquillo Pierna</td>
<td>Caulolatilus principes and C. affinis</td>
<td>Nov-Mar</td>
<td>Off-shore waters</td>
<td>Deep waters</td>
<td>Bahía Kino</td>
</tr>
</tbody>
</table>

#### Using traps

<table>
<thead>
<tr>
<th>Common name Spanish</th>
<th>Common name English</th>
<th>Target species</th>
<th>Fishing Season</th>
<th>Main Fishing areas</th>
<th>Characteristics of fishing areas</th>
<th>Ports of origin of the fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jaiba</td>
<td>Swimming crab</td>
<td>Callinectes bellicosus</td>
<td>July-March</td>
<td>Bahía Kunkaak</td>
<td>Near shore, soft bottom shallow areas</td>
<td>Bahía Kino</td>
</tr>
<tr>
<td>Cochito</td>
<td>Finescale triggerfish</td>
<td>Balistes polylepis</td>
<td>All year</td>
<td>West coast of Tiburón island</td>
<td>Near shore, rocky bottom shallow areas</td>
<td>Bahía Kino</td>
</tr>
</tbody>
</table>
Diving with hookah, for the capture of fish is done mostly during the night.

<table>
<thead>
<tr>
<th>Common name Spanish</th>
<th>Common name English</th>
<th>Species</th>
<th>Fishing Season</th>
<th>Main Fishing areas</th>
<th>Characteristics of fishing areas</th>
<th>Ports of origin of the fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Callo de hacha</td>
<td>Pen shell</td>
<td><em>Pinna rugosa</em> and <em>Atrina tuberculosa</em></td>
<td>All year</td>
<td>Bahía Kunkaak</td>
<td>Shallow areas on soft bottoms</td>
<td>Bahía Kino</td>
</tr>
<tr>
<td>Callo de escarlopa</td>
<td>Spiny oyster</td>
<td><em>Spondylus calcifer</em></td>
<td>All year</td>
<td>Kunkaak Bay, west coast of Tiburón Is.</td>
<td>Shallow areas on rocky bottoms</td>
<td>Bahía Kino</td>
</tr>
<tr>
<td>Pepino de mar</td>
<td>Sea cucumber</td>
<td><em>Isostichopus fuscus</em></td>
<td>All year</td>
<td>Kunkaak Bay, west coast of Tiburón Is.</td>
<td>Shallow areas on soft or rocky bottoms</td>
<td>Bahía Kino</td>
</tr>
<tr>
<td>Pulpo</td>
<td>Octopus</td>
<td><em>Octopus bimaculatus</em></td>
<td>May-Aug</td>
<td>Kunkaak Bay, west coast of Tiburón Is.</td>
<td>Shallow areas on rocky bottoms</td>
<td>Bahía Kino</td>
</tr>
<tr>
<td>Langosta</td>
<td>Lobster</td>
<td><em>Panulirus inflatus</em></td>
<td>Oct-Apr</td>
<td>Kunkaak Bay, west coast of Tiburón Is.</td>
<td>Shallow areas on rocky bottoms</td>
<td>Bahía Kino, Guaymas</td>
</tr>
<tr>
<td>Pargo rayado, coconaco</td>
<td>Barred pargo</td>
<td><em>Hoplopagrus guntheri</em></td>
<td>Nov-Mar</td>
<td>Kunkaak Bay, west coast of Tiburón Is.</td>
<td>Shallow areas on rocky bottoms</td>
<td>Bahía Kino, Guaymas</td>
</tr>
<tr>
<td>Pargo prieto, pargo culón</td>
<td>Dog snapper</td>
<td><em>Lutjanus novemfasciatus</em></td>
<td>Nov-Mar</td>
<td>Kunkaak Bay, west coast of Tiburón Is.</td>
<td>Shallow areas on rocky bottoms</td>
<td>Bahía Kino, Guaymas</td>
</tr>
<tr>
<td>Cabrilla sardinera</td>
<td>Leopard grouper</td>
<td><em>Mycteroperca rosacea</em></td>
<td>Nov-Mar</td>
<td>Kunkaak Bay, west coast of Tiburón Is.</td>
<td>Shallow areas on rocky bottoms</td>
<td>Bahía Kino, Guaymas</td>
</tr>
<tr>
<td>Baya</td>
<td>Gulf grouper</td>
<td><em>Mycteroperca jordani</em></td>
<td>Nov-Mar</td>
<td>Kunkaak Bay, west coast of Tiburón Is.</td>
<td>Shallow areas on rocky bottoms</td>
<td>Bahía Kino, Guaymas</td>
</tr>
<tr>
<td>Pinta</td>
<td>Broomtail grouper</td>
<td><em>Mycteroperca xenarcha</em></td>
<td>Nov-Mar</td>
<td>Kunkaak Bay, west coast of Tiburón Is.</td>
<td>Shallow areas on rocky bottoms</td>
<td>Bahía Kino, Guaymas</td>
</tr>
</tbody>
</table>
**APPENDIX 5. - Continued**

Diving with hookah, for the capture of fish is done mostly during the night

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cabrilla pinta</strong></td>
<td><strong>Spotted cabrilla</strong></td>
<td><strong>Epinephelus analogus</strong></td>
<td><strong>Nov-Mar</strong></td>
<td><strong>Kunkaak Bay, west coast of Tiburón island</strong></td>
<td><strong>Shallow areas on rocky bottoms</strong></td>
<td><strong>Bahia Kino. Guaymas</strong></td>
</tr>
<tr>
<td><strong>Cochito</strong></td>
<td><strong>Finescale triggerfish</strong></td>
<td><strong>Balistes polylepis</strong></td>
<td><strong>Nov-Mar</strong></td>
<td><strong>Kunkaak Bay, west coast of Tiburón island</strong></td>
<td><strong>Shallow areas on rocky bottoms</strong></td>
<td><strong>Bahia Kino</strong></td>
</tr>
<tr>
<td><strong>Caguama</strong></td>
<td><strong>Black sea turtle</strong></td>
<td><strong>Chelonia mydas agassizii</strong></td>
<td><strong>All year</strong></td>
<td><strong>Kunkaak Bay, west coast of Tiburón island</strong></td>
<td><strong>Shallow areas on rocky bottoms</strong></td>
<td><strong>Bahia Kino</strong></td>
</tr>
</tbody>
</table>

91 The capture of sea turtles is illegal since 1992, but is still practiced due to the continued demand for meat in the black market in Bahía Kino and Hermosillo.

1. The Seri governor and co-operatives would allow fishing activities inside the exclusive Seri waters by the fishermen from Bahía Kino in exchange for $1,000 pesos per month per group, amount that will be adjusted up or down accordingly to the fishing production of each group.

2. The permits will be issued, delivered and signed by the Seri governor, that makes the commitment to renew them every 30 days, only if Bahía Kino fishermen have their navigation and fishing permits signed and stamped by the Port Captain and the Director of the local SP office, and are organised in cooperatives or grupos solidarios.

3. Bahía Kino fishermen agree to keep their camps on the shores of Tiburón Island clean, and to engage in patrolling of this coastline to prevent fishing activities by other pangas from Guaymas, Sonora, from the State of Sinaloa, and from Puerto Peñasco, that will damage this working agreement.

4. In any moment and under any circumstance the governors Guardia Tradicional will break the law and act against Bahía Kino fishermen, and in the event that they find foreign boats that are fishing during the night they will act against them.

1. Formalize the relationships among the organizations present in the meeting through collaboration agreements in order to have greater transparency and strength in looking for solutions.

2. Communicate the limits of the exclusive fishing zone granted by Presidential Decree to the Comcaác Nation (Seri) in 1975 in order to minimize conflicts for the use of these waters with fishermen that do not belong to this region.

3. Control the use of the fishing areas inside the Comcaác territory to order fishing activities so it is carried on in a responsible and sustainable way, with the vigilance and control of the Seri Guardia Tradicional y coordination with the competent authorities, mainly in the natural protected area of Tiburón Island.

4. Update the cadre of fishing sector in the Region Kino-Comcaác territory, with the general purpose of knowing and controlling the use mainly by residents of such region.

5. Educate the fishing sector and promote among them the respect of closed fishing seasons and other types of existing regulatory measures, so fishing can be made in its optimal form.
APPENDIX 7. - Continued

6. Ask formally to the competent authorities the restriction of fishing using trawling nets by boats, due to the enormous impact of this form of extraction over species with commercial importance, in which the small-scale sector depends, and to the environments of the sea floor.

7. Ask formally to the competent authorities the restriction of fishing by night diving, due to the enormous effect it has by the extraction of the most productive animals, of juveniles, and the damage over the recovery capacity of species such as lobster, *cabrilla*, snappers, groupers. The high extraction efficiency of this activity does not allow it to be sustainable.

8. Ask the federal and state fishing authorities their active, periodical, and systematic participation to look together for solutions and alternatives to the problems presented.

9. To establish a technical advisory body with the participation of the fishing sector to contribute in this effort, and to provide the technical basis for the sustainable management of fisheries resources.

10. Finally it was agreed to present to the competent authorities the previous objectives goals with the purpose of giving follow-up to the mutual goals presented and discussed in an orderly and peaceful way, making an invitation to the authorities to contribute in the solutions of the problems of the fishing sector of this region.
APPENDIX 8. QUESTIONNAIRE USED TO SURVEY THE SERI TRADITIONAL ECOLOGICAL KNOWLEDGE ABOUT JAIBA.

Encuesta a pescadores Comcaác sobre conocimiento tradicional de la biología y ecología de jaibas zampt en el Canal de Infiernillo.

Versión: 20/julio/1998, Luis Bourillón

Nombre Pescador__________________________Edad_______
Fecha_____________________

I. Reproducción

1.a. ¿Hay tipos diferentes de jaibas que se pescan en el CDI? ¿Cómo se les llama en lengua Comcaác?

________________________________________________________________________

1.b. ¿Cuál es la temporada de reproducción de las jaibas en el CDI? ¿En qué meses traen huevera la mayoría de las hembras? (rodear con círculo meses más importantes, con una línea las temporadas).

Ene Feb Mar Abr May Jun Jul Ago Sep Oct Nov Dic

2.a. ¿Cómo se distinguen las jaibas hembras de los machos?

- Forma del abdomen (dibujar diferencias)
- Color
- Comportamiento
- Distribución
- Nombre Comcaác machos adultos_____________ hembras adultas_________

2.b. ¿Cómo se distinguen las hembras jóvenes que no se han reproducido (vírgenes) de las hembras adultas que ya se reprodujeron?

- Forma del abdomen (dibujar diferencias)
- Color
- Comportamiento
- Nombre Comcaác hembras jóvenes_______________

3. ¿Las jaibas prefieren algún lugar para aparearse? (señalar en el mapa)
APPENDIX 8. - Continued

4. ¿Cuánto tiempo dura el apareamiento?
   ( ) horas   ( ) días

5. ¿Cuánto tiempo vive una jaiba?
   <1 año  2  3  4  5>

6. ¿Cuántas veces se reproduce la hembra en un año? ¿Cuántas durante toda su vida?
   1  2  3  4>  1  2  3  4>

7. ¿Cuántos huevos pone en cada temporada de reproducción?
   <100 mil diez mil cien mil un millón dos millones >10 mill

8. ¿Cuánto tardan las jaibitas en salir de los huevos?
   <1 semana  1 semana  2 semanas  1 mes   ( ) semanas ( ) meses ( ) años
   meses

9. ¿A dónde van las jaibitas después que salen del huevo? (i.e., flotan, al fondo, orilla)

10. ¿Hay algún sitio en el CDI donde se junten las crías?

11. ¿Dónde se esconden las crías para no ser comidas por otros animales? ¿Cuáles animales las comen más?

12. ¿En cuánto tiempo crece una jaibita desde huevo hasta alcanzar la talla comercial?
   ( ) semanas   ( ) meses   ( ) años

13. ¿Cuál es la talla mínima comercial?
   <6.5 cm  6.5 cm  7.5 cm >7.5 cm
   (Dibujar aquí una regla para marcar la medida seleccionada por el pescador)

II. Alimentación

14.a. ¿Qué comen las jaibas?
APPENDIX 8. - Continued

14.b. ¿Qué prefieren de carnada?

14.c. ¿Qué carnada están usando ahora en las trampas?

14.d. ¿En qué parte del CDI encuentran esta comida? (señalar en el mapa)

15.a. ¿En qué lugares se alimentan principalmente?

15.b. ¿Hay algún lugar o lugares del CDI que sean un comedero importante? (señalar en el mapa)

16.a. ¿Comen lo mismo todo el año?

16.b. ¿Comen lo mismo los machos que las hembras?

16.c. ¿Qué comen las crías?

III. Movimientos

17.a. ¿Se entierran las jaibas?

17.b. ¿En qué meses?

Ene Feb Mar Abr May Jun Jul Ago Sep Oct Nov Dic

17.c. ¿Hay lugares especiales en el CDI donde se entierren? (señalar en el mapa)

18.a. ¿Hay migraciones dentro del CDI?

18.b. ¿En qué meses?

Ene Feb Mar Abr May Jun Jul Ago Sep Oct Nov Dic

18.c. ¿De dónde a dónde?

19. ¿Hay migraciones hacia fuera del CDI?

20. ¿Qué tipo de fondo prefieren para vivir las jaibas?

21. ¿Hay alguna hora del día en que prefieran estar aboyadas las jaibas?
APPENDIX 8. - Continued

IV. Pesca

22. ¿Hay lugares del CDI que sean más importantes para poner tramas de jaiba? (señalar en el mapa) y porqué?

23. ¿Hay lugares del CDI que no deberían tener nunca trampas y porqué?

24.a. ¿Crees que haya muy pocas o demasiadas trampas en el CDI?

24.b. ¿Cuál debería ser el número máximo de trampas por panga?

25. ¿Crees que otras actividades de pesca dentro o fuera del CDI afecten a la pesca de jaiba en el CDI (e.g. barcos camarones, acuacultura)?

26. ¿Crees que la pesca de jaiba esté afectando a otras pesquerías?

27.a. ¿A cuánto pagan ahorita el kilo de jaiba en la playa?

27.b. ¿Cuánto es lo más y lo menos que le han pagado?

28. ¿A qué cooperativa perteneces?

29.a. ¿De quién es la panga y el motor que traes?

29.b. ¿Cuántas trampas estás trabajando?

30.a. ¿Cuántos años tienes pescando jaiba?

30.b. ¿Qué año empezó la pesca de jaiba en el CDI?

30.c. ¿Qué cambios ha habido en la forma y zonas donde se pesca a jaiba entre hoy y cuando empezó la pesca?

31. ¿Cuántos años más crees que dure la pesca de jaiba en el CDI y porqué?

32. ¿Crees que los compradores estén interesados en que se conserve la jaiba del CDI?

33. ¿Antes que se pescara la jaiba que se pescaba en los meses de calor? ¿y en los meses de frío?

34. ¿Es mejor negocio la jaiba que esas otras pesquerías?
APPENDIX 8. - Continued

34.a. ¿Es más difícil o más fácil?
34.b. ¿Qué prefieres pescar?

V. Ecosistema y conservación

35. ¿De qué dependen las jaibas para poder sobrevivir en el CDI?
36.a. ¿Crees que las jaibas puedan acabarse o escasear demasiado por la pesca?
36.b. ¿Qué otro factor además de la pesca crees que pueda influir para que se escaseen demasiado?
37. ¿Qué se puede cambiar para que no se acaben?
   - Control del número de trampas ¿cuántas trampas hay ahí en el CDI?
   - Número legal de trampas permitido, ¿sabes cuál es?
   - Diseño de las trampas ¿qué le modificarías a la trampa?
   - Lugares donde se ponen las trampas ¿qué lugares no deberían tener nunca trampas?
   - Tipo de carnada, forma de encarnar, y tiempo que dura la carnada en el agua?
   - Capturar solo machos, capturar solo jaibas más grandes de cierta talla, ¿cuál sería esa talla?
38. ¿Qué hacen actualmente los pescadores Seris para que nos se acaben la jaiba?
39.a. ¿Qué otras cosas se podrían hacer?
39.b. ¿Qué cosas deberían hacer los pescadores de Bahía Kino?
40. ¿Habría diferencias en la pesca de la jaiba sin la zona exclusiva de pesca Comcaác en el CDI?
41. ¿Hay diferencias entre la forma en que los pescadores de Kino pescan la jaiba comparado a los pescadores Comcaác?
42. ¿Han dejado entrar a los pescadores de Bahía Kino a pescar jaiba dentro del CDI?
43. ¿Cree que el CDI sea más productivo o igual que las zonas de pesca de jaiba vecinas? ¿Porqué?
APPENDIX 9. LIST OF SERI TRADITIONAL GOVERNORS IN THE 1990S
AND PERIOD OF THEIR ADMINISTRATION.

<table>
<thead>
<tr>
<th>Name</th>
<th>Date period starts</th>
<th>Date period ends</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genaro Herrera Casanova</td>
<td>1990?</td>
<td>Sep-1992</td>
<td></td>
</tr>
<tr>
<td>Genaro Herrera Casanova</td>
<td>Dec-1995</td>
<td>June-1996</td>
<td>Pedro Romero loses for reelection</td>
</tr>
<tr>
<td>Ignacio Barnett Astorga</td>
<td>Nov-1997</td>
<td>Nov-1998</td>
<td>Felipe Romero is separated from office</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pedro Romero gets a stroke</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Genaro Herrera dies in 1999</td>
</tr>
<tr>
<td>Ricardo Estrella Romero</td>
<td>May-2001</td>
<td>Still Active Dec. 2001</td>
<td>First governor from Desemboque</td>
</tr>
</tbody>
</table>
APPENDIX 10. LIST OF INTERNAL AND EXTERNAL AUTHORITIES IN THE SERI COMMUNITIES.

Internal Organization Forms – “True” Seri organizations

Consejo de Ancianos
Elders Council

<table>
<thead>
<tr>
<th>Name of position</th>
<th>Number of Positions</th>
<th>Names of positions</th>
<th>Form of election</th>
<th>Normal Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consejo</td>
<td>Not fixed, current 3</td>
<td>Members</td>
<td>Selected by the Council</td>
<td>Their lifetime</td>
</tr>
</tbody>
</table>

Guardia Tradicional
Traditional Guard

<table>
<thead>
<tr>
<th>Name of position</th>
<th>Number of Positions</th>
<th>Names of positions</th>
<th>Form of election</th>
<th>Normal Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guardia Tradicional</td>
<td>Not fixed, 70</td>
<td>Commander, Guard</td>
<td>Selected from adult males, voluntary inclusion (no drafting)</td>
<td>Not limited</td>
</tr>
</tbody>
</table>
APPENDIX 10. - Continued

External Organization Forms – “Mexican” organizations

Bienes Comunales de la Isla Tiburón
Traditional Governor

<table>
<thead>
<tr>
<th>Name of Position</th>
<th>Number of Positions</th>
<th>Form of election</th>
<th>Normal Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gobernador Tradicional or Comisario de Bienes Comunales</td>
<td>Minimum of 6&lt;sup&gt;92&lt;/sup&gt;</td>
<td>Planilla elected by majority in closed voting of registered comuneros during a general meeting convened for that purpose</td>
<td>3 years</td>
</tr>
<tr>
<td>Secretario de Bienes Comunales</td>
<td>Same as above</td>
<td>Same as above</td>
<td>Same as above</td>
</tr>
<tr>
<td>Tesorero de Bienes Comunales</td>
<td>Same as above</td>
<td>Same as above</td>
<td>Same as above</td>
</tr>
<tr>
<td>Presidente del Consejo de Vigilancia</td>
<td>Same as above</td>
<td>Same as above</td>
<td>Same as above</td>
</tr>
<tr>
<td>Secretario Primero del Consejo de Vigilancia</td>
<td>Same as above</td>
<td>Same as above</td>
<td>Same as above</td>
</tr>
<tr>
<td>Secretario Segundo del Consejo de Vigilancia</td>
<td>Same as above</td>
<td>Same as above</td>
<td>Same as above</td>
</tr>
</tbody>
</table>

<sup>92</sup> The governor can have staff formed by as many people as he wanted. The current governor presented a staff of 11 including one vice-governor, treasurer and personal secretary with their substitutes, and 17 people more in charge of individual commissions like the commander of the traditional guard, ecotourism, cultural issues, community health, internal affairs, use of natural resources, hunting, community emergencies, flora and fauna, indigenous justice, treatment of immigrants.
APPENDIX 10. - Continued

Ejido Desemboque y su anexo Punta Chueca
Seri Ejido

<table>
<thead>
<tr>
<th>Name of Position</th>
<th>Number of Positions</th>
<th>Form of election</th>
<th>Normal Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comisario Ejidal or Presidente del Comisariado Ejidal</td>
<td>Minimum of 6</td>
<td>Planilla elected by majority in closed voting of registered ejidatarios during a general meeting convened for that purpose</td>
<td>3 years</td>
</tr>
<tr>
<td>Secretario del Comisariado Ejidal</td>
<td></td>
<td>Same as above</td>
<td>3 years</td>
</tr>
<tr>
<td>Tesorero del Comisariado Ejidal</td>
<td></td>
<td>Same as above</td>
<td>3 years</td>
</tr>
<tr>
<td>Presidente del Consejo de Vigilancia del Comisariado Ejidal</td>
<td></td>
<td>Same as above</td>
<td>3 years</td>
</tr>
<tr>
<td>Secretario del Consejo de Vigilancia del Comisariado Ejidal</td>
<td></td>
<td>Same as above</td>
<td>3 years</td>
</tr>
<tr>
<td>Tesorero del Consejo de Vigilancia del Comisariado Ejidal</td>
<td></td>
<td>Same as above</td>
<td>3 years</td>
</tr>
</tbody>
</table>

SCPP Seri, SCL
Seri Cooperative

<table>
<thead>
<tr>
<th>Name of Position</th>
<th>Number of Positions</th>
<th>Form of election</th>
<th>Normal Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presidente or Presidente del Consejo de Administración</td>
<td>Minimum of 4</td>
<td>Planilla elected by majority in open voting of registered cooperativistas during a general meeting convened for that purpose</td>
<td>5 years and can be re-elected</td>
</tr>
<tr>
<td>Secretario del Consejo de Administración</td>
<td></td>
<td>Same as above</td>
<td>Same as above</td>
</tr>
<tr>
<td>Tesorero Consejo de Administración</td>
<td></td>
<td>Same as above</td>
<td>Same as above</td>
</tr>
<tr>
<td>Presidente del Consejo de Vigilancia</td>
<td></td>
<td>Same as above</td>
<td>Same as above</td>
</tr>
</tbody>
</table>

Total number of positions for external organization = 16.
REFERENCES


Anonymous. 1944. Report on Seris from visit to Tiburón 10-11, September 1944. Copy stored in William N. Smith files Special Collections Library of the University of Arizona, Tucson.


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D.O.F. (Diario Oficial de la Federación). 1975. Decreto por el que se declara que única y exclusivamente los miembros de la tribu Seri y los de la Sociedad Cooperativa de Producción Pesquera S.C.L., podrán realizar actos de pesca en las aguas de los esteros y bahías, situados en el Golfo de California y de los litorales que forman la Isla del Tiburón localizada en el Mar de Cortés. February 11.

D.O.F. (Diario Oficial de la Federación). 1975. Decreto por el que se crea la Comisión para el Desarrollo de la Tribu Seri del Estado de Sonora, con el objeto de promover el desarrollo integral de dicha comunidad. February 11.


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