ecosystems and natural resources

Chapter 2

“Live off the interest, don’t mine the capital.”

Bohol is considered as one of the few provinces in the country that still has some of its diverse ecosystems left in reasonable condition. Its varied ecosystems are home to both migratory and endemic wildlife species. Bohol’s freshwater, beach, mangrove, coral reef, and open-water ecosystems are intricately tied culturally, economically and ecologically with the life of the Boholano people. This chapter provides a description of the ecosystems and natural resources of Bohol as a basis for understanding how to manage them.

Figure 2.1. The coasts are the natural crossroads between the sea and the land

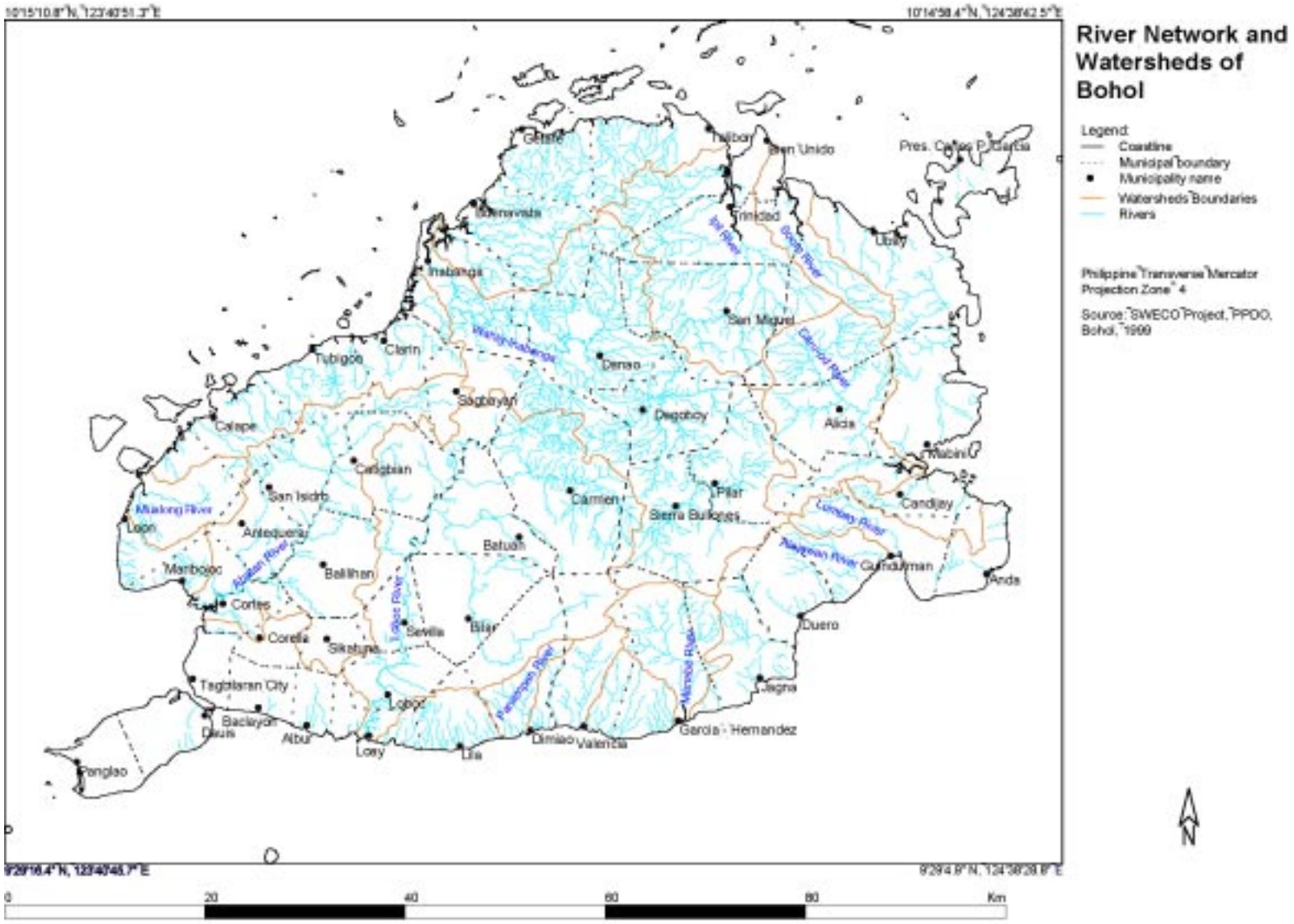

Figure 2.2. Map of river networks and watershed areas in Bohol

FRESHWATER ECOSYSTEM

There are eleven major rivers in Bohol fed by hundreds of tributaries emanating from the upland watersheds. The major river systems include the Wahig-Inabanga River (Inabanga), Ipil River (Trinidad), Soom River (Ubay), Caru-od River (Candijay), Lumbay River (Anda-Guindulman), Manaba River (Garcia Hernandez), Loboc River (Loay-Loboc), Panampan River (Dimiao), Abatan River (Cortes-Maribojoc), Moalong River (Loon) and Alejawan River (Duero).

Bohol has three major watersheds, all of which have been declared as protected areas under the National Integrated Protected Area System (NIPAS). These are the Wahig-Inabanga Watershed, Loboc Watershed and Duero Watershed. The Wahig-Inabanga Watershed covers two watershed projects of the DENR, namely, the Bohol Watershed Reforestation Project (BWRP) in Dagohoy and Wahig-Pamacsalan Watershed Reforestation Project (WPWRP) in Pilar.

The Wahig-Inabanga Watershed is the largest watershed covering 16 municipalities and 98 *barangays*, with a total area of 52,516 hectares. It has a daily discharge rate of about 1.5 million m³ during the rainy season, which gradually decreases to 600,000 m³ at the onset of the dry months (NRDB, 2000). During the rainy months, surface water easily flows out into the sea or overflows into the riverbanks. In 1994, the entire Wahig-Inabanga Watershed was proclaimed as a forest reserve by virtue of Presidential Proclamation No. 468.

Slash-and-burn ('kaingin') agriculture causes deforestation, which consequently triggers increased rate of surface water runoff and soil erosion - Ubay, Bohol

The second largest and first to be proclaimed (by Pres. Elpidio Quirino) as watershed forest reserve in Bohol (by virtue of Presidential Proclamation No. 450 dated December 23, 1953) is the Loboc Watershed. It has an area of 19,410 ha, part of which is a portion of the Rajah Sikatuna National Park (RSNP). Currently, the forest reserve is a project area of Bohol Alliance of Non-Government Organizations Foundation, Inc. (BANGON) which has received funding from the Australian Agency for International Development (AusAID), through the Philippine-Australia Community Assistance Program (PACAP), for its Loboc River Basin Development and Management Program - Area Focus Approach (Loboc-AFA). The foundation is developing an integrated management project in the entire watershed with its partner agencies.

Major and minor rivers and tributaries are vital to the coastal ecosystem because, through natural processes, discharge of large amount of organic matter and nutrients from the upland and lowland takes place.

Estuaries, which are that portion of the rivers affected by tidal exchange of seawater, are the main interface between the upland and coastal areas of Bohol. Estuaries have very high productivity and serve as spawning and/or feeding grounds of many species of fish, crustaceans, mollusks and migratory birds. However, they also carry the results of upland activities to the sea, which in most cases are destructive to the coastal areas, such as chemicals from use of pesticides and inorganic fertilizers in farmlands, liquid and solid wastes, and large volumes of sediment. Sediments from poor land use, deforestation and unsustainable farming practices are detrimental to the coastal resources, smothering seagrasses and corals and eventually choking them and blocking sunlight to the sea bottom, while pesticides and other chemicals quickly assimilate into the food chain and start causing negative impacts to the whole coastal ecosystem and human life.

The rivers and estuaries in Bohol have many uses. They commonly serve as harbors and navigation routes, areas for aquaculture development (e.g. Inabanga River), recreation and tourism (Loboc River), and fishing and sand quarrying areas. They also provide water for irrigation, domestic and industrial uses (e.g. Loboc Mini Hydro-Power Plant). They are the key interface between the sea and upland ecosystems. Thus, they should be conserved and managed to ensure that they continue to provide these social, economic and ecological services.

Management Strategies to Consider

- River bank stabilization through greenbelts or planting of ornamental plants and deep-rooted trees within the 20-meter environmental protection zone on both sides of the river and estuaries to minimize and/or prevent soil erosion

- Identification, by the MLGU and concerned communities, of a river or estuary for the "Adopt-A-River" Project under the Clean and Green Program of the DENR

- Community-Based Forest Management Agreement under the CBFM Program of the DENR to take over the management of swamps and mangrove areas, such as in Barangay Lincod, Maribojoc which now manages over 110 hectares of *Nypa* plantations along the Abatan River

- Enhancement and rehabilitation planting of site-specific mangrove species and 'nipa' to serve as buffer from strong winds and reduce water turbidity by binding and trapping sediments from upland activities flowing downstream

- Environment-friendly mariculture technologies that encourage local ownership and sustainable incomes as well as vigilance by the local community over rivers/estuaries

- Sustainable farming practices such as organic farming and reforestation of denuded areas

- Prevention of physical alterations, like construction of buildings and other infrastructure, that will affect the natural flow of the river

- Establishment and implementation of a clear zoning system to guide the LGU and resource users on what can and cannot be done in certain areas of the river/estuary

- Adoption of appropriate waste management practices

- Enforcement of laws against destructive fishing activities such as 'sudsud', fine-mesh nets, dynamite, and the use of chemicals and pesticides in large quantities to kill and catch fishes and crustaceans (e.g Nyhindrin, which is being commonly used)

MANGROVE ECOSYSTEM

Mangroves are woody, seed-bearing trees with specialized roots that thrive in brackish and/or waterlogged soil and exposed conditions. Mangroves surround most of Bohol and are most common around river systems, estuaries and in offshore islands.

Mangrove areas in the country, which sustain the life of our coastal ecosystem, have declined to about 123,000 ha in 1998 (DENR) from 450,000 ha in 1918 (Brown and Fisher) (Melana and Courtney, 1999). Large tracts of mangroves had been cut to pave the way for fishpond development and other various uses. Indiscriminate and illegal human use of mangrove ecosystems have serious consequences on the productivity of coastal resources (Table 2.1).

Some of the mangrove areas in Bohol are typical of riverine zones like this one in Cambuhat River, Buenavista, where the community have set up their own "tour".

With some 32 identified true species of mangrove (Yao, C.), Bohol has possibly one of the most biologically diverse mangrove ecosystems in the Philippines along with the one in Pagbilao, Quezon Province, Luzon. The largest and most biologically diverse mangrove area in Bohol is found in Cogtong Bay, which is bounded by Candijay and Mabini. It covers about 2,200 hectares.

Many people mistakenly look at mangroves as a muddy, smelly and fly-infested unproductive ecosystem. In fact, mangrove areas are one of the most productive and essential component of Bohol's ecosystems. One hectare of mangrove produces at least 600 kg of fish and shrimps per year. A healthy and biologically diverse mangrove ecosystem is economically estimated at US$ 500 to US$ 1,550 per hectare per year, the minimum valuation of a loss when mangroves are converted to other land uses (Dixon, 1989).

Table 2.1. Effects of indiscriminate human practices to the mangrove ecosystem

Exploitative Human Activities	Negative Implications	Effect on the Mangrove Ecosystem and Its Resources
Deforestation in the uplands	Increased soil erosion and surface water runoff	Increased siltation rate suffocates the specialized aerial roots of mangroves resulting to gradual death of juvenile tree
Rampant illegal cutting for firewood, either for domestic or economic purposes; as raw material for infrastructure development; for fishing device (e.g. fish cage, fish pen, fish corral)	Decreased mangrove cover and leaf litter	Loss of habitat (mangroves serve as breeding, spawning and rearing grounds for the complex cycle of marine vertebrates and invertebrates) and food for a variety of marine fauna (crustaceans, mollusks, fishes) and associated wildlife (migratory and endemic bird species, reptiles and insects)
Improper disposal of solid and liquid wastes from households, farmlands, and commercial and eco-tourism establishments	Increased rate in water pollution (from rivers, lakes and estuaries that drain to the seas)	Mangrove trees are attacked by pests (e.g. barnacles) that thrive on polluted seawaters
Fishpond development	Cutting of mangrove trees to give way to the development of dikes and canals	Fishpond dikes and canals limit the free flow of seawater and nutrients causing the death of associated flora and fauna and other mangroves in the surrounding areas
Reclamation	Cutting of mangrove trees to give way to infrastructure development	Loss of dominant and/or endemic species of mangroves

Mangroves act as spawning and nursery areas of many fishes, shrimps and mollusks. They provide large quantities of detritus through their fallen leaves, thereby, giving enough food and nourishment to various fauna. Wood from mangrove trees is characterized to have high calorific value (high heat content), which makes it ideal for firewood and charcoal making (one of the main reasons why mangroves are cut). Mangroves also act as natural buffer or protection against physical disturbances like strong winds and waves (that may be caused by storm or typhoon) and erosion. Their demise leads to increased damage to property and life.

People living within or adjacent to mangrove areas have a variety of uses for the different mangrove species (Table 2.2). There are also many traditional beliefs in the province regarding mangroves, which may have possibly helped maintain some of the areas.

Banacon Island in Getafe is known to be the biggest man-made mangrove forest in Southeast Asia with about 1,750 ha planted mostly with Rhizophora species, which suits the type of substrate in the area. The planting of mangroves in Banacon Island was initiated in the 1950s by one man, Mr. Eugenio "Nong Denciong" Paden, and his family.

Table 2.2. Common mangrove species in Bohol and their uses

Mangrove Species		Socio-Economic and Bio-Physical Uses
Scientific Name	**Common Name**	
Aegiceras corniculatum	Saging-saging	spawning grounds of fishes and shrimps
Aegiceras floridum	Tinduk-tindukan	spawning grounds of fishes and shrimps
Avicennia alba	Bungalon-puti	wood source of inferior firewood, used for small cabinet works; rice mortar; ointment from seeds used for relieving small pox ulceration; bark preparation used as astringent
Avicennia lanata	Piapi	wood source of inferior firewood, used for charcoal making and small cabinet works; ash from wood used for soap making
Avicennia marina	Bungalon	flowers source of pollen for bee colonies; rice mortar; ash from wood used for soap making; wood source of inferior firewood, used for small cabinet works; leaves used as fodder for animals
Avicennia officinalis	Api-api	wood source of inferior firewood, used for charcoal making and small cabinet woks; bark used as seasoning for raw fish; leaves used as fodder for farm animals
Bruguiera cylindrica	Pototan-lalaki	young fruit eaten as vegetable or preserved; wood used as firewood and for charcoal making
Bruguiera gymnorrhiza	Busain	wood used for house posts, flooring, furniture and cabinet manufacture, charcoal making, as pile, mine timber, firewood; bark source of tannin, used as seasoning for food; fruit substitute for betel nut; medicine for sore eyes
Bruguiera parviflora	Langarai	wood used for furniture and cabinet manufacture, flooring, charcoal making, as firewood, timber; bark used for seasoning
Bruguiera sexangula	Pototan	young leaves eaten as vegetable; roots used as incense; wood used as mine timber, pile, pole, firewood, for charcoal making, house posts, furniture and cabinet manufacture, flooring; bark source of tannin; fruit chewed as substitute for betel nut; lotion from fruits as medication for sore eyes
Camptostemon philippinensis	Gapas-gapas	wood used as construction and/or fencing material, firewood, for cabinet and charcoal making
Ceriops decandra	Malatangal	wood used as timber, firewood, for charcoal making, furniture and cabinet manufacture, house posts; decoction of bark to stop hemorrhage; bark source of dye and tannin
Ceriops tagal	Tangal	bark source of dye and tannin (for 'tuba' or local wine making); wood used as pile, pole, for firewood and charcoal making, house posts; bark yields plywood adhesive
Dolichandrone spathacea	Tui	wood used as firewood, construction material, for charcoal making

continued

Table 2.2. continued

Mangrove Species		Socio-Economic and Bio-Physical Uses
Scientific Name	**Common Name**	
Excoecaria agallocha	Buta-buta	resin from bark cures stomach cramp and various skin diseases; sap and wood preparation used as purgative, fish and arrow head poison, medication for toothache; wood used as incense, firewood
Heretiera littoralis	Dungon-late	wood used as timber
Lumnitzera littorea	Tabau	wood used as timber, pile, ship building material, for house posts, cabinet making, paving blocks; extract from decoction of leaves used to cure thrush
Lumnitzera racemosa	Kulasi	wood used as firewood, construction material, for charcoal making; extract from decoction of leaves used to cure thrush in infants
Nypa fruticans	Nipa	young leaves used for cigarette wrapping; fronds made into shingles for roofing; young seeds eaten raw or made into sweet meat; sap source of vinegar, sugar and 'tuba' (local wine)
Osbornia octodonta	Taualis	wood used as firewood, fencing material, for charcoal making
Pemphis acidula	Bantigi	wood used as fencing material, firewood
Rhizophora apiculata	Bakauan-lalaki	bark source of tannin; wood used as timber, fencing material, firewood, for charcoal and cabinet making, house posts
Rhizophora mucronata	Bakauan-babae	wood used for charcoal making, flooring, furniture and cabinet manufacture, as firewood, pile, pole, mine timber, post, tool handle; bark source of tannin; stilt roots used for small boat anchor
Rhizophora stylosa	Bakauan-bato/ Bakauan-bankau	wood used as firewood, construction and/or fencing material, tool handle, timber, pole, for charcoal making, furniture and cabinet manufacture
Scyphiphora hydrophyllaceae	Nilad	wood used as firewood, fencing material, tool handle
Sonneratia alba	Pagatpat	wood used for charcoal and cabinet making, as firewood, ship building material, post, pile for bridge and wharf construction/construction material; bark source of tannin; leaves used as fodder for goats and cattle; pneumatophores used as floats for fish nets, for manufacture of inner soles of shoes, substitute for cork; fruit eaten raw or cooked; fermented juice used to control hemorrhage
Sonneratia caseolaris	Pedada	wood used for charcoal and cabinet making, as firewood, ship building material, post, pile for bridge and wharf construction/construction material; bark source of tannin; leaves used as fodder for goats and cattle; pneumatophores used as floats for fish nets, for manufacture of inner soles of shoes, substitute for cork; fruit eaten raw or cooked; fermented juice used to control hemorrhage

continued

Table 2.2. continued

Mangrove Species		Socio-Economic and Bio-Physical Uses
Scientific Name	**Common Name**	
Sonneratia ovata	Pagatpat-babae	leaves used as fodder for farm animals; wood used for charcoal making, as ship building material, pile for bridge and wharf construction, timber, lumber
Xylocarpus granatum	Tabigi	wood used as timber, firewood, for charcoal making; oil used for illumination and hair; extract from decoction of bark used to treat cholera
Xylocarpus moluccensis	Piagau	highly priced wood, good for high grade furniture and cabinet manufacture; bark used as astringent and cure for diarrhea; decoction of roots used as alternative medicine

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Children in Panadtaran, Candijay make use of the resource in the area for making shingles out of 'nipa' (Nypa fruticans) fronds for domestic use. Mostly, people living near swamplands and mangrove areas produce 'nipa' shingles for additional income.

Possible Management Strategies to Consider

- Legally, mangroves are under the jurisdiction of the state, which gives the management responsibility to the DENR. To date, 2,110.61 hectares of mangrove forests have been distributed to deserving communities in Bohol for management (see Table 5.2. of Chapter 5) under the Community-Based Forest Management Program of the department. The program has led to community stewardship and ensures the rehabilitation and management of these areas. CBFMP is a very successful program and more communities should be encouraged to apply.

- Reforestation projects through DENR, DepEd (formerly DECS) and the like should be encouraged to manage these areas, but monitoring of their success after the planting is essential. Site assessment should be conducted with the help of the DENR prior to the planting to ensure site-specific and/or the right mangrove species, desired spacing (depending on the observation and suggestion of the community) and the right method of planting.

- Moratorium on the cutting of mangroves, e.g. for fishpond development, should be strictly imposed even in areas with FLAs. The law states that if the mangroves are not cut five years after the issuance of FLA, they may no longer be cut. Considering that FLAs are no longer released, in theory, no more mangroves should be cut.

- Encourage replanting of old abandoned fishponds and their management passed on to the community interested in managing the area.

- Encourage the establishment of multi-species mangrovetum/mangrove gardens around Bohol to ensure adequate supply of seeds and availability of all mangrove species found in Bohol. These can also act as mini-education centers showcasing mangroves, their products and aesthetic value, and the many services they provide.

- Encourage environment-friendly mangrove enterprise to the community managing the mangrove area to provide incentive for guarding and managing it.

- Implement the joint DA-BFAR and DENR General Memorandum Order No. 3, Series of 1991 and turn over idle, unproductive and abandoned fishponds (some of which are illegally utilized and occupied) to the communities for them to manage and rehabilitate the mangrove cover, and explore possible environment-friendly enterprise activities within these areas to sustain the re-planting.

BEACH ECOSYSTEM

Largely known for their recreation, tourism and aesthetic values, beaches are commonly the pride of many areas. A beautiful white beach often stands as evidence of healthy coral reef ecosystems offshore and attracts recreational activities. Bohol boasts of its white sandy beaches.

Beaches are commonly used for tourism development (e.g. hotels, restaurants, beach resorts, etc.), fish and boat landing, and as source of sand as a construction material, albeit being of very poor quality due to the salt content. Common crabs, fishes and birds abound in these areas, laying their eggs alongside turtles. Many environmental issues focus on the beach ecosystem, as it is the prime land for development and household settlement due to its aesthetic values.

A good example of a badly developed and managed beach is Alona Kew on Panglao Island where clusters of beach resorts have been built right into the beach. Coconuts that once lined the beach eventually fell due to gradual erosion of the sand caused ironically by the beach resorts. Despite the danger posed by the absence of a natural buffer, all the owners still continue to move their structures further and further into the coastal zone to “protect” their sand. Planning and implementation of setback zones could have prevented this.

All existing seawalls and structures built in this zone offer only a short-term solution to the rapidly depleting sand. These will eventually succumb to wave action and in fact cause major harm in the long-term by increasing erosion rates in the area. What used to be a picturesque Alona Beach, with its white sand and low-hanging coconut trees, is now replaced by a series of walls and improperly placed developments that look very unattractive. Likewise, many resorts even built their septic tanks into the beach without realizing the harm these would cause to the long-term quality of the coral reef and seagrass in the area.

It is interesting to note that worldwide, the most exclusive and expensive resorts are always well set back from the shoreline and have no structures in the coastal zone. Tourists appreciate this and the sands stay forever, thus ensuring a constant flow of guests and a steady revenue from tourism.

Possible Management Strategies to Consider

- LGUs should prevent construction of any structure (e.g. groins, piers, wharves, seawalls), which inhibits the sand from moving in any direction or disturbs the natural sand migration and increases erosion in the long run. Beaches have a long erosion and accretion cycle and a long-term study should be conducted before any structure is built in the area.

- All developments should be set back from the shoreline. In the Philippines, the environmental protection zone is set at 20 meters (in other countries, such as Sri Lanka, the setback is as much as 50-100 m). This will ensure that everyone has access to the beach and the natural beauty is maintained. Waste and septic tanks should be set back at least 200-250 m to minimize leaching to in the nearshore waters and coral reef ecosystems. Small-scale waste treatment plants could also be considered.

- Beach nourishment projects offer only short-term solutions to the problem and if the root cause of the problem (i.e. inadequate setbacks) is not resolved, then degradation of the beach ecosystem will continue.

- Ecological processes in the area should be protected. Sand dunes, seagrasses, coral reefs and mangroves all help generate and trap sand; their removal will result in further degradation. One two-kilogram parrotfish can produce up to 50 kg of sand per year; fish sanctuaries can in fact help the sand replenishment cycle (by allowing the corals to grow, and the fish to eat and convert them to sand).

- Better waste management should be practiced.

- Ensure public access to the beach. It is a natural beauty that, in the Philippine Constitution, is open for the enjoyment of everyone. Develop a suitable, simple, clear and consistent zoning plan and policies that allow access without damaging the area.

- All resort owners should agree on a set timeframe for removal of their structures back from the beach front, for example two years.

SEAGRASS ECOSYSTEM

Young fisherman diving in amongst Enhalus acroides seagrasses - Barangay Napo, Loon

Bohol has extensive seagrass beds with many of the Philippines' 14 species being represented. Seagrasses are the only true flowering plants that have managed to evolve into the coastal ecosystem, leaving their ancestors on land. They have extensive root systems, which bind sediment, flower regularly and disperse their seeds into the sea.

Large seagrass beds abound in Bohol. Near the pier in Tagbilaran City are very productive seagrass beds, which are being encroached upon by the port and a local hotel. They comprise a large area of Panglao Bay and abound in other towns.

Seagrass beds have very high productivity and are home to many mollusks, fishes, sea cucumber, urchins and the like. They are also the best gleaning grounds where many people can be seen at low tide collecting shellfishes for their dinner and other marine fauna for sale at the local markets. They are also home and favored food of the Philippine sea cow or 'dugong', although it has since disappeared in Bohol.

Seagrasses act as refuge as well as spawning and nursery grounds for many species, which spend part of their life cycle there until they are big enough to go to the coral reefs where they live as adults. They are sometimes gathered and used as fertilizer and raw material for furniture construction. These activities, however, should be discouraged as the seagrasses lose their potential as a productive ecosystem if removed. Often undervalued, seagrass beds are gradually giving way to construction and reclamation activities in Bohol at the expense of fishery production.

Possible Management Strategies to Consider

- Seagrass sanctuaries, such as those in U-og and Lawis, Inabanga, should be encouraged. They serve as a shell garden and ensure adequate supply of fish and shellfishes to the neighboring areas (the minimum size of a sanctuary could be 10-15 ha).

- In all developments, seagrasses should be considered as a productive ecosystem upon which many people depend. Before any development (e.g. reclamation) in the area, the benefits derived from a sustained healthy seagrass habitat should be integrated into the development plans. Also, the possible environmental and socio-economic impacts (aspects of biodiversity conservation, livelihood, etc.) should be considered.

- Illegal and destructive fishing methods such as 'sudsud', fine-mesh nets, 'baling', etc. should be minimized.

- Collection of juvenile fishes, like 'tagum-tagum', should be prohibited to allow them to grow into larger size, reproduce and ensure more catch for everyone.

- Closed seasons could be observed for certain species such as rabbitfishes, which spawn in seagrass areas at specific times of the year (3rd to 5th day of new moon).

OPEN-WATER ECOSYSTEM

The open-water ecosystem is relatively low in productivity when compared to other ecosystems and not so much is known in Bohol about this big ecosystem, which covers over 90% by volume of the province's coastal waters.

Pamilacan Island is one of Bohol's most famous islands surounded by deep water and has 12 species of marine mammals, turtles, rays and whalesharks parring by the island. These all appearing in the area due to the large volumes of food in the form of giant squids, shoaling pelagic fishes and huge volumes of plankton.

It is, however, the place where most fishing activities take place and where all the pelagic fishes of Bohol live. Bohol has many varieties of shoaling fish. Most pelagic fishes shoal in large numbers, a strategy biologically used to ensure their "safety". Commercial fishers, however, exploit this and literally harvest whole shoals of fish, thus preventing the spawning of the fishes in and around Bohol.

Giant squids, rays, 12 species of whales and dolphins, large pelagics, tunas, whale sharks, Spanish mackerels and scads all abound in Bohol's open sea, fed by the previously huge schools of fish which once came to Bohol on their yearly migration.

Just like the other ecosystems, this area is also under the onslaught of the commercial fishermen who use illegal fishing paraphernalia and fish within municipal waters. Fine-mesh nets, fish aggregating device (FAD), fish finders, power blocks, sonars and huge drift nets catch juvenile and gravid fish and basically scour everything in their path as long as it is in volume. The larger fishes are slowly being removed and as this happens the commercial fishers search for aggregations of smaller fishes.

Table 2.3. Some of the more common fish species of Bohol

Family Name	Local Name	English Name
Engraulidae	bolinao, boris, libud, tuakang	Anchovies
Lethrinidae	bagangan (young), bitilya, katambak, kirawan, madas, dugso, bakuktut, sapingan	Emperor breams
Exocoetidae	aliponghok (fingerling), antulihaw, bangsi, barongoy, bolador, eliu, laniu	Flying fish
Caesionidae	bilason, butlogan, dalagang bukid, sinao-an, sulid	Fusiliers, Bananafish
Belonidae	balo, bawo, dugso, doal, mangansing, batalay, sinao-an	Garfish, Needlefish
Mullidae	saramulyete, senok (young), tiao, timbungan	Goatfish
Serranidae	lapu-lapu, kugtong (large sized), suno, señorita, tingag, tiring, dolit, lilig, taleti-on, kobe, turnutulin, garopa	Groupers, Seabasses, Perchlets
Hemiramphidae	bamban, buging, kasusuwit, sasa, sausid, sawasid	Halfbeaks
Carangidae	damis, tawa-ay, baho-olo, salay-salay, barilason, pampano, talakitok, lagidlid (young), pagapa, makaagum, trakito, bitilya, badlon, mamsa, tabangka, tamarong	Jacks, Cavallas, Crevalles, Trevallies, Darts
Gerreidae	batuhan, batuhanan, bauhanon, malakapas	Mojarras, Silver biddies
Mugilidae	balanak, banak, gagapan, gapang, pili, gisao	Mullets
Siganidae	danggit, kitung, layap, samaral, tagbago	Rabbitfish, Spinefeet
Clupeidae	tamban, tunsoy, toy, haol-haol, helos, kabasi, mararapad, lupoy (fry), siliniasi (fry), mangsi	Sardines, Herrings, Sprats, Gizzard shads
Carangidae	galunggong, borot, burot-burot, matangbaka, hagumaa, gutlob	Scads
Leiognathidae	laway-laway, lulu-an (large sized), palangan (large sized), parutpot, palutpot, sapsap	Slipmouths, Ponyfish
Lutjanidae	aha-an, auman, lagan, mangagat, maya-maya, turnos	Snappers, Sea perches
Holocentridae	siga, baga-baga, ganting, suga-suga	Squirrelfish and Soldierfish
Acanthuridae	alibangbang, bagis, bakwak, bongkokan, indangan, kadlitan, kalmin-kalmin, labahita, mungit, pelason, saguranding, sunghan, tudlo-an	Surgeonfish, Tangs, Unicornfish
Nemipteridae	bisugo, lambado, lagaw, sagisi-on, bakay, silay	Threadfin breams, Spinecheeks
Scombridae	tulingan, barilis, bankulis, alumaan, tangigue, hasa-hasa, burao, kabalyas, tambakol, pirit, karao	Tunas and Mackerels
Labridae	bagondon, bugok, bungat, ipos-pos, labayan, lakhoy, lamon-lamon, lupit, maming	Wrasses

Year 2001 marks the third successive year that 'tulingan' (Family Scombridae) has not reached Bohol's shores clearly due to over-fishing. Those that make it close are never caught by the small fishers because they are swallowed up by the large nets of commercial fishers.

To make things even worse, every year, from August to September, the young 'tulingan' whose parents survive migrate around Bohol searching for feeding and nursery grounds. These 5-10 cm-long juveniles are all consistently vacuumed up by the commercial fishers, thus resulting in fewer and fewer adults caught every year. If allowed to grow, an average 'tulingan' can grow up

to 100-150 cm long, and will be a lot tastier and more expensive than 'pirit', which Bohol consumers still buy in huge volumes.

This once rich ecosystem is currently under severe stress and if not rehabilitated, it will become unproductive, unprofitable and useless.

Possible Management Strategies to Consider

- Delineate all municipal waters out to 15 km from the offshore islands of each coastal municipality as laid down in DAO 17, Series of 2001, of the DENR.
- Enforce commercial fishing laws and catch the commercial fishers who, in the first place, rarely fish outside of municipal waters.
- Coordinate the law enforcement efforts of LGUs with those of Bohol's Coastal Law Enforcement Councils of the three congressional districts.
- Ban the use of FADs in municipal waters. Each 'payaw' should be registered, its location noted, and taxed by the LGU. Perhaps, only fishing organizations should be allowed to establish these for exclusive use by municipal fishers using hook-and-line.
- Enforce the law on the capture and slaughter of manta rays (still openly sold in some places in Bohol), whales, whale sharks and dolphins as these can, in the future, be very profitable to local communities through the promotion of eco-tourism as evidenced by the Pamilacan Island dolphin and whale-watching activities.
- Enforce municipal boundaries and ban all fishing vessels registered as less than three (3) gross tons but still use active fishing gear (as defined by FAO 201 of the BFAR).
- Declare large open-sea sanctuaries. There is not one open-sea sanctuary in Bohol yet this ecosystem comprises over 90% by volume of the coastal waters of the island province.
- Map and identify the spawning/aggregation areas of Bohol and consider having closed seasons for these fishes during the spawning months.
- Consider setting minimum size limits for the sale of certain species based on predetermined biological factors, i.e. only mature individuals should be harvested.
- The Maritime Industry Authority (MARINA) and Philippine Coast Guard (PCG) could work together to validate some dubious boat sizes in Bohol (registered as 2.90 tons, yet have been re-built to about 5-10 gross tons and larger in size).

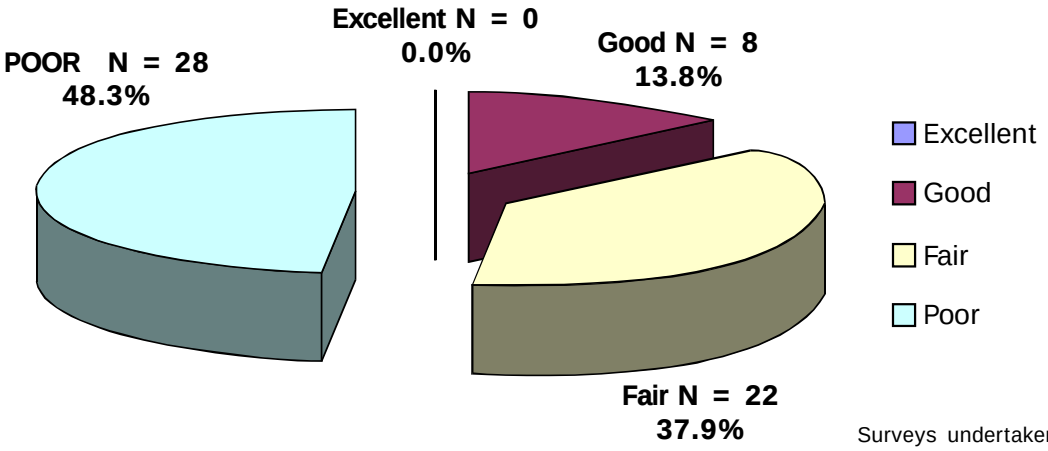
CORAL REEF ECOSYSTEM

Corals are often considered in Bohol as being 'bato', and thus are worthless "non-living" stones. They, however, are living animals that, if managed well, could produce for the Boholanos a bounty of resources forever. The coral reef ecosystem is in fact highly productive and biologically diverse, yet a fragile ecosystem. Worringly, in a recent survey at the LMP National Conference in Manila, 2001 only 4.2% of mayors in the Visayas region responded that a coral was an animal, whereas 41% identified them as a "rock" based on a multiple choice question.

Bohol is well known internationally as rich in corals and coral reefs especially in the islands of Panglao, Balicasag (Panglao) and Cabilao (Loon), as well as the Danajon Bank in Northern Bohol. Hundreds of tourists visit these sites yearly to dive into and snorkel the underwater "gardens".

In terms of biodiversity, coral reefs are known as the "rainforests" of the sea and serve as buffer against underwater currents. They provide food and refuge for thousands of marine flora and fauna. They have many uses at present, but current research suggests that some of the fauna and flora contained in coral reefs have great potential as cures for human aliments and other uses that are yet to be discovered. The precautionary principle in management should be strongly applied to them.

Since 1996, various teams from different agencies have conducted surveys on the status of the coral cover in Bohol. Earthwatch, WWF, Feed the Children-Philippines, BFAR, UP-MSI, CRMP, Reefcheck and the DENR have conducted research on some 58 sites. Only 8 sites or about 14 percent of the areas sampled are in good condition (with 50-75% live coral cover) and no site remains in pristine and/or excellent state. On the other hand, a glaring total of more than 86 percent are found to be in poor or fair condition (with 0-49% live coral cover). This means that, possibly, Bohol has already lost more than three quarters of its corals known to be the breeding grounds of diverse marine fauna.



Status of Bohol Coral Reefs at 8 Localities (58 Sites)
(About 86.2% of the reefs are now in poor and fair condition)

Figure 2.3. Status of coral reefs in Bohol

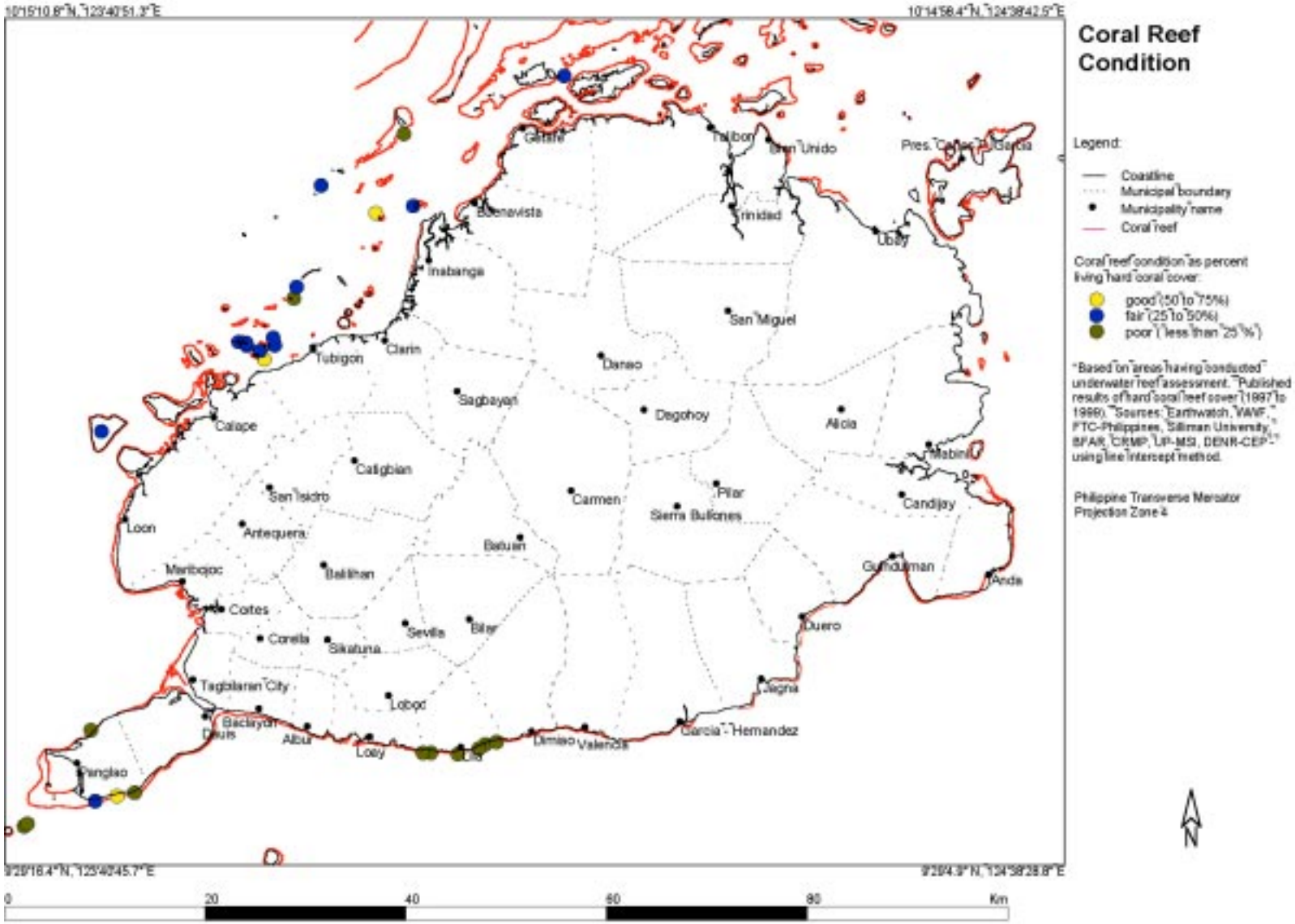


Figure 2.4. Map of assessed coral reefs in Bohol

The degradation of coral reefs can be attributed to siltation, anchorage, illegal fishing, storms, coral bleaching (due to temperature anomalies brought about by global warming) and construction of piers, houses and even churches in the past centuries (most of Bohol's ages-old churches are built of coral heads like the ones in Loon, Baclayon, Loboc, Dimiao, and Maribojoc). There had been reports about corals being used to bleach clothing and as personal souvenir items. Some are gathered and illegally exported for sale in other countries.

There is one real example of how some people regard corals. This certain family in Guindulman would yearly clean out, smash up and remove all the coral reefs in one area. They did this because the corals kept on ripping up their fishnets, thus a nuisance to their livelihood. Little did they know of the benefits of the corals and they never seemed to realize, until recently, that the corals are the houses and food of the fishes (no corals: no fish). That corals are useless is still a common belief around Bohol but as more information gets disseminated to the people, it is hoped that they will begin to see the benefits of leaving the corals intact.

Healthy corals in excellent condition can produce 20,000 kg of fish per square kilometer per year, enough to provide 50 kg of fish per person per year or enough for 400 families (Mc Allister and Ansula, 1993). On the other hand, poor corals can only produce 2-5,000 kg per square kilometer per year or enough to feed only 30-50 families, per square kilometer.

Danajon Bank

The Provincial Government of Bohol through the efforts of Governor Erico B. Aumentado and the BEMO are currently focusing their efforts on managing and protecting this unique feature. The double barrier reef is one of only ten documented double barrier reefs in the world and the only one in South Asia.

The Danajon reef is an excellent example of how the northern coastal LGUs of Bohol from Clarin to President Carlos P. Garcia could work together and implement inter-provincial CRM to protect a unique national treasure.

The Danajon Bank is a double barrier reef that runs parallel to the northern coast of Bohol and is composed of the outer Caubyan and inner Calituban barrier reefs. It is bounded by four municipalities (Getafe, Bien-Unido, Talibon and Ubay) in the south and the Camotes Sea in the north. To the west, it runs all the way to the next province, Cebu, and to the east and northeast it reaches up to the provinces of Leyte and Southern Leyte. Danajon is one of the few documented double barrier reefs in the world and is a very rare geological formation. It has supplied food to Cebu and Bohol for centuries but is in a very poor condition with 90% of it having poor and damaged coral reefs (Stuart J. Green and LGU-Talibon, 1997).

Map of Danajaon Double Barrier Reef,
showing outer barrier (Caubyan) and inner Barrier (Calituban)

Figure 2.5. Map of Danajon Bank

Possible Management Strategies to Consider

- Information, education and communication (IEC) campaign throughout the province on the value of coral reefs and their benefits
- Establishment of 15-50-hectare community-based marine sanctuaries, such as those already established in Lomboy-Kahayag, Pangangan Island, Calape; Tayong Occidental, Loay; Cabacongan, and Cabilao Island, Loon.
- Development of integrated coastal management (ICM) plan and zoning plan by LGUs
- More research on and documentation of coral reef areas in Bohol
- Regular monitoring and evaluation of already established sanctuaries, documentation of the trends, and sharing of best practices with other LGUs
- Establishment of education centers and model sanctuaries of high quality in and around the province
- Establishment of buoys to stop anchor damage, adoption of voluntary code of ethics for dive shops, deployment of information guides, and better documentation of dive areas
- Establishment of diver's fee systems for communities and LGUs interested in allowing divers inside their sanctuaries to help cover management and operating (patrolling activities) costs and to put the community as the clear manager of these reefs.
- More regular surveying and training of local communities and local divers for "reef check" and other monitoring activities if interest is shown
- More regular bio-physical monitoring of previously established marine protected areas (MPAs) by the LGUs, NGAs and NGOs to evaluate the results of their CRM-related activities, and passing on of the information to the BEMO
- Minimizing, if not totally preventing, illegal and destructive fishing activities around coral reefs
- Minimizing the illegal extraction of corals for construction of houses, seawalls, piers and other infrastructure and the sale of marine ornamentals
- Reducing surface water runoff and soil erosion from the uplands that result to increased sedimentation and siltation, thereby literally choking the coral reefs
- Integration of information on the coral reef ecosystem into the curriculum of the DECS
- More awareness raising work that a coral is in fact a delicate annual, not a stone or plant

SUMMARY

Bohol's various ecosystems are interrelated and play different but equally important roles in the life cycles of the marine organisms in the area. If one ecosystem is degraded, it will surely affect the other ecosystems in the area. The coastal and marine habitats of Bohol experience most of the pressure from the lowland and upland communities that has led to increased stress caused to them and increasing losses in economic benefits. These ecosystems are actually in a pretty poor condition but can still be rehabilitated. Coastal habitats need to be managed and full economic, social and ecological benefits must be considered prior to other developments in the area. Marine sanctuaries are a great way to rehabilitate small areas of the sea, and involve the communities in their management.