

# BURMA

## INTRODUCTION

**Area:** 676,581 sq.km.

**Population:** 35,313,905.

Burma extends from latitude 10°N in the extreme south, to latitude 18°N on the northern border with Tibet, a total distance of some 2,093 km. Between these two extremes, there exists an ecological spectrum of almost unique variety, ranging from tropical rain forest and coral reefs in the south to temperate forests of conifers, oaks and rhododendrons in the far north, where snow-capped mountains up to 5,792m mark the eastern extremity of the Himalayas. High mountain ranges form a continuous barrier along the western border with India and Bangladesh, extending southward parallel with the coast almost to the Irrawaddy Delta. In the east, the high crest of the Irrawaddy-Salween divide and the rugged mountains of the Shan Plateau border on China, Laos and Thailand. Between these western and eastern mountain barriers lies the fertile, densely populated basin of the Irrawaddy, with its main tributary, the Chindwin, joining it from the northwest. Burma's other great river, the Saiween, flows south through neighbouring Yunnan and then cuts through the Shan Plateau in deep, heavily forested gorges, before finally reaching the sea in the Gulf of Martaban. In the southeast, Tenasserim extends in a mountainous arm along the Thai border as far as the Kra Isthmus, and includes the hundreds of islands of the Mergui Archipelago in the Andaman Sea to the west.

Apart from the northern uplands of Kachin State, the climate is tropical monsoonal, with a rainy season coinciding with the southwest monsoon from May to October, and a generally well marked dry season from November to April. There are, however, important local variations, with mean annual rainfall ranging from as little as 750 mm in parts of the central dry zone to over 6,350 mm in Tenasserim.

Burma enjoys an unusually high floral and faunal diversity, ranging from typically Himalayan species in the north, to those associated with the Malay Peninsula in the south. The dominant vegetation type is forest, which covers about 42% of the land surface. Mixed deciduous forest, which features economically important teak and other hardwoods, is found throughout the dry zone of central Burma, with the exception of the densely populated Irrawaddy Valley. Evergreen forest is found in less heavily settled areas in the north and south of the country. Freshwater and tidal swamp forests, including mangrove, occur on the coast and in the Irrawaddy Delta, while temperate and alpine forest is found in the extreme north. (IUCN, in prep). Over 7,000 species of flowering plants and some 300 species of mammals, 360 reptiles and almost 1,000 birds have been recorded.

Although the human population is not high by south Asian standards, it is increasing steadily, and with the growth in population, more and more of the natural habitat is being destroyed by clearance for agriculture or exploitation for timber. Deforestation is currently estimated at

some 125,000 ha per year (FAO, 1985a). The loss of forest cover, or severe degradation, has been almost total in the Irrawaddy Delta, in the Irrawaddy and Sittang valleys and in extensive coastal areas. Closed forest cover is now restricted to the less accessible areas in the Arakan and Pegu hill ranges, the Shan Plateau and the northern and southern extremities of the country (IUCN, in prep).

Burma remains the only country in Southeast Asia where extensive natural areas have not yet been established as national parks or other adequately protected areas (MacKinnon & MacKinnon, 1986). Wildlife Sanctuaries cover only 0.7% of the total land area, although reserved forests, which for conservation purposes are in some respects comparable to wildlife sanctuaries, cover some 90,673 sq.km, or 13.4% of the total land area. Whilst nature conservation within designated areas has largely failed, civil unrest, particularly in the north of the country, has hampered intensive settlement and development, with consequent benefits for wildlife in those areas (IUCN, in prep).

In 1980, the Burmese Government requested the Food and Agricultural Organization of the United Nations and the United Nations Development Programme to assist in a joint Nature Conservation and National Parks Project with the Working People's Settlement Board. Objectives included natural ecosystem conservation, protection of endangered flora and fauna, and development of sanctuaries. The principal recommendations made by the project were: (a) formulation of a national conservation policy; (b) enactment of modern conservation legislation; (c) creation of a professional nature conservation agency; (d) establishment of an independent Department of Nature Conservation and National Parks; (e) initiation of public education programmes; and (f) designation of new protected areas (FAO 1985a). However, adoption and implementation of these proposals has been slow, and of the five areas proposed as potential national parks, only Alanguadaw Kathapa has been designated (Blower, 1985).

### **Summary of Wetland Situation**

With a coastline of 2,278 km, several very large estuarine and delta systems and numerous offshore islands, Burma possesses a great wealth and diversity of coastal wetland habitats, including extensive coral reefs, sandy beaches (important for nesting sea-turtles), intertidal mudflats and mangrove swamps. There are an estimated 517,000 ha of mangrove forest in Burma (Saenger *et al.*, 1983), mostly located in the Irrawaddy Delta and on the Tenasserim and Arakan coasts and offshore islands. However, only a small proportion of the mangrove forest remains in an undisturbed condition, and the once extensive forests of the Irrawaddy Delta are now much degraded. The mangroves are important not only as breeding areas for large waterbirds and many commercial fishes and crustaceans, but also as a source of nutrients for the otherwise poor offshore waters.

Many of the offshore islands contain a wide variety of marine and terrestrial habitats in a small area, and are the best localities for conserving coral reefs, mangrove forest and sea-turtle nesting beaches. In particular, islands in the Mergui Archipelago off the Tenasserim coast offer great potential for both conservation of marine ecosystems and eventual tourist development (FAO, 1985a). The remote oceanic islands, such as the Preparis

Islands (14°52'N, 93°41'E) and Coco (14°07'N, 93°22'E), may also be important breeding areas for sea-birds, and should be surveyed to assess their conservation value (FAO, 1985a).

Much the most extensive wetlands in the interior of the country are the seasonally inundated floodplains of the three main river systems: the Irrawaddy-Chindwin, Sittang and Salween. Such plains are estimated to form a surface of some 60,000 sq.km during the four or five months of the monsoon season. When flooded, they provide excellent feeding areas for large numbers of waterfowl and fertile spawning grounds for a number of freshwater fishes, among which species of carp, catfish and perch predominate. Large areas of the floodplains have been bunded and reclaimed for permanent agriculture, particularly in the northern and central portions of the Irrawaddy Delta, and the great majority of land still subject to seasonal inundation is used for cultivation of rice during the dry season. As a consequence, very little natural floodplain habitat remains, except perhaps along some of the larger rivers in remote northern regions.

Permanent freshwater bodies, including the two main lakes, Inle and Indawngy, cover about 130,000 ha. In addition, there are numerous man-made impoundments, tanks and village ponds, and some 41 major reservoirs with a total surface area of about 80,000 ha (FAO, 1980).

Fisheries production from the flood plain wetlands is officially recorded at some 110,000 tons per year, but this seems low considering the intensive levels of exploitation, and suggests statistical under-recording. The fisheries in permanent waters (rivers and lakes) are said to produce 37,000 tons, and freshwater aquaculture 2,400 tons (FAO, 1980).

Only a very small proportion of Burma's wetlands are legally protected within existing reserves. Coastal protected areas are limited to the Thamihla Kyun and Moscos Islands Wildlife Sanctuaries, and there is no current legislation for the establishment of marine protected areas. No freshwater wetlands are protected except for Wethigan Lake (440 ha), which has been designated as a Wildlife Sanctuary. Three important wetlands have, however, been proposed as protected areas, namely Inle Lake, Mong Pai Lake and Mohingyi Lake (IUCN, in prep).

### **Wetland Research**

Very little research seems to have been carried out on the wetlands of Burma, other than forest surveys and inventories in the mangrove forests of the Irrawaddy Delta. The FAO/UNDP Nature Conservation and National Parks Project included preliminary surveys of over 20 potential sites for protection, and several of these were wetlands, notably the southern Irrawaddy Delta, Inle Lake, Mong Pai Lake, Mohingyi Lake and Gyobyu Reservoir. Fisheries research and survey work is still at an early stage of development in Burma, and the facilities of the Department of Fisheries are rather restricted. In recent years, a number of oceanographic and biological observations have been undertaken in Burmese waters by local trawlers and research vessels from the USSR and USA on behalf of the Burmese Government. Fish culture investigations and training courses are centred at the Hlawga Freshwater Fisheries Research Station near Rangoon (FAO, 1980).

The present status of many waterfowl species in Burma is very poorly known, and indeed there has been very little serious ornithological investigation of any kind in the country for many years. However, in the winter of 1987/88, the Wildlife and Sanctuaries Division of the Forest Department conducted waterfowl censuses at three important sites, and intends to continue and expand these counts in the future.

### **Wetland Area Legislation**

The legal protection of natural resources in Burma rests on two acts, both dating from the pre-World War II colonial period. The 1902 Burma Forest Act (amended in 1906, 1912, 1926, 1938 and 1941) repealed all earlier forest acts. This act allows the Ministry of Agriculture and Forests to establish game sanctuaries and reserved forests on any land at the disposal of the government, and places responsibility for their management and protection on the Forest Department. The procedure for establishing reserved forests makes provision for certain activities, such as agriculture, to continue after designation (IUCN, in prep).

The 1902 Forest Act was enhanced by the 1936 Burma Wildlife Protection Act (amended in 1954), which makes provision for the establishment of wildlife sanctuaries on any government-owned land or on private land where the owner's consent has been obtained. The Act prohibits all hunting, fishing and wilful disturbance to any animal in wildlife sanctuaries, and similar activities in reserved forests have to be licensed. In addition, closed hunting seasons were established and a limited number of species received year-round protection. However, as with the 1902 Forest Act, the 1936 Act was not applicable nationwide and certain tribal areas were exempt (IUCN, in prep).

Although the 1902 Forest Act and the 1936 Wildlife Protection Act theoretically provide protection for wildlife in both reserved forests and in wildlife sanctuaries, neither act includes measures specifically to protect habitat. In 1985, new legislation was proposed which would not only strengthen conservation efforts but also for the first time make provision for the establishment of national parks and nature reserves (FAO, 1985b).

### **Wetland Area Administration**

Responsibility for managing game sanctuaries and wildlife sanctuaries lies with the Forest Department, which is one of the oldest in Asia. However, the Forest Department is overshadowed by the politically more influential State Timber Corporation, which has a monopoly on timber exploitation in reserved forests. Direct management of reserved forests and wildlife sanctuaries is carried out by District Forest Officers and their subordinate staff. The Forest Department has not, however, maintained any staff with specific wildlife conservation duties since 1942. Responsibility for the development of the proposed national parks, nature reserves and recreation areas rests with the Working People's Settlement Board, a government agency which is primarily involved in the management of State Agricultural Farms. This body, however, lacks the necessary authority for law enforcement under the existing legislation (IUCN, in prep).

## **Organizations involved with Wetlands**

### a) Governmental Organizations

Ministry of Agriculture and Forests - Planning and Statistics Department

The Director-General is the key government official within the Ministry for approval of international contacts

- Forest Department Wildlife and Sanctuaries Division Planning and Statistics Division

National Forest Survey and Inventory

Working People's Settlement Board

### b) International Organizations

Food and Agriculture Organization of the United Nations (FAO)

## WETLANDS

Site descriptions based on the literature, principally the reports of the FAO/UNDP Nature Conservation and National Parks Project in Burma and the IUCN Directory of Indomalayan Protected Areas (IUCN, in prep).

**Wetland name:** Upper Irrawaddy and Mogawng Chaung

**Country:** Burma

**Coordinates:** 25°45'N, 96°40'E to 23°30'N, 96°00'E;

**Location:** the upper Irrawaddy from the region of Tagaung, 60 km below its confluence with the Shweli, upstream to the region of Myitkyina on the Mali Hka, and the Mogawng Chaung to its headwaters in the region of Shaduzup, southern Kachin State, eastern Sagaing Division and northern Mandalay Division.

**Area:** Area of wetlands unknown; approximately 300 km of the Irrawaddy River and 90 km of the Mogawng Chaung.

**Altitude:** 100-250m.

**Biogeographical Province:** 4.9.4.

**Wetland type:** 11, 12, 13, 14, 15, 18 & 21.

**Description of site:** Large meandering rivers with many islands and sand banks, and the adjacent floodplains with numerous small lakes, marshes, seasonally flooded grassland and swamp forest. The rivers rise in the Kumon and Mangin Range and are mostly slow-flowing in broad valleys with extensive grassy marshes (iwins). The Mogawng Chaung passes through a gorge west of Myitkyina, and the Irrawaddy passes through a gorge north of Bhamo. The most extensive marshes are on the west bank of the Mogawng Chaung 40 km southwest of Myitkyina, on the west bank of the Irrawaddy opposite Bhamo, on both banks of the Shweli near its confluence with the Irrawaddy, and on the east bank of the Irrawaddy near Tonhon. The numerous lakes and ponds are mainly of the oxbow type, with a maximum area of 500 ha. The main Irrawaddy splits into several channels between Tonbon and Tagaung, creating a complex of large islands and sand banks.

**Climatic conditions:** Monsoonal climate; the average annual rainfall in southern Kachin varies between 1,800 mm and 2,500 mm.

**Principal vegetation:** The original vegetation cover in the valleys included extensive areas of short grass, known as iwins. The hills were covered with tropical broad-leaved evergreen forest dominated by species of *Terminalia* and *Shorea*. The present condition of the vegetation is not known.

**Land tenure:** No information.

**Conservation measures taken:** None.

**Conservation measures proposed:** None

**Land use:** No information.

**Disturbances and threats:** Security problems in northern Burma have resulted in a ready supply of firearms, and it is likely that hunting is widespread.

**Economic and social values:** No information.

**Fauna:** No recent information is available. In the early part of this century, the region was noted for its large numbers of wintering waterfowl, particularly Anatidae. Common winter

visitors included *Anser anser*, *A. indicus*, *Tadorna ferruginea*, *Anas penelope*, *A. strepera*, *A. crecca*, *A. poecilorhyncha*, *A. acuta*, *A. querquedula*, *A. clypeata*, *Aythya nyroca*, *A. fuligula*, *Mergus merganser* and *Fulica atra*. Other wintering waterfowl included *Podiceps cristatus*, *Ciconia nigra*, *Anas falcata*, *Aythya baeri*, *Vanellus cinereus*, several species of snipe *Gallinago* and *Larus brunnicephalus*. The area also supported a wide variety of breeding waterfowl including *Tachybaptus ruficollis*, *Phalacrocorax carbo*, *P. niger*, *Anhinga melanogaster*, *Ixobrychus cinnamomeus*, *I. flavicollis*, *Nycticorax nycticorax*, *Ardeola grayii*, *Bubulcus ibis*, *Egretta garzetta*, *E. intermedia*, *E. alba*, *Ardea purpurea*, *A. cinerea*, *Ciconia episcopus*, *Dendrocygna javanicus*, *Sarkidiornis melanotos*, *Nettapus coromandelianus*, *Gallixrex cinerea*, *Porphyrio porphyrio*, *Hydrophasianus chirurgus*, *Metopidius indicus*, *Rostratula benghalensis*, *Esacus recurvirostris*, *Glareola maldivarum*, *G. lactea*, *Vanellus duvaucelii*, *Charadrius dubius*, *Sterna aurantia*, *S. melanogaster*, *S. albifrons* and *Rhynchops albicollis* (Smythies, 1953).

Several rare species of waterfowl are known from this region: the White-bellied Heron *Ardea imperialis* was reported to be fairly common along the upper regions of the Mali Kha to the north; the White-winged Wood-Duck *Cairina scutulata* was formerly quite common in swamp forests and riverine marshes as far south as the Shweli River; the eastern race of the Sarus Crane *Grus antigone sharpii* once nested in the Iwins; and the Masked Finfoot *Heliopais personata* has been reported (Smythies, 1953). All four of these could still occur in the area. The Pink-headed Duck *Rhodonessa caryophyllacea* was recorded in the Bhamo area in the 19th Century. Although there have been no reliable sightings of this species in the wild since 1935 (in Bihar, India), there are recurrent rumours of its continued survival in the remote wetlands of northern Burma.

A small population of the Gharial *Gavialis gangeticus* occurred along the Shweli River in the early part of this century, but there have been no confirmed reports since 1927. The species may now be extinct in Burma (FAO, 1985a).

**Special floral values:** No information.

**Research and facilities:** Because of security problems in north Burma, the region has been closed to foreigners for many years and little if any research has been carried out by Burmese scientists.

**References:** FAO (1985a); Smythies (1953).

**Criteria for inclusion:** 0.

**Source:** Operational Navigation Charts and references.

**Wetland name:** Wetlands in Pidaung Game Sanctuary

**Country:** Burma

**Coordinates:** 25°15'-25°35'N, 97°04'-97°20'E;

**Location:** approximately 20 km west of Myitkyina, on the west bank of the Irrawaddy River in Myitkyina Forest Division, Kachin State.

**Area:** Area of wetlands unknown; Game Sanctuary 70,502 ha.

**Altitude:** 148-1,362m.

**Biogeographical Province:** 4.9.4.

**Wetland type:** 11, 13, 15 & 18.

**Description of site:** The sanctuary comprises rolling hills and valleys, and includes part of the riverine plains along the Irrawaddy to the east. The sanctuary is situated in an

amphitheatre of hills rising to some 2,400m. Underlying strata are probably Irrawaddy alluvial deposits.

**Climatic conditions:** Monsoonal climate. The mean annual rainfall in South Kachin varies between 1,800 mm and 2,500 mm.

**Principal vegetation:** The original vegetation cover of the plains included extensive areas of short grass, known as lwins. The hills were covered with dense tropical broad-leaved evergreen forest dominated by species of *Terniinalia* and *Shorea*. The present condition of the vegetation is not known.

**Land tenure:** No information.

**Conservation measures taken:** The area was originally declared a Game Reserve in October 1917 under the Burma Game Rules, 1917. A southern extension was notified in 1921. Both reserves were notified as a Game Sanctuary in September 1927, with a total area of 71,928 ha. The Pidaung East Extension Reserve (1,300 ha) and the Kamaing Kachin Hill Tract (191 ha) were gazetted as the Pidaung West Extension Reserve in 1938, and added to the sanctuary. During the second World War, parts of the sanctuary were converted to paddy cultivation; these areas have since been excised from the sanctuary (Tun Yin, 1954).

**Conservation measures proposed:** None

**Land use:** There are several villages just outside the sanctuary. Although no details are known, the immediate vicinity of the sanctuary, in common with much of the Irrawaddy valley, is probably heavily settled. The nearest major population centres are Myitkyina, Mogaung, Namti and Mayan, located between one and 12 km to the west.

**Disturbances and threats:** Security problems in northern Burma have led to a ready supply of firearms. This, and the 164 km of roads and paths within the sanctuary, probably leads to widespread poaching. In addition, six villages and three tea plantations have rights over parts of the protected area.

**Economic and social values:** No information.

**Fauna:** Very little recent information is available. Mammals observed in the sanctuary in 1953-54 included *Panthera tigris*, *P. pardus*, a bear, possibly *Selenarctos thibetanus*, *Elephas maximus*, *Bos gaurus*, *B. javanicus*, *Cervus porcinus*, *C. unicolor*, *Muntiacus muntjak*, *Cuon alpinus* and *Sus scrofa* (Tun Yin, 1954). A species of rhinoceros, probably *Dicerorhinus sumatrensis*, was reported in the 1950s, but was not considered to be resident in the sanctuary. Leopard *P. pardus* and Green Peafowl *Pavo muticus* are still present, but *E. maximus* and *B. javanicus*, although relatively abundant to the west of the sanctuary, are not currently present in the sanctuary (Salter, 1983). No information is available on the waterfowl.

**Special floral values:** No information.

**References:** Anon (1937); Burton (1950); FAO (1985a); IUCN (in prep); Salter (1983); Tun Yin (1954 & 1955).

**Criteria for inclusion:** 0.

**Source:** See references.

**Wetland name:** Indawngy Lake

**Country:** Burma

**Coordinates:** 25°03'-25°15'N, 96°18'-96°25'E;

**Location:** 110 km WSW of Myitkyina, Kachin State.



**Area:** c.12,000 ha.

**Altitude:** 169m.

**Biogeographical Province:** 4.9.4.

**Wetland type:** 14.

**Description of site:** A large, permanent, freshwater lake set in a broad valley, with an extensive marshy area to the north and northeast. The lake is fed by runoff from the surrounding hills (peaks to 1,550m), and drains northeast via a small river for a distance of 45 km into the Mogawng Chaung, a tributary of the Irrawaddy.

**Climatic conditions:** Monsoonal climate. The average annual rainfall in southern Kachin State varies from 1,800 to 2,500 mm.

**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:** Very little information is available. The lake is thought to be an important area for waterfowl, particularly wintering Anatidae. The Masked Finfoot *Heliopais personata* has been recorded (Smythies, 1953).

**Special floral values:** No information.

**Research and facilities:** Because of security problems, the region has been closed to outsiders for many years, and the lake does not appear to have been investigated for at least forty years.

**References:** Smythies (1953).

**Criteria for inclusion:** 0.

**Source:** Operational Navigation Charts.

**Wetland name:** Kyatthin Wildlife Sanctuary

**Country:** Burma

**Coordinates:** 23°30'-23°42'N, 95°24'-95°40'E;

**Location:** approximately 180 km NNW of Mandalay in Kanbalu township, upper Sagaing Division.

**Area:** Area of wetlands unknown; Wildlife Sanctuary 26,820 ha, comprising Kyatthin Wildlife Sanctuary (9,787 ha), Kyatthin Fuel Reserve (12,129 ha) and Kyatthin Extension Reserve (4,924 ha).

**Altitude:** 180-240m.

**Biogeographical Province:** 4.9.4.

**Wetland type:** 11, 12, 13, 15 & 18.

**Description of site:** The sanctuary lies between the Mu and Irrawaddy rivers, and has flat to undulating topography with a limited area of gullies and ridges in the west. Relatively straight and narrow streams drain the sanctuary and flow into the Mu River, a tributary of the Irrawaddy. Isolated pools remain in the drainage courses throughout the dry season, and a number of large, permanent ponds in the centre of the sanctuary, linked with seasonally flooded grassy depressions known as Iwins, ensure a year-round water supply. The streams

in the sanctuary have cut through a layer of alluvium to the underlying Tertiary sandstone, conglomerates and shales.

**Climatic conditions:** The sanctuary is located on the northern edge of Burma's Dry Zone, and thus has a low annual rainfall of about 1,100-1,500 mm. The monsoon season from June to October is characterized by erratic showers, light southerly winds, moderate temperatures and overcast conditions. Maximum and minimum temperatures at Shwebo, some 100 km to the south, range between 40.5°C and 3.0°C, with a mean annual temperature of 29.4°C.

**Principal vegetation:** The vegetation has been modified as a result of the extraction of firewood and annual burning of the grassland. Deciduous dipterocarp forest covers most of the sanctuary, and is dominated by *Dipterocarpus tuberculatus*, *Shorea oblongifolia* and *Pentacme siarnensis*. On more shallow, eroded soils and in areas of abandoned cultivation, secondary growth and scrub predominate, with some bamboo, particularly near the northeastern boundary. The Iwins support a variety of tall grasses, and there are areas of aquatic vegetation as well as paddy cultivation. A 6.4 km wide strip, centered about an abandoned railway line, has been extensively planted for fuel wood, mainly *D. tuberculatus* with some *Eucalyptus* sp (FAO, 1982a).

**Land tenure:** No information.

**Conservation measures taken:** The Wildlife Sanctuary was established under Department of Agriculture and Forests Notification No.1 1 7 dated 19 June 1941. Under this notification, the Kyatthin Fuel Reserve and the Kyatthin Extension Reserve became incorporated into the newly constituted Wildlife Sanctuary. The sanctuary was established to protect Thamin (*Cervus eldi thamin*), which receive nationwide protection from hunting under the 1936 Burma Wildlife Protection Act.

**Conservation measures proposed:** In 1982, FAO made a series of recommendations aimed at safeguarding the Thamin population. These included: (a) appointment of a sanctuary superintendent and ten guards; (b) construction of an office in the sanctuary; (c) control over bullock-cart traffic; (d) regulation of the extraction of forest produce; (e) initiation of research into Thamin ecology; and (f) realignment of the boundaries to exclude two villages from the sanctuary and to explore the possibility of its expansion to the south (FAO, 1982a). Blower (1983) recommended that the status of the sanctuary be upgraded to Nature Reserve.

**Land use:** The sanctuary embraces three villages with a combined population of about 1,000 people. In addition, 17 villages are located on the periphery of the sanctuary. The principal occupations of the inhabitants are agriculture, with rice and other crops being grown. Some 688 households have legal rights to collect timber for house-posts, fuel wood, bamboo, thatching and other forest products, in addition to holding grazing rights for 3,464 cattle. Much of the sanctuary is burnt annually to promote grass growth, and the resumption of fuel wood extraction from the plantations straddling the railway is being considered (FAO, 1982a).

**Disturbances and threats:** The sanctuary is quite densely settled and is heavily used for agriculture, grazing and extraction of fuel wood and other forest products. Bullock-cart traffic has led to disturbance to wildlife and also facilitates poaching, although the latter appears to be limited at present (FAO, 1982a).

**Economic and social values:** The sanctuary is of considerable value for scientific research, but is not considered to be of sufficient general interest to become a major tourist attraction.

**Fauna:** The sanctuary supports the largest population of Thamin *Cervus eldi thamin* in a protected area in Burma, and the only population which can be regarded as truly viable

(Blower, 1983). This subspecies is considered to be virtually extinct outside the country. Recent population censuses indicate that some 2,200 animals live in the sanctuary (FAO, 1985a; Salter & Sayer, 1986), in contrast to earlier estimates of between 50 and 500 individuals (FAO, 1983a). The only other Thamin in a protected area are an estimated minimum of 240 animals in Shwese-taw Wildlife Sanctuary, some 450 km to the southwest. Other noteworthy mammals include *Panthera pardus*, *Cuon alpinus* (reportedly common), a small number of Banteng *Bos javanicus* and *Cervus porcinus*. *Cervus unicolor*, *Muntiacus munitjak*, *Sus scrofa* and a macaque *Macaca* sp also occur (FAO, 1982a).

The avifauna includes a number of species which are restricted within Burma to the dry zone. Little information is available on the waterfowl. The endangered White-winged Wood-Duck *Cairina scutulata*, formerly reported present (Tun Yin, 1954), may still occur in the sanctuary, and *Ciconia nigra* and *C. episcopus* were recorded in April 1982. Reptiles include the Burmese Python *Python molurus bivittatus*.

**Special floral values:** No information.

**Research and facilities:** The area was surveyed in 1982 (FAO, 1982a). A rest house at Kinsan, in the centre of the sanctuary, was destroyed by fire in 1982.

**References:** Blower (1983); FAO (1982a, 1983a & 1985a); IUCN (in prep); Karpowicz (1985); Salter (1983); Salter & Sayer (1986); Tun Yin (1954).

**Criteria for inclusion:** lb. 2a.

**Source:** See references.

**Wetland name:** Inle Lake

**Country:** Burma

**Coordinates:** 20°27'-20°40'N, 96°52'-96°57'E;

**Location:** about 25 km SSW of Taunggyi, in the Balu Chaung Valley of Southern Shan State Forest Division, Shan State.

**Area:** 15,811 ha.

**Altitude:** 853m; nearby hills rise to 1,524m.

**Biogeographical Province:** 4.10.4.

**Wetland type:** 14 & 19.

**Description of site:** Inle Lake lies in the steep-sided, flat-bottomed Balu Valley. It extends for some 23 km in a north-south direction and has a maximum width of about 6.5 km. The lake is shallow, rarely exceeding 5m in depth, and is studded with floating islands of vegetation. The northern part of the lake is fringed with extensive marshes backed by a large area of rice paddies. Large portions of the lake, particularly along the western shore, have been reclaimed by infill for villages or converted into floating vegetable gardens. The lake is silting up rapidly with a consequent decrease in area of open water and a changing shoreline configuration. Seasonal fluctuations in water level are small.

**Climatic conditions:** The climate is monsoonal with an average annual rainfall of about 1,370 mm. The wettest period is May to September, although dry season rain on the Shan Plateau is more frequent than elsewhere in Burma. Although frosts are unknown, the climate is cool due to altitude, and persistent mists occur.

**Principal vegetation:** Much of the lake is covered by floating aquatic vegetation, including *Eichhornia crassipes*, and there are extensive fringing reed-beds of *Phragmites* and *Typha*, particularly to the north. In places, the vegetation mat is sufficiently stable to support

willows (*Salix* sp). There is a small area of seasonally flooded fig (*Ficus* sp) to the north of Yaungshwe. The lake dwelling Intha people cut strips off the vegetation mat and transport them to other parts of the lake to use as floating gardens. This activity has led to a mosaic of invasive species including water lilies. Most of the surrounding marshy plains have been converted to rice paddies.

**Land tenure:** No information.

**Conservation measures taken:** None.

**Conservation measures proposed:** It has been proposed that the lake and its immediate environs be designated as a Wildlife Sanctuary (FAO, 1985a & 1985b; Sayer & Saw Han, 1983).

**Land use:** Inle Lake and its surroundings formerly constituted the semi-independent Shan State of Nyaungshwe. The lake itself is currently occupied by the Intha people who migrated from Tenasserim in the 18th century. A number of pagodas are located in and around the lake and a religious festival takes place annually in September and October (Sayer & Saw Han, 1983). The region is densely populated, with some 70,000 Intha in residence. Most of these people live in houses on stilts in the lake and cultivate extensive floating gardens. Other occupations include fishing, weaving and metalwork. Khaungdine, a village on the west shore

of the lake, is a vacation camp site for model workers and outstanding students. The towns of Nyaungshwe and Mong Hsawk are located on the shores of the lake.

**Disturbances and threats:** The considerable human population subjects the waterfowl to intensive shooting, trapping and egg collection, in addition to competition for food from fishing activities. Consequently, the bird populations are now much depleted. Apparently, migratory ducks and shorebirds are brought to the local markets by the basket-full in autumn (Sayer & Saw Han, 1983). There is considerable disturbance to the lakeside vegetation, and discharge of effluent into the lake may pose a pollution hazard (FAO, 1985a).

**Economic and social values:** Inle Lake is famous for its leg-rowers, floating villages and floating markets. Large numbers of domestic and overseas tourists visit the area both to see the Intha and to buy their produce. The peak number of visitors occurs during the pagoda festival.

**Fauna:** A very important area for waterfowl; the lake is visited by large numbers of migratory waterbirds during the winter months, and supports a variety of resident species such as *Tachybaptus ruficollis*, *Phalacrocorax niger*, many herons and egrets, *Dendrocygna javanica*, *Nettapus coromandelianus*, *Porzana fusca*, *Amaurornis phoenicurus*, *Gallicrex cinerea*, *Porphyrio porphyrio* (common), *Hydrophasianus chirurgus* (up to 420) and *Metopidius indicus*. Some 3,000-4,000 ducks were present in late December 1982, and over 13,000 in March 1983 (Thet Tun & Sayer, 1983). The great majority of these were *Anas querquedula* (10,000 in March) and *Dendrocygna javanica* (up to 2,500), but also recorded were:

at least 250 *Anas poecilorhyncha*

250 *A. acuta*

250 *A. clypeata*

300 *Aythya nyroca*

Large numbers of herons and egrets were present in January 1987 and January 1988, including:

up to 300 *Ardeola grayii*

1,000 *Bubulcus ibis*  
310 *Egretta garzetta*  
280 *E. intermedia*  
200 *E. alba*

Other winter visitors have included *Anastomus oscitans* (six in February 1973), *Plegadis falcinellus* (five in January 1987), *Anas falcata* (maximum of six in January 1979), *Aythya baeri* (maximum of five in January 1982), *Rallus aquaticus*, *Himantopus himantopus* (up to 330), *Vanellus cinereus*, *Pluvialis dominica*, *Tringa glareola*, *Gallinago gallinago* (common), *G. stenura*, and *Larus brunnicephalus* (up to several hundred). Small numbers of *L. ridibundus* have also been reported in winter (King, 1983; D.A. Scott). The endangered eastern race of the Sarus Crane *Grus antigone sharpii* is said to occur in small numbers in the marshes between Inle Lake and Mong Pai Lake, 30 km to the south (Sayer & Saw Han, 1983).

The extensive marshes support a significant population of the rather rare and local Jerdon's Bushchat *Saxicola jerdoni*. The area is important for wintering birds of prey (*Circus aeruginosus*) *splonotus*, *C. cyaneus*, *C. melanoleucos* and *Aquila clanga*, hirundines (notably *Riparia riparia*, *Hirundo rustica*), the wagtails (*Motacilla citreola*, *M. flava*), several pipits and warblers (*Anthus spp*, *Acrocephalus spp* and *Phylloscopus spp*). The Striated Warbler *Megalurus palustris* is common.

The rich fish fauna includes the so called Inle Carp, which is said to grow up to one metre in length (Thet Tun & Sayer, 1983).

**Special floral values:** No information.

**Research and facilities:** The lake was surveyed in December 1982 and March 1983 (Sayer & Saw Han, 1983). King (1983) made some ornithological observations in 1972, 1973, 1979 and 1982, and waterfowl counts were carried out in January 1987 (D.A. Scott) and January 1988 (Pyone Pyone Aye, Khin Ma Ma Thwin and Shein Gay Ngai). A youth camp is located on the western shore and a hotel is planned for the Kaudaing hot-spring in the same area. The Hotel and Tourist Corporation provides boat trips and maintains a bungalow at the lake.

**References:** FAO (1985a & 1985b); IUCN (in prep); King (1983); Sayer & Saw Han (1983); Smythies (1953); Thet Tun & Sayer (1983); van der Yen (1987).

**Criteria for inclusion:** lb, 2a, 2b, 3b.

**Source:** Derek A. Scott and references.

**Wetland name:** Mong Pal Lake Proposed Wildlife Sanctuary

**Country:** Burma

**Coordinates:** 19°47'-20°12'N, 96°45'-97°06'E;

**Location:** about 30 km south of Inle Lake, in the Balu Chaung Valley of Southern Shan State Forest Division, Shan State.

**Area:** 62,208 ha.

**Altitude:** 840m.

**Biogeographical Province:** 4.10.4.

**Wetland type:** 15 & 17.

**Description of site:** A large hydro-electric and irrigation reservoir in the steep-sided, flat-bottomed Balu Valley. The lake was created in 1971-72 after the construction of a dam on the Balu River at Mong Pai, 65 km downstream from the outlet of Inle Lake. The

reservoir is 56 km long and mostly between five and 16 km wide. It contains a number of islands including Loi Pan Sone (1,236 ha), Ho Tein (1,198 ha) and Lonka (1,175 ha). At the end of the dry season and for much of the monsoon period, the water level is low; extensive mudflats are exposed and some of the islands become connected to the shore. The Balu valley to the north contains a mosaic of small lakes and marshes, and may sometimes be inundated.

**Climatic conditions:** The climate is monsoonal with an average annual rainfall of about 1,370 mm (at Inle Lake, 30 km to the north). The wettest period is May to September, although rain during the dry season is more frequent on the Shan Plateau than elsewhere in Burma.

**Principal vegetation:** There is relatively little aquatic vegetation because the lake is still young and is subject to extensive drying out. There is some *Eichhornia crassipes* along the margins, and rather sparse sedges and grasses emerge from the shallow water along the northwest shore of the lake. It seems likely that the extensive shallows in the northern part of the lake will eventually be colonized by dense marshes of reeds and grasses. The three larger islands and adjacent hills are covered with dry upper mixed deciduous forest. Some of the small islets to the north of Ho Tein island have a few trees rooted in shallow water.

**Land tenure:** No information.

**Conservation measures taken:** None.

**Conservation measures proposed:** It has been proposed that the lake and its immediate environs be designated as a Wildlife Sanctuary (FAO, 1985a & 1985b; Sayer & Saw Han, 1983). The Forest Department has also proposed that an extensive area of the Balu Chaung Valley extending from the Mong Pai Dam to south of Lawsawk be designated as a Catchment Protection Area (FAO, 1985a).

**Land use:** There are several villages on the shores of the lake. The principal livelihood is fishing and farming; crops include coffee, citrus fruit and barley.

**Disturbances and threats:** The local human population causes some disturbance to waterfowl populations, but much less so than at Inle Lake to the north.

**Economic and social values:** No information.

**Fauna:** A very important wintering area for migratory waterfowl, supporting a higher diversity and density of species than Inle Lake. Waterfowl observed by Sayer and Saw Han (1983) during a brief survey in February and March 1983 included at least 250 *Tachybaptus rutilcollis* and:

150 *Phalacrocorax carbo*

100 *Egretta intermedia*

25 *Ardea purpurea*

50 *A. cinerea*

400 *Dendrocygna javanica*

300 *Nettapus coromandelianus*

2,000 *Anas penelope*

300 *A. poecilorhyncha*

50 *A. acuta*

500 *A. querquedula*

10 *Aythya nyroca*

2,000 *Fulica atra*

Other waterbirds recorded during the survey included *Ardeola grayii*, *Bubulcus ibis*, *Jgretta garzetta*, *E. alba*, *Pandion haliaetus*, *Circus melanoleucos*, *Hydrophasianus chirurgus*, *Metopidius indicus*, *Tringa glareola*, *Gallinago* sp and *Larus brunnicephalus*. There is a small breeding colony of herons and egrets on an islet to the north of Ho Tein island. The endangered eastern race of the Sarus Crane *Grus antigone sharpii* is said to occur in small numbers in the marshes between Mong Pai Lake and Inle Lake. A six month old crane seen in captivity in March 1983 reportedly came from somewhere in the Mong Pai area (Sayer & Saw Han, 1983). However, local people report that the numbers of cranes have decreased markedly in recent years, and the population, if it still exists, must be considered to be seriously endangered.

**Special floral values:** None known.

**Research and facilities:** The lake was surveyed in February and March 1983 (Sayer & Saw Han, 1983). Good accommodation facilities are available at the dam site.

**References:** FAO (1985a & 1985b); IUCN (in prep); Sayer & Saw Han (1983); Thet Tun & Sayer (1983).

**Criteria for inclusion:** 2b, 3b.

**Source:** See references.

**Wetland name:** Wethigan Wildlife Sanctuary

**Country:** Burma

**Coordinates:** 20°34'N, 94°38'E;

**Location:** one km west of Salin Town and 50 km NNW of Minbu, Minbu District, Magwe Division.

**Area:** 440 ha.

**Altitude:** 60m.

**Biogeographical Province:** 4.4.1.

**Wetland type:** 14.

**Description of site:** The sanctuary comprises an oval lake of approximately 200 ha, featuring minor bays and indentations, and surrounded by marshes. It lies some 16 km west of the Irrawaddy River and two km east of the Salin River. The catchment area of the lake is limited, and there are no perennial inflowing or out flowing streams. Water depth varies from less than 0.5m to 2.0m, depending on the season. The basement sediment comprises unconsolidated, anaerobic organic material, and the lake is highly eutrophic.

**Climatic conditions:** The sanctuary lies within the dry zone, and has an average annual rainfall of only 750 mm. The southwest monsoon from June to October is strongly attenuated; there is a cool season from November to February and a hot, dry season from March to May.

**Principal vegetation:** Tall secondary scrub and scattered trees grow on the shore, whilst dense stands of *Typha* sp, up to 2m high, fringe the lake. Water lotus, possibly *Nymphaea* sp, covers large areas of open water. The lake and marshes are surrounded by secondary forest and cultivation.

**Land tenure:** No information.

**Conservation measures taken:** The site has been protected as a Wildlife Sanctuary since September 1939. The original sanctuary notification granted farmers the right to scare birds off crops, albeit without recourse to inflicting injury. Local people were given rights to graze

and water their cattle, and to collect lotus leaves, fruits and grass without restriction. Forest Department staff patrol the lake twice daily to curb hunting and fishing, and attempts to remove squatters and to control agricultural expansion in the sanctuary have been made (FAO, 1982b).

**Conservation measures proposed:** In 1982, it was recommended that (a) the sanctuary retains its present status; (b) activities should be restricted to those specifically mentioned in the original notification; (c) a full time officer should be appointed to the sanctuary; (d) the boundary should be clearly demarcated; (e) water levels should be monitored and, if necessary, some vegetation cleared to maintain open water habitat; and (f) comprehensive faunal surveys should be undertaken (FAO, 1982b).

**Land use:** The sanctuary is heavily used for livestock grazing and the collection of lotus leaves, fruits and fodder, while illegal hunting and fishing are widely practiced (FAO, 1982b). The environs of the protected area are fully settled, and there is a monastery adjacent to the lake.

**Disturbances and threats:** The principal problem is the small size of the sanctuary. Hunting, egg collection, fishing and habitat destruction all threaten the value of the site (FAO, 1982b), and both human habitation and cultivation have encroached on the sanctuary. Uncontrolled growth of lotus and *Typha* may eventually result in filling in of the lake and reversion to dry land.

**Economic and social values:** The sanctuary was established for waterfowl protection, and is valued as it covers a habitat that is rare in Burma, namely marsh and freshwater lake. Wethigan is the only protected freshwater wetland in the country.

**Fauna:** Tun Yin (1954) lists 64 species of birds known to occur in the sanctuary. Waterfowl recorded during a brief survey in June and July 1982 included *Tachybaptus ruficollis*, *Ixobrychus cinnamomeus*, *Bubulcus ibis*, *Dendrocygna javanica*, *Sarkidiornis melanotos*, *Nettapus coromandelianus*, *Anas poecilorhyncha*, *Porphyrio porphyrio*, *Himantopus himantopus* and *Charadrius dubius* (FAO, 1982b). However, the greatest numbers of birds are said to occur between November and February, when migratory ducks and shorebirds predominate. Some 200 *Anastomus oscitans* were observed in nearby rice paddies in July 1982, along with six *Mycteria leucocephala* and one *Ciconia episcopus* (Luthin, 1984).

**Special floral values:** No information.

**Research and facilities:** The sanctuary was briefly surveyed in 1982 (FAO, 1982b). It has not been developed as a tourist attraction, and there are no facilities for visitors.

**References:** FAO (1982b & 1985a); IUCN (in prep); Karpowicz (1985); Luthin (1984); Tun Yin (1954).

**Criteria for inclusion:** lb.

**Source:** See references.

**Wetland name:** Kaladan Estuary, Hunter's Bay and Combermere Bay

**Country:** Burma

**Coordinates:** 18°40'-20°30'N, 92°40'-94°10'E;

**Location:** on the Arakan coast from the Mayu estuary and region of Sittwe in the north to the Kaleindaung estuary and region of Taungup in the south, Rakhine State.

**Area:** c.500,000 ha.

**Altitude:** Sea level.



**Biogeographical Province:** 4.4.1.

**Wetland type:** 01, 02, 03, 05, 06, 07, 11, 13, 18 & 19.

**Description of site:** A vast complex of shallow sea bays and estuarine systems, with numerous islands, tidals channels and creeks, extensive mangrove swamps and alluvial plains. Several of the larger islands are hilly, rising to over 300m. The site extends for some 250 km from northwest to southeast, and is up to 60 km wide. It includes the estuarine systems of the Mayu River, Kaladan River, Mm Chaung, Kun Chaung, Amyek An Chaung, Lamu Chaung, Kaleindaung, Tanlwe Chaung, Tauagup Chaung and many smaller rivers, all draining the Arakan Yoma hills which rise abruptly to the east. Some of the most extensive mangrove swamps are situated between Ramree Island and the mainland coast in the south. Large areas of the coastal plain and mangrove swamps have been converted to rice paddies, particularly in the floodplains and estuaries of the Mayu and Kaladan rivers in the north. There are extensive intertidal mudflats along the northern edge of Hunter's Bay, around parts of Combermere Bay and in the Kaleindaung estuary. Coral reefs fringe the outer coasts of some of the larger islands.

**Climatic conditions:** Tropical monsoonal climate.

**Principal vegetation:** Mangrove forest. Some of the larger islands support tropical evergreen forest. The Arakan Yoma to the east are covered in dense tropical evergreen forest and pure stands of bamboo.

**Land tenure:** No information.

**Conservation measures taken:** One of the largest remaining stands of mangrove forest is included within the Wunbaik Reserved Forest.

**Conservation measures proposed:** None

**Land use:** No information.

**Disturbances and threats:** Much of the coastal plain and mangrove forest has already been converted to agricultural land, and this destruction of wetland habitat presumably continues. Some illicit hunting of crocodiles reportedly still occurs, large individuals being killed by spearing. Crocodiles are also caught accidentally in fishing nets.

**Economic and social values:** No information.

**Fauna:** During the early part of the present century, the area was of considerable importance for a wide variety of both resident and migratory waterfowl. Smythies (1953) lists the following as resident species: *Tachybaptus ruficollis*, *Phalacrocorax niger*, *Anhinga melanogaster*, twelve species of Ardeidae including *Egretta sacra*, *Ardea imperialis* and *A. sumatrana*, *Ciconia episcopus*, *Plegadis falcinellus*, *Dendrocygna bicolor*, *D. javanica*, *Cairina scu,ulata*, *Sarkidiornis melanotos*, *Nettapus coromandelianus*, *Grus antigone sharpii*, *Amaurornis akool*, *Gallicrex cinerea*, *Porphyrio porphyrio*, *Heliopais personata*, *Hydrophasianus chirurgus*, *Metopidius indicus*, *Esacus recurvirostris*, *Glareola maldivarum*, *G. lactea*, *Vanellus duvaucelii*, *Sterna aurantia*, *S. melanogaster* and *S. albifrons*. Regular winter visitors and passage migrants included *Gorsachius melanolophus*, *Anastomus oscitans*, *Ephippiorhynchus asiaticus*, *Leptoptilos javanicus*, *Threskiornis melanocephalus*, *Platalea leucorodia*, eleven species of Anatidae (including *Anas falcata* and *Aythya baeri*), over 30 species of shorebirds and *Larus brunnicephalus*. There are 19th Century records of the Pink-headed Duck *Rhodonessa caryophyllacea*.

Very little recent information is available, and the present status of waterfowl in the area is unknown. Some 200 *Anastomus oscitans* were reported north of Taungul in October 1982, and nine *Leptoptilos javanicus* were observed in coastal fields in February 1983 (Luthin,

1984). A population of the Estuarine Crocodile *Crocodylus porosus* still survives in the extensive mangrove swamps to the east of Ramree Island, although numbers have decreased greatly since the early 1960s, when the species was considered to be common.

Marize turtles are known to nest widely along the Arakan coast, but no details are available.

**Special floral values:** No information.

**Research and facilities:** Very little research of any kind has been carried out in the area in recent decades, presumably because of security problems.

**References:** Blower (1983); FAO (1985a); Karpowicz (1985); Luthin (1984); Smythies (1953).

**Criteria for inclusion:** lb, 2a, 3b.

**Source:** See references.

**Wetland name:** Mohingyi Lake

**Country:** Burma

**Coordinates:** 17°30'-17°36'N, 96°32'-96°41'E;

**Location:** 25 km NNE of Pegu, east of the Rangoon to Mandalay highway, southern Pegu Division.

**Area:** 9,060 ha.

**Altitude:** 7-1 lm.

**Biogeographical Province:** 4.4.1.

**Wetland type:** 17 & 19.

**Description of site:** A large, shallow, water storage reservoir on the Sittang plain, about 24 km west of the Sittang River and 45 km from the coast. The reservoir was constructed in 1904 in a flat area at the headwaters of the Zwebat Creek and Malaka Chaung, to provide water for a canal linking the Sittang and Pegu rivers. The bund is 5-9m high, with two sluices in the east draining into the canal and thence to the Sittang River. The water level reaches a maximum in about September, and by the end of the dry season, large areas are completely dry, although some fairly extensive lagoons and channels remain flooded throughout the year. As the water level recedes, the exposed mudflats are converted into rice paddies. The reservoir is surrounded by almost treeless agricultural land, much of which is seasonally flooded. The geology of the area comprises old alluvium, deeply incised by rivers, and more recent alluvial deposits confined to the existing drainage courses and their floodplains.

**Climatic conditions:** Tropical monsoonal climate typical of southern Burma, with some 3,200 mm rainfall during the May to October monsoon.

**Principal vegetation:** The reservoir supports a variety of marsh plant communities including water lilies, aquatic grasses and reeds which sometimes break free to form rafts. A few trees and shrubs grow on the bunds. Surrounding areas are mostly under cultivation for rice.

**Land tenure:** State owned.

**Conservation measures taken:** None.

**Conservation measures proposed:** A proposal has been made to designate the reservoir and its environs as a Wildlife Sanctuary, and the final draft notification has been deposited with the Government (FAO, 1985a). It is proposed that people should be allowed to continue fishing in the reservoir, but that a few small areas should be fully protected as breeding sites for water birds. A simple rest house and boat should be provided for visitors (FAO, 1985a).

**Land use:** The area is densely populated. The reservoir is very intensively fished; there are several duck farms along the western margin, and large numbers of domestic water buffalo and some cattle graze in the marshes. Hunting is widespread. Surrounding areas are almost entirely under cultivation for rice.

**Disturbances and threats:** The large human population, particularly near the western shore of the lake, and intensive fishing activities cause a considerable amount of disturbance to water birds. There is a great deal of hunting and collecting of birds' eggs. This constant disturbance and persecution is probably the main reason that bird populations are now well below the apparent carrying capacity of the wetland. The populations of some of the larger waterbirds are also limited by the lack of undisturbed nesting sites. This problem could be partially overcome by the construction of artificial islands with nesting trees.

**Economic and social values:** No information.

**Fauna:** An important area for both resident and migratory waterfowl. In the 19th Century, enormous concentrations of waterfowl were recorded on the Sittang plain in this general area, and the region was famous for its duck-hunting. In recent years, however, the numbers of birds using Mohingyi Lake have been comparatively low, probably because of the high levels of disturbance. Less than 1,000 waterfowl were recorded during censuses in early February 1987 and January/ February 1988. These included:

up to 50 *Phalacrocorax niger*

300 *Bubulcus ibis*

50 *Egretta intermedia*

46 *Anastomus oscitans*

19 *Threskiornis melanocephalus*

185 *Dendrocygna javanica*

140 *Anas crecca*

60 *Pluvialis dominica*

along with small numbers of *Tachybaptus ruficollis*, *Anhinga melanogaster*, *Ixobrychus sinensis*, *Ardeola grayii*, *Egretta garzetta*, *E. alba*, *Ardea purpurea*, *A. cinerea*, *Tadorna ferruginea*, *Nettapus coromandelianus*, *Anas acuta*, *Porphyrio porphyrio*, *Metapidius indicus*, *Vanellus cinereus*, *Charadrius dubius*, *C. alexandrinus*, *Numenius arquata*, *Tringa nebularia*, *T. ochropus*, *T. glareola*, *Gallinago gallinago*, *G. stenura*, *Calidris temminckii*, *C. ferruginea*, *Larus brunnicephalus*, *Chlidonias hybrida*, *Sterna aurantia* and *S. albifrons*. Other species known to occur at the lake include *Mycteria leucocephala* (30 in December 1982) and *Sarkidiornis melanotos*. In May 1983, some 70 *Anastomus oscitans* and 50 *Threskiornis melanocephalus* were present.

**Special floral values:** No information.

**Research and facilities:** The area was surveyed in December 1982 and May 1983 (FAO, 1985a), and waterfowl censuses were carried out in February 1987 (D.A. Scott) and January and February 1988 (Maung Maung Soe and Mm Tung Aung).

**References:** FAO (1985a); IUCN (in prep); Karpowicz (1985); Luthin (1984); van der Yen (1987).

**Criteria for inclusion:** 2b, 3b.

**Source:** Derek A. Scott and references.

**Wetland name:** Gyobyu Reservoir

**Country:** Burma

**Coordinates:** 17°21'-17°26'N, 96°02'-96°05'E;

**Location:** in the southwestern extremity of the Pegu Yoma hill range, near Taikkyi Township, 65 km north of Rangoon, Rangoon Division.

**Area:** 518 ha.

**Altitude:** 65m.

**Biogeographical Province:** 4.4.1.

**Wetland type:** 17.

**Description of site:** A small water storage reservoir with a catchment basin of 3,344 ha, surrounded by the Hlaing Yoma and Paunglin Reserved Forests. The reservoir was created in 1940 by damming the Gyobyu Chaung. It has a highly convoluted shoreline, numerous islands and a maximum depth of 30m. Although the surface area remains fairly constant, the water depth fluctuates by up to 9m between wet and dry seasons. The catchment area consists of slopes, ridges and valleys with a network of streams draining off the southwestern spur of the Pegu Yoma hills. Some of the streams are perennial. Steeply sloping hills surround the reservoir, resulting in an absence of a foreshore even at low water levels. Soils are generally light, and either sandy or loamy.

**Climatic conditions:** Tropical monsoonal climate with an average annual rainfall of about 2,500 mm, most of which falls between June and October. A cold dry season persists from November to February, and a hot dry season from March to May.

**Principal vegetation:** The steep shoreline of the reservoir has largely precluded development of emergent aquatic vegetation, but there are floating mats of grasses. The mixed deciduous forest on the surrounding slopes and ridges features an open to scattered tree cover, which includes *Tectona* sp and *Xylia dolabriformis* with an understorey of bamboo. Evergreen forest is found in the moister valley bottoms, and is characterized by heavier stocking of larger trees, principally *Dipterocarpus* spp, and an understorey of canes and creepers.

**Land tenure:** State owned; administered by the Rangoon City Development Corporation.

**Conservation measures taken:** Prior to the construction of the dam in 1940, the area was part of the Hlaing Yoma Reserved Forest. Control of the lake and its catchment area (3,862 ha) was subsequently transferred from the Forest Department to the Rangoon Municipality and currently rests with the Rangoon City Development Corporation.

**Conservation measures proposed:** In 1982, it was proposed that the area might be developed for recreational purposes. This was rejected and an alternative proposal was made to restore management of the area to the Forest Department, and to establish plantations to reduce exploitation of both the catchment area and the surrounding reserved forests (FAO, 1982c).

**Land use:** Water supply for the city of Rangoon. Some ten policemen and their families are the only residents in the area. There is, however, agricultural land adjacent to the catchment basin and a number of villages to the south and southwest. In 1977, Section 144 of the Security Act was imposed, and all human access and use of the area was prohibited, with the exception of dam maintenance and protection of the watershed.

**Disturbances and threats:** Local demand for firewood, bamboo, fishing and grazing is met in part by exploitation of the area. These activities appear to be tolerated by the security patrols. Logging, extraction of canes and firewood, and burning have already degraded much of the forest in the catchment area.

**Economic and social values:** The reservoir is one of the main sources of water for Rangoon.

**Fauna:** The lake supports a wide diversity of waterfowl including *Tachybaptus ruficollis*, *Phalacrocorax niger*, *Anhinga melanogaster*, *Ixobrychus cinnamomeus*, *Ardeola grayii*, *Bubulcus ibis*, *Egretta intermedia*, *Ardea purpurea*, *A. cinerea*, *Amaurornis phoenicurus* and *Metopidius indicus*. Winter visitors include *Pandion haliaetus*, *Circus melanoleucos* and *Larus brunnicephalus*. The area is too small to support viable populations of large mammals, although several noteworthy species are occasionally reported. These include *Panthera tigris*, *P. pardus*, *Cuon alpinus* and *Elephas maximus* (3-7 individuals). *Bos javanicus* and *B. gaurus* move into the area during the monsoon season.

**Special floral values:** None known.

**Research and facilities:** The area was surveyed in October 1981 and April 1982 to assess its suitability for recreational development. Access to the area has been restricted since 1977, and at present there are no facilities for visitors.

**References:** FAO (1982c & 1985a); IUCN (in prep).

**Criteria for inclusion:** 2b.

**Source:** See references.

**Wetland name:** Hlawga Lake

**Country:** Burma

**Coordinates:** 17°00'N, 96°07'E;

**Location:** about 20 km north of Rangoon and 6 km east of the Rangoon River, Rangoon Division.

**Area:** c.1,200 ha.

**Altitude:** 20m.

**Biogeographical Province:** 4.4.1.

**Wetland type:** 17 & 19.

**Description of site:** A shallow water storage reservoir in undulating terrain to the east of the Rangoon River. The lake has a deeply indented shoreline with many sheltered bays and many small wooded islands. The shore is gently shelving, and at low water levels large areas of mud are exposed. The lake is surrounded by sandy hills with dense scrub and secondary forest, and there is a large area of rice paddies on the plains to the north and east. Hlawga Wildlife and Zoo Park, to the southeast of the reservoir, consist of a fenced enclosure of 356 ha with dense scrub, a small freshwater lake (Zokanok Lake) and eleven small dams.

**Climatic conditions:** Tropical monsoonal climate typical of southern Burma, with an average annual rainfall of about 3,200 mm. Most of the rain falls during the southwest monsoon from May to October.

**Principal vegetation:** The sheltered bays support an abundant growth of submerged aquatic vegetation and some *Eichhornia crassipes*, and there are patches of elephant grass around the margins of the reservoir. The islands and surrounding sandy hills are covered in dense thorn scrub and secondary forest. There are extensive rice paddies to the north and east.

**Land tenure:** No information.

**Conservation measures taken:** The reservoir is unprotected. A 356 ha wildlife park (Hlawga Wildlife and Zoo Park) has been established close to the reservoir, for the purposes of public recreation and education. Some 400 mammals of ten species have been introduced into the park, and an Environmental Education Centre has been built. A master plan was

prepared by Kyaw Nyunt Lwin *et al.* (1982) as part of the UNDP/FAO Nature Conservation and National Parks Project in Burma. The Wildlife Park and the Education Centre were opened to the public in 1984, but the zoo has not as yet been completed.

**Conservation measures proposed:** None

**Land use:** Water supply for Rangoon. There is some fishing with nets and traps, and the marsh vegetation is heavily grazed by domestic water buffalo and cattle. The surrounding woodland is heavily exploited for firewood.

**Disturbances and threats:** There is some disturbance from fishing activities, and the surrounding woodland has been much degraded by cutting and over-grazing.

**Economic and social values:** Hlawga Reservoir is an important source of water for Rangoon. The nearby Hlawga Wildlife and Zoo Park will doubtless become a popular recreational area for local Burmese.

**Fauna:** The reservoir and nearby rice paddies support a wide variety of resident and migratory waterfowl. The area is particularly important for its large winter roost of Asian Openbill Storks *Anastomus oscitans*. A minimum of 500-1,000 birds have been present in recent years, and sometimes many more (Harald Sutter, pers. comm.). *Dendrocygna javanica* occurs in very large numbers, and up to several hundred *Sarkidiornis melanotos* have been recorded. Other waterfowl observed during recent surveys include *Tachybaptus ruficollis*, *Phalacrocorax carbo*, *P. niger* (up to 70), *Ardeola grayii*, *Bubulcus ibis*, *Threskiornis melanocephalus*, *Anas peociloryncha*, *Gallicrex cinerea*, *Metopidius indicus*, *Rostratula benghalensis*, *Glareola maldivarum* and a variety of migratory shorebirds. Four *Mycteria leucocephala* were present in May 1986. Wintering birds of prey include *Pandion haliaetus*, *Circus (aeruginosus) spilonotus*, *C. melanoleucos* and *Hieraaetus leucogaster*. One of Burma's few endemic birds, the White-throated Babbler *Turdoides gularis*, is common in the surrounding scrub.

**Special floral values:** None known.

**Research and facilities:** The reservoir is frequently visited by bird-watchers from Rangoon, and waterfowl censuses were carried out in February 1987 (D.A. Scott) and February 1988 (Pyone Pyone Aye, Khin Ma Ma Thwin and Shein Gay Ngai). Fish culture investigations and training courses take place at the nearby Hlawga Freshwater Fisheries Research Station.

**References:** FAO (1985b); Karpowicz (1985); Kyaw Nyunt Lwin *et al.* (1982); van der Ven (1987).

**Criteria for inclusion:** 3b.

**Source:** Derek A. Scott and references.

**Wetland name:** Irrawaddy Delta

**Country:** Burma

**Coordinates:** 16°55'-18°15'N, 94°15'-96°20'E;

**Location:** the delta system of the Irrawaddy River from the region of Myanaung, 70 km north of Henzada, to the outer islands along the coast.

**Area:** 3,500,000 ha.

**Altitude:** 0-15m.

**Biogeographical Province:** 4.4.1.

**Wetland type:** 02, 03, 05, 06, 07, 08, 11, 13, 15, 18 & 19.

**Description of site:** The delta system of the Irrawaddy River extends in a great alluvial fan from the limit of tidal influence near Myanaung (18°15'N) to the Bay of Bengal and Andaman Sea, 290 km to the south. This alluvial plain is bounded to the west by the southern Arakan Yoma range and to the east by the Pegu Yoma. The city of Rangoon, situated on the southernmost spur of the Pegu Yoma, lies at the southeastern edge of the delta. The entire area is overlain by a thick layer of recent alluvium brought down by the Irrawaddy. Three main types of soil have developed: meadow gleyey clay soils, meadow swampy soils and saline gleyey soils. The flow in the Irrawaddy is at its lowest in February and March; there is a sharp rise in level in April-May as a result of melting snow in the upper catchment, and a further steep rise in May-June with the onset of the monsoon. The maximum flow occurs in July or August. Most waterways are natural watercourses, and there is no extensive system of dredged canals, the only major canal being the Twante canal which links Rangoon with the western part of the delta.

The upper and central portions of the delta are almost entirely under cultivation, principally for rice. Until about 1850, much of this region comprised a complex of permanent and seasonal lakes, swamps and marshes, and vast areas of seasonally inundated plains and swamp forest. However, following the rush of settlers from Upper to Lower Burma in the late 19th Century, the construction of embankments and reclamation of land for agriculture has kept pace with the increase in population. Dyke building was initiated by the Government as early as 1861, and many embankments were constructed around 1880 and 1920. At present, there are some 1,300 km of major embankments in the delta, protecting over 600,000 ha of rice paddy. The system of embankments provides a unique example of partial flood protection. The major dykes form horseshoes around the areas between the main rivers, with the downstream ends left open. In the event of extreme flooding, the lower parts act as flood basins, thus slightly reducing the flood peak. The old embankments have been maintained, and projects are contemplated to extend the system even further. Despite these reclamation schemes, there still remain large tracts of land that are deeply flooded during the monsoon and retain water even during the dry season. In addition, there are numerous permanent oxbow lakes and associated marshes, particularly along the Irrawaddy between Myanaung and Henzada, along the Myitmaka, and along the upper Bassein and Daga rivers. The lower, seaward third of the delta, stretching 130 km from east to west, is completely flat with no local relief. About 520,000 ha of land are below high spring tide level and subject to tidal inundation. Much of this area is covered by mangrove forest, and cultivation is limited to the higher patches of ground. Sandy ridges, such as old beaches and sand banks, provide refuges for wildlife during the highest tides. Although the mangrove vegetation has been exploited for a very long time, there are some relatively intact stands remaining. The area is dissected into a number of islands and peninsulas by a series of large, southerly flowing rivers and a complex of smaller, interconnecting watercourses, all of which are at least intermittently saline due to tidal intrusion. Drainage is directly into the Bay of Bengal through nine major river mouths, the Bassein, Thetkethaung, Ywe, Pyamalaw, Irrawaddy, Bogale, Pyapon, China Bakir and Rangoon. These rivers carry a heavy silt load, and their waters are very turbid. The delta is actively accreting seawards, and as a result the sea is very shallow for some distance out to sea. Water depths are less than 5.5m across the whole coastline fronting the delta and up to 28 km offshore in the east. The present rate of advance of the delta is estimated at 5-6 km per 100 years, equivalent to about 1,000 ha per year. Several small islands, some of which are visible only at low tide, have developed offshore.

These include Kain Thaug Kyun off the mouth of the Irrawaddy River, and Kadonlay Kyun and Gayedgyi Kyun off the mouth of the Bogale River. Tides are semi-diurnal, and have a range of 2.0-2.5m along the outer coast. At Rangoon, 72 km from the open sea, the tidal range is 3.5-5.1m. Sea dykes have been constructed in some areas to prevent tidal inundation, and the Government has recently carried out several polderization schemes in the outer delta.

**Climatic conditions:** Monsoonal climate, with an average annual rainfall of about 1,500-2,000 mm in the north increasing to 2,500 mm in the southeast and 3,500 mm in the southwest. Over 90% of the rain falls between mid May and mid November. During the monsoon season, the maximum and minimum temperatures in the coastal zone are about 37°C and 22°C, respectively. The seas may be very rough, and there are often strong winds from the south and southwest. The period from mid October to mid February is generally dry and cool. Temperatures rise after February, and April and early May are characterized by hot, variable weather with pre monsoon squalls.

**Principal vegetation:** The natural vegetation of the lower, tidal delta is mangrove forest, but this has been heavily exploited and most of the remaining forest is in various stages of regrowth. Four types of forest are recognized (Salter, 1982):

1. low mangrove forest, colonizing soft mud submerged at every tide; characterized by species of *Ceriops*, *Avicennia*, *Kandelia* and *Bruguiera*;
2. tree mangrove forest, developing on mud banks inland of low mangrove forest and at the edges of tidal streams; dominated by species of Rhizophoraceae;
3. salt water *Heritiera* forest, on the landward side of the above two types, but still flooded at every tide; dominated by *Heritiera fomes*;
4. freshwater *Heritiera* forest, a closed evergreen high forest, flooded at high tide by only moderately brackish water; comprised mainly of *Bruguiera* and *Heritiera*.

Virtually all areas not within Reserved Forests are used for growing rice paddy or other crops.

**Land tenure:** No information.

**Conservation measures taken:** Almost all of the southern third of the delta is included within Reserved Forests. Most of these were established during the late 1800s and early 1900s, and have been managed primarily for fuel wood and, less commonly, charcoal production. Other areas are unprotected.

**Conservation measures proposed:** Three areas in the outer delta have been proposed for designation as Wildlife Sanctuaries: Meinmahla Kyun (site 12a), Kadonlay Kyun (site 12b) and the Letkokkon islands (site 12c). Salter (1982) has proposed that, in order to provide a further measure of protection to mangrove fauna and flora, Pyinalan, Kadokani and Pyindane Reserved Forests continue to be managed for sustained production of fuel wood, and that further encroachment by agriculture be prevented. He also recommends that crocodiles of breeding size and all species of sea turtle be given completely protected status under new wildlife legislation. A review of the present system of turtle egg collection should be undertaken, and measures instituted to ensure that this valuable resource is managed on a sustained yield basis. In addition, Blower (1983) has recommended that full protection be



given to the endangered River Terrapin *Batagur baska* and its eggs, and that the possibility of establishing a hatchery on Kadonlay Kyun or elsewhere be considered.

**Land use:** With a total population of about 3.5 million people and a population density of 100 per sq.km, the Irrawaddy Delta is one of the most densely populated parts in the country. Virtually all land not designated as Reserved Forest has been converted to intensive agriculture. The predominant form of cultivation is single rice cropping during the wet monsoon, and this accounts for two-thirds of the total area under cultivation. The rice yield is about 2,000-2,500 kg per hectare.

Numerous towns and villages are scattered throughout the delta and particularly along the larger rivers. In addition, temporary camps are established by forest workers and fishermen. All major rivers and streams are used by the local commercial fisheries, which operate mainly from small boats and fixed fishing frames. Prawns are a major product of the area. Every important sea turtle nesting beach is commercially exploited for eggs by local cooperatives. All these beaches fall within Reserved Forests, and are leased out by the Forest Department on a year to year basis. Throughout the delta, communication is easiest by water; virtually every householder owns a boat, and major population centres in the southern delta, such as Bogale, Moulmeingyun and Myaungmya, are served by steamer. The Irrawaddy itself is a very important artery for trade throughout a large part of Burma.

**Disturbances and threats:** The Irrawaddy is one of the most heavily silted rivers in the world, not only because of deforestation and serious erosion in the watershed, but also because of a long history of intensive agriculture along the river banks. Virtually all land outside the Reserved Forests has already been converted into agricultural land, and the mangrove forests within the Reserved Forests are now disappearing at a rapid rate. Large parts of the Kyagan Kwinbauk, Kakayen and Pyinland Reserved Forests have already been deforested and converted into agricultural land. A comparison between the situation in 1977 and the situation in 1986 indicates that if the present rate of destruction is maintained, all the mangrove forest will disappear in 50 years (Harald Sutter, pers. comm.).

The populations of Estuarine Crocodile *Crocodylus porosus*, sea turtles and River Terrapin *Batagur baska* have been drastically reduced by commercial exploitation and are now seriously threatened. The crocodile population continues to be exploited by the People's Pearl and Fisheries Corporation, which removed an average of 465 hatchlings per year during the period 1978-83 for rearing at a crocodile farm in Rangoon. Other threats to the remaining crocodiles include habitat destruction, collection of eggs for food, hunting of adults and juveniles, and entanglement in fishing nets. The number of sea-turtle eggs collected annually in the Irrawaddy Delta declined from 1,500,000 in 1911 to an average of 400,000 during the period 1978/79 to 1981/82. This decline in egg harvests has been reflected in a decline in adult turtles and the abandonment of some former nesting beaches. Mature turtles are taken by fishermen and caught by trawlers in their nets throughout the delta, and Hawksbill Turtles *Eretmochelys imbricata* are hunted for their "tortoise shell". At the turn of the century, approximately 70,000 eggs of the River Terrapin *Batagur baska* were collected annually in the delta. Although the species is now on the verge of extinction in the delta, the adult terrapins and their eggs continue to be taken wherever they are found.

**Economic and social values:** The northern and central parts of the delta are major rice-growing areas, producing 40% of the national total. The delta supports a very important fishery, especially for prawns, and has traditionally provided a large annual harvest of sea turtle eggs. The extensive mangrove forests have provided a valuable source of fuel wood

and timber for construction purposes. However, the mangrove and sea turtle resources have now been seriously depleted, and as further mangrove areas are cleared for agriculture, the important prawn fishery is at risk. The delta has some potential for tourism based on interest in the wildlife, although the shallowness of the sea around many of the outer islands tends to hinder access.

**Fauna:** One of the major commercial fish species in Burma, *Hilsa ilisha*, is abundant in the delta. The delta is still of great importance for a wide variety of both resident and migratory waterfowl, although populations of many species have declined dramatically since the end of the 19th Century. Resident species and monsoon visitors listed as common by Smythies (1953) and probably still at least fairly common include *Tachybaptus ruficollis*, *Phalacrocorax fuscicollis*, *P. niger*, *Anhinga melanogaster*, *Ixobrychus sinensis*, *I. cinnamomeus*, *Nycticorax nycticorax*, *Ardeola grayii*, *Bubulcus ibis*, *Egretta sacra*, *E. garzetta*, *E. intermedia*, *E. alba*, *Ardea purpurea*, *A. cinerea*, *Ardea sumatrana* (confined to the tidal estuaries and creeks), *Ciconia episcopus*, *Threskiornis melanocephalus*, *Dendrocygna javanica*, *Sarkidiornis melanotos*, *Nettapus coromandelianus*, *Anas poecilorhyncha*, *Rallus striatus*, *Amaurornis phoenicurus*, *Gallicrex cinerea*, *Porphyrio porphyrio*, *Heliopais personata*, *Hydrophasianus chirurgus*, *Metopidius indicus*, *Rostratula benghalensis*, *Esacus recurvirostris*, *Glareola maldivarum* (abundant), *G. lactea*, *Vanellus duvaucelii*, *Charadrius dubius*, *Gelochelidon nilotica*, *Sterna aurantia*, *S. melanogaster*, *S. albifrons* and *Rhynchops albicollis* (along the Irrawaddy north of Henzada).

Winter visitors and passage migrants include *Phalacrocorax carbo* (formerly bred), a wide variety of Anatidae, *Fulica atra*, about 30 species of migratory shorebirds, *Chlidonias hybrida*, *Hydroprogne caspia* and *Larus brunnicephalus* (very common). The most numerous wintering shorebird is probably *Charadrius mongolus*, which occurs in flocks of many thousands along the outer coast of the delta. *Tringa glareola* is also abundant. Other common shorebirds include *Vanellus cinereus*, *Pluvialis dominica*, *P. squatarola*, *Charadrius alexandrinus*, *C. leschenaultii*, *Limosa limosa*, *Numenius phaeopus*, *N. arquata*, *Tringa totanus*, *T. nebularia*, *T. ochropus*, *Xenus cinereus*, *Actitis hypoleucos*, *Gallinago gallinago*, *G. stenura*, *Calidris ruficollis*, *C. temminckii*, *C. subminuta*, *C. ferruginea* and *Limicola falcinellus*. *Eurynorhynchus pygmeus* was regarded by Smythies (1953) as a regular winter visitor in very small numbers, and *Limnodromus semipalmatus* has been recorded.

In the late 19th century, the Spot-billed Pelican *Pelecanus philippensis* nested in huge numbers in south Burma. One colony on the Sittang plain to the east of the delta was described in November 1877 as covering 100 square miles and containing millions of birds. Immense colonies still bred in the area in 1910, but the birds had disappeared completely by 1939. Small numbers were regularly reported in the delta in the 1940s, but no breeding sites were located. No pelicans have been recorded in recent years, and it may well be that the species is now extinct in Burma. The disappearance of this once abundant species can be directly attributable to the massive conversion of floodplain lakes and marshes into monocultures of rice throughout south Burma during the latter part of the 19th century and first decades of the present century.

A similar fate has befallen the Greater Adjutant Stork *Leptoptilos dubius*. In the late 19th century, this was an abundant breeding visitor (October to March) throughout the delta and Sittang plain, but the species had already become scarce by the 1940s, and is now a rare visitor. A single bird was reported on Meinmahla Kyun in late 1982. The Asian Openbill Stork *Anastomus oscitans* remains a common passage migrant and winter visitor. However,

the Painted Stork *Mycteria leucocephala*, which was regarded as a locally common resident in the early part of this century, is now only a scarce visitor.

Several species of large mammal occur in the delta, but their populations are small and scattered, with the possible exceptions of Sambar *Cervus unicolor*, Hog Deer *C. porcinus* and Wild Boar *Sus scrofa*, which have been reported from all Reserved Forests. Asian Elephants *Elephas maximus* are said to occur in Kadonkani, Meinmahla and Pyindaye Reserved Forests, but the total population in 1982 was only about 15 individuals. Other species reported to be present include Leopard, Tiger, Wild Dog and otters (*Panthera pardus*, *P. tigris*, *Cuon alpinus* and *Lutra* sp) (Salter, 1982).

The southern delta area is the last stronghold in Burma of the Estuarine Crocodile *Crocodylus porosus*. The total population was estimated at about 4,000 in 1980. Some two-thirds of these were confined to the eastern delta, mainly in the Pyindaye Reserved Forest and on Meinmahia Kyun. The population has declined dramatically over the last 30 years, largely as a result of over hunting.

Sea turtles nest on beaches along the seaward edges of Kyagan Kwinbauk Reserved Forest, Pyinzalu Kyun, Pyinalan Reserved Forest and Kadonkani Reserved Forest, and on the offshore islands of Kaingthaung, Kadonlay and Gayedgyi Kyun. Five species are known to occur: *Chelonia mydas*, *Caretta caretta*, *Lepidochelys olivacea*, *Eretmochelys imbricata* and *Dermochelys coriacea*. *C. mydas* is one of the commonest species. *C. caretta* is reported to be common at some beaches, but confusion has arisen over identification, and it is possible that many if not most of these are *L. olivacea*. *E. imbricata* and *D. coriacea* occur only in very small numbers. Almost all of the eggs laid are harvested, and many former nesting beaches have been abandoned, presumably because of this over-exploitation. It is clear that the turtle populations have declined markedly, and that two species, *D. coriacea* and *E. imbricata*, are now endangered, while the other three species must be considered seriously threatened (Blower, 1983; Salter, 1982).

The River Terrapin *Batagur baska*, which formerly nested in the delta in large numbers, is now reduced to a few remnant populations on some of the offshore islands and sand banks. The massive exploitation of both adults and their eggs has resulted in the near extermination of the species in Burma (Salter, 1983).

**Special floral values:** Good stands of continuous mangrove forest still exist in the Kadonkani Reserved Forest and in Pyindaye Reserved Forest (Salter, 1982).

**Research and facilities:** The southern delta was surveyed in November and December 1982 (Salter, 1982) and in 1983 (FAO, 1983c). The Forest Department is currently carrying out a forest inventory of the mangrove resources in the delta, to provide data for the development of a management plan. No serious ornithological investigations have been carried out for almost fifty years.

**References:** Blower (1983); FAO (1980, 1983b, 1983c, 1985a & 1985b); Groombridge (1982); IUCN (in prep); Karpowicz (1985); Luthin (1984); Maxwell (1911); Salter (1982 & 1983); Smythies (1953); Stoutjesdijk (1982).

**Criteria for inclusion:** 123.

**Source:** See references.

**Wetland name:** Meinmahla Kyun

**Country:** Burma

**Coordinates:** 15°52'N, 95°17'E;

**Location:** in the mouth of the Bogale and Kadonkani rivers, approximately 130 km southwest of Rangoon, Delta Forest Division.

**Area:** 12,960 ha.

**Altitude:** 0-25m.

**Biogeographical Province:** 4.4.1.

**Wetland type:** 02, 03, 05, 06 & 07.

**Description of site:** An estuarine island in the delta of the Irrawaddy River, almost entirely comprised of alluvial deposits from the Bogale River. The island is flat, with low cliffs to the south and west dropping to a narrow sandy beach. Numerous creeks and channels intersect the island which also features sand dunes and mudflats. The sea throughout the entire area is highly turbid and very shallow, being no deeper than 5.5m up to 28 km offshore. The tidal range is 2.0-2.5m.

**Climatic conditions:** Monsoonal climate with a mean annual rainfall at Bogale (60 km upriver) of 2,777 mm. The monsoon season extends from May to October.

**Principal vegetation:** The island is almost entirely covered in mangrove forest. It has been logged in the past, and much of the forest is somewhat degraded.

**Land tenure:** State owned; under the administration of the Divisional Forest Officer, Delta Forest Division.

**Conservation measures taken:** The island was notified as a Reserved Forest in 1895. Wildlife and vegetation is legally protected on the island, although licensed collection of crocodile hatchlings by the People's Pearl and Fisheries Corporation is permitted by the Forest Department.

**Conservation measures proposed:** It has been proposed that the island be designated as a Wildlife Sanctuary (FAO, 1985a). The People's Pearl and Fisheries Corporation has plans to protect the island as a crocodile sanctuary, in conjunction with the Forest Department. This would involve the construction of a base camp at Tawbaing Chaung and placement of nine guard posts at river mouths around the periphery of the island (Salter, 1982). The Corporation intends to restock the island with juvenile crocodiles from the Thaketa Crocodile Farm near Rangoon, in order to commence sustainable harvesting.

**Land use:** Intensive fishing in the creeks. There is no resident population on the island, but temporary camps are established by fishermen.

**Disturbances and threats:** There is some illegal logging on the island, and the waterways are heavily fished (FAO, 1985a).

**Economic and social values:** No information.

**Fauna:** An estimated 2,600 Estuarine Crocodiles *Crocodylus porosus* inhabit the island, representing about two-thirds of the entire population in the eastern delta. Other wildlife includes *Panthera tigris*, *P. pardus*, *Cuon alpinus*, *Lutra* sp and *Elephas maximus* (Salter, 1982).

The island is likely to be of considerable importance for both resident and migratory waterfowl, but almost no information is available. Salter (1982) mentions having seen 250 *Egretta* spp and one *Leptoptilos dubius* in late 1982.

**Special floral values:** Meinmahla Kyun contains one of the few extensive areas of mangrove forest in the Irrawaddy Delta not subject to heavy exploitation.

**Research and facilities:** The island was surveyed in November and December 1982 (Salter, 1982). There are no facilities.

**References:** FAO (1983c & 1985a); IUCN (in prep); Salter (1982 & 1983). **Criteria for inclusion:** 1b, 2a.

**Source:** See references.

**Wetland name:** Kadonlay Kyun

**Country:** Burma

**Coordinates:** 15°35'N, 95°16'E;

**Location:** about 10 km off the coast of the Irrawaddy Delta, opposite the mouth of the Bogale River, Delta Forest Division.

**Area:** 260 ha.

**Altitude:** Sea level.

**Biogeographical Province:** 4.4.1.

**Wetland type:** 02, 03, 05, 06 & 07.

**Description of site:** A low, flat island in the Irrawaddy Delta, formed exclusively of silt deposits from the Bogale River. The island is ringed by broad sandy beaches and mudflats with some mangrove forest, and there are grassy areas and sand dunes in the interior. The surrounding sea is very shallow, hampering access to the island.

**Climatic conditions:** Monsoonal climate, with an average annual rainfall of 2,777 mm at Bogale, 70 km to the north. The monsoon season extends from May to October.

**Principal vegetation:** Mangrove forest and areas of open grassland.

**Land tenure:** State owned.

**Conservation measures taken:** The island constitutes a part of the Kadonkani Reserved Forest, which was probably established in the late 1800s or early 1900s. Wildlife and vegetation are protected, although the Forest Department allows licensed collection of sea turtle eggs by the People's Pearl and Fisheries Corporation. Approximately 5,000 eggs are left each year to hatch in natural nests. The hatchlings are protected under cover for 5-6 days then released into the sea. However, the mortality of hatchlings prior to release is high (45% over the four seasons 1978/79 to 1981/82), and the nests are left to hatch only at the end of the season, when the species composition of nests may not be representative of the season as a whole (Salter, 1982).

**Conservation measures proposed:** A proposal has been made to designate the island as a Wildlife Sanctuary in order to gain fuller protection for the breeding sea turtles (Salter, 1982; FAO, 1983c).

**Land use:** Sea turtle eggs are collected by the Kadonkani Cooperative, which stations keepers on the island during the main turtle nesting season from September to February. Otherwise the island is uninhabited and difficult to approach due to the extreme shallowness of the surrounding waters.

**Disturbances and threats:** Salter (1983) reported that an average of 122,000 turtle eggs were collected each year during the period 1978-82. Sustained harvesting of turtle eggs at this level has almost certainly been the main cause for the decline in the number of eggs available for collection, probably mirroring a decline in the number of breeding adult turtles. Fishing nets and baited lines also contribute to turtle mortality. Excessive harvesting of the eggs of the River Terrapin *Batagur baska* has resulted in the near extermination of the species (Salter, 1983),

**Economic and social values:** No information.

**Fauna:** The island is an important nesting site for sea turtles, which lay in approximately 1,000 nests each year. According to local informants, the turtles are mostly Loggerheads *Caretta caretta*, but considerable confusion has arisen over identification, and it is now thought that the majorities are Olive Ridleys *Lepidochelys olivacea*. A few Green Turtles *Chelonia mydas* appear each year, and a single Leatherback *Dermochelys coriacea* nests every two or three years (Salter, 1982). In addition, the island may still support a very small number of River Terrapins *Batagur baska*. Salter (1982) observed some migratory shorebirds on the island in November/December 1982. No other information is available on the avifauna.

**Special floral values:** None known.

**Research and facilities:** The island was surveyed in late 1982 (Salter, 1982). There are no visitor facilities.

**References:** Blower (1983); FAO (1983c & 1985a); IUCN (in prep); Salter (1982 & 1983).

**Criteria for inclusion:** lb. 2a, 2c.

**Source:** See references.

**Wetland name:** Letkokkon Islands

**Country:** Burma

**Coordinates:** 16°17'N, 95°57'E;

**Location:** off the eastern edge of the Irrawaddy Delta, opposite the mouth of the China Bakir River, Delta Forest Division.

**Area:** 388 ha.

**Altitude:** Near sea level.

**Biogeographical Province:** 4.4.1.

**Wetland type:** 02, 03, 06 & 08.

**Description of site:** A group of small islands and mudflats formed by the deposition of silt from the China Bakir River. The area is separated from the mainland by a long shallow inlet, which dries out at low tide. The sea throughout the entire area is highly turbid and very shallow, being no more than 5.5m deep up to 28 km offshore. The tidal range is 2.0-2.5m.

**Climatic conditions:** Monsoonal climate, with a mean annual rainfall of about 2,780 mm. The monsoon season extends from May to October.

**Principal vegetation:** The area supports extensive reed beds with low scrub colonizing areas above the high-water mark.

**Land tenure:** No information.

**Conservation measures taken:** None.

**Conservation measures proposed:** It has been proposed that the area be designated as a Wildlife Sanctuary (FAO, 1983c).

**Land use:** Fishing. There is no permanent resident population on the islands.

**Disturbances and threats:** Local fishermen may disturb the wildlife, and military personnel are reported to hunt in the area (FAO, 1985a).

**Economic and social values:** No information.

**Fauna:** An important area for a wide variety of resident and migratory waterfowl. Large numbers of herons, egrets, ducks, shorebirds, gulls and terns have been reported, but no details are available. Beaches on the seaward side of the island appear suitable as nesting sites for sea turtles.

**Special floral values:** None known.

**Research and facilities:** The area was surveyed in late 1982 (Salter, 1982).

**References:** FAO (1983c & 1985a); IUCN (in prep); Salter (1982).

**Criteria for inclusion:** lb, 3b.

**Source:** See references.

**Wetland name:** Thamihia Kyun (Diamond Island) Wildlife Sanctuary

**Country:** Burma

**Coordinates:** 15°51'N, 94°17'E;

**Location:** about 10 km off the southern Arakan coast, opposite the mouth of the Bassein River, Irrawaddy Division.

**Area:** 88 ha.

**Altitude:** 0-24m.

**Biogeographical Province:** 4.4.1.

**Wetland type:** 03, 04 & 05.

**Description of site:** A small, offshore island to the west of the Irrawaddy Delta, measuring about 1,100m by 730m. The topography is undulating, with low cliffs to the south and west dropping to narrow, sandy beaches. Much of the island is pock-marked with bomb craters. With the exception of the north, the island is surrounded by a rocky reef, about 270m in width, comprising sandstone and shale. There are three small freshwater reservoirs on the island, the largest covering approximately 0.6 ha.

**Climatic conditions:** Monsoonal climate with an average annual rainfall of about 5,080 mm. The monsoon season extends from mid May to October, with some rain during April and November, and virtually none from December to March.

**Principal vegetation:** Sandy beaches are backed by a typical beach vegetation with *Hibiscus sp*, *Terminalia catappa*, *Casuarina equisetifolia* and *Cocos nucifera*. The sheltered northern part of the island has good cover of *Bombax malabaricum*, *Ficus spp*, *Lagerstroemia macrocarpa*, *Xylia dolabriformis*, *Terminalia belerica* and *Lannea grandis*. Evergreen shrubs and bamboo constitute a fairly dense understorey. The southern part of the island is more exposed, and supports a poorer cover with patches of open grassland and bare rock interspersed with evergreen thickets.

**Land tenure:** State owned; the sanctuary notification conceded 1.1 ha to the Port Commissioner of Bassein, and allowed fishermen to seek temporary shelter in bad weather.

**Conservation measures taken:** The island was declared a Wildlife Sanctuary in October 1970 by the Ministry of Agriculture and Forests. As a Wildlife Sanctuary, the fauna is protected in law by the 1936 Burma Wildlife Protection Act. Under this Act, the Forest Department is the licensing authority for collection of sea turtle eggs. Sea turtles, their eggs and nesting sites come under the provisions of the Fisheries Act (last amended in 1949), whereby the government controls turtle egg collection. Current turtle conservation measures include a closed season from 1 April to 15 May, purchase of 5,000-10,000 eggs annually by the Fisheries Department for rearing and release of hatchlings, and the protection of a very limited number of nests on the island itself. These conservation measures are considered inadequate to stem the present decline in turtle numbers.

**Conservation measures proposed:** Better protection of the sea turtles on Thamihia Kyun is urgently required if their populations are to be sustained. In 1983, it was recommended that:

(a) the island's legal status as a Wildlife Sanctuary be strictly enforced, and all turtle egg collection should cease; (b) four guards be permanently stationed on the island, both to protect the turtle nesting sites from poachers, and to prevent unauthorized landings; (c) the People's Pearl and Fisheries Corporation be encouraged to desist trawling or seining in coastal waters on the seaward side of the island between the Alguada Reefs (15°42'N, 94°13'E) and Cape Negrais (16°03'N, 94°12'E); and (d) more detailed studies of the turtle population on the island be undertaken (FAO, 1983b). In addition, a nationwide management plan for sea turtles was proposed, under which sustainable quotas for egg collection would be established and enforced (Salter, 1983).

**Land use:** Harvesting of sea turtle eggs and fishing. There is no resident local population on the island. The People's Pearl and Fisheries Corporation maintains a representative and a small number of labourers, and a policeman and forest guard are resident. In 1983, there was a temporary military garrison on the island. The island has a sheltered anchorage of some 3-5m in depth.

**Disturbances and threats:** The sea turtles are seriously threatened by the intensive egg-collecting and offshore trawling activities of the People's Pearl and Fisheries Corporation. Between 1.5 and two million eggs were harvested annually at the beginning of this century. By 1980, this harvest had fallen to an average of 150,000 eggs per year. The People's Pearl and Fisheries Corporation is still permitted to collect nearly all the turtle eggs, whilst its trawling operations offshore are thought to be responsible for about 100 turtle deaths each year.

**Economic and social values:** In recent years, some 150,000-200,000 turtle eggs have been collected each year by the Ngapudaw Township Cooperative for sale to the People's Pearl and Fisheries Corporation. This harvest, worth about US\$30,000 annually at Rangoon prices, is declining as the resource continues to be over-exploited (FAO, 1983b).

**Fauna:** The island is a very important nesting site for sea turtles. The Green Turtle *Chelonia mydas* is much the most abundant species. The Loggerhead *Caretta caretta* is also reported to be common (about one third as many as *C. mydas*), but some confusion has arisen over identification, and these may in fact be Olive Ridges *Lepidochelys olivacea*. A third species, the Hawksbill *Eretmochelys imbricata*, is occasionally reported. The number of turtle eggs collected on the island has declined by about 88% since the turn of the century, almost certainly reflecting a similar decline in the breeding populations (FAO, 1983b). The breeding population of *C. mydas* is currently estimated at about 1,800 females.

The Indian Muntjac *Muntiacus muntjak* and Hog Deer *Cervus porcinus* were introduced on the island in 1963, and are both still present.

**Special floral values:** None known.

**Research and facilities:** The island was surveyed in December 1982 and January 1983 to re-evaluate the site as a Wildlife Sanctuary (FAO, 1983b). There are no facilities for visitors.

**References:** Blower (1983); FAO (1983b & 1985a); Groombridge (1982); IUCN (in prep); Maxwell (1911); Salter (1982 & 1983).

**Criteria for inclusion:** 1b, 2a, 2c.

**Source:** See references.

**Wetland name:** Sittang Estuary and Gulf of Martaban

**Country:** Burma



**Coordinates:** 16°30'-17°25'N, 96°30'-97°20'E;

**Location:** from the head of the Sittang Estuary near Nyaungkhashe to the region of Khindan on the east coast of the Gulf of Martaban and the region of Minywa-athin on the west coast, Pegu Division and Mon State.

**Area:** c.150,000 ha.

**Altitude:** Sea level.

**Biogeographical Province:** 4.4.1./4.10.4.

**Wetland type:** 02, 05, 06, 07 & 08.

**Description of site:** The vast estuarine system of the Sittang River and adjacent Gulf of Martaban, with extensive intertidal mudflats stretching for some 80 km along both shores, and up to 10 km wide at low tide. The total area of mudflat may exceed 75,000 ha. Many small creeks enter along the west shore of the gulf, and there is a large area of degraded mangrove swamp east of Ohnbin. The estuaries of the Bilin River and several smaller rivers enter the gulf in the east. Large areas of the adjacent plains have been converted to rice paddies, and the plains are studded with numerous small water storage reservoirs (tanks).

**Climatic conditions:** Monsoonal climate, with the monsoon season extending from May to October.

**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:** No information is available. However, it is likely that the extensive intertidal mudflats are of considerable importance for migratory shorebirds and many other waterfowl.

**Special floral values:** No information.

**Research and facilities:** It appears that no studies have been made of this vast estuarine system, which contains one of the largest areas of intertidal mudflats in Southeast Asia.

**Criteria for inclusion:** 0.

**Source:** Operational Navigation Charts.

**Wetland name:** Moscos Islands Wildlife Sanctuary

**Country:** Burma

**Coordinates:** 13°47'-14°28'N, 97°46'-97°56'E;

**Location:** in the Andaman Sea, 20-30 km off the Tenasserim coast and 40-60 km from Tavoy, Tenasserim Division.

**Area:** Area of wetlands unknown; Wildlife Sanctuary 4,924 ha.

**Altitude:** 0-365m.

**Biogeographical Province:** 4.5.1.

**Wetland type:** 03, 04, 05 & 07.

**Description of site:** Three groups of small islands off the Tenasserim coast, lying on a north-south axis and stretching over some 70 km of sea. The islands comprise North Moscos (or Heinze Islands), Middle Moscos (or Maungmagan Islands) and South Moscos (or Launglon Bok Islands). The islands generally rise steeply from rocky shorelines to a

north-south oriented watershed. They constitute the exposed edge of underwater ridges, formed by late Tertiary tectonic movement and by volcanic activity. Altitudes range from sea level to about 300m on most islands. The largest island is Auk Bok, in the South Moscos group, measuring about 10 km by 2.4 km, and which, in common with a number of the other larger islands, features sandy bays and sheltered anchorages. Coral reefs are found around the South Moscos islands, and probably exist elsewhere in the sanctuary. The sea between the islands and the mainland averages about 24m in depth, and nowhere exceeds 40m.

**Climatic conditions:** Monsoonal climate with little or no rain during the cold season from December to February. The mean annual rainfall at Tavoy, some 13 km inland is 5,451 mm, the wettest months being May to October. Mean maximum and minimum temperatures at Tavoy are 37°C and 14°C, in April and January respectively.

**Principal vegetation:** The islands are covered with climax southern low tropical evergreen forest, which is at its most luxuriant in the South Moscos group. However, this primary cover, dominated by *Dipterocarpus* spp, has been modified to a certain extent by illegal felling. Lianas *Calamus* spp and epiphytes are abundant, and there are small areas of mangrove in the tidal zone. The beach vegetation includes some *Agathis* sp. Bamboo is uncommon, although there is a limited amount of *Neahouzeaua stricta* (FAO, 1982d).

**Land tenure:** No information.

**Conservation measures taken:** The islands were designated as a Game Preserve in 1924, under the Burma Game Rules 1917. The area was reconstituted as a Wildlife Sanctuary in September 1927.

**Conservation measures proposed:** In 1982, it was recommended that: (a) the collection of turtle eggs and swift let nests should cease immediately; (b) boundaries should be clearly marked and effectively guarded; (c) the three main islands of the South Moscos group and associated islets (totaling 2,330 ha) should be designated as a Marine National Park; (d) Middle Moscos should either remain as a Wildlife Sanctuary or be upgraded to a Nature Reserve; and (e) North Moscos should be excised from the sanctuary and revert to unclassed forest without special protection (FAO, 1982d).

**Land use:** Collection of sea turtle eggs, collection of swiftlet nests and fishing. There are no residents on the islands, although fishermen set up temporary camps during the dry season. Besides fishing, these people are engaged in some timber felling and collect other forest produce from within the sanctuary.

**Disturbances and threats:** Sustained high levels of egg-harvesting have significantly reduced the breeding population of sea turtles in the sanctuary, and the colonies of swift lets are similarly threatened by over-exploitation. Illegal logging and collection of forest produce threatens the forest cover (FAO, 1982d). An attempt was made in 1924-1929 to introduce Sambar *Cervus unicolor*, Indian Muntjak *Muntiacus muntjak*, Wild Boar *Sus scrofa* and Hog Deer *Cervus porcinus* (Tun Yin, 1954). Of these introductions, only *S. scrofa* is still present on the islands.

**Economic and social values:** Some 60,000 turtle eggs were collected annually in the 1930s. Current egg harvests number about 30,000 from South Moscos and 9,000 from the Middle Moscos group. All eggs laid are collected by a concessionaire based on Auk Bok, under license from the Forestry Department. Nests of the Edible-nest Swift let *Collocalia fuciphaga* are collected by Thaya Kone Village Cooperative Society, under a concession from the Forestry Department. In 1982, market prices for the nests ranged from US\$286 to US\$1,200 per kg. Current production averages about 28 kg per annum, which represents a decline of some

41% over the level achieved during 1951-1956. The swift let colony on Cradle Rock is now considered to be too small for commercial exploitation.

**Fauna:** The islands appear to be poor in terrestrial wildlife, possibly due to the presence of feral dogs. Wild Boar *Sus scrofa* and Crab-eating Macaque *Macaca fascicularis* are common, and mouse deer *Tragulus* sp and monitor lizards *Varanus* are also present. Sea turtles nested widely on all three island groups in the 1930s, but populations are now much reduced. Green Turtles *Chelonia mydas* are known to be present, and several other species may occur. The avifauna includes *Egretta sacra*, *Haliaeetus leucogaster* and *Ducula bicolor*. Edible-nest Swiftlets *Collocalia fuciphaga* nest in caves on Hgnettaik Kyun in the South Moscos and on Cradle Rock in the Middle Moscos.

**Special floral values:** No information.

**Research and facilities:** The harvests of turtle eggs and swiftlet nests have been monitored by the Forest Department, and Chhibber (1927) surveyed and described the geography of the region. The Middle and South Moscos groups were briefly surveyed in 1982 (FAO, 1982d). There are no visitor facilities on the islands.

**References:** Chhibber (1927); FAO (1982d & 1985a); IUCN (in prep); Salter (1983); Tun Yin (1954).

**Criteria for inclusion:** lb. 2a, 2c.

**Source:** See references.

**Wetland name:** Central Tenasserim Coast and northern Mergul Archipelago

**Country:** Burma

**Coordinates:** 11°25'-12°45'N, 98°20'-98°50'E;

**Location:** the central Tenasserim coast from Pyaze, 40 km north of Mergui, to Pisandaungsaung, 120 km south of Mergui, and the inner islands of the northern Mergui Archipelago, Tenasserim Division.

**Area:** c.1,100,000 of bays, estuaries, mudflats and mangroves.

**Altitude:** Sea level.

**Biogeographical Province:** 4.5.1.

**Wetland type:** 01, 02, 03, 05, 06 & 07.

**Description of site:** A vast complex of shallow bays, tidal channels and creeks, intertidal mudflats and mangrove swamps between the narrow coastal plain of central Tenasserim and a chain of large islands in the northeastern part of the Mergui Archipelago. The site includes the estuaries of the Kyaukpya River, Great Tenasserim River, Lenya River and many smaller rivers rising in the forested hills of the southern Bilaukaung range to the east, and also the nearby offshore islands. The larger islands, notably Kadan Kyun, Saganthit Kyun and Kanmaw Kyun, are hilly, rising to over 750m. The extensive mangrove swamps on the eastern side of the main islands are separated from those of the mainland coast by channels up to 5 km wide. There are sandy beaches on some of the islands, and coral reefs along the west coasts of Saganthit Kyun and Kanmaw Kyun.

**Climatic conditions:** Monsoonal climate, with an average annual rainfall of about 5,000 mm. The climate is somewhat transitional between the pronounced wet and dry seasons of the bulk of the country and the more even rainfall pattern of peninsular Malaysia. The prevailing winds blow from the west and southwest during the May to September monsoon, and from the north during the October to April dry season.

**Principal vegetation:** Mangrove forest and beach vegetation. Tropical rain forest and dry deciduous forest on the larger islands and coastal hill ranges.

**Land tenure:** No information.

**Conservation measures taken:** No information.

**Conservation measures proposed:** None

**Land use:** No information.

**Disturbances and threats:** Large areas of mangrove forest have been heavily exploited for timber and other products, or cleared for agricultural purposes. Crocodiles have long been exploited and their populations are now much reduced.

**Economic and social values:** No information.

**Fauna:** The region was known to be of considerable importance for a wide variety of resident and migratory waterfowl during the early part of the present century, but no recent information is available. Resident species reported by Smythies (1953) include *Phalacrocorax niger*, *Anhinga melanogaster*, *Egretta sacra*, *Ardea sumatrana*, *Mycteria leucocephala*, *Ciconia episcopus*, *Leptoptilos javanicus*, *Dendrocygna javanica*, *Cairina scutulata*, *Nettapus coromandelianus*, *Heliopais personata*, *Rostratula benghalensis*, *Esacus magnirostris*, *Glareola maldivarum*, *Sterna aurantia* and *S. melanogaster*. About 30 species of migratory shorebirds have been recorded, including *Tringa guttifer* and *Eurynorhynchus pygmeus*.

The Estuarine Crocodile *Crocodylus porosus* still occurs in the extensive tidal creeks and mangrove swamps, although now in greatly reduced numbers. Sea turtles nest on many islands in the Mergui Archipelago, and presumably occur in this area.

**Special floral values:** No information.

**Research and facilities:** Very little if any research has been carried out in the area, and almost no recent information is available.

**References:** Blower (1983); FAO (1985a); Smythies (1953).

**Criteria for inclusion:** 1b, 2a, 3b.

**Source:** See references.

**Wetland name:** Wetlands in Pakchan Proposed Nature Reserve

**Country:** Burma

**Coordinates:** 10°35'-10°55'N, 98°30'-98°40'E;

**Location:** the western part of Pakchan Reserved Forest, about 75 km north of Kawthaung and 60 km south of Bokpyin, Tenasserim Division.

**Area:** Area of wetlands unknown; proposed Nature Reserve 25,920 ha.

**Altitude:** Mainly near sea level; Nature Reserve to 750m.

**Biogeographical Province:** 4.5.1.

**Wetland type:** 02, 03, 07, 15 & 21.

**Description of site:** The proposed Nature Reserve includes a coastal strip of low-lying islands, tidal mangrove swamps and freshwater swamp forests, together with the forested hill ranges rising steeply to the east. Almost all the watercourses are perennial and flow either west, becoming brackish in their lower, tidal reaches, or east to the Pakchan River, which defines the Burma-Thailand border.

**Climatic conditions:** Monsoonal climate, transitional between the pronounced wet and dry seasons of the bulk of the country and the more even rainfall pattern of peninsular Malaysia.

The prevailing winds blow from the west and southwest during the May to September monsoon, and from the north during the October to April dry season. The average annual rainfall at Kawthaung, 75 km to the south, is 3,964 mm, with the wettest period being May to September. The mean minimum and maximum temperatures at Kawthaung are 21°C (December and January) and 34°C (March and April), respectively.

**Principal vegetation:** The coastal strip supports a diverse mangrove vegetation, with a primary *Avicennia* dominated accretion, a secondary *Rhizophora* dominated accretion and a Spring Tide Bank type of mixed *Bruguiera* sp and *Sonneratia* sp. The mangrove forest merges into freshwater swamp forest with an abundance of orchids and ferns. Most of the Reserved Forest is climax evergreen rain forest, characterized by a number of species restricted within the country to Tenasserim. Dipterocarpaceae are dominant, especially *Dipterocarpus* sp, with species of *Shorea*, *Parashorea*, *Anisoptera* and *Vatica* also common. *Eugenia*, *Garcinia*, *Lophapetalum*, also restricted within Burma to Tenasserim, are well represented, and the Burmese endemic palm *Calamus helferianus* is present.

**Land tenure:** State owned.

**Conservation measures taken:** The proposed Nature Reserve lies within Pakchan Reserved Forest (145,367 ha), established in July 1931 and contiguous with Lenya Reserved Forest (c.64,800 ha).

Conservation measures proposed: In 1983, it was recommended that after detailed surveying, a Nature Reserve should be established in the western and northern part of the Reserved Forest, to be managed in conjunction with the offshore proposed Lampi Marine National Park (FAO, 1983d).

**Conservation measures proposed:** None

**Land use:** In general, the area is sparsely populated. A number of villages are located close to the proposed boundary and along the coast, including Karathuri, Mathe, Aung Ba and Tolohusa. There is no known resident population in the Reserved Forest with the possible exception of a limited number of resin-tappers. Principal occupations include employment in the State Timber Corporation, fishing, trading and collecting forest produce such as resin (kanyin) and cane.

**Disturbances and threats:** The forest is under threat from illegal resin-tapping, often carried out on excessively small trees. The most serious threat lies in extensive, illegal logging in the east of the Reserved Forest, allegedly by Thais, to feed a number of saw-mills over the border. In addition, Thais are thought to be responsible for elephant hunting and smuggling live animals to Thailand.

**Economic and social values:** The Reserved Forest is of considerable value as protection for the watershed between the coast and the Pakchan valley.

**Fauna:** Little information is available on the fauna as large areas have not been surveyed due to security considerations. Large mammals known to occur in the Reserved Forest include *Panthera tigris*, *Elephas maximus*, *Sus scrofa*, *Hylobates lar*, *Presbytis obscura*, *Cervus unicolor* and a species of *Bos*. The region is known to support a very rich and diverse avifauna including several rare pheasants (Phasianidae), but no details are available on the water birds.

**Special floral values:** The proposed Nature Reserve includes areas of freshwater swamp, now a rare formation in Burma, and extensive mangrove formations still in excellent condition. The Reserved Forest includes some of the finest climax evergreen rain forest in Burma.

**Research and facilities:** The area was initially surveyed in 1982 (FAO, 1982d) and subsequently in more detail in 1983 (FAO, 1983d). However, there has been no comprehensive ecological survey of the area, and there are no scientific or visitor facilities.

**References:** Blower (1982); Chhibber (1927); FAO (1982d, 1983d & 1985a); IUCN (in prep).

**Criteria for inclusion:** lb.

**Source:** See references.

**Wetland name:** Lampi Proposed Marine National Park

**Country:** Burma

**Coordinates:** 10°37'-10°59'N, 98°00'-98°22'E;

**Location:** about 20 km off the west coast off Pakchan Reserved Forest and 80 km NNW of Kawthaung, Tenasserim Division.

**Area:** Area of wetlands unknown; proposed park 388,500 ha.

**Altitude:** Sea level to 465m.

**Biogeographical Province:** 4.5.1.

**Wetland type:** 01, 03, 04, 05, 06, 07 & 15.

**Description of site:** The proposed Marine National Park comprises Lampi Island (16,800 ha), the associated islands (areas unknown) and the intervening sea (about 370,000 ha). Lampi Island, which is oriented in a north-south direction, is about 48 km long and has a maximum width of some 6 km. The northern part of the island curves strongly to the west, forming a large bay in which Kubo Island is situated. Associated islands, which are all considerably smaller than Lampi, include Wa-Ale Kyun and Kanzagyi to the northwest, Pub Nala to the south and the Gregory group to the southeast. The topography of Lampi is generally hilly and rises steeply from sea level to 150-270m, exceeding 350m in places. Much of the coast is rocky, although there are a number of sandy beaches, bays and inlets. The sea between Lampi and the mainland is nowhere deeper than 24m and is generally about half that. Lampi, in common with the 900 or so islands of the Mergui Archipelago, was formed by a combination of tectonic movement and volcanic activity. Rocks are predominantly arenaceous quartzites and sandstones, intruded by granites or porphyries, or overflowed by lava (Chhibber, 1927). Many of the islands in the proposed Marine National Park consist of Moulmein series limestones which have weathered to form large caves. The supply of fresh water is relatively plentiful; whilst many small streams are seasonal, the Zon Chaung and the Sungai Alun are perennial. Major coral formations are found around the smaller islands, especially in the Gregory group, whilst formations around the main island of Lampi are relatively poor.

**Climatic conditions:** The monsoonal climate is transitional between the pronounced wet and dry seasons of the bulk of the country, and the more even pattern of rainfall in peninsular Malaysia. The prevailing winds blow from the west and southwest during the May to September monsoon, and from the northeast and north during the October to April dry season. The close proximity of the Gulf of Thailand across the Kra Isthmus (about 100 km wide at latitude 1°N), gives rise to rain-bearing winds from the east. The mean annual rainfall at Kawthaung, situated on the mainland some 80 km to the south, is 3,964 mm, the wettest period being May to September. Mean annual minimum and maximum temperatures at Kawthaung are 21°C (December and January) and 34°C (March and April), respectively.

**Principal vegetation:** Lampi Island is densely covered by largely undisturbed climax low tropical evergreen forest, dominated by dipterocarps, especially *Dipterocarpus alatus*. Epiphytic species are abundant and include lianas *Calamus* spp. Sandy beaches support beach forest, some with pure stands of *Casuarina equisetifolia*, as well as species of *Dillenia* and *Calophyllum*. Estuaries on the west coast of the island support apparently untouched mangrove formations. There are also some swampy areas.

**Land tenure:** No information.

**Conservation measures taken:** None.

**Conservation measures proposed:** In 1982, it was recommended that the area should be designated as a Marine National Park, after the introduction of nature conservation and national park legislation (FAO, 1982d). In 1985, it was recommended that more detailed surveys be undertaken, a master plan be prepared and specific protection for threatened species be implemented (FAO, 1985a).

**Land use:** The local human population is limited to a small fishing village on Pulau Nala island, which is about 1.6 km south of Lampi and within the proposed protected area. During the monsoon season, some five groups of Sal In marine nomads move in from the outer islands of the Mergui Archipelago and establish temporary camps on Lampi. They support themselves by fishing, hunting, and collecting eagle-wood (*Aquilaria agallocha*), mother-of-pearl, turbo shells, turtle eggs and sea cucumber.

**Disturbances and threats:** There is generally very little disturbance, although most if not all sea-turtle eggs are collected. The current high levels of egg-taking throughout the Mergui Archipelago preclude increases in the turtle population without conservation measures being taken (FAO, 1982d). Tavoy Forest Division is short of staff, and illegal logging and forest encroachment occur (FAO, 1982d).

**Economic and social values:** It is argued that the establishment of a Marine National Park would help to safeguard the culture of the Sal In marine nomads (FAO, 1982d). They reportedly number about 2,000 people and are thought to have arisen from aboriginal Malay stock. Although Lampi is described as having greater promise as a Marine National Park than all other comparable areas in Burma, security considerations and the threat of Thai pirates curb the tourist potential (FAO, 1985a).

**Fauna:** The mammals include an indigenous subspecies of the Lesser Mouse Deer, Small-clawed Otter, Crab-eating Macaque and langur (*Tragulus javanicus lampensis*, *Aonyx cinera*, *Macaca fascicularis* and *Presbytis* sp). Indian Muntjac *Muntiacus muntjak* and Wild Boar *Sus scrofa* are abundant, possibly because of the absence of predators. There is a large colony of flying foxes *Pteropus hypomelanus* on the small island of Pulau Myang Basa in the Gregory group. Dolphins (Delphinidae) are common, and the Dugong *Dugong dugon* may still occur in the area. Notable birds include Nicobar Pigeon *Caloenas nicobarica* and Edible-nest Swiftlet *Collocalia fuciphaga*, the latter inhabiting the caves of Pub Tika. Raptors include *Pandion haliaetus*, *Haliastur indus* and *Haliaeetus leucogaster*. Reptiles include monitor lizards *Varanus* sp. Despite the presence of a number of suitable nesting beaches for sea-turtles, only small numbers of turtles use the islands.

**Special floral values:** No information.

**Research and facilities:** The Mergui Archipelago, including Lampi, was initially surveyed in 1982 (FAO, 1982d). The forest on Lampi was surveyed in somewhat greater detail in 1983 (FAO, 1983d). There are no research or visitor facilities, and there has been no comprehensive ecological survey of the proposed protected area.

**References:** Anon (1937); Chhibber (1927); FAO (1982d, 1983d, 1985a & 1985b); IUCN (in prep); Tun Yin (1954).

**Criteria for inclusion:** 1b, 1e, 2b.

**Source:** See references.

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