overview

Badi Samaniego

Chapter 1
OVERVIEW

The Philippines, which is located at the apex of the Coral Triangle, is acknowledged as the world's center of marine biodiversity (Carpenter and Springer, 2005). Its coastal waters are teeming with species of corals, reef fishes, seagrasses and mangroves. Other marine vertebrate, invertebrate and plant organisms, as well as their terrestrial counterparts are also reported to be richly diverse. Their significance to human well-being is undeniable, as millions of Filipinos depend on coral reefs and their associated ecosystems, providing food and livelihood to small-scale artisanal and subsistence fisheries as well as commercial fisheries. Many of the coastal communities have low incomes and those below the poverty threshold are often dependent on the coastal habitats' ecosystems goods and services. These ecosystems provide diverse and valuable functions and services, such as coastal protection, fisheries production, and regulation services as well as recreational, educational and aesthetic values, contributing significantly to the tourism sector (Padilla, 2009). If these ecosystems are damaged beyond restoration, there would be profound consequences to the Filipino people.

The degradation of coastal ecosystems has already been observed in the Philippines (Gomez *et al.*, 1994) and has been recognized as the hottest of the hot spots in marine biodiversity (Roberts *et al.*, 2002). This is revealed by high levels of threats (overfishing, destructive fishing practices, unsustainable coastal development, sedimentation and pollution) on coral reefs (Burke *et al.*, 2002, 2011). Increasing populations in coastal areas are amplifying these threats, compromising food security and the socio-economic stability of the communities. This alarming state is further exacerbated by the impending impacts of climate change (*e.g.*, McLeod *et al.*, 2010) which have made the Philippines one of the most vulnerable social and economic states in Southeast Asia (Yusuf and Francisco, 2009). It is, therefore, imperative to accelerate efforts and produce synergistic impacts to overcome the threats at the local and national settings.

As a signatory to the Convention of Biological Diversity (CBD), the Philippines promotes the conservation of biodiversity for sustainable development. The Department of Environment and Natural Resources (DENR) – Protected Areas and Wildlife Bureau (PAWB) regularly reports to the CBD on the loss of biodiversity as well some specific gains in protecting biodiversity, promoting sustainable use, addressing threats, maintaining goods and services, among others.

Learning from the various initiatives, such as the CBD, the Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF) addresses these imperatives through concerted efforts and multi-lateral partnership among the six member countries — the Philippines, Indonesia, Malaysia, Papua New Guinea, Solomon Islands, and Timor-Leste. The CTI aims to safeguard the marine and coastal biological resources of the region for future generations, and to protect them from overfishing, destructive fishing practices, unsustainable coastal development, pollution, and impacts of climate change, and other emerging issues which destroy the richness, productivity and ecosystem services of the Coral Triangle. The CTI National Coordinating Committee (NCC) is chaired by the Department of Environment and Natural Resources (DENR) and co-chaired by the Department of Agriculture – Bureau of Fisheries and Aquatic Resources (DA-BFAR).

1.1 Rationale of the Study

The State of the Coral Triangle Report (SCTR) aims to document and promote the commitments to CTI through the goals and

Figure 1 Map of the Coral Triangle *(Source: DENR-PAWB-CMMO, 2012)*

plans of action. The Philippine SCTR presents the state and condition of the resources at coastal ecosystems exposed to various degrees of threats. This report purports to present the baselines at the start of the CTI, against which future reports may be compared to provide a measure of progress. The report also highlights the relevant government policies and programs on conservation, fisheries and aspects of governance both at the local and national levels appropriate to the problems and drivers in the archipelago. The SCTR utilizes the Pressure-State-Response (PSR, OECD 1994) approach to discuss opportunities and mechanisms to address the threats. Moreover, it assists in a systematic summarization and linking of key benchmarks (circa 2009) and monitoring indicators on the progress and implementation of targets of the National Plan of Action (NPOA) of the CTI. Lastly, the PSR integration of the benchmark conditions initiates the discussion on how to connect related corollary actions to achieve the higher level outcomes.

The Philippines, as one of the countries of the Coral Triangle Initiative is committed to the CTI through its National Plan of Action (NPOA) and Regional Plan of Action (RPOA) as agreed by the six countries in the Coral Triangle. The five goals of the CTI as stated in the National Plan of Action are:

- "priority seascapes" designated and effectively managed (large-scale geographies prioritized for investments and action, where best practices are demonstrated and expanded;
- Ecosystem Approach to Fisheries Management (EAFM) and other marine resources fully applied;
- Marine Protected Areas (MPA) established and effectively managed (including community-based resource

utilization and management);
- climate change adaptation measures achieved; and
- threatened status improving.

Actions in the NPOA/RPOA are expected to contribute to achieving higher level outcomes, such as sustaining coral reef ecosystems and services, establishing sustainable fisheries and improving food security and livelihood.

Development of coastal areas is crucial in the Philippines, where 78% of the 80 provinces and 56% of the 1,634 cities and municipalities, are located along its archipelagic coasts. These coastal settlements are exposed to climate variability. The dominant wind system over the Philippines is the Asian monsoon which blows from the northeast between December and March (*amihan*) and from the southwest between June and October (*habagat*). This monsoonal wind system affects the temperature, wind, and rainfall patterns in the country, demonstrating four distinct dry and wet classifications along a north-south, east-west gradient. Recent analysis (RESILIENT SEAS Program, David *et al.,* unpublished) using data on precipitation, sea surface temperature, and sea surface height shows 11 distinct climate clusters across the country. The ocean circulation around the Philippine archipelago is a product of the complex dynamics among the bathymetry, the seasonally reversing monsoons, as well as the tidal and non-tidal circulation between the West Philippine Sea and the Western Pacific (Wang *et al.,* 2008; Han *et al.,* 2009; Gordon *et al.,* 2011 as cited in Villanoy *et al.,* 2011). Winds blowing through gaps between islands can induce upwelling (*e.g.* off northern coast of Zamboanga Peninsula) and downwelling along the leeward sides of the islands (Chavanne *et al.,* 2002). Climate change variation is influenced by the Pacific Decadal Oscillation (PDO) that profoundly affect Sea Surface Temperature (SST) and exhibits thermal anomalies that result in coral bleaching (*e.g.* Arceo *et al.,* 2001; RESILIENT SEAS Report, 2011) and regime shifts in fisheries (Chavez *et al.,* 2003, Villanoy *et al.,* 2011).

The Philippines' estimated 26,000 km^2 of coral reef area is the second largest in Southeast Asia. Some 500 species of scleractinian or "stony" corals are known to exist, 12 species of which are considered endemic (*e.g.*, Veron, 1995), around 3,053 species of fish (Herre, 1953, Allen *et al.,* 2003, Allen & Erdmann, 2009, Fishbase.org, 2009), 2,724 of which are marine-based. Pelagic fish species number around 177 whereas demersal species total 2,351 (1,658 of these are reef-associated and 693 are associated with other nearshore habitats). There are 277 deep-sea fish species, while 173 species are found in freshwater environments. For marine plants, 16 species of seagrass are known to occur and the estimated total area of seagrass bed habitats is 978 km^2 (Fortes, unpublished). The Philippines has one of the highest number of mangrove species with 42 species representing 18 families (Spalding *et al.,* 2010, Polidoro *et al.,* 2010). Natural mangrove cover has declined to 247,268 hectares, while planted mangroves have already reached up to more than 44,000 hectares (Samson and Rollon, 2008, Primavera *et al.,* 2011). Several species are considered threatened, such as the dugong, cetaceans, whale sharks, manta rays, other sharks and marine turtles (Alava and Cantos, 2004).

There is a wide range of Philippine laws (*e.g.,* 1987 Philippine Constitution) and policies that deal with issues pertaining to:

- food security, livelihood and socio-economic conditions of the population;
- environment and natural resources, and habitats and the need for their protection, conservation and development; and
- related issues on security, safety, territory (Republic Act. No. or RA 9522, Baselines Law) and law enforcement.

Many laws and policies have created and improved the organizational and institutional mechanisms of the coastal and marine sector, particularly those relating to fisheries (RA 8550), biodiversity conservation (RA 7586 and EO 578), and integrated coastal management (EO 533).

The population in the Philippines was projected in 2009 at 92.1 million. The increase in population translated to an average growth rate of 2.04% annually during the period 2000 to 2007, but slightly fell to 1.9% very recently in 2011. The growth rate is a factor in determining how great a burden would be imposed on a country by the changing needs of its people for resources, infrastructure, and jobs. The population density in 2009 was estimated at 307 people per km^2, which was about 10% higher than the population density in 2003. It is estimated that more than 60% of the nation's total population lives in the coastal areas. Increasing population is a serious problem because of the implications on the limited natural resource base and may lead to over-exploitation of coastal and marine resources. Fish continues to be the principal source of protein for the country's population, accounting for 70% of the total animal protein intake and 30% of the total protein intake.

1.2 State of Fisheries in the Philippines

In 2009, the fisheries sector accounted for 2.2% of the country's Gross Domestic Product (GDP) at current prices, and 4.4% in constant prices. Recent data indicate that the sector declined by 3.84% in 2011 due to decreases in production of the commercial and municipal sectors. It is a common observation that fishers earn incomes that are usually below the poverty threshold levels which was reported in 2002 at PhP11,906 per capita per annum, or an equivalent of PhP1,000 per month, with fisher density range of 4.4 to 6.5 fishers/sq. km (SUPFA Report, 2007). In 2009, poverty threshold went up to PhP16,841 per capita per annum (NSCB 2012).

The Philippine capture fisheries production ranked 9th in the world in 2008 (FAO, 2008). In 2010, the sector produced 2.6 million MT (51% of total Philippine fish production) valued at PhP138.4 billion. The municipal sector accounted for 1.37 million MT valued at PhP77.6 billion, while the commercial sector had 1.25 million MT valued at PhP60.7 billion. Tuna fisheries account for 12% of the total fisheries production in the Philippines and contributes 4% to the GDP, and about one million people are involved in the industry (*i.e.,* the work force includes fishers, middlepersons, traders, fish processors, transportation sector, *etc*.). Total annual landings were estimated at 400,000 MT in 2009, of which 120,000 MT (30% of total) was caught in Philippine waters whereas 280,000 MT (70%) was from adjacent international waters.

Small pelagics are the main sources of cheap protein for lower income groups in the Philippines. These include sardines, anchovies, round herring, roundscads, mackerels, and fusiliers. They comprise about 60% of the total capture fishery production of the country as of 2003 (FAO, 2008) and estimated to have a Maximum Sustainable Yield (MSY) of 550,000 metric tons from the levels reported by Dalzell *et al.* (1987). However, the catch per unit of effort (CPUE) for small pelagic fishes continued to decline since the 1950s. Within the small pelagic fisheries, sardines are one of the commercially targeted species which accounted for a combined 442,045 MT valued at approximately PhP10.5 billion. However, present sardine stocks in the Philippines are showing signs of depletion.

The state of the demersal stocks in the Philippines has been characterized by a decline in biomass and a change in species composition (Armada, 2004). The major changes in catch composition include an increase in abundance of squids, shrimps and small pelagic species and substantial declines in the abundance of large commercially valuable species like groupers, snappers, sea catfish, *etc.* The present rates of exploitation of demersal fishes are reported to be beyond the MSY levels (Silvestre and Pauly, 1987 and Dalzell *et al.*, 1987). Also, the current level of production occurs at a higher level of effort indicating overcapitalization that is typical of a common property regime of exploitation in Philippine fisheries (Padilla, 2009). Other recent data on artisanal catch (*e.g.,* Mamauag *et al.,* 2009) appear to show a predominance of species with small sizes and low market prices.

The value of sustainable production from capture fisheries (excluding invertebrates and aquatic plants) reached up to an estimated PhP128 billion per year (based on 2006 data; in Padilla, 2009). However, due to the open-access exploitation regime, the net value is placed at about PhP13 billion. The annual potential yield from coral reef fish species, based on a coral reef area of 26,000 km^2 (initially reported as 33,000 km^2) ranges from 351,000 to 429,000 MT. The estimated current yield using a reef area of 26,000 km^2 is placed at over 169,000 MT with potential net values of about PhP2 billion to PhP2.5 billion and actual net value at less than PhP1 billion using the average price for coral reef-associated species in 2006 of PhP57 per kg. These values were observed to be slightly lower compared to the estimates using reef conditions from the previous years. The gross value of potential production from mangrove fisheries in 2006 decreased to the range of PhP1.49 billion to PhP6.09 billion/yr. The estimated contribution of mangrove ecosystems to actual fisheries production in 2006 reached 23,269 MT.

The live reef fish trade (LRFT) is an important fishery in the Philippines which mostly targets groupers (Mamauag, 2004). While generating significant export revenue and incomes for fishers/cagers, there is an observation that Philippine-wide catches peaked in the mid-1990s and gradually dropped since then. This decline in LRFT is demonstrated specifically in Palawan, a major source of live fish and hence where assessments are largely undertaken (PCSD, 2011).

Aquaculture contributes 38% to the annual fisheries production and is currently the biggest sector in the fisheries industry. The industry is growing rapidly, exhibiting a growth rate of 10.2% per year. In 2010, the aquaculture sector contributed 2,543,720 MT valued at PhP82 billion. Seaweed and sea cucumber have gained in food security, employment, quality products and profit in the export industry. In 2010, seaweed production in the Philippines ranked second in production at 1.8 million MT next to Indonesia at 3 million MT.

Coastal tourism brings substantial economic benefits to the Philippines. It is a source of foreign exchange and a significant part of national and local economies. Based on the WTTC satellite accounting, tourism accounts for 9.1% of GDP in the country, and like other Asian Coral Triangle Countries (CTC), tourism is one of the fastest growing sectors of the economy, already worth US$16.3 billion.

Domestic production of oil in the Philippines began in 1979 but has been very limited. Until 2010, the country has produced 61,860,820 billion barrels (bbl) of oil, 1,011,267 mmscf of natural gas, and 45,312,937 bbl of condensate. The Philippines holds an estimated 3.48 trillion cubic feet (Tcf) of natural gas reserves, most of which are found in the Malampaya gas field in Palawan (contains an estimated 2.6 Tcf of natural gas). According to the 2008 BP Statistical Energy Survey, the Philippines had natural gas consumption of 3.42 billion cubic meters. The country has two crude oil refining facilities which had a refining capacity of 282,000 bbl/d as of January 2008.

As an archipelagic country, the Philippines

relies heavily on the domestic and international shipping industry to link the islands and to transport goods and people. In 2009, the gross revenue of the Philippine Ports Authority (PPA) reached PhP7.129 billion, an increase of more than half-a-billion pesos (PhP503.37 million or 7.60 %) from 2008.

The significance of traditional knowledge is increasingly being recognised including its value as a complement to scientific findings that may well provide valuable insights (*e.g.,* Magos, 1994). Customary marine tenure systems and traditional practices, for instance, can be seen as viable alternatives to approach problems in fisheries management. Building on traditional knowledge on marine management strategies or activities in the context of national policies provides benefits to human communities and biodiversity, or the national and/or international conservation efforts including climate change adaptation. For issues on gender equality, these are actively promoted in the Philippines be it in the government or other sectors outside of the government. There are enabling policies and mechanisms that support gender equality in the Philippines.

1.3 Threats to Biodiversity

Poor coral cover in the Philippines has increased to 40% while areas with excellent cover has steadily declined to less than 1% in 2000-2004. This can be attributed to the continuing threats from coastal development, marine-based pollution, sedimentation, overfishing, and destructive fishing. In 2002, overfishing was the largest threat (about 40%) to the coral reefs in the Philippines followed by destructive fishing practices (approximately 36%). In 2012, however, destructive fishing gradually decreased whereas the other threats increased considerably. Levels of high and medium threats, particularly sedimentation and pollution grew significantly suggesting the escalation of problems brought about by these and other causes. These include inappropriate land use practices, irresponsible mining practices, deforestation (including illegal logging activities), improper waste disposal, *etc.* There was also significant growth in coastal development manifested by the increase in coastal populations, built-up areas, and urbanization, among others. In contrast, the level of destructive fishing practices appears to decrease through time in many sites indicating some successes in MPAs and fishery managements in several municipalities.

Still, the impacts of overfishing and to some extent destructive fishing practices on coral reefs are evident in the biomass of reef-associated fish. It is reported that more than 50% of the reef sites in the Philippines assessed between 1991 and 2004 are overfished (Nañola *et al.,* 2004). Overfishing is also observed in the live reef fish fishery especially in Palawan. Given the moderate to heavy fishing pressure that the groupers have been experiencing in recent years, the groupers' rate of depletion has, therefore, been increasing and the current harvests are no longer sustainable.

Recent estimates showed that there are about 2.2 million MT of organic pollutants released into the marine environment annually. These pollutants come from the domestic, agricultural and industrial activities from the land.

A major threat to marine turtles, one of the threatened species in the Philippines, is large-scale illegal harvest of eggs and collection of adults for the ornamental trade. Marine turtles are also threatened by coastal development and fisheries practices, including foreign fishers poaching and targeting marine turtles within Philippine waters.

Malpractices in aquaculture result in debilitating effects both to the environment and the stocks, such as massive fish kills which have economic consequences through losses in investments.

Given the impacts on ecosystems by the threats and pressures, endeavours, such as reef restoration, are considered to rehabilitate damaged habitats and conserve biodiversity. Reef restoration activities are being initiated in the Philippines to conserve local coral diversity and ecosystem productivity. Another consideration is restocking efforts, the main goal of which is to maintain production of target species at sustainable levels from depleted conditions due to overexploitation. Giant clams, sea cucumbers, sea urchins, and scallops are some of the species that are undergoing restocking initiatives.

1.4 Updates on the Goals of the CTI

The final section of this report presents the five goals of the CTI, their indicators, targets and initiatives undertaken. For Goal 1 (Priority Seascapes — improved governance and effective management), two seascapes (Sulu-Sulawesi Marine Ecoregion and West Philippine Sea) were designated. For Goal 2 (Ecosystem-based fisheries management), national policies on EAFM (*i.e.,* policy for tuna management) and live reef food fish trade are being drafted.

For Goal 3 (Improved management of Marine Protected Areas, or MPAs), 0.1% or 270,000 has. or 2,700 kms^2. are under some form of protection (total coral reef area is 26,000 sq. kms.). Ten percent of the 2% target by 2015 and 10% of the 10% target by 2020 are to be strictly protected. Recent assessment by Marine Protected Area Support Network (MSN) in 2011 showed 1,620 MPAs across the country are established and managed locally (Dizon *et al.,* 2011). MPA Effectiveness Assessment Tool (MEAT) was used to assess 110 MPAs which is 7% (31,520 has.) of the total area of 393,994.46 has. of these MPAs. For mangroves, around 57% (80,000 has.) of the remaining mangroves (140,000 has.) is under some form of protection, and mangrove replanting activities continue in many municipalities. There are some mangrove areas with 100% (full) protection. There is an increase in the number of Marine Key Biodiversity Areas (MKBA) in the marine biogeographic regions except in the Southeastern Philippine Sea which remained the same compared to 2009 data. Majority (about 66%) of the MKBAs are found in the Visayan Seas (Visayas Region) (at the top of the list), Sulu Sea and West Philippine Sea.

Initial outputs to characterize climate change vulnerabilities of the marine and coastal environments have been provided as initiatives to address Goal 4 – Climate change adaptation. The RESILIENT SEAS Program of the Department of Science and Technology (DOST) and the Marine Science Institute of the University of the Philippines established the framework and the subsequent initial activities to undertake vulnerability assessments (VA) of nearshore habitats, coastal beaches, fisheries and fishing communities. Climate typologies in the Philippines were described to provide exposure factors to complement the existing climatologic classification. Researches under the program established oceanographic, biophysical, fisheries and socio-economic indicators that are integral in the VA. The program also started to engage the participation of national and local governments as well as other academic institutions in the various activities of the program especially in the formulation of adaptation strategies.

NPOAs have been prepared to conserve and monitor threatened species, such as sharks, under Goal 5 – Threatened species status monitoring. Action plan for other species, the Turtle National Action Plan and the Marine Mammal Action Plan are under development. By 2015, the NPOA is slated to have produced Species Action Plans on seabirds, wrasses and other reef fishes. Other threatened species that are considered for restocking efforts include giant clams, scallops, and top shells, among others.

Other initiatives that are also considered in the NPOA include capacity-building, sustainable financing schemes, and public awareness. One innovation is the university mentoring program which aims to transfer knowledge and skill from centers of excellence to mentee higher education institutions for the latter to better assist local government units (LGUs) on the technical aspects of coastal resource management and enhance NPOA implementation. On sustainable financing, there is a set of mechanisms (*e.g.* Payments for Ecosystem Services)identified to generate funds for the national and local governments in order to undertake activities addressing the NPOA goals.

1.5 Findings and Conclusions

In summary, the ecological, socio-economic and governance characteristics of the coastal and marine realm in the Philippines are briefly presented in relation to the relevant pressures and threats and the on-going initiatives or actions, *i.e.,* referred to as responses, which aim to address the issues and examine the desired impacts (Table 1.1). This manner of presentation provides insights into identifying where the gaps and opportunities for improvement are in order to achieve outcomes, such as sustaining the health of coral reefs and ecosystem services and fisheries production, and improved food security.

The summary presented below provides insights on identifying the gaps, and the opportunities to link these gaps to the outcomes. These include the importance of valuation and accounting of the ecosystem goods and services applied over several areas of interest from research and monitoring to enabling environments (*i.e.,* advocacy and constituency building). Another is the need to set up processes, systems and standards of good CT practices. These can be operationalized through the platforms of the Coral Triangle MPA System (CTMPAS), Ecosystem Approach to Fisheries Management (EAFM) and Climate Change Adaptation (CCA), and the inter-hierarchical set-up of adaptive management cycle.

Finally, emphasis must be placed on capacity-building to sustain resilient CT knowledge-based communities. These initiatives are envisaged to produce results that will be relevant to the higher level outcomes through a process that forms a link between these two aspects. This process involves several elements integral to this linkage.

- First is to consider the operational framework of Integrated Coastal Management (ICM) with emphasis on coastal governance. The interdisciplinary, multi-sectoral, and ridge to reef approaches of ICM will allow the linkage between initiatives and outcomes.
- Second, given the importance of the economic valuation of ecosystem services, efforts to identify synergistic actions under this aspect are also crucial steps towards achieving the outcomes.
- Third, employing EAFM in attaining sustainable fisheries is also a significant step.
- Fourth, initiatives that will enable equitable access and use rights in coastal governance should also be envisioned.
- Finally, there should be systemic integration in bottom-up and top-down approaches in the management.

Table 1 State-Pressure-Response-Impact Matrix of the Philippine SCTR

State	Pressure	Response	Impact
Conditions of coral reef and other ecosystems (*e.g.*, coral cover, mangrove cover) are hardly improving. This also includes the goods and services provided by the coastal and marine ecosystems which are decreasing. More than 50% of Philippine reefs are overfished. Poor coral cover increased to 40%. Habitat loss for mangroves is 66% since the 1950s, whereas it is 30%-50% for seagrass beds.	Overfishing (**O**), sedimentation (**S**), coastal development (**CD**), pollution (**P**), destructive fishing (**DF**)	Number and size of protected areas (MPA) have gradually increased. Initiatives and policies are established for conservation and fisheries management. Incentives are identified to capture the true values of ecosystem goods and services (*e.g.*, enhancing the benefits derived from multifunctional values of eco-tourism goods and services).	Highlight the estimated benefits derived from coastal protection, ecotourism, *etc.* (in Padilla, 2009)
Fisheries production and catch rates are still declining. Daily catch rate of most municipal fisheries average only 1-2 kg/fisher/day which indicates severe exploitation. Depletion of fish populations of target species, changes in size and catch compositions, and to some extent local extinction of species (target and by catch).	**O**, **DF**, **CD**, market demand	Fisheries Code or RA 8550 is being implemented. Other national policies, initiatives, plans, *etc.*, on fisheries management are being developed. Provincial and municipal ordinances pertaining to fisheries management (*e.g.* gear restrictions) have been established.	There is a need to strictly implement fishery laws. One significant action is the banning of large, commercial fishing boats inside municipal waters.
Socio-economic condition of fishing communities remains in a dire situation. Majority of fishers are below the poverty threshold and have very few alternative livelihood options.	**O** and **CD** (*e.g.*, increasing population size, decreasing income and food consumption, thus increasing poverty level, inequitable utilization of resources)	Identification of other means of livelihood (income diversification). Finding opportunities towards enhancing education especially for next generations. Mariculture initiatives for selected species (seaweed, sea cucumber, groupers, rabbitfishes, *etc.*). National government assistance (*e.g.*, conditional cash transfer mechanism).	Identification of demographic and economic status among fishing communities. Potential areas for assistance.
Governance on coastal resource management needs to be strengthened. MPA with management rating is only 7% to total MPA size.	Weak governance system (needs more transparency, accountability, participatory, *etc.* mechanisms), lack of knowledge, absence of budgetary mechanisms, *etc.*	ICM being introduced	There is a need to fully implement governance standards and also to address issues, such as lack of political will, lack of systemic integration of governance among government entities (local and national), *etc*

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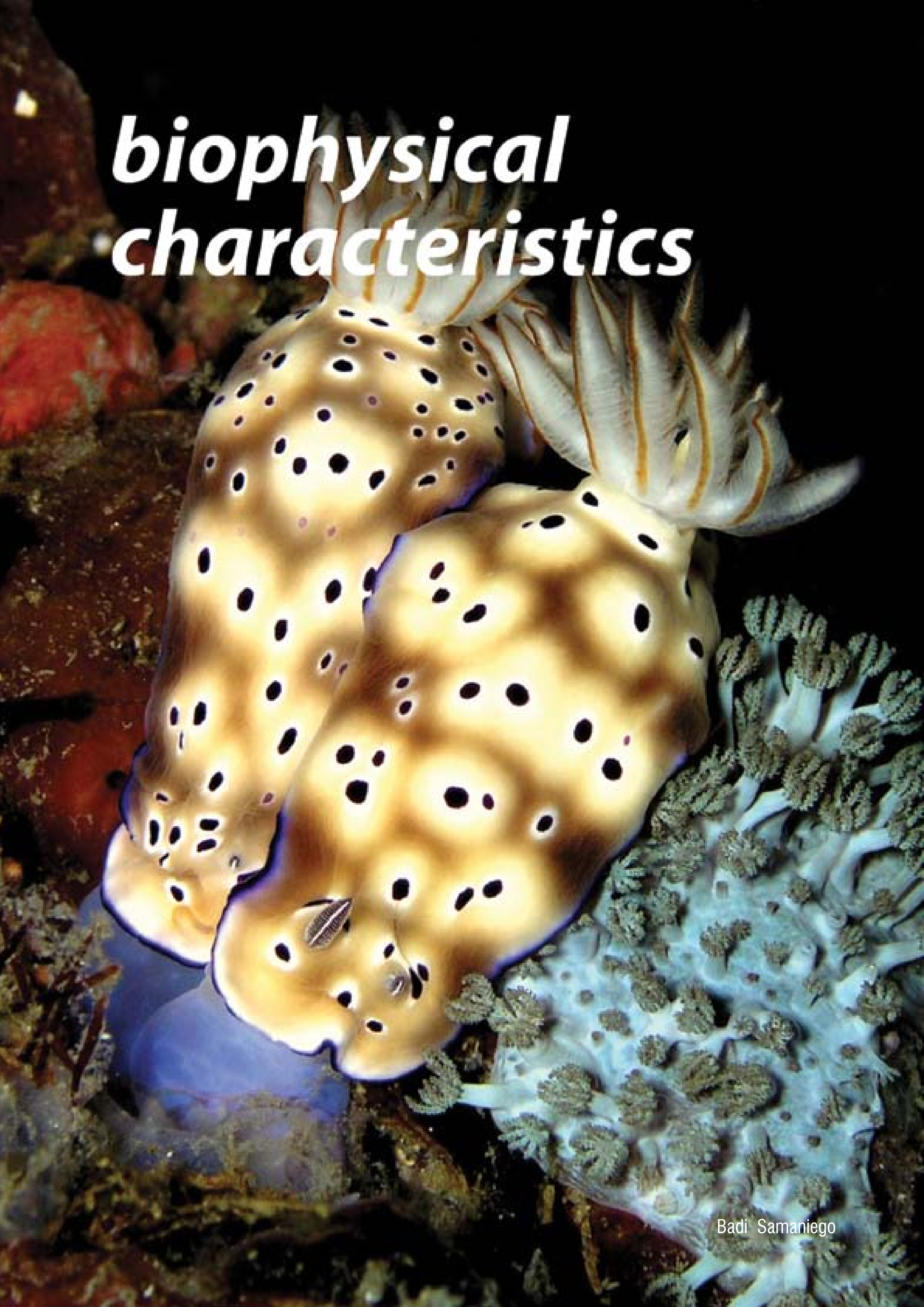
biophysical characteristics



Badi Samaniego

Chapter 2
BIOPHYSICAL CHARACTERISTICS

Biophysical features provide crucial information on the current states of habitats and resources in the country. These states influence their patterns of occurrence, distribution, and abundance.

2.1 Extent and Boundaries

The Philippine archipelago lies between 4°25’ and 21°7’ north of the equator (NAMRIA, 2011) (Figure 2.1). Made up of 7,597 islands, it stretches 1,880 kilometers from north to south, and forms one of the largest island groups in the world. It has a total land area of approximately 300,000 square kilometers (sq. kms.) and a total territorial water area including the exclusive economic zone (EEZ) of about two million sq. kms. Its coastline is about 37,008 kilometers long. It is bordered in the north by the Luzon Strait (Bashi Channel), in the south by the Celebes Sea, in the east by the Pacific Ocean, and in the west by the West Philippine Sea (*i.e.,* the Philippine part of the South China Sea).

2.2 Geography

The three main island groupings of the country are: Luzon in the north, Visayas in the central portion, and Mindanao in the south. Of all the islands, the largest are Luzon (40,420 square miles or 104,687 sq. kms.), Mindanao (36,537 square miles or 94,631 sq. kms.), and Samar (5,124 sq. mi. or 13,271 sq. kms.). As of 2011, the country has 13 regular and four special administrative regions, 80 provinces, 138 cities, 1,496 municipalities and 42,026 barangays (NSCB, 2011). Of the provinces, 62 (or 78 percent) are coastal, while only 17 are landlocked. Of the cities/municipalities, 832 (or 56%) are coastal (CRMP, 2001). The capital city is Manila, which is located along the coast of Manila Bay, an embayment on the western central section of Luzon. Five prominent bodies of water surround the archipelago, namely: the Philippine Sea, the West Philippine Sea , the Sulu Sea and the Celebes Sea and Luzon Strait.

2.3 Geology

In the past, the Philippine archipelago was submerged underwater, except for the Sierra Madre mountain range and other volcanic chains on the eastern part, until it was formed along the margin of southern China during the late Cretaceous period (Magdaraog, 1998). It is bounded by large lithospheric plates: the Philippine Sea plate and the Pacific plate to the east; the Eurasian plate to the west; and the Australian plate to the south, buffeted by the Indonesian plate. The convergence and interaction of these plates resulted in the geologic and tectonic evolution of the Philippine archipelago.

The archipelago is made up of variably aged lithospheric blocks known as terranes (Magdaraog, 1998). These blocks formed during the Tertiary period (*i.e.,* about 65 million years ago) and originated from various places. These may be composed of slivers of oceanic crust, island arc and continental material.

The islands are characteristically volcanic in origin (Figure 2.2). The large volcanic islands are traversed by mountain ranges. The mountains in Luzon include the Sierra Madre, Cordillera Central, the Caraballo Mountains, and the Zambales Mountains. The Diwata Mountains and Mount Apo, which is the highest peak in the country (altitude = 2,954 meters), are both found in Mindanao. On the other hand, the Palawan Micro-continental block (Palawan and Mindoro) and Zamboanga, are marginal continental blocks of the Eurasian plate.

Figure 2.1 Map of the Philippines with territorial boundaries as of 2009 *(Source: NAMRIA, 2011)*

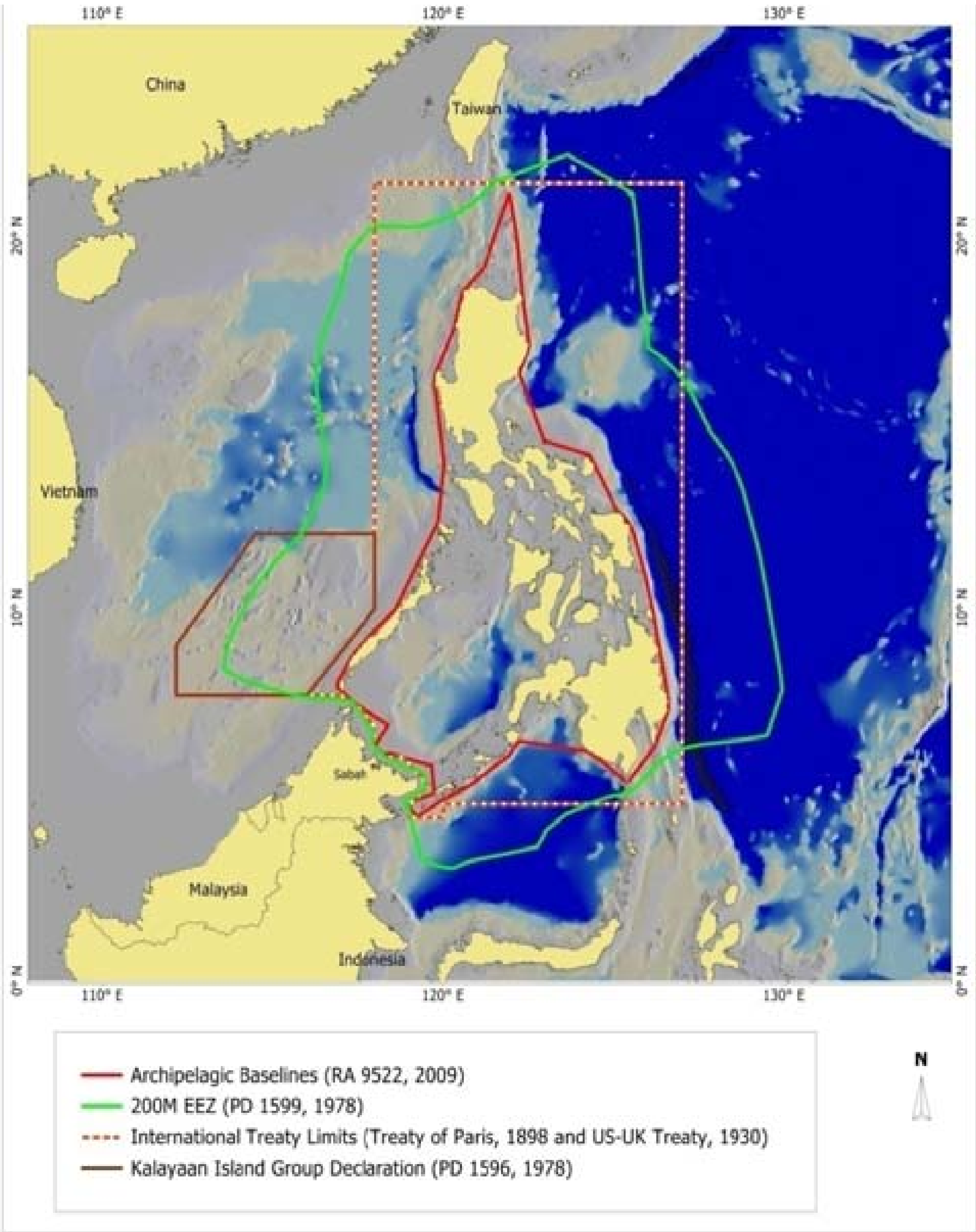
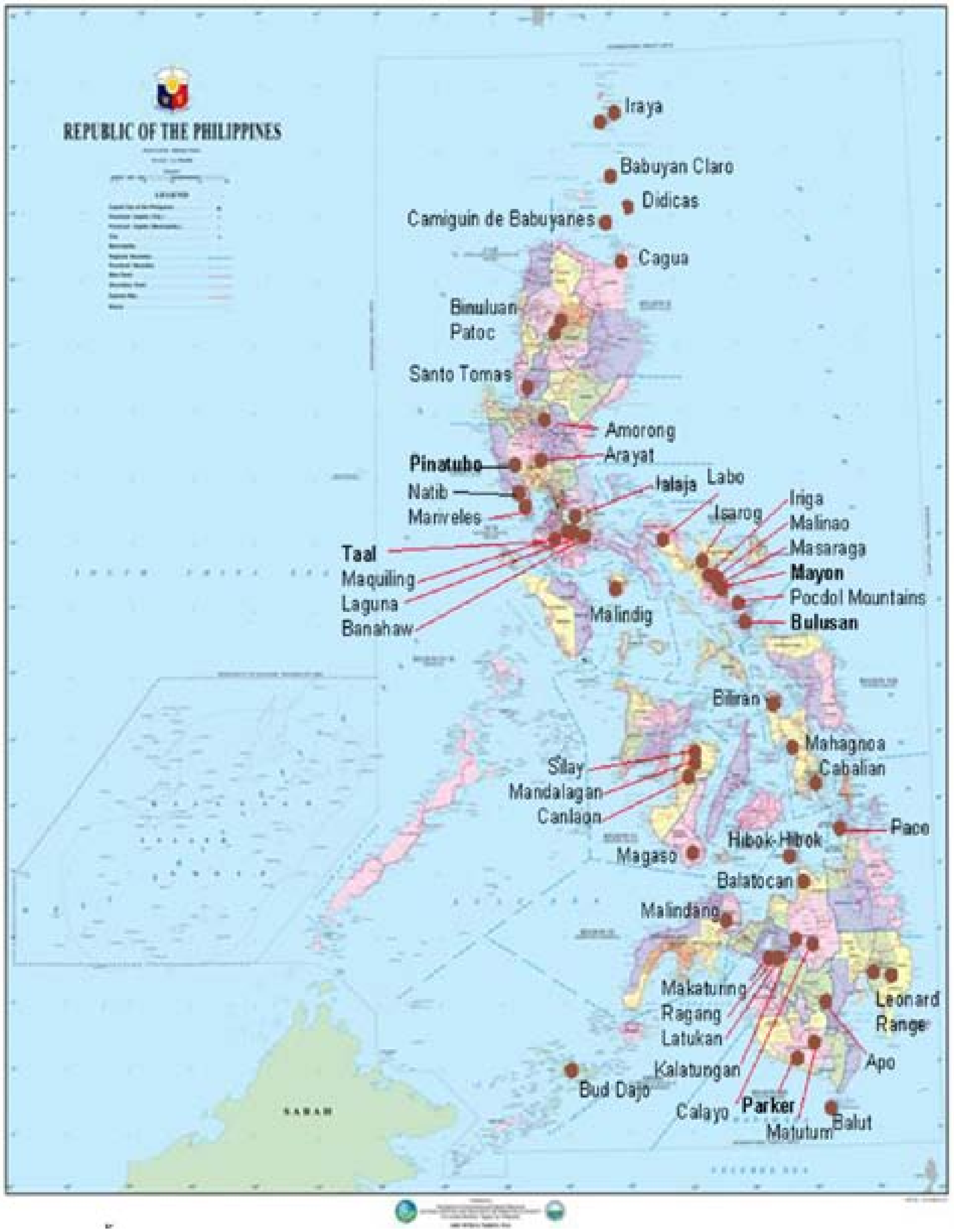


Figure 2.2 Distribution of some of the active and inactive volcanoes in the Philippine archipelago
(Source: modified from http://www.chanrobles.com/philippinemapofvolcanoes.htm



Islands with 20 or more active volcanoes often experience seismic activities. The most recent volcanic eruptions were in 1993 (Mayon Volcano in the Bicol Region, southeastern Luzon, dormant for 600 years) and in June 1991 and July 1992 (Mount Pinatubo, in central Luzon).

Philippine plate convergence occurs in three main locations: the west-dipping Philippine trench and the east Luzon trough to the east; the east-dipping subduction zones of the Manila-Negros-Sulu-Cotabato trench system; and the left-lateral Philippine Fault that cuts across the length of the archipelago (Magdaraog, 1998). The Philippine trench and east Luzon trough are convergent tectonic plate boundaries located about 100 km. from the eastern coastline of the Philippines. Earthquakes are experienced along these trenches as the Philippine Sea plate is being subducted or pushed under the archipelago. This westward subduction of the Philippine Sea plate also results in volcanic activities in Bicol and Leyte.

2.4 Climate

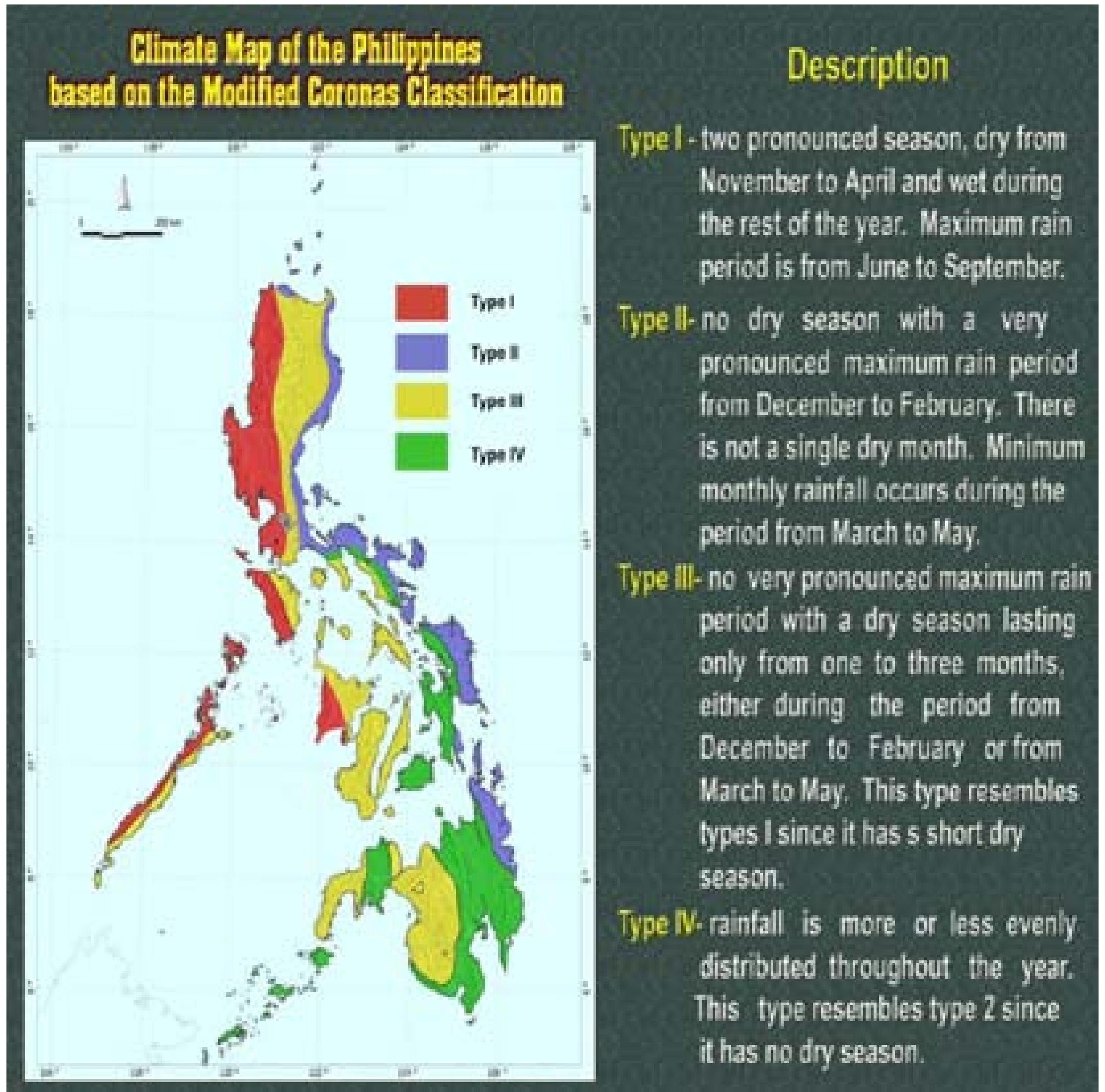
The climatology of the Philippines as an archipelagic state is characterized by the decadal patterns of large-scale variability manifested in the Pacific Decadal Oscillations (PDO) and also from the patterns of inter-annual variations, *e.g.,* at least two decades, in the monsoons. The dominant wind system over the Philippines is the Asian monsoon that blows from the northeast between December and March (*amihan*) and from the southwest between June and October (*habagat*) (Wang, *et al.* 2001). These processes affect the temperature, wind, and rainfall patterns in the country, and the north-south and east-west trends are classified accordingly into four Corona classifications (Type I–Type IV; Figure 2.3). Type I shows two pronounced seasons: dry from November to April and wet the rest of the year. Maximum rains are exhibited from June to September. Type II exhibits no distinct dry season with maximum rains from December-February, and minimum monthly rainfall from March-May without a distinct dry month. Type III does not show a distinct maximum rainfall with a dry season of around three months either in December-February or March-May, resembling Type I with its short dry period. Type IV resembles Type II having no dry season and having evenly distributed rainfall throughout the year.

Recent work by the Remote Sensing Information for Living Environments and Nationwide Tools for Sentinel Ecosystems in our Archipelagic Seas Program for Climate Change (RESILIENT SEAS Program, 2009-2012), funded under the DOST-PCAMRD, provides a complementary classification of the seas around the archipelago (Figure 2.4). This 10-11 category classification is crucial to understanding land and sea interactions in the coastal marine environments *(see further discussion in Chapter 5: Threats and Vulnerabilities)*. An integrated perspective of the two patterns and processes is imperative to meeting the challenges of climate change and adapting wisely to a rapidly changing environment.

The distinct exposure conditions that affect the various areas in the Philippines have led to the creation of 11 distinct climate typologies as seen in Figure 2.4 (David *et al.*, unpublished). Data on precipitation, sea surface temperature, and sea surface height were considered in the typologies.

Coastal and marine climate classification by David *et al.* (unpublished) shows the variability of Sea Surface Temperature Change (STC) (Figure 2.4). Cluster I exhibits the highest increase in observed Sea Surface Temperature (SST) data. Together with Clusters II, III, VI, VII and X, these show higher intensity of Sea Surface Height (SSH) anomaly during negative Pacific Decadal Oscillation (PDO) (occurring

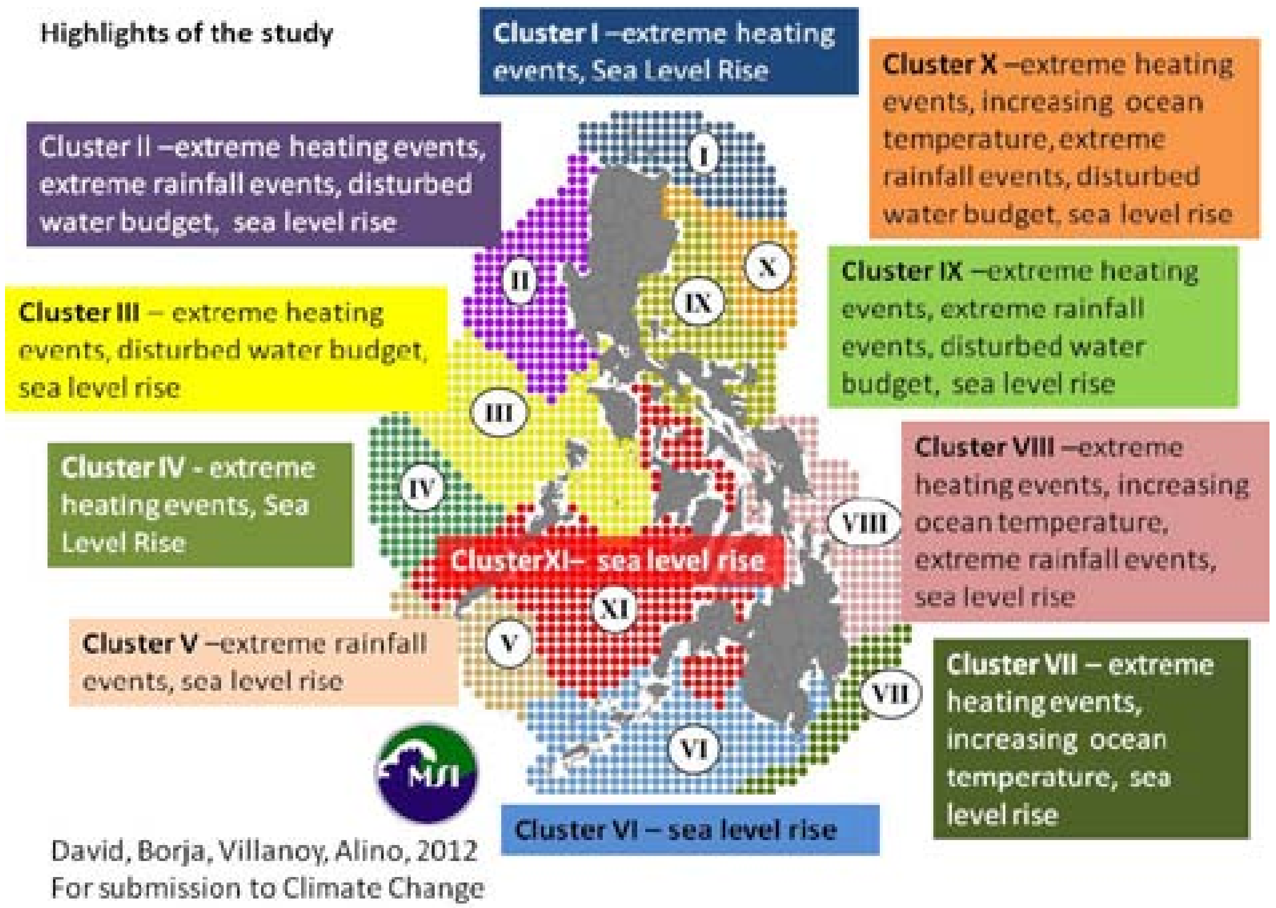
Figure 2.3 Climate map of the Philippines based on the modified Coronas classification *(Source: http://kidlat.pagasa.dost.gov.ph/cab/statfram.htm)*



every 10 years). Cluster II shows the negative SST anomaly during El Nino and positive during La Nina. Together with Clusters III and IV, they are characterized by a pronounced rainfall during the southwest monsoon. Most clusters have cooler SST during the northeast monsoon except Clusters V, VI and VII wherein lowest SST increase is observed in Cluster VI. Winds are highly monsoonal in Clusters I, VIII, IX and X with strong winds during the northeast monsoon.

Coastal and marine climatology Clusters I-V extend from north to south mostly exposed to the southwest monsoon, wherein Clusters I-III nearly corresponds to Type I climate of the modified Philippine Coronas Classification (PCC) in Figure 2.3. Cluster III overlaps with Clusters IV, V and some parts of VI nearly coincide with Type III of PCC. Type IV of the PCC is comparable with Clusters VI-VIII and some parts of IV. The Clusters (VIII-X) that are predominantly exposed to the northeast monsoon are similar to Type II of the modified PCC.

Figure 2.4 ClimateTypologies in the Philippines *(Source: David et al., unpublished)*

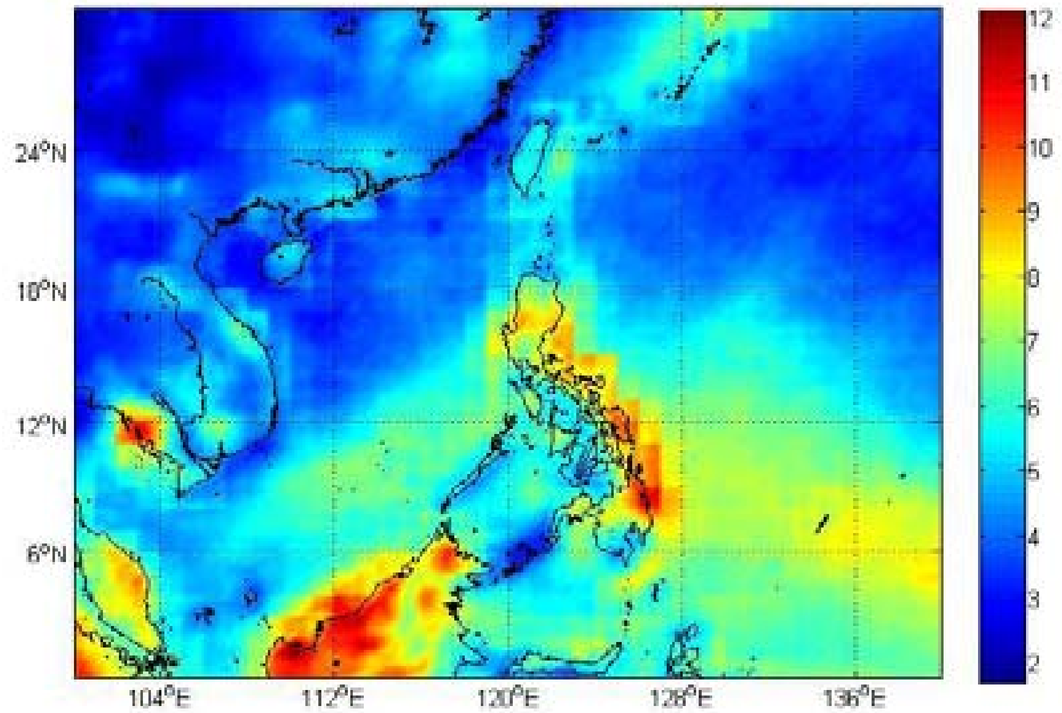


2.5 Hydrology

The Philippines receives an average rainfall of 2,500 millimeters per year (Magdaraog, 1998). Taking into account the effect of uneven distribution (Figure 2.5), slope, permeability and other factors on water availability, the average annual supply of surface runoff is estimated at 125,790 million cubic meters (mcm). Based on estimates of surface runoff and ground infiltration, the amount of water available for consumption is around 431 mcm per day. The estimated total demand for water in the country is 77 mcm per day. Around 84% of this is utilized by the agriculture sector for irrigation of the 1.5 million hectares of cropland. Domestic consumption amounts to 4.62 mcm per day, while the remaining 8% is used for commercial and industrial purposes.

Among the primary sources of surface freshwater are rivers, lakes and marshes (Magdaraog, 1998). The Philippines has over 70 lakes, including Laguna Lake (located southeast of Manila), which is the second largest lake in Southeast Asia.

Figure 2.5 Daily mean rainfall distribution in the Philippines
(Source: RESILIENT SEAS Project, DOST-PCAMRD, *2011)*



There are around 421 principal river basins around the country, the total area of which comprise 66% of the country's total land area. River basins with total area of 990 square kilometers or more are considered major river basins (Figure 2.6). These major river basins are sustained by more than 400 watersheds, which are areas of land that catch rain and drain or seep into a marsh. Rivers include the Abram River, Abulog River, Agno River, Bicol River, Cagayan River, Pampanga River, Pasig-Marikina River in Luzon; Ilabangan River, Jalaur River, Panay River in the Visayas; and Agus River, Agusan River, Buayan-Malungun River, Cagayan (de Oro) River, Davao River, and the Mindanao River in Mindanao.

There are around 21 million hectares of watersheds around the country, comprising 70% of the Philippines' total land area. Some of these watersheds are exposed to anthropogenic influences (caused by man), such: as logging, upland farming and pollution, bringing 17 major watershed areas in the country on the critical list. These 17 critical watersheds are: Santo Tomas, Busol, Lonoy, Angat, Marikina, Kaliwa, Umiray, Maasin, Mananga, Kotkot-Lusaran, Binahaan, Pasonangca, Ambogoc, Mahoganao, Malagos, Koronadal, Lake Lanao.

Another major source of freshwater is groundwater from aquifers underneath the earth's surface. Groundwater accounts for 14% of the total water resource potential of the Philippines (*Philippines Environment Monitor, 2003*). The safe yield or the amount of groundwater available for abstraction without resorting to groundwater extraction is estimated at 31,554 mcm per annum (Magdaraog, 1998). Areas with very high groundwater potential are Regions II (Cagayan Valley), VIII (Eastern Visayas), XI (Southeastern Mindanao), and X (Northern Mindanao) (The World Bank Group, 2003). Shallow wells cover 57,787 hectares while about 123,064 km^2 are deep well (www.psdn.org.ph). About 50% of the population utilizes ground water for drinking. The agricultural sector has the highest demand for groundwater resources.

Figure 2.6. Major river basins in the Philippines (Source: modified from Magdaraog, 1998)

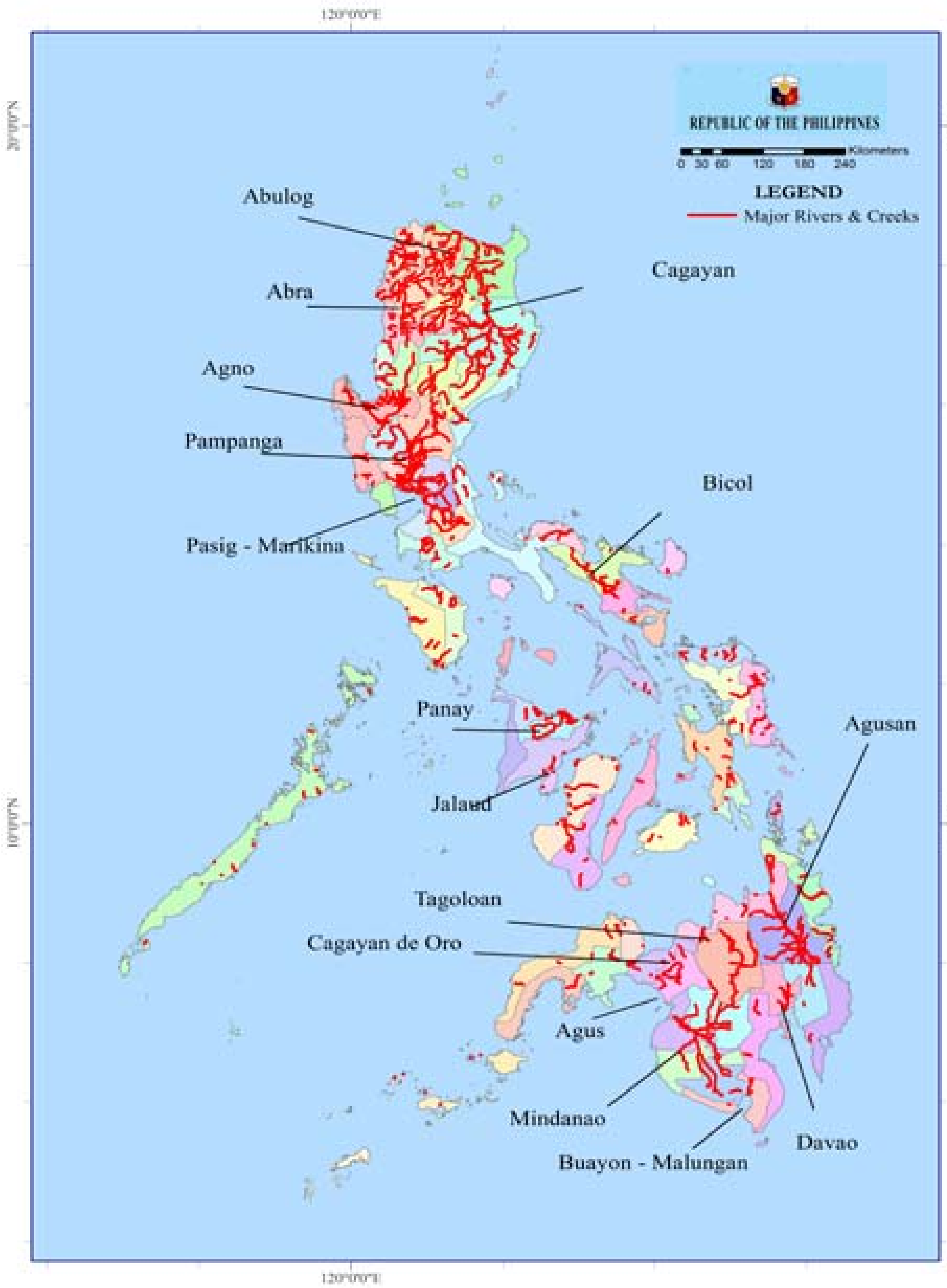
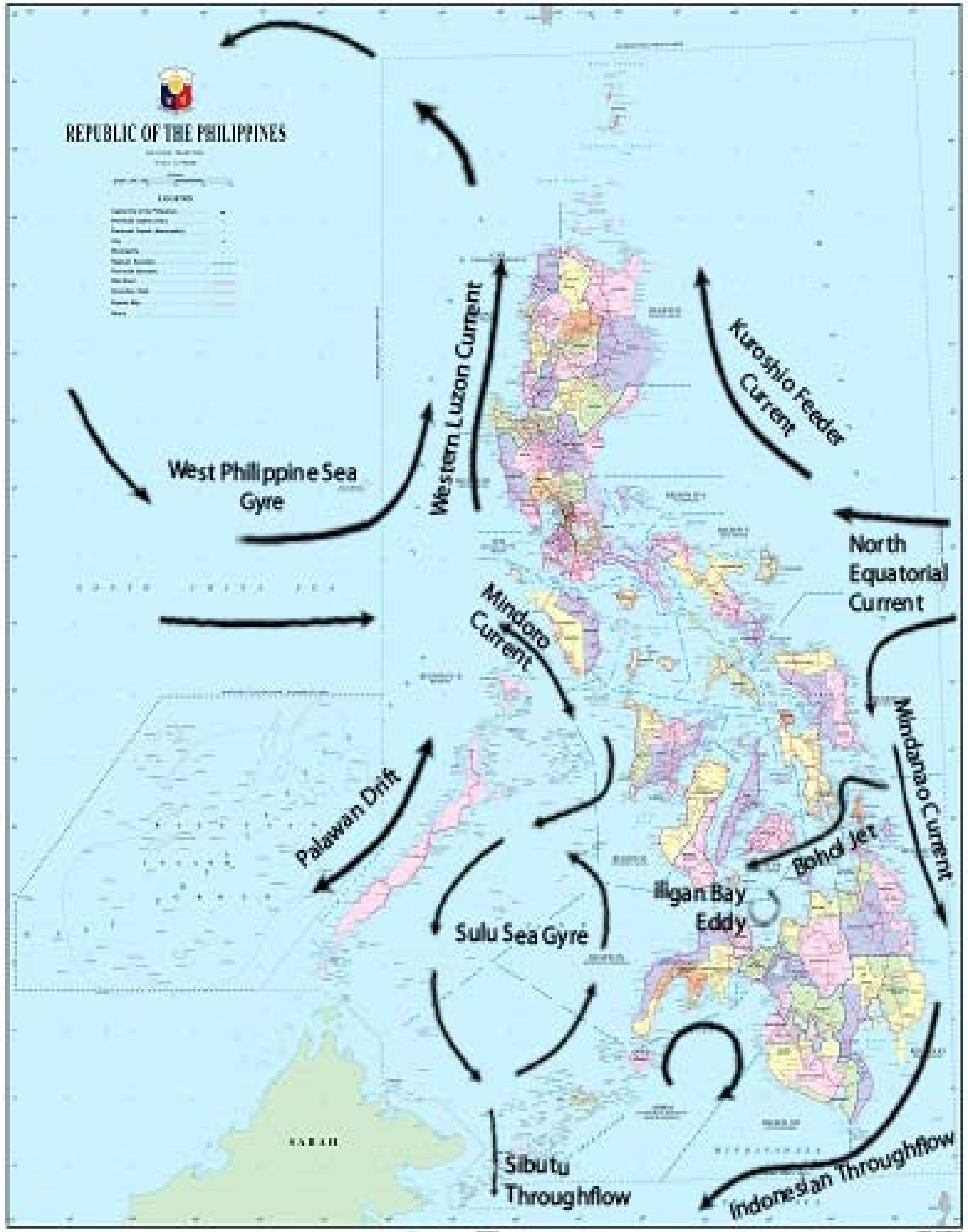


Figure 2.7 Water circulation around the Philippine archipelago *(Source: modified from David et al., unpublished)*



2.6 Oceanography

The ocean circulation around the Philippine Archipelago (Figure 2.7) is a product of the complex dynamics among the bathymetry, the seasonally reversing monsoons, as well as the tidal and non-tidal circulation between the West Philippine Sea and the Western Pacific (Wang *et al.,* 2008; Han *et al.,* 2009; Gordon *et al.,* 2011 as cited in Villanoy *et al.,* 2011).

The direct connection of the Philippine seas to the Western Pacific is through the San Bernardino Strait and the Surigao Strait. The North Equatorial Current bifurcation near 14^{o}N (Nitani, 1972; Toole *et al.,* 1990; Qiu and Lukas, 1996; Qiu and Lukas, 2003) forms the western boundary for the equatorward-flowing Mindanao Current and the nascent poleward-flowing Kuroshio. Pacific water seeps into the Sibuyan and Bohol Seas by way of the shallow San Bernardino and Surigao straits, respectively, and in greater volume through the 2,200 meter-deep Luzon Strait into the West Philippine Sea (Metzger and Hurlburt, 1996, 2001; Centurioni *et al.,* 2004; Qu *et al.,* 2006). On the western side of the archipelago, water flows from the West Philippine Sea through the Mindoro and Panay Straits. The Mindoro/Panay throughflow reaches into the Sulu Sea and adjacent Bohol and Sibuyan Seas via the Verde Island Passage and the Tablas and the Dipolog Straits. The West Philippine Sea also connects to the southern Sulu Sea via the Balabac Strait. The Sibutu Passage links the southern Sulu Sea to the Sulawesi Sea (Celebes Sea).

Once within the confines of the Philippine Archipelago, circulation and stratification are subjected to monsoonal winds that are textured by passages between island geomorphologies (land forms that evolved through time) (Pullen *et al.,* 2008, 2011; May *et al.,* 2011), by sea-air heat and freshwater fluxes including river outflow, and by regions with strong tidal currents. Overflow across < 500-m-deep topographic sills ventilates the depths of isolated basins, the Sulu Sea, and the smaller Bohol and Sibuyan Seas.

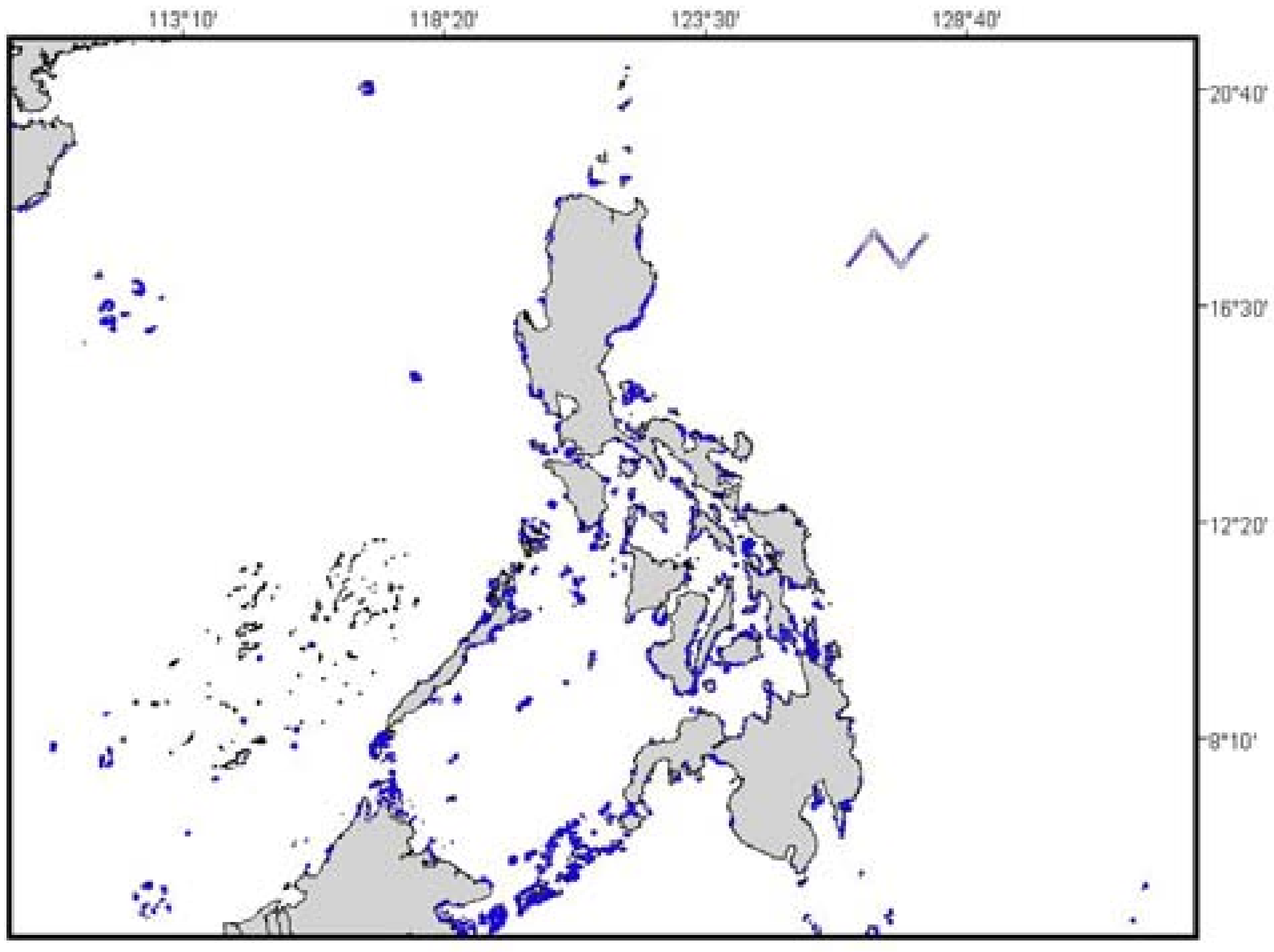
Monsoonal winds (Northeast and Southwest) forced through the complicated topography can give rise to lee eddies and wind stress curl zones, particularly during monsoon surges (Pullen *et al.,* 2008, 2011). Winds blowing through gaps between islands can induce upwelling (*e.g.,* off the northern coast of Zamboanga Peninsula) and downwelling along the leeward sides of the islands (Chavanne *et al.,* 2002).

2.7 Coral Reefs

The Philippines lies within the Indo-Malayan Triangle, which is the center of marine biodiversity (Burke *et al.,* 2002). Marine water resources are found within the total territorial water area of two million sq. kms., shelf area of 184,600 sq. kms., coral reef area, and coastline of 17,460 sq. kms. The latter includes swamplands of 246,063 hectares (has.) and fishponds of 253,854 has.

The Philippines has the second largest coral reef area in Southeast Asia (Burke *et al.,* 2002) (Figure 2.8). Estimates of the areal extent of Philippine coral reefs range from 10,750 to 33,500 sq. kms. depending on the varying assumptions of the maximum depth limits to which corals can be found (Carpenter, 1977, Swedish Space Corporation, Bryant *et al.,* 1998, Gomez *et al.,* 1994, Burke *et al.,* 2002, 2011). The estimate of 26,000 sq. kms. by Burke *et al.,* (2002) is the value that will be considered in this report, given the resolution in the method appropriate within the scale of the Philippine archipelago. Some 500 species of scleractinian or "stony" corals, 12 of which are endemic, have been identified(e.g.,Veron 1995). Annex A lists the number of species per family of corals identified in several sites in the Philippines (collections in the Coral Laboratory of the Marine Science Institute, University of the

Figure 2.8 Distribution of coral reefs in the Philippines (*Source: CT Atlas.reefbase.org)*



Philippines, headed by Dr. Wilfredo Licuanan).

Based on the biophysical attributes of the reef communities, six biogeographic regions have been identified: the West Philippine Sea (South China Sea), Sulu Sea, Celebes Sea, Visayas Region, the Northeastern Philippine Sea, and the Southeastern Philippine Sea (Nañola *et al.,* 2002).

Under the Coral Triangle Initiative, the Philippines declared two priority seascapes: (1). the Sulu-Sulawesi Marine Ecoregion (SSME), which has an existing formal cooperation agreement with Indonesia and Malaysia, and (2). the West Philippine Sea (WPS). The former encompasses the Sulu Sea, Celebes Sea, Visayan Sea and a small part of the West Philippine Sea biogeographic region. On the other hand, the latter covers only the West Philippine Sea biogeographic region.

The six biogeographic regions are further subdivided into 17 sections based on the extent of coral reef habitat as illustrated in Figure 2.9 and Table 2.1. The SSME seascape has 11 of these sections, while WPS seascape has seven.

The Palawan group of islands, including the Kalayaan Islands Group has the highest proportion of coral reefs (41.52%), followed by the Visayas region (29.07%), and Mindanao (18.14%), while Luzon and Mindoro have the least (11.27%) coral reef area (Table 2.1).

Figure 2.9 The six biogeographic regions in the Philippines based on coral reef fish communities and associated benthic characteristics: WPS -West Philippine Sea, SS - Sulu Sea, CS - Celebes Sea, VR - Visayas Region, NP - Northeastern Philippine Sea, SP - Southeastern Philippine Sea *(Source: Nanola et al., 2002)*

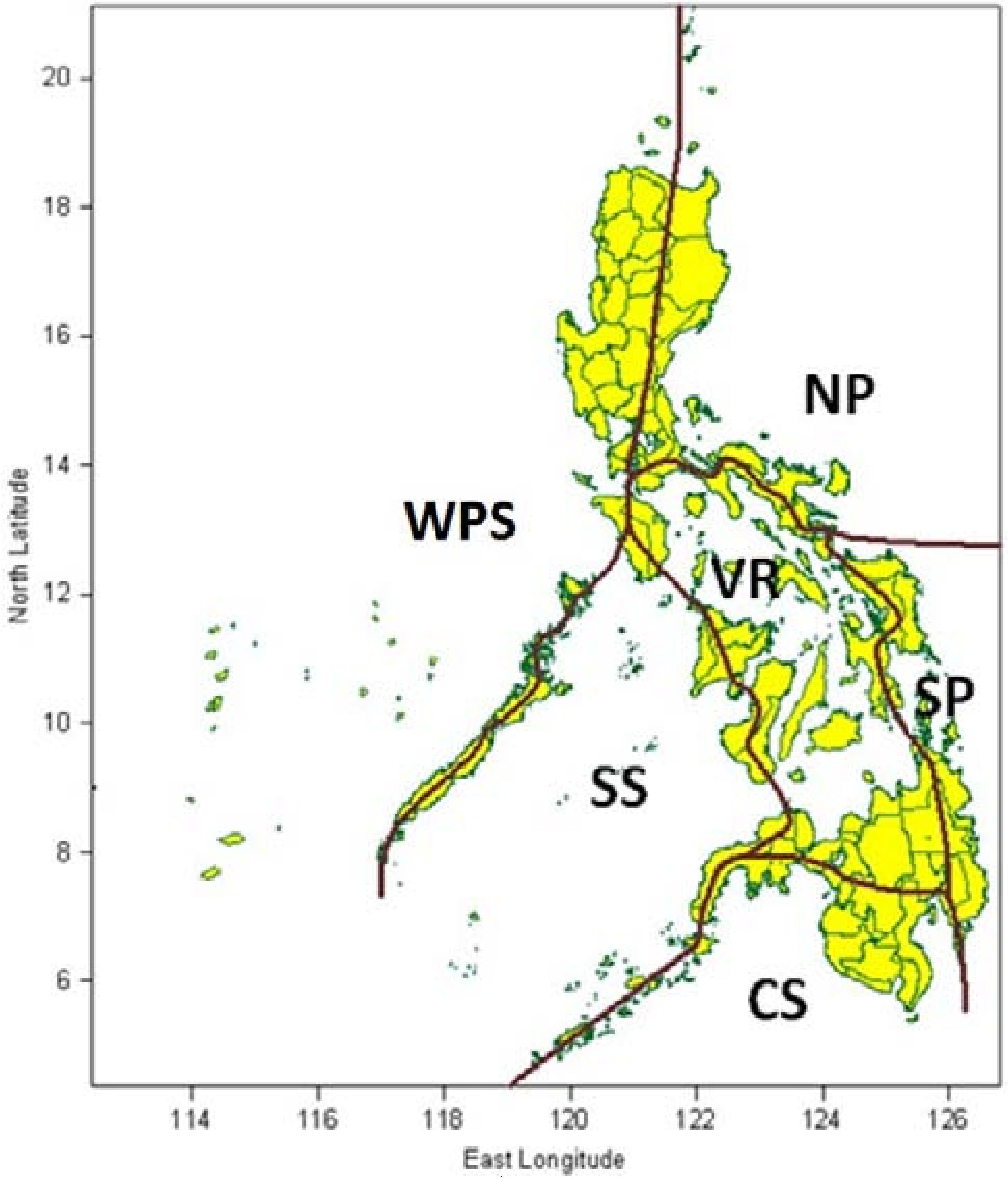


Table 2.1 Estimated cover of coral reef area among the different sub-divisions depicted in figure 2.9 *(Source: Ong et al., 2002, Nañola et al., 2011)*

REGION	Area (km²)	% of total area
WEST PHILIPPINE SEA		
West Philippine Sea	306.5	2.85
Kalayaan Islands	3,257.7	30.3
Western Palawan (NW Palawan Shelf)	147.9	1.38
SULU SEA		
Sulu Sea	468.8	4.36
	222.7	2.07
Calamianes/ Balabac transition	108.2	1.01
Visayas transition	143.4	1.33
Sulu archipelago transition	114.6	1.07
CELEBES SEA		
Mindanao	811.3	7.55
VISAYAN REGION		
South Luzon facing Visayas Region	229.3	2.13
Western Visayas	298.7	2.78
Central Visayas	1,750.8	16.29
Eastern Visayas	1,075.1	10
Northern Mindanao (including Southern Bohol)	317.3	2.95
NORTHEASTERN PHILIPPINE SEA		
	20.4	0.19
Eastern Luzon	655.5	6.1
SOUTHEASTERN PHILIPPINE SEA		
Eastern Mindanao	821.6	7.64
TOTAL	**10,749.8**	**100.00**

Around 3,053 species of fish are found in the Philippines (Herre, 1953, Allen et al, 2003, Allen & Erdman, 2009, Fishbase.org 2009), 2,724 of which are marine-based. Pelagic fish species are around 177 whereas demersal species total 2,351 (1,658 of this are reef-associated and 693 are associated with other nearshore habitats). There are 277 deep-sea fish species while 173 species are found in freshwater environments. Nanola *et al.,* (2011) identified a total of 721 species of reef-associated fishes from their study transects in 205 genera belonging to 52 families, and four species of cartilaginous fishes in three genera in two families. The most speciose families were Pomacentridae (125 species), Labridae (105), Serranidae (48), Chaetodontidae (41), Acanthuridae (36), Scaridae (36), and Apogonidae (30). These families comprised 58% of the total number of species observed. Other important families observed with considerable number of species were Lutjanidae (21), Blenniidae (20), Balistidae (18), Pomacanthidae (18), Holocentridae (17), Nemipteridae (17), Carangidae (15) and Gobiidae (15) (Table 2.2). Allen *et al.* (2011) identified at least 800 reef fish species in Calamianes Islands, Palawan alone. These numbers may not represent the actual total number of species in the Philippines given the limited size of sampling sites.

Nañola *et al.* (2011) provided the total number of reef fish species observed by family in the six biogeographic regions in the Philippines listed in Table 2.2. The list excludes all families with only one species observed (*i.e.*, Alopiidae, Aulostomidae, Callionymidae, Carcharhinidae, Centriscidae, Centropomidae, Clupeidae, Echeneidae, Fistulariidae, Gobiosocidae, Kyphosidae, Leiognathidae, Malacanthidae, Platycephalidae, Plotosidae, Zanclidae.

Table 2.2 Total number of species of reef fish observed by family in the six biogeographic regions in the Philippines *(Source: Nañola et al., 2011)*

Number	Family	CS	NP	WPS	SP	SS	VR	All Regions
Class Osteichthys								
1.	Acanthuridae	26	28	27	21	24	18	36
2.	Apogonidae	14	16	15	11	13	21	30
3.	Balistidae	13	7	10	5	11	6	17
4.	Blenniidae	8	9	15	7	9	7	21
5.	Caesionidae	7	11	10	5	11	7	12
6.	Carangidae	5	5	6	1	11	3	15
7.	Chaetodontidae	32	35	30	34	34	27	41
8.	Cirrhitidae	3	3	4	3	4	3	5
9.	Diodontidae	2	1	1	0	1	1	3
10.	Ephippidae	2	1	1	0	3	2	3
11.	Gobiidae	2	6	9	1	3	6	15
12.	Haemulidae	5	5	7	6	8	6	9
13.	Holocentridae	8	10	8	9	13	2	18
14.	Labridae	75	70	82	57	84	69	105
15.	Lethrinidae	3	3	6	3	5	2	7
16.	Lutjanidae	14	11	12	9	14	7	21
17.	Microdesmidae	2	3	4	2	3	3	6
18.	Monacanthidae	11	8	9	6	5	8	13
19.	Mullidae	9	9	8	7	11	7	12
20.	Muraenidae	2	0	1	1	2	0	4
21.	Nemipteridae	11	8	14	5	13	12	17
22.	Ostraciidae	4	3	4	3	3	4	4
23.	Pempheridae	1	1	1	1	1	2	2
24.	Pinguipedidae	5	4	5	2	6	3	6
25.	Pomacanthidae	11	15	14	11	13	10	18
26.	Pomacentridae	83	85	79	64	87	72	125
27.	Priacanthidae	0	1	1	0	2	1	3
28.	Pseudochromidae	2	3	4	3	2	2	5
29.	Scaridae	23	27	29	19	28	23	36
30.	Scombridae	1	1	2	0	0	0	3
31.	Scorpaenidae	3	3	3	1	3	3	7
32.	Serranidae	26	16	31	12	33	19	48
33.	Siganidae	9	10	8	9	10	8	11
34.	Sphyraenidae	2	1	2	0	3	2	3
35.	Syngnathidae	1	2	2	1	0	2	3
36.	Synodontidae	3	4	4	2	3	3	5
37.	Tetraodontidae	9	9	10	5	6	8	13
	Other families	8	7	6	5	9	7	16
Class Chondrichthys								
1.	Dasyatidae	0	0	0	0	3	0	3
	Total species	445	441	484	331	494	386	721

A time series monitoring (bi-annual) of coral reefs in the Philippines has been carried out since 2002 and showed declining trends in the species diversity of reef fish in some sites (Reefs Through Time, 2003, 2004, 2006, 2008, 2010).

2.8 Seagrass

The Philippines has 16 seagrass species as shown in Table 2.3 (Fortes, Unpublish, PNSC, 2004, Burke *et al*, 2002).

Table 2.3 List of the seagrass species found in the Philippines
(Source: Fortes, Unpublished)

FAMILY	Species
CYMODOCEACEAE	*Cymodocea rotundata*
	Cymodocea serrulata
	Halodule pinifolia
	Halodule uninervis
	Syringodium isoetifolium
	Thalassodendron ciliatum
RUPPICEAE	*Ruppia maritima*
HYDROCHARITICEACE	*Halophila becarii*
	Halophila decipiens
	Halophila minor
	Halophila minor var nov.
	Halophila ovalis
	Halophila spinulosa
	Halophila sp.
	Enhalus acoroides
	Thalassia hemprichii

Fortes and Santos (2004) reported that based on data from 96 sites around the country, the existing seagrass beds have an estimated total area of 978 km^2., of which around 36% (or 343 km^2) were identified using combined satellite images and ground truth surveys, while the rest are based on satellite images only (Annex B). The Seaweed Laboratory of the Marine Science Institute, University of the Philippines-Diliman (headed by Dr. Miguel Fortes) is presently undertaking an assessment on the updates of seagrass status in the Philippines.

In the Philippines, seagrasses have been used as packing material, children's toys, compost for fertilizer and animal feed. However, the major importance of seagrass beds to the livelihood of coastal populations lies in its ecological functions and support to fisheries and, to a certain extent, tourism. Seagrass beds provide habitat for juvenile and small adult fishes (*e.g.*, rabbitfish), invertebrates, reptiles (turtles) and mammals (Dugong). They also serve as buffer against waves and storm surges by maintaining sediment stability, hence, protecting the neighboring mangrove ecosystem and coral reefs. In addition, the high organic matter production of seagrass beds serve as nutrient source for these associated ecosystems.

2.9 Mangroves

The Philippines had around 400,000-500,000 hectares of mangrove area in the early 1900s (Brown and Fischer, 1998). The country is one of the richest in mangrove species, with 42 mangrove species representing 18 families (Table 2.4) (Spalding et al. 2010, Polidoro et al.) 2010, Samson and Rollon 2011).

Table 2.4 List of mangrove species in the Philippines
(Source: Spalding et al. 2010, Polidoro et al., 2010, Samson and Rollon, 2011)

FAMILY	SPECIES
ACANTHACEAE	Acanthus ebracteatus
	Acanthus ilicifolius
ARECACEAE	Nypa fruticans
AVICENNIACEAE	Avicennia alba
	Avicennia marina
	Avicennia officinalis
	Avicennia rumphiana
BIGNONIACEAE	Dolichandrone spathacea
BOMBACACEAE	Compostemon philippinense
	Campostemon schultzii
CAESALPINIACEAE	Cynometra iripa
COMBRETACEAE	Lumnitzera littorea
	Lumnitzera racemosa
EUPHORBIACEAE	Excoecaria agallocha
LYTHRACEAE	Pemphis acidula
MELIACEAE	Xylocarpus granatum
	Xylocarpus moluccensis
MYRSINACEAE	Aegiceras corniculatum
	Aegiceras floridum
MYRTACEAE	Osbornia octodonta
PLUMBAGINACEAE	Aegialitis annulata
PTERIDACEAE	Acrostichum aureum
	Acrostichum speciosum
RHIZOPHORACEAE	Bruguiera cylindrical
	Bruguiera exaristata
	Bruguiera gymnorhiza
	Bruguiera hainessi
	Bruguiera parviflora
	Bruguiera sexangula
	Ceriops decandra
	Ceriops tagal
	Kandelia obovata
	Rhizophora apiculata
	Rhizophora mucronata
	Rhizophora stylosa
	Rhizophora x lamarckii
RUBIACEAE	Scyphiphora hydrophylaceae
SONNERATIACEAE	Sonneratia alba
	Sonneratia caseolaris
	Sonneratia ovate
	Sonneratia x gulngai
STERCULIACEAE	Heritiera littoralis

The estimated mean production rates of Philippine mangroves range from 1-2 gram Carbon m^{-2} d^{-1} (Jacinto *et al.,* 2000). Mangrove forests serve as habitat to at least 54 species of crustaceans, 63 species of mollusks, and 110 species of fish, some of which are commercially important (PNMC, 1987 in PCAMRD, 1991; De la Paz and Aragones, 1985). Mangrove areas are utilized for aquaculture, salt production, and human settlement, and are important sources of forest products (*e.g.*, timber) as well as fishery products (*e.g.*, fish, shrimps, mollusks, crabs, fry) (Jacinto *et al.,* 2000).

However, the intensive utilization of mangroves has resulted in the decline of their cover. An estimated 337,000 hectares (75%) of mangrove areas have been lost, the bulk (278,657 has. or 66%) of which occurred between 1950–1990 (Samson and Rollon, 2008). In the mid-1980s, the highest rate of exploitation was recorded in the Visayas (at 72%) followed by Luzon (at 64%). Lesser degree of utilization was found in Mindanao and Palawan, at 10% and 21%, respectively. By 2005, natural mangrove cover had declined to 247,268 hectares, while planted mangroves have already reached up to more than 44,000 hectares *(Primavera, et al., 2011)*. Satellite images showed that 29% of the country's total mangrove area can be found in Mindanao. Old growth mangrove forests are only found in Mindanao (4,582 has.) and Palawan (5,317 has.) (Zamora, 1990), while the rest are secondary growth. A few of the most diverse and extensive mangrove areas in the Philippines are listed in Table 2.5.

Table 2.5 Diversity and estimated area of the important mangrove areas in the Philippines (Source: UNEP, 2004)

Site	Present area (km^2)	True mangrove species
Busuanga, Palawan	12.98	24
Coron, Palawan	12.96	26
San Vicente, Palawan	1.33	14
Ulugan, Palawan	7.90	16
San Jose, Mindoro	4.83	25
Subic, Zambales	1.48	23
Pagbilao, Quezon	19.39	32

2.10 Other Coastal Wetlands

Wetlands, as defined in the Ramsar Convention, encompass both inland (*e.g.*, lakes, rivers, swamps, marshes, *etc.*) and coastal wetlands (coral reefs, seagrass beds, mangroves, tidal flats, estuaries, coastal lagoons, *etc*). The Philippines has extensive areas of both wetland types, four of which are now designated as Wetlands of International Importance or Ramsar sites—Olango Island Wildlife Sanctuary, Naujan Lake National Park, Agusan Marsh Wildlife Sanctuary, Tubbataha Reefs Natural Park. Scott (1993) reported an overall wetland loss of 78% for the Philippines, one of the highest in Southeast Asia. The proposed National Wetland Action Plan of the Philippines (NWAPP) 2011-2016 identified priority wetlands based on criteria agreed upon during consultations. These priority wetlands for the period covered have been identified to optimize resources and achieve maximum impacts and outcomes from the activities in the NWAPP. Annex C lists the priority coastal and marine wetlands.

2.11 Endangered/Threatened Species

It is crucial to determine a list of species that are at risk of extinction due to threats because it serves as a tool for conservation planning, management, monitoring, and decision making. A number of marine species are recognized as threatened, endangered or extinct (IUCN Red List, 2004). Threats to these species have to be categorized to guide conservation investment among them.

Annex D shows the various species in the Philippines that need protection because of their endangered or threatened status based on the IUCN Red List, 2011 and CITES, 2011. Dugong, cetaceans, whale sharks, and manta rays are among the species that are being caught and killed mainly for their high quality but inexpensive meat (Alava and Cantos, 2004). Sharks, which are the top reef carnivores, have been destroyed and are now rarely observed in most reefs in the Philippines (Alino *et al.,* 2004). Five species of marine turtles are found in the Philippines, namely: green, hawksbill, olive ridley, loggerhead and leatherback. Only green, hawksbill and olive ridley turtles nest in the Philippines and the rest forage in Philippine waters. Green and hawksbill turtles nest throughout the Philippines year round, while olive ridley turtles nest mostly in the provinces of Zambales, Bataan and Batangas, particularly from August to September. Other species are targeted for their eggs, leather, oil, skin, fat and bones, which are either consumed as food or used as bait to catch other species. Some of these body parts are also believed to have various medicinal properties.

For more information on threatened/endangered species, see Chapter 5 of this report (section 5.1.4).

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governance

Photo taken by Ms. Remar Gallego, as she and the rest of the participants listen to the *barangay* officials and officers share their experience in running the Tandayag Marine Protected Area in Amlan during a field visit on June 8, 2012 in connection with the GIZ ACCCoast-Rare Socila Marketing Lite Workshop held on 4-9 June 2012 in Dumaguete City, Negros Oriental.

Chapter 3
GOVERNANCE

Legal instruments are essential in various facets of nation-building. The processes that underlie governance and the issues emerging from the cycle of governance are the drivers that bring about the formulation of laws and policies. A wide range of Philippine laws and policies deal with issues pertaining to:

- food security, livelihood and socio-economic conditions of the population;
- environment and natural resources and habitats, and the need for their protection, conservation and development; and,
- related issues on security, safety, territory and law enforcement.

Many laws and policies have created and improved the organizational and institutional mechanisms for coastal and marine governance. Sector-specific laws and policies, particularly those relating to fisheries, mining, air and water use, biodiversity conservation, pollution control, and solid waste management were recently developed or revised and implemented.

Policy development efforts have focused on managing the environment and natural resources, with heavy emphasis on coastal resources and fisheries, which are vital to the socioeconomic conditions of the population. In general, policy approaches to protection, preservation and promotion of marine resources were multi-sectoral and participatory.

The major problems that hampered the implementation of existing laws and policies include:

- lack of coordination;
- conflicts and gaps in the provisions of different policies; and,
- lack of capacity or resources for policy implementation, among others.

Some examples of major gaps in policies include:

- the need to clarify provisions on the territorial limits of municipal waters;
- conflicts in jurisdiction of national and local authorities; and,
- issues of access by commercial fishing interests.

3.1 Early Development of Governance

The Constitution of the Philippines stands at the highest level among the national legal instruments for coastal and marine management. Article I of the 1987 Philippine Constitution recognizes the archipelagic character of the country, describing the national territory as consisting of *"the Philippine archipelago, with all the islands and waters embraced therein and all other territories over which the Philippines has sovereignty or jurisdiction, consisting of its terrestrial, fluvial and aerial domains, including its territorial seas, the seabed, the subsoil, the insular shelves and other submarine areas. The waters around, between and connecting the islands of the archipelago, regardless of their breadth and dimensions, form part of the internal waters of the Philippines."*

The Constitution also highlights the importance of environment as it declares as state policy the protection and advancement of the right to health of the people and their right to a balanced and healthful ecology in accordance with the rhythm and harmony of nature (Article II, Sections 15-16). In terms of governance, the Constitution established a regime that recognizes the right of the people and their organizations *"to effective and reasonable participation at all levels of social, political and economic decision-making"* (Article XIII).

3.2 From National to Local Governance

The National Integrated Protected Areas System (NIPAS) Act of 1992 set out a national framework for the establishment of national parks and protected areas. Under this law, ten sites were declared high-priority protected areas, including: the Turtle Island Wildlife Sanctuary; Siargao Island Protected Landscapes and Seascapes; Batanes Protected Landscapes and Seascapes; and Apo Reef Marine Natural Park.

Similarly, the Constitution guarantees autonomy to local governments, including a system of decentralization (Article II, Section 25; Article X, Sections 2 and 3). The Local Government Code of 1992 (Republic Act 7160) was enacted providing for decentralization and the devolution to local government units (LGUs) of the delivery services and other functions related to local development. Among the specific functions devolved to LGUs are the promotion of health and safety, and the enhancement of the right of the people to a balanced ecology (Section 16, Republic Act 7160).

3.3 Towards an Integrated Management

In 1994, the Philippines adopted a National Marine Policy (NMP), which was to have provided an integrated policy planning and management framework for addressing the entire range of the country's marine, coastal and ocean-related interests (ARCDEV 2004). Although the 1994 NMP was far more comprehensive in scope than previous marine-related policies, there are still some gaps in its agenda, such as the absence of any treatment of major economic sectors, such as shipping and tourism. In addition, it proposes a sectoral rather than an integrative management framework. Hence, the governance of the Philippines' marine sector remains, for the most part, fragmented and uncoordinated within the nine years of the NMP's implementation.

The Government of the Philippines developed a draft document, titled "A Framework for Sustainable Philippine Archipelagic Development (ArcDev)", which aims to --

- facilitate ways of improving the implementation of mechanisms and of harmonizing various uses of resources and access arrangements;
- provide an enabling environment in which to harness the synergistic benefits of an integrated archipelagic policy; and,
- enhance an appreciation and awareness of the significance of a holistic approach towards addressing the various needs of the archipelago.

ArcDev focuses on the coastal and marine areas of the country, in an attempt to redress the imbalance in the existing planning and management framework that has, all along, unduly favored terrestrial areas.

3.4 Large-scale Biodiversity Conservation

Proclamation 1028 of June 1997 declared the entire Sulu and Celebes Seas as an Integrated Conservation and Development Zone. The Presidential Commission for the Integrated Conservation and Development of the Sulu-Celebes Seas (PCICDCS) was created to formulate, review, and implement programs which ensure the conservation of the rich marine biodiversity of the area. At the same time, it aims to promote sustainable development in coastal communities through income-generating opportunities.

Executive Order 578 was issued by the President in 2006 establishing the national policy on biological diversity, prescribing its implementation throughout the country particularly in the Sulu-Sulawesi Marine Ecoregion (SSME) and the Verde Island Passage Marine Corridor. This policy also provides for the review and updating of the Ecological Conservation Plan (ECP), the creation of a Task Force on Verde Island Passage (VIP) to ensure sustainable use of its resources, and the identification of other marine biodiversity corridors within the SSME that require urgent attention and appropriate conservation and management strategies.

3.5 Locally Managed Marine Protected Areas

The Local Government Code of 1991 provides for the empowerment of LGUs to establish marine protected area (MPAs) within their jurisdiction through municipal ordinances. The Fisheries Code of 1998 (RA 8550) also has a provision on the designation of at least 15% of municipal waters for fish refuges or sanctuaries and 25%-40% of fishing grounds as mangrove reserves.

From a community-based effort to a legally adopted strategy among local governments, the MPA initiative has gone a long way in the Philippines. Around 117 (10%) of the 1,208 MPAs in the country (MSN Report, 2009) were assessed in 2011, and 44% of these were reported to be effectively managed (CTSP Report, 2011). These results indicate that more effort is required to meet the goal of protecting at least 20% of the municipal waters by 2020 (CTI NPOA, 2011). Management level in the Philippines is generally "low" (Bleakley and Wells, 1995) and this is attributed mainly to the lack of public understanding and support, weak enforcement arrangements, lack of sustainable financing, unclear jurisdiction, roles and accountability for the implementation of MPAs, unclear hierarchy of objectives, adjacent stresses and disappointments with respect to unrealistic expectations of the rate of biomass buildup (Aliño *et al.,* 2004).

Establishment of alliances between municipalities or towns in the management of their MPAs in a network structure is mainly through Memoranda of Agreement by local chief executives (mayors and governors).

3.6 Sectoral Laws and Policies

3.6.1 Environment and Natural Resources

The broad policy framework for the management of the country's coastal and marine environment can be culled from the NMP, PDP, the Philippine Strategy for Sustainable Development (PSSD), the Philippine Action Plan for Agenda 21, the 1997 Philippine Environment Code and the various DENR administrative orders, proclamations, letters of instruction, *etc*.

The following are the major goals of the NMP with respect to coastal management and education:

- Explore, develop and manage offshore/ oceanic resources based on the principle of sustainable development;
- Develop and manage coastal resources within an integrated coastal zone management framework;
- Develop and enhance national marine consciousness through a comprehensive information program;
- Encourage the development of a marine research program;
- Adopt the "polluters pay" principle in ensuring the protection of the marine environment; and,
- Ensure the high quality of maritime professional schools and other such institutions for training experts in maritime-related issues.

The 1992 Declaration of the United Nations Conference on Environment and Development led the paradigm shift towards the protection, preservation and conservation of the environment. This was followed by the formulation of Agenda 21, Chapter 17 of which calls for the protection of the oceans, all kinds of seas, and coastal areas, as well as the protection, rational use, and development of living resources. Accordingly, the Philippines formulated the Philippine Agenda 21 that called for a national marine policy, the enactment of a Fisheries Code, and the preparation of Coastal Zone Management Plans at national, regional and local levels.

The main goal of the Philippine Agenda 21 is to have a *"harmonious integration of a sound and viable economy, responsible governance, social cohesion and harmony and ecological integrity to ensure that development is human development now and through future generations."* This implies that sustainability of development efforts must be ensured in order for rural development to make a significant impression on the daily lives of all stakeholders.

Pollution has been recognized as a serious problem as early as the 1970s, thus resulting in the enactment of various presidential decrees. Marine pollution control is enforced through PD 600, PD 979, and PD 984. More recently, pollution problems are addressed through Philippine Agenda 21, the 1999 Clean Air Act, and the various provisions of the Philippine Environment Code.

The Sanitation Code (PD 856) deals with the health problems posed by the environment, particularly with respect to the supply and quality of water. The Ecological Solid Waste Management Act of 2000 (RA 9003) enabled the shift to ecological systems not only to prevent land-based environmental degradation but also to prevent illegal dumping of wastes that causes pollution of waters. Other important laws include Proclamation 2146 "Proclaiming Certain Areas and Types of Projects as Environmentally Critical and Within the Scope of the Environmental Impact Statement System Established under PD 1586."

The following are the key legislations that cover coastal resource management:

- **Local Government Code (RA 7160)** – mandates development of medium-term community resource management plans;
- **Fisheries Code (RA 8550)** – addresses the need for coastal management as fisheries and other coastal and marine resources are used;
- **National Integrated Protected Areas System (RA 7586)** – enforces national and local ordinances for environmental protection;
- **Agricultural and Fisheries Modernization (RA 8435)** – establishes co-management systems, intergovernmental relations, links between People's Organizations and non-government organizations, cooperatives, and stipulates the provision of technical and extension services.

With respect to mangroves, Fisheries Administrative Order No. 60 puts forward the regulations concerning the issuance of fishpond permits and/or leases on public forestlands, to prevent wide-scale conversion of mangrove areas into fishponds. DENR Administrative Order No. 30 (1994) sets out the implementing guidelines for NGO-assisted community-based mangrove forest management projects for the DENR. A Joint Memorandum Circular No. 98-01 between DENR and the Department of Interior and Local Government (DILG) declared the Pagbilao Mangrove Swamp Forest as a genetic resources area and national training site for mangrove.

Governance

The Wildlife Resources Protection and Conservation Act of 2001 (RA 9147) provides for a system for species-specific protection measures at both the national and local government levels. Sections 4 and 91 of RA 8550 stipulate that it is unlawful for any person or corporation to gather, possess, sell or export ordinary, precious, and semi-precious corals, whether raw or in processed form, except for scientific or research purposes.

The Writ of *Kalikasan* is created from a provision in the Philippine Constitution (Article II, Section 16 on the Declaration of Principles and State Policies) that specifically deals on the conservation of resources. The purpose of the Writ of *Kalikasan* is to protect the rights of persons whose constitutional right to a balanced and healthful ecology is violated, or threatened with violation that may involve an environmental damage of such magnitude as to prejudice the life, health or property of inhabitants in two or more cities of provinces.

The National Climate Change Action Plan (NCCAP) was adopted in November 2011 to address a realistically achievable country-driven program of action for integrated climate change adaptation and mitigation for the next 18 years. The NCCAP focuses on seven strategic priorities, namely: (1) food security; (2) water sufficiency; (3) environmental and ecological stability; (4) human security; (5) sustainable energy; (6) climate-smart industries; and, (7) knowledge and capacity development. The NCCAP aims to, among others, enhance the resilience of fisheries production and distribution system, and that of fishing communities; develop, promote and sustain climate change mitigation and adaptation strategies for key ecosystems; increase and sustain management and conservation of key biodiversity areas; ensure strict implementation of environmental laws; and, promote and sustain ecosystem-based management approach in protected areas and key biodiversity areas.

Republic Act 8371 (1997) or the Indigenous People's Rights Act (IPRA) states that development programs, projects and activities must be developed in accordance with the recognition, and protection of ancestral domain/land rights, self-governance and empowerment, cultural integrity, social justice and human rights of indigenous people.

On June 6, 2006, Executive Order 533 adopted Integrated Coastal Management (ICM) as a national strategy for the development of the country's coastal and marine environment and resources. The strategy is aimed at promoting food security, sustainable livelihood, poverty alleviation, and reduction of vulnerability to natural hazards, while preserving ecological integrity. It sets the direction for improved coastal management through a given framework and operational path towards the effective implementation of ICM programs at the national and local levels. ICM is being implemented with the participation of national government agencies, local government units, and the civil society. ICM Education, ICM Training for LGUs, Environmental and Natural Resource Accounting and Valuation for ICM Planning, and Coastal and Marine Environment Information Management System are also being undertaken to support the implementation of the ICM Program. Along with the other national policies and laws, E.O. 533 supports the achievement of the Coral Triangle Initiative goals, as outlined in the Regional Plan of Action (RPOA) and the National Plan of Action (NPOA) adopted through Executive Order No. 797 of May 6, 2009. The NPOA mandates the DENR and CA to coordinate the implementation of the NPOA and jointly act as the national coordinating body of the NPOA. The NPOA looks to integrate priority actions of all local government units — especially those located in coastal areas — in the preparation and implementation of their local development plans and budgets.

3.6.2 Fisheries

The importance of fisheries, being the most vital marine living resource of the country, is evident in the 1987 Constitution, which declared the role of the State in protecting the rights of subsistence fishermen and local communities in the preferential use of the communal marine and fishing resources, both inland and offshore.

3.6.2.1 Philippine Fisheries Code of 1998

Republic Act 8550, also known as the Fisheries Code of 1998, has specific rulings that address the micro- or operational-level issues pertaining to different types of fishing and related activities. The noteworthy provisions of the code include: limitations to access using scientifically-determined procedures; integration of management systems involving inter-local government cooperation; and the enhancement and institutionalization of people's participation. It also clarifies the extent of LGU jurisdiction in municipal waters and the operations of commercial fishing within such areas (RA 8550, Sections 2, 4, 23, 16).

Sections 4 and 91 of RA 8550 stipulate that it is unlawful for any person or corporation to gather, possess, sell or export ordinary, precious, and semi-precious corals, whether raw or in processed form, except for scientific or research purposes.

3.6.2.2 Comprehensive National Fisheries Industry Development Plan (CNFIDP)

The adoption of CNFIDP through a Fishery Administrative Order (FAO) of the DA is designed to provide the comprehensive framework for promoting optimal development and long-term sustainability of benefits of the Philippines from its fisheries. The law provides the strategic priorities and directions of the fisheries sector (from 2006 to 2025) in response to current and potential issues and challenges impacting the sector. The CNFIDP contains both development (physical infrastructure support, expansion activities, marketing assistance), and conservation (resource rehabilitation, habitat restoration) elements. It also supports the programmatic implementation of the "Six Critical Actions" for improving capture fisheries, namely:

1. reduction and rationalization of fishing efforts;
2. protection and rehabilitation of fisheries habitats;
3. improved utilization of harvests;
4. enhanced local stewardship and management of resources;
5. supplemental/alternative livelihood for fishers; and,
6. capacity-building and institution-strengthening.

3.6.2.3 Philippine Development Plan (PDP 2011-2016)

Formerly known as the Medium-Term Philippine Development Plan (MTPDP), the PDP (2011-2016) serves as a guide in formulating policies and implementing development programs for six years of governance. It has a strategy specifically for increased fisheries production through the implementation of the Agriculture and Fisheries Modernization Act (AFMA) of 1997. The present PDP's vision is a competitive, sustainable, and technology-based agriculture and fishery sector driven by productive and progressive farmers and fisherfolk, supported by efficient value chains and well-integrated in the domestic and international markets. Strategies also include institutionalization of climate change adaptation and disaster and risk reduction.

3.6.3 Energy, Mining, and other Subsectors

Relevant laws on energy include Executive Order 462, which seeks to enable private sector participation in the exploration, development, utilization and commercialization of ocean, solar and wind energy resources for power generation and other energy uses. Presidential Decree 87, Presidential Proclamations 72, 1412 and 1413, and Republic Act 5092 also address specific sources of energy, such as oil, gas, petroleum, and geothermal energy. Republic Act 9136 (Electric Power Industry Reform Act of 2001) ensures social and environmental compatibility of energy sources and infrastructure, and promotes the utilization of indigenous and new and renewable energy resources in power generation in order to reduce dependence on imported energy. RA 9513 (Renewable Energy Act of 2008) accelerates the exploration and development of renewable energy resources, such as ocean energy sources.

The mining of seabed minerals, including sand mining, is covered by Presidential Proclamation (PP) 370 and administrative orders of the Department of Environment and Natural Resources (DENR), RA 7076 (People's Small Scale Mining Act of 1991), RA 7942 (Philippine Mining Act of 1995). The Philippines is also guided by the International Maritime Organization (IMO) Code for the Construction, Equipment of Mobile Offshore Drilling Units, the 1982 UNEP Guidelines concerning the Environment Related to Offshore Mining and Drilling within the Limits of National Jurisdiction, and Global Guidelines on Environmental Protection Measures of Offshore Mining and Drilling Operations.

RA 8550 criminalizes the gathering, sale or export of white sand, silica, pebbles and any other substance which make up any marine habitat.

3.6.4 Marine Transportation

To date, there is no comprehensive law or policy document that covers shipping and maritime transport activities in the archipelago. One reason may be that the sector is highly fragmented, with the needs and interests of different kinds of vessels sometimes coming into conflict with each other. Several initiatives in shipping by way of policy development are in direct implementation of international standards.

Administrative issuances and circulars from the Maritime Industry Authority (MARINA) provide guidelines in the absence of detailed laws. A number of Marcos-era presidential decrees also covered different aspects of the industry, such as, PD 666 and 667-A, which provided incentives for the shipbuilding industry; PD 760 and 761 covering foreign vessel registration; and PD 857 and 1284 organizing the functions of MARINA, the Philippine Ports Authority (PPA) and other concerned agencies.

Issues relating to the growing traffic of both Philippine and foreign ships in surrounding waters that need to be addressed include: hazards arising from normal shipping operations (oil spill, red tide contamination, toxic materials); regulation of foreign military movements in nearby waters; inter-island shipping; shipbuilding; construction of tunnels, bridges, causeways, passenger routes; oil tankers; bulk cargo; and waste disposal. For ports, the existing laws appear to be sufficient and the only identified gaps concern issues when the decision to build a port is not supported by the surrounding community.

3.6.5 Maritime Safety and Security

Further to the enactment of a Maritime Industry in 1974 (Presidential Decree 474) and the Domestic Shipping Development Act of 2004 (RA 9295), maritime security is a state wherein the country's marine assets, maritime practices, territorial integrity and coastal

peace and order are protected, conserved and enhanced (NMP 1994). Maritime safety, in standard usage, relates to the conditions of shipping, navigation and transportation with respect to freedom from natural hazards, unforeseen accidents, acts of piracy or other crimes. Nevertheless, maritime safety and security together involve a combination of preventive, law enforcement, and defense activities.

The Philippines, together with Singapore, Japan, China, Hong Kong and the United States, is among the top 15 flag states which control close to three-quarters of the world's shipping fleet. As ocean traffic increases, the Philippines is confronted with many issues, including ballast water exchange, trafficking of hazardous cargoes, air pollution, oil spill, training and qualification of inspectors, equipment and, most importantly, rising number of accidents at sea, the reporting of such accidents and compliance with international standards. RA 8544 declares it the policy of the State to *"promote and insure the safety of life and property at sea, protect and serve the marine environment and ecology, and prevent marine pollution and accident at sea."* However, it only covers the examination, registration and certification of competency of merchant marine officers, and in overseeing compliance with an international Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW, 1978, as amended), to which the Philippines is a signatory.

There are three major maritime safety issues in the country that need to be addressed. First is the unclear delineation of government functions. A large number of agencies are involved in maritime safety administration in the country, which results in conflicts and overlap of duties and responsibilities. Second is the fact that the industry operates within an outdated and inapplicable framework of maritime safety regulations. Lastly, safety of navigation is jeopardized by inadequate aids to navigation, such as lighthouses; insufficient search and rescue capability; lack of a vessel traffic control system; and poor weather forecasting and information dissemination.

Republic Act No. 7898, known as the Armed Forces of the Philippines (AFP) Modernization Act of 1995, provides the Philippine Navy and Air Force the opportunity to develop its surveillance, reconnaissance, and electronic capabilities, which are vital for the protection of the extensive maritime areas and the growing transnational threats posed by piracy, smuggling, poaching and illegal fishing. However, bureaucratic entanglements arising from cumbersome procurement and acquisition procedures have hampered the implementation of this Act.

The Philippine Coast Guard Law of 2009 was passed to establish the Philippine Coast Guard charged with enforcing laws promulgated, and administering rules and regulations for the protection of the marine environment and resources from offshore sources, or pollution within the maritime jurisdiction of the Philippines.

3.6.6 Territory and Jurisdictional Concerns

The delineation of the Philippine maritime jurisdiction is established and defined in the following main national laws.

- **Article 1, National Territory, The Constitution of the Republic of the Philippines, 1987;**
- **Republic Act No. 9522, 10 March 2009—** An Act to Amend Certain Provisions of Republic Act No. 3046, as Amended by Republic Act No. 5446, to Define the Archipelagic Baseline of the Philippines and for Other Purposes. RA 9522 defines the baselines around the main archipelago and declares a "Regime of Islands" under the Republic of the Philippines, consistent with Article 121 of the United Nations Convention on the Law of the Sea (UNCLOS), including

the Kalayaan Island Group (KIG), as constituted under Presidential Decree No. 1596, and the Bajo de Masinloc, also known as Scarborough Shoal;

- **Presidential Decree No. 1596, 11 June 1978—**Declaring a Certain Area as Part of the Philippine Territory and Providing for Their Government and Administration (PD 1596 constitutes the KIG);
- **Presidential Decree No. 1599, 11 June 1978**—Establishing an Exclusive Economic Zone and for Other Purposes; and
- **Presidential Proclamation No. 370, 20 March 1968**—Declaring as Subject to the Jurisdiction and Control of the Republic of the Philippines All Mineral and Other Natural Resources in the Continental Shelf.

3.7 Climate Change Initiatives in Management

Republic Act 9729, or the Climate Change Act of 2009, created the Climate Change Commission, a policy-making body attached to the Office of the President. The commission is tasked with coordinating, monitoring and evaluating both short- and long-term programs and action plans relating to climate change and disaster reduction, and risk management.

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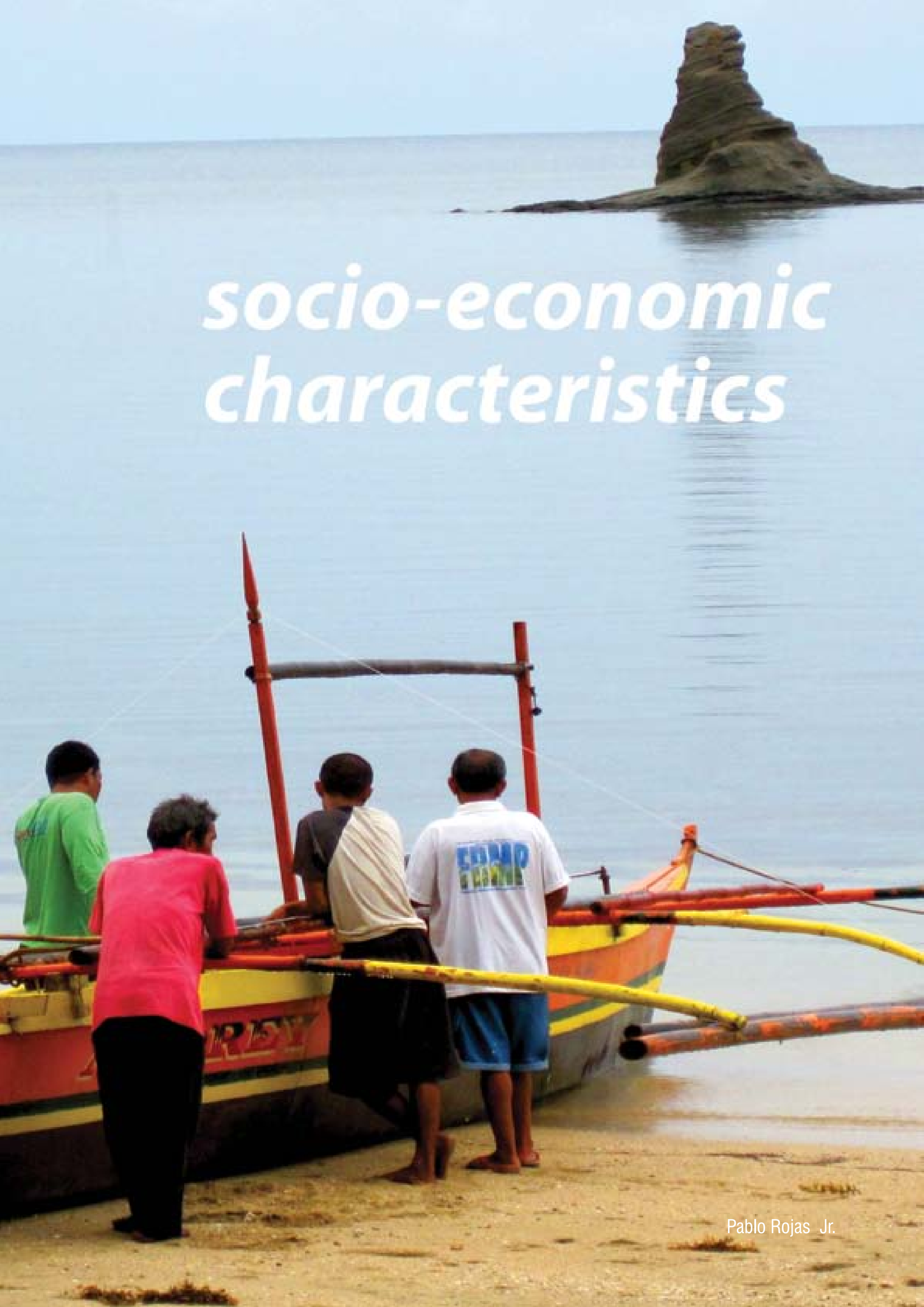
socio-economic characteristics



Pablo Rojas Jr.

Chapter 4

SOCIO-ECONOMIC CHARACTERISTICS

This section shows the trends in the use of various coastal marine resources in relation to the magnitude of users (*i.e.*, population size). Of great importance are capture fisheries and aquaculture in the lives of coastal communities that cut across a wide spectrum of society, including indigenous groups with their traditional ways. The use patterns, supply level and value of resources are discussed in relation to declining trends and food security. The monetary values of these resources and habitats are placed in the context of their ecosystem functions and services. The significance of other sectors, such as coastal tourism, sea transportation, and mineral, oil and gas explorations is also examined *vis-a-vis* the dynamics of the social, economic and ecological impacts.

4.1 Demographics

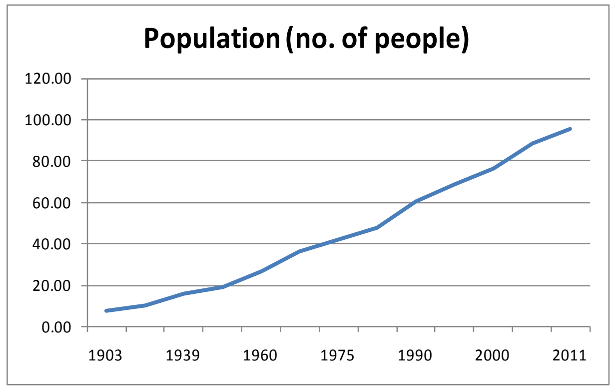
The country's island groups are divided into 17 regions. Each of these is further subdivided into successively smaller political units: provinces, cities and municipalities. To date, there are 80 provinces, 138 cities, 1,496 municipalities and 42,026 *barangays* in the country. Of these, coastal provinces comprise 78% while only 22% are landlocked. Coastal cities comprise 62%, and coastal municipalities comprise 56%.

Coastal areas are defined in the "Framework for Sustainable Philippine Archipelagic Development (ArcDev, 2004) as: *'those falling within the administrative zones of coastal municipalities or municipal administrative zone definition with 60 percent of the national population living in coastal towns and cities."*

The total number of people residing in coastal areas was about 36 million in 1990 (60% of the total), 41 million in 1995 (60% of total), 46 million in 2000 (60% of total), and 49 million in 2004 (60% of total).

Population size and growth rate. The population in the Philippines as of mid-2011 was projected at 95.7 Million (*2011 World Population Datasheet*). The increase in Philippine population translated to an average population growth rate of 2.04% annually during the period 2000 to 2007. The rate of natural increase was estimated at 1.9% in 2011. Past census data on population and projected population in 2011 are shown in Figure 4.1.

Figure 4.1 Population of the Philippines from 1900 to 2011
(Source: National Statistics Office)

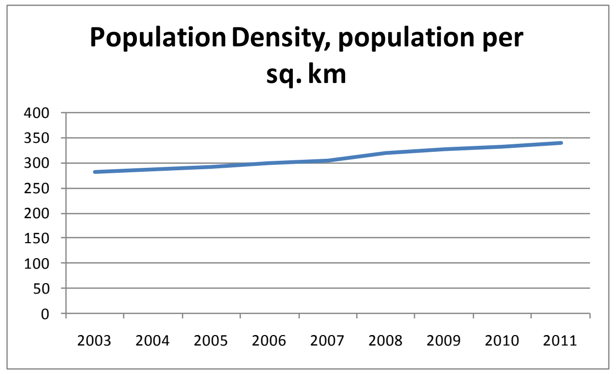


In 2009, the Philippines had an estimated total population of 92,153,028, an increase of 15,648,951 over the 2000 population count of 76,504,077. The 2009 census figure is almost twelve times the Philippine population in 1903 (7,635,426 persons), when the first census was conducted. By mid-2025 and mid-2050, it is projected that the population will increase to 120 million and 150 million, respectively. It was estimated that there are about 25 births per 1,000 population and six deaths per 1,000 population as of 2011.

The growth rate is a factor in determining how great a burden would be imposed on a country by the changing needs of its people for infrastructure (*e.g.*, schools, hospitals, housing, roads), resources (*e.g.*, food, water, electricity), and jobs.

Population density. The population density in 2011 was estimated at 339 people per square kilometer, which was 20% higher than the population density in 2003 at 282 people per sq. km. (Figure 4.2).

Figure 4.2 Population density (number of people km^2 *from 2003 t0 2011*
(Source: National Statistics Office)



Average household size. The average household size in the Philippines in 2007 was 4.8 persons. There are seven regions that had average household sizes higher than the national figure, namely: the Autonomous Region in Muslim Mindanao (ARMM), 5.8 persons; Region XIII (Caraga), Region IX (Zamboanga Peninsula), and Region V (Bicol), each with 5.0 persons per household; and Region X (Northern Mindanao), Region VI (Western Visayas), and Region VIII (Eastern Visayas), each with 4.9 persons per household. Meanwhile, the NCR had the lowest average household size of 4.4 persons.

Males outnumbered females. Based on the 2007 census, of the 88,304,615 household population, 50.5% were males while 49.5% were females. This resulted in a sex ratio of 102 males for every 100 females, slightly higher than the sex ratio of 101 males per 100 females in 2000. Regions VIII and XIII posted the highest sex ratio of 106 each. Moreover, NCR, Region IV-A, and ARMM were the only three regions which reported more females than males, that is, with sex ratios of less than 100.

Age structure. Based on the 2011 estimate, about 34.6% of the population had ages less than 14 years old, 61.1% were between 15-64 years old and 4.3% were 65 years old and above. The median age was 22.9 years old for both sexes, 22.4 years old for males and 23 years old for females.

Life expectancy at birth. Based on 2011 estimates, the life expectancy at birth for the whole population was 71.66 years old. Males have a life expectancy at 68.72 years old, while women are at 74 years old.

Literacy. About 92.6% of the whole population aged 15 years old and over can read and write, based on 2011 estimates. Literacy in males was at 92.5% while 92.7% for females.

Percent of population below $US2 per day PPP 2000/2009. About 45% of the population are living on less than US$2 purchasing power parity (PPP) a day at 2005 international prices.

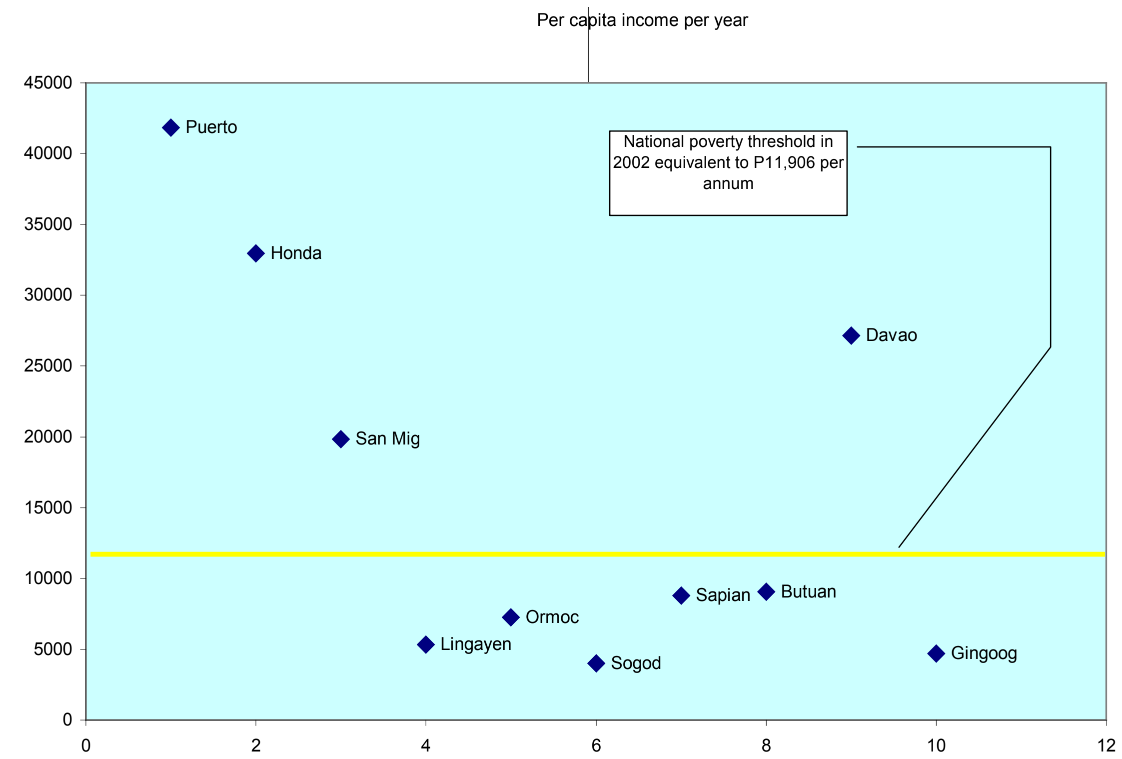
Coastal population. With its thousands of islands, the Philippines has one of the longest coastlines in the world at 37,008 kilometers. About 25 major cities lie on the coast. It is estimated that more than 60% of the nation's total population lives in coastal areas. In 2000, the total coastal population was 36 million. The population density in coastal population was at 286 persons km^{-2} in 2000, and 227 persons km^{-2} in 1990. It was estimated that in 2000, the number of people km^{-1} of coastline is at 2,467 persons. Increasing population is a serious problem because of the implications of the limited natural resource base. Rapid population growth aggravates the over-exploitation of coastal and marine resources.

Incomes and poverty levels. The country's GDP for the period 2006-2010 averaged PhP7.582 trillion, of which 13% is accounted for by the agriculture, fisheries, and forestry sectors which have been on a steady decline in their contributions since the late 1990's (NSCB, 2011). Of this amount, the fisheries sector contributes 20% to Gross Value Added in agriculture and fishing. In 2009, the fisheries sector accounted for 2.2% of Gross Domestic Product (GDP) at current prices, and 4.4% in constant prices. Recent data indicate that the sector declined by 3.84% in 2011 due to decreases in production of the commercial and municipal sectors – with the commercial sector registering a hefty 16% drop.

Virola et al. (2009) analyzed a broader maritime framework of which fisheries is an important component. The entire maritime sector consists of manufacturing, water transport, energy exploration, mining, and business activities that include tourism. In terms of sales receipts generated by the maritime sector, marine-related transport (water transport) contributes 16%, while tourism related business activities contribute 5%. Mining and energy contribute less than 3% in total.

It is a common observation that fishers earn incomes that are usually below the poverty threshold levels. The 2007 Sustainable Philippine Fisheries Agenda (SUPFA) study — which compared fisheries profile of nine bays investigated under the Fisheries Resources Management Project (FRMP) — provided an indication of incomes of fishers against the national poverty threshold during the time the study was implemented. The nine bays were (1) Lingayen Gulf, (2) San Miguel Bay and (3) Honda – Puerto Princesa Bay, (4) Sogod Bay, (5) Ormoc Bay, and (6) Sapian Bay, (7) Gingoog Bay, (8) Butuan Bay, and (9) Davao Gulf. At the time of the study, the poverty threshold for the Philippines as of 2002 was PhP11,906 per capita per annum or an equivalent of PhP1,000 per month. This is the estimated income required to purchase a basket of food and non-food commodities essential to basic human survival. From the SUPFA analysis, four bays yielded income levels that, on average, surpassed national poverty threshold levels. Three explanatory factors were highlighted: (1) higher productivity levels, as in the case of Honda and Puerto Princesa; (2) higher level of per capita incomes from both fishing and non-fishing sources, as in the case of Puerto/Honda, Davao, and San Miguel Bay; and (3) relatively lower fisherfolk density. For the bays that exhibited "below poverty threshold levels", parameters, Lingayen Gulf, Gingoog Bay, Sogod Bay, and Ormoc Bay were classic cases which contradict all conditions: these bays had low daily catch rates, per capita incomes were less than P10,000 per year, and fisherfolk densities were in the range of 4.4 to 6.5 fishers/sq. km. Income opportunities in Lingayen Gulf were observed to be limited to farming, livestock raising, employment, and aquaculture, which contributed a measly PhP400-500 to monthly incomes.

Figure 4.3 Per capita incomes of fishers in the 10 Sustainable Philippine Fisheries Agenda(SUPFA) bays (Source: SUPFA Report)

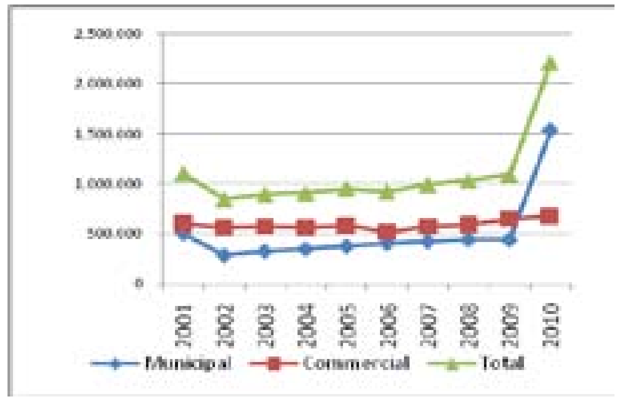


4.2 Resource Use Patterns and Issues

4.2.1 Production by Sector

The Philippines is an important producer of fish in the world. Fish continues to be the principal source of protein for the country's population, accounting for 70% of the total animal protein intake and 30% of the total protein intake. The fishing industry's contribution to GDP was 2.3% at current and 4.3% at constant prices (Philippine Fisheries Profile, 2008). The net surplus from the international trade of fish and fish products is valued at US$416 million. The fisheries sector provides direct and indirect employment to over one million people, or about 5% of the national labor force. Philippine fisheries consist of commercial, municipal, and

Figure 4.4 Total fisheries production by sector from 2001 to 2010 *(Source: BFAR, 2010)*



aquaculture sectors. The marine fishing sector is divided into two sectors, namely,

the commercial fisheries sector (large scale, using boats more than three gross tons), and the municipal fisheries sector (small scale, using boats less than three gross tons). These are characterized by multi-species tropical fish stocks and fishers using many different types of gears. Figure 4.4 illustrates the total marine (commercial and municipal) fisheries production from 2001 to 2010.

Philippine capture fisheries production ranked 9th in the world in 2008 (FAO, 2008). In 2010, the sector produced 2.6 million MT (51% of total Philippine fish production), valued at PhP138.4 million (BAS, 2010; www.bas.gov.ph). The municipal sector accounted for 1.37 million MT valued at PhP77.6 million while the commercial sector had 1.25 million MT valued at PhP60.7 million (Figures 4.5 and 4.6, respectively, BAS, 2010). It directly employed 675,700, while 56,700 fishers generated additional income from employment in ancillary activities like fish processing, marketing and boat building (BFAR, 2003). Its major fishery export in 2009 amounting to 196.2 million MT was valued at PhP31.92 milion (BAS, 2010).

Figure 4.5 Value of catch by sector, 2010 (Source: BAS, 2010)

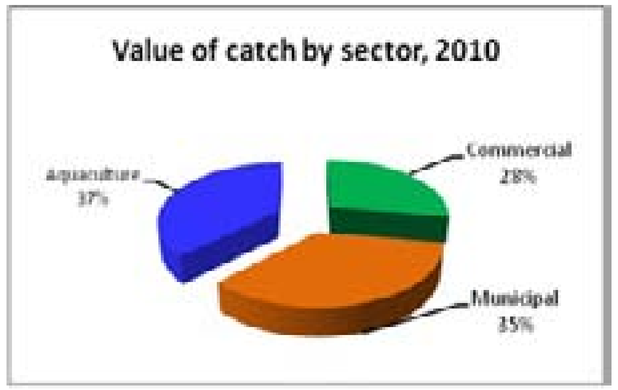
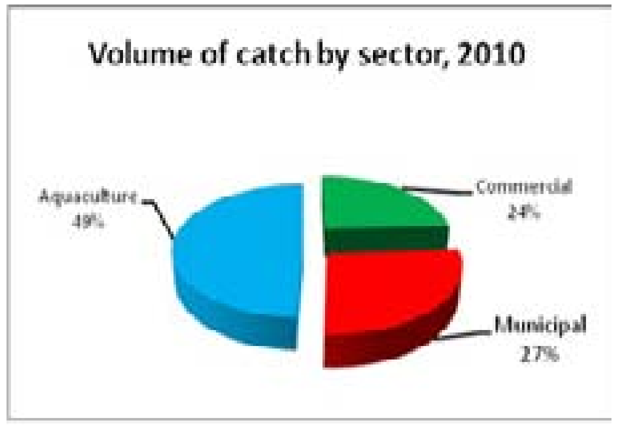


Figure 4.6 Volume of Catch by Sector, 2010 *(Source: BAS, 2010)*



4.2.2 Fisheries Production by Major Species

The major commercially important species groups include: tuna, small pelagics, and demersals.

4.2.2.1 Tuna

The country is the second biggest producer of tuna and tuna-like fishes in the Association of Southeast Asian Nations (ASEAN), and the third biggest producer of seaweeds, next to China and Japan.

The Philippines is a major tuna producer in the Western and Central Pacific Ocean (WCPO), both for domestic consumption and for export. Tuna fisheries are exploited by both the commercial and the municipal fishing sectors. Tuna are caught throughout the Philippine waters, but the most productive fishing grounds are: the Sulu Sea, the Moro Gulf, the waters extending to the North Celebes Sea, and the northeastern deep waters (east off Northern Luzon). Viable tuna fisheries also exist in the waters of western Negros, as well as northwestern and southern Luzon. Figure 4.7 shows increasing tuna production from 2001 to 2009. However, commercial tuna production in 2009-2010 showed a decline, probably due to the closure of the small pockets of fishing

grounds in the WCPO.

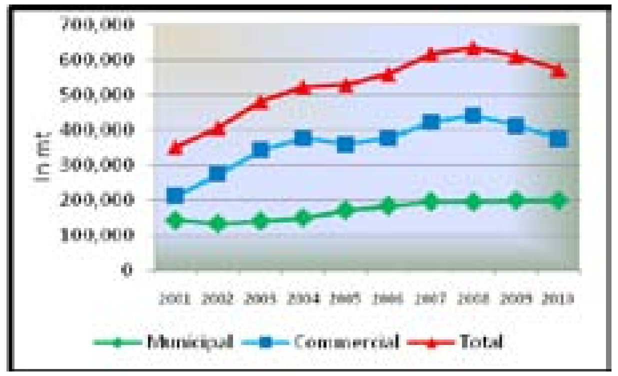


Figure 4.7 Tuna fisheries production (commercial and municipal) *(Source: BAS, 2001-2010)*

The tuna fisheries is 12% of the total fisheries production in the Philippines. This sector contributes 4% to the GDP, and about one million people are involved in the industry. Total annual landings was estimated at 400,000 MT in 2009, of which 120,000 MT (30% of total) was caught in Philippine waters, whereas 280,000 MT (70%) was from adjacent international waters. About 80% of Philippine tuna production is based in Mindanao, mainly in General Santos City, and domestic earnings reached PhP8 billion (US$140 million).

Several tuna species are targeted throughout the Philippine waters, including the three large oceanic species, namely, yellowfin tuna (*Thunnus albacores)*, bigeye tuna (*Thunnus obesus),* and skipjack tuna (*Katsuwonus pelamis),* which are also known to spawn extensively but the standing biomass (and catch) comprised mostly of juveniles. These oceanic tuna resources are recognized to be part of the regional stocks in the WCPO, revealed by tagging experiments. There is little seasonality other than that influenced by monsoonal events and movements into and out of the area. Neritic (continental shelf) tunas such as eastern little tuna *(Euthynnus affinis*), frigate tuna (*Auxis thazard*), bullet tuna (*A. rochei*), and longtail tuna (*Thunnus tonggol*) are abundant in inshore waters, and support large domestic fisheries. Billfish, round scad, rainbow runners, *mahimahi*, and sharks occur with the oceanic tuna species.

Most of the tuna catch is taken by purse seine, ring net, and handline gears, with a variety of other artisanal gears in use, such as gillnet, troll line, multiple handline, and mini-longline. The commercial sector provides the majority of the catch of oceanic tunas (about 70% of the total catch). This is primarily taken by larger purse seine vessels targeting skipjack and yellowfin, whereas the municipal sector catch, with handline as the predominant gear (estimated 70% of catches), takes similar quantities of both oceanic and neritic tunas.

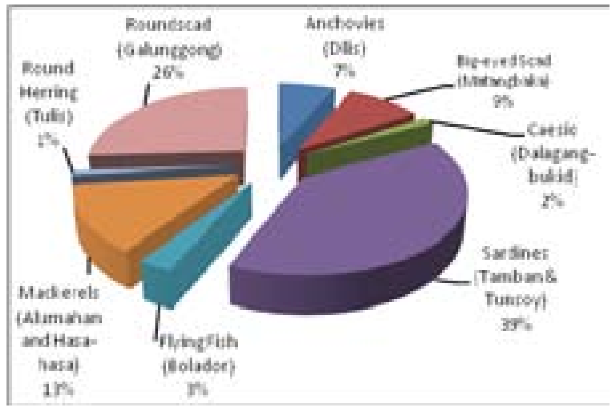
4.2.2.2 Small Pelagic Fishes

Small pelagics are the main sources of cheap animal protein for lower income groups in the Philippines. These include sardines, anchovies, round herring, roundscads, mackerels, and fusiliers. They are caught by both municipal (gill net, hook and line, ring net, beach seine, purse seine) and commercial fishing gears (purse seine, ring net and bag net). The major fishing grounds for small pelagic fishes are: the Sulu Sea, Visayan Sea, Moro Gulf, Lamon Bay, Cuyo Pass, Guimaras Strait, Western Palawan waters, and Manila Bay.

Historically, small pelagics have dominated the coastal fisheries in terms of volume of landings. It comprises about 60% of the total capture fishery production of the country as of 2003 (FAO, 2010), and estimated to have a Maximum Sustainable Yield (MSY) of 550,000 metric tons (Dalzell *et al.,* 1987). However, the catch per unit of effort (CPUE) for small pelagic fishes began to decrease in 1956, and have experienced a continuous decline ever since (Barut *et al.,* 2003).

Roundscads (*Decapterus* spp.) are considered as one of the most important small pelagic fish species in terms of its availability throughout the year. In 2010, however, sardines replaced roundscads as the dominant small pelagic species in terms of production, contributing 1,532.04 MT or 38% of the total pelagic fisheries production.

Figure 4.8 Proportion of Total Production of Small Pelagic Fisheries (Commercial and Municipal) *(Source: BAS, 2001-2010)*



4.2.2.3 Sardines

Within the small pelagic fishery, sardines are one of the commercially targeted species. For instance, two sardines — fimbriated sardine (*Sardinella fimbriata*), and the Bali sardine (*S. lemuru*) — accounted for a combined 442,045 MT, valued at approximately PhP10.5 billion (BAS, 2011). Sardines in the Philippines are known by a variety of local names including *manamsi*, *lao-lao*, *tunsoy*, *turay*, *tamban*, *tabagak*, *etc.* (Ganaden and Lavapie-Gonzales 1999). They form schools in waters over the continental shelf with depth of less than 200 meters, except for *Sardinella tawilis* which is confined and endemic to freshwater Taal Lake in Batangas. Peak sardine productivity and spawning in the country often coincide with the southwest monsoon (Dalzell *et al.,* 1990, Olaño *et al.,* 2009), although some species of *Sardinella* are reported to show recruitment pulses between February and September in the Visayan Sea (Guanco *et al.,* 2009). In Tawi-Tawi, group of islands southwest of Mindanao, *S. fimbriata*, *S. lemuru* and *S. albella* have shown two peak recruitment periods which is common in the Philippines (Aripin and Showers, 2000). Maturity is reached in two to three years for many species. However, heavy fishing pressure results in sardines being captured prior to maturation (Guanco *et al.,* 2009).

Sardines occur in high abundance especially in productive coastal areas or upwelling regions in the country. The strength of upwelling has been tied to recruitment where juvenile sardines obtain the greatest biomass in moderate upwelling conditions (Skogen 2005). It has also been observed that in areas where there is high landing of sardines, there is also a high rate of primary productivity suggesting that there are sardine-supporting habitats in the country. Upwellling, such as that along the Bicol Shelf, occurs where strong winds push surface water offshore allowing cooler, nutrient-rich water to rise into the shallow areas resulting in increased levels of primary productivity to support sardine populations (Whitehead, 1985). Villanoy *et al.,* (2011) demonstrated the influence of upwelling events upon the temporal variation in the catch of sardines off Zamboanga Peninsula in western Mindanao.

The sardine stocks in the Philippines are showing signs of depletion. Based on data from the NSAP, sardines in the western and central Visayas have been reported to be under heavy fishing pressure with stocks of *S. gibbosa*, *S. fimbriata*, and *S. lemuru* (reported as *S. longiceps*) being overexploited (Guanco *et al.,* 2009). In Sorsogon Bay (Southeast Bicol Peninsula), the dominant sardine *Escualosa thoracata*, appears to be overfished, showing decreasing catch with increasing effort (Olaño *et al*., 2009). In Honda Bay, Palawan, *Amblygaster sirm* is also over-exploited in that

it is harvested beyond optimal levels (Ramos *et al.,* 2009). However, other sardine species in Palawan are not over-exploited with size of captured fish greater than the length of first maturity (Ramos *et al.,* 2009).

4.2.2.4 Demersal Fishes

Stocks of demersal fishes in the Philippines are declining in biomass and a change in species composition has been reported (Armada, 2004). The major changes in catch composition include an increase in abundance of squids, shrimps, and small pelagic species, and substantial declines in the abundance of large commercially valuable species like groupers, snappers, sea catfish, *etc*. In the 1950s, demersal fish biomass was estimated at 5-17 MT per km^2. In the 1980s, it was 2-3 MT per km^2. From 2004-2008, there were reports of continuing decline but lacked data to support it. According to Armada (2004) the demersal fisheries in its current state will take some time to recover and there is a need to manage exploitation of the demersal fishery resources. Recently, few studies showed indications of further decline in catch *i.e.,* as low as 1-2 kg per fisher per day, and changes in catch composition of demersal fishes in the Philippines with present catches comprising predominantly of small-sized species and/or fish with lower market value (Maypa *et al.,* 2004, Mamauag *et al.,* 2009).

4.2.3 Fisheries Production and Economic Valuation

Economic valuation of marine ecosystems mainly from the fisheries production estimates is important because it provides the net benefits of their goods and services to the society if they are managed well and therefore integral in management and conservation aims (Cesar *et al.,* 2004).

A valuation study done by Padilla (2009) — the Country Environmental Analysis (CEA) — reviews and places a substantial volume of studies in a coherent framework, applies economic valuation across issues and interventions to enhance the rigor in prioritization, and thereby guides future programs and projects. The CEA is not only a document, but also a process of engagement and harmonization with various stakeholders, including the government, other development partners, NGOs, academics, and the private sector. However, this section will only present the fisheries production of ecosystems and their estimated values integral to the SCTR. For the greater detail of the scope of the CEA, it is recommended to read the full paper of Padilla (2009).

4.2.3.1 Fisheries Production from Coastal and Oceanic Waters

Padilla's study considered the Delphi technique to assess the Philippine fishery wealth, and some of the results are presented in Table 4.1. These estimates of maximum sustainable yield (MSY) for conventional fishery resources have been reflected in national fisheries policies (in Barut *et al.,* 1997).

http://blogs.panda.org/coral_triangle/files/2010/01/coraltrianglefishingwallpaper_freund231344_700px-300x201.jpg

Table 4.1 Estimated Potential Annual Production from Philippine Marine Waters *(Source: Padilla, 2009)*

Area	Potential Production (in MT)		
	Pelagic	Demersal	Total
I. Coastal areas (up to 200 m isobath)	800,000 +/- 200,000	600,000 +/- 200,000	1,400,000 +/- 200,000
Region 1: Tayabas Sea; Camotes Sea; Visayan Sea; Sibuyan Sea; Ragay Gulf; Samar Seal; related bays	120,000 +/- 30,000	90,000 +/- 30,000	210,000 +/- 30,000
Region 2: South Sulu Sea; East Sulu Sea; Bohol Sea; Guimaras Strait; related bays	112,000 +/- 30,000	84,000 +/- 30,000	196,000 +/- 30,000
Region 3: Moro Gulf; Davao Gulf; Southeast Mindanao Coast	80,000 +/- 20,000	60,000 +/- 20,000	140,000 +/- 20,000
Region 4: East Sulu Sea; Palawan; Mindoro (West Palawan; Cuyo Pass; West Sulu Sea; Batangas Coast)	264,000 +/- 70,000	198 ,000+/- 70,000	462,000 +/- 70,000
Region 5: North and Northwest Luzon (Lingayen Gulf; Manila Bay; Babuyan Channel; Palawan Bay)	64,000 +/- 30,000	48,000 +/- 20,000	112,000 +/- 30,000
Region 6: Pacific Coast except Southeast Mindanao (Leyte Gulf; Lagonoy Gulf; Lamon Bay; Casiguran Sound)	160,000 +/- 30,000	120,000 +/- 40,000	280,000 +/- 40,000
II. Oceanic areas	250,000 +/- 50,000	0	250,000 +/- 50,000
Total			**1,650,000 +/- 200,000**

Subsequent assessments of Philippine demersal and pelagic fisheries are close to the above estimates of experts. For demersal fisheries, the estimated MSY for exploited resources is placed at 340,000–390,000 MT (Silvestre and Pauly, 1987). Including the MSY estimate for unexploited and lightly fished hard bottom areas[1] of 200,000 MT would bring the total to 540,000-590,000 MT (Barut *et al.,* 1997). For exploited pelagic fisheries, MSY estimate is placed at 550,000 MT (Dalzell *et al.,* 1987), and when combined with MSY estimates of 250,000 MT for lightly fished small pelagic resources or fishing grounds[2], this would approximate the experts' estimates (Barut *et al.,* 1997). However, the rates of exploitation is beyond the MSY level as shown by the above studies of Silvestre and Pauly (1987), Dalzell et al (1987) and by resource accounting studies of Padilla and de Guzman (1994) and NSCB (1999). These studies have confirmed considerable depletion and depreciation of fishery resources.

In the context of the biological surplus yield model that these studies used, the current level of production occurs at a higher level of effort indicating overcapitalization that is typical of a common property regime of exploitation in Philippine fisheries. At the industry level, the potential rents from the fisheries have been fully dissipated by the high average fishing costs. In the long run, inefficient fishing vessels are expected to be driven out as the industry moves to a point of bio-economic equilibrium where revenues cover total costs. Nevertheless, some rents are realized by certain sectors due to more efficient fishing operations and higher remaining fish stocks. For this report, these intra-marginal rents or net values are estimated at 10% of gross values for all fisheries.

Production data obtained from the Bureau of Fisheries and Aquatic Resources (BFAR) and data was collected from BAS in order to disaggregate the production and value data and derive breakdown by species grouping and attribution by ecosystem. The latter was based on information contained in Fishbase (www.fishbase.org) and through consultations with some experts from the University of the Philippines Marine Science Institute (UPMSI). The production from "resident" species within each ecosystem are attributed fully to that ecosystem, while for "transient" species, a conservative 10% attribution was made. Values of total production (MT) of species groups of each ecosystem they utilize throughout their lifecycle are presented in Table 4.2.

1 *Offshore hard bottom areas around Palawan, southern Sulu Sea and central part of the country's Pacific coast.*

2 *Waters off Palawan, parts of the country's Pacific coast and some parts of Mindanao.*

http://www.greenpeace.org/international/ReSizes/OriginalWatermarked/PageFiles/25361/colourful-basslets.jpg

Table 4.2 Total production (MT) of species groups of each ecosystem utilized throughout their lifecycles *(Source: Padilla, 2009)*

Species group	Ecosystem						
	Coastal					Oceanic	Total
	Mangrove	Seagrass	Coral reef	Other coastal	Sub-total		
Small pelagic	10,100	-	83,272	950,743	1,044,115	-	1,044,115
Large Pelagic	178	-	1,355	-	1,532	603,372	604,904
Demersal	12,991	3,089	34,272	299,097	349,448	-	349,448
Other fish	-	-	-	9,883	9,883	-	9,883
Sub-total	23,269	3,089	118,898	1,259,723	1,404,978	603,372	2,008,350
% to row total	1.16	0.15	5.92	62.72	69.96	30.04	100.00
Invertebrates	6,833	5,292	75,851	52,805	140,781	-	140,781
Mammals	-	-	536	4,822	5,357	-	5,357
Aquatic plants	-	29	285	-	314	-	314
Sub-total	6,833	5,320	76,672	57,626	146,452	-	146,452
Tota	30,102	8,410	195,570	1,317,349	1,551,430	603,372	2,154,802
% to row tota l	1.40	0.39	9.08	61.14	72.00	28.00	100.00

Total fisheries production in 2006 (Table 4.2) reached over 2,154,000 MT, up from 1,750,000 MT in 2002. This represented an average annual increase of over 5% during this period. Over half of the total fish catch was accounted for by small pelagic species, followed by large pelagic and demersal species. Non-fish catches in 2006 exceeded 146,000 MT, accounted for primarily by invertebrates. By ecosystem, the biggest share is from near-shore areas (other coastal), excluding mangrove forests, seagrass beds, and coral reefs.

For the comparisons, it is assumed that oceanic pelagics are primarily large pelagic species and coastal pelagics are small pelagic species. Actual production of demersal species of about 350,000 MT is just half the potential of 600,000 +/-100,000 MT. Large pelagics catches of about 605,000 MT are more than twice the annual potential yield of a 250,000+/-50,000 MT. The production from small pelagics at about 1,044,000 MT is 15% higher than the annual potential yield of 800,000+/-100,000 MT. Total fisheries production of over 2 million MT is close to the maximum potential yield of 1,900,000 MT.

Table 4.3 Potential capture fisheries production and their corresponding values *(Source: Padilla, 2009)*

Table 4.3. Potential Capture Fish-Fisheries Production and their Corresponding Values *(Source: Padilla, 2009)*	Average price in 2006 (PhP/MT)	Potential annual production (MT/yr)	Total gross value in 2006 (million PhP)	Net value in 2006 (million PhP)
I. Coastal (small pelagic species)				
Low Estimate	55,574	600,000	33,344	3,334.42
High Estimate		1,000,000	55,574	5,557.36
Average		800,000	44,459	4,445.89
II. Coastal (demersal species)				
Low Estimate	65,822	400,000	26,329	2,632.88
High Estimate		800,000	52,658	5,265.76
Average		600,000	39,493	3,949.32
III. Oceanic (large pelagics species only)				
Low Estimate	65,173	200,000	13,035	1,303.46
High Estimate		300,000	19,552	1,955.19
Average		250,000	16,293	1,629.33
Total				
Low Estimate		1,200,000	72,708	7,270.76
High Estimate		2,100,000	127,783	12,778.32
Average		1,650,000	100,245	10,024.54

Notes:

**Production from coastal areas (pelagics and demersal species) includes those associated with mangroves, seagrass, and coral reefs. Attribution of production to these ecosystems will be made in succeeding sections. Prices are computed from the Philippine Fisheries Statistics*

*** Net value refers to the economic rents from fishing assumed to be 10% of the gross value (refer to discussions).*

Using 2006 wholesale prices,[3] the gross value of potential production is shown in Table 4.3. This shows that the value of sustainable production from capture fisheries (excluding invertebrates and aquatic plants) could reach about PhP128 billion per year. However, due to the open-access exploitation regime, the net value is placed at about PhP13billion. On the other hand, the value of actual fisheries production shown in Table 4.4 is placed at over PhP100 billion with the net value at 10%. A subset of the fisheries production data is the quantity and value of live ornamental fish that is collected primarily from coral reefs. This is a huge industry and accounts for much of the value of fisheries in this coral reef ecosystem. The total quantity reached a peak of almost 7,000 MT and tapered down to 6,660 MT in 2006, with total value of over PhP371 million in the same year (Table 4.5).

3 *All price data used in this chapter refer to wholesale prices, except otherwise stated.*

Table 4.4. Gross and net values of actual production in 2006 *(Source: Padilla, 2009)*

Species group	Gross Value (in million pesos)					
	Coastal				Oceanic	Total
	Mangrove	Seagrass	Coral reef	Coastal		
Small pelagic	248.2	-	2,947.9	37,114.5	-	40,310.6
Large Pelagic	12.4	-	77.7	-	31,769.0	31,859.0
Demersal	650.9	183.8	1,952.5	17,231.5	-	20,018.7
Other fish	-	-	-	650.2	-	650.2
Sub-total	911.4	183.8	4,978.2	54,996.1	31,769.0	92,838.5
% to row total	1.0	0.2	5.4	59.2	34.2	100.0
Invertebrates	520.0	380.5	4,566.0	3,775.7	-	9,242.2
Mammals	-	-	39.2	352.4	-	391.5
Aquatic plants	-	2.1	21.3	-	-	23.5
Sub-total	520.0	382.7	4,626.4	4,128.1	-	9,657.2
Total: All Species	**1,431.5**	**566.5**	**9,604.6**	**59,124.2**	**31,769.0**	**102,495.7**
% to row total	**1.4**	**0.6**	**9.4**	**57.7**	**31.0**	**100.0**
Net Value (in million pesos)						
Small pelagic	24.8	-	294.8	3,711.5	-	4,031.1
Large Pelagic	1.2	-	7.8	-	3,176.9	3,185.9
Demersal	65.1	18.4	195.3	1,723.1	-	2,001.9
Other fish	-	-	-	65.0	-	65.0
Sub-total	91.1	18.4	497.8	5,499.6	3,176.9	9,283.8
Invertebrates	52.0	38.1	456.6	377.6	-	924.2
Mammals	-	-	3.9	35.2	-	39.2
Aquatic plants	-	0.2	2.1	-	-	2.3
Sub-total	52.0	38.3	462.6	412.8	-	965.7
Total: All Species	**143.1**	**56.7**	**960.5**	**5,912.4**	**3,176.9**	**10,249.6**

Table 4.5. Quantity and value of live ornamental fish exports (Source: BFAR, 2002-2006)

Year	Quantity (MT)	FOB Value (million PhP)	Net value (million PhP)
2002	5,632	333.13	33.31
2003	5,912	348.17	34.82
2004	6,941	380.05	38.01
2005	6,698	368.91	36.89
2006	6,660	371.14	37.11

** Net value/economic rent is assumed at 10% of the gross value*

4.2.3.2 Fisheries Production from Coral Reefs

The status of Philippine coral reefs from 1981 to 2004 is shown in Table 4.6. These were based from on-site monitoring of a number of coral reef sites in the Philippines conducted by local institutions, primarily academic institutions. Coral reefs in the Philippines have been continuously degraded, reaching alarming proportions. The proportion of poor coral cover has increased, while areas with excellent coral cover has steadily declined from over 5% in 1981 to 4% in 1997 and less than 1% in 2000-2004. Relatively better reef cover may be found in Celebes Sea, Southern Philippine Sea, Sulu Sea and the Visayas biogeographic regions (Nañola *et al.,* 2002). The estimates at the national scale were used.

Table 4.6 Status of Philippine coral reefs (% of Total Area) *(Source: Padilla, 2009)*

Location	Category			
	Poor (0-24.9%)	Fair (25-49.9%)	Good (50-74.9%)	Excellent (75-100%)
1981 *(Gomez et al., 1981)*				
Luzon	31.4	42.8	22.3	3.5
Visayas	29.6	36.9	26.1	7.3
Mindanao	48.8	30.2	14	7
All	31.8	38.8	23.6	5.7
1997 *(Licuanan and Gomez,2000)*				
All	27	42	28	4
2000-2004 *(Nanola et al., 2002; Nanola et al., 2006)*				
West Philippine Sea	46	54	0	0
Northeastern Philippine Sea	48.1	51.9	0	0
Southeastern Philippine Sea	31	60.2	8.8	0
Visayas Region	47.6	50	2.4	0
Sulu Sea	56	36	8	0
Celebes Sea	20.5	48.7	28.2	2.6
All	40.8	53.3	5.7	0.2

Note: Percentages enclosed in parentheses after each category refer to live hard coral cover.

Fisheries production from key coastal habitats, such as coral reefs, depends largely on its health, extent of area, and biodiversity attributes. McAllister (1988) estimated the sustainable annual production per km^2 from coral reefs based on the condition category: excellent condition at 18 MT; good condition at 13 MT; fair condition at 8 MT; poor condition at 3 MT. Using the figures from McAllister (1988) and the recent information on coral reef condition and the area of coral reefs, the quantity and value of potential and actual fisheries yields from coral reefs are shown in Table 4.7. The annual potential yield from coral reef species, based on a coral reef area of 33,000 km^2 ranges from 351,000 to 429,000 MT. The estimated current yield using reef area of 27,000 km^2 is placed at over 169,000 MT. Potential net values stood at about PhP2 to PhP2.5 billion, while actual net value stood at less than PhP1 billion using the average price for coral reef associated species in 2006 of PhP57 per kg. The estimated contribution of coral reefs to coastal and marine fisheries production in 2006 is slightly lower compared to the estimates using reef conditions from the previous years. This may be due to the continuing degradation of coral reef cover between 2000-2004 and 2006 resulting in further decline in coral reef productivity.

Table 4.7 Calculated potential production quantity and value from Philippine coral reefs at 2006 Prices *(Source: Padilla, 2009)*

Reef Condition		Total reef area (km^2)		Sustainable production (tons/ km^2/yr)	Potential yield if reefs are in "good" condition (MT/yr)	Present calculated yield using current area and reef conditions (MT/yr)
Condition	% Area	Maximum possible area	Current area			
Poor	40.8	33,000	27,000	3	429,000 (using maximum area)	33,048
Fair	53.3			8		115,128
Good	5.7			13	351,000 (using current area)	20,007
Excellent	0.2			18		972
Total	100					169,155
Gross value of potential production (PhP million/year)			(using maximum area)		24,449	9,640
			(using current area)		20,003	
Net value of potential production (PhP million/year)			(using maximum area)		2,445	964
			(using current area)		2,000	

4.2.3.3 Fisheries Production from Mangroves

The estimates of fisheries production from mangrove forests are based on local studies which are summarized in Table 4.8. Fisheries productivity[4] covers a wide range (142-578 kg/ha/yr). It is site-dependent, while the influence in the quality of mangrove stands is not definitive. The value of mangrove fisheries is estimated using the reported mangrove cover in 1918, in 1980 corresponding to the time of the estimation of potential fisheries yields in the FIDC/NRMC report, and in 2006. With the original mangrove cover of 5,000 km^2 (500,000 has.) in 1918, the gross value of potential production from mangrove fisheries ould range from PhP3.57 billion to PhP14.56 billion per year in 2006 prices. In 1980, with mangrove area was reduced to an estimated 215,793 has., potential production value is about PhP1.54billion-PhP6.28 billion/yr. The corresponding gross values in 2006 decreased to PhP1.49billion-PhP6.09 billion/yr. Net values are 10% of the gross values. The estimated contribution of mangrove ecosystems to actual fisheries production in 2006 reached 23,269 MT. With the inclusion of invertebrates to fish production, the total contribution reached 30,102 MT. This estimate is close to the 29,681 MT estimated potential production in the same year using the lower end of the range in Table 4.8.

4 *The higher figure from Walton et al. is not considered as it assumed a very high dependence (at 80%) of coastal fisheries to mangrove ecosystems.*

4.2.3.4 Fisheries Production from Seagrass/Algal Beds

It is recognized that seagrass beds are habitats for numerous fish species and serve as food for sea turtles, hundreds of fish species, several species of waterfowl, and the manatee and Dugong (Short *et al.,* 2004). The endangered Dugong feed almost entirely on seagrasses (Spalding *et al.,* 2003). Seagrasses also support complex food webs on account of their physical structure and primary production. Seagrasses are an important part of the detrital food chain, they filter nutrients, and contaminants from the water, stabilize sediments and dampen water currents. There is no study available to provide an estimate of potential fisheries production from seagrass beds. Thus, the estimated contribution of seagrass and algal beds to fisheries production is based primarily on the attribution of the fisheries catch to various coastal and marine ecosystems. For 2006, the contribution is placed at about 3,089 MT of finfishes and additional 8,410 MT of invertebrates and aquatic plants. The total value is estimated at PhP379 million, about 29% accounted for by finfishes.

4.2.4 Timber, Fuelwood, and other Raw Materials

Timber production data from surveys and studies done in Philippine mangroves and reported in several studies are shown in Table 4.9. These are either determined from potential sustainable harvests or actual harvests based on the level of dependence of adjacent communities for various household purposes, such as for house construction, fencing, and fuelwood. The range of sustainable harvests is from 1.2 to 13.5 m^3/ha/yr. The volume of wood production from mangroves for the entire country may be estimated based on the various studies and using mangrove forest cover in 2006.

Table 4.8 Comparative Fisheries Production, Gross and Net Values from Mangrove Forests *(Source: Padilla, 2009)*

Author	Schatz (1991)	PIDS (1997)	Janssen and Padilla (1999)	Walton et al. (2005)
Reference year	1990	1992-1995	1995	2004
Location	Central Visayas	Pagbilao Bay and Ulugan Bay	Pagbilao Bay	Aklan
Type of vegetation	Managed and unmanaged mangroves	Old growth (Ulugan) and secondary growth (Pagbilao)	Secondary growth	Mangrove reforestation
Fisheries production (kg/ha/yr)	667	175.4	141.9	578-2568
Gross value (PhP/ha/yr) for reference year	13,450	6,743	1,940	25,307-121,072
Gross value (PhP/ha/yr) for 2006: Average price = 50.37/kg	33,597	8,835	7,149	29,114-129,350
Mangrove area in 1918 (ha)	500,000			
Fish production (MT)	70,969 – 289,000			
Gross value in 2006 (PhP million/year)	3,575 – 14,557			
Net value in 2006 (Php million/year)	358 – 1,456			
Mangrove area in 1980 (ha)	215,793			
Fish production (MT)	30,629 – 124,728			
Gross value in 2006 (PhP million/year)	1,543 – 6,283			
Net value in 2006 (PhP million/year)	154 - 628			
Mangrove area in 2006 (ha)	209,109			
Fish production (MT)	29,681 – 120,865			
Gross value in 2006 (PhP million/year)	1,495 – 6,088			
Net value in 2006 (PhP million/year)	150 - 609			

Notes: * Upper bound value of production per year is the lower bound from Walton et al., (2005) study.

** Net values are estimated at 10% of gross values.

Table 4.9 Timber production data of Philippine mangroves in 2006 *(Source: Padilla)*

Author	Schatz (1991)			PIDS (1997)		Janssen and Padilla (1999)	Walton et al. (2005)
Reference year	1990			1992-1995		1995	2004
Location	Central Visayas			Pagbilao Bay and Ulugan Bays		Pagbilao Bay	Aklan
Type of Vegetation	Mangrove Plantation	Managed Naturally Regenerated Strands	Unmanaged Understocked Stands	Old Growth (Ulugan Bay)	Secondary Growth (Pagbilao Bay)	Secondary growth	Mangrove reforestation
Timber Production (m³/ha/yr)	13	7.5	3.5	3.075	2.575	2.4	13.4
Net Valued (PhP/ha/yr) for reference year	1,950	1125	525	1283	1182	971	1638
Average price in reference year	300	300	300	834	918	819	244
Average price in 2006 (PhP/kg)	908	908	908	1836	2021	1540	265
Net value (PhP/ha/yr) for 2006	5903	3406	1589	2823	2602	1825	1776
Philippine mangrove area (ha)	209109	209109	209109	209109	209109	209109	209109
Total Net Value (PhP million/yr)	1234	712	332	590	544	382	371

a - Timber production corresponds to degrees of dependence of households to the mangroves: 30%, 50%, 75%, 100%. Gross value is based on shadow prices of next best alternative to the mangrove timber products.

b - Timber production is based from subsistence forestry extraction. Gross value is based on shadow prices of the next best alternative to the actual use of mangrove timber products.

c - Based from thinnings used apparently for fuelwood.

d - Values depend on uses of mangrove timber products, such as fuel wood, construction, fencing, etc. Net value is assumed 50% of gross value.

The valuation of non-marketed mangrove forest products depends on their use, and shadow prices adjusted to 2006 equivalent were used. The higher gross value per unit volume for the mangrove forest in Pagbilao and in Ulugan Bay is due to its use in house construction, while the lower gross value in Aklan is because it is used as fuelwood. Production costs of alternative timber products are assumed at 50%, hence net values are half of gross values. Net value of timber production in 2006 ranged from a low of PhP 332 million to a high of PhP1.23 billion. The average for all the estimates is about PhP596 million for the entire Philippines in 2006.

4.2.5 Live Reef Fish Fishery

Live reef fish fishery is important in the Philippines which mostly targets groupers (Mamauag, 2004). This fishery is also dependent on the health of the coral reef. While generating significant export revenues and incomes for fishers/cagers, there is an observation that Philippine-wide catches have peaked in the mid-1990s, but have gradually dropped through time (Figure 4.9). This declining trend in the LRFT is further demonstrated specifically in Palawan, where assessments are largely undertaken (Figure 4.10).

Figure 4.9 Total volume for export in the LRFT in the Philippines (1994-1999)
(Source: Mamauag, 2004)

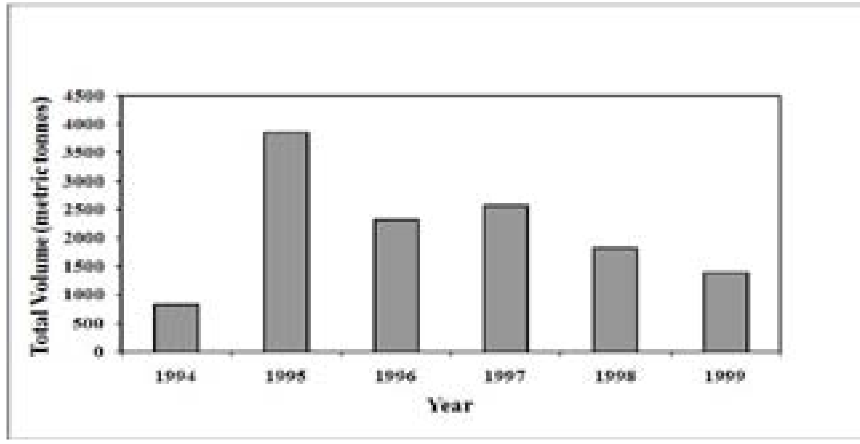
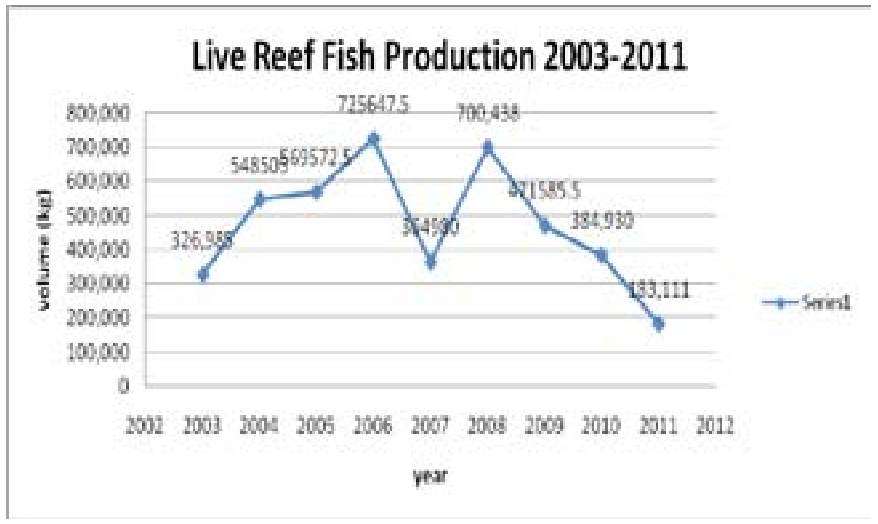


Figure 4.10 Total production in the LRFT in Palawan in 2002-2011
(Source: PCSD Report, 2011)



4.2.6 Aquaculture

Philippine aquaculture involves the farming of at least 18 species in inland and coastal waters. This sub-sector of the fisheries industry contributes 38% to the annual fisheries production and is currently the biggest sector in the fisheries industry (BAS, 2010). The industry is growing rapidly, exhibiting a growth rate of 10.2% per year. In the Philippines, it is widely recognized to have the highest potential in alleviating poverty from production and processing activities. In 2010, the aquaculture sector contributed 2,543,720 MT, valued at PhP82 billion.

The Philippines ranked 9th in the world in aquaculture production, contributing 741,142 million MT, valued at US$1,576,141 (FAO, 2008). It is a key producer of seaweeds, milkfish, tilapia and black tiger shrimp species in which the Philippines has developed seed production technologies to sustain production.

Aquaculture production comes from brackishwater fishponds, freshwater fishponds, fish pens, and fish cages in fresh and marine waters and mariculture. Total aquaculture production by culture environment is 2,477,392 MT.

4.2.7 Marine Aquaculture

In addition to fish, seaweeds and sea cucumber are also receiving much attention, and technologies are developed that create growth in the countryside and improve industry competitiveness (DOST-PCAMRD Report, 2010). Both taxa have gains in food security, employment, quality products and profit in the export industry.

Table 4.10 Aquaculture production by culture environment in the Philippines
(Source: DOST-PCAMRD Report, 2010)

Brackishwater	Weight (MT)
Fishpond	302,850
Fishcage	2,241
Fishpen	3,350
Total	**308,440**
Freshwater	**Weight (MT)**
Fishpond	144,724
Fishcage	101,611
Fishpen	62,002
Total	**308,337**
Marine waters	**Weight (MT)**
Fish cage	59,026
Fishpen	21,574
Total	**80,600**
Oyster, mussel and seaweed	**Weight (MT)**
Oyster, mussel and seaweed	1,779,862
Total	**1,779,862**
Grand Total	**2,477,392 MT**

4.2.7.1 Seaweeds

Research and Development support on seaweeds include culture technology enhancement to improve production capacity of Philippine seaweed farms, generation of new and improved seaweed strains for farming development using branch and spore culture technologies, micropropagation and cryopreservation. It will also improve seaweed post harvest and carrageenan extraction, recombinant production of carrageenase and agarase and production and characterization of oligocarragenan and oligoagar and production of novel red algal poly- and oligo- saccharides for various applications. In 2010, seaweed production in the Philippines ranked second in production at 1.799 MT next to Indonesia at 3.082 MT.

4.2.7.2 Mariculture Parks

The Philippines is charting a new direction for mariculture development and exploring new horizons of opportunities through the creation of Mariculture Parks (MPs). The objective of MPs is to promote sea farming as a major livelihood of coastal fishers. In addition to mariculture production, there are also ancilliary services that provide business and job opportunities for the community.

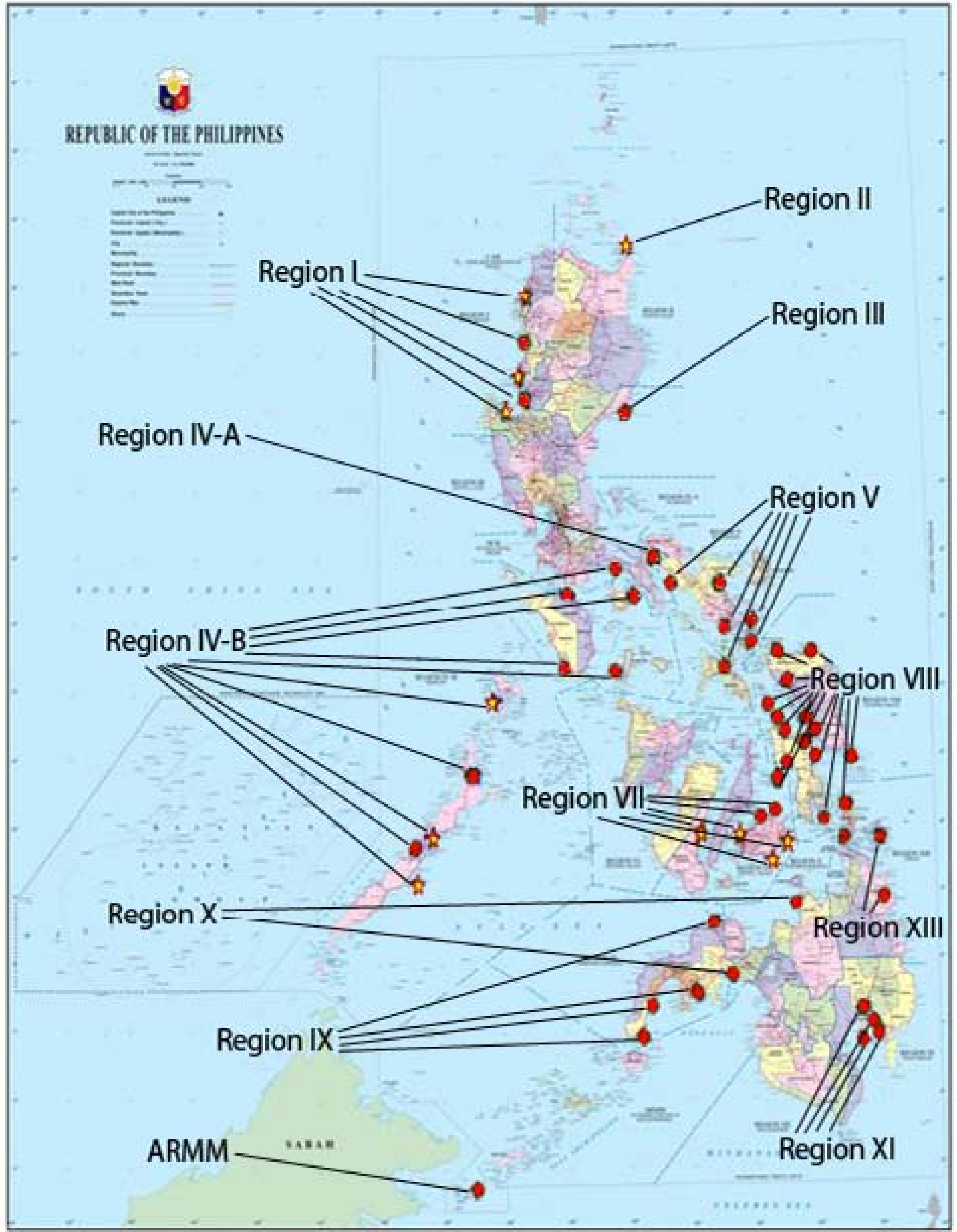
To date, there are 51 established MPs covering 49,553 hectares and 11 MPs for launching in 2011, covering 876 hectares in different regions of the country. There are about 5,000 cages with a total investment of PhP950 million. Panabo MP in Davao, for example, is producing rabbitfish (*danggit*) in polyculture with milkfish (*bangus*). Other species in the MPs are pompano, jack (*talakitok*) and grouper (NAST, 2011).

The present administration of President Aquino, through the DOST, has set the Five Priority Programs for 2011-2016, namely,

1. S and T solutions to pressing national problems;
2. Developing appropriate technologies that create growth in the countryside;
3. Improving industry competitiveness;
4. Use of S and T to enhance delivery of government and social services; and,
5. Building capacity in emerging technologies.

R and D in aquaculture focuses on "superfarms" of shrimp, milkfish and tilapia. The National Milkfish R and D program focuses on enhancement of milkfish broodstock management for production of good quality fry through refinement of broodstock management and improvement of milkfish hatchery technology using food enrichment and bio-encapsulation. Grow-out technology is also being enhanced for sustainable milkfish industry through improved culture

Figure 4.11 Location of existing mariculture parks in the Philippines *(Source: modified from PCAMRD, 2010)*



management practices for milkfish in ponds and cages, improving feed formulation, control of off-flavor and enhancement of milkfish culture operations through mechanization.

The National Shrimp R and D program puts emphasis on the development of good quality captive *Penaeus monodon* broodstock and spawners, ecology-friendly production technique, and handling protocols and value chain analysis for fresh/chilled/frozen shrimps reared in commercial and organic culture.

To boost the production capacity and competitiveness of tilapia production systems for the global market, the national Tilapia R and D program focuses on innovative approaches for tilapia culture, such as hatchery and grow out management schemes, use of prebiotics and probiotics, alternative feeding strategies for greener production and culture schemes for the fillet market. In addition, red tilapia production will be enhanced through breeding to increase the production capacity of the tilapia industry.

4.2.8 Coastal Tourism in the Philippines

The Philippines' tropical climate and diverse coastal environment with a variety of ecosystems and extremely rich biodiversity have made it an important area for coastal tourism development. Coral reefs, clean sandy beaches, crystal clear waters, and resorts that offer the classic attractions continue to draw tourists.

The coastal environment provides wildlife viewing, such as whale watching, turtle nesting, bird watching, and fish spotting. Coral reefs are a haven for SCUBA divers and snorkellers.

Coastal tourism brings substantial economic benefits to the Philippines. It is a source of foreign exchange and a significant part of national and local economies. Based on the WTTC satellite accounting, tourism accounts for 9.1 % of GDP of the country, and like other Asian Coral Triangle Countries (CTC), tourism is one of the fastest growing sectors of the economy, already worth US$16.3 billion (Alice Crabtree, Nov. 2007, *Coastal Marine Tourism Trends in the Coral Triangle and Strategies for Sustainable Development Interventions).*

The major coastal tourism destinations in the Philippines are shown in Table 4.11.

Table 4.11 Major coastal tourism destinations in the Philippines
(Source: Alan White et al., 2002. Coastal Tourism in the Philippines: The Sustainability Challenge)

White Sand Beaches
• Boracay Island, Aklan • Siargao Island, Surigao • Samal Island, Davao • Bohol Springs and beaches • Beaches of Palawan • Glan, Saranggani • Subic Bay, Zambales • Anilao, Batangas • Puerto Galera, Mindoro • Hundred Islands, Pangasinan
Resorts
• Puerto Azul, Cavite • Camiguin Island
Caves
• Puerto Princesa City Underground River, Palawan

About 2,887,715 foreign tourists visited the Philippines from January to September, 2011.

Table 4.12. Number of foreign tourists in the Philippines from 2009 to 2011
(Source: DOT, 2011)

TOURISM STATISTICS	
Year	Foreign Tourists
2009	3,017,099
2010	3,520,471
Jan–Sep 2011	2,887,715

**Excluding Filipinos from abroad*

4.2.9 Minerals, Oil, and Gas

Minerals, both metallic and non-metallic, abound in the Philippines. The country is rich in mines producing gold, copper, manganese, mercury, nickel, lead, paladium, platinum, iron, silver, and zinc. Our non-metallic minerals include: coal, barite, clay, diatomite, feldspar, limestone, mica, silica, magnesite, sulphur, talc, adobe, marble, gravel and sand, mineral oil (petroleum), natural gas, and rock asphalt.

The provinces of Mountain Province, Masbate, and in Mindanao are the leading sources of gold in the country. The best known copper-producing areas in the archipelago are: Cebu, the Mountain Province, Albay, Negros, Samar, and Zambales. Rich iron ore deposits are also found in Bulacan, Camarines Norte, Marinduque, and Samar. Chromite, manganese, lead, and zinc abound in the provinces of Zambales, Masbate, Ilocos Norte, Pangasinan, and Antique. Surigao del Norte has one of the world's richest nickel deposits, while Zambales is the site of the world's biggest deposit of high quality chromite.

Coal, an important mineral for fuel, abounds in Mindoro, Masbate, Cebu, Sorsogon and some parts of Mindanao. Natural asphalt, extensively used in road building, abounds in Leyte. Asbestos exists in Ilocos Norte and Zambales, although this mineral has been abandoned because it has been found to cause cancer. Laguna, Rizal, Camarines Sur, and Pampanga abound in stone, gravel and sand, clay and cement. There are rich marble deposits in Mindoro, Romblon, and Palawan. Surphur deposits exist in Camiguin Island, Cagayan, Leyte, Negros Occidental, Davao, and Mountain Province.

Of the 30 million hectares of land area of the country, 30% or 9 million hectares is considered to have high mineral potential. To date, only 2.7% of this area is being explored and developed. The promotion of mining investments and streamlining of the permit issuance has led to US$2.98 million in 2010 in terms of exports of minerals and mineral products, with investments reaching US$2.8 billion in 2009. In 2009, the mining industry employed 166,000, which is 0.5% of the total employment in the country. Mining contributed 1.3% to GDP or a gross value added of PhP96.9 billion (current prices) (DENR-MGB).

The Philippine offshore area including the Exclusive Economic Zone (EEZ) is estimated at 2.0 million km^2. Potential mineral offshore resources are placer minerals, including gold, chromites, magnetite, silica and aggregate resources (sand and gravel), decorative stones, manganese nodules/encrustation with associated copper, gold, zinc, and cobalt.

There is also exploration, mining, and production of iron ore in the Philippines, with 36,000 hectares of offshore magnetite iron ore sites in Northern Luzon (Cagayan, Ilocos Norte, and Ilocos Sur).

The Philippines also has potential in petrochemical oil or petroleum production to meet its needs. There are 16 sedimentary basins in the country, 13 of which are located offshore (Philippine Department of Energy).

Sedimentary basins are geologically formed through various chemical and physical processes and have accounted for a number of economically viable oil reserves on earth. These include: Sulu Sea and Eastern Shelf of Palawan — the largest areas at around 200 square kilometers. The list also includes: Southwest and Northwest Palawan, Mindoro-Cuyo Platform, Bicol Shelf, and Southeast Luzon, among others. Current estimate shows the country has an undiscovered resource of 7,920 million barrels oil equivalent, while discovered resource is 972.9 million barrels oil equivalent. As of 2010, thirty-four (34) Service Contracts are in operation, mostly in exploration stages. There are 302 wells drilled prior to the Service Contract System as introduced by PD 87 in 1972, while 261 wells have been drilled under the System.

Domestic production of oil in the Philippines began in the 1979 but has been very limited. Until 2010, the country has produced 61,860,820 bbls of oil, 1,011,267 mmscf of natural gas, and 45,312,937 bbls of condensate. To date, there are five producing fields, namely: Malampaya, Nido, Galoc, Matinloc and North Matinloc, all in offshore Northwest Palawan Basin. According to the 2008 BP Statistical Energy Survey, the Philippines consumed an average of 298 thousand barrels a day of oil in 2007.

The Oil and Gas Journal has reported that, as of January 2008, the Philippines holds an estimated 3.48 trillion cubic feet (Tcf) of natural gas reserves, most of which are found in the Malampaya gas field. According to the 2008 BP Statistical Energy Survey, the natural gas consumption of the Philippines in 2007 was 3.42 billion cubic meters. The country has two crude oil refining facilities, and had refining capacity of 282,000 bbl/d as of January 2008 at Petron Corporation's plant in Limay, Bataan, and Shell's Tabangao refinery. http: //www.mbendi.com/indy/oilg/as/ph/p0005.htm

The Philippines consumed natural gas in 2009 at around 3.33 billion cubic meters, 0.11% of the world total (2010 BP Statistical Energy Survey). The Philippines has 3.2 Tcf of proven natural gas reserves which started producing in 2001. While natural gas is mainly used for electric power generation, providing more than a third of the power requirement of the Luzon Grid, the government is continually pushing other uses, such as in the transport sector, particularly for public utility buses.

Malampaya is the largest natural gas development project in Philippine history, and one of the largest-ever foreign investments in the country. Shell Philippines Exploration (SPEX, operator, with a 45% stake), Texaco (45%), and the PNOC (10%) have come together to form the $4.5 billion Malampaya Deepwater Gas-to-Power Project. Malampaya is located in the West Philippine Sea, off the northern island of Palawan, and contains an estimated 2.6 Tcf of natural gas. A 312-mile (504-kilometer) pipeline links the field to three power plants in Batangas. The pipeline is among the longest deep-water pipelines in the world, with half of its length more than 600 feet deep.

4.2.10 Transportation and Shipping

As an archipelago, the Philippines relies heavily on the domestic and international shipping industry to link the islands and to transport goods and people. Shipping contributes to the economy by generating foreign exchange earnings and revenues through taxes and fees paid on bareboat chartered vessels, providing jobs, and facilitating technology transfer from shipping operations to ship management *(http://www.marina.gov.ph)*. In 2010, the country has 25 Port Management Offices (PMOs) (five in Manila/Northern Luzon, four in Southern Luzon, six in the Visayas, five in Northern Mindanao, and five in Southern Mindanao) *(Philippine Ports Authority, PPA)*. These ports play a major role in the growth of the national economy as they are sources of revenues from wharfage, dockage, port dues, usage fees, storage, pilotage, terminal fees, rental, share in arrastre/stevedoring, management fees, and other ancillary services. In 2009, PPA's gross revenue reached PhP7.129 billion, an increase of more than half-a-billion pesos (PhP503.37 million, or 7.60%) from 2008. From PPA's total port revenue PhP6.986 billion in 2009, the Manila International Container Terminal (MICT) operator International Container Terminal Services, Inc. (ICTSI) contributed 36% (PhP2.53 billion), whereas 12% (PhP840.25 million) was contributed by Asian Terminals, Inc. (ATI) in south harbor.

Table 4.13 Top 10 Port Management Offices (PMO) in terms of traffic volume in 2009 *(Source: PPA,2010)*

2009 Top 10 PMOs in terms of Traffic Volume				
Rank	Category			
	Cargo	Container	Passenger	Shipcall
1	Batangas	MICT	Batangas	Batangas
2	North Harbor	South Harbor	Calapan	Dumaguete
3	MICT	North Harbor	Zamboanga	Pulupandan
4	Limay	Davao	Tagbilaran	Davao
5	Surigao	Cagayan de Oro	Pulupandan	Calapan
6	South Harbor	General Santos	Dumaguete	Legazpi
7	Davao	Pulupandan	Legazpi	Iloilo
8	Pulupandan	Iloilo	Ozamiz	Tagbilaran
9	Iloilo	Zamboanga	Iloilo	Iligan
10	Cagayan de Oro	Nasipit	Iligan	Ozamiz

4.2.11 Knowledge and Practices of Indigenous Peoples in Coastal Areas

Communities that are original or aboriginal to a specific area have a body of knowledge called Indigenous Knowledge (IK). It may also be a long history of practice, in which case it is often called Traditional Knowledge (TK). Among the aspects of IK or TK (NUFFIC-IK-Unit and UNESCO-MOST, 1999 and 2002) are the following:

a. locally-bound, native to a specific area;
b. culture- and context-specific;
c. non-formal knowledge;
d. orally transmitted and generally not documented;
e. dynamic and adaptive;
f. holistic in nature; and,
g. closely related to the survival and subsistence of many people.

Today, the significance of IK/TK is getting more recognition, including its value as a complement to scientific findings. Customary marine tenure systems and traditional practices, for instance, can be seen as viable alternatives to existing approaches in fisheries management.

The country has two types of IK or TK. One includes practices of aboriginal groups scattered over the Philippine Islands. The other, those of populations that may or may not be marginalized members of mainstream society lining the Philippine coasts. In cognizance of the potential good that best practices of indigenous cultural communities (ICC) can contribute to society — cases that illustrate the good use of IK in developing desirable cost-effective and sustainable strategies — the Philippines' Indigenous Peoples Rights Act (IPRA) was enacted in 1997. The IPRA law not only recognizes the rights of ICCs but also aims to protect and promote these rights.

Out of the Philippines' population of 85 million a few years ago, 12 million were considered indigenous from approximately 110 different ethnolinguistic groups, or "cultural communities" (Colchester & Ferrari, *2007 and* Corazon, *2005)*. Following are some of the many indigenous cultural groups in the Philippines and their potential contributions to fisheries management.

4.2.11.1 Calamian Tagbanwa

The Calamian *Tagbanwa* inhabits Coron Island, one of the Calamianes Islands of North Palawan. Ethnoichthyological studies provided evidences that traditional fishers have a rich knowledge of fish and fishing (Sampang, 2005). The *Tagbanwa* classifies fish based on habitat, schooling behavior, morphological appearance and market value. Their knowledge of the habitat and the diet of the fish may contribute to the fishery management strategy. The folk taxonomy of the *Tagbanwa* includes fish as a life form, and their naming system is constructed in terms of their interaction with the marine environment. Hook and line, spear gun and gillnet are the commonly used fishing gear during southwest and northeast monsoon, respectively.

The *Tagbanua* believes in *panyain* or spirits that dwell in nature, including the lakes, trees and the seas. They hold to various sacred and/or conservation-related practices relating to resource use. For example, certain areas are protected as sanctuaries. They are sacred sites where the *panlalabyut* (a giant human-like octopus) is believed to dwell, and who may bring harm to those who trespass on these sites. In Coron Island alone, there are over 10 inland lakes that are considered *panyaan* (sacred waters). Also, the *Tagbanuas* have a cultural belief that some fish species should be avoided for consumption since they may pose a health risk. This belief is passed down through generations by oral tradition. Cutting trees near streams or springs is prohibited as the *Tagbanua* recognize the value of watersheds for irrigation of their crops and preventing soil erosion. Traditionally practiced punishments are *panglaw* — hands are tied in a wooden contraption for five days — and *burdun* — 12 lashes of rattan cane.

Fishing, hunting and foraging define the *Tagbanua's* way of life. The majority of them employ hook-and-line fishing either for subsistence or trade. The fishing season runs from June to mid-November. A few families are engaged in small-scale commercial trading of groupers, fresh fish and octopus; the harvest is determined by what can be sold or consumed immediately, due to the absence of electricity in the island. Interestingly, the *Tagbanua*s are unselfish and share their fish catch with other community members when their catch exceeds what their family needs. Coron Island is well-known for the fine quality of its edible swiftlets' nest *(Callocalia troglodytes)* which are found in caves. The *Tagbanua*s have been gathering these bird nests to trade with the Chinese since the 11th century. Such a hunting method is governed by an open and closed season for an improved harvest of the population of swiftlets. The nests are also sold to local dealers in Coron Market for PhP6,000-P18,000 per kilogram (approximately US$125 to $380).

There are three factors that explain the ecological balance in Coron Island until the mid-20th century: a low population vis-à-vis the resource base; a subsistence economy; and cultural norms that made it taboo for the *Tagbanuas* to indiscriminately exploit their forest and coastal resources. During the early 1970s, however, the Municipal Government sequestered many clan-caves when the *Tagbanuas* failed to pay the taxes imposed on them. Tax payments were used by the Municipal Government as a proof of ownership to the land, and since most of the *Tagbanua*s could not afford the annual payment, the lands were auctioned off to tourist resort developers and real estate agents.

In the 1980s, declining fisheries in the adjoining Visayas islands and southern Luzon coasts triggered the movement of fishers westward into the Calamianes waters. The *Tagbanua*s were again threatened by migrants encroaching in their area, particularly in Delian Island, thus forcing them to move upland in Coron Island. The struggle of the *Tagbanua*s to access their resources was aggravated by the onset of declining fish catches due to illegal fishing activities of these migrants.

By the mid-1980s, the waters surrounding the island were being degraded at an alarming rate by dynamite, cyanide, and other illegal and destructive fishing methods. The influx of migrants and the use of illegal fishing methods caused the decreasing fish harvest among Calamian *Tagbanwa*. The situation was so serious that the *Tagbanwas* faced food shortages.

In response to this ecological assault, the *Tagbanwas* organized the *Tagbanwa* Foundation of Coron Island in 1985 which applied to the DENR for a Community Forest Stewardship Agreement. This agreement would provide a 25-year legal tenure to the *Tagbanwa* people and allow them to manage their natural resources through a community forest management plan (Ferrari and de Vera, 2004).

The Calamian *Tagbanwa*, having been given the overall authority, plays a major role in the conservation and protection of their ancestral homeland. Poverty, the influence of migrants and the introduction of Christianity are seen as a hindrance to continuing their beliefs and practices in their ancestral waters. Information campaign, consistent implementation and recognition of their customary laws will help in the protection of their ancestral domain.

4.2.11.2 Ivatan

The *Ivatan* is a Filipino ethnolinguistic group predominant in the Batanes Islands, whose culture has largely been influenced by the prevailing climate in the islands. Exposed to high risks of disruption to their agriculture, the *Ivatan*s have adopted strategies that would enable them to sustain themselves and live reasonably well. Traditionally, because of the frequent typhoons and drought, they plant root crops that are able to cope with the environment (Bankoff, 2002). The *Ivatan* also studies the behavior of animals, sky color, wind and clouds to predict the weather.

On the other hand, the sea is also vital to the *Ivatan*'s way of life (Rowthorn, 2003). An interesting feature of the *Ivatan* fishing culture is the *tatayak,* which legend describes as a vehicle that slices through the largest ocean waves with ease. *Ivatan*s depend on the flying fish (*dibang*) and dolphinfish (*arayu*), which are abundant along the shores of Batanes from March to May (Datar, 2008).

The following review describes the beliefs and practices of fishers in the Batanes Islands, known as *mataws*, who engage in the capture of seasonal flying fish.

- **Harnessing the ecological knowledge of fishers.** There is a high respect for the environment, communal cooperation, and belief in the sacredness of relationships among the *Ivatans*.
- **Harnessing Observance of taboos and the performance of rituals as tools for resource management.** The rights to fish and use the *vanua* safely are gained by conducting an exchange through ritual sacrifices with the *anitu* or invisible spirit beings. The *vanua* becomes a sacred area for the duration of the fishing season, and fishing success is explained within a framework of purity and pollution.

  Indigenous peoples consider deities as well as environmental and ancestral spirits as owners of the natural resources. Thus, users need to consult them. Consultations take the form of rituals, which may include chanting, singing, dancing, praying, killing of animals (*e.g.* chickens and pigs), wine drinking and food sharing during communal meals. One possible result of rituals is the declaration of an area as a sacred site. As a result, sacred places become "*de facto*" protected areas.

- **Observing economic arrangements to protect the environment.** Reciprocity and mutual help arrangements are the traditional base of *Ivatan* economy.

Socio - Economic Characteristics

This is partly because cash is scarce in Batanes. A person might give a *mataw* onions or a sack of rice at the onset of the fishing season, which the *mataw* will reciprocate at the end of the season. The seasonal *mataw* fishing activity is closely integrated with farming which is a year-round activity. *Mataw*s, who are also farmers, contract out the care of their cattle or livestock and fields to enable them to concentrate on fishing during summer.

- **Implementation of organizational rules formulated by the association**. *Mataw* organizations regulate access and exploitation of resources within the *vanua* and traditional fishing grounds under the leadership of the ideal fisher who makes the first fishing trip of the season, and who has the power to ritually set precedents for the season. The main objective of the *vanua* organization is to protect the *mataw* fishing endeavour, *i.e*., to have a good season of fishing with as few accidents as possible. *Mataw*s must organize to prepare the *vanua* for the fishing season, to perform communal rituals for the benefit of the entire group, to assist one another in case of emergency, and to resolve conflicts among members. One important function of the *vanua* group is to formulate rules and regulations for fishing. The rules concern the behavior of the *mataw*s, many spell out taboos and penalties for violations. *Mataw*s are bound to help one another in case of accidents. *Mataw*s who break taboos have to provide the sacrificial animal to be used in "cleaning" the *vanua*.

In summmary, the *mataw* indigenous fishing tradition is a very specific way of deriving a living from the sea that integrates: (a) harnessing the ecological knowledge of fishers; (b) the observance of taboos and the performance of rituals; (c) the observance of economic arrangements to protect the environment; and, (d) the implementation of organizational rules formulated by the association.

4.2.11.3 Visayan Fishers

Certain folk beliefs and practices among Third World societies are found to be beneficial in terms of preserving ecological balance. This is especially true in the case of the concept of *mari-it* in the island of Panay (Magos, *In*: Ushijima and Zayas, 1994). Since these areas are considered sacred, natives would never dare ravage them, preventing their possible exploitation. There are also certain taboos observed by fishermen to protect themselves against the rage of sea spirits.

Shared beliefs and rituals contribute to the solidarity of the society (Cuadra *In*: Ushijima and Zayas, 1994). And through the various rituals, prescribed patterns of behavior that are repetitive in nature, the fishers both internalize and express social values, such as respect for property ownership and sharing. The rituals enable the communities to exercise a measure of control over their life source and conquer what could otherwise be the harshest living conditions.

In general, what the fishers fear most are the forces of nature beyond their control, like storms, strong winds and big waves. In everyday life, the presence of sharks also adds to their fears. And since big ships often sail the sea surrounding the island of Panay, the fishers are likewise afraid of their presence at night for fear that these might hit their fishing boats.

4.2.11.4 IK and Marine Resource Management

The greatest challenge to conservation of marine biological diversity and sustainability, as in the case of fisheries, is the understanding of the behavior of the users of the resources. And influencing the behavior of the users is imperative in the management of an area. Moreover, there is a need to understand the reasons behind cultural and spiritual beliefs and their motivations.

In the context of fisheries management, both property rights and indigenous rights are two important principles that recognize the potential of indigenous peoples in managing resources and influencing institutions towards policy advocacy and reform. Property rights are entitlements that have great impact on the ability of indigenous communities to exercise their ancestral rights and manage resources. Similarly, the legal recognition of community-based property rights should be understood as a goal that reflects an ideal outcome for many local communities that are or will be negotiating management agreements with the Government. Consequently, any management mechanism for fisheries resources needs to acknowledge the importance of incentives for cooperation and individual self-interest, as well as balancing the claims of multiple uses and users.

Many island communities have traditionally used area-based restrictions to facilitate the recovery of marine resources. Fisherfolk experiences were always taken into consideration in establishing procedures (*e.g*., the fisherfolk knowledge of water circulation around the island, traditional fishing operations, and fish behavior helping in determining the establishment of MPAs) (Flores *In:* Ushijima and Zayas, 1994).

Yet, while there is increasing recognition of the value of these management systems in conservation programs, government legislation is sometimes in conflict with community resource allocation systems, and traditional community-based efforts may not be recognized enough for their contribution to national and international marine protected areas, and development strategies and targets. Traditional beliefs have not been given the attention they deserve as a rich source of options and cues for carrying out changes in people's life-ways and habits. The reasons for this oversight are many, one may be the tendency of some modern environment planners and decision makers to distrust indigenous ecological belief systems as backward.

Thus far, the government's own fisheries management program has been narrowly focused, its prescriptions have been more into relieving symptoms rather than dealing with causes (Magos, *In:* Ushijima and Zayas, 1994). IK/TK can help bridge the gap. Sustainable development can be achieved by exploring some folk concepts and associated beliefs and practices that encourage environmental preservation and ecological balance.

4.2.12 Gender Issues

Gender equality is being actively promoted in the Philippines be it in the government or other sectors outside of the government. There are enabling policies and mechanisms that support gender equality in the Philippines, among them are:

- The 1987 Philippine Constitution - upholds equality before the law of men and women and recognizes the role of women in nation building;
- The establishment of the National Commission on the Role of Filipino Women in 1975 and its transformation into the Philippine Commission on Women in 2009 - acts as catalyst for gender mainstreaming, authority on women's concerns, and lead advocate of women's empowerment, gender equity, and gender equality in the country;
- The Philippines is signatory to the international Convention on the Elimination of all Forms of Discrimination against Women (CEDAW);
- Republic Act 7192, Women in Development and Nation Building Act - provides guidance and measures that mobilize and enhance participation of women in the development process in ways equal to that of men;
- The incorporation of the Gender and Development budget in the annual General Appropriations Act.

Moreover, a PATH Foundation study on the links between reproductive health and integrated coastal management revealed two major gender issues in coastal areas of Bohol and Palawan, namely, lack of access of women to credit and training for alternative livelihood, and lower level of secondary education attainment in men is a concern because this poses a limitation to employment options beyond fishing (Castro *et al.*, 2004).

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threats and vulnerabilities

Neal Oshima
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Chapter 5
THREATS AND VULNERABILITIES

Nature has the inherent ability to withstand undesirable impacts. The seas, for instance, have strong buffering characteristics. Unfortunately, undesirable influences, in excess or ocurring in increasing frequency, eventually harm the coastal and marine habitats and adversely affect related aspects, including food security and the economy.

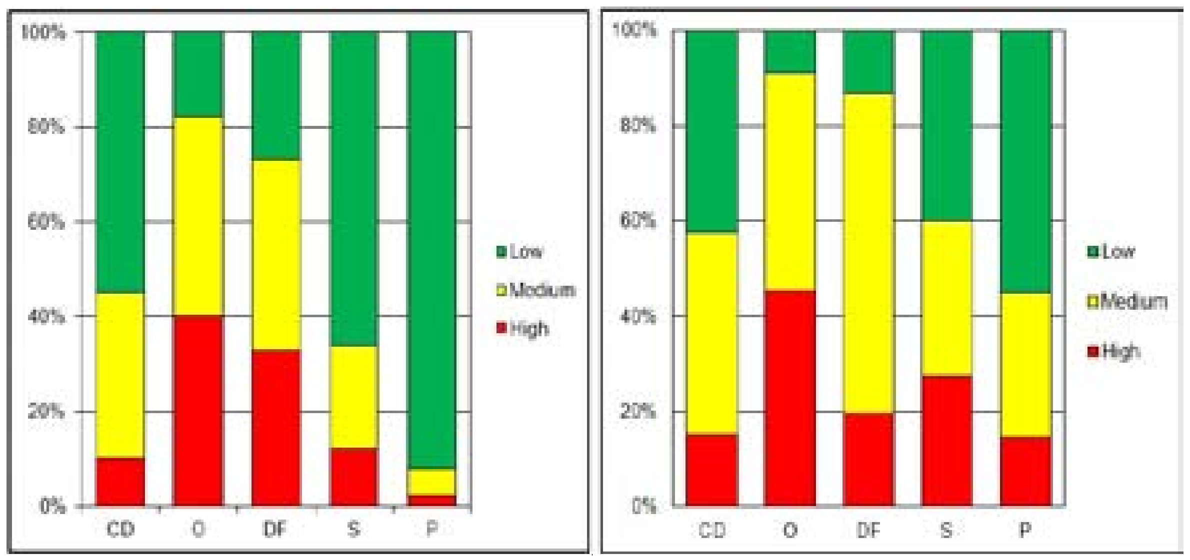
Current problems and issues have long plagued the coastal areas and marine waters of the Philippines and continue to do so today. For instance, increasing populations that intensify fishing pressure and exacerbate polluted conditions have been a major concern for years. However, recent situations have started to aggravate already existing problems, giving rise to emerging issues. Climate change, for one, has added to the extent of coral bleaching and may, perhaps, owing to adverse impacts on other resources, allow frequent occurrences of algal blooms. This chapter aims to describe various current and emerging threats.

5.1 Current Issues for Marine Resource Management

5.1.1 Fisheries Degradation and Food Security

The status report on Philippine coral reefs (Licuanan and Gomez, 2002; Tun *et al.,* 2004) revealed that live hard coral cover has decreased by 3%-5% of the total estimated cover in the 1980s. Moreover, the proportion of coral reefs in 'poor' condition has increased from 33% in the 1980s to the recent estimate of 40%, whereas 'excellent' condition reduced to 1% (Nanola *et al.,* 2004). This decline is attributed to the continuing threats from coastal development, marine-based pollution, sedimentation, overfishing, and destructive fishing (Burke *et al.,* 2002, Burke *et al.,* 2011). Based on the most recent assessment, there appears to be changes in the present level of threats compared with the previous data. In 2002, overfishing was the largest threat (about 40%) to the coral reefs in the Philippines, followed by destructive fishing practices (approximately 36%) (Figure 5.1). In 2012, however, most of the levels of major threats rose except for destructive fishing (Figure 5.1) (MSN Threat Assessment Workshop, 2012). High and medium level threats, particularly sedimentation and pollution, increased manifold suggesting the escalation of problems causing these. These include inappropriate land use practices, irresponsible mining practices, deforestation or illegal logging activities, improper waste disposal, *etc*. There was also considerable growth in coastal development manifested by the increase in coastal populations, built-up areas, and urbanization, among others. In contrast, the level of destructive fishing practices appears to decrease through time in many sites, indicating some successes in enforcement activities in MPAs and fishery managements in several municipalities.

Figure 5.1 Estimated Level of the Major Threats to Coral Reefs in the Philippines in 2002 (left) **and** 2012 (right) [**CD** – coastal development, **O** – overfishing, **DF** – destructive Fishing, **S** – sedimentation, **P** – pollution] *(Source: Burke et al., 2002, MSN Threat Assessment Workshop, 2012)*



5.1.1.1 Overfishing

Recent assessments, however, still showed that overfishing is a significant threat in more areas. Nanola *et al.,* (2011) reported low abundance of species at certain regions especially in the Visayas Region characteristic of intense fishing and habitat degradation that leads to subsequent species declines. Continuous unabated heavy exploitation is suggested to have a cumulative effect on the overall richness of species in the Visayas region.

The impacts of overfishing and to some extent destructive fishing practices on coral reefs are evident in the biomass of reef-associated fish. Based on the classification shown in Table 5.1, it was reported that more than 50% of the reef sites in the Philippines surveyed between 1991 and 2004 are overfished (Figure 5.2). The high fish biomass category was more common in the Visayas and Sulu Sea areas, comprising 25.9% and 32.9% of reefs, respectively. Very high fish biomass categories were observed where there was also high species diversity, such as West Philippine Sea and Sulu Sea each at 15% of the total reef area. These biogeographic regions contain large MPAs (Tubbataha Reef National Marine Park) and many expansive reefs (Kalayaan Islands Group in the West Philippine Sea). Thus, the only reefs with healthy fish populations are either in MPAs, which may have been protected for at least five years or those that are 'politically-protected' remote areas (*i.e.,* inaccessible to the multitude of artisanal fishers).

Table 5.1 Level of exploitation and fish biomass on coral reefs *(Source: Nanola et al., 2002)*

Reef Fish Biomass (metric tons per km²)	Fish Biomass Category	Level of Fishng
1 to 5	Very low	Overfished
5-1 to 10	Low	Overfished
11-20	Medium	Moderate
21-40	High	Minimal
>40	Very high	Minimal

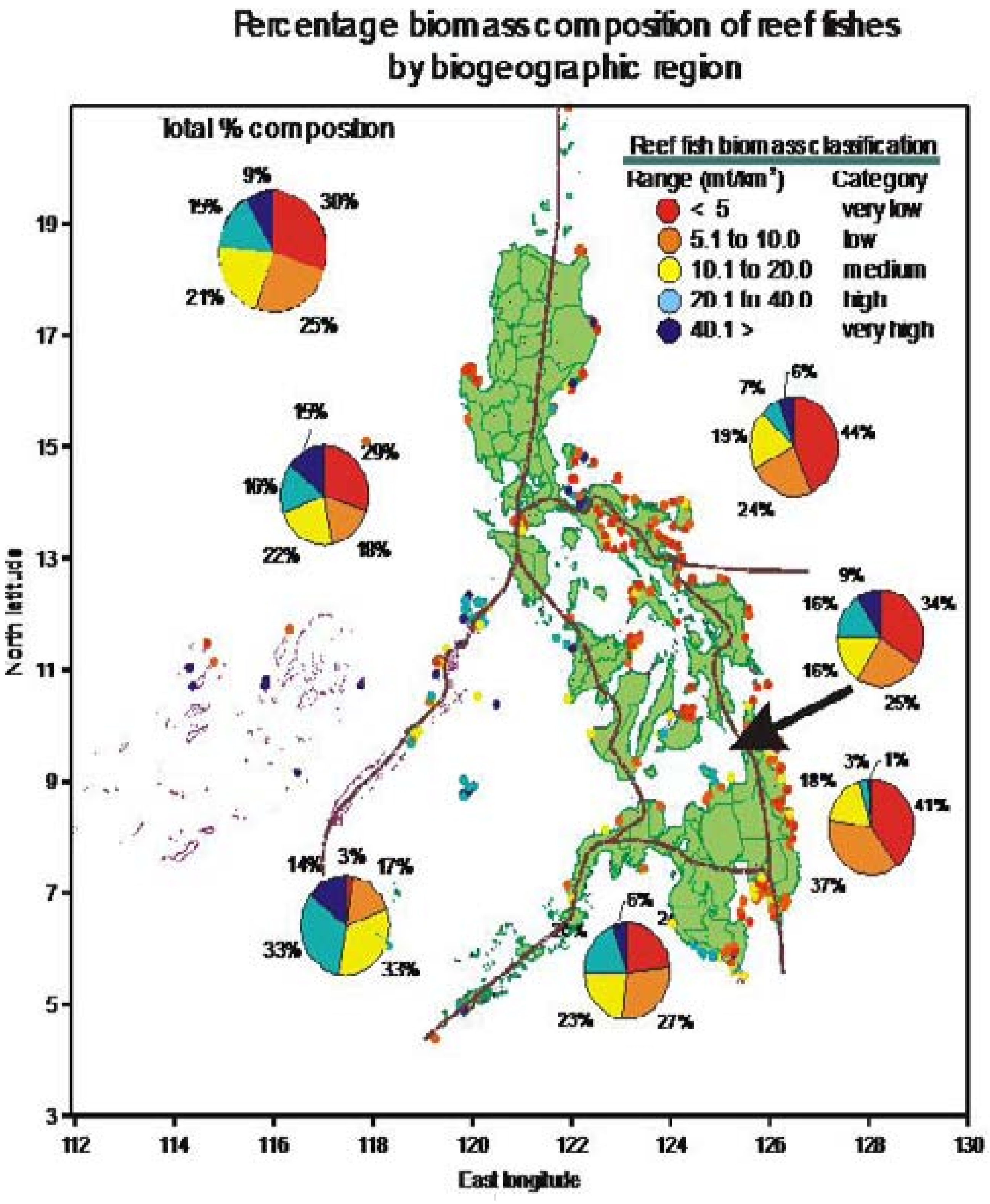
5.1.1.2 Overfishing in the Live Reef Food Fish Fishery in Palawan

The live reef food fish fishery of Palawan is a good case study to demonstrate overfishing of reef fishes. Indeed several assessments have shown stock depletion and overfishing since its establishment given their increasing demand in the market. Based on the current report from the Palawan Council for Sustainable Development (PCSD), the province-wide maximum sustainable yield for grouper (MSYG)[1] was computed at 186 MT/year under the best of conditions (*i.e.,* assuming no overfishing, no use of cyanide and other destructive methods for one year), while maximum sustainable export for grouper (MSEG)[2] was computed at

1. The maximum grouper productivity of a reef in an area in a year; measured in tons or kilograms of grouper fish per square kilometer or hectare of a reef per year

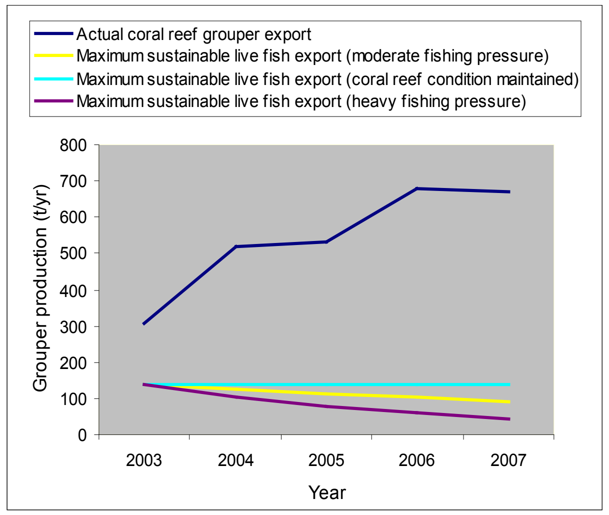
2. The maximum volume of live grouper in a year that can be shipped out of Palawan; assumed to be 75% of the MSYG

Figure 5.2 Percentage of Reef Fish Biomass Categories of the Biogeographic Regions in the Philippines *(Source: Nanola et al., 2002)*



139.5 MT/year. In contrast, the volume of live groupers shipped out of Palawan was recorded at 309.2 MT/year in 2003 and has steadily increased to 669.1 MT/year in 2007. This shipment data can be taken as the minimum harvest considering the inherent mortality associated with the live fish fishery. Given the moderate to heavy fishing pressure that the groupers have been experiencing since four years ago, the groupers' rate of depletion has therefore been increasing and the current harvests are no longer sustainable (Figure 5.3).

Figure 5.3 Live grouper (Palawan stocks) export from 2003 to 2007 under varying levels of fishing pressure *(Source: PCSD Report, 2011)*



The 2007 estimated provincial level depletion under varying levels of fishing pressure was 624.9 MT (heavy fishing pressure), 577.5 MT (moderate fishing pressure), and 529.5 MT (negligible fishing pressure). The same scenario of depletion is shown to occur on a per area cluster basis. The 2007 estimated level of depletion versus the estimated MSEG for the whole province and by cluster is shown in Table 5.2.

Contributing to the depletion are the generally bad health condition of our coral reefs due to (1) illegal methods of fishing, such as the use of cyanide and dynamite; (2) siltation from the land; (3) sea water temperature increase due to global warming; and (4) continuous overfishing over the years. Palawan has only 109.2 km² (13.4%) of reefs in excellent to good condition, while the larger area of 707.513 km² (86.63%) is classified as under fair to poor reef conditions. This translates to poor reef productivity (Figure 5.4).

5.1.2 Impacts on Adjacent Habitats

In spite of the ecological and economic value of seagrasses, between 30% and 50% of Philippine seagrass beds have been lost due to industrial development, ports, and recreation in the last 50 years (Fortes, 1995). Seagrass ecosystems are threatened by the loss of mangroves areas, which act as 'filter' for sediment from land, as well as coral reefs, which serve as buffer against waves and storm surges (PNSC, 2004).

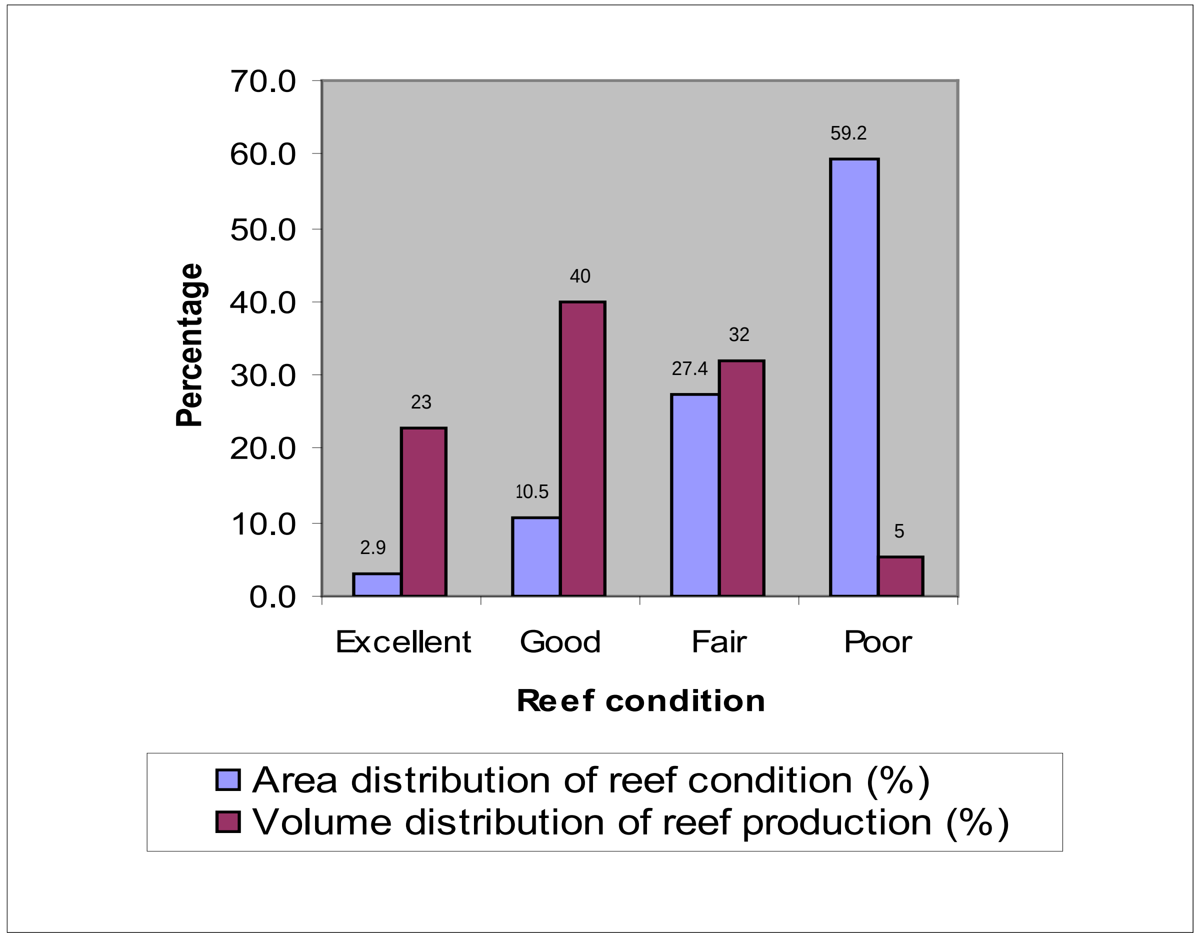
Harvesting of mangroves for fuelwood, construction and charcoal-making contributed largely to the destruction of the resource. Illegal cutting and overharvesting subsequently degraded the habitat and ecosystem (White and de Leon, 2004). But conversion of mangrove areas to fishponds accounts for a large portion of mangrove loss (66%). In the Philippines, about 279,000 hectares of mangroves lost from 1951 to 1988 were developed into culture ponds. The rate of mangrove loss has increased from 3,100 to 8,200 despite the government ban on further conversion of mangroves to fishponds in 1980 (White and de Leon, 2004).

In order to reduce the impacts of fishpond development, Primavera (2000) emphasized that mangrove-friendly aquaculture (MFA) technology that does not require cutting of trees is needed for aquaculture to be sustainable. Of the two types of MFA technology that are

Table 5.2 Estimated level of depletion of groupers (MT) in Palawan for 2007 *(Source: PCSD Report, 2011)*

Area	Live fish Export (MT)	MSEG (MT) for Heavy fishing pressure	Depletion (MT)	MSEG (MT) for Moderate fishing pressure	Depletion (MT)	MSEG (MT) for Negligible fishing pressure	Depletion (MT)
Province-wide	669.08	44.16	624.93	91.57	577.52	139.56	529.52
Calamianes Group	233.71	6.80	226.90	14.10	219.60	21.5	212.21
Mainland and nearby island municipalities	308.15	33.20	274.95	68.84	239.31	104.93	203.22
Cuyo Group	127.23	4.16	123.07	8.62	118.61	13.14	114.09

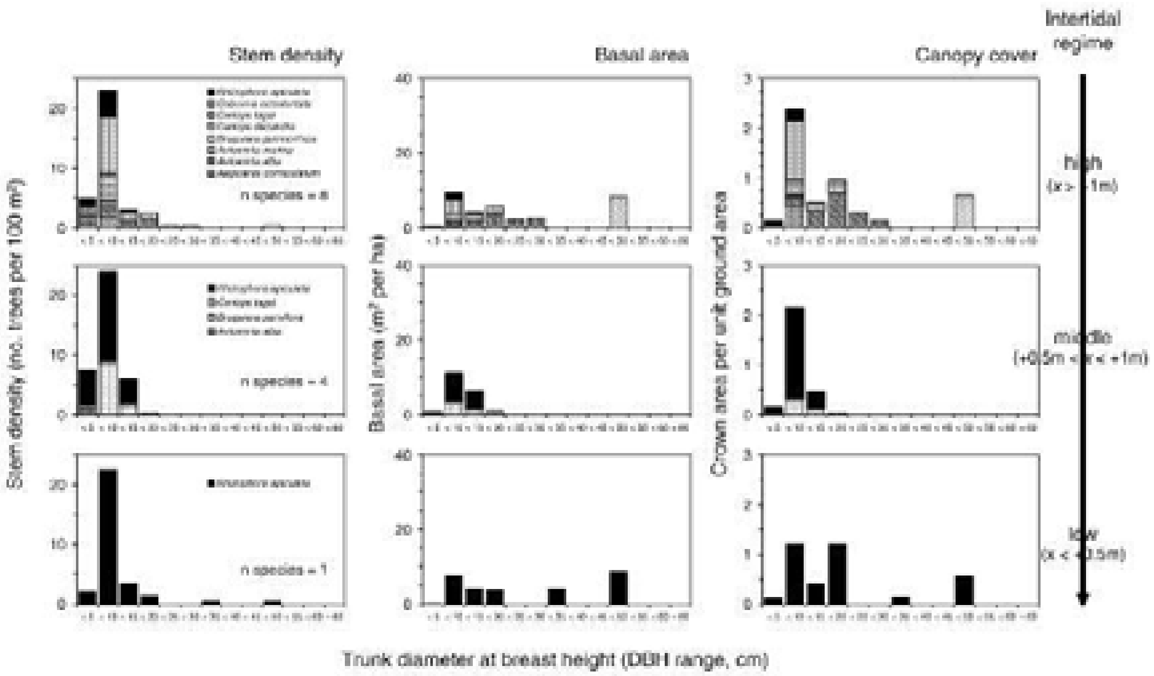
Figure 5.4 Percentage of live reef fish yield per condition in Palawan *(Source: PCSD Report, 2011)*



currently known, aquasilviculture is the one being practiced in the country. In 1987, a BFAR project established some 1.6 to 2.6-hectare milkfish ponds in Ubay, Bohol, where *Rhizophora* mangroves occupy around 80% of the area (Aypa and Bacongis, 1999 as cited in Primavera, 2000). The area yielded about 1 MT/ha/yr of milkfish for the first five years and became habitat to various wild fishes and invertebrates, as well as wild ducks and birds. However, the mangrove prop roots hampered the assessment and harvest of fish stocks. In addition, prolonged flooding was detrimental to the mangrove trees, while overgrowth of filamentous algae led to fish kills.

Planting mangrove trees has become a standard practice in coastal resource management in the Philippines. Recently, however, Samson and Rollon (2008) reported widespread tendency to plant mangroves in large areas (44,000 has.) that are not the natural habitat of mangroves, converting mudflats, sandflats, and seagrass meadows into often monospecific *Rhizophora* mangrove forests (Figure 5.5). From the evidence, it was argued that a more rational focus of the restoration effort should be the replanting of mangroves in the brackish-water aquaculture pond environments, the original habitat of mangroves. A number of management options was explored, the implementation of which ultimately depended on the political will of local and national governments.

Figure 5.5 Parameters of mangrove growth planted in an unnatural habitat
(Source: Samson and Rollon, 2008)

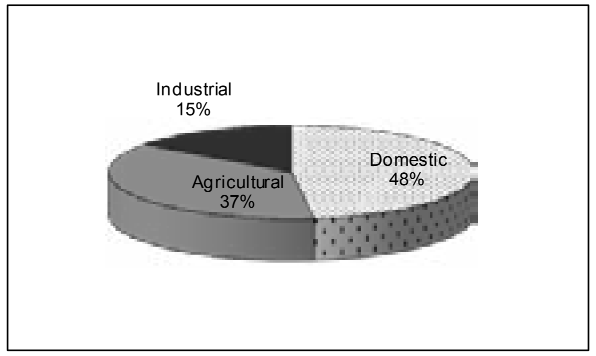


5.1.3. Excessive Nutrients and Other Pollution

Major sources of marine pollution include domestic and industrial wastes, agrochemical loading, siltation/sedimentation, toxic and hazardous wastes (including heavy metals and mine tailings), and oil spills. The basis for appraising water quality using certain physico-chemical indicators, such as dissolved oxygen (DO), fecal coliform, some heavy metals, pesticides and pH, is set by the Department of Environment and Natural Resources Administrative Order No. 34 (Series 1990) (McGlone et al., 2004).

Recent estimates (Brown Report, 2009) showed that there are about 2.2 million MT of organic pollutants released into the environment annually. These pollutants come from domestic, agricultural and industrial activities (Figure 5.6). In terms of water quality and quantity, the four critical regions are: the NCR (Metro Manila), Central Luzon, Southern Tagalog and Central Visayas. In these regions, the domestic and industrial sectors are the main contributors to water pollution.

Figure 5.6. Organic Wastes from Domestic, Agricultural and Industrial Sources and their Relative Contributions
(Source: Philippines Environment Monitor, 2003, Brown Report, 2009)



Despite the many water-related laws that are already in place, efforts to protect water resources from the impacts of pollution are hampered by: weak enforcement, inadequate resources, poor database, and lack of cooperation among national and local government agencies. The Clean Water Act was created to address the inadequacies of existing laws.

5.1.4 Threatened/Endangered Species

5.1.4.1 Marine Turtles

Nesting population and egg production are used as indicators to assess the status and population abundance of marine turtles. Data gathered by the Parks and Wildlife Bureau (PAWB)-Pawikan Conservation Project (PCP) in collaboration with DENR Regional Office, local government units, non-government organizations and resort owners show an increase in the number of olive ridley nests and eggs produced in Morong and Bagac (Bataan) and in San Antonio (Zambales) from August 2004 to February 2009 (Figure 5.7).

Another well-known nesting area is the Philippines Turtle Islands (also known as the Turtle Islands Wildlife Sanctuary or TIWS) and the Sabah Turtle Islands (Malaysia), both of which have been declared as the Turtle Islands Heritage Protected Area (TIHPA). TIHPA is the first trans-frontier protected area for marine turtles in the world, and covers six islands administered by the Philippines and three islands administered by Sabah. It is a major nesting area for green sea turtles in Southeast Asia. Hawksbill turtles also nest in the area although in small numbers. From 1984 to 2007, the PAWB-PCP recorded egg production and number of complete nestings in Baguan Island. Fluctuations in egg production and number of complete nests have been noted due to changes in weather patterns brought about by the El Niño or La Niña phenomena, and predation by monitor lizards (*e.g.*, *Varanus sp*.) (Figure 5.8).

Figure 5.7 Complete nests and egg production of Olive Ridley in Bataan and Zambales (August 2004 – February 2009) *(Source: PAWB-PCP, 2009)*

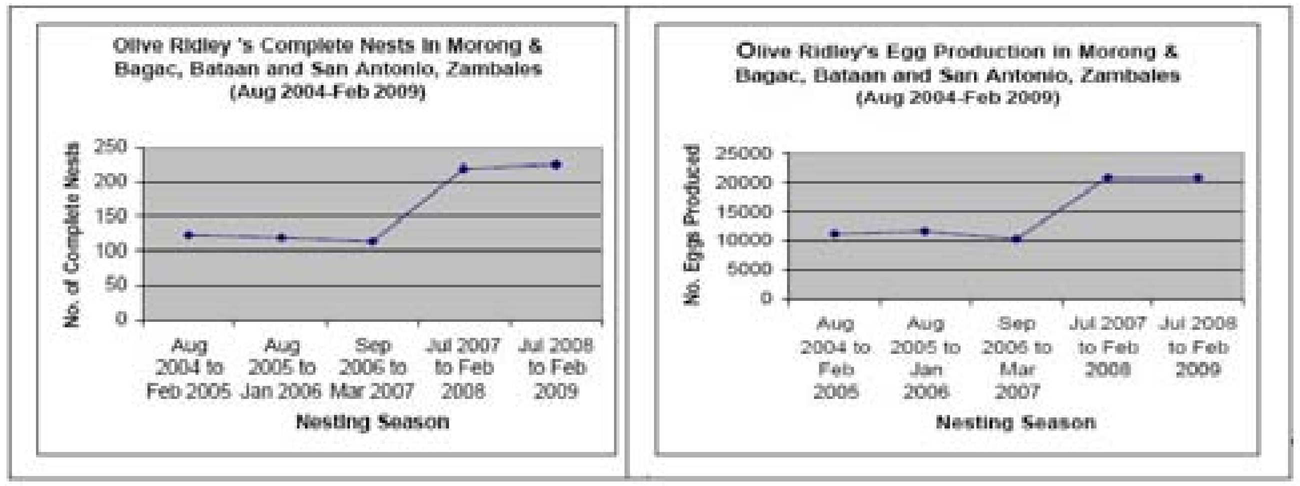
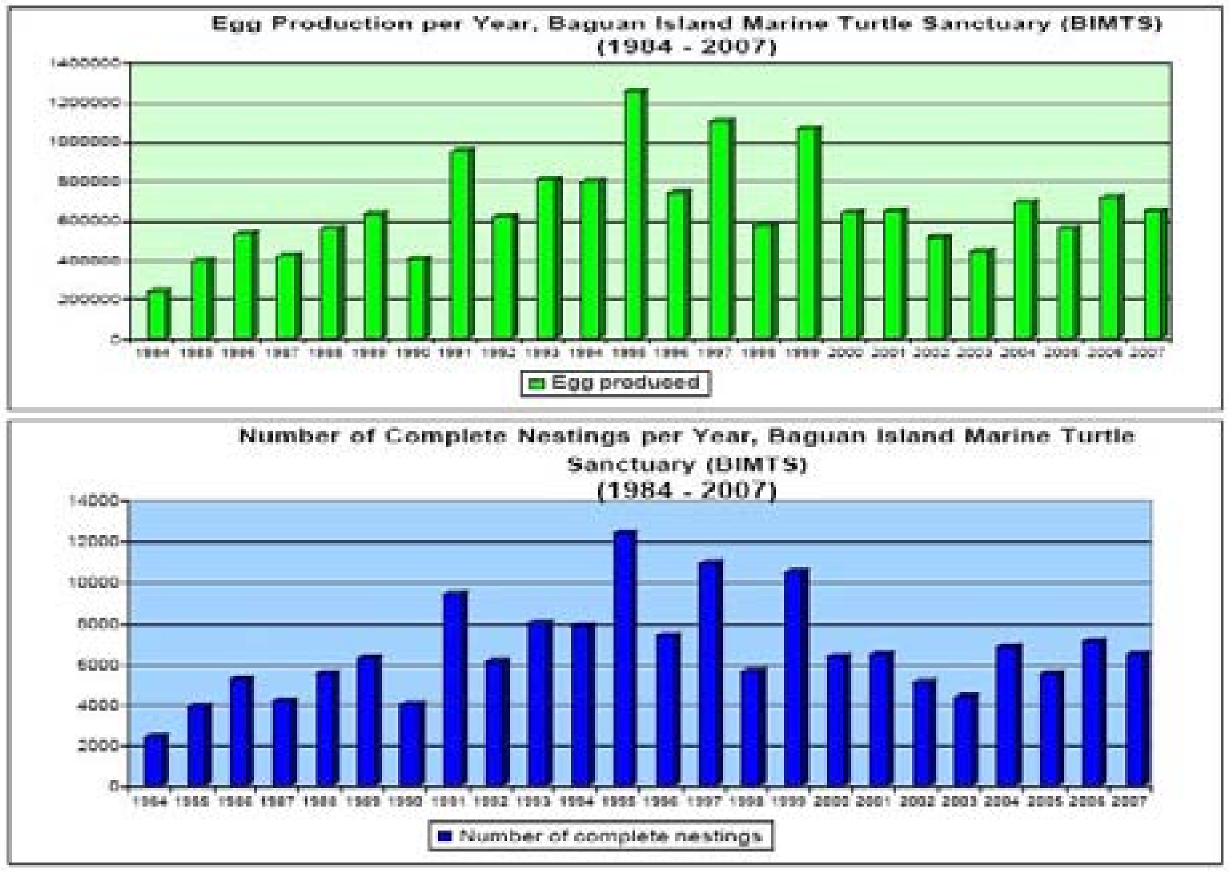


Figure 5.8 Number of Complete Nests and Egg Production per Year at BIMTS (1994–2007)
(Source: PAWB-PCP, 2007)



A major threat to marine turtles is large-scale illegal harvest of eggs and collection for ornamental trade. Sixty percent of the turtle eggs produced in TIWS except Baguan Island (which produces more than 50%) are still being collected for trade. Prior to the passage of Republic Act 9147, or the Wildlife Resources Conservation and Protection Act of 2001, collection of turtle eggs in designated islands of the Turtle Islands was regulated through a DENR permit system that allowed collection during the open season from April to December. Only 60% of the eggs were collected, the rest were conserved. After the passage of the Wildlife Act, the collection of sea turtles or any of its derivatives, including eggs, was prohibited. This has resulted in conflicts within and among stakeholders since egg collection is a source of livelihood and accounts for about 35% of the overall income sources in the area (Cola, 1999 as cited in BFAR-NFRDI and DENR-PAWB, 2005). A proposal for a phase-out on the collection of turtle eggs and phase-in of alternative livelihood projects in TIWS under a Memorandum of Agreement among stakeholders has been finalized and is pending approval.

Marine turtles are also threatened by coastal development and fisheries practices, including foreign fishers poaching and targeting marine turtles within Philippine waters. Developmental and foraging habitats of marine turtles are being proposed for declaration as Critical Habitats pursuant to RA 9147. Fishery impact on marine turtles is also a major issue. From a perception survey conducted by the DA-BFAR, gillnet, fish corral and set net are the fishing gears that

are most likely to catch marine turtles (DA-BFAR, 2007). Actual reports gathered by the PAWB-PCP throughout the country through its tagging program reveal that fish corral, gillnet and hook and line are the fishing gears that capture most turtles.

The Sulu Sea is a favourite poaching area of foreign fishers targeting marine turtles. In the last decade, over a thousand foreigners (over 600 are Chinese) have been arrested and charged for poaching in the waters of Palawan alone (WWF-Philippines, 2008).

5.1.4.2 Other Indicator Species

Other indicator species used by the BINU to assess status of marine and coastal biodiversity include whalesharks, humpback whales, and Irrawaddy dolphins. There are, however, insufficient data available for assessment.

The whale shark, *Rhincodon typus*, is one of two protected species in the Philippines, and is listed as vulnerable in the IUCN Red List Criteria, and Appendix II of the Convention on International Trade on Endangered Species (CITES). Whale sharks (and manta rays) are also protected by Department of Agriculture (DA)-Fisheries Administrative Order (FAO) 193, S. 1998, which bans the *"taking or catching, selling, purchasing and possession, transporting and exporting of whale sharks and manta rays".* There is no study on population estimates on any species of sharks in the Philippines. Anectodal claims of whale shark population in Donsol, Sorsogon in the 1990s was between 50 to 100 individuals. A decline in sighting rate was documented in Donsol between 1998 and 1999 using tourist-based sighting data (Grover, 2000, Alava and Yaptinchay, 2000 as cited in BFAR-NFRDI-PAWB, 2005). The World Wildlife Fund (WWF)-Philippines has initiated participatory research to identify individuals of the whale shark population in Donsol through distinguishing marks, sex, behaviour and photo-documentation.

Humpback whales have been observed off Babuyan Islands located at the northernmost tip of Luzon. Babuyan Islands is a significant marine conservation area, the only known breeding ground for humpback whales that migrate annually to the Philippines to breed. Over 100 individuals have been photo-identified from surveys conducted since 2000 (Acebes *et al.,* 2007 as cited in CREE website).

Irrawaddy dolphins, *Orcaella brevirostris*, are found in estuaries and semi-enclosed water bodies, such as bays and sounds. They are listed in Appendix 1 of the Convention on Migratory Species (CMS) to which the Philippines is a member-party. Range states of this migratory species are encouraged to develop a conservation and management plan for implementation by other range countries. In the Philippines, there is only one known population of less than 100 found in Malampaya Sound in Palawan. Major threats to this population include accidental killing in fishing gear, habitat degradation, possibly prey depletion from over-fishing and the destruction of fish spawning grounds (Dolar *et al.,* 2002 as cited in BFAR-NFRDI-PAWB, 2005). Several mortalities have been recorded, averaging about four a year. Experts propose to minimize fishing gear-dolphin interaction to avoid mortalities.

5.2 Emerging Issues for Marine Resource Use

5.2.1 Overview of Aquaculture in the Philippines

5.2.1.1 Overstocking and Fish Kill

At overstocked conditions, overfeeding and production cycles of cages of 5-6 months, fish competes for space, feeds, and oxygen. Depletion of oxygen is due to decomposing feed wastes and fecal matters that are deposited at the bottom of the lake and cages. This becomes fertilizer that can trigger phytoplankton or algal blooms and subsequent decay, using oxygen and releasing toxic compounds. A "fish kill' is a significant and sudden death of fish or other aquatic animals, such as crabs or prawns in large numbers usually in a clearly defined area. There are two possible reasons of fish kill: natural (lake overturn), man-made or anthropogenic (such as pollution due to aquaculture).

Most fish kills in Philippine lakes occur where aquaculture activities are excessive due to overstocking of fish in cages. According to studies, Taal Lake (Southeast of Manila) can support (or has a carrying capacity) of only 6,000 cages measuring 10 x 10 x 5 square meters at a stocking rate of 50,000 fish per cage. At the time of the fish kill it was found out that there were 12,000 cages stocked with 100,000-300,000 fish/cage, a clear example of overstocking. The fish kill has affected over 2,000 fishers around the lake, most of whom were dependent on fishing for livelihood.

There have been 192 documented cases of fish kills with almost half of the causes being attributed to aquaculture (Philminaq, 2007).

In 1999, a fish kill occurred in Murcieliagos Bay, Zamboanga del Norte, due to mercury and cyanide contamination, whereas the one that occurred in Lingayen Gulf in that same year was due to an oil spill from an oil tanker. From 2003 to 2005, there were fish kills that were of great magnitude due to overfeeding and overstocking which were observed in perennial areas, such as Taal lake but also in Isabela, Cebu, and Bohol and covering various species including tilapia, milkfish, shrimp and grouper. For this year, aside from the widely publicized Bolinao-Anda fish kill, there were five other fish kill occurrences in Camotes, Bais, Davao del Sur, and Cotabato affecting milkfish broodstock, siganids, and various types of freshwater species. In terms of economic losses, some occurrences were valued at a few thousand pesos while major fish kills cost hundreds of millions of pesos. The Bolinao fish kill in 2002 was reported to have cost PhP200 million, while the most recent one that occurred in June 2007 was estimated to cost between PhP40 million to PhP100 million (Philminaq, 2007).

The inability of local and national government agencies to regulate the stocking density of fish led to the overcrowding of fish cages and overstocking, which resulted in degradation of water quality that ended up in fish kills.

There is a need for proper monitoring of the water's physical, chemical, and biological conditions that cause fish kills so that the fish farmers can be given a warning to harvest their fish to avoid further losses.

5.2.1.2 Toxic Chemicals

Antibiotics that are used to treat diseased fish may affect wild fish populations and other organisms, although it is difficult to estimate these secondary effects on the surrounding ecology and environment. Antibiotics (*e.g.,* chloramphenicol and nitrofurans) were applied by shrimp farmers in the Philippines at the height of disease outbreaks. In brackishwater fishponds, a practice of controlling snail pests (*e.g., Cerithidea cingulata*) and fish predators in the past was using toxic organo-phosphate and tin-based chemicals which are now banned. Pesticides used in agricultural farms, *i.e.,* mainly organochlorines, pollute the aquatic environment as run-off which is both harmful to fish and humans. Indiscriminate use of such chemicals and the potential hazard to human health and possibility the development of bacterial resistance have become major concerns.

5.2.1.3 Increasing Demand in Trash Fish

The dependence of cultured fish on wild-caught fish is astounding. Fish oil and fish meal, which are essential ingredients of feed usually come from wild stocks, a third of which is used to make feed for aquaculture. On average, it can take 5-12 kg of feed to produce 1 kg of finfish, such as grouper, snapper, and seabass (www.wwf.org). Based on 2007 Philminaq Report's estimates, about 160,000 MT of wildfish/feed are wasted in tilapia pens, cages, and ponds, while more than 160,000 MT are wasted for bangus culture. While some argue that trash fish is not suitable for human consumption, in less developed countries such as the Philippines, even trash fish is eaten. Furthermore, these small fish species have vital roles in the ecosystem mainly as food for larger species of fish.

5.2.1.4 Alteration of Physical Environment

The nets of cages, pens, and associated moorings change the environment by preventing efficient water exchange and changing the current patterns caused by friction with the water currents. Friction from the nets can alter the residence time of water in a bay. Sometimes these structures can also cause obstruction to navigation routes and migration paths of different species of fish.

5.2.1.5 Eutrophication from Aquaculture

Aquaculture, like any other animal production activity, produces wastes in the form of particulates (mainly the uneaten food and faeces) and soluble substances (excreta), which increase the demand for biochemical oxygen, nitrates and phosphates in the receiving waters. The risk of negative impacts of aquaculture wastes is greatest in enclosed waters or sites with poor water exchange rates, such as in slow moving rivers, lakes and shallow bays. In these conditions, aquaculture production can lead to a build up of organic sediments and addition of nutrients to the water column. This, in turn, can lead to secondary effects, such as eutrophication, algal blooms, and low dissolved oxygen levels.

5.2.1.6 Environmental Impacts of Culture of Species

Some impacts of seaweed culture include changes in the marine ecosystem structure and function, alteration of currents and increasing shading of bottom environments. Nutrient stress, perhaps caused by too much seaweed culture in an area, has also been implicated in 'ice-ice' disease. Shading effect and the use of mangrove poles for stakes may adversely affect biological productivity in coral reefs and other nearshore environments.

Mussel and oyster farming also results in increased biodeposition of wastes on the seabed, the resulting organic enrichment inducing changes in sediment chemistry and biodiversity. For shrimp culture, effluents from shrimp ponds are high in both dissolved and particulate nitrogen and phosphorus, which elevate nutrient levels in receiving waters and promotes eutrophication. In brackishwater ponds, intensification of production methods can result in greater production of wastes, which unless intercepted and treated (filter traps, settlement ponds, biofiltration beds), are discharged into the coastal environment causing eutrophication and self-pollution problems in some areas of the country (*e.g.*, Bolinao).

5.2.1.7 Harmful Algal Blooms

The occurrence of harmful algal blooms (HABs or red tide) has become another important indicator of the degree of water pollution in the country. This phenomenon is caused by seasonal high organic loadings from rivers that drain into the bays. To date, red tide occurrences have been reported for 20 coastal areas and there have been 42 red tide outbreaks from 1983 to 2001.

Harmful algal blooms are one of the marine environmental problems and resource management issues that confront the Philippines. It has been recognized as a catastrophic phenomenon that has affected public health and the economy of the country since 1983. The first recorded occurrence of blooms of *Pyrodinium bahamense* var. *compressum*, a toxin-producing dinoflagellate was in 1983 in central Philippines, and since it was the first time that the country has experienced such kind of phenomenon, its impact in terms of public health and economy was great. Harmful algal blooms in the country, particularly *Pyrodinium* have expanded both in time and space. Blooms of *Pyrodinium* have spread to around 22 coastal areas of the country. Paralytic shellfish poisoning due to *Pyrodinium* has increased in severity during the last two decades with the country experiencing more than 540 outbreaks of harmful algal blooms with subsequent shellfish poisoning episodes between 1983 and 2002. Some species recur in the same geographic regions each year, while others are episodic, leading to the unexpected deaths of local fish, shellfish, mammals, and birds. Azanza (2005) observed a first-time occurrence of a *Prorocentrum minimum* bloom in Bolinao in 2002, where intensive and extensive aquaculture of *Chanos chanos* (milkfish) in fish pens and cages has been practiced for years now. The fish kill, which lasted almost simultaneously with the bloom of the organism, had its peak when the organisms' bloom was declining. Lack of oxygen in the cages and pens was the fundamental cause of the fish kill (Philminaq, 2007).

5.2.1.8 Invasive Species

Among the possible cases of invasion by marine organisms (mostly phytoplankton) in the Philippine waters are the following:

Pyrodinium bahamense* var. *compressum is a paralytic shellfish toxin-producing species which caused poisoning in Malaysia, Brunei, Indonesia and the Philippines. The first cases of Paralytic Shellfish Poisoning (PSP) in the Philippines was reported in 1983 and since then, *Pyrodinium* blooms have been recurring in various parts of the country. There is a possibility that the species could have been transported naturally or by ships. Its life cycle includes a cyst stage that can remain viable for years and be the source of future blooms once conditions become favorable.

***Alexandrium* spp.** The presence of the species was documented in 2003 in Bolinao, Pangasinan. The species can invade other areas through ship's ballast water. Its life cycle also includes a cyst stage that can remain viable for years.

Cochlodinium polykrikoides. The species bloomed on a regional scale in Southeast Asia from 2004-2005. It started in Brunei in November 2004, then to Sabah, Malaysia from December 2004 to January 2005. It reached Palawan by February 2005. The source of *Cochlodinium* bloom in Southeast Asia is unknown. The mode of transport may include natural *i.e.,* Asian currents or anthropogenic like ship's ballast water or transport of infected seafood.

The Philippines has one of the longest coastal areas in the world and many cities that can hold an average of five ports, each of which is vulnerable to invasion of exotic aquatic species coming from ballast water discharged by foreign vessels (Azanza *et al.,* 2006). To date, no research has been undertaken on the biological content of the tons of ballast water discharged in Philippine waters, which means that no substantial regulatory measures are being imposed. Research on the flora and fauna of ship's ballast water content and possible water treatments are needed to mitigate possible impacts of invasive species in the marine environment.

5.2.2 Coastal Tourism

Although coastal tourism brings economic benefits, it has many consequences. Impacts on coastal resources include: accelerated beach erosion, deteriorating coastal water quality, dumping of solid waste on beaches or in near-beach areas, coral reef degradation through anchorage and landing facilities, salt-water intrusion, and increasing traffic noise and congestion (White *et al.,* 2002).

5.3 Other Considerations (Recent Developments)

5.3.1 Reef Restoration

This program is being funded by the Department of Science and Technology (DOST) to: (1) implement the conservation of biodiversity and restore damaged reefs through community involvement, develop new techniques in coral propagation (sexual and asexual) as a means of conserving local coral diversity and sustainable source of coral materials for restoration; and (2) develop cost effective restoration techniques.

Community-based coral restoration techniques are ongoing in Bolinao, Pangasinan through the University of the Philippines' Marine Science Institute Marine Laboratory involving a cost-efficient transplantation technique in rearing fragments of staghorn corals (*A. pulchra* and *A. intermedia*) in situ nurseries for coastal communities.

As an offshoot of the program, reef restoration will be pilot-tested in six demonstration sites, such as Bohol, Boracay, Batangas with resort owners as partners, and Masbate, Leyte and Tawi-tawi with LGUs as partners.

5.3.2 Restocking Efforts

Marine invertebrates, such as sea cucumber, scallops, paphia and trochus are being studied for possible mariculture/sea ranching and restocking efforts.

5.3.2.1 Sea Cucumber

The Philippines is the 2nd largest exporter of sea cucumbers, next to Indonesia. This has become a multi-million dollar industry (Ferdouse, 2004), with global trade estimated at 708,207 MT and valued at USD7, 798 million (BAS, 2010). Sea cucumber ranks 8th among the fishery export products of the Philippines and are exported in the form of dried or salted in brine, while the rest are traded live, fresh, and chilled/frozen.

The resource is threatened by overexploitation due to lack of fishery and trade management policies that will maintain production at sustainable levels.

5.3.2.2 Scallops

Resource assessment, mariculture and management of scallops is implemented in Asid Gulf, Masbate. About five species of scallops are commercially exploited in the area, namely: *Decatopecten striatus*, *Chlamys senatoria nobilis*, *Chlamys macassarensis*, *Chlamys funebris,* and *Chlamys gloriosus*. Scallops are fast-growing tropical species.

Scallops have high potential for culture and *C. senatoria nobilis* is one of the target species for mariculture. The scallop species *D. striatus* is being studied as an indicator of climate change using oxygen isotopes.

5.3.2.3 Giant Clams

Giant clams are significant to the Filipino people in terms of culture, commerce, and ecology. Archaeological finds of preserved shells of *Tridacna maxima* and *Hippopus hippopus* in the Balobok Rockshelter (Sanga-Sanga Island, Bongao, Tawi-Tawi) dating back from the mid-Holocene epoch suggest that our Neolithic ancestors may have utilized giant clam shells (Faylona *et al.,* 2011). Fossil giant clam shells may be important tools for studying past climate changes in the Philippines, as has been done by paleoclimatologists with fossil shells found in Huon Peninsula in Papua New Guinea (Ayling *et al.*, 2006). Preserving sites of fossil giant clam shells is therefore important.

In the mid-1980s, the Marine Science Institute (MSI) and Silliman University (SUML) have conducted stock assessment surveys of giant clams in the Philippines, finding overharvested natural populations. The three large species

—*Tridacna gigas, T. derasa*, and *Hippopus porcellanus* — have become either virtually or nearly extinct (Juinio *et al*., 1989).

5.3.3 Oil and Gas

Under this sector, anecdotal accounts showed the perceived notion of the effect of sonic boom used by research vessels to determine seismic reflection profiles in oil and gas exploration activities. Seismic blasting is reported to damage reproductive organs, burst air bladders, and cause physiological stress in marine organisms. It can also cause behavioral modifications, alter fish distribution by some radius, and damage planktonic eggs and larvae. Fisherfolks in Tanon Strait in the Visayas recounted that such incidences in their coastal seas by exploration activities for oil and gas may have affected their fisheries.

5.3.4 Mining-related Issues

The mining industry is also faced with various but mostly anecdotal issues ranging from environmental matters, such as impact on habitats of *dugong* and whale sharks to political cases — *i.e.*, death of a local official by security personnel of a mining company (BHP Billiton) during a protest demonstration. Aside from the *dugong*, whale sharks, commonly known as *butanding* are present in Rapu-Rapu Island in Sorsogon, and the local government unit opposes a large-scale mining project because it potentially affects the multimillion whale watching tourism in the province.

Recently, residents in Pamplona, Cagayan have been conducting information and education campaigns (IEC) against the impending entry and operation of a mining company. Four barangays in Pamplona have submitted a petition to the municipal council against the entry of this company. The municipal council has yet to take action. In Aparri, Cagayan, residents recounted that on February 29, 2008, three large sea vessels docked and drilled magnetite sand along the off-shore area. The drillers were able to get approximately 200 kilograms of magnetite sand before they were forced to stop their operations by concerned residents. Vigilance among stakeholders also revealed another large sea vessel reported to collect magnetite sand in Aparri. These activities are being investigated by the Mines and Geosciences Bureau (MGB)-Region II and may be considered as smuggling of minerals if these do not follow government protocols, such as securing an Ore Transportation Permit (OTP).

5.3.4.1 Potential Risks and Effects

These mining projects claim to provide benefits to the people but given the risks from irresponsible mining practices, several communities do not want to accept these operations based on lessons from the experiences of others who had become victims of bad practices.

5.3.4.2 On Sources of Livelihood and Food Security

One of the negative effects of mining is the loss of farmlands near the coastal areas due to flooding brought about by coastal erosion and deforestation. The extent of damage may also include coastal habitats given that mine tailings usually are dumped into rivers that are transported to the coasts. Consequently, this may affect the conditions of the habitats and associated organisms that form the fishery resources, thus, livelihood of communities.

5.3.4.3 On Indigenous Peoples' (IPs) Rights

The mining areas being targeted for explorations are usually those in remote areas being occupied by various ethno-linguistic groups classified as Indigenous Peoples (IPs), whose major sources of livelihood are farming and fishing. These groups also suffer from government neglect, denying them of even the most basic social services.

5.3.4.4 Policy Recommendation

There is a need to develop a new mining code that is not created for the purpose of serving the interests of large mining Transnational Corporations (TNC) and local elites, but for the national industrialization that will cater to the needs of the country's populace.

5.3.4.5 Strategies

Given the plethora of issues pertaining to mining, there is a need to develop strategies that will promote responsible mining and ensure the protection of coastal habitats as well as the welfare of the communities.

- One of the effective ways to promote this goal is by carrying out IEC activities, making the issues comprehensible and, therefore, enhancing the awareness of the communities.
- A strategy to strengthen the solidarity among concerned sectors through creation of People's Organizations (PO) and alliances in the area can be considered in order to launch concerted mass actions, and increase people's participation in local governance.
- A strategy to broaden the network of advocacy groups who will support the mass actions and help in the projection of issues at the national and international levels is envisioned.
- The support for the formulation and legalization of resolutions in local governments for responsible mining will be of utmost priority.
- Finally, at the national level, support for policy recommendations and actions being undertaken both at the lower and upper legislative houses is deemed crucial.

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plan of action initiatives and future plans

Chapter 6

PLAN OF ACTION INITIATIVES AND FUTURE PLANS

The Philippine National Coral Triangle Initiative (CTI) Coordinating Committee (NCCC) envisioned a National Plan of Action (NPOA) to address the issues or the pressures that affect the present state of the country's resources and ecosystems. The national action plan is in accordance with the principles and guidelines set by the regional CTI. Five goals, with appropriate strategies and targets, have been identified in the NPOA to address prevailing issues:

- Goal 1 — Designate and effectively manage priority seascapes;
- Goal 2 — Apply ecosystem approach to fishery management;
- Goal 3 — Improve the management of marine protected areas (MPAs);
- Goal 4 — Achieve climate change adaptation; and,
- Goal 5 — Improve the status of threatened species.

This section presents the progress and performance of the NPOA implementation in terms of providing data and information on results achieved in each of the NPOA goals. The Philippines NCCC TWG conducted a series of technical workshops to come up with a set of measurable indicators. Data on these indicators are collected as and when available.

6.1 Monitoring and Evaluation Baselines with Indicators

6.1.1 Improved Governance and Effective Management of Priority Seascapes

6.1.1.1 Achievement of Targets to Date

The NPOA presented the following set of targets and indicators under Goal No. 1:

Table 6.1 Targets and indicators under Goal 1 *(Source: National Plan of Action, 2009)*

Objective	Description	Indicator	Target	Actual
Goal 1	Designate and effectively manage Priority Seascapes			
Target 1.1	Intermediate result: Priority seascapes designated, with investment plans completed and sequenced by 2012	Number (and area in sq. km.) of priority seascapes designated	2 priority seascapes designated (SSME with 1M sq. km. expanse and West Philippine Seas)	2 priority seascapes designated (SSME and West Philippine Seas)
		Number (and area in sq. km.) of priority seascapes with investment plans completed	2 priority seascapes with investment plans (SSME and West Philippine Seas)	1 priority seascape (SSME, with 1 M sq. km.) with investment plans. SSME has comprehensive action plans with cost information for three focal areas *e.g.*, MPAs, Threatened Species and Fisheries.
Target 1.2	Intermediate Result: Marine and coastal resources within all Priority Seascapes being sustainably managed	Number/area (in sq. km.) of priority seascapes under sustainable management 1.2.1. Presence of a management body 1.2.2. Policies and laws 1.2.3. Capacity 1.2.4. Financial resources leveraged through sustainable financing schemes and private sector partnerships relative to the requirements of investment plans 1.2.5. M&E system in relation to indicators of 4 other goals	1 priority seascape is under sustainable management	0 priority seascape is under sustainable management. The tool to assess and measure the sustainable management of a seascape has yet to be developed.

Under Target 1.1, the Philippines has been working towards the designation of two seascapes, *i.e.,* Sulu-Sulawesi Marine Ecoregion (SSME), and the West Philippine Sea (WPS). The 1 million sq. km. SSME has been designated by virtue of a ratified Memorandum of Understanding among Indonesia, Malaysia and the Philippines. It is also recognized by the CTI as a priority seascape. On the other hand, the WPS has been identified as another priority seascape under the NPOA. Various stakeholder consultations were conducted towards its formal designation.

In addition to their designations, each of the priority seascapes will have its framework and investments plan. The SSME has produced three comprehensive action plans, *i.e.*, one for each priority focus, namely, marine protected area (MPA), fisheries, and threatened species. Embedded in these comprehensive action plans are business plans to support their implementations over a five-year period. In the case of WPS, work is in progress for the preparation of the policy and institutional framework with investment plan. In addition, the following initiatives are undertaken, a vision has been formulated, the geographic expanse of the seascape is being finalized through stakeholder consultation, and scoping for coastal resources management approach for the seascape is on-going.

Under Target 1.2, initiatives towards capacity-building to ensure the sustainable management of the two seascapes are currently developed. The NPOA lists five elements that have to be strengthened, namely: presence of a management body; formulation of policies and laws; capacity building programs; financial resources leveraged through sustainable financing schemes and private sector partnerships relative to the investment plan requirements; and Monitoring and Evaluation (M&E) system in relation to indicators of four other goals. A guidebook on how to select, develop, and implement seascapes has been completed and published (Atkinson *et al.*, 2011). At this stage, the NPOA reports that the two priority seascapes are yet to be sustainably managed.

6.1.1.2 Projects, Programs, and Initiatives that Support Goal 1

The SSME Action Plans for sustainable fisheries, MPAs and networks, and protection of threatened, charismatic, and migratory species were published and launched in 2009[1]. These were further translated into Comprehensive Action Plans, which included costs of implementing the action plans, indicators at the purpose level, and SSME achievements in fisheries, MPAs and species conservation as well as lessons learned[2].

The West Philippine Sea (WPS), referring to the Philippine part of the South China Sea (SCS), is a newly identified priority seascape. WPS was selected and prioritized from three seascapes for potential development in the CTI through stakeholder consultations and a set of criteria. A vision for WPS was formulated in 2009 and seascape delineation was proposed. To date, scoping, processing of information and site-based consultations are proceeding with a view to developing a proposed Institutional and Policy Framework for WPS with a site-based business plan by the year 2013.

A significant development was the designation of the Coastal and Marine Management Office (CMMO) of the Protected Areas and Wildlife Bureau (PAWB) as the focal point of the Department of Environment and Natural Resources (DENR) for SSME and CTI affairs.

As for the recently released guidebook on seascapes approach (Atkinson *et al.,* 2011), WPS is in Step 2 of the three-step seascape process, *i.e.,* strategy development, while SSME is in Step 3, that is, strategy implementation and monitoring, and is already addressing most of the identified nine essential elements of a functional seascape.

6.1.2 Ecosystem-based Fisheries Management

6.1.2.1 Achievement of Targets to Date

The NPOA presented the following set of targets and indicators under Goal No. 2:

Goal 2 has four targets. Target 2.1 has two indicators. The first indicator measures the presence of a national policy on EAFM that harmonize existing laws and policy framework supporting EAFM. The second indicator looks at the area (in sq. km.) of management units with operational and effective law (fisheries) enforcement units.

6.1.1.2 Projects, Programs, and Initiatives that Support Goal 2

A major activity of this goal is the review and creation of amendments for national and local policies on fisheries (*e.g.*, Fisheries Code - RA 8550; NIPAS Act – RA 7586; Local Government Code – RA 7160; National Marine Policy) taking into consideration the Archipelagic Development Framework (ArcDev) and the Integrated Coastal Management (ICM) to achieve EAFM.

A project funded by USAID in 2008-2010, the Fisheries Improved for Sustainable Harvest Project of DA-BFAR had a country-wide scope with four pilot sites (Calamianes, Bohol, Surigao, and Tawi-Tawi) conducting activities that address EAFM goal (Armada *et al.*, 2009). One of the activities undertaken was a development of policy framework for EAFM implementation in the Philippines. A draft of a Fishery Administrative Order (FAO) was submitted to BFAR. CTSP has implemented a *dulong* fishery research as an entry point to EAFM in the VIP. Community-based fish catch monitoring was established in San Juan, Mabini and Calatagan, all in the Province of Batangas (Luzon). Data on fish catch composition and life stages, gears used, fishing ground, and fishing effort were gathered. Policy and market studies were also conducted for national and local policy discussions on the management of this resource and to determine potential sustainable livelihood options for communities dependent on fishery.
The GEF-UNDP Project on Sulu-Celebes

Table 6.2 Targets and Indicators under Goal 2 *(Source: National Plan of Action, 2009)*

Objective	Description	Indicator	Target	Actual
Goal 2	Fully apply ecosystem approach to management of fisheries and other marine resources			
Target 2.1	Intermediate result: Strong legislative, policy and regulatory frameworks in place for achieving an ecosystem approach to fisheries management	Presence of national policy on EAFM that harmonize existing laws and policy framework supporting EAFM	1 national policy on Ecosystems Approach to Fisheries Management (EAFM)	Absence of a national policy on EAFM
		Area (in sq. km.) of management units with operational and effective coastal law (fisheries) enforcement units Proposed revision: Number of coastal municipalities with operational coastal law enforcement	832 coastal municipalities	To be determined (TBD)
Target 2.2	Intermediate result: Improved income, livelihoods and food security of people in coastal communities across the region through a new sustainable coastal fisheries and poverty reduction initiative (COASTFISH)	Nutritional status of coastal families (quality of food)	TBD	TBD
		Annual per capita food thresholds and subsistence of populations (availability of food)	TBD	TBD
		Per capita consumption of fish	TBD	TBD
		Annual per capita poverty threshold and poverty incidences	TBD	TBD

Objective	Description	Indicator	Target	Actual
Target 2.3	Intermediate Result:Effective measures in place to help ensure exploitation of shared tuna stocks is sustainable, with tuna spawning areas and juvenile growth stages adequately protected	National policies, laws, agreements, or regulations adopted on allowable size limits for tuna species	TBD	TBD
		Number of sites and area (sq. km.) covered by temporal closed season of tuna spawning grounds (spawning grounds are assumed to be known)	TBD	TBD
		Change in conservation status of tuna based on IUCN-red list criteria assessment	TBD	TBD
		New proposed revision: The fishing industry's contribution to the country's Gross Domestic Product (GDP)	Increase by *x* percent from 2009 levels	In 2009, it was 2.2% and 4.4% at current and constant prices,respectively. *(Philippine Fisheries Profile, 2009)*
		New proposed revision:Total tuna catch (segregated by species)	TBD	Year 2010 Commercial- skipjacks: 177,698 metric tons Commercial – yellowfin: 85,351 MT Commercial- bigeye: 8,575 MT Municipal- skipjacks: 50,481 MT Municipal- yellowfin: 3,070 MT Municipal – bigeye: 387,099 MT
		Tuna catch estimate by gear particularly by handline and hook and line	TBD	Commercial- Handline- skipjacks – 131 MT Handline - yellowfin - 11,314 MT Handline – bigeye: 284 MT Total tuna catch using handline and hook and line: 11,729 MT Municipal: Hook and line – skipjacks: 25,200 MT Hook and line – yellowfin tuna: 43,400 MT Hook and Line – bigeye:1,400 MT Total Municipal tuna catch using hook and line: 70,000 MT
Target 2.4	Intermediate result: A more effective management and more sustainable trade in live reef fish and reef based ornaments achieved	National policies, laws, agreements, or regulations adopted on allowable size limits for LRFT	TBD	
		Number and area (in sq. km.) of locally managed areas for LRFT	TBD	
		A set of standards for fish supply to consumption	TBD	
		Change in conservation status of live reef fish species on IUCN-red list criteria assessment	TBD	

(Sulawesi) Seas Sustainable Fisheries Management (SCS-SFM) is implemented by the SSME Sub-Committee on Sustainable Fisheries. The Transboundary Diagnostic Analysis (TDA) of the Sulu-Celebes (Sulawesi) Large Marine Ecosystem is presently drafted. Once finalized, the groundwork for the development of the Strategic Action Plan (SAP) shall be initiated.

A management plan for the fish aggregrating device (FAD) of large pelagics (*e.g.,* tuna) is being prepared. The legal aspect of the plan is also reviewed, which involves pertinent instutional frameworks.

A National Stock Assessment Project (NSAP) which was implemented by BFAR produced an output that served as basis for the Reduction of Commercial Fishing Vessel License (CFVL) nationwide. A draft FAO is being reviewed by the National Fisheries Research and Development Institute (NFRDI)-BFAR prior to a national consultation process with NFARMC.

Another major activity under this goal was the adoption and implementation of a Comprehensive National Fisheries Industry Development Plan (CNFIDP) by BFAR through the USAID-funded FISH Project. An FAO was created and next step activities include creation of an operational programming budget and review of CNFIDP implementation to be carried out by BFAR.

A Small-Scale Fisheries Governance Project by WorldFish Center aimed to review governance and fisheries management strategies to provide policy recommendations for national and local governance levels. It also offered opportunities for capacity-building mechanisms for both levels with pilot sites distributed throughout the country, namely: Babuyan Channel, San Miguel Bay, Sogod Bay, Lanuza Bay, Lingayen Gulf, Honda Bay, Davao Gulf, and Sapian Bay. This project was supported also by several national agencies and institutions (DA-BAR, DOST ROs, NGOs, Academe, GEF International Waters Learning Exchange and Resource Network). Phase 1 of the project was in 2009-2010 and Phase 2 continued on in 2010-2011.

Pertinent fishery and environmental policies for mariculture was also initiated by a CTSP project. A sustainability assessment of mariculture practices in Sitangkai, Tawi-Tawi (Mindanao) and Taytay, Palawan (Luzon) served as basis for policy formulation.

To achieve an Ecosystem Approach to Fisheries Management, appropriate strategies or enabling mechanisms to address critical threats and implement viable fisheries management mechanisms need to be formulated. This required a close working relationship between municipal and commercial fishers, local government units, national government agencies and other key stakeholders. An example is the on-going Integrated Coastal Resource Management Program (ICRMP) project (2009-2013) with strong involvement of DENR-PAWB and DA-BFAR. Sampling sites are distributed in Luzon, Visayas and Mindanao.

Finally, local field enumerators in Dipolog, Sindangan, and Dapitan (all in Zamboanga del Norte in Mindanao) were trained to undertake fish landing surveys under the Sardine Enumerators Training. This activity aims to provide capacity-building mechanisms and, more importantly, aids in establishing policy recommendations for the sardine fishery in the area (*i.e.,* close season for sardines, *e.g.*, spatial and temporal closures/quotas).

Target 2.2 activities focus on the improvement of income, livelihood and food security among fishing communities. A Regional Fisheries Livelihood Programme (RFLP) project (supported by the Agencia Española del Cooperación Internacional para el Desarrollo (AECID) of Spain) was initiated in 2010 until 2011 to carry out resource and social assessments among coastal fisheries in Dipolog, Sindangan, and Murcielagos Bay covering 12 coastal towns of Zamboanga del Norte (western Mindanao).

Target 2.3 deals mainly with tuna fishery management. Several projects focused on the development of a management plan for exploited tuna species in the Philippines. A National Tuna Management Plan (NTMP) was updated in 2010 via the West Pacific East Asia (WPEA) Project that ends in 2013. The framework for the sustainable management, equitable use of tuna resources, promotion of responsible fishing practices by Philippine-flagged vessels fishing for tuna in areas beyond the national jurisdiction including the development of the fishing industry through the responsible trade of tuna and associated by-products is provided by the Plan. The primary objective is to promote the effective conservation, management, and equitable use of tuna resources for the sustainable development of the industry.

With implementation of the Philippine Fisheries Code of 1998 (Republic Act 8550) and all relevant domestic policies, legislation and regulations including the obligations of the Philippines under international fisheries instruments and regional fisheries agreements to which the country is a party, the Plan has been revised to align management measures with the need for the proper conservation of tuna resources and the aspirations of the Philippines for its tuna industry. The objectives, principles, and management measures contained in the Plan applies to all forms of municipal and commercial fishing for tuna up to the limit of the Philippine exclusive economic zone (EEZ), and in particular the capture of skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacores*), bigeye tuna (*Thunnus obesus*), Northern bluefin tuna (*Thunnus thunnus orientalis*), and albacore tuna (*Thunnus alalunga*). Specific management measures also apply to the operations of Philippine-flagged vessels fishing outside the jurisdiction of the Philippines, and also includes the trade of tuna products originating from the Philippines and caught elsewhere but transshipped in the country.

For Target 2.4 of Goal 2, initiatives have been pursued to develop and implement management plans for the live reef fish trade (LRFT) specifically in Palawan (Taytay and Araceli municipalities), Tawi-Tawi, and Surigao through CTSP with support funds from USAID and DANIDA from 2009 to 2013. It is expected that the local governments will improve their capacity to manage LRFT employing EAFM principles. An LRFT management plan has been developed for Taytay, Araceli and Quezon (in Palawan) with a stakeholders' workshop and a series of technical assessments that served as basis for the plan. Partnerships between local and international LRF traders' associations, academe, other government agencies, and international buyers are being established.

Also, the FISH Project (funded by USAID) resulted in policy recommendations for the live reef fish trade particularly in Palawan. CTSP also embarked on the study of identifying and assessing spawning aggregation sites (*spags*) of target species (*e.g.,* groupers) and establish these as protected areas (*i.e.,* seasonal closures). Strict enforcement of fishery laws for the LRFT, creation of an LRFT Council, and assessment and development of management schemes for reef-based ornamentals are being addressed.

6.1.3 Improving Management of MPAs

6.1.3.1 Achievement of Targets to Date

The NPOA presented the following sets of targets and indicators under Goal No. 3:

Table 6.3 Targets and indicators under goal 3 *(Source: National Plan of Action, 2009)*

Objective	Description	Indicator	Target	Actual
Goal 3	Establish and effectively manage Marine Protected Areas (MPAs)			
Target 3.1	Intermediate Result: Region-Wide Coral Triangle MPA System (CTMPAS) in place and fully functional by 2020.	Percent/area of total marine habitat area in CT region in some form of protected status	Complete baseline figures by 2010 2% of coral reefs protected by 2015; 10% of each coral reef and mangrove protected by 2020	Actual: Coral reefs: 0.1% = 270,000 ha. or 2,700 sq. km. under some form of protection (total coral reef area is 17,000 to 27,000 sq. km.) Mangrove: Total area is 80,000 ha. (primary growth). Total mangrove area remaining is 140,000 ha. Seagrass: TBD
Target 3.2		Percent/area of each major marine and coastal habitat type in strictly protected "no-take replenishment zones". (Note: fully protected, *i.e.*, no dumping also)	Mangroves -100% fully protected (on paper) Coral reefs - 10% fully protected of the 2% target by 2015; 10% of the 10% target by 2020	
Target 3.3		Percent/area of marine protected areas under "effective" management	10% of 2% target by 2015 fully protected coral reefs; 10% of the 10% target by 2020 fully protected coral reefs; Mangroves – TBD Seagrass - TBD	

6.1.3.2 Programs and Initiatives that Support Goal 3

The establishment of marine protected areas (MPAs) is regarded as an important component of coastal resource management (Alcala,1998). MPAs are set up to protect ecosystem values (Aliño *et al.* 2004), rehabilitate critical habitats, replenish fish resources, and promote tourism or recreation (*e.g.,* Hermes, 2004). In the Philippines, these MPAs are classified as shown in Table 6.4. Currently, there are 439 legally established marine protected areas, and many others are being proposed. Most of these MPAs are within municipal waters, although a few, such as Apo Reef and Tubbataha Reefs, are found offshore in the Sulu Sea. Some of these MPAs have been declared through the National Integrated Protected Areas System (NIPAS) Act while others were established through various national laws and municipal ordinances. One the most important protected areas in the country is the Tubbataha Reefs Natural Park, which has also been designated by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as a World Heritage Site.

For the past several years, the Philippines had exerted effort to monitor the performance of hundreds of MPAs through collaboration among academic institutions, conservation organizations, people's organizations, government, and development partners. Monitoring tools were developed, applied, assessed and refined.

Based on 2008 data, Weeks *et al.,* (2009) (Table 6.5) reported 985 MPAs being established in the Philippines covering an area of 14,943 km². Of these, 942 MPAs had a no-take component, with a combined no-take area of 1,459 km². Thus, 4.9% of coastal municipal waters (within 15 kms. of the coastline) were protected within MPAs, with 0.5% within no-take areas. Estimates of coral reef area in the Philippines varied between 20,000 km² (Weeks *et al.*, 2009) and 22,484 km² (Burke *et al.*, 2011). From this range, an estimated 2.7%-3.4% of coral reef areas in the Philippines is protected within no-take MPAs. Community-based MPAs comprised 95% of records in their database with a combined estimated area of 628 km² and no-take area of 206 km². The increase in area of no-take MPAs had been more modest, with notable increases in 1983, 1988, and 2007, with the declaration and expansion of two large no-take MPAs — Tubbataha Reef National Park (968 km²), and Apo Reef Natural Park (275 km²). The Visayan Sea bioregion (Visayas Region) had the most number of MPAs (67%). Although with fewer MPAs, the Sulu Sea and South China Sea (West Philippine Sea) biogeographic regions, nevertheless, were best protected, with 1.25% and 0.66% of their municipal water area within no-take MPAs, respectively. These bioregions (biogeographic regions) contained the large no-take areas of Tubbataha Reef National Park and Apo Reef Natural Park, respectively. The size of MPAs ranged from 0.01 km² to 27,89.14 km² (Siargao Protected Landscape and Seascape) (mean = 23.60 km²).

Table 6.4 Classification of the various declared MPAs in the Philippines *(Source: Tun et al., 2004, Arceo et al., 2008)*

Code	MPA Designation Status/Category	Total Number
AR	Artificial Reef	10
ECA	Environmentally Critical Area	1
RSP	Reserve, Sanctuary, Park	800
MTS	Marine Turtle Sanctuary	7
MSFR	Mangrove Swamp Forest Reserve	120
PLS	Protected Landscape and Seascape	10
SP	Seashore Park	1
TZMR	Tourist Zone Marine Reserve	65
WA	Wilderness Area	52
WT	Wetland	10
M	Multiple (more than 1 category)	50
U	Undetermined	50

In 2010, the MPA Support Network (MSN), a group made up of national government agencies, academe, NGOs, *etc.*, whose functions focus on MPA management in the Philippines, rolled out the Management Effectiveness Assessment Tool (MEAT) as a way to gauge MPA management performance for the 2011 Best MPA Awards. This is significant to CTI NPOA implementation as it provides a basis for determining how well Goal 3 of the NPOA is addressed.

Using MEAT, MSN facilitated the assessment of 110 of the 1,620 locally managed MPAs in the Philippines as part of the 2011 Best MPA Awards (Dizon *et al.,* 2011). This represents 8% or 31,520 of the 393,994.46 hectares (total area) of locally managed MPAs in the country.

Table 6.5 Number and size of MPAs per biogeographic region *(Source: Weeks et al., 2009)*

Marine Biogeographic Region[a]	Number of MPAs	MPA c (km²)		waters[b]	
		All	No Take	All	No Take
Celebes Sea	50	2,345.13	7.37	6.77	0.02
Northern Philippine Sea	35	2,469.60	7.54	6.52	0.02
Southern Philippine Sea	102	3,500.02	33.16	12.67	0.12
South China Sea (West Philippine Sea)	51	1,836.93	283.71	4.26	0.66
Sulu Sea	90	3,573.35	991.29	4.52	1.25
Visayan Seas (Visayas Region)	663	1,219.50	136.50	1.50	0.17

[a] *Marine bioregions (biogeographic regions) taken from Ong et al., 2002*

[b] *Municipal water boundaries (15 km offshore) were calculated following DENR, 2001.*

MEAT results show that, in terms of number, 70 or 64% of these benchmarked MPAs is effectively managed (Level 2 - Level 4). However, in terms of area, this translates to only 4,305 hectares effectively managed, or 14% of total area of locally-managed MPAs assessed by MEAT (Table 6.6).

Table 6.6 Benchmarks of management of local MPAs based on MEAT application
(Source: MSN-CI-CTSP Report, 2011)

Management Effectiveness	Number of MPAs (locally managed)	Total Area (hectares)
Level 0 - MPA need to satisfy the requirements of Level 1	26	24,590.44
Level 1 - MPA is Established	14	956.84
Level 2 - MPA is Strengthened	48	2,922.11
Level 3 - MPA is Effectively Sustained	21	1,361.39
Level 4 - MPA is Effectively Institutionalized	1	22.91
Total	**110**	**29,853.69**

Table 6.7 Result of gap analysis of present MPA management status in the Philippines
(Source: MSN-CI-CTSP Report, 2011)

Description	Number of MPAs	MPA MEAT	% with MPA MEAT
Total Number of MPAs recorded in the database	1208	117	9.6 %
Established MPAs	1072	113	10.5 %
Proposed MPAs	136	3	2.2 %
Biogeographic Zone			
Northeastern Philippine Sea	122	1	0.8 %
Southeastern Philippine Sea	48	2	4.2 %
South China Sea (West Philippine Sea)	107	18	16.8 %
Sulu Sea	85	28	32.9 %
Visayan Seas (Visayas Region)	740	41	5.5 %
Celebes Sea	104	26	25.0 %

Most of the larger MPAs were observed in Luzon followed by Mindanao. Visayas has the most number of small MPAs. From a gap analysis of the present MPA management status in the Philippines (2011), a total of 1,208 MPAs were recorded, 1,072 of which (89%) had an established status (Table 6.7). Compared with Week's report in 2009, there was an increase in number of MPAs in several biogeographic regions. There was four times as many presently in the North Philippine Sea (Northeastern Philippine Sea), double in the South China Sea (West Philippine Sea) and Celebes Sea, rose slightly in the Visayan Sea, and registered no considerable difference in the Sulu Sea. However, there appears to be a 50% reduction in the South Philippine Sea (Southeastern Philippine Sea) which needs further verification. The analysis also included MPAs that were evaluated using MEAT, an evidence-based tool used by MSN that largely emphasized experiences of MPAs in the Philippines.

As of end of September 2011, CTSP completed the assessment of nine out of 33 NIPAS MPAs using MEAT. The number represents 700,018 hectares, or 41% of the 1.7 million hectares of NIPAS MPAs. Three (33%) of the nine NIPAS

Figure 6.1 Location of NIPAS MPAs benchmarked for management effectiveness using MEAT
(Source: Dizon et al., 2011)

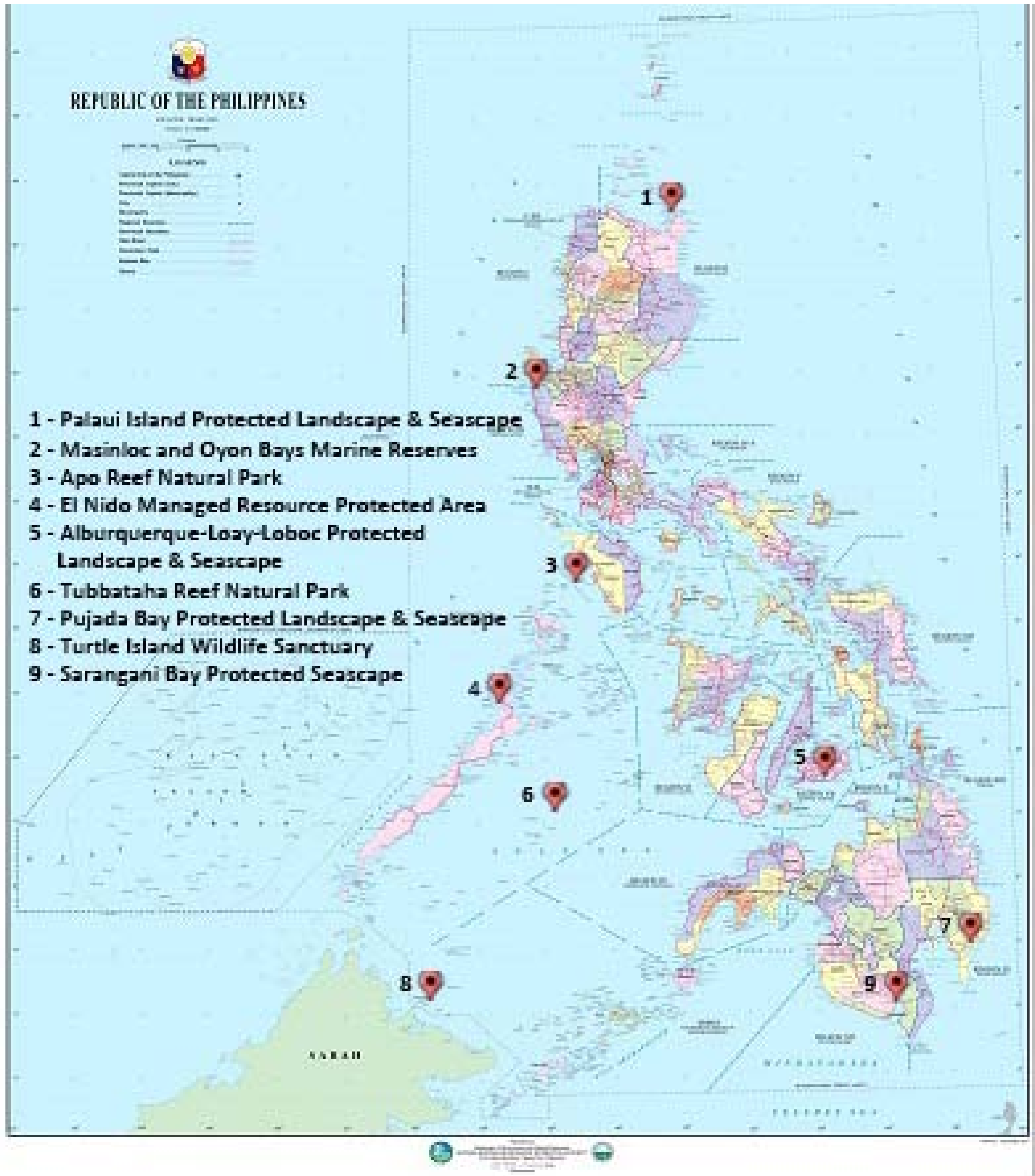


Table 6.8. Level of effective management of NIPAS MPAs in the Philippines *(Source: Dizon et al., 2011)*

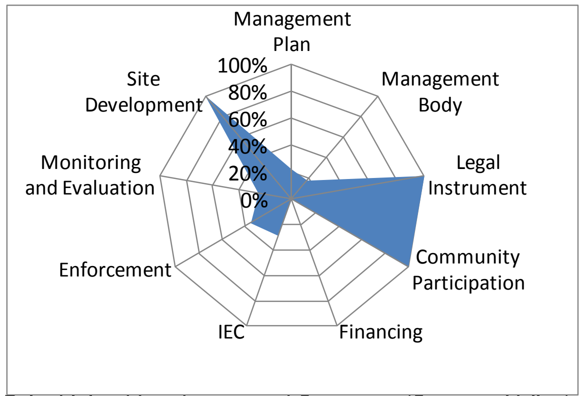
Region		Name of Marine Protected Area	Location (Province)	Area covered (hectare)	Level of management effectiveness
2	1	Palaui Island Marine Reserve	Cagayan	7,415	Level 0 - No management plan adopted
3	2	Masinloc and Oyon Bays Marine Reserve	Zambales	7,568	Level 0 - No management plan adopted
4B	3	Apo Reef Natural Park	Occidental Mindoro	15,792	Level 2 - MPA is strengthened
4B	4	El Nido Managed Resource Protected Area	Palawan	89,134	Level 1 - MPA is established
4B	5	Tubbataha Reefs Natural Park	Palawan	98,828	Level 3 - MPA is effectively sustained
7	6	Alburquerque-Loay-Loboc Protected Landscape and Seascape	Bohol	1,164	Level 0 - No management plan adopted; No baseline assessment conducted
ARMM	7	Turtle Island Wildlife Sanctuary	Tawi-Tawi	242,967	Level 1 - MPA is established
11	8	Pujada Bay Protected Landscape/Seascape	Davao Oriental	21,200	Level 1 - MPA is established
12	9	Sarangani Bay Protected Seascape	Sarangani & General Santos City	215,950	Level 2 - MPA is strengthened
TOTAL				700,018	

Table 6.9 2011 benchmarks of management of national MPAs based on MEAT application *(Source: Dizon et al., 2011)*

Management Effectiveness	Number of MPAs (nationally managed)	Total Area (hectare)
Level 0 - MPAs need to satisfy the requirements of Level 1	3	16,147
Level 1 - MPA is Established	3	353,301
Level 2 - MPA is Strengthened	2	231,742
Level 3 - MPA is Effectively Sustained	1	98,828
Level 4 - MPA is Effectively Institutionalized	0	
Total	9	700,018

Besides examining the level of effective management of MPA using MEAT, the focus or status of management was also evaluated, which includes: management plan, management body, legal instrument, community participation, financing, IEC, enforcement, monitoring and evaluation, and site development. Thresholds of these criteria were further known from the total scores in the MEAT analysis. Figure 6.2 shows the results of the assessment for all national MPAs (*i.e.*, NIPAS).

Figure 6.2 Assessment of management status of nine NIPAS sites in the Philippines *(Source: Dizon et al., 2011)*

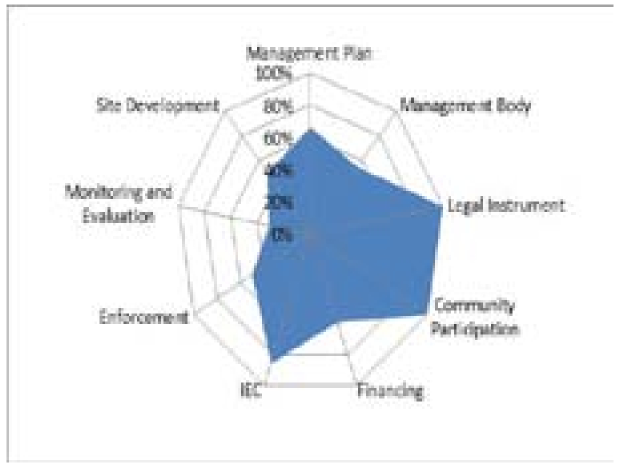


Palaui Island Landscape and Seascape (Cagayan Valley)

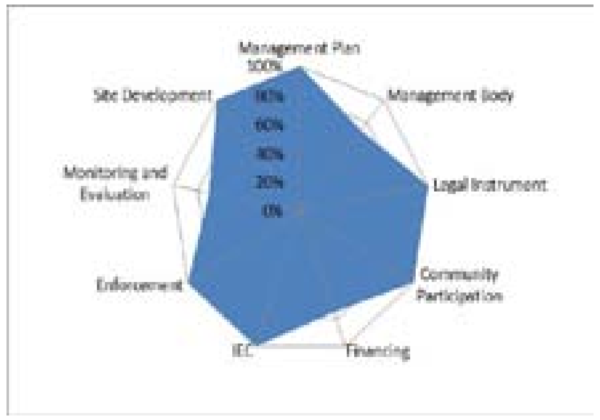
Alburquerque-Loay-Loboc PLS (Bohol)

Masinloc & Oyon Bays Marine Reserve (Zambales)

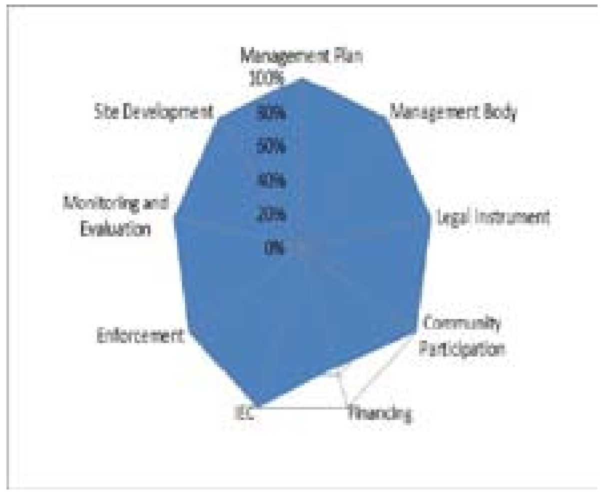
Sarangani Bay Protected Seascape



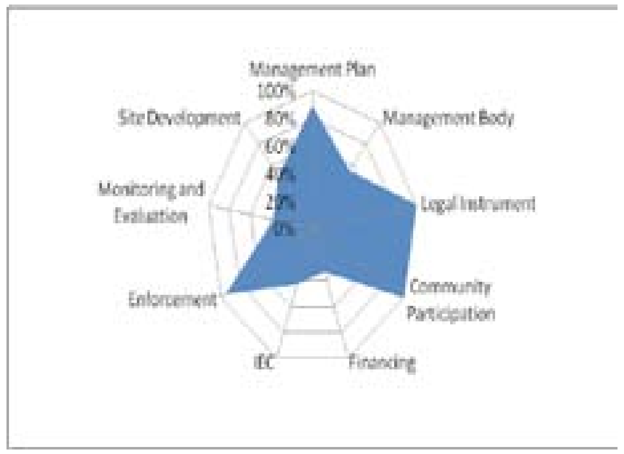
Turtle Islands Wildlife Sanctuary (Tawi-Tawi)



Apo Reef Natural Park (Occidental Mindoro)



Tubbataha Reefs Natural Park (Palawan)



Pujada Bay PLS (Davao Oriental)

El Nido-Taytay Managed Resource Protected Area (Palawan)

The largest MPA in the Philippines (Tubbataha Reefs Natural Park) has also the highest level of management status with high capacity in all criteria except in the financial aspect, although only slightly below 80%. This reflects the best conditions of the site (*e.g.* , high fish biomass, big sizes of fish, high species richness, extensive and less degraded reef habitats, *etc.*). Apo Reef Natural Park also showed relatively higher levels of management status indicating similarly remarkable conditions compared to Masinloc and Oyon Bays, Albuquerque-Loay-Loboc, and Palaui Island protected sites which require a lot of effort in several criteria.

A short review by Panga (2011) elucidated the importance of MPA network and provided some examples in the Philippines. MPA networks are created as connected, accelerated, and synergistic efforts (Laffoley *et al.,* 2008). Connected MPAs means that large-scale protection allows the maintenance of connectivity among ecosystems which, in turn, covers replicated and representative sites that also includes risk reduction aims aside from the basic fisheries and conservation goals. Furthermore, networks ideally bring cooperation among managers and the community for shared stewardship responsibilities. MPA networks also accelerate the protection of the reefs through larger areas covering more ecosystems, faster bioaccumulation, and recovery rates. Finally, large-scale protection permits cost-effectiveness through the economies of scale. Opportunities are increased due to the cooperation of managers and through multiplier effects of scaling up. Objectives of MPA networks focus not only on ecological attributes but also on the economic and socio-cultural aspects (Laffoley *et al.,* 2008). Guided by these principles, Panga (2011) showed some MPA management in the Philippines, which illustrated the different levels of networks by their structural framework. For example, the Masinloc Marine Sanctuary Association (in Zambales, western Luzon) is a municipality-based fishers federation. The structure is single-level, with several fishers formed into a federation further grouped into committees, which are composed of fisher-members from four different MPAs in the municipality: Panglit, Bani, San Salvador, and Taclobo MPAs (Ebue, 2011). Other multi-level structures are observed in some municipalities with their unique organizational set-up (Panga, 2011).

More sites are included in the recent information on marine key biodiversity areas (MKBA) in the Philippines (Fig. 6.3) (MKBA Report, 2009). There was an increase in the number of MKBAs in the marine biogeographic regions, except in the Southeastern Philippine Sea which remained the same in 2009 (Fig. 6.4). Majority (about 66%) of the MKBAs were identified in the Visayan Seas, Sulu Sea and West Philippine Sea. The Visayas Region had the most MKBAs followed by the Sulu Sea. There were even considerable increases in the Visayas Region and Celebes Sea (Figs. 6.3 and 6.4). However, there was still paucity of information from several places, such as Romblon (east of Mindoro Island), and the eastern shores of the Moro Gulf (southwest of the Mindanao (see Figure 6.3). The total coral reef areas within the MKBA are given in Table 6.10, although this report still used the previous data due to constraints in selecting estimates of reef extent from the present data set. Moreover, there appears to be less data on specific habitats, such as gravel beaches or rocky shores that are less likely to be studied given the lack of interest in them.

Figure 6.3 Updated MKBAs in the Philippines *(Source: CI MKBA Report, 2009)*

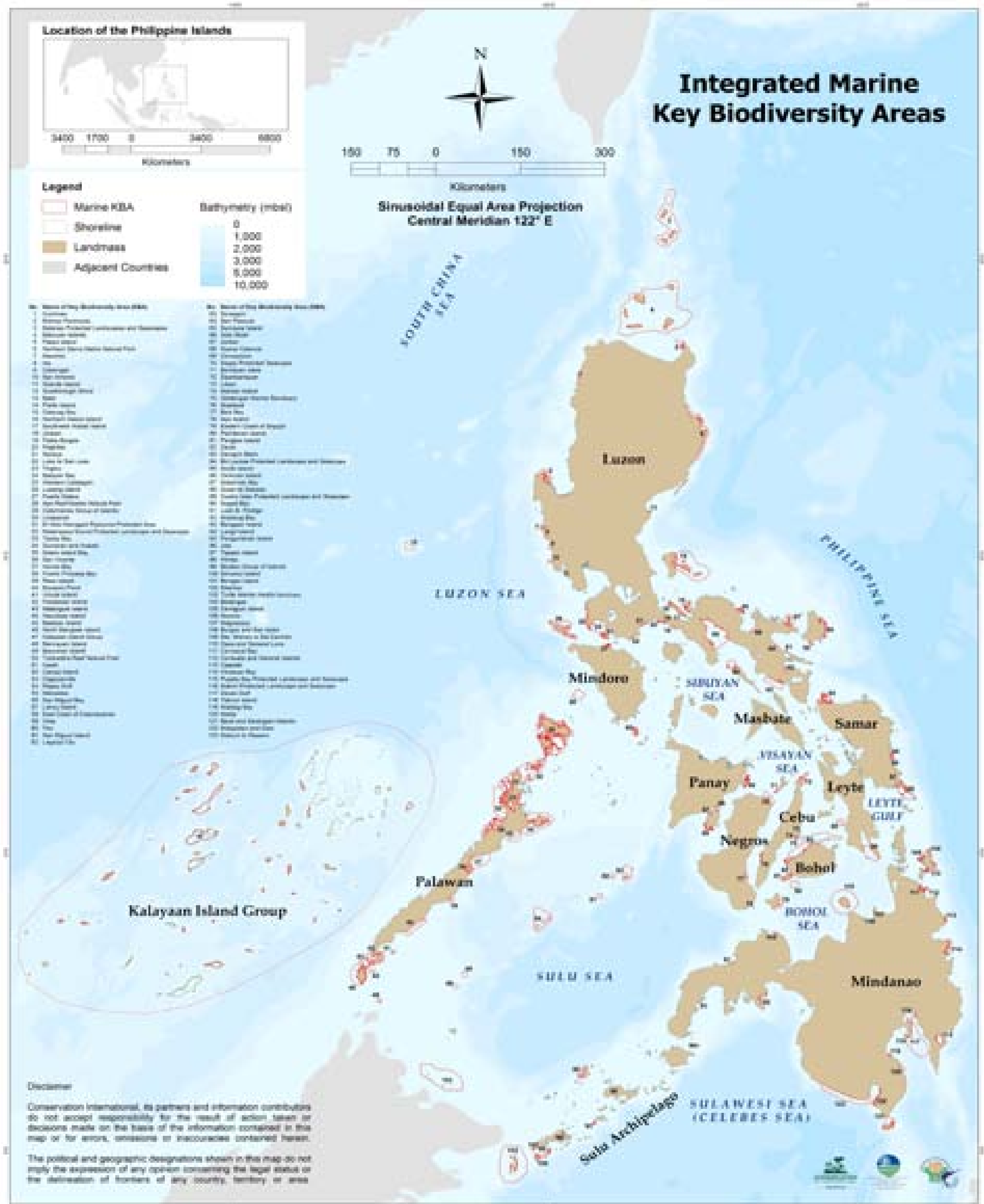


Figure 6.4 The Number of MKBAs Found in the Six Marine Biogeographic Regions of the Philippines (**A1** - Northeastern Philippine Sea, **A2** - Southeastern Philippine Sea, **B** – West Philippine Sea, **C**- Sulu Sea, **D**– Visayas Region, and **E** – Celebes Sea) *(Source: CI MKBA Report, 2009)*

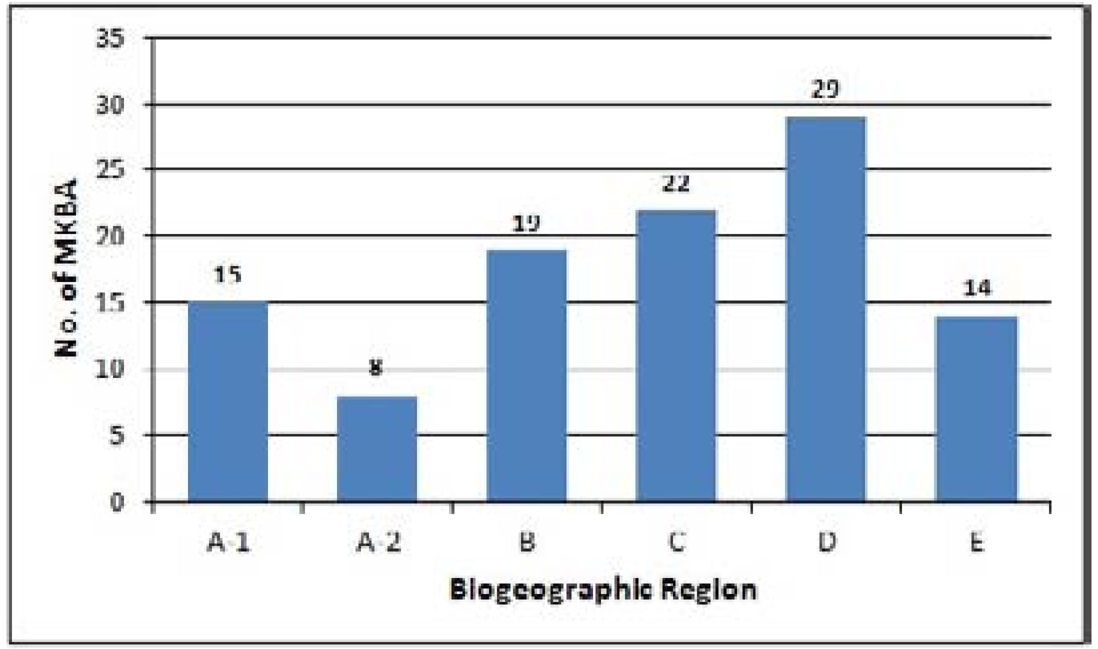


Table 6.10 Reef Areas Estimates Based on Satellite Images, Found in the MKBA Areas per Biogeographic Region *(Source: Ong et al., 2000, MERF, 2009)*

Biogeographic Zone	Name of Marine Biogeographic Region	Coral Reef Area within MKBA (ha)
A-1	Northeastern Philippine Sea	3,323,649.78
A-2	Southeastern Philippine Sea	505,111.81
B	West Philippine Sea (KIG = 22,846,585.81)	24,623,758.80
C	Sulu Sea (TRNMP = 90,419.67)	8,302,064.16
D	Visayan Seas (Visayas Region)	3,216,427.78
E	Celebes Sea	875,642.18

6.1.4 Climate Change Adaptation (CCA)

6.1.4.1 Achievement of Targets to Date

The NPOA presented the following sets of targets and indicators under Goal 4:

Table 6.11 Targets and indicators under Goal 4 *(Source: National Plan of Action, 2009)*

Objective	Description	Indicator	Target	Actual
Goal 4	Achieve climate change adaptation			
Target 4.1	Intermediate Result: Region-wide early action for climate change adaptation plan for the near-shore marine and coastal environment and small island ecosystems developed and implemented	Presence/absence of national climate change adaptation plan or framework	Baseline: 0 (2009)	1 - adoption of a CCA plan/ framework (2010)
		Area in sq. km. covered by climate change vulnerability assessment and identified early actions to address climate change impacts	Baseline: 15,000 sq. km. (Verde Island Passage Corridor, Apo Reef) in 2010	
		Land and water areas (in sq. km.) that have integrated climate adaptation into local governance (plans and actions)	Baseline: TBD Target: TBD	
		Number of local government units (*i.e.,* coastal municipal and cities) with local CC adaptation plans, budgets and implementing activities of the plan	Baseline: TBD Target: 900 coastal municipalities and cities	
		Number of educational institutions integrating CC in the curriculum	Baseline: TBD Target: TBD	
Target 4.2	Networked national centers of excellence on climate change adaptation for marine and coastal environments are established and in full operation	Number of institutions and networks addressing climate change adaptation coordinated with national government support	Target: At least one network for each of the biogeographic region	

6.1.4.2 Programs and Initiatives that Support Goal 4

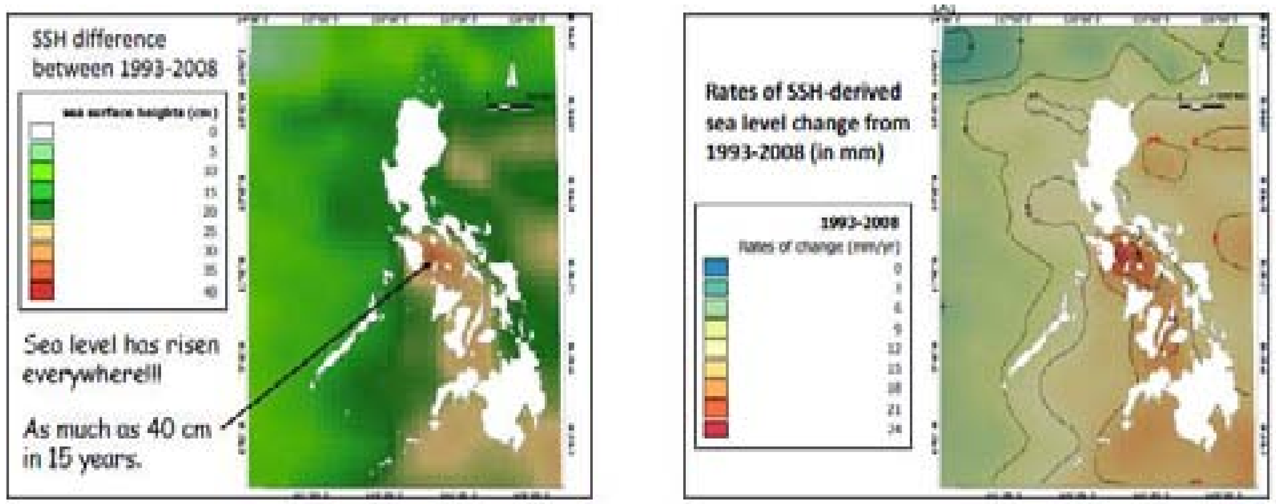
The Sulu-Sulawesi Seascape (SSS) Program of the Global Marine Division of the Conservation International supports the Verde Island Passage (VIP) MPA Network in formulating a climate-resilient MPA strategy. SSS helped establish the first climate-resilient (climate-smart) MPA in Lubang Island and have initiated the development of climate-resilient MPA strategy for Calatagan for inclusion in their municipal development plan. Two CI-Philippines projects focused on climate change – USAID Coral Triangle Support Partnership (CTSP), and IKI Ecosystem-based Adaptation – contribute to the SSS outcomes in the VIP.

The Remote Sensing Information for Living Environments and Nationwide Tools for Sentinel Ecosystems in our Archipelagic Seas (ReSiLIENT SEAS) Program was formerly known as the ICECREAM [Integrated Coastal Enhancement: Coastal Research, Evaluation and Adaptive Management Program. It is supported by the Department of Science and Technology (DOST) administered by the Philippine Council of Agriculture and Aquatic Research and Development (PCAARD) and implemented by six partner institutions led by the University of the Philippines-Marine Science Institute (UPMSI), having the following component researches on Climate Change:

Project 1. Climate Change and the Coast: Vulnerability of Bentho-Pelagic Productivity (CCC-BP) led by Dr. Laura David of UPMSI

Sites representing the different climate typologies in the Philippines were determined from this study. Automatic weather stations were installed at 10 sites across different environmental gradients in the country. The climate typology (see Figure 2.5 in Chapter 2) was derived from the modeling and simulation of oceanographic processes (*i.e.*, seasonal weather residence and material residence). The simulation showed highly monsoonal weather in the country. The sensitivity of rainfall anomalies in the southern parts of the country to Southern Oscillation Index (SOI) was highlighted. The sensitivity of Sea Surface Height (SSH) anomalies of the entire country to SOI was also observed. In addition, types I, II, III, IV, VII, and X (Figure 2.4 in Chapter 2) are also sensitive to Pacific Decadal Oscillation (PDO) state.

Figure 6.5 a & b Seal evel change in the Philippines 15 Years ago based on SSH difference (a) and Rate (b) *(Source: RESILIENT SEAS Project Report, 2011)*



Project 2. Retrospective Analyses of Climate Change from Coastal Erosion Trend and Uplifted Coral Reef Assemblages (RetroCET) led by Dr. Fernando Siringan of UPMSI

This research looked into sea level changes from 1992-2008 using the altimetry-derived SSH. The SSH data have also been compared with the available tide gauge data in order to extract the non-oceanographic signal in the datasets. The vulnerability of coastal villages in Davao and Iloilo to erosion and marine inundation has been assessed. Seasonal monitoring of shoreline changes, through GPS surveys and beach profiling was also done in Batangas and Zambales. Figure 6.5 shows sea level change in the past 15 years. The analysis which employed the stable isotope ratios and equipment are further presented in Figure 6.6.

Project 3. Monitoring and Impact Research on Resilience of Reefs (MIRROR) led by Dr. Wilfredo Y. Licuanan of De La Salle University (DLSU)

This study aimed to document changes in the reef, brought about by anomalously high sea surface temperatures (SST), using high resolution techniques of transect and permanent quadrat monitoring. The images, recruitment tiles, and transect data were processed and a transition matrix and system models were developed to project the responses of coral communities under different SST scenarios. Results included identification of coral genera susceptible to climate related bleaching, effects of temperature on coral cover and diversity (loss of 50% coral cover in one site associated with a drastic increase in SST. Further projections of reef health under

Figure 6.6 a-d Coral cores (6a) are taken to compare past (6b) and present (6c) conditions and sampled per density band of the coral to analyze for stable isotope ratios to reconstruct paleoenvironments (*Source: RESILIENT SEAS Project Report, 2011)*

various scenarios of climate change and human impacts will aid in communicating decision options for local governments and other constituents. This complements with other efforts in the RESILIENT SEAS program utilizing vulnerability assessments with adaptation strategies e.g. MPA and fisheries management to reduce risks in hazards through timely actions.

Project 4: Fisheries Ecosystem Connectivity and Monitoring (Fish EConnect) / UP Visayas; Project leader: Wilfredo L. Campos, Ph.D., University of the Philippines – Visayas

This project focuses on the *early life history* (ELH) of target species such as *Portunus pelagicus* and *Siganus fuscescens*. Together with Projects 6 & 7 (see below), comparative seasonal variability of target fisheries is demonstrated.

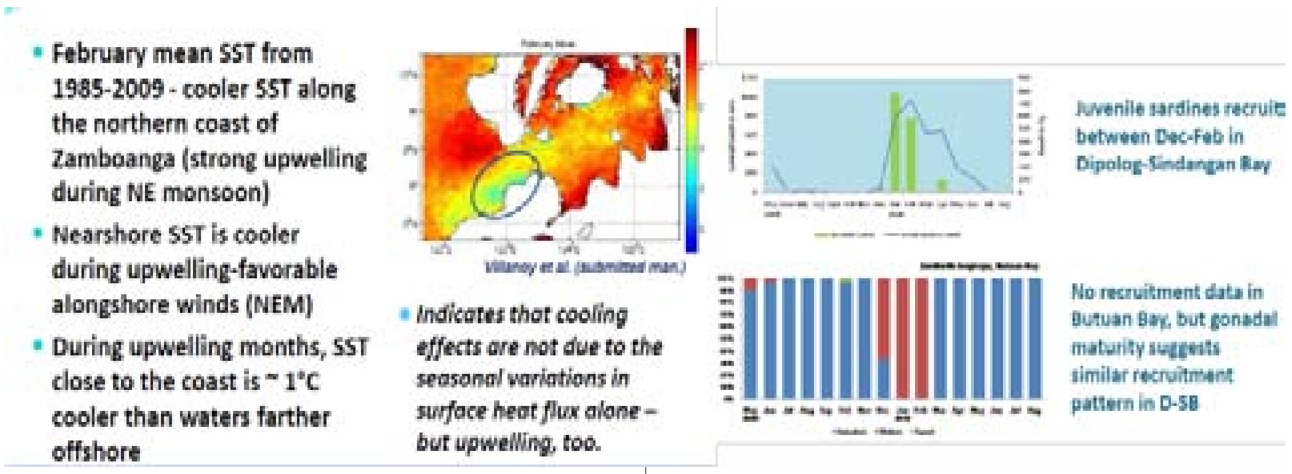
Project 5: Invertebrate Fisheries Populations as Response Indicators for Climate (INVERTS) / Xavier University; Project leader: Hilly Ann Roa-Quiaoit, Ph.D., Xavier University

The interaction of the local site attributes such as the extent of reef habitat, wave exposure and degree of fisheries exploitation have been found to be crucial to the relative vulnerability of *Tripnuestes gratilla* vis-à-vis storminess and sea surface temperature variability and climate related variation.

Project 6: Monitoring of Potentially Vulnerable Coastal Fisheries in Northwestern Mindanao (Coast Fish) led by Dr. Asuncion B. de Guzman of the Mindanao State University – Naawan

Coastal fisheries in the four bays of Northern Mindanao were studied to determine sustainability amidst high fishing pressure. Specifically, the sardine fishery in Sindangan, Zamboanga del Norte was observed to exhibit a variation (strong seasonality) that was linked to changes in monsoons. There appeared some relationships between fisheries and oceanographic patterns to show the linkages that can relate to climate change variability. Sardine stock variability was influenced by the periodic changes in the oceanographic processes (temperature-driven upwelling zones) (Figure 6.7).

Figure 6.7 Temperature-driven upwelling event off Sindangan, Zamboanga del Norte *(left panel)*, and its influence on plankton productivity crucial to the variability of the sardine populations *(right panel)* *(Source: Villanoy et al., 2011)*



Project 7: Climate Impact and Adaptation in the Coastal Environment (CLIMACE) led by Victor S. Soliman, Ph.D.; Bicol University, Tabaco City, Albay

Together with the other fisheries project components, CLIMACE provides value-added insights on the social and ecological aspects on the Siganid and scallop fisheries in the Bicol region. Their engagement with the most highly climate adaptation conscious Governor Joey Salceda allowed good opportunities for climate adaptation linkages with local governments and the Bicol University.

Project 8: Research and Development for Adaptive Management and Feedback Monitoring Networks (ADAPT) led by Dr. Porfirio M. Aliño, of UPMSI

The ADAPT project of the RESILIENT SEAS program (2009-2011) provided enabling activities towards determining adaptation strategies among the constituents of the sites. Training, monitoring and participation of local partners in relation to climate-related impacts were demonstrated in six sites. Participation in national workshops and international fora have highlighted the importance of an integrated interdisciplinary approach to adapt wisely to the climate challenge. Sensitivity of species, habitats, ecosystems and coastal communities to potential impacts of climate change variability, such as siltation related to increased precipitation, storm surge buffering of ecosystems, and thermal anomalies that lead to coral bleaching and mortality, were highlighted. These were important contributions to the vulnerability assessment (VA) and climate change simulation scenarios.

One of the mechanisms of building reef resilience was through the initial engagement of a broader network of coral bleaching watch partners. This has stimulated widespread reports of bleaching in the country. A system in the internet was set up that resulted in nationwide reporting and elicited over 500 hits of coral bleaching incidence around the country (Figure 6.8).

The publication of The State of the Coasts Report (2010) (Fig. 6.9) was a crucial output of the study to provide the status of resources and habitats as benchmark indices vis-a-vis climate change impacts. This research also focused on vulnerability assessments and identifying adaptation strategies.

Figure 6.8 Initial summary of inputs from Philippine Coral Bleaching Watch and NOAA Coral Reef Watch *(Source: RESILIENT SEAS National Workshop, 2010)*

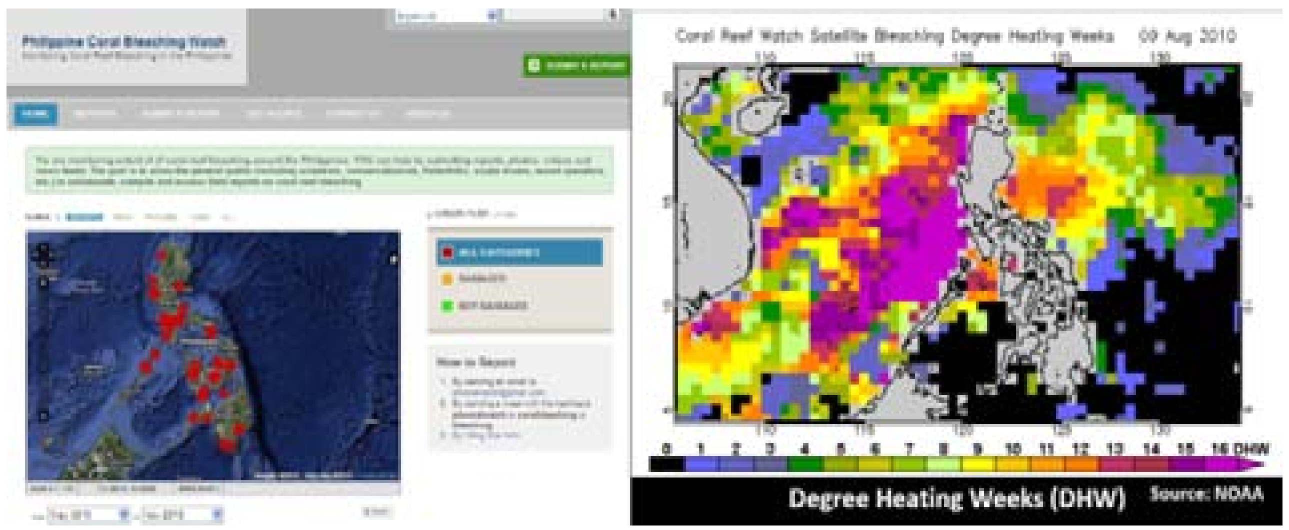


Figure 6.9 State of the Coasts Report 2010 *(left)* and the Reefs in Heat – a Photo Contest *(right)* – during the RESILIENT SEAS National Workshop 2010

Another project that focuses on climate change is the "Initiating the CTI Coastal Learning Adaptation Network (CLAN)" with financial assistance from the USAID and implemented by the Marine Environment and Resources Foundation (MERF) of UPMSI. Its primary objective is to initiate institutional learning partnerships among Coral Triangle regional and in-country partners and building the capacity of member countries in coastal climate change adaptation. Regional meetings and trainings are intended to facilitate exchanges on vulnerability assessment, the development and implementation of coastal adaptation strategies, and monitoring and evaluation processes (Fig. 6.10).

Fig. 6.10 Regional workshops on Coastal Climate Change Adaptation Initiatives organized by the CTI-CLAN Project of UPMSI

6.1.5.1 Achievement of Targets to Date

The NPOA presented the following sets of targets and indicators under Goal No. 5:

Table 6.12 Targets and indicators under Goal 5 *(Source: National Plan of Action, 2009*

Objective	Description	Indicator	Target	Actual
Goal 5	Improve the status of threatened species			
Target 5.1	Intermediate Result: Improve status of sharks, sea turtles, marine mammals and other identified threatened species	Number of species action plans and policies developed	2 – marine turtles and mammals by 2010; seabirds, wrasses and other reef fishes by 2015	1 - sharks
Target 5.2		Area (in sq. km.) of protected marine habitat that contributes to conservation of threatened species and for their protection	Protected spawning aggregation sites for fishes and nesting sites for turtles and birds - TBD by 2010; 10% of the 2% target by 2015 fully protected coral reefs; 10% of the 10% target by 2020 fully protected coral reefs; Mangroves – TBD Seagrass – TBD	
Target 5.3		Change in conservation status of threatened marine species assessed under IUCN red-list criteria	By 2009 – Philippine marine endemic bony fishes; wrasses assessed; By 2010 – baseline established for priority taxa By 2020 – status improved	

As shown above, the NPOA Goal 5 on the status of threatened species presents one target and three indicators.

The NPOA targets to produce three Species Action Plans. To date, the national plan of action on Sharks has been completed. Two other Species Action Plans, particularly the finalization of the Turtle National Action Plan, and the Marine Mammal Action Plan are under development. By 2015, the Species Action Plans on seabirds, wrasses and reef fishes are scheduled to have been developed.

In addition, the estimation of the area in square kilometer of protected marine habitat that contributes to the conservation of the threatened species is being determined.

6.1.5.2 Programs and Initiatives that Support Goal 5

Studies have been carried out to determine the recovery of population of marine turtles. In Region XI, critically endangered hawksbill turtles have been observed to nest in several sites (Punta Dumalag, Matina Aplaya, Davao City and in other areas). A 5-year Memorandum of Agreement (MOA) from year 2004 to 2009 has been forged among the DENR, the Mayor of Davao City, and the Davao Light and Power Company, Inc. for the conservation of marine turtles and dugong (*Dugong dugon*).

A Research & Development program for sea cucumber is currently implemented by the Marine Science Institute of the University of the Philippines to improve the management of natural populations and promote sustainable fishing.

Inventory and resource assessments of sea cucumber in key marine biogeographic areas in the country have been undertaken by Higher Education Institutes (HEIs) and supported by the Commission on Higher Education (CHED). This program enhances the capacities of the HEIs to conduct resource assessment, data handling, processing, and analysis.

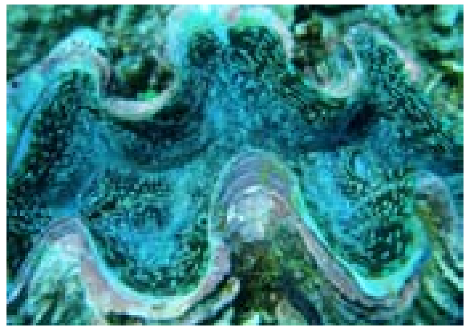
The Bicol University in Albay (southeastern Luzon) is assisting the local government unit of Cauayan, Masbate (Visayas Region) by providing scientific data as basis of ordinances and policies in the management of scallops in Asid Gulf, such as size limits, close season, zoning of scallop beds, *etc.*

***Paphia undulata* (Short-Necked Clam)**

A study of the biology and fishery of the short-necked clam *Paphia undulata* in Negros Occidental waters resulted in guidelines for the management of *paphia*, which include: (a) fishing sizes that are sexually mature, *i.e.,* > 45 mm, and (b) imposing close seasons during spawning (August – November).

***Trochus niloticus l.* (Top Shell)**

Community-based stock enhancement of top shell, *Trochus niloticus* L. aimed at enhancing the resource population by restocking the reef with juveniles and adult top shells, and helping restore the severely exploited *trochus* populations in Palawan. IEC activities (training-seminars on management and biology) were also undertaken. This is part of the Fish Sanctuary Management Plan of the community.



***Tridacna spp.* (Giant Clams)**

UP-MSI has undertaken a long-term restocking program of *T. gigas* using cultured seeds (Gomez and Mingoa-Licuanan, 2006, Mingoa-Licuanan and Gomez, 2007, Hazel *et al.*, 2009). MSI's giant clam restocking program in Philippine coastal waters has continued from 1990, transplanting cultured juveniles,

subadults, and/or broodstock largely of *T. gigas* (MIngoa-Licuanan and Gomez, 2007) in at least 64 sites. Natural recruitment of *T. gigas* has already been reported: (1) along the northwestern coasts of Pangasinan (western Luzon), particularly in the Malilnep Channel and waters off Cory Sandbar in Bolinao and near the Panacalan marine protected area in Anda, and off Quezon and Governor Islands in the Hundred Islands of Alaminos (Mingoa-Licuanan and Gomez, 2009); and (2) in waters off Cantaan in Guinsiliban, Camiguin (northern Mindanao) (Roa-Quioait, unpublished data). It is important to protect sites where periodic recruitment occurs to allow the establishment of *T. gigas* coinciding with natural hydrographic patterns. There must be coincident efforts to coordinate with the concerned local government units to render the recruitment site a protected area. Another ecological benefit to an area where giant clams are transplanted is marine biodiversity enhancement. Feeding aggregation of *Spratelloides delicatulus* or blue sprat on giant clam released gametes have been observed during *in situ* spawning induction of *T. gigas* in the ocean nursery (Maboloc and Mingoa-Licuanan, 2011). In addition, the giant clam shell, being of calcium carbonate, becomes a substrate for recruiting sessile marine organisms, including seaweeds, tubicolous polychaetes, sea squirts, boring and sessile bivalves, hard corals, soft corals, and boring and sessile sponges. Those working on restoration ecology have utilized the shell's chemical nature in developing methods for transplanting coral fragments (James *et al.,* 2011).

6.2 Capacity-building

CI-CTSP supports the establishment and implementation of the University Mentoring Program. The partnership with UP-MSI allows the engagement of recognized centers of excellence on marine science and related disciplines to serve as mentors in higher education institutions (HEIs), called mentees. The main objective is to transfer knowledge and skills from centers of excellence to mentee HEIs for the latter to better assist local government units (LGUs) on the technical aspects of coastal resource management and enhance NPOA implementation. Five centers of excellence and six mentee universities (*i.e.*, two from each or three CTSP geographies, namely, Verde Island Passage, Palawan, and Tawi-Tawi) were involved in the University Mentoring Program under a Memorandum of Understanding-type of collaboration (Figure 6.11). A short course in Science in Coastal Resource Management Foundation focused on physical and chemical oceanography, biology, coastal habitats, fisheries, and climate change topics.

Figure 6.11 Mentors and first batch of mentees of the Science in Coastal Resources Management Foundation Course *(Photo: CI-Philippines)*

The Coastal and Marine Management Office of the DENR-PAWB is involved in issues regarding management and conservation of marine and coastal ecosystems. CMMO also conducts capacity-building activities to enhance knowledge and skills in biodiversity conservation including Integrated Coastal Management. These activities are conducted among technical staff at PAWB and PAWCZMS. Trained technical staff provides echo seminars and trainings for provincial offices (PENRO and CENRO) and local government units.

Ecotourism, which is part of marine management and conservation, is also a subject of capacity building initiatives. PAWB has conducted trainings focusing on ecotourism concepts, principles, full site diagnostic, ecotourism planning and development process and business planning to capacitate Enterprise Development Assistants, DENR Technical Staff, and People's Organizations. In 2009, the Bureau took the lead in the capacity-building activity on the development of a Gender-Responsive Ecotourism Management Plan for Pamilacan Island in Bohol (GREMPPI). The activity was aimed at formulating/preparing GREMPPI and drafting guidelines on Ecotourism Management and Development Planning Process.

The Integrated Coastal Resource Management Project is being implemented by the DENR, DA-BFAR, and eight partner provinces and 80 municipalities implemented in six priority marine biodiversity corridors and ecosystems. Its goal is to manage coastal resources in a sustainable manner and to help increase the income of coastal communities. It has four components, namely:

1. Policy and Institutional Strengthening and Development, which will develop an institutional framework for national and local government coordination of Integrated Coastal Resources Management (ICRM);

2. ICRM and Biodiversity Conservation, which will protect and manage coastal ecosystems in selected threatened areas of high biodiversity;

3. Enterprise Development and Income Diversification to provide municipal fisherfolk with supplementary income and reduce their reliance on fishing by promoting environment-friendly sustainable enterprises and livelihoods; and,

4. Social and Environmental services and facilities to address the basic social services needs of disadvantaged coastal communities, and support efforts of local governments to mitigate coastal pollution and degradation of resources.

6.3 Financial Considerations: Sustainable Financing Mechanisms for MPAs

This section is a quick review of existing financing schemes that have directly or indirectly contributed to the enforcement and maintenance requirements of various MPAs in the country throughout the years.

6.3.1 User Fees

User fees are imposed on recreational visitors mainly in marine reserves or MPAs. This has been started mostly in the Visayas region through the initiatives of Silliman University, *e.g.*, Apo Island, and the former USAID-funded Coastal Resources Management Project, *e.g.,* Sumilon, Gilutongan and Olango MPAs. Another initiative, called Environmental and Natural Resources Accounting Project (ENRAP), set the technical guidelines in estimating user fees through a DENR Administrative Order that covered all protected areas under the NIPAS system, some of which included seascapes and MPAs including Hundred Islands National Park and El Nido Marine Park. Fees based on scuba diving at locally protected areas, such as those in the Mabini-Tingloy area in Batangas (Luzon) and in Moalboal, Siquijor and Bohol MPAs (Visayas Region) were determined as per recommendation by the Coastal Conservation and Education Foundation, Inc. (CCEF). The Mabini-Tingloy diving fee system has proven to be one of the more successful attempts, earning more than a million pesos per year for each municipality.

Aside from recreational user fees, other types of uses that have been subjected to a user fee scheme (or at least a study thereof) are aquaculture activities and development fees for resorts or other large-scale economic development projects located within or near MPA boundaries. Some LGUs also charge environment or green fees among certain users in an area.

6.3.2 Registration and Licensing Fees

This is a common form of revenue-generating mechanism employed for CRM. Registration and licensing of fishers has been practiced in the commercial sector and is being implemented by BFAR. The FISH Project implemented the program in one of its sites (*i.e.*, Ubay, Bohol), and the LGU raised almost a million pesos in a year. Another USAID-funded project (*i.e.*, Philippine Environmental Governance) also set up such schemes within coastal project sites. Finally, UP-MSI has recommended registration and a licensing scheme in the implementation of CRM projects in Northern Luzon. In most of these cases, revenues generated are used to partly fund enforcement activities of *Bantay Dagat* teams that monitor their local MPAs, or in the absence of MPAs, patrol their municipal waters to guard against fishing violations.

6.3.3 Trust Funds

The biggest endowment trust fund established for conservation objectives locally is the Foundation for the Philippine Environment (FPE). In 1992, USAID funded the purchase by WWF of US$19 million of commercial debt owed by the Philippines. In exchange for cancelling the debt, the Philippines allocated US$17 million to establish FPE. Interest earned from investing the funds in a financial instrument sustained the operations and projects of the FPE. The Puerto Princesa Subterranean River National Park in Palawan established a revolving-ETF of PhP8.9 million (US$190,000) in 1993, with its annual revenue supplemented with income from tourist fees and PhP3.2 million (US$68,000) from the city government of Puerto Princesa. Finally, the Tubbataha Reefs Natural Park established a sinking-ETF (contains about PhP8 million or US$170,000) in 1998.

6.3.4 Public-Private Partnerships

The objectives of these partnerships are varied and may range from simple corporate social responsibility targets to the convergence of values between conservation groups and profit-based organizations. In the Verde Passage, two such partnerships have been formed. One is the Batangas Bay Coastal Resources Management Foundation (BCRMF), which is composed of industry players in Batangas Bay. Also, First Gen. Corporation (power generator company) and Conservation International-Philippines formed First Philippine Conservation, Inc. (FPCI). The Coastal Resources Management (CRM) Program drafted for Verde was the main strategy for the Verde MBCC of the Sulu-Sulawesi Seascape project to provide technical supervision and guidance. Finally, FPCI signed up as the main implementing agency for Verde conservation work, committing to extend work in the area beyond the life of the SSS project.

The El Nido Foundation was formed in El Nido, Palawan, wherein the tourism industry has partnered with local communities and LGUs in the area.

6.3.5 Payments for Environmental Services (PES)

The definition of PES includes all types of contracts that place financial value on stewardship services — from one-on-one informal agreements to large-scale public systems that shift economic investments towards desirable land stewardship. The PES approach is attractive in that (a) it generates new financing; (b) it is sustainable; and (c) it is efficient.

In the Philippines, success stories of PES schemes have been found in the terrestrial sector, particularly for watershed management. Such experiences have yet to be found in the coastal and marine sector. An attempt was made in Verde Passage to establish a wastewater pollution permit system, which may not be exactly a PES scheme, but would approximate one. Attribution could not be established due to the sheer volume of domestic sources and the lack of wastewater management infrastructure in the municipalities involved. In fisheries, there is potential on individual tradable quotas, but conclusions have always pointed to the fact that such schemes may not be feasible due to the multi-species character of the country's fisheries. The ecotourism sector is another potential area, but there is a need to establish some form of tenure instrument to coastal dwellers and nearby communities if PES schemes are to take effect. Finally, mangrove forests may have a major role to play in relation to carbon sequestration scheme although this may take some time as more research is needed to determine how much carbon can really be stored in mangrove reforestation areas.

6.3.6 Government Budgetary Allocation for Coastal Resource Management (CRM)

The traditional source of funding for CRM has always been allocations from the general budget of the local or national government. Some LGUs, particularly those that have had the opportunity of receiving technical assistance from donor-funded projects, have set aside funds for financing enforcement and other management activities on a regular basis. Budgetary allocations increased almost 200% in 2003 from 1999 levels (PhP122,000). In terms of major island groupings, Mindanao LGUs average PhP750,000 per year followed by Visayas LGUs at PhP250,000 per year.

In the absence of alternative revenue sources, some LGUs have proposed to increase internal revenue allocations (IRAs) to include coastal waters in computing for IRAs. In other cases, such as those experienced by FISH Project sites, tapping into the Special Activity Fund (SAF) of LGU budgets proved successful in providing regular budgets for CRM. Still, in areas where MPA establishment and CRM have been institutionalized, MPA networks have been formed, such as in Surigao del Sur and Zamboanga del Sur (Mindanao). These alliances are sustained by annual contributions of member municipalities and enforcement efforts are coordinated, thus creating more impact and synergy among members.

Aside from those already mentioned, taxes, penalties and fines, are popular and often-tested modes for raising funds.

6.4 Public Awareness

Aside from pursuing capacity-building initiatives, PAWB is carrying out its Information, Education, and Communication (IEC) initiatives through workshops and seminars to effectively communicate its efforts to target stakeholders. The IEC Strategy is classified into three groups: Advocacy, Social Mobilization, and Public Information and Communication for Behavior Development.

- Initiatives on advocacy seek the support of decision-makers in biodiversity conservation in various fora on biodiversity and congresses, such as the National Ecotourism Congress.

- Social mobilization strategy provides opportunities to demonstrate the importance of raising awareness of biodiversity conservation involving various sectors including students, local constituents, *etc.* These activities are in the form of celebrations, such as *Dalaw-Turo* (a non-traditional, non-formal, and participatory approach in raising awareness on biodiversity conservation and sustainable development among students), World Wetlands Day event that showcases good practices of partner institutions in wetland management and conservation, and International Day for Biological Diversity, among others.

- Public Information and Communication for Behavior Development deals with producing IEC materials, such as posters, coffee table book, brochures, flyers, primers, calendars, bookmarks, button pins, and stickers. These are disseminated to different stakeholders to convey the urgent need to conserve biodiversity.

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