PHILIPPINES

INTRODUCTION

by the Haribon Foundation for the Conservation of Natural Resources

Area: 299,404 sq.km.
Population: 48,098,460 (1980) with an annual growth rate of 2.7%. The average population density of the country is 541.4 persons per sq.km.

The Philippine Archipelago comprises approximately 7,100 islands, most of which lie in three major island groups, namely Luzon, Visayas and Mindanao. The Archipelago is somewhat elongate in shape, extending for 1,840 km from north to south, and about 1,000 km from east to west at its broadest. The total coastline is about 17,460 km.

Geographically, the Philippines are considered a part of southeast Asia. The country is located between the Equator and the Tropic of Cancer, between latitudes 04°23' and 21°25'N, and between longitudes 1 16°OO' and 127°OO'E. It is bounded in the north by the Bashi Channel, in the east by the Pacific Ocean, in the south by the Celebes Sea, and in the west by the South China Sea.

The Philippines are situated some 965 km from the southeast coast of the mainland of Asia. To the north, Taiwan is the nearest neighbour, being only 97 km from Y'ami in Batanes Province, the northernmost island in the Philippine Archipelago. In the south, the archipelago extends to within a few kilometers of Sabah (North Borneo) and the northern Indonesian islands.

The Philippines are located in the "Pacific Ring of Fire", a region of frequent volcanic activity. The country also lies on the western Pacific earthquake belt which is a region of frequent land movements. This situation may help to explain the pattern of landform and topographic characteristics of the archipelago which is composed of a series of mountain ranges running in a general north-south direction in close proximity to the sea. There are, however, no very high mountains or very steep slopes, and the highest peak, Mount Apo, is only 2,930 meters above sea level. The archipelago has rather few large rivers but many small rivers and streams which empty directly into the sea. There are some large internal plains between the main mountain ranges, and narrow coastal plains around most of the larger islands.

There are four main climatic zones based on the distribution of rainfall, as follows:

- Type I: pronounced wet and dry seasons, the wet season during the months of June to November, and the dry from December to May.

- Type II: no proper dry season but with a very pronounced period of maximum rainfall in December, January and February.

- Type III: an intermediate type with no pronounced period of maximum rainfall and a short dry season lasting from one to three months only.
- Type IV: rainfall uniformly distributed throughout the year.

Summary of Wetland Situation

The Philippines are endowed with extensive wetland areas. These include such water bodies as lakes, rivers, ponds, inland and coastal marshes and swamps, estuaries and mangrove swamps. The total area of freshwater lakes has been estimated at about 114,000 ha, that of swamps and estuaries about 527,000 ha, and that of brackish ponds about 176,000 ha. In addition, there are some 130,000 ha of man-made reservoirs.

The most extensive wetland types include the following:

1. Mangrove swamps: applied to the type of forest occurring on tidal mudflats along sea coasts. These are found fringing the shores of the islands and extending inland along rivers and streams where the water is brackish. The conditions which are most favourable for their development are found in quiet bays into which flow large, slow-flowing rivers. Mangroves have come under considerable pressure from coastal development, forestry exploitation and particularly conversion to aquaculture ponds. Over 300,000 ha of an original estimated 450,000 ha of mangroves have been cleared legally and illegally over the last 60 years (Alvarez, 1984), and this destruction of mangroves continues. According to the Philippine National Mangrove Committee (1987), the area of mangrove forests decreased from 450,000 ha in 1920 to 146,139 ha in 1978.

2. Fishponds: bodies of water, generally rather small, enclosed by dikes of earth or other materials, and serving as enclosures for fish. In recent years, ponds have also been used for shrimp and prawn culture because of the high demand for these crustaceans in both local and foreign markets.

3. Lakes and reservoirs: mainly freshwater wetlands whose sizes range from about two hectares to tens of thousands of hectares.

4. Rivers, estuaries and deltas.

5. Marshes, including coastal marshes with salt-tolerant vegetation in brackish and/or saline habitats subject to tidal inundation, and inland freshwater marshes which are usually covered with dense vegetation.

6. Swamps: water-logged areas with inadequate drainage and usually dominated by shrub and tree vegetation.

7. Rice paddies: although rice paddies are now generally regarded as agricultural land rather than as wetlands, it is believed that most of the existing paddy areas were previously freshwater swamps and marshes.

The country has a rich water bird fauna; some 115 species of waterfowl have been recorded including 20 species of Ardeidae, 14 species of Anatidae, 17 species of Rallidae and 46 species of shorebirds. Two species, the Philippine Duck *Anas luzonica* and Brown-banded Rail Rallus *mirificus,* and several subspecies are endemic to the islands. The islands lie on a major migration route for east Asian shorebirds, particularly *Numenius madagascariensis, Calidris acuminata* and *C. ruficollis,* and the wetlands constitute important wintering areas for numerous migratory waterfowl.

Wetland Research

It is only in recent years that a coordinated programme of research has been conducted on wetlands. In the past, studies were occasionally carried out on a project basis, but these were rather specific and were not sufficiently comprehensive to cover all wetland areas in the country. Thus, for example, Laguna de Bay, the largest freshwater lake in the Philippines, has been studied intensively, while other lakes perhaps of comparable regional and national significance have scarcely been studied at all. Until recently, censuses of wildlife have been limited and sporadic. However, since the launching of a conservation programme in 1981, conservation activities have been gaining ground, and there has been a great increase in wildlife research on a national basis.

A considerable amount of research has been carried out on the mangrove resources. The Philippine National Mangrove Committee (1987) has recently reviewed the status, distribution and biological and ecological characteristics of the mangrove ecosystem in the Philippines, and has summarized traditional usage of mangroves, commercial exploitation and conversion to other uses. The Committee has discussed the development of a National Mangrove Management Plan, and has identified a total of 78,593 ha (58% of the remaining mangrove forest) for proclamation as conservation and preservation areas. The balance would be allocated for conversion to fishponds or released for other uses.

A major inventory and assessment of Philippine wetlands was initiated in 1986 as a component of the Asian Wetlands Inventory. A preliminary inventory of all wetland resources in the country has been prepared under the coordination of the Haribon Foundation (Haribon Foundation, 1986), and this has provided the basis for a comprehensive National Wetlands Inventory to be built up in the years to come. Surveys and detailed research projects have commenced at many of the nationally and internationally important sites, and a programme of waterfowl censuses has been initiated in the three major island groups.

The Asian Wetland Bureau, in collaboration with the Forest Research Institute and the Haribon Foundation, organized a series of training courses on bird-banding and wetland surveys in the Philippines in 1984-86, and in April and May 1987, conducted a training programme on rapid assessment techniques. The latter involved ground surveys at eight major wetland areas (Howes, 1987). In November 1987, the Asian Wetland Bureau established a Philippine office at the Department of Science and Technology, Region 7, in Banilad. This office will focus on conservation education, training, wetland surveys, wetland and water bird research, and production of guidelines for coastal development.

Wetland Area Legislation

There is no specific and comprehensive wetland legislation in the Philippines. The scanty jurisprudence over protected wetland areas comes under the national parks legislation with the effect that wetland issues are considered within the wider concern for national parks.

Legislation for the protection and conservation of natural areas appears to have commenced with the enactment of Public Act No. 3915 on I February 1932. This was "An Act for the Establishment of National Parks, Declaring such Parks as Game Refuges and for Other Purposes". The Act came into force two years later, on 1 January 1934, and resulted in the creation of 59 National Parks. Because of the lack of clear-cut definitions and the vague criteria

for selection of national parks, only ten of the original areas were able to meet the standards subsequently set out by the International Union for the Conservation of Nature and Natural Resources (IUCN). In 1975, therefore, an inter-agency team of technical personnel from the Development Academy of the Philippines (DAP), the Bureau of Forest Development (BFD), the Forest Research Institute (FORI), the U.S. Peace Corps and the then Department of Natural Resources recommended reclassification of the national park network into recreation areas, wildlife sanctuaries or strict nature reserves.

Apart from the national park network, several other categories of protected area have been established. These include Tourist Zones (including Biosphere Reserves) which are managed by the Philippine Tourism Authority and were set up under six Presidential Proclamations (Nos. 1,520, 1,522, 1,551, 1,653, l,667A and 1,801). Proclamation 1,801, signed in 1978, declared many islands and coastal zones as reserve areas for tourism and also implied some conservation aspects. A number of local government and community groups have begun to manage some of these reserve areas as Municipal Marine Parks. Such parks include the Municipal Marine Parks of Pamilacan and Balicasag in Bohol Province, and the Apo Island Municipal Marine Park in Negros Province. It is rather unfortunate that the first area to be established under Proclamation 1,801, the Sumilon Fish Sanctuary, has since been declared an open fishing ground because of political pressure.

Areas which are devoted to the conservation of game species and other wildlife including birds and fishes were defined and delineated by Presidential Decree No. 1,559 signed in 1978. At present, there are twelve such Game Refuges and Bird Sanctuaries in the country. Various types of enactments and laws have been promulgated to deal with the conservation issues relating to Game Refuges and Bird Sanctuaries. Proclamation 753 stated that all watersheds and lakes within watershed reservations were to be declared as Game Refuges and Bird Sanctuaries. Presidential Decree No. 704 stipulated that all streams, ponds and waters within Game Refuges and Bird Sanctuaries and National Parks were to be declared as fish refuges and sanctuaries.

Other laws and enactments directly linked to wetlands pertain to specific wetland types such as lakes, mangrove areas and marshes. Letter of Instruction No. 917 signed on 22 August 1979 stated that "mangrove forests essentially needed in foreshore marine life, including special forests which are the exclusive habitats of rare and endangered Philippine flora and fauna, are likewise declared wilderness areas".

Other legislation important for wetland conservation includes:

a) Presidential Decree No. 705, the Forestry Reform Code of the Philippines for the Conservation of Mangroves. This gives details of management practices such as the retention of buffer strips of a minimum width of 40 meters around brackish water fishpond developments and strips of a minimum width of 100 meters around sea areas. The Decree requires the owners of mangroves to maintain or replant belts of mangroves 20 meters wide on river banks and creek edges and not to fell in these areas.

b) Letter of Instruction No. 917, series of 1979, and Forestry Administrative Order No. 19. The Letter of Instruction provides that all areas declared as wilderness areas or green belts shall be closed to any form of exploitation; the Forestry Administrative Order officially reserved 30,000 hectares of Liguasan Marsh in North Cotabato Province as a Game Refuge and Bird Sanctuary.

c) Proclamation 2,152, which declares all mangrove swamps as forest reserves.

d) Presidential Decree No. 704 (Fisheries Development Decree of 1975), which deals with marine resources and swampy areas identified by the landscape classification committee of the Bureau of Forest Development and released to the Bureau of Fisheries and Aquatic Resources.

e) The Marine Pollution Decree of 1976 and Presidential Decree No. 979, which deal with a national policy to stop marine dumping.

In 1972, the Government instituted a ban on firearms and a total prohibition of hunting, but these laws have never been enforced, and hunting remains widespread. The hunting pressure on migratory shorebirds is particularly severe, the hunters using nets, traps, snares and light lures to catch tens of thousands of birds each year (Parish & Buckingham, 1985).

Wetland Area Administration

The administration of National Parks, Game Refuges and Bird Sanctuaries in the Philippines has always been centralized but has experienced six reorganizations in the last 55 years:

a) 1932-1950: The management and administration of parks and wildlife was the primary responsibility of the Bureau of Forestry in the Department of Agriculture and Natural Resources (DANR) (as per Act No. 3915 and DANR Administrative Order No. 88).

b) 1951-1955: Administration of parks and wildlife was entrusted to the Commission on Parks and Wildlife, Office of the President (as per Republic Act No. 3915 and DANR Administrative Order No. 88).

c) 1956-1971: Parks and wildlife were entrusted to the Parks and Wildlife Office, Department of Agriculture and Natural Resources, pursuant to Executive Order No. 216.

d) 1972-1982: Parks and wildlife were entrusted to the Bureau of Forest Development, Ministry of Natural Resources, (as per Presidential Decree No. 1, Letter of Implementation No. 9, and Presidential Decree Nos. 389, 705, 1,559 and 1,587).

e) 1982-1987: The development and management of all national parks in the provinces of Leyte, Negros Occidental and Palawan were entrusted to the Natural Conservation Office under the direct supervision of the Minister of Natural Resources (MNR Administrative Order No. 47).

f) 1987: Conservation programs and projects were entrusted to the Natural Resource Conservation and Environmental Protection Authority under the new Department of Environment and Natural Resources (DENR). The Forest Management Bureau is concerned with forest development and conservation, and assists the DENR in the formulation of policies for the development and management of protected areas.

Organizations involved with Wetlands

a) Governmental Organizations
- Department of Environment and Natural Resources, Ministry of Natural Resources Particularly the Protected Areas and Wildlife Bureau.
- Bureau of Forest Management, Ministry of Natural Resources

Concerned with forest development and conservation.

- Natural Resources Management Center, Ministry of Natural Resources

Particularly the National Mangrove Committee, the Remote Sensing Division and the Marine Parks Development Program. The NRMC houses the Headquarters of the Regional Mangrove Information Center, publishes the bulletin "Bakawan", and maintains the Regional Mangrove Information Network.

- Forest Research Institute (FORI), Ministry of Natural Resources Particularly the Outdoor Recreation and Wildlife Research Division. National Environmental Protection Council, Ministry of Human Settlement

-Forest Products Research and Development Institute, Ministry of Science The Department conducts some research on mangroves. Bureau of Fisheries and Aquatic Resources, Ministry of Agriculture and Food

The Bureau is responsible for fisheries development, improvement and management, and carries out studies of the fisheries resources at wetlands throughout the Philippines.

- Bicol River Basin Development Program

There are over ten similar River Basin Authorities in the Philippines.

- Bohol Integrated Area Development Project
- Cagayan Integrated Area Development Project
- Central Visayas Regional Projects
- Laguna Lake Development Authority

The specific authority for Laguna de Bay.

- Mindoro Integrated Rural Development Project
- Palawan Integrated Area Development Project
- Samar Integrated Rural Development Project
- Task Force Pawikan, Ministry of Natural Resources
- Zamboanga del Sur Development Project/PADAP

b) Non-governmental Organizations

- The Haribon Foundation for the Conservation of Natural Resources
- Wildlife Foundation of the Philippines
- Philippine Wildlife Conservation Foundation
- Ecological Society of the Philippines
- ICBP National Section
- International Center for Living Aquatic Resources Management (ICLARM) Particularly the ASEAN Integrated Coastal Resources Management Project.
- Asian Wetland Bureau - Philippines

c) Universities

- University of the Philippines

University bodies involved with wetlands include the Marine Science Institute and U.P. Science Research Foundation in the College of Arts and Sciences, Diliman Campus; the National Water Resources Council in the College of Engineering, Diliman Campus; and the College of Forestry and Program for Environmental Science and Management at Los Banos Campus.

- Mindanao State University

Particularly the College of Fisheries, Department of Biology and Natural Science Museum.

- Silliman University Research Centre, Silliman University

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WETLANDS

Site descriptions taken from a report prepared for this Directory by the Haribon Foundation for the Conservation of Natural Resources (Haribon Foundation, 1986), an inventory of the wetlands of Visayas and Mindanao compiled for the Directory by Perla M. Magsalay of the Asian Wetland Bureau (Philippines Office), and wetland data sheets provided by Simplicia N. Alonzo-Pasicolan of the Forest Research Institute, John R. Howes of the Asian Wetland Bureau and Robert S. Kennedy. Additional information has been taken from Project Aqua (Luther & Rzoska, 1971) and a report on the conservation of wetlands in the Philippines prepared by Jesus B. Alvarez Jr and Edgar G. Buensuceso for the 10th Asian Continental Section Conference of ICBP.

Wetland name: Palaui Island
Country: Philippines
Coordinates: l8°33'N, l22°08'E;
Location: in Santa Ana Municipality, off the extreme northeastern tip of Luzon.
Area: Several 100 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 03 & 06.
Description of site: 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 by up to 4.5 km wide, and has a maximum elevation of 307m.
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).
Principal vegetation: No information.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: No information.
Disturbances and threats: No information.
Economic and social values: No information.
Fauna: 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 Luzon Strait from Taiwan.
Special floral values: No information.
Research and facilities: Preliminary shorebird surveys have been conducted by Alonzo-Pasicolan (1987).
References: Alonzo-Pasicolan (1987).
Criteria for inclusion: lb. 2c, 3b.
Source: Haribon Foundation.

Wetland name: Buguey Wetlands

Country: Philippines
Coordinates: 18°17'N, 12l°50'E;
Location: on the north coast of Luzon, in the municipality of Buguey, Cagayan Province.
Area: c.14,400 ha (approximately 80% of Buguey Municipality consists of wetlands).
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 06, 07, 08, 10 & 19.
Description of site: A complex of coastal lagoons, freshwater marshes, brackish and saline marshes, mangrove swamps and intertidal mudflats, with some fishponds and shrimp ponds and a very large area of rice paddies; on the south shore of the Babuyan Channel, east of the mouth of the Cagayan River.
Climatic conditions: Humid tropical climate with an average annual rainfall of about 2,200 mm more or less evenly distributed throughout the year (Type IV).
Principal vegetation: The aquatic vegetation includes *Nypa fruticans,* mangrove species and *Ipomoea reptans.* Plant communities in adjacent areas include *Pandanus sp* and plantations of coconuts.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Aquaculture and rice cultivation in parts of the wetland, and illegal hunting throughout.
Disturbances and threats: The destruction of mangroves for the creation of shrimp and fishponds has greatly reduced the extent of the mangroves, 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 there have been incidents of birds dying from poisoning.
Economic and social values: The wetland is an important area for rice and fisheries production.
Fauna: An important staging and wintering area for migratory waterfowl, notably ducks and shorebirds. Some 3,000-5,000 ducks have been recorded in November, mostly *Dendrocygna* sp and *Anas luzonica.* Up to 3,000 other waterfowl have been observed, the commoner species including *Ixobrychus sinensis, I. eurhythmus, I. cinnamomeus, Bubulcus ibis, Egretta garzetta, E. intermedia, E. alba, Gallicrex cinerea* and *Sterna albifrons.* Over 940 shorebirds were recorded in April-May 1986 including:
32 *Rostratula benghalensis*
138 *Pluvialis dominica*
276 *Charadrius dubius*
65 C. *mongolus*
112 *Numenius phaeopus*
70 *Xenus cinereus*
57 *Heteroscelus brevipes*
10 *Limnodromus semipalmatus*
Special floral values: No information.
Research and facilities: Some waterfowl censuses have been carried out by Alonzo-Pasicolan.
References: Alonzo-Pasicolan (1987); National Water Resources Council (undated).
Criteria for inclusion: 1b, 3b.
Source: Haribon Foundation.

Wetland name: Pangasinan Wetlands
Country: Philippines
Coordinates: 16°02'N, 120°05'-120°20'E;
Location: on the coastal plain between Dagupan City and Binmaley Municipality, Pangasinan Province, central Luzon.
Area: c.3,000 ha.
Altitude: 0-5m.
Biogeographical province: 4.26.12.
Wetland type: 06, 10 & 19.
Description of site: A large area of fishponds and rice paddies with adjacent intertidal mudflats extending for about 25 km along the south shore of Lingayen Gulf, west of Dagupan City. Over ten rivers and creeks, all branches of the Agno River, run through the wetland and drain into the Gulf. 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.
Climatic conditions: Humid tropical climate characterized by two pronounced seasons; a dry season from November to April, and a wet season from May to October (Type I). The mean annual temperature is 27.5°C and the mean annual humidity 78.5%.
Principal vegetation: A few remnants of mangroves; cultivated areas with rice, sugar cane, corn and other crops.
Land tenure: The fishponds and rice paddies are privately owned.
Conservation measures taken: In 1987, the Bureau of Forest Development in Dagupan launched a Mangrove Revegetation Project to replant areas denuded of mangroves.
Conservation measures proposed: None
Land use: Aquaculture, agriculture (mainly rice-growing) and residential.
Disturbances and threats: Destruction of mangroves for the construction of fishponds has proceeded to the point at which almost no mangrove is left.
Economic and social values: The wetland supports an important fishery. The main species raised in the fishponds and other water impoundments include mullet *Mugil* sp, common carp *Cyprinus carpio, Soraderondon* sp, milkfish *Chanos chanos* and mudfish *Ophicephalus striatus.* The low-lying alluvial plain extending south from Lingayen Gulf is a major rice-growing area.
Fauna: An important staging and wintering area for migratory shorebirds. Alonzo-Pasicolan (1987) recorded a total of 687 shorebirds of 20 species in late November 1986.
Special floral values: No information.
Research and facilities: None
References: Alonzo-Pasicolan (1987).
Criteria for inclusion: le, 3b.
Source: Haribon Foundation.

Wetland name: Candaba Swamp
Country: Philippines
Coordinates: 15°05'N, 120°53'E;

Location: near the towns of Candaba, San Miguel and San Ildefonso, 50 km NNW of Metro Manila, Pampanga and Bulacan Provinces, central Luzon.
Area: 32,000 ha.
Altitude: 11 m.
Biogeographical province: 4.26.12.
Wetland type: 11, 15, 17, 18, 19 & 20.
Description of site: 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. The entire area is usually flooded in the wet season, but most of it dries out during the dry season (late November to April) and is converted into rice fields and plantations of watermelons. 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 km north of Baliuag. The impoundment is used as a fishpond during the rainy season, and then drained in January or February to be used for agriculture. Candaba Swamp 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. The natural retention capacity is estimated at approximately 1.5 billion cubic meters. The average depth of water is 1-2m, and the maximum about 5m.
Climatic conditions: Tropical climate with a pronounced dry season from November to May and a pronounced wet season from June to October (Type I).
Principal vegetation: No information is available on the aquatic vegetation; most of the flood plain is under cultivation for rice and other crops, and there are some patches of *Nypa fruticans* and mangroves in surrounding areas.
Land tenure: 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.
Conservation measures taken: None.
Conservation measures proposed: A proposal has been made by the local government of Pampanga to delineate some 500 ha of the swamp as a waterfowl sanctuary. The Haribon Foundation has proposed the establishment of a multiple use sanctuary which would protect migratory waterfowl populations, provide an educational and recreational facility for the general public, and act as a water storage reservoir for the local fisheries and for emergency irrigation of surrounding farmland.
Land use: Aquaculture (fishponds) and agriculture (mainly rice and water melons); fishponds and cultivation of rice and sugar cane in surrounding areas. The swamp was a traditional waterfowl hunting area in the past, and some hunting of ducks and rails, although now illegal, still occurs.
Possible changes in Land use: The swamp may be converted into a retention basin for routing peak discharges.
Disturbances and threats: Some siltation is occurring, but this is unlikely to be very serious in the short term unless drastic erosion takes place in the Sierra Madre Range. However, some portions of the marsh have been converted into fishponds while other areas have been drained for agricultural purposes. Large areas are planted with water melons during the dry season, and there is a possibility that water levels may be controlled so that crops can be grown all year round. There is some illegal hunting of birds for recreational purposes.
Economic and social values: The swamp is important for agricultural and fisheries production (mainly *Chanos chanos),* for flood control, and as a source of water for irrigation. It is a

favourite spot for local and visiting bird-watchers and naturalists, and has great potential for nature-oriented outdoor recreation and conservation education as there are few other places so close to the metropolitan area of Manila that support so much wildlife.
Fauna: An extremely important staging and wintering area for ducks, especially in October and November when the swamp regularly supports 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 is known to support such large concentrations of Anatidae. The two most abundant species are *Anas luzonica* and *A. querquedula; A. acuta* is common, and *Dendrocygna arcuata, Anas penelope, A. clypeata, Aythya ferina* and *A. fuligula* occur in significant numbers. *Anas strepera* and *Aythya baeri* were recorded in 1978 and 1979 respectively, the first observations of these species in the Philippines. The area is also very important for wintering egrets; about 3,000-5,000 *Egretta alba* were observed in January 1987. The reed-beds at Candaba and in the surrounding areas are one of the few known wintering areas of the Speckled Reed Warbler *Acrocephalus sorghophilus,* a very local species which breeds in northeastern China. The marshes support breeding populations of several Rallidae, notably *Rallus torquatus* and *Porphyrio porphyrio,* and some ducks may breed. In all, about 60 species of birds use the marsh for feeding and roosting.
Special floral values: No information.
Research and facilities: Preliminary faunal and floral surveys have been carried out.
References: Alonzo-Pasicolan (1987); Alvarez (1984); Glass *et al.* (1979); Karpowicz (1985); Kennedy & Dickinson (1980); Tahal Consulting Engineers (1978).
Criteria for inclusion: lb. le, 2a, 2b, 3a.
Source: Haribon Foundation and Robert S. Kennedy.

Wetland name: Manila Bay
Country: Philippines
Coordinates: l4°25'-14°55'N, 120°32'-121°00'E;
Location: intertidal areas from the Municipality of Balanga round the north end of Manila Bay to Cavite City, south of Metro Manila, Luzon.
Area: c.130,000 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 01, 02, 06, 07, 09 & 10.
Description of site: A large enclosed sea bay fringed by shallow intertidal mudflats and sand flats. The Bay is influenced to the north by the delta of the Pampanga and Meycauayan Rivers. Mangrove is limited and most has been converted to large areas of aquaculture ponds and salt pans. The Bay is saline with fresh water input from numerous rivers, notably the Panipanga River System as well as the Meycauayan and Pasig rivers. There is heavy surface runoff from Mount Bakaan and Mount Natib to the west. Salinities range from about 30 p.p.t. in the Bay to almost fresh in the estuaries, depending on rainfall and river discharge. The tidal variation is about 1.25m.
Climatic conditions: Tropical climate with a pronounced dry season from November to April, and a pronounced wet season for the remainder of the year (Type I). The area is protected from the northwest monsoon, but open to the southwest monsoon and cyclonic storms.
Principal vegetation: Relicts of mangrove swamp, particularly in the Bataan area; the dominant species are *Rhizophora apiculata, R. mucronata, Avicennia marina, Nypa fruticans*

and Sonneratia alba. There are also small areas of *Schyphiflora hydrophyllacea, S. acida, Acanthus illicifolius* and *Excoecaria agallocha.* Plant communities in adjacent areas include plantations of *Cocos nucifera* and denuded hill vegetation.

Land tenure: A mixture of state and private ownership.

Conservation measures taken: No protected areas have been established. The National Pollution Control Council and Haribon Foundation have launched an anti-pollution campaign.

Conservation measures proposed: There may be proposals in existence from Government agencies with regard to pollution, fisheries and aquaculture. Howes (1987) proposes management guidelines for replanting of mangrove species in aquaculture areas, and regular monitoring of shorebird concentrations and the benthic biomass of the intertidal flats.

Land use: The city and port of Metro Manila, a major centre for international trade and commerce, is situated on the east side of the Bay. Fishing is very important; 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. The milkfish *Chanos chanos* is the principal species involved. There is a salt pan industry at Cavite in the southeast, and several areas of shanty town development on the shores of the Bay. Surrounding areas are both urban (Metro Manila) and rural *(Cocos nucifera* plantations and other agricultural activities).

Possible changes in Land use: There is a high likelihood that there will be an increase in aquaculture projects at the expense of the remaining mangrove resources. In 1978 in the Philippines as a whole, there were additional applications for the destruction of about 21% of the remaining mangrove areas for aquaculture projects.

Disturbances and threats: The many threats to the wetland 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, pollution from heavy industry in the Metro Manila area, and the shooting of shorebirds at fishponds. There is continued denudation of the natural vegetation in the water catchment area.

Economic and social values: The site is very important for its fisheries production which supports a large urban population along the periphery of the Bay. It is an ideal area for research on fisheries, wildlife, biomass and marine pollution because of its close proximity to major research agencies.

Fauna: The intertidal mudflats, fishponds and saltpans are used by large numbers of migratory shorebirds in winter and during the migration seasons. Monthly counts by S. Gast at a high tide roost on a sandy reclamation area in Metro Manila during the period 1979-1982 revealed a maximum of about 32,000 shorebirds in January 1980. The commonest species were:

Pluvialis dorninica (8,000)
Charadrius dubius (2,000)
C. alexandrinus (15,000)
C. mongolus (5,000)
Calidris ruficollis (2,000)

In early April 1987, JR. Howes recorded about 8,000 shorebirds of 20 species at sevens sites, mainly drained fishponds and areas of intertidal mudflat. These included:

2,567 *Calidris ruficollis*
1,278 *C. ferruginea*
1,259 *Pluvialis dominica*
1,374 *Tringa stagnatilis*

Other waterfowl occurring commonly in the Bay include *Nycticorax caledonicus, Bubulcus ibis, Egretta garzetta, E. alba, Ardea purpurea, A. cinerea, Sterna hirundo, Chlidonias hybrida* (up to 2,000), *C. leucoptera* (up to 1,000) and *Gelochelidon nilotica* (up to 2,000).
Dolphins have been recorded in the bay.
Special floral values: The small pockets of mangrove swamp remaining in Pampanga Bay are of considerable value for research and conservation education.
Research and facilities: A considerable amount of research has been carried out by the National Pollution Control Commission in its Manila Bay Monitoring Project (Phase I). Some studies have been carried out by the Bureau of Fisheries and Aquatic Resources, and shorebird studies have been conducted by the Forest Research Institute and Asian Wetland Bureau. The Forest Research Institute and University of the Philippines at Los Banos are planning to carry out a productivity study of the benthic biomass.
References: Alas & Tomgson (1987); Alonzo-Pasicolan (1987); Howes (1987); National Water Resources Council (l983a).
Criteria for inclusion: lb, le, 2c, 3a.
Source: Simplicia Alonzo-Pasicolan, Haribon Foundation and John R. Howes.

Wetland name: Laguna de Bay
Country: Philippines
Coordinates: 14°ll'-14°32'N, l21°03'-121°29'E;
Location: 10 km southeast of Metro Manila, bounded in the north by Rizal Province and in the south by Laguna Province, Luzon.
Area: 91,136 ha. The area of the watershed excluding the lake is 382,000 ha.
Altitude: 2m.
Biogeographical province: 4.26.12.
Wetland type: 11 & 14.
Description of site: The largest lake in the Philippines, with a shoreline of about 220 km and a total volume of 3.2 billion cubic meters. A shallow freshwater lake, formerly an extension of Manila Bay which was cut off at its northern end by slight arching that took place along the eastern shore of the Bay. The lake is naturally eutrophic and highly productive. Increasing enrichment in terms of plant nutrients such as nitrogen and phosphorus has been caused by human activities in the watershed. The lake is surrounded by low-lying alluvial plains which are often inundated during heavy rainfall. The lake drains through a single outlet, the Napindan Channel, which joins the Marikina River seven km downstream to form the Pasig River. The latter flows into Manila Bay. The mean depth of the lake is 2.5-3.Om and the maximum 6.5m. The pH varies from 7.6 during the cool months to 10 at the peak of algal bloom in mid summer; the average is about 8.5. The water is relatively turbid, and has an average dissolved oxygen of 10.5 p.p.m. Wind action can cause severe turbidity due to suspension of bottom sediments, particularly during typhoons. At the end of the dry season, the level of the lake often falls below that of Manila Bay, allowing sea water to flow into the lake at high tide. However, a hydraulic control structure has recently been constructed on the Napindan Channel and this backflow no longer occurs. The lake reaches its maximum level between September and November, and then falls by an average of 1.7m to its lowest level in May or June. The lake is fed by 21 small rivers and streams, and the total inflow from the watershed is capable of flushing the entire lake once a year.

Climatic conditions: Most of the lake has a tropical climate with a pronounced dry season from November to April and a pronounced rainy season for the remainder of the year (Type I), but in the extreme east, the rainfall is more evenly distributed throughout the year (Type IV). The average annual rainfall varies from about 1,600 mm in the west to 3,200 mm in the mountainous northeastern part of the watershed. The mean annual temperature is 27°C; mean monthly temperatures range from 25°C to 29.5°C, and the extremes are 16°C and 40°C. The mean annual relative humidity 76%.

Principal vegetation: Large areas of *Eichhornia crassipes* in the lake and along quiet stretches of its tributaries. At its most prolific, the *Eichhornia* can cover as much as 5% of the lake's surface. There is some emergent marsh vegetation on the southeastern shore of the lake and in the Siniloan area, dominated by species of *Phragmites* and *Typha.* Other aquatic plants include *Nymphaea* sp*, Hydrilla verticillata, fpomoea reptans* and filamentous algae. The dominant natural vegetation is surrounding areas is *Imperata cylindrica* and *Saccharum spontaneoum,* but most of the land is cultivated for crops such as rice, corn, sugar cane, root vegetables, cacao, coffee and coconuts.

Land tenure: The lake is state owned (public water); surrounding areas are privately owned.

Conservation measures taken: No protected areas have been established. The Haribon Foundation has launched a "Save the Lake Movement", and a considerable amount of mass media coverage has been given to the problems facing the lake. As a result of pressure from the Haribon Foundation, the Rizal Cement Factory, which previously dumped its effluent into the lake at Binangonan, has been closed.

Conservation measures proposed: Various proposal have been made in the past for environmental improvement and the creation of fish sanctuaries to prevent further depletion of the fish stocks. In the early 1980s, the Laguna Lake Development Authority produced a Lake Fishery Zoning and Management Plan, the basic aim of which was to reduce the area of fish pens to 21,000 ha, but it seems that this plan was never implemented. Davies *et al*. (1986) have recently summarized the problems facing the lake ecosystem and have made a number of recommendations on fish pens, the use of the lake for irrigation and human water supply, and future research.

Land use: Open-water fishing has been carried out in the lake for a considerable time. In the 1960s, the commercial fishery consisted of finfish, shrimps, clams and snails. In 1961-1964, the yearly catch of fish averaged 80,000-82,000 metric tonnes and that of shrimps and molluscs about 240,000 metric tonnes. However, with the introduction of motor boats and widespread use of nets with very small mesh, fish stocks were seriously depleted, and by 1968 the annual harvest of fish had fallen to 39,000 metric tonnes. Most of the fish caught were of low market value and were used for animal feed. In 1970, the Laguna Lake Development Authority pioneered a new type of fish culture using fish pens to rear milkfish *(Chanos chanos)* and other species for human consumption. This proved to be very successful and there was a rapid proliferation of fish pens throughout the lake. By 1983, 31,000 ha of the lake were covered by fish pens, and by 1987, about 70% of the lake surface had been enclosed. Other uses include the raising of ducks and poultry, transportation, and irrigation. Land use in the watershed is varied; the northwestern portion is highly urbanized and industrialized, while the southern portion is mostly agricultural with rice production, livestock, poultry and duck-raising as the main activities. In the entire Laguna Lake basin, there are 43,800 ha of rice paddies, 11,900 ha of varied crops, 69,900 ha of fruit trees, 211,100 ha of forest, 141,900 ha of grassland and scrub, 4,000 ha of wetlands and 25,200 ha of developed land.

Possible changes in Land use: Fishpond operations are being encouraged in the surrounding areas to increase the supply of fish products for Metro Manila. As the demand for drinking water for Manila begins to exceed river sources, some thought is being given t the development of the lake for human water supply. This would require a programme of strict pollution control to improve water quality, which would in turn improve productivity and ensure the long-term sustainability of the lake system.

Disturbances and threats: The rapid proliferation of fish pens and intensive aquaculture have produced a number of serious problems including slower rates of fish growth and lower yields. The yield of fish from the fish pens was halved between 1973 and 1982, and the open water fishery showed a 46% decline in yield in the same period. Because of the poorer fish harvests, the fish pen operators have resorted to supplementary feeding and this has had a detrimental effect on water quality. Furthermore, the pens have rendered access to open water fishing areas difficult, and have reduced water circulation, which has favoured the spread of water hyacinth. The rapid development of the lake region has resulted in high levels of pollution from human, industrial and agricultural sources. The dumping of waste from plastic and textile factories and poultry farms has been especially harmful. The most serious pollutants are the heavy metals, lead, mercury and cadmium, and certain pesticides widely used on neighbouring agricultural land. Other threats to the lake system include the control of water levels for agricultural, domestic and industrial purposes, and extensive reclamation works on the foreshore for development of industrial estates, residential estates and recreation facilities. Deforestation in the water catchment area has resulted in severe soil erosion and increased siltation in the lake. The closure of Napindan Channel with a hydraulic control structure has prevented the inflow of sea water from Manila Bay, and this has resulted in increased turbidity of the lake waters and a subsequent increase in algal blooms.

Economic and social values: Laguna de Bay is of outstanding importance for its fisheries production, and could provide a very substantial source of fresh water for Metro Manila. However, unless effective measures are taken in the near future to curb over-exploitation and reduce levels of pollution, there is a real danger that these valuable natural resources will be destroyed.

Fauna: The lake is known to support at least 23 native species of fishes belonging to 16 families, and many more species have been introduced. Commercially important fishes include white goby, mudfish, ayungin, milkfish, catfish, kanduli, the tilapias, common carp and plasalit *(Glossogobius giurus, Ophicephalus striatus, Therapon plumbeus, Chanos chanos, Clarias* sp*, Anus manilensis, Ti/apia mossambica, T. nilotica, Cyprinus carpio* and *Tnichogaster* sp*).* The freshwater prawn *Macrobrachium* sp is also harvested commercially. A wide variety of waterfowl occur, the commoner species including *Ixobrychus sinensis, I. cinnamomeus, Ardea cinerea, Rallus mirificus* (a species endemic to the Philippines), *Porphyrio porphyrio, Fulica atra, Hirnantopus hirnantopus* and *Sterna albifrons.*

Special floral values: None known.

Research and facilities: A considerable amount of 1imno1ogicl and fisheries research has been carried out, and a continuous research programme has been developed to study the lake waters and their resources, isolate major problems and seek their solutions. Numerous studies have been conducted by the Laguna Lake Development Authority, Bureau of Forest Development, Forest Research Institute, University of the Philippines (Diliman and Los Banos), PCARRD, IRRI, National Museum and SEAFDEC. The lake exhibits an accelerated geological ageing which is of outstanding ecological interest.

References: Alonzo-Pasicolan (1987); Bureau of Fisheries and Aquatic Resources (1984-85); Davies *et al.* (1986); Laguna Lake Development Authority (1978); Lonsigan (1985); Luther & Rzoska (1971); National Water Resources Council (l983b).
Criteria for inclusion: le, 2d, 3b.
Source: Simplicia N. Alonzo-Pasicolan and Haribon Foundation.

Wetland name: Taal Lake
Country: Philippines
Coordinates: 14°OO'N, 121°19'E;
Location: 60 km south of Metro Manila, central Batangas Province, Luzon.
Area: 23,424 ha.
Altitude: 2.5m.
Biogeographical province: 4.26.12.
Wetland type: 14.
Description of site: A large caldera lake with an island of 4,537 ha in extent (Volcano Island) rising to 310m. The lake is fresh and oligotrophic; the maximum depth is 200m, the bottom is clay loam to sandy, and the pH values range from 7.0 to 8.5. The lake is fed by a number of streams rising on the Tagaytay Ridge adjacent to the lake, and in the Naligang, Cayluya and Palay-palay mountains to the west; it drains southwest into Pansipit River which flows into the nearby Balayan Bay at Lemery.
Climatic conditions: Tropical climate with a pronounced dry season from November to April and a pronounced wet season for the rest of the year (Type I). In the southeastern part of the watershed, the seasons are less pronounced (Type III). The mean annual temperature is 2TC, mean monthly temperatures ranging from 26° to 29°C. April and May are the warmest months with a mean maximum temperature of 35°C, and December and January are the coldest with a mean minimum of 22°C. The mean annual relative humidity is 78%, the monthly means ranging from a minimum of 60% to a maximum of 92%.
Principal vegetation: The dominant aquatic plants are *Vallisneria sp, Eichhornia crassipes,* filamentous algae, *Hydrilla verticillata* and *Ipomoea reptans.* The natural vegetation in surrounding areas is mainly composed of grasses and shrubs dominated by *Imperata cylindrica* and *Saccharum spontaneum.*
Land tenure: State owned (public water).
Conservation measures taken: In 1967, Volcano Island was made into a National Park, the Taal Volcano Island National Park (4,537 ha), but the lake itself is unprotected.
Conservation measures proposed: None
Land use: Fishing and outdoor recreation. Grazing of domestic livestock, cultivation of rice and other crops, and fruit farming in surrounding areas. There are several towns and villages around the lake.
Disturbances and threats: The most serious threats to the lake are urban encroachment and the continuing deterioration of soil quality as a result of erosion. The lake basin has experienced various degrees of erosion with approximately 32% of the land area classified as strongly susceptible to erosion. A variety of exotic fish species have been introduced into the lake, and recent volcanic activity has affected the limnological characteristics of the lake.
Economic and social values: Taal Lake is a very popular vacation spot; it is set amidst beautiful surroundings and includes the crater of one of the lowest volcanoes in the world. The lake

supports a major fishery for species such as milkfish *Chanos chanos,* common carp *Cyprinus carpio,* tilapia *Tilapia* spp, goby *Glossogobius giurus,* mudfish *Ophicephalus striatus* and ayungin *Therapon plumbeus*.
Fauna: The lake has a rich crustacean, molluscan and fish fauna with many endemic species such as the Tawilis *Harrengula tawilis.*
Special floral values: No information.
Research and facilities: There is a PHIVOLCS station on Volcano Island, and a field station of the Bureau of Fisheries and Aquatic Resources near the Pansipit River. A considerable amount of research has been conducted on the limnology of the lake and its invertebrate and fish fauna.
References: Luther & Rzoska (1971); National Water Resources Council (1983c).
Criteria for inclusion: 1b, 2d.
Source: Haribon Foundation.

Wetland name: Balayan Bay and Calatagan Peninsula
Country: Philippines
Coordinates: 13°49'-l3°5O'N, 120°37'-120°38'E;
Location: 80 km SSW of Metro Manila, Batangas Province, Luzon.
Area: 75,000 ha.
Altitude: 3-5m.
Biogeographical province: 4.26.12.
Wetland type: 01, 04, 05, 06, 07, 08 & 10.
Description of site: 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 outwards 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 13 km long and 900 meters wide. The outer edge of the reef is characterized by an intensive coral growth, which 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.
Climatic conditions: Tropical monsoon climate with a pronounced dry season from November to April and a pronounced wet season for the rest of the year (Type I).
Principal vegetation: Mangrove forest dominated by *Avicennia marina, Rhizophora mucronata* and *Sonneratia* sp, and beds of seagrasses and algae. Grassland, coconut plantations, rice paddies and corn fields in adjacent areas.
Land tenure: The Bay is state owned; the Calatagan coastal wetlands are privately owned.
Conservation measures taken: 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 amongst other local residents.
Conservation measures proposed: The Forest Research Institute is developing a programme of intensive conservation education in the area, with local officials of Batangas Province participating in its implementation (1987-1990).

Land use: Fishing for shrimps and finfish, aquaculture (fish and shrimp ponds), and commercial farming of seaweed *Eucheuma* sp. Cattle raising and the cultivation of rice, corn and coconuts in adjacent areas.
Disturbances and threats: The clearing of mangroves to make room for aquaculture ponds and the cutting of mangroves for firewood continue. A geothermal plant has been constructed in the Municipality of Balayan, and its waste is dumped into Balayan Bay.
Economic and social values: The Bay supports a very important fishery. Local communities are dependent to a large extent on the coastal resources for their livelihood, and approximately 30% of the population are fishermen and shrimp gatherers.
Fauna: Fish species include *Chanos chanos.* The intertidal mudflats are used by more than 10,000 shorebirds during their northward and southward migrations. About 5,200 shorebirds were observed in late October 1986, including:
370 *Pluvialis dominica*
770 *Charadrius dubius*
300 *C. alexandrinus*
460 *C. mongolus*
400 *Numenius arquata*
490 *Tringa totanus*
100 *Xenus cinereus*
230 *Actitis hypoleucos*
120 *Heteroscelus brevipes*
950 *Calidris ruticollis*
Five Asiatic Dowitchers *Limnodromus semipalmatus* were recorded during this survey.
Special floral values: No information.
Research and facilities: The area was used as a major bird-banding site by the MAPS Program in 1972, and in recent years, the Forest Research Institute and Asian Wetland Bureau have carried out studies on the migratory shorebirds.
References: Alonzo-Pasicolan (1987); Karpowicz (1985); Parish (1987).
Criteria for inclusion: 1b, le, 2c, 3b.
Source: Simplicia N. Alonzo-Pasicolan and Haribon Foundation.

Wetland name: Tayabas Bay including Pagbilao Bay
Country: Philippines
Coordinates: 13°53'N, 121'37'E to l3°32'N, l22°l0'E
Location: (Pagbilao Bay 13°55'N, 121°43'E); 100 km southeast of Metro Manila, east from Lucena City to the region of General Luna, Quezon Province, Luzon.
Area: c.50,000 ha; c.l00 km of coastline.
Altitude: 0-lOm.
Biogeographical province: 4.26.12.
Wetland type: 01, 02, 03, 06, 07, 10 & 19.
Description of site: A large sweeping sea bay,stretching from Pagbilao Bay in the northwest to the Bondoc Peninsula in the southeast; with extensive intertidal mudflats, sand flats, associated pockets of mangroves and offshore coral reefs. Much of the mangrove has been converted to fish culture ponds, and the area of fishponds continues to expand. The 700 ha patch of mangroves in the delta of the Palsabangon River and its distributaries in Pagbilao Bay is protected from strong

wave action by the islands of Pagbilao Grande, Dampalita and Patayan. The rivers entering Pagbilao Bay rise in the Sierra Madre Range to the northeast and constitute the major input of freshwater to the Bay. Salinities vary according to seasonal fluctuations in river discharge in estuarine areas. The pH values range from 7 to 8. The tide is predominantly of the semi-diurnal type with a mean tidal range of 0.91m and a diurnal range of 1.46m.

Climatic conditions: Humid tropical climate, intermediate between Type II and Type IV. There is no pronounced period of maximum rainfall, and the relatively short dry periods last for up to about three months. The rainy season starts in June and reaches its peak in October. The average annual rainfall is 3,147 mm, and the mean annual temperature 27.2°C. The hottest month is May, with a mean temperature of 28.9°C, and the coldest January, with a mean temperature of 25.4'C. The mean monthly relative humidity ranges from a low of 78% in April and May to a high of 84% in December and January. The area is unprotected from the northeast monsoon, trade winds or cyclonic storms.

Principal vegetation: Mangrove forest with true mangrove species and mangrove associates representing 23 families, notably Rhizophoraceae (eight species), Avicenniaceae (three species), Sonneratiaceae, Combretaceae, Aegiceritaceae, Meliaceae, Euphorbiaceae and Rubiaceae. The dominant species are *Rhizophora apiculata, R. mucronata, Ceriops tagal, C. decandra, Avicennia officinalis, A. marina, Excoecaria agallocha* and *Bruguiera cylindrica.* Plant communities in adjacent areas include dipterocarp forest on ridges, and plantations of *Cocos nucifera* and rice paddies on the coastal plain.

Land tenure: A mixture of state and private ownership; the fishponds are leased from the Government, and the rice paddies are privately owned.

Conservation measures taken: The Agroforestry and Mangrove Forest Research Center at Talipan in Pagbilao Bay includes 114 ha of good quality mangrove forest protected as a faunal sanctuary. The Center was established in 1975 by the Forestry Research Institute. A mangrove rehabilitation project has been established by the Forest Research Institute on the Bondoc Peninsula.

Conservation measures proposed: Recent proposals by Howes and Alonzo-Pasicolan call for (a) the development of management guidelines for reafforestation with mangrove species in aquaculture areas, (b) a shorebird monitoring programme and biomass study, and (c) stricter control over poaching and illegal wood-cutting in the Mangrove Forest Research Center.

Land use: Fishing is very important and supports many coastal towns and villages, particularly on the Bondoc Peninsula. A considerable proportion of the mangrove forest has been cleared for the construction of fishponds, and about 1,000 people are now involved in aquaculture in the region. Mangrove clearance is particularly evident in the southeastern and western sections of the Mangrove Forest Research Center. The mangroves are utilized for firewood, housing materials, boat and raft supports, and fence posts, and provide a source of tannin. In the surrounding areas there is limited subsistence agriculture including small-scale rice cultivation and plantations of *Cocos nucifera.*

Possible changes in Land use: There is an increasing interest in aquaculture projects, particularly at Unisan, Pitogo and Macalelon, where mangroves have recently been clear-felled for new schemes. In the water catchment area, particularly north of Pagbilao, there have been increases in logging and slash-and-burn agriculture in forested areas.

Disturbances and threats: The wetland habitats are under considerable pressure from general human encroachment, destruction of mangroves for aquaculture, pollution from the fishponds, and increased siltation as a result of deforestation in the water catchment area. Over 10,000 ha of

mangroves have already been cleared for fishponds. Other disturbances include the illegal hunting of shorebirds and ducks (*Anas luzonica*) even in the Mangrove Forest Research Center, frequent illegal cutting of mangroves in the Research Center, the use of dynamite for fishing on the coral reefs, and the use of poisons for fishing in the mangrove creeks.

Economic and social values: The site is important for local subsistance fisheries, particularly for residents of the agriculturally poor Bondoc Peninsula, and provides fish for the Metro Manila markets. The mangrove forest provides excellent protection against coastal erosion by wave action during tropical storms. The mangrove areas also serve as wind breaks which can contribute to the mitigation of wind damage to coastal settlements during typhoons. The relatively quiet waters in the mangrove forest also provide a refuge for fish during the storms. The mangroves are an important source of forest products for coastal residents. The Mangrove Forest Research Center at Talipon in Pagbilao Bay is of paramount importance for research and educational purposes.

Fauna: The site is an important staging and wintering area for migratory herons, egrets and shorebirds. In September 1986, Alonzo-Pasicolan recorded over 400 shorebirds of nine species at Pagbilao Bay; in April 1987, Howes (1987) visited six sites in Tayabas Bay and found about 500 shorebirds of 16 species. The commoner species included *Pluvialis dominica, Numenius phaeopus, Tringa glareola* and *Calidris ruficollis.* Nine species of Ardeidae have been recorded including large numbers of *Butorides striatus,* a roost of c.50 *Egretta garzetta* and *E. alba* at Pagbilao, and small numbers of the endangered Chinese Egret *Egretta eulophotes* at Pagbilao and Unisan. The remaining patches of mangroves at Pitogo and Macalelon hold small breeding colonies of *Nycticorax caledonicus,* and the mangrove channels at the Mangrove Forest Research Center are used by about 250 *Anas luzonica* as roosting and feeding areas.

Mammals found in the area include the Philippine Macaque and small cetaceans.

The Bay provides natural breeding and nursery grounds for a wide variety of molluscs, crustaceans, fish and other aquatic organisms of economic importance. Fishes occurring in the mangroves include species of *Periophthalmus, Thalassoma, Halichores, Sygnathoides, Gastrophysics, Actobathus, Manocanthus, Sardinella, Stolephorus, Sphyraena, Leiognathus* and *Caranx.* Two species of oysters, *Ostrea orientalis, 0. palmipes,* and barnacles *Balanus sp* are common on the prop roots of *Rhizophora* mangroves. The zoobenthos includes invertebrates of 13 families, the commonest being *Nereidare,* an important food item for shorebirds. Also present are *Telescopium sulcatus, T. rhizosphorarium, Uca spp, Sesarma spp, Thallasina anomala* and *Macrotermes gilvus.*

Special floral values: There is an excellent example of a Philippine mangrove forest at the Mangrove Forest Research Centre at Talipan, together with smaller pockets at Padre Burgos, Unisan, Pitogo and Macalelon.

Research and facilities: The Forest Research Institute has conducted many studies on mangrove yields, mangrove products, management techniques and wildlife at its Agroforestry and Mangrove Forest Research Center and Mangrove Experimental Forest and Nursery at Talipan in Pagbilao Bay.

References: Alonzo-Pasicolan (1987); Caleda (1987); Center for Development Studies (1977-78 & 1978); Howes (1987); Interwader (1987).

Criteria for inclusion: 1b, le, 2a, 2c, 3b.

Source: Simplicia N. Alonzo-Pasicolan, Haribon Foundation and John R. Howes.

Wetland name: Lalaguna Marsh
Country: Philippines
Coordinates: 13°55'N, 122°13'E;
Location: near the southernmost tip of Lamon Bay, NNW of Lopez Municipality, Quezon Province, Luzon.
Area: 300 ha during the dry season, 500 ha during the wet season.
Altitude: 4m.
Biogeographical province: 4.26.12.
Wetland type: 15.
Description of site: An inland freshwater marsh with dense reed-beds and abundant growth of other aquatic vegetation. The maximum depth of water is 3m. During the dry season (February to April), the water level recedes and about one third of the marsh dries out. Some boat navigation is possible in cleared areas.
Climatic conditions: Humid tropical climate with a pronounced period of maximum rainfall from November to January and a poorly defined dry season (Type II).
Principal vegetation: The dominant aquatic species are *Scirpus grossus, Eichhornia crassipes, Ipomoea reptans* and *Phragmites communis.* Coconut plantations and rice paddies are found in surrounding areas.
Land tenure: The marsh is state owned; surrounding areas are privately owned.
Conservation measures taken: An informal conservation awareness campaign was promoted in the area by the Forest Research Institute in 1979.
Conservation measures proposed: None
Land use: Fishing and harvesting of reeds *(Phragmites)* for basket-making and mat-weaving. Coconut plantations, rice paddies and residential sites in adjacent areas.
Disturbances and threats: Uncontrolled shooting and trapping of waterfowl, especially ducks and rails, is having a detrimental effect on the populations, and dogs from nearby residential areas cause considerable disturbance to nesting birds. A proposal has been made to stock the marsh with exotic species of fish, and this could pose a threat to the native fish fauna. The clearing of old coconut plantations in the water catchment area has resulted in severe soil erosion and this has led to an increase in sedimentation in the marsh.
Economic and social values: The marsh provides an important source of fish for local inhabitants, and supports a small reed-cutting industry.
Fauna: An important breeding and wintering area for a variety of waterfowl, especially Ardeidae, Anatidae and Rallidae. Counts have included:
up to 400 *Ardea cinerea*
700 *Dendrocygna arcuata*
200 *Anas luzonica*
1,000 *Porphyrio porphyrio*
1,000 *Fulica atra*
1,000 other Rallidae
500 *Gallinago* spp
Other fauna includes *Ptenochirus jagori, Pteropus vampyrus, Varanus salvator* and *Bufo marinus.*
Special floral values: None known.
Research and facilities: The Forest Research Institute conducted a census of game-birds in December 1981 (Fabellar, 1983).

References: Fabellar (1983).
Criteria for inclusion: lb. 2b, 3b.
Source: Simplicia N. Alonzo-Pasicolan and Haribon Foundation.

Wetland name: Lamon Bay and Alabat Island
Country: Philippines
Coordinates: 13°55'-1415'N, 122'00'-122°20'E;
Location: 120 km southeast of Metro Manila, on the Pacific Coast of Quezon Province, Luzon.
Area: c.225 km of coastline; Alabat Island 9,150 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 01, 02, 03, 06, 07 & 10.
Description of site: A large sea bay and island on the indented Pacific coast of Luzon, consisting of predominantly coral shore with pockets of intertidal mudflat and mangrove in the smaller bays. In many places, the nearshore corals have died and have been covered with silt to form sandy flats. The island of Alabat (33 km long) has an extensive mangrove fringe along its southwest shore, with several hundred hectares of intertidal mudflats exposed at low tide. Large portions of the original mangrove forest have been degraded or completely destroyed for the construction of fish and shrimp ponds. The average tidal rise and fall is about 1.25m.
Climatic conditions: Humid tropical climate with no dry season, but a very pronounced period of maximum rainfall from November to January (Type II). The Bay is unprotected from the northeast monsoon, trade winds and cyclones.
Principal vegetation: Thirty species of mangrove and mangrove associates have been recorded on Alabat Island. The dominant species are *Sonneratia alba, Avicennia marina, A. off icinalis, Rhizophora mucronota* and *Nypa fruticans.* The principal vegetation in adjacent areas is coastal scrub and plantations of *Cocos nucifera,* together with other subsistence crops, mainly rice and root vegetables.
Land tenure: A mixture of state and private ownership.
Conservation measures taken: None.
Conservation measures proposed: The Mangrove Forest Research Center (Forest Research Institute) at Pagbilao has made a proposal for a mangrove rehabilitation programme on Alabat Island. Howes (1987) proposes management of suitable areas for replanting of mangrove species and prevention of further conversion to fishponds. Future surveys are needed to determine the use of the Bay by migratory shorebirds.
Land use: Marine fisheries (finfish and shellfish), aquaculture (fish and shrimp ponds), small-scale collection of mangrove products for the local market, quarrying of coral for construction materials, and hunting (shorebirds and monitor lizards). The surrounding areas are used for agriculture, mainly rice, vegetables and *Cocos nucifera.*
Disturbances and threats: The main threats are the large-scale conversion of mangrove swamp into commercial culture ponds for milkfish and shrimps, and the indiscriminate cutting of mangrove trees for construction purposes, fuel and charcoal production. Other threats include over-fishing in the inshore zone by trawlers, fishing with dynamite on the coral reefs, uncontrolled cutting of *Nypa fruticans* for shingle production, and illegal hunting of shorebirds and lizards.

Economic and social values: The Bay supports an important fishery which provides a major source of food and income for the local community. The site is also important for fisheries research. The mangroves create an erosion barrier between coastal villages and the northeast monsoon.
Fauna: An important staging area for migratory shorebirds and a feeding area for Ardeidae. Forest Research Institute personnel reported large numbers of shorebirds foraging on intertidal areas on the southeastern coast of Alabat Island in September 1986, along with 300 *Bubulcus* ibis, 200 *Egretta garzetta* and 200 *E. alba.* Howes (1987) found smaller numbers of *Egretta* spp and eight species of shorebirds at three sites in April 1987.
Special floral values: Small pockets of accreting *Avicennia marina* mangrove provide an excellent example of this vegetation type in the Philippines.
Research and facilities: A government office, the Lamon Bay School of Fisheries, has been established at Lopez. Forest Research Institute personnel from the Mangrove Forest Research Center at Pagbilao conducted vegetation transects in the mangroves on the southwest side of Alabat Island in 1986, and the Forest Research Institute and Asian Wetland Bureau conducted wetland evaluation work with respect to shorebirds in 1986 and 1987 (Howes, 1987).
References: Alonzo-Pasicolan (1987); Howes (1987).
Criteria for inclusion: 1b, le, 2c, 3b.
Source: Haribon Foundation and John R. Howes.

Wetland name: Manlubas Swamp
Country: Philippines
Coordinates:14°09'N, 122°52'E;
Location: near Guinacutan and Labo, 65 km NNW of Naga, Camarines Norte Province, southeastern Luzon.
Area: Unknown.
Altitude: 1O-15m.
Biogeographical province: 4.26.12.
Wetland type: 15.
Description of site: A complex of freshwater ponds, swamps and marshes with an average depth of 2.5-3.0m; fed by local run-off and subterranean sources. Water levels fluctuate according to the season, and peripheral areas are cultivated during periods of low water level. Parts of the marsh have been reclaimed for agriculture.
Climatic conditions: Humid tropical climate with no dry season, but a very pronounced period of maximum rainfall from November to January (Type II).
Principal vegetation: No information is available on the aquatic vegetation; surrounding areas are mainly grassland, cultivated land and coconut plantations.
Land tenure: The ownership of the wetland is unknown; surrounding areas are privately owned.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing. Low-lying areas around the swamp are planted to seasonal crops such as rice, corn and cassava; higher ground is used for the cultivation of coconuts and bananas.
Disturbances and threats: Increasing portions of the marsh are being converted into agricultural land, and soil erosion in the water catchment area is resulting in increased siltation.

Economic and social values: An important source of fish and other aquatic products for the local community.
Fauna: An important breeding area for Rallidae and a wintering area for a wide variety of waterfowl.
Special floral values: None known.
Research and facilities: None
References: None
Criteria for inclusion: lb.
Source: Haribon Foundation.

Wetland name: Ragay Gulf
Country: Philippines
Coordinates:13°32'-13°58'N, 122°25'-122°47'E;
Location: between the Bicol and Bondoc Peninsulas, Quezon and Camarines Sur Provinces, southeastern Luzon.
Area: c.100 km of coastline.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 01, 02, 06, 07 & 10.
Description of site: A protected gulf area with an estuary in the northern part created by drainage from the mountains of the northern Bicol region (Mount Labo). The coast is largely intact mangrove with intertidal mudflats, particularly in protected bays such as Pens Bay. Some areas have been converted to aquaculture ponds, and there are some coral reefs offshore. The Gulf is saline with some dilution from the three main river sources to the north. The average tidal variation is about 1.25m.
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).
Principal vegetation: The aquatic vegetation includes mangroves in the intertidal zone, the principal species being *Rhizophora apiculata, Sonneratia alba* and *Ceriops tagal.* Other species include *Schyphiflora hydrophyllacea, Avicennia marina, Nypa fruticans, Excoecaria agallocha, Acanthus spp, Instia retusa, Lumnitzera sp, Bruguiera gymnorhiza, B. parviflora, B. cylindrica* and *Xylocarpus granatum.* The vegetation on the adjacent degraded hillsides is dominated by *Pandanus* spp and *Cocos nucifera.*
Land tenure: A mixture of state and private ownership.
Conservation measures taken: None.
Conservation measures proposed: Howes (1987) proposes the management of suitable areas (particularly near Guinayangan and Buenavista) for mangrove replanting schemes, and the strict application of the Bureau of Forest Development's guidelines for aquaculture development (i.e. Presidential Decree No.750) in the conversion of further areas to fishponds. Further study of waterfowl migration within the Gulf is required.
Land use: The principal activity is fishing, and there are important local fisheries in the vicinity of all mangrove areas. Mangroves are harvested for timber and other products, and mangrove forest has been converted to aquacuiture ponds in Guinayangan and Buenavista. The principal land use in the adjacent uplands is agriculture, mainly the cultivation of *Cocos nucifera* and maize.

Possible changes in Land use: About 15 hectares of mangrove at Guinyangan have been surveyed for conversion to aquaculture ponds, and some clearance has already been implemented.
Disturbances and threats: The conversion of mangrove forest at Guinyangan to aquaculture ponds is a major threat. Many fishponds along the seaward edge have been eroded by wave action and abandoned. A scheme to dam the upper section of the Gulf from Catimo to Guinyangan for use as a large-scale aquaculture project has failed. The continued denudation of the remaining forested patches in the water catchment area is causing increased soil erosion and this is resulting in increased siltation in the coastal wetlands.
Economic and social values: The fisheries are of considerable local importance in this agriculturally very poor region. The mangrove forest provides a natural barrier against coastal erosion. The Gulf is important for scientific research as it constitutes one of the few sites in Luzon with large areas of mangrove forest still in a healthy condition.
Fauna: An important area for migratory Ardeidae and shorebirds. Some 400 shorebirds of 18 species were observed at two sites in mid-May 1987, but the area undoubtedly holds many more birds during the peak migration seasons. More importantly, the area was found to hold a total of 41 Chinese Egrets *Egretta eulophotes* as well as lesser numbers of *E. garzetta, E. alba* and *Ardea purpurea.*
There is a very rich zoobenthic biomass evident in the intertidal mudflats.
Special floral values: The area supports some of the largest tracts of diverse mangrove forest in Luzon.
Research and facilities: The Forest Research Institute and Asian Wetland Bureau conducted a preliminary wetland evaluation and shorebird survey in April 1987 (Howes, 1987).
References: Howes (1987).
Criteria for inclusion: 1b, 2a, 2c, 3b.
Source: John R. Howes.

Wetland name: Lake Baao
Country: Philippines
Coordinates: 13°28'N, 123°18'E;
Location: approximately 4.8 km northwest of Baao Town, Camarines Sur Province, southeastern Luzon.
Area: 177 ha.
Altitude: 5m.
Biogeographical province: 4.26.12.
Wetland type: 14 & 21.
Description of site: A small freshwater lake and associated marshes with some swamp forest. The lake is fed by local run-off and several small rivers, and drains west into the Bicol River. The average depth of water is one meter, the dissolved oxygen values range from 8.0 to 8.8 p.p.m., the pH value is 6.4, and the total hardness (SBV) is 2.0. The water recedes during the summer months, and at the lowest water level, only one third of the lake area remains.
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).
Principal vegetation: The dominant aquatic species include *Ipomoea reptans, Nymphaea* sp and *Hydrilla* sp.

Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: The wetland is used for fish production, the most important species being mudfish *Ophicephalus striatus,* catfish *Clarias* sp and the tilapias *Tilapia mossambica, T. nilotica*. Wild ducks are caught in the area and sold to nearby municipalities.
Disturbances and threats: No information.
Economic and social values: Important for its fisheries production.
Fauna: The lake supports numerous waterfowl, particularly ducks and shorebirds.
Special floral values: No information.
Research and facilities: Some studies have been carried out by the Bicol River Basin Development Program in San Jose, Pili.
References: Rinconada Integrated Development Project Feasibility Study (1979).
Criteria for inclusion: lb. 3b.
Source: Haribon Foundation.

Wetland name: Lake Buhi
Country: Philippines
Coordinates: 13°28'N, 123°30'E;
Location: 40 km southeast of Naga, Camarines Sur Province, southeastern Luzon.
Area: 1,707 ha.
Altitude: c. 120m.
Biogeographical province: 4.26.12.
Wetland type: 14.
Description of site: A freshwater lake and associated marshes, almost surrounded by hills rising to 1,548m. The lake drains southwest into a tributary of the Bicol River. The average depth is 12m, and the bottom is loamy clay. The pH value is 6.3, and the average dissolved oxygen 10 p.p.m.
Climatic conditions: Humid tropical climate with no dry season, but a very pronounced period of maximum rainfall from November to January (Type II).
Principal vegetation: The aquatic vegetation includes *Hydrilla verticillata* and *Pistia stratiotes.*
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fisheries production, the principal species being mudfish, catfish, tilapia, carp (*Ophicephalus striatus, Clarias* sp, *Tilapia mossambica, Cyprinus carpio*) and freshwater shrimps. Other species of commercial importance include *gourami Gourami sp, plasalit Trichogaster pectoralis* and climbing perch *Anabas testudineus.*
Disturbances and threats: No information.
Economic and social values: The lake supports an important fishery.
Fauna: The lake is noted for its endemic fish *Mystichthys luzonensis,* a small species only 12.5 cm in length, commercially known as "tabios" or "sinarapan".
Special floral values: None known.
Research and facilities: Some studies of the fisheries have been carried out by the Bicol River Basin Development Program in San Jose, Pili.

References: Rinconada Integrated Development Area Project Feasibility Study (1979).
Criteria for inclusion: lb. 2d.
Source: Haribon Foundation.

Wetland name: Lake Bato
Country: Philippines
Coordinates: 13°20'N, 123°22'E;
Location: at Bato Town, approximately 9 km southwest of Iriga City, Camarines Sur Province, southeastern Luzon.
Area: 2,810 ha.
Altitude: 10m.
Biogeographical province: 4.26.12.
Wetland type: 14 & 21.
Description of site: A freshwater lake with extensive marshes and some swamp forest, fed by local run-off and several small streams. The lake drains into a tributary of the Bicol River which enters the sea near Naga City. The average depth is 8m, and the bottom is muddy clay. The pH value is 6.1, the average dissolved oxygen 10 p.p.m., and the total hardness (SBV) 2.4.
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).
Principal vegetation: Approximately 20 species of larger aquatic plants have been recorded, including *Ipomoea reptans, Hydrilla verticillata* and *Eichhornia crassipes.*
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing, especially for carp *Cyprinus carpio* and the tilapias *Tilapia nilotica, T. mossambica.* Minor fisheries include freshwater shrimps *Macrobrachium* sp*,* catfish *Clarias* sp and climbing perch *Anabas testudineus.*
Disturbances and threats: No information.
Economic and social values: The lake supports an important fishery.
Fauna: The lake has a rich fish fauna including the endemic species *Mystichthys luonensis.*
Special floral values: None known.
Research and facilities: Studies of the fisheries have been carried out by the Bicol River Basin Development Program in San Jose, Pili.
References: Bureau of Fisheries and Aquatic Resources (1984-85); Rinconada Integrated Development Area Project Feasibility Study (1979).
Criteria for inclusion: 1b, 2d.
Source: Haribon Foundation.

Wetland name: Natunawan Cove
Country: Philippines
Coordinates: 13°l6'N, 123°50'E;
Location: 15 km southeast of Tabaco, north of Albay Gulf, Albay Province, southeastern Luzon.
Area: Several hundred ha.
Altitude: Sea level.

Biogeographical province: 4.26.12.
Wetland type: 01, 06 & 07.
Description of site: A narrow, oblong cove with intertidal mudflats and mangrove swamps in its upper reaches. The cove receives freshwater input from several rivers and streams, and has an average depth of only l-2m. The substrate is muddy in the inner part of the cove, and increasingly sandy towards the mouth. The average tidal range is about 1.25m.
Climatic conditions: Humid tropical climate with no dry season, but a very pronounced period of maximum rainfall from November to January (Type II). The average annual rainfall is about 2,850 mm.
Principal vegetation: Eelgrass and mangroves; grassland and cultivated land in adjacent areas.
Land tenure: The cove is state owned; adjacent areas are privately owned.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing. Adjacent areas are cultivated for various short-term crops such as rice, corn, mongo and beans.
Disturbances and threats: No information.
Economic and social values: The cove is a traditional fishing area and provides a safe anchorage for small boats.
Fauna: The cove provides a sanctuary for juvenile siganids which are present for the greater part of the year. Peneanid shrimps and various species of molluscs, crabs and other invertebrates are also present.
Special floral values: None known.
Research and facilities: None
References: None
Criteria for inclusion: 1b, 2c.
Source: Haribon Foundation.

Wetland name: Naujan Lake
Country: Philippines
Coordinates: 13°1O'N, 121°1l'E;
Location: on the northeast coast of Mindoro Island, approximately 8 km from Pinagsabangan Town, Oriental Mindoro Province. The lake is bounded by four municipalities, Naujan, Pola, Victoria and Socorro.
Area: 10,875 ha.
Altitude: 20m.
Biogeographical province: 4.26.12.
Wetland type: 14.
Description of site: A large freshwater lake probably of volcanic origin, extending for about 1 4 km from north to south, and seven km from east to west. The lake is fed by local run-off and there are no major affluent; the outlet is near the north end through the Lumangbayan River. The eastern shore is precipitous, but to the west the land rises gradually and there are large areas of shallow water with an abundant growth of aquatic vegetation. There are several hot springs along the eastern shore. The maximum depth of the lake is 45m. The pH value ranges from 6.0 to 9.8, the dissolved oxygen value ranges from 7.0 to 8.0 p.p.m., and the total hardness (SBV) is 1.2.

Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV). The average annual rainfall is about 2,100 mm, and the mean monthly temperatures range from 28°C to 32°C.

Principal vegetation: Approximately 2,000 ha of the lake are dominated by the marsh grass *Vallisneria* sp and floating mats of *Eichhornia crassipes.* The phytoplankton consists of:

Ankistrodemus (46%)
Anacystis (23%)
Chlorella (17%)
filamentous algae (9%)
Botryococcus (1%)
Actinastrum (0.04%)
Strephanodiccus (0.04%)

Surrounding areas are covered in a mixture of forest, scrub and grassland with some orchards and coconut plantations.

Land tenure: The lake and surrounding areas are under public ownership.

Conservation measures taken: The lake is part of the Naujan Lake National Park (21,655 ha), established in 1956. The lake is open to commercial fishing subject to the following limitations: (1) permits must be renewed annually; (2) there are bag limits for certain species not included in the list of protected species; (3) fishing is only permissible between the hours of 4.00 am and 5.00 pm; (4) no fishing is permitted in the marshy area of the lake which has been declared a fish sanctuary. Unfortunately, the enforcement of these regulations and other park regulations is reported to be extremely poor.

Conservation measures proposed: The Ministry of Natural Resources has expressed the desire to establish a crocodile farm and crocodile sanctuary at the lake.

Land use: Fishing, especially for milkfish, mullet, goby and mudfish *(Chanos chanos, Mugil* sp, *Glossogobius giurus* and *Ophicephalus striatus).* Other species in the catches include the tilapias *Tilapia mossambica, T. nilotica,* carp *Cyprinus carpio,* the freshwater prawn *Macrobrachium* sp, and the freshwater snails *Ampullaria luzonica, Vivipara angularis.* Where the marshes permit cultivation, the land has been drained, cleared and planted with rice. A very profitable duck-raising industry thrives in the surrounding area, along with some cultivation of fruit trees and coconuts.

Disturbances and threats: Because of the increase in the human population in the area, the demand on the lake's natural resources has grown rapidly. Fishing is intensive and there is continuing conflict between preserving the National Park for wildlife and development of the area for commercial and subsistence level activities by the local residents. The privately owned fish corral built at the mouth of the Butas River with Government approval constitutes a major threat. Its massive door is opened during high tide and then closed, blocking the exit of marine species in their migration to the sea to breed. The small population of crocodiles, although protected by law, continues to be persecuted; fishermen catch young crocodiles on fishing lines and large animals are killed in nets.

Economic and social values: The lake is rich in nutrients and supports a major fishery of both demersal and pelagic species. Most of the inhabitants of the region depend on the lake for their livelihood.

Fauna: The rich fish fauna includes protected species such as *Mugil dussumieri, Caranx sexfasciatus* and *Lutianus argentimaculatus,* and harvestable species such as *Chanos chanos,*

Ophicephalus striatus, Glossogobius giurus, Clarias batrachus, Tilapia mossambica and *Gourami* spp.
The lake supports large numbers of ducks and other waterfowl. Resident species include *Tachybaptus ruficollis, Ardea purpurea, Dendrocygna arcuata, Anas luzonica, Ixobrychus cinnamomeus, Butorides striatus, Rallus torquatus, Porzana fusca, Poliolimnas cinereus, Amaurornis phoenicurus, Gallicrex cinerea, Gallinula chloropus, Porphyrio porphyrio pulverulentus* and *Sterna albifrons.* Wintering waterfowl include *Ixobrychus sinensis, Aythya fuligula* and *Fulica atra.* The raptors, *Haliastur indus intermedius, Haliaeetus leucogaster,* and the kingfisher *Halcyon chloris collaris* also occur at the lake.
The Philippine Crocodile *Crocodylus mindorensis,* an endangered species endemic to the Philippines, formerly occurred in the area, but may now be extinct on Mindoro. The Estuarine Crocodile *Crocodylus porosus* still occurs in the restricted zone of the National Park. Other reptiles include the Monitor Lizard *Varanus salvator.*
Special floral values: No information.
Research and facilities: The Bureau of Fisheries and Aquatic Resources has a Limnological Laboratory and Experimental Fish Pond at the lake.
References: Bureau of Fisheries and Aquatic Resources (1977-1979 & 1984-1985); Karpowicz (1985); Luther & Rzoska (1971); National Environmental Protection Council (1981); Rabor (1958); Ross (1984).
Criteria for inclusion: 1b, le, 2a, 2b, 3b.
Source: Haribon Foundation.

Wetland name: Catubig River and Estuary
Country: Philippines
Coordinates: 12°20'N, 125°00'E;
Location: south of Laoang, Northern Samar Province.
Area: 54 km of river in a total valley area of 83,600 ha; 444 ha of mangrove and nipa swamp.
Altitude: Sea level to 800m.
Biogeographical province: 4.26.12.
Wetland type: 02, 06, 07, 11 & 12.
Description of site: The Catubig River from its source in the highlands of northern Samar to the estuarine mangroves and intertidal mudflats at its mouth near the town of Laoang on the north coast of the island. The valley remains very much in its natural state, especially in the upper part of the watershed. Human interference with the indigenous terrestrial and aquatic ecosystems has occurred only in settled areas and on cultivated lands which comprise 30% of the total area. The pH values in the river range from 6.3 to 8.0. In the estuarine portion of the river, the average tidal rise and fall is 1.19m, and the overall range 1.4m.
Climatic conditions: Humid tropical climate with no dry season, but a very pronounced period of maximum rainfall from November to January (Type II). The site lies on the typhoon path.
Principal vegetation: There are 444 ha of mangrove and nipa swamps in the estuary, dominated by *Nypa fruticans* and *Rhizophora* sp. No information is available on the freshwater aquatic vegetation. Much of the water catchment area, particularly the southern (upper) part, is covered in primary dipterocarp forest. The dominant commercial species are *Pentacme contorta, Shorea negrosenses, S. polysperma, S. guigo, Dipterocarpus grandiflora* and *Hopea accumulata.*
Land tenure: No information.

Conservation measures taken: None.
Conservation measures proposed: None
Land use: Forestry and agriculture, mainly cultivation of rice and coconuts. Logging licenses have been issued in the water catchment area. The valley includes 15,604 ha of rice paddies, 10,994 ha of coconut plantations, 1,118 ha of grassland, 4,694 ha of scrub, 444 ha of nipa and mangrove, 5,022 ha of secondary forest and 43,254 ha of primary forest.
Possible changes in Land use: Several development projects have been proposed which would have a profound effect on the river. These include (a) the construction of a multipurpose reservoir with a total capacity of 150.4 million cubic meters and a dam height of 55m; (b) the construction of low dikes; (c) the construction of irrigation networks covering approximately 4,550 ha; (d) the construction of a hydro-electric power station with two 15 megawatt generators.
Disturbances and threats: The creation of a large reservoir would destroy much of the valley.
Economic and social values: No information.
Fauna: No information is available on the aquatic fauna. Forest wildlife includes the pig *Sus celebensis philippinensis,* the deer *Cervus unicolor* and the monkey *Macaca philippinensis.*
Special floral values: The valley possesses some of the finest virgin forests remaining in the Philippines.
Research and facilities: Sanya Consultants Incorporated, a Japanese company, has carried out a comprehensive development study of the valley for the Samar Integrated Rural Development Project.
References: Sanya Consultants (1984).
Criteria for inclusion: lb. 2b.
Source: Haribon Foundation and Perla M. Magsalay.

Wetland name: Lake Danao (Imelda)
Country: Philippines
Coordinates:11°04'N', 124°42'E';
Location: 10 km northeast of Ormoc City, Leyte Province.
Area: 196.7 ha.
Altitude: 640m.
Biogeographical province: 4.26.12.
Wetland type: 14.
Description of site: A small freshwater lake and associated marshes on Mount Danao in the highlands of north-central Leyte. The lake is fed by local run-off; it has a maximum depth of 182m, and the bottom is comprised of sandy, silty and clay sediments. The pH values range from 8.0 to 8.5, and the dissolved oxygen values from 7.0 to 8.0 p.p.m.
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).
Principal vegetation: The filamentous alga *Cladophora* sp is common in the lake; dominant macrophytes include *Panicum hemitomon* and *Hydrilla* sp. Humid tropical forest, patches of *Imperata cylindrica,* rice paddies and fields of sugar cane in surrounding areas.
Land tenure: The lake is owned by the Local Authority; a part of the surrounding area is owned by the Local Authority and the remainder is under private ownership.

Conservation measures taken: The lake is included in the Lake Danao National Park (1,500 ha), established in 1965 and administered by the Bureau of Forest Development. The lake is also within a Philippine National Oil Company Reservation.
Conservation measures proposed: None
Land use: Sport fishing, boating, swimming and other recreational activities; cultivation of rice and sugar cane in surrounding areas.
Disturbances and threats: The uncontrolled cutting of timber by slash-and-burn farmers poses a threat to the entire region.
Economic and social values: The lake provides many opportunities for outdoor recreation, and supports a small sport fishery.
Fauna: The rich fish fauna includes *Chanos chanos, Clarias* sp, *Tilapia* sp*, Cyprinus carpio* and *Glossogobius giurus.* The lake supports a wide variety of waterfowl, notably species of grebes (Podicipedidae), herons and egrets (Ardeidae) and ducks (Anatidae). The forests in the vicinity are important for a number of species of birds endemic to the Philippines.
Special floral values: None
Research and facilities: Magsalay carried out a preliminary faunal survey in June 1986.
References: None
Criteria for inclusion: lb.
Source: Haribon Foundation and Perla M. Magsalay.

Wetland name: Leyte Sab-a Basin
Country: Philippines
Coordinates: lO°57'-ll°23'N, 124°38'-125°03'E;
Location: on the northeastern plains of Leyte, from the region of Tolosa northwest to Carigara Bay, Leyte Province.
Area: 90,000 ha.
Altitude: 36m.
Biogeographical province: 4.26.12.
Wetland type: 11, 15, 19 & 22.
Description of site: A vast area of marshy plains with numerous small lakes and ponds, peat bogs, characteristic "binag" marshes and rice paddies. The water supply comes from a number of springs, small rivers, aquifers at the edge of the basin and local rainfall. A large number of waterways traverse the basin, most of these draining east into Leyte Gulf. The maximum depth of water in the marshes is 1.5 meters. Some of the lakes and ponds are permanent, but the water levels fluctuate by about one meter according to rainfall.
Climatic conditions: Humid tropical climate with no proper dry season, but a pronounced period of maximum rainfall from November to January (Type II).
Principal vegetation: Sedge marshes and rice paddies; coconut plantations and scrub on high ground.
Land tenure: Part of the area is owned by the Local Authority and the remainder is privately owned.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Cultivation of rice.

Disturbances and threats: The natural wetland areas are being converted into rice paddies and drained for other agricultural purposes.
Economic and social values: A considerable income is generated by the cultivation of rice, and the basin is the largest water catchment area on the island of Leyte. The region is considered to be the best area in the Province for agricultural development, but *Oncomelania snails,* the carriers of Schistosomiasis*,* are abundant.
Fauna: The area regularly supports large numbers of waterfowl, particularly herons and egrets (Ardeidae), ducks (Anatidae), rails and gallinules (Rallidae), and some shorebirds.
Special floral values: None known.
Research and facilities: Various studies have been carried out by the Leyte Sab-a Basin Development Authority.
References: National Water Resources Council (1980).
Criteria for inclusion: lb, le, 3b.
Source: Haribon Foundation and Perla M. Magsalay.

Wetland name: Lake Bito
Country: Philippines
Coordinates: lO°47'N, 124°59'E;
Location: 7 km NNW of Abuyog in east-central Leyte, Leyte Province.
Area: 126 ha.
Altitude: 10m.
Biogeographical province: 4.26.12.
Wetland type: 14.
Description of site: A small freshwater lake and associated marshes in low hills in east-central Leyte. The lake is fed by several small streams and local run-off; it has a maximum depth of 15m, a pH value of 7.0, an average dissolved oxygen value of 7.8 p.p.m., and an average total hardness (SBV) of 1.6.
Climatic conditions: Humid tropical climate with no dry season, but a very pronounced period of maximum rainfall from November to January (Type II).
Principal vegetation: *Ipomoea reptans* and the filamentous alga *Cladophora* sp*;* rice paddies, pandanus and some fruit trees in surrounding areas.
Land tenure: The lake is owned by the Local Authority. The surrounding land is partly owned by the Local Authority and partly by private individuals.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing with fish pens and fish traps, mainly for Tilapia sp and *Chanos chanos.* Cultivation of rice, coconuts and root crops in surrounding areas.
Disturbances and threats: The major threats to the lake are slash-and-burn farming in the catchment area, hunting and the illegal use of dynamite for fishing.
Economic and social values: The site is important for outdoor recreation and supports a locally important fishery.
Fauna: The lake supports a rich fish fauna including *Chanos chanos, Tilapia* sp, *Ophicephalus striatus* and Glossogobius giurus. The freshwater shrimp *Macrobrachium* sp also occurs. Some waterfowl use the lake, mainly grebes (Podicipedidae) and herons (Ardeidae).
Special floral values: None known.

Research and facilities: None
References: Bureau of Fisheries and Aquatic Resources (1984-85).
Criteria for inclusion: lb.
Source: Haribon Foundation and Perla M. Magsalay.

Wetland name: Layog and Higasaan Rivers
Country: Philippines
Coordinates: l0°37'-l0°45'N, l24°58'-l2502'E;
Location: south of Abuyog, Leyte Province.
Area: 10,500 ha.
Altitude: Sea level to 1,000m.
Biogeographical province: 4.26.12.
Wetland type: 11, 12 & 13.
Description of site: The Layog River and its tributary, the Higasaan River, from their sources at about 1,000m elevation in the hills of southern Leyte to the Layog estuary in Leyte Gulf south of Abuyog. In the lower reaches, the riverbanks are lined with nipa palms *Nypa fruticans,* and there are extensive riverine marshes near the river mouth.
Climatic conditions: Humid tropical climate with no dry season but a pronounced period of maximum rainfall from November to January (Type II).
Principal vegetation: Stands of *Nypa fruticans;* rice paddies, plantations of *Cocos nucifera* and secondary forest in adjacent areas.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing, transportation, outdoor recreation and water supply for domestic purposes; agriculture along the river banks and residential areas at the river mouth.
Possible changes in Land use: The region has been proposed as a resettlement site, and plans exist for the canalization of rivers and streams for irrigation in the water catchment area.
Disturbances and threats: Illegal logging in the upper water catchment area is causing soil erosion and increased siltation in the riverine marshes. Other threats include hunting and pollution from domestic waste and pesticides used on nearby rice paddies.
Economic and social values: The rivers are important for their fisheries and provide many opportunities for outdoor recreation.
Fauna: An important area for egrets and ducks (up to 500).
Special floral values: No information.
Research and facilities: None
References: National Water Resources Council (1980).
Criteria for inclusion: lb. 3b.
Source: Perla M. Magsalay.

Wetland name: Hinunangan Rice Paddies
Country: Philippines
Coordinates:10°23'N, 125°12'E;
Location: near Hinunangan, on the southeastern coast of Leyte, Southern Leyte Province.

Area: 5,000 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 19.
Description of site: A large area of rice paddies on the coastal plain of southeastern Leyte, surrounded by extensive coconut plantation. There are forested mounting to the west and southwest, including Mount Cabalian. The Das-ay River system flows through the paddy area.
Climatic conditions: Humid tropical climate with no dry season but a pronounced period of maximum rainfall from November to January (Type II).
Principal vegetation: Rice paddies *(Oryza sativa)* and reed marshes; plantations of *Cocos nucifera* and forests with *Ptecarpus* sp*, Weetenia macrophyla, Intsia bejuga* and *Pentacme contorta* in adjacent areas.
Land tenure: The rice paddies are privately owned; surrounding areas are public domain.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Cultivation of rice; agriculture, grazing of domestic livestock and hunting in surrounding areas.
Possible changes in Land use: Various irrigation schemes have been proposed including the Das-ay River Irrigation System, the Bugho Communal Irrigation System and an irrigation system in Hinundayan. There is also a new proposal to expand the area of rice paddies.
Disturbances and threats: Immediate threats include pollution with agro-chemicals, excessive hunting, and the collection of birds' eggs for human consumption.
Economic and social values: The wetland is an important rice-growing area.
Fauna: An important breeding and wintering area for grebes, egrets and ducks (including *Anas luzonica).*
Special floral values: The site is reported to have a wild fruit tree, known locally as "Kubi", with a fruit similar in taste to that of *Litchia chemensis* or *Nephalium longan.*
Research and facilities: None
References: National Water Resources Council (1980).
Criteria for inclusion: le, 3b.
Source: Perla M. Magsalay.

Wetland name: Lake Danao
Country: Philippines
Coordinates: lO°40'N, 124°20'E;
Location: in the northern part of Pacijan Island, one of the Camotes Islands east of Cebu Island, Cebu Province.
Area: 260 ha.
Altitude: c.5m.
Biogeographical province: 4.26.12.
Wetland type: 14.
Description of site: A freshwater lake, about 5 km long, with no definite outlet; the largest freshwater lake in Cebu Province. Most of the original vegetation has disappeared, and even the small islet in the lake has been planted with coconuts. The only remaining area of aquatic vegetation is on the east side of the lake, where the water is shallow and there is a dense growth

of submerged vegetation. The lake is fed by local run-off and is uniformly shallow with an average depth of 3m; it fills up during periods of heavy rainfall to a maximum depth of 5.1m, and recedes again during dry periods to a minimum depth of 1.1m. The average values for dissolved oxygen, pH and total hardness (SBV) are 5.0 p.p.m., 8.2 and 1.7, respectively.

Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).

Principal vegetation: *Pistia stratiotes, Panicum hemitomon, Hydrilla* sp and *Eichhornia crassipes;* plantations of coconuts and corn fields in surrounding areas.

Land tenure: State owned (public land).

Conservation measures taken: The site was declared a Game Refuge and Bird Sanctuary under Administrative Order No.1 dated 24 December 1965.

Conservation measures proposed: A proposal has recently been prepared by the Department of Environment and Natural Resources to increase staffing at the Game Refuge and Bird Sanctuary from two to five.

Land use: Fishing, mainly for species of *Tilapia, Cyprinus carpio* and *Chanos chanos,* and to a lesser extent for *Glossogobius giurus*, *Clarias* sp and freshwater shrimps; cultivation of coconuts and corn in surrounding areas.

Possible changes in Land use: There is a proposal to develop parts of the lake for brackishwater aquaculture.

Disturbances and threats: Although the lake has been designated as a Game Refuge and Bird Sanctuary, there is no effective protection, and there exists a possibility that fish pens and fish cages will be constructed in the lake.

Economic and social values: The lake supports a very rich fishery, and most of the local residents are dependent on this resource for their subsistence.

Fauna: The rich fish fauna includes *Tilapia* spp, *Cyprinus carpio, Chanos chanos, Glossogobius giurus* and *Clarias* sp. *A* wide variety of waterfowl occur including *Tachybaptus ruficollis, Egretta intermedia, Ardea purpurea* and *Dendrocygna arcuata.* The Estuarine Crocodile *Crocodylus porosus* formerly occurred at the lake; Groombridge (1982) reports that the population was still healthy in 1978, but according to other reports, the last individual was killed in 1971. Monitor lizards *Varanus* sp do still occur.

Special floral values: Several rare orchids and a variety of herbs of medicinal value grow along the shore of the lake.

Research and facilities: The Bureau of Fisheries and Aquatic Resources has carried out some studies of the fish resources, and the Asian Wetland Bureau Philippines surveyed in lake in April 1988.

References: Bureau of Fisheries and Aquatic Resources (1980, 1983 & 1984-85); Groombridge (1982).

Criteria for inclusion: lb.

Source: Haribon Foundation and Perla M. Magsalay.

Wetland name: Cogtong Bay

Country: Philippines

Coordinates: 9°51'N, 124°33'E;

Location: in the Municipalities of Mabini and Candijay, on the east coast of Bohol Island, Bohol Province.

Area: 2,000 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 01, 02, 03, 06, 07 & 10.
Description of site: The estuarine system of three small rivers, the Cabidian, Matulid and Sagumay, with extensive mangrove swamps and some areas of fishponds; and the adjacent small sea bay (Cogtong Bay), with extensive intertidal mudflats, several mangrove-covered islands and offshore coral reefs. The rivers rise in the hill ranges of southern Bohol. Cabidian River enters the bay in the north and forms the boundary between the two municipalities; Matulid River lies in the middle, and Sagumay River, the smallest of the three, enters the bay in the south near Candijay.
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).
Principal vegetation: Extensive mangrove swamps and areas of nipa palm *Nypa fruticans.*
Land tenure: The mangrove areas are state owned (public domain) and have been declared as public timberland. Surrounding areas are mainly privately owned.
Conservation measures taken: None.
Conservation measures proposed: The area has been proposed as a crocodile sanctuary and as a Game Refuge and Bird Sanctuary.
Land use: Fishing, aquaculture and domestic use of mangroves and nipa palms. The waters are navigable and are used by local boat traffic.
Possible changes in Land use: Some sectors have been designated as "alienable" and "disposable" for release for fish pond development.
Disturbances and threats: Destruction of mangroves for the development of more fishponds, over-exploitation of the mangroves and hunting.
Economic and social values: The mangrove and fishery resources are of considerable economic value to the local communities. Ancient burial sites in rock shelters around the bay are of considerable archeological interest.
Fauna: The Estuarine Crocodile *Crocodylus porosus* is still thought to occur in the area, and there have been reliable sightings as recently as 1984. The wetland also supports a wide variety of waterfowl including *Anas luzonica.*
Special floral values: No information.
Research and facilities: A preliminary survey has been carried out in support of the proposal to establish a crocodile sanctuary and Game Refuge and Bird Sanctuary in the area. The National Museum conducted archeological studies between 1983 and 1987.
References: None
Criteria for inclusion: lb, 2a, 2c, 3b.
Source: Perla M. Magsalay.

Wetland name: Lapinin Island and Cabulao Bay
Country: Philippines
Coordinates: 10°00'-10°09'N, 124°28'-l24°37'E;
Location: east of Ubay Town, on the northeast coast of Bohol Island, Bohol Province.
Area: 37,500 ha.
Altitude: Sea level.

Biogeographical province: 4.26.12.
Wetland type: 01, 03, 06, 07 & 10.
Description of site: Mangrove swamps and intertidal mudflats around an offshore island (Lapinin), two nearby islets (Lapinin Chico and Bonoon), the adjacent mainland coast, and the associated shallow sea bay (Cabulao). There are some areas of fishponds on the mainland coast, and offshore coral reefs.
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).
Principal vegetation: Mangrove swamps.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing; aquaculture and agriculture in adjacent areas.
Disturbances and threats: No information.
Economic and social values: No information.
Fauna: No information.
Special floral values: No information.
Research and facilities: None
References: None
Criteria for inclusion: 0.
Source: Perla M. Magsalay.

Wetland name: Trinidad and Quinobatan Mangroves
Country: Philippines
Coordinates: lO°03'-10°09'N, l24°l9'-l24°22'E;
Location: mainly north of the village of Trinidad, on the north coast of Bohol Island, Bohol Province.
Area: 10,500 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 02, 06 & 07.
Description of site: The estuarine system of the Ipil River, with mangrove swamps along the lower reaches of the river and associated creeks, and extensive intertidal mudflats at the mouth of the estuary.
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).
Principal vegetation: Mangrove swamps.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing and cutting of mangroves for local use; agriculture in adjacent areas.
Disturbances and threats: No information.
Economic and social values: No information.
Fauna: No information.
Special floral values: No information.

Research and facilities: None
References: None
Criteria for inclusion: 0.
Source: Perla M. Magsalay.

Wetland name: Jetafe Mangroves and Mahanay Island
Country: Philippines
Coordinates: 1O°08'-1O°13'N, 124°08'-124°16'E;
Location: between Jetafe and Talibon, on the north coast of Bohol Island, Bohol Province.
Area: 9,000 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 03, 06 & 07.
Description of site: A large area of coastal mangrove swamps and intertidal mudflats on the north coast of Bohol east from the region of Jetafe to the Tulang Point area and around several nearby offshore islands including Mahanay, Banacon and Handayan.
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).
Principal vegetation: Mangrove forest.
Land tenure: No information.
Conservation measures taken: Large-scale replanting of mangroves has taken place on a community level at Banacon Island under the supervision of the Forest Research Institute.
Conservation measures proposed: None
Land use: Fishing and forestry; agriculture in adjacent areas.
Disturbances and threats: No information.
Economic and social values: No information.
Fauna: No information.
Special floral values: No information.
Research and facilities: None
References: None
Criteria for inclusion: 0.
Source: Perla M. Magsalay.

Wetland name: Inabanga Coast
Country: Philippines
Coordinates: 9°57'-10°05'N, l23°59'-l24°08'E;
Location: on the northwest coast of Bohol Island, from Tubigon to the Inabanga Estuary and Buenavista, Bohol Province.
Area: About 22 km of coastline, with 450 ha of mangroves and 300 ha of aquaculture ponds.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 01, 02, 06, 07 & 10.
Description of site: A broad strip of coastal mangrove swamps and sandy mudflats between Tubigan and Buenavista, including the estuaries of the Inabanga and Clarin Rivers which rise in

the deforested hills of northern Bohol. The mangrove fringe is over two km wide in places, but in other areas much of the mangrove has been converted to aquaculture ponds. There are numerous offshore islands covered in mangroves and fringed with coral reefs. The tidal variation is 1.8m.

Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).

Principal vegetation: Mangrove forest dominated by *Avicennia officinalis, A. alba,* with some *Sonneratia caeseolaris* and *S. alba,* particularly near the river banks. The dominant regenerating species is *Ceriops tagal* with some *Rhizophora apiculata* and *Nypa fruticans.* Further inland *Avicennia*
officinalis is dominant, with small patches of *Acanthus* sp*, Acrostichum aureum, Lumnitzera* sp and *Schyphiflora hydrophyllacea* amongst the fishponds. The principal vegetation in adjacent areas is a plantation of *Cocos nucifera.*

Land tenure: The aquaculture ponds are privately owned; the mangroves and mudflats are partly state owned and partly private.

Conservation measures taken: None.

Conservation measures proposed: Howes (1987) recommends (a) that mangrove replanting schemes already in progress in the Jetafe area to the east be expanded along the northwest coast of Bohol, (b) that the further conversion of mangroves to aquaculture projects be limited, and (c) that protection be given to the remaining large tracts of relatively intact mangrove forest.

Land use: Fishing, aquaculture and harvesting of mangrove products for local use; cultivation of coconuts and subsistence agriculture (fruit and vegetables) in adjacent areas. There is a small port at Tongod near Inabanga Town.

Disturbances and threats: The major threats are the continuing conversion of mangrove areas to aquaculture ponds, widespread cutting of mangroves for local use, excessive harvesting of *Nypa fruticans*, dynamite fishing on the coral reefs, fish poisoning, and pollution from domestic waste. There is a very high density of fish traps in the area, and over-exploitation of the marine resources may become a problem. Deforestation continues in the water catchment area, and this must be having a detrimental effect on the wetland. Hunting pressure is heavy, especially on whistling-ducks *Dendrocygna arcuata.*

Economic and social values: A very important region for its fisheries, which are based on the mangrove resource and offshore coral reefs. This fact has been acknowledged by local fishermen who implemented the mangrove reafforestation project at Jetafe to the east.

Fauna: An important staging and wintering area for migratory shorebirds. Small numbers of twelve species of shorebirds were observed between Inabanga Estuary and Tubigan in late April 1987; these included five *Numenius madagascariensis.* Nine Chinese Egrets *Egretta eulophotes* and two *E. sacra* were also found during the survey. Over 4,800 shorebirds of 14 species were recorded in mid-September 1987, along with about 300 *Dendrocygna arcuata.* The most abundant species were *Tringa totanus, T. nebularia* and *Calidris ruficollis.* Four Asian Dowitchers *Limnodromus semipalmatus* were particularly noteworthy.

Special floral values: The site contains one of the largest areas of mangroves on Bohol, and is an excellent example of the mangrove/mudflat ecosystem in the Philippines. The mangroves are particularly diverse in species composition.

Research and facilities: Some studies have been conducted by the Central Visayas Regional Projects Office and the Bureau of Forest Development, Region 7. Shorebird surveys were carried out by Interwader in April 1987 (Howes, 1987), and by the Asian Wetland Bureau Philippines in September 1987.

References: Howes (1987).
Criteria for inclusion: 1b, le, 2a, 2c, 3b.
Source: John R. Howes and Perla M. Magsalay.

Wetland name: The Coast of Southwestern Bohol
Country: Philippines
Coordinates: 9°33'-9°57'N, 123°43'-l24°03'E;
Location: the southwestern coast of Bohol Island from Tubigan to Loay, Bohol Province.
Area: c.45 km of coastline; 12,600 ha of wetlands.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 01, 02, 06, 07 & 10.
Description of site: The coastal mangrove and sandy mudflat zone between Tubigan and Loay, including Calape Bay and Maribojoc Bay and the estuary of the Abatan River in the latter bay. The mangrove fringe varies in width and attains its greatest extent in the two sheltered bays. There are several large areas of aquaculture ponds on the landward edge of the mangroves, e.g. at the Brackishwater Aquaculture and Development Training Center (37 ha), at Bentig (50 ha) and at Barangay Lincod (54 ha). The offshore zone is dominated by a coraline reef structure. The tidal variation is 1.8m.
Climatic conditions: Humid tropical climate with the seasons not very pronounced; relatively dry from November to April and wet for the remainder of the year (Type III). The site is partly sheltered from the northeast monsoon and trade winds and is open to the southwest monsoon and frequent cyclonic storms.
Principal vegetation: The coastline is fringed with mangroves consisting of *Avicennia officinalis, A. marina, A. alba* and *Sonneratia alba,* with some *Rhizophora apiculata, R. mucronata* and *Ceriops tagal.* The mangroves around the fishponds at Maribojoc Bay are dominated by *S. alba, S. caeseolaris,* with a scattering of *A. off icinalis, A. alba,* and a few patches of *R. mucronata* and *Excoecaria agallocha.* There are large areas of *Nypa fruticans* along all major watercourses, and plantations of *Cocos nucifera* in adjacent areas.
Land tenure: Most of the mangrove areas are state owned, as are the aquaculture ponds at the Brackishwater Aquaculture Development and Training Center; other aquaculture ponds and adjacent areas are under private ownership.
Conservation measures taken: None.
Conservation measures proposed: Howes (1987) recommends further wetland evaluation surveys to determine key sites for migratory shorebirds and *Egretta* spp, and to evaluate potentially suitable areas for mangrove replanting schemes.
Land use: Fishing, largely offshore, to cater for the local and export markets via Tagbilaran and Tubigan ports. In Maribojoc Bay, large areas of *Nypa fruticans* are being exploited on a commercial basis. There is a considerable amount of aquaculture near Loay, Loon and Lomboy, especially for milkfish *Chanos chanos* and shrimps *Macrobrachium* sp. Salt is produced at Calape. The main forms of land use in adjacent areas are agriculture and forestry (Loboc Watershed Reforestation Project).
Disturbances and threats: Major threats include the clearance of mangroves for aquaculture projects, widespread cutting of mangroves for firewood, fodder, poles and other domestic uses, excessive harvesting of *Nypa fruticans,* and pollution from pesticides used on adjacent

agricultural land. The development of a further 41 ha of aquaculture ponds near the east bank of the Abatan River has already been approved, and would result in the loss of a large area of *Nypa fruticans* of considerable importance to the local communities. The over-exploitation of the offshore cockle beds and other marine resources, combined with destruction of mangroves, is likely to cause a reduction in the natural productivity of these resources with consequent adverse effects on the local economy. Deforestation in the watershed also constitutes a major threat.

Economic and social values: A very important site for local fisheries, supporting the economy of all coastal villages in southwestern Bohol, and providing input to the fisheries export market to Cebu City and other locations within the Visayas.

Fauna: The intertidal zone is an important feeding area for egrets *(Egretta* spp) and migratory shorebirds. Over 2,000 shorebirds were recorded in the Calape, Bentig and Barangay Lincod areas in September 1987, mainly *Tringa totanus, Heteroscelus brevipes, Calidris ruficollis* and *C. ferruginea.* Small numbers of *Numenius madagascariensis* were especially noteworthy. Other water birds recorded at this time included 16 *Butorides striatus,* 28 *Egretta garzetta* and 100 *Dendrocygna arcuata.*

Special floral values: The area has some of the most extensive and diverse mangrove forests in the Visayas.

Research and facilities: A wetland evaluation survey was carried out by the Asian Wetland Bureau in April and May 1987 (Howes, 1987), and Magsalay made some counts of shorebirds in September 1987.

References: Howes (1987).

Criteria for inclusion: lb. le, 2c, 3b.

Source: John R. Howes and Perla M. Magsalay.

Wetland name: Silot Bay

Country: Philippines

Coordinates: lO°24'N, 124°00'E;

Location: on the east coast of Cebu Island in Liloan Municipality, 15 km northeast of Cebu City, Cebu Province.

Area: 100 ha.

Altitude: Sea level.

Biogeographical province: 4.26.12.

Wetland type: 06, 07 & 08.

Description of site: A shallow tidal lagoon, roughly circular in shape, fringed with mangrove swamps and with two mangroves covered islets. The lagoon is connected to the sea by a channel 20 meters wide, which has been dredged up to the wooden bridge spanning it. The maximum depth of the lagoon is five meters and the salinity 25-32 p.p.t. Fresh water input comes from seepage and local run-off. Large areas of mudflat are exposed at low tide.

Climatic conditions: Humid tropical climate with the seasons not very pronounced; relatively dry from November to April and wet for the rest of the year (Type III).

Principal vegetation: Mangrove swamps with *Sonneratia caeseolaris, Avicennia officinalis,* some *Bruguiera conjugata, Ceriops roxbughiana* and *Lumnitzera racemosa,* and five species of algae. *Cocos nucifera, Pandanus tectorium, Leucaena glauca* and other common vascular plants in surrounding areas.

Land tenure: Some areas are owned by the Government but leased to private individuals for fish pond development; other parts are privately owned.
Conservation measures taken: The size of the fishing nets and the number of fishponds have been limited, and commercial exploitation of the mangroves has been prohibited.
Conservation measures proposed: Propoa1 have been made to limit the mesh size of the fishing nets, to restrict the number of fishermen using the bay, and to improve agricultural practices and establish cottage industries in the region to provide an alternative source of income for the local inhabitants and thereby reduce pressure on the natural resources of the bay.
Land use: Fishing, cutting of mangroves for local use (leaves for animal fodder and trunks for construction purposes), and outdoor recreation; aquaculture, agriculture and urban development in surrounding areas.
Disturbances and threats: The major threats include illegal dynamite fishing and fish poisoning, over-.exploitation of coral for building materials, and excessive cutting of mangroves for domestic use. There is a possibility that more of the mangroves will be cleared for aquaculture projects.
Economic and social values: Fishing provides a valuable source of income for the local people, and the bay is a popular area for outdoor recreation.
Fauna: The bay supports a very rich invertebrate and fish fauna, and is an important feeding area for a wide variety of herons, egrets, shorebirds and terns.
Special floral values: None known.
Research and facilities: The University of San Carlos has established a Marine Research Station at Silot Bay and has carried out a number of studies on the fauna, flora and ecology of the Bay.
References: Juario *et al*. (1970); Miller (1972 & 1973); San Carlos University (Biology Department) (1970).
Criteria for inclusion: lb, 3b.
Source: Perla M. Magsalay.

Wetland name: Mactan, Kalawisan and Cansaga Bays
Country: Philippines
Coordinates: l0°17'-l0°23'N, l23°54'-124°02'E;
Location: on the east coast of Cebu Island north from Cebu City, and on the south and west shores of Mactan Island, Cebu Province.
Area: 18,000 ha including at least 3,800 ha of coral and sand flats, 350 ha of intertidal mudflats, 400 ha of mangrove swamps and 500 ha of fishponds.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 01, 02, 06, 07, 09 & 10.
Description of site: A complex of shallow sea bays and channels, extensive intertidal sand flats and mudflats, mangrove swamps, fishponds, salt pans and seaweed culture ponds, with coral reefs offshore. The area includes the mangroves, sand flats and fringing coral reefs of southern and western Mactan Island, the narrow Mactan Channel which separates the island from the Cebu mainland, the adjacent mainland coast (including Kalawisan Bay, Cansaga Bay and the estuary of the Cansaga River) with fringing mudflats and mangroves, and a large area of fishponds at Jugan in Cansaga Bay. The tidal variation is 1.8m, and there are strong tidal currents

within the coral reef and Mactan Channel zones. Salinities range from brackish in the aquaculture ponds to hypersaline in the saltpans.

Climatic conditions: Humid tropical climate with the seasons not very pronounced; relatively dry from November to April and wet for the remainder of the year (Type III). The site is partly sheltered from the northeast monsoon and trade winds, and open to the southwest monsoon or at least to frequent cyclonic storms.

Principal vegetation: Mangrove forest dominated by *Sonneratia alba* in the sandier areas, and *Avicennia marina* in the muddier areas. Other mangrove species include *Rhizophora mucronata* (in rocky areas), *Nypa fruticans, Lumnitzera racemosa, Excoecaria agallocha* and *Rhizophora apiculata.* Non-mangrove species in drier areas include *Sesuvium portulacastrum, Leucaena glauca, L. leucocephela, Bambusa blumeana* and *Glauca spp.* Sea-grass beds are dominated by *Thalassia* spp and the seaweeds *Turbinaria spp* and *Buergesinia* spp. The seaweeds *Caulerpa* sp and *Eucheuma* sp are cultivated on a commercial scale in specially constructed ponds. There are plantations of *Cocos nucifera* and subsistence agricultural crops in adjacent areas.

Land tenure: Most of the site is state owned but the greater part is leased to private individuals; surrounding areas are mostly privately owned.

Conservation measures taken: Jugan Fishponds and adjacent areas important as roosting sites for shorebirds are protected by the owners. A part of Mactan Bay has been replanted with *Rhizophora* mangroves by the local inhabitants, and the sides of bunds in the Kalawisan area have been planted with *Rhizophora* to prevent erosion.

Conservation measures proposed: A proposal has been made to introduce a complete ban on hunting in the area. Howes (1987) recommends that mangrove replanting and rehabilitation schemes be extended throughout the area, and that further conversion of mangroves into aquaculture ponds be terminated. Howes also recommends that further research be carried out on the importance of the site for waterfowl, and that the mangrove forest in Mactan Bay be used as an outdoor centre for education for local foresters and school and university students.

Land use: Predominantly offshore fishing; also the harvesting of shellfish and mangrove products, navigation and outdoor recreation. Fishponds at Jugan are used for the culture of milkfish *(Chanos chanos)* and prawns, while ponds in the Kalawisan region are used for the culture of the seaweeds *Caulerpa racemosa* and *Eucheuma* sp on a commercial scale. *Nypa fruticans* is used for the production of alcohol, and *Rhizophora* mangroves for the production of tannin. Surrounding areas are both rural and industrial, with a port complex and international airport.

Possible changes in Land use: There is a possibility of increased industrial activity in Cebu City and reclamation of intertidal areas for housing in Magellan Bay. Continued deforestation and the resulting soil erosion in the water catchment area may affect land use.

Disturbances and threats: The principal threat is pollution from the Cebu Port and Industrial Zone, particularly the Shell Oil Terminal built on the coral reef on the south coast of Mactan Island. Pollution from the Asian Alchohol Plant at Cansaga Bay was particularly damaging to fish stocks, but this plant was closed down about ten years ago as a result of complaints from local fishermen. Other disturbances include heavy hunting pressure, particularly at Kalawisan, dynamite fishing and fish poisoning at Mactan and Kalawisan, and general over-exploitation of the marine resources.

Economic and social values: The offshore fisheries are very important for the local economy and the Cebu market. The seaweed culture ponds provide a base for exports to Japan, and

mangroves and nipa palms are harvested locally for construction purposes, tannin and animal fodder (leaves of *Sonneratia* and *Avicennia* spp*).*

Fauna: One of the most important staging areas for migratory shorebirds in the Visayas. Up to 3,700 shorebirds were observed at Jugan Fishponds in 1986, and almost 1,600 were observed in the area in April 1987. Twenty-three species were recorded, the commonest being *Pluvialis dominica, Charadrius mongolus, Tringa totanus, T. nebularia, Actitis hypoleucos, Heteroscelus brevipes* (710 in April 1987) and *Calidris ruficollis* (maximum of 2,600 in 1986). The area is also important for a variety of herons and egrets, including the endangered Chinese Egret *Egretta eulophotes,* 17 of which were observed on the sand flats of southern Mactan in April 1987. Terns *(Sterna* spp) are common, and several species of ducks including *Anas clypeata* and *Aythya fuligula* have been recorded at Jugan Fishponds.

Fishes include *Mugil* spp and *Siganus sp.*

Special floral values: Magellan Bay and Cansaga Bay on southern Mactan support small pockets of mature *Sonneratia/Avicennia* type mangrove forest.

Research and facilities: Magsalay conducted regular monthly counts of shorebirds at Jugan Fishponds in 1986, and the Asian Wetland Bureau carried out a wetland evaluation of the area in April 1987 (Howes, 1987). The University of San Carlos in Cebu City has a marine research station off Mactan Island, concerned mainly with research on coral reefs.

References: Howes (1987); Parish (1987); Magsalay (in press).

Criteria for inclusion: lb, le, 2a, 2c, 3b.

Source: John R. Howes and Perla M. Magsalay.

Wetland name: Olango Island

Country: Philippines

Coordinates: l0°14'-lO°l7'N, 124°02'-124°04'E;

Location: between Cebu and Bohol Islands, 4 km east of Mactan Island and 15 km east of Cebu City, Cebu Province.

Area: 5,800 ha, including about 2,900 ha of intertidal flats.

Altitude: Sea level.

Biogeographical province: 4.26.12.

Wetland type: 03, 05, 06 & 07.

Description of site: A low-lying island off the east coast of Mactan Island, with extensive intertidal coralline sand flats and mudflats, mangrove swamps and coral reefs. The tidal range is about 1.8m.

Climatic conditions: Humid tropical climate with the seasons not very pronounced; relatively dry during October-November and April-June, and wet for the remainder of the year (Type III). The island is partly sheltered from the southeast monsoon and trade winds by Bohol and Mactan Islands, but is open to the northwest monsoon and associated cyclonic storms.

Principal vegetation: Mangrove forest dominated by *Avicennia alba* along the seaward edge and in the accreting zone. *Rhizophora apiculata* is common along the edges of the forest, and there are some patches of *Sonneratia alba* and *Lumnitzera racemosa.* There are plantations of *Cocos nucifera* and a few small areas of agricultural crops in the interior of the island.

Land tenure: Mostly state owned, with a few privately owned plots of land near some of the beaches. The island comes under the jurisdiction of Lapulapu City.

Conservation measures taken: Some areas have already been replanted with mangroves, and others will be replanted in the near future as part of a Government scheme. In April 1988, the District Council on Olango Island enacted a new bylaw to ban hunting on the island.
Conservation measures proposed: The Asian Wetland Bureau Philippines has submitted a proposal to the authorities in Lapulapu, recommending that the island be declared a Migratory Bird Sanctuary, the first such sanctuary in the Philippines. The Asian Wetland Bureau Philippines has also submitted a proposal to the Central Visayas Regional Project and Department of Environment and Natural Resources concerning the mangrove-replanting scheme.
Land use: Offshore fishing and the harvesting of shellfish and edible seaweeds. The island has a small resident population of mostly fishermen.
Possible changes in Land use: The University of San Carlos is investigating the possibility of constructing water catchment cisterns in the two small bays on the island. These could have some adverse effects on the coastal ecosystems.
Disturbances and threats: Mangroves are cut indiscriminately for domestic use. The main threat to the water bird populations is heavy hunting pressure from organized groups of hunters from Cebu and Mandaue cities. These hunters specialize in shorebirds, particularly the larger species such as *Numenius arquata.*
Economic and social values: The waters around the island support an important fishery.
Fauna: One of the most important staging areas for migratory shorebirds in the central Philippines. Over 10,000 shorebirds have been recorded at one time, and the total number using the site may be as many as 50,000. *Numenius arquata* is particularly common. Up to 48 Asian Dowitchers *Limnodromus semipalmatus* were recorded in autumn 1987, making Olango Island the most important site for this rare species in the Philippines. The island is also an important staging area for *Numenius madagascariensis* and *Calidris tenuirostris* (376 in autumn 1987). Other water birds occurring in significant numbers include *Egretta garzetta, E. alba* and *Anas luzonica.*
Special floral values: No information.
Research and facilities: Preliminary surveys were carried out by the Asian Wetland Bureau Philippines between August and November 1987 and in early 1988, and detailed research is now planned. The University of San Carlos maintains research facilities on the nearby island of Mactan.
References: None
Criteria for inclusion: lb. 2a, 3a.
Source: Perla M. Magsalay.

Wetland name: Pinamungahan Mangroves and Fishponds
Country: Philippines
Coordinates:10°18'N, 123°35'E;
Location: near the village of Pinamungahan, on the west coast of Cebu Island, 33 km west of Cebu City, Cebu Province.
Area: 800 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 04, 06, 07 & 10.

Description of site: A stretch of intertidal mudflats and sand flats with stands of mangroves (Cabiangon Beach), rocky shores with some mangroves (Pandacan), a large area of fishponds between Pandacan and Cabiangon partly separated from the coastal mangroves by a national highway, and a large inland fish pond at Tajao, 1.5 km to the north of Cabiangon.
Climatic conditions: Humid tropical climate with the seasons not very pronounced; relatively dry from from November to April and wet for the rest of the year (Type III).
Principal vegetation: Mangrove swamps, *Nypa fruticans* and algae; plantations of coconuts and bananas, shrubbery and grassland in adjacent areas.
Land tenure: The site is partly under private ownership and partly owned by the Local Authority but leased to private individuals; surrounding areas are mostly privately owned.
Conservation measures taken: None.
Conservation measures proposed: It is recommended that a hunting ban be enforced, that Presidential Decree No.705 relating to the protection of mangroves be properly implemented, and that work on the rehabilitation of the mangroves be initiated.
Land use: Fishing, aquaculture and outdoors recreation; agriculture and urban development in surrounding areas.
Disturbances and threats: The disposal of mine tailings from the Atlas Consolidated Mining & Development Corporation takes place 6-8 km away from the site and causes some contamination in the area. Other threats include dynamite fishing, fish poisoning and excessive hunting.
Economic and social values: The fishery and mangrove resources are of considerable importance for the local communities.
Fauna: One of the most important staging areas for migratory shorebirds on Cebu Island. Up to 1,900 birds of 21 species were recorded during the autumn migration in 1986, the dominant species being *Pluvialis dominica, Tringa totanus, T. nebularia, Actitis hypoleucos, Calidris* ruficollis and *Himantopus himantopus.*
Special floral values: No information.
Research and facilities: Magsalay has carried out some censuses of shorebirds.
References: Magsalay (in press); Parish (1987).
Criteria for inclusion: lb. 3b.
Source: Perla M. Magsalay.

Wetland name: Moalboal Wetlands
Country: Philippines
Coordinates: lO°58'N, 123°24'E;
Location: near the villages of Tunga and Tubli, north of Moalboal, on the west coast of Cebu Island, Cebu Province.
Area: 300 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 06, 07 & 10.
Description of site: A stretch of coastal mangrove swamps and intertidal mudflats at the south end of Copton Bay, and adjacent fishponds in areas of former mangrove forest. There are rocky areas inland.
Climatic conditions: Humid tropical climate with the seasons not very pronounced; relatively dry from November to April and wet for the rest of the year (Type III).

Principal vegetation: Mangrove swamps; coconut plantations, agricultural land and shrubbery in adjacent areas.
Land tenure: The site is owned by the Local Authority but leased to private individuals; surrounding areas are largely privately owned.
Conservation measures taken: None.
Conservation measures proposed: There are proposals to enforce a hunting ban and to implement Presidential Decree No.705 relating to the protection of mangroves.
Land use: Aquaculture, fishing and anchorage for fishing boats; cultivation of corn and cash crops in adjacent areas.
Disturbances and threats: Excessive hunting pressure, dynamite fishing and fish poisoning.
Economic and social values: The local inhabitants depend on the fishery and mangrove resources for their livelihood. The area is also used as a field laboratory by the Moalboal School of Fisheries.
Fauna: An important staging area for migratory shorebirds; up to 1,500 shorebirds of 21 species have been recorded, the commonest being *Pluvialis dominica, Charadrius dubius, C. mongolus, Tringa totanus, T. stagnatilis, T. nebularia, Actitis hypoleucos* and *Calidris ruficollis.* The wetland also supports a variety of other waterfowl, notably herons, egrets, gulls and terns.
Special floral values: None
Research and facilities: The Moalboal School of Fisheries maintains a field laboratory at the site, and Magsalay has conducted some censuses of shorebirds.
References: Magsalay (in press); Parish (1987).
Criteria for inclusion: 1b, 3b.
Source: Perla M. Magsalay.

Wetland name: Talabong Island and Bais Bay
Country: Philippines
Coordinates: 9°34'N, 123°1O'E;
Location: on the southeast coast of Negros Island, 5 km north of Tanjay, Negros Oriental Province.
Area: 6,400 ha (Talabong Island 209 ha).
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 01, 02, 03, 06 & 07.
Description of site: Talabong Island is a low-lying island completely covered by mangrove forest; it lies to the southeast of Dewey/Dacu Island, and with this higher island, separates North Bais Bay from South Bais Bay. The island is named after the herons, locally known as "Talabong", which occur there. The Panamangan River and two smaller rivers flow into Bais Bay, and there are large areas of intertidal mudflats, sand flats and coral reefs in both sections of the bay. Salinities range from 28-33 p.p.t.
Climatic conditions: Humid tropical climate with the seasons not very pronounced; relatively dry from November to April and wet for the rest of the year.
Principal vegetation: Mangrove forest dominated by species *of Rhizophora, Avicennia* and *Sonneratia,* and nipa palms *Nypa fruticans* in the estuaries. Twenty-six species of marine benthic algae have been found in South Bais Bay, including nine species of red algae (Rhodophyceae), 12 species of green algae (Clorophyceae), three species of brown algae (Phaeophyceae) and two

species of blue-green algae (Cynnophyceae). The dominant plants in surrounding areas include *Cocos nucifera, Leucaena leucocephala, L. glauca, Bambusa blumeana* and a variety of common shrubs.
Land tenure: The site is owned by the Local Authority; surrounding areas are privately owned.
Conservation measures taken: The commercial exploitation of timber has been prohibited. In November 1985, the Bureau of Forest Development, Region 7, and the Local Government of the City of Bais signed a Memorandum of Agreement for the joint protection and management of the area. Forest guards have since been employed to warden the area.
Conservation measures proposed: A proposal has been made to declare the area as a Game Refuge and Wildlife Sanctuary. The Bureau of Forest Development has outlined a development plan for the site in a Memo dated 10 July 1986, and there are plans to construct a viewing area for local visitors and tourists.
Land use: Fishing, cutting of mangroves for local use, and marine research; agriculture, aquaculture and recreational activities in adjacent areas.
Disturbances and threats: The destruction of mangroves continues, and there is a danger of over-exploitation of the marine resources of the bay. The site is threatened by pollution from effluents from the pulp and paper mills at Bais Sugar Central.
Economic and social values: Approximately 30% of the total population of the region depend on the wetland for their livelihood. The mangrove forests also serve a valuable function in protecting Bais City from strong winds and marine pollution.
Fauna: A very important spawning and nursery ground for both inshore and pelagic species of fishes, crabs, shrimps, other crustaceans and molluscs. The area also supports large numbers of herons, egrets, ducks, shorebirds and mangrove forest birds.
Special floral values: No information.
Research and facilities: Some marine research has been conducted in the area.
References: Alcala & Alcazar (1984).
Criteria for inclusion: lb. le, 2c, 3b.
Source: Haribon Foundation and Perla M. Magsalay.

Wetland name: Lake Balinsasayao and Lake Danao
Country: Philippines
Coordinates: 9°21'N, 123°1O'E;
Location: in the mountains of southern Negros Island, 12 km west of Sibulan, Negros Oriental Province.
Area: Lake Balinsasayao 76 ha, Lake Danao 28 ha.
Altitude: 1,040m.
Biogeographical province: 4.26.12.
Wetland type: 14.
Description of site: Two small crater lakes separated by a narrow mountain ridge, and situated in a hollow between four mountains, Mount Mahungot to the south, Mount Kalbasan to the north, Mount Balinsasayao to the east and Mount Guidabon to the west. Lake Balinsasayao lies to the northwest of the ridge and Lake Danao to the southeast. The lakes are fed by local run-off and are fresh.
Climatic conditions: Humid tropical climate with the seasons not very pronounced; relatively dry from November to April and wet for the rest of the year (Type III).

Principal vegetation: No information is available on the aquatic vegetation; the dominant vegetation in surrounding areas is dipterocarp forest.
Land tenure: The lakes and the surrounding area (3,900 ha) are state owned.
Conservation measures taken: None.
Conservation measures proposed: The Bureau of Forest Development has proposed that the lakes and surrounding area be designated as a National Park, but the site is currently under the jurisdiction of the Board of Energy and the proposal is still awaiting approval. The Department of Environment and Natural Resources, Region 7, is currently preparing a proposal requesting acquisition of the area from the Board of Energy.
Land use: Fishing, mainly for *Tilapia mossambica, Cyprinus carpio, Ophicephalus striatus, Anquilla* sp*, Macrobrachium* sp, *Viruna literata, Fabricus* sp and *Chanos chanos.* Surrounding forests are exploited for timber and charcoal production.
Disturbances and threats: The uncontrolled cutting of timber by the Kaingiros (slash-and-burn farmers) is reducing the inflow of water to the lakes and causing a fall in water levels.
Economic and social values: The lakes support a significant fishery.
Fauna: The lakes possess a rich fish fauna, including a number of introduced species, and the surrounding dipterocarp forests are rich in bird life.
Special floral values: No information.
Research and facilities: None
References: Alcala & Carambana (undated); Cadelina *et al.* (1985).
Criteria for inclusion: lb.
Source: Haribon Foundation and Perla M. Magsalay.

Wetland name: Lake Balanan
Country: Philippines
Coordinates: 9°07'N, 123°Ol'E;
Location: in the mountains near the extreme southern tip of Negros Island, 5 km north of Siaton, Negros Oriental Province.
Area: Unknown.
Altitude: 1,000m.
Biogeographical province: 4.26.12.
Wetland type: 14.
Description of site: A freshwater lake in the forested mountains of southern Negros, with a shape resembling a figure of eight, the narrowest point between the two main portions of the lake being only 90 meters wide. The lake is surrounded by mountain ranges, and is fed by three streams, two of which rise on Lamaraw Mountain and the third on Anupugan Mountain.
Climatic conditions: Humid tropical climate with two pronounced seasons, a dry season from November to April and a wet season for the rest of the year (Type I).
Principal vegetation: No information is available on the aquatic vegetation; surrounding areas are covered in luxuriant tropical rain forest.
Land tenure: The area is Public Domain.
Conservation measures taken: The lake and surrounding forests are currently being managed as a Watershed Area by the Bureau of Forest Development.
Conservation measures proposed: A proposal has been made to designate the area as a Game Refuge and Wildlife Sanctuary to protect the large population of bats and other wildlife. This

proposal was endorsed by the Department of Environment and Natural Resources, Region 7, in January 1987.
Land use: Subsistence and commercial fishing, and public water supply; extraction of timber, slash-and-burn farming and cultivation of vegetables and other cash crops in surrounding areas.
Disturbances and threats: Slash-and-burn farming is having a detrimental effect on the region as a whole.
Economic and social values: The lake is an important source of water, and its fishery provides a source of income for the local inhabitants.
Fauna: A wide variety of waterfowl have been recorded including herons, egrets, ducks, rails and gallinules.
Special floral values: No information.
Research and facilities: Cadelina *et al.* (1985) carried out a study of the socio-economic importance of the lake for local inhabitants.
References: Cadelina *et al.* (1985).
Criteria for inclusion: lb.
Source: Perla M. Magsalay.

Wetland name: Pagatban River and Estuary
Country: Philippines
Coordinates: 9°23'N, 125°43'E;
Location: 10 km east of Bayawan, on the southwest coast of Negros Island, Negros Oriental Province.
Area: 2,500 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 01, 02, 05, 06, 07, 11 & 19.
Description of site: The lower reaches of the Pagatban River, its estuary and the adjacent shallow, semi-circular bay bounded by a sandy beach extending from the river mouth to Candumao Point to the west. There are extensive intertidal mudflats in the estuary and bay, belts of mangrove swamp l00-200m wide along the riverbanks, and rice paddies inland. The estuarine portion of the river extends upstream for about 500 meters.
Climatic conditions: Humid tropical climate with two pronounced seasons, a dry season from November to April and a wet season for the rest of the year (Type I).
Principal vegetation: Mangrove swamps and rice paddies; agricultural land and some relict patches of dipterocarp forest in adjacent areas.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing and harvesting of shrimps, oysters and fish fry; agriculture in surrounding areas. The permit held by the Insular Lumber Company for logging in the area was cancelled in 1979.
Disturbances and threats: The disposal of mine tailings from a large copper mining operation run by the Construction Development Corporation of the Philippines caused serious pollution and siltation problems, and resulted in the local extinction of some marine animals. However, the Corporation ceased operating in the area in about 1980.

Economic and social values: No information.
Fauna: The endangered Philippine Crocodile *Crocodylus mindorensis* may still occur in the area; Ross (1984) reported that two individuals were still surviving in the Pagatban River in 1981.
Special floral values: No information.
Research and facilities: Alcala conducted some research on the effects of mine tailings on marine animals.
References: Alcala (1979-1982); Ross (1984).
Criteria for inclusion: 1b, 2a.
Source: Perla M. Magsalay.

Wetland name: Ilog River Estuaries
Country: Philippines
Coordinates: 1O°Ol'-lO°04'N, l22°42'-122°47'E;
Location: on the southwestern coast of Negros Island, Negros Occidental Province.
Area: c.5,000 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 02, 06, 07, 10 & 19.
Description of site: The estuarine and delta systems of the two main distributaries of the Ilog River, with extensive intertidal mudflats, mangrove swamps, fishponds and adjacent rice paddies. The two estuaries are about nine km apart; both are prone to frequent floods, which bring large volumes of sediment to the area.
Climatic conditions: Humid tropical climate with two pronounced seasons, a dry season from December to April and a wet season for the rest of the year (Type I).
Principal vegetation: Mangrove swamps.
Land tenure: Owned by the state and leased to fishpond operators.
Conservation measures taken: None.
Conservation measures proposed: Alcala *et al.* have proposed the establishment of a Bird Sanctuary.
Land use: Fishing, aquaculture, harvesting of shellfish and other sea foods, transportation, anchorage for boats, and outdoor recreation; cultivation of rice and urban development in surrounding areas. The wetland is situated in a very densely populated area.
Disturbances and threats: There is considerable pressure on the wetland from general human encroachment. Agricultural development has contributed to severe siltation, and the dumping of effluents from a nearby sugar mill has resulted in fish being killed.
Economic and social values: The Ilog estuaries support a locally important fishery and provide opportunities for a variety of recreational activities.
Fauna: Thirty-eight species of fish have been recorded, 36 of which are edible. The invertebrate fauna includes 17 species of gastropods, 20 species of pelecypods, 22 species of crustaceans, one species of chiton and one species of brachipod. The estuaries are also important for a wide variety of resident and migratory waterfowl.
Special floral values: No information.
Research and facilities: Alcala *et al.* have conducted a survey of the water, animal and plant resources of the Ilog River.

References: Alcala *et al.* (undated-a & undated-b).
Criteria for inclusion: 1b, 3b.
Source: Haribon Foundation and Perla M. Magsalay.

Wetland name: Panubulon Island and Guiwanon Islets
Country: Philippines
Coordinates: l0°23'-1030'N, 122°33'-122°43'E;
Location: southeast of Nueva Valencia, at the south end of Guimaras Island, Guimaras Sub-Province, southeast of Panay.
Area: 14,000 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 03, 06 & 07.
Description of site: Numerous small islands and islets with fringing mangrove swamps and extensive intertidal mudflats, off the southeast coast of Guimaras Island. The principal islands are Panubulon Island, Guiwanon Island and its associated islets, and Inampulugan Island.
Climatic conditions: Humid tropical climate with two pronounced seasons, a dry season from November to April and a wet season for the rest of the year (Type I).
Principal vegetation: Mangrove swamps.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing and outdoors recreation.
Disturbances and threats: None known.
Economic and social values: The inhabitants of the islands are largely dependent on the mangrove and marine resources for their livelihood.
Fauna: The area is reported to be important for migratory ducks and shorebirds, but no detailed surveys have been made.
Special floral values: None known.
Research and facilities: None
References: None
Criteria for inclusion: lb. le, 3b.
Source: Perla M. Magsalay.

Wetland name: Ajuy, San Dionisio and Sara Wetlands
Country: Philippines
Coordinates: 11°07'-l1°23'N, 122°58-123°07'E;
Location: in the Municipalities of Ajuy, San Dionisio and Sara, near the east coast of Panay Island, Iloilo Province.
Area: 45,000 ha.
Altitude: 0-lOm.
Biogeographical province: 4.26.12.
Wetland type: 10 & 19.

Description of site: A large complex of fishponds and rice paddies adjacent to the Sampunong Bob Bird Sanctuary, a 54 ha patch of secondary forest with a large breeding colony of herons.
Climatic conditions: Humid tropical climate with the seasons not very pronounced; relatively dry from November to April and wet for the rest of the year (Type III).
Principal vegetation: Rice paddies *(Oryza sativa);* plantations of *Cocos nucifera,* root crops and shrubbery in surrounding areas; grassland dominated by *Imperata cylindrica on* the hillsides around Sampunong Bob Bird Sanctuary.
Land tenure: The wetlands are privately owned; surrounding areas are mainly privately owned.
Conservation measures taken: The wetlands are unprotected. The breeding colony of herons is protected in the Sampunong Bob Bird Sanctuary (54 ha), which is wardened by a forest guard.
Conservation measures proposed: None
Land use: Cultivation of rice and aquaculture; agriculture and grazing of domestic livestock in surrounding areas.
Disturbances and threats: The major threats are the hunting of herons and other birds in their feeding areas, the uncontrolled burning of cogon grass *(Imperata cylindrica),* and the cutting of trees.
Economic and social values: Fish and rice production.
Fauna: The rice paddies and fishponds provide a rich feeding area for about 100-150 pairs of Purple Herons *Ardea purpurea* which breed and roost in the Sampunong Bob Bird Sanctuary. The wetlands are also a feeding area for large numbers of egrets *Egretta* spp and presumably many other waterfowl.
Special floral values: None known.
Research and facilities: Magsalay *et al*. carried out a preliminary survey of the area in May 1987, and the Bureau of Forest Development is proposing to carry out a detailed study of the Purple Herons.
References: None
Criteria for inclusion: le, 2c, 3b.
Source: Perla M. Magsalay.

Wetland name: Bancal Bay
Country: Philippines
Coordinates: 11°28'-11°34'N, 123°05'-123°09'E;
Location: near the village of Balasan, at the northeastern tip of Panay Island, Iboilo Province.
Area: 7,700 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 01, 02, 03, 06, 07 & 10.
Description of site: A shallow sea bay with numerous low-lying islands, and the estuarine systems of several small rivers, with large areas of intertidal mudflats, mangrove swamps and fishponds.
Climatic conditions: Humid tropical climate with the seasons not very pronounced; relatively dry from November to April and wet for the rest of the year (Type III).
Principal vegetation: Mangrove swamps.
Land tenure: No information.
Conservation measures taken: None.

Conservation measures proposed: None
Land use: No information.
Disturbances and threats: No information.
Economic and social values: No information.
Fauna: No information.
Special floral values: No information.
Research and facilities: None
References: None
Criteria for inclusion: 0.
Source: Penn M. Magsalay.

Wetland name: Pilar Bay
Country: Philippines
Coordinates: 11°25'-11°36'N, 122°45'-123°00'E;
Location: southeast of Roxas, on the northeast coast of Panay Island, Capiz Province.
Area: 52,000 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 01, 03, 06, 07 & 19.
Description of site: A shallow sea bay with numerous low-lying islands, large areas of intertidal mudflats and mangrove swamps, and adjacent rice paddies.
Climatic conditions: Humid tropical climate with the seasons not very pronounced; relatively dry from November to April and wet for the rest of the year (Type III).
Principal vegetation: Mangrove swamps.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: No information.
Disturbances and threats: No information.
Economic and social values: No information.
Fauna: No information.
Special floral values: No information.
Research and facilities: None
References: None
Criteria for inclusion: 0.
Source: Perla M. Magsalay.

Wetland name: Sapian and Capiz Bays
Country: Philippines
Coordinates: 11°29'-11°37'N, 122°30'-122°45'E;
Location: west of Roxas, north of the village on Sapian, on the north-central coast of Panay Island, Capiz Province.
Area: 3,000 ha.
Altitude: Sea level.

Biogeographical province: 4.26.12.
Wetland type: 01, 02, 05, 06, 07 & 08.
Description of site: Two adjoining shallow sea bays, Sapian (the larger of the two) in the west and Capiz in the east, with extensive intertidal mudflats, sandy beaches, mangrove swamps, the estuaries of several small rivers, and associated coastal lagoons and marshes.
Climatic conditions: Humid tropical climate with the seasons not very pronounced; relatively dry from November to April and wet for the rest of the year (Type III).
Principal vegetation: Mangrove swamps.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: No information.
Disturbances and threats: No information.
Economic and social values: No information.
Fauna: No information.
Special floral values: No information.
Research and facilities: None
References: None
Criteria for inclusion: 0.
Source: Perla M. Magsalay.

Wetland name: Kalibo Wetlands
Country: Philippines
Coordinates: l1°32'-ll°46'N; 122°16'-122°30'E;
Location: near the towns of Kalibo, New Washington and Albasan, on the north coast of Panay Island, Aklan Province.
Area: c.25,000 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 01, 02, 04, 05, 06, 07 & 19.
Description of site: The estuarine and delta system of the Alcan River near Kalibo, and the extensive tidal lagoon and creek system of Batan Bay and Banga Baylet to the southeast. Mangrove swamps constitute about 80% of the area; there are extensive intertidal mudflats at the mouth of the Alcan River and in Batan Bay, stretches of rocky shore and sandy beach, and rice paddies inland. Salinities range from 16-31 p.p.t.
Climatic conditions: Humid tropical climate with two pronounced seasons, a relatively dry season from January to April and a wet season for the rest of the year with the heaviest precipitation occurring from October to December (Type I/Ill). The average annual rainfall is about 3,800 mm, and the mean annual temperature 27°C.
Principal vegetation: Mangrove swamps and rice paddies.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Shrimp fishing is very important in the area, particularly in Batan Bay.

Possible changes in Land use: Proposed irrigation schemes to service an additional 10,260 ha of agricultural land in the water catchment area of the Alcan River are likely to have an impact downstream in the estuary and delta.
Disturbances and threats: None
Economic and social values: The rich shrimp fishery provides a livelihood for many of the local inhabitants. Sixteen species of decapod crustaceans are harvested commercially.
Fauna: The very rich invertebrate fauna includes at least 39 species of decapod crustaceans belonging to 13 families.
Special floral values: No information.
Research and facilities: None
References: Anon (1977a).
Criteria for inclusion: lb. le, 2c, 3b.
Source: Haribon Foundation and Perla M. Magsalay.

Wetland name: Lake Manguao
Country: Philippines
Coordinates: 10°46'N, I 19°33'E;
Location: 7 km southeast of Taytay, northern Palawan Island, Palawan Province.
Area: 643 ha.
Altitude: 25m.
Biogeographical province: 4.26.12.
Wetland type: 14.
Description of site: A very deep freshwater lake set amongst low hills in northern Palawan. The lake is fed by several small rivers and local run-off, and retains water throughout the dry season.
Climatic conditions: Humid tropical climate with two pronounced seasons, a dry season from November to April and a wet season for the rest of the year (Type I). The average annual rainfall is about 2,200 mm, and the mean annual temperature about 27°C.
Principal vegetation: No information.
Land tenure: No information.
Conservation measures taken: The whole of Palawan Island has been declared a wildlife preserve.
Conservation measures proposed: None
Land use: No information.
Disturbances and threats: No information.
Economic and social values: No information.
Fauna: The Estuarine Crocodile *Crocodylus porosus* is still believed to occur at the lake.
Special floral values: No information.
Research and facilities: None
References: Ross (1984).
Criteria for inclusion: lb. 2a.
Source: Haribon Foundation.

Wetland name: Ulugan Bay
Country: Philippines

Coordinates: 10°05'N, 118°47'E;
Location: on the north coast of Palawan Island, 35 km north of Puerto Princesa, Palawan Province.
Area: 1,880 ha of mangroves.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 01, 03, 07 & 10.
Description of site: A small sea bay between hilly headlands, with several small islands, offshore coral reefs, and extensive mangrove swamps (the Baheli-Macarascas Mangroves) along the southern and eastern shores. Some areas of mangroves have been converted to fishponds. Seven perennial rivers drain into the mangroves: the Banaog, Kamanglet, Sia, Buruang, Egdasen, Baheli and Kayulo. Salinities range from 9.2 to 23.9 p.p.t., and pH values from 7.0 to 7.5. The tide is predominantly of the diurnal type, with a mean diurnal range of 1.22m.
Climatic conditions: Humid tropical climate with two pronounced seasons, a dry season from January to April and a wet season for the rest of the year (Type I). February is the driest month and August the wettest. The average annual rainfall is about 2,200 mm. Mean monthly temperatures range from a low of 26.6°C in November to a high of 28.7°C in April.
Principal vegetation: Mangrove swamps with seven species of true mangrove belonging to three families: Rhizophoraceae, Euphorbiaceae and Meliaceae.
Land tenure: No information.
Conservation measures taken: The whole of Palawan Island has been declared a wildlife preserve.
Conservation measures proposed: None
Land use: Cutting of mangroves for charcoal production, and aquaculture.
Disturbances and threats: The main threat is excessive cutting of mangroves, particularly *Rhizophora* and *Bruguiera,* for charcoal production. Some mangroves have also been destroyed for the development of fishponds.
Economic and social values: The extensive mangrove swamps provide excellent protection against wave erosion during storms, and serve as natural breeding and nursery grounds for molluscs, crustaceans and fishes of economic importance.
Fauna: The mangroves support a very rich invertebrate and fish fauna.
Special floral values: No information.
Research and facilities: The Center for Development Studies has carried out an inventory and assessment of the mangrove resources.
References: Center for Development Studies (1977-78 & 1978).
Criteria for inclusion: 1b, 2c.
Source: Haribon Foundation.

Wetland name: Tubbataha Reef
Country: Philippines
Coordinates: 08°44'-08°57'N, 119'48'-120'03'E;
Location: in the Sulu Sea, 160 km southeast of Palawan and 265 km WNW of the Zamboanga Peninsula, Mindanao.
Area: Northern reef 7,400 ha, North Islet 2 ha; southern reef 2,400 ha, South Islet 1.5 ha.
Altitude: Sea level.

Biogeographical province: 4.26.12.
Wetland type: 03.
Description of site: Two coral atolls four nautical miles apart, comprising the Tubbataha Reef. The northern atoll is a ringed, stocking-shaped reef with a large, deep lagoon. The most prominent feature of the reef is North Islet, a two hectare coralline sand cay. The southern atoll is a ringed, triangular-shaped reef, with a wide, shallow lagoon and a 1.5 hectare coralline sand cay, South Islet. A concrete lighthouse has recently been erected on this islet. There is a third and much smaller cay, Jessie Beazley Islet, about two nautical miles northwest of the northern atoll. This sandy, peanut-shaped cay is devoid of vegetation; it is approximately 100 square meters in area and is fringed by an extensive reef.
Climatic conditions: Tubbataha Reef is open to both the southwest and northeast monsoons and is greatly affected by cyclonic disturbances. The rainy season occurs during the southwest monsoon (from June to September), when a combination of strong winds, heavy rains and high seas produces the worst conditions of the year. The northerly winds generally set in during October and continue until April. The calmest time of year is from the middle of March to late May. Temperatures are uniformly high throughout the year, and the difference between the mean temperatures of the hottest month (May) and the coolest (January) is only 1.9°C. The relative humidity exceeds 70% for the greater part of the year.
Principal vegetation: There are extensive beds of eelgrass, mainly *Thalassia* sp and *Enhalus* sp, in the lagoons and particularly around South Islet; the dominant algae are species of *Caulerpa* and *Halirneda.*
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: Tubbataha Reef is being considered for the establishment of a marine park.
Land use: Fishing. There is a lighthouse on South Islet.
Disturbances and threats: Collection of birds' eggs and killing of sea turtles for human comsumption, and in recent years, illegal dynamite fishing around the reefs.
Economic and social values: No information.
Fauna: North and South islets support large breeding colonies of sea-birds, South Islet is occasionally used by nesting Green Sea Turtles *Chelonia mydas,* and Jessie Beazley Islet is often used as a roosting area by sea-birds. The breeding sea-birds are *Sula dactylatra, S.* sula, *S. leucogaster, Sterna fuscata, S. bergii. Anous stolidus* and *A. tenuirostris.*
Special floral values: No information.
Research and facilities: Surveys have been carried by the Natural Resources Management Center in its Marine Parks and Reserves Development Program.
References: Kennedy (1982); Natural Resources Management Center (1981).
Criteria for inclusion: lb. 2c.
Source: Haribon Foundation.

Wetland name: Lake Mainit
Country: Philippines
Coordinates: 09°26'N, 125°32'E;

Location: near the extreme northern tip of Mindanao Island in the Municipalities of Mainit, Alegria, Jabonga and Kicharao, on the boundary between Surigao del Norte and Agusan del Norte Provinces.
Area: 13,836 ha.
Altitude: 27m.
Biogeographical province: 4.26.12.
Wetland type: 14.
Description of site: A large freshwater lake on a narrow plain between hill ranges near the northern tip of Mindanao. The lake is fed by fourteen small rivers and streams; it has one outlet, the Lalinawan River, which flows south into Pagusi Lake and the Tubay River, and eventually into Butuan Bay. The shoreline is steeply shelving, and the maximum depth of the lake is about 200 meters. The pH values range from 6.5 to 7.8.
Climatic conditions: Humid tropical climate with no proper dry season but a very pronounced period of maximum rainfall from October to January (Type II). The average annual rainfall is 3,180 mm, and the mean monthly temperatures range from 27°C to 30.5°C.
Principal vegetation: Marshy areas of the lake are dominated by *Hydrilla verticillata, Pistia stratiotes, Chara* sp and *Cladophora* sp. Most of the surrounding area is under cultivation.
Land tenure: No information.
Conservation measures taken: The regional office of the Bureau of Forest Development has an on-going reafforestation programme in the area.
Conservation measures proposed: None
Land use: Fishing, mainly for goby, tilapia, mudfish, freshwater catfish and carp (*Glossogobius giurus, Tilapia* sp, *Ophicephalus striatus, Clarias* sp and *Cyprinus carpio)*. Other species in the catches include eel, milkfish, climbing perch and plasalit *(Anguilla* sp*, Chanos chanos, Anabas testudineus* and *Trichogaster* sp). Land around the lake is intensively cultivated. Various timber companies operate in the water catchment area, and several small and medium sized industries are dependent on the forest resources of the area.
Disturbances and threats: Indiscriminate gathering of raw materials for small scale industries.
Economic and social values: The lake supports an important fishery; fish production was estimated at 369 metric tonnes in 1977. The economy of the municipalities around Lake Mainit is heavily dependent upon the agricultural production concentrated around the perimeter of the lake.
Fauna: The rich fish fauna includes non-migratory, migratory and introduced species. No information is available on the waterfowl.
Special floral values: No information.
Research and facilities: Various studies have been carried out on the lake's fisheries and other hydro-biological resources.
References: Bureau of Fisheries and Aquatic Resources (1984-85); Gracia *et al*. (1981); NACIAD (1985).
Criteria for inclusion: lb, le.
Source: Haribon Foundation.

Wetland name: Agusan Marsh
Country: Philippines
Coordinates: 8°00'-8°19'N, 125°52'-l26°02'E;

Location: near Bunawan in the interior of northeastern Mindanao Island, Agusan del Sur Province.
Area: 89,359 ha.
Altitude: c.55m.
Biogeographical province: 4.26.12.
Wetland type: 10, 11, 13, 14, 15 & 19.
Description of site: A vast complex of freshwater marshes and watercourses with numerous small shallow lakes and ponds in the upper basin of the Agusan River and its tributaries. The maximum depth of water is 4m. Some parts of the marsh have been converted into fishponds and rice paddies. The rivers rise in the hills of eastern Mindanao and cause extensive flooding in the marshes from November to March. The drainage is north via the Agusan River into Butuan Bay.
Climatic conditions: Humid tropical climate with an average annual rainfall of 2,750 mm. The rainfall is more or less evenly distributed throughout the year (Type III).
Principal vegetation: Freshwater marshes with *Cyperus* spp, *Typha* sp and *Phragmites* sp; secondary growth dipterocarp forest, scrub and cultivated land (mainly rice paddies) in surrounding areas.
Land tenure: State owned (public land).
Conservation measures taken: The wetland has been declared a "reserved area".
Conservation measures proposed: Ross (1984) has suggested that the area could be made into a crocodile sanctuary if the local inhabitants could be convinced that they could ranch or crop crocodiles on a sustained yield basis. Parts of the water catchment area have been proposed as protected areas to reduce soil erosion and sedimentation. The Bureau of Forest Development has recommended that an area of 5,363 ha be designated as a reserve for the reintroduction of the Eastern Sarus Crane *Grus antigone sharpii.*
Land use: Fishing, some aquaculture and agriculture (mainly rice and cash crops). The region is sparsely populated because of the annual flooding of the Agusan River.
Possible changes in Land use: Proposed development projects in the water catchment area include the construction of dams and reservoirs for hydro-electric, flood control and irrigation purposes.
Disturbances and threats: Parts of the marsh have already been converted into aquaculture ponds and agricultural land, and large-scale drainage is being considered. The crocodiles are heavily persecuted. Clear-cutting of forests in the water catchment area has resulted in severe flooding and increased rates of sedimentation in the wetland.
Economic and social values: The wetland supports a small subsistence fishery, and is an important source of water for irrigation.
Fauna: An important area for a variety of water birds, notably herons and egrets such as *Bubulcus ibis* (over 500), *Ardea purpurea* and *A. cinerea* (over 200). The Eastern Sarus Crane *Grus antigone sharpii, now* extinct in the Philippines, was last recorded in Agusan Marsh in 1965.
The marshes support the largest population of the Estuarine Crocodile *Crocodylus porosus* remaining in the Philippines, and it is thought that the endangered Philippine Crocodile *C. mindorensis* may also be present.
Special floral values: No information.
Research and facilities: Some studies have been carried out by the Forest Research Institute, North Central Mindanao Forest Research Center, Cotabato-Agusan River Basin Development Project and Bureau of Forest Development. Ross (1984) gathered some information on the

crocodile population. However, the area remains very poorly known and is especially worthy of further study.
References: Anon (1977b & 1983); Ross (1984).
Criteria for inclusion: 1b, 2a, 2b.
Source: Haribon Foundation, Simplicia N. Alonzo-Pasicolan and Perla M. Magsalay.

Wetland name: Hijo River
Country: Philippines
Coordinates: 07°15'-07°32'N, l25°50'-l26°05'E;
Location: 50 km northeast of Davao City, Davao del Norte Province, Mindanao.
Area: 58,200 ha.
Altitude: 500- 1,000m.
Biogeographical province: 4.26.12.
Wetland type: 11 & 12.
Description of site: The upper basin of the Hijo River, including the Masara River, Balite Creek, Lingdan River, Calmah Creek, Magdaum Creek and many smaller rivers and streams, in the mountains of southeastern Mindanao. The Hijo River eventually flows south into Davao Gulf. The flow of water is relatively stable throughout the year because of the even distribution of the precipitation. The pH values range from 7.6 to 8.5.
Climatic conditions: Humid tropical climate with the rainfall evenly distributed throughout the year (Type IV). The average annual rainfall is approximately 2,400 mm; the mean monthly temperatures vary from a high of 24°C in May to a low of 21°C in January, and the mean relative humidity is 82%. The area is almost free of typhoons.
Principal vegetation: No information is available on the aquatic vegetation. The terrestrial vegetation includes logged-over dipterocarp forest, secondary forest, secondary scrub and cultivation.
Land tenure: Some 648 ha of the watershed are under concession to the North Davao Mining Corporation.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: The water catchment area includes 14,601 ha of cultivated land, 411 ha of grassland, 41,154 ha of forest, 1,698 ha of secondary scrub and 318 ha of developed land.
Possible changes in Land use: Approximately 8% of the Hijo River basin will be affected by the mining operations of the North Davao Mining Corporation.
Disturbances and threats: Mining activities and the disposal of mine tailings.
Economic and social values: No information.
Fauna: Fish species include *Osphronemus gourami, Trichogaster pectoralis* and *Anguilla* sp. The forests support a large variety of mammals, birds and reptiles including many of the species endemic to Mindanao and the Philippines.
Special floral values: No information.
Research and facilities: None
References: Synergistic Consultants (1981).
Criteria for inclusion: 1b, 2b.
Source: Haribon Foundation.

Wetland name: Lake Leonard
Country: Philippines
Coordinates: 07°24'N, 126°04'E;
Location: 60 km northeast of Davao City, Davao del Norte Province, Mindanao.
Area: 6 ha.
Altitude: c.800m.
Biogeographical province: 4.26.12.
Wetland type: 14.
Description of site: A tiny freshwater lake and associated marshes in the forested mountains of southeastern Mindanao, near the source of a tributary of the Hijo River.
Climatic conditions: Humid tropical climate with an average annual rainfall of about 2,400 mm more or less evenly distributed throughout the year (Type IV).
Principal vegetation: No information is available on the aquatic vegetation. Secondary forest, scrub and cultivation in surrounding areas.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Forestry throughout the water catchment area, and slash-and-burn farming, mainly for crops such as corn, sweet potatoes, coconuts, coffee and cacao, around the lake. Most of the cultivated land has been established at the expense of secondary forest.
Disturbances and threats: The edge of the lake is badly silted as a result of human activities on the upper slopes of the watershed, particularly road construction, shifting cultivation and logging. The disposal of mine tailings is also having a direct adverse impact on the lake's resources. The continued survival of *Crocodylus mindorensis* is highly precarious because of the present intensity of human activities within the watershed; the major threats to the species are accelerated siltation in the lake, poaching, pollution from pesticides and the destruction of the natural vegetation on the lake shore.
Economic and social values: No information.
Fauna: Fishes include *Anguila pacifica, Clarias batrachus, Glossogobius giurus, Ophicephalus striatus* and *Tilapia mossambica.* The endangered Philippine Crocodile *Crocodylus mindorensis* occurs at the lake during the breeding season in July, August and September. The surrounding forests support a very diverse avifauna including many of the species endemic to the Philippines.
Special floral values: No information.
Research and facilities: None
References: Synergistics Consultants (1980).
Criteria for inclusion: lb, 2a, 2b.
Source: Haribon Foundation.

Wetland name: Davao Gulf
Country: Philippines
Coordinates: 6°35'N, 125°23'E to 7°22'N, l25°50'E;
Location: the western shore of Davao Gulf from its northern extremity to the region of Pedada, Davao City and Davao del Sur Province, Mindanao.
Area: c.l20 km of coastline.

Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 01, 02, 05, 06, 07 & 10.
Description of site: A large sheltered sea bay consisting of several smaller bays with mangrove swamps and intertidal sand flats and mudflats. Much of the mangrove has been converted to aquaculture ponds, but there remains a narrow fringe along most of the coast and there are still extensive areas in some protected bays and along river channels. The major rivers entering the bay are the Sumlug, Tagum, Davao and Pedada. The water is saline and the maximum tidal variation is 1.75m.
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).
Principal vegetation: Mangrove forest dominated by *Sonneralia alba, Avicennia marina, A. officinalis* and *Rhizophora mucronata.* Less common species include *Ceriops tagal, Schyphiflora hydrophyllacea, Xylocarpus mollucensis, X. granatum, Rhizophora apiculata, Hibiscus tiliaceus, Bruguiera parviflora, Acanthus illicifolius, Heritiera littoralis, Aegicus* sp *and Casuarina equesetifolia.* There are plantations of *Cocos nucifera* and agricultural crops in adjacent areas.
Land tenure: A mixture of state and private ownership.
Conservation measures taken: A small farm west of Davao City is maintained by the owner, Mr Donego, as a private wildlife sanctuary.
Conservation measures proposed: Howes (1987) recommends that further surveys be carried out to determine the importance of the Gulf for migratory shorebirds, and to identify mangrove areas suitable for reafforestation, management and protection.
Land use: Offshore fishing in the Gulf, and aquaculture in areas cleared of mangroves; agriculture and some prospecting for gold in adjacent areas.
Disturbances and threats: Increased industrial development near Davao City poses a threat of pollution, especially from mercury, which is used in gold processing. Increased forest clearance in the water catchment area, particularly in the Mount Apo region, is likely to have an adverse effect on the coastal wetlands, and there is a possibility that more mangroves will be cleared for aquaculture ponds.
Economic and social values: A very important area for fisheries production, supplying the local markets in and around Davao City. Also a popular area for outdoor recreation, particularly scuba diving on the coral reefs off Alabat Island.
Fauna: An important feeding area for egrets and ducks, and an important staging area for migratory shorebirds. In May 1987, Howes (1987) visited four sites and observed small numbers of *Egretta eulophotes, E. garzetta, E. intermedia,* 445 *Dendrocygna arcuata,* 26 *Anas luzonica* and 675 shorebirds of 17 species including *Numenius inadagascariensis.* The private sanctuary on the Donego farm supports small numbers of *Dendrocygna arcuata, Anas luzonica* and other waterfowl.
Special floral values: Some of the small patches of mangrove forest support a very diverse mangrove flora.
Research and facilities: The Davao del Sur School of Fisheries at Malalag has carried out research on the fisheries, and several shorebird surveys were conducted in 1986 and 1987 by Ingle, Howes and others.
References: Ingle (1986); Howes (1987).
Criteria for inclusion: 1b, le, 2a, 2c, 3b.
Source: John R. Howes.

Wetland name: Liguasan Marsh
Country: Philippines
Coordinates: 6°35'-7°15'N, 124°17'-12452'E;
Location: in the basin of the Mindanao River in south-central Mindanao, North Cotabato and South Cotabato Provinces.
Area: 220,000 ha.
Altitude: 10-30m.
Biogeographical province: 4.26.12.
Wetland type: 11, 13, 14, 15, 19 & 20.
Description of site: A vast complex of river channels, small freshwater lakes and ponds, extensive marshes and arable land subject to seasonal flooding in the basin of the Mindanao River. Most of the area is under water during periods of heavy rainfall; some 140,000 ha dry out during dry periods and are cultivated. The marsh, although generally known as Liguasan, actually consists of two adjoining marshy basins, Liguasan marsh and Libungan marsh, with different water regimes. Liguasan lies at the confluence of the Pulangi, Maganoy, Buluan and Allah rivers, and Libungan lies at the confluence of Libungan and Mindanao rivers.
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).
Principal vegetation: Freshwater marshes with an abundant growth of *Eichhornia crassipes.* The dominant vegetation in surrounding areas includes *Livistona rotundifolia, Corypha elata, Nypa fruticans, Areca catechu, Pandanus tectorius, Calamus mallis, Asplenium nidus, Drynaria quercifolia* and a wide variety of climbing ferns and orchids. There is a 5,000 ha patch of virgin forest with a very rich flora within the marsh.
Land tenure: The marshes are state owned; surrounding areas are privately owned.
Conservation measures taken: 30,000 ha of the marsh were declared a Game Refuge and Bird Sanctuary in 1979. An inventory of the wildlife has been carried out to identify areas essential for the preservation of wildlife and aquatic resources. A survey team has been formed to explore the rich flora and fauna of the marsh, and a laboratory has been established for the identification, preservation, propagation and production of wildlife, particularly endangered species.
Conservation measures proposed: The Government aims to ensure a continuous yield of useful plant and animal products by establishing a balanced cycle of harvest and renewal. Efforts to increase wildlife populations will include the preservation of breeding stocks, restrictions on the harvest and habitat improvement. Then, as populations increase, the Southern Philippine Development Authority, in cooperation with other government and private agencies concerned with the preservation and propagation of wildlife and aquatic resources, plans to encourage commercial enterprises based on the wildlife resources of the marsh.
Land use: Fishing, aquaculture and agriculture. The Government has recognized the importance both economically and politically of Liguasan Marsh and, in the Cotabato-Agusan River Basin Development Project, has initiated the construction of a cut-off channel from the Pagulungan sector of the Rio Grande de Mindanao to prevent and control floods. A major development project, the Liguasan Marsh Freshwater Fisheries Project, has recently been established under the auspices of the Southern Philippine Development Authority. The project, a Government investment of some 13.7 million pesos, aims to exploit the fishery and agricultural resources of the marsh in an extensive food production programme. The project includes the installation of at

least 800 fish cages for tilapia culture and another 400 fish corrals for fish capture. Progress to date has included the construction of an ice plant and cold storage facility at Piket to store up to ten tons of fish, 200 fish cages at Ponol to serve as a field laboratory for new technology in fish culture, 225 fish corrals distributed amongst 112 families, and a fattening tank to fatten up the mudfish caught in the marsh.
Possible changes in Land use: New proposals under the Liguasan Marsh Freshwater Fisheries Project include the construction of 300 fish cages and 20 hectares of fish pens at Pebpulangian, the construction of an earthen broodstock and hatchery pond for breeding *Tilapia nilotica* and *T. mossambica,* and an aquaculture scheme to produce eels. There is also a scheme to farm crocodiles for their hide, and a plan to quarry the mud of the marsh for use as organic fertilizer.
Disturbances and threats: The main threat in the past has been the conversion of marshes to rice paddies and other agricultural land. The Liguasan Marsh Freshwater Fisheries Project will involve the conversion of large areas of marsh into aquaculture ponds and fish pens, and quarrying activities for the production of fertilizers are likely to cause considerable disturbance.
Economic and social values: The marsh is home to 112,000 Maguindanaon families whose primary means of livelihood are fishing when water levels are high and agriculture when they are low. Because of its very rich wildlife, the marsh has considerable potential for nature tourism. However, the area is a stronghold of the Moro National Liberation Front and access is restricted.
Fauna: The marsh supports a great variety of aquatic wildlife, including 20 species of fishes, three species of reptiles, and over 20 species of waterfowl, notably herons, egrets and ducks. Liguasan is the only locality in the Philippines for the Comb-crested Jacana *Irediparra gallinacea.* The marsh is one of the last strongholds for the endangered Philippine Crocodile Crocodylus *mindorensis,* and the Estuarine Crocodile *C. porosus* also occurs. The endangered Monkey-eating Eagle *Pithecophaga jefferyi* is reported to be present in the forested areas in the marsh.
Special floral values: The marsh is particularly rich in orchids.
Research and facilities: A variety of faunal and floral surveys have been carried out, and the South Philippine Development Authority has established a limnological laboratory at Lagundi near Piket.
References: Ingle (1986); Karpowicz (1985); Ross (1984).
Criteria for inclusion: 1b, le, 2a, 2b, 3b.
Source: Haribon Foundation and Robert S. Kennedy.

Wetland name: Lake Buluan
Country: Philippines
Coordinates: 6°39'N, 124°50'E;
Location: southeast of Buluan Town, on the boundarybetween
Maguindanao and Sultan Kudarat Provinces, south-central Mindanao.
Area: 6,500 ha.
Altitude: c.35m.
Biogeographical province: 4.26.12.
Wetland type: 14.
Description of site: A large freshwater lake and associated marshes in the upper basin of the Mindanao River. The lake is fed by a river rising in the hills of southern Mindanao, and drains north via the Buluan River into the Mindanao River. It is the third largest lake in Mindanao and

the sixth largest in the Philippines. The lake is shallow, with a depth of 3-6m, greenish in colour, and has a muddy bottom. The pH values range from 6.8 to 7.3, and the dissolved oxygen is 6.9 p.p.m.
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).
Principal vegetation: The aquatic vegetation includes *Ipomoea reptans, Pistia stratiotes and Eichhornia crassipes.* There are rice paddies in surrounding areas.
Land tenure: No information.
Conservation measures taken: None.
Land use: Fishing, mainly for *Labeo rohita, Tilapia mossambica, T. nilotica, Ophicephalus striatus, Cyprinus carpio* and *Trichogaster* sp. Other species caught include *Anabas testudineus, Glossogobius giurus, Clarias* sp and the freshwater shrimp *Macrobrachium* sp. Cultivation of rice in surrounding areas.
Disturbances and threats: The intensification of agricultural activities in the immediate vicinity of the lake may result in increased siltation.
Economic and social values: The lake supports a rich fishery, with production estimated at about 1,600 kg per hectare per year.
Fauna: The lake has a diverse fish fauna, and the marshes are known to be important for waterfowl, but few data are available. About 100 Javan Pond-Herons *Ardeola speciosa* were observed in reed marshes on the western shore of the lake in January 1982. This species had not previously been known to occur in the Philippines, and it is assumed that colonization has taken place in recent times (Kennedy *et al., 1984).*
Special floral values: No information.
Research and facilities: Some studies have been carried out on the fisheries.
References: Bureau of Fisheries and Aquatic Resources (1984-85); Kennedy *et al.* (1984).
Criteria for inclusion: lb, le, 2b, 3b.
Source: Haribon Foundation and Perla M. Magsalay.

Wetland name: Lake Sebu
Country: Philippines
Coordinates: 6°14'N, 124°42'E;
Location: *53* km WNW of Buayan, South Cotabato Province, southern Mindanao.
Area: 350 ha.
Altitude: c.700m.
Biogeographical province: 4.26.12.
Wetland type: 14.
Description of site: A small freshwater lake and associated marshes on the southeastern flank of the rugged Tiruray Highlands of South Cotabato. The shoreline of the lake is very indented, and there are two small islands, Tugayo and Rom's. The lake receives water from local run-off and several small rivers. It retains water throughout the year, and has a maximum depth of 45m. The bottom is sandy-mud. Values of 6.8 for the pH, *2.5* for the total hardness (SBV), and 8.0-8.5 p.p.m. for the dissolved oxygen, have been obtained.
Climatic conditions: Humid tropical climate with an average annual rainfall of 934 mm, more or less evenly distributed throughout the year (Type IV). Mean temperatures range from 27°C to 28°C.

Principal vegetation: The aquatic vegetation includes *Eichhornia crassipes, Nymphaea* sp*, Hydrilla* sp, *Ipomoea reptans, Pistia stratiotes* and *Vallisneria* sp. The lake is surrounded by grassland.
Land tenure: The lake is state owned. Surrounding areas have been designated as ancestral lands and reservation areas for cultural minorities.
Conservation measures taken: None.
Conservation measures proposed: The Haribon Foundation has proposed that fish sanctuaries be established in strategic areas to protect the spawning grounds of both indigenous and introduced species.
Land use: Fishing, duck-raising and the harvesting of freshwater shrimps and snails. Major fisheries include *Tilapia* spp*, Ophicephalus striatus, Cyprinus carpio* and *Glossogobius* sp; minor fisheries include *Anabas testudineus,* the freshwater shrimp *Macrobrachium* sp, and the freshwater snails *Vivipara angularis* and *Ampullaria luzonica.* Surrounding areas are inhabited by indigenous tribes and other cultural minorities, including the controversial Tasaday tribe.
Disturbances and threats: None known.
Economic and social values: The lake supports a rich fishery.
Fauna: The lake has a diverse fish fauna, and supports large populations of the freshwater snails *Vivipara angularis* and *Ampullaria luzonica.* No information is available on the waterfowl.
Special floral values: No information.
Research and facilities: Gracia *et al.* have carried out a study of the lake's fishery.
References: Bureau of Fisheries and Aquatic Resources (1984-85); Gracia *et al.* (undated).
Criteria for inclusion: lb, 2b.
Source: Haribon Foundation.

Wetland name: Lake Lanao
Country: Philippines
Coordinates: 07°53'N, 124°15'E;
Location: in the municipalities of Dansalan, Mulundo, Jaraka, Linuk, Bayong, Binidayon, Tugaya and Lanao, Lanao del Sur Province, west-central Mindanao.
Area: 34,700 ha.
Altitude: 710m.
Biogeographical province: 4.26.12.
Wetland type: 14.
Description of site: A large, oligotrophic, freshwater lake in the uplands of west-central Mindanao, formed by the tectonic-volcanic damming of a basin between two mountain ranges and the collapse of a large volcano. Lake Lanao is the largest lake in Mindanao and the second largest in the Philippines. The lake basin is shallowest in the north and becomes progressively deeper towards the south. There is a large area east of the two southern islands with a depth greater than 100m; the average depth is 60.3m and the maximum 112m. The lake is fed by four rivers; its only outlet, the Agus River, flows southwest into Iligan Bay via two channels, one over the Maria Cristina Falls and the other over the Cinnamon Falls. The pH values range from 6.8 to 8.9.
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV). The average annual rainfall varies from 2,864 to 2,890 mm, and the mean monthly temperatures vary between a maximum of 27.6°C and a minimum of 22.2°C.

Principal vegetation: Extensive reed-beds of *Typha* sp around the edges of the lake, and large areas of *Eichhornia crassipes* on the surface. Other common aquatic plants include *Nymphaea nouchali* and *Vallisneria sp.* Most of the surrounding areas have been cleared for agriculture but there is still some primary dipterocarp forest on the nearby Sacred Mountain, and there are patches of secondary dipterocarp forest at Wao.

Land tenure: The lake is owned by the Local Authority; surrounding areas are partly state owned and partly private.

Conservation measures taken: The lake has been declared a National Park and Reserve, and is under the jurisdiction of the Bureau of Forest Development. An environmental impact assessment has been carried out on the National Power Corporation's Hydro-electric Project on the Agus River.

Conservation measures proposed: There is a proposal to conduct further environmental impact assessments of all the hydro-electric projects of the National Power Corporation on the Agus River and at Maria Cristina Falls.

Land use: The lake serves as a reservoir for the generation of hydro-electric power on the Agus River. Other major uses include commercial and sport fishing, and outdoor recreation. The commercially important fishes are mudfish *Ophicephalus striatus,* tilapia *Tilapia spp,* goby *Glossogobius giurus* and cyprinids. Other species in the catches include catfish, climbing perch, plasalit, eels, the freshwater shrimp *(Clarias* sp*, Anabas testudineus, Trichogaster* sp*, Anguilla* sp, *Macrobrachium* sp), and the freshwater snails *Ampullaria luzonica* and *Vivipara angularis.* Grasslands adjacent to the lake are grazed by cattle, water buffalo and goats. There are several towns and many villages around the lake, and Mindanao State University Campus is situated here.

Disturbances and threats: The construction of additional spillways for the hydro-electric power station involves more dredging of river banks and destruction of riparian habitat. Logging in the water catchment area is accelerating soil erosion, and this is causing increased siltation and affecting water quality in the lake. Hunting causes considerable disturbance, and there is some pollution from insecticides and herbicides. The introduction of exotic species of fishes has undoubtedly had some negative effects on the very interesting native fish fauna.

Economic and social values: The lake supports a major fishery, and is important for recreational activities including boating, swimming and sport fishing. The Lanao Lake and Agus River system generates 70% of the electricity used by the people of Mindanao.

Fauna: Lake Lanao is of great limnological interest. The fauna includes many species of fishes and invertebrates, which are endemic to the lake, and presents an outstanding opportunity for research on evolution in the Cyprinids. There are about twenty species of Cyprinidae endemic to the lake including *Puntius (Barbodes) tamarus, P. baolan, P. binotatus, P. clemensi, P. diza, P. flavifucus, P. katolo, P. lanaoensis, P. lindog, P. manalak, P. sirang, P. tras, P. tumba, Cephalocampus pachychilus, Mandibularca resinus, Osphatulus trunculatus, 0. palaemophagus* and *Strattellicypris palata.* Other fishes occurring in the lake include species of Silurid, Anabantid, Anguillid, Ophiocephalid, Centrarchid and Chanid, but many of these have been introduced.

The lake supports large numbers of waterfowl, particularly Ardeidae, Anatidae and Rallidae. Counts have included:

over 500 bitterns *Ixobrychus* spp

500 egrets *Egretta spp*

50 *Ardea purpurea*

200 *Porphyrio porphyrio*
200 *Fulica atra*
100 *Gallinago* spp
and smaller numbers of *Gallicrex cinerea* and *Gallinula chioropus.* Mammals occurring in the area include the wild pig *Sus celebensis* and deer *Cervus* sp.
Special floral values: No information.
Research and facilities: A considerable amount of research has been undertaken on the limnology of the lake and its fish fauna, particularly by Mindanao State University College of Fisheries. A floral and faunal survey of Lake Lanao and its vicinity has been carried out by the Biology Department of the University.
References: An-Lim (1975); Frey (1974); Lewis (1974); Luther & Rzoska (1971); Tawagon (1984).
Criteria for inclusion: lb. le, 2b, 2d, 3b.
Source: Haribon Foundation, Simplicia N. Alonzo-Pasicolan and Perla M. Magsalay.

Wetland name: Lake Dapao
Country: Philippines
Coordinates: 7°48'N, 124°03'E;
Location: 7 km southwest of Ganassi town and Lake Lanao, Lanao del Sur Province, west-central Mindanao.
Area: 1,011 ha.
Altitude: 960m.
Biogeographical province: 4.26.12.
Wetland type: 14.
Description of site: A deep freshwater lake, with a maximum depth of 120m, in the hills southwest of Lake Lanao. It receives water from local run-off and several small rivers. The pH value ranges from 6.5 to 6.7, and the dissolved oxygen level from 7.8 to 8.2 p.p.m.
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).
Principal vegetation: The aquatic vegetation includes *Hydrilla* sp and the filamentous alga *Cladophora* sp.
Land tenure: No information.
Conservation measures taken: None.
Land use: Fishing.Major fisheries include *Ophicephalus striatus, Tilapia mossambica* and *Cyprinus carpio*; minor fisheries include *Glossogobius giurus* and *Clarias* sp.
Disturbances and threats: No information.
Economic and social values: The lake supports a rich fishery.
Fauna: No information.
Special floral values: No information.
Research and facilities: Some work has been carried out on the lake's fishery.
References: None
Criteria for inclusion: lb.
Source: Haribon Foundation.

Wetland name: Panguil Bay
Country: Philippines
Coordinates: 7°56'-804'N, 123°36'-123°46'E;
Location: south of Tangub City, on the boundaries of Misamis Occidental, Zamboanga del Sur and Lanao del Norte Provinces, western Mindanao.
Area: 19,500 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 01, 06 & 07.
Description of site: A shallow sea bay at the head of Iligan Bay, with extensive intertidal mudflats and mangrove swamps.
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).
Principal vegetation: Mangrove swamps.
Land tenure: State owned (Public Domain).
Conservation measures taken: None.
Conservation measures proposed: Sumalig Island in Tambulig District has been proposed as a crocodile sanctuary by government agencies.
Land use: No information.
Disturbances and threats: No information.
Economic and social values: No information.
Fauna: Thought to be an important area for migratory waterfowl, but no data are available. The Estuarine Crocodile *Crocodylus porosus* probably still occurs in the area.
Special floral values: No information.
Research and facilities: None
References: Ross (1984).
Criteria for inclusion: lb, 2a, 3b.
Source: Perla M. Magsalay.

Wetland name: Lake Wood
Country: Philippines
Coordinates: 7°51'N, l23°10'E;
Location: 29 km west of Pagadian City, Margosatubig Municipality, Zamboanga del Sur Province, western Mindanao.
Area: 792 ha.
Altitude: 320m.
Biogeographical province: 4.26.12.
Wetland type: 14.
Description of site: A shallow, freshwater lake with associated marshes in the hills north of Malangas and Igot Bay. The lake is fed by local run-off and several small rivers. Although it becomes very shallow in summer, it does not dry out completely. It overflows through the Bisuangan Creek into the Kumalarang River. The pH value ranges from 6.5 to 7.0, and the dissolved oxygen level from 8.0 to 12.0 p.p.m.
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV).

Principal vegetation: The dominant species around the lake is *Lumbia* sp(Palmae). There are also some marsh grasses and filamentous algae such as *Cladophora* sp. Surrounding areas are under cultivation for coconuts, corn, sweet potatoes and other crops.
Land tenure: The lake is state owned; parts of the surrounding land are under private ownership.
Conservation measures taken: The lake is situated within a Bureau of Forest Development Protected Area. A municipal ordinance prohibits the construction of houses within 50 meters of the lakeshore.
Conservation measures proposed: None
Land use: Fishing. Major fisheries include *Ophicephalus striatus, Tilapia* sp and *Glossogobius giurus*; minor fisheries include *Cyprinus carpio, Anguilla* sp and *Anabas testudineus.*
Disturbances and threats: The lake is threatened by excessive fishing, while adjacent areas are subjected to heavy hunting pressure.
Economic and social values: The lake's fishery is one of the primary sources of food and income for the local people.
Fauna: The lake is known to be of some importance for waterfowl, but no details are available.
Special floral values: No information.
Research and facilities: Some work has been carried out on the lake's fishery.
References: Bureau of Fisheries and Aquatic Resources (1984-85).
Criteria for inclusion: lb.
Source: Haribon Foundation.

Wetland name: Malangas and Igot Bay
Country: Philippines
Coordinates: 7°35'-7°47'N, 123°01'-123°12'E;
Location: east of Malangas and south of Buug, Zamboanga del Sur Province, western Mindanao.
Area: 34,000 ha.
Altitude: Sea level.
Biogeographical province: 4.26.12.
Wetland type: 01, 02, 03, 06 & 07.
Description of site: The inner part of Dumanquilas Bay in the Malangas area and at Igot Bay; a large shallow sea bay with extensive coral reefs, intertidal sand flats and mudflats, mangrove swamps, the estuaries of several small rivers, and numerous small islands (including the Nipa Nipa Islands and Igot Island).
Climatic conditions: Humid tropical climate with the rainfall more or less evenly distributed throughout the year (Type IV). The average annual rainfall is about 2,580 mm, the mean annual temperature 27.6°C, and the mean relative humidity about 83.7%.
Principal vegetation: Mangrove swamps.
Land tenure: The mangroves at Malangas are privately owned; other areas are mainly privately owned.
Conservation measures taken: None.
Conservation measures proposed: There is a plan to prohibit indiscriminate logging in the mangroves at Malangas.

Land use: Subsistence fishing and logging in the mangroves; agriculture and human settlements in surrounding areas.
Disturbances and threats: Indiscriminate logging in the Malangas area and general human encroachment on the wetland habitat are the major threats.
Economic and social values: No information.
Fauna: This area is known to be very rich in waterfowl and reptiles, including several endemic species. Some 29 species of waterfowl and nine species of reptiles have been recorded along with giant toads and swamp frogs.
Special floral values: No information.
Research and facilities: None
References: None
Criteria for inclusion: lb. 2b, 2d, 3b.
Source: Haribon Foundation and Perla M. Magsalay.

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