

IDENTIFYING AND UNDERSTANDING RESOURCE
USERS OF PANAMA'S COIBA NATIONAL PARK

by

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Masters project submitted in partial fulfillment of the
requirements for the Master of Environmental Management degree in
the Nicholas School of the Environment and Earth Sciences of
Duke University

2002

Abstract

Large marine protected areas are increasingly being used as tools of Integrated Coastal Management. Coiba National Park, located off the Pacific coast of the Republic of Panama, is a large marine protected area (*216,543 hectares / 866 km² marine habitat*) in its management infancy, and is thus an ideal site for the development, testing, and implementation of social and biological management options. A comprehensive survey of communities in the park buffer zone was undertaken with local university students in order to characterize communities which have significant impacts on park resources. Results of this survey have been incorporated into management recommendations and a constructive analysis of the current park management plan. Five communities and one industrial port were identified as having the greatest impact on park resources based on their extractive use of park resources. Based on previous research in this field, stakeholder participation and input was determined to be a necessity for successful long term park management. Such involvement should begin with the six identified communities. The current park management plan may benefit from the establishment of local advisory committees tasked with conflict resolution and decision making. In addition, the development of a comprehensive, integrated, and sustainable tourism plan for the park is recommended.

Acknowledgements

I would like to thank, first and foremost, Dr. Todd Capson from the Smithsonian Tropical Research Institute in Panama City, Republic of Panama. This project was Dr. Capson's inspiration from the beginning. He secured funds to pay for my expenses during my three months working on the project, and even allowed me to live in his home in Panama City when I was not traveling. Dr. Capson realized what a rare and special place Coiba National Park is, and it became a dream of his to protect and conserve it. It is my hope that because of this project that dream is one step closer to becoming a reality. The funding for the project was provided through the Johnson Research Opportunities Fund of the Smithsonian Tropical Research Institute (STRI). This is a discretionary fund controlled by the director of STRI. I would like to therefore thank Dr. Ira Rubinoff, Director of STRI, and Dr. Cristian Samper, Deputy Director of STRI for the \$3000 that was graciously provided for the completion of this study as well as for their overall interest in the project.

I would also like to thank Dr. Michael K. Orbach, my project advisor at the Duke University Marine Lab. His help with the process and comments on the written document were a crucial part of the process. Dr. Randall Kramer at the Duke University Nicholas School of the Environment and Earth Sciences taught me everything I know about survey research in his course, "Survey Research Methods." I would like to thank him for his "hands-on" teaching approach and for his help with developing the survey instrument used in this project. Finally, I would like to thank Dr. Joseph Bonaventura at the Duke University Marine Lab for his academic support, emotional support, and his precious advice on "living improvisationally."

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1.1 BACKGROUND

Marine protected areas (MPA's) are increasingly being viewed as an effective way to protect and conserve marine resources as well as serving as nurseries to help support adjacent fisheries. The definition of a "marine protected area" varies according to the user, but it can be generally understood as a geographical area which is afforded some level of protection from user activities in order to achieve specific management objectives. This area may include both marine and terrestrial resources. The World Conservation Union (IUCN) defines MPA's as, "Any area of the intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environmentⁱ." The U.S. Marine Protected Areas Executive Order 13158, issued in May 2000, defines an MPA as "any area of the marine environment that has been reserved by Federal, State, territorial, tribal or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources thereinⁱⁱ."

Fisheries managers worldwide face the stigma of a poor track record of maintaining productive and sustainable fisheries. This is mainly due to the misconception that fishing should be allowed everywhere and at all timesⁱⁱⁱ. Protected areas can benefit fisheries and improve fisheries management in many ways. Reserves can help maintain sufficient fish biomass of reproductively active fish by harboring larger fish which in turn produce exponentially larger numbers of eggs. This is due to the fact that the majority of marine species possess a pelagic larval dispersal phase which carries larvae outside the reserve to fishing grounds. Fish may also emigrate across reserve boundaries providing improved fishing grounds in waters immediately adjacent to reserves^{iv}. It has been shown that five small marine reserves in St. Lucia have enhanced surrounding fisheries, demonstrated by a 46-90% increase in artisanal fishers' catch. In Florida, reserves have produced world-record sized fish for recreational fishers^v. Another benefit is the protection of important bottom habitat which is often destroyed or altered due to destructive fishing gear such as bottom trawls. Callum Roberts states straightforwardly that, "Ideally marine reserves should be established on the principle of 'no-take'. While beneficial effects have been measured from reserves that allow some kinds of exploitation, experience shows that 'no-take' reserves are much easier to implement and enforce^{vi}."

Coiba National Park (*Parque Nacional Coiba*), is a large marine protected area located approximately 15 miles off the Pacific coast of the Republic of Panama (*See Maps 1-3, Appendix D*). The government of Panama declared the Island of Coiba as well as a number of nearby islands in the same archipelago a National Park in 1991. The park encompasses 270,125 hectares (*675,000 acres / 2,700 km²*), eighty percent of which (216,543ha) are marine habitat. To give one a feeling for the immense size of this marine protected area, the park is 5,000 acres larger than the state of Rhode Island^{vii}. The park's 9 principal islands are uninhabited, with the exception of the main island of Coiba whose penal colony has served as the home to some of Panama's worst criminals. Besides the penal colony located at Punta Damas, there is a small ranger station with modest overnight facilities located near Punta Cristo. The near-pristine, well-preserved state (*the waters of the park have likely been fished since around 500 A.D. by pre-Columbian natives*) of Isla Coiba and the surrounding islands can be attributed to the presence of the penal colony which has been in use since the early 20th century (1919).

In the decade since its declaration as a national park, officials at Panama's National Environmental Authority (*Autoridad Nacional del Ambiente/ANAM*) have recognized the potential value of the Park for ecotourism. Even with the presence of a low-security prison colony with dangerous criminals living somewhat freely on the island, Coiba has received more than its share of tourists. In fact, Coiba National Park is the #1 revenue-generator among all national parks in the Republic of Panama, primarily from Park dues paid by cruise ships that stop at the ANAM park facilities on the northern shore of the island near Isla Coibita. The national police (*Policia Nacional*) have jurisdiction over the penal colony, and have regularly patrolled a 3 mile area around Coiba island^{viii} to protect boaters and fishermen from the free-roaming prisoners and to prevent escape attempts.

The protection of the park's bountiful natural resources and biodiversity is of immediate importance since the penal colony, which has served as the sole successful "guardian" of this park, is slowly being decommissioned and is scheduled to be completely shut down sometime in 2002. As of the date of this publication (May 2002), approximately 100 prisoners remain on the island. ANAM, the government authority responsible for protecting and managing the park, has not been able to control illegal fishing activities due to a lack of financial resources. Although it is common knowledge that illegal

fishing takes place in park territory, it has been extremely limited around the island of Coiba due to the constant presence of the National Police. According to park officials, as the police presence has dwindled along with the number of prisoners remaining on the island, illegal fishing has increased dramatically in the park. The ANAM park authorities lack the staff, equipment, security, and capital required to successfully enforce park regulations. Other than the prison, the ANAM facilities are the only development on the island and include the park ranger’s office, a small biological research station, some simple lodging facilities, and two short paths to vista points.

As this national park begins its transition from being the site of a large penal colony to an area of ecotourism, many management challenges must be met. Primary among them is the involvement of the local communities. Of the tens of towns in the region surrounding the park, five have been identified as having the potential for impacting the resources of the park, primarily through illegal and destructive fishing activities. Another significant source of park resource degradation identified by this study is the industrial shrimp trawlers which fish in the areas adjacent to the park.

1.2 THE BIOLOGICAL ENVIRONMENT

Protecting this precious and unusually well-preserved area of Panama needs to be recognized as a high priority for ANAM, the government of Panama, and conservation-minded people in both Panama and abroad. The park’s astonishing resources include a 20 km-long river with equally lengthy tributaries on the main island, islands covered with predominantly primary forests, high numbers of endemic species, bird species which include the last Panamanian flocks of the threatened scarlet macaw, *Ara macao*, a 135 hectare (337.5 acre) coral reef (the 2nd largest in the entire Central-Eastern Pacific, and the largest in the Central American region), and 23 species of cetaceans. The largest island, Coiba, is of volcanic origin, has an area of 50,314 acres, and comprises 93.5% of the land area in the park.

| <u>Islands in Coiba National Park</u> | <u>Area (Hectares)</u> |
|--|-------------------------------|
| Coiba | 50,314 |
| Jicarón | 2,002 |
| Brincanco | 330 |
| Uva | 257 |
| Coibita | 242 |
| Canal de Afuera | 240 |
| Jicarita | 125 |
| Pajaros | 45 |
| Afuerita | 27 |
| <i>Total Land Area of Park</i> | 53,582 |
| <i>Total Marine Area of Park</i> | 216,543 |
| Park Total Area | 270,125 |

Table 1: Islands of Coiba National Park

The remaining 3,268 ha of island territory is made up of the islands of Jicaron, Jicarita, Canal de Afuera, Afuerita, Pajaros, Uva, Brincanco, and Coibita.

The highest point of the park is the 416m tall *Cerro de la Torre* (Tower Hill) located in the central portion of Coiba island. Average annual temperature hovers near 26°C and annual precipitation is 350cm (140in). Primary forests are dominant on the main island of Coiba, although there has been some limited forestry activity in the past. In 1993 a biological laboratory was established on Coiba, and activities there have identified 36 species of mammals, 147 bird species, and 39 species of amphibians and reptiles. In the marine environment surrounding the islands, 69 species of marine fish, 12 species of echinoderms, 45 species of molluscs, and 13 species of crustaceans have been identified. Four species of cetaceans abound in the waters of this park as well. Humpbacks (*Megaptera novaeangliae*), Orcas or killer whales (*Orcinus orca*), pan-tropical dolphins (*Stenella attenuata*), and bottlenose dolphins (*Tursiops truncatus*) have been identified in the park waters. There have also been occasional sightings of 19 other cetacean species. Along with the abundant natural resources described here, pre-Columbian artifacts from around 500AD have also been found on Coiba island^{ix}.

1.3 THE POLICY PROBLEM

A policy process which involves local communities in the region surrounding the park is a necessity if conservation of the park resources is to be achieved. The region of concern is the coastline between Punta Burica in the province of Chiriqui to Punta Mariato in the province of Veraguas. This area encompasses the Gulf of Chiriqui (*Golfo de Chiriqui*) and the Gulf of Montijo (*Golfo de Montijo*) (See Map 3, Appendix D). This analysis will look into policy options such as community involvement as well as the complex nature of the human environment that the policy must take into consideration. As mentioned above, the main problem is that the park is beginning to experience increased pressures from illegal fishing practices within park boundaries due to the reduced presence of the previously highly visible National Police on the main island of Coiba.

The first step to making Coiba a more attractive tourist destination was the removal of the prisoners from the island. However, the removal of the prisoners is synonymous with the removal of the only protection that the park had. The small, understaffed, and under

funded ANAM park office on Coiba is entirely incapable of patrolling and enforcing regulations in a park which is larger than Rhode Island. As the number of National Police in the park has decreased with the number of prisoners remaining, illegal fishing activity has increased. In order to effectively protect and manage Coiba National Park, the people who interact with the park need to be effectively managed. At present, the fishermen who are fishing illegally in the park present the biggest threat to the park's resources. The first step to developing an effective policy, therefore, is to determine who exactly are the people who need to be managed; in other words, who is doing the illegal fishing that is taking place within park boundaries? Where are they coming from? Why are they fishing in the park and not other places? These and many other questions formed the core of my research.

1.4 CURRENT PARK MANAGEMENT PLAN

The current management plan for Coiba National Park can be found in the library of the National Authority of the Environment (ANAM) in Panama City. It was written in July of 1996 by the Spanish Agency of International Cooperation (AECI), the Spanish Agency for the Conservation of Nature, and the Panamanian National Institute of Renewable Natural Resources (INRENARE). The plan outlines general objectives of the park and of the management plan. Foremost among them is securing the conservation of Coiba National Park. The plan allows for the continuing of "traditional activities," although it fails to describe them in particular. In general the plan can be described as a collection of vague, easily misinterpreted statements. The plan calls for much action, but does not say much that is concrete. It contains statements such as, "This shall be determined," and "A study shall be conducted." There is, however, no regulatory body in charge of making sure that these things get done. In fact, in the 6 years since the plan has been written, the majority of what it calls for has not been accomplished or even started.

According to the management plan, there are five zones defined in the park. These are: scientific reserves, ecotourism areas, "extensive use" zones (open to public use, tourism, education), "controlled use" zones (degraded areas which will be used for extensive tourism), and "special use" zones (includes the penal colony and the park administrative facilities). These zones are defined in an appendix, but no maps of the zones exist.

Discarded fishing gear “is to be eliminated” from the ocean floor, including rocky outcroppings. Again, no description of who shall conduct this activity or who shall oversee it is provided. It simply “shall be done.” Recreational artisanal fishing is permitted in the park. The only portion of the 60-page document which deals with fishing activities is a short section entitled “Professional Artisanal Fishing,” which I describe in Chapter 3. It states that the only permitted commercial extraction allowed in the park is “traditional fishing of a professional character.” The plan is full of vague and unclear statements such as, “Noncompliance with these rules will result in a ban from the park for a reasonable time in accordance with the violation committed.” These types of statements are quite useless when it comes down to actual park management.

This plan is a good start, but is in need of revision if it is to serve as an effective management tool. It contains a number good ideas, such as the zoning of certain areas within the park, but it appears that the zones were arbitrarily created without consideration of local stakeholders, biological parameters, or traditional uses. As the only official document legally describing allowed and prohibited activities, it again is too vague. According to the unclear way in which one section is written, it allows for the use of longlines within the park, something which goes against the very purpose of the plan. Consequences of illegal activities are also left to the open discretion of ANAM. These need to be clearly defined in order to prevent misinterpretation. It contains no mention of how management decisions are to be made, or of who is to make them. Community involvement should be a necessary part of the management plan.

Chapter 2: Description of Methodology

A comprehensive systematic survey of communities in the park buffer zone was undertaken in order to characterize and rank communities by degree impact on park resources. First, focus groups were conducted in order to better understand the fishing practices in this region and to identify communities which may have an impact on park resources. Second, face-to-face surveys were then undertaken in order to identify and describe these communities. Local university students were recruited in order to help with survey implementation (interviews). Results from this survey work were then used in order to make recommendations for the current park management plan which incorporate the local communities identified. Work was also conducted with regulatory and enforcement agencies in order to disseminate preliminary results.

2.1 PRIMARY RESEARCH QUESTIONS

My first objective was to clearly define the research questions. In other words, what particular information about the communities around Coiba National Park was I focusing on? After a meeting with Dr. Todd Capson of the Smithsonian Tropical Research Institute, six primary objectives were identified. These were:

1. Who is fishing inside the boundaries of Coiba National Park (CNP)?
2. Why do they fish there and what could influence them to fish elsewhere or pursue another occupation?
3. How aware are they of the National Park, its boundaries, and its regulations?
4. What are typical attitudes towards the regulatory agency ANAM and the presence of CNP?
5. How do these fishermen perceive the health of the fisheries in regions adjacent to CNP?
6. How intense is the fishing activity in this region, and how might it impact the resources in CNP?

The next step was to design a survey which could answer these questions. The greatest challenge was creating a survey which could be clearly understood by fishermen who likely had never participated in this type of research. The average American has probably participated in hundreds of surveys by the time they are adults. Questions which utilize scaled responses, or which have a set of answers from which to select from, are very familiar to us and easily understood. On the other hand, the Panamanian fishermen I was to survey had most likely never seen such surveys. Another consideration was the high rate of illiteracy among the villagers we were to survey. It

was decided that a one-on-one, face-to-face survey was the best approach to deal with these issues. A mail survey was out of the question since we could not obtain a list of fishermen's names or addresses, and since such a survey would likely be extremely foreign and ignored. Phone surveys were also out of the question since the many of the households in these villages (or all in some cases) did not have telephones.

2.2 FOCUS GROUPS

In order to write an effective and complete survey, focus groups were conducted with fishermen from various communities around Coiba National Park. Kevan Mantel, a dive master from the only recreational dive boat outfit operating in the region, the *Coiba Explorer*, met with me to discuss the problem of fishing within the park boundaries. He had seen the fishing first-hand, and was able to document some of the destructive practices going on in the park. He identified the communities of Pedregal, Puerto Vidal, Pixvae, and Bahia Honda as communities which he perceived to be the ones fishing within park boundaries. These communities are where I started my focus group discussions. In those discussions I asked a general question about which other communities fished around Coiba Island and received names of more villages. Focus groups were then conducted in those communities as well. In the end, any community which was named more than once in a focus group interview was chosen as a site for the final survey implementation.

Focus groups were conducted by visiting a village in question and immediately locating the most senior townsperson available. In most cases I started by approaching the local police. They would then guide me to the "representante", or town representative. If this person was not available, I would ask to be taken to a fisherman. Often times this process was not as easy as it sounds, and I would have to ask for directions to "the bar where the fishermen hang out". Then, through trial and error, I would identify a fisherman or fishermen who could provide reliable information about the fishing scene in that village. I would generally ask one or more fishermen if they had some time to talk to me about the research I was conducting. I often offered an incentive such as a meal or a drink. We would then sit and talk for an hour or more. I did not have a sheet of paper with any pre-scripted questions on it, however I did have in my mind what information I wanted to get out of the interview. All I brought with me to the focus groups was a small

field notebook which I could fit in my pocket and a pen. This was in order to have as casual an atmosphere as possible. During the discussions, I asked questions about where the fishermen fished, the size of their boats, the total number of fishermen in the area, the various types of equipment they used and when they used them, what they did with the fish they caught, how the fishing was in terms of productivity, and whether or not their experiences were the norm for other fishermen in the village. These discussions were often very entertaining and animated, and a wealth of information was obtained from them. Although it was all “anecdotal,” it would later prove very useful in designing the survey and in a general assessment of the situation in and around Coiba National Park.

Perhaps the most valuable aspect of the focus groups was that I was able to orient myself to the situation in any given town and make contacts with important townspeople. This proved to be priceless information when it came time to return to these places for survey implementation. Often the contacts I made during these focus group visits helped me schedule a return visit during times fishermen would be present; for example, implementation was scheduled during a fishing festival in Remedios when all fishermen were present. For more difficult to reach places such as the villages of Pixvae and Bahia Honda, I was able to schedule my arrival and departure according to infrequent boat departures, allowing for more efficient travel during the survey implementation phase. All this planning was necessary because I had to coordinate my travel and survey implementation with that of the four students who worked with me on weekends only.

All in all, ten villages were visited between May 26, 2001 and June 3, 2001, for the purpose of conducting focus groups. These were Bahia Honda, Hicaco, Gobernadora, Pedregal, Pixvae, Puerto Armuelles, Puerto Remedios, Puerto Vidal, Puerto Mutis, and Santa Catalina. A preliminary visit to the industrial shrimp port “Vacamonte” was attempted on June 19, but this visit failed as I traveled to the port via taxi and was not permitted to enter the port facility. Even this failure proved to be valuable as it forced me to search for a successful way to access that elusive port (which I finally discovered via contacts in Panama City).

2.3 SURVEY DESIGN

A survey draft was designed in order to answer the six primary research questions. The

draft was written in English and then translated to Spanish by a translator in Santiago. I worked with the Panamanian translator during the entire process in order to ensure the accuracy of the translation and to explain the intent of certain questions. Prior to survey pretesting, the draft was sent to the Institutional Review Board at Duke University and was approved for use as a survey research tool. Oral consent for each survey was given before the subject participated (*See Survey Questionnaire, Appendix A*). The draft was pretested on June 13, 2001, in the village of Montijo. I entered Montijo and started asking around in order to identify a potential survey respondent. With the help of some local children, the household of a fisherman was identified. I interviewed this fisherman with the draft survey.

The map portion of the draft was to be filled out by the respondent with four different colors of crayons representing different catch: one color for shrimp, one for lobster, one for fish, and one color for shark. This system proved to be very difficult to communicate to all the fishermen surveyed, and was abandoned for simple fishing route tracing in the final survey. In order to thank the first fishermen for participating, I gave him one of the packs of crayons for his children who were sitting around us listening to what this unusual American visitor to their household had to say. When I did this, one of the children who was from a different family looked at the crayons and cried, “My uncle is a fisherman!” He obviously wanted a pack of crayons for himself! So he led me to his uncle’s house, who I then interviewed next. The purpose of telling this anecdote is to remind the researcher to never underestimate the power of an incentive or reward for those who participate in the research. When working in rural Central America, such incentives can be as simple as a pack of crayons.

After conducting the pretests, I made the necessary revisions to the survey. Many of the more complicated question-types were abandoned for simpler “true/false” questions. A scale which contained 5 divisions was simplified to an easier-to-understand 3 division scale (Always – Sometimes – Never). In the end, although I would have preferred working with more detailed responses, I discovered that the simpler the answer choices were, the better. I also printed some large print versions of the scales and question choices that were used in order to place them in front of the respondent during the interview so that they could be referred to when necessary.

The next step was the recruitment of a few students to help me with implementing the survey. I spoke on the phone with Dr. Carlos Seixas at the Veraguas branch of the University of Panama, a professor of marine biology. He agreed to have 4 of his best students participate in the study, on a volunteer basis. We set up a time to meet with the students the following week. On June 14, 2001 I met with the four students, Verónica Castro, Hugo Leon, Betzi Pérez, and Milagros Saldaña, and explained the project to them. I spent a few hours that afternoon training them in the process of interviewing for the survey. We went through the survey question by question and they helped with the final minor revisions made to the survey.

2.4 CHOOSING THE SAMPLE POPULATION

In order to conduct a randomized survey from which results could be extrapolated to the larger population of fishermen, it would be necessary to obtain a list of names of all fishermen in the communities I was targeting for my survey. Since there were no fishermen's organizations or lists of fishermen's names available, this would require obtaining a list of all registered boats in the region. From this list fishermen or boats could be randomly selected for interviews. All fishing vessels in Panama are required to register with the Autoridad Marítima de Panama (Panamanian Maritime Authority). However, after speaking with officials in one region, I became aware of the fact that a very small percentage of fishermen actually register their boats. While looking at the list that they had in the office, the officials guessed that close to 50% of fishermen who were fishing in the region were not registered and thus did not appear on the list. This information was supported by conversations I had with fishermen in focus group discussions. It was thus concluded that obtaining a list of all fishermen in the towns was not possible.

There are seven basic survey methods which are used to characterize fishermen and their activities. These are mail, telephone, door-to-door, fishing logbooks, diaries/catch cards, access point, roving, and aerial surveys^x. In access point or "site-intercept" surveys, the surveyor sits at a dock or other departure place of fishing vessels. If the surveyor remains at this location for a sufficient amount of time, every fishermen will have had an equal opportunity to be surveyed as they would have departed or arrived at the dock during the

survey time period. I was unfortunately not able to utilize this method either, as I found out during focus group discussions that many of the fishermen I was targeting spent up to 10 days at sea on a given fishing trip. I would have had to spend at least ten days at the dock of each village in order to randomly sample in this way, since my survey time frame would have had to be as long as the longest fishing trip in order to give fishermen an equal chance at being surveyed. I did not have this amount of time available, since surveying 10 communities, for example, may have required over 100 days of surveying.

Therefore, I decided to obtain as many surveys in a given town as possible given my time frame. In other words, I utilized an ‘opportunistic’ sampling frame. This survey would not be random and thus statistical conclusions about the larger population could not be drawn. Nevertheless, I decided that much valuable information could still be obtained and comparisons between villages could still be made. Thus, my data will be presented as summary statistics and no statistical comparisons will be made. I would like to reiterate the importance of the data, despite the lack of a randomized sampling method. I strongly feel that the descriptions of the surveyed communities are accurate. Much time was spent in each community during focus groups, survey implementation, and time spent living in the community. I spent time living in the homes of fishermen in communities where no other housing options were available. I spent hours talking with fishermen even after a survey was completed. I feel that my descriptions are as accurate as it is possible to obtain in a three month time period, and should not be disregarded because of a lack of a randomized sampling method.

2.5 SURVEY IMPLEMENTATION

On June 26, 2001, survey implementation began in the village of Puerto Mutis. The week prior to our visit I had spoken with “Luis,” the owner of a popular restaurant-bar in town called “*El Jardín de Puerto Mutis*”. He agreed to allow us to use his establishment as a “base” from which we were to conduct all of the surveys. I posted signs on the buses which ran to and from Puerto Mutis alerting fishermen of the time and place that we would be surveying. We also offered a free meal to all who were surveyed in order to encourage participation. Luis also agreed to spread word of the meeting to his clientele, many of whom were fishermen. As I was in the process of planning the meeting and spreading the word around, I was told more than once that having a “*reunion*” or meeting

with the fishermen was not going to work. I was told that nobody would show up and was even told a story about how some government officials planned a large meeting with the fishermen in this region and only 3 showed up. However, a handful of fishermen did manage to show up to our meeting, and with 4 surveyors we managed to survey 14 fishermen in the end. Many of the interviews were obtained by actively recruiting fishermen who were in the village and bringing them over to the bar to be surveyed. It was actually preferred to have respondents “trickle in” to the bar, since only 4 could be interviewed at any one time. For other villages, such as Remedios, I merely called one of my contacts from that town and arranged a day that we would arrive for the surveys. The contact agreed to meet us and to help us in identifying fishermen to interview. Finally, for a few places such as Mariato and the surrounding villages, I had no contacts prior to our arrival since I had not conducted focus groups there. In such cases we approached the town in a method similar to that which was used for the focus groups. Fishermen were thus identified and interviewed.

A total of fourteen points of departure were surveyed. Thirteen were villages and one was the industrial shrimp port Vacamonte. The villages surveyed were Gobernadora, Remedios, Bahia Honda, Santa Catalina, Puerto Mutis, Mariato (and surrounding villages), Hicaco, Pedregal, Puerto Vidal, Pixvae, Armuelles, Cebaco, and Aguadulce. The four respondents from Cebaco were surveyed while attending a meeting on Isla Gobernadora. No actual visit to Cebaco was made. The surveys were conducted during the one-month period between June 26, 2001 and July 28, 2001. One hundred and seventy surveys were completed during this time period. The speed at which this number of surveys was completed can be directly attributed to the assistance of the student interviewers as well as the advanced planning that went into each village visit. One survey was discarded in the end because of nonsensical and inconsistent responses which were attributed to the respondent’s drunkenness at the time of the survey.

The National Environmental Authority (ANAM) has primary jurisdiction over Coiba National Park. ANAM has a park management plan in place slated for review by the national offices in Panama City sometime during 2002. According to the park management plan, the only fishing which is allowed in the park is “hook and line fishing^{xi}.” Longline fishing is not allowed in the park according to park rangers, although it is not specifically prohibited by the plan. Trawling of any kind is strictly prohibited within park boundaries. Harvesting of benthic organisms such as crab and conch is also prohibited along with extractive diving activities. According to park regulations outlined in the management plan, none of the activities described above are to take place anywhere within park boundaries. The norms for the regulating fishing activity in all marine national parks states the following: “*The fishing activity which is permitted within National Marine Parks is the type known as professional traditional artisanal fishing and sport fishing. All artisanal and sport fishermen shall register their boats at the park registry and shall present the required navigation and fishing credentials and permits^{xii}.*” As it stands, boats which are fishing within park boundaries must first stop on the main island of Coiba and register with the ANAM park officials at the park office on the northern tip of the island. Many boats do in fact follow this practice and register on the island, and I was able to obtain records of boat permits issued in the park for an entire year between 1999 and 2000. However, it is commonplace to see long-lining boats and gill-netters registering to fish in the park, although both those fishing practices are prohibited by park regulations. Coiba Park regulations state the following in terms of permitted and prohibited fishing activities^{xiii}:

- *Fishing is not permitted in Zones designated as ecotourism areas, Scientific Reserves, or controlled use areas*
- *Only hook-fishing (on a line or hand-line) is permitted*
- *Fishermen may only fish for pelagic and rock species*
- *Boats may not carry any fishing equipment that can be utilized for fishing, such as harpoons or chuzos, other than the authorized types*
- *Noncompliance of these rules will result in the revoking of fishing privileges for a reasonable time period based on the extent of the infraction*

Zoned areas such as ecotourism areas and scientific reserves exist only on paper and are not recognized by fishermen or currently enforced by park officials. These zones exist primarily for future reference, and their locations are not well known by fishermen. The only rules which are currently “encouraged”, such as “please do not use gill nets on the coral reefs,” are actually variations of existing park regulations. This enforcement scheme has come about due to a lack of financial and personnel resources to enforce actual regulations. Currently the Park staff consists of one to three rangers who have a single boat and limited gasoline available. Park rangers each spend around 20 days on island on a rotating schedule. Rules as they are currently *enforced* are^{xiv}:

- No gill net fishing is allowed in rocky areas or on reefs
- No long-lining is allowed within 3 miles of Coiba Island
- Boats which fish within 3 miles of Coiba Island must first register with park authorities

Thus, the current situation of Coiba National Park can be creatively described as a “Transition from a Penal Colony to a Paper Park.” The central island of the park, Isla Coiba, and its surrounding waters have been afforded protection from extractive use due to the presence of the penal colony since the park was declared in 1991. As this area transitions from a prison to a vacation destination, the management authorities will face numerous challenges, the first of which is how to protect the park from damaging extractive use such as longlining, gill netting, and trawling without the presence of the National Police.

Chapter 4 will describe the “human ecological profile” for the stakeholders of Coiba National Park. This profile outlines the governmental and non-governmental organizations involved, as well as the fishing communities which exist in the areas surrounding Coiba National Park.

4.1 THE GOVERNMENT

The human ecology, or “cultural ecology” of a coastal environments are the human components of the system that are inter-related with the non-human components. This is an important concept, as it allows us to make recommendations which consider the cultural as well as the physical ecology of the coastal environment in question. The concept of cultural ecology, as explained by Dr. Michael Orbach, constitutes the human constituencies of the coastal environment itself and the humans who constitute the relevant policy and management structures^{xv}. Human ecology, for the purpose of this discussion, shall be defined as the legislative entities with interest or oversight, administrative agencies with authority or responsibility, and other relevant public and private sector entities and constituencies^{xvi}. The human ecology “network” of Coiba National Park is, as expected, a complicated one (*See Figure 1, Appendix B*).

The Republic of Panama is a sovereign independent nation with a democratic, representative government, modeled after the government of the United States of America. The federal government is divided into legislative, executive, and judicial branches. Government entities can be separated into three categories: State Ministries, which are part of the Executive branch, Decentralized institutions, and Independent organizations. On the executive side, I will begin by describing the relevant ministries which may be involved in the management of Coiba National Park and its surrounding communities. The *Ministerio de Desarrollo Agropecuario* (MIDA), or the “Ministry of Agriculture and Aquaculture”, is most likely the only one of the government ministries to have a stake in relevant issues. In fact, MIDA has several development programs present in the communities around Coiba National Park. MIDA has one regional office which controls aquaculture and another which deals with cattle ranching. Cattle ranching happens to be the other main source of employment besides fishing for the villagers who fish in Coiba Park, so a regional development initiative would necessarily involve MIDA. The heads of the ministries are also members of the presidential cabinet, so there is obviously political pressure involved with the management of this agency.

MIDA is also responsible for fishery management on the continental waters outside of Coiba National Park. They collect statistics on capture, capture per unit effort, and fishing effort, develop technology for management of commercially exploited marine species, and evaluate populations of commercial fish. They are also tasked with publication of results of research on subjects relevant to management of fishery resources. Currently, there is no communication between MIDA officials and the park management. Since the park's presence and proper management will necessarily impact surrounding fish stocks, MIDA should have considerable input into the management of Coiba park. In summary, MIDA has the responsibility and authority for managing fisheries outside of park boundaries.

Enforcement of regulations outside of park boundaries is the responsibility of the Panamanian Maritime Authority (*Autoridad Marítima de Panama*, AMP). They enforce all boating and fishing regulations in state waters, which include Panama's territorial sea as well as the submarine continental shelf. The AMP is a decentralized institution. The AMP's jurisdiction ends at the park boundary, and there is little evidence of historical cooperative activity between the ANAM park authorities and the AMP. The AMP, which was established in 1998, is also charged with "Administering coastal and marine resources" and "promotion of socio-economic development related to the maritime sector^{xvii}."

IPAT, the Panamanian Tourism Institute (*Instituto Panamenio de Turismo*), is another decentralized institution which is tasked with tourism development as well as development of both foreign and local investment opportunities related to tourism. IPAT has expressed interest in development of tourism infrastructure in Coiba Park and surrounding communities, but no concrete plans nor cooperative efforts with ANAM have been developed. With neighboring Costa Rica rivaling Panama's pristine resources and yet far outpacing Panama's meager tourism economy, there is great incentive for IPAT to stimulate ecotourism in Panama. Coiba National Park would therefore be of great interest to IPAT for the development of a regional ecotourism industry. In fact, the primary reason for the decommissioning of the penal colony on Coiba Island is to create a more tourist-friendly environment in the Park.

Finally, and most important among the relevant decentralized institutions, is ANAM, the National Environmental Authority (*Autoridad Nacional del Ambiente*). ANAM is set up with a national office in Panama City, and a regional office in each of the 9 provinces throughout Panama. Under the head ANAM administrator are 4 national “*direcciones*,” or management boards, which deal with specific issues. One such board is the *Dirección de Patrimonio Natural*, or the Board of Natural Patrimony (*See Figure 3, Appendix B*). The Board of Natural Patrimony is broken into three offices. One office, the Administration of Protected Areas and Wildlife, oversees all protected areas in Panama, including Coiba National Park. The park guards report to regional administration in the province of Veraguas where the park lies. Although a few islands of the park are technically in the province of Chiriqui, that province does not oversee any park activities. The regional administration reports in turn to the national office in Panama City.

At present, the park rangers and Veraguas province officials at ANAM feel that their responsibilities of park regulation enforcement is impossible due to a lack of physical and financial resources. Also, the park guards feel that they have reason to be concerned for their physical safety when they stop and cite a boat for illegal fishing activities. Many fishing vessels are armed and some are rumored to be involved in the Colombian drug trade. ANAM guards told me in personal conversations that they will need either weapons training and certification to carry arms or the cooperation of the National Police in order to do their job.

4.2 NON-GOVERNMENTAL ORGANIZATIONS

On the non-governmental side of the issue, there are three organizations which should be considered. The first is the Smithsonian Institute of Tropical Research (STRI), which is located in the capital city of Panama. Dr. Todd Capson of the Smithsonian’s ICBG project is currently submitting proposals to stakeholders in order to increase park vigilance and to demarcate park boundaries. The park is of interest to STRI because of the rich and primarily unexplored natural resources, both marine and terrestrial, which could potentially be the basis for new research projects. Another non-governmental organization which has expressed some interest in the park is ANCON (*La Asociación Nacional para la Conservación de la Naturaleza*) which is known as the most influential

Panamanian NGOs. Finally, “*Araucaria: Cooperacion Espanola*”, a Spanish organization, has had a presence on the island for many years through a project called “*Proyecto de Coiba*” or The Coiba Project. The main objective of this project was the development of a biological laboratory on the island to catalogue the park’s biological resources. There was a substantial amount of basic research and a preliminary catalogue of organisms was published, but the presence of Araucaria has been fading in recent years. The Spanish presence on the island was rumored to be connected to a fairly large-scale tourism development which was in the preliminary planning stages for the island. As the outlook for such a development dwindled, so has the presence of this Spanish organization, although there is some continuing although minimal scientific research still taking place.

4.3 COMMUNITY STRUCTURE – PEOPLE AND GOVERNMENT

Finally, and possibly of greatest importance, is the structure of the communities in the towns and cities whose fishermen utilize park resources. There are three main types of fishermen who are fishing in CNP. First are the local artesanal commercial or subsistence fishermen. These fishermen live in relative proximity to the park (within a one-day boat ride) and may be fishing for themselves or for a small commercial venture which owns the boat. Boats are small, 20-35 foot wooden boats with small outboard motors. There are usually around 4 fishermen per boat. The second are the commercial shrimp trawlers. Although shrimp trawling is explicitly illegal in park waters, fishing in the park is a common and openly admitted-to activity. These shrimp trawlers could be having some of the largest impact on park resources. Finally, there is a small group of local, recreational fishermen who come from large cities such as Santiago to sport-fish in the park. There is also one charter boat, the *Coiba Explorer*, which takes tourists to park waters for SCUBA diving and sport-fishing, but it is not currently known whether that boat is still in operation.

The local artesanal-type fishermen who fish in the park have been identified in at least thirteen communities of varying size in the park buffer zone (*See Map 3, Appendix D*). These communities range in size from small coastal villages with no running water and no electricity to larger communities such as Pedregal which are just a few miles from very large urban centers. The local community structure and the structure of the local

government is important to understand when looking at the potential involvement of such communities in park management and protection (*See Figure 2, Appendix B*). Some of these communities have been fishing in park waters for many years, and may not support the idea of having to fish in other than their traditional fishing grounds. Others have only recently begun fishing off the coast in park waters due to diminishing and unstable coastal resources or to a recent change in livelihood from agriculture to fishing.

The local government structure of these communities usually revolves around a community representative or a local board (*see Appendix B, Figure 2*). This structure, however, varies from community to community as far as who is the most influential person in a particular town. In general, the provinces (states) are divided into districts or counties, which are further divided into local “corregimientos”. These local areas are where the representante is most influential. They can be considered community leaders who have the respect within the community as well as some political influence which may be used to get things accomplished. These community leaders should be considered an important resource when designing and implementing community management initiatives.

In summary, there exists an intricate system of institutions, organizations, and communities who should be considered stakeholders in the management of Coiba National Park. There is a potential for more cooperative activity (horizontal integration) between federal agencies such as ANAM, AMP, and MIDA. Inter-agency cooperation should be developed between the agency which oversees fisheries (MIDA) and the agency which oversees the park (ANAM) since the park, if properly managed, could serve as a key element in regional fishery management. Enforcement of regulations inside (ANAM) and outside (AMP) park boundaries are another area of potential cooperation. There are well organized communities in regions surrounding the park that should be included in the management process as well. The next chapter will focus on the process of identifying which of these communities have the most significant impact on park resources through extractive fishing activities.

Results from this survey have demonstrated which communities or user groups are exploiting park resources. Results also provide a comprehensive description of those users groups including fishing gear,

time at sea, boat size, and fisher’s attitudes. A total of 169 surveys were used for this analysis. The distribution of surveys conducted in each village can be seen in *Figure 5.0*. The minimum number of surveys conducted in a single place

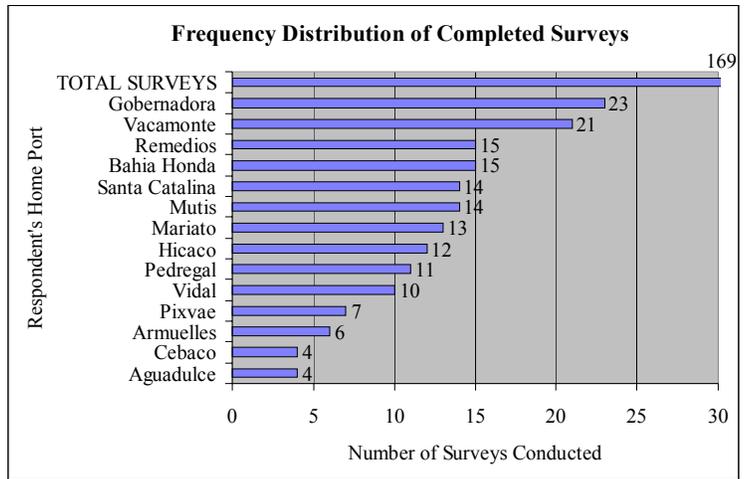


FIGURE 5.0 Distribution of surveys completed for each point of departure.

was 4 and the most was 23. Of the surveyed communities determined to be “significant resource users”, which will be explained in detail later, the minimum number of surveys conducted was 10 in Puerto Vidal and the maximum was 21 in Vacamonte.

5.1 IDENTIFICATION OF SIGNIFICANT RESOURCE USERS

The primary goal of the survey was to identify and describe the communities which fished most intensively in Coiba National Park. Initial analysis of the data identified five such communities and one industrial port. The first analysis was a simple comparison of the percentages of respondents who indicated that they fished in at least one area of

Coiba National Park. As can be seen in Figure 5.1, the six ports of departure reporting the most respondents indicating fishing in the park are Puerto Mutis, Puerto Remedios, Pedregal, Bahia Honda, Puerto Vidal, and Vacamonte. One problem with this approach, however,

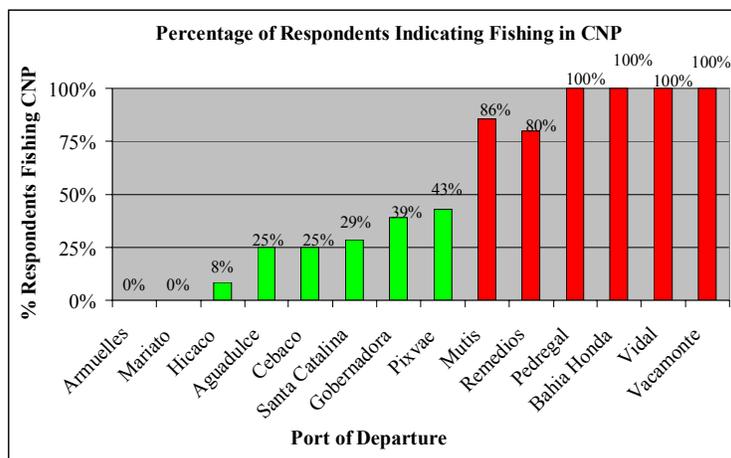


FIGURE 5.1 Percentage of respondents who indicated fishing in CNP.

is that it does not give an estimate of fishing intensity, and therefore a fisherman who fishes on one small island in the corner of the park is weighted equally with a fisherman who spends his entire fishing trip fishing around all of the park’s islands. I therefore performed a second analysis which took into consideration the number of islands of the

park which were fished. I divided the park into five general areas: Coiba Island, Jicarón/Jicarita, Coibita, Contreras, and Canales. I then calculated the total number of possible “hits” in those regions. For example, if one fisherman was interviewed, there would be five possible “hits”, one for each area. If ten fishermen were interviewed, the

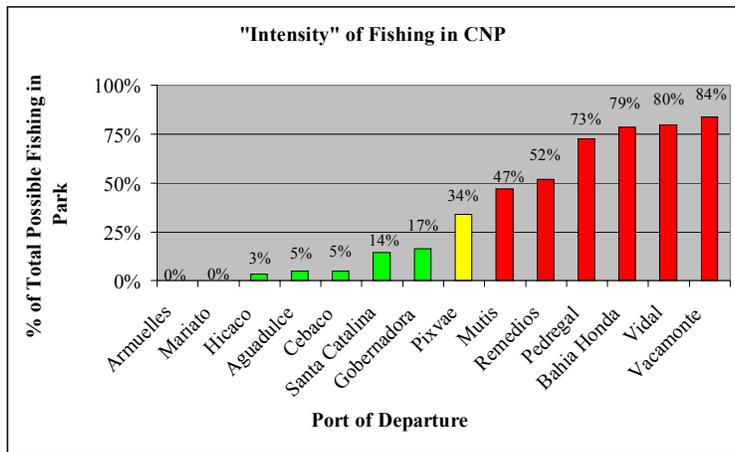


FIGURE 5.11 Fishing intensity in CNP by village

total number of possible “hits” was 50. I then calculated how many hits were recorded for each village and constructed a percentage of the total possible hits for each. A score of 100% would therefore indicate that every fisherman interviewed indicated fishing in every area of the park. The results (Figure 5.11) were nearly identical to the previous analysis, implicating the same six villages as before.

The only difference in the “intensity” analysis is that Puerto Remedios switched positions with Puerto Mutis. It can be thus determined that although more of the respondents from Puerto Mutis replied that they fished in the park (86% compared to 80% for Remedios) the fishers from Remedios actually fished in more areas of the park than those from Puerto Mutis. The village of Pixvae came in seventh position in both analysis, but has not been included in my list of the most important villages. This is due to the fact that at present there is only a single large fishing boat that leaves from Pixvae. The majority of fishermen in this village have been trained in construction and are working on a large private construction project on nearby Canales de Tierra that has guaranteed them employment for the next five years. The fishermen who remain in Pixvae are mostly fishing from small canoes with no motors in the Bay of Pixvae which is not within park boundaries.

It can therefore be concluded that the six ports of departure which are doing the most fishing within the boundary of Coiba National Park are, in order of intensity, Vacamonte, Puerto Vidal, Bahia Honda, Pedregal, Puerto Remedios, and Puerto Mutis.

It is worthwhile mentioning the communities of Santa Catalina, Gobernadora, and Pixvae as having reported between 29% and 43% of respondents fishing in park boundaries. These three communities reported “intensity values” of 14%, 17%, and 34%, respectively. These communities should be considered as moderately important communities in terms of their impact on park resources. As explained above, Pixvae residents are largely fishing in the nearby waters outside of the park boundaries. For this reason Pixvae need not be considered an immediate concern. Gobernadora and Santa Catalina, however, should remain a concern for park managers. The communities of Aguadulce and Cebaco, which each report 25% of surveyed fishermen fishing in the park, should not be considered large-impact communities. The reported figure of 25% only represent a single survey reporting fishing in the park, since the total number of surveys in these communities was 4. These communities were determined to be insignificant as a result of discussions and focus groups with fishermen. The 5% “intensity value” reported for each community more accurately describes the situation.

I was not able to find a parameter by which it was possible to correlate the fishing intensity in the park. The locations of the “Big Six,” the type of gear used, and the size of the communities all show no relation to fishing in the park. One hypothesis which remains untested is that there is a relationship between “access to ice” and fishing within the park. This may be the case as the length of fishing trips for those fishermen who fish in the park is approximately 10 days due to the distance of the park to the shore. If this is in fact the case, it can be assumed that with continued depletion of nearshore waters and increased development of communities (including access to electricity), we will see an increase in the numbers of fishermen fishing in the offshore waters around the national park. The following sections describe the “Big Six” group of communities in more detail.

“THE BIG SIX” COMMUNITIES COMBINED DATA

Using the combined data of the “Big Six” communities which fish most frequently in Coiba National Park, I analyzed gear use, catch, bycatch, and fisher’s attitudes and opinions.

Eighty-six surveys were conducted in the “Big Six” communities. One of the primary questions about these communities is the type of fishing gear they use. Unfortunately, the fishermen who were surveyed did not use just a single type of gear all year round, so the frequency of gear use must also be mentioned.

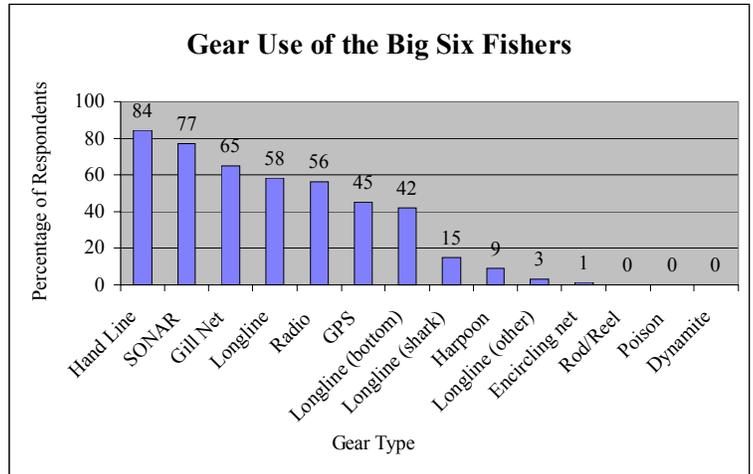


FIGURE 5.2.1 Gear used by “Big Six” fishers.

Figure 5.2.1 shows the fourteen types of gear and technologies listed on the survey, and the percentage of respondents who reported using each gear type. The two top gear types chosen were hand line and SONAR, 84% and 77% respectively. The fact that SONAR was mentioned by 77% of the respondents is not surprising due to the presence of the shrimp fleet and the well-equipped fleet of fishing vessels departing from Puerto Remedios. In addition, most of the boats that are fishing within park boundaries must be equipped for long-distance and long-duration travel.

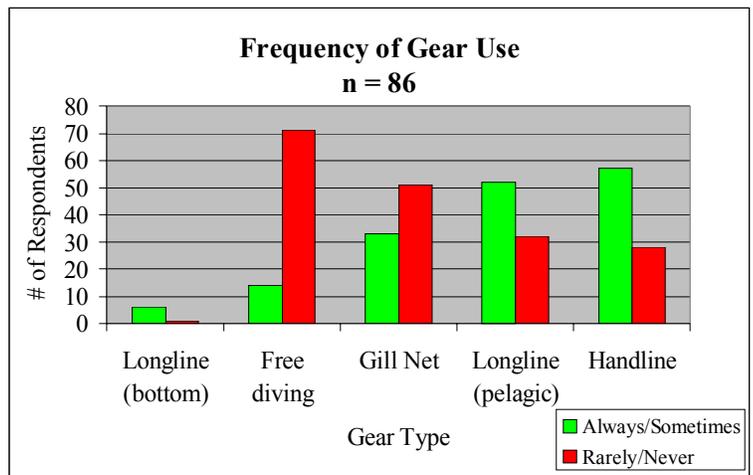


FIGURE 5.2.2 Gear frequently used by “Big Six” fishers (green).

Handlines refer to either lines which are tied to foam floats and set in the water near the boat or to “la maquina” which is a hand-cranked mechanical reel attached to the deck of the boat. Gill nets and longlines are also frequently being used by the big six communities, with reporting percentages of 65% and 58% respectively. The high percentage of fishers using these highly destructive practices should be a concern to park

managers. It is important to note that the data does not represent gear used in the park necessarily, only gear used by communities that reported some fishing in the park. However, this information does help provide an accurate description of the capabilities of those fishers who are working within park boundaries, whether legally or not.

Figure 5.2.2 shows the relative frequency of gear use for the “Big Six” fishermen. The survey asked respondents how frequently they used each of four general gear types or fishing methods: diving, longline, gill net, and hand line. The respondents had four categories to choose from: always, sometimes, rarely, and never. Sometimes was defined as “around 50% of the time you fish” and rarely was defined as “less than 50% of the time you fish.” In order to clarify the responses, I binned the responses further into two groups: Always/Sometimes and Rarely/Never. The green bars in figure 5.2.2 show that more than half of the respondents indicated either always or sometimes using longline. There was a similar response for hand line, but I feel that these data need further clarification to be fully understood. Those who selected frequent use of longline were likely using longline as their primary gear type. Handlines are used frequently, but are not, except in a very few cases, the primary gear used. The more qualitative data and open ended responses showed that handlines are often used during some portion of the day in order to catch fish to eat or fish to bring home to the family. They are also used as a last resort when the fishers have no luck with other gear types. I would therefore conclude that although handlines are used “frequently,” they do not reflect a large portion of the time spent fishing. Another concern is the large percentage of fishers indicating fishing with longlines. Many of the longliners have recently switched over to fishing with this gear, and they are targeting shark. There is an emerging market for shark fins, and there are a few wealthier fishermen who have been making arrangements to finance other fishermen to switch from other gear types to longline. They then sell their catch to these fishermen in order to pay off their debt. One fisherman in particular told me during an interview that he could pay off the debt for the new gear in just a few good fishing trips. He then continued to sell his catch to this debtor “middle-man” even after his debt had been paid in full. This switch to longline fishing is cause for concern. Longline fishing has many problems with sea-bird and turtle bycatch. Longline fishers reported such turtle bycatch (*See Figure 2, Appendix C*).

The targeting of shark, snapper, and grouper, and is also a concern from both the ecological perspective as well as an economic one. From the ecological perspective, these species are both long living and slow growing, making overfishing a likely occurrence and population recovery difficult. Direct exploitation has resulted in a decline of a number of long-lived fishes including pelagic sharks, swordfish, groupers, rockfishes, and sturgeon.^{xviii} Some of the shared characteristics of these species are low natural adult mortality, relatively large body size and large adult biomass, delayed maturity, and breeding in predictable locations and at predictable times^{xix}. In addition, grouper are susceptible to reproductive success declines at low population levels. (the Allee effect, depensation, inverse density dependence)^{xx}. This should be considered a very serious and irreversible consequence of overfishing fishes such as grouper. In such cases, reduced mortality (cessation of fishing) may not be sufficient for population recovery, especially if exploitation has been intense, and populations may never recover to a pre-exploited state.

For Coiba National Park, there is a great incentive to prevent the fishing of these species. Perhaps the most obvious reason is the popularity of these species to tourists, especially SCUBA divers. There are few places in the world where divers can experience large grouper, shark, turtles, and diving birds such as Cormorants. The fact of the matter is that people will pay large amounts of money to SCUBA dive if there is a chance they will encounter shark or large grouper. Some shark species such as hammerhead are especially attractive to divers. These are all species which are either targeted or caught as bycatch in the longline fishery, and the loss of such species would be devastating both ecologically and in terms of lost tourism revenue to Coiba National Park. In addition to their use of longlines, over 30% of respondents also said they used gill nets either always or sometimes.

The next step is to identify what the fishermen are catching. The survey asked fishers to rank the top three species which they caught for each of the four primary gear types. The responses were compiled by taking the data from the top three choices for each fisherman

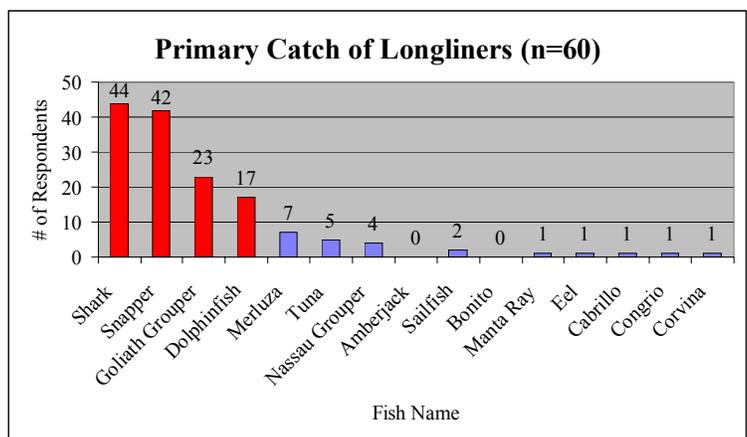


FIGURE 5.2.3 – Longliner principal targeted catch.

and combining it into a single list. This compilation can be seen in Figures 5.2.3 – 5.2.5.

Longliners comprised 60 of the 86 “Big Six” respondents surveyed. The top targeted

species are shark, snapper, grouper, dolphinfish, and “*merluza*.” For this survey question, the term “*linea*” was utilized. In Spanish, “*linea*” signifies “longline,” but there are regional differences in how fishermen referred to their equipment. In some villages, “*palangre*” or “*palandre*” is used to describe a demersal or bottom

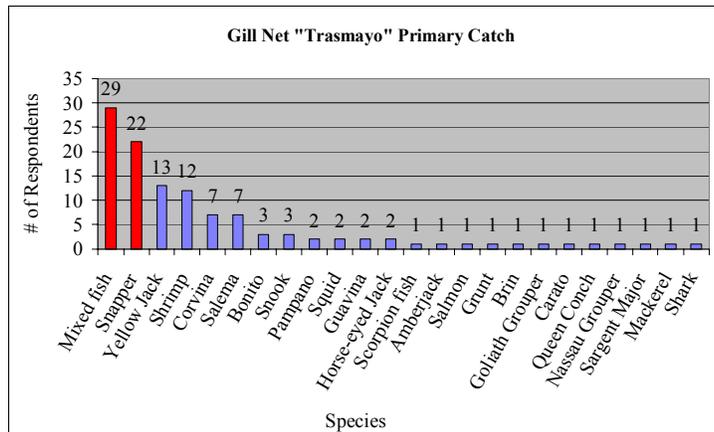


FIGURE 5.2.4 Primary catch for gill nets

longline. “*Linea de Tiburon*” or “shark line” is specifically used by those who use steel gangion for targeting shark. These more specific names were not used for this particular question, and this data displays a mixture of the aforementioned longline types.

The primary catch reported for gill net fishers (29 of 65 respondents, 44.6%) was “*revoltura*,” which in a direct translation means “scrambled.” This is a term used for a mixture of various species of small or juvenile fish, and can include amberjack, yellowjack, horse-eyed jack, pampano, snapper, scorpionfish, and schoolmaster. Snapper was the other most often mentioned catch for gill netters. This analysis did not distinguish between drift nets and set nets and it is recommended that future data collection address this difference.

Handline catch (Figure 5.2.5) is by far dominated by snapper. 82 of 84 (98%) of respondents indicated snapper as a primary catch, with *revoltura* far behind in second place with 16 of 84 respondents (19%). It would appear from this

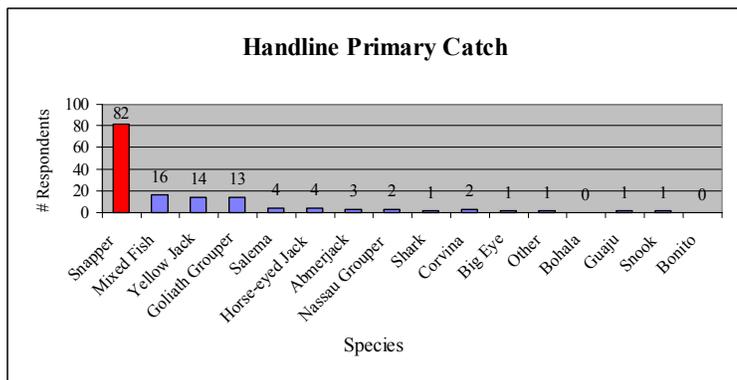


FIGURE 5.2.5 Primary catch for hand line

data that the primary targeted species overall are snapper, *revolutura*, yellow jack, and grouper. In order to assess the most targeted species independent of gear type, I asked respondents to review a long list of species names and record the frequency at which they caught them. Figure 5.2.6 shows landing frequency by species. The answers

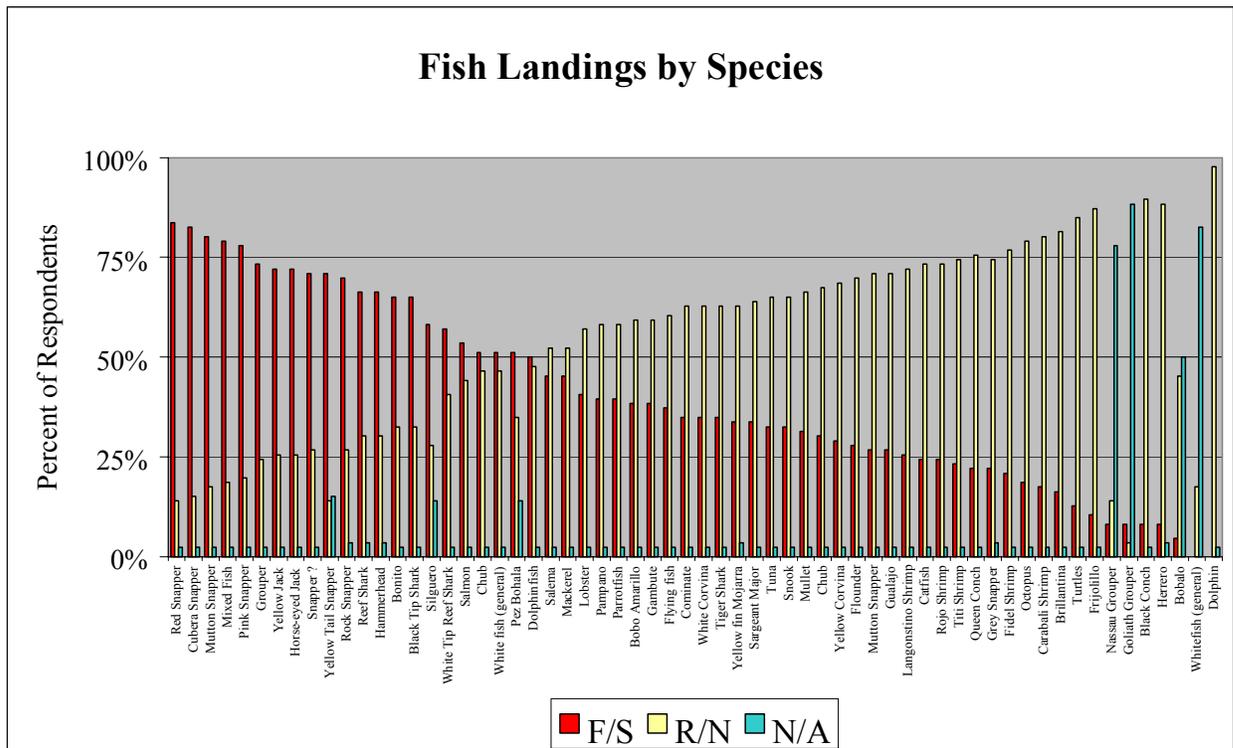


FIGURE 5.2.6 Landing frequency by species. Red denotes fish reported as being caught frequently or sometimes; yellow as rarely or never; blue denotes no response or the respondent did not recognize the name.

“frequently” and “sometimes” were again binned into a single group as were “rarely” and “never.” According to this data, snapper, *revoltura*, and grouper are in fact among the most often targeted and landed species. Other species for which at least 50% of the respondents replied “frequently or sometimes” are: yellowjack, horse-eyed jack, various sharks including hammerhead, rainbow runner, and dolphinfish. Effective management of snapper stocks must be implemented on a regional basis to prevent a collapse such as has been the case in the Gulf of Mexico red snapper fishery.

There are three basic types of *bycatch* involved in fisheries. *Kept bycatch* are nontarget species that are retained by the fishery, as is common amongst the shrimp trawlers of Panama. *Discards* are animals discarded after capture, either dead or alive. *Unobserved mortalities* include mortalities of animals that are due to gear interactions, but are not captured by the gear^{xxi}. It is too early to be able to determine conclusively if removal of large predators alter the structure and function of marine ecosystems, but experimental work does suggest such effects. One reason for the difficulty of conducting such research is the lack of knowledge of what a *true*, unaltered large marine ecosystem should look like, due to the consequences of a long history of overfishing^{xxii}. Crowder and Murawski

(1998) suggest the usefulness of an *adaptive management* approach to regulating bycatch in fisheries. This approach takes the uncertainty of the effects of management decisions into account, and requires experimental evaluation of the results of such decisions. It also allows for enough flexibility that changes can be made to management decisions based on the experimental results. In addition, Corwder and Murawski stress the importance of utilizing marine protected areas to evaluate the effects of fishing practices by providing a large area where such practices do not take place. MPAs can provide important “control” areas which make fisheries management decisions more effective^{xxiii}.

A preliminary assessment of the bycatch fishermen reported with their catch was conducted. Some species that are obviously not targeted, such as dolphin and turtle, can be extrapolated from Figure

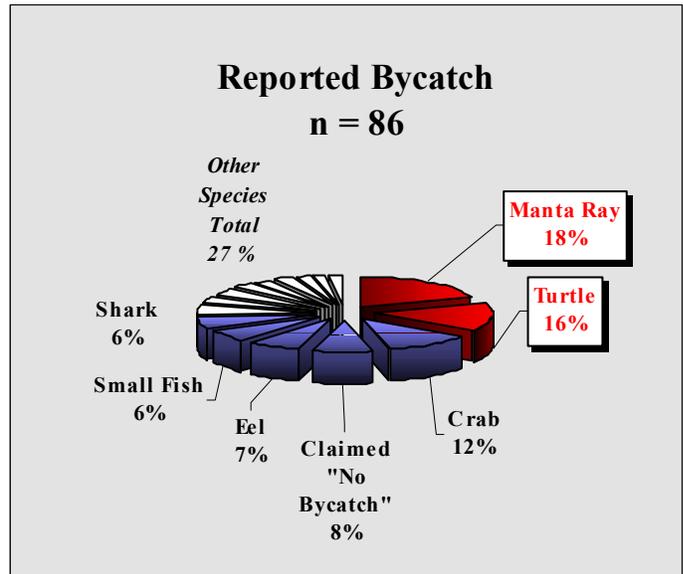


FIGURE 5.2.7 Bycatch reported by the “Big Six” fishers.

5.2.6 above. (See Figures 1 and 2,

Appendix C for specific data on reported

frequency of turtle and dolphin landings; Shrimp trawler’s capture of turtle and dolphin can be seen in Figure 3, Appendix C) For example, 22% of respondents indicated “rarely” capturing dolphin. These were primarily gill net interactions. Over 23% reported “always” or “sometimes” landing turtles. When I first visited Pedregal I examined the cargo hold of one longline boat which had just returned to port and I found turtle meat and fins which the fishermen were taking home to eat. In discussions with shrimp fishermen in various ports I was alerted to the fact that many shrimp boats carry TED’s aboard (as is required by law) but they do not use them or they sew the opening closed because they believe their presence reduces catch, especially of large fishes which they can and do sell at the shrimp port when they return from a trip. This survey question, however, did not specifically ask about bycatch. To accomplish this the survey asked, “What things do you catch accidentally in your net or on your line?” This would signify non-targeted catch. Interestingly, the two most reported answers were manta ray and turtle. Eighteen percent of respondents reported manta ray bycatch and sixteen percent of the 86 surveyed reported turtle bycatch (See Figure 5.2.7). Only 6% reported

shark bycatch, and I believe this low number is because the majority who catch shark are specifically targeting those animals. On the other hand, many of the gill net users reported catching small sharks quite frequently in another section of the survey. The 12% who reported crab bycatch were likely shrimp trawlers. Eel (often specifically the moray eel) was reported as bycatch by 7% of the respondents. The remaining 27% was made up of various species which were reported as bycatch by only a small percentage of respondents.

Fisher’s opinions should be considered a very important part of managing any fishery. It has been said many times by many people that fishery management is not about managing the fishery, but about managing the people.

Managing the fishing within a National Park should address the issue in the same way.

I therefore asked the fishermen six questions where they had to choose between “I agree,” “I disagree,” “I don’t know,” and “No comment.” Item non-response was also recorded.

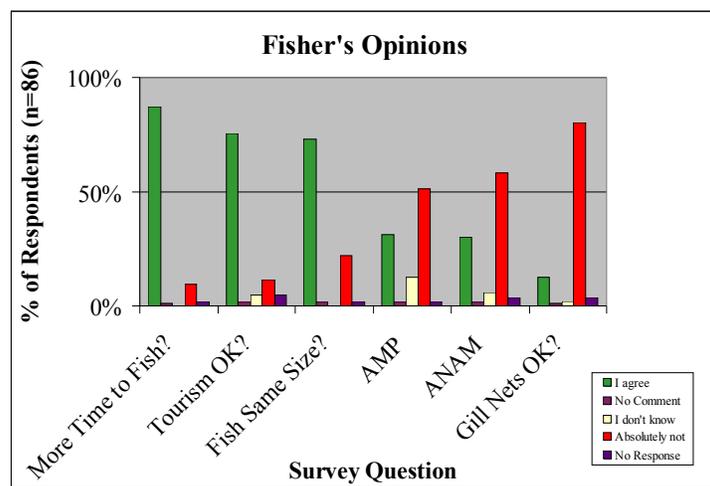


Figure 5.2.8 Fisher’s opinions towards various issues: Does it take you more time to catch the same amount as in years past? Could tourism be a good thing for the region where you live? Are the fish you catch the same size as in years past? Does AMP respond to the needs of fishermen? Does ANAM respond to the needs of fishermen? Do gill nets do the same amount of damage as other gear types?

(See figure 5.2.8) Two questions had to do with the perceived state of the fishery. Respondents were read the statement, “Recently I have had to fish for a longer period of time to catch the same as in years past.” As expected, an overwhelming 87% of the fishermen agreed with this statement. Next they were read, “The fish that I catch are of the same size as in years past.” A 73% majority agreed with this statement as well.

The next two questions aimed to assess their opinions on tourism and the use of gill nets. They were read, “The development of tourism could be a good thing for my community.” 76% of the 86 respondents agreed with this statement, while only 12% disagreed. This is encouraging news considering the high potential the area in and around Coiba National Park has for ecotourism development. Such tourism could supply a much needed

employment alternative for the many fishermen in who live outside the park. Their opinions on the use of gill nets was assessed by reading the statement, “The use of gill nets does not do any more damage to the environment than other types of gear.” A surprising 80% of respondents, including many gill net users themselves, strongly disagreed with this statement. I can recall quite a few respondents telling me how much damage they can cause, especially when they are lost. One respondent in particular told me that he knew he was doing a lot of damage by fishing with gill nets, but he said that he has to be able to feed his family somehow.

The last two questions asked the fishermen how they felt about two regulatory agencies, the National Environmental Authority (ANAM), which has jurisdiction within park boundaries, and the Panamanian Maritime Authority (AMP), which has jurisdiction on the waters outside of Coiba National Park. The question was phrased in a positive manner (so as not to lead respondents towards a negative answer) and stated that the agency does indeed respond to the needs of the fishermen. The majority of respondents disagreed with the statement for both agencies, 51% for AMP and a slightly higher disapproval rating of 58% for ANAM.

Whatever the reason behind these feelings, it is clear that ANAM must try and work more with the fishermen in its management of the park. With 58% of fishermen feeling that their needs are not being addressed, ANAM would be wise to develop better relations with the people whose livelihoods depend to some extent on the resources ANAM is tasked with protecting.

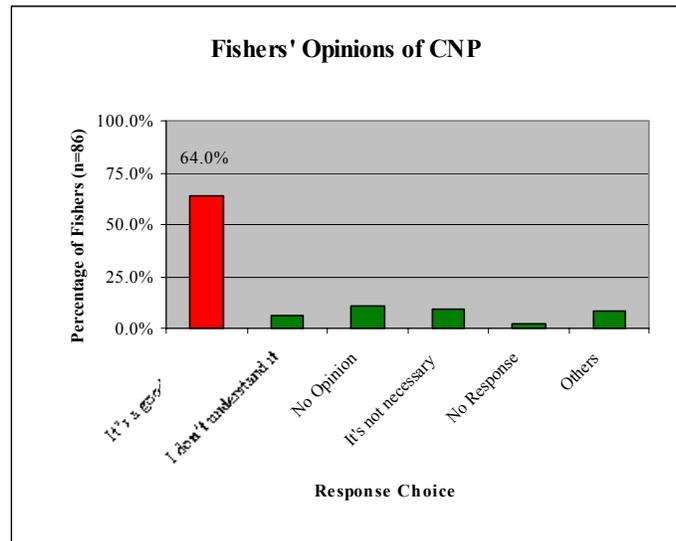


Figure 5.2.9 How do the “Big Six” feel towards what they perceive to be Coiba National Park?

Respondents were also asked to describe their opinion of Coiba National Park. The majority (67%) of fishermen replied that they thought the park was, “A good thing.” This is another encouraging finding since this shows fishermen’s general appreciation of the park and that they may value the resources that it is protecting.

When asked if they had witnessed illegal fishing within the park boundaries, 57% said yes. It is not unreasonable to assume that this percentage is actually somewhat higher and that some of the respondents who said no were perhaps afraid to tell the truth. Even if this is not true, over half of the people from the “Big six” communities have seen illegal fishing in the park. Considering that most people misunderstand the park’s boundary to be a 3 nautical mile radius around Coiba Island, this figure is surprisingly high. It can

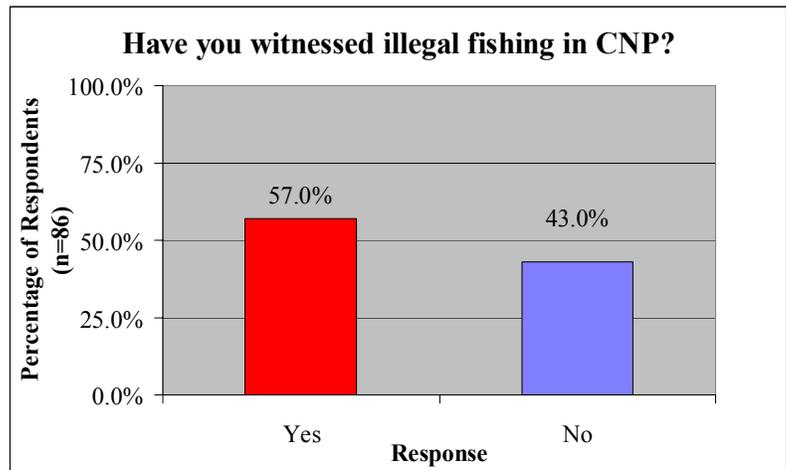


FIGURE 5.2.10 Over half of the “Big Six” fishers surveyed replied that they had witnessed illegal fishing within the boundaries of Coiba National Park.

only be assumed that with the removal of the prisoners and the national police patrols from the island, the illegal fishing in Coiba National Park will only continue and worsen, threatening the precious resources that have been protected and preserved for so long.

Finally, it is important to know some basic demographic information about these communities. The mean age of the 86 fishermen surveyed from the “Big Six” communities was 36.5 years. Over 74% of respondents said that they were originally from the town where they were currently fishing. Fifty-five percent had relatives who were older than them who were also fishermen. I expected there to be more fishermen who came from fishing families, however many told me during interviews that they had recently made a livelihood change from agriculture to fishing. Most of those involved in “agriculture” are actually cattle ranchers. Every one of the 86 fishermen in this group replied that they fished for a living; none could be considered “recreational fishermen.” Ninety-three percent of respondents said that their income was based primarily on fishing. Ninety-two percent reported eating the fish that they caught. The median length of a typical fishing trip was 8 days. Fishers reported a median of 2.5 trips per month lasting 8 days in length. The median number of fishermen per boat was five. The median overhead per trip (food, water, fuel, ice) was US\$700. Thirteen hours a day are spent fishing and half of the respondents said they spent more time fishing at night than during the day. Only 8%

reported fishing more frequently during the day. This information is valuable for park managers, as they will probably be more successful in protecting park resources if they run patrols at night than if they patrols just during the daytime. Not many of the fishermen who were interviewed owned the boat they fished from; 33.7% were working on someone else's boat. However, one would only expect around 20% of fishermen to be boat with an

| Question | Answer (median values shown) |
|--|---|
| Mean age | 36.5 years |
| Relatives Fished? | 55% Yes |
| Are you from here? | 74.4% Yes |
| Do you fish for a living? | 100% Yes |
| Family income primarily from fishing? | 93% Yes |
| Do you also eat the fish you catch? | 92% Yes |
| Do you own the boat you fish on? | 33.7% Yes |
| How long is your boat? | 35 feet |
| How many fishermen on your boat? | 5 people total |
| What is the overhead for a fishing trip? | \$700 / Trip |
| How long is a typical trip? | 8 days |
| How many trips per month? | 2.5 trips / month |
| How many hours / day fishing on a trip? | 13 hours / day |
| Do you fish more during the day or at night? | 50% more at night 29% the same time day and night 12% it depends on various factors 8% more during the day |

FIGURE 5.2.11 General description of the “Big Six” fishermen. Age of fishermen is reported as a mean. Other non-percentage values report the median.

average of 5 people on each boat. The median boat size was 35 feet in length. All boats that I saw, with the exception of some large steel shrimp boats, were made of wood.

The “Big Six” fishermen can thus be described as a group of fishermen who primarily utilize gill nets and longlines as their principal gear, with the obvious exception of the shrimp trawlers. A large portion of their reported discarded bycatch includes manta ray and turtle. They typically spend around 8 days at sea, take 2-3 fishing trips each month, and much of their fishing takes place at night. Most consume some portion of the fish they catch. In general, most of the fishermen feel that Coiba National Park is a good thing, although over half reported witnessing illegal fishing activities within their *perceived* park boundary.

The following are individual descriptions of each of the “Big Six” communities, in order of the most reported fishing within park boundaries to the least. The descriptions are made from both qualitative and quantitative data from focus group visits and interviews. It is my hope that this information may be useful for individuals who are considering working with or in these communities.

5.3 VACAMONTE – THE INDUSTRIAL SHRIMP PORT

Vacamonte is a large industrial shrimp port that is controlled by the Panamanian Maritime Authority, the AMP. There is a single entrance to the port which is gated and guarded by AMP officials. The first time I went to visit Vacamonte I went in a Taxicab from Panama City. The port is located about 45 minutes from the city. On this initial visit I arrived at the gate and was not permitted to enter. I was instructed to go to the main office of the AMP in Panama City and request a permit to enter the port. Later, while conducting interviews of shrimp fishermen at



FIGURE 5.3.1 A shrimp trawler at Vacamonte: target catch or bycatch?

a shrimpers “hangout” in Panama City, I acquired a contact who was a shrimp fisherman on disability leave. He offered to help me out and show me how to access the port without having to apply for a permit. Since time was of the essence, I agreed. We met the following day at the main bus terminal in Panama City. From there we took a bus which reads “Vacamonte” directly to the port. I discovered that only the 8am bus travels directly to the port and passes through the security gate. It is the bus that the workers and fishermen take to the port. The buses that leave later in the day stop outside of the port in the small town of Vacamonte. At the security stop an AMP officer boarded the bus, walked down the aisle, and walked off. I was never sure what the purpose of this “check” was, but no one was required to show ID of any kind. On a subsequent visit, however, the guard requested to see all persons’ ID cards. In Panama, it is required by law that all people carry an identification card at all times. The guard checked my passport and said nothing.

The port consists of an AMP office, the shrimp and fish processing plants, and a cafeteria for the workers. I spent the majority of my time in the cafeteria, which provided a good staging spot for my interviews. I selected my respondents with the filter question,

| Fishing Areas <i>within Park Boundaries</i> Identified by Respondents n = 20 | | | | | |
|---|----------|----------|-----------|-------------------|-------------------|
| | Coiba | Coibita | Contreras | Canales de Afuera | Jicarón/ Jicarita |
| Si | 16 (80%) | 14 (70%) | 20 (100%) | 19 (95%) | 16 (80%) |
| No | 4 | 6 | 0 | 1 | 4 |

FIGURE 5.3.2 Shrimp trawling within Coiba National Park

“Do you fish in the Bay of Chiriqui or the Bay of Montijo?” These are the general areas on either side of Coiba National Park (*See Map 3, Appendix D*). If they answered yes to either question, I interviewed them. If they answered no, I thanked them and told them I was interested only in fishermen who fish in that region. They often helped me locate individuals who did. The docks at the port hold around 300 large commercial fishing vessels, all but very few of which are shrimp trawlers. There are a handful of longline vessels as well. There is in fact some degree of education which takes place here. One shrimp-boat captain whom I interviewed told me that on occasion the captains are required to attend meetings in which they are told where they are and are not allowed to fish.

One of the most surprising results of the survey was the high percentage of the 20 shrimp fishermen who reported trawling in Coiba National Park. As described in the “methods” section above, I had survey respondents indicate on a provided map the areas where they commonly fished. The results of this data can be seen in Figure 5.3.2. (*See Appendix D, Map 4 for an example of a map indicating the fishing areas one shrimp fisherman labeled with the types of shrimp they caught in each area.*) As can be seen in Figure 5.3.2, 100% of those interviewed indicated trawling in at least one area of the park. The islands of Contreras, which is the part of the park furthest from Coiba Island, was most intensively fished. The least intensively marked area was the island of Coibita, which is very near the park ranger station. Even so, 70% of the trawlers still indicated fishing in this area. It is overwhelmingly obvious that there is some intensive trawling taking place in the park, and this is supported even further by the 39% of respondents who indicated they had witnessed other fishermen fishing illegally in “the park,” however they defined it themselves. One shrimper even told me during an interview that, “There will be more and more trawlers in the park when they take the prisoners off the island unless something is done to stop them.”

The most obvious problems that I found among the shrimpers as well as the artisanal fishermen was a general misunderstanding of the actual park boundaries. When asked where fishing was prohibited, only 11% of the shrimpers mentioned islands in the park other than the main island of Coiba. Even when fishermen talk about the “park,” they are often referring to the land of the island of Coiba and the waters on what is referred to as the “inside” part of the island. The part being referred to is the large bay on the eastern, landward side of the island, “Bahia Damas.” The penal colony and a coral reef are located within this region, and therefore many people consider this protected and patrolled area “the park.” In fact, 39% of the shrimp fishermen surveyed said the inside part of the island was the only part that was off limits for fishing. It is possible that a small amount of effort put towards educating shrimp fishermen as to the actual park boundaries and meeting with the boat owners about asking their captains not to fish in park boundaries could go a very way. Forty-five percent of those surveyed were boat captains, so it is clear that even the people in charge of the boats don’t understand the boundaries well. The majority of shrimp fishermen surveyed had 16-20 years of fishing experience, and the mean age was 45 years, so I was clearly not interviewing young mariners who hadn’t learned the regulations yet. I feel that educational efforts at the shrimp port should be implemented and would be effective, especially given the 61% of the shrimpers who said they thought that Coiba National Park was “a good thing.”

5.4 PUERTO VIDAL

Puerto Vidal is a small port town which houses about 15 large (25’-35’) fishing boats. The primary gear used is the longline and primary catch includes snapper and goliath grouper (*pargo y cherna*). Although these fishermen seem to be fishing in the park, this community should not be considered a great concern because of its small size and remote location. It can take up to six hours to travel by bus to Puerto Vidal from Santiago, the nearest major city. The roads are extremely poor and a 4x4 vehicle would be worthwhile, although not absolutely necessary. Puerto Vidal is primarily a port-of-access which many people from remote villages such as Pixvae and Bahia Honda utilize in order to travel to the interior. There is no housing available for visitors, however there is a large house near the police station, and the owner has apparently rented rooms in the past. Pixvae has a supply boat which leaves Puerto Vidal once a week and brings food, diesel, and other essentials to the townspeople. There is a bar near the port where many fishermen and boaters hang out while waiting for the tides to rise so they can leave. It

was rather difficult to locate the fishermen in this location. There were always about 2 or 3 boats anchored in the river just upstream of the port. It does not have the “tight” community feeling that some of the other villages had, and for this reason it might be difficult to get much more accomplished there than the posting of signs or holding a small meeting. I must add that these observations were based on two or three visits to Puerto Vidal, and should be taken into consideration but not necessarily be considered an accurate description of the town. However, of all the villages that I visited during my three months in Panama, this is the only village where I experienced a feeling of uneasiness or unwelcomeness. This may have been largely circumstantial. I initially overcame this when I was focus-group interviewing a captain and I recognized his last name and the manner in which he introduced himself. It turns out I had spent a good deal of time in a focus group with his brother in another port town. This served as an “ice-breaker” and he proceeded to introduce me to a few other fishermen who were in town.

Most of the fishermen here spend from 7-10 days at sea during a typical fishing trip. Ice is obtained at a plant facility at the dock. Two of the ten whom I interviewed targeted shrimp in addition to fish. Three of the ten also targeted shark. The average boat length was 31.8 feet with the smallest being 26 feet and the largest being 36 feet long. Sixty percent reported having fishermen previously in their family, so fishing appears to be somewhat of a tradition here. Only 3 of the 10 fishers interviewed owned their own boat, but this is again likely due to the fact that there are commonly 5 fishermen per boat during a trip. Snapper and grouper seemed to be a common target catch for these fishermen. All ten reported using handline while fishing, although not necessarily as their primary gear.

5.5 BAHIA HONDA

Bahia Honda has about 20 fishing boats operating, ranging from 18-35 feet in length, all of which are using longlines or gill nets, and occasionally spears for lobster diving. There are approximately 80 fishermen in the village, captains and mariners included. They sell their fish at Remedios and Puerto Mutis. Marco Gonzales, a fisherman in Puerto Mutis, finances longline gear for fishermen to use for shark finning. A few the fishermen in Bahia Honda had reported getting their start in longlining this way. He fronts them the gear or money and they pay him off by selling their catch to him; their

debt can usually be paid off in 2 or 3 good fishing trips. After they have resolved their debt, they usually continue selling fins to him. There is apparently no market for shark meat, so they are just finning at this point. As far as catch is concerned, one Bahia Honda *tiburonero* reported getting 70lbs for an 8 day trip in 1992, with bad years during 1994 and 1995. He reports now only getting around 30lbs of fins per 8 day trip. This typical gentleman is longlining with a 1000m longline with 50-80 hooks set. An 8 day long trip with 4 men total on the boat runs expenses in gas, food, and ice of about \$250. A typical catch might consist of 500lbs of fish and 35lbs of shark fins with a total value of around \$1000, netting the fishermen a total profit of \$750. Baitfish are caught with a gillnet. One fisherman said a Taiwanese company “Oceanis” also buys shark fins from the fishermen here.

The typical fisherman from Bahia Honda considers the boundary of Coiba National Park to be a three mile buffer around the main island of Coiba (*See Map 5, Appendix D for a map of this perceived boundary.*) To that effect, one fisherman reported that, “Everyone from here [Bahia Honda] fishes inside the 3 mile park boundary because there are no fish outside of 3 miles.” There is an great misunderstanding of where the true park boundary lies. This fact, along with the fact that the majority have “traditionally” fished within park boundaries, gives Bahia Honda the potential to be the source of great conflict in the future. The people believe that they have the right to be fishing in what we call the “park” because that is where they have always fished. Putting a stop to this activity will not be met without resistance, unless the fishermen of Bahia Honda feel that they have a real stake in the decision making process.

5.6 PEDREGAL

Pedregal is a large city of around 18,000 residents which lies just a few miles south of David, the second largest city in Panama behind Panama City itself. The small-scale local fishermen fish in very small boats, one or two to a boat, and do not venture far from home. However, there is a large long-line industry in Pedregal. There are two companies, *Desapesca* and *Dimantín* which control most of the market. A typical 35’ longline boat is well equipped electronically and will be at sea for 10-12 days. Despite the long trip, some fishermen reported fishing within park boundaries. Target catch is *dorado*(dolphinfish), shark, snapper, and Goliath grouper. Since the fishermen are

working for one of two large companies, “controlling” violations within park boundaries should be relatively simple. The “representante” of the community, the *Honorable* Rito Barret, was a great help and was very supportive of the project. He is very interested in working with anyone who is in favor of sustainable fishery management, and is well respected in the community. During one particular visit to his house, we were standing outside the front of the house. Nearly every car which drove by honked and waved hello. Without interrupting our conversation he smiled and waved back, as if it was something he was very used to doing. Despite the size of Pedregal, there is a very tight-knit community feeling. There are a number of shrimp boat captains who live in Pedregal, but who work out of the far-away port of Vacamonte. They regularly travel by bus or car to the port, which is around a six hour trip each way. It is very easy to get around the town, and the people are very friendly and cooperative. I spent some of my time at the two fishing companies’ docks, but the majority was spent going from household to household speaking with the fishermen in their own homes. In the process, I was able to enjoy many delicious home cooked meals. Of the eleven surveys conducted in Pedregal, all but 2 reported targeting shark. The catch that they reported catching the most of recently was dolphinfish, grouper, and snapper. The majority of the fishers are longlining and have relatively sophisticated equipment aboard (100% of the fishers surveyed reported having SONAR aboard, all respondents use GPS, and all but one have radios).

As far as the gear they are using is concerned, all of the 11 respondents use pelagic longlines (for shark, dorado, tuna, etc.), and all but one used demersal longlines for species such as cherna and pargo. Five of the eleven admitted having caught turtles on their longlines, with one saying he could hook up to 50 on their 8 miles of line. Another fisher told of a time when they caught 52 turtles on a single line. All but two of those were still alive, and there were more males than females (*he said he could tell by the tail length*). The longlines range from 3 to 32 miles in length. In addition, 73% reported using the mechanical handline “*la maquina*” for snapper. One fisher said he used 80m lines on this equipment. Only two respondents have radar. The average fisherman surveyed in Pedregal had 17 years of fishing experience. The majority, 64%, do not own the boat they fish from. Only 1 of the 11 uses a gill net and only uses it “occasionally for bait.” Nearly half, 45%, admitted to having seen others fishing illegally in the park. Again, most fishermen believe there 3 mile limit that is the prohibited zone for CNP.

I feel that this community is an important one to target for community outreach and the cooperation of officials will be easily attainable.

5.7 PUERTO REMEDIOS

The vast majority of fishers in this town work for one of two owners of fishing/exporting companies. One is Eduardo Correa, owner of a fairly large fishing fleet of about 25 boats. The boats are well equipped and are likely to be fishing in CNP. The primary gear being used is the longline and drift net. The other business owner, who lives on the other side of town, has a smaller fleet of around 10 boats. The survey was conducted during a festival when all the fishermen were in town, so this can be considered one of the most representative samples taken, since the fishermen had a fairly equal chance of getting surveyed. A total of 15 fishermen were interviewed. Most take between 3 and 4 trips monthly, with each trip lasting from 7-10 days. None of the 15 said they targeted shrimp or lobster. All target fish and 75% target shark as well. Only 40% own their own boats, since the owners of the exporting businesses own many of the boats in town. The primary gear used are longline and gill nets. Gill nets are used by 87% of those interviewed, and longline by 73%. Longliners primarily target snapper, grouper, shark, and dolphinfish. Twenty percent of the fishers said they free dive (spearfish) as well. The boats they use are fairly well equipped. Sixty percent have SONAR, 20% have GPS, and 67% have a radio aboard. The boats that are owned by Eduardo Correa are all very well-equipped with these technologies, and they communicate frequently on the radio to advise each other of weather and fishing conditions.

It is my belief that this community is a very important one in terms of protecting park resources. The combination of the number of fishermen from the town, their non-selective gear, and the species they are targeting should make Puerto Remedios a strong concern for park management. It must also be understood that there are two fairly large and successful businesses which are benefiting from fishery resources in the region. Both owners were very helpful and cooperative during focus group investigations and the survey implementation, and could prove to be good points of contact if approached in the right way. It might also be worth mentioning that I heard from fishermen in other villages that Remedios, due to its proximity to the inter-American highway, is rumored to be a port that is utilized in the trade of illegal narcotics. I saw no evidence of this during

my few visits, but it might be worthwhile to know that there is a possibility of this type of activity related to the fishing industry.

5.8 PUERTO MUTIS

If I had to choose a place to initiate or test a community education or management initiative, it would probably be Puerto Mutis, due to its accessibility, the number of fishers who utilize this port, and the people I interacted with there. There is also an ANAM office nearby. This is a small town located just south of Santiago. It is easily accessible by car or bus from Santiago in less than 1 hour. The town houses a large port from which many 30'-40' fishing vessels leave. There are some other small communities such as Montijo and Rincon Largo which are nearby and use the port here as a point of departure. Many of the boats from this port seem to be fishing in the park both illegally with gill nets and legally with handlines, targeting grouper.

A total of 14 total interviews were conducted here. This was the site of our very first survey implementation. The fishermen here take an average of 2.6 trips per month, and all but one reported a trip length of 7-10 days. Only about 1/3 of those interviewed are boat owners. All fishers reported targeting fish, 79% target shark (mostly around Coiba and Jicarón), 4 of the 14 target lobster, and 3 of the 14 shrimp. The species which are primarily targeted are snapper, goliath grouper, and *merluza*. All 14 reported using hand lines, 79% use a demersal longline, 36% use a pelagic longline, and 43% use gill nets. The boats are well equipped, with 93% reporting having SONAR, 42% with GPS, and 57% with radar. Six of the fishermen said they used gill nets sometimes or always, with 8 saying rarely or never. Nine said they used longline sometimes or always, with five saying rarely or never. Many of the longliners use gill nets for catching bait, and handlines on occasion. Although Puerto Mutis ranks lowest among the Big Six communities, it remains an important community in terms of protecting Coiba National Park, and might be a good starting point for implementation of community based programs.

6.1 ENFORCEMENT

Creating policy alternatives to resolve the problems of park regulation enforcement and illegal fishing activities is no simple task. A few things are essential to the success of park management. The first, and most obvious task should be to enforce current park regulations and to eliminate illegal fishing in the park. It is especially important to eliminate destructive fishing practices such as trawling. This can be accomplished with improved boundary demarcation and increased patrols around the island. Panama is a developing country, and it can be expected that the park agency ANAM may always lack the resources, including money and personnel, to effectively and properly manage a park of this size. Some creative way of involving the local community in the stewardship of these resources is needed.

An option for helping ANAM with the process of patrolling the park would be the training of the National Police who are currently guarding the prisoners on the island to become park guards. This would eliminate the need for weapons training and certification, which, in the words of current park guards, is a necessity if they are to make stops and issue citations for illegal activities within the park. Fishermen and those involved in the transport and sale of illegal goods by boat are known to carry arms, and it is in the best interest of the park guards to be armed. Another possibility would be to involve local fishermen in the patrolling of the park. With a park the larger than the land area of Rhode Island, it is easy to imagine the large number of boats that would be needed to patrol the waters effectively. Local fishermen already have boats and know the waters around the islands well. They could be trained as a “civilian patrol force” and patrol the marine waters, perhaps even in exchange for fishing rights within the park or a regular salary. Their boats would have to be equipped with radios so they could alert the park police of illegal fishing without having to make stops themselves.

6.2 COMMUNITY INTEGRATION

The next focus of park management should be to integrate key communities and other stakeholders into the decision-making process. Some communities have a history of fishing within the park, and it will be necessary to have their cooperation. The best way

to accomplish this is to give these communities a say in the decision-making that goes on. If they feel like they are “part of the park” it is much more likely that they will cooperate and even help with park protection as opposed to being “outsiders.”

6.3 MANAGEMENT OF LEGAL FISHING

Legal fishing within park boundaries (i.e. “hook and line” fishing and sport-fishing) also needs to be managed sensibly. Currently, it is not known what type and intensity of fishing activity can be considered “sustainable” within the park. In order to achieve conservation objectives, one must consider how many fishers and of what type will be allowed to fish legally with “hook and line.” It is quite possible for an unregulated hook and line fishery to have serious impacts on the park ecosystem. For this reason, certain significant areas of the park should be designated as “no-take” regions. As explained in section 1.1, no-take marine reserves should play an important role in MPA management. With this in mind, I recommend the historically enforced 3 nautical mile area around Coiba Island (*See Map 5, Appendix D*) be enforced as a no-take zone where no extractive activities of any kind are permitted. This area would likely not be a source of great conflict since it is the area that is currently understood to be “off limits” by many fishermen. In contrast, attempting to enforce a no-take zone where fishermen have traditionally fished will be much more controversial. The second reason why I propose this area is that because of its relatively pristine state it might provide an important “control” for scientific experiments on the effects of fishing activities on ecosystems in nearby regions.

6.4 ALTERNATIVE EMPLOYMENT OPPORTUNITIES

Finally, many of the communities rely on fishing to sustain themselves, and there may be no real alternative for work in that community. Thus, reasonable alternatives must be considered in order to rectify this problem, especially if legal fishing effort within the park must be reduced. It is important to remember that changes in administration bring changes in policy, as we have seen in the environmental policies of the United States in recent years. The current ANAM administration is supportive of conserving Coiba Island in its current, undeveloped state. However, there is no guarantee that future ANAM administrators might not concede large portions of the island’s coast to large-scale resort

development. This possibility must be considered, as policies undertaken in the near future which should be designed to prevent or discourage this sort of development in the future. Developing a specific “eco-tourism” plan that emphasizes and benefits from the undisturbed state of the park is one method that may help prevent future development of the island.

A policy option, which I consider a necessity to the long-term survival of the park, is the development of local tourism in the villages near the park. Due to its remote location ten or more miles off the mainland coast, the main island of Coiba is inaccessible to the majority of potential tourists. The Lonely Planet tour book for Panama^{xxiv} currently describes lodging and transportation to Coiba National Park, but only the most adventurous and creative traveler, foreign or local, would be able to manage planning a trip to the park. In fact, I had more than one conversation with locals around Santiago who, after hearing of my project, told me they had always been interested in seeing the park but didn’t know how to get there. It would frankly take around ten minutes for me to explain the options for travel, which went something like, “You have to get to this port on Thursday and take the community boat to town “X.” Once there, you will have to hire a boat to take you to the park ... if the boat and driver happen to be there. If not, you will be stuck there because there are no hotels or restaurants in that town, and there will be no boats back to the port until the following day.” Developing a simple plan for transportation of tourists to the park with advertising in IPAT (Panamanian Board of Tourism) offices and tour books would be relatively simple and necessary. If stimulating tourism and park revenue is a goal, it would make sense to involve local fishermen who have boats in that development process. Local communities could serve as launching grounds for tourist operations. Since most of these communities are a good distance from any major city, lodging and restaurants would also be needed. These are all things that could be developed with the involvement of local fishing communities. There are also a number of non-governmental organizations and private, wealthy landholders with an interest in the park. These are all potential sources of capital for park “development” in terms of protection and sustainable ecotourism.

6.5 FINANCIAL SECURITY

I would also recommend soliciting funds from non-governmental agencies to fund

projects that would supply ANAM with the resources needed to patrol the park more successfully. This should be addressed first, since, in the words of a dive-boat operator who worked in the park, “The park is being HAMMERED by fishermen every day now that the prisoners are leaving.” This individual described in an email one example of a trawler that was incurring significant bycatch of dolphins as it trawled through the park waters. When he informed the boat captain over the radio that he was in a protected area, he was told to leave them be. He traveled to the park headquarters and reported the activity, but the guards were without a boat and could do nothing about it. I would recommend to initially secure the perimeter of the park with buoys and patrols, followed by or coupled with community involvement and input as to potential solutions of problems and development of a tourism industry in the region.

6.6 LEARNING FROM THE PAST: LESSONS FROM OTHER PARKS

I would like to emphasize the importance of the first two steps of this process, the clear outlining of the park boundaries with a system of buoys to eliminate confusion as to where the park boundaries lie, and the involvement of local stakeholders. Local stakeholders should be considered, at very least, to be the “Big Six” communities which I have identified. However, I strongly feel that just placing buoys and increasing park patrols alone will be unsuccessful in terms of the long-term success of the park. Examples of this type of top-down, command and control management have been known to fail due to the non-cooperation and even “uprising” of locals. For example, a case study of the Soufriere Marine Management Area in St. Lucia, West Indies, showed that a poorly designed collaborative coastal zone management project led to locals’ disappointment and distrust of management authorities, and eventually to blatant defiance of regulations. When the marine police intervened, conflict was inevitable and threats were even made to managers and rangers^{xxv}. This may be preventable in the case of Coiba National Park by involving these stakeholders in the decision process and keeping them up to date on all park activities. The Soufriere case provides several “lessons” to managers: There must be a general devolution of power, and management authorities must be open to changes that many threaten their power. Differences within and between user groups must be taken into consideration. Finally, effective enforcement that leads to voluntary compliance and self-imposed regulation is required. In an attempt to resolve the conflict that erupted, a broad-based Stakeholder Committee was established as the

main forum for dispute resolution, consultation, and participatory decision-making^{xxvi}. In a study conducted in the Visayas, Philippines, it was determined that there were six factors that led to the overall success of MPAs. These were a relatively small population size, a perceived crisis in terms of reduced fish populations before MPA establishment, successful alternative income projects, a high level of community participation in decision making, continuing advice from the implementing organization, and inputs from the municipal government^{xxvii}. For Coiba National Park, I feel effective park management is possible if based on these criteria and if a well-designed plan is put into effect. For example, Regional Committees could be established in villages and could meet periodically to inform, education, and solicit opinions of its members. They could also participate in the park management decision-making process.

6.7 CONCLUSION

Panama's Coiba National Park should be considered an ecological jewel. It has remained unintentionally protected from most extractive use for almost 100 years by the presence of a penal colony on the main island. As the prison is decommissioned, park management faces a difficult situation. Park resources must be protected, however there are not sufficient financial resources in the Park's budget to provide this protection. This transition from a penal colony to a paper park provides an ideal setting for the implementation of an effective management plan. Six communities were identified as having the greatest impact on park resources through their extractive fishing activities. These communities must be involved in park management as well as in educational efforts in order to prevent a crisis from developing, as has been the case in many other marine protected areas in developing countries. Using what we have learned from previous research as well as what we know about the communities from this survey, I feel there is adequate knowledge to design and implement an effective strategy for preserving Coiba National Park. Even in the face of scientific uncertainty, management techniques based on past successes and new discoveries can and must be utilized.

*Usuarios de los Recursos de la Region
Del
Pacífico Este Panameño**

Versión VI

Junio - Agosto 2001

Todd Capson, Smithsonian Tropical Research Institute (STRI)
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Smithsonian Tropical Research Institute

N I C H O L A S
School of the E N V I R O N M E N T

* Por el propósito de éste estudio estamos definiendo la Región del Pacífico Este así como la región entre la península Burica y la Península de Azuero, de la costa extendiéndose hasta la isla Jicarita. Esta región es primariamente compuesta del Golfo de Chiriqui, el Golfo de Monitjo, y el Parque Nacional Isla de Coiba. Esta región NO incluye el Golfo de Panamá.

4. Cuánto tiempo aproximadamente está usted en el mar durante un viaje?
- Menos de 24 horas
 - 2 – 3 días
 - 4 – 6 días
 - 7 – 10 días
 - Más de 10 días
5. Durante un viaje, cuántas horas al día se dedican a la pesca?
- Horas: _____
6. Durante un día de 24 horas, cuando pescas más? Escoja entre:
- Pesco con la misma frecuencia durante el día y la noche
 - Pesco más durante el día
 - Pesco más durante la noche
 - Depende:

—
7. Por favor, nombre o describa las áreas donde usted pesca en búsqueda de lo siguiente:
- Camarón:

 - Langosta:

 - Pescado:

 - Tiburón:

8. En este mapa, nos gustaría colorear las áreas que indican donde usted pesca **más frecuentemente**. Solo coloree las áreas donde usted pesca.

9. Siempre ha pescado en los mismos lugares?

- Sí
- No

LAS SIGUIENTES DECLARACIONES TIENEN QUE VER CON LOS FACTORES QUE INFLUYEN EN DONDE USTEDES TIENDEN A PESCAR. DESEAMOS SABER POR QUE USTED DECIDE DONDE PESCAR.

10. ¿Es usted la persona que decide donde el bote pescará?

Si, yo decido donde pescar.

No, yo no decido porque alguien más lo decide.



- Si la respuesta es No, quien toma la decisión? Nombre / Posición _____

Conteste si es cierto o falso cada uno de las siguientes oraciones . Se repetirá la oración de ser necesario.

11. El clima afecta donde se decide pescar. Por ejemplo: si está tormentoso afuera, pesco en un lugar, si se calma va a otro lugar. **VERDAD / FALSO**

12. Los consejos que escucha de otros pescadores afecta donde va a pescar. Por ejemplo, si otro pescador le dice algún lugar bueno para la pesca, usted va también a ese lugar. **VERDAD / FALSO**

13. La estación en especial, sea invierno o verano, afecta donde va a pescar. Por ejemplo, durante el verano pesco en algún lugar y durante el invierno en otro. **VERDAD / FALSO**

14. Dependiendo del pez que desee capturar afecta donde va a pescar. Por ejemplo, si deseo capturar corvina, voy a este lugar, si deseo tiburón, a tal otro. **VERDAD / FALSO**

15. Dependiendo de dónde encuentro los peces con el ecosonar afecta donde va a pescar. **VERDAD / FALSO**

16. Faltan aquí OTRAS razones que influyen el lugar donde decidirá pescar?

- POR FAVOR DESCRÍBALAS:

17. Por favor, responda si o no a las siguientes preguntas. Usted puede responder si a más de una pregunta.

- Usted pesca solo como una actividad de diversión / recreación? SI / NO / A
VECES
- Usted pesca para vivir? SI / NO / A
VECES
- Usted come del pescado que captura? SI / NO / A
VECES
- Su ingreso familiar viene principalmente de la pesca? SI / NO / A
VECES
- Tiene usted otras razones para pescar? SI / NO / A
VECES



- Si la respuesta es si, por favor describa:

18. De donde parte su bote?

- _____

19. En qué lugar vive actualmente?

- _____

20. Pertenece usted al pueblo donde está actualmente?

- Si
- No
- Si es no, porqué vive ahí?

Me mudé por que la pesca es buena

Me mudé porque encontré trabajo allí

Me mudé porque tengo familia en esa área

Otra (Explíquela): _____

21. Cuántos años lleva pescando en esa área?

- _____

22. Basándose en su experiencia, cómo usted considera que es la pesca comparada con los años pasados?:

- _____

23. Ha cambiado los especies que pesca?

- SI / NO



- Si la respuesta es “SI”, Explique pórque y cuales especies pescaba antes y cuales pesca ahora:

24. Han habido pescadores **anteriormente** en su familia, mayores que usted, como su abuelo, padre, o tio?

(tiene que ser alguien **más viejo**)

- No
- Si

- ▶ Si la respuesta es si: Su familiares pescaron en esa área también?

SI / NO

- Si es si de nuevo: Conteste si es cierto o falso el siguiente enunciado:

“La pesca está igual o mejor que cuando pescaban mis ancestros”

Cierto / Falso

25. Conteste si es cierto o falso el siguiente enunciado: “Yo pesco cualquier pez que abunde en cualquier época del año.”

- Cierto

- ▶ Si es cierto: qué especies capturó más durante **ese año** en particular?

- _____

- Falso

26. Compró usted el bote en el que pesca?

- Si
- No

27.Cuál es el nombre del bote en el que pesca? (Si no tiene nombre, ponga el nombre del capitán)

(Si quieren saber porque, dile que es para separar las respuestas del mismo bote)

- _____

28. Qué tan grande es el bote en el que pesca? Especifique el **ancho y largo**

- LARGO: _____pies ○ ANCHO: _____pies

29. En su bote, cuantos pescadores hay **incluyéndose** usted mismo?

- _____

30. Viven los pescadores de su bote en el mismo pueblo que usted?

- Si
○ No
○ *OTRAS:*

31. Usa usted el siguiente equipo mientras pesca? Responda si o no a cada una:

- Caña y carril SI / NO
○ Cuerda de mano SI / NO
○ Palangre SI / NO
○ Línea con flotas SI / NO
○ Trasmayo SI / NO → Tamaño: _____pulgadas.
 Cuantas? _____
○ Rede de Vuelo SI / NO → Cuando? _____
○ Arpón SI / NO
○ Veneno SI / NO
○ Dinamite / Bomba SI / NO
○ Ecosonar SI / NO
○ GPS SI / NO
○ Radio SI / NO
○ Otros : *Describalos*

32. Que tan frecuente usted usa los trasmayos?

POR FAVOR ESCOJA DE LAS OPCIONES (Mostrar el cartel y leer alto):

- Siempre / Casi Siempre (cerca de 100% del tiempo que pesca)
○ Algunas veces (cerca del 50% del tiempo que pesca)
○ Raramente (menos del 50% del tiempo que pesca)
○ Nunca (0 % del tiempo que pesca)
○ Otras: _____

33. Con qué frecuencia usa la Linea?

- Siempre / Casi Siempre (cerca de 100% del tiempo que pesca)
- Algunas veces (cerca del 50% del tiempo que pesca)
- Raramente (menos del 50% del tiempo que pesca)
- Nunca (0 % del tiempo que pesca)
- Otras: _____

34. Qué tan frecuentemente usa usted la cuerda de mano o “ril”?

- Siempre / Casi Siempre (cerca de 100% del tiempo que pesca)
- Algunas veces (cerca del 50% del tiempo que pesca)
- Raramente (menos del 50% del tiempo que pesca)
- Nunca (0 % del tiempo que pesca)
- Otras: _____

35. Con qué frecuencia usted bucea para pescar?

- Siempre / Casi Siempre (cerca de 100% del tiempo que pesca)
- Algunas veces (cerca del 50% del tiempo que pesca)
- Raramente (menos del 50% del tiempo que pesca)
- Nunca (0 % del tiempo que pesca)
- Otras: _____

36. Si usted usa un trasmayo, menciones los peces que pesca más frecuentemente, en el orden de cantidad que las captura (*el que más, de primero, al que sigue de segundo, etc*).

○ _____

- Tiburón? Si / No
 - Que tipo:
 - Casón? Si / No
 - Martillo? Si / No
 - Punta Blanca? Si / No
 - Tigre? Si / No
 - Toyo/Punti Negra? Si / No

37. Si usted usa la Línea, menciones los peces que pesca más frecuentemente, en el orden de cantidad que las captura (*el que más, de primero, al que sigue de segundo, etc*).

○ _____

- Tiburón? Si / No
 - Que tipo:
 - Casón? Si / No
 - Martillo? Si / No
 - Punta Blanca? Si / No
 - Tigre? Si / No
 - Toyo/Punti Negra? Si / No

38. Si usted usa la Cuerda de mano, menciones los peces que pesca más frecuentemente, en el orden de cantidad que las captura (*el que más, de primero, al que sigue de segundo, etc*).

○ _____

- Tiburón? Si / No
 - Que tipo:
 - Casón? Si / No
 - Martillo? Si / No
 - Punta Blanca? Si / No
 - Tigre? Si / No
 - Toyo/Punti Negra? Si / No

39. Alguna vez se ha enredado un delfin o una tortuga en su red?

- Delfin: SI / NO **Frecuencia:** Siempre / Frecuentemente / Algunas Veces / Raramente
- Una tortuga? SI / NO **Frecuencia:** Siempre / Frecuentemente / Algunas Veces / Raramente

40. Si usa trasmayo o línea para pescar, ocasionalmente captura otras especies que no desea capturar. Podría decir cuales especies usted captura así y que **porcentaje o cuantas libras** del contenido de la red aproximado es de lo que no deseaba?

- *Por Ejemplo: "Capturo Manta raya frecuentemente y cerca del 10% de lo capturado son especies que no deseaba capturar."*

- Especies: _____
- Porcentaje / libras del contenido total: _____ (Contenido Total: _____ libras)

41. Conteste "sí" o "no" a las siguientes oraciones: Qué hace usted con el porcentaje que captura accidentalmente? Conteste "sí" o "no": Usted:

- Lo devuelve al océano SÍ / NO
- Lo guarda para venderlo o comerlo SÍ / NO
- Lo guarda y lo usa como carnada SÍ / NO
- Se lo regala a otros pescadores SÍ / NO
- Algo más: _____

42. Que usa para carnada y donde la consigue?

- Uso: _____
- Lo consigo: _____

43. Voy a leer los nombres de unas especies comunes. Quiero saber si usted ha encontrado estas especies **en él último año** en sus redes, líneas, o cuerdas. Indique la frecuencia que ha encontrado estas especies en su equipo, basándolo en la siguiente escala:

(Frecuentemente / Algunas Veces / Raramente / Nunca o No sé)

| Nombre | Frecuencia (F / A / R / N) | NOMBRE | Frecuencia (F / A / R / N) |
|------------------|---------------------------------------|-----------------------|---------------------------------------|
| Achotillo | | Lisa | |
| Atún | | Mojarra | |
| Bagre | | Pajarita | |
| Berrugate | | Pampa | |
| Blanco | | Pargo Amarillo | |
| Bobalo | | Pargo Blanco | |
| Bobo Amarillo | | Pargo de la Mancha | |
| Bobo Blanco | | Pargo de Seda | |
| Bonito | | Pargo Grande | |
| Brillantina | | Pargo Kaki | |
| Cam. Carabali | | Pargo Rojo | |
| Cam. Fidel | | Pargo Roquero | |
| Cam. Langostino | | Pescado Blanca | |
| Cam. Rojo | | Pez Loro | |
| Cam. Titi | | Pez Bohala | |
| Caracol | | Pulpo | |
| Cherna / Mero | | Revoltura | |
| Cojinua | | Robalo | |
| Cominate | | Salema | |
| Concha Negra | | Salmón | |
| Corvina Amarilla | | Sargento | |
| Corvina Blanca | | Sierra (Mackarella) | |
| Delfin | | Silguero | |
| Dorado | | Tib. Casón | |
| Frijolillo | | Tib. Martillo | |
| Gambute | | Tib. Punta Blanca | |
| Gualajo | | Tib. Tigre | |
| Herrero | | Tib. Toyo/Punta Negro | |
| Jurel | | Tortugas | |
| Langosta | | Merluza (Congrio) | |
| Lenguado | | Otras? : | |

44. Qué hace que el capitán del barco decida terminar el viaje de pesca?

- _____

45. Cuántas libras puede almacenar tu bote cuando esté lleno?

- _____

46. Con que frecuencia ha vuelto con el bote **lleno al máximo** en el ultimo año nada más?

- Siempre / Casi siempre (cerca de 100% del tiempo que pesca)
- Algunas veces (cerca del 50% del tiempo que pesca)
- Raramente (menos del 50% del tiempo que pesca)
- Nunca (0 % del tiempo que pesca)
- Otras: _____

47. Con que frecuencia ha vuelto con el bote lleno al máximo en el pasado?

- Siempre / Casi siempre (cerca de 100% del tiempo que pesca)
- Algunas veces (cerca del 50% del tiempo que pesca)
- Raramente (menos del 50% del tiempo que pesca)
- Nunca (0 % del tiempo que pesca)
- Otras: _____

—▶ ○ **Eso fue en los años:** _____

48. Le toma más tiempo llenar su bote en la actualidad que en años pasados?

- SI / NO
- Más información:

49. Suelta alguna vez usted el ancla mientras pesca?

- SI
 - Si es cierto: Cuando usa el ancla?:
 - _____
- NO

POR FAVOR EXPLIQUE QUE OPINA DE LAS SIGUIENTES DECLARACIONES CON LAS SIGUIENTE ESCALA: *(Muestre la escala y hable en voz alta)*

50. El desarrollo del turismo en esa área podría ser algo bueno para su comunidad.

| | | |
|---|-----------------------------------|----------|
| Estoy de acuerdo Completamente No! | Sin comentarios / No lo sé | |
| 1 | 2 | 3 |

51. Está bien pescar con trasmayos - Es igual para el ambiente que pescar con otros equipos.

| | | |
|---|-----------------------------------|----------|
| Estoy de acuerdo Completamente No! | Sin comentarios / No lo sé | |
| 1 | 2 | 3 |

52. La Autoridad Nacional del Ambiente (ANAM) responde a las necesidades de los pescadores artesanales.

| | | |
|---|-----------------------------------|----------|
| Estoy de acuerdo Completamente No! | Sin comentarios / No lo sé | |
| 1 | 2 | 3 |

53. La Autoridad Marítima de Panamá (AMP) responde a las necesidades de los pescadores artesanales.

| | | |
|---|-----------------------------------|----------|
| Estoy de acuerdo Completamente No! | Sin comentarios / No lo sé | |
| 1 | 2 | 3 |

54. Recientemente he tenido que pescar por un más largo periodo de tiempo para capturar lo mismo que en años anteriores.

| | | |
|---|-----------------------------------|----------|
| Estoy de acuerdo Completamente No! | Sin comentarios / No lo sé | |
| 1 | 2 | 3 |

55. Los peces que he capturado tienen el mismo tamaño que en años anteriores.

| | | |
|---|-----------------------------------|----------|
| Estoy de acuerdo Completamente No! | Sin comentarios / No lo sé | |
| 1 | 2 | 3 |

Si NO: Cuales son más chicos? _____

56. Qué leyes están los pescadores obligados a seguir cuando pescan en las áreas donde acostumbran hacerlo? Dime **todos** que hay:

○ _____

57. Cree que **todas** estas leyes son justas?

- Si
- No
- Si no, Qué leyes cree usted que son injustas?

• _____

58. Es común que entre todos pescadores, algunos no siguen las leyes de pesca.
Cuales leyes ha visto a otros pescadores violando?

- No he visto violaciones
- Prefiero no responder
- _____

▪ Qué tan frecuente ve usted que estas leyes son violadas?

- Siempre / Casi Siempre (cerca de 100% del tiempo que pesca)
- Algunas veces (cerca del 50% del tiempo que pesca)
- Raramente (menos del 50% del tiempo que pesca)
- Nunca (0 % del tiempo que pesca)
- Otras:

59. Qué opina del Parque Nacional Isla Coiba?

POR FAVOR ESCOJA DE LAS SIGUIENTES OPCIONES: (Muestre el cartel y lea en voz alta)

- Pienso que es algo muy bueno
- No lo creo algo necesario / no es algo útil
- No entiendo para qué fue creado ese parque
- No tengo opinión al respecto / prefiero no opinar
- Otras comentarios: _____

60. Hasta dónde es prohibido pescar en el Parque Nacional Isla Coiba?

61. Ha visto alguien pescando en esas áreas, dónde está prohibido la pesca?

Si es cierto, ¿De dónde viene esta gente?

No

62. Si usted fuera encargado de la protección de los recursos marinos, que haría?

63. Cual es el total de gastos que usted o el capitán paga para un viaje típico?

Días de viaje: _____

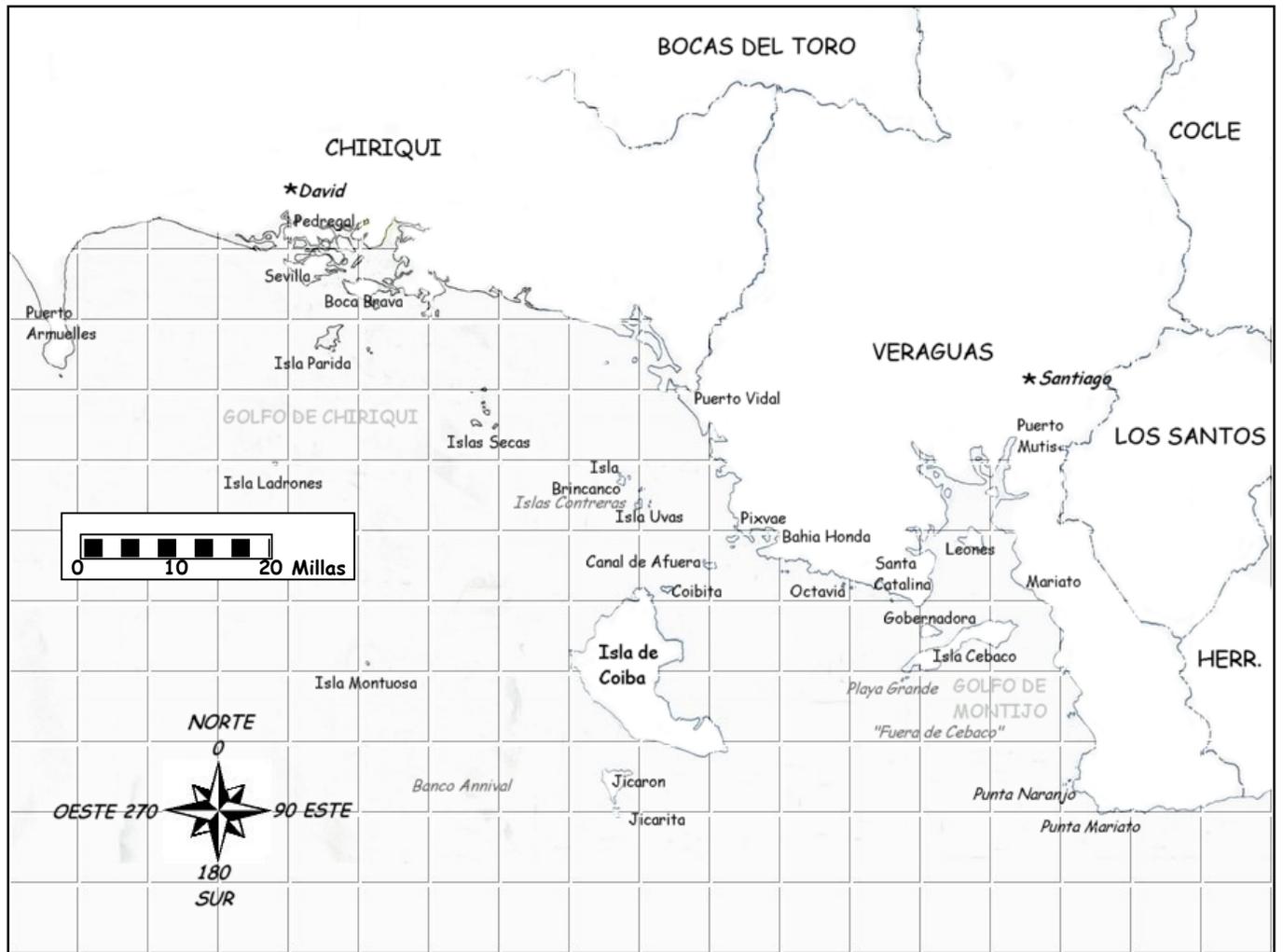
Gastos: \$ _____

64. En su opinión, quien o que está causando más daño a los recursos marinos dónde usted pesca?

66a. Cuales especies se deben tener veda?

66b. Cómo debe ser la veda?

65. Qué edad tiene? _____



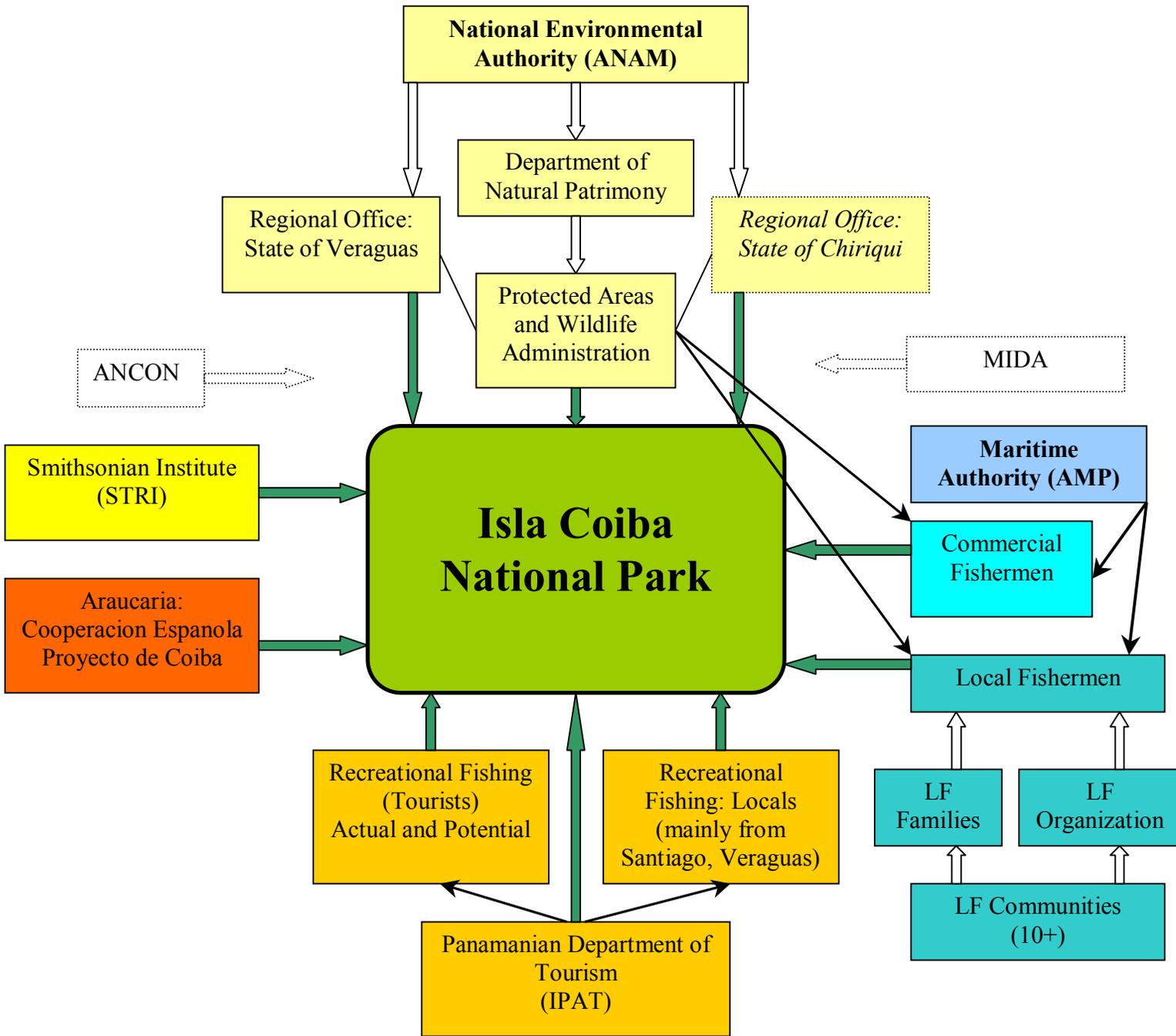


Figure B1: Human Ecology Network for Isla Coiba National Park. (Dashed lines indicate indirect or possible future relationships)

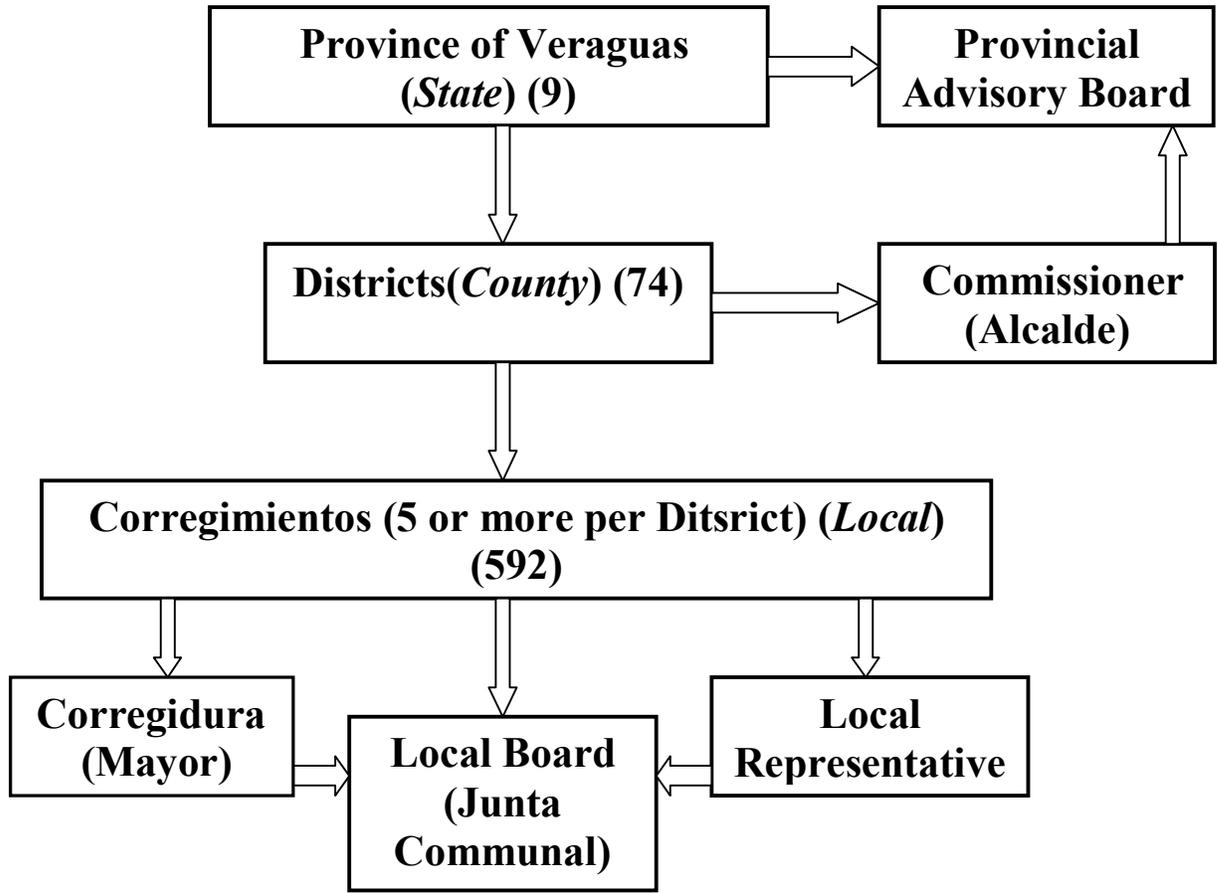


Figure B2: Provincial, districts, and local government structure, showing U.S. analogues.

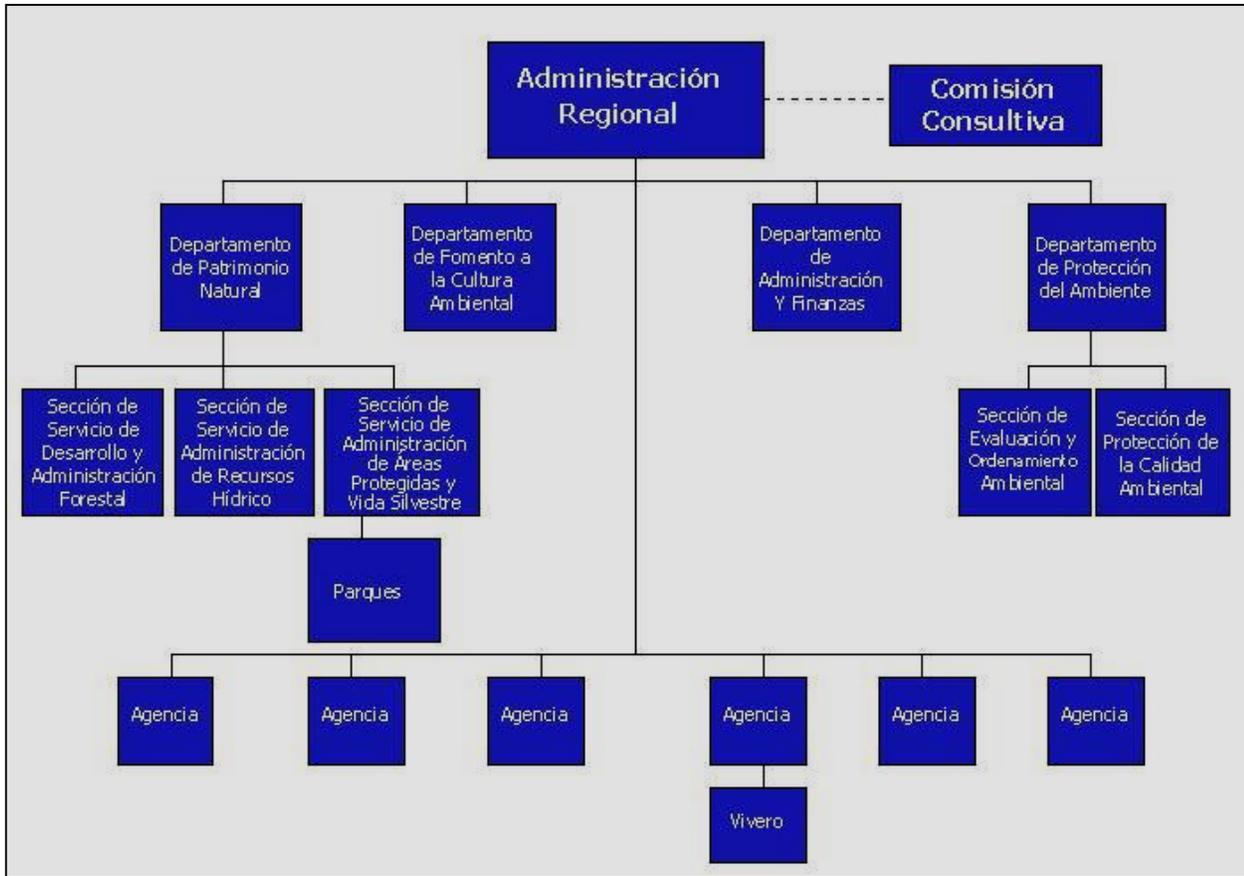


Figure B3 : Regional administrative structure of ANAM

Appendix C: Supplementary Graphs

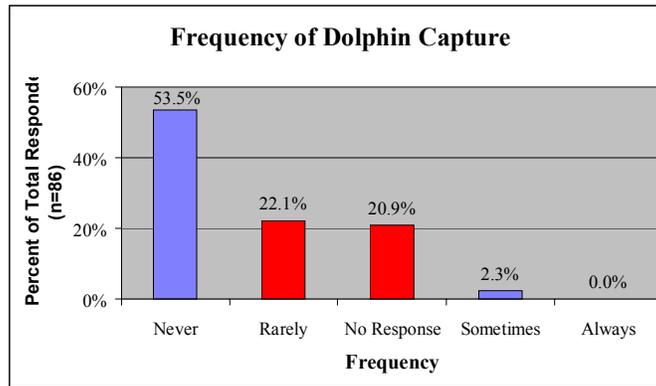


Figure C1: Frequency of Dolphin (mammal) capture reported by the “Big Six” fishermen.

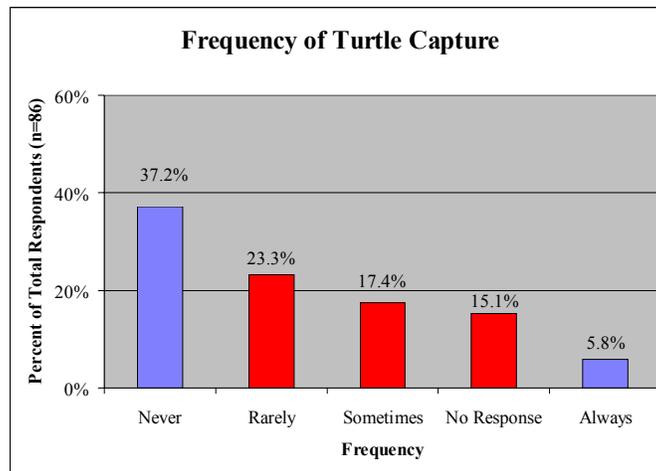


Figure C2: Frequency of turtle capture reported by the “Big Six” fishermen.

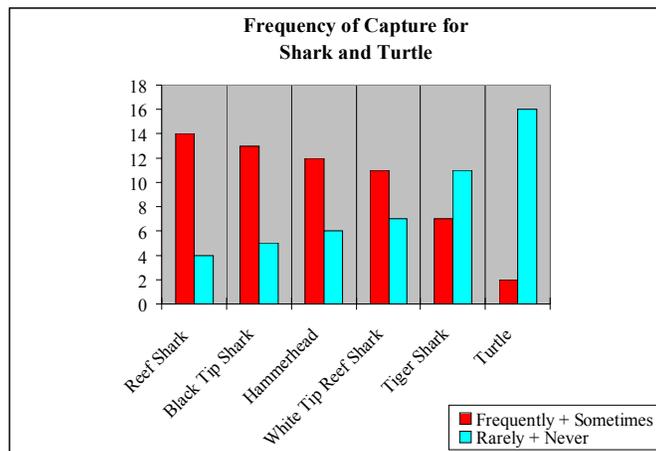


Figure C3: Shark and turtle bycatch reported by shrimp fishermen. (n=20)

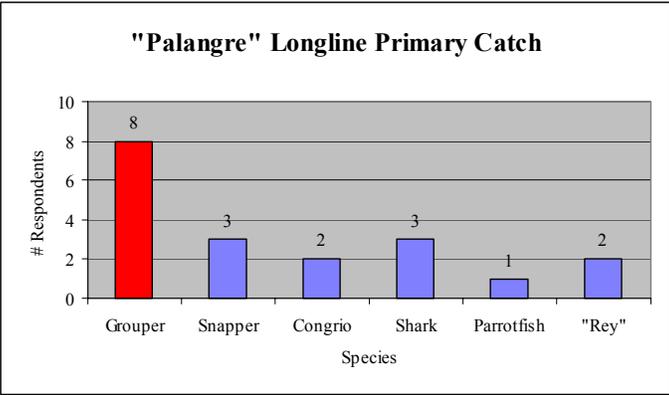


Figure C4: Primary catch of demersal longline (*palangre*).

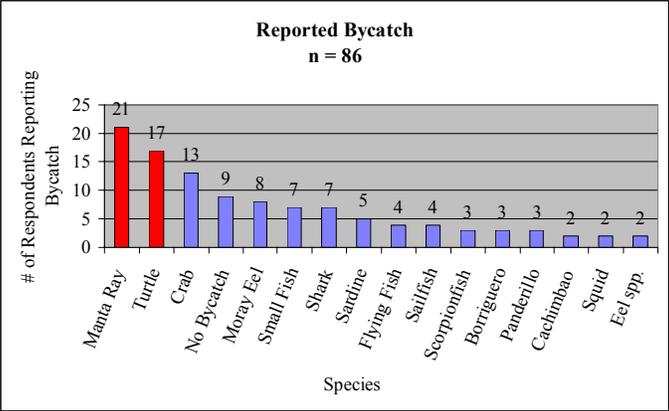
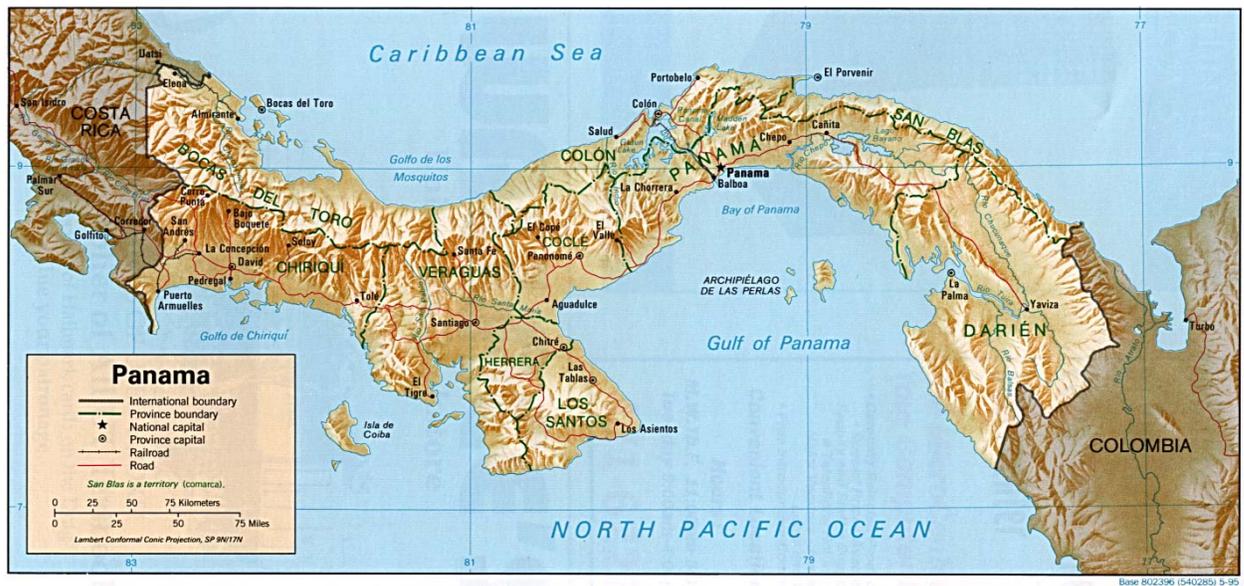
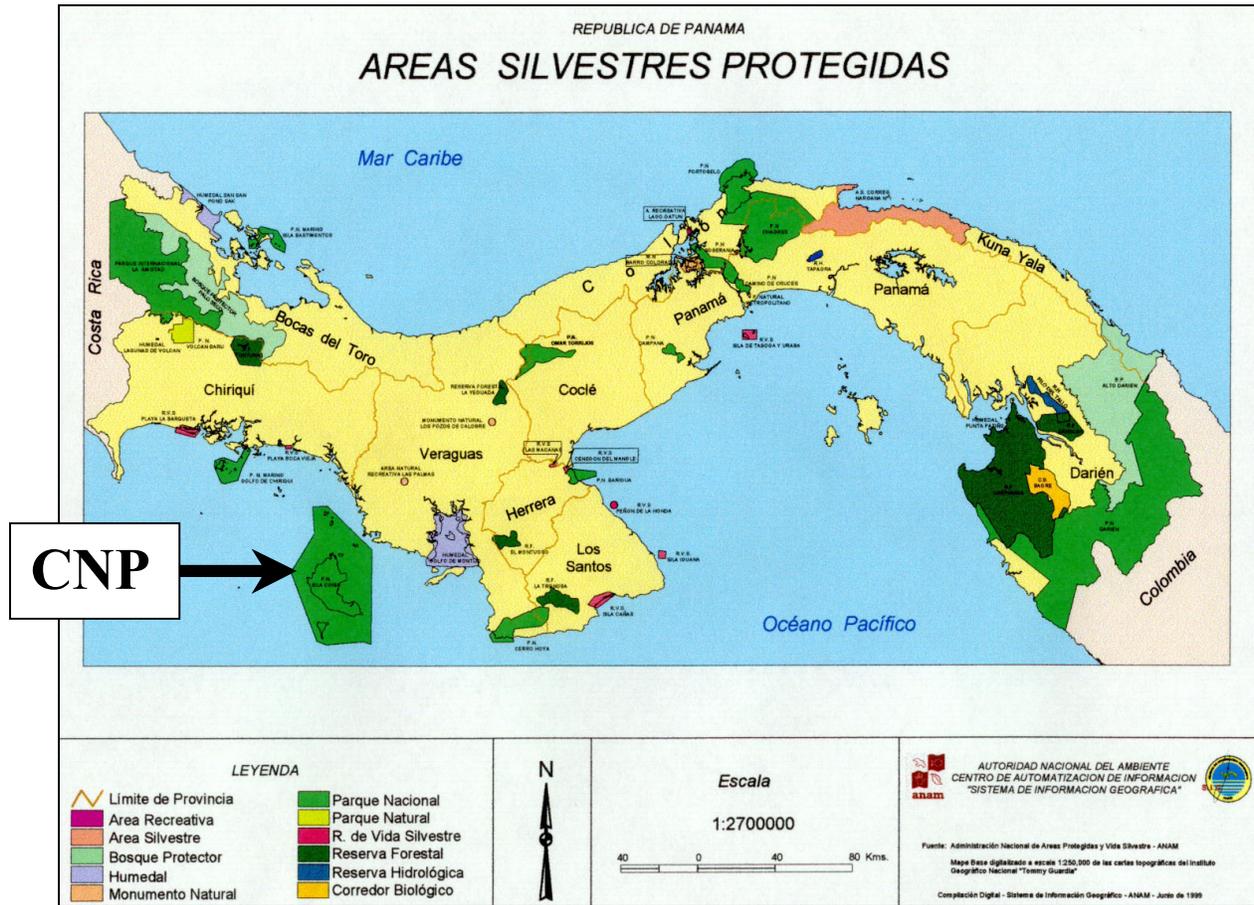


Figure C5: Bar graph of "Big Six" bycatch.

Appendix D: Maps of Republic of Panama and Coiba National Park



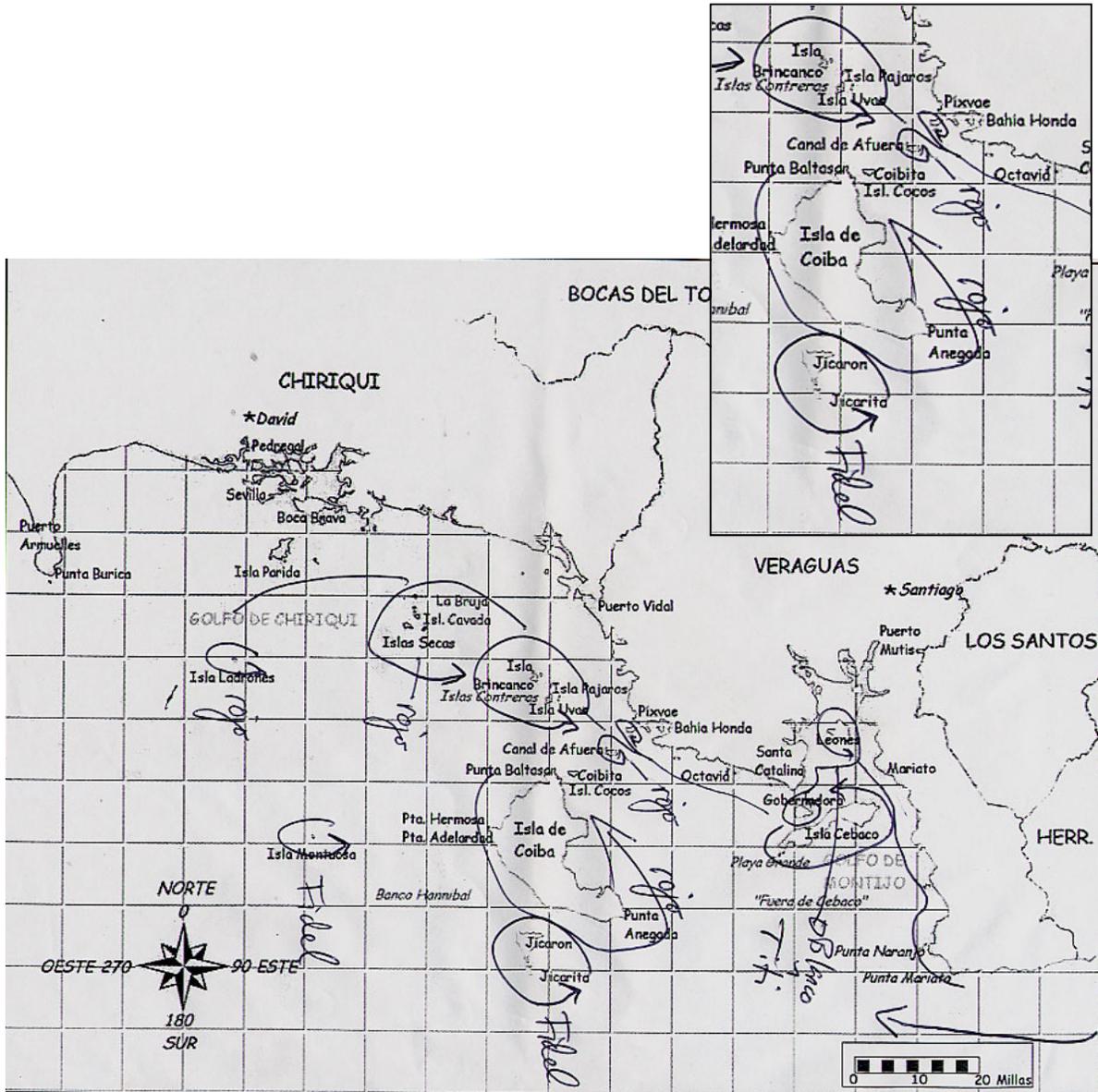
Map 1: The Republic of Panama. Political divisions shown in dark green. (Graphic courtesy of University of Texas at Austin Library at http://www.lib.utexas.edu/maps/americas/panama_relief.jpg)



Map 2: Panama's Protected Areas. Coiba National Park is marked with black arrow. (Map courtesy of the *Autoridad Nacional del Ambiente (ANAM)*.)



Map 3: The buffer zone region around Isla Coiba National Park. Coastal cities labeled contain stakeholders for Coiba National Park management decisions. (Inset highlights Coiba National Park boundaries.)



Map 4: Result of one survey of a shrimp trawler. Arrows denote trawling route and words indicate the type of shrimp targeted (names in Spanish). Inset in upper right is an enlargement of the area around Coiba National Park.



Map 5: Map of the perceived 3-mile park boundary (shaded in red around island coast.) Actual Park boundary is shown by the outer solid black line marked with red circles, squares, and stars. These marks are the proposed buoy sites. The inner broken red line indicates proposed patrol areas. (Map courtesy of Dr. Todd Capson, STRI, adapted)

Source and Amount of Support

Funding for the study was provided through the Johnson Research Opportunities Fund of the Smithsonian Tropical Research Institute in Panama City, Panama. This is a discretionary fund controlled by the director of STRI. \$3000 was graciously provided for the completion of this study.

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