SRI LANKA

INTRODUCTION

by S.W. Kotagama, Leonard Pinto and Jayampathi L. Samarakoon

Area: 65,610 sq.km**.**
Population: 14,850,000 (1981).

Sri Lanka is a pear-shaped island in the Indian Ocean, situated between latitudes 5°54'N and 9°52'N, and longitudes 79°39'E and 81°53'E, and separated from India by a channel only 35 km wide at its narrowest. The island measures 435 km from north to south, and 225 km from east to west at its widest. That the island is a detached part of the continental Deccan plateau is evident from its continental shelf and rock formations. Nine-tenths of the island is composed of crystalline rocks of pre-Cambrian age (Cooray, 1967). The greater part of the lowland is composed of very strongly metamorphic Palaeozoic rocks of the Vijayan series. There are areas of Miocene limestone in the northwest and southeast, and very small patches of fossiliferous Jurassic formations in the northwest (Puttalam) and Sabaragamuwa Province (Ratnapura). Plio-Pleistocene gravels occur as isolated patches in the northwest and southeast, and there are quaternary deposits in river valleys and along much of the east and west coasts.

Sri Lanka became an island probably in the late Miocene times, the southwestern sector having been the first to separate from India, with alternate shallow floodings and elevations at various times thereafter. There are also indications that parts of the island have, through subsidence, elevation, erosion and even faulting, produced three peneplains or erosions levels, at sea level to 120m, 300m to 700m, and 910m to 2,438m, respectively. Two-thirds of the island is lowland, with the highlands, at a general elevation of l, 400-l,800m, covering some 10,400 sq.km in the south-central part of the country.

Climatically, three major areas can be recognized. The overall climate is monsoonal with a southwest monsoon in May to August, and a northeast monsoon in October or November to January. The largest climatic area is the low country dry zone; this includes almost the entire northern half of the island, together with much of its eastern side, as far as the southeast coast. Although heavy rains occur during the northeast monsoon, the region is otherwise hot and dry, and is mostly covered with secondary forest and scrub. The annual rainfall ranges from 600 to 1,900 mm. The climate in the southwestern lowlands is very different, and is generally hot and humid, the annual rainfall on occasions exceeding 5,000 mm. The rainfall is concentrated into the period of the southwest monsoon, but also occurs during the northeast monsoon. The highlands also lie within this wet zone, but have a subtropical to temperate climate, depending on altitude.

In the lowlands, temperatures are typically tropical, varying from about 24°C to 32°C. However, at higher elevations much lower temperatures are recorded (10-20°C), and the temperature occasionally approaches zero at localities such as Nuwara Eliya, Horton Plains and Mount Pidurutalagala. In the lowlands, the mean average temperature is about 27°C, in the mid-country about 24°C, and in the highlands about 15°C. There are only slight seasonal variations in temperature, the fluctuations being 1.8°C at the coast, 2.7°C in the uplands and 2.4°C in the highlands.

Although large areas of the island are under cultivation, especially for tea and rubber, there are still some significant areas of dense jungle remaining. The natural forest cover is presently estimated at approximately 23% of the total land area. Most of this (20%) is in the dry zone low country, while only 3% is in the wet zone, including the hill country. Since the control of malaria in the 1950s, most land development has taken place in the dry zone, especially in the basins of the Mahaweli Ganga and the southeastern rivers (MacKinon & MacKinnon, 1986).

Summary of Wetland Situation

The wetlands of Sri Lanka can be very broadly considered under three groups: offshore and marine systems, coastal systems and inland systems.

1. Offshore and Marine Systems

These include shallow sea bays and trait, tnall offshore islands and islets. Some of these sites have received considerable attention because of their fisheries potential.

2. Coastal Systems

These include estuaries, brackish to saline lagoons and mangrove swamps, along with rocky seacoasts, sandy beaches, salterns, saltpans and aquaculture ponds. A considerable amount of information is available on the estuaries and lagoons of Sri Lanka (e.g. Abewickrema, 1960 & 1966; Anon, 1977; Arudpragasam, 1975 & 1984; Fernando, 1983; Marga Institute, 1985a; Norris, 1957; de Silva, 1984), and the mangrove ecosystems have been the subject of many studies (e.g. Aruchelvam, 1968; Flueeler, 1983; Jayewardene, 1985 & 1987; Macnae & Fosberg, 1981a & 1981b; Modenke & Modenke, 1983; Seneviratne, 1978 & 1979; Sivakumar, 1979). Much of this information was recently brought together by the Conference on Critical Habitats (organized by the Coast Conservation Department) and Conference on Coastal Ecoystems (organized by the National Aquatic Resources Agency).

Estuaries

There are some 45 estuaries around the coast of Sri Lanka, belonging to two types: basin estuaries where rivers discharge into relatively shallow basins which in turn open into the sea (e.g. Puttalam Lagoon, Negombo Lagoon and Jaffna Lagoon), and riverine estuaries where rivers discharge into the sea by way of relatively narrow channels (e.g. Kaluganga Estuary and Kelaniganga Estuary). The total extent of the basin estuaries is estimated at 40,000 ha, whereas that of the riverine estuaries is unknown. Sand barrier formation in recent years has transformed some basin estuaries into lagoons (e.g. Koggala Lagoon). In other cases, e.g. Batticaloa Lagoon and Kokkilai Lagoon, sand barriers erase the connection with the sea during a part of the year. Many of the estuaries are under threat from the disposal of industrial effluents and domestic sewage, oil pollution, sand mining, salt exclusion schemes and reclamation for housing developments.

Some hydrographic information is available for the major basin estuaries and a few riverine estuaries, and a little information is available on primary productivity and phytoplankton biomass. Several studies have been carried out on seasonal changes in zooplankton diversity and abundance, and on other invertebrates, particularly annelids, molluscs and crustaceans. A considerable amount of research has been carried out on the fisheries.

Lagoons

There are some 40 true lagoons around the coast of Sri Lanka. They are most common along the southern, southeastern and eastern coasts, where littoral drift causes accumulations of sand as barriers and spits at river mouths through which the freshwater discharge is low. The total area of the lagoons is estimated at about 20,000 ha. Many are seasonal features, formed during the wet season and subsequently drying out during the dry season. In some lagoons, the water becomes hypersaline when sources of fresh water dry up and the connection with the sea is erased by sand barriers (e.g. lewayas in Hambantota). In others, freshwater run-off has a dominant effect and the salinity is very low. In the long term, the lagoons will silt up and provide a barrier against coastal erosion. In the short term, their significance rests mainly upon fisheries, salt production, wildlife, tourism and reclamation of land for agriculture and human settlement.

Mangroves

Mangroves are discontinuously distributed along the coastline, and are absent along exposed shorelines, particularly in the southwest, south and northeast. The main mangrove areas are situated in Mullaitivu, Trincomalee, Kathiraveli, Vakarai, Panichankerni, Valaichenai, Batticaloa, Karativu, Komari, Potuvil, Hambantota, Pilinawa, Matara, Galle, Gintota, Muthurajawela, Negombo, Chilaw, Mundel, Puttalam, Kalpitiya and Mannar, and on the Jaffna Peninsula. The total area of mangroves was conservatively estimated at 3,000-4,000 ha in 1969. However, recent remote sensing studies have indicated that there are 6,296 ha of mangroves in the districts of Colombo, Amparai, Gampaha, Trincomalee, Batticaloa and Puttalam alone, and the total area of mangroves is likely to be close to 10,000 ha.

The mangrove genera *Rhizophora, Avicennia, Excoecaria, Lumnitzera* and *Aegiceras* are distributed island-wide. *Xylocarpus granata* occurs on the west and the east coasts, *Bruguiera cylindrica* occurs only on the west coast, *Ceriops tagal* is absent from Jaffna, and *Nypa fruticans* occurs only in the southwest. Some studies have been carried out on the zonation and pattern of succession in the mangrove forest, and limited information is available on the fishes and invertebrate fauna associated with the mangroves.

Many of the mangrove swamps are under threat from extraction of fuelwood and timber for construction (notably in Jaffna, Batticaloa, Trincomalee, Puttalam and Negombo), and reclamation for housing developments (particularly in densely populated areas such as Negombo). As yet, large-scale transformation of mangrove swamps to brackishwater ponds for aquaculture has n'ot occurred in Sri Lanka. Some 300 ha of shrimp ponds have been constructed in the mangroves (e.g. in Negombo and Chilaw), and a further 1,000 ha have been leased for expansion of aquaculture, but most of this land is situated in areas where mangroves have already been degraded.

Detailed information on the avifauna and other wildlife of the coastal wetlands is only available for a small number of sites. Wetlands such as Bundala and Kalametiya have received a considerable amount of attention, especially from bird-watchers. However, it was not until the early 1980s, when J.D.N. & J. Banks began to carry out monthly censuses of shorebirds at Bundala, that continuous data gathering was attempted at a wetland in Sri Lanka. Recently, the annual mid-winter waterfowl count, organized by the Ceylon Bird Club since 1983, and selected ecological studies by the Field Ornithology Group have greatly increased the amount of

information available on the avifauna of other coastal sites. However, there remain many coastal sites, which are still poorly known.

3.Inland Systems

The natural freshwater habitats consist of about nine large rivers and 94 small rivers (flowing more or less radially and totalling 4,563 km in length), numerous streams (particularly in the wet zone), extensive marshes, which are either connected to rivers or represent seasonally contracted flood plains isolated from the rivers, and many small permanent and seasonal ponds. Although there are no large natural lakes in Sri Lanka, there are many floodplain lakes of the varzea type, known as villus, which cover a total area of about 12,500 ha. Many of the largest villus are situated in the Mahaweli River system in the east. Here there are about 40 of these shallow, seasonal lakes varying in size from nine to 550 ha. Wilpattu National Park, in the west, also possesses a number of very small freshwater villus along with a unique group of salt villus far inland.

In addition to the natural wetlands, there are numerous man-made freshwater habitats. The most important of these are the tanks or "wewa", which vary in size from a few hectares to 6,500 ha at full spill level. Some of these date back 1,500 years and formed part of an intricate water supply system for rice cultivation. Other man-made wetlands include approximately 2,400 km of irrigation channels and some 833,000 ha of rice paddies, as well as numerous very small rain-filled tanks and flooded areas caused by overspill and seepage from the irrigation channels.

Rivers and streams

The nine major rivers, about 25 smaller rivers and their numerous tributary rivers and streams drain a total of 103 basins (Fernando & Indrasena, 1969). Thirty-six of the streams in the highlands were investigated in 1970 by the Austrian-Ceylonese hydrobiological mission. The findings of this investigation have given a good general picture of the status of mountain streams in the country (Costa, 1972; Costa & Starmuhlner, 1972; van den Elzen, 1972; Liyanage & Starmuhiner, 1972; Radda, 1973; Starmuhlner, 1974; Weninger, 1972). Because of their short courses, most of the rivers and streams of the uplands and highlands are fast-flowing, with many waterfalls and rapids. The aquatic plant communities are generally very simple. Various species of Podostomaceae occur on rocks, which are mostly covered by rapidly flowing water, while species such as *Dicraea elongata* and *Podostemum subulatus* are found in the quieter parts of the rapids. Other common species include *Miniathus ceylanicus, Dicraea stylosa, Zeylanidium olivaeaum* and *Farmeria metzgerioides.*
In the lowlands, where the flow of the rivers and streams is sluggish, rooted aquatics with floating or submerged leaves occur along the river margins. Dominant species include *Nymphaea spp, Blyxa aubertii* and *Aponogeton crispum.* On the banks of the rivers, a belt of *Hanguana malayana, Phragmites karka* and *Brianthus arudinaceus* often occurs between the flowing water and adjacent marshes and shallow pools. Elsewhere, the river banks typically support gallery forest with species such as *Terminalia arfuna, Mitragyna parvifolia, Madhuca longifolia, Polyalthia longifolia* and *Diospyros malabarica.*
Thirty-one species of fishes have been recorded in the rivers and streams (Radda, 1973).
The invertebrates include three species of crabs, 1 1 species of prawns and 3 1 species of gastropods (Costa, 1972; Costa & Fernando, 1967; Starmuhlner, 1974).

Man-made lakes (tanks and reservoirs)

The most common freshwater habitats are the irrigation tanks, of which there are over 10,000 in Sri Lanka. About 3,500 may be regarded as significant water bodies, although only about 60 exceed 300 ha in size. The total area of these man-made lakes exceeds 170,000 ha. The tanks and reservoirs can be classified as follows: (a) shallow and heavily silted, with a relatively uniform depth (e.g. Giant's Tank); (b) shallow with a gently sloping bottom (e.g. Tabbowa Tank); (c) deep, encompassing one valley (e.g. Nalanda Reservoir); and (d) deep, encompassing many valleys (e.g. Senanayake Samudra). There are wide variations in the pH (6.8-7.5), calcium content, nitrate and phosphate levels. Slightly acidic waters are common in the southwestern and hilly regions, while more alkaline waters occur in regions with high calcium levels in the Miocene limestone areas.

Ecologically, tanks have enriched Sri Lanka greatly, many of them harbouring a very diverse flora and fauna. The duration of water retention during the year is an important factor influencing the floral composition in a tank ecosystem. Typically, the deeper tanks or reservoirs may have little or no macrophytic vegetation because of the large seasonal fluctuations in water level. Even deep-water tolerant species such as *Nymphaea* do not do well in the high water conditions. However, some forms of floating or floating-leaved plants may occur in the shallower parts of sheltered coves. At low water levels, grasses and annuals invade the drawdown zones of the tanks, and are usually subjected to heavy grazing. For this reason, the drawdown zones of large tanks tend to have a barren appearance with very sparse vegetation.
The deeper water near the centre of the tanks usually has only planktonic species.

Sometimes, however, this zone is invaded by varcono algae and vascular plants such as *Azolla pinnata, Wolffia arrtiza, Pistia stratiotes, Hydrilla verticillata, Lemna spp* and *Najas spp.* In addition, large areas of water may be covered by naturalized exotics such as *Salvinia molesta* and *Eichhornia crassipes.* Some of these species are also found in shallow water along with sedges and asoids. The common species in the shallow, marginal zones are *Limnophytum obtasifolium, Hygrorhiza aristata, Typha augustifolia, Xyris spp, Cyperus spp, Ipomoea aquatica, Ericaulon spp, Jussiaea repens, Panicum spp, Asteracantha longifolia* and *Polygonum spp*. Common shrubs on adjacent high ground include *Hibiscus tiliaceus, Pandanus zeylanicus, Cerbera manghas* and *Syzigium* spp.

The shallow village tanks are swampier in character, with very rich aquatic plant communities. Water levels are very low during the dry season, and many of the tanks dry out completely at this time. The small tanks support a very rich and diverse phytoplankton in which species of *Oscillatria, Microcystis, Hyella* and *Coelosphaerium* are common.

The zooplanktonic and zoobenthic faunas of the tanks have been well documented by Fernando (l965b, 1969 & 1974) and Fernando & Ellepola (1969). Fifty-nine species of freshwater fishes occur in Sri Lanka, including five, which have been introduced (Fernando & Indrasena, 1969). Most of these occur in the tanks and reservoirs. Approximately half of the species belong to the family Cyprinidae, which includes several very abundant species such as *Puntius vittatus, Rasbora daniconius* and *Danio aequipinnatus.* Among the catfishes, *Wallago attu, Ompok bimaculatus, Heteropneustes fossilis* and *Macrones vittatus* are abundant. One of Sri Lanka's indigenous fishes, *Etroplus suratensis,* which occurs in most lakes and estuarine waters, has been the subject of many behavioural studies (e.g. Samarakoon, 1981 & 1983).

Waterfowl are abundant at many of the tanks, reflecting the high densities of the fish populations. Species of cormorants *(Phalacrocorax* spp) and herons and egrets (Ardeidae) are particularly common. Widespread amphibians and reptiles include species of *Rana, Crocodylus*

palustris, Varanus salvator and *Cerberus rhynchops fortoises.* The otter *Lutra ceylonensis* occurs in most lakes.

Wetland Conservation

In recent years, the National Aquatic Resources Agency (NARA), Coast Conservation Department (CCD), and Natural Resources, Energy and Science Authority (NARESA) have shown increasing interest in wetlands. Several of the well-established National Parks such as Wilpattu and Yala include signficant wetlands, while other important sites, such as Chundikkulam, Kokkilai, Kalametiya, Bundala and Wirawila-Tissa, have been designated as Sanctuaries. A large part of the very important Mahaweli River system of villus has received protected status in the Flood Plains National Park and Somawathiya National Park. The threats to wetlands have not, however, diminished. The expansion of aquaculture, the destruction of mangroves for timber and firewood, the reclamation of land for housing, and the development of saltpans continue to threaten wetlands, particularly in the coastal zone.

The need for the integrated management of the coastal zone in Sri Lanka was recognized in the mid-1970s. Consequently, the Coast Conservation Act of 1981 gave a mandate to the Coast Conservation Department to prepare a Coastal Zone Management Plan by October 1986. The National Aquatic Resources Agency, the Natural Resources, Energy and Science Authority, the Central Environment Authority, the Forest Department, the Fisheries Department and other governmental and non-governmental agencies contributed in the preparation of this management plan, which seeks to provide for sustainable yields from multiple uses of the estuaries, lagoons and mangroves in the coastal zone. The problems involved in the management of the coastal zone have been discussed at some length by authors such as de Alwis (1980), Amarasinghe (1978 & 1985), Amarasinghe and de Alwis (1980), Anon (1983), Marga Institute (1978 & 1982), Ranasinghe (1985), Sadacharan (1985), Soysa et al. (1982) and Wickremaratne (1985).

Although there are several non-governmental organizations concerned with the environment in Sri Lanka, only a few have shown interest in wetland conservation, and the most active of these are mainly interested in wildlife, particularly birds. It is hoped that through the present NGO apex organization, the Sri Lanka Environment Congress, more interest in wetlands can be generated and more people encouraged to play an active role in wetland conservation.

Wetland Research

A considerable amount of research has been conducted on the wetlands of Sri Lanka. However, emphasis has been mostly on obtaining basic biological information and much of the research has been commercially oriented, e.g. fisheries research. The status of the inland and estuarine fisheries of Sri Lanka has recently been summarized by Jayasekara (1986) and Samarakoon (1986). Much of the hydrological, limnological and fisheries research has focused on two coastal wetlands near Colombo: Colombo Lake (now a highly polluted and silted lagoon) and Negombo Lagoon. Other work on the estuarine and inland fisheries has included studies by Bruin (1971), B.S. Fernando (1973), C.H. Fernando (1956 & 1965a), Fernando and Indrasena (1969), Funegaard (1985), Pillai (1967), Raphael (1977), Senanayake (1981) and Ward and Wyman (1975).

In recent years, avifaunal surveys and waterfowl censuses have been carried out at wetlands throughout the country. The results of the censuses have been summarized by Hoffmann (1985 & 1987), Powell (l984a & 1984b) and van der Yen (1987), and the most important sites for

waterfowl listed by Hoffmann (1982 & 1984), Jayawardhane (1987) and Karpowicz (1985). The recent interest shown by the aquatic agencies NARA and CCD has given an impetus to research, and conservation oriented ecological research is likely to become more prevalent in the future.

Four important workshops /symposiums on wetlands have been held in Sri Lanka in recent years. These were:

1 Workshop on Critical Habitats in the Coastal Zone of Sri Lanka, organized by the Coast Conservation Department of Sri Lanka, US-AID and the University of Rhode Island; 12-15 May 1986.

2. Symposium on Oceanography and Marine Sciences, organized by the National Aquatic

Resources Agency of Sri Lanka and the Sri Lanka Association for the Advancement of Science; 17-18 October 1986. 3. Workshop on the Research Needs for Aquatic Ecosystems of Sri Lanka (Coral Reefs, Estuaries, Seagrass Beds, Mangroves, Lagoons and Wetlands, and associated aspects of Nature and Wildlife Conservation), organized by the National Aquatic Resources Agency of Sri Lanka; 6-7 November 1986. 4. Regional Symposium on New Perspectives in Research and Management of Mangrove Ecosystems, organized by the Natural Resources, Energy & Science Authority of Sri Lanka and UNESCO; 11-14 November 1986.

Wetland Area Legislation

There is no specific legislation governing the conservation of wetlands, but these sites can be, and indeed some are, protected under the Fauna and Flora Protection Ordinances (Act No. 1 of 1970). In addition the Coast Conservation Act (Act No. 57 of 1981) also gives protection to coastal systems. Under the Fauna and Flora Protection Ordinances, specific sites can be declared Sanctuaries, Strict Natural Reserves, Nature Reserves or National Parks, while under the Coast Conservation Act, sites can be designated as critical habitats for protection (non-development areas). Regulation and control of fishing in inland waters is exercised at present through the Inland Water Regulations of 1978.

Sri Lanka has not yet signed the Ramsar Convention, although the convention has received widespread approval in principle. It is understood from reliable sources that a document for Government sanction has now reached Cabinet level. Given the support of the NGOs and the interest in protecting critical wetland habitats shown by the Coast Conservation Department, the Natural Resources, Energy and Science Authority, and the National Aquatic Research Agency, it is anticipated that Sri Lanka will soon become a Contracting Party to the Convention.

Wetland Area Administration

The administration of protected areas designated under the Fauna and Flora Protection Ordinances is the responsibility of the Department of Wildlife Conservation, whilst other coastal areas declared as non-development zones are administered by the Coast Conservation Department. Many of the inland wetlands (most of which are state owned) come under various departments and ministries. Such government agencies include the Ministry of Lands (mostly state owned lands), the Department of Inland Fisheries (some seasonal tanks, fish ponds etc.), the Department of Irrigation (reservoirs of all sizes), the Low Lying Reclamation Board (certain marsh areas), the Urban Development Authority (marshes close to urban centres) and the Mahaweli Authority of Sri Lanka (the Mahaweli floodplain system). In addition, the Central

Environment Authority, created in 1980, acts as an advisory and co-ordinating organization looking after all environmental issues. The Central Environment Authority is to have wide-ranging legislative powers, which will enable it to prevent implementation of projects, which are environmentally undesirable. The CEA is currently in the process of preparing a National Conservation Strategy.

Organizations involved with Wetlands

a) Governmental Organizations

- Central Environment Authority (CEA)

The CEA is an advisory and co-ordinating organization, created in 1980 to look after all environmental issues.

- Department of Wildlife Conservation, Ministry of State The Department includes the National Park Service and is responsible for the administration of protected areas designated under the Fauna and Flora Protection Ordinances.

- Natural Resources, Energy and Science Authority (NARESA)

NARESA is conducting the Zoological and Botanical Surveys of Sri Lanka and the National Mangrove Study. The Director-General, Dr. R.P. Jayewardene, is the Chairman of the National Mangrove Committee.

- National Aquatic Resources Agency (NARA)

The coordinating administrative infrastructure for planning and management of natural aquatic resources.

- Coast Conservation Department (CCD)

The CCD is responsible for the administration of all coastal areas.

- Ministry of Fisheries

The Ministry and its Departments are responsible for all fisheries in the sea, coastal lagoons and inland waters.

- Mahaweli Authority of Sri Lanka, Ministry of Mahaweli and Mahaweli Development

Responsible for development in the Mahaweli River system.

- Department of Irrigation

Responsible for reservoirs of all sizes.

- Low Lying Reclamation Board

Responsible for certain marsh areas.

- Urban Development Authority

Responsible for marshes close to urban centres.

b) Non-governmental Organizations

- Sri Lanka Environment Congress

The apex organization for non-governmental conservation bodies in Sri Lanka - Wildlife and Nature Protection Society of Sri Lanka By far the largest and oldest NGO in Sri Lanka, established in 1894. The Society publishes the journal "Loris". - Ceylon Bird Club. The Bird Club has maintained records of bird observations throughout the island for nearly 50 years, and has organized mid-winter waterfowl counts since 1983.

- March for Conservation

A conservation body established in 1980 and focusing on education and research.

- Field Ornithology Group The Group was established in 1976; it focuses on field studies and holds an annual conference.

- ICBP National Section

The Section includes representatives of the four NGOs concerned with birds and the Government Department of Wildlife Conservation.

c) Universities

- Open University of Sri Lanka
- University of Batticaloa
- University of Kelaniya

The Department of Zoology conducts research on aquaculture and fisheries in coastal lagoons and mangroves, and is involved in the Coast Conservation Programme.

- Ruhuna University, Fisheries Science
- University of Jaffna
- University of Colombo, Marine Ecology
- University of Sri Jayawardena Pura

[redacted]

WETLANDS

Site descriptions compiled from information provided by S.W. Kotagama of March for Conservation, Leonard Pinto of the Open Universty of Sri Lanka, Malcolm A.B. Jansen of the Mahaweli Authority of Sri Lanka, Ll. Samarakoon of the University of Kelaniya, and Thilo W. Hoffmann of the Ceylon Bird Club. Additional waterfowl count data were provided by Bennie L. Abeyratue, J.D.N. and J. Banks, Douglas B. Ranasinghe, Yasa Ratnayake and S.C. Seneviratne.

Wetland name: Wetlands of Delft Island
Country: Sri Lanka
Coordinates: 9°31'N, 79°41'E;
Location: on Delft Island, about 40 km southwest of Jaffna, Jaffna District, Northern Province.
Area: Unknown.
Altitude: Near sea level.
Biogeographical Province: 4.13.4.
Wetland type: 03, 08 & 17.
Description of site: Several shallow lagoons and a few freshwater ponds on Delft Island, including Vedduk Kulam, Periya Kulam, Arichandrapiddi Kulam and Vellaikali. Delft Island is a low-lying coral island of about 6,000 ha (approximately 8 km by 8 km), situated in the Palk Strait between the Jaffna Peninsula and Rameswaram (India). The largest wetland, Periya Kulam, is a shallow lagoon of about 200 ha, bordered by *Palmyra* palms to the west and flooded grassland with coral outcrops to the north, south and east.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: No information is available on the aquatic vegetation. The wetlands are surrounded by grassy plains, barren land, scrub, coconut groves and small seasonal agricultural holdings.
Land tenure: The wetlands are state owned; surrounding areas are partly state owned and partly private.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: There is a small resident population on the island, living from fishing and agriculture.
Disturbances and threats: No information.
Economic and social values: The island is important for its fisheries.
Fauna: Of great importance for flamingos *Phoenicopterus ruber,* ducks and shorebirds. Hoffmann (1985) recorded 50 *P. ruber* and 12,550 Anas *acuta* at Vedduk Kulam in January 1984, while Powell (1984b) recorded approximately 20,000 ducks at Periya Kulam in the same winter. These included
6,000 *Anas querquedula,*
2,000 *A. penelope*
and 1,100 *A. acuta.*
Other waterfowl present at this time included over 650 *Pluvialis dominica.*
Special floral values: No information.
References: Hoffmann (1982 & 1985); Karpowicz (1985); Powell (l984b).
Criteria for inclusion: lb, 3a.
Source: See references.

Wetland name: Punkudutivu Lagoon
Country: Sri Lanka
Coordinates: 9°36'N, 79°50'E;

Location: Punkudutivu Island, Jaffna District, Northern Province.
Area: 390 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 03 & 08.
Description of site: A shallow, brackish to saline, tidal lagoon occupying much of the interior of Punkuditivu Island, a small island off the western tip of the Jaffna Peninsula. The lagoon is 1-2m deep; it is connected to the sea by two channels on the north side. Extensive mudflats are exposed at low tide.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Sea grasses; cultivated land in adjacent areas.
Land tenure: The lagoon is state owned; surrounding areas are privately owned.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing, particularly for prawns; cultivation in surrounding areas.
Disturbances and threats: No information.
Economic and social values: The lagoon is important for its fisheries production.
Fauna: Of great importance for flamingos *Phoenicopterus ruber,* ducks, shorebirds and terns. Fifty *P. ruber* and 250 *Anas penelope* were present in January 1984.
Special floral values: No information.
References: Hoffmann (1982 & 1985); Karpowicz (1985).
Criteria for inclusion: lb. 3b.
Source: J.I. Samarakoon.

Wetland name: West end of Jaffna Peninsula
Country: Sri Lanka
Coordinates: 9°36'-9°46'N, 79°50'-80°01'E;
Location: Jaffna District, Northern Province.
Area: c.20,000 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 01, 03, 05, 06, 07 & 08.
Description of site: The complex of shallow sea bays, intertidal mudflats, mangrove swamps and saline marshes at the western end of the Jaffna Peninsula, including the large shallow lagoon between the western tip of the Jaffna Peninsula, Mandaitivu Island, Kayts Island and Karaitivu Island (10,1 13 ha), the mudflats and open land along the north shore of Kayts Island, the mudflats and mangroves around Mandaitivu Island, the Punalai Causeway area between Karaitivu Island and Jaffna Peninsula, and the Uppu Kuli and Mudali Kuli wetlands on Karaitivu Island. The main lagoon between Karaitivu, Kayts and the peninsula is mostly about 1-2m deep, with some areas up to 4m in depth; tidal variations are slight. The shoreline consists of sand, shingle and mud with patches of mangrove scrub and many small tidal creeks. Uppu Kuli and Mudali Kuli are two small wetlands on the western side of Kayts Island. Uppu Kuli is a freshwater lagoon of 40 ha; Mudali Kuli is an area of flooded grassland of approximately 20 ha.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Extensive beds of seagrasses throughout the shallow sea areas; also some *Avicennia* mangroves on the north shore of Kayts Island and between Kayts Island and Mandaitivu Island, and salt marsh communities on the east shore of Karaitivu Island. Rice paddies, other cultivated land, thorn scrub and barren land in adjacent areas.

Land tenure: The wetlands are state owned; surrounding areas are partly state owned and partly private.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing for finfish and prawns; human settlement and cultivation in adjacent areas.
Disturbances and threats: The principal threats are the continuing destruction of mangrove vegetation, and severe pollution and land-filling west of Jaffna town.
Economic and social values: Fishing provides the main livelihood for many of the local people.
Fauna: The area is particularly important for migratory ducks and shorebirds, which occur in very large numbers, especially during the migration seasons. In January 1984, a concentration of 25,000 ducks was located near the Jaffna-Kayts causeway, including *15,000 Anas acuta, 9,000 A. penelope* and 1,000 *A. querquedula.* Fourteen species of shorebirds were also present, including 5,000 *Limosa limosa* and 145 *Numenius arquata.* Over 1,000 ducks (including small numbers of *Atias crecca* and *A. clypeata)* were found roosting at Uppu Kuli, and *1,200 L. limosa* were present at Mudali Kuli. The area is also of importance for *Phoenicopterus ruber,* gulls and terns.
Special floral values: No information.
Research and facilities: Some research has been carried out by the University of Jaffna, and several mid-winter waterfowl censuses have been made.
References: Hoffmann (1982 & 1985*);* Karpowicz (1985); Powell (l984b); Sachithananthan (1969); Sachithananthan & Perera (1970); Salm *(1975).*
Criteria for inclusion: lb. 3a.
Source: L. Samarakoon.

Wetland name: Uppu Aru Lagoon
Country: Sri Lanka
Coordinates: 9°39'-9°44'N, 80°04'-80°10'E;
Location: in the interior of the Jaffna Peninsula, 10 km east of Jaffna, Jaffna District, Northern Province.
Area: 3,000 ha.
Altitude: Near sea level.
Biogeographical Province: 4.13.4.
Wetland type: 07 & 08.
Description of site: A brackish lagoon with fringing mangroves, linked to the main Jaffna Lagoon to the south by a short channel. The lagoon lies to the north of the Navatkuli Bridge and is bisected by a causeway; it has a maximum depth of about 3m. There are extensive mudflats and salt marshes of great importance for migratory water birds, especially in the Sarasalai area and near Puttur (the middle section of the lagoon and connection to Thondamannar Lagoon).
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Mangrove swamps dominated by *Avicennia; Palmyra* palms, coconut plantations, grassland, rice paddies and extensive vegetable gardens in surrounding areas.
Land tenure: The wetland is state owned; surrounding areas are partly state owned and partly private.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Cultivation in surrounding areas. There are several villages with some light industry at the northwestern end of the lagoon.
Disturbances and threats: No information.
Economic and social values: No information.

Fauna: Of great importance for flamingos *Phoenicopterus ruber,* ducks and shorebirds. Waterfowl recorded in mid-winter 1983/84 included:
370 *Anas crecca*
875 *A. acuta*
2,700 *A. querquedula*
800 *A. clypeata*
2,590 *Limosa limosa*
11 other species of shorebirds
Special floral values: No information.
References: Hoffmann (1985); Karpowicz (1985); Powell (1984b).
Criteria for inclusion: Ib. 3b.
Source: See references.

Wetland name: Thondamannar Lagoon
Country: Sri Lanka
Coordinates: 9°34'-9°49'N, 80°08'-80°29'E;
Location: in the interior of the Jaffna Peninsula, east of Jaffna, Jaffna District, Northern Province.
Area: 7,787 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 07 & 08.
Description of site: A shallow brackish to saline lagoon stretching for about 45 km along the northern side of the Jaffna Peninsula. The lagoon was formed by the combined action of barrier formation and drowning of a river valley. The northwestern section of the lagoon (Vallai Lagoon) is connected to the Indian Ocean by a narrow channel at Thondamannar, and is saline and tidal. There are extensive mangrove swamps and seagrass beds in the northwest and in the southeastern arm of the lagoon in the Vadamarachchi area, as well as extensive mudflats at the eastern and western ends. The exit of the southeastern arm has been dammed at its narrowest point to prevent ingress of sea water. Wind mills have been installed to pump out the brackish water, which is replenished by rain water during the wet season. The average depth of the lagoon during the wet season is about two meters deep; most of the southeastern section dries out during the dry season (April to September).
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Sea grass beds, some salt marsh vegetation and mangrove swamps dominated by *Avicennia* sp; *Palmira* and coconut palms, open forest arid scrub, rice paddies and other crop lands in surrounding areas.
Land tenure: The lagoon is state owned; surrounding areas are partly state owned and partly private.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing, especially for prawns; agriculture in surrounding areas. There has been some experimental cage culture of the fishes *Siganus jarvus* and *S. oramin* and the shrimp *Penaeus indicus* in the lagoon.
Possible changes in land use: Conversion of the southeastern arm of the lagoon into a freshwater lake.
Disturbances and threats: A Salt Water Exclusion Scheme is in progress in the southeastern part of the lagoon. The slow process of desalination will take many years to complete, and will have far-reaching ecological consequences. Since the dam was constructed, this section of the

lagoon has received insufficient inflow to retain water throughout the year. Extraction of timber has caused a marked reduction in mangrove cover. Large areas of the wetland have been reclaimed for agriculture and this reclamation continues. Parts of the lagoon are used for aquaculture, and there is some pollution with pesticides used on the adjacent agricultural land.
Economic and social values: The lagoon supports an important prawn fishery, and the mangroves provide fuel and food for the local inhabitants.
Fauna: Of great importance for flamingos *Phoenicopterus ruber,* ducks, shorebirds, gulls and terns. Waterfowl recorded in January 1984 included
520 *Anas penelope,*
3,600 *A. acuta*
and 900 *A. querquedula.*
By far the most important area for water birds is the western portion of the lagoon near Thondamannar, Vallai and Achchuveli.
Special floral values: No information.
Research and facilities: Some research has been carried out by the Department of Zoology, University of Jaffna, and several waterfowl censuses have been made. The Thondamannar Field Research Center of the Department of Education is located on the north shore of the lagoon.
References: Arudpragasam (1975); Fernando (1977); Hoffmann (1982 & 1985); Karpowicz (1985); Kugathasan (1969); Pillai (1960); Salm (1975); de Silva (1984).
Criteria for inclusion: lb. 3b.
Source: J.I. Samarakoon and T.W. Hoffmann.

Wetland name: Jaffna Lagoon
Country: Sri Lanka
Coordinates: 9°27'-9°39'N, 80°03'-80°24'E;
Location: between the Jaffna Peninsula and the mainland, southeast of Jaffna, Jaffna District, Northern Province.
Area: c.40,000 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 07 & 08.
Description of site: A large, shallow, tidal lagoon with extensive intertidal mudflats, some fringing mangroves and a broad connection to the sea at its western end. The lagoon was formed by the combined action of barrier formation and drowning of a river valley. At low tide, some 2,000 ha of mudflats are exposed at the eastern end of the lagoon.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Extensive beds of sea grasses throughout the lagoon and some fringing mangroves, particularly around bays in the southeast; Palmyra palms, rice paddies and other crop lands in surrounding areas. There are extensive coconut plantations along the northeastern shore.
Land tenure: The lagoon is state owned; surrounding areas are partly state owned and partly private.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing; there are a few fishing villages on the shores of the lagoon and salt pans in the eastern sector.
Disturbances and threats: No information.
Economic and social values: The lagoon supports an important fishery.
Fauna: The most important site in Sri Lanka for the Greater Flamingo *Phoenicopterus ruber,* and of considerable importance for migratory ducks, shorebirds, gulls and terns. As many as

5,000 P. ruber have been recorded on numerous occasions. The lagoon is particularly important for shorebirds; a concentration of 30,000 shorebirds in the winter of 1983/84 included
3,000 *Limosa limosa,*
6,500 *Calidris minuta*
and 16,000 *C. ferruginea* (Powell, 1984b).
Migratory ducks recorded in January 1984 included
770 *Anas penelope,*
865 A. acute
and 350 *A. querquedula* (Hoffmann, 1985).
Special floral values: No information.
References: Arudpragasam (1974); Hoffmann *(1982 & 1985*); Karpowicz (1985); Powell (1984b); Sachithananthan (1969); Sachithananthan & Perera (1970); Selvarajah & Costa (1978).
Criteria for inclusion: 1b, 3a.
Source: T.W. Hoffmann.

Wetland name: Chundikkulam Lagoon
Country: Sri Lanka
Coordinates: 9°26'-9°32'N, 80°24'-80°37'E;
Location: at the base of the Jaffna Peninsula, east of Elephant Pass, Jaffna District, Northern Province.
Area: 13,500 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 07 & 08.
Description of site: A large brackish lagoon with some fringing mangroves and sea grass beds. The lagoon once formed part of the Jaffna Lagoon system and was saline, but with the closure of the Elephant Pass causeway at the west end, the salinity of the lagoon is said to have decreased, and large areas now dry out during the dry season (April to September). Numerous small streams enter the lagoon along its southern shore. There is a fairly extensive Government saltern (salt producing area) on the western side of the Elephant Pass causeway, and this was the reason why the former tidal connection between Chundikkulam and Jaffna lagoons was permanently interrupted.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Mangrove swamps and sea grass beds; plantations of *Palmyra* palms and scrub forest in surrounding areas.
Land tenure: The lagoon is state owned; surrounding areas are partly state owned and partly private.
Conservation measures taken: An area of 11,158 ha, including the southeastern portion of the lagoon and adjacent lands, was declared a Bird Sanctuary (the Chundikkulam Sanctuary) under the Fauna and Flora Protection Ordinances in February 1938.
Conservation measures proposed: None
Land use: Prawn fishing and some salt production; cultivation of *Palmyra* palms in adjacent areas.
Possible changes in land use: Conversion to a freshwater lake.
Disturbances and threats: The isolation of the lagoon from tidal influence has undoubtedly had major ecological consequences, but these have never been studied. A salt-water exclusion scheme was started but later abandoned. However, there are plans to revive the scheme again. The Ceylon Bird Club has strongly protested against this being done without a careful environmental impact assessment. The Bird Sanctuary has never been adequately protected, and

has been open to a variety of abuses. Parts of the lagoon are used for aquaculture, and the surrounding forests are being cleared.
Economic and social values: The lagoon supports a subsistence fishery.
Fauna: Of great importance for a wide variety of waterfowl, notably *Mycteria leucocephala, Threskiornis melanocephalus, Platalea leucorodia*, migratory ducks, *Fulica atra,* migratory shorebirds, gulls and terns. Waterfowl observed in the winter of 1982/83 included:
500 *Phoenicopterus ruber*
125 *Anas crecca*
4,000 *A. acuta*
6,300 *A. querquedula*
Special floral values: No information.
Research and facilities: Some waterfowl censuses have been carried out.
References: Hoffmann *(1982 & 1985*); Karpowicz (1985); Powell (l984b).
Criteria for inclusion: lb, 3a.
Source: J.I. Samarakoon and T.W. Hoffmann.

Wetland name: Chalai Lagoon
Country: Sri Lanka
Coordinates: 9°20'-9°26'N, 80°37'-80°44'E;
Location: on the northeast coast between Chundikkulam Lagoon and Nanthi Kadal Lagoon, Mullaitivu District, Northern Province.
Area: 1,460 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 07 & 08.
Description of site: A long, narrow, brackish coastal lagoon with some mangrove swamps and sea grass beds. The lagoon is fed by several small streams, and is seasonally tidal. The water level fluctuates widely, and parts of the lagoon are impounded for salt production during the dry season. The lagoon adjoins Chundikkulam Lagoon (site 7) to the northwest.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Mangrove swamps and sea grass beds; dense forest and scrub in surrounding areas, with some rice paddies and barren areas.
Land tenure: The lagoon is state owned; surrounding areas are partly state owned and partly privately owned.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Salt production during the dry season and a small amount of fishing; some cultivation near the southern section of the lagoon.
Disturbances and threats: Conversion of the lagoon to salt pans and aquaculture ponds.
Economic and social values: Salt production and fisheries.
Fauna: Reported to be of considerable importance for a wide variety of waterfowl, notably large water birds, ducks, shorebirds, gulls and terns, especially in conjunction with Chundikkulam Lagoon. The lagoon seems to be particularly important as a staging area for departing shorebirds in spring.
Special floral values: No information.
References: Hoffmann (1982).
Criteria for inclusion: lb, 3b.
Source: J.I. Samarakoon and T.W. Hoffmann.

Wetland name: Nai Aru Lagoon
Country: Sri Lanka
Coordinates: 9°06'-9°l0'N, 80°50'-80°53'E;
Location: on the northeast coast 12 km SSE of Mullaitivu, Mullaitivu District, Northern Province.
Area: 1,760 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 02, 06 & 07.
Description of site: A large estuarine lagoon with some mangrove swamps and sea grass beds. The lagoon is fed by several small streams; it has a narrow connection to the sea and is seasonally tidal. The maximum depth near the mouth of the lagoon is about 3-4 meters; the water is brackish, increasing to about 30 p.p.t. seasonally.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Some mangrove swamps and sea grass beds. The lagoon is surrounded by dense forest and scrub, with some rice paddies, other crop lands and coconut palms, particularly in the northwest.
Land tenure: The lagoon is state owned; surrounding areas are partly state owned and partly privately owned.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Prawn fishing; paddy cultivation and shifting cultivation in surrounding areas.
Disturbances and threats: The freshwater inflow is diminishing, as more and more water is diverted from the inflowing streams for irrigation and other uses, and the lagoon is silting up.
The connection with the sea is becoming permanently blocked by a sand bar, and this is resulting in diminished recruitment of penaeid post-larvae.
Economic and social values: The lagoon supports a major prawn fishery.
Fauna: A very important wintering area for migratory ducks, shorebirds, gulls and terns, especially when surrounding grasslands are flooded in winter. Considerable numbers of a wide variety of water birds have been observed in the area, but no details are available.
Special floral values: No information.
References: Hoffmann (1982); Perera & Sachithananthan (1977).
Criteria for inclusion: 1b, 3b.
Source: J.I. Samarakoon and T.W. Hoffmann.

Wetland name: Kokkilai Lagoon
Country: Sri Lanka
Coordinates: 8°56'-9°03'N, 80°52'-80°58'E;
Location: on the northeast coast, southeast of Nayaru Lagoon and northwest of Pulmoddai, Mullaitivu and Trincomalee Districts, Northern and Eastern Provinces.
Area: 2,995 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 02, 06 & 07.
Description of site: A large estuarine lagoon with extensive sea grass beds and some small patches of mangrove swamp and mudflats, particularly along the western and southern shores. The lagoon is fed by several small streams; it is linked to the sea by a narrow channel and is seasonally tidal, but for much of the year the channel is blocked by a sand bar. The maximum

depth near the mouth of the channel is about four meters; the water is brackish, with the salinity increasing to about 30 p.p.t. seasonally.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Extensive sea grass beds and some mangrove swamps. The lagoon is surrounded by cultivated land and scrub, with some patches of open forest.
Land tenure: The lagoon is state owned; surrounding areas are partly state owned and partly privately owned.
Conservation measures taken: The lagoon was declared a Wildlife Sanctuary under the Fauna and Flora Protection Ordinances in 1951, but the degree of protection is reported to be very poor.
Conservation measures proposed: None
Land use: Prawn fishing; paddy cultivation and some shifting cultivation in surrounding areas. The lagoon is situated in a densely populated region with many small villages.
Disturbances and threats: In some years, the connection with the sea remains permanently blocked by a sand bar, preventing recruitment of penaeid post-larvae. Regular marinal breaching is required to sustain shrimp productivity. Parts of the lagoon are used for aquaculture, and the adjacent patches of forest are being cleared for cultivation.
Economic and social values: The lagoon supports a major prawn fishery.
Fauna: Known to be a very important site for a wide variety of waterfowl including pelicans, cormorants, herons, egrets, storks, ducks and migratory shorebirds, but no recent information is available. The lagoon was once famous as a wintering area for large numbers of Greater Flamingos *Phoenicopterus ruber.*
Special floral values: No information.
References: Hoffmann (1982); Karpowicz (1985); Pillai (1960); Salm (1975); de Silva (1984).
Criteria for inclusion: 1b, 3b.
Source: J.I. Samarakoon.

Wetland name: Periyakarachchl Lagoon and Sinnakarachchi Lagoon
Country: Sri Lanka
Coordinates: 8°40'-8°47'N, 81°06'-81°ll'E;
Location: 13-20 km northwest of Trincomalee, Trincomalee District, Eastern Province.
Area: Periyakarachchi 650 ha; Sinnakarachchi 780 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 06, 07, 08 & 09.
Description of site: Two shallow, brackish coastal lagoons with some mangrove swamps, seagrass beds and extensive mudflats, on the east coast north of Trincomalee. Both lagoons are fed by several small streams and are seasonally tidal. They both have a maximum depth of about two meters, and dry out completely during drought periods. Much of the southern section of Sinnakarachchi Lagoon has been converted into saltpans, and salt pans are now being constructed in the northern section.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Some mangroves and sea grasses; rice paddies, coconut palms and scrub forest in surrounding areas.
Land tenure: The lagoons are state owned; surrounding areas are partly state owned and partly privately owned.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing for finfish and prawns, and salt production; shifting cultivation and permanent cultivation of rice and coconuts in surrounding areas.

Disturbances and threats: Parts of Periyakarachchi Lagoon are being developed for aquacuiture, large areas of Sinnakarachchi Lagoon are being developed for salt production, and there is a siltation problem.
Economic and social values: The lagoons support small subsistence fisheries, and salt production is important at Sinnakarachchi Lagoon.
Fauna: An important area for migratory ducks and shorebirds. Flamingos *Phoenicopterus ruber* have been known to occur, and *Ephippiorhynchus asiaticus* is occasionally reported.
Special floral values: No information.
References: Hoffmann (1982).
Criteria for inclusion: l b, 3b.
Source: J.I. Samarakoon and T.W. Hoffmann.

Wetland name: Ullackalie Lagoon
Country: Sri Lanka
Coordinates: 8°20'-8°25'N, 8l°20'-81°23'E;
Location: near Toppur, 25 km southeast of Trincomalee, Trincomalee District, Eastern Province.
Area: 1,300 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 07 & 08.
Description of site: A large, shallow, brackish coastal lagoon on the east coast south of Trincomalee. There are extensive mangrove areas on the shores of the lagoon and at its southern end. The lagoon is permanent and up two meters deep; it is fed by several small streams and is seasonally tidal. During the rainy season, the lagoon is connected to the Verugal River to the south by a seasonal channel (Uppu Aru).
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Some mangroves; dry zone evergreen forest and scrub in surrounding areas.
Land tenure: The lagoon and surrounding areas are state owned.
Conservation measures taken: The western part of the lagoon lies within the Seruvila-Allai Sanctuary (c.15,552 ha), established in October 1970.
Conservation measures proposed: None
Land use: Subsistence fishing.
Disturbances and threats: No information.
Economic and social values: The lagoon supports a small fishery.
Fauna: An important site for large water birds, migratory ducks and shorebirds. Seasonal floods along the Uppu Aru at the south end of the lagoon are particularly important for migratory water birds.
Special floral values: No information.
References: Hoffmann (1982).
Criteria for inclusion: lb, 3b.
Source: Ll. Samarakoon and T.W. Hoffmann.

Wetland name: Mahaweli Ganga Flood Plain System
Country: Sri Lanka
Coordinates: 7°48'-8°28'N, 81°01'-81°34'E;
Location: along the Mahaweli River from its mouths near Trincomalee SSW to the region of Polonnaruwa, Polonnaruwa and Trincomalee Districts, North-Central and Eastern Provinces.

Area: c.50,000 ha.
Altitude: Sea level to 50m.
Biogeographical Province: 4.13.4.
Wetland type: 02, 07, 11, 13, 14, 15, 18, 19 & 21.
Description of site: The Mahaweli Ganga is Sri Lanka's largest water resource. Its flood plain, covering about 50,000 ha, is the most extensive in the country. The alluvial plain begins a few km upstream from the township of Mannampitiya. The deltaic plain commences with the first distributary, the Kandakadu Aru, which flows eastwards to join another Mahaweli distributary, the Verugal Aru. The combined flow of the merged streams enters the sea near Verugal, on the east coast. Some of this water is diverted at the Verugal anicut for irrigation purposes. Below the Verugal Aru there is another major distributary, the Koddiya Aru, which reaches the coast at Mutur. Both this and the Mahaweli Ganga main channel discharge into Koddiyar Bay, a large and deep re-entrant of the continental margin formed at the head of a submarine canyon. The shore region of Koddiyar Bay near the mouth of the Mahaweli Ganga is a sandy beach ridge of variable width, with mangrove swamps fringing small lagoons and tidal creeks. The extreme western part of Koddiyar Bay opens into the elongated and shallow Tambalagam Bay which is surrounded by extensive mangrove swamps. Mangrove swamps also occur along the main rivers up to 5 km inland from their mouths.
Upstream from the coast, the flood plain is composed of a complex system of river channels, riverine marshes (or villus), their associated seasonally flooded grasslands, and freshwater swamp forests. The characteristic feature of the flood plain is the dominance of water tolerant plants (hydrophytes) in the biological community. The different habitat types vary considerably in their characteristics according to factors such as duration of the wet period, depth of flooding, salinity of the water, and quantity of nutrients available.
There are approximately 10,000 ha of freshwater riverine marshes (villus) occurring in association with the Mahaweli Ganga and its distributaries. These villus are shallow, saucer-shaped depressions that occupy natural depressions between the levee ridges of the channels of the Mahaweli and its various active and former distributaries, or between these levee ridges and adjacent upland areas. The villus are maintained by the annual cycle of rainfall and river flooding. Most of the villus are directly connected to the river by narrow channels. During the dry season when the river is low, much of the water in the villus flows out into the river through these channels. Although some of the villus may retain water throughout the year, others become dry, or virtually so, for short periods every year. However, even when surface water has disappeared, wet soil conditions may still prevail. Villus generally have waters which are suitable for most irrigation purposes, although high salinities are often encountered as a result of high evaporation during the extensive drawdown periods that occur annually. The principal villus are as follows:

- Handapan Villu and Bendiya Villu: 7°48_7°5lN, 8l°02'-8l°05'E; Polonnaruwa District; 796 ha; two interconnected villus which usually retain water throughout the year. Protected in the Flood Plains National Park.
- Gengala Villu: T54'N, 81°06'E; Polonnaruwa District; 264 ha; dries out completely under extreme drought conditions. Protected in the Flood Plains National Park.
- Velankadu Villu: 7°54'N, 8l°04'E; Polonnaruwa District; 679 ha; usually retains water throughout the dry season. Partly protected in the Flood Plains National Park.
- Karapola Villu and Hewanpitiya Villu: 7°54'-7°58'N, 8l°07'-81°10'E; Polonnaruwa District; 552 ha; some water always retained even in dry years. Protected in the Flood Plains National Park.

- Mutugalla Villu: 7°58'-8°01'N, 8l°03'-8l°l0'E; Polonnaruwa District; 453 ha; rarely dries out completely. Protected in the Flood Plains National Park.
- Katuwanwila Villu and Kanavadi Villu: 8°00'-8°07'N, 81°08'-81°10'E; Polonnaruwa District; 213 ha. Protected in the Flood Plains National Park.
- Kokku Villu: 8°02'N, 8l°09'E; Polonnaruwa District; 40 ha; may dry out during the dry season. Protected in the Flood Plains National Park.
- Vandevettena Villu: 8°03'N, 81°10'E; Polonnaruwa District; 162 ha; rarely dries out.
- Tamdra Villu: 7°55'N, 81°07'E; Polonnaruwa District; 30 ha; dries out completely during the dry season. Protected in the Flood Plains National Park.
- Uradi Villu: 8°04'N, 8l°1O'E; Polonnaruwa District; originally 98 ha; the villu has recently been incorporated into a Government livestock farm and the vegetation replaced by improved grassland; flooding is now restricted.
- Kudapattu Villu Vette: 8°05'N, 81°10'E; Polonnaruwa District; 62 ha; dries out completely during the dry season.
- Maiwatta Villu: 8°05'N, 81°12'E; Polonnaruwa District; 149 ha; never dries out completely. Protected in the Flood Plains National Park.
- Meen Villu:8°07'N, 81°1O'E; Polonnaruwa District; 285 ha; never driesout completely. Protected in the Somawathiya National Park.
- Dambakadawela Wewa Vette and Kanjankadawala Vette: 8°09'N, 81°08'E; Polonnaruwa District; 384 ha; never dries out completely. Protected in the Somawathiya National Park.
- Koyamala Villu: 8°08'N, 8l°1O'E; Polonnaruwa District; 158 ha; never dries out completely. Protected in the Somawathiya National Park
- Tirikonamadu Villu: 8°08'N, 81°14'E; Polonnaruwa District; 251 ha; usually dries out during the dry season.
- Gangapahala Villu: 8°05'-8°10'N, 81°13'-8l°14'E; Polonnaruwa District; 131 ha; may dry out in extreme drought conditions. Protected in the Tirikonamadu Nature Reserve.
- Kompanachchi Villu: 8°10'N, 81°l4'E; Trincomalee District; 160 ha; remains wet throughout the year. Protected in the Somawathiya National Park.
- Eruvilal Kottaly Vette: 8°10'-8°l3'N, 81°ll'-8l°13'E; Polonnaruwa District; over 500 ha; permanent but subject to very wide fluctuations in water level. Protected in the Somawathiya National Park.
- Velvevette Villu: 8°07'N, 81°14'E; 14'E; Polonnaruwa District; 179 ha; remains wet throughout the year. The western part of the villu is protected in the Tirikonamadu Nature Reserve.
- Tamaramadu Villu: 8°1O'N, 8l°10'E; Trincomalee District; 160 ha; may dry out completely during the dry season. Protected in the Somawathiya National Park.
- Pawana Vette: 8°12'N, 81°14'E; Trincomalee District; 120 ha; wet for only a short period of the year. Protected in the Somawathiya National Park.
- Potanveli Vette: 8°08'N, 81°09'E; Polonnaruwa District; 12 ha; wet for only a few months of the year. Protected in the Somawathiya National Park.
- Parakasu Vette: 8°08'N, 81°10'E; Polonnaruwa District; 48 ha; dries out during the dry season. Protected in the Somawathiya National Park.
- Peria Vette: 8°10'N, 81°l 1'E; Polonnaruwa District; 30 ha; dries out during the dry season. Protected in the Somawathiya National Park.
- Karadonode Vette: 8°06'N, 8l°ll'E; Polonnaruwa District; 30 ha; usually dries out completely during the dry season. Protected in the Somawathiya National Park.
- Tamara Villu: 8°09'N, 81°12'E; Trincomalee District; 40 ha; dries out only in extremely dry years. Protected in the Somawathiya National Park.
- Vellai Vette: 8°13'-8°16'N, 81°14'-81°16'E; Trincomalee District; 400 ha; dries out only in extremely dry years. Protected in the Somawathiya National Park.

- Sittaru Vette: 8°15'N, 81°14'E; Trincomalee District; 100 ha; dries out completely during the dry season. Protected in the Somawathiya National Park.
- Angodai Vette: 8°14'N**,** 81°16'E; Polonnaruwa District; 170 ha; usually does not dry out completely. Protected in the Tirikonamadu Nature Reserve.
- Palia Villu: 8°l7'N, 81°l6'E; Trincomalee District; 160 ha; more or less permanent. Partly protected in the Somawathiya National Park.
- Vavana Villu: 8°22'N, 8l°12'; Trincomalee District; 120 ha; never dries out completely.
- Peram Villu: 8°18'N, 81°14'E; Trincomalee District; 16 ha; dries out completely during the dry season. Protected in the Somawathiya National Park.
- Sangankuli Vette: 8°16'N, 81°21'E; Trincomalee District; 128 ha; dries out completely during the dry season.
- Tikkana Villu: 8°15'N, 81°21'E; Batticaloa District; permanent with wide fluctuations in water level.
- Kariaveli Villu and Periya Kariaveli Villu: 8°14'-8°15'N, 81°21'-81°23'E; Batticaloa District; 96 ha; flooded for only short periods of the year.

Tamdra Villu: 7°55'N, 81°07'E; Polonnaruwa District; 30 ha; dries out completely during the dry season. Protected in the Flood Plains National Park.
Uradi Villu: 8°04'N, 8l°10'E; Polonnaruwa District; originally 98 ha; the villu has recently been incorporated into a Government livestock farm and the vegetation replaced by improved grassland; flooding is now restricted.
Kudapattu Villu Vette: 8°05'N, 81°10'E; Polonnaruwa District; 62 ha; dries out completely during the dry season.
Maiwatta Villu: 8°05'N, 81°12'E; Polonnaruwa District; 149 ha; never dries out completely. Protected in the Flood Plains National Park.
Meen Villu: 8°07'N, 81°1O'E; Polonnaruwa District; 285 ha; never driesout
completely. Protected in the Somawathiya National Park.
Dambakadawela Wewa Vette and Kanjankadawala Vette: 8°09'N, 81°08'E;
Polonnaruwa District; 384 ha; never dries out completely. Protected in the Somawathiya National Park.
Koyamala Villu: 8°08'N, 8l°1O'E; Polonnaruwa District; 158 ha; never dries out completely. Protected in the Somawathiya National Park. Tirikonamadu Villu: 8°08'N, 81°14'E; Polonnaruwa District; 251 ha; usually dries out during the dry season.
Gangapahala Villu: 8°05'-8°lO'N, 81°13'-8l°14'E; Polonnaruwa District; 131 ha; may dry out in extreme drought conditions. Protected in the Tirikonamadu Nature Reserve.
Kompanachchi Villu: 8°lO'N, 81°l4'E; Trincomalee District; 160 ha; remains wet throughout the year. Protected in the Somawathiya National Park.
Eruvilal Kottaly Vette: 8°lO'-8°l3'N, 81°ll'-8l°13'E; Polonnaruwa District; over 500 ha; permanent but subject to very wide fluctuations in water level. Protected in the Somawathiya National Park.
Velvevette Villu: 8°07'N, W 14'E; 14'E; Polonnaruwa District; 179 ha; remains wet throughout the year. The western part of the villu is protected in the Tirikonamadu Nature Reserve.
Tamaramadu Villu: 8°10'N, 8l°10'E; Trincomalee District; 160 ha; may dry out completely during the dry season. Protected in the Somawathiya National Park.
Pawana Vette: 8°l2'N, 81°14'E; Trincomalee District; 120 ha; wet for only a short period of the year. Protected in the Somawathiya National Park.
Potanveli Vette: 8°08'N, 81°09'E; Polonnaruwa District; 12 ha; wet for only a few months of the year. Protected in the Somawathiya National Park.
Parakasu Vette: 8°08'N, 81°10'E; Polonnaruwa District; 48 ha; dries out during the dry season. Protected in the Somawathiya National Park. Peria Vette: 8°lO'N, 81°l 1'E; Polonnaruwa

District; 30 ha; dries out during the dry season. Protected in the Somawathiya National Park.
Karadonode Vette: 8°06'N, 8l°ll'E; Polonnaruwa District; 30 ha; usually dries out completely during the dry season. Protected in the Somawathiya National Park.
Tamara Villu: 8°09'N, 81°12'E; Trincomalee District; 40 ha; dries out only in extremely dry years. Protected in the Somawathiya National Park.
Vellai Vette: 8°13'-8°16'N, 81°14'-81°16'E; Trincomalee District; 400 ha; dries out only in extremely dry years. Protected in the Somawathiya National Park.
Sittaru Vette: 8°15'N, 81°14'E; Trincomalee District; 100 ha; dries out completely during the dry season. Protected in the Somawathiya National Park.
Angodai Vette: 8°14'N, 81°16'E; Polonnaruwa District; 170 ha; usually does not dry out completely. Protected in the Tirikonamadu Nature Reserve.
Palia Villu: 8°l7'N, 81°l6'E; Trincomalee District; 160 ha; more or less permanent. Partly protected in the Somawathiya National Park.
Vavana Villu: 8°22'N, 8l°12'; Trincomalee District; 120 ha; never dries out completely.
Peram Villu: 8°18'N, 81°14'E; Trincomalee District; 16 ha; dries out completely during the dry season. Protected in the Somawathiya National Park.
Sangankuli Vette: 8°16'N, 81°21'E; Trincomalee District; 128 ha; dries out completely during the dry season.
Tikkana Villu: 8°15'N, 81°21'E; Batticaloa District; permanent with wide fluctuations in water level.
Kariaveli Villu and Periya Kariaveli Villu: 8°14'-8°15'N, 81°21'-81°23'E; Batticaloa District; 96 ha; flooded for only short periods of the year.
Mawila Villu: 8°12'N, 81°16'E; Polonnaruwa District; 64 ha; permanent with small fluctuations in water level. Protected in the Tirikonamadu Nature Reserve.
Kalla Kombu Villu: 8°14'N, 81°22'E; Batticaloa District; 30 ha; seasonal.

Many of the villus are at least partly surrounded by freshwater swamp forest, which occurs on seasonally flooded soil, normally in a zone between the levees of the river and the villu marshes. These freshwater swamps may extend up to three km or more from the river system.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: The vegetation of the villus shows definite patterns of zonation related to the duration and depth of flooding. In the centre or ponding area of the villu where the water is deep, floating leaved aquatic forms such as *Nymphaea siellata, Nelumbo nucifera, Nymphoides spp, Aponogeton natans* and *Aponogeton crispum* occur, often forming dense associations with submerged aquatics such as *Ceratophyllum demersum* and *Hydrilla verticillata.* Some buoyant grasses such as *Hygrorhiza aristata* extend over the water to form dense mats. Floating aquatics such as *Pistia stratiotes, Neptunia oleracea* and *Lemna spp* also occur. Further from the centre, where the duration and depth of flooding decrease, various other aquatic species appear. These include *Alternanthera sessilis, Polygonum spp, Jussiaea repens, Juncus effusus, Ipomoea aquatica* and *Monochoria hastata.* The most abundant grasses are *Panicum repens, Digitaria longiflora, Brachiaria mutica, Sacciolepsis interrupta, Echinocloa colonum, Paspalum vaginatum* and *Paspalidium* spp. On the wide margins where wet conditions are brief and depths of flooding slight, there are creeping grasses such as *Cyonodon dactylon* and various essentially terrestrial plants which are capable of surviving the brief inundations. Some trees occur around the margins of the villus. Among these are *Terrninalia arfuna, Madhuca longifolia, Barringtonia asiatica* and *Mitragyna parviflora.* In the deltaic plain villus, where the depths of inundation are not so great, trees are more widespread and include *Hibiscus tiliaceus* and *Erythrina variegata* in addition to the above.

The common tree species in the freshwater swamp forests are *Terminalia arfuna, Mitragyna parviflora, Hydrocarpus venenata, Madhuca longifolia* and *Barringtonia asiatica.* These swamp forests also have a high diversity of understorey species including rattan *Calamus rotang*. In mature forests, the trees may reach up to 25m in height.

On the banks of the rivers, a belt of *Hanguana malayana, Phragmites karka* and *Brianthus arudinaceus* often occurs between the flowing water and the neighbouring marshes and shallow pools. Riparian vegetation occurs on the banks of the rivers in locations where it has not been cleared for tobacco cultivation. The typical riparian species are *Terminalia arjuna, Mitragyna parviflora, Polyalthia longifolia, Diospyros malabarica* amd *Madhuca longifolia.*

The mangroves of the Mahaweli system are less diverse than those in other parts of Sri Lanka.

The major species are *Rhizophora mucronata, Avicennia marina, Acanthus ilicifolius, Lumnitzera racemosa, Aegiceras corniculatum* and *Scyphiphora hydrophyllacea. Sonneratia apetala* exists in small numbers near the mouth of the main Mahaweli River. Mangrove associates such as *Acrostichum aureum* and *Hibiscus tiliaceus* occur along the inner margins of the mangrove swamps in the transition zone to riverine forest. Halophytes such as *Acthrocnemum indicum* and *Suadea monoica* occur on the fringes of infrequently flooded hyper saline flats, along with *Acanthus ilicifolius.*

The dominant vegetation of dry ground throughout the Mahaweli Ganga flood plain is tropical dry mixed evergreen forest (monsoon forest), but large areas of this have been cleared for pasture (mainly *Damana* grasslands) and agricultural land.

Land tenure: The wetland areas, including all of the villus, are state owned; surrounding areas are mainly state owned with some private holdings around villages.

Conservation measures taken: The entire alluvial valley (or upper flood plain) of the Mahaweli Ganga System has been designated as the Flood Plains National Park (17,350 ha), and the upper deltaic plain as the Somawathiya National Park (37,000 ha). These two National Parks, along with the Wasgamuwa National Park (33,765 ha) to the southwest and the recently established Tirikonamadu Nature Reserve (25,032 ha) to the northeast, form a contiguous system of protected areas. Twenty-six of the principal villus are wholely included within these protected areas, and a further three are partially included. In most cases, no new development activities are permitted at these villus. The Somawathiya area was first protected as a Sanctuary of 22,274 ha, created in August 1966. The Sanctuary was increased in size to 37,000 ha and designated as a National Park under the Fauna and Flora Protection Ordinances in December 1986. The Flood Plains National Park and Wasgamuwa National Park were established under the Fauna and Flora Protection Ordinances in August 1984. In addition, some 40,000 ha of upland dry forests and riverine forests around three reservoirs in the upper basin of the Mahaweli Ganga have recently been protected in the Victoria, Randenigala and Rantambe Sanctuary, established in January 1988. However, the lower deltaic plain and extensive mangrove swamps at the river mouth have no legal protection.

Conservation measures proposed: Management plans are currently being prepared for the protected areas. An Environmental Plan of Action has been prepared to guide a number of activities aimed at taking advantage of the positive impacts of development in the Mahaweli basili and mitigating adverse impacts.

Land use: Livestock grazing is the principal land use activity throughout the flood plain, and occurs at all the villus except Sittaru Vette. Many of the villus are used for fishing, notably Handapan, Bendiya, Gengala, Velankadu, Karapola, Hewanpitiya, Mutugalla, Katuwanwila, Kanavadi, Eruvival Kottaly, Angodai and Vanana. Other widespread activities include the cutting of reeds and cane, the cultivation of tobacco on levee ridges, and brick-making. There is some cultivation of rice and other crops around a few of the villus, and some forest exploitation, e.g. around Pawana Vette.

Possible changes in land use: The on-going Mahaweli Ganga Project is a multipurpose river basin, development programme which aims to bring over 100,000 ha of dry zone land under permanent irrigation. The programme includes several dam projects in various stages of completion in the upper river catchments. These dam projects are likely to bring about major hydrological and ecological changes in the floodplain habitats.

Disturbances and threats: The Mahaweli Ganga Project (Accelerated Mahaweli Development Programme) poses a major long-term threat to the natural wetlands of the flood plain system. Dam construction and diversion of water in the upper reaches of the rivers will result in lowered downstream releases in the rivers. Lower river flow and the reduction in frequency and magnitude of flooding could result in a substantial decrease in area of the flood plain villu swamps. Lowered river flow could also lead to increased salinity intrusion at the river mouth. Return flows, rich in pesticides and agro-chemicals from adjacent areas being developed for agriculture under the Mahaweli Development Programme, could lead to eutrophication of the villus.

Other major disturbances in the flood plain include cattle grazing in the grasslands, brick-making and cultivation of tobacco on the levee ridges, extraction of sand from the rivers, and road construction. Over-grazing has led to the degradation of some of the villu grasslands and the proliferation of undesirable weed species. The natural vegetation at Uradi Villu and Tirikonamadu Villu has been replaced with "improved" grassland for livestock farming. A new road is being constructed across one edge of Gengala Villu in Flood Plains National Park. The mangrove swamps are being destroyed to meet demands for firewood, charcoal and timber for construction.

Economic and social values: The flood plain is of considerable value for fisheries production, livestock grazing and flood control. The villu marshes, in particular, are important for livestock and dairy production. The mangrove swamps and estuaries support important fishery resources in the Koddiyar Bay and nearby coastal waters.

Fauna: The wetlands of the Mahaweli Ganga flood plain system are extremely important for a wide variety of resident and migratory water birds. A large proportion of Sri Lanka's 250 resident bird species are known from the Mahaweli flood plains, and a further 75 migratory species have been recorded as winter visitors. The floodplain marshes support large resident populations of *Phalacrocorax carbo. P. fuscicollis, P. niger, Anhinga melanogaster, Buhulcus ibis*. *Ardeola grayii. Egretta garzetta, E. intermedia, E. alba, Ardea purpurea, A. cinerea, Mveteria leucocephala, Anastomus oscitans, Ciconia episcopus, Leptoptilos javanicus. Threskiornis melanocephalus, Dendrocygna javanica, Porphyrio porphyrio, Ilydrophasianus chirurgus, Rostratula benghalensis, Hirnantopus hirnantopus* and *Vanellus indicus. Common* migrants include *Anas querquedula, Pluvialis dominica, Charadrius dubius, Limosa lirnosa, Tringa stagnatilis, T. glareola, Gallinago stenura* and *Chlidonias hybrida.* Birds of prey associated with the wetlands include *Pandion haliaetus, Haliastur indus, Ichthyophaga ichthyaetus and Spilornis cheela.*

The upper alluvial valley is particularly important for large mammals, especially the Asian Elephant *Elephas maximus, as it* serves as a migratory corridor between the wet season and dry season feeding grounds of the herds, which occur in this region. The riverine marshes, villus and associated swamp forests are said to support the greatest density of large mammals in Sri Lanka. At least 600 and perhaps as many as 1,000 elephants occur in the Mahaweli flood plains, along with several other endangered species of mammals such as the Leopard *Panthera pardu*, the endemic Purple-faced Langur *Presbytis senex,* the endemic Toque

Macaque *Macaca sinica,* and the Sloth Bear *Melursus ursinus.* Some of the commoner mammals include Fishing Cat, Rusty-spotted Cat, Jackal, Sambar, Spotted Deer, Wild Boar, Water Buffalo, Porcupine and Black-naped Hare *(Felis viverrina, F. rubiginosus, Canis aureus, Cervus unicolor, Axis axis, Sus scrofa, Bubalus bubalis, Hystrix indica* and *Lepus nigricollis).*

The marshes support large populations of reptiles including *Python molurus,* water snakes, Marsh Crocodile, Estuarine Crocodile (in Wasgomuwa National Park) *(Natrix spp, Crocodylus palustris, C. porosus), Varanus bengalensis* and the endemic species *Calotes zeylonensis and Otocryptis weigamanni.* Amphibians include the endemic palm-frond frog *Hylerana gracilis.*
Common fish species in the villus include *Anabas testudineus, Ophiocephalus siriatus, 0. parulius, Labeo fisheri, Etroplus suratensis, Ompok bimaculatus* and the introduced *Tilapia mossambica.* Species such as *Labeo dussumieri* are totally dependent on the flood plain marshes for completion of their life cycle.
Special floral values: A rare herb *Pentapetes phoenicea* occurs in a few very restricted locations in the freshwater swamp forest.
Research and facilities: Very little serious research has been conducted in the flood plain system. Some preliminary investigations have been carried out on the physical parameters, vegetation, fisheries and avifauna in the villu swamps. However, the recent inclusion of the alluvial valley and upper deltaic plain within the reserve network should enhance possibilities and facilities for future research.
An environmental assessment of the Mahaweli Development Programme was carried out in the late 1970s (Tippets *et al.,* 1980), and more recently, the Centre for Environmental Studies (State University of Leiden) has made an evaluation of the environmental problems and the role of settler-households in conservation in the region (Drijver *et al.,* undated).
References: Abeywickrema (1966); de Alwis & Eriyagama (1969); Anon (1980); Drijver *et al* (undated); Hettiarachchi (1983); Hoffmann (1982); IUCN (in prep); Jansen (1981 & 1985); Tippets *et al*. (1980).
Criteria for inclusion: 123.
Source: Malcolm A.B. Jansen.

Wetland name: Minneriya Tank
Country: Sri Lanka
Coordinates: 7°59'-8°04'N, 80°52'-80°54'E;
Location:20 km northwest of Polonnaruwa, Polonnaruwa District, North-Central Province.
Area: 2,550 ha.
Altitude: c.100m.
Biogeographical Province: 4.13.4.
Wetland type: 17.
Description of site: An ancient irrigation tank, built in the third century, with a catchment area of 24,000 ha. The main source of water is from a diversion of the Amban Ganga, along the Elahara Channel. The maximum depth is 10.7m; the water is fresh with a pH of 7.5.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone. The average annual rainfall is about 1,146 mm and the mean annual temperature 27.5 °C.
Principal vegetation: The phytoplankton is dominated by *Microcystis* and *Melosira.* No information is available on the aquatic macrophytes. The tank is in a region of dry mixed evergreen forest.
Land tenure: The tank is state owned; surrounding areas are partly state owned and partly privately owned.
Conservation measures taken: The water body and surrounding forests in the catchment area are protected in the Minneriya-Giritale Sanctuary (6,699 ha), established in July 1938. The Sanctuary has since been designated as a Biosphere Reserve.
Conservation measures proposed: There are plans to establish a much larger Nature Reserve (the Giritale-Minneriya Nature Reserve), which will extend southwards almost to *Elahera* and will include the nearby Giritale Tank (308 ha).

Land use: Fishing, water supply for irrigation and domestic use, and brick-making at low water levels during the dry season. The tank is situated in a fairly densely inhabited area.
Disturbances and threats: Dumping of paddy husks.
Economic and social values: Fisheries production and water supply. The annual production of fish is estimated at 873 metric tonnes.
Fauna: Economically important fishes include *Labeo dussumieri, Puntius sarana, P. dorsalis, P. chola, Cyprinus carpio, Wallago attu, Ompok bimaculatus, Heteropneustes fossilis, Macrones vittatus, Tilapia mossambica, Etroplus suratensis, Osphronemus goramy, Ophiocephalus striatus, Glossogobius giuris* and *Mastacembelus armatus.* The most abundant species in the fish catches are *Puntius* spp and *Tilapia.*
The tank is known to support small numbers of a wide variety of waterfowl including pelicans, cormorants and storks, but no details are available.
Special floral values: No information.
Research and facilities: The MEP Systems Centre, together with research, educational and meeting facilities, is being built on the shores of the tank.
References: Fernando & Indrasena (1969); Indrasena (1965); Mendis (1965). **Criteria for inclusion:** lb.
Source: Leonard Pinto.

Wetland name: Upaar (Panichchankeni) Lagoon and Uppu Alan
Country: Sri Lanka
Coordinates: 8°03'-8°12'N, 8l°20'-81°27'E;
Location: 45 km SSE of Trincomalee and 50 km northwest of Batticaloa, Batticaloa District, Eastern Province.
Area: 2,590 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 02, 07 & 08.
Description of site: Upaar Lagoon is a large estuarine lagoon with a depth of 1-2m. It is fed by numerous small streams and, at certain times of the year, opens to the sea through a narrow channel at its southern end. The much smaller lagoon of Uppu Alan is situated to the south; this is fed by two small streams and is connected with the south end of Upaar Lagoon by a short channel. Both lagoons are seasonally tidal, the maximum tidal range being about 40 cm.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: There are extensive mangrove swamps around the edges of the lagoons and some sea grass beds. The wetlands are in a region of dry evergreen mixed forest and scrub.
Land tenure: The lagoons and surrounding areas are state owned.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Subsistence fishing; some rice cultivation in the east.
Disturbances and threats: Siltation.
Economic and social values: Fisheries production.
Fauna: The lagoon, especially the southern part, is known to be important for large water birds and migratory shorebirds, but no details are available.
Special floral values: No information.
References: Hoffmann (1982); Pillai (1960); Salm (1975).
Criteria for inclusion: 1b, 3b.
Source: J.I. Samarakoon and T.W. Hoffmann.

Wetland name: Vandeloos Bay, Elephant Point and Thenadi Bay
Country: Sri Lanka
Coordinates: 7°49'-8°00'N, 8l30'-81°34'E;
Location: on the east coast 20-40 km northwest of Batticaloa, Batticaloa District, Eastern Province.
Area: Unknown.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 01, 02, 03, 04, 05, 06, 07 & 08.
Description of site: Two sea bays separated by the promontory of Elephant Point. Vandeloos Bay in the south contains the estuarine system of the Valaichchenai and Maduru Oya rivers. The two rivers unite in a broad estuarine lagoon (Valaichchenai Lagoon) which opens into the bay during the wet season and is then tidal. There are several large muddy islands in the lagoon, and extensive fringing mangrove swamps and brackish marshes. The maximum depth is about two metres, and the tidal range 40-60 cm. Elephant Point, at the north end of Vandeloos Bay, is fringed with mudflats, salt marshes and mangroves, and has extensive offshore coral reefs. The promontory contains one fairly large tidal lagoon with extensive mangrove swamps which were, however, mostly destroyed during a cyclone in November 1978. Thenadi Bay extends west from this point; the shores of the bay are sandy, and there are some coral reefs offshore. A small coral debris island in the bay supports a large breeding colony of sea-birds.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Mangrove swamps in Valaichchenai Lagoon and at Elephant Point, coconut plantations around Vandeloos Bay, and settlements and small fields in adjacent areas.
Land tenure: Valaichchenai Lagoon and Elephant Point are state owned; the shores of Vandeloos Bay and other adjacent areas are almost entirely privately owned.
Conservation measures taken: None.
Conservation measures proposed: The Ceylon Bird Club has, on several occasions, recommended that Elephant Point, the adjoining part of Vandeloos Bay and the whole of Thenadi Bay be declared a sanctuary or nature reserve.
Land use: Fishing for finfish and prawns. The latter are caught with hand-operated purse seines during the northeast monsoon. Elephant Point is uninhabited.
Disturbances and threats: Until recently, the most serious threat to the area was the large-scale removal of corals and coral rocks for lime kilns, and the cutting of mangroves to fuel these kilns. These practices were prohibited by the authorities some years ago, but it is understood that there has been a resumption of coral mining within the last three years. Fishing with dynamite is a common occurrence, and causes severe damage to the coral reefs. The principal threats at Valaichchenai Lagoon are heavy siltation and pollution with industrial effluents from a nearby state-owned paper mill. The pollution has caused frequent fish kills and has completely destroyed the fishery in the lagoon.
Economic and social values: There is a fairly important seasonal prawn fishery in Vandeloos Bay and off Elephant Point, and the lagoon supports a small subsistence fishery.
Fauna: The mudflats and mangroves around Elephant Point are of great importance for migratory shorebirds, at least 17 species having been observed at one time. The point and adjacent Thenadi Bay are important feeding areas for six or seven species of terns, while the small coral island in Thenadi Bay supports a large breeding colony of *Sterna hirundo, S. dougallii, S. bergii* and S. *(albifrons) saundersi* (Hoffmann, 1982). Valaichchenai Lagoon is thought to be of importance for a variety of waterfowl, but no details are available.
Special floral values: No information.
References: Hoffmann (1982); Karpowicz (1985).

Criteria for inclusion: lb. 2c, 3b.
Source: J.I. Samarakoon and T.W. Hoffmann.

Wetland name: Batticaloa Lagoon
Country: Sri Lanka
Coordinates: 7°22'-7°46'N, 81°35'-81°48'E;
Location: on the east coast at Batticaloa, Batticaloa District, Eastern Province.
Area: 14,118 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 02, 06, 07, 08 & 10.
Description of site: A very large and relatively deep estuarine lagoon which opens into the sea through two narrow channels (at 7°28'N and 7°46'N) during the wet season and is then tidal. Sand bars are built up by wave action during the dry season, blocking these connections with the sea. The lagoon receives fresh water from numerous small rivers and streams during the wet season. Several large islands are under cultivation for rice. The lagoon is almost entirely surrounded by a fringe of mangroves, and there are extensive sea grass beds. The maximum depth is about 4m; the water is brackish, with the salinity increasing to 30 p.p.t. at certain times of the year.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Mangrove swamps and seagrass beds. Some patches of mangrove remain in good condition. Surrounding areas are mostly under cultivation for rice, coconuts and other crops.
Land tenure: The lagoon is state owned; surrounding areas are privately owned.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Prawn fishing, aquaculture and the discharge of urban waste; agriculture (mainly rice) and housing in surrounding areas. A small shrimp farm (0.7 ha) on the edge of the lagoon came into operation in 1977. A further 7.2 ha of ponds have been constructed since then, and the owner has leased 40 ha of the lagoon from the Government for future expansion of his operations.
Disturbances and threats: The lagoon is under considerable threat from the dumping of urban refuse, siltation, dyke construction for aquaculture, and oil pollution from motor boats. There has been large-scale extraction of mangroves for use in lime kilns and for beams and poles.
Economic and social values: The lagoon supports a major prawn fishery which provides the livelihood for a large number of people.
Fauna: The lagoon is known to be important for large wading birds and migratory shorebirds, but no details are available.
Special floral values: No information.
Research and facilities: The University of the East at Chenkaladi, near the north end of the lagoon, has conducted some research at the lagoon. Research facilities are avilable at the Fisheries Corporation.
References: Hoffmann (1982); Pillai (1960); de Silva (1984).
Criteria for inclusion: 1b, 3b.
Source: J.I. Samarakoon.

Wetland name: Wetlands in Maduru Oya National Park
Country: Sri Lanka

Coordinates: 7°23'-7°35'N, 81°05'-81°20'E;
Location: between the Polonnaruwa to Batticaloa road and the Mahiyangana to Padiyatalawa road, Amparai, Badulla and Polonnaruwa Districts, Eastern and Ova Provinces.
Area: c.l0,000 ha of wetlands.
Altitude: 30-150m.
Biogeographical Province: 4.13.4.
Wetland type: 11, 12 & 17.
Description of site: The Maduru Oya National Park lies in a region of undulating peneplain broken by a number of prominent rock outcrops and ridges rising to heights of up to 685m. Wetland habitats include the Maduru Oya (6,100 ha), Ulhitiya (2,270 ha), Ratkinda, NDK, Henanegala and Kadupaharaella reservoirs, and tributaries of the Mahaweli and Maduru Oya rivers.
Climatic conditions: Tropical monsoonal climate influenced by two monsoons; the wet northeast monsoon from October to February, and the dry monsoon from March to May. The average annual rainfall is 1,650 mm, and the mean annual temperature about 27°C. Annual evapotranspiration rates normally exceed precipitation levels.
Principal vegetation: No information is available on the aquatic vegetation. The climax community of the area is tropical dry mixed evergreen forest characterized by *Drypetes seperia, Chioroxylon sweitenia, Manilkara hexandra, Pterospermum canescens, Feronia limonia, Cassia fistula* and *Dimophocalyx glabellus.* However, a major part of the forest within the park has been heavily exploited in the past for shifting cultivation, and much of the park now consists of secondary growth and open grassland.
Land tenure: State owned.
Conservation measures taken: Protected within the Maduru Oya National Park (51,468 ha), established in November 1983 under the Fauna and Flora Protection Ordinances. The park is designed to protect the immediate catchments of five reservoirs developed under the Accelerated Mahaweli Programme. A draft management plan has been prepared.
Conservation measures proposed: There are plans to link the park with the Gal Oya National Park in the south, through the proposed Nilgala Jungle Corridor (10,260 ha).
Land use: Commercial fishing is permitted in the reservoirs under licence.
Disturbances and threats: Maduru Oya reservoir has become overgrown with the floating weed Salvinia molesta, and measures for its physical eradication are now envisaged. Poaching and illicit timber-felling remain serious problems in the National Park.
Economic and social values: The National Park contains a number of ancient Buddhist shrines, temples, dagobas, statues and hermitages from different eras in Sri Lankan history. Of particular interest is an ancient sluice on the old breached earthen bund of the Maduru Oya. The upper sluice was built in two stages, the first of which dates back to before the sixth century BC. The lower sluice is believed to be even older.
Fauna: The dominant fishes in the reservoirs include *Barbus spp, Osphronemus goraniy* (possibly introduced), *Channa* spp, catfish (Siluriformes) and *Tilapia mossambica.* Reptiles include *Varanus bengalensis, V. salvator, Python molurus, Bungarus spp, Naja naja* and the Marsh Crocodile *Crocodylus palustris.*
The main reservoirs are relatively new and of little importance for water birds. However, Kadupaharaella Reservoir now has a lowered spill and may in due course become important for breeding water birds such as *Pelecanus philippensis, Mycteria leucocephala* and *Leptoptilos javanicus.* The White-bellied Sea-Eagle *Haliaeetus leucogaster* is present.
The National Park supports a rich mammalian fauna including *Elephas maximus, Melursus ursinus, Loris tardigradus, Macaca sinica, Presbytis entellus, Canis aureus, Panthera pardus, Felis viverrina, Sus scrofa, Muntiacus muntjak, Axis axis, Cervus unicolor* and *Bubalus bubalis.*

Special floral values: A rare and endemic tree *Vatica obscura,* the only species of the Dipterocarpaceae to occur in the dry zone, is found in restricted locations on the banks of the Maduru Oya and Gallodai Aru rivers.
Research and facilities: The Open University of Colombo and the Eastern University, Batticaloa, are conducting studies on the fauna and flora of the National Park. Accommodation and research facilities are available at Kandeganwila.
References: IUCN (in prep).
Criteria for inclusion: 1b, 2a, 2b.
Source: T.W. Hoffmann and references.

Wetland name: Senanayake Samudra
Country: Sri Lanka
Coordinates: 7°08'-7°15'N, 81°26'-81°32'E;
Location: in Gal Oya National Park, southwest of the town of Inginiyagala, Amparai District, Eastern Province.
Area: 7,770 ha.
Altitude: c.80m.
Biogeographical Province: 4.13.4.
Wetland type: 17.
Description of site: A large water storage reservoir created by the damming of the Gal Oya at Inginiyagala in 1948. The reservoir was constructed as part of a development scheme to open up some 162,000 ha of forest for agricultural and industrial purposes. The reservoir is fairly deep, with a maximum depth of 33.5m, and has a catchment area of about 100,000 ha. The water is fresh, with a pH of 6.8. The water level is subject to wide seasonal fluctuations; at low water levels, the exposed shoreline supports a luxuriant growth of grasses.
Climatic conditions: Tropical monsoonal climate with an average annual rainfall of 2,267 mm and a mean annual temperature of 27.7°C.
Principal vegetation: The lake supports relatively few aquatic macrophytes. *Coelosphaerium, Microcystis* and *Melosira* are abundant in the phytoplankton. Plant communities in surrounding areas include dry evergreen mixed forest and savanna type grassland. The grassland, which is dominated by *Cymbopogon confertiflorus* and *Themeda sp,* is entirely artificial; it developed with logging in the bed of the reservoir and is maintained by periodic inundation of the land. Annuals such as *Eragrostis* sp and *Eleusine* sp tend to be common on low-lying areas which are flooded for long periods annually. In higher areas, which may not be submerged every year, perennials such as *Cynodon dactylon* and *Brachiaria sp* are more common.
Land tenure: The lake and surrounding areas are state owned.
Conservation measures taken: The lake has been declared a sanctuary. The surrounding forests in the catchment area are protected in the Gal Oya National Park (25,900 ha), established in February 1954.
Conservation measures proposed: None
Land use: Water supply for irrigation and domestic use; also fishing. The National Park is uninhabited, but the valley area surrounding the park has been developed intensively for agricultural purposes under the Gal Oya Development Scheme begun in 1949.
Disturbances and threats: Inadequate protection of the catchment area has led to massive erosion and siltation of the reservoir. Land is being cultivated and itinerant fishermen have illegally settled within the park. Other disturbances include poaching, collection of food, medicinal products and fuelwood from the forests, and frequent fires in the savanna (often started by fishermen).

Economic and social values: The lake supports an important fishery and is a valuable source of water for irrigation. Fish production is estimated at 873 metric tonnes per year.
Fauna: The reservoir is important for a wide variety of water birds including large numbers of *Pelecanus philippensis, Phalacrocorax carbo, P. fuscicollis, P. niger,* many herons and egrets, storks (notably *Anastomus oscitans), Threskiornis melanocephalus, Platalea leucorodia,* migratory ducks and shorebirds. Birds of prey include *Haliastur indus, Ichthyophaga ichthyaetus* and *Haliaeetus leucogaster.*
Thirty-two species of mammals have been recorded in the National Park. Of special interest are the Asian Elephants *Elephas maximus,* which come to graze on the grass along the edge of the reservoir. The size of the elephant population is estimated at 260-300 animals. Other noteworthy mammals include *Panthera pardus, Melursus ursinus, Presbytis entellus, Macaca sinica, Sus scrofa,* three species of deer and *Bubalus bubalis.*
Among the reptiles present in the park, the Marsh Crocodile *Crocodylus palustris,* monitor lizard *Varanus bengalensis* and freshwater turtles *Melanochelys srijuga, Lissemys punctata,* are common. Amphibians include *Bufo melanostictis, Rana tigrina, R. limnocharis, R. gracilis* and *Rhacophorus cruciger.*
Commercially important fishes include *Labeo dussumieri, Puntius sarana, Puntitius dorsalis, Wallago attu, Ompok bimaculatus, Heteropneustes fossilis, Tilapia mossambica, Trichogaster pectoralis, Etroplus suratensis* and *Ophicephalus striatus.*
Special floral values: No information.
Research and facilities: The National Park is mostly inaccessible except by boat. The Department of Wildlife Conservation maintains a bungalow for the public at Ekgal Aru, some distance away from the National Park. There is also a tourist hotel at Inginiyagala. A considerable amount of research has been carried out on the elephant population in the park.
References: Fernando & Indrasena (1969); Hoffmann (1982); IUCN (in prep).
Criteria for inclusion: 2a, 2b, 3b.
Source: Leonard Pinto.

Wetland name: Arugam Kalapuwa
Country: Sri Lanka
Coordinates: 6°51'N, 81°49'E;
Location: on the east coast, 3 km south of Pottuvil, Amparai District, Eastern Province.
Area: 248 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 07 & 08.
Description of site: A shallow, brackish lagoon with some fringing mangroves and an extensive marshy area to the north. The lagoon is connected to the sea by a narrow channel passing under a causeway along the eastern side. It is fed by several small streams and local rainfall, and is seasonally tidal. The depth of water exceeds 3m in some places; the salinity varies seasonally to a maximum of over 30 p.p.t.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Some mangrove forest. The lagoon is surrounded by open forest, scrub, rice paddies and other cultivated land.
Land tenure: The lagoon is state owned; surrounding areas are partly state owned and partly private.
Conservation measures taken: None.
Conservation measures proposed: None

Land use: Fishing, mainly for prawns; livestock grazing and cultivation of rice and other crops in adjacent areas.
Disturbances and threats: Siltation.
Economic and social values: The lagoon supports a small subsistence fishery.
Fauna: The lagoon is known to be very important for large water birds and migratory ducks, shorebirds, gulls and terns, but no details are available.
Special floral values: No information.
References: Hoffmann (1982).
Criteria for inclusion: lb. 3b.
Source: J.I. Samarakoon.

Wetland name: Lahugala and Kitulana Tanks
Country: Sri Lanka
Coordinates: 6°49'N, 8l°47'E;
Location: near Lahugala, 12 km southwest of Pottuvil, Amparai District, Eastern Province.
Area: c.400 ha.
Altitude: Near sea level.
Biogeographical Province: 4.13.4.
Wetland type: 17.
Description of site: Three small water storage reservoirs, Lahugala (243 ha), Kitulana and Sengamuwa, in the basin of the Heda Oya about seven km inland from the coast.
Climatic conditions: Tropical monsoonal climate with an average annual rainfall of 1,650 mm.
Principal vegetation: The dominant emergent vegetation in the tanks is the reedy grass *Oplismenus compositus.* The tanks are surrounded by dry mixed evergreen forest with species such as *Hemicyclia sepieria* and the palm *Manilkara hexandra.*
Land tenure: The tanks and surrounding areas are state owned.
Conservation measures taken: The tanks are protected in the Lahugala-Kitulana National Park (1,554 ha), created in October 1980. The area was initially protected as a sanctuary in July 1966.
Conservation measures proposed: The park lies within the proposed elephant corridor connecting Ruhuna and Yala National Parks.
Land use: The Pottuvil to Moneragala trunk road runs through the southeastern sector of the park. The park is uninhabited, but there is a small settlement on the boundary.
Disturbances and threats: A proposed development project in the lower Uva basin will result in an expansion of cultivated land which will further isolate the park and its elephant population.
Economic and social values: The historic site of Magulmahavihara lies close to the National Park.
Fauna: Known to be of importance for large water birds, ducks (notably *Dendrocygna javanica)* and migratory shorebirds, but few details are available. Large water birds known to occur include *Pelecanus philippensis, Ardea purpurea, Mycteria leucocephala* and *Leptoptilos javanicus.* Other wetland species include the eagles *Haliaeetus leucogaster* and *Ichthyophaga ichthyaetus* and the kingfishers *Alcedo atthis, Pelargopsis capensis* and *Halcyon smyrnensis.* The surrounding high forest harbours at least two of Sri Lanka's endemic birds: Ceylon Spurfowl *Galloperdix bicalcarata* and Red-faced Malkoha *Phaenicophaeus pyrrohocephalus.*
Herds of up to 150 Asian Elephants *Elephas maximus* congregate at Lahugala Tank during periods of drought. Other mammals include *Presbytis entellus, Melursus ursinus, Pant hera pardus, Sus scrofa, Muntiacus muntjak* and *Axis axis.*
Special floral values: No information.
Research and facilities: Some research was carried out on elephant ecology in 1967-69.
References: Hoffmann (1982); IUCN (in prep); Katugaha (1982).

Criteria for inclusion: lb, 2a, 3b.
Source: See references.

Wetland name: Wetlands in Yala East National Park
Country: Sri Lanka
Coordinates: 6°32'-6°36'N, 8l°43'-8l°45'E;
Location: in Yala East National Park, 40 km SSW of Pottuvil, Amparai District, Eastern Province.
Area: 626 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 05, 07 & 08.
Description of site: A chain of shallow, brackish to saline coastal lagoons including Bagura Kalapuwa (154 ha), Andarakala, Itikala and Yakkala Kalapuwas (272 ha) and Kumana Villu (200 ha), as well as the extensive sandy beaches along the adjacent coastline, in Yala East National Park. The lagoons are fed by many small streams, seepage and local rainfall; Bagura Kalapuwa is seasonally tidal and Kumana Villu is occasionally inundated by sea water. The lagoons are generally less than 2m deep, and are subject to extensive drying out during the dry season. Kumana Villu is famous for its extensive mangrove swamps; it is fed by the perennial Kumbukkan Oya and is surrounded by scrub jungle.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone. The mean temperature is 27 -30 ° C.
Principal vegetation: The vegetation at Kumana Villu includes the mangroves *Rhizophora, Lurnnitzera* and *Sonneratia,* along with *Mitragyna parvifolia, Acrostichum* sp and marsh grasses. Stands of *Sonneratia caeseolaris* include trees exceeding seven metres in height. The dense forest and semi-arid thorn scrub in surrounding areas include species such as *Manilkara hexandra, Hemicyclea sepieria, Bauhinia racemosa, Cassia fistula, Chloroxylon sweitenia* and *Salvadora persica.*
Land tenure: The wetlands and surrounding areas are state owned.
Conservation measures taken: Kumana Villu was first protected as a Bird Sanctuary in 1938. The Bird Sanctuary and the other wetlands in the area are now included in the Yala East National Park (18,148 ha), established in December 1969. The National Park is contiguous with Ruhuna (Yala) National Park (126,781 ha) along the Kumbukkan Oya to the south.
Conservation measures proposed: None
Land use: None at the wetlands. There is one small village of 14-15 families within the National Park.
Disturbances and threats: Siltation is reported to be a problem at all the lagoons, and poaching is a problem throughout the park. The small village of Kumana, established less than 100 years ago, has been an irritant in respect of the National Park, and numerous attempts have been made to re-settle the families in a better area. The village is totally inconsistent with the laws governing a national park, and constitutes a serious threat to the park's integrity.
Economic and social values: No information.
Fauna: The lagoons are of great importance for a wide variety of waterfowl. The Kumana Villu Bird Sanctuary is one of the most important breeding areas for waterbirds in the southeast of the country, and is also one of the most important sites for migratory waterfowl in the south (Powell, 1984b). Common water birds include *Tachybaptus ruficollis, Pelecanus philippensis, Phalacrocorax niger, Anhinga melanogaster, Nycticorax nycticorax, Ardeola grayii, Egretta spp, Ardea purpurea, A. cinerea, Mycteria leucocephala, Anastomus oscitans, Thresk iornis melanocephalus, Platalea leucorodia, Dendrocygna javanica, Gallicrex cinerea, Gallinula*

chloropus, Porphyrio porphyrio, Hydrophasianus chirurgus and *Himantopus himaniopus. Phoenicopterus ruber* has often been recorded at Andarakala, Itikala and Yakkala Kalapuwas, and large numbers of *Anas querquedula* were present at Kumana Villu in January 1984 (Hoffmann, 1985). The Black-necked Stork *Ephippiorhynchus asiaticus,* one of Sri Lanka's rarest birds, is still present in the area.

Asian Elephants *Elephas maximus* often occur in the marshes at Kurnana Villu. Other mammals in the National Park include Leopard *Panthera pardus,* Sloth Bear *Melursus ursinus,* Water *Buffalo Bubalus bubalis* and the scarce and local Stripe-necked Mongoose.

Special floral values: The mangrove swamp at Kumana Villu is of considerable botanical interest.

Research and facilities: Research has been limited to a few avifaunal studies. Various visitor facilities are available in the National Park.

References: Hoffmann (1982 & 1985); IUCN (in prep); Powell (l984b).

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

Source: J.I. Samarakoon and T.W. Hoffmann.

Wetland name: Wetlands in Ruhuna (Yala) National Park

Country: Sri Lanka

Coordinates: 6°16'-625'N, 81°22'-81°32'E;

Location: on the southeast coast, east of Tissamaharama, Hambantota District, Southern Province.

Area: Area of wetlands unknown; National Park 126,781 ha**.**

Altitude: 0- 160m.

Biogeographical Province: 4.13.4.

Wetland type: 05, 07, 08, 11, 14, 15 & 17.

Description of site: A complex of brackish coastal lagoons, seasonal freshwater ponds, large and small abandoned tanks, waterholes, rivers and seasonal streams along with 64 km of coastline in Ruhuna National Park. Some of the lagoons are the estuarine lagoons of minor rivers, and there are two major estuaries in the park: those of the Kumbukkan Oya and Menik Ganga. Both of these are seasonally blocked by sand bars during the dry season. The National Park is bounded to the north and west by cultivated land, and to the southeast by the Indian Ocean. The land is essentially flat and low-lying with occasional steep rocky outcrops or inselbergs. The general northwest-southeast trend in the drainage of the area reflects the shallow slope of the plain to the southeast (70m inland dropping to less than 3m near the coast).

The numerous waterholes, tanks, lagoons and rivers in the park provide a variety of fresh, brackish and saline water habitats. The freshwater bodies in particular form a vital water supply for the large mammals in the park, assuming particular importance during the dry season. Most of the water bodies are less than 5 ha in extent and are very shallow, with few exceeding 30 cm in depth. Only very small areas of the larger lagoons and estuaries, usually at the seaward margin, have depths in excess of one meter, and in most cases, large areas on the landward side of the lagoons dry out during the dry season. Similarly, only the very large tanks such as Heenwewa and Katagamuwa exceed one meter in depth, and most of the smaller tanks dry out completely in dry years. The water is alkaline in most of the water bodies, but a pronounced diurnal rhythm is observed related to the daily cycle of respiration and photosynthesis. Water temperatures are high, ranging from about 25°C in the early morning to 32°C in the afternoon. The water temperature at midday often exceeds the air temperature, particularly in the coastal lagoons where the temperature frequently reaches 37°C.

Two of the largest water bodies in the park are Udapothana Lagoon (390 ha) and Pahalapothana Lagoon (340 ha) in the east. These are estuarine lagoons at the mouths of the Kurunde Ara and

Nabadag Ara, respectively. Both are brackish to saline lagoons, less than two metres deep and seasonally tidal. Other significant wetlands include the following:

- Buttuwa Wewa: 30 ha. An artificial lake with a maximum depth of 2m, created by an earth-filled bund across a seasonal stream. The lake is permanent and contains many submerged trees which are used as nesting sites by large numbers of herons, egrets and storks.

- Wilapala Wewa: 64 ha. A semi-permanent freshwater lake in a natural depression, surrounded by open grasslands. The lake has a maximum depth of 20 cm and a pH of 6.2-7.4; it dries out completely during severe droughts.

- Heenwewa: 6.75 ha. An artificial lake rich in aquatic vegetation, with a maximum depth of Sm and a pH of 7.4-7.8. The lake was created by excavation and deepened in 1979 to retain water throughout the dry season.

- Gonalabba Lagoon: 19 ha. A permanent brackish lagoon separated from the sea by a sand bar and surrounded by grassland. The lagoon is fed by local runoff and seepage of seawater; it has a maximum depth of one metre, a salinity of 5.2-9.1 p.p.t. and a pH of 7.5-8.0.

- Buttuwa Lagoon: 15 ha. A permanent brackish lagoon with some mangrove vegetation along its seaward edge. The lagoon is fed by rainwater and seepage of seawater; it has a maximum depth of one metre, a salinity of 7.9-10.5 p.p.t., and a pH of 7.3-7.6.

- Katagamuwa Tank: 28 ha. A large freshwater tank with a maximum depth of two metres, a pH of 8.2-8.8, and a high density of floating vegetation. The water level recedes during the dry season but the tank rarely dries out completely.

- Mahasilawa Lagoon: 2.5 ha. A brackish estuarine lagoon with some mangrove vegetation along one edge. The mouth of the lagoon rarely breaches, but seawater enters by seepage. The maximum depth is 30 cm, the salinity 5.9-11.4 p.p.t., and the pH 7.6-8.3. The lagoon seldom dries out completely.

Climatic conditions: Tropical monsoonal climate with an annual rainfall of between 900 and 1,300 mm and a mean annual temperature of 27°C. The park lies in the low country dry zone, and has a pronounced dry season from May to September.

Principal vegetation: The aquatic vegetation in most of the water bodies is relatively poor. The only wetlands with large amounts of floating vegetation are Heenwewa and Katagamuwa. The vegetation at these tanks includes *Nymphaea spp, Neptunea spp, Ceratophyllum sp, Hydrilla verticillata* and *Typha angustifolia. Azolla pinnata, Lemna* spp and numerous phytoplanktonic species are present in most water bodies. Common phytoplankters include species of *Mycrocystis, Pinularia, Naricular, Scenedesmus* and *Nostoc,* along with some filamentous blue-green algae.

In the mangroves, the dominant species are *Sonneratia caeseolaris, Acanthus ilicifolius, Rhizophora mucronata, Avicennia marina, Aegiceras corniculatum, Excoecaru agallocha* and *Lumnitzera racemosa.*

The predominant vegetation in the National Park is semi-arid thorn scrub, interspersed with pockets of fairly dense forest characterized by species such as *Manilkara hexandra, Chioroxylon sweitenia, Hemicyclea sepieria, Bauhinia racemosa, Salvadora persica*, and less frequently *Cassia fistula, Azadirachta indica* and *Feronia limonia.* Shrub vegetation consists of

Dichrostachys cinerea, Randia dumetorum, Zizyphus sp, Gymnosporia emarginata and Carissa spinarum. There are extensive open grasslands around some of the tanks and lagoons, and locally some shifting cultivation.

Land tenure: The wetlands and surrounding areas of the National Park are state owned.

Conservation measures taken: Protected within the Ruhuna (Yala) National Park, first established in February 1938 (13,680 ha) and subsequently increased in size in 1954, 1967, 1968, 1969 and 1973 to its present size of 126,781 ha.

Conservation measures proposed: Priorities for management have yet to be formally identified and outlined in a management plan. It has been recommended that the park be extended offshore to include Great and Little Basses, considered to be the finest coral reefs in Sri Lanka.

Land use: Nature conservation and wildlife tourism. The seasonal camp at Patanangala, in Block I, is used by fishermen from late September until early April. There is a little rice cultivation (e.g. near Katagamuwa Tank) and some shifting cultivation (e.g. near Bambawa Tank).

Disturbances and threats: Most of the wetlands are well protected within the National Park and under no immediate threat, although siltation is reported to be a problem at some of the lagoons. The main threats elsewhere in the National Park are poaching, tree-felling, encroachment by cultivation, and entry by free-ranging domestic livestock. The problem of encroachment is particularly acute in Blocks III, IV and V. where there is extensive illicit cultivation (including plantations of Cannabis) and frequent burning to provide grazing in the dry season. The integrity of the park has greatly suffered as a result of the ethnic disturbances, and there is now little if any enforcement of the park regulations in the major portion of the National Park. The seasonal migrant fishermen's camp at Patanangala has gradually increased from two or three huts and about a dozen fishermen in the 1940s to hundreds of huts and fishermen in recent years. With the increasing availability of motor-boats, fishing is becoming almost a year-round activity. The fishermen all come from Tangalle. Efforts to curb or freeze these activities or to shift the camp outside the park have failed. The camp poses a threat to adjacent areas of the park and important nearby waterholes, and over-fishing, especially of lobsters, has become a problem. The beaches are becoming littered with debris left by the fishermen, and sea turtles in the vicinity are caught in their nets. Over-utilization by visitors has become apparent in some areas of the park.

Economic and social values: Over 100,000 visitors were recorded in the National Park in 1981.

Fauna: Some information is available for most invertebrate groups occurring in the water bodies. Only Ostracoda, Gastropoda and Oligochaeta appear to be widely distributed over the different types of water bodies. Decapoda appear to be restricted to rivers and estuaries, though a limited fauna occurs in some lagoons. Polychaeta and Scyphozoa are confined to estuaries and lagoons, whilst most other groups are restricted to the freshwater tanks and villus. The crabs include *Scylla serrata, Varuna littorata, Chiromantes* sp and *Neoepisesarma* sp, and the prawns include *Penaeus indicus, P. monodon, Metapenaeus dobsoni, M. elegans, Macrobrachium rosenbergii* and *Atya typus.*

The estuaries support a rich fish fauna, but the closed lagoons have a rather restricted fauna and the smaller muddy pools have no fish at all. The following species of fishes have been recorded in the lagoons: *Lutianus lunulatus, Leiognathus sp, Scatophagus argus, Ambassis sp, Sillago siharna, Caranx ignobilis, Tilapia mossarnbica, Etroplus suratensis, Therapon jarbua, Pertica filarnentosa, Thrissocles mystax, Anchoviella indica, A. commersonii, Amblygaster clupeoides, Chanos chanos, Megalops cyprinoides Tylosurus strongylurus, Hyporamphus xanthopterus, H. gaimardi, Mugil kelaartii, Macrones gulio, Brachirus orientalis* and *Tricanthus brevirostris.*

Notable reptiles include the Estuarine Crocodile *Crocodylus* porosus, which occurs in the estuary of the Kumbukkan Oya and probably also in the estuary of the Menik Ganga and elsewhere. The Marsh Crocodile C. *palustris* is common in the rivers and waterholes, and *Varanus bengalensis* also occurs.

The wetlands support a great diversity of waterfowl, although most species occur only in small numbers. There is a small breeding population of Black-necked Storks *Ephippiorhynchus asiaticus* (one of Sri Lanka's rarest birds) and a breeding colony of Asian Openbill Storks *Anastomus oscitans.* Other residents or local migrants include *Pelecanus philippensis, Phalacrocorax carbo, P. fuscicollis, P. niger, Anhinga melanogaster, Nycticorax nycticorax, Ardeola grayii, Butorides striatus, Egretta garzetta, E. intermedia, E. alba, Ardea purpurea, A. cinerea, Mycteria leucocephala, Ciconia episcopus, Leptoptilos javanicus, Threskiornis melanocephalus, Platalea leucorodia, Dendrocygna javanica, Porphyrio porphyrio, Esacus recurvirostris, Himantopus himantopus, Vanellus indicus* and V. *malabaricus.* Common winter visitors include *Anas acuta, A. querquedula, Pluvialis dominica, P. squatarola, Charadrius leschenaultii, C. mongolus, Limosa limosa, Numenius phaeopus, N. arquata, Tringa totanus, T. stagnatilis, T. nebularia, T. glareola, Actitis hypoleucos, Arenaria interpres, Calidris minuta, C. ferruginea, Larus brunnicephalus, Chlidonias hybrida, C. leucoptera, Gelochelidon nilotica and Sterna albifrons.* Sixteen species of shorebirds were recorded by B.A. Lane in April 1984 including significant numbers of *Calidris minuta* and *C. ferruginea.* Waterfowl counts at some of the wetlands in the park in January 1986 and January 1988 included:
up to 16 *Pelecanus philippensis*
100 *Mycteria leucocephala*
200 *Platalea leucorodia*
295 *Dendrocygna javanica*
100 *Anas querquedula*
140 *Larus brunnicephalus*
The National Park supports a rich mammalian fauna including *Melursus ursinus, Panthera pardus, Canis aureus, Elephas maximus, Sus scrofa, Axis axis, Cervus unicolor* and *Bubalus bubalis.*
Special floral values: No information.
Research and facilities: Limited research facilities are available in the park. Preliminary limnological studies were carried out at many of the lagoons, tanks and waterholes by the Joint Aberdeen and Colombo Universities Expedition in 1978. Elephant research has been carried out by the University of Peradeniya, and ecological studies of a number of other large mammals have been made. Of the park's five blocks, only Block I in the southwest is readily accessible and open to the public. Various facilities are available for visitors including several guest bungalows and camp-sites, and there is a small museum in the park.
References: Hoffmann (1982 & 1987); IUCN (in prep); Karpowicz (1985).
Criteria for inclusion: lb, 2a, 2b, 3b.
Source: S.W. Kotagama, J.I. Samarakoon and T.W. Hoffmann.

Wetland name: Palatupana Maha Lewaya
Country: Sri Lanka
Coordinates: 6°15'N, 81°23'E;
Location: on the coast, 10 km ESE of Tissamaharama, Hambantota District, Southern Province.
Area: 194 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 08 & 09.
Description of site: A brackish coastal lagoon, much of which has been converted into salt pans. The lagoon is fed by several small streams and is seasonally tidal. The maximum depth is two metres, and the salinity varies seasonally to a maximum of 30 p.p.t. Large areas of the lagoon dry out during the dry season.

Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: No information is available on the aquatic vegetation. The lagoon is surrounded by scrub jungle.
Land tenure: The lagoon and surrounding areas are state owned.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Salt production.
Disturbances and threats: None known.
Economic and social values: No information.
Fauna: Known to be an important area for large water birds, flamingos *Phoenicopterus ruber,* ducks and shorebirds, but no details are available.
Special floral values: No information.
References: Hoffmann (1982).
Criteria for inclusion: 1b, 3b.
Source: J.I. Samarakoon.

Wetland name: Wirawila, Tissa, Debara and Yoda Tanks
Country: Sri Lanka
Coordinates: 6°l6'-6°17'N, 81'14'-81°19'E;
Location: near Tissamaharama, Hambantota District, Southern Province.
Area: c.900 ha.
Altitude: 15m.
Biogeographical Province: 4.13.4./4.2.1.
Wetland type: 17.
Description of site: Four water storage reservoirs (tanks) on the coastal plain near Tissamaharama: Wirawila Wewa (300 ha) six km west of the town, Tissa Wewa (150 ha) and Debara Wewa on the northwestern outskirts, and Yoda Wewa (450 ha) to the east. Wirawila is a shallow tank with scattered dead trees and grassy shoreline; it is surrounded by scrub jungle and cultivation. At low water levels, large areas of bare mud are exposed.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: No information.
Land tenure: The tanks are state owned.
Conservation measures taken: Wirawila, Tissa and Debara tanks are protected within the Wirawila-Tissa Bird Sanctuary (4,167 ha), established in 1938.
Conservation measures proposed: None
Land use: No information.
Disturbances and threats: No information.
Economic and social values: No information.
Fauna: Wirawila was formerly a very important site for large water birds, notably *Pelecanus philippensis* (e.g. 400 in September 1972), cormorants, herons, egrets, storks, ibises and spoonbills, and is still an important wintering area for ducks and shorebirds in some years. Water levels were very high in January 1986, and few birds were present. However, in January 1987, large numbers of *Anas querquedula* and *A. acuta* were reported, along with:
10 *Pelecanus philippensis*
50 *Phalacrocorax carbo*
20 P. *niger*
15 *Ardea cinerea*
100 *Mycteria leucocephala*
3 *Anastomus oscitans*

200 *Platalea leucorodia*
1,000 *Dendrocygna javanica*
50 *Hydrophasianus chirurgus*
and large numbers of *Gelochelidon nilotica.* In January 1988, conditions were again poor and the only birds present were 150 *Phalacrocorax niger,* 36 herons and egrets of five species, 1,000 *Dendrocygna javanica,* 50 *Himantopus himantopus* and a few other shorebirds. The three other tanks, and especially Debara Wewa, are known to be important for large water birds, but few details are available. Waterfowl present in January 1988 included 25 *Pelecanus philippensis,* 25 *Mycteria leucocephala* and 60 *Hydrophasianus chirurgus.* Fishes recorded from Wirawila include *Puntius sarana, Puntitius dorsalis, Ompok bimaculatus, Heteropneustes fossilis*, *Macrones vittatus, Tilapia mossambica* and *Glossogobius giuris.*
Special floral values: No information.
References: Fernando & Indrasena (1969); Hoffmann (1982); van der Yen (1987).
Criteria for inclusion: lb. 2a, 3b.
Source: Bennie L. Abeyratue.

Wetland name: Bundala Lewaya, Embilikala Kalapuwa, Malala Lewaya and Koholankala Lewaya
Country: Sri Lanka
Coordinates: 6°09'-6°12'N, 81°09'-81°15'E;
Location: 2-16 km east of Hambantota, Hambantota District, Southern Province.
Area: 1,990 ha of lagoons; Bird Sanctuary 6,216 ha.
Altitude: Near sea level.
Biogeographical Province: 4.13.4./4.2.1.
Wetland type: 05, 06, 08 & 09.
Description of site: A group of four shallow, brackish lagoons with some salt pans, the interconnecting channels and marshes, and the adjacent sea coast, west of Hambantota. The easternmost lagoon, Bundala Lewaya, was originally a brackish lagoon of about 520 ha in extent, separated from the sea by a natural sand bar and with an average depth of less than one meter. However, the lagoon has now been divided up by a series of bunds to facilitate commercial salt extraction, and water levels are kept constant by artificial means. Embilikala Kalapuwa (430 ha) is a fresh to brackish lagoon, immediately to the west of Bundala Lewaya It is permanent and has a depth of l-2m. Malala Lewaya (650 ha) is a similar fresh to brackish lagoon to the west of Embilikala Kalapuwa, and connected to that lagoon by a narrow channel; it receives freshwater inflow from the Malala Oya stream. The westernmost lagoon, Koholankala Lewaya (390 ha), has been developed for salt production. It is less than a metre deep and subject to wide fluctuations in water level. The salinity exceeds 30 p.p.t. during dry periods. The surrounding terrain is generally flat with sand dunes along the coast and sparse dry evergreen scrub inland.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: No information is available on the aquatic vegetation. The arid vegetation elsewhere in the Sanctuary consists largely of grassy flats studded with *Acacia scrub.* Other shrubs include *Capparis zeylanica* and *Cassia sp*. There are some rice paddies to the north of Embilikala Kalapuwa and Malala Lewaya.
Land tenure: Koholankala Lewaya is owned by the National Salt Corporation (a state agency); the other lagoons and surrounding areas in the Bundala Bird Sanctuary are also state owned.
Conservation measures taken: Protected within the Bundala Bird Sanctuary (6,216 ha), established under the Fauna and Flora Preservation Ordinances in 1969.
Conservation measures proposed: A proposal has been made to upgrade the Bird Sanctuary to National Park. Staff of the Department of Wildlife Conservation should be stationed in the

Sanctuary as a matter of urgency to curb the many illicit acts which are being perpetrated in the reserve.

Land use: Salt production at Bundala Lewaya and Koholankala Lewaya, some fishing at Embilikala Kalapuwa and Malala Lewaya, and wildlife tourism, particularly bird-watching, in the Sanctuary; livestock grazing and some cultivation in surrounding areas.

Possible changes in land use: There is a possibility that the salt pans atBundala and Koholankala will be expanded, and salt production may be developed at the other two lagoons as well.

Disturbances and threats: The degree of protection within the Sanctuary is reported to be poor. Villagers living on the periphery of the Sanctuary fish, graze their livestock and cut the scarce tree vegetation inside the boundary, and there has been some encroachment by settlements. There has also been some illegal shooting. The development of aquaculture, especially for prawns, and expansion of the salt industry pose threats at all four lagoons, as does the large-scale collection of mollusc shells for use in lime kilns. Disturbance from tourism is also creating some problems. The Air Force recently established a bombing and firing range within the Sanctuary, but this was closed down following representations from conservation bodies.

Economic and social values: The lagoons support a small subsistence fishery. Visitors to the Bird Sanctuary number up to 15 parties per day (IUCN, in prep).

Fauna: Bundala Sanctuary is the most important wetland for birds in Sri Lanka outside the Northern Province. The lagoons constitute one of the most important wintering areas for migratory shorebirds in the country, regularly accommodating over 15,000 shorebirds at one time. Peak counts in recent years (1983-88) have included:

31 *Recurvirostra avosetta*
800 *Pluvialis dominica*
90 *P. squatarola*
85 *Charadius dubius*
300 *C. alexandrinus*
1,500 *C. mongolus*
490 *Limosa limosa*
330 *Tringa totanus*
3,600 *T. stagnatilis*
250 *T. nebularia*
1,000 *T. glareola*
280 *Arenaria interpres*
11,700 *Calidris minuta*
17,000 *C. ferruginea*
16 *Limicola falcinellus*
150 *Philomachus pugnax*

Common resident shorebirds include *Rostratula benghalensis, Himantopus himantopus (up* to *2,700), Esacus recurvirostris (up* to 40) and *Vanellus indicus.* Regular shorebird censuses have produced sightings of a number of rare visitors to Sri Lanka such as *Haematopus ostralegus, Charadrius asiaticus, C. hiaticula, Tringa erythropus, Calidris canutus* and *Eurynorhynchus pygmeus.* Other species of waterfowl recorded during mid-winter censuses in 1986, 1987 and 1988 have included:

up to 78 *Tachybaptus ruficollis*
970 *Pelecanus philippensis*
595 *Phalacrocorax fuscicollis*
1,130 *P. niger*
28 *Anhinga melanogasser*
280 herons and egrets of 7 species

534 *Mycteria leucocephala*
2 *Anastomus oscitans*
3 *Leptoptilos javanicus*
7 *Threskiornis melanocephalus*
530 *Platalea leucorodia*
1,000 *Phoenicopterus ruber*
76,000 *Anas acuta*
129,000 *A. querquedula*
17 *A. clypeata*
65 *Hydrophasianus chirurgus*
150 *Larus brunnicephalus*
300 *Chlidonias hybrida*
54 *Gelochelidon nilotica*
90 *Hydroprogne caspia*
The rare Black-necked Stork *Ephippiorhynchus asiaticus* is an occasional visitor to the Bird Sanctuary, while both the White-bellied Sea-Eagle *Haliaeetus leucogaster* and Brahminy Kite *Haliastur indus* are breeding residents. The forest in the Sanctuary still harbours a few Asian Elephants *Elephas maximus,* and migratory herds of up to 80 animals occasionally visit the area. Other mammals include *Presbytis entellus, Panthera pardus, Axis axis* and *Bubalus bubalis.* Reptiles include the Marsh Crocodile *Crocodylus palustris* and *Varanus bengalensis.* The adjacent coast is an important breeding area for sea turtles.
Special floral values: No information.
Research and facilities: Numerous waterfowl surveys and shorebird censuses have been carried out in the Sanctuary, the latter particularly by J.D.N. and J. Banks. There is a National Sea Turtle Survey Research Hut on the coast.
References: Hoffmann (1982 & 1987); IUCN (in prep); Karpowicz (1985); Powell (1984b); van der Yen (1987).
Criteria for inclusion: 1b, 2a, 2b, 3a.
Source: J.I. Samarakoon, J.D.N. & J. Banks, Yasa Ratnayake and T.W. Hoffmann.

Wetland name: Maha Lewaya and Karagan Lewaya
Country: Sri Lanka
Coordinates: 6°07'-6°09'N, 81°06'-81°09'E;
Location: near Hambantota, Hambantota District, Southern Province.
Area: 1,160 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4./4.2.1.
Wetland type: 08 & 09.
Description of site: Two brackish to saline coastal lagoons on the south coast in the vicinity of the city of Hambantota. Maha Lewaya (260 ha) lies east of the city, and Karagan Lewaya (900 ha) is situated in the western suburbs. Maha Lewaya has been developed for salt production, while Karagan Lewaya is a naturally formed hypersaline lagoon. Salinities of 217 and 420 p.p.t. were recorded at Maha and Karagan respectively in November 1987. The pH values at this time were 7.6-7.9 and 7.1-7.2 respectively. Both lagoons are less than a metre deep and subject to wide fluctuations in water level.
Climatic conditions: Tropical monsoonal climate with an average annual rainfall of about 2,000 mm; in the low country dry zone.

Principal vegetation: The phytoplankton in both lagoons is dominated by blue-green algae such as *Microcystis, Nostoc* and *Oscillatoria.* The lagoons are surrounded by scrub forest and grassland with some sparsely used cropland to the north and dune vegetation to the south.
Land tenure: Karagan is state owned; Maha is owned by the National Salt Corporation (a state agency). Surrounding areas are partly state owned and partly private.
Conservation measures taken: Karagan Lewaya has been classified as a Site of Scenic Beauty by the Coast Conservation Department's Resource Base Map.
Conservation measures proposed: Karagan Lewaya has been proposed as a sanctuary.
Land use: Salt production at Maha Lewaya; shifting cultivation and coconut plantations in surrounding areas.
Disturbances and threats: The principal threat at both lagoons is further development of salt pans for salt production. There are plans to turn Karagan Lewaya into a private saltern for the establishment of a salt-based industry. The Ceylon Bird Club and other non-governmental conservation bodies are opposing this transformation. Removal of sand is also reported to be a problem at Karagan.
Economic and social values: Salt production at Maha provides some employment for local people.
Fauna: An important area for a wide variety of waterfowl, notably pelicans, flamingos, ducks, shorebirds, gulls and terns. Concentrations of up to 3,000 Greater Flamingos *Phoenicopterus ruber* are regular at Karagan Lewaya. Waterfowl recorded during mid-winter censuses in 1987 and 1988 included:
up to 60 *Tachybaptus ruficollis*
425 *Pelecanus philippensis*
130 *Phalacrocorax niger*
21 *Mycteria leucocephala*
42 *Platalea leucorodia*
2,500 *Phoenicopterus ruber*
2,900 Anas acuta
670 *A. querquedula*
400 *Himantopus himantopus*
190 *Pluvialis dominica*
110 *Charadrius dubius*
90 *C. alexandrinus*
1,100 *C. mongolus*
400 *Limosa limosa*
140 *Tringa totanus*
1,100 *T. stagnatilis*
90 *T. nebularia*
2,600 *T. glareola*
140 *Actitis hypoleucos*
420 *Calidris minuta*
2,050 *C. ferruginea*
130 *Larus brunnicephalus*
120 *Chlidonias hybrida*
50 *C. leucoptera*
550 *Gelochelidon nilotica*
125 *Sterna hirundo*
280 *S. albifrons*
Eight species of herons and egrets and many other species of shorebirds were present in small numbers.

Special floral values: No information.
Research and facilities: Regular waterfowl censuses have been carried out in recent years, and in November 1987, a study was made at Karagan Lewaya to assess the threat posed by the establishment of a private saltern (de Silva & Rhaman, 1987).
References: Hoffmann (1982 & 1987); Karpowicz (1985); de Silva & Rhaman (1987); van der Yen (1987).
Criteria for inclusion: lb. 2a, 3a.
Source: J.I. Samarakoon, Yasa Ratnayake and T.W. Hoffmann.

Wetland name: Lunama Kalapuwa and Kalametiya Kalapuwa
Country: Sri Lanka
Coordinates: 6°05'-6°06'N, 80°56'-80°59'E;
Location: 17-21 km west of Hambantota, Hambantota District, Southern Province.
Area: Lunama Kalapuwa 212 ha; Kalametiya Kalapuwa 200 ha.
Altitude: Sea level.
Biogeographical Province: 4.2.1.
Wetland type: 07 & 08.
Description of site: Two coastal lagoons west of the mouth of the Walawe Ganga. Lunama Kalapuwa is a brackish lagoon with extensive mangrove swamps; Kalametiya Kalapuwa is a permanent, slightly brackish lagoon with abundant aquatic vegetation and a mangrove fringe. Both are fed by several small streams, and have maximum depths of 2-3m.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Mangrove swamps at both lagoons, and reed-beds and abundant submerged aquatic vegetation at Kalametiya Kalapuwa rice paddies, other cultivated land, grassland, scrub and coconut plantations in surrounding areas.
Land tenure: The lagoons are state owned; surrounding areas are partly state owned and partly private.
Conservation measures taken: The two lagoons were first protected as a Sanctuary in 1940, but this was denotified in 1946 because of opposition from local people. After a prolonged campaign by various conservation bodies, the area was re-declared a Sanctuary (the Kalametiya Sanctuary) in 1984.
Conservation measures proposed: None
Land use: Fishing, especially for prawns; shifting cultivation, rice cultivation and excavation of shells in adjacent areas.
Disturbances and threats: The area of open water in both lagoons has decreased by more than 50% during the past 30 years, mainly because of siltation. An expansion of the mangroves has also occurred at Kalametiya, and this has accelerated the process of siltation. Other threats include disturbance from fishing activities, excavation of mollusc shells for use in lime kilns, reclamation of land for rice cultivation, and pollution with pesticides entering the lagoons in agricultural runoff from the Walawe Development Scheme to the north. Excessive hunting was reported to be a problem prior to the renotification of the Sanctuary in 1984.
During the late 1950s or early 1960s, excess fresh water from the Uda Walawe Reservoir was diverted into Kalametiya Kalapuwa. Subsequently a groyne and canal were constructed to ensure drainage of water from the lagoon into the sea. As a result, the salinity was permanently depressed and the recruitment of penaeid prawn post-larvae and fish severely obstructed. The fishery that existed prior to these changes collapsed, and now fishing is only a marginally important subsistence activity.
Economic and social values: The lagoons formerly supported important prawn fisheries, but these have declined in recent years.

Fauna: Kalametiya Kalapuwa is a very important wetland for both resident and migratory waterfowl, with breeding colonies of pelicans, herons, egrets, and Openbill Storks *Anastomus oscitans,* and large wintering populations of migratory ducks and shorebirds. This is the only place in Sri Lanka where the Glossy This *Plegadis falcinellus* has been regularly reported in recent years. A flock of 26 was observed in 1982, and smaller numbers have been reported on several occasions since then. Some 5,000 ducks were recorded in January 1983, but few were present in the following year, presumably because of heavy hunting pressure. Waterfowl recorded during mid-winter censuses in 1986, 1987 and 1988 included 560 herons and egrets of nine species (mainly *Bubulcus ibis* and *Egretta garzetta)* and:
up to 270 *Pelecanus philippensis*
200 *Phalacrocorax niger*
12 *Anhinga melanogaster*
33 *Mycteria leucocephala*
6 *Anastomus oscitans*
37 *Threskiornis melanocephalus*
82 *Platalea leucorodia*
70 *Dendrocygna javanica*
160 *Anas acuta*
2,000 *Anas querquedula*
60 *Porphyrio porphyrio*
120 *Hydrophasianus chirurgus*
630 *Himantopus himantopus*
1,000 *Pluvalis dominica*
1,000 *Charadrius mongolus*
50 *Larus brunnicephalus*
30 *Gelochelidon nilotica*
At least 17 other species of migratory shorebirds have been recorded in small numbers. Lunama Kelapuwa is also an important wintering area for migratory ducks and shorebirds, although numbers are usually much smaller than at Kalametiya. Waterfowl recorded during mid-winter censuses in January 1987 and January 1988 included:
4 *Pelecanus philippensis*
200 *Phalacrocorax niger*
80 *Dendrocygna javanica*
1,200 *Anas querquedula*
16 *Porphyria porphyrio*
17 *Hydrophasianus chirurgus*
62 *Himantopus himantopus*
21 *Larus brunnicephalus*
along with small numbers of five species of herons and egrets, 13 species of migratory shorebirds and four species of terns.
Special floral values: The mangrove vegetation at Kalametiya is in good condition and presents the full range of successional stages.
Research and facilities: Mid-winter waterfowl censuses have been carried out in recent years. The Ministry of Fisheries maintains a circuit bungalow at the nearby village of Gurupokuna.
References: Hoffmann (1982 & 1987); Karpowicz (1985); Marga Institute (1985b); van der Yen (1987).
Criteria for inclusion: 1b, 2a, 2b, 3a.
Source: J.I. Samarakoon, S.C. Seneviratne and T.W. Hoffmann.

Wetland name: Streams in Horton Plains National Park
Country: Sri Lanka
Coordinates: 6°47'-6°50'N, 80°46'80°50'E;
Location: in the central highlands. 20 km south of Nuwara Eliya, Central Province.
Area: Area of wetlands unknown; National Park 3,162 ha.
Altitude: 2,100-2,200m.
Biogeographical Province: 4.13.4./4.2.1.
Wetland type: 12.
Description of site: A number of small mountain streams flowing through gently undulating grasslands at an altitude of 2,100-2,200m in the Horton Plains National Park. Tributaries of three major rivers originate from within the park, the Mahaweli and Uma flowing to the north, and the Walawe to the south. Belihul Oya, a small stream feeding the Walawe, tumbles over a cliff as a large and spectacular waterfall. The streams are generally 2-5m in width and up to 50 cm deep, with an average flow of about 75 cm per second. The water is acidic, with a pH of 5.4. Stagnant pools with muddy bottoms are subject to eutrophication.
Climatic conditions: Subtropical monsoonal climate with a mean annual temperature of 15°C. Rain occurs throughout most of the year, but there is a distinct dry season from January to March. Ground frost is common in February.
Principal vegetation: The streams support a variety of aquatic macrophytes as well as the algae *Bulbochecta sp, Nitella* sp and *Batrocliospermum* sp. The surrounding grasslands are dominated by tussock grasses such as *Chrysopogon zeylanicus* and *Cymbopogon confertifiorus,* except in damp hollows where pure stands of *Chimonobambusa (Arundinaria) densifolia* have developed. A rich herbaceous flora flourishes with numerous species of both temperate and tropical origin. *Gordonia sp* and *Rhododendron arboreum* occur in isolated patches on the plains, and high altitude cloud forest persists on the steep western slopes.
Land tenure: The National Park is state owned.
Conservation measures taken: The streams are protected within the Horton Plains National Park (3,162 ha), first established as a Nature Reserve in December 1969 and upgraded to a National Park in March 1988. The area had previously received some protection as it was used as a hunting area by the British prior to Independence in 1948. The National Park adjoins the eastern edge of Peak Wilderness Sanctuary (22,380 ha).
Conservation measures proposed: It has been recommended that the Peak Wilderness Sanctuary be united with Horton Plains National Park in a "Highland National Park".
Land use: Fishing is allowed on a permit basis. Prior to the establishment of the Nature Reserve in 1969, the plains were cleared and terraced for the cultivation of potatoes, but this was terminated in 1979. Adjacent areas are used for tea and Eucalyptus plantations.
Disturbances and threats: Uncontrolled burning of grasslands by local inhabitants continues, and trees are illicitly felled, mainly for firewood. This loss of vegetation is increasing the risk of soil erosion, and threatening the water supply downstream. In recent years, the trees in the park have been dying in increasing numbers, so much so that in certain areas up to 50% of the forest cover has now disappeared. The reasons for this are unknown, but may be linked to climatic changes.
Economic and social values: No information.
Fauna: There are no indigenous fishes in the streams, but *Salmo gairdneri* has been introduced. Amphibians include the frog *Rana lirnnocarsis greeni.* The interesting invertebrate fauna includes abundant larvae of *Simulium* sp and *Chironomus* sp, a variety of Ephemeroptera, Plecoptera and Odonata, the platyhelminth *Dugesia nannophallus,* the annelid *Limnodrilus hoffmeisteri,* the mollusc *Paludomus nigricans* and the crustaceans *Paratelehusa (Ceylonphusa) enodis, P.* rugosa and *Caridina singhalensi5.* The endemic freshwater shrimp *C. singhalensis is* believed to be confined to a 10 km stretch of stream within the park (de Silva, 1982).

The National Park supports a rich mammalian fauna including Kelaart's Long-clawed Shrew *Feroculus feroculus* (a monotypic genus endemic to the montane regions of Sri Lanka), Slender Loris *Laris tardigradus,* Purple-faced Langur *Presbytis vetulus* and Fishing Cat *Felis viverrina.* The avifauna includes several of Sri Lanka's endemic forest birds.
Special floral values: No information.
Research and facilities: Limnological investigations have been carried out by Costa (1974), and some work has been conducted on the endemic freshwater shrimp (de Silva, 1982). Accommodation is available in the reserve, and camping is permitted.
References: Costa (1974); IUCN (in prep); de Silva (1982).
Criteria for inclusion: la, 2b, 2d.
Source: Leonard Pinto and T.W. Hoffmann.

Wetland name: Bellanwilla-Attidiya Marshes
Country: Sri Lanka
Coordinates: 6°50'N, 7954'E;
Location: on the southeastern outskirts of Colombo, east of Attidiya, Colombo District, Western Province.
Area: c.60 ha.
Altitude: Near sea level.
Biogeographical Province: 4.2.1.
Wetland type: 15.
Description of site: A complex of shallow freshwater ponds, marshes and seasonally flooded grassland with scattered shrubs and small trees, on the coastal plain of the wet zone, southeast of Colombo City. The Bolgoda canal runs through the marsh, dividing it into two almost equal portions. Numerous shallow pools and muddy areas have been created by water buffaloes. The area was cultivated for rice until 1980, but since then, has reverted to marshland, and is now one of the most important of the few remaining wetlands around Colombo.
Climatic conditions: Tropical monsoonal climate; in the low country wet zone.
Principal vegetation: Open water areas are almost entirely covered in Salvinia sp and *Eichhornia crassipes.* Most of the marsh is covered with low reeds and grasses, with some patches of tall reeds and clumps of bushes.
Land tenure: The marsh is state owned; surrounding areas are mostly privately owned.
Conservation measures taken: None.
Conservation measures proposed: The marsh has been proposed as a Nature Reserve. Gunawardana (1988) has made various recommendations for management.
Land use: Fishing for finfish and shrimps, livestock grazing (water buffalo and cattle), and cutting of reeds and shrubs for fuel; agriculture and urban development in surrounding areas. Less than 20 people live in the marsh, but over 10,000 live in the immediate vicinity.
Disturbances and threats: Effluents from a nearby garment factory are discharged into the Bolgoda canal, and have resulted in large fish kills. Several species of fishes, including two of Sri Lanka's endemic species *Aplocheilus dayi* and *Ehiwara fluviatilis,* and the economically important freshwater shrimp *Macrobrachium rosenbergii,* have been almost exterminated in the marsh. The dumping of domestic waste along the adjacent roads has also caused some pollution. Most of the larger trees have been cut down for firewood. There is a considerable amount of hunting of large water birds, particularly with snares, nets and catapults, and some egg-collecting.
Economic and social values: Because of its easy access and close proximity to the city of Colombo, the marsh has excellent potential for conservation education and scientific research.

Fauna: The marsh supports a wide variety of water birds in small numbers, and is an important roosting site for herons and egrets. Some 43 species of waterfowl were recorded during a study in 1986 and 1987. These included several scarce species in Sri Lanka, such as *Phalacrocorax fuscicollis, Rallus striatus* and *Porzana fusca,* as well as *Pelecanus philippensis, Ixobrychus flavicollis, Mycteria leucocephala, Anastomus oscitans, Threskiornis melanocephalus, Platalea leucorodia, Dendrocygna javanica, Gallicrex cinerea, Porphyrio porphyrio* (a common breeding bird), *Hydrophasianus chirurgus, Rostratula benghalensis* and a variety of migratory shorebirds. Thirty-nine species of fishes have been recorded, including four of Sri Lanka's endemic species. The marsh is also rich in butterflies (52 species including nine endemics) and dragonflies (37 species).
Special floral values: No information.
Research and facilities: Members of the Young Zoologists' Association in Colombo carried out an ecological study of the marsh in 1986 and 1987.
References: Gunawardana (1987 & 1988).
Criteria for inclusion: lb. 2b.
Source: T.W. Hoffmann.

Wetland name: Muthurajawela Swamp
Country: Sri Lanka
Coordinates: 7°03'N, 79°55'E;
Location: between Hendala and Ja-Ela, 10 km northeast of Colombo, Gampaha District, Western Province.
Area: 2,429 ha.
Altitude: Near sea level.
Biogeographical Province: 4.2.1.
Wetland type: 07, 08 & 15.
Description of site: A large area of brackish marshes, mangrove swamps and freshwater marshes on the coastal plain of the wet zone, northeast of Colombo. The wetland merges into Negombo Lagoon (site 32) to the northwest. The main marsh is traversed by a navigational canal (the Hamilton Canal). In 1767, the first reclamation project commenced on the orders of Iman William Flack, the then Governor of Ceylon. Several attempts have since been made to reclaim the area, but mostly with little success because of the acid sulphate soils.
Climatic conditions: Tropical monsoonal climate; in the low country wet zone.
Principal vegetation: Mangrove swamps and grassy marshes.
Land tenure: The wetland is state owned; surrounding areas are privately owned.
Conservation measures taken: None.
Conservation measures proposed: As one of the few marshes in the Colombo area which has not yet been reclaimed for agriculture or filled in for development, Muthurajawela Swamp should be protected, not only for the benefit of wetland fauna and flora, but also as a recreational area (Hoffmann, 1987). There is now a movement by local NGOs to have at least essential portions of the marsh protected.
Land use: In historic times, the wetland was used for paddy cultivation, but salt intrusion has led to the abandonment of cultivation.
Possible changes in land use: The Greater Colombo Economic Commission has put forward a proposal to fill the marsh for housing developments and industrial estates.
Disturbances and threats: The principal long-term threat is reclamation for urban and industrial development. Present disturbances include heavy shooting pressure, the cutting of mangroves for poles, over-fishing and illicit manufacture of liquor.
Economic and social values: No information.

Fauna: An important area for a wide variety of water birds, including many herons and egrets, *Anastomus oscitans, Dendrocygna javanica* and wintering ducks (mainly *Anas querquedula* and *A. acuta).* Waterfowl recorded during the mid-winter censuses in January 1987 and January 1988 included *Phalacrocorax carbo, Ixobrychus sinensis, I. flavicollis, Ardeola grayii, Bubulcus ibis, Egretta intermedia (250), Ardea cinerea, Dendrocygna javanica* (120), *Porphyrio porphyrio, Vanellus indicus* and *Gallinago stenura.*
Special floral values: No information.
References: Hoffmann *(*1982 *&* 1987); Stoutjesdijk (1982); van der Yen *(*1987*).*
Criteria for inclusion: 1b, 2b.
Source: Douglas B. Ranasinghe and T.W. Hoffmann.

Wetland name: Negombo Lagoon
Country: Sri Lanka
Coordinates: 7°06'-7°l2'N, 79°49'-79°53'E;
Location: 20 km north of Colombo, Gampaha District, Western Province.
Area: 3,502 ha.
Altitude: Sea level.
Biogeographical Province: 4.2.1.
Wetland type: 02, 07 & 08.
Description of site: A large estuarine lagoon opening to the sea at its northern end, and receiving freshwater input from the Ja-Ela, Damdugam Oya and Old Dutch Canal. The maximum depth is about *2*-3m*,* but most of the lagoon is very shallow (less than 50 cm*).* The salinity ranges from 1 to 40 p.p.t., and the pH from 5.8 to 8.8. Seasonal fluctuations in water level are high (30 cm), compared to tidal fluctuations (18 cm at spring tides and two cm at neap tides). The town of Negombo is situated at the northern end of the lagoon, near its mouth.
Climatic conditions: Tropical monsoonal climate with an average annual rainfall of 2,018 mm and a mean annual temperature of 27°C. The lagoon is situated on the edge of the low country wet zone.
Principal vegetation: Mangrove forest dominated by *Rhizophora spp, Bruguiera spp, Avicennia marina* and *Lumnitzera racemosa;* also beds of *Halodule, Zostera, Thalassiodendron, Najas and Padina.* Rice paddies, grassland and coconut plantations in surrounding areas.
Land tenure: The lagoon is state owned; surrounding areas are partly state owned and partly private.
Conservation measures taken: None.
Conservation measures proposed: The Natural Resources, Energy and Science Authority of Sri Lanka and the National Aquatic Resources Agency are expected to declare a large part of the lagoon as a Mangrove Park in the near future. This will be the first such park in Sri Lanka.
Land use: Fishing and cutting of mangroves for poles; agriculture, aquaculture and housing in adjacent areas.
Disturbances and threats: The clearing of mangroves for housing projects, cutting of mangroves for firewood, and illicit manufacture of liquor.
Economic and social values: The lagoon supports an important fishery.
Fauna: An important area for a wide variety of waterfowl including resident species of cormorants, herons and egrets, and migratory species of shorebirds, gulls and terns. The rich fish fauna includes *Etroplus suratensis,* a popular aquarium fish endemic to Sri Lanka. Invertebrates include a wide variety of polychaetes and molluscs, the crabs *Scylla serrata, Portunus pelagicus,* and prawns of the genera *Penaeus* and *Metapenaeus.*
Special floral values: The mangrove community contains a high diversity of species compared to other sites on the west coast of Sri Lanka.

Research and facilities: A considerable amount of hydrological, limnological and fisheries research has been carried out at the lagoon.
References: Aruchelvam (1986); Pinto (1980 & 1982); Pinto & Wignaraja (1980); Ramanathan (1969); Samarakoon & Raphael (1972); Wijeratne (1984).
Criteria for inclusion: 1b, 2b.
Source: Leonard Pinto.

Wetland name: Mundel Lake
Country: Sri Lanka
Coordinates: 7°42'-7°52'N, 79°47'-79°50'E;
Location: 20 km south of Puttalam, Puttalam District, Northwestern Province.
Area: 3,361 ha.
Altitude: Near sea level.
Biogeographical Province: 4.2.1.
Wetland type: 07 & 08.
Description of site: A shallow, brackish coastal lagoon with fringing mangrove swamps and brackish marshes, separated from the sea by a sandy ridge, and connected to Puttalam Lagoon to the north by a channel which has been deepened by dredging. The lagoon is permanent, with a maximum depth of 2-3m and an average depth of less than lm. Extensive mudflats are exposed at low water levels. The site also includes the much smaller Muthupantiya Lagoon just south of Udappuwa. This is a very shallow lagoon with extensive mudflats at low water levels.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Mangrove swamps, salt marsh vegetation and sea grasses; coconut plantations, rice paddies, other cultivated land and scrub in surrounding areas.
Land tenure: The lagoon is state owned; surrounding areas are partly state owned and partly private.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing, especially for prawns; aquaculture, rice cultivation and coconut plantations in surrounding areas.
Disturbances and threats: Siltation, the development of aquaculture schemes in the lagoon, excessive commercial fishing and heavy hunting pressure. The relatively low number of ducks present in recent years has been attributed to the severe disturbance caused by shooting. Effluents from planned aquaculture facilities will be diverted into the lagoon.
Economic and social values: The lagoon supports an important commercial fishery.
Fauna: A very important wetland for a wide variety of water birds, notably herons and egrets, shorebirds and terns. Waterfowl recorded during a census in January 1988 included 100 herons and egrets of five species, and:
450 *Himantopus himantopus*
300 *Vanellus indicus*
1,160 *Pluvialis dominica*
80 *Charadrius dubius*
185 *C. alexandrinus*
400 *C. mongolus*
60 *Limosa limosa*
2,000 *Tringa stagnatilis*
50 *T. nebularia*
650 *Calidris minuta*
1,300 *C. ferruginea*

50 *Larus brunnicephalus*
550 *Chlidonias hybrida*
5,000 *C. leucoptera*
320 *Gelochelidon nilotica*
65 *Hydroprogne caspia*
1,000 *Sterna hirundo*
2,200 *S. albifrons*
The lagoon was formerly an important wintering area for ducks, but numbers have been low in recent years, apparently because of heavy shooting pressure. Only 250 ducks of four species were present in January 1984, and none was present in January 1988.
Special floral values: The mangrove swamps and salt marsh communities are of considerable botanical interest.
Research and facilities: Some mid-winter waterfowl censuses have been carried out in recent years.
References: Hoffmann (1982 & 1985); Karpowicz (1985).
Criteria for inclusion: lb. 3a.
Source: J.I. Samarakoon and T.W. Hoffmann.

Wetland name: Puttalam Lagoon
Country: Sri Lanka
Coordinates: 7°58'-8°2l'N, 79°43'-79°50'E;
Location: at Puttalam, 120 km north of Colombo, Puttalam District, Northwestern Province.
Area: 36,426 ha.
Altitude: Sea level.
Biogeographical Province: 4.2.1.
Wetland type: 02, 06, 07, 08 & 09.
Description of site: A large brackish to saline coastal lagoon with broad connection into the open sea at its northern end. The lagoon extends for some 30 km from north to south and is up to 11 km wide. Much of the lagoon is fringed by mangrove swamps which cover an area of about 3,000 ha; salt marsh vegetation occurs in some places on the shoreline, and there are very large beds of sea grasses at the north end of the lagoon and in Dutch Bay to the north. Few parts of the lagoon exceed 3m in depth, and the average depth is less than lm. The lagoon is tidal, and the water level also fluctuates seasonally according to rainfall. Extensive mudflats are exposed at low tide and at low water levels during the dry season, particularly along the western shore and at the southern end. Two much smaller lagoons, Karaitivu (260 ha) and Kalpitiya (390 ha), branch off the main lagoon near its mouth in Dutch Bay, Karaitivu to the east and Kalpitiya to the west. There are large areas of salt pans adjacent to both these lagoons and also along the eastern shore of the main lagoon. The lagoon is linked to Mundel Lake to the south by a dredged channel, and receives freshwater inflow from the Mi Oya and several other streams entering from the east. It is exceptional amongst estuarine lagoons in that the salinity rarely decreases below 15 p.p.t., even during the rainy season.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Some 3,000 ha of mangrove swamps, small areas of salt marsh vegetation, and extensive beds of sea grasses; coconut plantations, cultivated land, open forest, scrub and grassland in surrounding areas.
Land tenure: The lagoon is state owned; surrounding areas are partly state owned and partly private.
Conservation measures taken: None.
Conservation measures proposed: None

Land use: Fishing for prawns and small fish with throw-nets, and salt production, particularly at Palavi in the southeast; aquaculture (mainly for prawns) and cultivation of coconuts and other crops in surrounding areas. There is a naval base at Kalpitiya.
Possible changes in land use: A proposal has been made to develop aquaculture in the lagoon, using pens and cages.
Disturbances and threats: The principal threats are the expansion of aquaculture schemes and saltpans in the area, and destruction of mangroves for firewood, beams and poles.
Economic and social values: The lagoon supports a major fishery for finfish, prawns and mussels, and is an important breeding area for a variety of commercially important fishes and prawns. Some 2,000 fishermen were operating in the lagoon in 1982. Total fisheries production has been estimated at 45 kg/ha/yr.
Fauna: A very important wetland for a wide variety of water birds, notably pelicans, herons, egrets, ducks, shorebirds and terns. Large numbers of waterfowl were present in January 1988, but the vast size of the wetland precluded any complete census. The commoner large water birds and ducks included *Pelecanus philippensis, Phalacrocorax niger, Nycticorax nycticorax, Ardeola grayii, Bubulcus ibis, Egretta garzetta, E. intermedia, Platalea leucorodia, Dendrocygna javanica, Anas acuta* and *A. querquedula.* Shorebirds, gulls and terns recorded during a partial census of the shoreline and adjacent salt pans included the following:
190 *Himantopus himantopus*
140 *Pluvialis dominica*
200 *Charadrius dubius*
60 C. *alexandrinus*
5,900 C. *mongolus*
110 *Tringa totanus*
7,380 *T. stagnatilis*
135 *T. nebularia*
75 *Arenaria interpres*
6,100 *Calidris minuta*
3,000 *C. ferruginea*
170 *Larus brunnicephalus*
65 *Gelochelidon nilotica*
45 *Hydroprogne caspia*
6,500 *Sterna hirundo*
along with many other species in small numbers.
Kalpitiya Lagoon was formerly an occasional haunt of the Dugong *Dugong dugon.* The Green Sea Turtle *Chelonia mydas* still occurs in the area.
Special floral values: The extensive mangrove swamps and sea grass beds are of considerable botanical interest.
Research and facilities: Some mid-winter waterfowl censuses have been carried out in recent years. The Fisheries Department and the National Aquatic Research Agency maintain various facilities at the lagoon including a laboratory at Kalpitiya (NARA).
References: Amarasinghe & Perera (1984); Durairatnam (1963); Hoffmann (1982); Jayasuriya (1984); Perera & Siriwardena (1982); Ramanathan (1969); Samarakoon (1986).
Criteria for inclusion: 1b, le, 2a, 2b, 3a.
Source: J.I. Samarakoon and T.W. Hoffmann.

Wetland name: Wetlands in Wilpattu National Park
Country: Sri Lanka
Coordinates: 8°12'-8°32'N, 79°52'-80°10'E;

Location:30-60 km west of Anuradhapura and 30 km northeast of Puttalam, Puttalam and Anuradhapura Districts, Northwestern and North-Central Provinces.
Area: Area of wetlands unknown; National Park 131,692 ha.
Altitude: Sea level to 152m.
Biogeographical Province: 4.13.4./4.2.1.
Wetland type: 04, 05, 07, 08, 11, 14, 15 & 17.
Description of site: All the small permanent and seasonal lakes, ponds and marshes (villus) in Wilpattu National Park, especially Atha and Periya Uppu villus, as well as several small water storage reservoirs (tanks) and the park's five main river systems. There are about 40 villus, most of which are fresh although several are saline. They are formed in shallow depressions where local run-off collects over an impermeable layer or where water percolates through a thin layer of soil from the underlying Jaffna limestone. The principal river systems are the Modaragam Aru, Kala Oya, Denigaha Ella, Berige Ella and Pan Ella. The park is situated in a flat, sandy region, and many of the villus are surrounded by sand dunes. The western margin borders on Dutch Bay and Portugal Bay, and the park includes about 40 km of coastline. Most of the coast is rocky with limestone cliffs, but there are some sandy beaches, notably east of Kudirimalai Point, and also some dune formations and small patches of mangrove swamp.
Climatic conditions: Tropical monsoonal climate typical of Sri Lanka's low country dry zone. Fairly heavy rains in March and April are followed by an extensive dry period from May until early September. The major rainy season lasts from September until December. The average annual rainfall is 1,000 mm, and the mean annual temperature 27.2 °C.
Principal vegetation: No information is available on the aquatic vegetation. Three categories of terrestrial vegetation can be distinguished: littoral vegetation including salt-tolerant grasses and low scrub adjacent to the beach; monsoon scrub of very low stature; and monsoon forest with tall emergents such as *Manilkara hexandra* and *Chioroxylon sweitenia.* Some 73% of the park is dense forest and the rest is more open habitat.
Land tenure: The whole of the National Park is state owned.
Conservation measures taken: Protected within Wilpattu National Park, first established in February 1938 and subsequently extended in 1967, 1969 and 1973 to its present size of 131,692 ha. The park has been abandoned in recent years because of civil disturbances in the area.
Conservation measures proposed: Sea areas in Dutch Bay and Portugal Bay adjacent to the park have been proposed as Marine Sanctuaries, largely to protect the Dugong *Dugong dugon.*
Land use: Nature conservation. There is a small fishing village at Pookulam in the extreme northwestern corner of the park, established as overflow from Mullikulam, outside the park. In addition, there are seasonal fishing camps along the coast at Kudirimalai, Palugaturai and Kolankanatte.
Disturbances and threats: None known at the wetlands. Well-organized illegal extraction of timber and poaching have been the principal problems in the National Park. The expanding village at Pookulam and increasing usage of the seasonal fishing camps along the coast threaten the integrity of the park.
Economic and social values: There are a number of historic sites in the park, mostly temples and monasteries with dagobas but also including the remnants of breached tanks left over from the agricultural period of the ancient Sinhalese civilizations. The Catholic churches at Palugaturai and Pallakandal attract many thousands of pilgrims each year.
Fauna: The numerous wetlands in the park support a wide variety of resident and migratory waterfowl. There are large breeding populations of Painted Storks *Mycteria leucocephala* and Openbill Storks *Anastomus oscitans,* and smaller numbers of breeding Spot-billed Pelicans *Pelecanus philippensis.* Other resident species include *Tachybaptus ruticollis, Phalacrocorax fuscicollis*, *P. niger, Anhinga melanogaster, Nycticorax nycticorax, Ardeola grayii, Egretta garzetta, E. intermedia, E. alba, Ardea purpurea, A. cinerea, Ciconia episcopus, Leptoptilos*

javanicus, Threskiornis melanocephalus, Platalea leucorodia, Dendrocygna javanica, Porphyrio porphyrio, Hydrophasianus chirurgus, Himantopus himantopus, Esacus recurvirostris, Vanellus indicus, Chlidonias hybrida and *Sterna albifrons.* The ducks *Anas acuta and A. querquedula* and a number of migratory shorebirds are common winter visitors and passage migrants. Periya Uppu Villu regularly harbours large concentrations of *A. acuta and A. querquedula* just prior to the return migration in March and April.

The park supports a rich mammalian fauna including Asian Elephant *Elephas maximus* (resident population of at least 70 animals), Sloth Bear *Melursus ursinus,* Leopard *Panthera pardus* and Water Buffalo *Bubalus bubalis* (about 160 animals).

The Marsh Crocodile *Crocodylus palustris* is fairly common, and the Pond Turtle *Melanochelys trijuga* and Soft-shelled Turtle *Lissemys punctata* are resident in most of the larger permanent villus. Other reptiles include the monitor lizard *Varanus bengalensis,* the rat snake *Ptyas muscosus* and the python *Python molurus.*

Special floral values: No information.

Research and facilities: Basic faunal and floral surveys have been carried out, and the populations of Asian Elephant, Muntjac Deer, langurs and Toque Monkeys have been the subject of special studies. There are several lodges and guesthouses for visitors, and a good network of roads has been constructed, particularly between the main villus.

References: Hoffmann (1982 & 1984); IUCN (in prep); Karpowicz (1985).

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

Source: T.W. Hoffmann and references.

Wetland name: Nachchaduwa Tank

Country: Sri Lanka

Coordinates: 8°15'N, 80°29'E;

Location: 10 km southeast of Anuradhapura, Anuradhapura District, North-Central Province.

Area: 1,784 ha.

Altitude: c.100m.

Biogeographical Province: 4.13.4.

Wetland type: 17.

Description of site: A large irrigation tank with a maximum depth of 7.6m, extensive shallow areas and an abundance of aquatic plants. The catchment area is about 61,000 ha. The water is fresh with a pH of 7.5.

Climatic conditions: Tropical monsoonal climate; in the low country dry zone. The average annual rainfall is about 1,090 mm and the mean annual temperature 27.5°C.

Principal vegetation: The phytoplankton is dominated *by Melosira.* No information is available on the aquatic macrophytes. The tank is in a region of dry mixed evergreen forest.

Land tenure: The tank is state owned; surrounding areas are partly state owned and partly privately owned.

Conservation measures taken: None.

Conservation measures proposed: None

Land use: Fishing and water supply for irrigation and domestic use.

Disturbances and threats: No information.

Economic and social values: Fisheries production and water supply. The annual production of fish is estimated at 204 metric tonnes.

Fauna: Economically important fishes include *Labeo dussumieri* (the most abundant species), *Puntius sarana, P. dorsalis, Ompok bimaculatus, Heteropneustes fossilis, Anabas testudineus* and *Ophiocephalus striatus.* Known to be an important site for a wide variety of waterfowl including pelicans, cormorants and storks, but no details are available.

Special floral values: No information.
References: Mendis (1965).
Criteria for inclusion: 1b, 3b.
Source: Leonard Pinto.

Wetland name: Giant's Tank
Country: Sri Lanka
Coordinates: 8°52'N, 80°02'E;
Location: near Murukkan, 18 km southeast of Mannar, Mannar District, Northern Province.
Area: 1,840 ha.
Altitude: Less than 25m.
Biogeographical Province: 4.13.4.
Wetland type: 17.
Description of site: An ancient water storage reservoir (tank), now heavily silted, on the coastal plain of northwestern Sri Lanka, about five km from the sea. The tank is fed by an ancient canal, recently restored, which carries water from the Malwatu Oya river (Aruvi Aru). The tank has a catchment area of 9,850 ha, a maximum depth of 3.2m, and a pH of 7.5. The water level fluctuates widely according to usage for irrigation and monsoon rainfall.
Climatic conditions: Tropical monsoonal climate with an average annual rainfall of 1,051 mm and a mean annual temperature of 27.8°C.
Principal vegetation: There are few aquatic macrophytes; the phytoplankton includes *Oscillatoria, Microcystis* and *Hyella*. The tank is surrounded by rice paddies and dry scrub forest.
Land tenure: The tank is state owned; surrounding areas are partly state owned and partly private.
Conservation measures taken: Protected in the Giant's Tank Sanctuary (3,944 ha), established in September 1954 under the Fauna and Flora Preservation Ordinances. The sanctuary is maintained by the Department of Wildlife Conservation.
Conservation measures proposed: None
Land use: Fishing and water supply for irrigation and domestic use.
Disturbances and threats: Siltation as a result of forest clearance in surrounding areas, and eutrophication.
Economic and social values: The tank supports an important fishery; production is estimated at about 200 metric tonnes per year.
Fauna: Commercially important fishes include *Labeo dussumieri, Puntius sarana* (abundant), *Puntitius dorsalis, Ompok bimaculatus, Heteropneustes fossilis, Tilapia mossambica* and *Ophicephalus striatus.*
The tank is known to be important for a variety of large water birds, ducks and shorebirds, but few details are available. An estimated 11,000 ducks were present in 1965, including *1,000 Nettapus coromandelianus;* in February 1984, Powell recorded 1,800 *Anas penelope* and *1,100 A. querquedula.* The Comb Duck *Sarkidiornis melanotos* has been reported.
Asian Elephants *Elephas maximus* occur in the vicinity of the tank.
Special floral values: None known.
Research and facilities: Some studies have been carried out at the tank, mainly on the fisheries.
References: Fernando & Indrasena (1969); Hoffmann (1982 & 1985); Karpowicz (1985); Powell (1984b).
Criteria for inclusion: 1b, 3b.
Source: Leonard Pinto.

Wetland name: Vankalai Kalapuwa, Periya Kalapuwa and Mannar Causeway
Country: Sri Lanka
Coordinates: 8°48'-9°03'N, 79°52'-79°57'E;
Location: between Vankalai and Mannar, Mannar District, Northwestern Province.
Area: Vankalai Kalapuwa 200 ha; Periya Kalapuwa 650 ha; Mannar Causeway c.7,500 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 06, 07, 08 & 17.
Description of site: A complex of tidal lagoons, mangrove swamps, salt marshes and extensive intertidal mudflats stretching from Vankalai Kalapuwa in the south to the base of the Mannar Peninsula in the north. Vankalai Kalapuwa (200 ha) and Periya Kalapuwa (650 ha) are shallow tidal lagoons with mudflats and mangrove swamps. Both are brackish to saline, with depths of 1-3m. They are bordered on their seaward side by a sand spit with openings to the sea at both ends. The coastal marshes and mudflats extend northwards from Periya Kalapuwa along both sides of the Mannar Causeway. To the north of the causeway, there is an abandoned water storage reservoir (tank) of 60 ha with shallow brackish water (Kora Kulam).
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Mangrove vegetation and salt marsh communities; rice paddies, sparse grassland and open scrub with scattered palms in adjacent areas.
Land tenure: The lagoons and surrounding areas are state owned.
Conservation measures taken: None.
Conservation measures proposed: There is a long-standing proposal that the triangular area between Vankalai, Mantai and Mannar, including the Mannar Causeway, should be made into a sanctuary or nature reserve, chiefly for water birds.
Land use: Fishing, mainly for prawns; cultivation of rice and some livestock grazing in surrounding areas.
Disturbances and threats: Water birds are subjected to considerable shooting pressure along the Mannar Causeway.
Economic and social values: Vankalai and Periya lagoons support a small prawn fishery.
Fauna: The entire area is known to be of great importance for large waterbirds, ducks, shorebirds, gulls and terns, but few details are available. In mid-January 1984, Periya Kalapuwa held 6,000 *Anas penelope* and about 10,000 *A. querquedula,* while Vankalai Kalapuwa held a roost of about 8,000 shorebirds, mainly *Charadrius leschenaultii (1,800), Calidris minuta* and *C. ferruginea.* The mudflats along the Mannar Causeway are believed to be the first landfall for many of the migratory shorebirds entering Sri Lanka in the autumn. During the monsoon period, Kora Kulam provides a high-tide roost for shorebirds, which feed along the causeway at low tide. Some 1,500 *Anas querquedula, 400 Pluvialis squatarola, 1,300 Limosa limosa, 170 Tringa totanus* and 4,000 *Calidris minuta* were present at the tank in January 1984 (Powell, l984b). B.A. Lane recorded over 500 shorebirds in the area in April 1984, including *300 Calidris minuta* and *100 C. ferruginea.*
The Indian Courser *Cursorius coromandelicus occurs in* the proposed sanctuary area.
Special floral values: No information.
References: Hoffmann (1982 & 1985); Karpowicz (1985); Powell (l984b).
Criteria for inclusion: 1b, 2c, 3a.
Source: J.I. Samarakoon and T.W. Hoffmann.

Wetland name: Adam's Bridge
Country: Sri Lanka

Coordinates: 9°04'-9°09'N, 79°27'-79°40'E;
Location: between Talaimannar and Danushkodi (India), 25-50 km WNW of Mannar, Mannar District, Northern Province.
Area: Unknown.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 01, 03 & 06.
Description of site: A chain of about 20 small islands with associated sand banks and intertidal mudflats, stretching for almost 30 km between Mannar Peninsula in the east and Rameswaran Peninsula (India) in the west.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Sea grasses; species of *Spinifex* and *lpomoea* on the sandy islands.
Land tenure: No information.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing.
Disturbances and threats: No information.
Economic and social values: No information.
Fauna: The extensive intertidal mudflats off the western end of Mannar Island are a wintering area for large numbers of shorebirds, gulls and terns of a wide variety of species, including the Oystercatcher *Haematopus ostralegus* and Crab Plover *Dromas ardeola.*
Special floral values: There are some interesting Baobab trees on Mannar Island and the Mannar Peninsula, which were brought to Sri Lanka by Arab traders over a thousand years ago.
References: Hoffmann (1982); Karpowicz (1985).
Criteria for inclusion: lb, 3b.
Source: T.W. Hoffmann.

Wetland name: Palk Bay, Devil's Point and Vidattaitivu Lagoon
Country: Sri Lanka
Coordinates: 8°59'-9°25'N, 79°59'-80°04'E;
Location: from the east end of the Mannar Causeway, Mannar District, north to Devil's Point, 30 km SSE of Jaffna, Jaffna District, Northern Province.
Area: c.70 km of coastline; Vidattaitivu Lagoon 1,300 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 01, 03, 05, 06, 07 & 08.
Description of site: The extensive intertidal mudflats, sand banks and mangrove swamps on the shores of Palk Bay and Devil's Point, and a shallow brackish coastal lagoon (Vidattaitivu) of about 1,300 ha, adjacent to the southern edge of the bay. There are several small islands off Devil's Point.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
Principal vegetation: Mangroves; scrub jungle in adjacent areas.
Land tenure: State owned.
Conservation measures taken: None.
Conservation measures proposed: None
Land use: Fishing; some shifting cultivation in adjacent areas.
Disturbances and threats: No information.
Economic and social values: No information.

Fauna: Known to be an important area for migratory shorebirds, and probably important for many other species of waterfowl, but little information is available. The largest concentration of Crab Plovers *Dromas ardeola* ever recorded in Sri Lanka was observed at Devil's Point. In April 1984, B.A. Lane recorded over 3,800 shorebirds on a five km stretch of mudflats at the south end of Palk Bay; these included:
30 Pluvialis squatarola
1,560 Charadrius mongolus
650 Tringa totanus
15 Xenus cinereus
1,560 Calidris ferruginea
Lane has suggested that as many as 80,000 shorebirds may utilize the extensive mudflats stretching for about 100 km from Mannar Causeway around Palk Bay to Jaffna.
Special floral values: No information.
Criteria for inclusion: Ib. 3a.
Source: J.I. Samarakoon and T.W. Hoffmann.

Wetland name: Iranaitivu Islands
Country: Sri Lanka
Coordinates: 9°17'N, 79°59'E;
Location:in Palk Bay, eight km off Devil's Point and 40 km south of Jaffna, Jaffna District, Northern Province.
Area: c.550 ha.
Altitude: Sea level.
Biogeographical Province: 4.13.4.
Wetland type: 03.
Description of site: Two small offshore islands with fringing coral reefs. The interior of the main island is flooded during the rainy season.
Climatic conditions: Tropical monsoonal climate; in the low country dry zone.
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: Reported to be important for migratory ducks, shorebirds, gulls and terns, but few details are available. Only 80 ducks were recorded during a survey in January 1984. However, local people reported that normally there were large concentrations of ducks on the main island in mid-winter (10,000 birds or more). It is possible that the islands are used mainly as a roosting area by the ducks. Three Crab Plovers *Dromas ardeola* were present in January 1984.
Special floral values: No information.
References: Hoffmann (1982 & 1985).
Criteria for inclusion: 1b, 3b.
Source: See references.

REFERENCES

Abeywickrema, B.A. (1960). Estuarine vegetation of Ceylon. Proc. Abidjan Symposium on the humid tropics: 207-210. Paris: UNESCO.

Abeywickrema, B.A. (1966). The Estuarine Vegetation of Ceylon. In: Scientific Problems of the Humid Tropical Zone Deltas and their Implications. Proc. Dacca Symposium. Paris: UNESCO.

Alwis, K.A. de & Eriyagama, G.J. (1969). Some Observations on Soil-Vegetation Relationships in the Lowland Dry Zone of Ceylon. The Ceylon Forester 9: 53-76.

Alwis, R. de. (1980). Problems of marine pollution and the conflicts in the coastal zone of Sri Lanka. Economic Review 6: 10-11. Amarasinghe, S.R. (1978). Coast Conservation. Loris 14: 355-357.

Amarasinghe, S.R. (1985). Coastal Zone Management. Economic Review 10: 4-7. Amerasinghe, S.R. & de Alwis, R. (1980). Coastal zone management in Sri Lanka. In: Proc. 2nd Symposium on Coastal and Ocean Management, Florida.

Amarasinghe, S.R. & Perera, W.K.T. (1984). A preliminary survey of peripheral vegetation communities of Puttalam Lagoon and Dutch Bay. Fortieth Annual Session of the Sri Lanka Association for the Advancement of Science. (Abstract).

Anon. (1977). Stop killing our lagoons. Loris 14: 127. Anon. (1980). Environmental impact report for the Accelerated Mahaweli Programme.

Anon. (1983). Sri Lanka coastal zone management plan: evaluation needs and proposed action

plan. Report prepared by James Dobbin Associates Incorporated for Coast Conservation Division of Ministry of Fisheries, Colombo.

Aruchelvam, K. (1968). The mangroves. The Ceylon Forester 8(3 & 4): 59-92.

Arudpragasam, K.D. (1974). Seasonal and diurnal variation in salinity and water movement in

Jaffna Lagoon. Estuarine Coastal Mar. Sci. 2: 251-259.

Arudpragasam, K.D. (1975). The lagoons and coastal waters of Sri Lanka. Proc. Sri Lanka Assn. Adv. Sci. 31: 65-75.

Arudpragasam, K.D. (1984). Ecology of rocky shores and estuaries in Sri Lanka. In: Fernando, C.H. (ed.), Ecology and Biogeography in Sri Lanka: 283-296. The Hague: Dr. W. Junk.

Bird, E. (1982). Coastal landforms of the Asian Humid Tropics. In: Soysa, C.H, Sien, CL. & Collier, W.L. (eds), Man, Land and Sea; Coastal Resource Use and Management in Asia and the Pacific: 3-13. Bangkok: The Agricultural Development Council.

Bruin, G.H.P. de. (1971). Fluctuation in species composition of penaeid prawns in estuaries. Bull. Fish. Res. Sta. Ceylon 22: 47-51.

Cooray, P.G. (1967). An introduction to the geology of Ceylon. Spolia Zeylanica 31: 1-324.

Costa, H.H. (1972). Results of the Austrian Ceylonese Hydrobiological Mission 1970 of the First Zoological Institution of the University of Vienna (Austria) and the Department of Zoology of the Vidyalankara University of Ceylon, Kelaniya. Part V: Deepoda Caridae. Bull. Fish. Res. Sta. Sri Lanka (Ceylon) 23: 127-135.

Costa, H.H. (1974). Limnology and turchery biology of the streams of Horton Plains, 1974, Sri Lanka (Ceylon). Bull. Fish. Res. Sta. Sri Lanka (Ceylon) 25: 15-56.

Costa, H.H. (in press). The Physical, Chemical and Biological Characteristics of the Fresh Water Bodies in the lowlands of Sri Lanka. Spolia Zeylanica.

Costa, H.H. & Abesiry, R.R. (1978). Hydrobiology of Colombo Lake VII: The food of Tilapia mossambica. Spolia Zeylanica 32: 97-114.

Costa, H.H. & Fernando, E.C.M. (1967). The food and feeding relationships of the common meso and macro fauna of the Maha Oya, a small mountainous stream at Peradeniya. Cey. J. Sc. (Bio. Sci.) 7: 74-90.

Costa, H.H. & de Silva, S.S. (1969). Hydrobiology of Colombo Lake I: Diurnal variations in temperature, hydrochemical factors and zoo-plankton. Bull. Fish. Res. Sta. 20: 141-149.

Costa, H.H. & de Silva, S.S. (1978a). Hydrobiology of Colombo Lake II: Seasonal variations in phvsico-chemical factors. Spolia Zeylanica 32: 26-41.

Costa, H.H. & de Silva, S.S. (1978b). Hydrobiology of Colombo Lake 111: Seasonal fluctuations of the plankton. Spolia Zeylanica 32: 42-59.

Costa. H.H. & de Silva, S.S. (1978c). Hydrobiology of Colombo Lake IV: Seasonal fluctuations in aquatic fauna living on water plants. Spolia Zeylanica 32.

Costa, H.H. & de Silva, S.S. (1978d). Hydrobiology of Colombo Lake V: Seasonal study of the marginal fauna. Spolia Zeylanica 32.

Costa, H.H. & de Silva, S.S. (1978e). Hydrobiology of Colombo Lake VI: Seasonal variations in primary productivity. Spolia Zeylanica 32.

Costa, H.H. & Starmuhiner, F. (1972). Results of the Austrian Ceylonese Hydrobiological Mission 1970 of the First Zoological Institution of the University of Vienna (Austria) and the Department of Zoology of the Vidyalankara University of Ceylon, Kelaniya. Part 1: Preliminary Report - Introduction and Description of the Stations. Bull. Fish. Res. Sta. Ceylon 23: 4376.

Drijver, C., Toornstra, F. & Lionel Siriwardena, S.S.A. (undated). Mahaweli Ganga Project Sri Lanka: evaluation of environmental problems and the role of settler-households in conservation. Centre for Environmental Studies, State University of Leiden, The Netherlands.

Durairatnam, M. (1963). Studies on the seasonal cycle of sea surface temperatures, salinities and phytoplankton in Puttalam Lagoon, Dutch Bay and Portugal Bay along the West Coast of Ceylon. Bull. Fish. Res. Sta. Ceylon 16: 9-24.

Elzen, PM.N. van den. (1972). Results of the Austrian Ceylonese Hydrobiological Mission 1970 of the First Zoological Institute of the University of Vienna (Austria) and the Department of Zoology of the Vidyalankara University of Ceylon, Kelaniya, Ceylon. Part IV: List of Reptilia and Amphibia collected in the mountains of southwest Ceylon, with notes on finding localities. Bull. Fish. Res. Sta. Sri Lanka (Ceylon) 23: 113-125.

Fernando, B.S. (1973). Prawn fishery: a new commercial endeavour. Loris 13: 27-30.

Fernando, C.H. (1956). The fish fauna of paddy fields and small irrigation ditches in the western lowlands of Ceylon, and a bibliography of references to fish in paddy fields. Ceylon J. Sci. (Bio. Sci.) 7: 223-227.

Fernando, C.H. (1965a). The development of Ceylon's fisheries XI. The role of the inland waters in relation to the development of Ceylon's fisheries and a note on the pearl oyster fishery. Bull. Fish. Res. Sta. Ceylon 17: 291-297.

Fernando, C.H. (1965b). A preliminary survey of 21 Ceylon lakes. Part III: Parasites, predators, food of fish and marginal fauna. Bull. Fish. Res. Sta. Ceylon 18: 17-28.

Fernando, C.H. (1969). Some freshwater Mollusca from Ceylon with notes on their distribution and biology. Bull. Fish. Res. Sta. Ceylon 20: 135-140.

Fernando, C.H. (1974). Guide to the freshwater fauna of Ceylon (Sri Lanka). Suppl. 4. Bull. Fish. Res. Sta. Sri Lanka (Ceylon) 25: 27-81.

Fernando, C.H. & Ellepola, W.B. (1969). A preliminary study of two village tanks in the Polonnaruwa area with biological notes on these reservoirs in Ceylon. Bull. Fish. Res. Sta. Ceylon 20: 101-134.

Fernando, C.H. & Indrasena, H.A. (1969). The freshwater fisheries in Ceylon. Bull. Fish. Res. Sta. Ceylon 20: 101-134.

Fernando, D.H. (1977). Lamellibranchiate fauna of the estuarine and coastal areas in Sri Lanka. Bull. Fish. Res. Sta. Sri Lanka (Ceylon) 27: 29-54.

Fernando, H.Y.C. (1983). Summary, conclusions and recommendations of the report on coral reefs, lagoons and mangroves. ESCAP Project for the Development of a Coastal Environmental Management Plan for a Pilot Project Area along the West Coast of Sri Lanka.

Flueeler, T. (1983). A mangrove inventory in Eastern Sri Lanka. A case study of Man's Pressure on Natural Resources. ACRS.

Funegaard, P. (1985). Brackishwater aquaculture in Sri Lanka: prospects and problems. Bay of Bengal News 20: 8-10.

Geisler, R. (1967). Limnologische Ichthyologiche Beobachtungen in Sudwest Ceylon. Int. Revue. Ges. Hydrobiol. 52: 559-572.

Gunatilleka, W.D.A. & Costa, H.A. (1978). Hydrobiology of Colombo (Beira) Lake VIII:

Bacterial Ecology. Spolia Zeylanica 32: 115-132.

Gunawardana, J. (1987). Birdlife of the Bellanwila-Attidiya Marshes; a Provisional Report. Ceylon Bird Club. Unpublished report.

Gunawardana, J. (1988). A General Assessment of the Bellanwila-Attidiya Marshes. Ceylon Bird Club. Unpublished report.

Hettiarachchi, A. (1983). Fisheries of Villus in the Mahaweli River System of Sri Lanka. J. Inland Fisheries Vol. II: 50-56.

Hoffmann, T.W. (1982). Provisional Inventory of Wetlands in Sri Lanka. Loris 16: 94-96.

Hoffrnann, T.W. (1984). Sri Lanka Report on Wetlands. Paper presented at the 10th ICBP Asian Continental Section Conference, Kandy, Sri Lanka, April 1984. ICBP.

Hoffmann, T.W. (1985). The 2nd Duck Count in Sri Lanka (Mid-January 1984). Loris 17: 19-24.

Hoffmann, T.W. (1987). The 3rd Mid-winter Waterfowl (Duck) Count in Sri Lanka (January

1986). In: van der Yen, J., Asian Waterfowl 1987: 66-70. Slimbridge: IWRB.

Holsinger, E.C.T. (1955). The distribution and periodicity of the phytoplankton of three Ceylon lakes. Hydrobiologia 7: 25-35.

Indrasena, H.H.A. (1965). A Preliminary Survey of 21 Lakes. Part I: Fisheries of two lakes, Parakrama Samudra and Minneriya Wewa. Bull. Fish. Res. Sta. Ceylon 18: 1-5.

Ingle, R.W. & Fernando, C. H. (1963). On some fresh and brackishwater crustaceans from Ceylon. Crustaceana 6: 101-109.

IUCN. (in prep). Directory of Indomalayan Protected Areas: Sri Lanka. IUCN Conservation Monitoring Centre, Cambridge.

Jansen, M.A.B. (1981). Villus of the floodplains of the Mahaweli Ganga. Loris 15: 337-340.

Jansen, M.A.B. (1985). A Network of National Parks for Sri Lanka. Tigerpaper 12: 4-7. Bangkok.

Jayasekara, A.M. (1986). Inland Fisheries of Sri Lanka. In: Mepham, R.H. (ed.), Proc. FAO/1PFC Workshop on Strategies for the Management of Fisheries and Aquaculture in Mangrove Ecosystems, Bangkok, Thailand, 23-25 June 1986: 236-244. Rome: F.A.O.

Jayasinghe, J.M.P.K. & Arudpragasam, K.D. (1980). A preliminary study of zooplankton of the Moratuwa-Panadura estuary. Proc. Sri Lanka Assn. Adv. Sci. 36: 41.

Jayasuriya, P.M.A. (1984). The finfish and shellfish fishery of Puttalam Lagoon. Proc. Sri Lanka Assoc. Adv. Sci. 40: 50.

Jayawrdhane, C.B.SJ(. (1997). The Wet1nd of Sri Lanka. Report presented at the Third

Conference of the Contracting Parties, Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Regina, Canada, May/June 1987.

Jayewardene, R.P. (1985). The mangroves of Sri Lanka. Bakawan, Newsletter of the Regional Mangrove Information Network for Asia and the Pacific 4: 8-10.

Jayewardene, R.P. (1987). Sri Lanka. In: Mangroves of Asia and the Pacific, Status and Management: 219-230. Technical Report of the UNDP/UNESCO Research and Training Pilot Programme on Mangrove Ecosystems in Asia and the Pacific (RAS/79/002). UNESCO, COMAR and UNDP.

Karpowicz, Z. (1985). Wetlands in East Asia - A Preliminary Review and Inventory. ICBP Study Report No. 6. Cambridge, ICBP.

Katugaha, H.I.E. (1982). Lahugala revisited. Loris 16 (2): 64, 65 & 102.

Kugathasan, K.S. (1969). Mangrove vegetation of the lagoon: hydrobiological survey of the Thondamannaru lagoon. Northern Province Science Teachers' Association Bull. 7.

Liyanage H. (1978). Hydrobiology of Colombo (Beira) Lake IX: Productivity of Tilapia mossambica. Spolia Zeylanica 32: 133-149.

Liyanage H. & Starmuhiner, F. (1972). Results of the Austrian Ceylonese Hydrobiological Mission 1970 of the First Zoological Institute of the University of Vienna (Austria) and the Department of Zoology of the Vidyalankara University of Ceylon, Kelaniya. Part I: Introduction and Description of the stations. Bull. Fish. Res. Sta. Ceylon 23: 43-76.

MacKinnon, J. & MacKinnon, K. (1986). Review of the Protected Areas System in the Indo-Malayan Realm. Cambridge: IUCN.

Macnae, W. & Fosberg, F.R. (1981a). Rhizophoraceae. In: Dassanayake, M.D. & Fosberg, F.R. (eds), A Revised Handbook to the Flora of Ceylon, Vol. II: 487-500. Smithsonian Institute.

Macnae, W. & Fosberg, F.R. (1981b). Sonneratiacea. In: Dassanayake, M.D. & Fosberg, F.R. (eds), A Revised Handbook to the Flora of Ceylon, Vol. II: 450-453. Smithsonian Institute.

Marga Institute. (1978). Resource use and management in the coastal zones of the Asian humid tropics. Sri Lanka Country Study (Draft). Marga Institute Doc: M/58, INT/117.

Marga Institute. (1982). Sri Lanka: Perspectives of the Coastal Zone. In: Soysa C.H, Sien, C.L. & Collier, W.L. (eds), Man, Land and Sea; Coastal Resource Use and Management in Asia and the Pacific: 252-272. Bangkok: The Agricultural Development Council.

Marga Institute. (1985a). Selected lagoon ecosystems in the Hambantota District of Southern Sri Lanka (Draft). Colombo: Marga Institute.

Marga Institute. (1985b). Environmental changes, ecological conditions and sociological aspects of two lagoon ecosystems in southern Sri Lanka. Colombo: Marga Institute.

Mendis, A.S. (1964). A contribution to the limnology of Colombo Lake. Bull. Fish. Res. Sta. Ceylon 17: 213-220.

Mendis, A.S. (1965). A preliminary survey of 21 Ceylon lakes: limnology and fish production potential. Fish. Res. Sta. Ceylon 18: 7-16.

Modenke, H.N. & Modenke, A.L. (1983). Avicenniaceae. In: Dassanayake, M.D. & Fosberg, F.R. (eds), A Revised Handbook to the Flora of Ceylon, Vol. IV: 125-136. Smithsonian Institute.

Norris, C.E. (1957). The doomed lagoons. Loris 7: 365. Pearson, J. (1912). Biological survey of Trincomalee Harbour. Spolia Zeylanica 8: 30-40.

Pearson, J. (1923). Hydrographical investigations at Lake Thambalagam. Ceylon J. Sci. Sec. C., Bull. No. 1: 1-12.

Pemadasa, M.A., Balasubramaniam, S., Wijesenad, H.G. & Amarasinghe, L. (1979). The ecology of a salt marsh in Sri Lanka. J. Ecology 67: 41-73.

Perera, W.K.T. & Sachithananthan, K. (1977). Topography of Nanthi Kadal and Nayaru Lagoons. Bull. Fish. Res. Sta. Sri Lanka 27: 9-15.

Perera, W.K.T. & Siriwardena, P.P.G.S.N. (1982). Topography of Puttalam Lagoon. J. Inland Fisheries 1: 97-104.

Pillai, T.G. (1960). Some marine and brackishwater serpulid polychaeta from Ceylon, including new genera and species. Ceylon J. Sci. (Bio. Sci.) 3: 1-2.

Pillai, T.G. (1967). Brackishwater Fishery Resources. Bull. Fish. Res. Sta. Ceylon 18: 75-85.

Pinto, L. (1980). Some ecological aspects of population of mangrove crabs occurring within the islets of Negombo Lagoon, Sri Lanka. Proc. First Asian Symposium on Mangrove Environment, Research and Management. University of Malaya and UNESCO.
Pinto, L. (1982). Distribution of zonation of mangroves in the Northern part of the Negombo Lagoon (Sri Lanka). J. Natn. Sci. Coun. Sri Lanka 10: 245-255.

Pinto, L. & Wignaraja, S. (1980). Some ecological aspects of the edible oyster *Crassostrea*

cucullata (Born) occurring in association with mangroves in Negombo Lagoon, Sri Lanka. Hydrobiologia 69: 11-19.

Powell, A. (1984a). A survey of migratory waterfowl in Sri Lanka. Loris 6: 260-263.

Powell, A. (1984b). A survey of the more important coastal wetlands of Sri Lanka used by migratory waterfowl. Unpublished report.

Ramanathan, S. (1969). A preliminary report on *Chanos* fry surveys carried out in the brackishwater areas of Mannar, Puttalam and Negombo. Bull. Fish. Res. Sta. Ceylon 20: 79-85.

Raphael, Y.I. (1977). Brackishwater aquaculture in Sri Lanka. Proc. Indo-Pacific Fish. Coun. 17th Session, Colombo, Sri Lanka. Sect.3: 127-130.

Radda, A.C. (1973). Results of the Austrian Ceylonese Hydrobiological Mission 1970 of the First Zoological Institute of the University of Vienna (Austria) and the Department of Zoology of the Vidyalankara University of Ceylon, Kelaniya. Collection of fishes. Bull. Fish. Res. Sta. Ceylon 24: 135-151.

Ranasinghe, I. (1985). An evaluation of the implementation of the Coast Conservation Act, No. 57 of 1981. Economic Review 10: 19-20.

Sachithananthan, K. (1969). Salinity and temperature of the surface waters in the Jaffna Lagoon. Bull. Fish. Res. Sta. Ceylon 20: 87-89.

Sachithananthan, K. & Perera, W.K.T. (1970). Topography and substratum of the Jaffna Lagoon. Bull. Fish. Res. Sta. Ceylon 21: 75-85.

Sadacharan, D. (1985). Sector paper on coastal marine resource systems. Sri Lanka National Conservation Strategy (Draft).

Saim, R. (1975). Coastal resources in Sri Lanka, India and Pakistan. Description, Use and Management. WWF, UNESCO & UNEP.

Samarakoon, J.I. (1981). Parental behaviour and ecology of the Asian cichlids *Etroplus*

suratensis and Etroplus maculatus in an estuary in Sri Lanka. Ph.D. thesis, Illinois State University.

Samarakoon, J.I. (1983). Breeding patterns of the indigenous cichlids *Etroplus suratensis*

and Etroplus maculatus in an estuary in Sri Lanka. Mahasagar. Bull. Nat. Inst. Oceanogr. 16: 357-362.

Samarakoon, J.I. (1986). Fisheries and Aquaculture in Estuaries, Lagoons and Mangroves in the context of Coastal Zone Management in Sri Lanka. In: Mepham, R.H. (ed.), Proc. FAO/IPFC Workshop on Strategies for the Management of Fisheries and Aquaculture in Mangrove Ecosystems, Bangkok, Thailand, *23-25* June 1986: 10-20. Rome: F.A.O.

Samarakoon, J.I. & Raphael, Y.I. (1972). On the availability of seed of culturable shrimps in the Negombo Lagoon. In: Pillai, T.V.R. (ed.), Coastal Aquaculture in the Indo-Pacific Region: *251-259.* Surrey: Fishing News Books.

Schiemer, F. (ed.). (1983). Limnology of Parakrama Samudra, Sri Lanka. The Hague: Dr. W. Junk Publishers.

Selvarajah R. & Costa, H.H. (1978). The Ecology and distribution of Conchostraca

(Crustacea) in Jaffna Peninsula. Bull. Fish. Res. Sta. Ceylon 28.

Senanayake, F.R. (1981). The athu kotu (brush pile) fishery of Sri Lanka. ICLARM

Newsletter. 4: 20-21.

Seneviratne, E.W. (1978). The Sri Lanka Mangroves. Proceedings of UNESCO Seminar on human uses of the mangrove environment and management implications, Dacca.

Seneviratne, E.W. (1979). Report on the regional seminar on human uses of the mangrove

environment and management implications. The Sri Lanka Forester *14: 43-48.*

Silva, K.H.G. de. (1982). Aspects of the ecology and conservation of Sri Lanka's endemic

freshwater shrimp *Caridina singhalensis.* Biol. Conserv. *24: 219-231.*

Silva, R. de. & Rhaman, D.S. (1987). An ecological study of the Karagan Lewaya. Loris 17(6): 240-246.

Silva, S.S. de. (1984). Coastal lagoons. In: Fernando, C.H. (ed.), Ecology and Biogeography in Sri Lanka: *297-320.* The Hague: Dr. W. Junk.

Sivakumar, J. (1979). Evolution of the coastal sand dune and mangrove resources in the North

Eastern belt of Sri Lanka. Marga Institute Doc. *M/65 SYMP. KL.*

Soysa, C.H., Sivakumar, J. & Wanigasekera, E. (1982). Sri Lanka: Perspective of the coastal zone. In: Soysa, C.M., Sien, C.L. & Collier, W.L. (eds), Man, Land and Sea: Coastal Resource Use and Management in Asia and the Pacific. Bangkok: The Agricultural Development Council.

Starmuhiner, F. (1974). Results of the Austrian Ceylonese Hydrobiological Mission 1970 of the First Zoological Institute of the University of Vienna (Austria) and the Department of Zoology of the Vidyalankara University of Ceylon, Kelaniya. Part XVII: The freshwater gastropods of Ceylon. Bull. Fish. Res. Sta. Sri Lanka (Ceylon) 25: 97-181.

Stoutjesdijk, J.A. (1982). Polders of the World: Compendium of Polder Projects. Delft: Group Polder Development, Department of Civil Engineering, Delft University of Technology.

Tippets, Abbett, McCarthy & Stration. (1980). Environmental Assessment of Accelerated Mahaweli Development Programme, Ministry of Mahaweli Development, Colombo, Sri Lanka.

Yen, J. van der. (1987). Asian Waterfowl 1987: Midwinter Bird Observations in some Asian Countries. Slimbridge: IWRB.

Ward, J.A. & Wyman, R.L. (1975). The cichlids of the resplendent isle. Oceans 8: 42-47. Weerakoon, A.C.J. (1957). Some animals of the paddy field. Loris 8: 220-227.

Weninger, C. (1972). Results of the Austrian Ceylonese Hydrobiological Mission 1970 of the First Zoological Institute of the University of Vienna (Austria) and the Department of Zoology of the Vidyalankara University of Ceylon, Kelaniya. Part II: Hydrochemical studies on mountain rivers in Ceylon. Bull. fish. Res. Sta. Ceylon 23: 77-100.

Wickremaratne, H.J.M. (1985). Environmental problems of the coastal zone in Sri Lanka. Economic Review 10: 8-16.

Wijeratne, M.J.S. (1984). The Biology and Fishery of Grey Mullets (Mugilidae, Pisces) in Negombo Lagoon, Sri Lanka. Ph.D. thesis, University of Kelaniya, Sri Lanka.