An aerial photograph of Bohol Island, Philippines, showing its green landmass and the surrounding turquoise and blue waters of the Danao Bank. The island's coastline is irregular, with numerous small islets and reefs visible. The water transitions from a shallow turquoise near the shore to a deep blue further out.

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# ACRONYMS & ABBREVIATIONS

BAFOR	Bisayas Alliance of Fisherfolks and Operators for Reform	MPA	marine protected area
BEMO	Bohol Environmental Management Office	NGO	nongovernment organization
BLA	baseline assessment	NIPAS	National Integrated Protected Area System
CBRM	Community-based Resource Management Project	NRDB	Natural resources database
CBRMP	Community-based Resource Management Project	NSO	National Statistics Office
CeLeBoSoLe Council	Cebu, Leyte, Bohol and Southern Leyte Management Council	PAMB	Protected Area Management Boards
CLEC	Coastal Law Enforcement Council	PCRA	participatory coastal resource assessment
CRM	coastal resource management	PFC	Philippine Fisheries Code
CRMP	Coastal Resource Management Project	PHO	Provincial Health Office
CVRP-Phase I	Central Visayas Regional Project-I	PhP	Philippine peso
DA-BFAR	Department of Agriculture – Bureau of Fisheries and Aquatic Resources	PO	people’s organization
DENR	Department of Environment and Natural Resources		
EBFM	Ecosystem-based fisheries management		
FARMC	Fisheries and Aquatic Resources Management Councils		
FISH	Fisheries Improved for Sustainable Harvest		
GT	gross ton		
ICM	integrated coastal management		
KAMADA	<i>Kahugpongan sa Mananagat sa Danajon, Inc.</i>		
LGU	local government unit		
MAC	Marine Aquarium Council		
MFARMC	Municipal Fisheries and Aquatic Resources Management Councils		

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# FOREWORD

Boholanos depend on natural resources for most of their livelihood, either directly or indirectly. And, being an island surrounded by diverse coral reefs, mangroves and rich tropical seas, majority of our coastal dwellers are fishers or are employed in marketing of coastal resources for consumption or for viewing and enjoying these resources through tourism. No matter whether a person is a fisher, a boat operator, a vendor, a tourism guide or owner, a scuba diver or in any related occupation, all depend on these healthy and productive coastal ecosystems. If our coral reefs and mangroves die or our fish disappear or our waters become unduly polluted, all of these persons will ultimately become unemployed. And, the Bohol economy in general will decline and the vicious cycle of poverty will worsen.

Our fisheries, an essential marine resource, supported by coastal waters and healthy ecosystems, not only provide income for many people but also a good portion of our diet. Fish as food is still one of the cheapest sources of good protein and at least in part, defines our island culture. But, fisheries are declining rapidly in Bohol. The fish caught in northern Bohol in the vicinity of the Danajon Bank are drastically smaller and of lower quality than they were 15 - 20 years ago. The trends are ominous and must be reversed if we are to survive on this island in a healthy state.

The Danajon Bank is a rich and rare coral reef and marine resource that supports many uses and valuable resources. All efforts to reverse its decline and nurse it back to health are laudable and essential. This profile is a first important step to develop viable management actions for the environment of the Danajon area of northern Bohol and its associated fisheries. The process is underway and moving to improved fisheries management. Let's provide all the support we can to this effort. Let's read and make use of this profile to guide us in the planning and implementation process.

Erico B. Aumentado  
Governor, Province of Bohol

# PREFACE

This **Coastal Environmental and Fisheries Profile of Danajon Bank, Bohol, Philippines** is an essential and major step in the process of developing and implementing fisheries and coastal resource management plans for the northern Bohol area. The activities leading to this profile that started with the beginning of the Fisheries Improved for Sustainable Harvest (FISH) Project in 2003 include:

- setting up an office in Bohol and initiating agreements with all the participating municipalities, the province and other stakeholders;
- conducting baseline assessments of the habitats and fisheries in the core areas of the Danajon Bank as a means for measuring change during the project;
- determining “early fisheries management actions” based on the initial baseline studies and other sources of information locally;
- beginning implementation of these “early actions” toward improved fisheries and habitat management in the area (e.g., improved law enforcement, improved and more marine protected areas, etc.); and
- compiling baseline information from many sources to develop a comprehensive environmental and fisheries profile (this document).

With this profile in place, the courses of action in order to move forward are to:

- continue to implement “early actions” while formulating medium and long-term actions and plans; and
- develop an “Ecosystem-based Fisheries Management (EBFM) Plan” that builds on the baseline information, profile information and analysis, and that is informed from the experience of incrementally planning and implementing ever improved “early actions” that test the viability of implementation in the field.

An important theme of the FISH Project is to utilize an EBFM approach. The thrust of EBFM is to maintain the integrity of the underlying ecosystems that support fisheries in the Danajon Bank. It is realized that if coral reefs are destroyed, their associated fisheries die. And, if fish in general are not allowed to mature to reproductive age, fisheries will collapse. It is also known that fish, fisheries and all marine resources, are finite in extent, meaning that they can only support a predictable level of extraction, beyond which they will decline and ultimately disappear.

Thus, to plan for improved fisheries and coastal resource management in Danajon Bank and vicinity, we must

take into account the physical and human elements that affect the larger ecosystem. We must fully understand all the natural and human forces in the area and we have to strive to meet or balance diverse societal objectives in the process. This is a tall order but is what needs to happen!

The bottom line is that to improve fisheries productivity and environmental quality in the Danao Bank, many things need to change. The parameters that govern fisheries and coral reef ecosystems are known and have limits. If we want to keep them viable for years to come for the benefit of all stakeholders, the given limits need to be understood and of course followed. An EBFM plan will provide the road map to do this and this profile is an essential step.

The Authors

# CHAPTER 1

## OVERVIEW OF ECOSYSTEM-BASED FISHERIES MANAGEMENT IN DANAJON BANK

*“It is no longer a provocative statement to argue that human activities impact ecosystem dynamics at all scales, and across scales; that there are no pristine areas free from human influence or social systems independent of nature’s subsidies. We are currently living in the Anthropocene era where most aspects of the functioning of the Earth system cannot be understood without accounting for the strong influence of humanity. A major challenge in this era of extensive transformations is to actively strengthen and enhance the capacity of the biosphere, from local to global levels, to support and sustain social and economic development” (Folke 2003).*

### INTRODUCTION

As captured in the above quote, marine ecosystems are generally in a state of decline globally and most especially in tropical, impoverished contexts. Overfishing is depleting important predatory organisms (sharks, groupers, tuna) and habitat degradation is reducing the ability of fish stocks to replenish themselves.

The situation is reaching crisis proportions for Philippine coastal communities that depend on these resources for protein and economic growth. A variety of causes have been identified including: poverty, overconsumption, ignorance, poor land management, destructive fishing and overfishing. Fisheries catch-per-unit-effort is declining in most places (Barut *et al.* 2004; DA-BFAR 2004). Coral reefs, mangroves and water quality are being degraded in many locations (Aliño *et al.* 2004; White and De Leon 2004). Systemic conditions underlie these environmental trends and limit the options available to policymakers. For example, the rising national Gini Index for the Philippines, 46.6 (2003) (Index Mundi CIA World Factbook 2003), now at 48 out of 100 and among the highest in the world, indicates that wealth is becoming increasingly concentrated in fewer



**TABLE 1. CORE MARINE FISHERIES PROBLEMS AND UNDERLYING FACTORS.**

<b>Core fisheries problems</b>	<b>Contributing factors</b>
Declining fish stocks Loss of marine biodiversity Loss of revenues and benefits from fisheries and coastal resources	Overfishing Illegal and destructive fishing Coastal habitat degradation Siltation and pollution Post-harvest losses Inefficient marketing
<b>Systemic underlying conditions</b>	<b>Contributing factors</b>
Inequitable distribution of benefits from fisheries and coastal resource uses	Open access to marine resources Inter- and intra-sectoral conflicts Low awareness and participation in management Lack of employment/poverty among artisanal fishers
Rapid population growth	Low awareness of the implications of overpopulation to food security Lack of delivery mechanisms for reproductive health programs in rural coastal communities
Inconsistent policies and programs for sustainable fisheries	Continued investments in production-oriented programs Conflicting and fragmented national policies
<b>Core fisheries problems</b>	<b>Contributing factors</b>
Weak institutional and stakeholder capacity to plan and implement fisheries management	Absence of incentives and vision for institutional change to support sustainable fisheries Inadequate technical and financial support to LGU fisheries management initiatives Weak and inadequate law enforcement Inadequate interagency coordination mechanisms for fisheries and CRM
Lack of a constituency for sustainable fisheries	Low awareness and understanding of implications of overfishing on food security and economic development Polarization of stakeholders over means to achieve sustainable fishing

hands. Poverty, now directly affects about 40% of the Filipino populace and is still worsening. Natural resources are extracted at ever increasing rates as populations grow (at approximately 86 million people and increasing at 2.2% annually) and pressures mount to export commodities to service external debt (US\$58 billion or 3.8 times the annual national budget) (CIA 2005).

Table 1 displays some of the key fisheries problems affecting marine fisheries in the Philippines and underlying factors. The issues are complex and interrelated requiring holistic policy responses. While the problems are numerous, the Philippines is known globally for innovative responses. Community-based coastal resources management (CBCRM), community-based marine protected areas and integrated coastal management (ICM) have been experimented with for

decades and are being adopted on a fairly wide scale. There have been significant advances in improving the management of coastal and nearshore areas, with improvement in enforcement to stop illegal and damaging practices in many places.

### **WHY A FISHERIES ECOSYSTEM PROFILE FOR DANAJON BANK?**

Each resource management effort should be guided by an organizing framework. The so-called “top-down” framework, which is primarily led by government agencies, and “bottom-up” framework, which is frequently led by nongovernment agencies and resource users, have been the two most influential frameworks in the Philippines. Recently, scientists and policymakers have begun to advocate for the adoption of an “ecosystem-based management” framework. This

framework suggests that resource management decisions are based on a consideration of ecosystem limits, ecological linkages and linkages between humans and their environment.

The Fisheries Improved for Sustainable Harvest (FISH) Project is a five-year effort focused on strengthening the capability of local and national institutions to manage coastal resources and marine fish stocks. FISH has adopted an ecosystem-based fisheries management (EBFM) framework that is defined in the following manner:

EBFM considers geographically specified fisheries management that takes account of knowledge and uncertainties about, and among, biotic, abiotic and human components of ecosystems, and strives to balance diverse societal objectives. Such an approach will address human activities and environmental factors that affect an ecosystem, the response of the ecosystem, and the outcomes in terms of benefits and impacts on humans. A distinguishing feature of an ecosystem approach is an emphasis on protecting the productive potential of the system that produces resource flows. For an ecosystem that is already degraded, the goal becomes one of rebuilding or restoring the ecosystem (Christie *et al.*, unpublished).

The FISH project is initially focusing on four important target areas in the Philippines (Figure 1). Danajon Bank is an area of international significance due to its double barrier coral reef formation. And above all, it is locally very important because of its high degree of

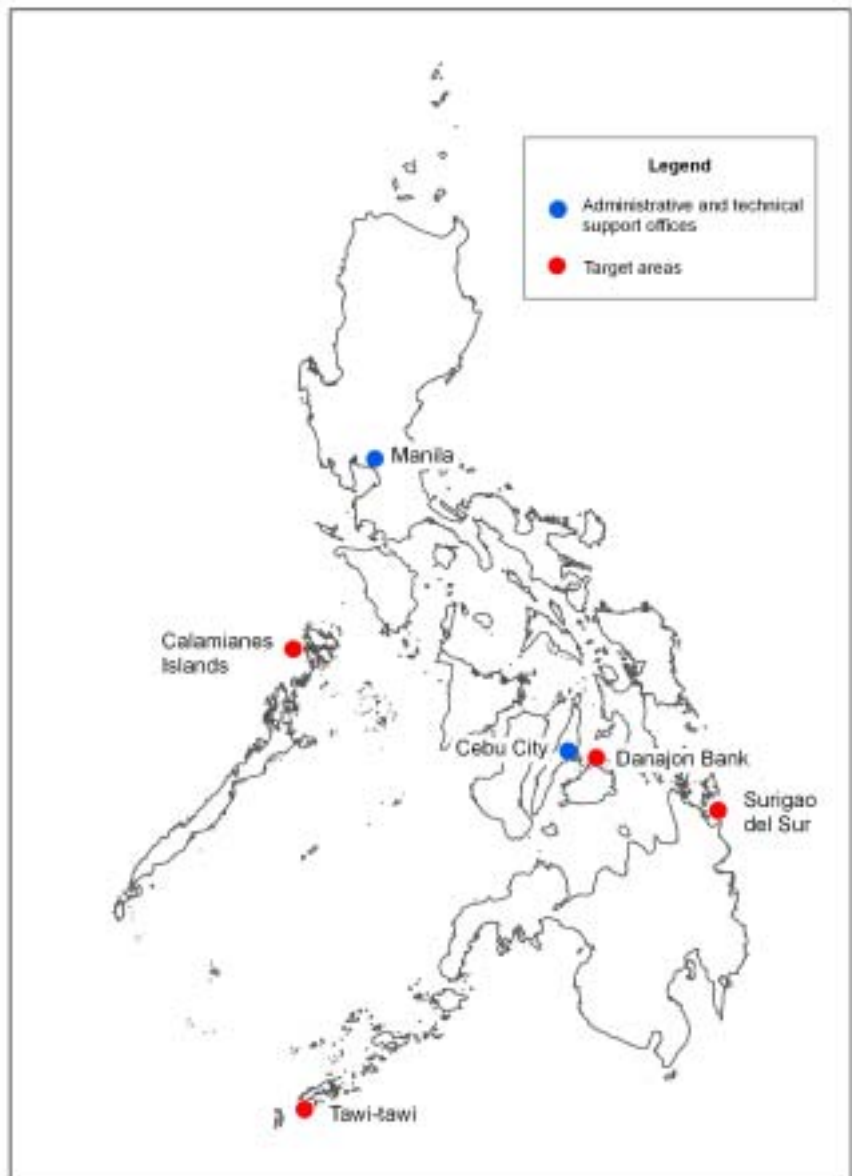


FIGURE 1. FISH TARGET SITES AND ADMINISTRATIVE CENTERS.

marine biodiversity, and high dependence of coastal communities on its marine resources.

In the case of FISH, the EBFM principles define project site boundaries and guide planning and institutionalization initiatives in the following specific manner:

1. The project areas are informed by ecological criteria (fisheries boundaries that represent ecosystem function) rather than by political boundaries.
2. The project is working with clusters of municipal governments that comprise the fisheries ecosystem of concern.

3. The planning effort is intended to encourage each municipal government to look beyond their boundaries for planning purposes and to set the stage for an ecosystem-based plan as opposed to only a municipal government plan. FISH will still be supporting CRM plans in each municipal government as a stepping stone toward an EBFM approach.
4. Early actions for coastal and fisheries management will be strategically based on the results of baseline assessments that show opportunities to improve fisheries from an ecosystem perspective. These early actions are borne out of the need to start management quickly to catalyze long-term planning processes and engender stakeholder commitment.

The most compelling reason to adopt EBFM as a guiding management framework is that fisheries are embedded with large social and ecological systems that must be managed holistically. The marine and coastal habitats, living resources and coastal communities are linked ecologically, economically and socially. For example, many fish naturally move across institutional and political boundaries. The most valuable fish frequently rely on prey fish and other organisms for food. Most fish require a variety of habitats to reproduce and grow. Water quality, which is affected by land use patterns, directly impacts the health of coral reef, mangrove and seagrass areas. If habitats continue to be degraded and fishing pressure remains high, fish stocks are bound to collapse. The negative implications for coastal communities and economies can be serious and long-lasting.

While the problems may seem insurmountable, there are many successful initiatives to build on in the Philippines. The EBFM approach of the FISH Project builds step by step, and complements existing management systems that are already proven and functioning in the Philippines. It utilizes the existing legal and institutional framework while encouraging progress toward ecosystem-wide management. It assumes that functioning ICM or CRM units at the community, municipal/city and provincial levels that

consider fisheries management are the foundation of effective EBFM. EBFM tools include the fundamentals of sound coastal planning as well as more focused tools such as marine protected areas, limitations on fishing effort and gear, and fisheries law enforcement, among others.

A primary output of the FISH Project in each of the four target areas is an ecosystem-based coastal and fisheries management plan. A prerequisite to the development of this plan is the compilation of information to collectively comprise a coastal and fisheries management profile that provides adequate data and basis from which the plan can be formulated. In addition, the process leading to the management plan is important so that the local stakeholders are engaged and take full ownership of the plan as it evolves (Figure 2).

Several key steps and strategies in the development of the profile and management plan are as follows:

1. Compile all existing relevant information on the target area for planning.
2. Conduct scientific baseline studies on fisheries and coastal habitats to monitor change and to provide rigorous data input to resource management.
3. Conduct participatory coastal resource assessments (PCRAs) in selected coastal communities to build an information base and to engage local stakeholders (Deguit *et al.* 2004).
4. Conduct stakeholder planning workshops that utilize all relevant local information for management plans of coastal municipalities that is consistent with and evolves into the ecosystem-based management plan for the target area of concern.
5. Analyze and publish the body of available, relevant information as the basis for a management framework for coastal and fisheries resources.
6. Implement action plans as appropriate with a broad constituency.

The final chapter of this profile provides some suggestions for management plan field interventions.



FIGURE 2. TARGET AREA PLANNING AND IMPLEMENTATION PROCESS FOR FISH EBFM PROCESS.

A project support framework to develop the coastal ecosystem profiles for the target area relies on substantial data from PCRA and scientific baseline assessments (BLA) with outputs stored in several spatially explicit databases (Figure 3). This will be utilized in the ecosystem profile development.

The FISH Project plans to implement various strategies to improve the management of fisheries in project sites. Below is a partial list of these strategies:

1. conducting strategic planning based on baseline and ongoing assessments and profiles;
2. conducting participatory monitoring and evaluation to inform planning and implementation;
3. educating stakeholders through participatory planning and engagement in the management process as well as other learning activities;
4. implementing marine protected area networks designed to protect and rehabilitate coral reef and other coastal habitats, support fish stocks through spillover of adults and larval

dispersal, and provide social and economic benefits;

5. limiting access to fishery resources through registration, licensing, zoning, gear restrictions and other options as appropriate for a given area; and
6. strengthening coastal and fisheries law enforcement.

## PAST COASTAL AND FISHERIES MANAGEMENT EFFORTS IN BOHOL

Bohol's important fisheries and marine biodiversity resources are in a state of rapid decline—a looming crisis for coastal communities that depend on these resources for their livelihoods and food. All of the key problems cited in Table 1 are found in Bohol. In the Danao Bank area, local fishers are particularly concerned with the rampant use of illegal fishing methods, the inconsistent implementation of fisheries laws, and the competition between commercial and municipal fishers for dwindling resources.



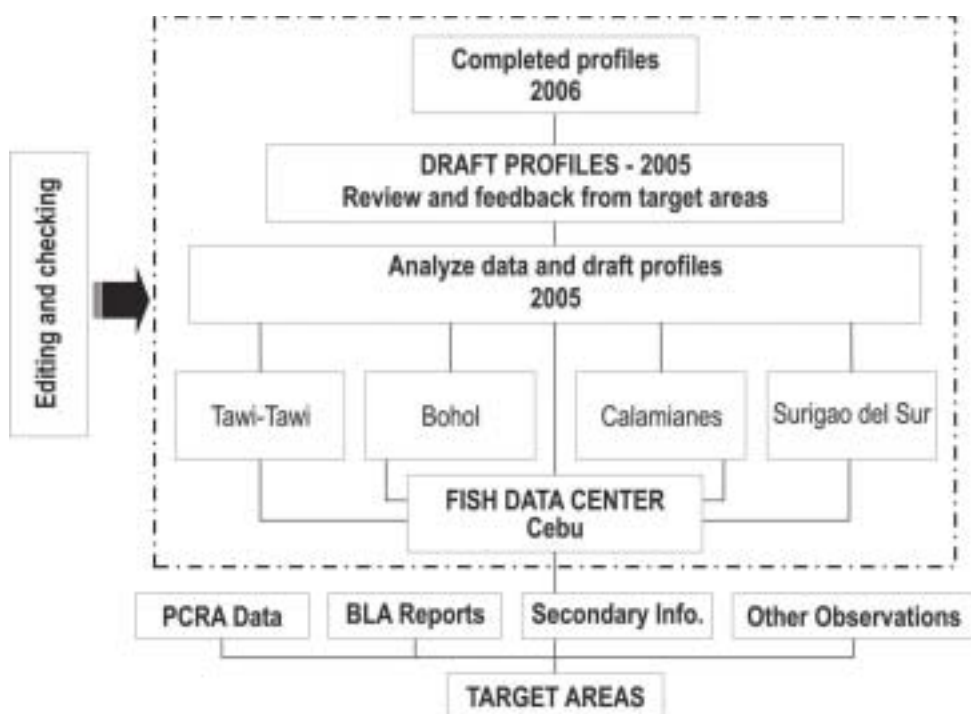


FIGURE 3. PROJECT SUPPORT FRAMEWORK FOR PROFILES.

Fisheries management in the Philippines has historically been informed by government policies that encourage increased fishing effort and modernization. Only recently, through the Fisheries Code of 1998, has sustainable fisheries management emerged as an organizing principle. In addition, other national laws and policies support sustainable use and management of coastal resources. But the practical field implementation is only beginning and basic controls on fishing effort, capture of juveniles, capture of endangered species and use of destructive fishing methods are lacking in most places.

Important components of EBFM are not new to the Philippines and Bohol. As early as 1986, the Central Visayas Regional Project-I utilized ecosystem-based management in its implementation by focusing interventions in uplands (reforestation) and nearshore (fisheries). However, since this was a pilot project in community-based management, the major activities were on community organization, capability-building and mobilization, and improving productivity of upland and nearshore areas by introducing interventions such as reforestation, artificial reefs and fish aggregating devices.

The Coastal Resource Management Project (CRMP) was active in this area from 1996 to 2004 (CRMP 2004). This project worked primarily through local government units (LGUs) to implement ICM, a planning process focused on improving the management of nearshore coastal habitats and resources. In northern Bohol, the main accomplishments of CRMP were the institutionalization of CRM best practices in most of the LGUs. LGUs developed and adopted CRM plans, Fisheries and Aquatic Resources Management Councils (FARMCs) and one or more best practices including marine protected areas, among others.

Currently, the Project Seahorse Foundation for Marine Conservation, the Marine Aquarium Council and the Community-based Resource Management (CBRM) Project are active in northern Bohol. The Project Seahorse Foundation has a long standing collaboration with seahorse gatherers and coastal communities and has been active primarily in monitoring reef systems, establishment of marine protected areas, development of an advocacy network of fishers, and implementation of national and international policies. The MAC is focused on educating coastal communities about the negative effects of cyanide fishing and developing market

systems that bring net-caught aquarium fish to foreign markets for a premium price. The CBRM Project is working with selected LGUs to implement a variety of habitat restoration projects for improved CRM.

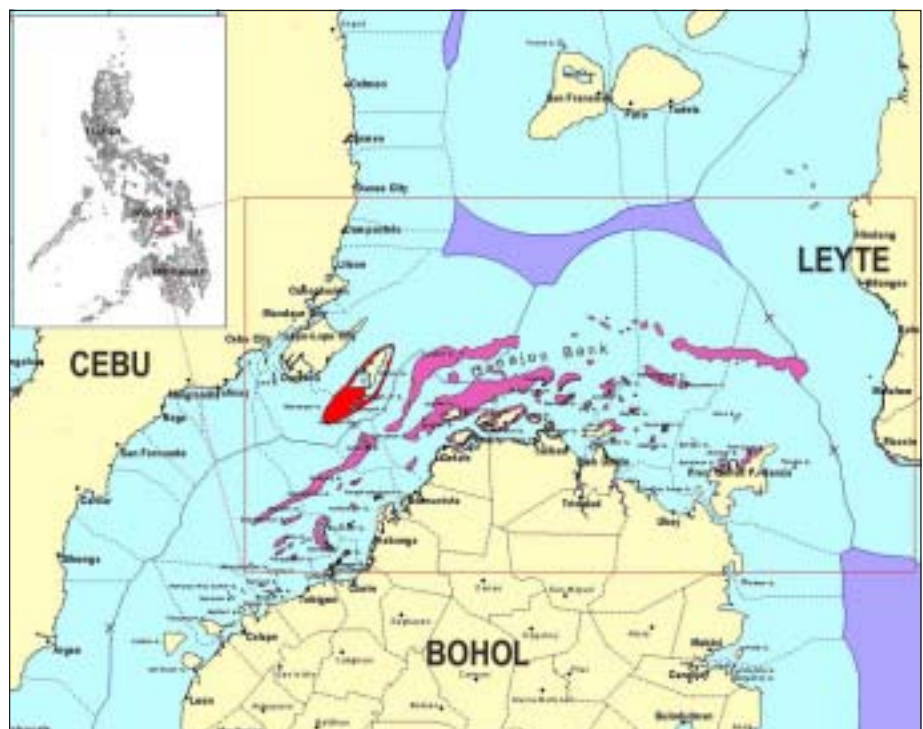
Overall, the FISH Project, along with various other projects and institutions, is working toward establishing EBFM in the Philippines. It will necessarily build from the valuable experiences in coastal and fisheries management in the past. This fisheries ecosystem profile is an initial step to describing the state of coastal communities and fishery resources for Danaon Bank, while identifying policy responses to address declining fishery resources. The problems are profound, but much can be accomplished with dedication and commitment!



# CHAPTER 2

## SOCIOECONOMIC AND INSTITUTIONAL CONDITIONS IN DANAJON BANK

The Danajon Bank or Double Barrier Reef, located off northern Bohol Island, is the only double barrier reef in the Philippines and is 1 of only 3 such sites in the Indo-Pacific (Pichon 1977). The reef is spread across almost 130 km and consists of 3 large reefs. Caubiyán is the largest covering about 143 km<sup>2</sup>. There are 5 smaller reefs in the northern outer region and 1 other large reef, Calitubas, in the inner region. The overall area of the Danajon Bank is 272 km<sup>2</sup> with an aggregate coastline of 699 km including 40 islands (Figure 4) (Fish Project, GIS data). The Danajon Bank makes up over 1% of the total area of coral reef of the Philippines (estimated at 27,000 km<sup>2</sup>).



**FIGURE 4. DANAJON BANK DOUBLE BARRIER REEF, NORTHERN BOHOL.**



Sixteen municipalities and 1 city include the Danajon Bank within their area of jurisdiction, within 4 provinces and 2 administrative regions. In Region 7, 10 municipalities belong to Bohol and 2 to Cebu. In Region 8, 4 belongs to Leyte and 1 city to Southern Leyte. The shoreline of all 16 municipalities and 1 city covers 699 km (Table 2). Ten National Integrated Protected Area System (NIPAS) sites occur within these boundaries and include 7 strict nature reserves and 3 protected seascapes (Green *et al.* 2002). To date, 60 community and municipal-based marine protected areas (MPAs) have been established within the area in various stages of protection and management (CCEF 2004). The FISH Project activities focus on 4 Bohol municipalities with jurisdiction on the Danajon Bank (Figure 5).

TABLE 2. MUNICIPALITIES WITH JURISDICTION OVER THE DANAJON BANK AND THEIR SHORELINE.

Province	Municipality	Shoreline (km)
Bohol	Tubigon	28
	Clarín	29
	Inabanga	62
	Buenavista	32
	Getafe	77
	Bien Unido*	45
	Trinidad	8
	Ubay*	61
	Pres. Carlos P. Garcia*	76
	Talibon*	86
Cebu	Lapu-lapu City	112
	Cordova	21
Leyte	Matalom	14
	Bato	4
	Hilongos	12
	Hindang	7
Southern Leyte	Maasin City	25
Total		699

\*Municipalities that are focal areas of the FISH Project.

## THREATS TO COASTAL RESOURCES

Danajon Bank area has been subjected to extremely high fishing pressure, largely through unsustainable and destructive, not to mention illegal, fishing methods (Figure 6). The use of cyanide and compressors is widespread. In a 1995 survey of northern Bohol, it was determined that dynamite fishing was the preferred method in the area because it yielded the highest average catch of 17.5 kg per person-hour (ADB *et*

*al.* 2003). Since that time, such catches, even with use of dynamite, have dwindled because few fish remain in the area. Collection of fish for the aquarium trade has taken its toll through the use of cyanide, resulting in further reef degradation. Fisheries outside of the shallow reef areas are also heavily exploited by a combination of small-scale locally based fishers and commercial fishing boats that fish illegally inside the 15 km municipal boundary.

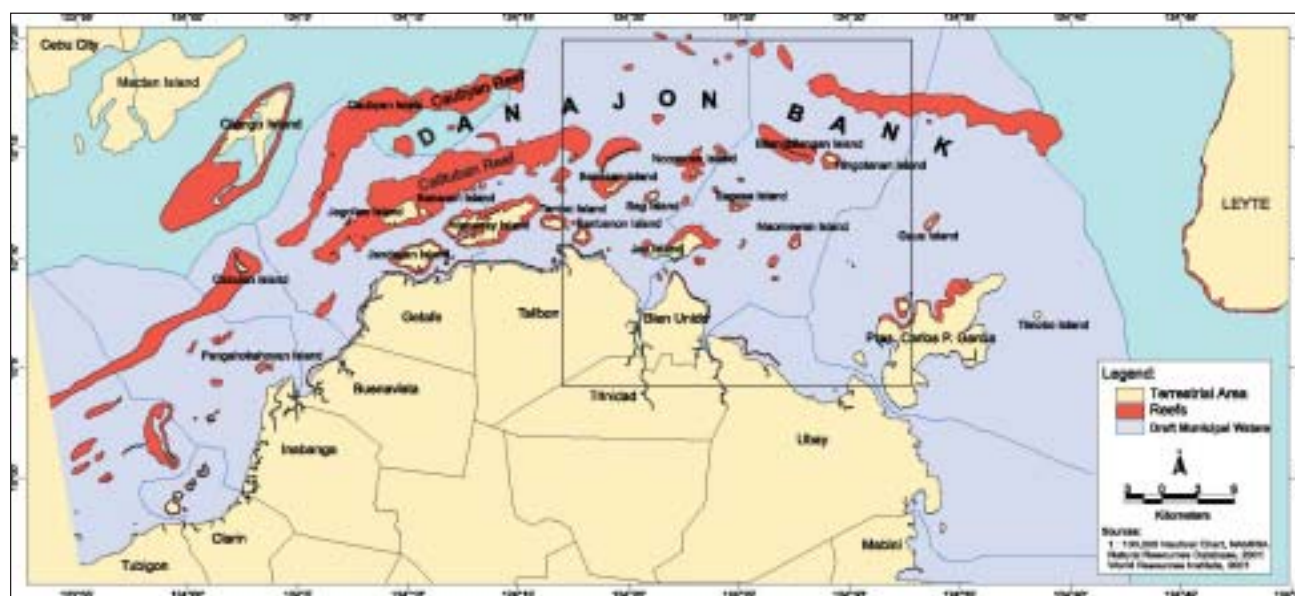


FIGURE 5. MAP SHOWING TARGET AREAS OF THE FISH PROJECT ON THE DANAJON BANK.

# **LEGEND:**

- 1st District Coastal Law Enforcement Council
- 2nd District Coastal Law Enforcement Council
- 3rd District Coastal Law Enforcement Council
- Unofficial municipal water boundaries
- Beach seine, fine-mesh push and pull nets (small-scale)
- Trawl, seine net and other fishing gears using scaring devices
- Use of natural fish poisons (vines/roots)
- Commercial fishing (ring net)
- Semi-commercial lift net and bag net
- Small-scale commercial fishing
- Dynamite fishing
- Fish aggregating devices
- Illegal cutting of mangroves
- Illegal sand extraction
- Muro-ami fishing
- Coral extraction
- Cyanide fishing
- Smuggling, piracy
- Superlight

**Sources:**  
**BEMO (2001)**  
**Coastal Law Enforcement**  
**Councils 1, 2 & 3**  
**CRMP (2001)**  
**NRDB (2001)**

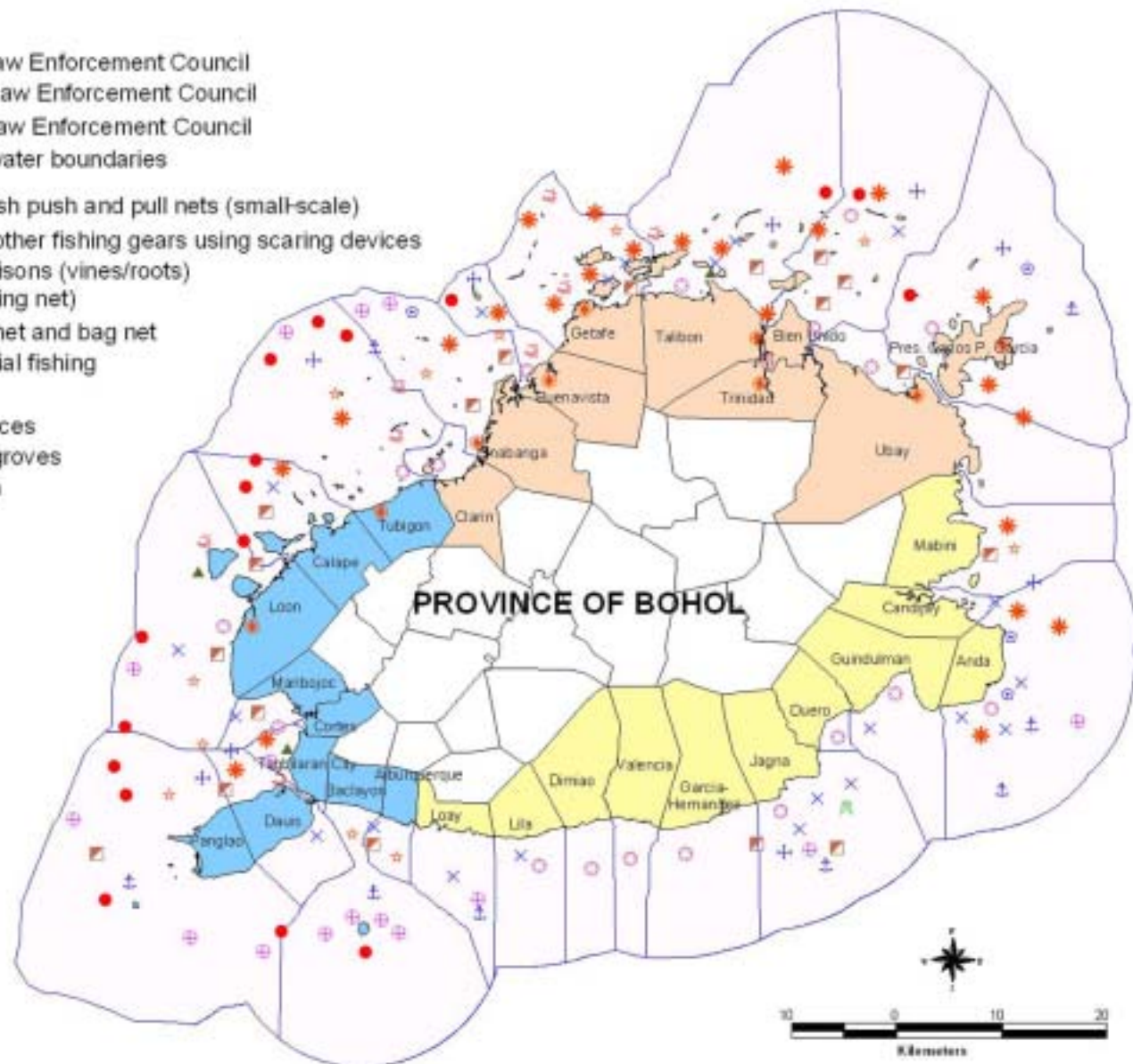


FIGURE 6. DESTRUCTIVE AND ILLEGAL FISHING AROUND BOHOL (GREEN ET AL. 2002).

In addition to fishing-related disturbances, the overall reef condition is also degraded due to sediment accumulation, causing smothering and prohibiting coral regrowth. The coastal areas adjacent to the Danaon Bank have high-density settlements, such as in Tubigon (539 persons/km<sup>2</sup> compared to the average density for the Province of Bohol of 282 persons/km<sup>2</sup>) (ADB *et al.* 2003). The high population density within these communities leads to conversion of more land for settlement, agriculture and landfills for waste disposal. This all adds to the pollution load in the Danaon area. Mangroves are also being removed and the area converted to other uses, thus contributing to increased runoff from terrestrial areas. The loss of mangroves also reduces critical nursery habitat and shoreline resilience to erosion and storms.

The final threat to the area is the poverty in northern Bohol and surrounding provinces. Over 60 percent of the coastal inhabitants of northwestern Bohol live below the poverty line of PhP6,000 per month (Green *et al.* 2002). This low income drives fishers to catch smaller fish and use more efficient but destructive methods. Such poverty significantly lowers the capacity of people to change their behavior and switch to alternative, sustainable livelihoods.

## SOCIOECONOMIC CONTEXT OF DANAON BANK

Northern Bohol is an area rich in coastal resources. Historic and contemporary human interactions with these resources are complex. A comprehensive understanding of these interactions is the logical first step toward improving coastal and fisheries management.

The overall socioeconomic conditions in northern Bohol are not well documented. What little information exists has been collected by various entities and is dispersed. This section will provide an overview of what is known. When possible, information is provided at the level of the FISH focal area. Chapter 5 suggests what socioeconomic and governance information is needed for the development of a comprehensive coastal and fisheries management plan for the area.

## BASIC STATISTICS

The FISH Project is focusing its efforts in the municipalities of Talibon, Bien Unido, Ubay and Pres. Carlos P. Garcia. Each of these municipalities has a unique and colorful history in which the sea and coastal areas frequently play central roles ([www.bohol.ph](http://www.bohol.ph)).

- Talibon is 17,704 ha in area with 54,147 inhabitants in 2000 in 25 barangays. The name may have been derived from the term *talibong*—a spear used to look for gold. The municipality was the site of a guerrilla resistance to the occupying Japanese in World War II led by Pres. Carlos P. Garcia. Various rivers bisect the municipality and provide access to the interior.
- Ubay is 20,755 ha in area with 59,827 inhabitants in 2000 in 44 barangays. The name Ubay is likely derived from the term *ubay-ubay* which means alongside. Traders are reported to have traveled on a trail alongside (*ubay*) the beach to avoid strong currents in the area.
- Bien Unido is a relatively small municipality of 4,482 ha with 22,176 inhabitants in 2000 in 15 barangays. The name of this municipality signifies the unification of two sitios, originally part of the municipality of Trinidad, which by 1981 became a separate municipality.
- Pres. Carlos P. Garcia consists of 6,528 ha with 20,744 inhabitants in 2000 in 23 barangays. This island municipality, consisting of 7 islands, was originally named Lapinig Grande. By 1997, this name was changed to honor the former Philippine President from Bohol.

A brief review of income levels and health and education systems suggests that the socioeconomic conditions in these four municipalities are below national standards, despite the considerable coastal natural resource base. Downward socioeconomic trends are exacerbated by worsening environmental conditions.

## INCOMES WITHIN NORTHERN BOHOL FISHING COMMUNITIES

Bohol is one of the poorest provinces in the country based on overall selected poverty indicators. According to the latest NSO annual poverty indicator

survey, approximately 47% of Bohol families are under the Philippine government's poverty threshold levels. The incidence of individuals living in poverty has increased by 10.5% since 1997 in Bohol. The average monthly family income is only approximately PhP4,745, or less than US\$100 per month. Approximately 51% of a family's income was spent on food while less than 1% was spent on medical care.

Fishing communities are among the poorest and most marginalized in the Philippines. Approximately 8,854 fishers are found in the four FISH focal municipalities. In 1997, the average monthly income from fishing was approximately PhP1,830 per month or US\$69 (at 1997 exchange rates). While precise estimates are difficult to make, over 60% of the coastal inhabitants lived below the poverty line of PhP6,000 per month for a family of 5-6 members in 1997 (Green *et al.* 2000). Considering dwindling resources, it is almost certain that fishery-based incomes have declined.

Livelihoods vary considerably between the different groups of fishers. Lantern fishing communities are among the poorest of the poor. To quote a recent report by Project Seahorse Foundation,

The average annual gross income for sea-based and land-based economic activities was found to be PhP55,616. Fishing trips by fishers yielded on the average, PhP120/trip. These figures were below the average family income for Bohol, at PhP77,291 for 2000, and Region VII, at PhP94,676 for 2000 (NSO 2000). This is also below the national average of PhP88,782 for 2000 (NSO 2000) (Barbon 2005a&b).

These incomes are likely augmented by remittances from family members working abroad or elsewhere in the Philippines. The impact of such income sources is unknown.

The high incidence of poverty limits options available to FISH, government officials and resource users and suggests that the stakes are high. If environmental degradation continues, the poorest and most dependent sectors will suffer the most.

## HEALTH

The Rural Health Unit and its Barangay Health Stations are the most important institutions for medical care delivery for most rural inhabitants. There is a serious, and growing, lack of personnel servicing northern Bohol municipalities (PATH-Philippines 2004). While life expectancy is on the rise—a factor that has likely contributed to growing rates of coastal resource extraction—basic health services (including reproductive health services) are lacking. The provincial development plan dedicates considerable attention to these matters:

In 2002, Bohol's health resources included 33 hospitals and clinics spread all over the province providing secondary and tertiary level health services to the public with a total bed capacity of 1,143 or 1 hospital bed per 1 thousand population. This is below the standard of 1 bed per 500 people... Out of 1,109 barangays in the province, only 29% of these barangays in 2002 have Barangay Health Stations where primary health care can be accessed in the rural communities of the Province. This could explain the fact that the majority (75%) of child deliveries in Bohol in 2002 were done in the home rather than in hospitals or other health centers with only 55% of deliveries in that year attended by midwives...

In Bohol, malnutrition still exists. Operation Timbang results showed that about 30% of preschool children (under 5) weighed were found to be malnourished at varying degrees in 2002. Among school children in public schools, 41.65% of the total public elementary school population enrolled at the start of the School Year were found to be malnourished. About 6% of babies born in Bohol 2002 weighted less than 2,500 grams...

Infant death rates were highest in the municipalities of Pres. C.P. Garcia (42.11 per 1,000 newborns), Buenavista (33.10), Valencia (31.50), Dagohoy (26.91) and Talibon at 23.47 per 1,000 live births...



According to the Provincial Health Office, only 61% of families in the province in 2002 had access to safe drinking water while about 18% of the households in Bohol still have no sanitary toilets (PHO 2002)...

## POPULATION GROWTH

With the Philippine population of approximately 86 million people projected to double in 28 years, infrastructure, services and environmental conditions will be stretched to the limits. Family size can be thought of as a reproductive health issue. Research in the Philippines demonstrates that many women want access to reproductive health services, based on desires for improved personal health and concern for the health and well-being of their children.

Region VII is one of the fastest growing regions in the Philippines. Five out of the 16 administrative regions have growth rates higher than the national figure. Two of these are in Luzon (Central Luzon - Region III - 3.20 % and Southern Tagalog - Region IV - 3.72 %), one in the Visayas (Central Visayas - Region VII - 2.79 %), and two in Mindanao... (NSO 2000).

Since 1990, the coastal population in Region VII has increased 24.7% and Bohol's population has grown by 19.5% (NSO 2001).

Expert organizations have expressed concern regarding the recent rapid growth in Bohol's population.

The population of Bohol grew at an average annual growth rate of 2.95 percent during the intercensal period 1995-2000. This was the highest population growth rate ever recorded in Bohol since 1903 and a ballooning 2.06 percentage point difference from that of 1990-1995 period. If this growth rate continues, the population of Bohol is expected to double in about 23 years... The number of households likewise rose from 191,657 households in 1995 to 213,215 households in 2000. The average household size recorded was 5.34 persons, higher than the figure five years ago (5.18

persons) and the national average of five persons. (PATH-Philippines 2004)

The Bohol population is very young, with half of the population at younger than 22 years of age.

Population densities in the Danao Bank area varies, as likely associated with economic opportunities, land tenure and historic patterns (Figure 7). The growth rate in northern Bohol is likely significantly lower than other areas within Region VII (Green *et al.* 2000), partly due to limited economic opportunities. However, the population densities on outlying islands on Danao Bank are extraordinarily high, and suggest a high level of dependence on coastal resources (Figure 8).

## EDUCATION

Effectively defining and establishing a sustainable relationship between human needs and environmental quality is based upon the participation of a well-informed public in policymaking. There is a growing awareness in the Philippines of the declining status of coastal resources and the need for improved management. Formal and nonformal education initiatives, highlighting key coastal issues and solutions, are central activities within the FISH Project. While there are encouraging trends, the overall educational infrastructure in Bohol is in a chronic state of need, and considerable financial barriers frequently prevent children from attending school. To quote the Provincial Development Plan:

...more than half or 52% in Bohol had attended/ finished elementary education; one-fourth (24%) high school and only 13% with college education. Females dominated the higher levels of education with 13% of the total household population aged 5 years and over. For the year 2004, more than 40 thousand students are expected to enroll in all levels of education in Bohol. Almost half of these are in the elementary level...

The lantern fishers of Bohol that collect seahorses and other marine animals on Danao Bank are among the poorest in the Philippines. Their access to

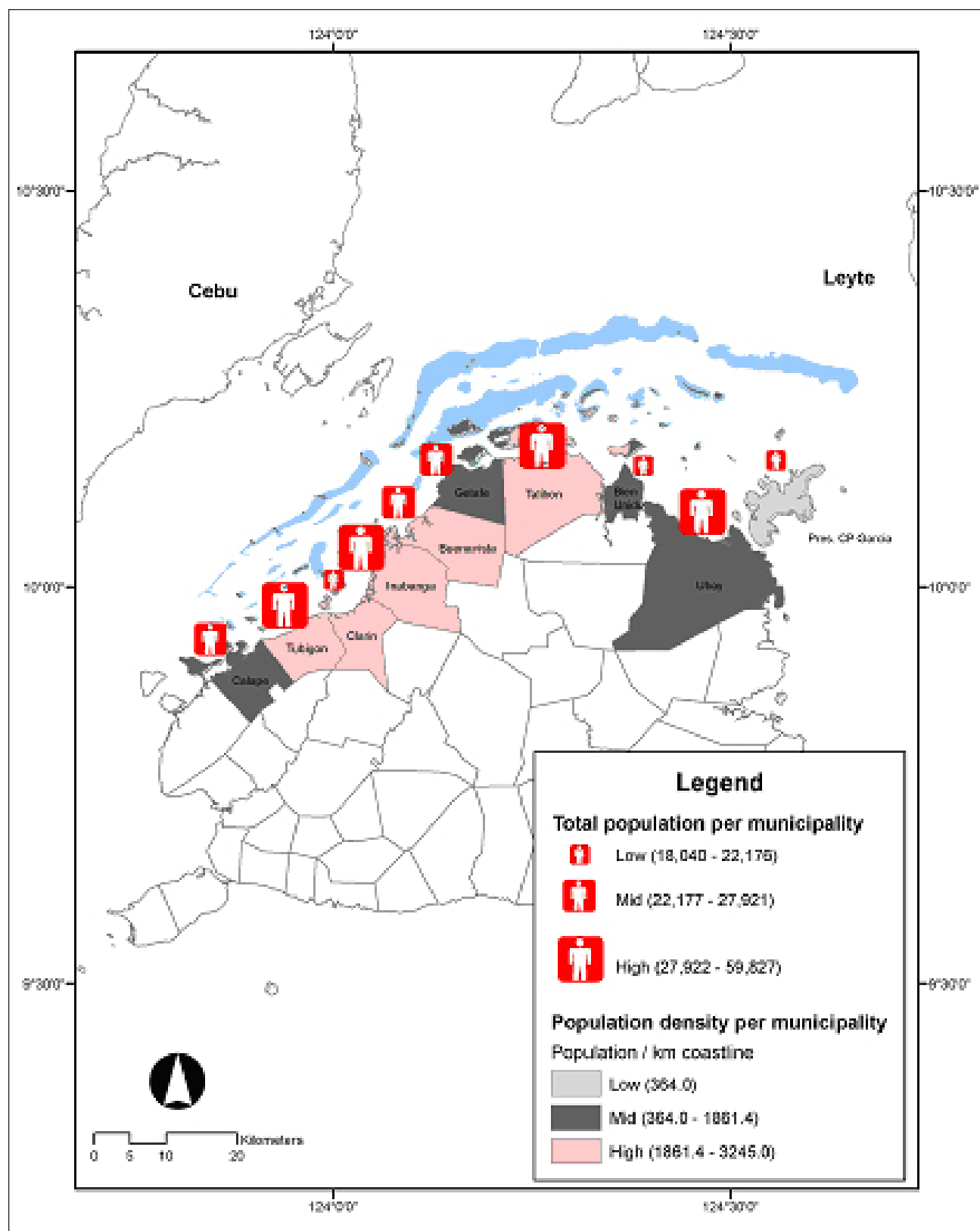


FIGURE 7. POPULATION AND POPULATION DENSITY PER MUNICIPALITY (GREEN *ET AL.* 2004).



**FIGURE 8. DENSE POPULATION LEVELS ON CALITUBAN ISLAND.**

formal education is even more limited according to Project Seahorse research (Barbon 2005b).

Formal education among lantern fishers was found to be very low, with the majority not having finished elementary school (81%). Twelve percent had finished elementary school, and the remaining 7% had achieved a higher level of formal education. Their wives on the other hand fared better in terms of education. Only 61% of them were not able to finish elementary education compared to the 81% of their husbands and 19% were also able to finish high school, 11% higher than for the lantern fishers.

Despite these limitations, literacy remains high in Bohol according to Department of Education statistics at somewhere between 82 and 98% of the population—a condition that broadens the suite of available tools for education campaigns to engage the public.

## **COASTAL ECONOMIC ACTIVITIES**

Currently Bohol is heavily dependent on agriculture and fishing with approximately one-third of the working population engaged in these livelihoods (Green *et al.* 2000). In the northwest Bohol coast, approximately 50% of the population is engaged in

fishing, and only 5% of coastal inhabitants own agricultural land (Calumpang *et al.* 1997). Underemployment and unemployment are serious, but not at crisis levels. For example, approximately 80% of the labor force (between 15-64 years old) is employed and 19.4% unemployed in Ubay (PATH-Philippines 2004).

With a rapidly growing population and limited marine resources, economic diversification is a key dimension for sustainable development. Sustainable coastal tourism is one such diversifying opportunity. Northern Bohol is

blessed with a wealth of tourist destinations that remain largely untapped. To quote the *Lonely Planet* tourism guidebook, an essential reference for most foreign travelers:

Ubay...has a lively market on the sea, just near the wharf selling everything from woven goods to ice cream...Way off most travelers' maps, Ubay offers masses of uncharted tourism territory around nearby Pres. Garcia Island. No official accommodation exists on the island at this stage, but it is a great place to meander through the mangroves, and organizing homestays through the village captain is possible once on the island. (Rowthorn *et al.* 2003)

The double barrier reef represents a potential global attraction for divers and ecotourists, potentially providing numerous jobs and stable tax revenue, but only if its ecological condition is significantly improved.

While the tourism potential is considerable, the definition and implementation of critical components of a Bohol sustainable tourism plan remain incomplete:

...The province clearly lacks a concerted program in arts and culture...that will sustain Bohol's status as an Eco-cultural Tourism Destination of the country. The Provincial Government has yet to map out a clear agenda

for a sustained eco-cultural development. While it has been declared that Bohol's Development Vision as a prime Eco-cultural Tourism Destination of the country, there is no mention of general strategies in the field of culture... (Bohol Provincial Government)

Preparing local residents to actively capitalize on the tourism trade remains as another task at hand.

In summary, while tourism is one alternative to rampant resource extraction, its development will require careful planning and changes in how coastal areas are currently treated. Clean and unobstructed beaches, healthy mangroves and coral reefs, and educated local tourism brokers are the assets that will attract and sustain tourism.

Seaweed culture is another alternative to resource extraction (Figure 9). Thousands of families on the outlying islands depend on *Eucheuma* spp. culturing to either supplement or provide a main source of income. While potentially vulnerable to disease and fluctuations in price, seaweed culturing can provide considerable income. Water quality must be excellent to culture most seaweeds successfully.

Finally, pond culture of fish and shrimp has been a long-standing source of income for some on the north Bohol coast (Figure 10). For example, in the municipality of Pres. Carlos P. Garcia, approximately 405 ha of developed fishponds are maintained and operated by 52 separate owners (MAO 2004). While an important part of the economy, the impacts on mangroves can potentially reduce ecosystem services from this essential habitat.



FIGURE 9. SEAWEED CULTURING ON DANAON BANK.



FIGURE 10. AQUACULTURE ON NORTHERN COAST OF BOHOL.

## THE STATE OF COASTAL PLANNING AND GOVERNANCE

The level of experience with and progress toward coastal planning and management are inconsistent around the Danaon Bank area—primarily due to the fact that previous coastal management projects did not cover all municipalities. The Coastal Resource Management Project and the FISH Project have developed benchmark indicators of progress toward coastal management. Figures 11-13 indicate that some municipalities, especially those in the northwest portion of the Danaon Bank area, are further along in reaching

these benchmarks.

The coordination of various government and nongovernment entities is a critical step toward effective

coastal management. Figure 14 demonstrates that a wide variety of institutional partners in the area have a role to play.

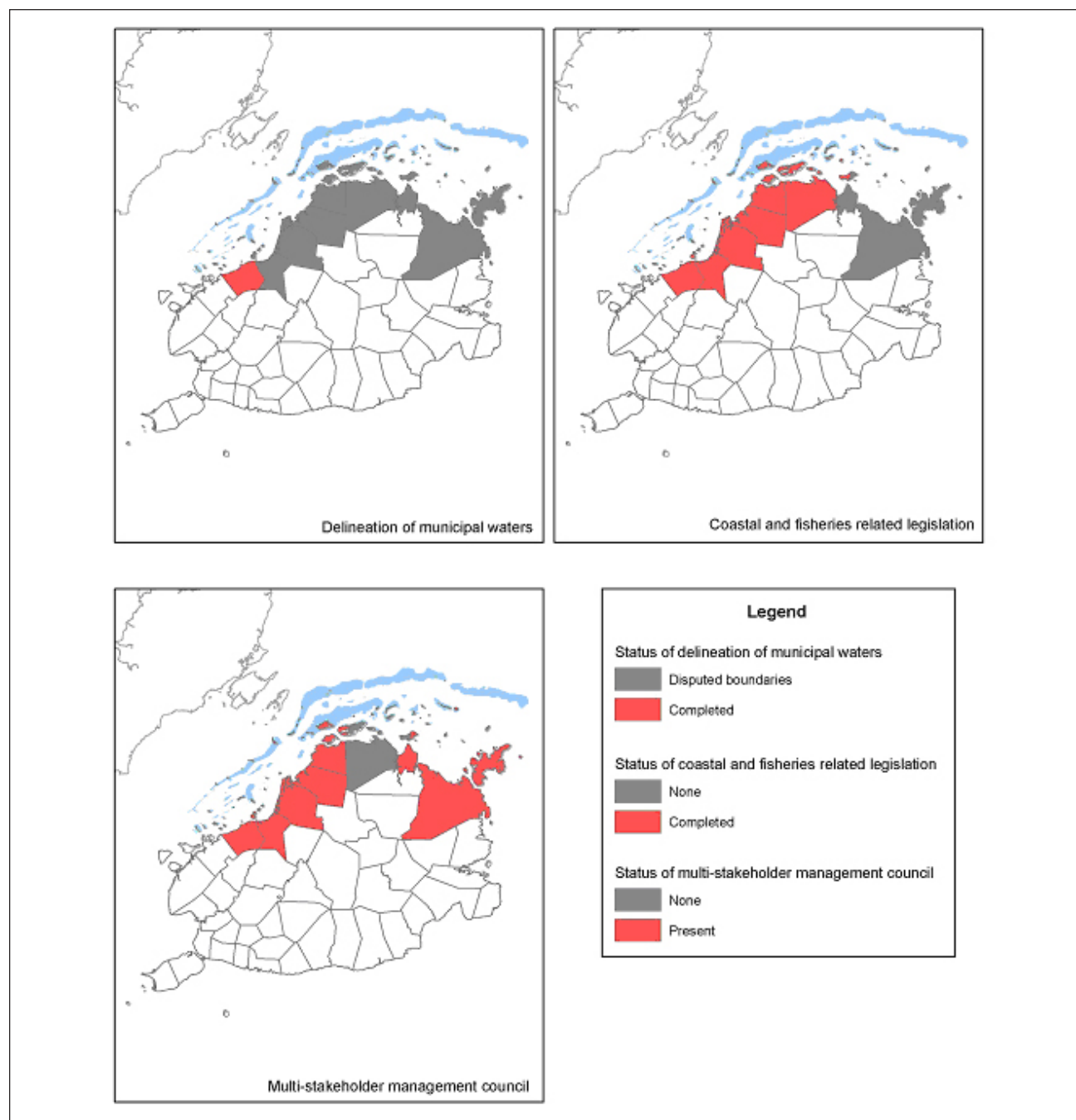


FIGURE 11. STATUS OF CRM BEST PRACTICES: DELINEATION OF MUNICIPAL WATERS, PRESENCE OF COASTAL AND FISHERIES-RELATED LEGISLATION, AND PRESENCE OF A MULTISTAKEHOLDER MANAGEMENT COUNCIL (GREEN *ET AL.* 2004).



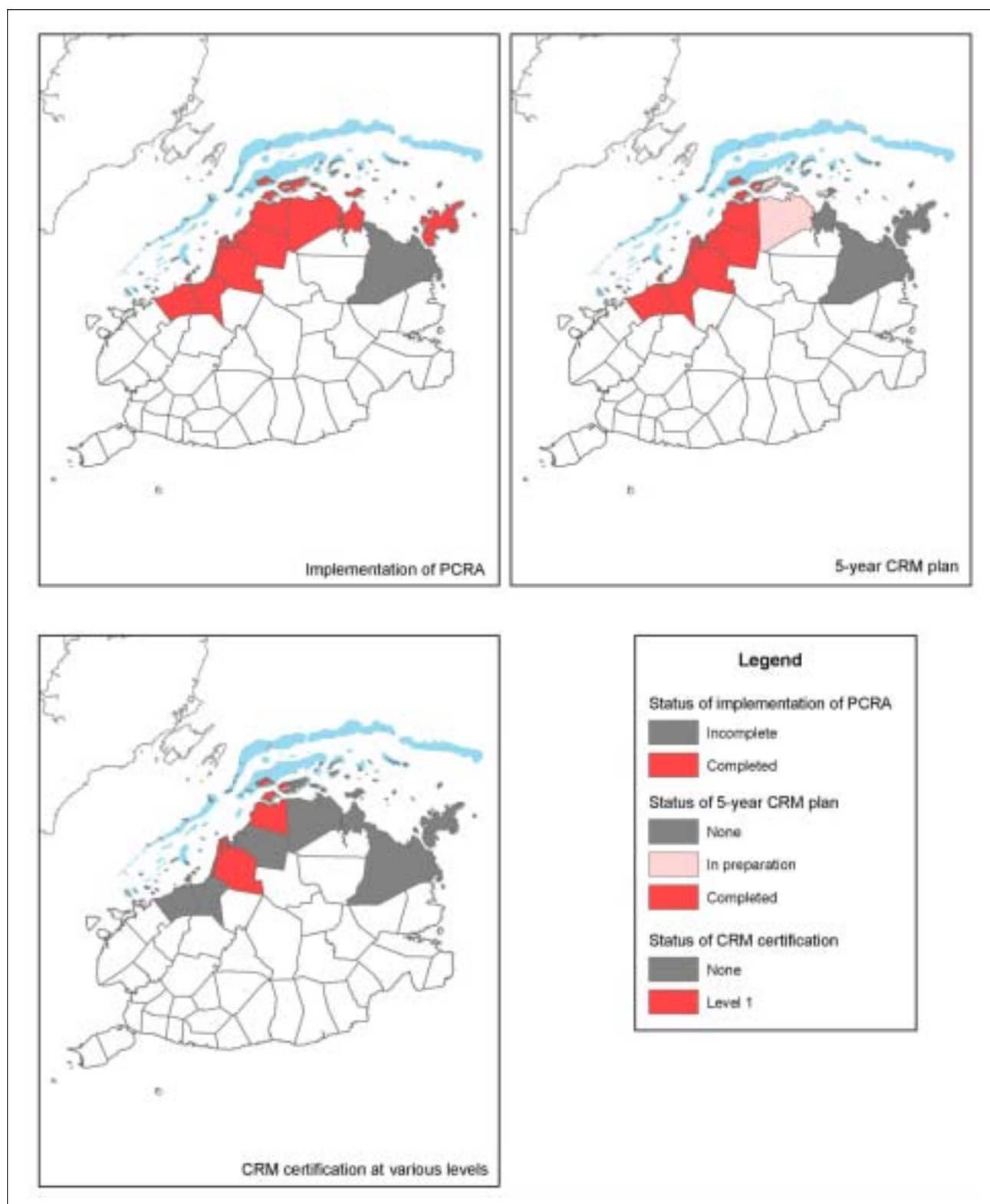


FIGURE 12. STATUS OF CRM BEST PRACTICES: IMPLEMENTATION OF PCRA, PRESENCE OF FIVE-YEAR CRM PLAN AND CRM CERTIFICATION (GREEN *ET AL.* 2004).



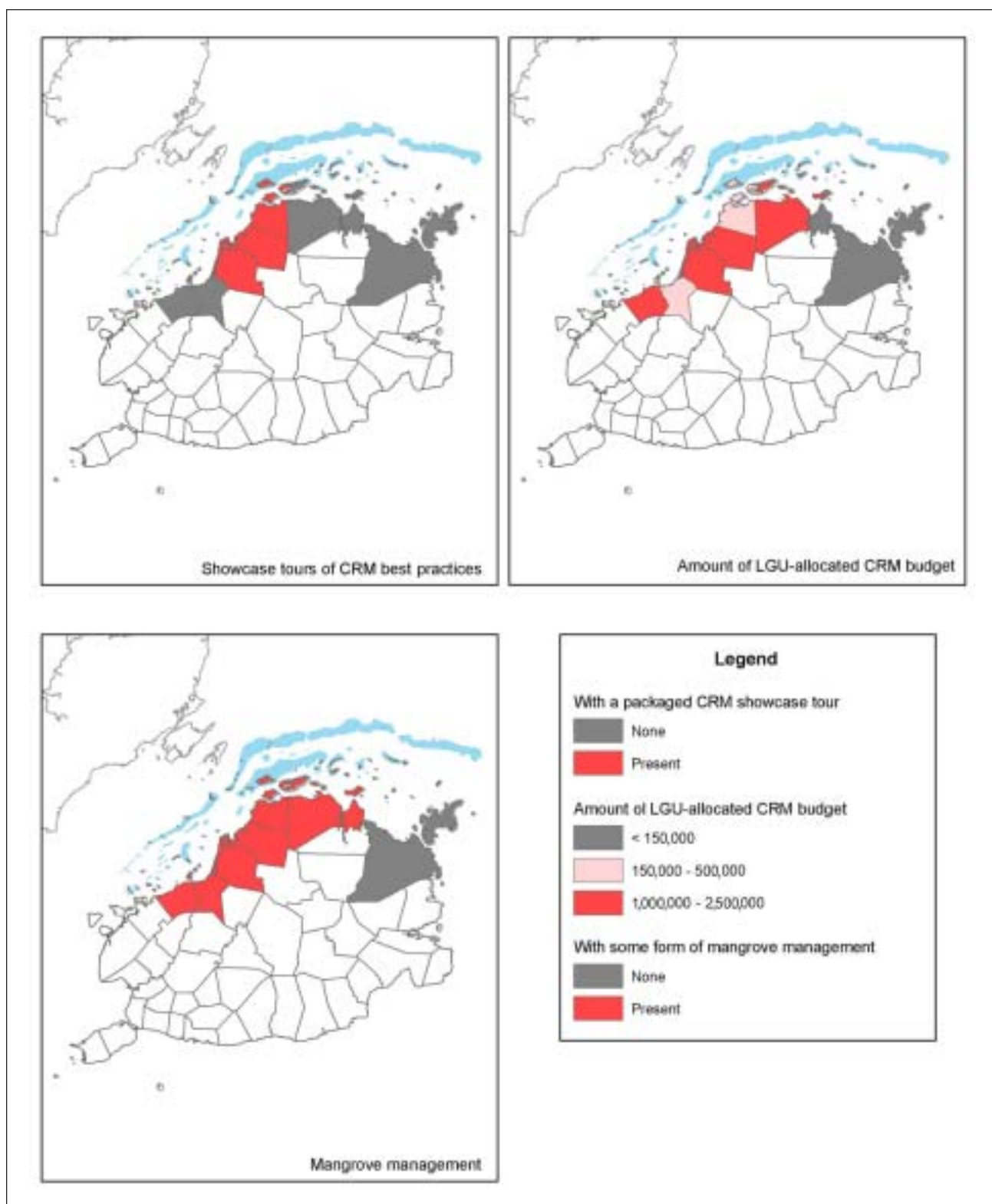


FIGURE 13. STATUS OF CRM BEST PRACTICES: PRESENCE OF A CRM SHOWCASE, CRM BUDGET AND SOME FORM OF MANGROVE MANAGEMENT (GREEN ET AL. 2004).

## SUMMARY

The Danaojon Bank area is a region with socio-economic conditions that make fisheries management difficult, namely, the large population is generally poor and highly reliant on fishery resources. Coastal and fisheries resource management is relatively new to the FISH Project target municipalities. Nonetheless, the leaders of this area are taking bold steps toward

improving fisheries management. As detailed in the next chapter, the impetus to take action comes from the realization that coastal habitats can no longer sustain the level of exploitation they have been exposed to for the last few decades. The situation has serious consequences for food security, biodiversity conservation and economic growth.

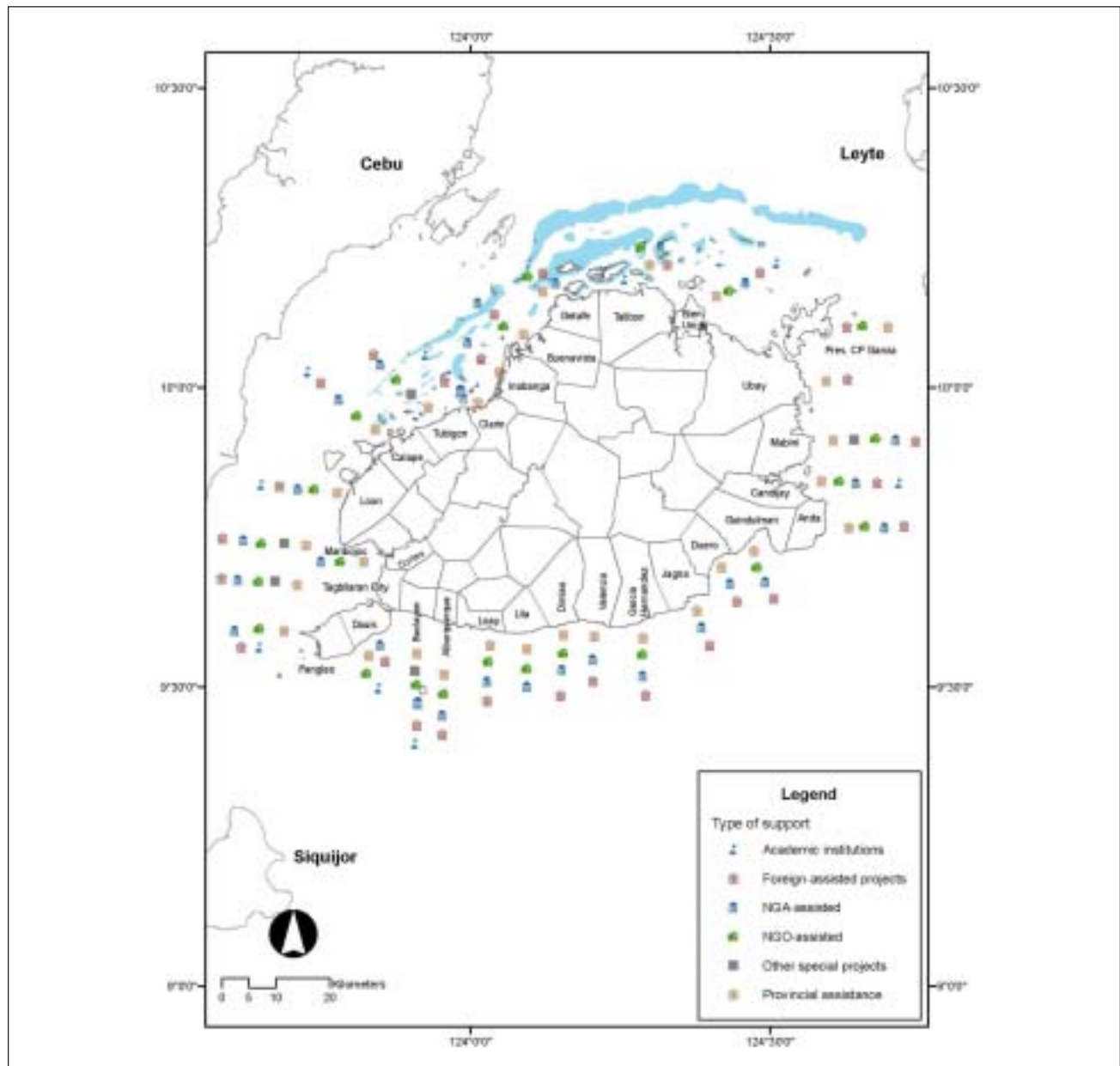


FIGURE 14. PRESENCE OF RELEVANT INSTITUTIONS IN MUNICIPALITIES (GREEN *ET AL.* 2004).



# CHAPTER 3

## STATUS OF COASTAL AND MARINE ECOSYSTEM IN DANAJON BANK



DANAJON BANK IS A COMPLEX REEF SYSTEM WITH A VARIETY OF HABITATS.

This chapter provides an overview of the condition of coastal and marine resources that sustain the human communities of Danajon Bank. This area is of global ecological significance given the high level of marine biodiversity as well as the unique nature of the Danajon Bank's double barrier reef.

### **CENTER OF THE CENTER OF INSHORE FISH BIODIVERSITY**

Carpenter and Springer (2005) have shown that a peak of marine biodiversity occurs in the central Philippine Islands. Special attention to marine conservation efforts in the Philippines and especially within the Danajon Bank is warranted because of its importance as a global epicenter of marine biodiversity.

## GEOLOGICAL SIGNIFICANCE

Pichon (1977) describes the Danajon Double Barrier Reef as follows: It is a unique geologic structure in the Philippines having developed through 6,000 years of coral growth. It is a larger and better-defined structure than other known double barrier reefs in the world. The outer reef lies 11 km offshore, and is composed of several units up to 23 km long each. The inner barrier is 2 km wide and separated from the littoral by an inshore channel, 28 m deep at most. The origin of the double barrier can be explained by a restart of subsidence after an initial reef building phase and/or by the favorable influence of tidal currents on coral growth on a submarine ridge pre-existing in the original lagoon.

The morphological and ecological characteristics are strongly influenced by local particulars of the environment. Key influences are: low energy conditions (little swell or wave action), tidal currents and a high rate of sedimentation. Because the location of the Danajon Bank protects it from strong monsoon winds and heavy oceanic swells, sediments tend to accumulate inside the reef lagoons. Consequently, light penetration is poor as evidenced by the narrow depth range of coral growth. Coral communities are well developed only on the slopes. Reef flats of both barriers are largely covered by sedimentary deposits. A comparison with the classical scheme of zonation for Indo-Pacific reefs suggests that the double barrier of Bohol represents a degraded stage in the reef evolutionary series (Pichon 1977). The degraded stage in the evolution of the reef could be partially attributed to the increased rate of sedimentation over the last several hundred years of human development on Bohol Island.

## ECOLOGICAL AND BIOLOGICAL SIGNIFICANCE AND STATUS

Danajon Bank has a high degree of diversity in its marine flora and fauna. The large reef structure, relatively protected from strong currents and storms, encourages a wide variety of microhabitats to flourish inside and adjacent to the reef lagoons and slopes. The

outer barrier reefs and slopes contain the most prolific coral growth while the inner reefs and lagoons are more turbid and contain less coral growth and more sediment. Seagrass beds dominate the inner lagoons and mangroves border many of the inner islands.

While coral diversity in the area is high, actual living coral cover is low. In 1997, 103 scleractinian and 3 nonscleractinian coral species were recorded by Calumpong *et al.* (1997). In 2004, 211 hard coral species (205 scleractinian in 15 families and 6 non-scleractinian in 4 families) were recorded by the Silliman University survey team (Calumpong 2004). Nine of the 12 sites surveyed in six locations on the Danajon Bank in 2004 had less than 25% living hard coral cover remaining while the other 3 sites exhibited just over 25% living hard coral cover, generally indicating a reef with low coral cover (Figure 15). Coral cover had decreased in 2004 from the mean cover of 29.5% measured from five sites in 1996 (Reboton and Luchavez 2002).

In another recent study of 28 nearshore, artisanal reef fishing grounds, benthic conditions were found to be in poor condition: 32% rubble, 28% sand or silt, 9% dead coral and only 12% live coral (Marcus *et al.*, unpublished) (Figure 16). This study also measured a significant decrease in benthic heterogeneity and a 16% increase in coral rubble between 2000 and 2003, potentially due to dynamite/blast fishing.

The survey led by Calumpong (2004) also assessed mortality, condition and succession indices to

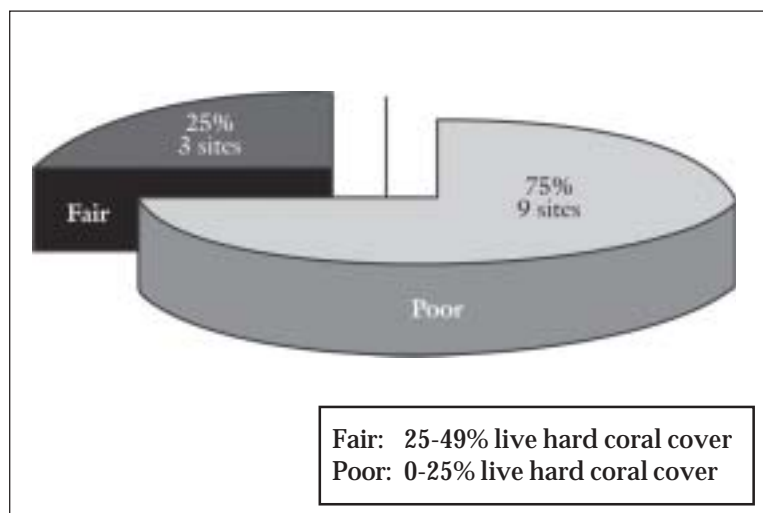


FIGURE 15. STATUS OF LIVE HARD CORAL COVER IN DANAJON BANK CORAL REEFS IN 2004 (CALUMPONG 2004).

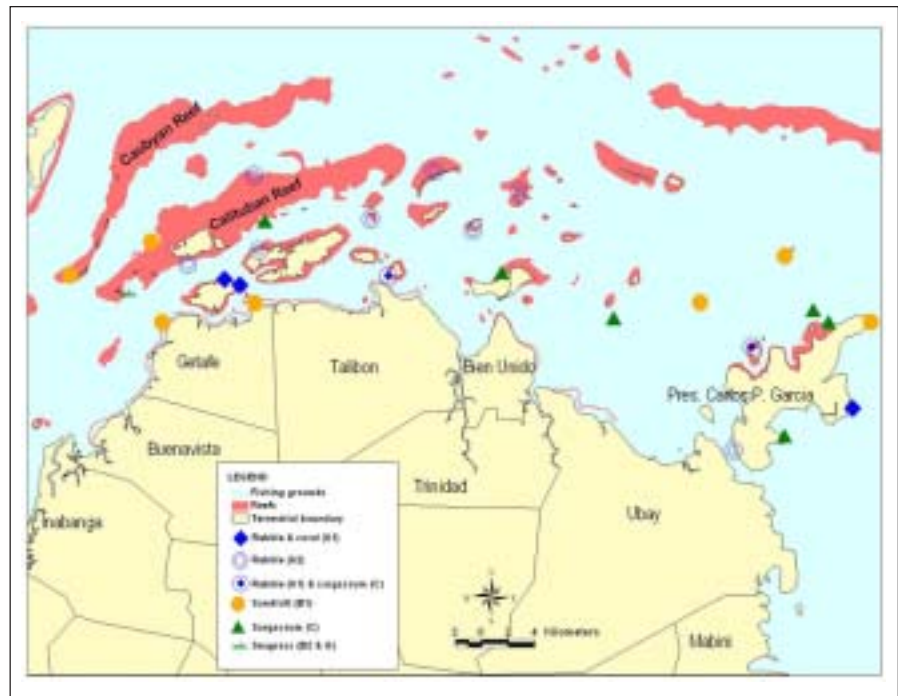


A survey in 2004 showed that fish diversity was greatest in the two outer islands of Hingutan and Bilangbilangan, while the nearshore sites such as Tintiman and Basiao had the lowest diversity (Calumpong 2004). The reefs of the outer islands were less silted and in better condition, perhaps accounting for the greater diversity. Fish densities in all six sites surveyed were low by Philippine standards for a typical reef, with the maximum number of fish counted per 500 m<sup>2</sup> approaching 800 (Figure 17).

Fish that are sensitive to fishing pressure (target species) were rare on most of the reefs surveyed (Figure 18). Also, all established and proposed reserve sites had greater density than their neighboring fished sites (Figure 19). This suggests that established reserves are receiving some protection and/or that communities have chosen healthier reefs for proposed reserves. But fish biomass was very low at most sites suggesting that the general status of the Danajon Bank is degraded (Calumpong 2004; Calumpong 2005).

20 demonstrates that a significant amount of northern Bohol's mangroves have been converted to aquaculture ponds.

There are wide areas of seagrass beds within and surrounding the Danajon Bank. Almost all species of seagrass that occur in the Philippines are represented, although the fish fauna in seagrass beds in Danajon were sparse and consisted mostly of juveniles. Many of the



**FIGURE 16. BENTHIC CONDITIONS ON 28 NEARSHORE REEF FISHING GROUNDS (MARCUS *ET AL.*, UNPUBLISHED).**

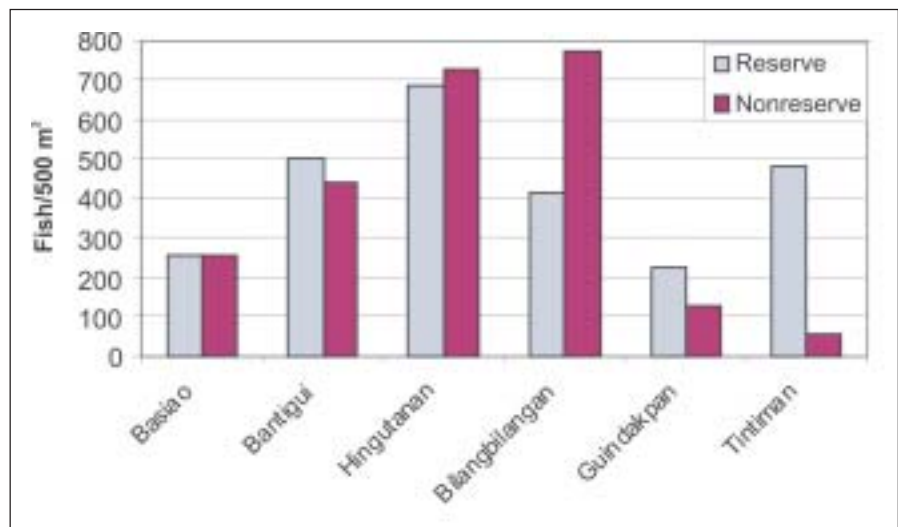


FIGURE 17. MEAN REEF FISH DENSITIES (ALL FISH) FOR RESERVES OR PROPOSED RESERVES (CALUMPONG 2004).



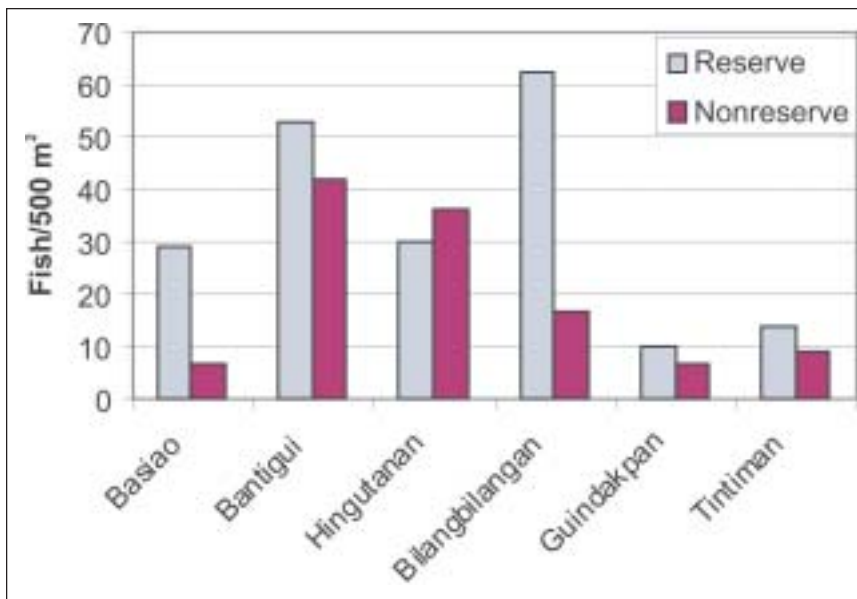


FIGURE 18. MEAN TARGET FISH DENSITIES FOR RESERVES OR PROPOSED RESERVES (CALUMPONG 2004).

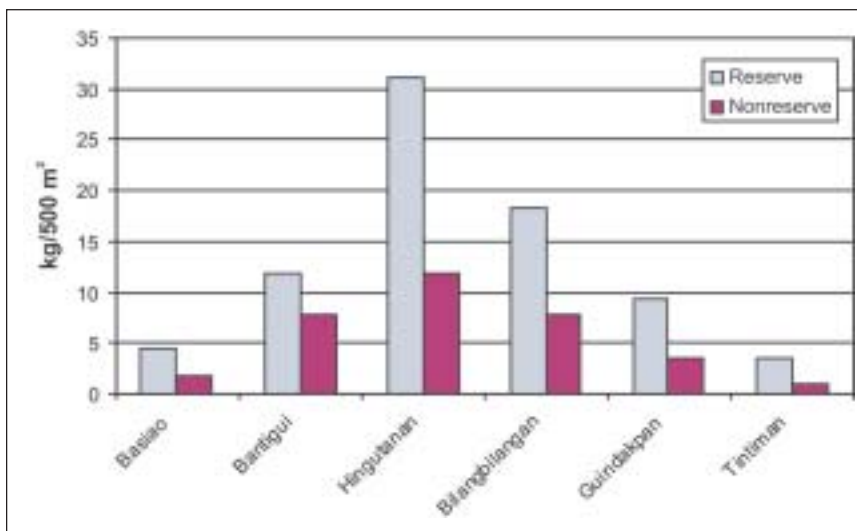


FIGURE 19. TOTAL REEF FISH BIOMASS FOR RESERVES AND PROPOSED RESERVES (CALUMPONG 2004).

species seen were moving from seagrass beds to sargassum beds. No significant biomass was recorded. Fish census observation was generally hampered by poor water visibility. Turbidity appears to limit most coral and other growth to shallow depths.

The macro-invertebrate fauna of the sample sites were poor in diversity and density. Only a few sites had economically important species of sea urchins, sea cucumbers, mollusks and crabs. Low densities indicated that collection and gleaning was occurring within the

existing and proposed MPAs (Calumpong 2004). Seahorse density has also been measured to be extremely low at 0.105 fish per 200 m<sup>2</sup> in areas that were once known for their seahorse fishery (Marcus *et al.*, unpublished). Severe overfishing, in part due to global demand, appears to be the main cause of decline in seahorse density on the Danajon Bank (Marcus *et al.*, unpublished). Furthermore, multiple studies suggest that seahorse populations have been unable to rebound due to the animals' low mobility and the continual reduction of necessary habitat, in part by blast fishing reducing the reefs to rubble (e.g. Marcus *et al.*, unpublished; Panes *et al.*, unpublished).

Finally, there are likely ecological and oceanographic links between Danajon Bank and the Visayan and Camotes Seas. Fish and invertebrates utilize various habitats and areas. No studies have been conducted that verify this, however.

## SUMMARY

The Danajon Bank is of global significance due to its high levels of marine biodiversity. It is also the foundation of the local economy and provides a large share of the area's food. In the last few

decades, the area's coral reefs have been severely damaged by illegal and destructive fishing practices and sedimentation. These trends, while alarming, are reversible if immediate and substantial actions are taken. If ignored, the consequences for local communities are certain to be drastic.



MANGROVES ARE IMPORTANT HABITATS AND SOURCE OF FUEL, NORTHERN BOHOL ISLAND.



FIGURE 20. MANGROVE AND FISHPOND AREAS IN NORTHERN BOHOL.



# CHAPTER 4

## FISHERY STATUS AND TRENDS IN DANAJON BANK



FISHING IS AN IMPORTANT LIVELIHOOD AND SOURCE OF FOOD FOR COASTAL COMMUNITIES.

### INTRODUCTION

The fisheries of Danajon Bank involve a wide variety of gears that exploit diverse fish stocks. Fishing gears operate at various scales and impact the environment in different ways. The fisheries supply local, national and international markets. Fishers engage in small-scale operations to meet subsistence needs and to sell their catch to dependent urban markets. The fisheries are central to local economies, and provide an important source of livelihoods and protein to local people. However, these fisheries are in a state of rapid decline.

## FISHERY OVERVIEW

Danajon Bank plays a major role in the fishing industry of the province of Bohol. About 54% of the fishers, 44% of the nonmotorized boats and 62% of the motorcrafts of the entire province (Table 3) are found in the 9 coastal municipalities bounding the Danajon Bank.

Densities of fishers per kilometer of coastline are high (Figure 21) and highlight the importance of sustainable fisheries management and establishing limits to the number of fisheries and fishing crafts.

TABLE 3. NUMBER OF FISHERS AND BOATS IN DANAJON BANK MUNICIPALITIES AND THE REST OF THE COASTAL MUNICIPALITIES OF BOHOL PROVINCE (MODIFIED FROM ARMADA *ET AL.* 2004).

Municipality	Counts						Density (count/km coastline)			
	Fishers		Non- motorized boats		Motorized boats		Fishers	Non- motorized boats	Motorized boats	Fisher to boat ratio
	N	%	n	%	n	%				
Danajon Bank										
Pres. C.P. Garcia	2,093	6.4	610	5.2	591	6.6	36.7	10.7	10.4	1.7
Ubay	1,492	4.5	406	3.5	380	4.2	38.3	10.4	9.7	1.9
Bien Unido	3,176	9.6	840	7.2	940	10.5	264.7	70.0	78.3	1.8
Talibon	3,476	10.5	750	6.4	1,490	16.6	165.5	35.7	71.0	1.6
Getafe	2,170	6.6	700	6.0	664	7.4	127.7	41.2	39.1	1.6
Buenavista	1,000	3	492	4.2	159	1.8	125.0	61.5	19.9	1.5
Inabanga	2,281	6.9	874	7.5	629	7.0	162.9	62.4	44.9	1.5
Clarin	335	1.0	150	1.3	84	0.9	47.9	21.4	12.0	1.4
Tubigon	1,670	5.1	261	2.2	620	6.9	128.5	20.1	47.7	1.9
Subtotal	17,693	53.7	5,083	43.5	5,557	62.1				
Rest of Bohol										
Calape	1,006	3.1	458	3.9	314	3.5	67.1	30.5	20.9	1.3
Loon	1,544	4.7	933	8.0	378	4.2	64.3	38.9	15.8	1.2
Maribojoc	362	1.1	159	1.4	60	0.7	36.2	15.9	6.0	1.7
Cortes	363	1.1	233	2.0	54	0.6	139.6	89.6	20.8	1.3
Tagbilaran	719	2.2	273	2.3	328	3.7	57.8	21.9	26.4	1.2
Panglao	1,655	5.0	880	7.5	356	4.0	66.2	35.2	14.2	1.3
Dauis	1,634	5.0	502	4.3	286	3.2	66.6	20.5	11.7	2.1
Baclayon	637	1.9	158	1.4	213	2.4	57.2	14.2	19.1	1.7
Alburquerque	402	1.2	80	0.7	122	1.4	80.4	16.0	24.4	2.0
Loay	472	1.4	286	2.4	80	0.9	42.9	26.0	7.3	1.3
Lila	348	1.1	60	0.5	162	1.8	40.1	6.9	18.7	1.6
Dimiao	391	1.2	220	1.9	59	0.7	65.2	36.7	9.8	1.4
Valencia	418	1.3	122	1.0	171	1.9	63.6	18.6	26.0	1.4
Garcia Hernandez	473	1.4	145	1.2	73	0.8	29.6	9.1	4.6	2.2
Jagna	1,187	3.6	268	2.3	219	2.4	84.8	19.1	15.6	2.4
Duero	466	1.4	250	2.1	77	0.9	68.5	36.7	11.3	1.4
Guindulman	596	1.8	262	2.2	126	1.4	37.3	16.4	7.9	1.5
Anda	1,048	3.2	550	4.7	70	0.8	55.2	29.0	3.7	1.7
Candijay	283	0.9	156	1.3	91	1.0	28.3	15.6	9.1	1.2
Mabini	1,256	3.8	608	5.2	156	1.7	43.3	21.0	5.4	1.6
Subtotal	15,260	46.3	6,603	56.5	3,395	37.9				
Grand total	32,953	100	11,686	100	8,952	100				

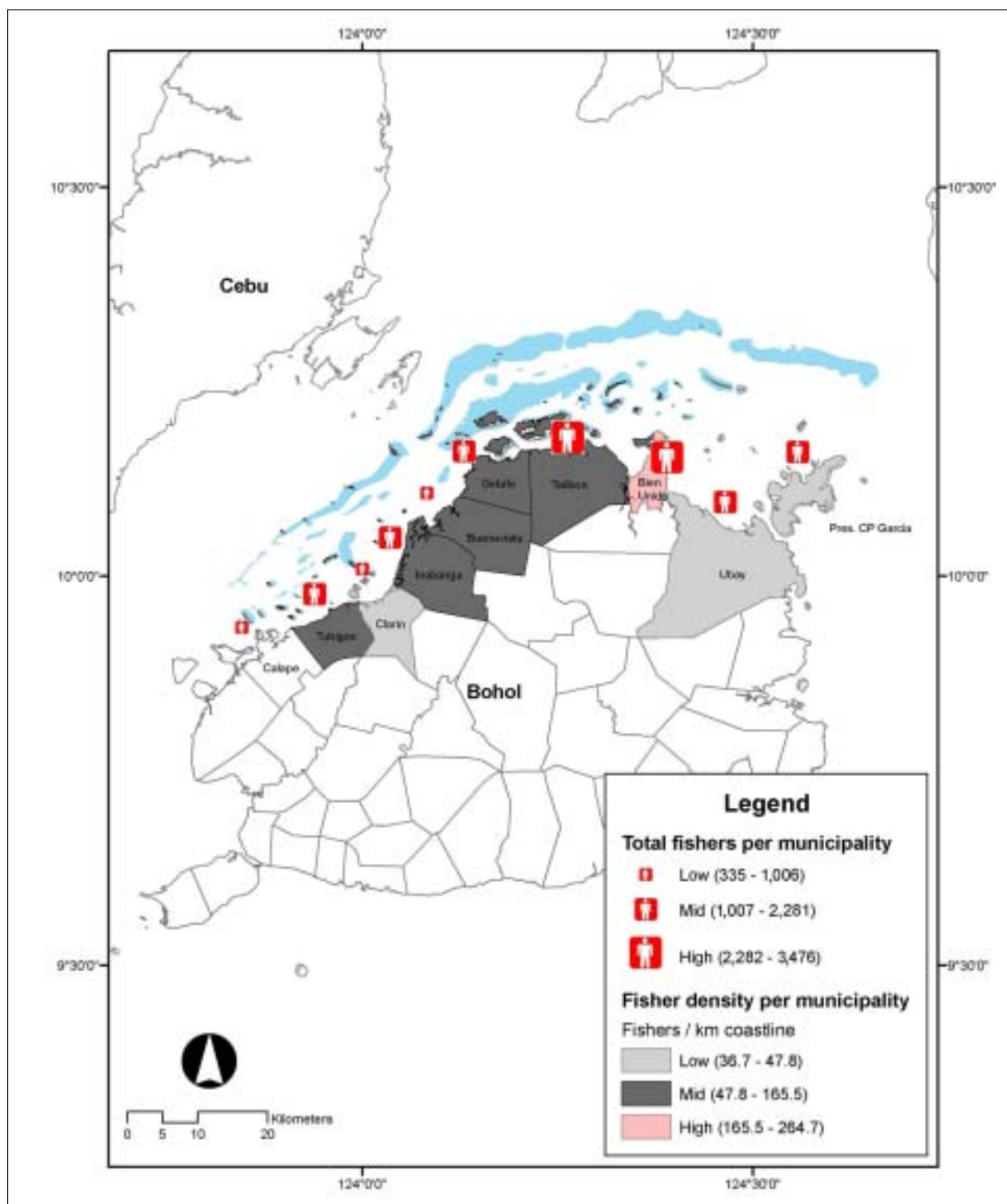


FIGURE 21. NUMBER AND DENSITY OF FISHERS PER MUNICIPALITY IN NORTHERN BOHOL (MODIFIED FROM GREEN *ET AL.* 2004).

## FISHING GEARS

A partial inventory of fishing gears conducted by the FISH Project in 2004 showed that there were about 5,000 fishing gear units in the four municipalities of the

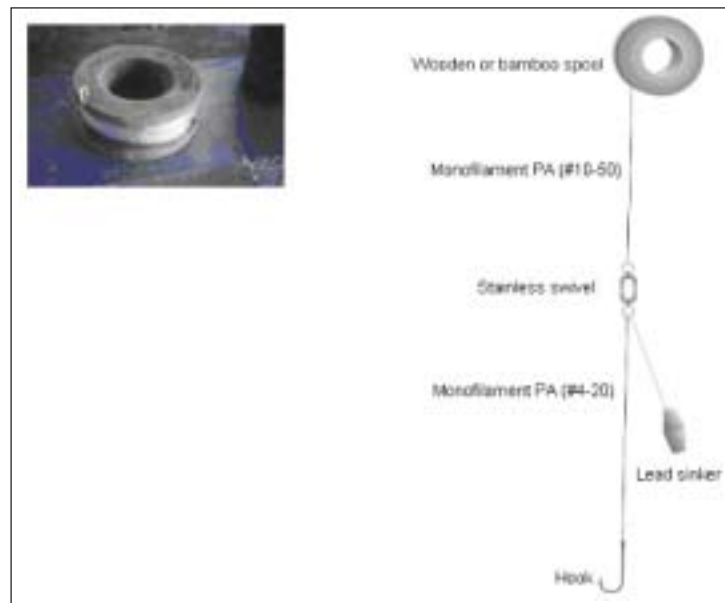
FISH focal area belonging to at least 20 generic types and 44 specific types (Table 4). The most common ones were the crab gillnet (*panglambay*), simple hook and line (*pasol*), squid troll (*ulang-ulang*), bottom-set gillnet (*palugdang*), spear fishing (*pamana*), drift gillnet (*palutaw*),



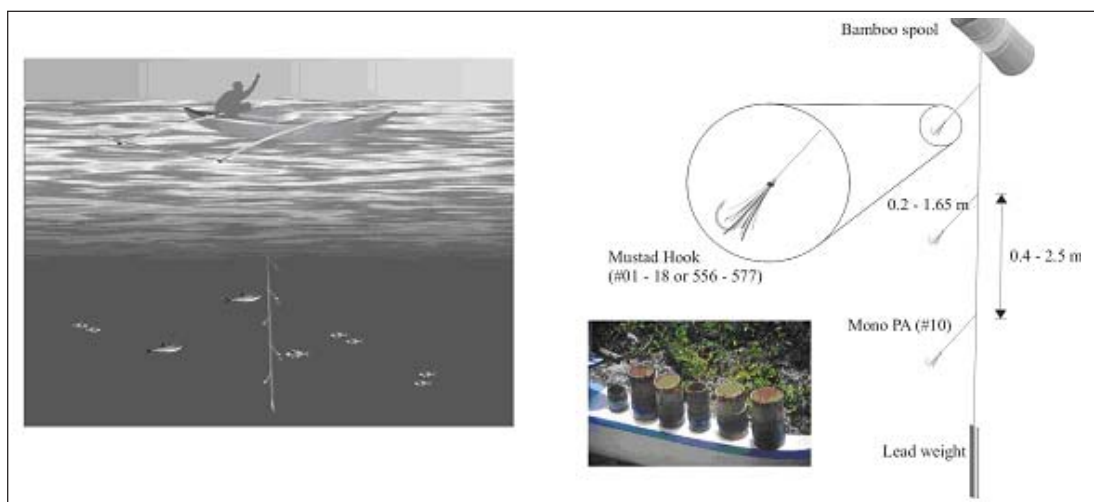
**TABLE 4. INVENTORY OF FISHING GEARS IN DANAJON FOCAL AREA, BY MUNICIPALITY (FRAGILLANO 2004).**

Fishing gear	Local name	Talibon	Bien Unido	Ubay	Pres. C.P. Garcia	Total
Barrier net	<i>pukot pahubas</i>		2			2
Bottomset gillnet	<i>palugdang, panayming</i>	122	37	5	143	307
Crab gillnet	<i>pukot panglambay</i>	234	205	117	173	729
Drift gillnet	<i>palutaw, paanod</i>	64	174	64	21	278
Drive-in gillnet	<i>sagiwsiw, ariba-ariba</i>	35	20	3	3	61
Encircling gillnet	<i>likos, lihos</i>		7	2	1	10
Set gillnet			30			30
Set gillnet (with plunger)	<i>dumbol</i>	40	73	24	2	139
Shrimp gillnet	<i>pamasayan</i>	3				3
Squid gillnet	<i>pukot pangnokos</i>	25	9		1	35
Trammel net	<i>double net, triple net</i>	29	9	6	10	54
Bottomset longline	<i>palangre, kitang</i>	30	90	55	52	227
Hook and line	<i>pasol</i>	249	101	266	68	684
Hook and line (with float)	<i>pataw-pataw</i>	46	43			89
Multiple handline	<i>bira-bira, undak</i>	45	47	26	130	248
Surface-set longline	<i>kitang (panasa)</i>		1			1
Troll line	<i>subid</i>		7			7
Squid troll	<i>ulang-ulang</i>	78	186	5	42	311
Squid jig	<i>undak (nokos)</i>				12	12
Bagnet		2				2
Filter net	<i>sanggab</i>		20			20
Fish corral	<i>bungsod, tower</i>	151	39	17	4	211
Round haul seine	<i>lawag</i>	6				6
Stationary liftnet	<i>bintol</i>			4		4
Beach seine	<i>baling</i>	21	54	17	2	94
Beach seine (shrimp)	<i>baling sa pasayan</i>			4		4
Danish seine	<i>liba-liba</i>	30	92	27	2	151
Midwater trawl	<i>palupad</i>			5		5
Otter trawl	<i>palakaya</i>	20	45	12		77
Scissor net	<i>sudsud</i>	5	1	1		7
Crab liftnet	<i>sapyaw (sa lambay)</i>	105	17	84		206
Crab pot	<i>panggal panglambay</i>	102	37	57	1	197
Crab trap		4	3			7
Eel trap	<i>bantak, pambakasi</i>		1			1
Fish trap	<i>bubo</i>	28	30	3	6	67
Shrimp pot	<i>bubo pangpasayan</i>	18		13		31
Squid trap	<i>panggal pangnokos</i>			16		16
Blast fishing	<i>tiro</i>	61	38	15		114
Cast net	<i>laya</i>	15				15
Dive fishing w/ compressor			20	2		22
Gleaning	<i>panginhas</i>	27			16	27
Scoopnet	<i>sikpaw, mosquito net</i>	35				35
Spear fishing	<i>pana</i>	93	148	37	16	294
Spear with compressor	<i>pana-compressor</i>	120	32			152
<b>Total</b>		<b>1,843</b>	<b>1,618</b>	<b>887</b>	<b>689</b>	<b>5,037</b>

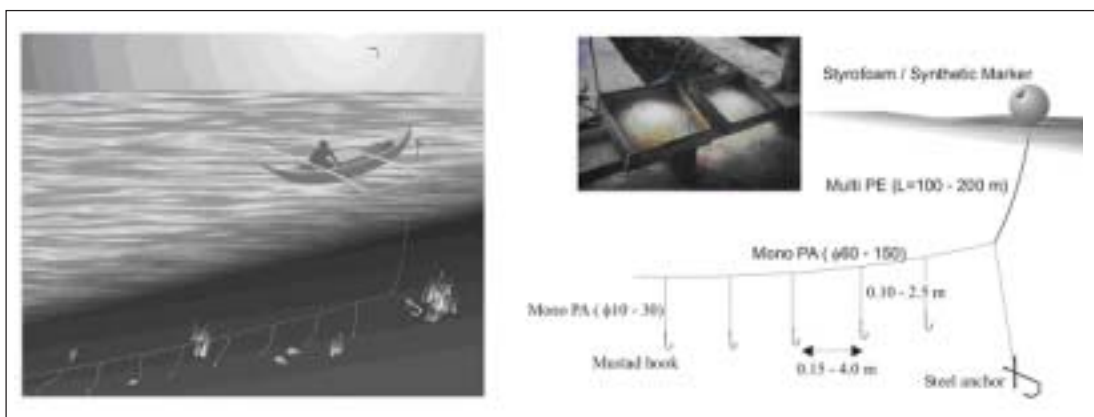
## COMMON FISHING GEARS IN DANAJON BANK.



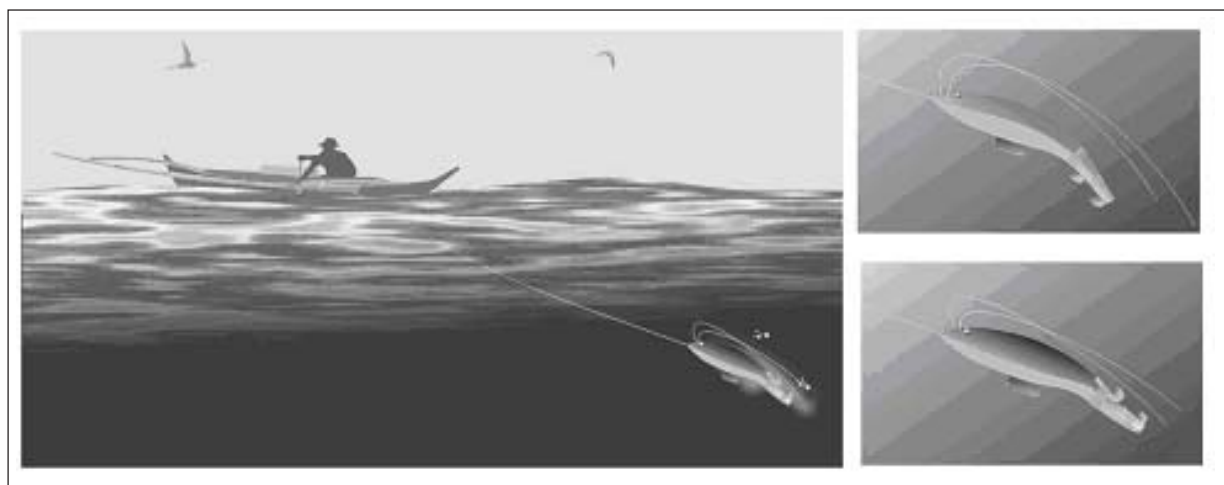
SIMPLE HOOK AND LINE (*PASOL*)



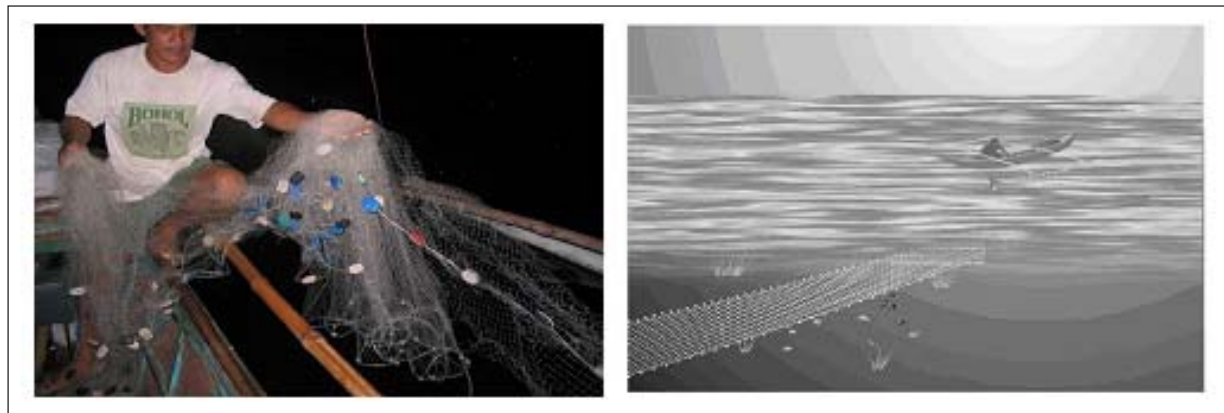
MULTIPLE HANDLINE (*BIRA-BIRA*)



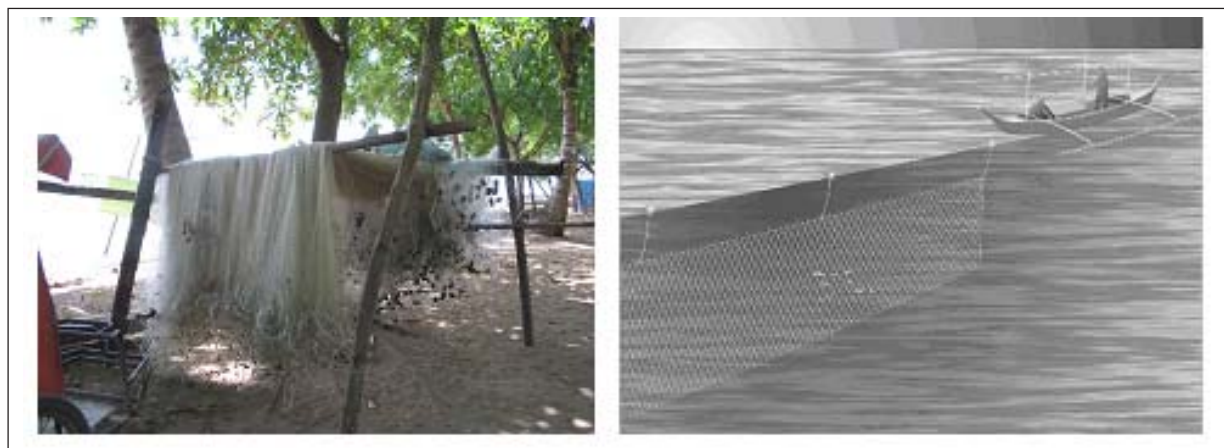
BOTTOM-SET LONGLINE (*PALANGRE*)



**SQUID TROLL** (*ULANG-ULANG*)



**BOTTOM-SET GILLNET** (*PALUGDANG*)



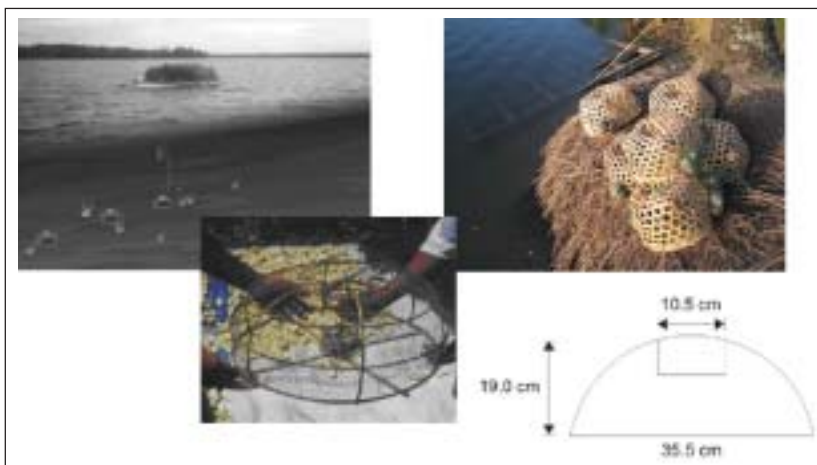
**DRIFT GILLNET** (*PALUTAW*)



CRAB GILLNET (*PANGLAMBAY*)



CRAB LIFTNET (*SAPYAW*)

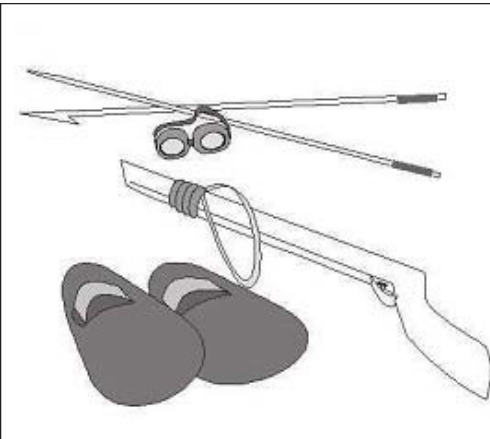


CRAB POT (*PANGGAL*)





FISH CORRAL (*BUNGSOD*)



SPEAR FISHING (*PAMANA*)

multiple handline (*bira-bira*), bottom-set longline (*palangre*), fish corral (*bungsod*), crab liftnet (*sapyaw*) and crab pot (*panggal*).

Based on a recent survey of fishing gears, Figure 22 displays the density of fishing gears in the area. Gillnets, hook and line, and spears contribute the vast majority of fish catch in most municipalities. Gillnets are an important fishing gear throughout the Philippines. In reef systems, they are frequently used near reef slopes. On Danajon Bank, gillnets provide a significant portion of the landings (Figure 23). In chapter 5, possible policy responses to the use of fine-mesh gillnets are explored.

## FISHING PRACTICES

A number of fishing gears have undergone modifications from their original design and have specific local names. Like in the case of hook and lines and gillnets, many have been improved and modified to

catch specific target species. For example, *pataw pambalo* is a type of hook and line that catches specifically garfish or *balo* and *pukot pangmangsi* is an encircling gillnet designed to catch herrings and sardines.

High fishing pressure on the harvestable stocks of Danajon Bank has resulted into changes in the composition of fish populations. Some fishing gears are no longer used because they no longer catch the fishes they used to catch before. Others are only operated occasionally because of low catch rate for species they were designed to catch. Some fishing gears designed to catch a particular species are still regularly used but they are catching other species instead. Multiple handlines (*bira-bira*) and bottom-set longline (*palangre*) in some areas of Danajon Bank have reduced their fishing operation because of the sharp decline in the population of jacks, emperors and snappers. Bottom-set longline (*palangre*) are catching mainly eels (*ubod*) instead of grouper (*pugapo*) and drift gillnets (*panulingan*) are



catching primarily Indian mackerel (*anduhaw*) instead of bullet tuna (*tulingan*).

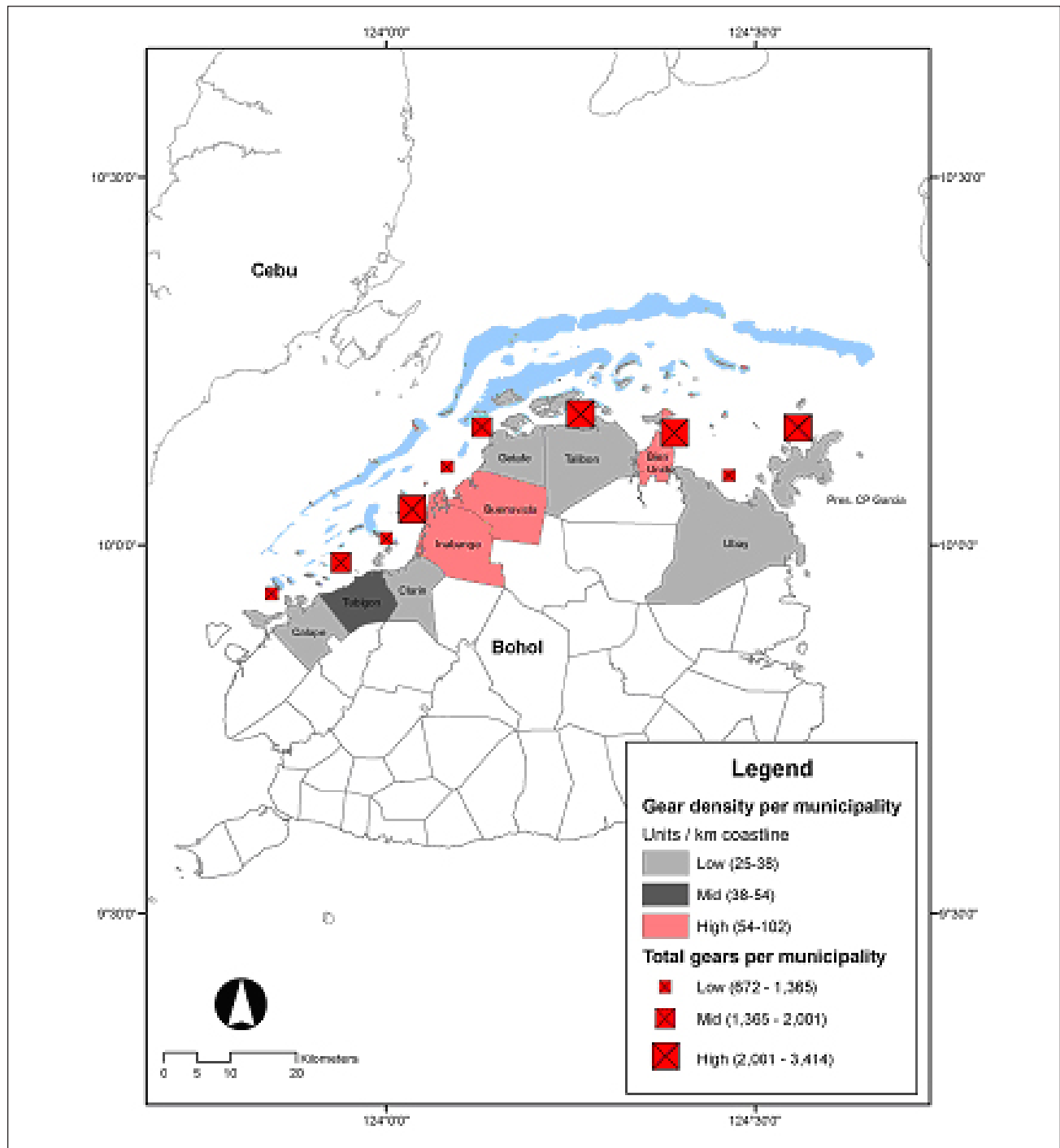


FIGURE 22. DENSITY AND NUMBERS OF FISHING GEARS PER MUNICIPALITY IN NORTHERN BOHOL (MODIFIED FROM GREEN *ET AL.* 2004).

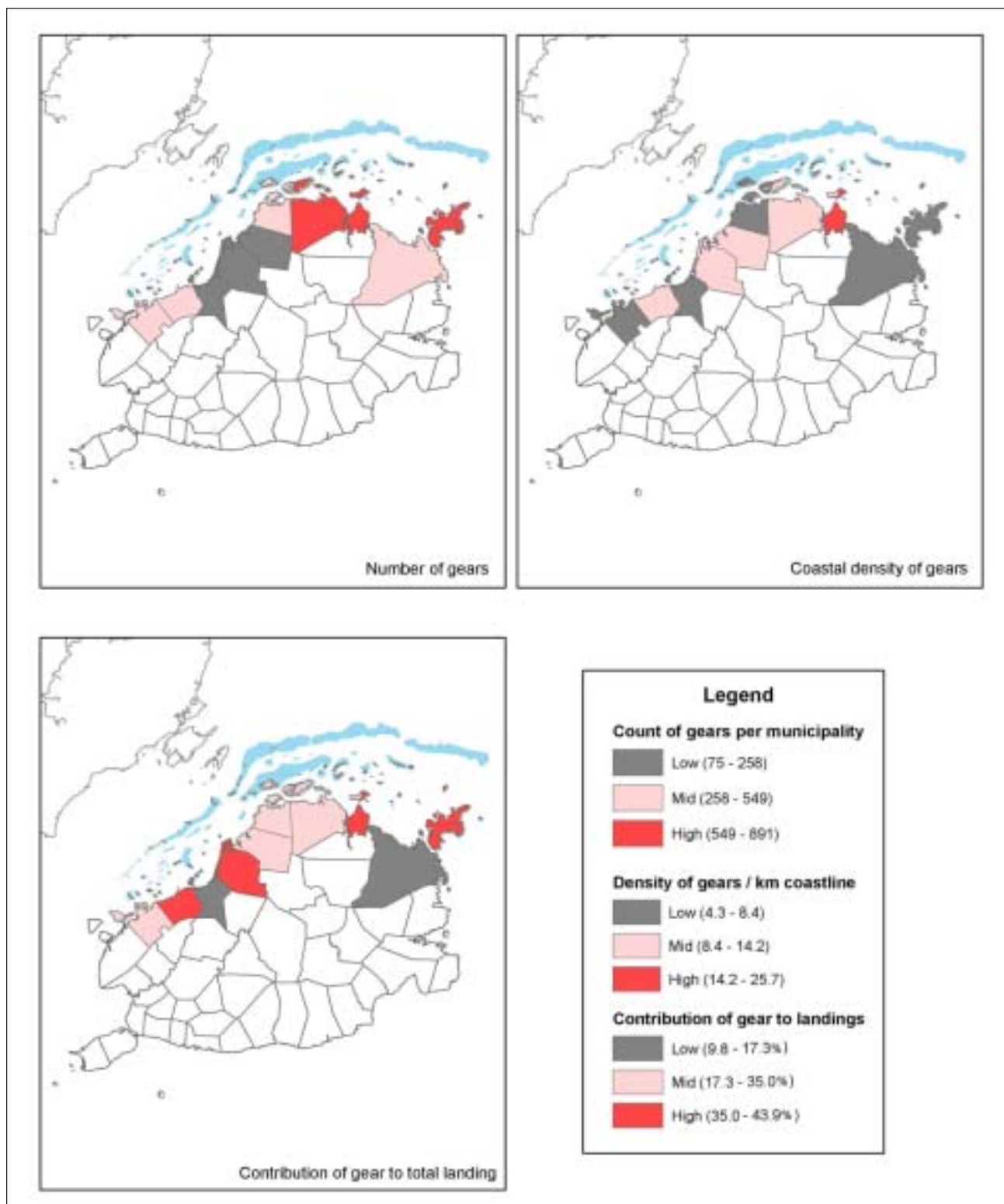


FIGURE 23. GILLNET DISTRIBUTION, DENSITY AND CONTRIBUTIONS TO LANDINGS (MODIFIED FROM GREEN *ET AL.* 2004).

Hook and line fishing is also important and is commonly used to target valuable, piscivorous species such as grouper and snapper (Figure 24).

Spearfishing is common on Danajon Bank and provides a significant portion of the landings (Figure 25).

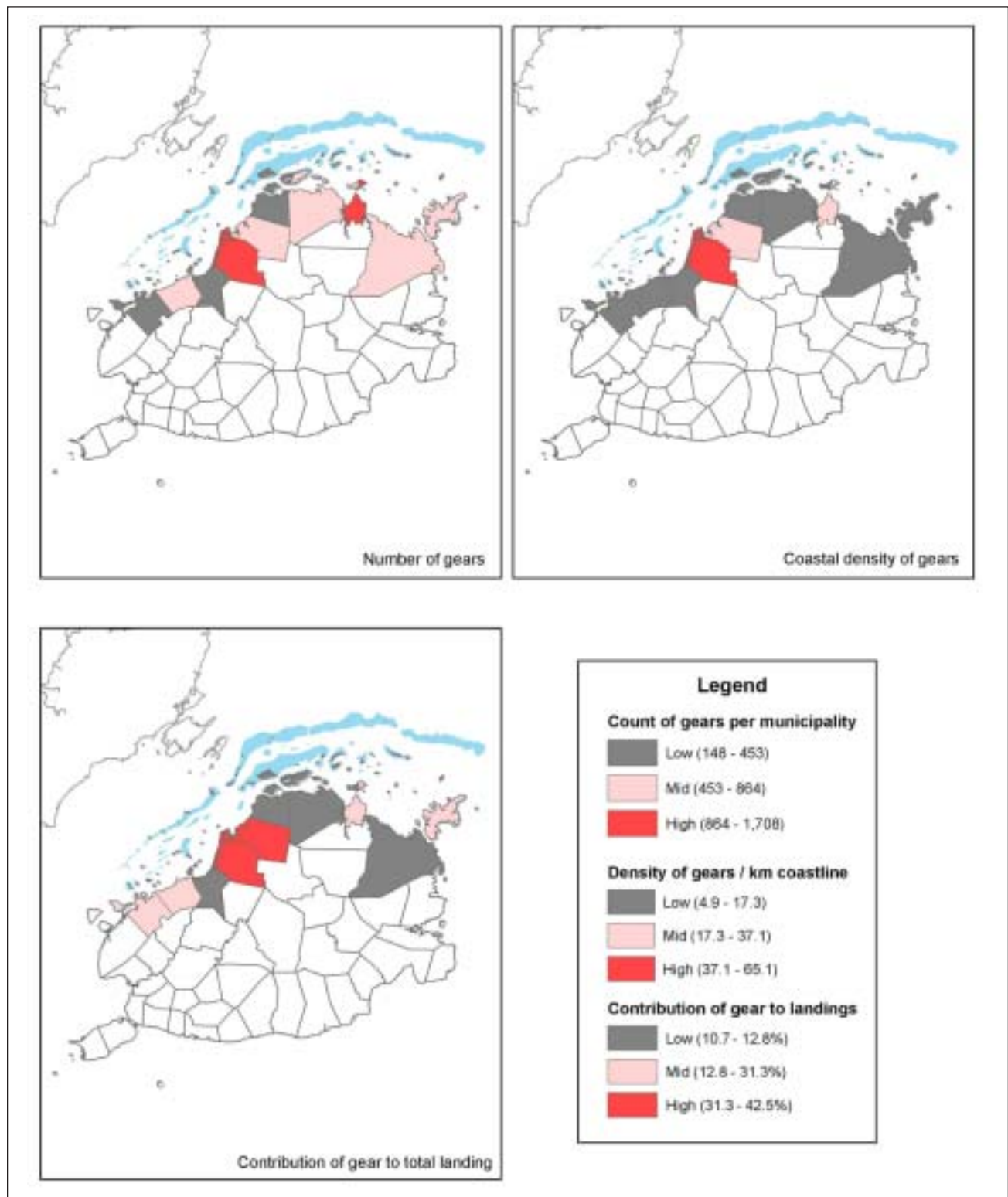


FIGURE 24. HOOK AND LINE DISTRIBUTION, DENSITY AND CONTRIBUTIONS TO LANDINGS (MODIFIED FROM GREEN *ET AL.* 2004).

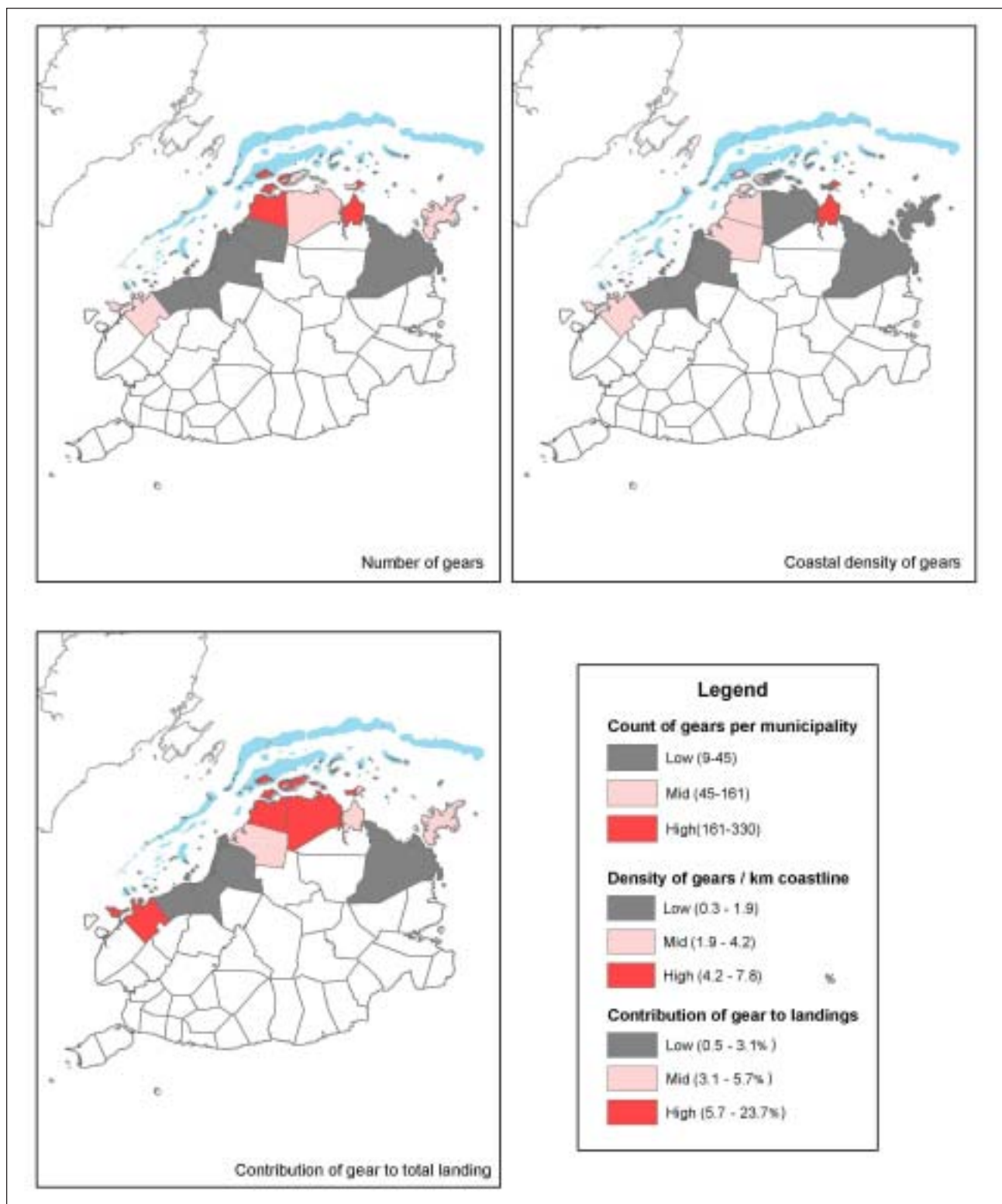


FIGURE 25. SPEAR DISTRIBUTION, DENSITY AND CONTRIBUTIONS TO LANDINGS (MODIFIED FROM GREEN *ET AL.* 2004).

## FISHERY CONDITION

Overwhelmingly, the most important issue raised by municipal fishers in Danaojon Bank during a survey conducted in 2003 was the rampant operation of small-scale trawls and modified Danish seine (*hulbot-hulbot*) (Table 5) in the municipal waters. This was followed by problems with illegal fishing activities such as blast fishing, spearfishing with the use of compressor and use of noxious substances (cyanide) in catching or collecting fish. The other important issues raised during that time also included reduction of catch due to increase in boats and fishers and due to excessive fishing in general, intrusion of commercial fishing boats in the municipal waters, and use of destructive gears such as drive-in nets and other fine-mesh nets.

As demonstrated by systematic monitoring, the use of illegal and destructive fishing methods has a negative impact on fish abundance and diversity. The trawl survey conducted by the FISH Project in 2004 showed a very low demersal biomass density of 0.45 t/



MANY SMALL FISH ARE SEEN IN MARKETS IN NORTHERN BOHOL.

km<sup>2</sup> for the Danaojon Bank (FISH Project 2005b) compared to the low demersal biomass density estimated for Manila Bay in 1992-1993. The catch is composed mainly of low-value species (Table 6) such as slipmouths (*potpot*), pufferfish (*butete*), flathead (*sunugan*), goatfish (*timbang*) and cardinal fish (*moong*)—species that would be considered trash fish two decades ago.

TABLE 5. TEN MOST IMPORTANT ISSUES RAISED BY MUNICIPAL FISHERS IN THE VARIOUS FISHING GROUNDS OF BOHOL PROVINCE (MODIFIED FROM ARMADA ET AL. 2004).

Rank	Issues	Fishing ground		Total
		Rest of Bohol	Danaojon Bank	
1	Trawls and small-scale, modified Danish seines ( <i>hulbot-hulbot</i> ) operating in municipal waters	4	133	137
2	Spearfishing with compressor	37	13	50
3	Commercial fishing vessels operating inside municipal waters (e.g., Danish seines and ringnets)	38	8	46
4	Decrease in fish catch attributed to overfishing	19	4	23
5	Blast fishing	3	19	22
6	Fishing with noxious substances (cyanide, <i>tubli</i> , etc.)	11	11	22
7	Increase in the number of boats and fishers competing for limited resources in a limited area	11	9	20
8	Drive-in nets ( <i>bahan</i> , <i>sagiwsiw</i> or <i>dagoydoy</i> )	6	6	12
9	<i>Baling</i> (beach seine) operations	1	6	7
10	Ban of certain fishing operations (e.g., trammel nets, <i>sudsud</i> , whale shark fishing, manta fishing, <i>baling</i> , etc.) affects negatively the livelihood of the community	4	3	7



**TABLE 6. TOP 10 SPECIES/GROUPS CAUGHT DURING TRAWL SURVEY (FISH PROJECT 2004).**

Species/group	Local name	Common name	% weight	% number
1. <i>Leiognathus splendens</i>	<i>dangay, potpot</i>	Splendid ponyfish	42.9	72.0
2. <i>Saurida tumbil</i>	<i>banghutin</i>	Greater lizardfish	7.4	0.3
3. <i>Arothron</i> sp.	<i>butete</i>	Pufferfish	7.3	0.5
4. <i>Platycephalus indicus</i>	<i>sunugan</i>	Bartail flathead	6.4	0.3
5. <i>Upeneus tragula</i>	<i>timbangan</i>	Freckled goatfish	4.2	3.4
6. Lolliginidae	<i>taroroton</i>	Squid	3.8	1.5
7. <i>Apogon</i> sp.	<i>moong</i>	Cardinalfish	3.6	3.0
8. <i>Scolopsis taeniopterus</i>	<i>silay</i>	Lattice monocle bream	2.9	0.9
9. <i>Loligo</i> sp.	<i>taroroton, nokos</i>	Squid	2.5	0.6
10. <i>Leiognathus rivulatus</i>	<i>potpot</i>	Ponyfish	2.3	3.5
Others			16.7	14.0

**TABLE 7. TOP 10 SPECIES CAUGHT DURING THE BOTTOM-SET LONGLINE SURVEY IN DANAJON BANK (FISH PROJECT 2004).**

Species	Local name	Common name	% weight	% number
1. <i>Therapon jarbua</i>	<i>bugaong</i>	Crescent perch	50.6	35.7
2. <i>Lethrinus lentjan</i>	<i>katambak</i>	Pink ear emperor	15.5	13.3
3. <i>Nemipterus hexodon</i>	<i>lagaw</i>	Ornate threadfin bream	5.8	4.7
4. <i>Congridae</i>	<i>obod</i>	Yellow pike conger	3.6	6.8
5. <i>Lutjanus chrysotaenia</i>	<i>manilan-on</i>	Spanish flag snapper	3.4	1.9
6. <i>Pentapodus setosus</i>	<i>siwsiw</i>	Butterfly whiptail	2.9	9.2
7. <i>Epinephelus sexfasciatus</i>	<i>pugawo</i>	Sixbar grouper	1.3	0.2
8. <i>Gymnothorax</i> sp.	<i>bakasi, panangitan</i>	Moray eel	1.2	5.1
9. <i>Muraenesocidae</i>	<i>obod</i>	Common pike conger	1.2	2.1
10. <i>Aluterus monoceros</i>	<i>saguksuk</i>	Unicorn leatherjacket	1.1	0.1
Others			13.4	20.7
<b>Total</b>			<b>100.0</b>	<b>100.0</b>

The results of bottom-set longline (*palangre*) survey conducted by the FISH Project (2005b) also showed a very low catch rate in Danajon Bank 4.77 kg per fishing operation despite the 1,000 number of hooks used in the area. The catch was dominated by the crescent perch (*bugaong*), emperor (*katambak*) and threadfin bream (*lagaw*) (Table 7). High-value fish such as the grouper (*pugapo*) and snapper (*maya-maya*) were not well represented in the catch.

The catch and effort monitoring conducted from May to July 2004 in the Danajon Bank likewise showed the very low catch rates of many fishing gear types compared to other FISH Project areas (Table 8). Noticeably low compared to all other areas are the drift gillnet (*palutaw*), bottom-set longline (*palangre*) and squid jig (*ulang-ulang*).

Table 9 summarizes the relative importance of the various species in the FISH Project focal area. This was estimated from the aggregate of the catches monitored from May to July 2004. The most common species encountered during the catch monitoring were the blue crabs (*lambay*), sardines (*mangsi*), slipmouths (*potpot*) and scad (*caraballas*).

The above data demonstrate that illegal fishing and overfishing are negatively affecting fish catch composition and catch rates. During a June 2005 workshop sponsored by the FISH Project, blast fishing and cyanide fishing were identified as two destructive and illegal fishing methods that need to be stopped. The management responses identified in Chapter 5 consist of both incentives and improved enforcement.

**TABLE 8. SUMMARY OF CPUE (KG/DAY) FROM CATCH AND EFFORT MONITORING IN DANAJOON BANK (MAY-JULY 2004) COMPARED TO OTHER FISH PROJECT AREAS AND OTHER SIMILAR FISHING GROUNDS (MODIFIED FROM FISH 2004).**

Fishing gear	Local name (Danaojon Bank)	Danaojon Bank	Coron Bay	Lanuza Bay	Tawi-Tawi Bay
Bottom set gillnet	<i>palunod, palugdang</i>	15.7	9.0	4.9	
Drift gillnet	<i>palutaw, paanod</i>	7.4	21.5	11.7	55.9
Set gillnet with plunger	<i>dumbol</i>	10.3	4.5	3.8	23.3
Bottom-set longline	<i>palangre, kitang</i>	4.5	11.0	9.0	15.6
Multiple handline	<i>bira-bira, undak</i>	3.7	12.5	4.4	19.6
Simple hook and line	<i>pasol</i>	2.5	5.6	4.3	13.4
Squid jig	<i>ulang-ulang, pangnokos</i>	1.5	2.3	3.9	5.4
Crab liftnet	<i>sapyaw (sa lambay)</i>	3.4			
Fish corral	<i>bungsod, tower</i>	5.4	107.6	2.4	12.1
Crab pot	<i>panggal panglambay</i>	6.7		2.7	
Fish trap	<i>bubo</i>	9.1	21.6	5.3	11.7
Scissor net	<i>sudsud</i>	0.7			
Handspear	<i>pana</i>	2.8	8.3	6.3	5.2
Stationary liftnet	<i>bintol</i>	13.6		3.1	
Baby trawl	<i>palakaya</i>	13.7			

**TABLE 9. TOP 20 SPECIES (ACCORDING TO LOCAL NAME) BY WEIGHT IN THE AGGREGATE CATCH OF ALL MUNICIPAL FISHING GEARS MONITORED IN DANAJOON BANK FOCAL AREA FROM MAY TO JULY 2004 (FRAGILLANO 2004).**

Local name	Species/group	% weight
1 <i>lambay</i>	<i>Portunus pelagicus</i>	21.8
2 <i>mangsi</i>	<i>Sardinella</i> sp.	6.5
3 <i>potpot</i>	<i>Leiognathus</i> spp.	5.3
4 <i>caraballas</i>	<i>Selaroides leptolepis</i>	4.8
5 <i>anduhaw</i>	<i>Rastrelliger</i> spp.	4.2
6 <i>maubgas</i>	<i>Spratelloides</i> sp.	4.1
7 <i>timbangan</i>	<i>Upeneus</i> spp.	4.1
8 <i>guno</i>	<i>Atherina</i> sp.	4.1
9 <i>nokos</i>	<i>Loligo</i> spp.	3.0
10 <i>samook</i>	<i>Gerres oyena</i>	2.9
11 <i>gilang</i>	<i>Spratelloides</i> sp.	2.6
12 <i>bawo</i>	<i>Tylosorus acus melanotus</i>	1.9
13 <i>lupoy</i>	<i>Sardinella albella</i>	1.8
14 <i>sasa</i>	<i>Hemiramphus far</i>	1.7
15 <i>danggit</i>	<i>Siganus canaliculatus</i>	1.4
16 <i>silay</i>	<i>Scolopsis vosmeri</i>	1.3
17 <i>katambak</i>	<i>Lethrinus</i> spp.	1.3
18 <i>pasayan</i>	<i>Penaeus</i> spp.	1.1
19 <i>molmol</i>	<i>Scaridae</i>	1.1
20 <i>lagaw</i>	<i>Nemipterus hexodon</i>	1.0
	Others	24.0

## ON BLUE CRABS (*LAMBAY*)

Among the gears with the highest contribution to the landed catch are crab gillnet (*pukot panglambay*), crab liftnet (*sapyaw*) and crab pot (*panggal*), three fishing activities that target specifically blue crabs. These three fishing gears significantly contribute to the aggregate composition of the catch. Blue crabs contributed to almost 22% of the total municipal catch landings monitored (Fragillano 2004), the highest contribution by a single group in the overall catch. Blue crab fisheries is itself an industry in Danaojon Bank. It supports a wide range of endeavors from catchers, to buyers, and to crab meat processors. At present, it is one of the few harvestable marine resources that remained viable despite the relatively high overall fishing pressure. Blue crab, being low in the trophic system, with high reproductive rate and is fast-growing, was able to sustain its optimum stock size. Overfishing may have eliminated its predators and food competitors thus sustaining the stock. However, there are strong indications that the blue crab industry in Danaojon Bank has grown to a large proportion than it can sustain. Market demand has driven the processors to produce more crab meat, the buyers to offer higher prices and the fishers to catch more. And in fact there are indications that the fishers are now catching less as well as relatively smaller individuals.

The use of fine-mesh nets by beach seine (*baling*), round haul seine (*lawag*), fish corral (*bungsod*), stationary liftnet (*new look*), Danish seine (*liba-liba*) and baby trawl are, to various degrees, still tolerated in

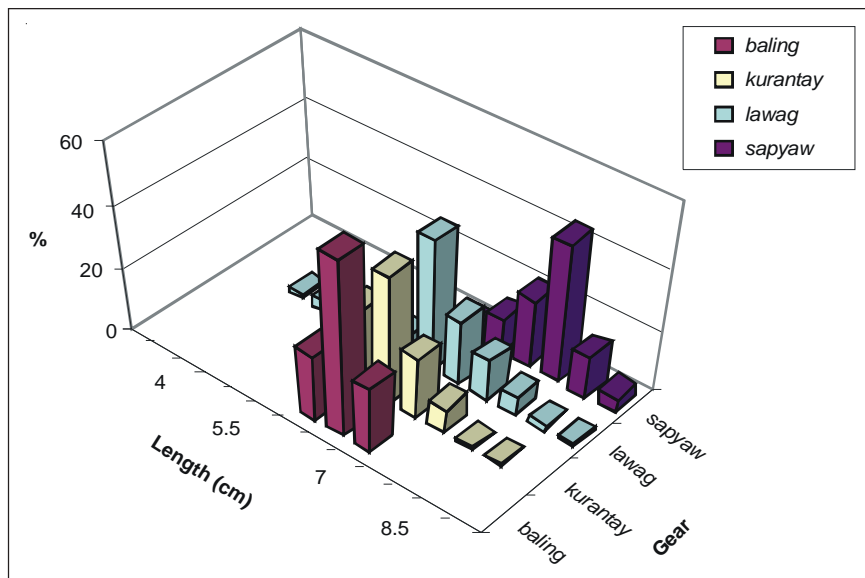


FIGURE 26. COMPARISON OF SIZE COMPOSITION OF *STOLEPHORUS INDICUS* (BOLINAO) CAUGHT BY VARIOUS FISHING GEARS IN DANAJOON BANK IN 2003 (ARMADA ET AL. 2004).

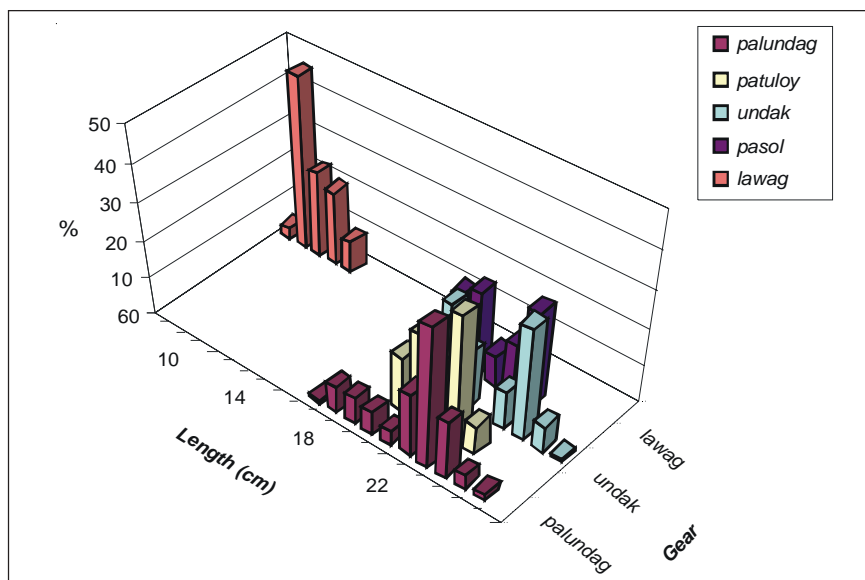


FIGURE 27. COMPARISON OF SIZE COMPOSITION OF *RASTRELLIGER BRACHYSOMA* (HASA-HASA) CAUGHT BY VARIOUS FISHING GEARS IN DANAJOON BANK IN 2003 (ARMADA ET AL. 2004).

many fishing grounds of the Danaojon Bank. Some gears, such as round haul seine (*lawag*), that are designed to catch naturally small species of fish such as anchovies (*bolinao*) are catching nontarget species. The size composition of *bolinao* caught by *lawag* is comparable to other fishing gears (Figure 26). However, the problem arises when *lawag* starts to catch other species of fish, such as *Rastrelliger brachysoma* (*hasa-hasa*), that have the potential to grow larger (Figure 27).

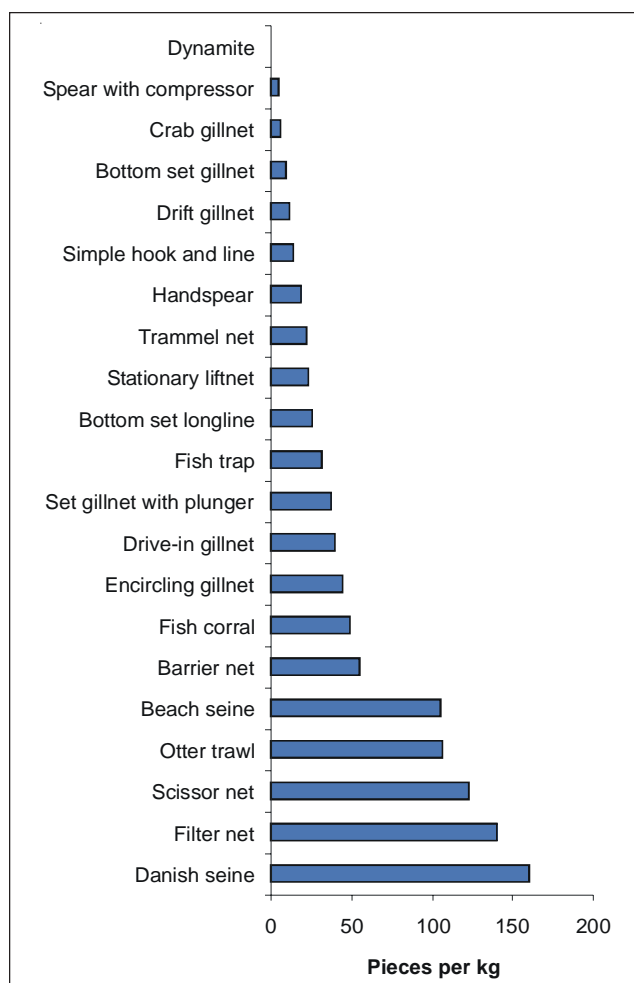


FIGURE 28. INDICATIVE SIZES OF RABBITFISH (NUMBERS PER KG) CAUGHT BY VARIOUS FISHING GEARS IN DANAON BANK.

The fine-mesh nets also negatively impact the important rabbitfish (*danggit*) fisheries. Those gears using fine-mesh nets, such as Danish seine, filter net, scissor net, trawl, beach seine, barrier net and fish corral, are catching the juvenile stages of rabbitfish (Figure 28).

### ON RABBITFISH (*DANGGIT*)

Along with blue crabs, several species of squids, garfishes (*balo*), anchovies (*bolinao*), mackerels (*anduhaw*), scads (*tamarong*) and bullet tunas (*tulingan*), fishers perceived rabbitfish (*danggit*) to be an important fisheries resource in Danaon Bank (Armada *et al.* 2004). Despite the perceived importance of *danggit* as a fishery resource in Danaon, *danggit* comprised only 1.4% (by weight) of the aggregate catch landings monitored (Fragillano 2004). This very low weight contribution is primarily due to very low average sizes of *danggit* being

caught by major fishing gears in Danaon Bank.

Obviously, this species, despite its high reproductive rate and fast growth rate has been reduced to a population of young and juveniles by fishing gears with fine-mesh nets. In addition, fishing gears operated in seagrass areas catch gravid *danggit* during spawning events.

During a June 2005 workshop hosted by the FISH Project, fine-mesh nets were identified by policymakers and resource users as a critical threat to sustainable fisheries on Danaon Bank. While the negative impacts of such nets are increasingly acknowledged in the region, workshop attendees also recognized that developing policies to curtail usage of such nets will be a complex undertaking. Understandably, policymakers are reluctant to take on controversial issues, especially when stricter regulations will, at least in the short term, have a negative impact on the livelihoods of some poor resource users.

In addition to food fisheries, important globalized nonfood fisheries also operate in the Danaon Bank area. The seahorse fishery feeds a global market in traditional medicines, tonic foods, aquarium displays and curios. Like all majority of fisheries in Bohol, the seahorse populations are being depleted, with a high percentage of the catch consisting of juveniles (Torrechilla *et al.*, unpublished). Seahorses are gathered mainly at night, and caught while fishers gather other organisms. The catch rates are relatively low—averaging two seahorses per fisher per day and no catch on most days—partly due to their naturally low densities. As fishers deplete fisheries resources and adopt new diving technologies, even deep-water seahorse populations are being heavily exploited (Panes *et al.*, unpublished).

Danaon Bank supplies the global market with ornamental fish. According to a locally active nongovernment organization, the Marine Aquarium Council (MAC), the ornamental fish collection started in Bohol more than 20 years ago, introduced by roving collectors from Cebu where collection started in the 1950s. While efforts are underway to introduce less destructive methods, sodium cyanide is still frequently used to stun and capture the fish. This technique kills a high percentage of nontarget species and coral. Almost all of these fish are exported to the United States of

America and Europe. The improper use of compressed air diving equipment is also very dangerous for divers.

## SUMMARY

The once rich fisheries of Danaojon Bank are not sustainably harvested— a condition that is both risky for local communities and economically inefficient. The effects of widespread use of illegal and destructive fishing methods are apparent. Fishing effort is far beyond sustainable levels. With increased attention to monitoring and sound management, this once productive fishery ecosystem could return to sustainable harvest levels. The final chapter of this profile suggests various immediate actions that, if carried out, will improve fisheries management on Danaojon Bank.



USE OF FINE-MESH NETS RESULTS IN OVERFISHING.



# CHAPTER 5

## RECOMMENDATIONS FOR COASTAL AND FISHERIES MANAGEMENT IN DANAJON BANK

### KEY MANAGEMENT ISSUES

As this profile documents, the coastal and fisheries resources of Danajon Bank are both valuable and imperiled. The challenges that government agencies, projects and coastal communities face in this arena are complex and well established. Systemic conditions such as poor governance, poverty and ignorance frequently undermine even initially successful management processes (Christie *et al.* 2005). But interest in improving fisheries and coastal management remains high—especially as the consequences of the *status quo* become apparent. A wide variety of coastal and fisheries management initiatives have focused on improving environmental conditions while addressing pressing economic issues in the Central Visayas region. This chapter is an overview of immediate actions to improve the fisheries and other resources of the Danajon Bank.

Green *et al.* (2004) provide a comprehensive summary of key issues and appropriate policy actions to address overfishing and habitat degradation in the Central Visayas. After a series of consultative workshops, the following issues were identified as problematic for the area's fisheries ecosystems:

- various forms of overfishing;
- illegal fishing and overly efficient fishing gears;
- habitat degradation;
- lack of marine protected area coverage; and
- lack of incentives to encourage sustainable resource management.

During a similar workshop of Bohol policymakers hosted by the FISH Project in June 2005, the use of illegal active gears and fine-mesh nets and blast fishing were identified as the top priority issues to be addressed for Danajon Bank.

## ECOSYSTEM-BASED FISHERIES MANAGEMENT PLANNING AND IMPLEMENTATION PROCESS

As discussed in this profile, the FISH Project has adopted ecosystem-based fisheries management (EBFM) as its management framework. This holistic approach to fisheries management considers ecological function and health as well as links between human communities and their environment. Figure 2 provides an overview of the planning and implementation process for the four FISH target areas.

### Phase 1: baselines, constituency engagement and planning

As indicated in Phase 1 activities, up-to-date and multidisciplinary information is the basis for the development of context-appropriate management responses. **Participatory coastal resource assessment (PCRA)** and ecological and social **baseline assessments** record both local knowledge and scientific observations (Figure 2). This process is well underway in Danaojon Bank. Once management responses are initiated, ongoing monitoring will provide tangible material for education campaigns and allow for ongoing adjustments through an adaptive planning process.

Since ecosystem-level planning is a novel and ambitious approach, **scenario analysis and planning** can provide stakeholders an opportunity to consider the implications and trade-offs associated with various strategies before actions are taken and resources are

committed. Scenario analysis is also helpful to identify potential opportunities associated with and barriers to hypothetical management interventions. Based on a scenario analysis exercise at the June 2005 planning workshop, the initial management interventions below were discussed.

## MANAGEMENT INTERVENTIONS APPROPRIATE FOR DANAJOON BANK

Based on a series of consultations and thorough situational analysis, Green *et al.* (2004) suggest increasing the coverage of marine protected areas (MPAs), joint management of commercial and municipal fisheries, licensing of fishing boats, providing preferential access to stocks and fishing grounds for local commercial and artisanal fishers, strengthening reproductive health programs and establishing a sequential benchmarking system to monitor progress. Participants from Bohol in the June 2005 FISH Project workshop identified the following initial strategies to reduce the impacts of the use of active fishing gears and fine-mesh nets and of blast fishing in Danaojon Bank (Box 1). Given the complexity of the issues, implementation should first focus on sites that are within the jurisdiction of Bohol province with expansion to the other three provinces to follow as appropriate.

### BOX 1. IMMEDIATE INTER-LGU FISHERIES MANAGEMENT INTERVENTIONS FOR DANAJOON BANK.

1. Strengthen planning and enforcement efforts that involve Cebu, Leyte and Bohol.
2. Ratify and implement an agreement among Bohol municipal governments to protect Danaojon Bank, coordinate interventions, share information and expertise, and harmonize municipal fishery ordinances.
3. Strengthen Coastal Law Enforcement Teams (CLECs) and other municipal-based enforcement teams through education and capacity development.
4. Implement Danaojon-wide registration and licensing of municipal fishers, fishing vessels and gears.
5. Delineate municipal waters.
6. Intensify education campaign on the importance of Danaojon Bank and the effects of destructive fishing gears.
7. Conduct socioeconomic monitoring of fishing communities, including research relevant to illegal and destructive fishing practices.
8. Strengthen POs and FARMCs.
9. Establish a network of MPAs.
10. Develop alternative and supplemental livelihoods for the poor affected by regulations.
11. Increase municipal and provincial budget allocations for coastal and fisheries management.

The considerable experience with coastal and fisheries management in the Danajon Bank area provides a firm foundation for EBFM. As highlighted in Chapter 1, most municipal governments have dedicated at least some personnel and finances into planning and enforcement activities. Some have taken more ambitious steps by creating long-term coastal management plans and established MPAs in which fishing is prohibited. While these are significant first steps, the restoration of Danajon's coastal and fisheries resources will require an expansion of management efforts that is sustained indefinitely. The above lists of desirable policies as identified by local constituencies and policymakers constitute an ambitious, but necessary, agenda.

The following integrated management framework includes specific field activities and mechanisms for their long-term support. Its three key components—MPAs, fisheries management and enforcement—are complementary and mutually reinforcing. The effective establishment of these components relies on robust institutional support, timely information and adaptive planning.

## MARINE PROTECTED AREAS

Scientific consensus is still evolving on MPA design parameters such as optimal size and configuration. There are strong indications, however, that considerable economic, social and ecological benefits are generated by long-standing and well-managed MPAs (Russ 2002). Nearby internationally recognized success stories such as Apo Island provide inspiration and indication of the potential benefits.

Some 31 MPAs exist on Danajon Bank (Table 10). A few of these are well-supported by municipal governments and nongovernment organizations (NGOs) such as the Project Seahorse Foundation. The majority of these MPAs are small and not yet well established or managed (according to the MPA rating system applied) although some have been in existence since 1996 and provide valuable lessons in design and management for this context. Based on recent interviews, having sustainable financing and establishing effective enforcement system are among the most serious management challenges (Langjhar, unpublished). A network of MPAs, in either the social or ecological sense,

has not yet been established and may help address some of these issues by spreading management costs and pooling enforcement resources. In summary, while there is a foundation to work from, there remains considerable work ahead to develop a functional network of MPAs that will provide significant social and ecological benefits. Existing community-based MPAs should be strengthened while additional community-based MPAs are established as a means to engage local communities in coastal stewardship.

To reach the goals of stabilizing and significantly increasing fish biomass in the area new forms of MPAs should be introduced. **Offshore MPAs** that close deepwater areas to fishing permanently or seasonally could provide some degree of protection for pelagic fish stocks that support both commercial and municipal fisheries. Areas closed to fishing during peak reproductive times, a type of MPA, would help ensure that a sustainable standing stock of fish is maintained. Increased involvement of commercial fishers in the



**BASDIO MARINE SANCTUARY, BOHOL.**

**TABLE 10. MARINE SANCTUARIES ESTABLISHED UNDER MUNICIPAL ORDINANCES WITHIN THE FISH PROJECT TARGET MUNICIPALITIES OF THE DANAJOON BANK (LANGJHAR, UNPUBLISHED).**

MPA name	Barangay	Municipality	Year established by ordinance	Size (ha)	Management rank (points) <sup>1</sup>
Bantigian	Saguise	C.P. Garcia	?	?	1 (9)
Sidlakan	Saguise	C.P. Garcia	?	?	1 (10)
Agining	Agining	C.P. Garcia	?	?	2 (16)
Popoo	Popoo	C.P. Garcia	2004	13.6	1 (8)
Basiao	Basiao	C.P. Garcia	2004	28	1 (6)
Baud	Baud	C.P. Garcia	2005	21.7	1 (6)
Pong-Gamay	Lapinig	C.P. Garcia	1986	?	2 (17)
Bantigue	Butan	C.P. Garcia	2005	18.9	1 (6)
Sinandigan	Sinandigan	Ubay	2004	51.6	1 (12)
Tipolo	Tipolo	Ubay	2003	33	1 (11)
Bilangbilangan East	Bilangbilangan East	Bien Unido	2002	44.5	2 (17)
Bilangbilangan West	Bilangbilangan West	Bien Unido	2002	71.9	1 (12)
Hingotanan East	Hingotanan East	Bien Unido	2002	21.8	2 (17)
Hingotanan West	Hingotanan West	Bien Unido	2002	71.8	1 (13)
Sagasa	Sagasa	Bien Unido	2002	26.9	1 (10)
Pinamgo	Pinamgo	Bien Unido	2002	37.8	2 (16)
Mandawa	Mandawa	Bien Unido	2002	59.1	2 (17)
Liberty	Liberty	Bien Unido	2002	18.8	2 (16)
Poblacion	Poblacion	Bien Unido	2002	69.8	2 (16)
Tuboran	Tuboran	Bien Unido	2002	12.5	2 (17)
Malingin	Malingin	Bien Unido	2002	114.9	1 (15)
Maomawan	Maomawan	Bien Unido	2002	128	1 (15)
Nocnocan	Nocnocan	Talibon	2002	19 *	0 (3) **
Cataban	Cataban	Talibon	1996	19.9	2 (20)
Guindacpan	Guindacpan	Talibon	1996	46.4 *	0 (4) **
Calituban	Calituban	Talibon	1988	57.3	0 (4)
Sag	Sag	Talibon	2004	36	1 (11)
Santo Niño <sup>2</sup>	Santo Niño	Talibon	2000	7.1	0 (5)
San Francisco <sup>2</sup>	San Francisco	Talibon	1996	7.8	1 (10)
Tanhaligue <sup>2</sup>	Tanhaligue	Talibon	2000	43.9	0 (5)
Bagacay <sup>2</sup>	Bagacay	Talibon	1986	?	1 (8)

<sup>1</sup> MPAs were ranked on a 1-5 scale using the MPA rating system developed and employed by the Coastal Conservation and Education Foundation, Philippines (MPA database version 2004). Points are assessed based on attainment of measurable management activities and benchmarks such as: baseline assessment and monitoring, education, formation of management body, management plan development, municipal ordinance approval, boundary demarcation, effective enforcement, sustainable financing, alternative livelihood development, etc.

<sup>2</sup> Ratings for these four sites in Talibon were assessed from 2004 surveys.

\* Rating based upon the 2005 survey in which the barangay identified an informal sanctuary relocation.

\*\* The area (in ha) presented is the size of the original marine sanctuary because delineation of proposed sanctuary relocation has not yet been performed.

fisheries management planning process will be important and necessary for such initiatives to succeed. The FISH Project is taking steps in this direction by collaborating with the Bisayas Alliance of Fisherfolks and Operators for Reform (BAFOR) (Ostdahl, unpublished). FISH and BAFOR will collect data on the pelagic stocks that migrate between the Camotes Sea and the Danao Bank, with an objective of increasing biomass in both areas by implementing short-term self-

imposed closed seasons at peak spawning times in particular areas. Although still in the early stages, this collaboration is one of the first to work directly with the commercial sector on fisheries management. More frequent and repeated forums that include both commercial and municipal fishers along with representatives of the Bureau of Fisheries and Aquatic Resources (BFAR), local governments and NGOs in the area will be useful for planning and zoning of allowable



activities, and can also serve to raise awareness of overfishing and other threats to coastal sustainability among the commercial sector.

The current system of small inshore MPAs in Danajon Bank does not provide sufficient protection for critical habitats and overfished stocks. In the absence of fishing effort control, even successful ones cannot support the intense and growing fishing pressures adjacent to boundaries (Christie *et al.* 2002). An unsustainably high proportion of fish that migrate outside small MPAs are likely caught outside boundaries.

For these reasons, **large MPAs**

should be established that include coral reef, seagrass and mangrove areas. These MPAs, larger than 1,000 ha, should be strategically placed so as not to completely displace municipal fishers. Habitat diversity should be maximized within their boundaries to help assure that organisms complete their life cycle. Priority sites for large MPAs should include areas on the outer edge of Danajon Bank facing Cebu since these areas are more remote, less affected by siltation and accessible by dive boats from Mactan Island. A prolonged educational and participatory planning program will need to precede large MPA establishment. Given their size, and likely remoteness, the Coast Guard and other agencies will need to be engaged to ensure compliance and enforcement. Such large MPAs would support sustainable fisheries and may, if well positioned and properly managed, catalyze dive tourism in the area. Diving interests in Mactan Island should be engaged as important stakeholders in planning areas that are accessible to their dive boats. While potentially controversial, Danajon Bank appears to be large enough to accommodate both large MPAs and well-managed fisheries. The degree of controversy is likely to be directly related to the degree to which management responsibilities and benefits are equitably shared between fishing and tourism interests (Oracion *et al.* 2005; Pomeroy *et al.* 2005).



HIGH CORAL COVER IN THE GILUTONGAN MARINE SANCTUARY, CORDOVA, CEBU.

The process of MPA establishment could be systematized to a greater extent so that both ecological and social connectivity processes are taken into consideration (White *et al.* 2006). While it may be unrealistic to conduct genetic connectivity studies, basic oceanographic studies of current patterns will suggest which areas are sources and sinks of coral and fish larvae. Social connectivity—a measure of the degree to which managers, leaders and resource users are able to collaborate, share resources and maintain mutual support networks—will influence management sustainability. Social networks are essential to maintaining long-term viability of MPA networks (Pollnac and Pomeroy 2005). Optimizing biological and social connectivity will likely entail trade-offs. Scenario planning provides a useful tool for considering these trade-offs before scarce financial resources and effort are expended.

## FISHERIES MANAGEMENT

Spatial management tools, such as MPAs, should be complemented with standard fisheries management techniques that manage gear types, minimum fish size and timing.

In fact, standard fisheries management and MPAs should be viewed as nested strategies that can optimize sustainable fishery harvests, while maintaining important biodiversity and associated recreational uses



of marine resources. To date, there has been little attention to standard fisheries management in the area. Fishing effort is largely unregulated for both the commercial and municipal fisheries sectors—a dangerous policy resulting in overfishing, food insecurity and habitat degradation.

Key fisheries management interventions that are under consideration for Danaojon Bank are a closed season for rabbitfishes (during periods of reproduction and juvenile recruitment), ban on selling rabbitfishes during closed season, minimum mesh size limit for crab gillnets, minimum size limit for blue crabs, ban on catching and selling gravid (with eggs) blue crabs, mesh size limits for traditional fine-mesh fishing gears (like the fish corral), ban on destructive gears like the trammel net, seagrass sanctuaries (intended for rabbitfishes), zoning of fishing activities, and fisher/boat registration and licensing.

Since MPAs and fisheries management require sacrifice in the short term, alternative or complementary income development programs should be initiated. These programs are complex and most feasible when linkages to the private sector and markets are well established. The environmental and social implications of each type of project should be carefully assessed before implementation begins. While technically outside the mandate of the project, FISH will be collaborating with other partners to facilitate such economic development.

## ZONATION

As a way of integrating MPAs and standard fisheries management, the entire Danaojon Bank area should eventually be zoned into multiple use zones (Figure 29). Zonation can effectively separate conflicting resource uses (e.g., fishing and dive tourism). Similar to the system in the Australian Great Barrier Reef, zones should be established for sustainable fishing, tourism and conservation. A participatory scenario planning process should be undertaken to ensure that scientifically developed information, local knowledge and constituency interests are considered.

Municipal CRM plans and ordinances can be developed to allocate areas according to local user rights for specific uses such as fish and/or seaweed culture, tourism and recreation uses, boat channels and docking area, and other use zones as appropriate. The zonation scheme should be periodically re-evaluated to ensure that necessary changes are included over time.

The zone boundary defining municipal waters is probably the most important one that warrants immediate formalization and strict enforcement. This boundary is frequently ignored by commercial fishing operations (boats greater than 3 GT) that view it as arbitrary and denying them of traditional fishing grounds. The encroaching of commercial operations encourages municipal fishers to adopt increasingly more efficient (and expensive) gears in order to compete.

Creating protective zonation schemes for sensitive habitats, for example, mangroves and estuaries, should be encouraged. In such zones, development should be controlled and habitat restored. The overall ecological health of Danaojon Bank will depend on maintaining and restoring these habitats. As highlighted in Chapter 3, large areas of Danaojon Bank have been negatively impacted by upland development and clearing of mangrove areas that act to trap sediments before they reach coral areas. Large areas of mangroves in northern Bohol have been reforested and can act as demonstration sites and seed sources (Green *et al.* 2004).

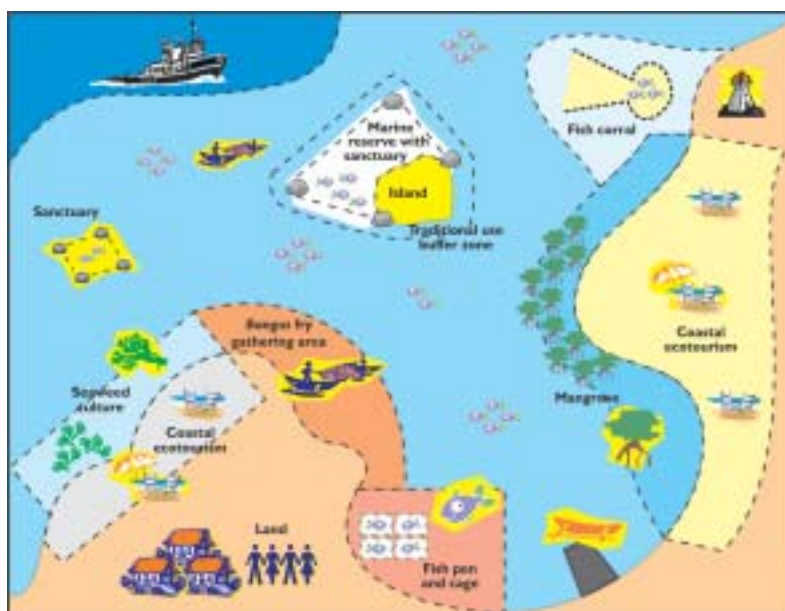


FIGURE 29. EACH MUNICIPALITY NEEDS A ZONING PLAN.

While it is beyond the mandate of the FISH Project to work directly in upland areas, it is important that marine, coastal and upland policies and interventions are harmonized.

## ENFORCEMENT

Equitable and sustained enforcement of coastal and fisheries regulations is the cornerstone upon which all the above management interventions depend. Fortunately, various effective enforcement activities are currently underway in the area (Box 2).

By law, the municipal government plays a central role in enforcement of regulations within municipal waters. Experience demonstrates that a committed mayor can eradicate illegal fishing, but the frequent turnover of mayors makes sustained progress a challenge. Enforcement must be institutionalized, financed and professionalized to the point where it is sustained regardless of whether a municipal mayor is an ardent supporter of his or her predecessor's enforcement programs. The Provincial Government should take on the role of catalyst, capacitor and supporter of municipal level enforcement because issues and violations cut across municipal territorial jurisdictions. The efforts of committed mayors will also depend on the support of national institutions tasked with law enforcement such as the Philippine National Police and the Coast Guard. Necessary basic equipment, such as boats, global

positioning units and radios, must also be available for enforcement to function properly. Finally, the CLECs and the Provincial Government of Bohol must commit to *transparent, equitable and accountable enforcement* because enforcement is a sensitive social and political exercise involving conflict and confrontation. A comprehensive education program focused on the importance of law enforcement, the proper steps to apprehend illegal fishers, and the appropriate use of the evidence and law is fundamental to any effective enforcement campaign.

While these enforcement efforts have been very successful, they are difficult to maintain in the long term. Also, frequently only the most vulnerable are prosecuted, rather than the mastermind and financier of illegal fishing activities. These tendencies are frequently related to how institutions and incentive structures function.

## INSTITUTIONALIZATION OF EBFM

In the Philippines, the contradicting policies of increased fishery production and sustainable resource management are apparent. The relatively recent, and quite radical, decentralization of governance without sufficient financial and technical support at the municipal level is of central importance. Finally, the separate, and sometimes contradictory, management policies of nearshore artisanal fisheries (small boats operating within 15 km of shore) and offshore commercial fisheries (fishing boats greater than 3 GT, 15

### Box 2. COASTAL LAW ENFORCEMENT IN BOHOL.

Three CLECs in Bohol have been able to apprehend hundreds of illegal fishers and have received the Galing Pook Award for creative environmental law enforcement in 2003. At the municipal level, **Municipal Coastal Law Enforcement Teams** are organized and supported with municipal resources. In the FISH target municipalities, the Fish Wardens of Talibon, Bien Unido Coastal Law Enforcement Team, Task Force Kalikupan-Pres. Carlos P. Garcia and the Coastal Environmental Protection Unit in Ubay have been organized recently with annual budgets ranging from PhP200,000 to 700,000. Members of these groups have undergone extensive training in legal means of surveillance, evidence collection and apprehension. These efforts have resulted in the confiscation of numerous illegal fishing gears. When appropriate, the application of *swift, serious and public* enforcement actions has proven successful in deterring illegal fishing.



CONFISCATED ILLEGAL FISHING NETS.

km offshore) pose many institutional challenges to EBFM. Municipal governments have jurisdiction over artisanal fisheries, while BFAR has jurisdiction over commercial fisheries.

Achieving the Ecosystems-based Fisheries Management (EBFM) in the Philippines is a formidable task in the light of existing policies and regulations concerning fisheries management. Some initiatives have been undertaken which attempted to address the interactive political, economic, cultural, institutional, environmental problems plaguing a common fisheries ecosystem. Unfortunately, the current legal landscape is not entirely supportive of EBFM. In addition, the present legal regime is still plagued by ineffective mechanisms for enforcement and implementation. (Eisma-Osorio 2005)

Basic legal and institutional structures exist for the realization of EBFM. Eisma quotes the important Local Government Code:

Section 33. Cooperative Undertakings Among Local Government Units. – Local Government Units may, through appropriate ordinances, group themselves, consolidate, or coordinate their efforts, services and resources for purposes commonly beneficial to them...

Fortunately, the 1998 Philippine Fisheries Code (PFC), provides important legal basis for sustainable fisheries management: “conventional fisheries regulations are already expressed in the PFC. Maximum sustainable yield, closed seasons, and limiting access through licenses are sufficiently dealt with in the Code. Science-based management decisions for EBFM are somehow implied from these rules. These can provide adequate and sound bases when EBFM is jointly adopted by LGUs” (Eisma-Osorio 2005).

EBFM initiatives will need to consider what is already working in the country and to build on existing and functional ICM models. It was noted that introducing new terms, structures, organizations and laws is potentially disruptive when one considers that

the current and progressive Fisheries Code of the Philippines took more than 10 years to craft before it was enacted by Congress in 1998. The Fisheries Code calls for a holistic approach to coastal and fisheries management and many opportunities remain to realize its full implementation.

EBFM will require the engagement of national, provincial and municipal government organizations, NGOs and people’s organizations (POs). The BFAR within the Department of Agriculture and the Department of Environment and Natural Resources are the two key national agencies responsible for coastal and fisheries management. Because of the relative power held by municipal governments to manage their coastal resources and people, innovations in institutional structures will most likely occur in the manner that LGUs coordinate and work together. Their jurisdictions are large enough to fully address some EBFM problems but not large enough for others that span over multiple LGU boundaries.

At the provincial level, the Bohol Environmental Management Office (BEMO) plays a key coordinating and technical support role. The Governor of Bohol provides important leadership and momentum to this process.

The municipal government will play a central role in any management activities since most of Danajon Bank is within municipal waters (out to 15 km from shore). Mayors and their municipal councils will need to support the development of management plans and ordinances to back regulations. These institutions will also need to provide equipment and incentives to citizen enforcement groups and to facilitate access and information to police organizations into municipal waters.

Managing Danajon Bank as a whole will require that municipal governments collaborate with one another. Such a high level of coordination is novel and will likely take significant time to establish norms and practical experience. Those mayors more experienced in fisheries and coastal management should play lead roles in inter-LGU organizations. While challenging, clear benefits exist from such an approach. Turnover of individual mayors will be less disruptive to management as a whole. Scarce and expensive resources

such as boats and engines could be shared. Illegal fishers will not escape prosecution by targeting waters outside their home municipality.

A current trend is to cluster municipal LGUs around logical ecosystem-based boundaries, such as bays, along coastlines or channels between two islands. These efforts are starting to result in joint planning and implementation efforts for coastal law enforcement. As highlighted by Eisma-Osorio (2005),

[T]he implementation of EBFM is anchored on the basic principle of collaborative and collective responsibility. EBFM requires a structure that will ensure coordination and cooperation among LGUs. There are two options which are identified: (a) tapping existing structures such as the Regional Development Council in the case of inter-provincial cooperation or Provincial Development Council in the case of inter-municipality collaboration; or (b) creating a separate management structure such as the cluster municipality councils. Forging new partnerships and finding areas of common ground for collaborative action are central to the process of implementation as well as building and strengthening the roles and capacities of LGUs and major stakeholders.

In addition to government support, there is an important role for NGOs and POs. In the Danajon Bank area, the Project Seahorse Foundation, PATH Foundation Philippines, Feed the Children Foundation, Eco-Gov Project, Community-based Resource Management Project and other NGOs work effectively with resource users and government entities. PATH Foundation Philippines (<http://www.pfpi.org/about.html>) is currently working in two coastal municipalities (Talibon and Ubay) in the Danajon Bank area with an integrated reproductive health-coastal management approach. FISH and PATH Foundation already have an active collaboration that will expand to help ensure that underlying issues, such as unmanaged population growth, are considered in plans for Danajon Bank.

Project Seahorse Foundation is also another important partner interested in working with FISH to

improve the management of Danajon Bank. This NGO has been active in the area for years with considerable success in establishing MPAs, monitoring of reef habitats and seahorse populations, local and international education, and organizing the fishery sector (Blanco 2005).

Frequently these NGOs work to establish POs to ensure program responsiveness to local needs and encourage participation. Most of the MPAs, aquaculture projects and other fisheries management initiatives in the area have associated POs that play central roles in project design and implementation. Developing effective fisheries management at a Danajon Bank-wide scale will require that these POs are networked. Project Seahorse Foundation has worked to establish one such fisheries federation named *Kahugpongan sa Mananagat sa Danajon, Inc.* (KAMADA, Inc.) (Barbon 2005a).

Historically, the private sector's role in fisheries or coastal monitoring, planning and policy development has not been very strong. Developing viable alternatives to the use of cyanide for the capture of aquarium and live food fish will require collaboration with the private sector. Enforcement capacity, even with the above outlined improvements, has not been able to keep up with the explosive growth of these sectors which encourage corruption at many levels and have been resistant to traditional command-and-control approaches to management and enforcement. The Marine Aquarium Council (MAC), an international NGO that is active in southern Danajon Bank, works closely with the private sector at all levels to encourage a sustainable aquarium fish industry (Box 3). Their experience and program should be encouraged throughout Danajon Bank where such fish are gathered.

Similarly, the private sector should be engaged in encouraging sustainable beach and dive tourism. While not currently a large part of the Danajon economy, there is considerable interest in developing the tourism sector. If fisheries and marine habitats are better managed, tourism is likely to increase thus necessitating that infrastructure is carefully developed and that tourism ventures support conservation measures in tangible and appropriate ways.

The above analysis demonstrates that effective fisheries management in Danajon relies on the expertise

### Box 3. AQUARIUM FISH COLLECTION AND THE MARINE AQUARIUM COUNCIL.

The MAC works with resident collectors in two sites in the southernmost section of Danao Bank in the island province, Batasan Island (municipality of Tubigon) and Tangaran (a coastal village in the municipality of Clarin). MAC has worked with the local governments of both municipalities, and other stakeholders, in the formulation of a collection area management plan and in training fishers in the use of nets. Part of this plan is the establishment or maintenance of existing marine sanctuaries. There are marine sanctuaries in both Batasan Island and the village of Tangaran. The training of fishers was conducted by fellow aquarium fish collectors from other sites who have already shifted to the use of nets with the help of previous programs focusing on reform in the aquarium collection and trade.

There are now 61 certified tropical fish collectors in these two sites (34 in Batasan Island and 27 in the village of Tangaran). These collectors were former cyanide users. They ship most of their MAC-certified fish to MAC-certified exporters in Cebu and Manila, who in turn ship these to MAC-certified importers in the US and Europe. Cyanide fishing and dynamite fishing around these collection sites have been significantly reduced.

Now some of the aquarium fish collectors in these two sites have become trainers themselves in the use of nets, and are helping aquarium fish collectors in other sites where MAC works shift to a more sustainable way of aquarium fish collection. The MAC is an international not-for-profit corporation that promotes sustainable coral reef management, sets standards and is an accreditation body for international certification of the global marine aquarium trade. (*Ronnet Santos, MAC*)

and support of a wide variety of stakeholder groups and institutions. Multisectoral and multitiered planning boards will be essential to encourage clear communication and integrated policy development. Established through a memorandum of understanding, the Cebu, Leyte, Bohol and Southern Leyte Management Council (CeLeBoSoLe Council) was formed to oversee policy developments affecting Danao Bank. The council and a technical working group are composed of key persons from provincial and municipal governments of Bohol, Leyte, Cebu and Southern Leyte, alongside key national agencies and NGOs.

At the June 2005 planning meeting hosted by the FISH Project, a Bohol-based multisectoral and multi-institutional board named the Danao Bank Fisheries Management Planning Technical Working Group was formed (Office of the Governor-Bohol 2005). Convened by the Governor of Bohol and to be facilitated by the BEMO, this group has the following mandates:

- Develop a ten-year fisheries management plan towards the sustainable management, wise utilization, protection and conservation of fisheries resources of Danao Bank, covering the municipal waters of Tubigon, Clarin, Inabanga, Buenavista, Getafe, Talibon, Bien

Unido, Trinidad, Ubay and Pres. Carlos P. Garcia.

- Propose policies and other measures in support of the programs and strategies embodied in the ten-year fisheries management plan.
- Propose mechanisms for inter-LGU and inter-agency collaboration in the management of the Danao Bank.
- Coordinate and consult with the concerned municipalities, national government agencies, NGOs, POs, academic institutions, assisting organizations, private individuals and other institutions in the development of the ten-year fisheries management plan for Danao Bank.
- Perform oversight function in the implementation and monitoring of programs, strategies, policies and other recommendations embodied in the ten-year fisheries management plan for Danao Bank.
- Exercise such other duties and functions as may be authorized by the Provincial Governor or the *Sangguniang Panlalawigan*.

### MONITORING AND ADAPTIVE MANAGEMENT

Monitoring of social and ecological systems provides fundamental information at all steps in the



management process. Baseline information establishes conditions prior to program implementation. Ongoing periodic monitoring provides managers with an idea of how socioecological systems are responding to interventions. This information is essential to developing context-specific management plans and educational programs.

The goal of fisheries management is to modify human behavior in a manner that encourages sustainability. Therefore successful fisheries management is reliant on a clear understanding of social, economic and institutional systems and how they align with management objectives. At present, only the most basic social indices are regularly monitored. The following is a list of essential socioeconomic variables and governance processes that should be monitored for development of an effective fisheries management plan (Christie *et al.* 2003):

- fishing effort, costs and profits;
- local and national trade patterns for fisheries products;
- municipal and commercial fishing interactions;
- fishing and tourism infrastructure and interactions;
- illegal and legal fishing behaviors and patterns;
- perceptions of coastal resources and management;
- willingness and capacity of government and nongovernment institutions to support EBFM for commercial and municipal fisheries; and
- management status of declared MPA.

Without such information, decisions are grounded in impressions and assumptions—a condition that is unlikely to lead to successful policy development (Christie *et al.* 2003; DAI and MERF 2004).

Similarly, ecological conditions and fishery responses to management must be monitored for successful adaptive planning. In the Danajon area, the FISH Project will focus on a number of essential parameters such as:

- fish density, diversity and biomass;
- catch per unit of effort of major fishing gears; and

- benthic conditions, particularly living coral cover.

In addition, focused studies on particular processes, such as general current patterns, will assist with MPA network design.

The effective management of social, economic, governance and ecological systems will determine whether fisheries resources and marine habitats are restored and sustained on Danajon Bank. Some of the necessary social, governance and ecological information has been collected in the Danajon Bank area by previous coastal management and conservation projects, but EBFM requires a considerable broadening of monitoring effort. Such information should be fed into a multisectoral planning process that has the full support of resource users and institutions with decisionmaking and enforcement mandates. A series of informational workshops that disseminate findings and develop human capacity should be developed in order to support adaptive planning.

## SUSTAINING THE PROCESS

EBFM represents a novel and ambitious response requiring dedication and flexibility on the part of leaders, officials and resource users. Identifying and preparing for likely challenges will improve the chance for success. While Table 13 displays a list of general challenges and potential solutions, the process of identifying issues and potential solutions specific to Danajon Bank is a productive exercise.

Even successful management processes that overcome some of the above issues may be difficult to maintain over the long term (Christie 2005). The Philippines, while home to tremendous human resources and experience, faces ever increasing economic, social and environmental pressures. A complex planning process that is frequently reliant on external funds and expertise is inherently unstable. Attention to the following dynamics is fundamental if progress toward EBFM is to be sustained in the long term and beyond the life of the FISH Project .

While the importance of multisectoral planning boards is clear, experience from the Municipal Fisheries and Aquatic Resources Management Councils and Protected Area Management Boards (PAMB) suggests

that these groups are challenging to maintain. Common problems are the: lack of a clear mandate, confused relations between LGUs and national agencies, and high membership frustration and turnover (Doyle 2005). In some cases, such as the PAMB for the Tubbataha National Park, the organization is very effective. Real influence, sustainable financing and transparent decisionmaking are some of the factors that influence whether such groups remain committed. Attention to incentive structures, development of human and institutional capacity, and concrete systems of accountability are central to sustaining institutional commitment (Lowry *et al.* 2005).

Maintaining citizen commitment, which is fundamental to developing workable resource management systems, requires attention to effective community organizing strategies, meaningful participation and conflict resolution (Christie *et al.* 2005; Oracion *et al.* 2005). The barriers to sustained participation by impoverished resource users are considerable. While numerous civic organizations exist, active participation in such groups is not widespread among all social and livelihood groups particularly the most marginalized. For example:

of some 80 lantern fishers interviewed, only 24 (30%) of them were involved in at least one community-based organization. Of these 30%, the most common community organization that they were affiliated with was the *Tampuhan*. This is a mutual help organization where group members work together to cover the needs of its members during funerals, illnesses, baptisms, birthdays and fiestas. Very few were members of a fisher's organization, cooperative or non-government organization. (Barbon 2005b)

Developing viable solutions to these potential challenges will require a lengthy participatory and



PLANNING MEETINGS BRING STAKEHOLDERS TOGETHER.

adaptive policymaking process. Unfortunately, institutional norms that discount environmental issues and illegal practices are well established in some areas of Danajon Bank. Understandably, the local citizenry does not always prioritize these issues. The dramatic changes that are necessary to recover degraded marine systems will require a profound change in how Philippine society relates with these resources. Policies to establish sustainable fisheries in Danajon Bank will undoubtedly generate controversy and debate. However, if the monitoring and planning processes remain open, participatory and grounded in reliable information then local commitment is more likely to develop (Pollnac and Pomeroy 2005).

## SUSTAINABLE FINANCING

Improved management of Danajon Bank will rely on ongoing monitoring, planning and action taking—all of which require financial support. Sustaining coastal and fisheries management, even at a very modest level, will require that officials prioritize these activities as a basic service on par with supporting traditional sectors such as education, health and infrastructure development. Elected officials and enforcement agents will need to fully engage in a planning process to identify priorities and opportunities to sustain activities. NGOs play necessary roles by

**TABLE 11. CHALLENGES AND POTENTIAL SOLUTIONS FOR EBFM IN DANAJON BANK.**

Challenges	Potential solutions
<b>Context issues:</b>	
Unsustainable financing: heavy reliance on external funding for fisheries and coastal management	Endowment for Danajon Bank; taxation and permit fee system for coastal resource use
Weak governance: corruption, unclear mandates	Multisectoral planning groups to encourage decisionmaking transparency, leadership development and community organization
Institutional inertia	Incentives to encourage relevant national agencies and LGUs to develop supporting policies, regulations and technical assistance for EBFM; education campaigns making public officials accountable to their constituencies
Legal framework is not conducive to EBFM: no clear legal framework for inter-LGU collaboration; commercial fishing operations consider municipal water boundaries to be arbitrary	Policy and legal initiatives, joint planning by LGUs, artisanal and commercial fishing interests
Ignorance of impacts of environmentally damaging practices, such as illegal fishing, deforestation, shoreline hardening	Enforcement, education
<b>Resistance to change:</b>	
Potential to lose community/LGU support while scaling up management efforts	Participatory planning, continued support of community-level projects
Conflict: between commercial and municipal fishers, between legal and illegal fishers, between fishing and tourism interests	Conflict resolution training, mediation by objective third party
Powerful and illegal fishing syndicates for live fish trade and trawling resistant to change	Enforcement at multiple levels, education, international pressure to regulate markets
Unwillingness to limit access/fishing effort due to poverty and ignorance	Targeted closures, education, alternative livelihood development

providing funding, technical support and external evaluation of government commitment.

Developing sustainable financial mechanisms and funding streams will help sustain progress (Milne and Christie 2005). Creative solution schemes will need to be developed. For example, fines for illegal fishing should be used to provide sustainable financing for enforcement activities. Financial incentives and awards should be provided for particularly active and effective enforcement agents. Diver fees collected by guards and barangay officials at small community MPAs can be used to support monitoring and patrols as is done elsewhere in the Philippines.

Considering the unique ecological nature of Danajon Bank, an international campaign should be launched to establish an endowment fund to support its monitoring and management. Fees collected from private sector interests that benefit from improved resource management (e.g., diving, aquaculture and commercial fishing) would support long-term

management of an ecosystem from which users derive profits and would help ensure stakeholder engagement in planning how funds are used.

## SUMMARY

Danajon Bank and reliant human communities are in crisis. A globally significant ecosystem that took some 6,000 years to create is literally on the brink of collapse—an event that would have serious consequences for thousands of people. Fortunately, the will to change how Danajon Bank is treated is growing. Decisionmakers, scientists and citizens increasingly realize that a sustained and comprehensive program is of the highest priority.

The first steps have already been taken. Fisheries and habitat baselines, the June 2005 planning meeting and this profile represent some of the initial steps toward improved management of Danajon Bank. The success of any process will depend, to a great extent, on the degree to which resource users and policymakers commit to a collaborative process of research, planning,

action taking and evaluation. Out of the June 2005 meeting, a province-wide planning group has been formed. Their role will be to foster, with FISH and other organizations, the improved management of Danaon Bank. We hope that this profile will serve well as a resource for those engaged in that challenging, but potentially rewarding, process.

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