Coral reefs, sea-grass beds, and mangrove forests are critical resources supporting ecosystems and livelihoods in coastal areas of the Philippines. This chapter explores the role and current status of these resources, as well as those of beaches, other shoreline areas and fisheries.

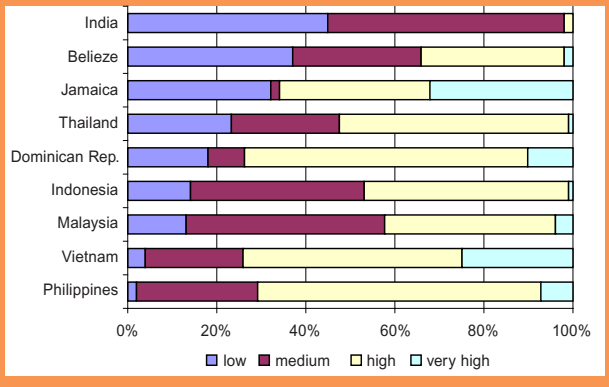
Coral reefs –"rainforests of the sea." Coral reefs are widespread and can be found throughout virtually the entire archipelago, except perhaps in some areas of north and south-central Mindanao and east of northern Luzon. The approximately 26,000 square kilometers of Philippine reefs (Gomez et al. 1994; Burke et al. 2002) provide many direct and indirect benefits, including food, livelihoods, recreation, protection from erosion, and extremely high levels of biodiversity.

Nationwide surveys conducted from the 1970s to the 1990s found that 4 to 5 percent of the reefs were in excellent condition, 25 to 27 percent good, 39 to 42 percent fair, and 27 to 31 percent poor (Gomez and Alcala 1979; Licuanan and Gomez 2000). Recent analyses of some 50 sites indicate declining trends in the percentage of coral cover and reef fish abundance in all regions of the Philippines. One exception is the Visayan Seas area where the many coastal resource management programs and marine protected areas (MPAs) in recent years have helped curtail illegal fishing and encouraged more sustainable management efforts.

The general trend is negative for the coral reefs in the Philippines. A recent international analysis of coral reef status found that the Philippines had the most degraded reefs of all sampled countries. This study estimated that 98 percent of coral reefs in the Philippines were at risk from human activities, with 70 percent at high or very high risk (Figure 2.1).

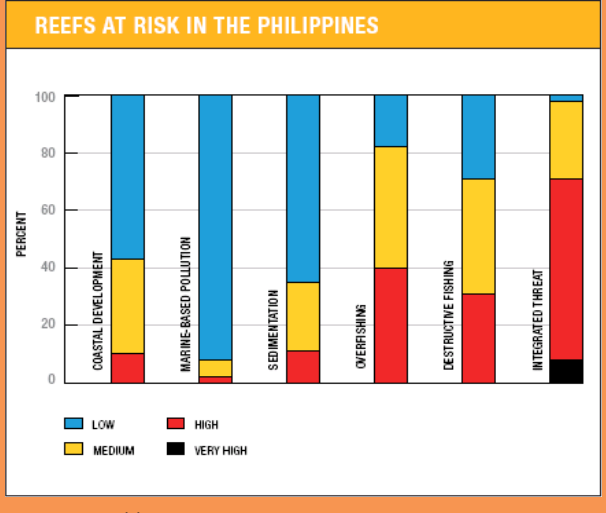
Destructive fishing and overfishing are the most prevalent problems affecting the coral reefs of the Philippines, while other major threats include sedimentation and coastal development. Furthermore, coral reefs are the most sensitive of all ecosystems to global warming, pollution, and new diseases. Figure 2.2 illustrates the threats to coral reefs separately as well as combined.

Figure 2.1 Reefs at Risk Threat Index.



Source: World Resources Institute 2002.

Figure 2.2 Different Threats to Coral Reefs.

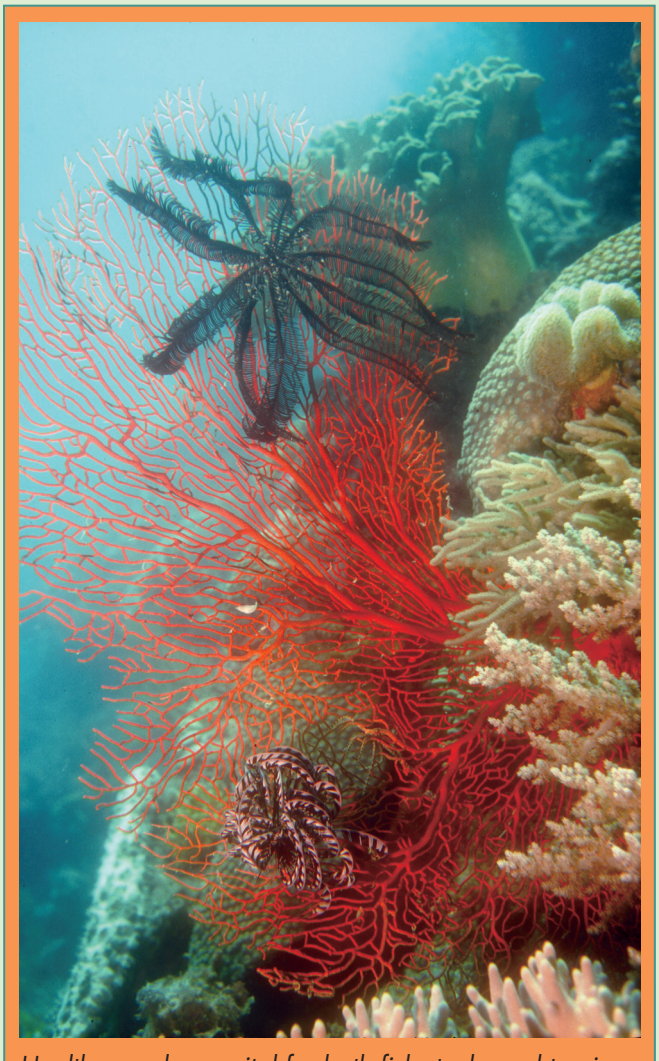


Source: World Resources Institute 2002.

Historically rich coral reef and sea-grass coastal habitat areas—such as the Danajon Double Barrier Reef in northern Bohol Island; portions of western Palawan Island; the Lingayen Gulf in northern Luzon; and parts of

Marinduque, Mindoro and selected areas of other major islands—have mostly been degraded by sedimentation. Destructive fishing is also a culprit, but in areas where it is being slowed and stopped, it is sedimentation that continues to take its toll on water quality and coral reefs and their associated fisheries. Once the reefs are covered in sediment, recovery—if it takes place at all—is very slow.

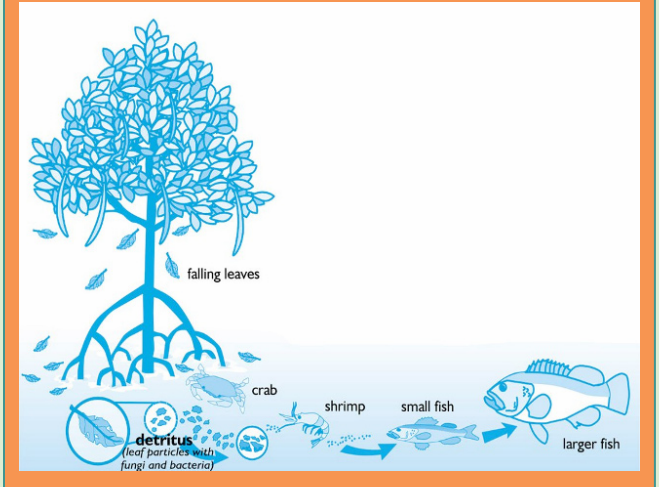
Mangroves—A multiple-function resource. Mangroves protect coasts from storms, erosion, and floods, and help purify water. They are important feeding sites for many commercially important fish species (mullet, tilapia, eel and especially milkfish), shrimps, prawns, mollusks, crabs, and sea cucumbers. Fry that gather in mangrove areas are very important for aquaculture. Important aspects of mangroves are depicted in Figures 2.3 and 2.4.



Healthy corals are vital for both fish stocks and tourism.

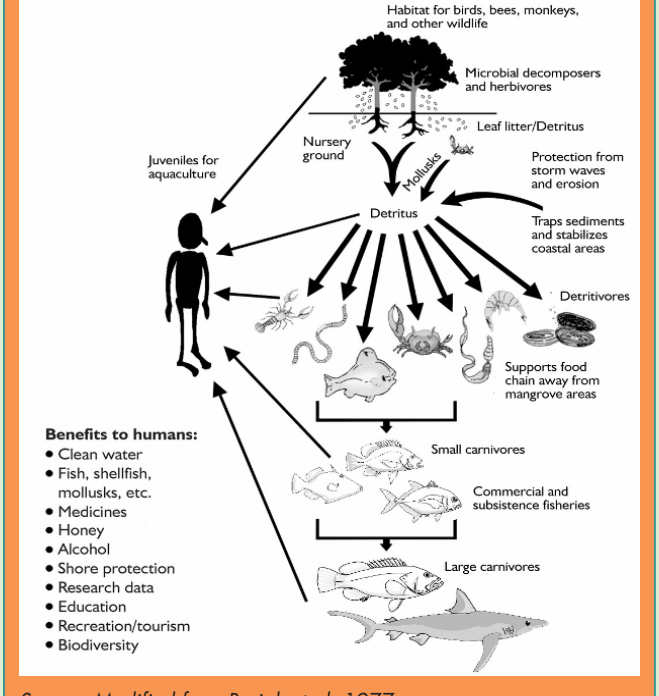
Photo: Ingvar Bundgaard Jensen.

Figure 2.3 Mangrove Detrital Food Chain.



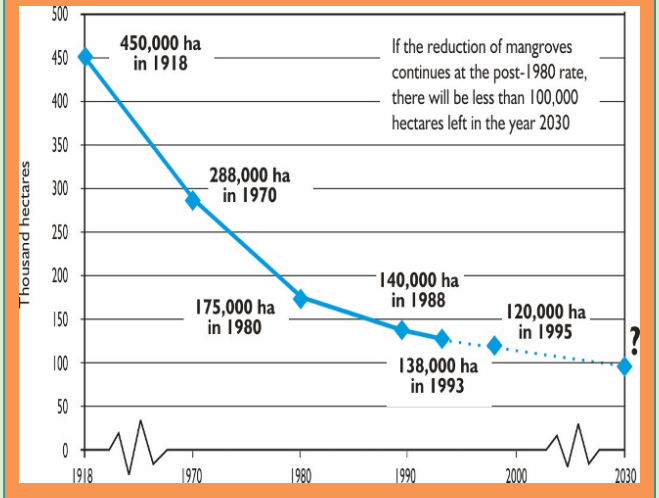
Source: Authors.

Figure 2.4 Mangroves and their Ecological and Economic Products.



Source: Modified from Berjak et al. 1977.

Figure 2.5 Mangrove Resource Decline in the Philippines.



Sources: Brown & Fischer 1918; DENR 1988, 1998; White and de Leon 2004.

Areas on the coast in Negros that used to be covered by mangroves now feature fishponds.

Photo: Alan White.

Replanting of mangroves contributes to the stability of mangrove cover in the country.

Source: Authors.

Mangrove coverage in the Philippines has declined from around 450,000 hectares in 1918 to only about 120,000 hectares in 1995 (Figure 2.5). A recent interpretation of 2002 satellite images by the National Mapping and Resource Information Authority (NAMRIA) and the Forest Management Board (FMB) indicated a total area of 248,813 hectares. This estimate, however, has not been validated on the ground.

The rate of exploitation in the mid-1980s was highest in the Visayas. Satellite image analyses indicate that Mindanao has the most mangrove areas in the country (29 percent of the country's total) while Luzon and Mindoro have the least. Old-growth mangrove forests are mainly found in Mindanao (4,582 hectares) and Palawan (5,317 hectares) (Zamora 1990).

Mangrove cover nationwide is now relatively stable, with some increases seen in areas of intense coastal resource management, particularly around Bohol and Siquijor Islands in the Visayas.

Mangrove forests have been converted to aquaculture, salt production, and human settlement. Conversion to fishponds represents about 289,000 hectares of the losses noted above. These fishponds mainly cultivate milkfish and shrimps (Primavera 1993). The use of mangrove forest wood on the part of local populations (if beyond sustainable levels) also contributes to the decline in this type of forest.

The conversion of mangroves into fishponds normally results in an overall loss of coastal

The people of Pangangan Island off Calape, Bohol, have found in mangroves a natural way to protect their island's only road link to the mainland from typhoon damage. The four kilometer long causeway is protected by mangroves planted in recent decades by local schoolchildren.

Source: Over Seas, The Online Magazine for Sustainable Seas, December 1998, Vol. 1, No. 12.

Mangrove reforestation in coastal villages in Tinambac, Camarines Sur, has improved the local fish catch. The new mangrove forest brought back red snapper fish species that had previously disappeared due to lack of habitat.

Source: BFAR Region 5 website.

productivity and fisheries yield. Fishponds pollute mangrove swamps with organic and inorganic fertilizers, chemical toxins, and antibiotics. The use of seawater for fishponds also causes the salinization of the ground water and adjacent lands, including agricultural lands—such as in Central Visayas. In many cases, a few large fishpond entrepreneurs gain at the expense of marginal capture fisherpeople (Primavera 1991 and 1993).

Until recently, fishpond leases cost only about $2 per hectare per year, in contrast to conservative resource rent estimates of $538 per hectare per year for fish and $42 to $156 per hectare per year for wood harvests from mangroves (Evangelista 1992; Primavera 2005). As a result of the very low fees for fishpond leases many families own or lease large fishpond areas. Many of these ponds, however, are either underutilized or abandoned. In general, productivity is low in Philippine fish farms when compared to, for example, Thai shrimp farms, which have an average size of 2 hectares or less (Primavera 2005). By reducing farm sizes, fish farmers could increase pond yields and old pond areas could instead be used for replanting mangroves.

During the past decade or so, the loss of mangroves to fishponds has declined, in part as a result of an improved implementation of national policies for mangrove conservation.

Sea-grass beds, a vital resource for underwater life. Sea-grass beds provide the intermediate buffer necessary for coral reefs to protect coasts and mangroves from strong waves and surges and for mangroves to protect reefs from erosion and sedimentation (Fortes 1989 and 1995). The exchange of mutual benefits among mangrove, sea grass and coral reef ecosystems is illustrated in Figure 2.6.

Sea-grass beds also support and harbor many juvenile fishes (including rabbitfish), adult rabbitfish, and commercially important shrimps, prawns, crabs, sea urchins, and sea cucumbers. Sea-grass habitats also serve as the feeding

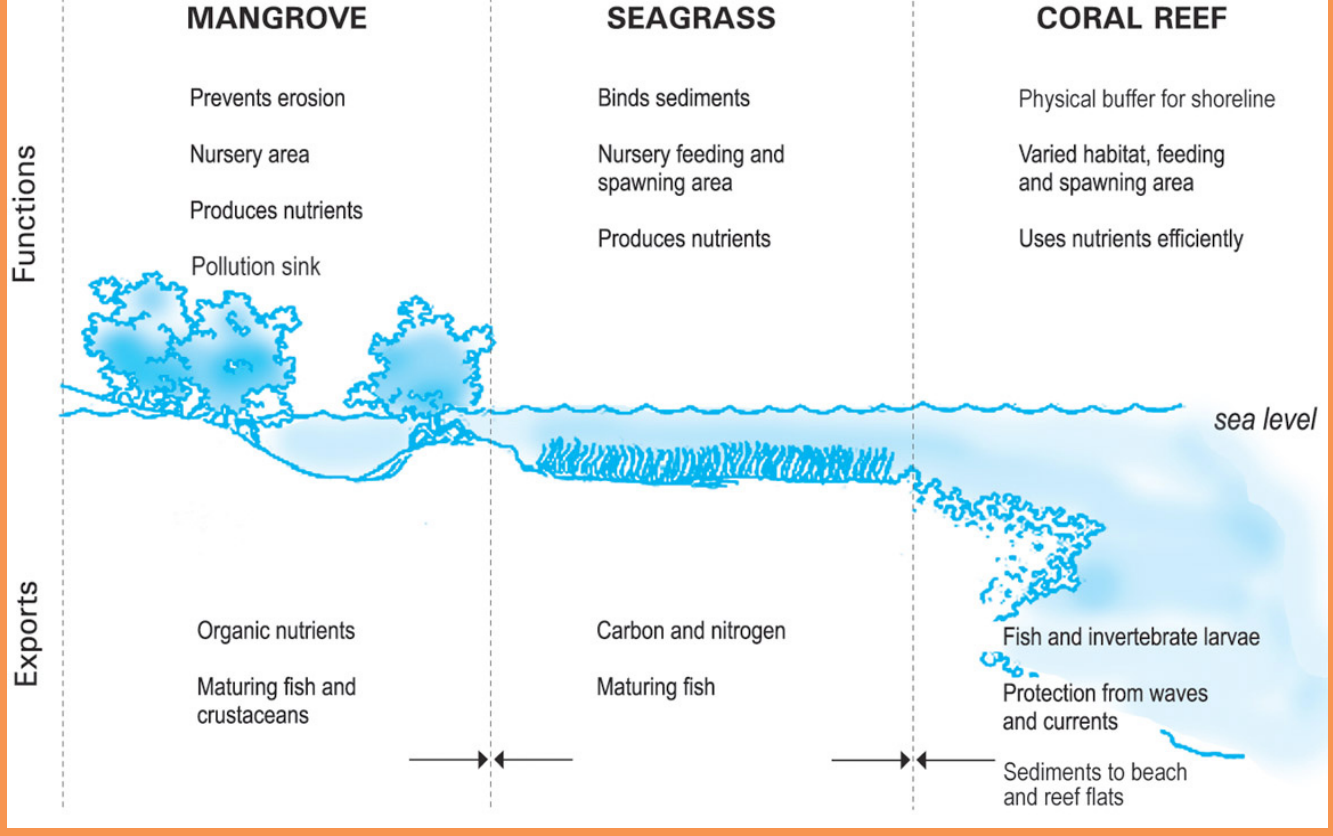
ground for marine turtles and the highly endangered dugong. Some 16 species of sea grasses have been identified (Fortes and Santos 2004).

From surveys in 96 sites, 978 square kilometers of sea-grass beds have been identified in the country, mostly in northwestern, western, and southern areas, with outlying islands having sizeable beds. About half of the sea-grass beds have either been lost or severely degraded over the past 50 years, and the rate of degradation is increasing. Sea-grass losses and degradation result from coastal development (industries, ports), waste disposal, sedimentation, destructive fishing (raking, trawling, and the construction of fish corrals), eutrophication (water pollution caused by excessive plant nutrients), boat traffic, and aquaculture (Fortes 1995).

Beaches, foreshore, and shoreline areas. Beaches are the most widely recognized habitat in the coastal zone. Recreation and tourism draw millions of people to beaches for rest and relaxation. They are used extensively for fishing activities, boat landings, and construction materials. Many other species also compete with humans for use of beaches. Sea turtles lay their eggs in the sand above the high tide lines. Terns, plovers, and other seabirds lay their eggs in the upper beach or dunes. Beaches also provide habitat for burrowing species, such as clams, crabs, and many other small crustaceans. Such organisms are part of the complex intertidal community that attracts fish and shore birds.

In addition, beaches are extremely important as buffers between the land and sea. They

Figure 2.6 Exchange of Mutual Benefits between Mangrove, Sea grass, and Coral Reef Ecosystems.



Source: Authors.

Aeta children collect shellfish on a beach in Northern Luzon.

Photo: Finn Danielsen.

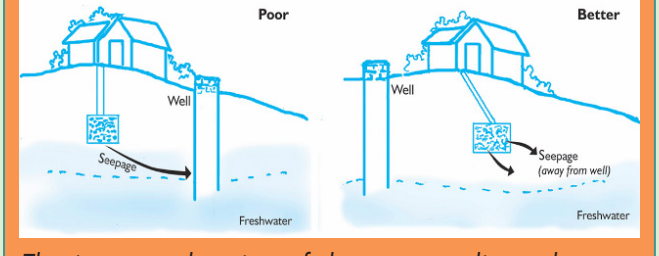
provide protection against waves and erosion and remove silt and sediments from the water as it passes over the ground surface. This is particularly important in areas where impervious surfaces, such as asphalt pavement, cement sidewalks, compacted soils, and buildings, drain to the seashore. Water passing through the beach sand is diffused so that the point of discharge is spread over a larger area rather than one small point (DENR et al. 2001.)

Coastal erosion from natural causes in the Philippines is an issue in areas with high-energy (wave or storm prone) coasts. Wave-prone coasts occur in northern Luzon, the eastern shores of Lingayen Gulf, and along the eastern seaboard. The internal seas are not erosion-prone, except in areas where development has infringed on the coastal strip or beach and thus exacerbates loss of beach or coastal vegetation. Such areas are increasingly common adjacent to or near urban development centers, where erosion is prompting the construction of illegal protective seawalls. Sea-level rise will exacerbate coastal erosion to some degree along all shorelines, but will be worse in low-lying areas or those that are being degraded by shoreline structures and development.

With the majority of municipalities and 25 of the largest cities located in the coastal zone, the country's foreshore and shoreline areas are mainly being used for settlements and housing. The proliferation of coastal dwellers—with no proprietary or tenure rights over the land they occupy and often no basic facilities for sanitation, solid waste management, sewerage, or water supply—is a contributing factor in the degradation and deterioration of the coastal environment and beaches throughout the country. Figure 2.7 shows a typical problem.

Coastal development of industries, ports, and resorts on the foreshore and reclamation and shoreline protection works (such as jetties) are also prevalent. Industries are situated by the sea for ease of transport of raw and finished materials. Land filling or reclamation involves the dredging and placement of materials to turn aquatic habitat into land for housing, tourism or manufacturing facilities, ports, and/or harbors. These activities clear aquatic vegetation (such as mangroves), smother coastal ecosystems, increase cloudiness of the water, and alter the water system as a whole.

Figure 2.7 Well or Groundwater Contamination Resulting from Improper Location of Sewage Disposal Systems.



The improper location of the sewage disposal system causes contamination of the well or seepage into the groundwater and ultimately the ocean.

Source: Rees 1990.

Table 2.1 Total Fish Production (MT) and Value (billions of PhP) by Sector, Philippines, 1997-2005.								
YEAR	Commercial		Municipal		Aquaculture		TOTAL	
	Volume (MT)	*Value (PhP B)*	*Volume (MT)*	*Value (PhP B)*	*Volume (MT)*	*Value (PhP B)*	*Volume (MT)*	*Value (PhP B)*
1997	884,651	25.9	764,727	25.5	879,014	22.4	2,528,392	73.6
1998	940,533	29.7	744,675	26.2	910,961	22.1	2,596,169	78.5
1999	948,754	32.2	779,820	28.8	943,289	24.1	2,671,863	85.2
2000	946,485	33.9	793,824	30.0	988,869	27.0	2,729,178	90.8
2001	976,539	36.1	833,188	31.3	1,096,790	31.2	2,906,517	98.6
2002	1,042,193	39.1	857,294	34.8	1,191,018	29.5	3,090,505	104.0
2003	1,109,636	42.0	1,055,143	40.6	1,454,503	37.2	3,619,282	119.8
2004	1,128,382	48.3	1,080,764	45.7	1,717,026	44.8	3,926,172	138.8
2005	1,135,222	47.7	1,132,120	49.9	1,895,793	49.1	4,163,135	146.7
Ave.	1,012,488	37.2	893,506	34.7	1,230,807	31.9	3,136,801	104.0

Sources: BAS: Fisheries Statistics of the Philippines, 1997-2001; 2001-2003; 2004; 2005.

Note: For the purpose of this document, municipal fisheries refer only to marine municipal fisheries, and aquaculture data refers to brackish water and marine production and its value. Freshwater production was excluded from the analysis. Total production and value refer to fisheries production and value in the marine sector. Some data may be missing, particularly in the municipal and aquaculture sectors, due to the data gathering constraints of BAS.

Fisheries. During the past 14 years, fishing has on average contributed 4 percent to total GDP and accounted for 20 percent of gross value added in the agriculture, fishery, and forestry sectors. The contribution to total GDP, however, has been gradually decreasing from 5 percent in the early nineties, down to 4 percent in the mid-90s and less than 3 percent since 1997.

The Philippines fisheries sector includes three main subsectors: commercial, municipal, and aquaculture. The municipal sector can further be divided into marine and inland fisheries. The Philippines Fisheries Code of 1998 defines municipal fishing as fishing without vessels or with vessels of 3 Gross Tons (GT) or less. Fishing with vessels of more than 3 GT is considered commercial fishing. Legally, commercial fishing is restricted to areas outside of municipal waters or waters beyond 15 kilometer from the shoreline. Table 2.1 illustrates total fish production and value by sector.

Growth in the marine aquaculture sector has been the fastest, at an average of 8.4 percent over the past seven years (Table 2.2). The year 2001 saw a double-digit growth rate in marine aquaculture, and subsequent years were not far behind with almost 9 percent growth rates. Seaweed aquaculture contributed to the bulk of production, accounting for 67 percent and 68 percent of total aquaculture production in 1997 and 2003 respectively (BAS 1997-2001; 2001-2003).

Table 2.2 Growth Rates in Fish Production by Sector, Philippines, 1997-2004 (Percentage).				
Year	Com-mercial	Muni-cipal	Aqua-culture	Total
1998	6.3	-2.6	3.6	2.7
1999	0.9	4.7	3.5	2.9
2000	-0.2	1.8	4.8	2.1
2001	3.2	5.0	10.9	6.5
2002	6.7	2.9	8.6	6.3
2003	6.5	7.5	8.6	7.6
2004	1.7	1.8	18.7	7.4
AVERAGE	3.6	3.0	8.4	5.1

Source: BAS 1997-2001; 2001-2003; 2004.

Commercial and marine municipal fisheries had fluctuating growth rates over the period. Average growth rates were 3.6 percent and 3 percent respectively between 1997 and 2004. This indicates the need to diversify fisheries production into aquaculture and veer away from capture fisheries, if growth rates are to remain positive and the fisheries sector is to contribute positively to GDP. This option, however, would require a thorough assessment of environmental impacts from increased aquaculture production.

The species that consistently contributed the most to the total volume of capture marine fisheries production are listed in Table 2.3. Growth in aquaculture has been dominated by the species (see Table 2.4).

Overfishing and declining fish stocks. While demand for fish and fishery products has been growing in recent decades, the catch per unit effort or CPUE (the total number of fish caught per unit of time, an indicator of fish abundance) has been declining, following worldwide trends in fisheries. As an archipelagic state with over 2.2 million square kilometers of seas, the Philippines is fortunate in having vast fishery resources at its disposal. All of its main fish species and marine organisms, however, are showing severe signs of overfishing. In addition, destructive fishing methods using dynamite and cyanide and other gears resulting in habitat degradation, are also a major cause of the decline in fisheries productivity and CPUE.

Municipal fisherman in Northern Luzon.

Photo: Finn Danielsen.

Table 2.3 Contribution of Top Species to Total Volume of Capture Marine Fisheries Production, 1997-2004 (Percentage).

Species	1997	2001	2003	2004
Round Scad	14	16	15	20
Indian Sardines	12	11	8	13
Skipjack	7	6	7	10
Frigate Tuna	7	6	9	13
FIMB. Sardines	6	5	3	3
Anchovies	5	5	4	
Yellowfin Tuna	4	5	6	8
Slipmouth	4	4	3	3
Big-eyed Scad	3	4	5	3
Others	38	38	39	24

Sources: BAS: Fisheries Statistics of the Philippines. 1997-2001; 2001-2003; 2004.

Table 2.4 Contribution of Top Species to Total Aquaculture Production, 1997-2004 (Percentage).

Species	1997	2001	2003	2004
Tiger Prawn*	4	3	2	
Tilapia*	9	9	9	9
Milkfish*	16	18	17	16
Seaweed	67	64	68	70
Others	4	5	3	5

** introduced species*

Sources: BAS: Fisheries Statistics of the Philippines. 1997-2001; 2001-2003; 2004.

Despite the continued expansion of the country's commercial fishing fleet, total fish catch leveled off in the early 1990s. Since then, marine fisheries production has been around 1.6 to 1.8 million tons annually.

Studies have shown that as early as the late 1960s, the country had reached the maximum economic yield of its demersal fish stocks (fish living on or near the bottom), except in the offshore hard bottoms around Palawan, the Southern Sulu Sea, and the central part of the Pacific coast (Silvestre and Pauly 1989). Current biomass of demersals is only 10 to 30 percent of the levels in the late 1940s (Luna 2004).

With respect to small pelagic (open sea) fisheries, overfishing and declining CPUE has also been observed, except in lightly fished areas off Palawan, parts of the Pacific coast, and some parts of Mindanao (Silvestre and Pauly 1989). Biomass has declined to about 17 percent of levels in the early 1950s, and economic rent dissipation is estimated to reach about $290 million annually. Figure 2.8 shows the major fishing areas in the country that are considered to be seriously overfished.

Lingayen Gulf is a major fishing ground located in Northern Luzon. Studies reveal it "reached its maximum sustainable yield (MSY) more than 20 years ago, and that the fishery now has 400 percent too much effort for the available fish stocks. Catch rates in the gulf are five times smaller than they were 15 years ago, compelling fishers to invest more time and money in dwindling catches." (Hilomen et al. 2002.)

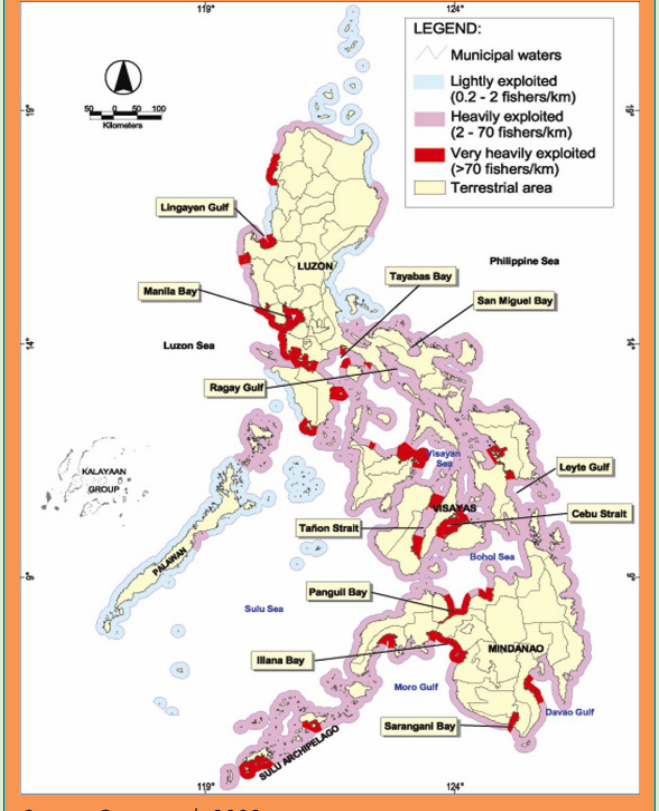
In the period between 1998 and 2001, 30 percent more fish were harvested than could be replenished through the sea's natural productivity. Such excess fishing has resulted in economic losses, conservatively estimated at about PhP 6.25 billion (about $125 million) per year in lost fish catch (ICLARM 2001).

Finally, analyses of annual catch per unit effort (CPUE) in six coastal provinces in the Philippines for the common hook-and-line type of fishing showed that in some cases fish catch per unit effort was less than five percent of the

A small, commercial-size fishing boat.

Photo: Alan White.

Figure 2.8 Map of Heavily Exploited Areas.



Source: Green et al. 2003.

original levels of only a few decades ago (Figure 2.9; Green et. al. 2003).

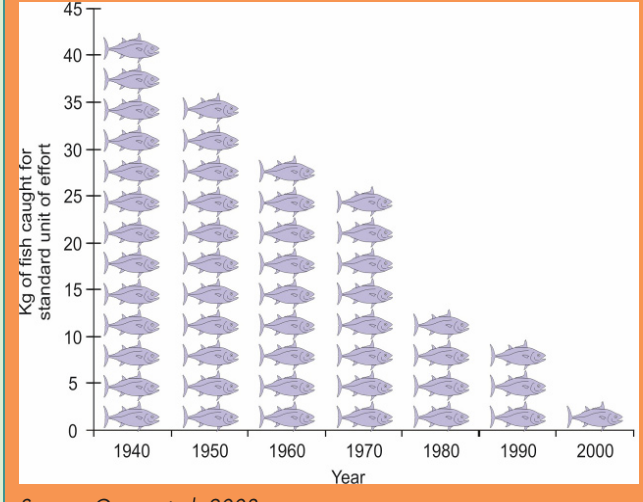
According to some estimates, if the declining trend in fish production continues, by 2010 only around 10 kilograms of fish per year will be available for each Filipino (Figure 2.10; Bernascek 1996).

Nationwide, fisherfolk are concerned about their low CPUE. The municipal sector in particular feels increasing competition from

Fisherfolk displaying their fish trap, the common method of capturing fusiliers, outside the sanctuary on Sumilon Island reef.

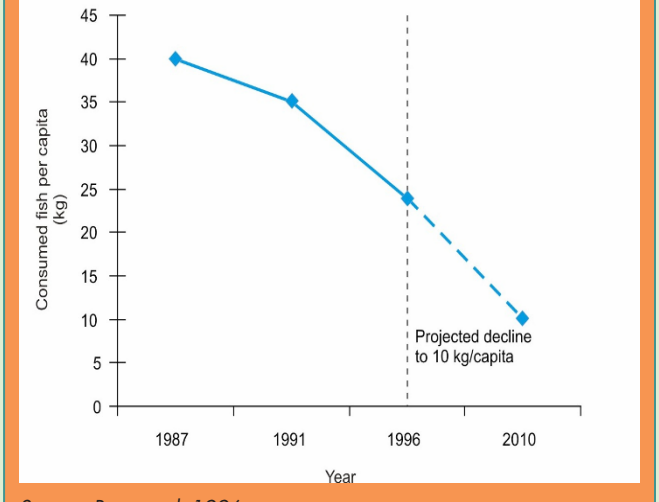
Photo: Alan White.

Figure 2.9 Decline in Average CPUE for Hook and Line Fishing in Six Provinces.



Source: Green et al. 2003.

Figure 2.10 Per Capita Fisheries-Related Food Available for Consumption in the Philippines.



Source: Bernascek 1996.

Box 2.1 BFAR Study Warns of Fish Shortage in Davao Gulf in 2007.

DAVAO CITY, 26 September 2005 – The Davao Gulf could suffer a fish shortage by 2007 if unregulated fishing continued in the region's 520-kilometer fishing ground, an official of the Department of Agriculture-Bureau of Fisheries and Aquatic resources (BFAR) warned.

Jose Villanueva, project leader of the National Stock Assessment Project (NSAP) of BFAR in Region 11, said the latest results of the NSAP study showed that the exploitation rate (ER) of growth overfishing (harvesting of fish before reaching the first maturity stage) within the Davao Gulf area is nearing critical level.

"The ratio is way above the standard level of 0.5," he said. Once the ER reached the ratio of 0.9, Villanueva said it is already considered critical. He said by this time, the Davao Gulf will run out of fish products. Fish species that will be most hurt by the projected depletion are moonfish or *bilong-bilong*, scads and round scads or borot.

"In two years, if we fail to stop the harvesting of small fishes, we would end up without fish," Villanueva said.

Source: Philippines Daily Inquirer, September 26, 2005.

the commercial sector, which often fishes illegally within the 15 kilometer municipal water limit. Nevertheless, despite the very low catch rates, the numbers of municipal fisherpeople are still increasing due to the lack of economic opportunities elsewhere.

Furthermore, a significant percentage of what they capture is used for their own consumption, thus providing a major source of survival. In some areas, fish catches during the lean season are almost solely used for feeding families rather than for commercial purposes.

The situation concerning overfishing in Davao Gulf is described in Box 2.1.

Biodiversity. The Philippines has recently been identified as a biodiversity "hotspot"—that is, an area where the Earth's biological wealth is most distinctive and rich and where its loss will be most severely felt if conservation efforts are not successful. The coastal and marine waters of the Philippines contain some of the world's richest ecosystems, characterized by extensive coral reefs, sea-grass beds, and dense mangrove forests. For example, the number of species (488) of hard stony corals (scleractinians) found in Philippine coral reefs far exceeds the 70 species found in the Caribbean (Werner and Allen 2000). Its 16 species of sea grasses are second only to western Australia, which has 17 species. The total diversity of all taxa of marine life is not known, but estimates of species numbers are high, as shown in Table 2.5.

Sites that have a particularly rich assemblage of coral reef-associated marine life include Tubbataha Reefs in the Sulu Sea; Apo Reef Mindoro; the Calamianes Islands in northern Palawan; Tawi-Tawi and Balabac Islands, Sulu Sea; parts of the Central Visayas, such as the Danajon Double Barrier Reef and connecting islands off northern Bohol Island; and islands in the Bohol (Mindanao Sea), such as Apo, Selinog, Camiguin, and Sumilon. Marine mammals are scattered but well known in the Tanon Strait, off southern Bohol and the Cebu Islands, in the Sulu Sea, and off northern Palawan.

Table 2.5 Estimated Numbers of Marine Species that Occur in the Philippines.

Taxonomic group	Species in Philippines	Species world-wide
Marine fishes (all)	2818	?
Marine reef associated fishes	1727	?
Marine 'cartilaginous' fishes	164	?
Seagrasses	16	67
Stony corals	488	700
Marine mollusks	2000+	
Other marine invertebrates	10,000+	
Marine mammals (cetaceans)	25	80
Other marine mammals (Dugong)	1	?
Marine reptiles (sea turtles)	5	8
Marine reptiles (sea snakes)	17	?
Seabirds	20	?

Sources: FISHBASE 2005; Fortes and Santos 2004; Werner and Allen 2000; Alava and Cantos 2004; Magdaraog 1998; Compagno et al. 2005.

Unfortunately, many of the important marine species in the Philippine marine environment are threatened. Some of the main threatened species are listed in Table 2.6. The main threats to marine species are habitat loss and degradation, pollution, and local and commercial fishing activities.

Although an estimated population of at least 1 million resident and migratory water and shore birds is still found in the Philippine coastal ecosystems, severe habitat loss, disturbance, and hunting are causing declines in most

Table 2.6 Threatened and Legally Protected Marine Species and their Habitat Requirements.

Marine animals	Habitat requirements
Reptiles	
Sea turtles (all species)	Coral reefs, seagrass beds, beaches, and near-shore waters
Sea snakes (all species)	Fringing coral reefs, mid- water reefs
Mammals	
Sea cow (dugong)	Seagrass beds, bays with reefs
Dolphins (all species)	Open water areas and mid-water reefs
Whales and porpoises (all species)	Open water areas
Fish	
Whale sharks (1 species)	Open water and mid-water reefs
Manta rays (all species)	Open water and coral reefs
Milkfish (1 species)	Estuaries, coral reefs, and open water areas
Crabs	
Coconut crabs (*Birgus latro*)	Beach areas
Molluscs	
Giant clams (7 species)	Coral reefs, seagrass beds and sandy areas
Giant triton shell (*Charonia tritonis*)	Coral reefs
Helmet shell (*Cassis* spp.)	Coral reefs
Kapis shell (*Placuna placenta*)	Coral reefs, sandy areas
Corals	
Stony and precious corals (all species)	Estuaries, reefs and mudflats
Birds	
Seabirds	Coral reefs
Water birds (5 species inc. 1 extirpated)	Remote, oceanic islets without human disturbance and predators; rocks and cliffs
Shorebirds (5 species)	Coastal ecosystems: mangroves, ponds, lagoons

Sources: DENR et al. 2001; IUCN Red Data List 2004; Jensen 2004.

Brown booby birds nesting on the North Islet of Tubbataha Reefs, where they are protected from human disturbance.

Photo: Alan White.

populations. In one extreme case, the Philippine Pelican, *Pelecanus philippinesis*, is now extinct in the Philippines.

The presence of large congregations of oceanic seabirds is a good indicator of the environmental status and health of remote atolls and small island ecosystems. Seabirds generally require intact and undisturbed habitats for successful breeding and roosting, in combination with an abundance of their main food sources such as squid and smaller fish species.

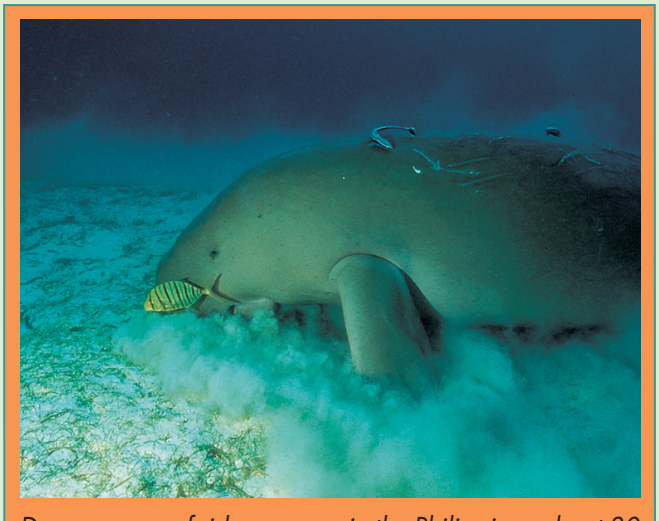
Habitat loss and degradation affects many marine species. There is a parallel trend to that of seabirds for both sea turtles and the dugong. About 30 years ago, dugongs were believed to be fairly common throughout the Philippine Archipelago, where they are called duyong or baboy-dagat (sea pig). But today, the dugong population is considered to be both sparse and scattered. The decline has been caused by the widespread loss and degradation of sea-grass beds, the dugong's feeding sites. The incidental catches of dugongs in fishing gear (gill nets,

trawl, and fish corrals) and the use of dynamite fishing methods are other major causes of dugong deaths (UNEP 2004).

The loss of biodiversity may also be linked to high population growth and density, according to a new study by DENR. The study found that loss of biodiversity was higher in areas of the Philippines with rapid population growth and in-migration (DENR-PAWB et al. 2004).

Many reefs and smaller marine islets are now inhabited and the ecosystems have been modified to the extent that they can no longer sustain their original biodiversity, which included beach forest, marine and terrestrial mammals, birds, and reptiles.

The rapidly growing Southeast Asian regional market for marine products also affects Philippine marine biodiversity. This market is based on both legal and illegal trade. The strong demand leads to unsustainable rates of harvesting, which are threatening species that were once plentiful and bringing many already endangered species ever closer to the brink of extinction (See Boxes 2.2 and 2.3). For a discussion of aquarium fisheries and trade (see Box 1.1, p. 4).



Dugongs were fairly common in the Philippines about 30 years ago. Today the dugong is threatened and the remaining population is sparse and scattered.

Photo: FISH-Project.

Box 2.2 Live Reef Food Fish Trade.

The trade in live reef fish for food is an important industry with an estimated annual retail value of US$ 1 billion in the Asia-Pacific region, at least US$ 30 million in the Philippines, and US$ 18 million in Palawan.

While historically most of the live reef fish trade was for ornamental fish and marine organisms, since the early 1990s the trade has increasingly been focused on live fish for food. The high price for live food fish was the most significant factor in the emergence of the industry. All live reef food fish exported from the Philippines go to Hong Kong and Taiwan.

The type of fishing involved with this trade creates several adverse effects including loss of biodiversity, decreased food production and food security, and decreased livelihood opportunities in coastal communities. Among the destructive practices used to harvest live reef organisms is the use of cyanide, which fishers often squirt on a reef to stun the fish and make them easier to capture. The practice, however, not only stuns the fish, but also severely degrades the reef.

Law enforcement is difficult, and corruption at various levels, as well as social conflicts between those involved in the trade and others, such as local resource users and managers and conservationists, beset the trade.

A large percentage of economic benefits accrues to relatively few and the degradation of coral reefs and overfishing for the trade threaten the livelihood of already marginalized fishing communities.

Sources: FISH Project and Palawan Council for Sustainable Development. June 2005.

Box 2.3 Whale Sharks: Delicacy or Tourist Attraction?

Though ferocious-looking, whale sharks are gentle creatures that feed primarily on microscopic marine organisms called plankton. They are, however, are also considered a delicacy and often served in banquets.

While the hunt for whale sharks used to be limited to traditional hunting villages where the meat was used for local consumption, it is now done primarily in response to an increasing export demand.

The market for whale sharks is in Taiwan, Hong Kong, Singapore, and Japan. Each shark, cut and frozen, fetches as much as PhP 800,000 ($16,000). Reportedly local fishers may receive prices as high as PhP 80,000 ($1,600) for a whale shark. Companies sometimes even offer boats and other means of support to the fishers.

Whale sharks, although protected, are threatened in the Philippines

Photo: Alan White.

But while fishing efforts increased and new whale shark fisheries were opened up in at least 5 provinces, catches went down. From about 56 to 100 sharks per site per year in four of the primary fishing sites years prior to 1997, catches decreased to about 13 sharks per site in at least 11 sites in 1997, illustrating the impact on the species as well as the unsustainability of the industry in the long run.

That things can be very different is evident in Donsol, Sorsogon. This town quickly became not only a major tourism destination for whale shark watching, but the discovery of a large aggregation of the animals–with one of the highest densities of whale sharks in the world—and the subsequent slaughter of six of them by fishers of neighboring towns created a public outcry and propelled the issuance of the Fisheries Administrative Order (FAO) No. 193, which bans the killing and trading of whale sharks including manta rays throughout the Philippines. The LGU of Donsol also enacted a local ordinance declaring its municipal waters a sanctuary for the whale sharks.

With the help of WWF, which together with the LGU and the Donsol Municipal Tourism Council (DMTC), implemented the Butanding Ecotourism Development Project to secure the financial viability, environmental sustainability and social acceptability of ecotourism, Donsol quickly became an important eco-tourism destination in the Bicol region. In 2003, the ecotourism program ranked first in the most visited attraction in the Bicol region and won the Kalakbay Award, given by the Philippines-Department of Tourism. The following year, Time Magazine named Donsol as the Best Wild Animal Encounter in Asia.

Sources: Adapted from Over Seas – The Online Magazine for Sustainable Seas, and http://crmsd.wwf.org.ph/donsol/wshark.php.