



UNEP/GEF Project:
REVERSING ENVIRONMENTAL DEGRADATION TRENDS IN
THE SOUTH CHINA SEA AND GULF OF THAILAND

PHILIPPINE WETLANDS IN THE SOUTH CHINA SEA: CONSERVATION PRIORITIES

SPECIALIZED EXECUTING AGENCY:
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PROTECTED AREAS AND WILDLIFE BUREAU



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DENR-PAWB
Ninoy Aquino Parks and Wildlife Center
Quezon Avenue, Diliman
1101 Quezon City, Philippines
Tel. (+632) 924-6031
Fax. (+632) 925-0109; (+632) 925-8950
planning@pawb.gov.ph
<http://www.pawb.gov.ph>

Prepared for publication by: Perry S. Ong, Ruth Grace B. Rosell-Ambal, Danilo S. Balete, Carlo C. Custodio, Nathaniel C. Bantayan, Renato D. Cruz, Renato T. Cruz, John Francisco A. Pontillas and Marlynn M. Mendoza (National Focal Point – Philippine Wetlands)

Design and lay-out by: Joy M. Navarro

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I. INTRODUCTION

The whole western coasts of the Philippines form the easternmost boundary that defines the South China Sea. This area encompasses a high diversity of ecosystems and biogeographic regions. Comprising this section that connects the Philippines to the South China Sea are the Batanes and Babuyan group of islands in the north, western flanks of Luzon and Mindoro islands, the Calamianes group of islands, the western stretch of Palawan island, and the Balabac group of islands in the south.

The initial process of identification of Philippine wetlands¹ directly linked to the South China Sea applied the watershed approach to establish the linkages between the offsite sources of degradation, such as deforestation, to those wetlands. To narrow down the selection of the wetlands, the diversity of coral reefs, mangroves, seagrass and seaweeds were also considered, based primarily on the priority wetlands identified during the Philippine Biodiversity Conservation Priority Setting Program (PBCPP). As a result, 28 wetland sites of the Philippines were selected, distributed over nine general sections of the western coast of the Philippines. Detailed characterization of each of these wetlands can be found in Annexes 1 and 2. The nine sections and the number of sites per section (indicated in parenthesis) are as follows:

1. Northern Philippines (4)
2. Northwestern Philippines (3)
3. Northwest Manila Bay (3)
4. Southwest Manila Bay (1)
5. Taal Lake-Pansipit River-Balayan Bay (2)
6. Northern and Western Mindoro (5)
7. Calamianes Group of Islands (3)
8. Mainland Palawan (7)
9. Balabac Group of Islands (1)

Eventually this set of listing was deemed too broad for the purpose of the Strategic Action Programme for the South China Sea. Further instructions from the regional programme management led to the identification of sites that directly contribute to the objectives of the program. The process of selection is discussed in more detail in the next chapter.

¹ "Wetlands" for the South China Sea Project are limited to coastal lagoons, estuaries and tidal flats and mudflats. The generally accepted definition of wetlands as adopted by the Ramsar Convention encompasses a wide range of ecosystems that include, but are not limited to, coral reefs, mangroves, sea grasses, and fisheries. As delimited by the scope of the South China Sea project, these other wetland habitats and ecosystems were accorded special attention on their own and considered stand alone project components.

II. PROCESS OF SITE PRIORITIZATION

The prioritization exercise to identify the key wetland sites directly linked to the South China Sea that meet the requirements of the Strategic Action Plan (SAP) underwent a long process of review of current and continuing projects, as well as studies on economic valuation, legislation, institutional and administrative arrangements and Geographical Information System database. The site selection process benefited greatly from the available information in the PBCPP (Ong *et al.*, 2002), Key Conservation Sites of the Philippines (Mallari *et al.*, 2001), Transboundary Diagnostic Analysis (Talaue-MacManus, 2000), Directory of Philippine Wetlands (Davies *et al.*, 1990), and Directory of Asian Wetlands (Scott, 1989).

Identification of Initial Long List

The initial long list considered in the prioritization of wetlands directly linked to the South China Sea, consisted of 28 sites, 22 of which were initially identified from PBCPP, a priority-setting process that identified a total of 412 priority areas in the Philippines for biodiversity conservation (Ong *et al.*, 2002), and 6 sites from Mallari *et al.* (2001), Talaue-MacManus (2000), Davies *et al.* (1990), and Scott (1989). The priority wetland sites, grouped based on their regional locations, are the following:

- 1) Northern Philippines (4) - Batanes and Babuyan Group of Islands, Buguey Wetlands, Palui Island and Kalbario Patapat National Park
- 2) Northwestern Philippines (2) - Agno River-Pangasinan Wetlands-Lingayen Gulf, and Bataan Natural Park -Subic Bay Forest Reserve
- 3) Northwest Manila Bay (3) - Candaba Swamp, Mariveles Mountains, Manila Bay
- 4) Southwest Manila Bay (1) - Laguna de Bay-Pasig River-Manila Bay-Northwest Cavite
- 5) Taal Lake-Pansipit River-Balayan Bay-Batangas Bay (2) - Taal lake-Pansipit River and Balayan Bay-Batangas Bay-Calatagan Peninsula
- 6) Northern and Western Mindoro (5) - Mt. Calavite, Mt. Iglit-Baco, Mt. Halcon-Sablayan, Malpalon, and Mt. Hinunduang
- 7) Calamianes Group of Islands (3) - Caluit Island, Busuanga Island and Culion Island
- 8) Mainland Palawan (7) - Bacuit Bay-El Nido, Malampaya Sound, San Vicente-Taytay-Roxas forests, Puerto Princesa Subterranean River National Park, Ulugan Bay, Anapalan-Victoria Ranges, Mt. Mantalingahan
- 9) Balabac Group of Islands (1) - Balabac

Site characterization of these sites covering all aspects according to regional agreed outline are presented as Annex 2. The information included the following:

1. Name
2. Geographical location
3. Type
4. Size
5. Wetland biodiversity
6. Uses and socio-economic values
7. Threats and causes
8. Wetland management aspects

In the process of selecting the areas for consideration as an investment area for the next phase of the South China Sea project, the following steps were undertaken to narrow down the priority areas. The first step was to go back to the title of the project, "Reversing Environmental Degradation of the South China Seas and the Gulf of Thailand," to guide the selection process. The National Wetlands Committee agreed that reversing environmental degradation trends include:

1. Maintenance and protection of remaining pristine environment, which encompass on-site interventions to protect existing biodiversity.
2. Restoration of degraded environment, which encompass on-site interventions to restore lost biodiversity. Restoration activities refer to activities that will lead to the recovery and rehabilitation of degraded areas and the delisting of threatened species from the threatened category because their population level has increased to a level that ensures their survival.
3. Prevention of degradation by removing and reducing the cause of degradation that encompass off-site interventions to remove/reduce cause of loss of biodiversity to maintain the good condition of the site. Prevention activities remove factors that threaten the population of priority species. Prevention activities involve off site activities, dealing with factors outside of the areas and species being protected.

It was also agreed that based on the above definitions, prevention activities should form part and parcel of any restoration or protection and maintenance activities as investments made in restoration or protection and maintenance will be negated if no prevention activities are undertaken simultaneously, i.e. factors that contributes to the degradation of good sites and those that further degrades degraded areas are not removed.

Furthermore, the National Wetland Committee also agreed that environmental degradation is measured in terms of:

1. Pollution
2. Loss of biodiversity
3. Decrease in fish productivity

For this element of the selection, loss of biodiversity is the primary determinant in the selection of an area while the pollution and decrease in fish productivity were secondary considerations. Loss of biodiversity includes the loss of habitat in terms of the area coverage of such habitats (quantity) and the status of the habitat (quality) and the number of threatened species found in the said areas (quantity) and the level of diversity of species found in the said areas, particularly of endemic species (quality). Philippine wetlands that qualify under the South China Sea project are those wetlands that that directly contribute to the environmental degradation of the South China Sea. Areas that are recipient of South China Sea impacts were excluded in the selection process.

III. SELECTION OF PRIORITY AREAS

Once these parameters were agreed upon by the National Wetland Committee, the 28 short-listed areas were reviewed again. Immediately, the Buguey wetlands, Palau Island and the Batanes and Babuyan islands in Northern Luzon were dropped off the list as they were determined to be recipients of South China Sea impacts rather than contributing to the environmental degradation of the South China Sea. The fourth area, the Kalbario-Patapat National Park was more an offsite source of degradation and its relationship to the South China Sea were several steps removed. This had the effect of removing Northern Luzon as a region for consideration.

The six sites which form the Northern and Western Mindoro were also removed from the list as five were forests in mountains and several steps removed from the South China Sea. This also had the effect of removing Mindoro from the next level of analysis.

The forests in the mountains of mainland Palawan (San Vicente-Taytay-Roxas, the Anapalan-Victoria Ranges and Mount Mantalingahan) were also excluded from the next level of selection as these were more offsite sources of degradation and their relationship to the South China Sea were several steps removed.

Balabac was also excluded from the next level of selection as very little information is available about the site compared to the other candidate sites, thus more energy would be required before a decision can be made regarding Balabac.

The remaining areas in the six regions were then classified according to whether or not they require restoration activities, protection, or maintenance activities.

Restoration:

1. Northwest Manila Bay
Candaba Swamp-Pampanga River-Mariveles Mountains-Manila Bay
2. Southwest Manila Bay:
Laguna Lake-Pasig River-Manila Bay-Northwest Cavite
3. Northwestern Philippines
Pangasinan Wetlands-Lingayen Gulf-Agno River
4. Mainland Palawan
Malampaya Sound

Maintenance:

1. Northwestern Philippines
Zambales Coast-Subic Bay-Bataan National Park
2. Taal Lake-Pansipit River-Balayan Bay-Batangas Bay
3. Calamianes
4. Mainland Palawan
El Nido
Puerto Princesa Subterranean River National Park /Ulugan Bay

Prevention:

1. Northwestern Philippines
Pangasinan Wetlands-Lingayen Gulf-Agno River
Zambales Coast-Subic Bay-Bataan National Park
2. Northwest Manila Bay
Candaba Swamp-Pampanga River-Mariveles Mountains-Manila Bay
3. Southwest Manila Bay:
Laguna Lake-Pasig River-Manila Bay-Northwest Cavite
4. Taal Lake-Pansipit River-Balayan Bay-Batangas Bay
5. Calamianes
6. Mainland Palawan Areas
El Nido
Puerto Princesa Subterranean River National Park/Ulugan Bay
Malampaya Sound

Selection of Priority Areas Based on the Type of Reversing Activities

The rationale for the grouping was to make the selection fairer, by comparing areas that require similar primary activities whether restoration, protection, or maintenance.

1. Restoration Activities

From the four regions representing wetland areas identified as priority for restoration, two wetland sites were selected as priority for investment for different reasons: Southwest Manila and Malampaya Sound. Southwest Manila Bay was selected as a model problem area. From a biodiversity point of view, Manila Bay would seem dead if its current biodiversity status is assessed. However, it is an important biodiversity area historically and data from the Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) and Manila Bay Environmental Management Project - Department of Environment and Natural Resources (MBEMP-DENR) report (2004) indicates that Manila Bay still contain remarkable biodiversity and performs critical environmental services. It is also the type locality for the Olive Ridley Turtle. It is a model problem area because of the onslaught of unplanned development, the multitude of stakeholders with competing vested interests in the subregion and the scale of the area that needs to be covered, among others.

Furthermore, the National Wetland Committee firmly believes that if Manila Bay can be successfully restored, then there is no place in the South China Sea and the Gulf of Thailand where restoration work cannot be done. Lessons learned from the restoration efforts in Manila Bay could be invaluable to the rest of the South China Sea and Gulf of Thailand where similar conditions exist.

On the other hand, comparatively speaking, Malampaya Sound is in the early stages of degradation and thus it would take less effort and resources to restore it back to good condition, than Manila Bay. Hence it is considered to be a model demonstration site since the size of the area under consideration is manageable, the level of awareness and participation of stakeholders involved are comparatively high than in other areas.

2. Protection and/or Maintenance Activities

From list of six regions, four were identified as priority for protection and/or maintenance activities, of which three were selected as priority areas for investment, again for different reasons. These areas are: 1) Taal Lake-Pansipit River-Balayan Bay-Batangas Bay, 2) Calamianes, and, 3) Puerto Princesa Subterranean River National Park (PPSRNP)-Ulugan Bay.

Taal Lake-Pansipit River-Balayan Bay-Batangas Bay was selected as a priority for protection and maintenance activities because if present degradation trends continue, then it is likely to go the way of Manila Bay. Hence intervention is urgently needed to ensure that the degradation trends are reversed as soon as possible.

On the other hand, the biodiversity of the PPSRNP-Ulugan Bay and the Calamianes in Palawan are in better shape than the other regions and thus would require less effort and resources to maintain it in its current condition and address various issues that threaten their current condition. Between the PPSRNP-Ulugan Bay and the Calamianes, PPSRNP has the advantage of being declared a World Heritage Site and Ulugan Bay is proposed to be included as part of expanded PPSRNP and consequently as part of the World Heritage Site.

IV. FINAL SITE SELECTION FOR INVESTMENT

In the final selection of sites for the development of investment proposals, the choices were narrowed down to just two areas, Malampaya Sound for restoration and the Taal Lake-Pansipit River-Balayan Bay-Batangas Bay for protection and maintenance. Other factors such as local government unit interest and local community participation were taken into consideration in the final selection.

ANNEX 1.

The Philippine Wetlands in the South in China Sea

ANNEX 2.

Site Description of Wetlands in the Philippines Directly Connected to the South China Sea

Philippine wetlands that are directly linked to the South China Sea were identified using the watershed approach; source of the degradation that affects the South China Sea was also considered. This was eventually narrowed down to include only 28 sites described below that directly contribute to the objectives of the program.

I. Northern Philippines

1. Batanes and Babuyan Island Groups Coordinates: 19°20'N 121°27'E
Area: 20,084 ha (Batanes Group) 60,340 ha (Babuyan Group) Altitude: 0 – 1,085 masl

The Batanes and Babuyan Island groups are at the northern tip of the Philippines, between Luzon and Taiwan, and extend for more than 200 km from north to south. The main islands in the Batanes group are Itbayat, Batan and Sabtang, while the main islands in the Babuyan group are Calayan, Camiguin Norte, Fuga, Babuyan and Dalupiri.

Batanes, home of the Ivatan people and famous for its distinctive culture and architecture, has attractive coastal sceneries that are popular destinations for tourists. The eastern side of Batan and Itbayat has broad U-shaped valleys, including wave-cut cliffs, sea caves and secluded white sandy beaches.

The Batanes Group of Islands was proclaimed as the Batanes Islands Protected Landscape and Seascape (BIPLS) under Proclamation No. 335 on February 28, 1994 with a total area of 213,578 ha, including 20,323 ha of land and 193,255 ha of marine areas. It was a recipient of the World Bank-Global Environment Facility (GEF) funded Conservation of Priority Protected Areas Program (CPPAP) from 1995-2002.

About 64% of the land area of the Batanes Islands is classified as forest, but most has been converted to agricultural land or grassland. A few fragmented primary forests remain, and secondary forests are found in old kaingin clearings. Habitat types include beach forest, secondary forest, lowland evergreen rainforest and montane forest.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) birds, Endemic (En)}:

Plants

At least 47 species are endemic to the Batanes and Babuyan Islands.

Lilium philippinense T

Podocarpus costalis T

Podocarpus polystachyus T

Sixteen (16) species of vascular plants are endemic to the Batanes Islands,

Reptiles

An undescribed species of snake, *Lycodon* sp. Batanes En

Batan narrow-disked gecko *Gekko porosus* Batanes En

Batan smooth-scaled gecko *Lepidodactylus balioburicus* Batanes En

Green turtle *Chelonia mydas* T

Hawksbill turtle *Eretmochelys imbricata* T

Jareck's flying lizard *Draco jackeri* (newly described) Batanes En

Olive ridley turtle *Lepidochelys olivacea* T

Birds

Chinese Egret *Egretta eulophotes* T

Elegant Scops-owl *Otus elegans calayensis* Restricted Range Endemic subspecies

Short-crested Monarch *Hypothymis helenae personata* Restricted Range Endemic subspecies

Whistling Green-pigeon *Treron formosae filippina* Restricted Range Endemic subspecies

Yellow Bunting *Emberiza sulphurata* T

Mammals *Poorly known*

Indochinese shrew *Crocidura attenuata* Only known site of Philippine distribution

Ryukyu Flying Fox *Pteropus dasymallus* T

The Batanes and Babuyan Island Groups are important flyways for migratory birds moving between Japan, Taiwan and the Philippine Archipelago. These Islands support three restricted-range species that are also endemic subspecies, reported to be common or uncommon on one or more of the islands in the past, but little recent information about their status is available. Twenty-one (21) subspecies (including the three given above) are endemic to this region, several of which are known from just one or two of the islands. Remaining forest areas maybe under localized pressure from clearance for cattle grazing and agricultural crops. Some kaingin and over-exploitation of forest products occur, but widespread agricultural intensification is unlikely. The greatest threats are probably from future commercial development, especially for the tourist market.

Hunting of wildlife occurs, including for a striking variety of yellow and white viper that is sought after by enthusiasts for its supposed medicinal value. Coconut crabs and fruitbats are both exported as a delicacy, and migrating Grey-faced Buzzards *Butastur indicus* are captured for local consumption and the pet trade. Local people complain that Taiwanese fishermen are damaging the fish resources by using such techniques as dynamite fishing.

2. Palaui Island
Area: 1320 ha

Coordinates: 18°33'N, 122°08'
Wetland type: intertidal flats

Found in the town of Santa Ana, Cagayan, off the extreme northeastern tip of Luzon, it is an area of Intertidal mudflats and sand flats with offshore coral reefs around a small island off the northern tip of Luzon. The island is 10 km long and up to 4.5 km wide and has a maximum elevation of 307m. It has a humid tropical climate with rainfall more or less evenly distributed throughout the year (Type IV).

It is an important staging area for migratory shorebirds, particularly during the autumn migration. The island provides the first significant area of mudflats for shorebirds crossing the Bashi Channel and the Luzon Strait from Taiwan. Preliminary shorebird surveys were conducted by Alonzo-Pascicolan (1987).

3. Buguey Wetlands
Area: c. 14,400 ha

Coordinates: 18°17'N, 121°50'E

Wetland types: intertidal flats; mangrove; saline lagoons and marshes,

Buguey Wetlands are on the North coast of Luzon, east of the mouth of the Cagayan River, and cover about 80% of Buguey Municipality. It is a complex of coastal lagoons, freshwater marshes, brackish and saline marshes, mangrove swamps and intertidal mudflats, with some fish ponds and shrimp ponds and a very large area of rice paddies, making it an important area for rice and fish production. The aquatic vegetation includes *Nypa fruticans*, mangrove species and *Ipomea reptans*. Plant communities in adjacent areas include *Pandanus* sp., and plantation of coconuts. It has a humid tropical climate with the rainfall of about 2,200 mm, more or less evenly distributed throughout the year (Type IV).

The Buguey Wetlands are important staging and wintering areas for migratory waterfowl, notably ducks, and shorebirds. Some 3,000-5,000 ducks were recorded in November, mostly the threatened Philippine Duck and tree-ducks *Dendrocygna* sp. Up to 3,000 other waterfowls and more than 1,000 shorebirds are regularly recorded there during Annual Waterfowl Census (AWC) counts (Alonzo-Pascicolan, 1987).

The Buguey Wetlands are threatened by conversion of mangroves and marsh to other uses. Mangroves have been greatly reduced by the creation of shrimp and fishponds, and this destruction continues. Waterfowl hunting, although illegal, is widespread, and there is extensive use of pesticides by the rice farmers. Ducks and egrets frequently feed in the rice paddies, and birds have died from poisoning.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Birds

Asian Dowitcher *Limnodromus semipalmatus* C
 Cattle Egret *Bubulcus ibis* C
 Cinnamon Bittern *Ixobrychus cinnamomeus* C
 Great Egret *Casmerodius albus* C
 Greater Painted-snipe *Rostratula benghalensis* C
 Grey-tailed Tattler *Tringa brevipes* C
 Intermediate Egret *Mesophoyx intermedia* C
 Little Egret *Egretta garzetta* C
 Little Ringed Plover *Charadrius dubius* C
 Little Tern *Sterna albitrons* C
 Mongolian Plover *Charadrius mongolus* C
 Pacific Golden-plover *Pluvialis fulva* C
 Philippine Duck *Anas luzonica* CT
 Philippine Hawk-eagle *Spizaetus philippensis* T
 Schrenck's Bittern *Ixobrychus eurhythmus* C
 Terek Sandpiper *Tringa cinerea* C
 Watercock *Gallixrex cinerea* C
 Whimbrel *Numenius phaeopus* C
 Yellow Bittern *Ixobrychus sinensis* C

4. Kalbario-Patapat National Park (KPNP)
 Area: 3,616 ha

Coordinates: 18°32'N 120°55'E
 Altitude: up to 1,294 masl.

Kalbario-Patapat National Park (KPNP) is found in the towns of Adams and Pagudpud, Ilocos Norte, on Pasaleng Bay, about 72 km northwest of Laoag City, and 185 km west of Aparri. It is easily accessible, as it is adjacent to a national highway. Its topography is generally mountainous with rugged, steep terrain. Along the coast there are white sandy beaches, sand dunes, rock formations and good diving sites. Very little is known about its wetlands. This area has considerable potential for tourism, given the variety of natural features and the relatively easy access.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) birds, Endemic (En)}:

Birds

Blackish Cuckoo-shrike *Coracina coerulescens* R
 Blue-breasted Flycatcher *Cyornis herioti* R
 Flame-breasted Fruit-dove *Ptilinopus marchei* RT
 Golden-crowned Babbler *Stachyris dennistouni* R
 Green-faced Parrotfinch *Erythrura viridifacies* RT
 Luzon Bleeding-heart *Gallicolumba luzonica* R
 Luzon Hornbill *Penelopides manillae* R
 Luzon Scops-owl *Otus longicornis* R
 Philippine Eagle-owl *Bubo philippensis* T
 Rabor's Wren-babbler *Napothera rabori* R
 Red-crested Malkoha *Phaenicophaeus superciliosus* R
 Rufous Coucal *Centropus unirufus* R
 Scale-feathered Malkoha *Phaenicophaeus cumingi* R
 Short-crested Monarch *Hypothymis helanae* R
 Spotted Buttonquail *Turnix ocellata* R
 Spotted Imperial-pigeon *Ducula carola* T
 Whiskered Pitta *Pitta kochi* RT
 Yellow Bunting *Emberiza sulphurata* R

Upland farming is not as prevalent compared to further south in the Mountain Province or Benguet province. High demand for fuel wood in Ilocos Norte has led to serious degradation of remaining forest stands. Collection of forest products and hunting are problems in the proposed Natural Park with some encroachment into the forests for kaingin.

II. Northwestern Philippines

5. Agno River-Pangasinan Wetlands-Lingayen Gulf

Coordinates: 16°2' to 16°34'N: 119°58', 120° 25'E 16°02'N, 120°05'E to 120°20'E	Area: about 200,000 ha (Lingayen Gulf)
Altitude: 0-5 masl	Area: about 3,000 ha (Pangasinan)
Wetland types: estuary, intertidal flats mangrove (Lingayen Gulf) intertidal flats (Pangasinan wetlands)	

Lingayen Gulf is found on the West Coast of Central Luzon, in Pangasinan and La Union provinces while the Pangasinan Wetlands are found on the coastal plain between Dagupan City and Binmaley Municipality in Pangasinan, Central Luzon. It has a humid tropical climate characterized by two pronounced seasons; a dry season from November to April and a wet season from May to October (Type 1). The mean annual temperature is 27.5°C and the mean annual humidity is 78.5%

Agno River is the largest of the seven major rivers that drains into the Lingayen Gulf located in the northwestern part of the Philippines. Over ten rivers and creeks of the Agno River run through the Pangasinan Wetlands in Central Luzon, an area of fishpond and rice paddies with adjacent intertidal mudflats before draining into the Gulf. A large area of privately owned fishponds and rice paddies with adjacent intertidal mudflats extends for about 25 km along the south shore of Lingayen Gulf, west of Dagupan City. The fishponds and mudflats cover 1,969 ha; the waterways 664 ha. Extensive mangrove swamps once occurred in the area, but these have been almost completely cleared for the construction of fishponds. The wetland lies at the northern edge of the alluvial plains of Central Luzon, which have been extensively flooded by the monsoon rains in recent years. A few remnants of mangroves and cultivated areas with rice, sugar cane, corn and other crops still exist. This site is an important staging and wintering area for about 20 species of migratory shorebirds (Alonzo-Pascicolan, 1987).

The wetlands support an important fishery. The main species raised in the fishponds and other water impoundments include mullet *Mugil sp.*, common carp *Cyprinus carpio*, *Saraderondon sp.*, milkfish *Chanos chanos*, and mudfish *Ophiocephalus striatus*. The low-lying alluvial plain extending south from Lingayen Gulf is a major rice-growing area. Destruction of mangroves for the construction of fishponds has proceeded to the point at which almost no mangrove is left. The DENR has launched a Mangrove Revegetation Program to replant areas denuded of mangroves.

The Lingayen Gulf forms a large inlet of the South China Sea that indents the western coast of Central Luzon. Lingayen Gulf is an extensive coastal gulf whose waters can be divided into three parts: i) the West Coast, characterized by coral reefs and sea grass beds; ii) the inner part of the Gulf with mangroves and nipa stands; and, iii) the East Coast, with intertidal mudflats. Brackishwater and freshwater fishponds are found further landwards. Several Islands found at the mouth of the Gulf are fringed with coral reefs. There are extensive sea grass beds and large areas of algal flats, the main species being *Acanthophora spicifera*, *Caulerpa spp.*, *Gracilaria verrucosa*, and *Laurencia spp.* Mangroves are present in strips along the coast and HY-Ra fruticans is common where there is some freshwater influence. The Gulf is considered a common resource, with fishpond areas leased to private individuals by the government. Fish include true reef-dwellers such as groupers, snappers, siganids, surgeon fish and butterfly fish, and transient types such as fusiliers, threadfin bream, flathead and rainbow runners. Offshore fish include slipmouths, anchovies, yellowfin and skipjack tuna. There is little information on shorebirds.

Lingayen Gulf is vital for the subsistence of coastal communities- approximately 15,000 fishermen operate in the Gulf. Activities include:

- a) Brackish and freshwater aquaculture
- b) Fish collection for the aquarium industry
- c) Subsistence fishing of grouper, snapper and siganid.
- d) Gathering of seaweed, sea cucumbers and sea urchins (for consumption) and gathering of molluscs (for consumption and shell-craft).

Inland of the Gulf, the area is important for rice growing. Rice production accounts for up to 90% of all agricultural production in the area.

Drastic over-exploitation of the gulf's resources is evident. There are too many people for the available resources, leading to increasing competition for decreasing resources. The stocks of fish, invertebrates and seaweed are decreasing. Blast fishing and fish poisoning are rampant. There is pollution caused by upland-based mining operations, which also cause serious siltation in the rice paddies and fishponds. The pollution threat is very great - cadmium and mercury from mine tailings enter the Gulf. As of 1979, the level of cadmium in waters off the gulf was five times the maximum NPCC standard. The level for mercury was just below the permissible level.

The Gulf was the pilot site of the ongoing Philippine component of the ASEAN-USAID Coastal Resources Management Project (CRMP), the aim of which was to develop a community-based management program for the resources to help raise the low socio-economic conditions of the Coastal communities. Continuing research on socio-economics and resource evaluation is being undertaken by the University of the Philippines-Diliman (Institute of Social Work and Community Development, Marine Sciences Institute); University of the Philippines-Visayas (College of Fisheries) and Bureau of Fisheries and Aquatic Resources (BFAR).

6. Zambales Coast-Bataan National Park (BNP)-Subic Bay Forest Reserve (SBFR)
 Coordinates: 14°41'N 120°25'E Area: 23,688 ha (BNP) 24,415 ha (SBFR)
 Altitude: 30 – 1,253 masl (BNP); 400– 500 masl (SBFR)

Located at the western coast of Central Luzon, the Zambales Coastline stretches from Lingayen Gulf and down south towards Subic Bay. It is characterized by extensive intertidal sandflats and coral reefs with pockets of mangrove in the smaller bays, with several offshore islands fringed with coral reefs.

The Bataan National Park (BNP) was declared as a national park in 1945, covering 31,365 ha but was reduced to 23,688 ha in 1980 through Proclamation No. 1956. It is proposed as a natural park under the National Integrated Protected Areas System (NIPAS). The Subic Bay Forest Reserve (SBFR) was established primarily to zone the area into different portions for management and development under the jurisdiction of the Philippine government through the Subic Bay Metropolitan Authority (SBMA) in 1993. BNP and SBFR were recipients of the World Bank-GEF-funded CPPAP and one of the three sites provided with technical assistance to improve biodiversity conservation by the Nordic Agency for Development and Ecology (NORDECO).

The BNP covers the towns of Hermosa, Orani, Samal, Abucay, Balanga, Pilar, Bagac, Morong in Bataan province while the SBFR covers the towns of Subic and Olongapo City in Zambales province.

Located within the Subic Bay-Bataan National Park are the few remaining undisturbed and surviving forests on Luzon that face the South China Sea. The forest, a vital watershed for the communities living around the park, surrounds Subic Bay, a small sea bay with offshore coral reefs, mangrove swamps, intertidal sandflats and mudflats.

Together, the BNP and the SBFR are contiguous and its forests extend from Subic Bay National Park up the northwestern slope of Mt. Natib in Bataan National Park, the highest point at 1,253m. These are one of the few remaining undisturbed forests in the Zambales biogeographic zone, and some of the few surviving forests on Luzon that face the South China Sea (those in the Sierra Madre to the northeast facing the Pacific Ocean are different in character). The lowlands around Subic Bay National Park are now predominantly agricultural land and human settlements. The lower slopes of the mountains are covered by grassland, cropland and secondary growth. Old growth forest is mainly confined to the steep slopes and gullies at higher altitudes. Lowland dipterocarp forest is found at c.100-900 m and montane forest above about 900 m. Between 3,000 to 5,000 ha of primary lowland dipterocarp forest is estimated to remain in the watershed, although much of this was damaged by the Mt. Pinatubo eruption in 1992.

Much of this forest was formerly included in the Subic Military Reservation, which was under U.S. Navy control until 1993 when it was turned over to the Philippine Government and became Subic Bay National Park. The portion of the Subic Military Reservation under the control of the U.S. Navy was well protected, but the lowland forests here are of great commercial value and the land is under considerable pressure from a variety of economic developments. Under a new administration, the Subic Bay Metropolitan Authority, there was a boom of new industries within the reservation. The former military base has been transformed into a center for trade and industry. The forests of this Important Bird Areas (IBA) are a vital watershed for the communities living around the park. They are the home of

indigenous communities of Aetas and Negritos, who survive within the boundaries of Subic Bay National Park.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Birds

Blackish Cuckoo-shrike *Coracina coerulescens* R
Green Racquet-tail *Prioniturus luconensis* RT
Green-faced Parrotfinch *Erythrura viridifacies* RT
Luzon Scops-owl *Otus longicornis* R
Philippine Cockatoo *Cacatua haematurus* T
Philippine Duck *Anas luzonica* T
Philippine Eagle-owl *Bubo philippensis* T
Philippine Hawk-eagle *Spizaetus philippensis* T
Red-crested Malkoha *Phaenicophaeus superciliosus* R
Rufous Coucal *Centropus unicolor* R
Scale-feathered Malkoha *Phaenicophaeus cumingi* R
Spotted Buttonquail *Turnix ocellata* R
White-fronted Tit *Parus semilarvatus* R
White-lored Oriole *Oriolus albiloris* R

Mammals

Golden-Crowned Flying Fox *Acerodon pallidus*
Northern Luzon giant cloud rat *Phloeomys pallidus*
Philippine brown deer *Cervus mariannus*
Philippine warty pig *Sus philippensis*

One of the largest recent counts of Philippine Duck was in SBFR. The lowland tropical rainforest in SBFR and the BNP is very vulnerable to exploitation because it harbors tree species of high commercial value. The migration of settlers into the unguarded forestland is leading to conversion of forests into agricultural land and kaingin. Firewood gathering, charcoal making, illegal logging, illegal grazing, hunting and gathering, and natural threats like typhoons, fires and volcanic eruptions are degrading the forests and their wildlife. Much of the forest in this IBA was badly damaged by ashfall from the Mt. Pinatubo eruption in 1992.

A new road was recently constructed eastward from Morong. Further development of this road could lead to the destruction of the closed canopy forest that currently extends from the shoreline up to the peak of Mt. Natib. Both sides of the piloted road have already been logged. Earth-moving work has caused tremendous erosion, silting the rivers and ricelands below. The road is reportedly used to haul logs to the sea at night via Mabayo Point, and local people use the road to reach the Bataan National Park in order to carry out timber clearing activities.

Between 1997 to 1999, a faunal inventory and assessment of the biodiversity of SBFR was conducted by the University of the Philippines Diliman with funding provided by the Philippine Council for Agriculture, Forestry and Natural Resources, Research and Development (PCARRD), Department of Science and Technology (DOST). A baseline biodiversity inventory of Bataan Natural Park was also conducted in 1996 by the Nordic Agency for Development and Ecology (NORDECO). As part of the technical assistance provided by NORDECO to improve biodiversity conservation in Bataan Natural Park, information, education and communication materials (e.g. flip charts, field guides, comics, slides, etc.) have been developed and distributed.

III. Northwest Manila Bay (includes the Candaba Swamp-Pampanga River-Southern Bulacan-Southeastern Bataan-Manila Bay)

Manila Bay is a large enclosed sea bay fringed by shallow intertidal mudflats and sandflats. Most of the Mangroves in the area have been converted to large areas of aquaculture ponds and saltpans. The Bay includes to the north the extensive intertidal areas from the Municipality of Balanga in Bataan province. It is also influenced by the Pampanga River that flows through the Candaba Swamp: a complex

of freshwater ponds, swamps and marshes with seasonally flooded grasslands that acts as a natural flood retention basin holding wet season overflow and is also an important staging and wintering area for migratory birds. The River breaks into numerous small tidal channels that have been developed extensively into brackish fishponds before flowing out into Manila Bay.

7. Candaba Swamp

Area: 32,000 ha

Wetland types: complex of freshwater ponds, swamps and marshes

Coordinates: 15°05'N 120°53'E

Altitude: 11 masl

Candaba Swamp is listed as a Ramsar site but not as a protected area. It is near the towns of Candaba, Pampanga; and San Miguel and San Ildefonso, Bulacan, about 50 km north-northwest of Metro Manila. It acts as a natural flood retention basin holding wet season overflow from the Maasim, San Miguel, Garlang, Bulu and Penaranda Rivers, and draining into the Pampanga River, but most of it dries out during the dry season from late November to May and a pronounced wet season from June to October (Type 1) and is converted into rice fields and plantations of watermelons.

It is a complex of freshwater ponds, swamps and marshes with surrounding areas of seasonally flooded grassland, arable land and palm savanna on a vast alluvial flood plain. Candaba Swamp was formerly an extremely important staging and wintering area for ducks, especially in October and November when the swamp regularly supported between 5,000 and 10,000 birds. In 1982, about 100,000 ducks were observed in a single day. No other site in the Philippines has been known to support such large concentrations of Anatidae, but the number of wintering wildfowl has recently declined dramatically. Several threatened waterbirds occurred here in the past, although the populations of some of these have presumably declined or disappeared. However, it still supports the only known regular wintering population of Streaked Reed-warbler in the world. The main area for waterfowl is an impoundment of about 300 ha, with a mixture of open shallow water, small islands, and rafts of floating vegetation, adjacent to the Pampanga River about nine kilometers north of Baliuag. The natural retention capacity is estimated at approximately 1.5 billion cubic meters. The average depth of water is 1-2 m and the maximum about 5 m.

A small part of the swamp is state owned and has been classified as "alienable and disposable"; the remainder is privately owned by many individuals.

The main threats are conversion of marshland to agricultural purposes, and changes in agricultural practices. Local people began growing rice instead of watermelons in the surrounding area, which entails draining the marshes in December or January instead of March or April. Water levels may be controlled further for crops to be grown all year round. Other threats to the wetlands and their biodiversity include siltation and the introduction of exotic fish species. Illegal hunting of waterbirds for food and recreation continues to be a problem. It is also a favorite spot for bird-watchers and naturalists, and has some potential for nature-oriented outdoor recreation and conservation education.

In 1994, an action plan for the conservation of the swamp and its waterbirds was developed with the participation of the local government of Pampanga, community leaders, the DENR, the Haribon Foundation and the Wild Bird Society of Japan.

No information is available on the aquatic vegetation as most of the flood plain is under cultivation for rice and other crops. Some patches of *Nyssa fruticans* and mangroves in surrounding areas still exist.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Birds

Baer's Pochard *Aythya baeri* CT

Common Pochard *Aythya ferina* C

Eurasian Wigeon *Anas penelope* C

Garganey *Anas querquedula* C

Great Egret *Casmerodius albus*

Northern Pintail *Anas acuta* C

Northern Shoveler *Anas clypeata* C

Philippine Duck *Anas luzonica* CT

Purple Swamphen *Porphyrio porphyrio* C
 Spot-billed Pelican *Pelecanus philippensis* CT
 Streaked Reed-warbler *Acrocephalus sorghophilus* T
 Tufted Duck *Aythya fuligula* C
 Wandering Whistling-duck *Dendrocygna arcuata* C

8. Mariveles Mountains
 Area: 23,688 ha

Coordinates: 14°31'N 120°29'E
 Altitude: 1,420 masl (maximum)

The Mariveles Watershed Forest Reserve was established through R.A. 3092 in July 1996. It is proposed as a Natural Park under the NIPAS. The Mariveles Mountains are in Mariveles and Limay, in southern Bataan, near the entrance to Manila Bay, and rise steeply from sea level to 1,420 m. An area of forest is shown on recent forest cover maps, which is reported to include both lowland and montane forest, including mossy forest. This includes old reforestation plantations in the former Lamao Arsenal and old growth forest at the peak of Mt. Mariveles.

Potential threats to this area include exploration for mining, should current applications be approved. Surveys are required to investigate both the extent and quality of the remaining habitats, mammalian fauna and herpetofauna, the current status of the threatened and restricted-range birds and other biodiversity.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Birds

Blackish Cuckoo-shrike *Coracina caerulescens* R
 Celestial Monarch *Stachyris striata* RT
 Golden-crowned Babbler *Stachyris dennistouni* R
 Green Racquet-tail *Prioniturus luzonensis* RT
 Ijima's Leaf-warbler *Phylloscopus ijimae* T
 Isabela Oriole *Oriolus isabellae* RT
 Luzon Bleeding-heart *Gallicolumba luzonica* R
 Luzon Striped-babbler *Stachyris striata* R
 Philippine Cockatoo *Cacatua haematuropygia* T
 Philippine Hawk-eagle *Spizaetus philippensis* T
 Philippine Kingfisher *Ceyx melanurus* T
 Red-crested Malkoha *Phaenicophaeus superciliosus* R
 Rufous Coucal *Centropus unirufus* R
 Scale-feathered Malkoha *Phaenicophaeus cumingi* R
 Spotted Buttonquail *Turnix ocellata* R
 White-fronted Tit *Parus semilarvatus* R
 White-lored Oriole *Oriolus albiloris* R

9. Manila Bay

Coordinates: 14°40'N, 120°46'E

Area: 130,000 ha (Cavite and Bataan portions); 465 ha (Cities of Manila, Pasay and Parañaque)

Wetland types: shallow sea bay, intertidal flats, estuaries, mangrove

Manila Bay encompasses the following towns of Orani, Samal, Abucay, Pilar, Orion, Limay, Mariveles and Balanga of Bataan province; Masantol and Sexmoan of Pampanga; Obando, Bulacan, Paombong, Malolos, and Hagonoy of Bulacan; Bacoor, Cavite City, Kawit, Noveleta, Rosario, Tanza, Naic, and Ternate of Cavite; and the cities of Caloocan, Manila, Pasay, Parañaque, and Las Piñas of the National Capital Region. Specifically, it includes the extensive intertidal areas from the Balanga round the north and east shores of Manila Bay to Cavite City, south of Metro Manila. This large, enclosed sea bay is fringed by shallow intertidal mudflats and sand flats. Relicts of mangrove swamp survive, particularly in the Bataan area, but most have been converted to large areas of aquaculture ponds and salt pans. Plant communities in adjacent areas include coconut plantations and denuded hill vegetation.

The city and port of Metro Manila is situated on the eastern side of the Bay and directly connected to the South China Sea. The site is very important for its fish production that supports a large urban population along the periphery of the Bay. There are high concentrations of fish traps and extensive

mariculture within the open sea area, and aquaculture schemes cover about 70 km of the coastline. A salt pan industry at Cavite lies in the southeast, and there are several areas of shantytown development on the shores of the Bay.

Large numbers of migratory shorebirds, including several threatened species, use the intertidal mudflats, fishponds and salt pans in Manila Bay in winter and during the migration seasons. Monthly counts at a high tide roost in Metro Manila in 1979-1982 revealed a maximum of about 32,000 shorebirds in January 1980, and in early April 1987, about 8,000 shorebirds of 20 species were recorded at seven sites, mainly drained fish ponds and areas of intertidal mudflat. It has consistently registered the highest numbers of waterbirds at any site in the Philippines during the Asian Wetland Counts in 1990-1994.

The many threats to Manila Bay include the destruction of the remaining patches of mangroves for aquaculture, reclamation of intertidal areas for housing development, road construction and salt pans, continuous dredging and pollution (solid waste, domestic sewerage, industrial waste, and oil spills). There is continued denudation of the natural vegetation in the water catchment area. The heavily polluted and silted Pasig River drains into the Bay.

Shooting of shorebirds at fishponds and dynamite fishing are additional threats to the bay's biodiversity. Construction along the shoreline, especially in the Roxas Boulevard area, has disturbed the roosting areas of shorebirds, which have been forced to use alternative roosting places, such as the Ninoy Aquino International Airport Complex.

Manila Bay is an ideal area for research on fisheries, wildlife, biomass and marine pollution because of its close proximity to major research agencies. The Bureau of Fisheries and Aquatic Resources has carried out some studies, and the Forest Research Institute (Now the Ecosystems Research and Development Bureau-ERDB) and Asian Wetland Bureau (now Wetlands International) have conducted shorebird studies. The small pockets of mangrove swamp remaining in Pampanga Bay are of considerable value for research and conservation education.

A Presidential Task Force for the rehabilitation of Manila Bay was created in October 1993 to provide a mechanism for the management of the bay. A comprehensive management plan was submitted to the Office of the President in 1994.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Birds

Black-faced Spoonbill *Platalea minor* CT
 Cattle Egret *Bubulcus ibis* C
 Chinese Crested-tern *Sterna bernsteini* CT
 Chinese Egret *Egretta eulophotes* CT
 Common Sandpiper *Tringa hypoleucos* C
 Common Tern *Sterna hirundo* C
 Curlew Sandpiper *Calidris ferruginea* C
 Great Egret *Casmerodius albus* T
 Grey Heron *Ardea cinerea* C
 Gull-billed Tern *Sterna nilotica* C
 Kentish Plover *Charadrius alexandrinus* C
 Little Egret *Egretta garzetta* C
 Little Ringed Plover *Charadrius dubius* C
 Marsh Sandpiper *Tringa stagnatilis* C
 Mongolian Plover *Charadrius mongolus* C
 Nordmann's Greenshank *Tringa guttifer* CT
 Pacific Golden-plover *Pluvialis fulva* C
 Philippine Duck *Anas luzonica* CT
 Purple Heron *Ardea purpurea* C
 Rufous Night-heron *Nycticorax caledonicus* C
 Rufous-necked Stint *Calidris ruficollis* C
 Whiskered Tern *Chlidonias hybridus* C
 White-winged Tern *Chlidonias leucopterus* C
 Worcester's Buttonquail *Turnix worcesteri* RT

IV. Southwest Manila Bay (includes Laguna [Lake] de Bay-Pasig River-Manila Bay-Northwest Cavite)

The Southwest Shores of Manila Bay extend from the city and port of Manila situated on the eastern side of the Bay to Cavite City, south of Metro Manila. This part of the Bay is very important for its fisheries production that supports a large urban population along its periphery. High concentrations of fish traps and extensive mariculture within the open sea area, and aquaculture schemes cover about 70 km of the coastline. Large numbers of migratory shorebirds use the intertidal mudflats, fishponds and saltpans in the Bay in winter and during the migration seasons. It is also influenced by Laguna de Bay, the largest lake in the Philippines, and the most important freshwater wetland in the country in terms of support to local communities, which flows into the Pasig River before eventually discharging into Manila Bay.

10. Laguna de Bay (6) Coordinates: 14°11'-14°32'N; 121°03' - 121°29'E;
 Area: 91,136 ha. Altitude: 2 masl
 Wetland types: rivers, streams – slow flowing; freshwater lake and associated marshes

Laguna de Bay is located 10 km southeast of Manila, bounded in the north and east by Rizal province and in the south by Laguna province, Luzon. Most of the lake has a tropical climate with a pronounced dry season from November to April and a pronounced wet season for the remainder of the year (Type I), except in the extreme east, where the rainfall is more evenly distributed throughout the year (Type IV). The average annual rainfall varies from about 1600 mm in the west to 3200 mm in the mountainous northeastern part of the watershed. The mean annual temperature is 27°C; mean monthly temperature range from 25°C to 29.5°C, and the extremes are 16°C and 40°C. The mean annual relative humidity is 76%.

It is the largest lake in the Philippines with a shoreline of 220 km and a total volume of 3.2 billion cubic meters. A shallow freshwater lake, it is thought to have previously been an extension of Manila Bay that was cut off at its northern end by tectonic movements (slight arching that took place along the eastern shore of the lake). The lake is naturally eutrophic and highly productive. Increasing enrichment in terms of plant nutrients such as nitrogen and phosphorous has been caused by human activities in the watershed. Low-lying alluvial plains with a watershed catchment area of 382,000 ha surround the lake (excluding the lake). Only one outlet, the Napindan Channel, is found at its northwest end that joins the Marikina River 7 km from the lake to form the Pasig River, which flows through Metro Manila and discharges into Manila Bay.

Main inflows are situated in the south and east. The lake is shallow, with a mean depth of 2.5-3.0m and a maximum of 6.5m, although this varies greatly between the wet and dry seasons. Its maximum level is reached between September and November, just before the end of the wet season and then falls by an average of 1.7m to its lowest level at the end of the dry season in May. The residence time of the water in the lake is approximately one year. At the end of the dry season, the lake level may fall below the level of Manila Bay and so seawater may flow into the lake via reverse flow in the Pasig River. Although the lake is eutrophic with regard to the levels of nutrients entering it, there is heavy turbidity due to wind-induced sediment suspension, cutting down drastically the light available for photosynthesis. In some areas of the lake, primary production is at critically low levels due to this inorganic turbidity. If seawater flows into the lake, the sodium ions can flocculate some of the suspended particles, allowing greater light penetration and greater primary production. Large blue-green algae blooms can cause heavy fish kills after calm weather. The average pH is 8.5 and the oxygen concentrations are normally high due to the lake's shallow depth and large surface area. The north and western shores of the lake are highly industrialized and urbanized. Intensive agriculture, particularly for rice, leads to heavy nutrient inflows into the lake, particularly of nitrogen.

The lake is state owned (public water) and a common resource while surrounding areas are privately owned. Fishpens cover a very large area of the lake (up to one-third) and the Sierra Madre Mountains to the east of the lake are heavily deforested. Other uses of the lake include irrigation of rice land, especially to the southwest, navigation and water supply for industry.

A major threat to the lake is pollution - industrial, domestic and agricultural. About 900 industries are located in the lake basin, 90% of which are classified as highly polluting. Only 20% of these have any kind of wastewater treatment facilities. The lakeshores, particularly in the north and west are very highly

populated but have no sewage treatment facilities. In the south and parts of the west, the lake is contaminated by nitrates from fertilizers, and by pesticides from ricefields.

Another threat is from the closure of the NHCS. It seems that the entry of seawater into the lake has a beneficial effect in that it clears the water, allowing higher primary production. Fish growth during this period is the fastest for the whole year. It is thought that the permanent closure of the NHCS will reduce the primary production and hence fish production.

Siltation in the lake caused by the deforestation of the Sierra Madre Mountains to the east of the lake is an extremely serious problem. The lake may have become shallower and more turbid, again cutting down primary production. Primary production levels are close to zero at certain times of the year.

Another problem associated with deforestation on the Sierra Madre and the Marikina River upper catchment is the increased frequency of flooding around the lakeshore towns, especially the Metro Manila municipalities of Tagig, Pateros and Pasig. Severe and prolonged flooding has occurred frequently in the last two decades.

Prolonged flooding may be partly due to the operation of the NHCS and MF. Originally, three flood control structures were envisioned - the above two, together with the Paranaque Spillway (PS) which would have discharged excess water from the lake directly into Manila Bay and would thus serve as a second outlet from the lake avoiding Manila. However, the construction of the PS was deemed too expensive, so a provision for reverse flow was built into the MF that theoretically would allow water to drain out of the lake into the Marikina River after the river level had fallen to below that of the lake. However, it seems that this option may not be working as well as had been expected.

The main plan for the lake is the possibility of using it as a source of Manila's domestic water supply early in the next century. This was one of the reasons why the NHCS was built; to stop the entry of saline water into the lake to render it suitable for human consumption. However, along with this there must be a strict pollution control program that will be very difficult to implement.

Since 1986, extensive media campaigns have been launched to highlight the problems of the lake and the Laguna Lake Development Authority (LLDA) held numerous dialogues with Non-Government Organizations (NGOs), fishing associations and other users of the lake in order to draft some conservation measures. There are signs that there is greater control of factories discharging wastes into the lake as part of the DENR's & LLDA's pollution control programs.

Laguna de Bay is the most extensively studied lake in the Philippines, particularly for water quality and techniques of pen and cage culture. Studies have been carried out by LLDA, Southeast Asia Fisheries Development Center - Aquatic Development (SEAFDEC-AQD), University of the Philippines (UP)-Diliman and UP-Los Banos. There is a freshwater research station of SEAFDEC-AQD at Binangonan, Rizal and a limnological laboratory of UP Los Banos. The LLDA laboratory is a short distance from the lake in Pasig.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Invertebrates

Ampullaria luzonica

Corbicula manilensis

Macrobrachium sp.

Vivipara angularis

Giant golden apple snail or kuhol was introduced.

Fish

At least 23 native species of fish belonging to sixteen families and a lot of introduced species.

Catfish/Hito *Clarias batrachus*

Common Carp/Karpa *Cyprinus carpio*

Grunt/Ayungin *Leiopotherapon plumbeus* (maybe an endemic)

Manila Sea Catfish/Kanduli *Arius manilensis*

Milkfish/Bangus *Chanos chanos*

Mudfish/Dalag *Ophicephalus striatus*

Pasalit/Gourami *Trichogaster rectoralis*

Tilapia *Oreochromis mossambicus*
Tilapia *Oreochromis nilotica*
White Goby/Biyang Puti *Glossogobius giuris*

Birds

Black Coot *Fulica atra*
Black Winged Stilt *Himantopus himantopus*
Cinnamon Bittern *Ixobrychus cinnamomeus* C
Grey Heron *Ardea cinerea* C
Little Tern *Sterna albilfrons* C
Purple Swamphen *Porphyrio porphyrio* C
Rail *Rallus mirificus* En
Yellow Bittern *Ixobrychus sinensis* C

V. Taal Lake-Pansipit River-Balayan Bay and Batangas Bay

Taal Lake, situated in the Southern Luzon, is the deepest lake in the Philippines and has one of the highest levels of diversity of migratory fishes of any lake in the country. It is a large caldera lake fed by a number of streams rising on the Tagaytay ridge. It drains into the Pansipit River, the lake's only outflow, which flows out to Balayan Bay. The Bay is characterized by rocky shores and supports a diverse range of coastal ecosystems that includes seagrass beds, fringing reef and extensive mudflats.

11. Taal Lake	Coordinates: 14 ⁰⁰ 'N; 121 ⁰⁹ 'E
Area: 23424 ha	Altitude: 2.5 masl
Wetland type: freshwater lake and associated marshes	

Taal Lake, the third largest lake in the country, is located 60 km south of Manila, in Batangas province, Luzon. Formerly known as Bombon Lake, it is one of the lowest volcanoes in the world and one of the most beautiful places in the Philippines, with a high value as a tourist attraction.

It is a caldera lake and was formed, at least partly, by the collapse of a large volcanic caldera. It is a very deep lake, one of the deepest in the country, with a maximum depth of 200 m. The deepest portions are in the southeast and northeast, while the shallowest portions (down to 50 m) are found across the middle, either side of Volcano Island. Inflows to the lake are many small rivers originating from the Tagaytay Ridge reaching 641 masl which runs northwest of the lake, while there is only one outflow, the Pansipit River which leaves the southwest region of the lake and empties, 17 km later, into Balayan Bay. Volcano Island, in the middle of the lake, has an area of 4537 ha and a highest point of 311 m ASL. It contains a recent crater lake (Yellow Lake) that resulted from an eruption in 1911.

Surface water temperatures range from 25⁰C in the cool months of December to February to 31⁰C in the warmest months (April/ May). It seems that the lake stratifies, probably in the period April to December, with the thermocline being found at around 50 m. Dissolved oxygen concentrations are very high down to a depth of about 50 m, with very little remaining at 75 m. Chloride values are high, probably as a result of volcanic activity, with values of 380-390 ppm. This high level of chloride has led to high conductivity readings of 1000 - 1400 micro siemens/cm. The pH values recorded are mostly noticeably alkaline, the range being 7.3 to 9.6. The lake has a high transparency, with Secchi disc readings between 3.8 and 6.5m. Substantial volcanic activity is always a possibility and will affect the limnological characteristics of the lake, especially in the region of Volcano Island.

In the late 1930s, 47 species of fish were recorded. Currently, this number has changed with the eradication of some species and the introduction of others. Many of these 47 species of fish were catadromous, migrating from the coastal areas to the lake via the Pansipit River when still larvae, and migrating back to the sea when about to attain sexual maturity.

The lake is very important for fisheries. The Tawilis fishery is particularly important, as is the fishery for migratory fish such as maliputo (*Caranx ignobilis*) due to their high market value. But little information on the present status of these populations is available. Crustaceans such as crabs of the family Girapsidae (talangka) and small Atyid shrimps are also gathered, as are some of the molluscs such as *Corbicula manilensis* (tulya). Cage culture for *Oreochromis nilotica* has increased through the years. The

introduction of exotic fish seems to have had a negative impact on the native fish, particularly the endemic *Harengula tawilis*.

Cage culture may become more important in the lake, though the local fishermen seem to be suspicious of any aquaculture development due to the negative experiences of the small fishermen on the nearby Laguna de Bay. Soil erosion in the catchment area of the lake is potentially high, with 32% of the land classified as highly susceptible to erosion. Over-fishing with fish corrals on the Pansipit River has prevented the migration of many of the commercially important fish such as maliputo (*Caranx ignobilis*).

The Taal Volcano National Park was established in 1967, but has been transformed into the Taal Volcano Protected Landscape and Seascape (TVPLS) with a Protected Areas Management Board (PAMB) led by the Dept. of Environment and Natural Resources under NIPAS.

The Philippine Institute of Volcanology (PHIVOLCS) has a station at Talisay on the northern edge of the lake, and also a monitoring station on the north shore of Volcano Island. A BFAR station is located near the Pansipit River. A considerable amount of research carried out in the 1930's by Villadolid on the commercial fish of the lake and these papers still remain the best and most informative of all the work done on the lake. There has also been an investigation of the Tawilis fishery in 1976 and an extensive study on the bathymetry, temperature and oxygen regime in the lake, also in 1976.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Invertebrates

A migratory crab of family Grapsidae (talangka) of commercial importance

Small freshwater shrimps of the family Atyidae (apta) commercial importance

The molluscan fauna includes *Melania blatta*, *M. laterita*, *M. pantherina*, *M. craba*, *Vivipara angularis* and *Corbicula manilensis*

Plants

Hydrilla verticillata

Imperata cylindrica (cogon) dominates surrounding landscape

Vallisneria sp.

Fish

Asohos *Sillago sihama* Migratory

Bambangin/Mangrove Snapper *Lutjanus argentimaculatus* Migratory

Banak/Mullet *Mugil macrolepis* Migratory

Banak/Mullet *Mugil melinopterus* Migratory

Bangus/Milkfish *Chanos chanos* Migratory

Biya/White Goby *Glossogobius giuris* Resident

Buan-buan/Ox-eyed Tarpan *Megalops cyprinoides* Migratory

Commerson's Glassy Perchlet *Ambassis commersonii* Migratory

Dalag/Mudfish *Ophicephalus striatus* Resident

Freshwater sardine, *Harengula tawilis* En

Gagaong/Convex-lined Therapon *Therapon jarbua* Migratory

Goby *Rhinogobius flaviventris* En

Gossaner Blenny *Omobranchius ferox* En

Grunt/Ayungin *Leiopotherapon plumbeus* Resident (maybe an endemic)

Igat/Palos/Eel *Anguilla mauritiana* Migratory

Kataba/Archer fish *Toxotes jaculatrix* Resident

Maliputo/yellow-fin jack *Caranx ignobilis* Migratory

Manipis/Jack *Caranx* sp. Migratory

Mionorus bombonensis En

Nile Tilapia *Oreochromis niloticus niloticus* Introduced

Palowon/Mud Gudgeon *Ophieleotri aporos* Resident

Ritang/Spadefish *Scatophagus argus* Migratory

Rock Flagtail *Kuhlia rupestris* Migratory

Talakitok/Big-eye trevally *Caranx sexfasciatus* Migratory

12. Balayan Bay and Calatagan Peninsula

Coordinates: 13⁰49'-13⁰ 50'N: 120⁰ 37'-120⁰ 35'E.

Area: 75,000ha

Wetland types: shallow sea bay, rocky seacoast, beaches, intertidal flats, mangroves, coastal lagoons and marshes

Balayan Bay and Calatagan Peninsula is 80 km South-Southwest of Manila, Batangas, Luzon. It is a large sea bay with intertidal flats and mangrove forest (Balayan Bay), adjacent areas of fish and shrimp ponds, and the coastal wetlands of the Calatagan Peninsula to the west, including Pagapas Bay. In Balayan Bay and the adjacent smaller Pagapas Bay, the substrate is generally muddy but there are some small areas of sandy flats. The tidal range is high, and at low tide the mudflats extend outward for about 900 meters. Approximately 50% of the original mangrove forest has been cleared for the construction of fish and shrimp ponds. The West Coast of Calatagan Peninsula faces the South China Sea and is bordered by a broad and well-developed fringing reef about 13km long and 900 meters wide. The outer edge of the reef is characterized by an intensive coral growth that is usually exposed at low tide. The reef flats are sandy with an abundant growth of seagrasses, and the inner reef near the lagoon is sandy and rocky.

Mangrove forests are dominated by *Avicennia marina*, *Rhizophora mucronata* and *Sonneratia alba* species. Beds of seagrasses and algae are also found. Grassland, coconut plantations, rice paddies and cornfields surround the adjacent areas.

The Bay is state-owned while the Calatagan coastal wetlands are privately owned. The Bay supports a very important fishery. Local communities are dependent on the coastal resources for their livelihood - 30% of the population are fishermen and shrimp gatherers. Aquaculture (both fish and shrimp) and commercial farming of seaweed are also important. Cattle raising and the cultivation of rice, corn and coconuts are carried out in adjacent areas.

The clearing of mangroves to make room for aquaculture ponds and the cutting of mangroves for firewood continues. A geothermal plant has been constructed in the Municipality of Balayan and its waste is dumped into Balayan Bay.

No protected areas have been established but a private landowner has taken measures to protect the mangroves fringing his property in Balayan Bay, and some efforts, have been made to improve environmental awareness among other local residents. There is now a Bay-wide alliance of local government units working together as the Bay had been developed into a major tourism dive site and became a major earner as well.

The area was used as a major bird-banding site by the MAPS Program in 1972, and in recent years, the Forest Research Institute (now the Ecosystems Research and Development Bureau) and Asian Wetland Bureau have carried out studies on the migratory shorebirds.

Balayan Bay and the Calatagan Peninsula are important for migratory shorebirds and many different types of coastal ecosystems are represented within the bay.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Fish

Milkfish *Chanos chanos*

Birds

Asiatic Dowitchers *Limnodromus semipalmatus*

Common Redshank *Tringa totanus*

Common Sandpiper *Actitis hypoleucos*

Grey Tailed Tattler *Heteroscelus brevipes*

Kentish Plover *Charadrius alexandrinus*

Little Ringed Plover *Charadrius dubius*

Mongolian Plover *C. mongolus*

Pacific Golden Plover *Pluvialis fulva*

Rufous-Necked Stint *Calidris ruficollis*

Terek Sandpiper *Xenus cinereus*

Western Curlew *Numenius arquata*

VI. Northern and Western Mindoro

13. Mt. Calavite to the northwestern coast of Mindoro

Coordinates: 13°29'N 120°24'E

Area: Not estimated

Altitude: 1,515 masl (maximum)

Mt. Calavite is located on the northwestern tip of Mindoro Island. The north and northwest sides of the mountainous headland, until recently, were forested extending to the beach. However, much of the forest has already been cleared for agriculture. The area has still some value as a watershed and water source for the communities. Mt. Calavite and FB Harrison were declared together as a game refuge and bird sanctuary by virtue of Executive Order No. 9 on 28 January 1920. They are now proposed as a wildlife sanctuary under the NIPAS. Mt. Calavite National Park (17,000 ha) was declared by Executive Order No. 9 on 26 January 1925.

Mt. Calavite is on a mountainous headland at the northwestern tip of Mindoro Island. Until recently the area was a wilderness, with the north and northwest sides forested to the beach, but much of the forest has been cleared for agriculture. There are now large tracts of cogonal grassland, with second growth lowland forest patches confined to gullies and very steep slopes.

Several hundred families reside inside Mt. Calavite National Park, and most are engaged in farming. The area also has some value as a watershed and water source for the small town of Paluan.

Recent sightings of the Tamaraw *Bubalus mindorensis* in Mt. Calavite National Park were reported.

A number of potential threats to the forests occur. On the occidental side of Mindoro, perennial fires in the grasslands adjoining forests have eroded the buffer zones of open canopy second growth forest or brush around them. Most of the grasslands are being used as pasture, and regular burning is the conventional practice used to encourage the growth of young grass shoots, which often are left to spread into the forest, and are slowly decimating remaining forests.

14. Mt. Iglit-Baco on the southwestern coast of Mindoro

Coordinates: 12°51'N 121°10'E

Altitude: 2,487 masl (maximum)

Area: <75,445 ha

Situated in the High Mountains of Central Mindoro is Mt. Iglit-Baco, popularly known as the home of the tamaraw (Mindoro endemic pygmy water buffalo). Several rivers flow from the mountain range including the Lamintao and Anahawin Rivers to the South China Sea.

Mt. Iglit-Baco National Park (MIBNP) is home to four Philippine cultural groups (Batangan, Hinunuo, Mayan and Bangan), who practice traditional agriculture and depend on the park for game and food gathering. MIBNP was declared under Republic Act No. 6148 on 9 November 1970. The MIBNP was the recipient of the Department of Environment and Natural Resources-European Union-National Integrated Protected Areas Program (DENR-EU-NIPAP). It straddles the towns of Sablayan and Calintaan in Mindoro Occidental and Bongabong and Bansud, in Mindoro Oriental. MIBNP is mostly grassland, with one area of forest close to Mt. Iglit, a few other small patches, and an extensive block on steep slopes in the Mindoro Oriental sector of the park. These are mainly montane forests on very steep slopes, with some areas of lowland dipterocarp forest. There is a about 367 ha stand of acacia *Samanea saman* woodland at 50-100 m in the southern part of the park close to Lamintao River, and an area of agohe *Casuarina equisetifolia* forest at the Tamaraw Gene Pool Area, along the Anahawin River. Most of the mountains and plateaus in the east of the park are covered in grassland or heavily degraded forest.

The mountains north of the national park still hold extensive forests, but most of these are montane forests on the higher slopes. However, there are some areas of lowland forest, for example on Mts. Katmuran-Kiblatoy, where sizeable tracts of such habitat are reported to be present. A survey in the 1990s found patches of forest as low as 300 m in this range (as seen from Villa Cervesa, Victoria), but there were signs of human encroachment as represented by burning and the presence of agricultural tracts near the slopes.

Mt. Iglit-Baco National Park is most famous for the conservation of the tamaraw *Bubalus mindorensis*, a Mindoro endemic, and its grassland habitat. Much of this grassland is excluded from this IBA, it is still likely to be extremely important for this species. Significant numbers of deer and wild pigs are also reported to occur there. Mt. Iglit-Baco is the type locality for the Mindoro pallid flying fox *Pteropus sp. a*, which is believed to have very small and fragmented populations, and is probably highly endangered.

Threats to this area include cattle ranching, upland farming and firewood gathering, which have led to rapid deforestation both inside and outside the Mt. Iglit-Baco National Park. The unpredictable law and order situation in the immediate vicinity of the park has made it difficult to prevent these disturbances. However, some of the remaining forests are very remote, and therefore relatively safe.

Most of the grasslands are used as pasture, and regular burning is the conventional practice to encourage the growth of young grass shoots. In many cases, these are left to spread into the forest, which are slowly being eroded. The stand of acacia woodland near to the Lamintao River is threatened by over-harvesting for furniture making. There are ecotourism activities in the lower parts of the park near the Anahawin River, the impacts of which are not known.

Hunting and poaching of the resources of the national park are also reported to be problems. The main hunting pressure is caused by trophy hunters from outside the park, but it is also caused to some extent by the traditional hunting of the Mangyans, whose numbers have increased quite substantially. The tamaraw, although protected by law, is still hunted in this area, especially in the remote parts.

The provincial government of Mindoro Occidental has developed a conservation education campaign for local schools in the vicinity of the national park, with the local DENR and the Toyota Corporation.

15. Mt. Halcon-Sablayan areas to the central western coast of Mindoro

Siburan Coordinates: 12°48'N 120°55'E Area: 25,000 ha Altitude: 50-400 masl

Mt. Halcon Coordinates: 13°15'N 120°59' E Area: 60,000 ha Altitude: 2,580 masl (maximum)

Mt. Halcon straddles the towns of San Teodoro, Baco, Calapan, Naujan, Victoria, Socorro, Pinamalayan, Gloria and Bansud in Mindoro Oriental and Sablayan and Santa Cruz, Mindoro Occidental. Mt. Halcon rises to 2,580 m, and is the third highest mountain in the Philippines. With its associated peaks, it includes the northernmost portion of the mountainous spine of the island of Mindoro. The Mt. Halcon IBA extends for almost 60 km along the border between Mindoro Occidental and Mindoro Oriental. The western slopes of the mountains have a seasonal climate with wet and dry seasons, whereas the eastern slopes have an evenly distributed rainfall, leading to a large diversity of natural vegetation types. In the east, the lower slopes support dipterocarp forests, with lower montane forest between about 1,000 and 1,700 m, in places with large areas of bamboo thicket and landslides with herbaceous cover. Mossy forest is found from c.1,700 to 2,200 m, and alpine shrubs and heath above this around the peaks of the mountains. On the western slopes are "parang" vegetation with patches of dipterocarp forest and stands of Mindoro pine.

In places the forest is naturally stunted (only c.10-12 m tall) with a highly uneven canopy and many needle-leaved trees, for example around Ilong Ridge. However, very large areas have been cleared and in 1991 kaingin (shifting cultivation) was found to be penetrating far up the most accessible valleys. In the area on Mt. Ilong visited in that year, the lower edge of forest was at around 750 m. It descended somewhat lower on ridges and valley sides to the north and south, but was broken-canopied there. Between 750 and 850 m, logging by pit-saw was intensive and the forest very open, with trees up to 20 m tall and a dense scrub layer. Only above 850 m did a natural primary forest of the lowland/lower montane transition type exist, extending up to 1,000 m with a canopy around 15 m tall.

These mountains are a tribal territory of both the Iraya Mangyan and Alangan tribes, who have ancestral land claims on the area. Mt. Halcon and its secondary peak and slopes are the watersheds of important riverine systems on the island, vital for agricultural productivity in the lowlands of northern Mindoro. The spectacular mountains in this IBA are popular with mountaineering clubs.

Most of the Halcon range is difficult of access and hence difficult to patrol. Because of remoteness of the area, much of the forest cover is still in fairly good condition. However, illegal pit-saw logging has severely damaged the forest below 850 m on Mt. Ilong, and extensive logging was underway at up to 700 m on the north slopes of Mt. Baco (near Mt. Halcon) in 1992. Kaingin encroachment was following close behind this logging, and rattan, canes and vines were being harvested. Regeneration of

forest may not be possible in many areas, as the catchments here appear extremely vulnerable to erosion, judging from the number of visible landslides.

Mt. Halcon, the third highest peak in the country, has the potential to be a tourist attraction to the large numbers of foreign and Filipino tourists staying at the nearby town of Puerto Galera. It is already a regular mountaineering destination in the dry season. The forests of Mt. Halcon are the watersheds of important riverine systems on the island flowing to the South China Sea and are vital for the agricultural production in the area. The Sablayan Coast and the adjacent islands and islets are characterized by intertidal sandflats, fringing coral reefs and mangrove swamps.

Siburan is the largest tract of lowland forest known on Mindoro. It is adjacent to the large Sablayan penal colony, which restricts access to the forest and therefore provides some degree of protection. The forest is about 30 km southeast of Sablayan, with forest on the south and east edge of the penal colony. This forest is contiguous with the patchy forests on the limestone ridge running north from Malpalon (PH043). In 1991, it was estimated that about 1,500 ha of lowland forest remain, with a similar area of unvisited montane forest further east. The lowland forest is a generally closed canopy with trees of up to 25 m or more and a relatively open forest floor. There are fewer limestone outcrops causing less disruption to the canopy than at Malpalon. The small Lake Lubao borders the forest.

Most threatened and restricted-range lowland forest birds of the Mindoro Endemic Bird Area were recorded recently at Siburan. It is almost certainly the largest and most important lowland forest site on Mindoro, particularly given the current relatively low level of disturbance there. The protection of this IBA probably represents the best opportunity to prevent the extinction of the highly threatened Mindoro Bleeding-heart, Black-hooded Coucal and Mindoro Hornbill. Lake Lubao, bordering the forest, holds a few waterbirds.

The future of Siburan is not secure, although there is presumably some degree of protection afforded by the proximity of the penal colony. The prisoners have some impact on the forest, as they use it for the collection of firewood, rattan and bamboo, and for snaring birds. Species such as Black-hooded Coucal may be confined to undisturbed areas of forest where dense tangles of vines and rattans are found, and this is being slowly cleared away from the forest nearest to the prison, due to the collection of rattan for furniture production by the prisoners. A large tree felled at this location was being milled on site for either furniture or building purposes. However, in general there are minimal signs of human activity in the forest, with very few paths and no logging reported.

A serious threat is posed to Siburan by encroaching slash-and-burn cultivation (kaingin) by local people and refugees. The influence of the penal colony has kept deforestation to a minimum, but the forest has no formal protection and is likely to come under increasing pressure in the future.

The Sablayan forest is under the jurisdiction of the Department of Justice, and an integrated social forestry project is running in the region.

The forests of Siburan had been proposed as a new protected area, and it has been suggested that the increasing outside interest shown in the birds of Siburan could provide greatly needed encouragement to conservation in the area. This site provides a unique opportunity to see at least four species that are almost impossible to find anywhere else in the world.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Insects

Euploea tableri mangyan T, Halcon En

Amphibians

Mindoro tree frog *Philautus schmackeri* Mindoro En

Reptiles

Philippine crocodile *Crocodylus mindorensis* T, En

Birds

Ashy Thrush *Zosterops cinerea* RT

Black-hooded Coucal *Centropus steerii* RT

Mindoro Bleeding-heart *Gallicolumba platenae* RT

Mindoro Hornbill *Penelopides mindorensis* RT
Mindoro Imperial-pigeon *Ducula mindorensis* RT
Mindoro Scops-owl *Otus mindorensis* R
Mountain Shrike *Lanius validirostris* R
Philippine Cockatoo *Cacatua haematurus* T
Philippine Hawk-eagle *Spizaetus philippensis* T
Scarlet-collared Flowerpecker *Dicaeum retrocinctum* RT
Spotted Imperial-pigeon *Ducula carola* T

Mammals

Forest Mouse *Apomys gracillirostris* was discovered in 1995 Mindoro En
Mindoro Climbing Rat *Anonymomys mindorensis* Mindoro En
Spiny Rat *Maxomys* *nov. sp.* (a genus previously from Palawan) Mindoro En
Tamaraw *Bubalus mindorensis* T, Mindoro En

16. Malpalon
Area: 25,176 ha

Coordinates: 12°42' N 120°58'E
Altitude: 894 masl (maximum)

Malpalon is found in the towns of Calintaan and Sablayan, Mindoro Occidental. This includes a group of forest remnants on a limestone ridge adjacent to MIBNP, a few kilometers to the south of Siburan. The ridge peaks at just below 1,000 m, and is forested for several kilometers. Clearance has been very recent here, such that many big trees and residual patches of forest exist in the lowlands, especially along field edges and watercourses. Continuous forest is now only found on the sides of steep, narrow ridges. Here the forest was on very irregular broken ground, creating heterogeneous forest types with many areas of scrubby thickets and few tracts of tall shady forest.

A species of wild pig occurs at Malpalon, and the Tamaraw *Bubalus mindorensis* was present in the past and still occurs nearby.

There has been extensive clearance of forest for kaingin at Malpalon. Forest fires, spreading from areas of secondary growth and cogon (grassland), can be a serious risk in the dry season. Collection of firewood, rattan and bamboo was probably increasing with the population.

Hunting is claimed locally not to be serious, but snare traps for terrestrial animals are common, and spear traps for pigs are so numerous that it can be unsafe to leave any path in the area.

A small area, mostly grassland, around Tusk Peak, is within MIBNP. Apparently none of the area is protected, although some of it is afforded nominal protection as a "Catchment Forest".

The most important areas are probably the remnant patches below 500 m, which are difficult to protect by statutory means. The Kalikasan Mindoro Foundation has started an ambitious education programme, centered on species such as the endemic birds and the Tamaraw, to make barangays and villages feel responsible for their remaining forests and to encourage more sustainable use.

There is insufficient socio-economic data for this area to understand the loss of biodiversity and the conservation measures needed.

17. Mt. Hinunduang
Area: 29,799 ha

Coordinates: 12°35' N 121°17'E
Altitude: c.150-1,300 masl

Found in the towns of Mansalay, Mindoro Oriental and Calintaan and San Jose, Mindoro Occidental. Mt. Hinunduang lies at the southern end of the central mountain ranges of Mindoro. Recent forest cover maps show a relatively extensive forest block on the mountain, most of which is presumably montane. A survey was carried out at San Vicente in 1991 in the Watershed of Tauga River below Mt. Hinunduang. Fieldwork concentrated on the lower-altitude quality forest and the mountain itself was not visited. No primary forest was found below 550 m although the long valley of the Tauga River, which provides access, had large trees and scattered secondary forest along its sides and floor down to about 150 m. Kaingin and small plantations (of fruit and cash crops) had penetrated most of the valley bottoms up to 500 or 600 m and were scattered through the remaining forest. The forest was of true lowland type at its lowest altitudes, but higher up was impoverished by steep slopes, exposure and recent logging (an

abandoned road crosses the area at 750-820 m) and was therefore difficult to assign to type. Small blocks of closed-canopy primary lowland forest persisted on some flatter ridges.

Several of the threatened and restricted-range birds of the Mindoro Endemic Bird Area have been recorded on Mt. Hinunduang, and the extensive montane forests which remain there are likely to prove to be important for montane species, notably the endemic Mindoro Imperial-pigeon and Mindoro Scops-owl. The areas of lowland forests at San Vicente and possibly elsewhere on the lower slopes of the mountain are also important for the conservation of some of the endemic lowland forest birds of Mindoro, such as Scarlet-collared Flowerpecker. Threatened subspecies of endemic wild pigs occur in this IBA.

At San Vicente, kaingin and plantations were encroaching into the forest, as described above, and the forest was used for rattan and creeper harvesting, and hunting for birds and (the threatened) wild pigs. Commercial logging operations within Oriental Mindoro have been stopped for quite some time, and the canopy of the logged-over areas has already closed. However, many of these stands are seriously threatened by poaching and slash-and-burn agriculture.

The San Vicente area has been zoned by the local DENR for reforestation, timber stand improvement and rattan plantation by concession holders. DENR has plantation sites much lower down the river which were not mature enough in 1991 to take pressure off the natural forests. However, this poses a threat to the area because DENR requires that all secondary growth be cleared prior to planting.

Surveys are required in this IBA, to investigate both the extent and quality of the remaining habitats and the current status of the threatened and restricted-range birds and other biodiversity.

VII. Calamianes Group of Islands

The Calamianes Group of Islands is situated in the northernmost section of the Palawan province. The coastlines of the islands are highly indented and are characterized by intertidal sand flats, mangrove forest and mudflats, seagrass beds and extensive coral reefs.

18. Calauit Island
Area: >4,000 ha

Coordinates: 12°18'N 119°52'E
Altitude: 0 - 236 masl

Calauit is a small, low-lying island in the Calamian group, north of Palawan. It is a short distance from the much larger island of Busuanga (PH048). The natural vegetation there is lowland forest, with beach forest and mangroves along the coast. Plantations, secondary growth and open grassland have replaced much of the forest. Calauit Island Game Reserve and Bird Sanctuary (3,400 ha) was declared by Proc. No. 1578 on 31 August 1976.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Amphibians

Brown-striped Tree Frog *Polypedates macrotis*
Everett's Tree Frog *Rhacophorus everetti*

Birds

Blue-headed Racquet-tail *Prioniturus platenae* RT
Chinese Egret *Egretta eulophotes* T
Grey Imperial-pigeon *Ducula pickeringii* RT
Palawan Blue-flycatcher *Cyanis lemprieri* R
Palawan Flowerpecker *Prionochilus plateni* R
Palawan Hornbill *Anthracoceros marchei* RT
Palawan Tit *Parus amabilis* R
Philippine Cockatoo *Cacatua haematuropygia* T
Yellow-throated Leafbird *Chloropsis palawanensis* R

Mammals

Calamian Hog-deer *Axis calamianensis* EN
Palawan Stink Badger *Mydaus marchei*

Binturong *Arctictis binturong*
Bearded Pig *Sus barbatus*
Bottlenose Dolphin *Tursiops truncatus*
Minke Whale *Balaenoptera acutorostrata*

Several threatened and restricted-range species of the Palawan Endemic Bird Area were recorded on Calauit, including the threatened Grey Imperial-pigeon, Blue-headed Racquet-tail and Palawan Hornbill, and unconfirmed reports of the Philippine Cockatoo.

Threats to the habitats on Calauit include cutting of timber, agricultural expansion, burning of vegetation and the collection of forest product. Exploitation of birds is also reported.

19. Busuanga Islands Coordinates: 12°05' N 120° 05'E
Area: Not estimated Altitude: 0 – 653 masl
Wetland types: shallow sea bays; small offshore islands/islets; sea beaches; intertidal mudflats and sandflats; mangrove; coastal brackish saline lagoons and marshes; rivers and streams, both slow flowing and fast flowing

Not officially protected but part of this IBA was proclaimed as a Marine Reserve/Tourist Zone in 1978 by Proc. No. 1801.

Busuanga (87,500 ha) is the largest island in the Calamian group, to the north of Palawan. There are two mountain ranges on the island, the Chinabayan and the Wayan ranges. It retains patches of open canopy broadleaf lowland forest, consisting of small to medium sized trees on poor soil, which are mostly found on ridges.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Amphibians

Philippine Discoglossid Frog *Barbourula busuangensis* EN

Reptiles

Green Turtle *Chelonia mydas*
Hawksbill Turtle *Eretmochelys imbricata*
Philippine Crocodile *Crocodylus mindorensis*
Estuarine Crocodile *Crocodylus porosus*

Birds

Blue Paradise-flycatcher *Terpsiphone cyanescens* R
Blue-headed Racquet-tail *Prioniturus platenae* RT
Palawan Flowerpecker *Prionochilus plateni* R
Palawan Hornbill *Anthracoceros marchei* RT
Philippine Cockatoo *Cacatua haematuropygia* T
White-vented Shama *Copsychus niger* R
Yellow-throated Leafbird *Chloropsis palawanensis* R

Mammals

Bearded Pig *Sus barbatus* En
Bottlenose Dolphin *Tursiops truncatus*
Calamian Hog-deer *Axis calamianensis* En
Leopard Cat *Prionailurus bengalensis* En
Palawan Flying Fox *Acerodon leucotis* En
Palawan Porcupine *Hystrix pumila* En
Palawan Stink Badger *Mydaus marchei* En
Palawan Tree Shrew *Tupaia palawanensis* En
Short-tailed Mongoose *Herpestes brachyurus* En

The forests on Busuanga are not believed to be under serious threat of encroachment, apart from occasional cutting apparently for local use. However, an old carabao trail leading into the Chinabayan mountain range has been greatly widened and is now continually used, which may indicate increasing

pressure on this area. There is a need to assess the current status of the habitats at this site, and to determine whether it still supports populations of any of the threatened and restricted-range species that formerly occurred there.

20. Culion Island
Area: 45,600 ha

Coordinates: 11°50' N 119°55' E
Altitude: 70-467 masl

Culion (45,600 ha) is a reserved area as a leper colony under the Department of Health and the provincial government. It is the second largest of the Calamian group, to the north of Palawan. It retains patches of open canopy broadleaf lowland forest, consisting of small to medium sized trees on poor soil, found both along the ridges and on flat areas.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Amphibians

Philippine discoglossid frog *Barbourula busuangensis* EN

Reptiles

Green Turtle *Chelonia mydas*

Hawksbill Turtle *Eretmochelys imbricata*

Philippine Crocodile *Crocodylus mindorensis*

Estuarine Crocodile *Crocodylus porosus*

Birds

Blue Paradise-flycatcher *Terpsiphone cyanescens* R

Blue-headed Racquet-tail *Prioniturus platenae* RT

Palawan Blue-flycatcher *Cyanis lemprieri* R

Palawan Flowerpecker *Prionochilus plateni* R

Palawan Hornbill *Anthracoceros marchei* RT

Palawan Peacock-pheasant *Polyplectron emphanum* RT

Philippine Cockatoo *Cacatua haematuropygia* T

White-vented Shama *Copsychus niger* R

Yellow-throated Leafbird *Chloropsis palawanensis* R

Mammals

Bearded Pig *Sus barbatus* En

Bottlenose Dolphin *Tursiops truncatus*

Calamian Hog-deer *Axis calamianensis* En

The forests on Culion are not believed to be under serious threat of encroachment, apart from occasional cutting apparently for local use.

VIII. Mainland Palawan

21. Bacuit Bay-EI Nido

Area: 35,284 ha

Wetland types: shallow sea bays; small offshore islands and islets

Coordinates: 11°10'N 119°23'E

Altitude: 0 – 648 masl

Bacuit Bay is located within the municipality of EI Nido at the northernmost tip of Palawan Island. The area is a popular nature spot with its diverse coastal ecosystems. This includes extensive intertidal sandflats and mudflats, mangroves forests, seagrass beds, and extensive coral reefs.

EI Nido Managed Resource Protected Area was proclaimed by virtue of Proc. No. 32 on October 8, 1998. It covers a land area of 35,283.64 ha and a marine area of 53,847.57 ha. This IBA is one of the recipients of the DENR-EU-NIPAP. It is included within the EI Nido Marine Reserve, which covers 95,000 ha, much of which is marine but also includes a substantial area of land. Some extensive areas of old growth forest are shown on the low hills there on recent forest cover maps. There are reported to be extensive areas of forest on limestone (ironwood) and beach forest there.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Marine Reptiles

Green turtle *Chelonia mydas* T
Hawksbill Turtle *Eretmochelys imbricata* T
Olive Ridley Turtle *Lepidochelys olivacea* T

Birds

Blue Paradise-flycatcher *Terpsiphone cyanescens* R
Palawan Flowerpecker *Prionochilus plateni* R
Palawan Hornbill *Anthracoceros marchei* RT
Palawan Peacock-pheasant *Polyplectron emphanum* RT
Palawan Swiftlet *Collocalia palawanensis* R
Sulphur-bellied Bulbul *Ixos palawane nsis* R
White-vented Shama *Copsychus niger* R
Yellow-throated Leafbird *Chloropsis palawanensis* R

Marine Mammals

Bottlenose Dolphin *Tursiops truncatus*
Finless Porpoise *Neophocaena phocaenoides*

The areas logged on Palawan are relatively recent, and the majority of the forest within the closed canopy line is primary. Small-scale timber extraction and the operations of well-organized logging operations are hastening the depletion of the forest cover on the island. The Ten Knots Development Corporation had developed the EI Nido Resort for ecotourism, including birdwatching.

Mainland Palawan and its associated islands are included in a Biosphere reserve, declared in 1990. An integrated management plan was prepared for the Palawan Biosphere Reserve, Environmentally Critical Areas Network (ECAN), to zone the island, which incorporates the existing EI Nido Marine Sanctuary and other protected areas. This area includes terrestrial core zone (primitive wilderness area strictly protected) and buffer zone (regulated use allowed) areas.

22. San Vicente-Taytay-Roxas
Area: 152,30 ha

Coordinates: 10°46' N 119°20' E
Altitude: 701 masl (maximum)

Several large blocks of old growth forest are shown on recent forest cover maps between the towns of San Vicente, Taytay and Roxas, in northern Palawan. Much of this area is low-lying, with the hills reaching a maximum altitude of only 701 m, so all of these are likely to be lowland forests.

The birds of this area are generally poorly known, but there are records of several of the threatened and restricted-range species of the Palawan Endemic Bird Area, including the threatened Palawan Peacock-pheasant, Philippine Cockatoo, Blue-headed Racquet-tail and Palawan Hornbill. The extensive lowland forests in this IBA are likely to support significant populations of these and other threatened and restricted-range species.

Logging in Palawan is relatively recent, and the majority of the forest within the closed canopy line is primary. Small-scale timber extraction and well-organized illegal commercial logging operations are hastening the depletion of the forest cover.

Surveys are required to investigate both the extent and quality of the remaining habitats and the current status of the threatened and restricted-range birds and other biodiversity.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Birds

Blue-headed Racquet-tail *Prioniturus platenae* RT
Palawan Hornbill *Anthracoceros marchei* RT
Palawan Peacock-pheasant *Polyplectron emphanum* RT
Palawan Swiftlet *Collocalia palawanensis* R

Palawan Tit *Parus amabilis* R
 Philippine Cockatoo *Cacatua haematuropygia* T
 Yellow-throated Leafbird *Chloropsis palawanensis* R

23. Malampaya Sound

Coordinates: 10⁰ 43'N-11⁰00'N; 119⁰16'E-119⁰ 28 'E Area: 30,000 ha
 Wetland types: shallow sea bay; estuaries; small offshore island and islets; intertidal mudflats and sandflats; mangrove

Malampaya Sound is one of the most important fishing grounds in the Philippines. It is located in northwest coast of Palawan in Taytay municipality, situated between two landmasses that form a horseshoe shaped area characteristic of a delta type estuary. It is divided into two sections: the outer sound and the inner sound. The important ecosystems that serve as spawning and nursery ground for the rich aquatic life that inhabits the Sound include coral reefs, seagrass beds, and mangrove estuaries. It is an extremely indented bay that is divided into an outer section dominated by sandy substrates and coral; and an inner section characterized by muddy substrates and mangrove. The mangrove areas (2,513 ha) were classified as follows: primary old growth mangroves (304 ha), young mangrove (1,652 ha) and reproduction brush (557 ha). It is the only place in the Philippines where the globally endangered Irrawady Dolphin is found.

The main inflow into the sound is the Abongan River from the south. Apart from the broad flat valley of the Abongan River, the topography surrounding the Sound is the rolling hill topography characteristic of northern Palawan. The inner part of the sound is extremely shallow (only about 1 m at low tide) with a fine mud substrate. The surrounding hills are either still forested or being cleared by settlers for cultivation. Further inland, ricefields dominate the valley of the Abongan River.

The area around northwest Palawan is one of the richest fishing grounds in the Philippines. This is in part thought to be due to the input from the mangrove areas in the Sound, thus it is vital to the support of the local coastal fisheries. The Sound is also the livelihood for many local communities that are increasing rapidly due to in-migration from other Philippine islands where the coastal resources have already been degraded. The mangrove is used for local uses such as cutting for firewood and building.

Commercial trawling has been banned in the Sound. It is recommended that the inner part of the Sound be afforded some kind of protected status, and that absolutely no conversion of mangroves to fishponds be allowed.

Ecosystem Research and Development Bureau (ERDB) in 1989 assessed the timber resources of the mangrove areas, while Asian Wetlands Bureau (AWB) carried out a brief survey of the status of the mangrove. The Sound was proclaimed the Malampaya Sound Protected Landscape and Seascape under the NIPAS law and was the recipient of the DENR-EU-NIPAP conservation program.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Mangroves

Acanthus sp., *Acrosticum aureum*, *Acrosticum aureum*, *Brugiera gymnorhiza*, *Brugiera sexangula*, *Ceriops decandra*, *Ceriops tagal*, *Excoecaria agallocha*, *Hibiscus tiliaceus*, *Lumnitzera racemosa*, *Nypa fruticans*, *Rhizophora apiculata*, *Rhizophora mucronata* and *Xylocarpus granatum*

Invertebrates and Fishes

Penaeid shrimps, rabbitfish (*Siganus* spp.) mullet/banak (*Mugil* spp.), anchovies and other fish of the families carangidae and Scombridae are common in and around the mangrove areas.

Herpetofauna

Green Sea Turtle *Chelonia mydas* T
 Hawksbill Turtle *Eretmochelys imbricata* T

Birds

Green Imperial Pigeon *Ducula aenea palawanensis*
 Palawan Malkoha *Phoenicomalphaeus curvirostris*
 Palawan Peacock Peasant *Polyplectron emphanum*

Palawan Racket-tailed Parrot *Prioniturus platenae*
Philippine Cockatoo *Cacatua haematuropygia*
Stork-Billed Kingfisher *Pelargopsis capensis*
Tabon Bird *Myapodius freycinet cumingii*
Talking Myna *Gracula religiosa palawanensis*
Whimbrel *Numenius phaeopus*
White-breasted Sea Eagle *Haliaeetus leucogaster*

Terrestrial Mammals

Long Tailed Macaques *Macaca fascicularis*
Northern Palawan Lesser Tree Squirrel *Callosciurus juvenus*
Palawan Bear Cat *Arctictis binturong*
Palawan Porcupine *Therurus pumilus*
Palawan Skunk *Mydaus marchaei*
Palm Civet Cat *Paradoxurus hermaphroditus*
Small Leopard Cat *Felis minuta*
Marine Mammals
Bottlenose Dolphin *Tursiops truncatus*
Irrawady Dolphin *Orcaella brevirostris* T
Sea Cow *Dugong dugon* T

24. Puerto Princesa Subterranean River National Park-Ulugan Bay

Coordinates: 10°10'N 118°55'E

Area: > 3,901 ha

Altitude: 0 - 1,593 masl

Puerto Princesa Subterranean River National Park (PPSRNP) – Ulayan Bay is on west coast of Palawan, about 81 km north of Puerto Princesa. St. Paul Bay bounds it to the north and the Babuyan River to the south. The landforms in the park are associated with rocky mountains (of marble and limestone) running from north to south that forms spectacular limestone formations.

PPSRNP (3,901 ha) was declared by Proc. No. 835 on March 26, 1971. It is situated on the west coast of Palawan. This was later increased to more than 20,000 ha that included the whole of the adjacent Babuyan River catchment as part of its inscription as a UNESCO World Heritage Site. The main feature of the park is an 8.2 km navigable underground river, an underground river flowing within a deep cavern under rugged limestone and marble cliffs which features cathedral-like caverns and domes, that drains into the St. Paul Bay. To the south of the Park is Ulugan Bay with its extensive mangrove swamps and mudflats found in the inner part of the bay. The relatively intact mangrove area represents one of the very few remaining areas of old-growth mangrove in the country.

Two-thirds of the area is covered by lush tropical rainforest from the shoreline to the highest peak, and one-third is thinly vegetated karst limestone. The vegetation types include lowland forest (often with a 35 m canopy), coastal forest and karst forest. There is a small human population in the park, whose livelihoods are fishing and farming.

The human population in the park is currently small, occupying an area suitable for rice cultivation on both sides of the Cabayugan River. Many small areas adjacent to the park were cleared for cultivation in the early 1990s, which could pose a serious long-term threat to the forests inside the park. Some logging was recently reported from inside the park, and gathering of rattans would pose a major problem if left unchecked. However, the park is relatively well manned and actively managed by the local government of Palawan.

All of Palawan and associated islands are included in a Biosphere reserve, declared in 1990. An integrated management plan has been prepared for the whole Palawan Biosphere Reserve (ECAN), to zone the island, incorporate the existing PPSRNP and other protected areas which includes terrestrial core zone (primitive wilderness area strictly protected) and buffer zone (regulated use allowed) areas.

The PPSRNP is currently a popular destination for visiting bird-watchers, and most of the threatened and restricted-range birds of the Palawan Endemic Bird Area have been recorded there. Several threatened species are regularly seen in the extensive lowland forests there, and the populations of Palawan Peacock-pheasant and Philippine Cockatoo in the park are particularly important.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Plants

Dao *Dracontemelon dao*

Kamagong *Diospyros* sp.

Malugai *Pometia pinnata*

Birds

Ashy-headed Babbler *Malacocincla cinereiceps* R

Blue Paradise-flycatcher *Terpsiphone cyanescens* R

Blue-headed Racquet-tail *Prioniturus platenae* RT

Chinese Egret *Egretta eulophotes* T

Falcated Wren-babbler *Ptilinichla falcata* RT

Melodious Babbler *Malacopteron palawanense* R

Nordmann's Greenshank *Tringa guttifer* T

Palawan Blue-flycatcher *Cyornis lemprieri* R

Palawan Flowerpecker *Prionochilus plateni* R

Palawan Flycatcher *Ficedula platenae* RT

Palawan Hornbill *Anthracoceros marchei* RT

Palawan Peacock-pheasant *Polyplectron emphanum* RT

Palawan Swiftlet *Collocalia palawanensis* R

Palawan Scops-owl *Otus fuliginosus* RT

Palawan Tit *Parus amabilis* R

Philippine Cockatoo *Cacatu a haematuropygia* T

Sulphur-bellied Bulbul *Ixos palawanensis* R

White-vented Shama *Copsychus niger* R

Yellow-throated Leafbird *Copsychus niger*

Mammals

Binturong *Arctictis binturong*

Oriental Small-clawed Otter *Amblonyx cinereus*

Palawan Flying Fox *Acerodon leucotis* T, En

Palawan Flying Squirrel *Hylapetes nigripes* En

Palawan Montane Tree Squirrel *Sundasciurus rabori* En

Palawan Porcupine *Hystrix pumila* En

Palawan Stink-badger *Mydaus marchei* En

25. Ulugan Bay

Coordinates: 10°02'-10°08'N, 118°4'118°50'E

Area: 1,880 ha. of mangroves

Wetland types: shallow bay; mangrove; estuary; offshore islands; intertidal mudflats; sea beaches; coral reefs; seagrass bed; offshore islands; and small bays

Ulugan Bay, located in the mid-western coast of Palawan about 35 km north of Puerto Princesa City, is a major shallow bay with the most diverse coastal mangrove forests associated with estuary, offshore islands, intertidal mudflats, sea beaches, coral reefs, seagrassbeds, small islands, and smaller bays, number of rivers empty into the bay including Banaog, Kamanglet, Sia, Burnang, Egdasen, Baheli and Kayulo. Salinities range from 9.2 to 27 ppt. and pH values from 7.0 to 7.5. The tide is predominantly of diurnal type, with a mean diurnal range of 1.22 meters. It is one of the remaining natural habitats of the salt water crocodile, *Crocodylus porosus*.

Ulugan Bay and the rivers joining it are used in the transport of cargo and passengers to and around the Bay including PPSRNP and Port Barton. On the eastern coast is the research and training center of the Palawan National Agricultural College - Regional Institute of Fisheries (PNAC - RIFT). In the southern corner is a infrastructure complex of the Philippine Navy. Coral boulders are being gathered and used as filling materials for the reclamation project in barangay Macarascas. Mangroves are cut for charcoal production and as fish poles, fencing and housing materials, furniture and firewood. Small-scale fishing like hook and line, crab traps, fish traps, fish corrals and fishnets are noticeable in the bay. Nipa fronds are used in making roofing materials. Crabs, shrimp and mollusks are collected as food items. There is an abandoned fishpond of about four ha in the inland mangrove area along the Bahile River. Three mining companies in the western side of the bay occupy a reclaimed area of the mangrove forest.

Mangrove trees are being cut excessively and destroyed for various purposes. Siltation of the bay results from the operations of the mining companies. Oil pollution from the naval ships and other boats had killed some stands of *Rhizophora* and *Bruguiera*. Domestic wastes from the coastal communities are dumped into the area. Over-collection of corals is depleting this important resource.

Ulugan Bay is a declared Naval Reserve while the coastal mangrove area is a forest reserve. Mangrove reforestation projects had been undertaken at the Bahile River estuary. The UNDP is undertaking a project to protect the bay by promoting alternative livelihoods including sustainable tourism activities.

The ERDB-DENR conducted vegetation studies of mangrove forest in the bay while PNAC-RIFT did research on ichthyofauna of the bay.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Plants

Among the mangrove species found are: *Acanthus ilicifolius*, *Acrotrichum aurum*, *Acrotrichum ebracteatus*, *Acrotrichum speciosum*, *Agliceras floridum*, *Avicennia lanata*, *Bruguiera gymnorrhiza*, *Bruguiera sexangula*, *Bruguiera cylindrical*, *Bruguiera parviflora*, *Caesalpinia crista*, *Cerbera manghas*, *Ceriops tagal*, *Cynometra ramiflora*, *Derris trifoliata*, *Excoecaria agallocha*, *Heritiera littoralis*, *Hibiscus tiliaceus*, *Lumnitzera littorea*, *Lumnitzera racemes*, *Nypa fruticans*, *Rhizophora mucronata*, *Rhizophora apiculata*, *Rhizophora stylosa*, *Sonneratia alba*, *Scyphiphora hydrophyllacea*, *Terminalia catappa*, *Thespesia populnea*, *Xylocarpus granatum*, *Xylocarpus granatum* and *Xylocarpus mekongensis*

Invertebrates

Several species of marine mollusks have been identified including *Carithium*, *Conus pondulus*, *Cypraea*, *Hippopus*, *Lambis*, *Natica*, *Oliva*, *Pinctada*, *Strombus*, *Telescopium*, *Tridacna*, *Trochus*, *Vasum*.

Reptiles

Philippine Cobra *Naja naja*
Reticulated python *Python reticulatus*
Salt Water Crocodile *Crocodylus porosus*

Birds

Black-naped Tern Stern *Sterna sumatrana*
Blue-Naped Parrot *Tanygnathus lucionensis*
Common Sandpiper *Actitis hypoleucos*
Crow *Corvus enca*
Dusky Grey Heron *Ardea sumatrana*
Eurasian Bittern *Butorides striatus*
Lesser Coucal *Centropus benghalensis*
Orange-bellied Flowerpecker *Dicaeum trigonostigma*
Philippine Cockatoo *Cacatua haematuropygia*
Reef Heron *Egretta sacra*
Stork-Billed Kingfisher *Pelargopsis capensis*
Velvet-fronted Nuthatch *Sitta frontalis*
Whimbrel *Numenius phaeopus*
White Collared Kingfisher *Halcyon chloris*
Yellow-throated Leafbird *Chloropsis palawanensis*

Mammals

Long tailed macaques *Macaca fascicularis*

26. Victoria and Anapalan ranges
Area: 182,456 ha

Coordinates: 9°23'N 118°18'E
Altitude: 50-1,798 masl

The Victoria and Anapalan mountain ranges and the adjacent foothills and lowlands is located in central Palawan, to the southwest of Puerto Princesa. There are montane forests on the higher peaks and large tracts of little disturbed lowland forest in the valleys and foothills southwest of Iwahig Penal Colony, in the foothills on the Sulu Sea side of the mountains and to the shoreline on the South China Sea coast in

some places. Victoria Peak is reported to support the largest area of ultramafic forest on Palawan, and other habitats there include lowland dipterocarp forest and lower and upper montane forest. Although not officially protected, it is included in the Environmentally Critical Areas Network (ECAN) as a buffer zone under the Strategic Environmental Plan for Palawan.

The most serious threats to the forests here are illegal logging and kaingin. Emigration from other parts of the Philippines to Palawan is high and squatting is commonplace. Concessions for Almaciga resin and rattan gathering exist, which are often not exploited in a sustainable way. The exploitation of birds is a threat in this area, which affects Palawan Peacock-pheasant and parrots.

Ancestral domains have been claimed by Tagbanua and Palawan peoples here, but have not been approved yet. If approved, they could provide some protection to the remaining forests.

Palawan and its associated islands are included in a Biosphere reserve, declared in 1990. An integrated management plan has been prepared for the whole Palawan Biosphere Reserve (ECAN), to zone the island. This IBA includes terrestrial core zone (primitive wilderness area strictly protected) and buffer zone (regulated use allowed) areas.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Reptiles

Palawan Earless Sphenomorphus *Sphenomorphus palawanensis* En

Birds

Ashy-headed Babbler *Malacocincla cinereiceps* R
 Blue Paradise-flycatcher *Terpsiphone cyanescens* R
 Blue-headed Racquet-tail *Prioniturus platenae* T
 Chinese Egret *Egretta eulophotes* T
 Falcated Wren-babbler *Ptilinichla falcate* RT
 Japanese Night-heron *Gorsachius gorsagi* T
 Melodious Babbler *Malacopteron palawanense* R
 Palawan Blue-flycatcher *Cyornis lemprieri* R
 Palawan Flowerpecker *Prionochilus plateni* R
 Palawan Flycatcher *Ficedula platenae* RT
 Palawan Hornbill *Antrauceros marchei* RT
 Palawan Peacock-pheasant *Polyplectron emphanum* RT
 Palawan Scops-owl *Otus fuliginosus* R
 Palawan Striped-babbler *Stachyris hypogramm ica* R
 Palawan Swiftlet *Collocalia palawanensis* R
 Palawan Tit *Parus amabilis* R
 Philippine Cockatoo *Cacatua haematurropygia* T
 Philippine Hawk-eagle *Spizaetus philippensis* T
 Sulphur-bellied Bulbul *Ixos palawanensis* R
 White-vented Shama *Copsychus niger* R
 Yellow-throated Leafbird *Chloropsis palawanensis* R

Mammals

Northern Palawan Tree Squirrel *Sundasciurus juvenis* En
 Palawan Stink Badger *Mydaus marchei* En
 Binturong *Arctictis binturong*
 Oriental Short-clawed Otter *Amblonyx cinereus*
 Palawan Flying Fox *Acerodon leucotis* En
 Palawan Montane Tree Squirrel *Sundasciurus rabori* En
 Palawan Tree Shrew *Tupaia palawensis* En

27. Mt. Mantalingajan
 Area: 169,406 ha

Coordinates: 8°48' N 117°40'E
 Altitude: about 400 - 2,086 masl

Mt. Mantalingajan, which encompasses the towns of Quezon, Brooke's Point and Bataraza, is in southern Palawan, and at 2,086 m is the highest mountain on the island. The Mantalingajan range includes

an estimated 70,000 ha of montane mossy rainforest, with stunted forest on the exposed tops. Lowland rainforest is found in the northwest of the mountains on the coastal plain, around the Ilog-Ilog River. To the southeast of the mountains, the forest has been cleared up to 800 m on the slopes, although some slope forest remains on the top of the flanking coastal ridge from about 400 m upwards. The transition from lowland to montane forest occurs at approximately 1,000 m. The forest becomes progressively stunted with the Mantalingajan peak appearing particularly so, with large areas of slope scoured by landslides, and conifer re-growth occurring.

The southeastern slopes of the mountains have been cleared for kaingin up to 800 m in most places, and the level lowlands on this side of the mountains are almost entirely deforested. The areas logged on Palawan are relatively recent, and the majority of the forest within the closed canopy line is primary. Small-scale timber extraction and well-organized logging operations are hastening the depletion of the forest cover on the island.

In the past, the Mantalingajan range and the adjacent lowlands contained most threatened and restricted-range birds in the Palawan Endemic Bird Area and is probably the stronghold of the Palawan Striped-babbler, which is known only from its montane forests. Little recent information on the status of most of the threatened species in this area, but the extensive lowland forests on the coastal plains to the west of the mountains are likely to be important for several of them, including the Philippine Cockatoo.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Amphibians

Mary's frog *Micrixalus mariae* E

Birds

Ashy-headed Babbler *Malacocincla cinereiceps* R
 Blue Paradise-flycatcher *Terpsiphone cyanescens* R
 Blue-headed Racquet-tail *Prioniturus platenae* RT
 Falcated Wren-babbler *Ptilocichla falcate* RT
 Melodious Babbler *Malacopteron palawanense* R
 Palawan Blue-flycatcher *Cyornis lemprieri* R
 Palawan Flowerpecker *Prionochilus platani* R
 Palawan Flycatcher *Ficedula platenae* RT
 Palawan Hornbill *Antrauceros marchei* RT
 Palawan Peacock-pheasant *Polyplectron emphanum* RT
 Palawan Scops-owl *Otus fuliginosus* R
 Palawan Striped-babbler *Stachyris hypogrammica* R
 Palawan Swiftlet *Collocalia palawanensis* R
 Palawan Tit *Parus amabilis* R
 Philippine Cockatoo *Cacatua haematurapigia* T
 Philippine Duck *Anas luzonica* T
 Sulphur-bellied Bulbul *Ixos palawanensis* R
 White-vented Shama *Copsychus niger* R
 Yellow-throated Leafbird *Chloropsis palawanensis* R

Mammals

Palawan montane tree squirrel *Sundasciurus rabori* EN
 Palawan soft-furred mountain rat *Palawanomys furvus* T, EN

IX. Balabac Group of Islands

28. Balabac Island
 Area: 35,277 ha

Coordinates: 7°57' N 117°01'E
 Altitude: 567 masl (maximum)

Thirty small islands and islets with fringing coral reefs and intertidal sandflats comprised the island municipality of Balabac located on the southern-most part of Palawan. The principal islands are Bugsuk, Pandanan, Matangule, Bancalan and Balabac. Balabac (34,200 ha), the largest of the group of islands south of Palawan, has lowland forests, but little forest cover is reportedly remaining on the island. It

is proclaimed as a Marine Reserve/Tourist Zone in 1978 by Proc. No. 1801, but not officially protected under the NIPAS.

There is insufficient data about the Balabac Group of Islands socio-economic pressures that affect its biodiversity.

Among the important biodiversity found and their status are {Threatened (T), restricted-range (R) and Congregatory (C) birds, Endemic (En)}:

Amphibians

Brown-striped tree frog *Polypedates macrotis* En
 Rough-skinned tree frog *Philautus longicrus* En
 South-East Asian wood frog *Rana sanguinea* En

Reptiles

Estuarine crocodile *Crocodylus porosus* T
 Hawksbill turtle *Eretmochelys imbricata* T

Birds

Ashy-headed Babbler *Malacocincla cinereiceps* R
 Blue-headed Racquet-tail *Prioniturus platenae* RT
 Falcated Wren-babbler *Ptilocichla falcate* RT
 Grey Imperial-pigeon *Ducula pickeringii* RT
 Melodious Babbler *Malacopteron palawanense* R
 Palawan Blue-flycatcher *Cyornis lemprier* R
 Palawan Flowerpecker *Prionochilus plateni* R
 Palawan Hornbill *Antracoceros marchei* RT
 Palawan Scops-owl *Otus fuliginosus* R
 Palawan Tit *Parus amabilis* R
 Philippine Cockatoo *Cacatua haematuropygia* T
 White-vented Shama *Copsychus niger* R
 Yellow-throated Leafbird *Chloropsis palawanensis* R

Mammals

Greater Mouse-deer *Tragulus napu* En
 Palawan Flying Fox *Acerodon leucotis* En
 Palawan Shrew *Crocidura palawanensis* En
 Palawan Tree Shrew *Tupaia palawanensis* En

Many of the threatened and restricted-range species of the Palawan Endemic Bird Area were recorded on Balabac in the past, including the threatened Grey Imperial-pigeon, Philippine Cockatoo, Blue-headed Racquet-tail and Palawan Hornbill. It is unclear whether there is enough natural habitat remaining on the island to support significant populations of any of these birds. Surveys are required to investigate both the extent and quality of the remaining habitats there and the current status of the threatened and restricted-range birds and other biodiversity.

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