ASSESSMENT OF CONSERVATION STATUS AND MANAGEMENT RECOMMENDATIONS FOR KALAMETIYA SANCTUARY

BY

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DECLARATION

The work described in this thesis was carried out by me at the University of Sri Jayawardhanapura under the supervision of Prof. Hemanthi Ranasinghe and Mr. K.P.L Nishantha. A report on this has not been submitted to any other university or another degree.

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Affectionately Dedicated

To

My ever loving Mother

And teachers

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ABSTRACT

Kalametiya Sanctuary is situated on the southeastern coast between Tangalle and Yala National Park. The area covered by Sanctuary including Kalametiya and Lunama lagoons is about 712 ha. However, it has been largely destructed and the fishery resources of the lagoons are also reported to be depleted. The objectives of the study were to assess the floristic and faunistic diversity of some of the most prominent ecosystems within the Sanctuary and to assess the socio-economic status of the villagers in the neighborhood. A management plan has also been prepared with a view to make conservation more efficient.

Selective sampling was carried out in the 3 distinct ecosystems within the Sanctuary ie. Mangroves, Arid Zone forest and the Coastal ecosystem. Nine 10 x 10 m plots were established in each ecosystem type. In these the number of species, number of individuals in each species were assessed. DBH (Diameter at breast Height) was measured in all the trees over 10 cm DBH. The saplings and bushes were recorded in plots of 5 x 5m within the large one. Small plots 1 x 1 m were used to count the number of ground flora (below 1m height). Fauna in the Sanctuary were also observed. A questionnaire survey was conducted in five Grama Niladhari (GN) Divisions, which are inside or at close proximity to the Sanctuary. Ten families were selected randomly from each GN Division. Ecosystems were compared using floristic composition and ecological indices. From the socio-economic survey the type and magnitude of pressures to the Sanctuary from the neighboring communities were assessed.

In total, 72 plant species belonging to 34 families and 3301 individuals were counted in all the plots established in the Sanctuary in the arid zone forest, mangrove forest and coastal ecosystem. The highest diversity of 1.13 was shown by arid zone forest. The highest dominance was shown by Coastal vegetation. In the faunistic survey, 76 bird species were recorded. Questionnaire survey showed that low income, low education level and temporary occupations of the villagers. Prevent poaching, encroachments and shell mining and increasing of the income and awareness of neighboring community can be recommended as probable measures to conserve the sanctuary successfully.

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ABBRIVIATIONS

FSMP	Forestry Sector Master Plan
IUCN	International Union of Conservation Nature and Natural Resources
DWLC	Department of Wildlife Conservation
CEA	Central Environment Authority
MAB	Man and the Biosphere
FD	Department of Forest
Sp	Species
FPIU	Field Project Implementation Unit

CHAPTER 1

INTRODUCTION

1.1 Introduction

In-situ conservation of species within its natural ecosystem is the best method for genetic conservation (Tilakarathne, 1996). In-situ conservation refers to protection zones and areas of high biodiversity. These areas, described as natural ecosystems, will protect species with minimum interference. The buffer zone or semi natural ecosystems can allow for some human disturbance as long as the impact of humanity is not greater than any other factor (Agrawal, 1996). This provides the opportunity for conservation of area and genetic materials for future without difficulty.

For the conservation purpose, many categories of protected areas have been established in the world. However, their conservation status has not been assessed systematically. Information about the floristic composition, faunistic composition and other information about these areas are not available in the relevant administrative institutes.

Before selecting an area for the purpose of conservation, its worth for conservation should be assessed carefully. Ecosystems, population, species or communities included in an area and their importance indicate this conservation status. Importance may be due to the rarity, endemism or endangered condition. Uniqueness, specificity and cultural value of an area are also very important factors in conservation.

In-situ conservation is the ideal method for conserving species and gene pools. Yet it is difficult to practice, as large extents of forests have to be protected. Further, in some instances, the areas in which a major part of the tree population occurs are not within state jurisdiction, and therefore difficult to protect (Tilakarathne, 1996). Therefore, there is a need to monitor both biodiversity and its local uses in all natural forest in order to plan how best to manage them in the interest of both conservation and local economy (FSMP, 1995). After assessing the distribution and status of biodiversity in a protected area it is necessary to establish the rules and regulations according to the conservation status.

1.2 Previous studies

This type of evaluation has been addressed to some extent under the forestry sector development project by an extensive survey of traditional use of forests covering 130 villages in 24 DS (Divisional Secretary) Divisions (IUCN, 1993; FSMP, 1995). However, this has not been carried out for the Kalametiya Sanctuary.

The Central Environment Authority has recognized the Kalametiya Sanctuary as a wetland and then Ministry of Transport, Environment and Women's affairs had published wetland report. This report had studied only the wetland characteristics of Kalametiya and Lunama lagoons. Quantitative assessment of flora in the area has not been done.

1.3 Scope of the study

The protected status of Kalametiya Sanctuary existed so far mainly "on paper". The Department of Wildlife Conservation (DWLC) has shown very limited capacities to deal with the site-specific habitat and water management issues. The coordination between line agencies is almost entirely absent (CEA, 1995). In accordance with the available data of Kalametiya Sanctuary, it is at the lowest state of conservation mainly because it is partly state owned and partly private owned. Adverse impacts on the sanctuary have been recorded mainly due to human interferences. Therefore, assessments of conservation status and management recommendations are necessary for this sanctuary.

1.4 Objectives

To assess the floristic diversity, faunistic diversity and socio-economic status of the Kalametiya sanctuary and preparation of management plan to increase the conservation status.

CHAPTER 2

LITERATURE REVIEW

2.1 Global Distribution of Protected Areas

Most of the nations accept the protection of their natural heritage, living resources and conservation of biological diversity. One hundred and twenty four countries have now proclaimed one or more national parks or similar reserves. But the level of protection and management objectives may vary even between areas in same country (Jhon and Mackinnon, 1986). Today about 4.9% of the total land surface of Earth covering has been demarcated as protected areas (Asthana and Asthana, 1998).

There are some national and international organizations to protect the environment. United Nation's Environment Programme (UNEP) is an inter-governmental organization, which seeks to develop common environmental strategies, and the World Bank created the Global Environment Facility (GEF) to support developing countries to take appropriate actions towards the environmental issues (Thirumurthy and Fanthome, 1996).

Many countries have become party to international agreements relating to the conservation of biodiversity. The MAB programme, Ramsar convention, Bonn convention on migratory species and World Heritage convention are concerned especially with protecting internationally important properties for conservation (Jhon and Mackinnon, 1986).

2.2 Protected Areas in Sri Lanka

The establishment and management of protected area is one of most important ways of ensuring that the natural resources are conserved (Jhon and Mackinnon, 1986). In modern times, the protected areas have grown progressively since the enactment of Fauna and Flora Conservation Ordinance of Sri Lanka. The beginnings of this network area marked by the fact that game sanctuaries established from 1900 onwards were subsequently abolished under the new Ordinance and declared as National Reserves and sanctuaries (Wijesinghe, 2000).

With the time, adverse impacts on the forest and wild animals were increased. The protected areas co-exist today with a number of human induced pressures. Many socio-economic, cultural and political changes have taken place over few decades, including an increased demand of natural resources due to population growth, the implementation of large scale projects, change in cultural and social values and opening up of new land areas for human habitats (Review of environmental legislation, 1993). As a result of that, the protected area network has been expanded. Now there are many categories of protected areas in Sri Lanka. The 2.1 table shows the extent of designated areas administered by the FD and DWLC.

Table 2.1: Extent of designated areas administered by the FD and DWLC.

National designation		No	Area, ha/ proportion of total land area, % in 1994
FD	Forest Reserve	177	466,335 (7.1%)
	Proposed Reserve	217	589,338 (8.9%)
	National Heritage Wilderness Area	1	11,187 (0.2%)
	Total	395	1,066,910 (16.1%)
DWLC	Jungle Corridor	1	10,360 (0.2%)
	National Park	12	462,442 (7.0%)
	Nature Reserve	3	33,372 (0.5%)
	Sanctuary	52	284,117 (4.3%)
	Strict Natural Reserve	3	31,574 (0.5%)
	Total	71	821,871 (12.4%)

Source: (FSMP, 1995)

Many of the protected areas are small and isolated, reflecting fragmented nature of much of the remaining natural habitat (FSMP, 1995). At present, there are 52 sanctuaries in Sri Lanka and Kalametiya Sanctuary is one of them. Of all Protected areas around ten percent is in Dry Zone, balance in Wet Zone and Intermediate Zone (Wijesinghe, 2000).

2.3 Bioclimatic Zones in Sri Lanka

Sri Lanka's equatorial position gives its lowlands a tropical climate, with year round temperatures of 27-28 ^{0}c a relatively constant day length. Rainfall is largely governed by monsoonal winds, which occur two seasons of the year from mid May to September and December to February (Ashton et al., 1997). The climatic condition and soil conditions are favorable to the different climatic condition found in different regions of the island. There are differences in the type of forest that develops and in the plant and animal communities found therein. The main climatic regions found in Sri Lanka are wet zone, intermediate zone dry zone and arid zone (Figure 1).

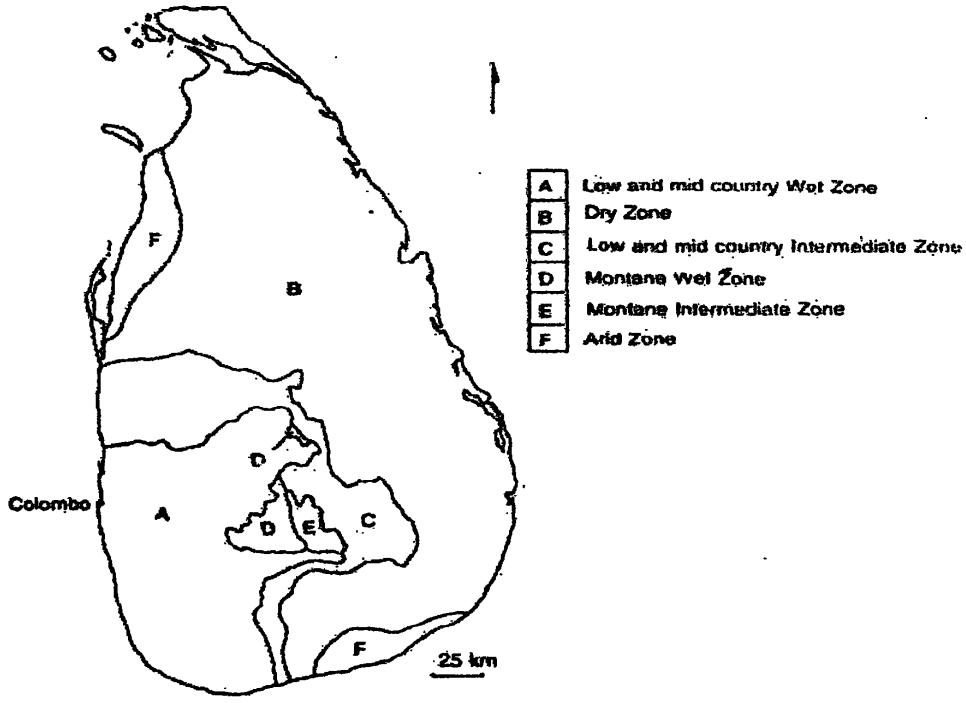

Figure 1: Bioclimatic zones of Sri Lanka
Source: (Arupragasm, 1995)

2.4 Ecosystems

The ecosystem is an important hierarchic level of biological systems (Barthlot and Winiger, 2001). Ecosystems comprise the biotic community in conjunction with the associated complex of physical factor that characterized the physical environment (Mackenzie et al., 1999). Sri Lanka's rich biodiversity, encompassing a wide range of ecosystems, is mainly due to the geographic location of the island, its climate, topography and spatial distribution and diversity of its soils (Ministry of Forestry and Environment, 2000).

In broadest sense, there are two major types of ecosystems: Aquatic and Terrestrial. Subdivisions of aquatic type are fresh water, estuaries and marine aquatic ecosystem (Kormondy, 1999). Sri Lanka has multitude of coastal and marine ecosystems. From the coast a number of water bodies extended inland forming estuaries and lagoons along the coast of Sri Lanka. There are about 46 lagoons and estuaries covering 121,460 ha land area (Paulraj et al., 1989).

The terrestrial ecosystems include the different type of forests, grassland, desert and montane environments (Arupragasm, 1995). Different types of forests found in Sri Lanka can be summarized as 2.2 table. Most extensive type of forest in the island is dry mixed evergreen forest found in the dry zone. In the intermediate zone the vegetation changes to semi ever green forest or Intermediate zone forests.

In the wet zone vegetation has been largely categorized by elevation with wet evergreen or rain forest. In the hills montane forest are found. The non-forest vegetation types are mostly grasslands found in small pockets in all climatic zones of the country (Ashton et al., 1997).

Table 2.2: Different vegetation types of Sri Lanka according to the climatic zones

Vegetation type	Climatic zone
Tropical wet evergreen forest / Tropical rain forest	Wet Zone
Tropical montane forest	Wet Zone
Intermediate Zone forest	Intermediate Zone
Dry mixed evergreen forest	Dry Zone
Tropical thorn forest	Arid Zone

Source: (Hettige, 1990)

Arid zone forest, mangrove forest and coastal ecosystems are some of the most prominent ecosystems in Kalametiya sanctuary and each ecosystem type has been described below.

2.4.1 Arid Zone Forest ecosystem

A natural forest is a naturally occurring ecosystem dominated by trees. These ecosystem have evolved long period of time and eventually attained a climax state, where the different components are in a state of dynamic equilibrium with each other (Arupragasm, 1995).

In the Arid Zones of the Northwest and Southeast extremities of the country thorn scrub predominates. This comprises small trees and thorny shrubs (Ashton et al, 1997). These areas have very long dry seasons. There are semi-evergreen thorn forest of lower stature and with an under growth of thorny shrubs. Some tree species of Dry Zone are also found in this region, but they grow much lower heights than in Dry Zone. The common species are *Carissa spinarum* (Heen karaba), *Zizyphus sp.*, *Acacia sp.* and *Dichrostachys cinera* (Andara) (Hettige, 1990).

2.4.1.1 Adaptations of arid zone forest ecosystem

The plants of this ecosystem have many adaptations. These features are induced by drought and dry conditions. The plants have well-developed root systems, which may be profusely branched. These enable the roots to absorb sufficient quantity of water. Stems of some plants become very hard, woody and cover with thick coating of wax. In some plants stem have been modified into thorns and fleshy for the protection of water. Sometimes, main stem itself becomes bulbous and fleshy to store water within the plants (Shukla and Chandel, 2000).

Plant leaves are reduced, fleshy, cuticles or wax layer can be seen on the leaves to protect the water from transpiration. Sometimes the stem and leaves may be cover with dense hairs for the reduction of transpiration and rolling leaves at the dry conditions are the effective modification for reducing the water loss. Shining leaves reflect the rays of light and do not allow them to go to deep in to the plant tissues (Shukla and Chandel, 2000).

2.4.2 Mangrove ecosystem

The mangrove ecosystem is defined as the intertidal and supratidal zone muddy shores in bays, lagoons and estuaries dominated by highly adapted woody halophytes, associated with continuous water courses, together with their populations of plants and animals. The mangrove ecosystem is composed of two main parts, the terrestrial component and aquatic component (Pinto, 1986). Mangroves possess a rich flora and fauna unique in their own way and highly productive systems (Asthana and Asthana, 1998).

2.4.2.1 Adaptations of mangrove forest ecosystem

The mangrove plant species are well adapted to that environment, where normal plant cannot survive, and provide habitats for a large number of fauna and flora (Kapurusinghe, 2000). There are shallow normal roots and many stilt roots or prop roots for efficient anchorage in muddy sandy soil. Some plants have large number of adventitious root buttresses from basal part of the tree for providing sufficient support to the plants. Negative geotropic roots called pneumatophores can be seen in some plants to get sufficient aeration (Shukla and Chandel, 2000). As well as leaves are thick, entire, succulent, generally small sized and glassy appearance for avoiding dry condition. Viviparous mode of seed germination or germination

of seeds, while the fruits still attached to mother plant to assure the growth of seedlings (Pinto, 1986).

2.4.3 Coastal ecosystem

The plants of the coastline are not subject to the tidal effect. There are sand dunes, which accumulated by wind blown activity. The productivity of sand dunes is very low, since its moisture content is low (Pinto and Kotagama, 1990). The coastal dune ridge accounts for a number of xenophytic plant communities reflecting limited moisture conditions as a result of well-drained sandy soil. The plants are very short and have been grown along the sandy beach (CEA, 1995).

2.5 The Kalametiya Sanctuary

Kalametiya Sanctuary is situated on the southeastern coast between Tangalle and Yala National Park. The sanctuary is important for wild life. Particularly for birds. The sanctuary comprises two lagoons namely; Kalametiya and Lunama. The sanctuary lies away from the built-up areas. So it is so calm place. The Kalametiya sanctuary is a "Managed Nature Reserve, which managed mainly for the sustainable use of ecosystems (Green, 1990). It can be defined as an area containing predominantly unmodified natural systems, managed to ensure long-term protection and maintenance of biological diversity, while providing at the sometime a sustainable flow of natural products and services to meet community needs (FSMP, 1995). The area was declared as a sanctuary in 1938 (2500 ha) and this status abolished in 1946 due to local opposition. Renotification occurred in 1984 (712ha).

The common arid zone forest plant species found in Kalametiya Sanctuary are *Carissa spinarum* (Heen karaba), *Zizyphus sp.*, *Acacia sp.*, *Dichrostachys cinera* (Andara) and *Cassia auriculata* (Ranawara). Scrublands and secondary jungle vegetation mainly found on sloping terrain of east of Lunama lagoon (CEA, 1995).

The mangroves of Kalametiya Sanctuary are good in condition with full range of success ional stage. Mainly *Sonnaratiya caseolaris, Exocoecaria agallocha* and *Luminetzera racemosa* can be seen in this area (CEA, 1995). Coastline of the Kalametiya area has been badly degraded.

racemosa can be seen in this area (CEA, 1995). Coastline of the Kalametiya area has been badly degraded.

.6 Fauna in Kalametiya sanctuary

ome of the faunal surveys have been conducted so far. The complex has been important in upporting shrimp production, but the hydrological changes (desalinization) have reduced its otential in this considerably. Several animal species have disappeared and large mammals elephants) were wiped out. Nevertheless, the lagoon complex still supports many species. he fauna present in the sanctuary are summarized in 2.3 table.

able 2.3: Fauna in Kalametiya sanctuary

	Number of species	Endemism
ish	41	1
eptiles	38	10
irds	151	1
lammals	20	2

ource: (CEA, 1995)

lany of these faunal species are nationally and some are globally threatened. The latter nclude python, five marine turtle species, estuarine crocodile, slender loris, otter, jungle cat, shing cat and mouse deer (CEA, 1995). The sanctuary is a place, which has birds verywhere, in woods, lagoons and along the seashore. Specially, the area is important for the nigratory birds. The Glossy Ibis is recorded annually from Bellanwila-Attidiya bird anctuary as well as from Kalametiya Sanctuary (Henkanaththegethera and Herath, 2000).)ther than that, pelicans, herons, egrets and open-billed stork can be seen.

oth Western and Eastern ends of Kalametiya towards the Rekawa are famous for turtle ndings. The long, broad isolated sandy beaches provide an ideal environment for turtle esting. Five out of six turtle species come to the shore to lay eggs every year. The dominant

2.7 Ecological values of Kalametiya Sanctuary

The Kalametiya sanctuary comprises arid zone open thorn forest. It provides habitats for many mammals, birds, reptiles and other micro and macro organisms and the sanctuary supports breeding colonies of pelicans, herons, egrets and open-billed stork and other large population of wintering birds (CEA, 1995). The soil of forest generally acts as a sponge taking up rainwater when available in quantity and releasing it gradually in to the soil (Wijesinghe 1990).

Mangrove and other coastal wetlands form an important buffering zone between land and sea. They act as sponges, holding water decrease flooding in the surrounding ecosystem and mangroves supply nursery ground for much valued prawns (Hanks, 1998). Lagoons serve as feeding ground and productive habitats for juvenile of fish and they maintain the biological, hydrological processes, energy flow and nutrient cycling.

The plants act as the primary producers of food chains. More or less thick layer of leaf litter, which is absent in open area helps to maintain detritus food chains and it protects the soil (Wijesinghe, 1990). Wetland vegetation can act as shields against strong winds or salt laden winds and protect coastline and adjacent cropland and infrastructure against destruction and erosion by wave energy (Lavieren and Benthem, 1994).

2.8 Socio- economic values of Kalametiya Sanctuary

Natural forests contain a wealth of products, which traditionally have been used by people living in the vicinity (FSMP, 1995). There is evidence that the mangrove communities have affected the economy of tropical countries for a long time similar to the tropical rain forest.

Mangrove communities are important in production of honey and salt, providing firewood, food and beverages (De Silva and Balasubramanium, 1984: Kapurusinghe, 2000). The lagoons produce large stock of fish that provide nutrients. Mainly, good protein source and income source for the people. Excavation of mollusk's shells from the sanctuary area has been main income source of some villagers (Green, 1990). Fodder for the cattle and buffaloes are taken from mangrove forest and using the pore roots of *Sonaratia* trees can produce bottle stoppers and floats (Pinto, 1996).

Wetland characteristics provide opportunities for the scientific and educational studies about natural ecosystems. This is the place where, provide the opportunities for the recreational enjoyment and spiritual renewal of visitors (Lavieren and Benthem, 1994).

2.9 Threats to the Kalametiya Sanctuary

The open water in both lagoons has decreased by more than 50%durind past few decades. Mainly, due to the siltation. Other treats include disturbance from fishing activities, excavation of mollusk shells for use in limekilns, reclamation of land for rice cultivation and pollution by pesticides originating from the agricultural Walawe development scheme. Excessive hunting was also reported to be a problem to the Kalametiya sanctuary (Green, 1990).

CHAPTER 3

MATERIALS AND METHODOLOGY

3.1 Study area

The Sanctuary is situated on the southeastern coast of Sri Lanka, roughly mid-away between the towns of Tangalle (approximately 20 km) to west Hambantota (20 km to the east) (CEA, 1995). The Sanctuary including Kalametiya and Lunama lagoons are located at bottom of the Kachigal Ara catchments west of the Walawe Ganga mouth. Administratively the site lies in the Hambantota District of Southern Province and Ambalantota Divisional Secretary's Division. In total five Gramasevaka Divisions come within in this boundary. Namely; Hungama, Bata-ata South, Hatagala, Lunama North and Luanama South. Kalametiya and Lunama lagoons and the Sanctuary lay roughly in-between the latitude's 6^0 $05^/$ - 6^0 $06^/$ N and longitudes 80^0 $56^/$–80^0 $59^/$ E (Green, 1990). Figure 2 shows that the view of Kalametiya lagoon.

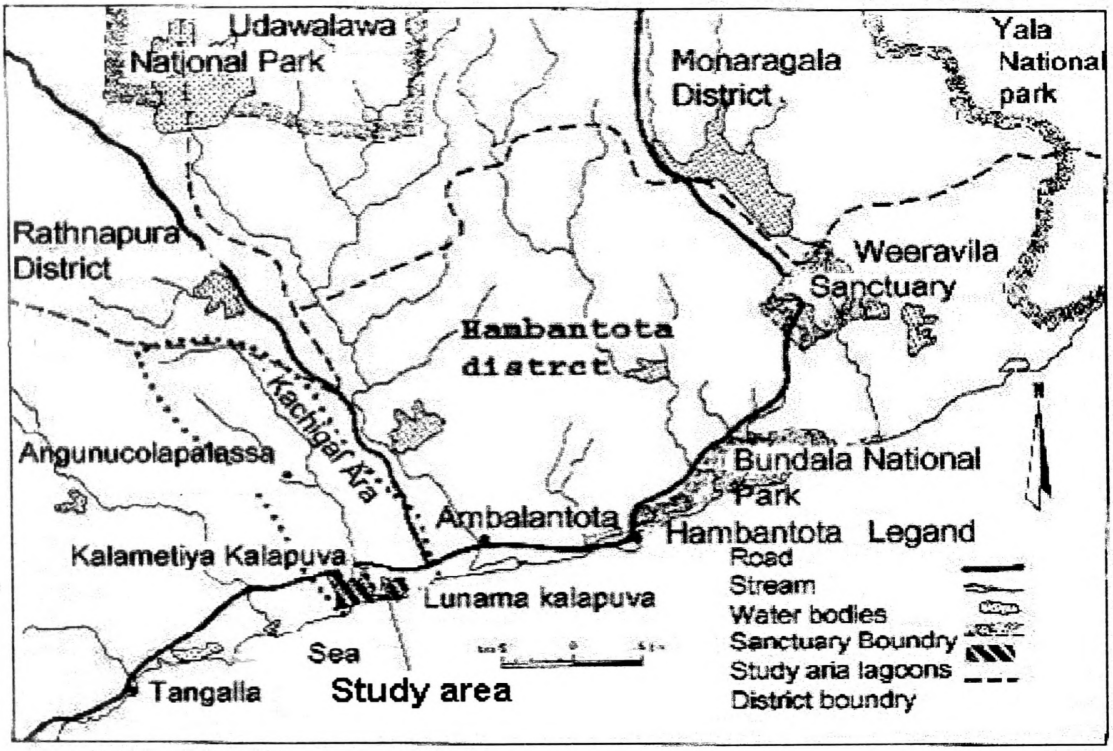

Figure 3.1 Study area

Source:(CEA,1995)

3.1.1 Landscape and Physical features

The Sanctuary area comprises of two inter connected, brackish water lagoons. These have been connected through 2 km long man- made channel. Within the Sanctuary, marshlands, mangroves, open thorny vegetation, chena and abandoned paddy fields can be seen. Along the coast there is narrow ridge of sand dunes separating the lagoons from the sea. The Kalametiya lagoon measures 606 ha in extent (CEA, 1995). Man-made landmark of the sanctuary area are the Tangalle – Hambantota motorway and the minor roads network. Settlements are concentrated along these roads and around the sea outlet of the Kalametiya lagoon.

Figure3. 2: A view of Kalametiya lagoon.

3.1.2 Geology and Geomorphology

Underlain by Precambrian formations, the area is predominated by sedimentary rocks and quartz. The main mineral resource is shell deposits that extended in a 1.5 km to 3 km wide sub – surface plain formed by marine influences (CEA, 1995). The shell deposits of

economic importance exist about 500km from Gurupokuna to Bundala. The area 0.6m to 3m thick and are found up to 5m bellow the surface (FPIU, 2003).

3.1.3 Soils

The area mainly comprises of "Reddish - brown earths" and "Low humic gley soils" that are well drained and have high gravel content.

3.1.4 Hydrology and Water quality

The lagoons used to be fed by a combined influx of main water runoff from the Kachigal Ara catchments, drainage from up stream small-scale (paddy) land seepage from the sea and Udawalawe scheme's fresh water that supply to the paddy fields. This water has caused the lagoon water to reduce its salinity (CEA, 1995).

3.1.5 Climate

The Sanctuary is situated in the country's Dry Zone, and the area receives on average 1000 – 2000 mm annual rainfall. This largely falls in October-December and in April-June during the Southeast monsoon (Jayatissa, 1996). Mean air temperature is about 27 ^{0}c and relative humidity is in average of 75 – 80 % for most of the year (CEA, 1995).

3.2 Floristic survey

3.2.1 Distribution of plots

The Sanctuary was divided mainly into three parts; arid zone ecosystem, mangrove ecosystem and coastal ecosystem. The sites were selected purposively to make sure that all the ecosystem types present are included. The area was plotted randomly and nine plots were established in each ecosystem.

3.2.2 Data collection from the sample plots

i) Sample plots 10m×10m were used to count the number and to measure the Diameter at Breast Height (DBH) of all trees, which were over 10 cm DBH.

ii) Saplings, bushes and small sized trees below 10 cm DBH and over 1 m were recorded in all 5m×5m plots.

iii) Small plots 1m×1m were used to count the number of all ground flora below 1m in height.

3.2.3 Stand variables

The information obtained from a vegetation analysis expressed in various ways. Following variables were used to find the composition of the trees in the Sanctuary.

i) Frequency: The chance or probability of an individual of given species to be present in a randomly placed plot. It is concerned with the homogeneity of occurrence of individuals of a species within an area (Agrarwal, 1992).

$$\text{Frequency} = \frac{\text{Number of plots in which a species occurs}}{\text{Total number of plot sampled}} \times 100$$

ii) Relative frequency: The ratio between total frequency of one species and sum of frequency of all species.

$$\text{Relative frequency} = \frac{\text{Frequency of one species}}{\text{Sum of frequency of all species}} \times 100$$

iii) Density: is an expression of the numerical strengths of a species.

$$\text{Density} = \frac{\text{Total number of individuals of a species in all plots}}{\text{Total number of plot sampled}} \times 100$$

iv) Relative Density (RD): The numerical strength of a species (organism) in a community represents their number per unit area (Dash, 1999).

Relative Density: $\frac{\text{Number of individuals of a species}}{\text{Number of individuals of all species}} \times 100$

v) Abundance: The study of individuals of different species in the ecosystem per unit area.

$$\text{Abundance} = \frac{\text{Total number of a species in all plots}}{\text{Total number of plots in which the species occurrence}} \times 100$$

vi) Basal Area (BA): Basal area is the cross sectional area of a tree at breast height (1.3m above the ground) or trees on a given area above a certain diameter. The Basal Area gives an idea of crowding in a forest (UNESCO/UNEP/FAO, 1990). This calculated using the following formula.

$$\text{Basal Area} = \pi D^2 / 40{,}000 \text{ cm}^2$$

(Where D is DBH- Diameter at Breast Height in cm)

vii) Relative Basal Area (RBA): The ratio between total basal area of a species and total basal area of all species.

$$\text{Relative Basal Area} = \frac{\text{Total Basal Area of a single species}}{\text{Total Basal Area of all specie}} \times 100$$

viii) Important Value Index (IVI): In order to have a really ecological importance of a species with respect to the community structure, the percentage values of the relative density and relative dominance (RBA) are added together and this value out of 3000 is called the IVI of the species (Ambasth and Ambasth, 2000).

$$IVI = RF + RB + RBA$$

(Expression of Dominance of a species)

ix) Ecological indices:

Species diversity may be through of as being composed of two components. The first is the number of species in community, which refer to as species richness. The second component is species evenness or equitability (Ludwig and Reynolds, 1988). Evenness and Richness were calculated for each plots using Shannon's formula as follows.

Shannon-weiner index (H′) = $-\Sigma Pi \times \log (Pi)$

(Pi-Proportional abundance)

$$\text{Evenness (J)} = \frac{H'}{H\max}$$

Where H max = log (S), and S = Number of species found in stand.

Dominancy = 1-J

3.3 Faunistic survey

3.3.1 Method of observation

Information about the fauna was collected through visual observation, interviews with local resource users and through a literature search. Here, special attention was paid for the birds, because of the sanctuary is famous for birds. 6 transects (100 x 50m) were used in each vegetation type and made 10 consecutive observations per transect during the study period. A binocular (7×50) was used for the observation and the birds were identified according to the guidebooks of Wijerathne et al. (2000) and Kotagama and Fernando (2000). In this survey only daytime observation was done and the observations were averaged.

3.4 Socio- economic Survey

3.4.1 Questionnaire Survey

Questionnaire survey was used to find the socio-economic status of the Sanctuary. The used questionnaire was well structured, comprising of two parts; family description (age, family

monthly income, main income source, education level and religion) and human interaction to the Sanctuary. The questionnaire, used is shown in Appendix 10.

Five Grama Niladhari Divisions that overlaps with the Sanctuary was selected for the survey. They are Hungama, Bata-ata South, Hatagala, Lunama North and Luanama South. Ten families from each Division were selected randomly for the survey.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Floristic composition of the Sanctuary

The total number of 3301 individuals was counted in all the 27 plots established in arid zone forest, mangrove forest and coastal vegetation ecosystem. 72 plant species belonging to 35 families were recorded in the three ecosystems. Floristic composition observed in the 3 ecosystems studied is shown in Table 4.1 and the list of plant species shown in Appendix 1. Distribution of individuals in three ecosystems has been graphically represented in figure 4.1. The climbers found in different ecosystems are also indicated in Appendix 1.

Table 4.1: Distribution of individuals in three ecosystems.

Ecosystem	Tree individuals (DBH>10cm)	Trees, shrubs and saplings (DBH<10cm)	Ground flora individuals	Total number of individuals
Arid Zone Forest	92	289	672	1059
Mangrove Forest	98	77	1478	1653
Coastal Vegetation	17	41	537	595
				3301

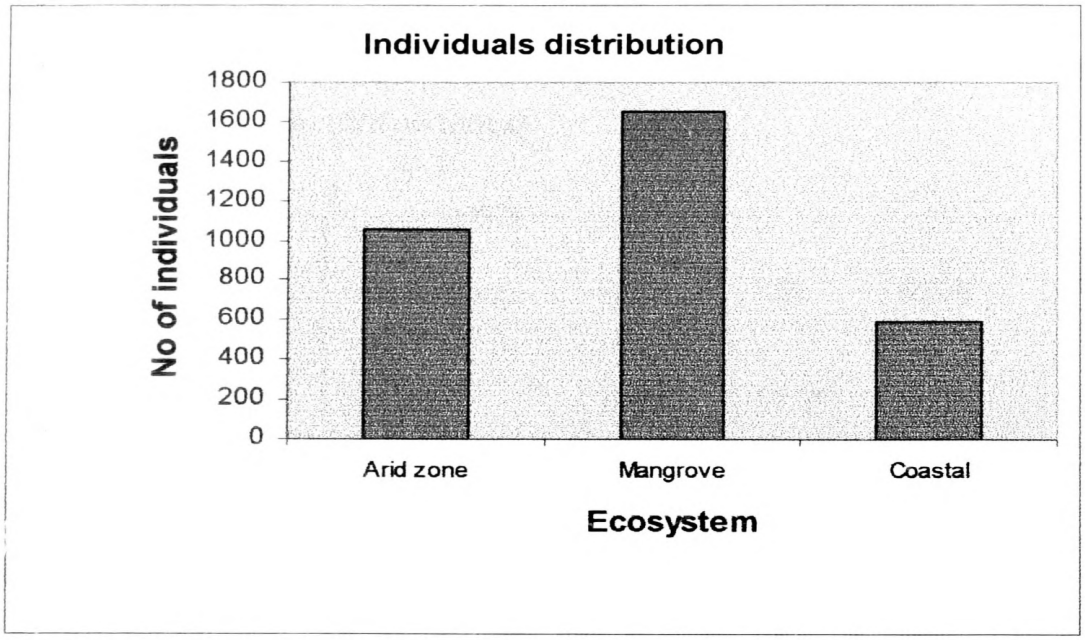

Figure 4.1: Distribution of individuals in three ecosystems.

4.1.1 Floristic composition of the arid zone forest

A total number of 92 trees above 10 cm DBH were enumerated in all plots of arid zone forest. 961 of shrubs, trees and saplings having DBH below 10 cm and ground flora were also counted. Total number of 1059 individuals belonging into 25 families and 50 species were assessed in arid zone forest ecosystem. Their frequency, abundance and density are shown in Appendix 2. 100% frequencies were shown by *Cassia auriculata* (Ranawara), *Acasia planifrons* (Andara) and *Teprosia purpurea* (Katupila).

Total vegetation densities including tree species, shrubs, sapling and ground flora were estimated to be 105900 individuals per/ha. According to the Important Value Index of tree species (Table 5.2) Leguminoceae was the most prominent family and *Acasia planifrons* (Andara) was the most prominent species. The other species were *Cassia auriculata* (Ranawara) and *Zyzyphus mauritiana* (Debara) respectively. The IVI of plant species above 10 cm DBH is graphically represented in Figure1.3.

Table 4.2:IVI of tree species from arid zone forest

(RF-Relative Frequency, RD-Relative density, RBA-Relative Basal Area, IVI-Important Value Index)

Name of species	Local name	RF	RD	RBA	IVI
Acasia Planifrons	Andara	14.57	17.39	3.53	0.52
Cassia auriculata	Ranawara	14.75	19.57	4.96	0.12
Zyzyphus mauritiana	Debara	11.48	14.13	8.01	0.11
Azadirachta indica	Kohomba	3.27	3.26	26.28	0.11
Feronia elephantum	Divul	6.55	6.52	19.07	0.11
Salvadora pesica	Mallittan	11.48	7.61	10.56	0.09
Euphobia qniquorum	Daluk	6.55	5.43	6.09	0.06
Euphobia tirucalli	Nawahandi	11.48	7.61	3.85	0.08
Ricinus communis	Endaru	6.56	6.52	0.80	0.05
Thespesia populnea	Suriya	3.88	2.17	7.53	0.04
Scolopia schreberi	Katukurundu	4.92	4.35	3.20	0.04
Manilkara hexandra	Palu	3.28	3.26	5.29	0.04
Zizyphus rugosa	Mahaeraminiya	3.28	2.17	0.96	0.02
Vitex negando	*Nika*	1.64	1.09	0.16	0.01

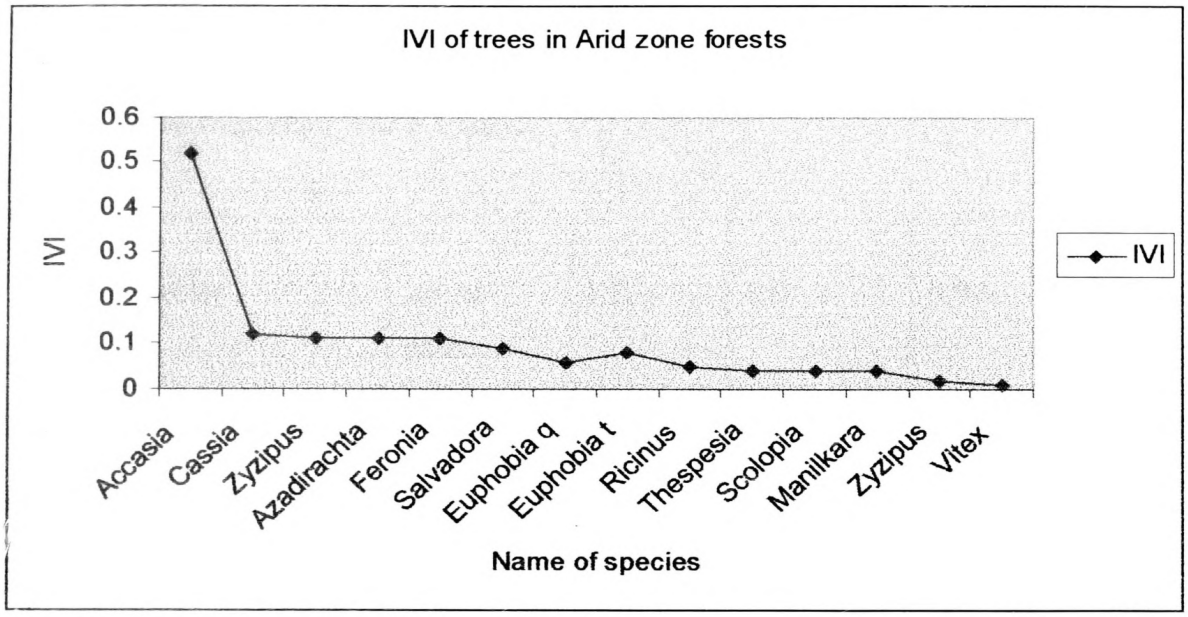

Figure 4.2: IVI of the trees in arid zone forest.

4.1.2 Floristic composition of the mangrove forest

Total number of 1653 individuals was recorded in mangrove forest falling into 13 families and 13 species. The frequency of *Sonnaratia caseolaris, Exocaria agallocha* and *Caleodendrum inerme* species were 100 % (Appendix 3).

Total vegetation densities of tree species, shrubs, sapling and ground flora were estimated to be 165300 individuals per/ha. According to the IVI of mangrove forest (Table 5.3), tree species were ranked as *Sonnaratia caseolaris, Exocaria agallocha* and *Caleodendrum inerme* in descending order. Other than that, Salvinia, Pistia sp. and Eichonia sp. that are highly invasive waterweeds, has invaded the Kalametiya and Lunama lagoons.

Table 4.3:IVI of tree species from mangrove forest

(RF-Relative Frequency, RD-Relative density, RBA-Relative Basal Area, IVI-Important Value Index)

Name of species	Local name	RE	RD	RBA	IVI
Sonnaratia caseolaris	Kirala	33.33	62.20	71.50	0.56
Exocaria agallocha	Tela	33.33	33.67	26.73	0.32
Caleodendrum inerme	Veraniya	33.33	4.08	1.81	0.13

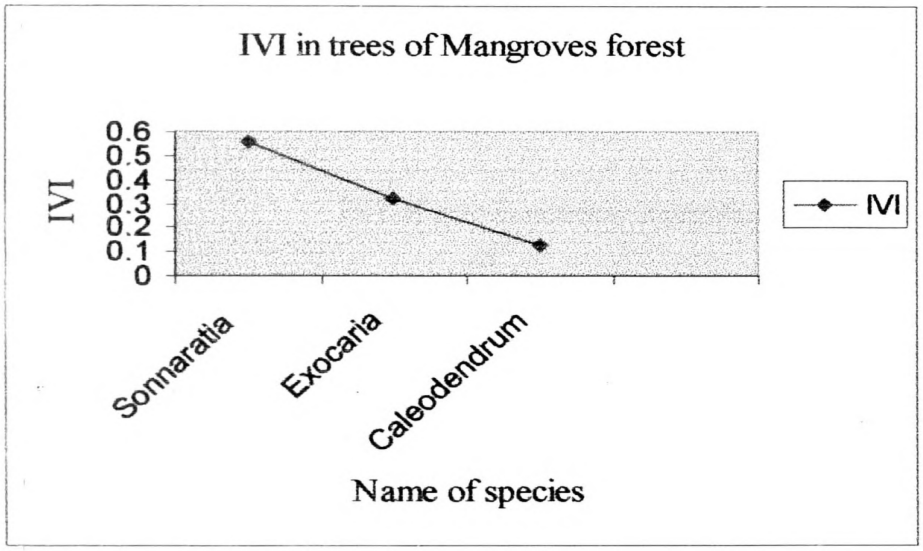

Figure 4.3: IVI of the trees in mangrove forest.

4.1.3 Floristic composition of the coastal vegetation

Total number of 597 individuals was enumerated in coastal vegetation ecosystem. It included 13 families and 13 species. 100% frequency was recorded by *Ipomea pescaprae* (Bimtamburu), which are indicated in Appendix 4.

Total vegetation densities for coastal vegetation ecosystem including tree species, shrubs, and sapling and ground flora were estimated to be 59500 individuals per/ha. In accordance with IVI, *Pandanus foetidus* (Vetakeiya) and *Thespesia populnea* (Suriya) were prominent species in coastal vegetation ecosystem (Table 4.4).

Table 4.4:IVI of tree species from coastal vegetation ecosystem
(RF-Relative Frequency, RD-Relative density, RBA-Relative Basal Area, IVI-Important Value Index)

Name of species	Local name	RF	RD	RBA	IVI
Pandanus foetidus	Vetakeiya	60.10	52.94	35.02	0.49
Thespesia populnea	Suriya	33.33	41.18	63.45	0.46
Macroptilium lathyroids	Mudumurunga	6.67	5.88	1.52	0.04

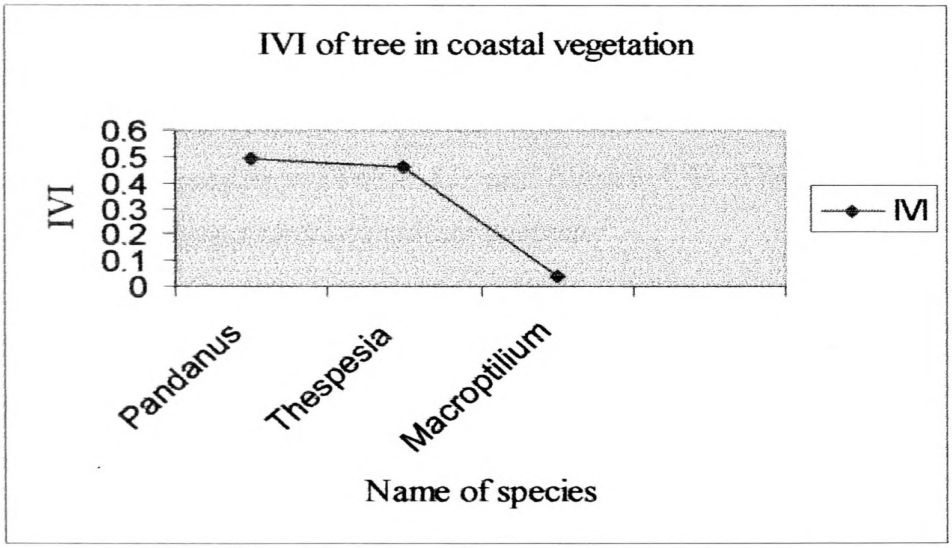

Figure 4.4: IVI of the trees in coastal vegetation.

When comparing these three ecosystems, the arid zone forest ecosystem shows the open scrub nature. There were uneven layers of shrubs. Number of large trees was negligible and

erbaceous layer or ground flora layer was not denser than mangrove forest and most of them ere medicinal plant. Generally, height of the trees was not higher than 3-4m.

lthough there were some human interactions, the mangrove vegetation at the sanctuary was n good conditions with full range of successional stage. Height of the *Sonnaratia* trees was bout 7m and it was the prominent species. These trees have distributed densely in this cosystem. But number of shrubs in this ecosystem was lower than arid zone forest cosystem due to high moisture content in the soil there was large number of ground flora ndividuals.

he coastal ecosystem showed sparse scrub nature. Large trees in the area were negligible ecause of the neighboring community has cut down *pandanus* trees in the coastline. There ere only 17 large trees (10cm <DBH) individuals which belonging into three families. This ndicates that coastal ecosystem as the highly destructive ecosystem than the other cosystems.

.1.4 Floristic diversity of the ecosystems

Diversity indices were calculated for each different ecosystem (Appendix 5). The diversity ndices showed higher value for arid zone forest and lower values for mangrove forest and coastal vegetation ecosystem (Table 4.5 and Figure 4.4). There was no significant difference etween mangrove forest and coastal ecosystem.

According to the results, evenness of arid zone forest and coastal vegetation was the same. With regard to the evenness, the lowest value was resulted from mangrove forest. The highest value for dominance was showed by mangrove forest and lowest value shown by arid zone forest.

Table 4.5 Values of diversity indices (Shannon-weiner diversity index, Evenness and Dominance of each ecosystem).

Ecosystem	Diversity	Evenness	Dominance
Arid zone forest	1.13	0.10	0.02
Mangrove forest	0.46	0.07	0.03
Coastal vegetation	0.43	0.10	0.09

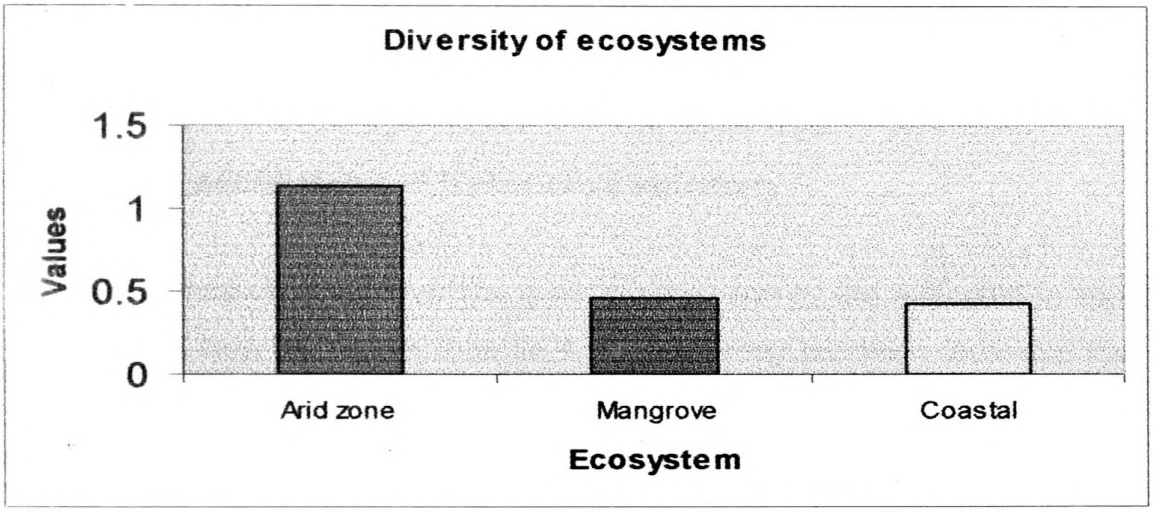

Figure 4.5 Diversity of ecosystems

4.2 Faunistic composition

Some fish fauna present in the Lunama and Kalametiya lagoons have been shown in the appendix 6. The most common fish species is Tilapia. There are two Tilapia species in the lagoons; *Sarherodon mossambicus* and *Oreochromis mossambicus*. According to the available data, there are 41 species inhabiting the lagoons. The list includes one endemic species: the Walking catfish *Clarius brachysoma* (Magura). Seven species are introduced.

When considering the reptiles and amphibians, total numbers of 38 species of reptiles have been recorded at the study site (appendix 7). These include 15 snake species, 23 reptile species and 23 0f tetrapodes. Among them 10 are endemic and 25 species are threatened. The globally threatened Eurasian crocodile could be seen in this area. Other than that four endangered species of sea turtles were found in Kalametiya area.

76 bird species that are indicated in appendix 8 could be identified during the study period. Out of them12 species were migratory shore birds and the other 64 were resident species. There were large number of Herons, Egrets, storks and jacanas. Jungle fowl was the endemic bird species, which found in this sanctuary.

20 mammals species have been recorded in this area. Out of two species the Toque monkey and Bicolor spiny rat were endemic and 6 species of them were threatened. Namely; the Slender Loris, Otter, Jungle cat, Mouse deer Fishing cat and Bicolor spiny rat. The list of mammals inhibiting the Kalametiya sanctuary is indicated in appendix 9.

4.3 Socio-economic status of Kalametiya sanctuary

All the raw data obtained from the questionnaire survey are indicated in appendix 11 and 12. The analyzed data are shown in table 4.6. The survey has been indicated that there were 220 members in 50 families. Gender distribution of the area was 46.36% males and 53.64% females. Their average family size was 4.4.

Agriculture and fishery are the major source of income to many households in this area (table 4.6). Shell mining provides a source of income for 14% of families and animal husbandry is also become a income source of some families. There were permanent occupation methods for 16%families residing in this area.

According to the data shown in 4.6 table, the monthly income of many families are lower than Rs.4000. Interviews revealed that, these amount is also vary with the climatic factors like heavy rain and drought. From the income methods as, farming, fishing and shell mining cannot be expected stable monthly income. As a result of that, poverty is evident in this area.

Educational level of majority of the respondents was between the ranges of year five to ordinary level. 98% of the surveyed families residing in the Kalametiya area were Buddhist. 2% of sampling families was catholic.

Table: 4.6 Socio-economic data of the Kalametiya area.

Age group	15-25	26-35	36-45	46-55	56-65	>65
% of respondents	16%	30%	20%	14%	12%	8%

Occupation	Farming	Mining	Fishing	Livestock management	Permanent	Other
% of families	22%	14%	28%	8%	16%	12%

Income group (Rs)	<1000	1000-2000	2000-3000	3000-4000	>4000
% of families	2%	8%	18%	34%	38%

Level	No schooling	Up to 5	5 to O/L	O/L to A/L	>A/L
% of respondents	4%	8%	48%	24%	16%

The second part of the questionnaire was constructed to get an idea about human impacts on the sanctuary. The results that obtained are shown in appendix 12 and analyzed results are indicated in Table 4.7.

Among the surveyed families 56% fulfilled their firewood need from the Sanctuary. The main tree species, which they used, were *Acasia planifrons (Andara), Cassia auriculata (Ranawara), Zyzyphus mauritiana (Eraminiya)* and mangrove tree species. The Sanctuary provides indigenous medicines for 64% families residing in the area.

The people who are doing animal husbandry use the sanctuary for lying and grazing of cattle and buffaloes. The Sanctuary provides some fruits and vegetables for 40% families in this

area. Fruits of *Sonnaratia caseolaris* (Kirala), leaves of *Acrostichum aureum* (Kerenkoku) and *Ipomoea aquaca* etc. are used as fruits and vegetables.

Interviews revealed that almost all the families consumed fresh water fish, which caught from the lagoons. The main waste disposal method of many people were composting and burning. Therefore, no considerable effect from the domestic waste to the Sanctuary. There was no remarkable corporation to tourism by the local people.

Table 4.7: Human interaction with the Sanctuary.

Interaction	Firewood	Medicine	Fishing	Animal husbandry	Food
% of families	56%	64%	10%	8%	40%

CHAPTER 5

MANAGEMENT PLAN

5.1 Key issues

5.1.1 Spreading of invasive plant species

Some plant species act as invasive species within the lagoons. Many of these plant species are fresh water loving and highly invasive. eg *Typha latifolia* , *Pistia* sp. and *Eichonia crassipes.* This has been a threat for the fishery resources and biodiversity of the Sanctuary.

5.1.2 Degradation of ecosystems

Reduction of forest, mangroves and coastal vegetation due to agriculture and human settlements as well as significant reduction of *Pandanus sp.* in the coastline was recorded. Intensive felling and setting fire to the forest for the chena cultivation has also been a cause for degradation of the ecosystems in the area.

5.1.3 Encroachment and boundary issues

The Sanctuary partly is state owned and partly private owned. The landowners have further extended their boundaries toward the Sanctuary. Large extents of land has been encroached by the people who are living within and in the surrounding area.

5.1.4 Exploitation of wood and non-wood products

The villagers cut the forest for the construction of houses, as fodder, fuel wood and making furniture. As non wood products they exploit medicinal plants, bees honey, fruits and vegetables from the Sanctuary.

5.1.5 Shell mining

Mollusk shells are being excavated for the production of lime and chicken feeds. This severely affects the well being of the Sanctuary. Mining of shells has led to the formation of many pits in the Sanctuary.. Excavated shells are transported along the path running through the Sanctuary by vehicles. This has created lot of problems to the animals living in the Sanctuary.

5.1.6 Over grazing by domestic animals

Cattle and buffaloes feed on the grasslands of the Sanctuary. This has led to the reduction of palatable and nutrient plants. As a result, hard and unpalatable plants had increased and become a major threat to the Sanctuary. Pruning branches of trees as fodder also reduce the forest cover. Construction of cattle's hut and lying of cattle within the Sanctuary have resulted in the destruction of grasses.

5.1.7 Over fishing

Undesirable fishing methods in lagoons (drift-nets and ja-kotu fishing), uncontrolled exploitation and immature fish caught have caused the reduction of natural recruitment of shrimp and fish.

5.1.8 Poaching and reduction of animal diversity

Hunting of wild animals and birds has been recorded in this area. Shooting of mammals, birds, poaching of sea turtle and collection of their eggs have reduced the diversity of animals.

5.1.9 Hydrological changes of lagoon water

Agrochemical and nutrient rich water influx from the upper catchments and paddy fields have caused eutrophication of the lagoons. Further, return flows from the Udawalawe Scheme through the Kachigal Ara leads the desalinization of lagoon water. Water pollution due to the cattle dung and urine is also a major health threat, since a large number of families in

metiya use Kachigal Ara to fulfill there drinking water need. Heavy loads of silt brought achigal Ara have caused sedimentation of lagoons and threatening the aquatic habitat. e adverse factors have resulted the reduction of aquatic organisms and changing of food ns of the lagoons.

10 Lack of institutional corporation

k of corporation and coordination between DWLC and, FD and other organizations can een. Insufficient presence of field staff is also a major problem.

1 Proposed new development projects

ording to the development project plan, Tannery factories, Hotels, Golf course and istrial zone will be constructed in this area. These may cause destruction of landscape nery, wildlife habitats, forest cover and tourist potential of the area.

Objective of Management Plan

i) Protect and improve the quality of ecosystems and biodiversity of the Sanctuary.

ii) Develop a well-trained and motivated sanctuary staff and provide them the necessary tools for the enforcement

iii) Improve the hydrological regime benefiting both natural and natural resources and wild population.

vi) Promotion of aesthetic, educational and scientific values of the Sanctuary and encourage visitation, research and awareness.

vii) Help quality of life of the people living in villages close to the Sanctuary.

3 Strategies and recommendations

rategy-1

ncrease physical presence, patrolling and observation of DWLC personnel.

ecommendations

he Sanctuary should be upgraded to a national park with new boundaries. Then, the new oundaries and regulations need to be gazetted to ensure the protection of the Sanctuary and

ts environment. The patrolling of the Police and the Sanctuary staff should be strengthened o curtail poaching of wild animals and other related offences.

Strategy- 2

Reduce the dependency of local people on the Sanctuary and maintain correct balance of environment protection and economic development.

Recommendations

The Sanctuary can be internally zoned to reflect the different kinds of resources within each zone and most appropriate use of those recourses. As a example, a core area can be demarcated for absolute protection. Outside that a buffer zone can be demarcated and management done with neighboring communities. Within the buffer zone, gathering of wild fruits and vegetables, indigenous medicine and collecting firewood can be allowed. Permanent settlements, burning of vegetation and introduction of trees or animal species likely to be invaded or threatened in the Sanctuary need to be prohibited.

The practice of home gardening and agroforestry can be promoted by providing incentives to reduce the dependency on the Sanctuary for the indigenous medicine and firewood. Private forest planting can be introduced to get much needed timber by providing incentives and opportunities. People could be motivated to establish mangrove plantations, reforestation using suitable plant species in the Sanctuary and along the coastline including the sand dunes. This will help to protect the environment. Removal of invasive plant species (*Typa latifolia, Opuntia sp.* and *Pistia sp.*) is necessary, because these species have overcome the growth of other plant species.

Mixing of agrochemical and nutrient rich water with the lagoon water has to be prevented. The eutrophicated area of the both lagoons should be rehabilitated with the help of community. In addition to that, desalinization of lagoon water due to the fresh water inflow from upper catchments area needs to be prevented.

Grazing by domestic animals in the Sanctuary may be allowed, where it does not conflict with the maintenance of the Sanctuary. Encroachments and poaching of wild mammals, water birds, sea turtles and their eggs should be strongly prohibited. Maximizing the income from the lagoons by regulating the fishing activities and replenishing the lagoons with fish and

shrimp stock can be done. In addition to that, provision of social services like roads health and other financial assistance will help to overcome the poverty of neighboring community.

Shell mining need to be prohibited and the degraded area due to the mining activities should be rehabilitated. It is strongly recommended to regulate shell mining through a license system, without harming the ecosystems and pits should be leveled after mining activities cease. For the rehabilitation of mine spoil site both mechanical and biological measures can be used. Selection of appropriate species for the reforestation is also an important factor.

Strategy-3

Develop educational programs, educational facilities and establish a Sanctuary visitor center jointly with the co-operative society.

Recommendations

Through the schools and youth groups the management staff of the Sanctuary can extend its true value to the younger generation. Other than that, local schools can be directly contacted through the local education offices by offering facilities for field excursions or classroom lessons.

It is necessary to establish a reference center, which includes information about the Sanctuary. Scientific information, maps, species list, and papers should be available in here.. Further, a small library, where relevant textbooks and other reference materials are placed will improve the knowledge of people about the Sanctuary. Conducting regular resource inventories will help to identify different forest types and resources included in the Sanctuary. All these studies should be done jointly with the co-operative society and it may be a better way to focus the mind of people toward the Sanctuary.

Media, leaflets, posters, stickers and attractive things can be used for advertising. Basic information about the Sanctuary should be presented simply and briefly, but in an interesting fashion. Then the visitors can gain greater understanding of what they are going to experience.

Directly and indirectly the Sanctuary can enhance employment opportunities in region. The surrounding people should be employed as the Sanctuary staff, because the villagers will support to them. Promotion of bioprospecting and devise a stable mechanism for implementation is also very important. Establish linkages with educational institutions, state NGO's and the private sector to promote and implement research and educational programmes may help to conserve the natural resources of the Sanctuary.

5.4 Implementing organizations

For the implementation of the recommended ideal conservation activities, following organizations and groups can be suggested.

Central Environment Authority
Department of Wildlife Conservation
Forest Department
Irrigation Department
Ministry of Fisheries and Aquatic Resources Development
National Science Foundation
National Livestock Development Board
Ceylon Tourist Board
Coastal Conservation Department

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APPENDICES

Appendix I

List of plant species recorded in different ecosystems of Kalametiya sanctuary.

Family	Name of species	Local name
Amaranthaceae	*Aerva lantana*	Polpala
Amaranthaceae	*Alternanthera sessilis*	Mukunuwenna
Amaranthaceae	*Nothosacrva brachiata*	Galtampala
Aristolochiaceae	*Calotropis gigntea*	Wara
Aristolochiaceae	*Cyathula zeylanica*	
Asclepiadaceae	*Gymnema sylvetre*	
Pteridaceae	*Acrostichum aureum*	Kerankoku
Borangiaceae	*Carmona retusa*	Hintambala
Cactaceae	*Opuntia dilleni*	Patok
Combretaceae	*Luminetzera racemosa*	Bombu
Compositae	*Eclipta prostrata*	Kikirindiya
Compositae	*Euparium odoratum*	Neluwa
Compositae	*Mikania corduta*	Lokapalu
Compositae	*Tridax pracumbens*	Tridax
Compositae	*Vernonia cinnera*	Monarakudumbia
Compositae	*Vernonia zeylanica*	Pupula
Convolvulaceae	*Ipomoea aquatica*	Kankun
Convolvulaceae	*Ipomoea pescaprae*	Bimtamburu
Crassulaceae	*Bryophyllum pinnatum*	Akkapana
Cyperaceae	*Cyprus rotandus*	Kalanduru
Euphobiaceae	*Acalypha indica*	Kuppameniya
Euphobiaceae	*Euphobia quniqunorum*	Daluk
Euphobiaceae	*Exocaria agallocha*	Tela

Euphobiaceae	*Euphobia triculli*	Nawahandi
Euphobiaceae	*Phyllanthus niruri*	Pitawakka
Euphobiaceae	*Ricinus communis*	Erandu
Filacoutiaceae	*Scolopia schreberi*	Katukurundu
Goodeniacea	*Seaevola sericea*	Polkichabada
Malvaceae	*Abutilon aciaticum*	Anoda
Malvaceae	*Plectranthus zeylanicus*	Iriveriya
Malvaceae	*Sida acuta*	Bebila
Malvaceae	*Thespesia popuinea*	Suriya
Meliaceae	*Azadirachta indica*	kohomba
Lamiaceae	*Ocimum sanctum*	Madurutala
Lamiaceae	*Orthosiphon aristaltes*	Ratutora
Leguminoceae	*Cassia auricalata*	Ranawara
Leguminoceae	*Cassia sophera*	Urutora
Leguminoceae	*Crotalaria verrucosa*	Andanahiriya
Leguminoceae	*Desmodium triflorum*	Undupiyaliya
Leguminoceae	*Dichrostachys cinera*	Andara
Leguminocea	*Macroptetilium lathyroids*	
Leguminoceae	*Sophora tomentosa*	Mudu murunga
Leguminoceae	*Tephrosia purpurea*	Katupila
Liliaceae	*Asparagus recemosus*	Nawahandi
Liliaceae	*Aloe vera*	Komarika
Liliaceae	*Gloriosa superba*	Niyangala
Pandanaceae	*Pandanus foetidus*	Vetake
Passifloraceae	*Plssiflora foetida*	Padawel
Plumberginaceae	*Plumbago zelanica*	Elanetul
Pontederiacaea	*Eichonia Crassipes*	Diyahabarala
Portulacaceae	*Portulaca oleraceae*	Gendakola
Pteridaceae	*Acrostichum aureum*	Kerankoku
Rhamnaceae	*Zizyphus ooenoplia*	Heenearaminiya
Rhamnaceae	*Zizyphus mauritiana*	Debara
Rhamnaceae	*Zizyphus rugosa*	Mahaeraminiya
Rubiaceae	*Ixora coccinea*	Ratmal

Rubiaceae	*Pavatta indica*	Pavetta
Rubiaceae	*Randia dumitarum*	Kukurumana
Rutaceae	*Attantia ceylanica*	Yakinaran
Rutaceae	*Feronia elephantum*	Divul
Sapindaceae	*Cardispermum halicacabum*	Welpenela
Solanaceae	*Datura metal*	Attana
Solanaceae	*Solanum xanthocarpum*	Elabatu
Sonnaratiaceae	*Sonnaratia caseolaris*	Kirala
Scrophulariaceae	*Bacopa monniera*	Lunuwilla
Typhaceae	*Typha latifolia*	Hambu
Verbenaceae	*Caleodendrum inerme*	Veraniya
Verbenaceae	*Lantana camara*	Gandapana
Verbenaceae	*Lippia nodifolia*	Hiramanadetta
Verbenaceae	Stachytapthera jamaicensis	Balunakuta
Verbenaceae	Vitex negundo	Nika
Vitaceae	*Cissus quadrangularis*	Heeraessa
Zygophyllaceae	*Tribuus terrestris*	Gokatu

Appendix II

Frequency abundance and density of trees, shrubs, saplings, ground flora and climber species from Arid zone forest.

Tree species (DBH>10cm) recorded from arid zone forest
(St- Number of stems, Fre- Frequency, Abu- Abundance and Den-Density)

Name of species	Local name	St	Freq	Abu	Den
Accasia Planifrons	Andara	18	100	200.00	200.00
Cssia auriculata	Ranawara	16	100	177.78	177.78
Zyzyphusmauritiana	Debara	13	77.78	185.71	144.44
Azadirachta indica	Kohomba	3	22.22	150.00	66.67
Feronia elephantum	Divul	6	44.44	150.00	66.67
Salvadora pesica	Mallittan	7	44.44	140.00	77.78
Euphobia qniquorum	Daluk	7	55.55	125.00	55.55
Euphobia tirucalli	Nawahandi	5	77.78	100.00	77.78
Ricinus communis	Endaru	9	44.44	150.00	55.55
Thespesia populnea	Suriya	2	22.22	100.00	66.67
Scolopia schreberi	Katukurundu	2	33.33	133.33	44.44
Manilkara hexandra	Palu	2	22.22	100.00	22.22
Zizyphus rugosa	Mahaeraminiya	2	11.11	100.00	22.22
Vitex negando	Nika	1	11.11	100.00	11.11

Shrubs and saplings (DBH<10cm) from arid zone forest

(St- Number of stems, Fre- Frequency, Abu- Abundance and Den-Density)

Name of species	Local name	St	Freq	Abu	Den
Gymnema sylvestre	Masbedda	9	55.55	180.00	100.00
Carmona retusa	Hintambala	8	88.89	100.00	88.89
Opuntia dillenii	Patok	19	88.89	237.54	211.11
Eupatorium deratum	Neluwa	14	77.78	200.00	155.55
Vernonia zeylanica	Pupula	11	55.55	220.00	122.22
Bryophyllum pinatum	Akkapana	13	66.67	216.67	144.44
Orthosiphon ristalates	Pusmal	6	44.44	150.00	66.67
Cassia auriculata	Ranawara	13	100.00	111.11	111.11
Cassia sophera	Urutora	3	33.33	100.00	33.33
Crotalaria verucosa	Andanahiriya	7	55.55	140.00	77.78
Dichrostachys cinera	Andara	15	55.55	300.00	166.67
Ocimum sanctum	Madurutala	13	66.67	216.71	144.44
Tephrosia purpurea	Katupilla	38	100.00	422.22	422.22
Aloe vera	Komarika	2	22.22	100.00	22.22
Plectranthus zeylanicus	Iriveriya	2	22.22	100.00	22.22
Abutalonasi asiaticum	Anoda	17	88.89	212.53	188.89
Phoenix zeylanica	Indi	2	22.22	100.00	22.22
Plumbago zelanica	Ela netul	6	33.33	266.67	88.89
Zizyphus mauritiana	Debara	27	44.44	150.00	66.67
Zizyphus ooenoplia	Eraminiya	2	77.78	385.71	188.89
Ixora coccinea	Ratmal	3	22.22	100.00	22.22
Pavetta indica	Pavetta	4	33.33	100.00	33.33
Randia dumentorum	Kukurumana	7	77.78	100.00	77.78
Atantia ceylanica	Yakinaran	6	44.44	150.00	66.67
Solanum xanthacarum	Elabatu	11	66.67	183.33	122.22
Turnera ulmiflora	Bediwada	10	66.67	166.67	111.11
Lantana camera	Gandapana	12	88.89	150.00	133.33

Ground flora from arid zone forest

(St- Number of stems, Fre- Frequency, Abu- Abundance and Den-Density)

Name of species	Local name	St	Freq	Abu	Den
Aerva lantana	Polpala	28	66.66	466.67	131.11
Cyathula zeylanica	Karalheba	13	55.55	260.00	133.33
Cyporus rotandus	Klanduru	562	100.00	6244.44	634.44
Acalypha indica	Kuppameni	19	44.44	475.00	211.11
Desmodium triflorum	undupiyali	118	55.55	2360.00	131.11
Phylanthus niruri	Pitawakka	18	44.44	450.00	200.00
Mimosa pudica	Nidikumba	8	55.55	160.00	88.89
Sida acuta	Bebila	12	77.78	171.43	133.33
Tribulus terrestris	Gokatu	83	100.00	922.22	92.22

Climbers from arid zone forest

(St- Number of stems, Fre- Frequency, Abu- Abundance and Den-Density)

Name of species	Local name	St	Freq	Abu	Den
Saccrostemma bunoianum	Muwakiriya	5	33.33	166.67	55.55
Mikania cordata	Lokapalu	11	55.55	220.00	122.22
Asparagus recemosa	Hatawariya	2	22.22	100.00	22.22
Gloriosa superba	Niyangala	6	44.44	150.00	66.67
Tinosphora cordifolia	Rasakinda	17	88.89	212.50	88.89
Passiflora foetida	Padawel	3	22.22	150.00	33.33
Hemidesmum indicus	Iramuasu	38	100.00	422.20	422.22
Cardispermum alicacabum	Welpenela	8	33.33	266.67	88.89
Cissus quadrangularis	Heeressa	10	44.44	250.00	111.11

Appendix III

Frequency abundance and density of trees, shrubs, saplings, ground flora from mangrove forest.

Tree species (DBH>10cm) recorded from mangrove forest

(St- Number of stems, Fre- Frequency, Abu- Abundance and Den-Density)

Name of species	Local name	St	Freq	Abu	Den
Exocaria agallocha	Thela	33	100.00	366.67	366.67
Sonnaratia caceolaris	Kirala	61	100.00	677.78	677.78
Cleodendrum inerme	Veraniya	4	44.44	44.44	44.44

Shrubs and saplings (DBH<10cm) from mangrove forest

(St- Number of stems, Fre- Frequency, Abu- Abundance and Den-Density)

Name of species	Local name	St	Freq	Abu	Den
Luminetzera recemosa	Bombu	42	100.00	466.67	466.67
Acrostichum aureum	Kerenkoku	4	11.11	400.00	44.44
Typha latifolia	Hambupan	31	55.55	620.00	344.44

Ground flora from mangrove forest

(St- Number of stems, Fre- Frequency, Abu- Abundance and Den-Density)

Name of species	Local name	St	Freq	Abu	Abu
Alternenthera sessilis	Mukunuwenna	71	185.18	17775.00	788.89
Eclipta prostata	Kikirindiya	213	55.55	4260.00	2366.6
Ipomoea aquatica	Kankun	4	185.18	100.00	44.44
Cyprus rotandus	Kalanduru	834	100.00	9266.67	9266.67
Portulaca oleracea	Gendakola	157	100.00	1744.44	1944.44
Bacopa monniera	Lunuwilla	174	88.89	1933.33	1933.33
Eichonia crassipes	Diyaparendel	15	66.67	250.00	166.67

Appendix IV

Frequency abundance and density of trees, shrubs, saplings, ground flora from coastal vegetation.

Tree species (DBH>10cm) recorded from coastal vegetation

(St- Number of stems, Fre- Frequency, Abu- Abundance and Den-Density)

Name of species	Local name	St	Freq	Abu	Den
Macroptilium lathyroids	Mudumurunga	1	11.11	100.00	100.00
Thepesia poplnea	Suriya	7	55.55	140.00	77.77
Pandanus foetidus	Wetakeiya	9	66.67	150.00	11.11

Shrubs and saplings (DBH<10cm) from coastal vegetation

(St- Number of stems, Fre- Frequency, Abu- Abundance and Den-Density)

Name of species	Local name	St	Freq	Abu	Den
Calotropis gignntea	Wara	11	77.78	159.14	122.22
Eupatorium odoratum	Neluwa	12	88.89	150.00	133.33
Scavola sericea	Polkichchabada	3	33.33	100.00	33.33
Datura metal	Attana	8	66.67	133.33	88.89
Lantana camara	Gandapana	7	55.55	140.00	77.78

Ground flora from Coastal Vegetation

(St- Number of stems, Fre- Frequency, Abu- Abundance and Den-Density)

Name of species	Local name	St	Freq	Abu	Den
Nothosaerva brachiata	Galtampala	73	55.55	1460.00	811.11
Tridax procumbens	Tridax	15	66.67	300.00	200.00
Vernonia cinera	Monarakudymbi	18	88.89	187.50	166.67
Ipomoea pescaprae	Bimtamburu	62	100.00	688.89	688.89
Lippia nodifolia	Hiramanadetta	160	100.00	1777.78	177.78
Tribulus terrestris	Gokatu	63	776.78	885.71	688.89
Cyprus rotandus	Kalanduru	147	88.89	1837.55	1633.33

Appendix V

Floristic diversity of tree species from arid zone forest, Mangrove forest and coastal vegetation eco system

Floristic diversity of tree species from arid zone forest
(Pi-Proportional abundance)

Name of species	Local name	Pi	log Pi	Pi.log Pi
Accasia Planifrons	Andara	0.104	-0.984	-0.102
Cssia auriculata	Ranawara	0.902	-1.035	-0.095
Zyzyphusmauritiana	Debara	0.096	-1.017	-0.097
Azadirachta indica	Kohomba	0.078	-1.109	-0.086
Feronia elephantum	Divul	0.078	-1.109	-0.086
Salvadora pesica	Mallittan	0.073	-1.139	-0.083
Euphobia qniquorum	Daluk	0.052	-1.283	-0.077
Euphobia tirucalli	Nawahandi	0.065	-1.109	-0.067
Ricinus communis	Endaru	0.078	-1.183	-0.086
Thespesia populnea	Suriya	0.052	-1.109	-0.067
Scolopia schreberi	Katukurundu	0.069	-1.160	-0.080
Manilkara hexandra	Palu	0.052	-1.283	-0.067
Zizyphus rugosa	Mahaeraminiya	0.052	-1.283	-0.067
Vitex negundo	Nika	0.052	-1.83	-0.067
				-1.127

Floristic diversity of tree species from mangrove forest

(Pi-Proportional abundance)

Name of species	Local name	Pi	log Pi	Pi.log Pi
Exocaria agallocha	Thela	0.246	-0.609	0-0.150
Sonnaratia caceolaris	Kirala	0.455	-0.342	-0.156
Cleodendrum inerme	Veraniya	0.298	-0.525	-0.156
				-0.462

Floristic diversity of tree species from coastal vegetation

(PI-Proportional abundance)

Name of species	Local name	Pi	log Pi	Pi.log Pi
Thepesia poplnea	Suriya	0.412	-0.385	-0.159
Pandanus foetidus	Wetakeiya	0.385	-0.415	-0.161
Macroptilium lathyroids	Mudu murunga	0.294	-0.385	-0.113
				-0.433

Appendix VI

Some fish species found in Kalametiya and Lunama sanctuary and their status

E - Endemic species

I - Introduced species

Family	Species	Sinhala name	Status
Anguillidae	*Anguilla biocolor*	Kalu aanda	
Anguillidae	*Anguilla nebulosa*	Polmal aanda	
Clupeidae	*Ehirava fluviatillis*		
Cyprinidae	*Amblypharyngodon melettinus*	Soreya	
Cyprinidae	*Chela laubuca*	Tatu dandiya	
Cyprinidae	*Cyprinus carpio*	Rata petiya	I
Cyprinidae	*Labeodussumieri*	Hiri kanaya	
Cyprinidae	*Labeo porcellus*	Hirikanaya	I
Cyprinidae	*Labeo rohita*		
Cyprinidae	*Puntius amphibious*	Mada ipilla	
Cyprinidae	*Puntius filamentosus*	Petiya	
Cyprinidae	*Puntius sarana*	Mas petiya	
Cyprinidae	*Tor khudree*	Lehella	
Bagridae	*Mystus gulio*	Anguluwa	
Bagridae	*Mystus keletius*	Path ankutta	
Bagridae	*Mystus vittatus*	Iri ankutta	
Siluridae	*Ompok bimaculatus*	Walapotta	
Cllariidae	*Clarias brachysoma*	Mgura	E
Heteropneustidae	*Heteropeneustes fossilis*		
Hemiramphidae	*Zenarchopterus dispar*	Morella	

Source:(CEA, 1995)

Appendix VII

Reptile species found in Kalametiya and Lunama sanctuary and their status.

Snakes

++ - Globally threatened species

\+ - Nationally threatened species

E - Endemic species

I - Introduced species

Family	Species	Sinhala name	Status
Thyplophidea	*Thyphlops spp.*	Kanaulla	E/+
Boidea	*Phytthon molurus*	Pimbara	++/+
Colubbridae	*Ptyas mucosus*	Garandiya	
Colubbridae	*Dryocalamus nympha*	Karawala	+
Colubbridae	*Oilgodon spp.*	Dathketiya	E/+
Colubbridae	*Boiga spp.*	Mapila	E/+
Colubbridae	*Dendrelaphis tristis*	Haldanda	E/+
Colubbridae	*Ahaetulla nasutus*	Ehetulla	
Colubbridae	*Ahaetulla pulverulentus*	Henakandaya	
Colubbridae	*Amphiesma stolata*	Aharakuka	
Colubbridae	*Xenochorophis piscator*	Diyanaya	E/+
Colubbridae	*Cerberus rhynchops*	Kunudiya kluwa	
Elapidea	*Bungarus caeruleus*	Thel karawela	
Elapidea	*Brungarus ceylanicus*	Madukaluwa	E/+
Elapidea	*Naja naja*	Naya	

Source:(CEA, 1995)

Tetrapodes

Family	Species	Sinhala name	Status
Dermochelidae	*Dermochelyse coriacea*	Dhara kesbewa	++/+
Chlonidae	*Lepidochelys oliviacea*	Batu kesbewa	++/+
Chlonidae	*Caretta caretta*	Olugedi kesbewa	++/+
Chlonidae	*Eretmochelys imbricata*	Potu kesbewa	++/+
Chlonidae	*Chelonia mydas*	Gal kesbewa	++/+
Emydidae	*Melanochelys trijuga*	Galibba	+
Testunidae	*Testudoelegans*	Taraka ibba	+
Trionichidae	*Lissemys punctata*	Kiri ibbaHala kimbula	+
Crocodidae	*Crocodylus palustris*	Geta kimbula	+
Crocodidae	*Crocodylus porosus*	Hala kimbula	++/+
Gekkoinidae	*Caloductylodes illingworthi*	Maha gal huna	E+
Gekkoinidae	*Crytodactylus spp.*	Huna	E
Gekkoinidae	*Hemidactylus depressus*	Hali huna	E+
Gekkoinidae	*Hemidactylus leschenaulti*	Kimbul huna	
Gekkoinidae	*Hemidactylus frenatus*	Gval huna	
Agamidae	*Calotes calotes*	Palakatussa	
Agamidae	*Calotes versicolor*	Gra katussa	
Scincidae	*Dasia heliana*	Polon heeraluwa	+
Scincidae	*Mabuya beddomii*	Vairan hikanela	
Scincidae	*Mabuya bibronii*	Le hikanela	+
Scincidae	*Mabuya carinata*	Garandi hikanela	
Varanidae	*Varanus salvator*	Kabaragoya	
Varanidae	*Varanus cepedianus*	Thalagoya	

Source:(CEA, 1995)

Appendix VIII

Bird species found in Kalametiya and Lunama sanctuary and their status.

+ -Nationally threatened species

E -Endemic species

M -Migratory species

Aq-Aquatic

R-Rare

Family	Species	Sinhala name	Status
Podicipiadea	*Podicepsruficollis*	Heengembituruwa	R/Aq
Phalacrocoracidea	*Phlacrocorax neiger*	Punchi diyakawa	R/Aq
Ardeidea	*Ardea cinerea*	Alukoka	R/AQ
Ardeidea	*Ardea pupurea*	Karavelkoka	R/AQ
Ardeidea	*Ardeola greyii*	Kanakoka	R/AQ
Ardeidea	*Bubulous ibis*	Gavakoka	R/Aq
Ardeidea	*Egretta alba*	Maha sudu koka	R/Aq
Ardeidea	*Egretta intermedia*	Sudu medi koka	R/AQ
Ardeidea	*Egretta gazetta*	Kuda ali koka	R/AQ
Ardeidea	*Ixobrichus sinesis*	Kahameti koka	R/AQ
Ardeidea	*Dupetor flavicollis*	Kalu koka	R/Aq
Ciconiidea	*Ibis leucocephalus*	Lathuvakiya	R/AQ
Ciconiidea	*Anastomus oscitanus*	Vivara tuduwa	R/AQ
Threskiornithidea	*Plegadis falcinellus*	Silutu da tuduwa	AQ/+
Threskiornithidea	*Platelea leucorodia*	Ul penda seruwa	M/AQ
Anatidea	*Dendrocygna javenica*	Handialluwa	R/AQ
Anatidea	*Anas acuta*	Mahatumba seruwa	R/AQ
Acciptridea	*Haliastur indus*	Gargeni seruwa	M/AQ
Acciptridea	*Accipiter badius*	Bamunu piyakussa	M/Aq

Acciptridea	*Spilornis cheela*	Daramudu rajaliya	R
Phasianidea	*Gallus lafayetti*	Sarapukussa	R
Phasianidea	*Pavo cristatus*	Lanka weli kukula	R/E/+
Rallidea	*Gallinula chloropus*	Monara	R
Rallidea	*Porpyrio porpyrio*	Indiyanu galinuwa	R/AQ
Jacanadea	*Hydrophasianuschirurgus*	Nil kitala	R/AQ
Charadriidea	*Vanellus indicus*	Ratukaramal kirala	R/AQ
Scolopacidea	*Tringa erythropus*	Thithrathpa silibilla	M/AQ
Scolopacidea	*Tringa totanus*	Waguru silibilla	M/AQ
Scolopacidea	*Tringa galareola*	Palpa silibilla	M/AQ
Scolopacidea	*Tringa hypoleucos*	Podu silibilla	M/AQ
Recurvirostridea	*Himantopus himantopus*	Kalu ipallawa	M/Aq
Laridea	*Larus brunnnicephalus*	Hisadumburu galuviya	M/AQ
Laridea	*Chlidonias hybrida*	Kangul lihiniya	M/AQ
Laridea	*Chlidonias leucopetra*	Kangul lihiniya	M/AQ
Laridea	*Hydroprogene caspia*	Kaspiyanjala lihiniya	M/AQ
Laridea	*Sterna albifrons*	Kuda mahuru lihiniya	M/AQ
Laridea	*Sterna bergii*	Mudu lihiniya	R/AQ
Colombidea	*Treron pompadora*	Pompadra batagoya	R
Colombidea	*Treron bisincta*	Layaranbatagoya	R
Colombidea	*Streptopelia chinensis*	Alukobeiya	R
Psittacidae	*Psittacula krameri*	Ranagirawa	R
Cuculidea	*Clamator coramandus*	Gomarakondakoha	R
Cuculidea	*Eudynamys scolopacea*	Koha	R
Cuculidea	*Centropus sinensis*	Atikukula	R
Apodidea	*Cypsiurusparvus batassiensis*	Wehilihiniya	R
Alcedinidea	*Halcyon smynensis*	Layasudupilihuduwa	R
Meropidea	*Merops orentalis*	Palawan biguharaya	R
Meropidea	*Merops leschenaulti*	Pinguishbinguharaya	R
Meropidea	*Merops philippinus*	Pendanilbinguharaya	R
Coraciidea	*Corasias bengalensis*	Dumbonna	R
Capitonidea	*Megalima zeylanica*	Poloskottoruwa	R

Picidea	*Dinopium bengalensis*	Pitaratu ratkirala	R
Hirundinidea	*Hirundo riparia*	Karawelivuru lihiniya	M
Hirundinidea	*Hirundo daurica*	Ratu kati wehilihiniya	M
Laniidea	*Lanius cristatus*	Dumburu sabaritta	M
Oriolidea	*Oriolus xanthornus*	Hisakalu kahakurulla	R
Sturnidea	*Acridotheres tristis*	Myna	R
Corvidea	*Corvus splendens*	Colomba kakka	R
Corvidea	*Corvus macrorhynchos*	Kalukaputa	R
Irenidea	*Aegithina tiphia*	Irawa	R
Pycnonitidea	*Phycnotus cafer*	Kondaya	R
Pycnonitidea	*Phycnotus luteolus*	Bamasudu kondaya	R
Muscicapidea	*Turdoides affinis*	Demaliccha	R
Muscicapidea	*Terpsiphones paradisi*	Rehenmara	M/R
Muscicapidea	*Orthotomus sutorius*	Battichcha	R
Muscicapidea	*Cosychus saularis*	Polkiccha	R
Nectariniidea	*Nectarinia zelonica*	Damkati sutikka	R
Nectariniidea	*Nectarinia lotenia*	Lotenge sutikka	R
Nectariniidea	*Nectarinia asiatica*	Dam sutikka	R
Ploceidea	*Ploceus philippinus*	Ruk wadukurulla	R
Ploceidea	*Lonchura strata*	Pitasudu weekurulla	R
Ploceidea	*Lonchura punctulata*	Tith weekurulla	R
Ploceidea	*Lonchura malcca*	Hisakalu weekurulla	R

Appendix IX

Mammal species recorded at Kalametiya sanctuary.

++ - Globally threatened species

\+ - Nationally threatened species

E - Endemic species

Family	Species name	Sinhala name	Status
Soricideae	*Crocidura sp.*	Hikmiya	E/+
Loricideae	*Loris tardigrandus*	Unahapuluwa	+
Cercopithecideae	*Macca sinica*	Rilawa	
Cercopithecideae	*Presbitis entellus*	Aluwandura	E
Canideae	*Carnis auranus*	Nariya	
Mustelideae	*Lutra lutra*	Diyaballa	+
Viverrideae	*Paradoxuruus hermaphrod*	Kalawedda	
Viverrideae	*Virrecula indica*	Urulawa	
Herpestideae	*Herpestes edwerdsi*	Alumugatiya	
Felideae	*Felis chaus*	Wal balala	+
Felideae	*Felis viverrina*	Handun balala	+
Suideae	*Sus scrofa*	Walura	
Tragulideae	*Tragulus memminna*	Meminna	+
Cervideae	*Cervus axis*	Tith muwa	
Manideae	*Manis crassicacaundata*	Kaballawa	
Sciurideae	*Funambulus plamarum*	Irilena	
Murideae	*Bandicota sp.*	Podi urumiya	E/+
Murideae	*Coelomys mayori*	Katumiya	
Murideae	*Rattus rattus*	Gemiya	
Murideae	*Vandeleuri sp.*	Gas meeya	E/+

Source:(CEA, 1995)

Appendix X

Questionnaire used for the socio-economic survey.

Social and economical data

1.Name:

2. Address:

3. Grama Niladhari Division:

4. Divisional Secretariat:

5. Age: (15-25, 26-35, 36-45, 46-55, 56-65, 66-75, >66)

5. Gender: (Male/Female)

7. Main income source: (Faming, Fishing, Shell mining, Livestock management, Permanent jobs, Other)

8.Educational level: (No schooling, Up to 5, Year 5 to O/L, O/L to A/L, >A/L)

Details of impacts to the sanctuary

1. Agricultural practices: (Chena, Rice, coconut, other)
2. Lime industry: Mining, Mining, Crushing, Wholesale, Transporting, Other)
3. Consumption of forest: (Firewood, Timber, Food, indigenous medicine)
4. Consumption of aquatic resources: (Sea, Lagoon)
5. Livestock management within the sanctuary: (Grazing, Fodder, Other)
6. Waste disposal: (Domestic waste, From tourism, Other)
7. Waste management / disposal techniques: (Burning, Composting, Disposed to the sanctuary)
8. Corporation to the tourism: (Transport, Accommodations, Supplements of food, Other)

Appendix XI

Socio-economic information of Kalametiya area

GND-Grama Niladari Division

(BS-Bata ata South, LS-Lunama South, LN-Lunama North, H-Hungama)

FMI-Family monthly income

MIS-Main income source

Mem-Family members

GND	No	Mem	Male	Female	Age	FMI	MIS	Edu
BS	1	2	1	1	5	4	5	5
BS	2	3	1	2	3	4	2.2	4
BS	3	4	3	1	2	4	2.2	3
BS	4	4	1	3	1	5	2.2	4
BS	5	4	2	2	3	4	2.2	3
BS	6	5	1	4	1	3	2.2	3
BS	7	5	2	3	6	5	2.2	1
BS	8	4	2	2	2	3	2.2	3
BS	9	4	3	1	2	4	2.2	3
BS	10	6	3	3	1	2	2.2	3
LS	11	5	3	2	4	5	1	3
LS	12	4	1	3	3	5	1	3
LS	13	5	2	3	4	2	1	3
LS	14	3	2	1	3	2	1	3
LS	15	6	4	2	4	4	6	4
LS	16	5	4	1	2	4	4	3
LS	17	4	3	1	1	3	3	4
LS	18	4	2	2	1	4	6	3
LS	19	5	3	2	3	4	3	5
LS	20	7	4	3	1	4	1	3

LN	21	3	1	2	6	5	2	4
LN	22	5	2	3	2	5	4	5
LN	23	7	3	4	4	5	4	3
LN	24	3	2	1	4	5	2	5
LN	25	4	1	2	2	5	2	3
LN	26	5	4	1	2	5	2	5
LN	27	5	2	3	2	4	5	5
LN	28	6	2	4	5	5	5	5
LN	29	1	-	1	5	1	1	1
LN	30	4	1	3	2	5	1	3
H	31	6	1	5	4	5	6	3
H	32	7	3	4	5	5	2.2	5
H	33	6	3	3	4	4	4	2
H	34	4	1	3	5	5	3	4
H	35	4	2	2	2	3	3	3
H	36	4	1	3	3	3	3	2
H	37	4	1	3	3	3	3	3
H	38	4	1	3	3	3	6	4
H	39	5	2	1	3	2	3	3
H	40	5	2	3	6	4	1	2
Ha	41	3	2	1	1	3	4	4
Ha	42	3	1	2	2	4	4	3
Ha	43	4	1	3	5	3	6	4
Ha	44	5	3	2	1	5	2.1	4
Ha	45	6	4	2	2	5	2.1	2
Ha	46	4	2	2	2	5	6	3
Ha	47	4	2	2	2	5	5	4
Ha	48	3	1	2	3	4	2.1	3
Ha	49	3	1	2	2	4	2.1	4
Ha	50	4	3	1	4	4	1	3

Age groups: 1. (15-25), 2. (26-35), 3. (36-45), 4. (46-55), 5. (56-65), 6. >60

Family monthly income (FMI): 1. (<1000), 2. (1000-2000), 3. (2000-3000), 4. (3000-4000), 5. (>4000)

Main income source (MIS): 1. Farming2. Fishing (2.1 Inland/2.2 marine), 3.Shell mining, 4.Permenent / Government jobs

Educational level (Edu.): 1.No schooling, 2.Up to 5, 3.Year 5 to O/L, 4.O/L to A/L, 5. >A/L

Appendix XII

Human interactions with the sanctuary

GND-Grama Niladari Division

(BS-Bata ata South, LS-Lunama South, LN-Lunama North, H-Hungama)

GND	No	Fire wood	Medicines	Fishery	Livestock	Waste	Food
BS	1	Y	Y	N	N	N	Y
BS	2	N	Y	N	N	N	Y
BS	3	Y	Y	Y	N	N	Y
BS	4	Y	Y	N	N	N	Y
BS	5	Y	Y	N	N	N	Y
BS	6	N	N	N	N	N	N
BS	7	N	Y	N	N	N	N
BS	8	Y	Y	N	N	N	Y
BS	9	N	Y	N	N	N	N
BS	10	Y	Y	N	N	N	Y
LS	11	Y	Y	N	N	N	Y
LS	12	N	Y	N	N	N	Y
LS	13	Y	Y	N	Y	N	Y
LS	14	N	Y	N	N	N	Y
LS	15	N	N	N	N	N	N
LS	16	Y	Y	N	N	N	N
LS	17	N	Y	N	N	N	Y
LS	18	Y	N	N	N	N	N
LS	19	Y	Y	N	N	N	N
LS	20	N	Y	N	N	N	N
Ha	21	Y	Y	N	N	N	N
Ha	22	Y	Y	N	N	N	N
Ha	23	Y	Y	N	Y	N	N

Ha	24	Y	Y	N	N	N	N
Ha	25	N	N	N	N	N	N
Ha	26	Y	Y	N	N	N	N
Ha	27	Y	Y	N	N	N	N
Ha	28	N	Y	N	N	N	Y
Ha	29	Y	Y	N	N	N	Y
Ha	30	Y	Y	N	N	N	N
H	31	N	Y	N	Y	N	N
H	32	N	Y	N	Y	N	Y
H	33	N	Y	N	N	N	Y
H	34	N	N	N	N	N	N
H	35	N	Y	Y	N	N	Y
H	36	N	Y	Y	N	N	Y
H	37	N	N	N	N	N	N
H	38	N	N	N	N	N	N
H	39	N	Y	Y	N	N	Y
H	40	N	Y	Y	N	N	Y

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