

STATISTICAL ANALYSIS OF BIODIVERSITY INFORMATION

April 2017





Enhancing Biodiversity Conservation and Sustenance of Ecosystem Services in Environmentally Sensitive Areas (ESA) Project

BIODIVERSITY BASELINE SURVEY FOR THE ESA PROJECT

STATISTICAL ANALYSIS

April 2017

CONTENTS

1.0 FLORA DIVERSITY ANALYSIS	8
1.1 HABITAT HETEROGENEITY	8
1.1.1 Dry Mixed Evergreen Forests	8
4.2.2 Disturbed forests	8
4.2.3 Scrub forests	8
4.2.4 Tank associated habitats	9
4.2.5 Coastal habitats	9
4.2.6 Chena and associated habitats	9
4.4 SPECIES DIVERSITY	9
5.0 HERPETOFAUNA DIVERSITY ANALYSIS	16
5.2.3 Species Diversity	16
5.2.4 Species status and their conservation status	16
5.3 HERPETOFAUNA DIVERSITY IN KALA OYA RIVER SUB-BASIN AREAS AND ITS IMPORTANCE	17
5.3.1 Eile area	17
5.3.2 Eluwankulama	18
5.3.3 Suduweli Tahala-Morapathana	18
5.3.4 Weerakkodichole- Thabbowa	18
5.3.5 Horiwila-Ambagahawewa	18
5.3.6 Galpaya-Hinguruwelpitiya-Ranva Kannda-Nambatiwewa	18
5.3.7 Manawa	18
5.3.8 Wilpaththu National Park	19
5.4 HABITAT HETEROGENEITY, SPECIES DIVERSITY AND DISTRIBUTION	19
6.0 AVIFAUNA DIVERSITY ANALYSIS.....	20
6.3 RESULTS	20
6.3.2 Diversity within Habitats	20
6.3.3 Avifaunal Diversity within the Eight Sub-Basins	21
7.0 MAMMAL DIVERSITY ANALYSIS	24
7.3 RESULTS	24
7.3.1 Diversity within Habitats	24
8.0 FRESHWATER FAUNA AND FLORA DIVERSITY ANALYSIS	29
RESULTS	29
SAMPLING STATIONS AND RECORDED MANGROVE SPECIES	31
Location 01	31
Location 02	33
Location 03	34



Location 04	35
Location 05	36
Location 06	37
Location 07	39
Location 08	40
Location 09	42
Location 10	44
Location 11	45
Location 12	46
9.0 BUTTERFLY DIVERSITY ANALYSIS	47
A. Eile area sub basin (Transect 1, 2, 3, 4).....	48
B. Eluwankulama sub basin (Transect 5 and 6).....	49
C. Suduweli Tahalawa, Morapathana sub basin (Transects 7 and 8)	51
D. Weerakkodichole, Tahabbbowa sub basin (Transect 9, 10)	51
E. Horiwila / Ambagahawewa sub basin (Transect 11 and 12).....	52
F. Galpaya Hinguruwelpitiya Ranva kannda, Nambatiwewa, sub basin (Transect 13, 14, 15, 16)	53
G. Manawa area sub basin (Transect 17, 18 19 20,).....	55
H. Wilpattu NP area, sub basin (Thelbipuwewa) (Transect 22, 23, 24).....	58
10.0 DRAGONFLY DIVERSITY ANALYSIS	60
10.4 RESULTS.....	60
10.3.1 Species distribution according to the sub-basin/cluster level.....	60
11.0 MARINE FLORA AND FAUNA DIVERSITY ANALYSIS	68
11.2 BAR REEF AND REEF HABITATS	68
11.3.1 Fish and Invertebrate counts.....	70
11.4 SAMPLING SITES	72
11.5 MARINE FAUNA RECORDED IN KALPITIYA SEA AREA	74
11.6 MARINE FLORA RECORDED IN KALPITIYA SEA AREA	74
11.6.1 Sampling methodology for marine fauna	75
11.6.2 Marine fauna sampling results	75
CRITICAL SPECIES.....	80



Acronyms

BR	Breeding Resident
BS	Biodiversity Secretariat
BBS	Biodiversity Baseline Survey
CAH	Chena & Associating Habitats
CH	Coastal Habitat
CR	Critically Endangered
CR (PE)	Critically Endangered Possibly Extinct
DD	Data Deficient
DF	Disturbed Forest
<i>DMEF</i>	<i>Dry Mixed Evergreen Forests;</i>
DS	District Secretariat
E	Endemic
EN	Endangered
ESA	Environmentally Sensitive Areas
GEF	Global Environment Facility
GIS	Geographic Information Systems
IAS	Invasive Alien Species
IBA	Important Bird Area
KOB	Kala Oya Basin
LC	Least Concern
LUPPD	Land Use Policy Planning Department -Sri Lanka
MMDE	Ministry of Mahaweli Development and Environment
M	Migrant
NT	Near Threatened
PMU	Project Management Unit
SF	Scrub Forest
TAH	Tank Associate Habitat
TOR	Terms of Reference
UM	Uncertain Migrant
UNDP	United Nations Development Programme
VCPs	Variable Circular Plots
VU	Vulnerable
PMU	Project Management Unit
MASL	Mahaweli Authority of Sri Lanka



List of Tables

Table 1 Number of species represented by each family in Kala Oya Basin	9
Table 2 Number of species belonging to each conservation category	10
Table 3 : Threatened and data deficient plant species surveyed in KOB	10
Table 4 Endemic plant species found in Kala Oya Basin	12
Table 5 Plant diversity indices for different habitats	13
Table 6 Most abundant woody plant species within Kala Oya Basin	14
Table 7 Most abundant woody plant species within each habitat	14
Table 8 Number of species in transects	14
Table 9 Status of the herpetofauna recorded in the Kala Oya river basin.....	16
Table 10 Distribution of amphibian species in Kala Oya river sub basins and their species status and conservation status according to the IUCN red list 2012.....	17
Table 11 Distribution of reptiles’ species in Kala Oya River sub basins and their species status and conservation status according to the IUCN red list 2012	17
Table 12 Avifaunal diversity within the transects	20
Table 13 Summary information for Sub-basins	21
Table 14 Observed fauna in different localities of Kala oya Basin.....	24
Table 15 Status of the Identified Species at Kala Oya Basin	26
Table 16 Distribution of Mammalian Fauna in an identified six habitats at Kala Oya Basin	26
Table 17 True mangrove species recorded from the area	29
Table 18 The checklist of mangrove associate species and other plant species recorded from Kala Oya-Pomparippu area	30
Table 19 Recorded true mangrove and mangrove associate species (Transect – 50 m to the forest)	31
Table 20 Densities of true mangrove and mangrove associate species in each transect	32
Table 21 Species Richness Indices (L 1).....	32
Table 22: Recorded True mangrove and mangrove associate species (Transect – 100 m to the forest).....	33
Table 23: Densities of true mangrove and mangrove associate species in each transect	33
Table 24 Species Richness Indices (L 2).....	33
Table 25 Recorded True mangrove and mangrove associate species (Transect – 100 m to the forest).....	34
Table 26 Densities of true mangrove and mangrove associate species in each transect	34
Table 27 Species Richness Indices (L 3).....	34
Table 28 Recorded true mangrove and mangrove associate species (Transect – 150 m to the forest)	35
Table 29 Densities of true mangrove and mangrove associate species in each transect	35
Table 30 Species Richness Indices (L 4).....	35
Table 31 Recorded true mangrove and mangrove associate species (Transect – 100 m to the forest)	36
Table 32 Densities of true mangrove and mangrove associate species in each transect	36
Table 33 Species Richness Indices (L 5).....	36



Table 34 Recorded true mangrove and mangrove associate species (Transect – 285 m to the forest)	37
Table 35 Densities of true mangrove and mangrove associate species in each transect	37
Table 36 Species Richness Indices (L 6)	38
Table 37 Recorded true mangrove and mangrove associate species (Transect – 50 m to the forest)	39
Table 38 Densities of true mangrove and mangrove associate species in each transect	39
Table 39 Species Richness Indices (L 7)	39
Table 40 Recorded true mangrove and mangrove associate species (Transect – 50 m to the forest)	40
Table 41 Densities of true mangrove and mangrove associate species in each transect	40
Table 42 Species Richness Indices (L 8)	41
Table 43 Recorded true mangrove and mangrove associate species (Transect – 100 m to the forest)	42
Table 44 Densities of true mangrove and mangrove associate species in each transect	42
Table 45 Species Richness Indices (L 9)	43
Table 46 Recorded true mangrove and mangrove associate species (Transect – 50 m to the forest)	44
Table 47 Densities of true mangrove and mangrove associate species in each transect	44
Table 48 Species Richness Indices (L 10)	44
Table 49 Recorded true mangrove and mangrove associate species (Transect – 50 m to the forest)	45
Table 50 Densities of true mangrove and mangrove associate species in each transect	45
Table 51 Species Richness Indices (L 11)	45
Table 52 Recorded true mangrove and mangrove associate species (Transect – 50 m to the forest)	46
Table 53 Densities of true mangrove and mangrove associate species in each transect	46
Table 54 Species Richness Indices (L 12)	46
Table 55 Endemic butterfly species found in transects surveyed	47
Table 56 Nationally threatened species found in transects	48
Table 57 List of Butterfly species recorded from the Eile area (Transects 1,2,3,4,) and their status and population density (m ²)	48
Table 58 List of butterfly species recorded from the Eluwankulama area (Transect 5 and 6)	50
Table 59 List of butterfly species recorded from the Suduweli Tahalawa, Morapathana area (Transect 7 and 8) with their status and population density (m ²)	51
Table 60 List of butterfly species recorded from Werakkodichole, Tahabbbowa area (Transect 9 and 10) with their status and population density (m ²)	52
Table 61 List of butterfly species recorded from Horiwila/ Ambagahawewa (Transect 11 and 12) with their status and Population density (m ²)	53
Table 62 List of butterfly species recorded from Galpaya, Hinguruwelpitiya, Ranva kannda, Nambatiwewa (Transect 13, 14, 15, and 16) with their status and Population density (m ²)	54
Table 63 List of butterfly species recorded from the Manawa area (Transect 17, 18, 19, and 20) with their status and population density (m ²)	55
Table 64 List of butterfly species recorded from Wilpattu NP area (Transect 21, 22,23, and 24) with their status and population density (m ²)	58



Table 65 Species richness and diversity of butterflies in different sub basin in the Kala Oya river basin	59
Table 66 Species abundance in the sub-basins of Kala Oya Basin	63
Table 67 Species density (m ²).....	65
Table 68 Checklist of Odonate species previously recorded but were not observed during the survey	67
Table 69 Areas with a high dragonfly/ damselfly species richness and their corresponding species richness	67
Table 70 Shannon’s Wiener diversity index for coral reef sample sites	70
Table 71 Shannon’s Wiener diversity index for Sea grass sample sites	79
Table 72 No of Critical Species in Each Habiatat Cluster or Sub Basin (No of Species in each Habiat)	80



List of Figures

Figure 1 Herpetofauna diversity in Kala Oya River Basin	16
Figure 2 Herpetofauna diversity vs habitat in Kala Oya River basin	19
Figure 3 Mammalian Distribution in different habitat types within the Kala Oya Localities (Habitat Types: P = Dry Mixed Evergreen Forest, Q= Disturbed, R= Scrub forest, S= Tank associate habitat, T= Coastal Habitat, U= Chena & associating habitats).....	27
Figure 4 Status of Identified Mammals at Kala Oya basin localities	28
Figure 5 Number of species representing different families	61
Figure 6 Conservation status of Odonata species based on IUCN Red List 2012	62
Figure 7 Species richness and diversity index values (Shannon–Wiener diversity index $S = -\sum (P_i \ln P_i)$) in each sub basin.....	62
Figure 8 Substrate compositions of sample sites	70
Figure 9 Fish and Benthic Invertebrate Belt counts at survey sites	71
Figure 10 Percentage algal cover and herbivores on transects.....	72
Figure 11 Non-metric multidimensional scaling ordination for seagrass sampling sites	75
Figure 12 Seagrass species compositions in samples areas	79



1.0 FLORA DIVERSITY ANALYSIS

1.1 Habitat heterogeneity

The surveyed area of the Kala Oya basin lies completely within the dry zone of the country. Though the area surveyed belongs to a single climatic zone, floristic species and their composition gradually changes along the river basin even within the same habitat type. Forests were taller and denser upstream of the basin. A total of 96 quadrats distributed among six major habitat types were sampled.

1.1.1 Dry Mixed Evergreen Forests

This was the most frequently encountered habitat type during this survey, found in a total of 41 quadrats in varying locations (42.7% of the total). The canopy cover, ranging between 50-90%, had an average of 73.34% for this type of habitat. The average canopy height varied between 10m to 15m while some emergent trees appeared sporadically. Canopy cover as well as the canopy height gradually increased towards upstream areas of the main river catchment. Under-shrubs and ground vegetation was usually less with ground cover almost consisting of only leaf litter in some quadrats (17C, 17D). Occasionally woody lianas were found which reached up to the canopy.

4.2.2 Disturbed forests

Only 8 quadrates of disturbed forests were sampled during the survey. Clear distinction between this forest type and the previous type was quite hard to be determined since almost all forests were disturbed to at least a small degree. These quadrats were considered as disturbed forests considering the overall appearance of the habitat. The canopy cover of this habitat, which ranged from 40% to 75%, averaged at 65.60%. The average height of the canopy ranged between 5m to 10m with some emergent trees of *Manilkara hexandra*. Some trees were covered with non-woody lianas. Lower vegetation was denser than in the previous habitat type and no distinct stratification were found. Ground layer was more exposed to sunlight and some areas were covered with grasses and small sun-loving herbs.

4.2.3 Scrub forests

18 quadrates surveyed belonged to this habitat type. Most of these habitats were regenerating eco-systems which were heavily disturbed by anthropogenic activities. Few other scrub forest quadrats appeared to be natural and were found in and around rocky outcrops. These outcrops were not much elevated above the existing ground level (i.e. not outcrops in hill tops). The soil layer was very thin in these quadrats.

A special microhabitat was found in quadrats 6A, 6B, 6C and 6D - a sand dune situated a considerable distance from the sea. Some unique plant species were found in this location. Generally, the canopy level of this main habitat varied between 4m to 8m, but there were some trees reaching up to 12m-15m in regenerating eco-systems. In natural scrub forests, the canopy level was low and scrubs appeared sparsely than in regenerating eco-systems. The canopy cover of this habitat type which varied between 10% to 60%, averaged at 32.9%. Most of the plants found in this habitat were thorny shrubs which were entangled in each other and overlaid by



various species of lianas. Scrubs covered the entire strata from its top to the ground level by their branches. In the remaining ground, various species of herbs and grasses were found.

4.2.4 Tank associated habitats

Altogether 16 quadrats were surveyed and it was found that the average canopy cover of this habitat was 40.1%. It varied between 10% and 80% with lesser values being found in tank downstream sections. Canopy height varied between 5m to 15m depending on the quadrat.

4.2.5 Coastal habitats

Only 4 quadrats of coastal habitats were surveyed. Two of them were saltwater marshes and the other two were a mixture of saltwater marsh and mangrove. In the two saltwater marshes, canopy cover was zero as they had no tree species. Although the number of species found in this habitat was very low, plants that were found were unique to this habitat.

4.2.6 Chena and associated habitats

This was a highly disturbed habitat, which was cleared for Chena cultivation. Chena is cultivation practices that clears the forest and cultivate for 3-4 seasons and then again abandons it allow regeneration of the forest. Only one season per year is available for these farms since its water requirement depends directly on the Northeast monsoonal rains. After the harvesting, which takes place between February–March, the remaining crops are left idle and serves as a good food source for some wild animals such as elephants. Abandoned Chena and its marginal vegetation were assessed in this survey in 9 quadrats. Working Chena was not selected as quadrats.

Canopy cover of this habitat which varied from 5% to 40% averaged at 26.9%. There were no distinct canopy trees except remnants of the destroyed forest, which were used as shading trees during cultivation.

4.4 Species Diversity

A total of 609 species belonging to 107 families (Table 1) were recorded during this survey (Please refer to Report on ‘Database for Habitat Monitoring’ for a list of all species that were surveyed during this BBS. The highest number of species were reported from the family Fabaceae while Malvaceae and Acanthaceae were the second and third highest. 42 families were represented by only one species and another 16 families were represented by only two species. The top 15 families have been given below.

Table 1 Number of species represented by each family in Kala Oya Basin

Rank	Family	No. of species
1	Fabaceae	82
2	Malvaceae	41
3	Acanthaceae	29
4	Asteraceae	27
5	Euphorbiaceae	26
6	Rubiaceae	26
7	Cyperaceae	24



Rank	Family	No. of species
8	Lamiaceae	20
9	Amaranthaceae	17
10	Convolvulaceae	17
11	Phyllanthaceae	16
12	Apocynaceae	14
13	Rutaceae	14
14	Boraginaceae	11
15	Commelinaceae	11

511 species of the total reported plants (83.91%) are native to Sri Lanka while a further 26 species (4.27%) are endemic. 72 species (11.82%) are exotic species where most of them have naturalized in Sri Lankan eco-systems. Very few species of these exotics were cultivated species, which were recorded only when they were present in a considerable extent of the surveyed quadrats.

Among the indigenous plants, 61 species reported in KOB are considered as ‘threatened’ species by Red Data List - 2012. A summary of the conservation statuses of the species recorded can be found in Table 2 below.

Table 2 Number of species belonging to each conservation category

Conservation Status Red Data List - 2012	No. of species
CR(PE) ¹	1
CR ²	3
EN ³	15
VU ⁴	42
NT ⁵	63
LC ⁶	403
NE ⁷	3
DD ⁸	7

¹CR(PE) – Critically Endangered (Possibly Extinct); ²CR – Critically Endangered; ³EN – Endangered; ⁴VU – Vulnerable; ⁵NT – Near threatened; ⁶LC – Least Concerned; ⁷NE – Not Evaluated; ⁸DD – Data Deficient

Species belonging to CR(PE), CR, EN and DD categories have been given below .

Table 3 : Threatened and data deficient plant species surveyed in KOB

Family	Species	Common Name	Distribution Status	Conservation Status
Malvaceae	<i>Hibiscus panduriformis</i> Burm.f.		Native	CR(PE)
Amaranthaceae	<i>Aerva javanica</i> (Brum. f.) Juss. ex Schult.	පොල්කුඩු පලා, පොල්පලා	Native	CR
Fabaceae	<i>Macrotyloma axillare</i> (E. Meyer) Verdc.		Native	CR



Family	Species	Common Name	Distribution Status	Conservation Status
Phyllanthaceae	<i>Sauropus quadrangularis</i> (Willd.) Müll.Arg.		Native	CR
Acanthaceae	<i>Hygrophila polysperma</i> (Roxb.) T.Anderson		Native	EN
Acanthaceae	<i>Monothecium aristatum</i> (Nees) T. Anderson		Native	EN
Amaranthaceae	<i>Achyranthes diandra</i> Roxb.		Endemic	EN
Cyperaceae	<i>Cyperus cephalotes</i> Vahl		Native	EN
Cyperaceae	<i>Cyperus clarkei</i> T. Cooke		Native	EN
Dioscoreaceae	<i>Dioscorea trimenii</i> Prain & Bukill	දෙහිය අල	Endemic	EN
Ebenaceae	<i>Diospyros ebenum</i> J.Koenig ex Retz.	කළුවර	Native	EN
Euphorbiaceae	<i>Croton caudatus</i> Geiseler	වැල් කැප්පෙටියා	Native	EN
Fabaceae	<i>Ormocarpum sennoides</i> (Willd.) Brenan & J. Leonard	සුදු අවරිය	Native	EN
Fabaceae	<i>Teramnus mollis</i> Benth.	වල් කොල්ලු	Native	EN
Fabaceae	<i>Vigna aconitifolia</i> (Jacq.) Marechal	මකුශ්ඵ	Native	EN
Malvaceae	<i>Abutilon subumbellatum</i> Philcox		Endemic	EN
Rubiaceae	<i>Diyaminauclea zeylanica</i> (Hook.f.) Ridsdale	දිය මී	Endemic	EN
Rubiaceae	<i>Oldenlandia ovatifolia</i> (Cav.) DC.		Native	EN
Vitaceae	<i>Cissus adnata</i> Roxb.		Native	EN
Fabaceae	<i>Alysicarpus bupleurifolius</i> (L.) DC.		Native	DD
Fabaceae	<i>Alysicarpus monilifer</i> (L.) DC.		Native	DD
Fabaceae	<i>Alysicarpus scariosus</i> (Spreng.) Thwaites		Native	DD
Fabaceae	<i>Crotalaria juncea</i> L.	හණ	Native	DD
Hydrocharitaceae (previously under Najadaceae)	<i>Najas marina</i> L.		Native	DD
Menispermaceae	<i>Tinospora sinensis</i> (Lour.) Merr.	බු කිඳ, වල් කිඳ, රස	Native	DD



Family	Species	Common Name	Distribution Status	Conservation Status
Solanaceae	<i>Physalis minima</i> L.	කීද හීන් මොව්ව, ලිං මොව්ව, නළල් මොව්ව	Native	DD

Table 4 Endemic plant species found in Kala Oya Basin

Family	Species	Common Name	Conservation Status
Acanthaceae	<i>Dicliptera neesii</i> (Trimen) L.H. Cramer		NT
Acanthaceae	<i>Rhinacanthus flavovirens</i> Amaras. & Wijes.	අනිච්ච	VU
Acanthaceae	<i>Rhinacanthus polonnaruwensis</i> L.H. Cramer		LC
Achariaceae	<i>Hydnocarpus venenata</i> Gaertn.	මකුළු, මකුල, මකුල්ල, මකිටිය	LC
Amaranthaceae	<i>Achyranthes diandra</i> Roxb.		EN
Annonaceae	<i>Uvaria sphenocarpa</i> Hook. f. & Thomson		LC
Asteraceae	<i>Vernonia zeylanicum</i> (L.) Less.	හීන් බෝටිය, පුපුල, වල් පුපුල	LC
Celastraceae	<i>Cassine balae</i> Kosterm.	තරළ	LC
Commelinaceae	<i>Murdannia spirata</i> (L.) G.Brückn.		LC
Dioscoreaceae	<i>Dioscorea trimenii</i> Prain & Bukill	දෙහිය අල	EN
Euphorbiaceae	<i>Mallotus eriocarpus</i> (Thwaites) Müll. Arg.	බුළු පෙන්න, වැල් කැප්පෙටියා	LC
Fabaceae	<i>Derris parviflora</i> Benth.	කල වැල්, සුදු කල වැල්	LC
Fabaceae	<i>Painteria nitida</i> (Vahl) Kosterm.	දිය මාර	VU
Lamiaceae	<i>Premna procumbens</i> Moon	ලේ කොළ පලා	LC
Loganiaceae	<i>Strychnos benthami</i> C.B. Clarke		NT
Loranthaceae	<i>Dendrophthoe ligulatus</i> (Thwaites) Tiegh.		VU
Malvaceae	<i>Abutilon subumbellatum</i> Philcox		EN
Malvaceae	<i>Diplodiscus verrucosus</i> (Thwaites) Kosterm.	දික්වැන්න, දික් ඇන්ද	LC
Malvaceae	<i>Triumfetta glabra</i> Spreng.		VU
Melastomataceae	<i>Memecylon capitellatum</i> L.	දැඳි කහ, දොඩන්කහ, වැල්	LC

STATISTICAL ANALYSIS OF BIODIVERSITY



Family	Species	Common Name	Conservation Status
		කහ, වැලි කහ, ඉදල් ගහ, අඳුන්, කායම්	
Oleaceae	<i>Chionanthus albidiflorus</i> Thwaites	අඹුල් කොරකහ, තක්කඩ ගස්	VU
Putranjivaceae	<i>Drypetes gardneri</i> (Thwaites) Pax & Hoffm.	ගල් වීර, ඇට වීර, යකිල්ද	NT
Rubiaceae	<i>Diyaminauclea zeylanica</i> (Hook.f.) Ridsdale	දිය මී	EN
Rubiaceae	<i>Pavetta gleniei</i> Thwaites ex Hook.f.	ගල් හැඹුල්ල, එළ තෙරන	NT
Rutaceae	<i>Micromelum minutum</i> Wight & Arn.	වල් කරපිංචා	LC
Rutaceae	<i>Murraya gleniei</i> Thwaites ex Oliv.		NT

A total of 4,139 plants were measured in 4.8 hectares (96 100m×5m quadrats) during this survey. All species diversity calculations were done using these measured trees. A summary of the diversity calculations has been given in the following table (Table 5).

Table 5 Plant diversity indices for different habitats

Habitat type	Total	DME Forest	Disturbed Forest	Scrub Forest	Tank associated habitats	Coastal habitats	Chena & associated
No. of quadrats	96	41	8	18	16	4	9
Species Richness [s] (including non-woody species)	609	388	227	340	349	42	246
Species Richness [s] (only woody species)	149	116	62	74	53	5	47
Shannon Entropy [exp(H)]	5.75	5.26	4.96	5.07	4.24	1.65	4.65
Simpson's Index of Diversity [1-D]	0.96	0.94	0.94	0.95	0.90	0.64	0.94
Simpson's Reciprocal Index [1/D]	26.82	17.47	18.11	19.71	10.49	2.75	15.61
Chao 2 Estimator [S2]	151.97	120.00	66.84	81.67	58.06	14.00	51.98

The most abundant woody plant species within the surveyed area was *Drypetes sepiaria*. 86.8% of these plants were reported in dry mixed evergreen forest habitats while 10.6% was reported in scrub forests. Interestingly, only 5 plants were reported in disturbed forests. The top 20 abundant species have been given below in Table 6.



Table 6 Most abundant woody plant species within Kala Oya Basin

Rank	Family	Species	No. of trees
1	Putranjivaceae	<i>Drypetes sepiaria</i>	537
2	Picrodendraceae	<i>Mischodon zeylanicus</i>	382
3	Euphorbiaceae	<i>Mallotus eriocarpus</i>	152
4	Ebenaceae	<i>Diospyros ovalifolia</i>	138
5	Combretaceae	<i>Terminalia arjuna</i>	137
6	Rubiaceae	<i>Psydrax dicoccos</i>	118
7	Fabaceae	<i>Bauhinia racemosa</i>	113
8	Rubiaceae	<i>Mitragyna parvifolia</i>	98
9	Lamiaceae	<i>Vitex leucoxylon</i>	91
10	Malvaceae	<i>Grewia helicterifolia</i>	90
11	Malvaceae	<i>Grewia damine</i>	89
12	Meliaceae	<i>Azadirachta indica</i>	83
13	Fabaceae	<i>Dichrostachys cinerea</i>	78
14	Sapindaceae	<i>Lepisanthes senegalensis</i>	77
15	Euphorbiaceae	<i>Mallotus philippensis</i>	65
16	Sapotaceae	<i>Manilkara hexandra</i>	65
17	Rutaceae	<i>Limonia acidissima</i>	63
18	Ebenaceae	<i>Diospyros vera</i>	59
19	Malvaceae	<i>Diplodiscus verrucosus</i>	59
20	Euphorbiaceae	<i>Excoecaria agallocha</i>	55

Table 7 Most abundant woody plant species within each habitat

Habitat type	Most abundant species	No. of trees
DME forest	<i>Drypetes sepiaria</i>	466
Disturbed forest	<i>Grewia damine</i>	61
Scrub forest	<i>Mischodon zeylanicus</i>	83
Tank associated habitats	<i>Terminalia arjuna</i>	82
Coastal habitats	<i>Avicennia marina</i>	25
Chena & associated habitats	<i>Bauhinia racemosa</i>	32

The following is the ranking of transects for the most number of species recorded during the survey (Table 8). This includes both woody and non-woody species.

Table 8 Number of species in transects

Rank	Transect number	Number of species
1	5	174
2	14	168
3	2	167
4	18	165
5	10	156
6	11	152
7	21	150



Rank	Transect number	Number of species
8	9	147
9	15	143
10	22	135
11	6	134
12	8	134
13	12	127
14	17	123
15	1	122
16	7	117
17	19	113
18	3	110
19	20	104
20	16	100
21	24	90
22	13	81
23	23	64
24	4	41



5.0 HERPETOFAUNA DIVERSITY ANALYSIS

5.2.3 Species Diversity

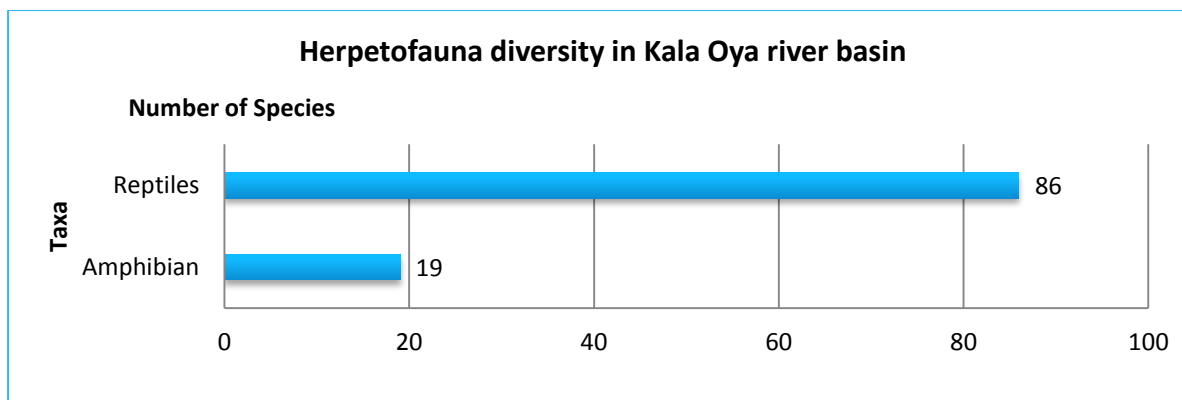


Figure 1 Herpetofauna diversity in Kala Oya River Basin

Nineteen species of amphibian species recorded and which included 5 families (Bufonidae, Microhylidae, Dicroglossidae, Rhacophoridae and Ranidae) and 12 genera (*Duttaphrynus*, *Kaloula*, *Microhyla*, *Ramanella*, *Uperodon*, *Euphlyctis*, *Zakerana*, *Hoplobatrachus*, *Sphaerotheca*, *Pseudophilautus*, *Polypedates* and *Hylarana*) (Figure 1).

Eighty six species of reptiles were recorded in the Kala Oya basin. Out of the 86 species of reptiles recorded 38 were tetrapod reptiles and 48 were snakes. All recorded reptile species were belongs to 20 families and 59 genera.

5.2.4 Species status and their conservation status

Within the sampling period in Kala Oya River basing it found 4 & 20 amphibian and reptiles endemic species respectively, as well as other species were indigenous. Nine endangered and 01 Critically Endangered reptile species were recorded.

Table 9 Status of the herpetofauna recorded in the Kala Oya river basin

Taxa	Species Status		Conservation Status					
	Endemic	Indigenous	NT	LC	VU	DD	EN	CR
Amphibian	4	15	1	15	0	2	0	0
Reptiles	20	66	11	53	10	1	9	1

Note: EN-Endemic, IN-Indigenous, NT-Near Threatened, LC- Least Concern, VU-Vulnerable, DD-Data Deficient, EN- Endangered, CR-Critically Endangered.

Considering amphibian species diversity recorded in the 8 sub basing regions Eile area, Horiwila-Ambagahawewa and Manawa areas recorded high diversity (Table 10) and generally reptiles diversity were high is 7 areas except Eluwankulama (Table 11).



Table 10 Distribution of amphibian species in Kala Oya river sub basins and their species status and conservation status according to the IUCN red list 2012

Sub-basin	# of habitat types	# Species & status		Conservation Status					
		Amphibian	Status	NT	LC	VU	DD	EN	CR
Eile area	4	18	EN 4, IN14	1	14	1	2	0	0
Eluwankulama	3	16	EN 3, IN13	1	13	0	2	0	0
Suduweli Tahala, Morapathana	1	10	EN 3, IN7	1	8	0	1	0	0
Werakkodichole, Thabbowa	4	9	EN 2, IN7	1	6	1	1	0	0
Horiwila, Ambagahawewa	4	18	EN 4, IN14	1	15	1	2	0	0
Galpaya Hinguruwelpitiya	5	12	EN 2, IN10	1	9	1	1	0	0
Ranva kannda, Nambatiwewa									
Manawa	4	18	EN 4, IN14	1	14	1	2	0	0
Wilpattu NP	3	13	EN 4, IN09	1	11	0	1	0	0

Note: EN-Endemic, IN-Indigenous, NT-Near Threatened, LC- Least Concern, VU-Vulnerable, DD-Data Deficient, EN- Endangered, CR-Critically Endangered.

Table 11 Distribution of reptiles' species in Kala Oya River sub basins and their species status and conservation status according to the IUCN red list 2012

Sub-basin	# of habitat types	# Species & status		Conservation Status					
		Reptiles	Status	NT	LC	VU	DD	EN	CR
Eile area	4	43	EN 7, IN36	5	29	6	0	3	0
Eluwankulama	3	19	EN 3, IN16	3	14	0	0	2	0
Suduweli Tahala, Morapathana	1	43	EN 10, IN31	8	27	6	0	1	1
Werakkodichole, Thabbowa	4	39	EN 13, IN26	4	28	4	0	2	1
Horiwila, Ambagahawewa	4	31	EN 8, IN23	5	23	3	0	0	0
Galpaya	5	45	EN 14, IN31	8	30	5	0	1	1
Hinguruwelpitiya, Ranva kannda, Nambatiwewa									
Manawa	4	57	EN 19, IN38	10	37	7	0	2	1
Wilpattu NP	3	49	EN 16, IN33	7	29	8	0	4	1

Note: EN-Endemic, IN-Indigenous, NT-Near Threatened, LC- Least Concern, VU-Vulnerable, DD-Data Deficient, EN- Endangered, CR-Critically Endangered.

5.3 Herpetofauna diversity in Kala Oya river sub-basin areas and its importance

5.3.1 Eile area

The area is located at the end of the Kala Oya river basin which meets the Indian Ocean. Generally it is comprised of 4 major ecosystem types; Dry Mixed Evergreen Forest, Scrub Forest, Tank Associate Habitats and Coastal Habitats. A total of 61 herpetofauna species were recorded (Table 03 & 04) among them 11 species were endemic to the area. The major threats to the herpetofauna were identified as vegetation clearing for Chena cultivation, sand mining, limestone mining and cattle farming.



5.3.2 Eluwankulama

Comparatively this area was highly modified by human activities such as cashew, coconut plantations and paddy cultivations. But mainly 3 ecosystem types were found; Dry Mixed Evergreen Forest, Scrub Forest and Tank Associate Habitats. Out of 35 species of herpetofauna found 6 species were endemic to the area. The main threat to the herpetofauna in the area is clearing of natural vegetation, as this leads to loss of amphibian and reptiles micro habitat in main ecosystems.

5.3.3 Suduweli Tahala-Morapathana

53 herpetofauna species were recorded in this sub basin area and it included the endangered skink species *Eutropis beddomii* (Beddome's skink) and critically endangered skink species *Nessia hickanala* (Shark-headed Snake Skink) in transect number 8A and 7C respectively (Table 03 & 04). Therefore conservation of these habitats should be of high concern. The main threat to these populations is the loss of micro habitat by clearing of forest for Chena cultivations.

5.3.4 Weerakkodichole- Thabbowa

48 herpetofauna species were recorded in this area and it included 2 endangered species; *Cnemaspis kumarasinghei* (Kumarasinghe's day gecko), *Eutropis beddomii* and 1 critically endangered *Nessia hickanala* (Table 03 & 04). Those species were recorded in the transect 9C and 10C which were located in the eco tone of the dry mixed evergreen forest. This indicates that the protection of the forest is very important as these species are roaming to the edge of the ecosystem. These areas are legally protected by Thabbowa sanctuary but illegal Chena cultivations were observed during surveying.

5.3.5 Horiwila-Ambagahawewa

The area is surrounded by the agricultural lands and it is highly disturbed by the human movement. But some of the isolated forest patches were observed and in this forested areas 49 herpetofauna species were found which it included 12 endemics. Conservation of these areas will be helpful to protect *Geochelone elegans* (Indian star tortoise) population as they preferred vegetation types existed among the forest patches.

5.3.6 Galpaya-Hinguruwelpitiya-Ranva Kannda-Nambatiwewa

Hilly isolated forest patches is found in this sub-region and its included 5 ecosystems types which harbors 57 herpetofauna species. It included 16 species of amphibians (2) and reptiles (14). This included 1 endangered species of skink *Eutropis beddomii*, and 1 critically endangered *Nessia hickanala*. These rocky habitats make some of the best habitats for skink and gecko species that live in this sub basin. Unfortunately these rocky habitats were being destroyed by quarry activities even during the survey period.

5.3.7 Manawa

A total of 75 herpetofauna species were recorded in this sub region. It comprised of 4 and 19 amphibian and reptile species respectively. It included 2 endangered species, a gecko- *Cnemaspis kumarasinghei*, a skink- *Eutropis beddomii* and 1 critically endangered *Nessia hickanala*. There is a high diversity of herpetofauna concentrated in four types of eco systems in the area.



5.3.8 Wilpaththu National Park

In Wilpaththu national park sub-region area, the species diversity comprised of 62 species of herpetofauna which included 4 amphibians and 16 reptile species. It included 4 endangered species, a gecko- *Cnemaspis kumarasinghei*, a skink- *Eutropis beddomii*, a Chameleon- *Chamaeleo zeylanicus* (Indian chameleon), a crocodile- *Crocodylus porosus* (Estuarine crocodile) and 1 critically endangered *Nessia hickanala*.

5.4 Habitat heterogeneity, species diversity and distribution

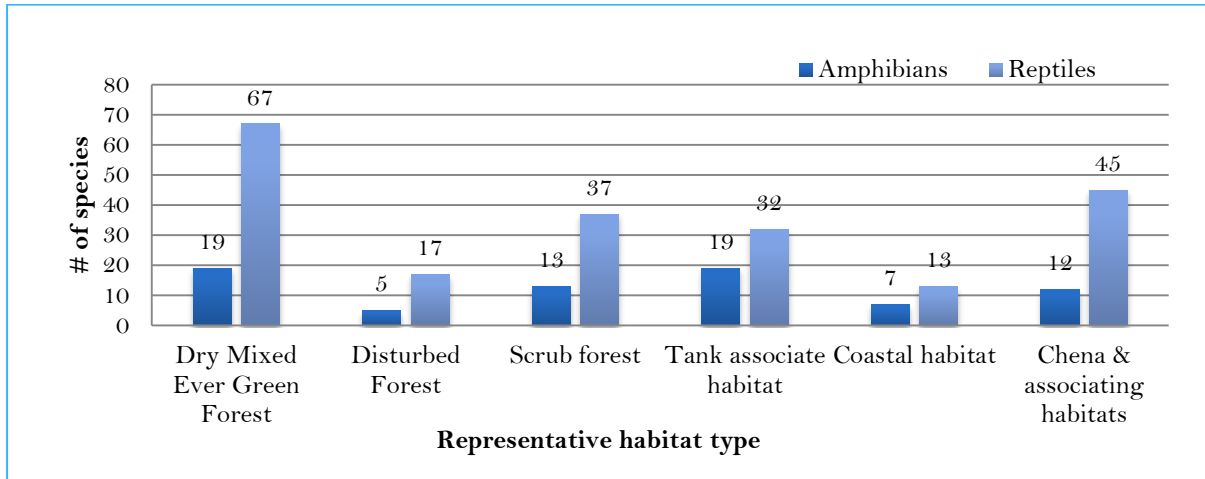


Figure 2 Herpetofauna diversity vs habitat in Kala Oya River basin

High species diversity of herpetofauna was recorded in 4 habitat types; Dry mixed evergreen forest, scrub forest, tank associate habitats and Chena & associate. Four species of amphibians and 20 species of reptiles were recorded in all of above 4 habitats.



6.0 AVIFAUNA DIVERSITY ANALYSIS

6.3 Results

6.3.2 Diversity within Habitats

Of the 188 bird species, only 111 were recorded in the VCPs during the sampling time frame within a 20m distance and therefore were subject to further analysis. The balance could be treated as opportunistic observations.

The highest species diversity was recorded from transects that included a variety of habitats including both aquatic and terrestrial: Nabatayagama Tank and associated forests (Transect 14) located adjacent to Namal Uyana Conservation Forest recorded the highest diversity followed by Manawa tank associated habitats (Transect 19).

Of the Dry mixed evergreen forests, highest bird diversity was recorded from Manawakanda forests (Transect 17) followed by Higuruwelpitiya (Transect 13) and Eile tank associated DMEF (Transect 1). Least diversity was observed from DMEF of Suduwelithalawa (Transects 7 & 8) and this might be due to high density of the forest cover. The most commonly found bird species with highest population densities within the transects were *Pycnonotus luteolus* (White-browed Bulbul), *Stigmatopelia chinensis* (Spotted Dove), *Pycnonotus cafer* (Red-vented Bulbul), *Nectarinia zeylonica* (Purple-rumped Sunbird), *Acrocephalus dumetorum* (Blyth's Reed Warbler) and *Aegithina tiphia* (Common Iora). Nationally threatened *C. festivus* was recorded from Transect 18 while *L malabarica* was recorded from Transects 6 and 12.

Table 12 Avifaunal diversity within the transects

Trans ect	Sub basin	Main Habitat	# of speci es	Ende mics	Threatened species		Shannon Wiener
					National	Global	
1	Eile Tank and the coastal wetland	DMEF	39	1			3.089263457
2		SF and Tank	37	2			2.86802819
3		Disturbed SF & abandoned quarry	22	1			2.404241532
4		SWM and mangroves	37	1			2.837637881
5	Eluwankulama Area	Tank associated	39	2			3.362404167
6		SF	33	5	1 (VU)		2.720507655
7	Suduwelithalaw a and Morapathana Area	DMEF	21	1			2.620364374
8		DMEF	23	3			2.613919832
9	Werakkodichole & Tahabbowa Area	SF, aband. Chena	38	3			2.912685518
10		Chena & Dis. Forests	31	4			2.773988299
11	Horiwila area	Dis. Forest & tank catch.	21	1			2.740915389



Trans ect	Sub basin	Main Habitat	# of speci es	Ende mics	Threatened species		Shannon Wiener
					National	Global	
12		DMEF & Chena	35	4	1 (VU)		2.715507563
13	Galpaya, Hinguruwelpitiya, Ranawa Kanda & Nambatiwewa area	DMEF	39	4			3.362049512
14		SF & Tank associated	51	5			3.52172657
15		SF & Dist. Forests	31	2			3.126275154
16		DMEF	31	3			3.260144361
17	Manawa Kanda area	DMEF	42	5			3.355627183
18		Dist. Forests and Tank ass.	33	3	1 (VU)		3.134277433
19		Tank associated	48	4			3.43915158
20		DMEF & abnd. Chena	34	4			3.189920661
21	Wilpattu National Park	DMEF & Villu	37	4			3.017458927
22		SF	24	5			2.698676389
23		DMEF	21	4			2.304498065
24		DMEF & SF	29	5			2.698424615

DMEF- Dry Mixed Evergreen Forests; SF- Scrub Forests

6.3.3 Avifaunal Diversity within the Eight Sub-Basins

For the analysis of the avifauna within the eight sub-basins, the opportunistic birds encountered are also taken in to consideration. Table 13 provides a brief summary of the same. As indicated in the table, the number of bird species observed within VCPs were highest in sub basin 6 (Galpaya) while in two sub-basins opportunistic bird encountered were high (Eluwankulama and Suduwelithalawa). The main reason for these high opportunistic observations was the inclusion of birds observed in small tanks in the vicinity, adding a considerable number of aquatic birds to the list.

Table 13 Summary information for Sub-basins

	Sub basin/Clusters							
	1	2	3	4	5	6	7	8
Total number Sp.	105	140	71	89	88	90	102	89
Within VCPs	64	54	29	48	48	64	67	48
Opportunistic obs.	41	86	42	41	40	16	35	41
No. of Families	43	57	43	41	43	43	43	38
No. of Endemic Species	04	07	06	07	05	06	07	08
No of Migrant Species	27	23	11	10	9	13	10	13
No. of Nationally threatened species	-	03	-	-	02	-	01	-
No. of Globally threatened species	-	01	-	-	01	-	01	01
Shannon wiener Index	3.00126	3.34323	2.71843	2.85772	2.96343	3.75677	3.5677	2.93287



Sub-Basin 1 (Elie Tank and the Associated Coastal Wetlands)

Of the 105 Species recorded, 41 were opportunistic observations, consisting mainly of migrant wader species that occupied transect 4 and the adjoining salt marsh and mangrove area indicating the importance of this transect as a feeding ground for migratory waders. None of the nationally or globally threatened species were encountered from this sub-basin and the number of endemics encountered (4) was less compared to the other sub-basins.

Sub Basin 2: Eluwankulama Area

Of the 8 sub basins, the highest species number was recorded from this area, and this can be accounted to the presence of Eluwankulama Tank (Transect 5), adjoining riverine and scrub vegetation as well as vast areas of paddy fields. Seasonal water holes appeared with rain and this attracted large numbers of aquatic birds, mainly species belonging to family Ardeidae and Phalacrocoracidae. It should be noted that although only 54 species were within its VCPs, a separate detailed study of the area indicated presence of 140 species, indicating the importance of protecting this habitat which is located adjacent to Wilpattu National Park boundary and directly receives water from the Kala Oya.

Nationally and globally threatened *L. javanicus* was only observed from this area and that was a single opportunistic record. *C. festivus* (White-naped Woodpecker) was also recorded from this sub-basin. Seven endemic species were found in this sub basin.

Sub Basin 3: Suduwelithalawa and Morapathana Area

The least number of bird species (71) was encountered from this sub basin and could be accounted to human interventions including abandoned cultivations (cashew) and thick forests. The opportunistic observations (42) were mainly of the birds that flew above the transects or were encountered within small tanks in the area. Six endemic species represented the avifaunal assemblage of this sub-basin while no nationally or globally threatened species were observed.

Sub Basin 4: Weerakkodichole & Tahabbowa Area

This area mainly consisted of Chena (abandoned and cultivated) and a few disconnected forest patches. There was a seasonal stream dissecting Transect 9, as well as vast paddy area that adjoined the sub basin, which provided habitats for several aquatic birds. The area bordered the Tabbowa Sanctuary as well as the Weerakkodicholai Reserve Forests. As a result a considerable number of forest birds, including the Grey hornbill were observed from this area. 89 bird species that included seven endemic species were recorded from this sub-basin. No nationally or globally threatened species were observed during the study period.

Sub Basin 5: Horiwila area

The vegetation in this area is highly fragmented and degraded, while Chena cultivation is the prominent land use. Yet the presence of small tanks (include Abaga wewa) increased the areas potential to harbour 88 Bird species. 40 species are of opportunistic observations recorded mainly from small tanks. Five endemic species and two nationally threatened (*Porzana fusca* - Ruddy breasted Crake (VU); and *Lonchura malabarica* - White-throated Munia (VU) was recorded from the sub basin. A colony of *Phalacrocorax niger* (Little Cormorant) and Indian Night Heron was



observed at Abagaha wewa, and there was indications that these two bird species together with few other aquatic birds use the trees in this tank for breeding purposes.

The globally threatened Woolly neck Stork together with several migrant waders were observed in a small tank with receding waters.

Sub Basin 6: Galpaya, Hinguruwelpitiya, Ranawa Kanda & Nambatiwewa area

Galawala DS Division contains a higher proportion of forest areas and rocky outcrops. The only water body in this sub-basin was the Nambatiwewa Tank, which was located adjacent to Namal Uyana Conservation Forest and most of this tank bed area was dried up, limiting the encounter of water birds. In total 90 bird species were recorded of which only 16 were opportunistic observations. The bird list included six endemic species, and no nationally or globally threatened species were encountered during the study period.

Sub Basin 7: Manawa Kanda area

This sub-basin includes a variety of habitats and hence a higher number of bird species (102) were present. Manawa tank is an important habitat for aquatic birds, while the dry mixed forest patches associated with Manawakanda provides habitats for forest birds. 67 bird species were encountered within the 20 m of the VCPs, including seven endemic birds. Largest concentration of globally threatened *C. episcopus* was observed from this area. Presence of the nationally threatened *Chrysocolaptes festivus* (White-naped Wood pecker) added to the importance of this site.

Sub Basin 8: Wilpattu National Park

Mixed habitats including tank beds, rock outcrops and dry mixed evergreen forests were sampled within the 4 transects set in Wilpattu National Park. The total number of birds recorded was 89 and the rainy conditions prevailed during the sampling period might have reduced the species numbers. Seven migrant species including *Galloperdix bicalcarata* (Sri Lanka Spurfowl) was recorded. Globally threatened *C. episcopus* was observed outside the transects. No nationally threatened species were observed.



7.0 MAMMAL DIVERSITY ANALYSIS

7.3 Results

7.3.1 Diversity within Habitats

For the convenience of the comparisons of diversity, 24 km line transects were clustered to 8 areas. Out of 24, 4 transects lines were plotted inside the Wilpattu National park to give a better comparison of distribution of mammals near the protected areas and to provide some indication of the home ranges of some mammals.

A total of 39 species (22 families and 32 Genera) were recorded during the survey; 7 species of bats, 4 species of cat family members, 3 species of deer, 3 species of herpestids, 2 viverrids, 2 species of squirrels, 4 muridae members, 3 cercopithicidae members and so on. All the mammals identified in those 8 areas are shown in Table 14.

Table 14 Observed fauna in different localities of Kala oya Basin

Species Name	Conservation Status	Clusters of Transects in Different Locations							
		A	B	C	D	E	F	G	H
<i>Bubalus bubalis</i>					*	*	*	*	*
<i>Canis aureus</i>	LC	*			*	*	*	*	*
<i>Macaca sinica</i>	LC	*	*	*	*	*	*	*	*
<i>Semnopithecus priam</i>	LC	*	*	*	*	*	*	*	*
<i>Semnopithecus vetulus</i>	EN	*	*					*	
<i>Axis axis</i>	LC	*	*	*	*	*	*	*	*
<i>Rusa unicornis</i>	NT		*		*		*	*	*
<i>Elephas maximus</i>	EN	*	*	*	*		*	*	*
<i>Felis chaus</i>	NT	*	*	*	*	*	*	*	*
<i>Prionailurus rubiginosus</i>	EN	*							
<i>Prionailurus viverrinus</i>	EN	*	*				*	*	*
<i>Panthera pardus</i>	EN	*	*				*		*
<i>Herpestes edwardsii</i>	LC	*	*	*	*	*	*	*	*
<i>Herpestes smithii</i>	LC	*		*	*		*	*	*
<i>Herpestes brachyurus</i>	LC	*		*					
<i>Paradoxurus hermaphroditus</i>	LC	*			*		*	*	*
<i>Hystrix indica</i>	LC	*	*	*	*	*	*	*	*
<i>Lepus nigricollis</i>	LC	*	*	*	*	*	*	*	*
<i>Mus booduga</i>	LC		*	*	*	*	*	*	*
<i>Rattus rattus</i>	LC	*	*	*	*	*	*	*	*
<i>Bandicota indica</i>	LC	*							
<i>Tatera indica</i>	LC	*	*	*	*	*	*	*	*
<i>Lutra lutra</i>	VU	*	*		*	*	*	*	*



Species Name	Conservation Status	Clusters of Transects in Different Locations							
		A	B	C	D	E	F	G	H
<i>Pteropus giganteus</i>	LC		*	*	*	*	*	*	*
<i>Funambulus palmarum</i>	LC	*	*	*	*	*	*	*	*
<i>Ratufamacroura</i>	LC	*	*	*	*	*	*	*	*
<i>Loris lydekkerianus</i>	NT				*	*			
<i>Susscrofa</i>	LC	*	*	*	*	*	*	*	*
<i>Moschiolameminna</i>	LC	*	*	*	*	*	*	*	*
<i>Muntiacus muntjak</i>	NT	*			*				*
<i>Melursus ursinus</i>	EN				*				*
<i>Viverriculaindica</i>	LC	*	*	*	*	*	*	*	*
<i>Maniscrassicaudata</i>	NT	*	*		*	*	*	*	*
<i>Hipposideros speoris</i>	LC								*
<i>Kerivaulapicta</i>	NT						*		*
<i>Hipposideros galeritus</i>	VU								*
<i>Megadermas pasma</i>	VU								*
<i>Pipistrellus coromandra</i>	VU								*
<i>Cynopterus sphinx</i>	LC								*
Total Number of Species		27	23	20	27	21	27	26	34

Note: A= Transect 1-4, EileWewa Area
 B= Transect 5-6, Eluwankulama Area
 C= Transect 7-8, Suduwelithalawa and Morapathana Area
 D= Transect 9-10, Weerakkodochole and Thabbowa Area
 E= Transect 11-12, Horiwila and Ambagaswewa Area
 F= Transect 13-16, Galpaya, Hinguruwelpitiya, Ranawa Kanda and Nambatiwearea
 G= Transect 17-20, Manawa Area
 H= Transect 21-24, Wilpatthu National Park

33 species of indigenous mammals were recorded from the 48 quadrates and another 6 species were recorded opportunistically in the Wilpattu National park. All those six species belong to Chiropterans. Statuses of the identified species at Kala Oya Basin are shown in Table 14. Mammals Diversity and its Estimates for habitats, based on quadrates sampling are shown in Table 15 and Figure 3. Levels of Diversity and Endemism together with Endangered, Near Threatened and Vulnerability of recorded mammalian species in different localities at Kala Oya Basin are summarized in Figure 4.

- Eile Wewa area (Locality A) had 27 species of mammals and out of which 3 were endemics, 5 endangered, 3 near threatened and 1 vulnerable. The area is comprised of Dry Mixed Evergreen Forest, Scrub Forest, Tank Associated and Coastal Habitats which are most favourable to mammalian life.
- Eluwankulama Area (Locality B) was having 23 species of mammals including 3 Endemics, 4 Endangered, 3 Near Threatened and 1 Vulnerable. This locality has Dry



Mixed Evergreen Forest, Scrub Forest and Tank Associated Habitats like Eile Wewa areas, which are suitable for the abundance of mammals.

- The Lowest numbers of mammalian species were recorded from Suduwelithalawa and Morapathana Area (Locality/ cluster C) which is 20, of which 2 are endemic, 1 endangered and 1 threatened. This region consists of scrubbed and tank associated habitats which are not suitable for many species of mammals.
- Locality D (Weerakkodichole and Thabbowa Area) is comprised of Dry Mixed Evergreen Forest and Disturbed Forest with 27 species of mammals (2 Endemic, 2 Near Threatened and 1 Vulnerable). There are agricultural lands nearby and small domesticated populations of goat, cattle and chicken which disturb wild fauna species. Also it was observed that illegal timber cutting was happened in this area.
- Horiwila and Ambagaswewa Area (Locality E) was having second lowest number of mammals; 21. 2 Endemic, 2 Near Threatened and 1 vulnerable species were identified within the habitat of Dry Mixed Evergreen, Disturbed Forest, Scrub and Chena associated habitats. This area has low species richness due to high levels of anthropogenic activity.
- Locality F (GalaPaya) sub basin was having 27 number of identified mammal species distributed in four type of habitats namely Dry Mixed Evergreen, Disturbed, Scrub and Tank. 2 endemics, 3 endangered, 4 near threatened and 1 vulnerable species were observed at this locality.
- Locality G is having 26 species of mammals; 3 endemics, 3 endangered 3 near threatened and 1 vulnerable within the habitats of Dry Mixed Evergreen Forest, Tank Associated and Chena Associated.
- Locality H belongs to Wilpatthu National park which recorded 2 Endemics, 4 Endangered, 5 near threatened and 4 vulnerable mammal species.

Table 15 Status of the Identified Species at Kala Oya Basin

Categories	Clusters of Transects in Different Locations							
	A	B	C	D	E	F	G	H
Total Species Richness								
Quadrates & Opportunistic	32	35	24	31	25	39	36	44
Quadrates only	27	23	20	27	21	27	26	34
Number of Genera	22	21	18	26	21	26	23	32
Number of Families	15	14	13	19	17	18	17	20
Number of Endemics	03	03	02	02	02	02	03	02
Number of Endangered	05	04	01	02	00	03	03	04
Number of Near Threatened	03	03	01	05	03	04	03	05
Number of Vulnerable	01	01	00	01	01	01	01	04

Table 16 Distribution of Mammalian Fauna in an identified six habitats at Kala Oya Basin

Clusters of Transects	Number of Species	Habitat Types					
		P	Q	R	S	T	U
1-4 (A)	27	24	00	15	22	12	00
5-6 (B)	23	20	00	15	15	00	00
7-8 (C)	20	18	00	00	00	00	00
9-10 (D)	27	26	20	00	00	00	00



Clusters of Transects	Number of Species	Habitat Types					
		P	Q	R	S	T	U
11-12 (E)	21	11	14	00	00	00	15
13-16 (F)	27	25	11	14	14	00	00
17-20 (G)	26	23	00	00	21	00	20
21-24 (H)	34	2	00	22	00	00	00

Habitat Types: P = Dry Mixed Evergreen Forest, Q= Disturbed, R= Scrub forest, S= Tank associate habitat, T= coastal habitat, U= Chena & associating habitats

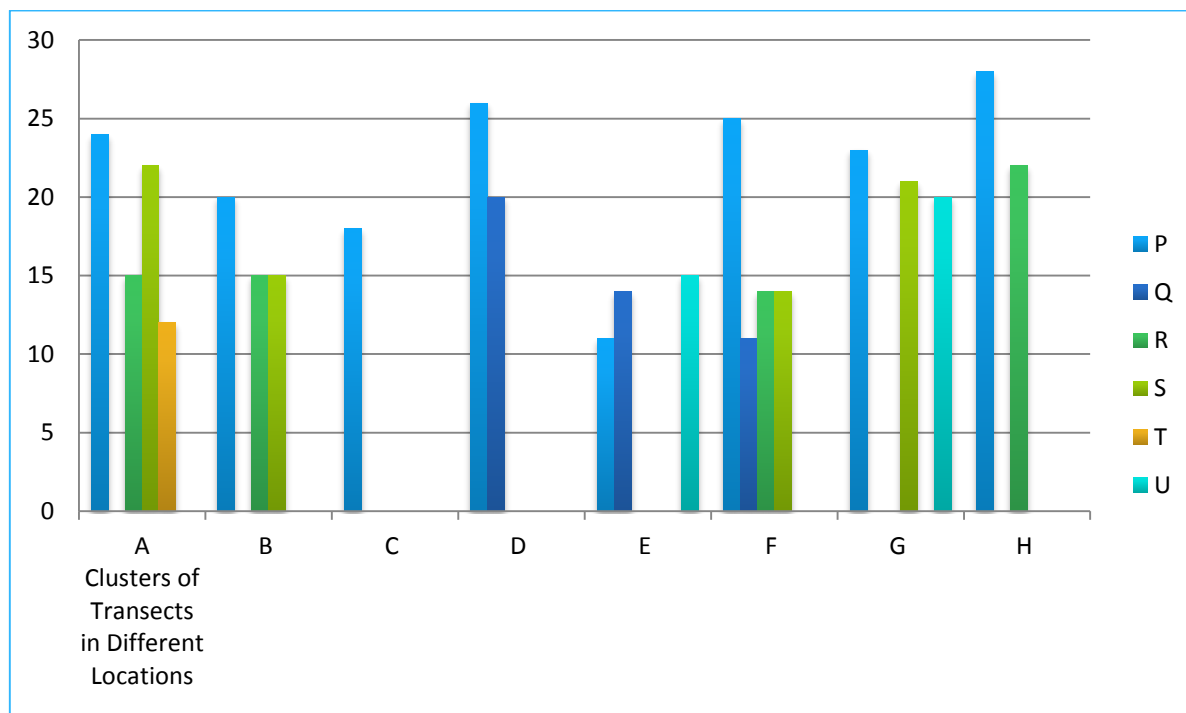


Figure 3 Mammalian Distribution in different habitat types within the Kala Oya Localities (Habitat Types: P = Dry Mixed Evergreen Forest, Q= Disturbed, R= Scrub forest, S= Tank associate habitat, T= Coastal Habitat, U= Chena & associating habitats)



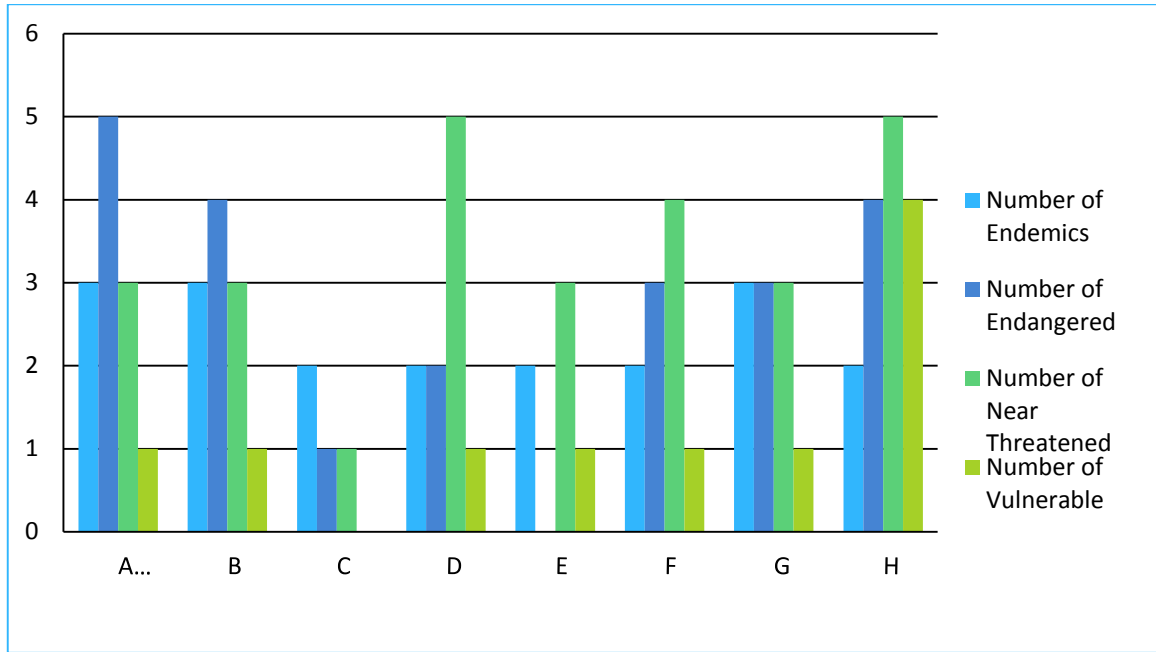


Figure 4 Status of Identified Mammals at Kala Oya basin localities



8.0 FRESHWATER FAUNA AND FLORA DIVERSITY ANALYSIS

Results

Table 1 provides the list of true mangroves found in the area and their conservation status. A total of 14 true mangroves were found.

Table 17 True mangrove species recorded from the area

Family	Scientific name	Common names	IUCN Status
Avicenniaceae	<i>Avicennia marina</i> (Forsk.) Vierh.	E : Grey mangrove/White mangrove S : Manda T : Kanna/Venkandal	LC
	<i>Avicennia officinalis</i> L.	E : Indian mangrove S : Manda T : Kanna/Upu attha	NT
Combretaceae	<i>Lumnitzera racemosa</i> Willd.	E : Teruntum bunga puteh S : Sudu beriya T : Thipparethai	NT
Euphorbiaceae	<i>Excoecaria agallocha</i> L.	E : Buta-buta/Blind-your-eyes S : Thelakeeriya T : Thillai	LC
Lythraceae	<i>Pemphis acidula</i> Forst.	S : Muhudu wara T : Kiri maram	NT
Meliaceae	<i>Xylocarpus granatum</i>	E : Mangrove cannonball S : Mutti kadol T : Kadal manga/Somuntheri	EN
Myrsinaceae	<i>Aegiceras corniculatum</i> (L.) Blanco	E : Black mangrove/River mangrove S : Heen kadol/Awari kadol T : Vettilaikanna/Narikandal	LC
Rhizophoraceae	<i>Bruguiera cylindrica</i> (L.) Blume	E : Bakau Putih S : Mal kadol T : Sirukandal	EN
	<i>Bruguiera gymnorrhiza</i> (L.) Lamk.	E : Oriental mangrove S : Rath kadol	VU
	<i>Ceriops tagal</i> (Perr.) C.B. Robinson	E : Tengar S : Punkanda T : Chirukandal	NT
	<i>Rhizophora apiculata</i> BL.	S : Rana kadol T : Kandal	NT
	<i>Rhizophora mucronata</i> Lamk.	E : Asiatic Mangrove S : Murunga kadol T : Kandal	LC
Rubiaceae	<i>Scyphiphora hydrophyllacea</i> Gaertn.f.	S : Kalu kadol	VU
Sonneratiaceae	<i>Sonneratia alba</i> J. Smith	S : Sudu mal kirala/Gal kirala T : Vellai-kinnai	EN



Species typical to dry zone riverine forests and dry deciduous forest were found as associates (Table 18).

Table 18 The checklist of mangrove associate species and other plant species recorded from Kala Oya-Pomparippu area

Family	Scientific name	Common names	IUCN Status
Acanthaceae	<i>Acanthus ilicifolius</i> (L.)	E : Holly-leaved acanthus S : Katu ekiliya	LC
Aizoaceae	<i>Sesuvium portulacastrum</i> (L.) L.	E : Shoreline purslane/sea purslane S : Mahasarana T : Vankiruvilai	NT
Amaranthaceae	<i>Suaeda monoica</i> Forssk. Ex J.F.Gmelin	E : Jamb/Jambolan T : Umiri	NT
Amaryllidaceae	<i>Crinum asiaticum</i> L.	E : Poison bulb S : Tolabo T : Vichamunkil	LC
Areaceae	<i>Phoenix zeylanica</i>	S : Wal indi	
Asclepiadaceae	<i>Calotropis gigantea</i> (L.) <u>W.T.Aiton</u>	S : Wara	
Asteraceae	<i>Mikania micrantha</i> Kunth	S : Wathu palu	
Bignoniaceae	<i>Dolichandrone spathacea</i> (L.f)	S : Diyadanga	NT
Celastraceae	<i>Pleurostyliia opposita</i> (Wall.) Alston	S : Panakka/Piyari T : Chiru/Piyari	LC
Combretaceae	<i>Terminalia arjuna</i> (Roxb.) Wight & Arn. <i>Terminalia catappa</i> L.	E : Arjuna/Arjun tree S : Kumbuk E : Indian Armand S : Kottamba	LC
Fabaceae	<i>Derris trifoliata</i> Lour. <i>Cassia auriculata</i> (L) <i>Tamarindus indica</i> <i>Acacia cornigera</i> (L.)Willd. <i>Caesalpinia bonduc</i> (L)	S : Kalawel T : Pungai S : Ranawara E : Matara tea T : Avarai S : Siyabala T : Puli E : Bullhorn acacia S : Katu andara S : Kumburu E : Grey nicker T : Punaikkalaichchi	LC LC LC
Lamiaceae	<i>Premna latifolia</i>	S : Wal midi T : Erumaimulla	LC
Lamiaceae	<i>Clerodendron inerme</i> (L)	E : Glorybower/Bagflower S : Wal gurenda T : Pichuvilathi	LC



Family	Scientific name	Common names	IUCN Status
Malvaceae	<i>Hibiscus tiliaceus</i> L.	S : Wal beli: T : Vellai	LC
	<i>Thespesia populnea</i> (L.) Sol. ex Correa	E : Portia tree S: Gan suriya	LC
	<i>Berrya cordifolia</i>	S : Halmilla E : Tricomalee wood T : Chavandalai	LC
Melastomataceae	<i>Memecylon umbellatum</i> Burm.f.	S: Korakaha E : Blue mist	LC
Meliaceae	<i>Azadirachta indica</i> A. Juss. , 1830	S : Kohomba E : Margosa	
Moraceae	<i>Ficus hispida</i> L.f	S : Kata Dimbula	LC
Myrtaceae	<i>Syzygium cumini</i> (L.) Skeels.	S : Madan	LC
Pteridaceae	<i>Acrostichum aureum</i> (L.)	E : Golden leather fern S : Karan koku T : Minni	LC
Rubiaceae	<i>Nauclea orientalis</i> (L)	S : Bakme T : Vammi/Atuvangi	LC
Salvadoraceae	<i>Azima tetraantha</i> Lam.	S : Katu niyanda	LC
Sapotaceae	<i>Manilkara hexandra</i> (Roxb.) Dubard	S : Palu	
Sterculiaceae	<i>Pterospermum suberifolium</i> (L.) Willd.	S : Velan	
Teliaceae	<i>Muntingia calabura</i>	E : Jam tree	
Verbenaceae	<i>Lantana camara</i> L.	S : Gandapana E : Lantana	

Sampling stations and recorded mangrove species

Location 01

Ceriops tagal was the plant with highest density in this location. The Margalef and Shannon Wiener species richness indices were 1.9218 and 2.7304 respectively.

Table 19 Recorded true mangrove and mangrove associate species (Transect – 50 m to the forest)

Species	Transect 01 (50 m)				
	1	2	3	4	5
<i>Avicennia marina</i>	2	4	9	2	2
<i>Avicennia officinalis</i>	1	1			2
<i>Bruguiera cylindrical</i>	1		9	24	11
<i>Bruguiera gymnorrhiza</i>		7	4	38	
<i>Ceriops tagal</i>	43	6	9	15	1
<i>Excoecaria agallocha</i>	5	5	2	2	
<i>Lumnitzera racemosa</i>	3	1	1	3	4
<i>Pemphis acidula</i>	1	1		2	1



Species	Transect 01 (50 m)				
	1	2	3	4	5
<i>Rhizophora apiculata</i>				3	8
<i>Rhizophora mucronata</i>	22	10	11	5	12
<i>Scyphiphora hydrophyllacea</i>	1	1			
<i>Aegiceras corniculatum</i>	1				1
<i>Thespesia populnea</i>	1		2		1
<i>Premna serratifolia</i>	2				1
<i>Clerodendrum inerme</i>	2		1	2	2
<i>Azima tetraacantha</i>					1
<i>Sesuvium portulacastrum</i>				1	
<i>Derris trifoliata</i>	3		1	1	2
<i>Syzygium cumini</i>			1		
<i>Phoenix zeylanica</i>					2

Table 20 Densities of true mangrove and mangrove associate species in each transect

Species	Density (m-2)					Mean Density (m-2)
	1	2	3	4	5	
<i>Avicennia marina</i>	0.04	0.08	0.18	0.04	0.04	0.076
<i>Avicennia officinalis</i>	0.02	0.02	0	0	0.04	0.016
<i>Bruguiera cylindrical</i>	0.02	0	0.18	0.48	0.22	0.18
<i>Bruguiera gymnorrhiza</i>	0	0.14	0.08	0.76	0	0.196
<i>Ceriops tagal</i>	0.86	0.12	0.18	0.3	0.02	0.296
<i>Excoecaria agallocha</i>	0.1	0.1	0.04	0.04	0	0.056
<i>Lumnitzera racemosa</i>	0.06	0.02	0.02	0.06	0.08	0.048
<i>Pemphis acidula</i>	0.02	0.02	0	0.04	0.02	0.020
<i>Rhizophora apiculata</i>	0	0	0	0.06	0.16	0.044
<i>Rhizophora mucronata</i>	0.44	0.2	0.22	0.1	0.24	0.240
<i>Scyphiphora hydrophyllacea</i>	0.02	0.02	0	0	0	0.008
<i>Aegiceras corniculatum</i>	0.02	0	0	0	0.02	0.008
<i>Thespesia populnea</i>	0.02	0	0.04	0	0.02	0.016
<i>Premna serratifolia</i>	0.04	0	0	0	0.02	0.012
<i>Clerodendrum inerme</i>	0.04	0	0.02	0.04	0.04	0.028
<i>Azima tetraacantha</i>	0	0	0	0	0.02	0.004
<i>Sesuvium portulacastrum</i>	0	0	0	0.02	0	0.004
<i>Derris trifoliata</i>	0.06	0	0.02	0.02	0.04	0.028
<i>Syzygium cumini</i>	0	0	0.02	0	0	0.004
<i>Phoenix zeylanica</i>	0	0	0	0	0.04	0.008

Table 21 Species Richness Indices (L 1)

Margalef Species Richness Index	Shannon Wiener Index
2.7304	1.9218



Location O2

A total of ten 50 m transects were laid. Table 22 provides the density of each species and the density data were depicted as a percentage. *Ceriops tagal* was the plant with highest density in this location. The Margalef and Shannon Wiener species richness indices were 0.9061 and 1.2341 respectively (Table 24).

Table 22: Recorded True mangrove and mangrove associate species (Transect – 100 m to the forest)

Species	Transect 01 (50 m)					Transect 02 (50 m)				
	1	2	3	4	5	1	2	3	4	5
<i>Avicennia marina</i>	17	10	16	20	51	14	10	11	21	65
<i>Bruguiera cylindrica</i>	4									
<i>Bruguiera gymnorrhiza</i>			1						3	
<i>Ceriops tagal</i>	23	21	20	55	10	30	45	32	33	6
<i>Excoecaria agallocha</i>	3		3							2
<i>Lumnitzera racemosa</i>	3		1			1				2
<i>Rhizophora mucronata</i>	23	42	30	15	50	4	26	6	23	15
<i>Xylocarpus granatum</i>						4				
<i>Aegiceras corniculatum</i>	9	18	18		4		5	3		14
<i>Clerodendrum inerme</i>	4	4								

Table 23: Densities of true mangrove and mangrove associate species in each transect

Species	Density (m ⁻²)										Mean Density (m ⁻²)
	1	2	3	4	5	1	2	3	4	5	
<i>Avicennia marina</i>	0.3 4	0.2 2	0.3 2	0. 4	0.5 1	0.2 8	0.2 2	0.2 2	0.4 2	0.6 5	0.354
<i>Bruguiera cylindrica</i>	0.0 8	0	0	0	0	0	0	0	0	0	0.008
<i>Bruguiera gymnorrhiza</i>	0	0	0.0 2	0	0	0	0	0	0.0 6	0	0.008
<i>Ceriops tagal</i>	0.4 6	0.4 2	0.4 4	1. 1	0.1	0.6	0.9	0.6 4	0.6 6	0.0 6	0.534
<i>Excoecaria agallocha</i>	0.0 6	0	0.0 6	0	0	0	0	0	0	0.0 2	0.014
<i>Lumnitzera racemosa</i>	0.0 6	0	0.0 2	0	0	0.0 2	0	0	0	0.0 2	0.012
<i>Rhizophora mucronata</i>	0.4 6	0.8 4	0.6 3	0. 3	0.5	0.0 8	0.5 2	0.1 2	0.4 6	0.2 3	0.411
<i>Xylocarpus granatum</i>	0	0	0	0	0	0.0 8	0	0	0	0	0.008
<i>Aegiceras corniculatum</i>	0.1 8	0.3 6	0.3 6	0	0.0 4	0	0.1	0.0 6	0	0.1 4	0.124
<i>Clerodendrum inerme</i>	0.0 8	0.0 8	0	0	0	0	0	0	0	0	0.016

Table 24 Species Richness Indices (L 2)

Margalef Species Richness Index	Shannon Wiener Index
0.9061	1.2341



Location 03

Acrostichum aureum was the plant with highest density in this location. The Margalef and Shannon Wiener species richness indices were 1.2257 and 1.3744 respectively.

Table 25 Recorded True mangrove and mangrove associate species (Transect – 100 m to the forest)

Species	Transect 01 (50 m)				Transect 02 (50 m)		
	1	2	3	4	1	2	3
<i>Avicennia marina</i>	1						
<i>Ceriops tagal</i>	10						
<i>Excoecaria agallocha</i>	15	7	25	20	7		11
<i>Rhizophora mucronata</i>	5		4				
<i>Aegiceras corniculatum</i>			1	5			
<i>Premna serratifolia</i>	12		22	7	2		11
<i>Clerodendrum inerme</i>		3					
<i>Derris trifoliata</i>	6	3	7	10		1	
<i>Acanthus ilicifolius</i>	55	20	17	11	14	6	10
<i>Acrostichum aureum</i>	53	47	57	40	46	55	42
<i>Caesalpinia bonduc</i>	4	9		5			
<i>Terminalia arjuna</i>		1					
<i>Mikania micrantha</i>	9	4		2	5		
<i>Berrya cordifolia</i>		1					

Table 26 Densities of true mangrove and mangrove associate species in each transect

Species	Density (m ⁻²)				Density (m ⁻²)			Mean Density (m ⁻²)
	1	2	3	4	1	2	3	
<i>Avicennia marina</i>	0.02	0	0	0	0	0	0	0.003
<i>Ceriops tagal</i>	0	0	0	0	0	0.2	0	0.029
<i>Excoecaria agallocha</i>	0.3	0.14	0.5	0.4	0.14	0	0.22	0.243
<i>Rhizophora mucronata</i>	0.1	0	0.08	0	0	0	0	0.026
<i>Aegiceras corniculatum</i>	0	0	0.02	0.1	0	0	0	0.017
<i>Premna serratifolia</i>	0.24	0	0.44	0.14	0.04	0	0.22	0.154
<i>Clerodendrum inerme</i>	0	0.06	0	0	0	0	0	0.009
<i>Derris trifoliata</i>	0.12	0.06	0.14	0.2	0	0.02	0	0.077
<i>Acanthus ilicifolius</i>	1.1	0.4	0.34	0.22	0.28	0.12	0.2	0.380
<i>Acrostichum aureum</i>	1.06	0.94	1.14	0.8	0.92	1.1	0.84	0.971
<i>Caesalpinia bonduc</i>	0.08	0.18	0	0.1	0	0	0	0.051
<i>Terminalia arjuna</i>	0	0.02	0	0	0	0	0	0.003
<i>Mikania micrantha</i>	0.18	0.08	0	0.04	0.1	0	0	0.057
<i>Berrya cordifolia</i>	0	0.02	0	0	0	0	0	0.003

Table 27 Species Richness Indices (L 3)

Margalef Species Richness Index	Shannon Wiener Index
1.2257	1.3744



Location 04

Acrostichum aureum was the plant with highest density in this location. The Margalef and Shannon Wiener species richness indices were 1.6673 and 1.6637 respectively

Table 28 Recorded true mangrove and mangrove associate species (Transect – 150 m to the forest)

Species	Transect 01 (50 m)			Transect 02 (50 m)			Transect 03 (50 m)		
	1	2	3	1	2	3	1	2	3
<i>Avicennia marina</i>									2
<i>Bruguiera cylindrica</i>		2			1			7	5
<i>Ceriops tagal</i>		5	3		3	7		1	2
<i>Excoecaria agallocha</i>	7	17	10	3	1		4	4	10
<i>Lumnitzera racemosa</i>			12			2	3	9	
<i>Pemphis acidula</i>		1							
<i>Rhizophora mucronata</i>	15	45	5	21	22	21	5	4	7
<i>Aegiceras corniculatum</i>		2					1	4	1
<i>Premna serratifolia</i>		2	6		3			3	
<i>Derris trifoliata</i>		10	2			1		1	2
<i>Acanthus ilicifolius</i>	8	2	30	2		16	13	5	17
<i>Acrostichum aureum</i>	26	20	6	27	13	8	30	20	22
<i>Caesalpinia bonduc</i>	5	18	11	4	4	6	4	4	12
<i>Terminalia arjuna</i>		1							

Table 29 Densities of true mangrove and mangrove associate species in each transect

Species	Density (m ⁻²)			Density (m ⁻²)			Density (m ⁻²)			Mean Density (m ⁻²)
	1	2	3	1	2	3	1	2	3	
<i>Avicennia marina</i>	0	0	0	0	0	0	0	0.04	0	0.004
<i>Bruguiera cylindrica</i>	0	0.04	0	0	0.02	0	0	0.14	0.1	0.033
<i>Ceriops tagal</i>	0	0.1	0.06	0	0.06	0.14	0	0.02	0.04	0.047
<i>Excoecaria agallocha</i>	0.14	0.34	0.2	0.06	0.02	0	0.08	0.08	0.2	0.124
<i>Lumnitzera racemosa</i>	0	0	0.24	0	0	0.04	0.06	0.18	0	0.058
<i>Pemphis acidula</i>	0	0.02	0	0	0	0	0	0	0	0.002
<i>Rhizophora mucronata</i>	0.3	0.9	0.1	0.42	0.44	0.42	0.1	0.08	0.14	0.322
<i>Aegiceras corniculatum</i>	0	0.04	0	0	0	0	0.02	0.08	0.02	0.018
<i>Premna serratifolia</i>	0	0.04	0.12	0	0.06	0	0	0.06	0	0.031
<i>Derris trifoliata</i>	0	0.2	0.04	0	0	0.02	0	0.02	0.04	0.036
<i>Acanthus ilicifolius</i>	0.16	0.04	0.6	0.04	0	0.32	0.26	0.1	0.34	0.207
<i>Acrostichum aureum</i>	0.52	0.4	0.12	0.54	0.26	0.16	0.6	0.4	0.44	0.382
<i>Caesalpinia bonduc</i>	0.1	0.36	0.22	0.08	0.08	0.12	0.08	0.08	0.24	0.151
<i>Terminalia arjuna</i>	0	0.02	0	0	0	0	0	0	0	0.002

Table 30 Species Richness Indices (L 4)

Margalef Species Richness Index	Shannon Wiener Index
1.6673	1.6637



Location 05

A total of six 50 m transects were laid. *Avicennia marina* was the plant with highest density in this location. The Margalef and Shannon Wiener species richness diversity indices were 1.4319 and 1.3011 respectively (Table 33).

Table 31 Recorded true mangrove and mangrove associate species (Transect – 100 m to the forest)

Species	Transect 01 (50 m)				Transect 02 (50 m)		
	1	2	3	4*	1	2	3
<i>Avicennia marina</i>	4	12	12	33	21	7	21
<i>Avicennia officinalis</i>	3		3	3			
<i>Bruguiera cylindrica</i>		1		1	2		
<i>Bruguiera gymnorrhiza</i>				2			
<i>Ceriops tagal</i>		1	5	3	5	1	7
<i>Excoecaria agallocha</i>	16	7	9	6	11		3
<i>Lumnitzera racemosa</i>	5	3		5	8	2	
<i>Pemphis acidula</i>	21			1	8		
<i>Rhizophora apiculata</i>				3			
<i>Rhizophora mucronata</i>	12		2	10	4	12	12
<i>Aegiceras corniculatum</i>	2			1			
<i>Thespesia populnea</i>		2					
<i>Premna serratifolia</i>	7		3	5		3	5
<i>Azima tetracantha</i>			3				

*numbers for 100 m

Table 32 Densities of true mangrove and mangrove associate species in each transect

Species	Density (m ⁻²)				Density (m ⁻²)			Mean Density (m ⁻²)
	1	2	3	4	1	2	3	
<i>Avicennia marina</i>	0.08	0.24	0.24	0.33	0.42	0.14	0.42	0.267
<i>Avicennia officinalis</i>	0.06	0	0.06	0.03	0	0	0	0.021
<i>Bruguiera cylindrical</i>	0	0.02	0	0.01	0.04	0	0	0.010
<i>Bruguiera gymnorrhiza</i>	0	0	0	0.02	0	0	0	0.003
<i>Ceriops tagal</i>	0	0.02	0.1	0.03	0.1	0.02	0.14	0.059
<i>Excoecaria agallocha</i>	0.32	0.14	0.18	0.06	0.22	0	0.06	0.140
<i>Lumnitzera racemosa</i>	0.1	0.06	0	0.05	0.16	0.04	0	0.059
<i>Pemphis acidula</i>	0.42	0	0	0.01	0.16	0	0	0.084
<i>Rhizophora apiculata</i>	0	0	0	0.03	0	0	0	0.004
<i>Rhizophora mucronata</i>	0.24	0	0.04	0.1	0.08	0.24	0.24	0.134
<i>Aegiceras corniculatum</i>	0.04	0	0	0.01	0	0	0	0.007
<i>Thespesia populnea</i>	0	0.04	0	0	0	0	0	0.006
<i>Premna serratifolia</i>	0.14	0	0.06	0.05	0	0.06	0.1	0.059
<i>Azima tetracantha</i>	0	0	0.06	0	0	0	0	0.009

Table 33 Species Richness Indices (L 5)

Margalef Species Richness Index	Shannon Wiener Index
1.4319	1.3011



Location 06

A total of twenty five 50 m transects were laid. *Avicennia marina* was the plant with highest density in this location. The Margalef and Shannon Wiener species richness indices were 0.1609 and 0.2134 respectively (Table 39).

Table 34 Recorded true mangrove and mangrove associate species (Transect – 285 m to the forest)

Species	Transect 01 (50 m)					Transect 02 (50 m)					Transect 03 (50 m)					Transect 04(50 m)				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
<i>Avicennia marina</i>	43	23	19	34	21	24	17	25	38	37	31	31	41	34	32	34	15	29	14	36
<i>Avicennia officinalis</i>		4																		
<i>Bruguiera gymnorrhiza</i>	1																			
<i>Ceriops tagal</i>	1																			
<i>Excoecaria agallocha</i>	17	1		16		5														
<i>Lumnitzera racemosa</i>	4	4	21	6	7	9														
<i>Aegiceras corniculatum</i>	1																			
<i>Premna serratifolia</i>				1																
Species	Transect 05 (50 m)					Transect 06 (35 m)														
	1	2	3	4	5	1	2	3	4	5										
<i>Avicennia marina</i>	25	16	23	68	17	11														
<i>Avicennia officinalis</i>																				
<i>Bruguiera gymnorrhiza</i>																				
<i>Ceriops tagal</i>																				
<i>Excoecaria agallocha</i>																				
<i>Lumnitzera racemosa</i>						32														
<i>Aegiceras corniculatum</i>																				
<i>Premna serratifolia</i>																				

Table 35 Densities of true mangrove and mangrove associate species in each transect

Species	Density (m ⁻²)					Density (m ⁻²)					Density (m ⁻²)				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
<i>Avicennia marina</i>	0.86	0.5	0.4	0.7	0.42	0.48	0.5	0	0.5	0.76	0.74	0.6	0.6	0.6	0.8
<i>Avicennia officinalis</i>	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Bruguiera gymnorrhiza</i>	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Ceriops tagal</i>	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Excoecaria agallocha</i>	0.34	0	0	0.3	0	0.1	0	0	0	0	0	0	0	0	0
<i>Lumnitzera racemosa</i>	0.08	0.1	0.4	0.1	0.14	0.18	0	0	0	0	0	0	0	0	0



Species	Density (m ⁻²)					Density (m ⁻²)					Density (m ⁻²)				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
<i>Aegiceras corniculatum</i>	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Premna serratifolia</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Species	Density (m ⁻²)					Density (m ⁻²)					Density (m ⁻²)	Mean Density (m ⁻²)
	1	2	3	4	5	1	2	3	4	5	1	
<i>Avicennia marina</i>	0.68	0.6	0.7	0.7	0.3	0.58	0.3	1	0.5	0.32	0.31	0.557
<i>Avicennia officinalis</i>	0	0	0	0	0	0	0	0	0	0	0	0.003
<i>Bruguiera gymnorrhiza</i>	0	0	0	0	0	0	0	0	0	0	0	0.001
<i>Ceriops tagal</i>	0	0	0	0	0	0	0	0	0	0	0	0.034
<i>Excoecaria agallocha</i>	0	0	0	0	0	0	0	0	0	0	0	0.081
<i>Lumnitzera racemosa</i>	0	0	0	0	0	0	0	0	0	0	0.91	0.001
<i>Aegiceras corniculatum</i>	0	0	0	0	0	0	0	0	0	0	0	0.001
<i>Premna serratifolia</i>	0	0	0	0	0	0	0	0	0	0	0	0.001

Table 36 Species Richness Indices (L 6)

Margalef Species Richness Index	Shannon Wiener Index
0.1609	0.2134



Location 07

A total of three 50 m transects were laid. *Acanthus ilicifolius* was the plant with highest density in this location. The Margalef and Shannon Wiener species richness indices were 1.6237 and 1.4378 respectively (Table 43).

Table 37 Recorded true mangrove and mangrove associate species (Transect – 50 m to the forest)

Species	Transect 01 (50 m)		
	1	2	3
<i>Avicennia marina</i>	1		7
<i>Bruguiera cylindrica</i>	1	3	
<i>Bruguiera gymnorrhiza</i>			1
<i>Excoecaria agallocha</i>	5	21	11
<i>Lumnitzera racemosa</i>	1		
<i>Rhizophora mucronata</i>	5	6	
<i>Thespesia populnea</i>		1	
<i>Premna serratifolia</i>	4	1	4
<i>Azima tetracantha</i>	6		
<i>Acanthus ilicifolius</i>	68	37	
<i>Acrostichum aureum</i>	12	39	17
<i>Phoenix zeylanica</i>	1	1	
<i>Mikania micrantha</i>		20	
<i>Azadirachta indica</i>		1	

Table 38 Densities of true mangrove and mangrove associate species in each transect

Species	Density (m-2)			Mean Density (m-2)
	1	2	3	
<i>Avicennia marina</i>	0.02	0	0.14	0.053
<i>Bruguiera cylindrica</i>	0.02	0.06	0	0.027
<i>Bruguiera gymnorrhiza</i>	0	0	0.02	0.007
<i>Excoecaria agallocha</i>	0.1	0.42	0.22	0.247
<i>Lumnitzera racemosa</i>	0.02	0	0	0.007
<i>Rhizophora mucronata</i>	0.1	0.12	0	0.073
<i>Thespesia populnea</i>	0	0.02	0	0.007
<i>Premna serratifolia</i>	0.08	0.02	0.08	0.060
<i>Azima tetracantha</i>	0.12	0	0	0.040
<i>Acanthus ilicifolius</i>	1.36	0.74	0	0.700
<i>Acrostichum aureum</i>	0.24	0.78	0.34	0.453
<i>Phoenix zeylanica</i>	0.02	0.02	0	0.013
<i>Mikania micrantha</i>	0	0.4	0	0.133
<i>Azadirachta indica</i>	0	0.02	0	0.007

Table 39 Species Richness Indices (L 7)

Margalef Species Richness Index	Shannon Wiener Index
1.6237	1.4378



Location 08

A total of five 50 m transects were laid. *Acrostichum aureum* was the plant with highest density in this location. The Margalef and Shannon Wiener species richness indices were 1.8647 and 1.7116 respectively (Table 46).

Table 40 Recorded true mangrove and mangrove associate species (Transect – 50 m to the forest)

Species	Transect 01 (50 m)				
	1	2	3	4	5
<i>Avicennia marina</i>					2
<i>Bruguiera cylindrica</i>	4	9	3	1	
<i>Bruguiera gymnorrhiza</i>					10
<i>Excoecaria agallocha</i>	3	8	8	5	24
<i>Lumnitzera racemosa</i>				1	
<i>Rhizophora mucronata</i>	15	2	4	9	14
<i>Thespesia populnea</i>		2			
<i>Premna serratifolia</i>	5	7	10	2	4
<i>Clerodendrum inerme</i>					1
<i>Derris trifoliata</i>	1	5	2		
<i>Acanthus ilicifolius</i>		21	42		
<i>Acrostichum aureum</i>	27	31	16	16	40
<i>Terminalia arjuna</i>	2	6	3		1
<i>Phoenix zeylanica</i>	1		1		
<i>Mikania micrantha</i>		11	11		25
<i>Azadirachta indica</i>		1			
<i>Ficus hispida</i>			4		
Unknown grass			60		
<i>Lantana camara</i>					3

Table 41 Densities of true mangrove and mangrove associate species in each transect

Species	Density (m-2)					Mean Density (m2)
	1	2	3	4	5	
<i>Avicennia marina</i>	0	0	0	0	0.04	0.008
<i>Bruguiera cylindrica</i>	0.08	0.18	0.06	0.02	0	0.068
<i>Bruguiera gymnorrhiza</i>	0	0	0	0	0.2	0.040
<i>Excoecaria agallocha</i>	0.06	0.16	0.16	0.1	0.48	0.192
<i>Lumnitzera racemosa</i>	0	0	0	0.02	0	0.004
<i>Rhizophora mucronata</i>	0.3	0.04	0.08	0.18	0.28	0.176
<i>Thespesia populnea</i>	0	0.04	0	0	0	0.008
<i>Premna serratifolia</i>	0.1	0.14	0.2	0.04	0.08	0.112
<i>Clerodendrum inerme</i>	0	0	0	0	0.02	0.004
<i>Derris trifoliata</i>	0.02	0.1	0.04	0	0	0.032
<i>Acanthus ilicifolius</i>	0	0.42	0.84	0	0	0.252
<i>Acrostichum aureum</i>	0.54	0.62	0.32	0.32	0.8	0.520
<i>Terminalia arjuna</i>	0.04	0.12	0.06	0	0.02	0.048
<i>Phoenix zeylanica</i>	0.02	0	0.02	0	0	0.008
<i>Mikania micrantha</i>	0	0.22	0.22	0	0.5	0.188
<i>Azadirachta indica</i>	0	0.02	0	0	0	0.004
<i>Ficus hispida</i>	0	0	0.08	0	0	0.016
Unknown grass	0	0	1.2	0	0	0.240
<i>Lantana camara</i>	0	0	0	0	0.06	0.012



Table 42 Species Richness Indices (L 8)

Margalef Species Richness Index	Shannon Wiener Index
1.8647	1.7116



Location 09

A total of ten 50 m transects were laid. *Acrostichum aureum* was the plant with highest density in this location. The Margalef and Shannon Wiener species richness indices were 0.9947 and 1.0181 respectively (Table 49).

Table 43 Recorded true mangrove and mangrove associate species (Transect – 100 m to the forest)

Species	Transect 01 (50 m)					Transect 02 (50 m)				
	1	2	3	4	5	1	2	3	4	5
<i>Avicennia marina</i>						1				
<i>Avicennia officinalis</i>		2			8	3	2		1	2
<i>Bruguiera cylindrica</i>	20	5	10	10		25	11	11		15
<i>Bruguiera gymnorrhiza</i>					5					6
<i>Lumnitzera racemosa</i>	2					2				
<i>Pemphis acidula</i>			3							
<i>Rhizophora mucronata</i>	8	2	3	3	4					4
<i>Aegiceras corniculatum</i>			3							
<i>Thespesia populnea</i>							4			1
<i>Clerodendrum inerme</i>							2			
<i>Azima tetracantha</i>										6
<i>Premna serratifolia</i>	1	4			2					
<i>Acrostichum aureum</i>	25	30	18	33			11	5		
<i>Caesalpinia bonduc</i>			2					6		1
<i>Mikania micrantha</i>			2		68					2
<i>Crinum asiaticum</i>					1					

Table 44 Densities of true mangrove and mangrove associate species in each transect

Species	Density (m-2)					Density (m-2)					Mean Density (m-2)
	1	2	3	4	5	1	2	3	4	5	
<i>Avicennia marina</i>	0	0	0	0	0	0.02	0	0	0	0	0.002
<i>Avicennia officinalis</i>	0	0.04	0	0	0.16	0.06	0.04	0	0.02	0.04	0.036
<i>Bruguiera cylindrica</i>	0.4	0.1	0.2	0.2	0	0.5	0.22	0.22	0	0.3	0.214
<i>Bruguiera gymnorrhiza</i>	0	0	0	0	0.1	0	0	0	0	0.12	0.022
<i>Lumnitzera racemosa</i>	0.04	0	0	0	0	0.04	0	0	0	0	0.008
<i>Pemphis acidula</i>	0	0	0.06	0	0	0	0	0	0	0	0.006
<i>Rhizophora mucronata</i>	0.16	0.04	0.06	0.06	0.08	0	0	0	0	0.08	0.048
<i>Aegiceras corniculatum</i>	0	0	0.06	0	0	0	0	0	0	0	0.006
<i>Thespesia populnea</i>	0	0	0	0	0	0	0.08	0	0	0.02	0.010
<i>Clerodendrum inerme</i>	0	0	0	0	0	0	0.04	0	0	0	0.004
<i>Azima tetracantha</i>	0	0	0	0	0	0	0	0	0	0.12	0.012
<i>Premna serratifolia</i>	0.02	0.08	0	0	0.04	0	0	0	0	0	0.014



Species	Density (m-2)					Density (m-2)					Mean Density (m-2)
	1	2	3	4	5	1	2	3	4	5	
<i>Acrostichum aureum</i>	0.5	0.6	0.36	0.66	0	0	0.22	0.1	0	0	0.244
<i>Caesalpinia bonduc</i>	0	0	0.04	0	0	0	0	0.12	0	0.02	0.018
<i>Mikania micrantha</i>	0	0	0.04	0	1.36	0	0	0	0	0.04	0.144
<i>Crinum asiaticum</i>	0	0	0	0	0.02	0	0	0	0	0	0.002

Table 45 Species Richness Indices (L 9)

Margalef Species Richness Index	Shannon Wiener Index
0.9947	1.0181



Location 10

A total of five 50 m transects were laid. *Bruguiera cylindrica* was the plant with highest density in this location. The Margalef and Shannon Wiener species richness indices were 1.3073 and 1.3576 respectively (Table 52).

Table 46 Recorded true mangrove and mangrove associate species (Transect – 50 m to the forest)

Species	Transect 01 (50 m)				
	1	2	3	4	5
<i>Avicennia marina</i>		12		1	
<i>Bruguiera cylindrica</i>	8	20	7	89	10
<i>Excoecaria agallocha</i>	7	18	5	5	2
<i>Lumnitzera racemosa</i>		2		1	
<i>Pemphis acidula</i>				1	
<i>Aegiceras corniculatum</i>	1		1		
<i>Thespesia populnea</i>		3		4	3
<i>Premna serratifolia</i>	5				
<i>Azima tetracantha</i>		11	11	22	13
<i>Acanthus ilicifolius</i>	35				
<i>Acrostichum aureum</i>	18	5	20		
<i>Suaeda monoica</i>		3			
<i>Phoenix zeylanica</i>			1		
<i>Mikania micrantha</i>					1

Table 47 Densities of true mangrove and mangrove associate species in each transect

Species	Density (m-2)					Mean Density (m-2)
	1	2	3	4	5	
<i>Avicennia marina</i>	0	0.24	0	0.02	0	0.052
<i>Bruguiera cylindrica</i>	0.16	0.4	0.14	1.78	0.2	0.536
<i>Excoecaria agallocha</i>	0.14	0.36	0.1	0.1	0.04	0.148
<i>Lumnitzera racemosa</i>	0	0.04	0	0.02	0	0.012
<i>Pemphis acidula</i>	0	0	0	0.02	0	0.004
<i>Aegiceras corniculatum</i>	0.02	0	0.02	0	0	0.008
<i>Thespesia populnea</i>	0	0.06	0	0.08	0.06	0.040
<i>Premna serratifolia</i>	0.1	0	0	0	0	0.020
<i>Azima tetracantha</i>	0	0.22	0.22	0.44	0.26	0.228
<i>Acanthus ilicifolius</i>	0.7	0	0	0	0	0.140
<i>Acrostichum aureum</i>	0.36	0.1	0.4	0	0	0.172
<i>Suaeda monoica</i>	0	0.06	0	0	0	0.012
<i>Phoenix zeylanica</i>	0	0	0.02	0	0	0.004
<i>Mikania micrantha</i>	0	0	0	0	0.02	0.004

Table 48 Species Richness Indices (L 10)

Margalef Species Richness Index	Shannon Wiener Index
1.3073	1.3576



Location II

A total of six 50 m transects were laid. *Acanthus ilicifolius* was the plant with highest density in this location. The Margalef and Shannon Wiener species richness indices were 1.2435 and 1.269 respectively (Table 55).

Table 49 Recorded true mangrove and mangrove associate species (Transect – 50 m to the forest)

Species	Transect 01 (50 m)					
	1	2	3	4	5	6
<i>Avicennia marina</i>				1		
<i>Avicennia officinalis</i>	1				2	
<i>Bruguiera cylindrica</i>	12	37	37	13	14	6
<i>Excoecaria agallocha</i>	9	22	1	13	9	6
<i>Lumnitzera racemosa</i>	1			2		
<i>Pemphis acidula</i>			1			
<i>Rhizophora mucronata</i>	7	1	6	7	6	4
<i>Aegiceras corniculatum</i>			2			
<i>Premna serratifolia</i>	1	14		12		4
<i>Acanthus ilicifolius</i>	18	33	154		100	197
<i>Acrostichum aureum</i>	28	15	20	54	74	23
<i>Caesalpinia bonduc</i>		5				1
<i>Phoenix zeylanica</i>			1			

Table 50 Densities of true mangrove and mangrove associate species in each transect

Species	Density (m ²)						Mean Density (m ⁻²)
	1	2	3	4	5	6	
<i>Avicennia marina</i>	0	0	0	0.02	0	0	0.003
<i>Avicennia officinalis</i>	0.02	0	0	0	0.04	0	0.010
<i>Bruguiera cylindrica</i>	0.24	0.74	0.74	0.26	0.28	0.12	0.397
<i>Excoecaria agallocha</i>	0.18	0.44	0.02	0.26	0.18	0.12	0.200
<i>Lumnitzera racemosa</i>	0.02	0	0	0.04	0	0	0.01
<i>Pemphis acidula</i>	0	0	0.02	0	0	0	0.003
<i>Rhizophora mucronata</i>	0.14	0.02	0.12	0.14	0.12	0.08	0.103
<i>Aegiceras corniculatum</i>	0	0	0.04	0	0	0	0.007
<i>Premna serratifolia</i>	0.02	0.28	0	0.24	0	0.08	0.103
<i>Acanthus ilicifolius</i>	0.36	0.66	3.08	0	2	3.94	1.673
<i>Acrostichum aureum</i>	0.56	0.3	0.4	1.08	1.48	0.46	0.713
<i>Caesalpinia bonduc</i>	0	0.1	0	0	0	0.02	0.020
<i>Phoenix zeylanica</i>	0	0	0.02	0	0	0	0.003

Table 51 Species Richness Indices (L 11)

Margalef Species Richness Index	Shannon Wiener Index
1.2437	1.269



Location 12

A total of two 50 m transects were laid. *Acrostichum aureum* was the plant with highest density in this location. The Margalef and Shannon Wiener species richness diversity indices were 1.7639 and 1.3239 respectively (Table 58).

Table 52 Recorded true mangrove and mangrove associate species (Transect – 50 m to the forest)

Species	Transect 01 (50 m)	
	1	2
<i>Avicennia officinalis</i>		3
<i>Bruguiera cylindrica</i>	15	8
<i>Bruguiera gymnorrhiza</i>		1
<i>Ceriops tagal</i>	2	3
<i>Excoecaria agallocha</i>	66	
<i>Lumnitzera racemosa</i>	6	7
<i>Rhizophora apiculata</i>	10	4
<i>Rhizophora mucronata</i>	70	8
<i>Thespesia populnea</i>	2	
<i>Premna serratifolia</i>	4	3
<i>Azima tetraacantha</i>		2
<i>Acrostichum aureum</i>	8	106
<i>Terminalia arjuna</i>	2	
<i>Dolichandrone spathacea</i>	1	

Table 53 Densities of true mangrove and mangrove associate species in each transect

	Density (m-2)		Mean Density (m-2)
	1	2	
<i>Avicennia officinalis</i>	0	0.06	0.03
<i>Bruguiera cylindrica</i>	0.3	0.16	0.23
<i>Bruguiera gymnorrhiza</i>	0	0.02	0.01
<i>Ceriops tagal</i>	0.04	0.06	0.05
<i>Excoecaria agallocha</i>	1.32	0	0.66
<i>Lumnitzera racemosa</i>	0.12	0.14	0.13
<i>Rhizophora apiculata</i>	0.2	0.08	0.14
<i>Rhizophora mucronata</i>	1.4	0.16	0.78
<i>Thespesia populnea</i>	0.04	0	0.02
<i>Premna serratifolia</i>	0.08	0.06	0.07
<i>Azima tetraacantha</i>	0	0.04	0.02
<i>Acrostichum aureum</i>	0.16	2.12	1.14
<i>Terminalia arjuna</i>	0.04	0	0.02
<i>Dolichandrone spathacea</i>	0.02	0	0.01

Table 54 Species Richness Indices (L 12)

Margalef Species Richness Index	Shannon Wiener Index
1.7639	1.3239



9.0 BUTTERFLY DIVERSITY ANALYSIS

During the survey, 84 species of butterflies belonging to 5 families were recorded. This represented about 34.42 % of the island's total butterfly fauna.

There were three endemic species- *Troides darsius*, Sri Lanka Birdwing, *Mycalesis subdita*, Sri Lanka Tamil Bush Brown, *Appias galena*, Sri Lanka Lesser Albatross. Moreover, there are 7 nationally threatened species found in the Kala Oya river basin, out of which five are Vulnerable (VU): *Papiliocrino* - Banded Peacock, *Ariadne merione* - Common Caster, *Bybliai lithyia* - Joker (Error! Reference source not found.), *Virachola perse* - Large Guava Blue, *Spindasis lohita* - Long-banded Silverline, and two are Near Threatened (NT) *Iraota timoleon* - Silver Streak Blue, *Pelopidas agna* - Little Branded Swift.

When considering the distribution of endemic species, the Sri Lanka Birdwing - *Troides darsius*, was found in Dry Mixed Evergreen Forest, the Sri Lanka Tamil Bush Brown - *Mycalesis subdita* was found in Chena associated habitats, Disturbed Forest areas and Dry Mixed Evergreen Forest, the Sri Lanka Lesser Albatross - *Appias galena*, was found in tank associated habitats and Dry Mixed Evergreen Forests (Table 55).

Table 55 Endemic butterfly species found in transects surveyed

Genus	Species	Common Name	Red List status	T9	T12	T13	T15	T17	T19	T22	T23	T24
<i>Appias</i>	<i>galene</i>	Lesser Albatross	LC			11	4	2	9	3	12	27
<i>Troides</i>	<i>demoleus</i>	Sri Lanka Birdwing	LC			1		2				
<i>Mycalesis</i>	<i>subdita</i>	Tamil Bush Brown	LC	1	3		12					

The nationally threatened Joker - *Bybliai lithyia* which is Vulnerable, was found only in meadows with seasonal flooding on coastal habitats T1 and T2. These areas belong to the North and North West butterfly zones. The Common Caster - *Ariadne merione*, was recorded only once in this habitat (T2). The Banded Peacock - *Papilio crino* mainly found in Dry Mixed Evergreen Forest areas was found in T9, T17, T19, T20. The Large Guava Blue - *Virachola perse* mainly found in Scrub Forests was observed in T21. The Long-banded Silverline - *Spindasis lohita* found in Dry Mixed Evergreen Forests was observed in T16.

Two species falling in the Near Threatened category, the Little Branded Swift – *Pelopidas agna* and the Silver Streak Blue – *Iraota timoleon* were recorded in Scrub Forests in T6 and tank associated habitats in T18 respectively.



Table 56 Nationally threatened species found in transects

Genus	Species	Common Name	Red List Status	T1	T2	T6	T9	T 16	T 17	T 18	T 19	T 21
Papilio	crino	Banded Peacock	VU				1		1		1	1
Ariadne	merione	Common Caster	VU		1							
Byblia	ilithyia	Joker	VU	3	9							
Virachola	perse	Large Guava Blue	VU									1
Pelopidas	agna	Little Branded Swift	NT			1						
Spindasis	lohita	Long-banded Silverline	VU					1				
Iraota	timoleon	Silver Streak Blue	NT							1		

According to the different habitats, the transects of the Kala Oya were categorized to seven different sub basins. However, only the distribution in the sub basins in Kala Oya with relevance to the respective transect is discussed here. Annex 04 outlines the geographic coordinates of the transects.

A. Eile area sub basin (Transect 1, 2, 3, 4)

The Joker, *Byblia ilithyia* (Figure 81), a characteristic species confined to seasonal flooding habitats (Gamage, R. 2014, Redlist 2012) was found only in meadows with seasonal flooding.

This nationally threatened species which falls under the Vulnerable (VU) category was found only in T1 and T2 (IUCN Redlist 2012). The Common Caster, *Ariadne merione*, a Vulnerable species, was recorded only once- in habitat T2 (Shannon Index 3.68, Simpson Index 0.1084). According to density values, the Dark Grass Blue shows the highest density (Table 57).

Table 57 List of Butterfly species recorded from the Eile area (Transects 1,2,3,4,) and their status and population density (m²)

	Genus	Species	Common Name	Red List status	No. butterfly flies	Status	Population density (m ²)
1	<i>Azanus</i>	<i>jesous</i>	African Babul Blue	LC	3	Indigenous	0.0001875
2	<i>Ariadne</i>	<i>ariadne</i>	Angle Castor	LC	53	Indigenous	0.0033125
3	<i>Tirumala</i>	<i>limniace</i>	Blue Tiger	LC	1	Indigenous	0.0000625
4	<i>Ampittia</i>	<i>dioscorides</i>	Bush hopper	LC	1	Indigenous	0.0000625



	Genus	Species	Common Name	Red List status	No. butterfly flies	Status	Population density (m ²)
5	<i>Lambrix</i>	<i>salsala</i>	Chestnut Bob	LC	2	Indigenous	0.000125
6	<i>Ariadne</i>	<i>merione</i>	Common Caster	VU	1	Indigenous	0.0000625
7	<i>Eurima</i>	<i>Hecabe</i>	Common Grass Yellow	LC	33	Indigenous	0.0020625
8	<i>Cepora</i>	<i>Cepora</i>	Common Gull	LC	7	Indigenous	0.000875
9	<i>Prosotas</i>	<i>nora</i>	Common Line Blue	LC	8	Indigenous	0.0005
10	<i>Danaus</i>	<i>genutia</i>	Common Tiger	LC	6	Indigenous	0.00075
11	<i>Pachliopta</i>	<i>hector</i>	Crimson rose	LC	1	Indigenous	0.0000625
12	<i>Hypolimnas</i>	<i>misippus</i>	Danaid Eggfly	LC	1	Indigenous	0.0000625
13	<i>Zizeeria</i>	<i>Karsandra</i>	Dark Grass Blue	LC	73	Indigenous	0.0045625
14	<i>Delias</i>	<i>eucharis</i>	Jezebal	LC	11	Indigenous	0.0005
15	<i>Byblia</i>	<i>ilithyia</i>	Joker	VU	12	Indigenous	0.00075
16	<i>Catopsilia</i>	<i>pomona</i>	Lemon Emigrant	LC	1	Indigenous	0.0000625
17	<i>Junonia</i>	<i>lemonius</i>	Lemon Pansy	LC	20	Indigenous	0.00125
18	<i>Lampides</i>	<i>boeticus</i>	Pea Blue	LC	1	Indigenous	0.0000625
19	<i>Junonia</i>	<i>almanac</i>	Peacock Pansy	LC	1	Indigenous	0.0000625
20	<i>Danaus</i>	<i>chrysippus</i>	Plain Tiger	LC	55	Indigenous	0.0034375
21	<i>Leptosia</i>	<i>nina</i>	Psyche	LC	6	Indigenous	0.000375
22	<i>Clotis</i>	<i>amata</i>	Small Salmon Arab	LC	38	Indigenous	0.002375
23	<i>Appias</i>	<i>libythea</i>	Striped Albetross	LC	5	Indigenous	0.0003125
24	<i>Acraea</i>	<i>violae</i>	Tawniy Coster	LC	2	Indigenous	0.000125
25	<i>Zizula</i>	<i>hylax</i>	Tiny Grass Blue	LC	11	Indigenous	0.0006875
26	<i>Potanthus</i>	<i>confucius</i>	Tropic Dart	LC	1	Indigenous	0.000125
27	<i>Ypthima</i>	<i>ceylonica</i>	White Four Ring	LC	4	Indigenous	0.00025
28	<i>Ixias</i>	<i>pyrere</i>	Yellow Orange tip	LC	1	Indigenous	0.0000625
29	<i>Leptotus</i>	<i>Plinius</i>	Zebra Blue	LC	6	Indigenous	0.000375

B. Eluwankulama sub basin (Transect 5 and 6)

This area consisted mainly of two different habitats- tank associated habitat and Dry Mixed Evergreen Forest. The results indicate that the Eluwankulama ecosystem contained 23 species of butterflies (Table 58). However, no endemic species were recorded. The species richness according to the Shannon index was 3.88, showing fairly high diversity.



The Little Branded Swift, *Pelopidas agna*, falling under the Near Threatened (NT) category was recorded within Scrub Forest habitats of the area. According to the density values, the Common Jezebel showed the highest density values (Table 58).

Table 58 List of butterfly species recorded from the Eluwankulama area (Transect 5 and 6)

	Family name	Species name	Common Name	Red List status	No. of butterflies	Status	Population density (m ²)
1	<i>Tirumala</i>	<i>limniace</i>	Blue Tiger	LC	12	Indigenous	0.0015
2	<i>Ampittia</i>	<i>dioscorides</i>	Bush hopper	LC	2	Indigenous	0.00025
3	<i>Euploea</i>	<i>core</i>	Common Crow	LC	14	Indigenous	0.00175
4	<i>Eurima</i>	<i>Hecabe</i>	Common Grass Yellow	LC	28	Indigenous	0.0035
5	<i>Danaus</i>	<i>genutia</i>	Common Tiger	LC	7	Indigenous	0.000875
6	<i>Pachliopta</i>	<i>hector</i>	Crimson rose	LC	7	Indigenous	0.000875
7	<i>Hypolimnias</i>	<i>missippus</i>	Danaid Eggfly	LC	2	Indigenous	0.00025
8	<i>Zizeeria</i>	<i>Karsandra</i>	Dark Grass Blue	LC	15	Indigenous	0.001875
9	<i>Euchrysops</i>	<i>cnejus</i>	Gram Blue	LC	2	Indigenous	0.00025
10	<i>Delias</i>	<i>eucharis</i>	Jezebel	LC	16	Indigenous	0.002
11	<i>Zizina</i>	<i>otis</i>	Lesser Grass Blue	LC	2	Indigenous	0.00025
12	<i>Junonia</i>	<i>lemonius</i>	Lemon Pansy	LC	9	Indigenous	0.001125
13	<i>Pelopidas</i>	<i>agna</i>	Little Branded Swift	NT	1	Indigenous	0.000125
14	<i>Orsotriaena</i>	<i>medus</i>	Medus Brown	LC	3	Indigenous	0.000375
15	<i>Catopsilia</i>	<i>pyrantha</i>	Mottled Emigrant	LC	8	Indigenous	0.001
16	<i>Lampides</i>	<i>boeticus</i>	Pea Blue	LC	21	Indigenous	0.002625
17	<i>Danaus</i>	<i>chrysippus</i>	Plain Tiger	LC	32	Indigenous	0.004
18	<i>Anthene</i>	<i>lycaenina</i>	Pointed Cilite Blue	LC	1	Indigenous	0.000125
19	<i>Leptosia</i>	<i>nina</i>	Psyche	LC	3	Indigenous	0.000375
20	<i>Acraea</i>	<i>violae</i>	Tawney Coster	LC	3	Indigenous	0.000375
21	<i>Potanthus</i>	<i>confucius</i>	Tropic Dart	LC	1	Indigenous	0.000125
22	<i>Ypthima</i>	<i>ceylonica</i>	White Four Ring	LC	4	Indigenous	0.0005
23	<i>Leptotus</i>	<i>Plinius</i>	Zebra Blue	LC	4	Indigenous	0.0005



C. Suduweli Tahalawa, Morapathana sub basin (Transects 7 and 8)

Dry Mixed Evergreen Forest was the prominent habitat type with open dunes in some areas. During the period of survey, 22 species were observed in this habitat. The Shannon index (H') was 3.99. According to the density values, the White Four Ring shows the highest density value (Table 59).

Table 59 List of butterfly species recorded from the Suduweli Tahalawa, Morapathana area (Transect 7 and 8) with their status and population density (m²)

	Family name	Species name	Common Name	Red List status	No. butterfly flies	Status	Population density (m ²)
1	<i>Ariadne</i>	<i>ariadne</i>	Angle Castor	LC	4	Indigenous	0.0005
2	<i>Junonia</i>	<i>iphita</i>	Chocolate Soldier	LC	5	Indigenous	0.000625
3	<i>Mycalesis</i>	<i>perseus</i>	Common Bushbrown	LC	2	Indigenous	0.00025
4	<i>Jamides</i>	<i>celeno</i>	Common Cerulean	LC	1	Indigenous	0.000125
5	<i>Euploea</i>	<i>core</i>	Common Crow	LC	9	Indigenous	0.001125
6	<i>Eurima</i>	<i>Hecabe</i>	Common Grass Yellow	LC	2	Indigenous	0.00025
7	<i>Cepora</i>	<i>Cepora</i>	Common Gull	LC	4	Indigenous	0.0005
8	<i>Castalius</i>	<i>rosimon</i>	Common Pierrot	LC	2	Indigenous	0.00025
9	<i>Neptis</i>	<i>hylas</i>	Common Sailor	LC	5	Indigenous	0.000625
10	<i>Spindasis</i>	<i>vulcanus</i>	Common Silverline	LC	1	Indigenous	0.000125
11	<i>Pachliopta</i>	<i>hector</i>	Crimson rose	LC	3	Indigenous	0.000375
12	<i>Euchrysops</i>	<i>cnejus</i>	Gram Blue	LC	2	Indigenous	0.00025
13	<i>Freyeria</i>	<i>putli</i>	Grass Jewel	LC	1	Indigenous	0.000125
14	<i>Spialia</i>	<i>galba</i>	Indian Skipper	LC	2	Indigenous	0.00025
15	<i>Delias</i>	<i>eucharis</i>	Jezebel	LC	4	Indigenous	0.0005
16	<i>Zizina</i>	<i>otis</i>	Lesser Grass Blue	LC	2	Indigenous	0.00025
17	<i>Junonia</i>	<i>lemonius</i>	Lemon Pansy	LC	3	Indigenous	0.000375
18	<i>Orsotriaena</i>	<i>medus</i>	Medes Brown	LC	9	Indigenous	0.001125
19	<i>Catopsilia</i>	<i>pyrantha</i>	Mottled Emigrant	LC	9	Indigenous	0.001125
20	<i>Graphiun</i>	<i>agamemnon</i>	Tailed Jay	LC	1	Indigenous	0.000125
21	<i>Acraea</i>	<i>violae</i>	Tawney Coster	LC	1	Indigenous	0.000125
22	<i>Ypthima</i>	<i>ceylonica</i>	White Four Ring	LC	16	Indigenous	0.002

D. Weerakkodichole, Tahabbowa sub basin (Transect 9, 10)

Dry Mixed Evergreen Forests dominated this area. Disturbed Forest, Scrub Forest, abandoned Chena and Riparian forest are other habitat types found within this area. The results indicated that the habitat showed 29 species of butterflies. The Shannon index (H') was 3.90. The Banded Peacock, *Papilio crino*, a Vulnerable (VU) species was recorded in this area. According to the density values, the Plain Tiger (*Danaus chrysippus*) showed the highest density values (Table 60).



Table 60 List of butterfly species recorded from Werakkodichole, Tahabbowa area (Transect 9 and 10) with their status and population density (m²)

	Family name	Species name	Common Name	Red List status	No. of butter flies	Status	Population density (m ²)
1	<i>Ariadne</i>	<i>ariadne</i>	Angle Castor	LC	6	Indigenous	0.00075
2	<i>Papilio</i>	<i>crino</i>	Banded Peacock	VU	1	Indigenous	0.000125
3	<i>Tirumala</i>	<i>limniace</i>	Blue Tiger	LC	4	Indigenous	0.0005
4	<i>Badamia</i>	<i>exclamationis</i>	Brown Awl	LC	1	Indigenous	0.000125
5	<i>Lambrix</i>	<i>salsala</i>	Chestnut Bob	LC	7	Indigenous	0.000875
6	<i>Jamides</i>	<i>celeno</i>	Common Cerulean	LC	2	Indigenous	0.00025
7	<i>Euploea</i>	<i>core</i>	Common Crow	LC	21	Indigenous	0.002625
8	<i>Eurima</i>	<i>Hecabe</i>	Common Grass Yellow	LC	13	Indigenous	0.001625
9	<i>Cepora</i>	<i>Cepora</i>	Common Gull	LC	3	Indigenous	0.000375
10	<i>Castalius</i>	<i>rosimon</i>	Common Pierrot	LC	1	Indigenous	0.000125
11	<i>Pachliopta</i>	<i>hector</i>	Common Rose	LC	1	Indigenous	0.000125
12	<i>Neptis</i>	<i>hylas</i>	Common Sailor	LC	12	Indigenous	0.0015
13	<i>Spindasis</i>	<i>vulcanus</i>	Common Silverline	LC	1	Indigenous	0.000125
14	<i>Danaus</i>	<i>genutia</i>	Common Tiger	LC	10	Indigenous	0.00125
15	<i>Pachliopta</i>	<i>hector</i>	Crimson Rose	LC	15	Indigenous	0.001875
16	<i>Zizeeria</i>	<i>Karsandra</i>	Dark Grass Blue	LC	16	Indigenous	0.002
17	<i>Pareronia</i>	<i>ceylanica</i>	Dark Wanderer	LC	2	Indigenous	0.00025
18	<i>Euchrysops</i>	<i>cnejus</i>	Gram Blue	LC	5	Indigenous	0.00625
19	<i>Everes</i>	<i>lacturnus</i>	Indian Cupid	LC	1	Indigenous	0.000125
20	<i>Delias</i>	<i>eucharis</i>	Jezebal	LC	18	Indigenous	0.00225
21	<i>Zizina</i>	<i>otis</i>	Lasser Grass Blue	LC	4	Indigenous	0.0005
22	<i>Catopsilia</i>	<i>pomona</i>	Lemon Emigrant	LC	2	Indigenous	0.00025
23	<i>Junonia</i>	<i>lemonius</i>	Lemon Pansy	LC	4	Indigenous	0.0005
24	<i>Junonia</i>	<i>almanac</i>	Peacock Pansy	LC	1	Indigenous	0.000125
25	<i>Danaus</i>	<i>chrysippus</i>	Plain Tiger	LC	52	Indigenous	0.0065
26	<i>Leptosia</i>	<i>nina</i>	Psyche	LC	6	Indigenous	0.00075
27	<i>Mycalesis</i>	<i>subdita</i>	Tamil Bush Brown	LC	1	Endemic	0.000125
28	<i>Zizula</i>	<i>hylax</i>	Tiny Grass Blue	LC	2	Indigenous	0.00025
29	<i>Ypthima</i>	<i>ceylonica</i>	White Four Ring	LC	42	Indigenous	0.00525

E. Horiwila / Ambagahawewa sub basin (Transect 11 and 12)

Disturbed Forest, Scrub Forest, abandoned Chena, Riparian forest, Tank associated habitats, Dry Mixed Evergreen Forest are habitat types found within this area. The results indicated that the habitat had 18 species of butterflies. The Shannon index (H') was 3.566. One endemic species, the Sri Lanka Tamil Bush Brown, *Mycalesis subdita*, was found in Dry Mixed Evergreen Forest



habitat. According to the density values, the Common Crow (*Euploea core*) showed the highest density values (Table 61).

Table 61 List of butterfly species recorded from Horiwila/ Ambagahawewa (Transect 11 and 12) with their status and Population density (m²)

	Family name	Species name	Common Name	Red List status	No. of butter flies	Status	Population density (m ²)
1	<i>Tirumala</i>	<i>limniace</i>	Blue Tiger	LC	11	Indigenous	0.001375
2	<i>Ampittia</i>	<i>dioscorides</i>	Bush hopper	LC	2	Indigenous	0.00025
3	<i>Lambrix</i>	<i>salsala</i>	Chestnut Bob	LC	4	Indigenous	0.0005
4	<i>Euploea</i>	<i>core</i>	Common Crow	LC	29	Indigenous	0.003625
5	<i>Melanitis</i>	<i>leda</i>	Common Evening Brown	LC	1	Indigenous	0.000125
6	<i>Eurima</i>	<i>Hecabe</i>	Common Grass Yellow	LC	11	Indigenous	0.001375
7	<i>Cepora</i>	<i>Cepora</i>	Common Gull	LC	4	Indigenous	0.0005
8	<i>Neptis</i>	<i>hylas</i>	Common Sailor	LC	1	Indigenous	0.000125
9	<i>Danaus</i>	<i>genutia</i>	Common Tiger	LC	2	Indigenous	0.00025
10	<i>Pachliopta</i>	<i>aristolochia</i>	Crimson Rose	LC	7	Indigenous	0.000875
11	<i>Euchrysops</i>	<i>cnejus</i>	Gram Blue	LC	4	Indigenous	0.0005
12	<i>Delias</i>	<i>eucharis</i>	Jezebel	LC	5	Indigenous	0.000625
13	<i>Catopsilia</i>	<i>pyrantha</i>	Mottled Emigrant	LC	3	Indigenous	0.000375
14	<i>Lampides</i>	<i>boeticus</i>	Pea Blue	LC	3	Indigenous	0.000375
15	<i>Danaus</i>	<i>chrysippus</i>	Plain Tiger	LC	8	Indigenous	0.001
16	<i>Mycalesis</i>	<i>subdita</i>	Tamil Bush Brown	LC	3	Endemic	0.000375
17	<i>Ypthima</i>	<i>ceylonica</i>	White Four Ring	LC	20	Indigenous	0.0025
18	<i>Leptotus</i>	<i>Plinius</i>	Zebra Blue	LC	3	Indigenous	0.000375

F. Galpaya Hinguruwelpitiya Ranva kannda, Nambatiwewa, sub basin (Transect 13, 14, 15, 16)

During the study period, 55 species of butterflies including 3 endemic species- Sri Lanka Birdwing, *Troides darsius*, Sri Lanka Tamil Bush Brown, *Mycalesis subdita* and the Sri Lanka Lesser Albatross, *Appias galena* were recorded in this area. Among them 1 nationally threatened species was identified. The results indicated that this area as a habitat showed the highest butterfly diversity (55 species). The Shannon index (H') was 4.89. According to the density values, the Common Grass Yellow and Pea Blue showed the highest density values (Table 65).



Table 62 List of butterfly species recorded from Galpaya, Hinguruwelpitiya, Ranva kannada, Nambatiwewa (Transect 13, 14, 15, and 16) with their status and Population density (m²)

Family name	Species name	Common Name	Red List status	No. of butterflies	Status	Population density (m ²)	
1	<i>Azanus</i>	<i>jesous</i>	African Babul Blue	LC	3	Indigenous	0.000188
2	<i>Ariadne</i>	<i>ariadne</i>	Angle Castor	LC	3	Indigenous	0.000188
3	<i>Papillio</i>	<i>polymnestor</i>	Blue Mormon	LC	2	Indigenous	0.000125
4	<i>Tirumala</i>	<i>limniace</i>	Blue Tiger	LC	18	Indigenous	0.001125
5	<i>Ampittia</i>	<i>dioscorides</i>	Bush hopper	LC	2	Indigenous	0.000125
6	<i>Tagiades</i>	<i>japetus</i>	Ceylon Snow Flat	LC	1	Indigenous	0.0000625
7	<i>Lambrix</i>	<i>salsala</i>	Chestnut Bob	LC	4	Indigenous	0.00025
8	<i>Junonia</i>	<i>iphita</i>	Chocolate Soldier	LC	7	Indigenous	0.000438
9	<i>Hasora</i>	<i>chromus</i>	Common Banded Awl	LC	1	Indigenous	0.0000625
10	<i>Mycalesis</i>	<i>perseus</i>	Common Bushbrown	LC	24	Indigenous	0.0015
11	<i>Jamides</i>	<i>celeno</i>	Common Cerulean	LC	3	Indigenous	0.000188
12	<i>Euploea</i>	<i>core</i>	Common Crow	LC	18	Indigenous	0.001125
13	<i>Eurima</i>	<i>Hecabe</i>	Common Grass Yellow	LC	52	Indigenous	0.00325
14	<i>Cepora</i>	<i>Cepora</i>	Common Gull	LC	5	Indigenous	0.000625
15	<i>Papilio</i>	<i>polytes</i>	Common Mormon	LC	2	Indigenous	0.000125
16	<i>Castalius</i>	<i>rosimon</i>	Common Pierrot	LC	1	Indigenous	0.0000625
17	<i>Pachliopta</i>	<i>aristolochia</i>	Common Rose	LC	11	Indigenous	0.001375
18	<i>Neptis</i>	<i>hylas</i>	Common Sailor	LC	24	Indigenous	0.0015
19	<i>Danaus</i>	<i>genutia</i>	Common Tiger	LC	4	Indigenous	0.00025
20	<i>Pachliopta</i>	<i>hector</i>	Crimson rose	LC	23	Indigenous	0.001438
21	<i>Mycalesis</i>	<i>mineus</i>	Dark Brand Bushbrown	LC	2	Indigenous	0.000125
22	<i>Jumides</i>	<i>bochus</i>	Dark Cerulean	LC	6	Indigenous	0.000375
23	<i>Mycalesis</i>	<i>patnia</i>	Gladeye Bush Brown	LC	7	Indigenous	0.000438
24	<i>Parantica</i>	<i>aglea</i>	Glassy Tiger	LC	1	Indigenous	0.0000625
25	<i>Hypolimnias</i>	<i>bolina</i>	Grate Eggfly	LC	3	Indigenous	0.000188
26	<i>Hebomoia</i>	<i>glaucippe</i>	Great Orangetip	LC	1	Indigenous	0.0000625
27	<i>Junonia</i>	<i>atlites</i>	Grey Pansy	LC	8	Indigenous	0.0005
28	<i>Everes</i>	<i>lacturnus</i>	Indian Cupid	LC	3	Indigenous	0.000188
29	<i>Spialia</i>	<i>galba</i>	Indian Skipper	LC	4	Indigenous	0.00025
30	<i>Curetis</i>	<i>thetis</i>	Indian Sunbeam	LC	1	Indigenous	0.0000625
31	<i>Delias</i>	<i>eucharis</i>	Jezebel	LC	10	Indigenous	0.000625
32	<i>Zizina</i>	<i>otis</i>	Lesser Grass Blue	LC	11	Indigenous	0.001375
33	<i>Junonia</i>	<i>lemonius</i>	Lemon Pansy	LC	1	Indigenous	0.0000625
34	<i>Phalanta</i>	<i>phalantha</i>	Leopard	LC	4	Indigenous	0.00025



Family name	Species name	Common Name	Red List status	No. of butterflies	Status	Population density (m ²)
35	<i>Appias galene</i>	Lesser Albatross	LC	15	Endemic	0.001875
36	<i>Chilades lajus</i>	Lime Blue	LC	5	Indigenous	0.000313
37	<i>Papilio demoleus</i>	Lime Butterfly	LC	4	Indigenous	0.00025
38	<i>Spindasis lohita</i>	Long-banded Silverline	VU	1	Indigenous	0.0000625
39	<i>Orsotriaena medus</i>	Medus Brown	LC	12	Indigenous	0.00075
40	<i>Rathida amor</i>	Monkey Puzzle	LC	1	Indigenous	0.0000625
41	<i>Catopsilia pyrantha</i>	Mottled Emigrant	LC	23	Indigenous	0.001438
42	<i>Lampides boeticus</i>	Pea Blue	LC	52	Indigenous	0.00325
43	<i>Junonia almanac</i>	Peacock Pansy	LC	2	Indigenous	0.000125
44	<i>Tajuria cippus</i>	Peacock Royal	LC	1	Indigenous	0.0000625
45	<i>Danaus chrysippus</i>	Plain Tiger	LC	3	Indigenous	0.000188
46	<i>Leptosia nina</i>	Psyche	LC	3	Indigenous	0.000188
47	<i>Troides darsius</i>	Sri Lanka Birdwing	LC	1	Endemic	0.0000625
48	<i>Graphiun agamemnon</i>	Tailed Jay	LC	2	Indigenous	0.000125
49	<i>Mycalesis subdita</i>	Tamil Bush Brown	LC	15	Endemic	0.000938
50	<i>Acraea violae</i>	TawnyCoster	LC	5	Indigenous	0.000313
51	<i>Zizula hylax</i>	Tiny Grass Blue	LC	33	Indigenous	0.002063
52	<i>Potanthus confucius</i>	Tropic Dart	LC	4	Indigenous	0.00025
53	<i>Borbo cinnara</i>	Wallace's Swift	LC	2	Indigenous	0.000125
54	<i>Ypthima ceylonica</i>	White Four Ring	LC	40	Indigenous	0.0025
55	<i>Leptotus Plinius</i>	Zebra Blue	LC	18	Indigenous	0.001125

G. Manawa area sub basin (Transect 17, 18 19 20,)

During the study period, 42 species of butterflies including 2 endemic species, the Sri Lanka Birdwing, *Troides darsius* and the Sri Lanka Lesser Albatross, *Appias galena* were recorded in this area. Amongst the butterflies recorded during the survey, the nationally threatened Banded Peacock, *Papilio crino*, and Silver Streak Blue, *Iraota timoleon* were also recorded. The Shannon index (H') was 4.27. According to the density values, the Common Crow showed the highest density values (Table 63).

Table 63 List of butterfly species recorded from the Manawa area (Transect 17, 18, 19, and 20) with their status and population density (m²)

Family name	Species name	Common Name	Red List status	No. of butterflies	Status	Population density (m ²)
1	<i>Papilio crino</i>	Banded Peacock	VU	2	Indigenous	0.000125
2	<i>Papillio polymnestor</i>	Blue Mormon	LC	3	Indigenous	0.000188
3	<i>Tirumala limniace</i>	Blue Tiger	LC	50	Indigenous	0.003125
4	<i>Ampittia dioscorides</i>	Bush hopper	LC	1	Indigenous	0.0000625
5	<i>Junonia iphita</i>	Chocolate Soldier	LC	7	Indigenous	0.000438
6	<i>Mycalesis perseus</i>	Common	LC	11	Indigenous	0.001375



Family name	Species name	Common Name	Red List status	No. of butterflies	Status	Population density (m ²)
		Bushbrown				
7	<i>Euploea core</i>	Common Crow	LC	122	Indigenous	0.007625
8	<i>Taractrocera maevius</i>	Common Grass Dart	LC	4	Indigenous	0.00025
9	<i>Eurima hecabe</i>	Common Grass Yellow	LC	66	Indigenous	0.004125
10	<i>Papilio polytes</i>	Common Mormon	LC	3	Indigenous	0.000188
11	<i>Castalius rosimon</i>	Common Pierrot	LC	1	Indigenous	0.0000625
12	<i>Pachliopta aristolochia</i>	Common Rose	LC	2	Indigenous	0.000125
13	<i>Neptis hylas</i>	Common Sailor	LC	5	Indigenous	0.000313
14	<i>Danaus genutia</i>	Common Tiger	LC	44	Indigenous	0.00275
15	<i>Pachliopta hector</i>	Crimson rose	LC	17	Indigenous	0.001063
16	<i>Jumides bochus</i>	Dark Cerulean	LC	1	Indigenous	0.0000625
17	<i>Euchrysops cnejus</i>	Gram Blue	LC	11	Indigenous	0.001375
18	<i>Junonia atlites</i>	Grey Pansy	LC	1	Indigenous	0.0000625
19	<i>Everes lacturnus</i>	Indian Cupid	LC	6	Indigenous	0.000375
20	<i>Spialia galba</i>	Indian Skipper	LC	4	Indigenous	0.00025
21	<i>Curetis thetis</i>	Indian Sunbeam	LC	2	Indigenous	0.000125
22	<i>Delias eucharis</i>	Jezebal	LC	2	Indigenous	0.000125
23	<i>Zizina otis</i>	Lesser Grass Blue	LC	48	Indigenous	0.003
24	<i>Catopsilia pomona</i>	Lemon Emigrant	LC	13	Indigenous	0.000813
25	<i>Junonia lemonius</i>	Lemon Pansy	LC	15	Indigenous	0.000938
26	<i>Appias galene</i>	Lesser Albatross	LC	11	Endemic	0.001375
27	<i>Papilio demoleus</i>	Lime Butterfly	LC	7	Indigenous	0.000438
28	<i>Orsotriaena medus</i>	Medus Brown	LC	3	Indigenous	0.000188
29	<i>Catopsilia pyrantha</i>	Mottled Emigrant	LC	7	Indigenous	0.000438
30	<i>Lampides boeticus</i>	Pea Blue	LC	78	Indigenous	0.004875
31	<i>Danaus chrysippus</i>	Plain Tiger	LC	34	Indigenous	0.002125
32	<i>Neopithecops zalmora</i>	Quaker	LC	1	Indigenous	0.0000625
33	<i>Talicauda nyseus</i>	Red Pierrot	LC	5	Indigenous	0.000313
34	<i>Dophla evelina</i>	Red Spot Duke	LC	1	Indigenous	0.0000625
35	<i>Iraota timoleon</i>	Silver Streak Blue	NT	1	Indigenous	0.0000625
36	<i>Clotis amata</i>	Small Salmon	LC	1	Indigenous	0.0000625
		Arab				
37	<i>Troides darsius</i>	Sri Lanka Birdwing	LC	2	Endemic	0.000125
		Birdwing				
38	<i>Appias libythea</i>	Striped Albatross	LC	13	Indigenous	0.000813
39	<i>Acraea violae</i>	Tawny Coster	LC	16	Indigenous	0.001
40	<i>Zizula hylax</i>	Tiny Grass Blue	LC	11	Indigenous	0.000688
41	<i>Ypthima ceylonica</i>	White Four Ring	LC	32	Indigenous	0.002
42	<i>Leptotus plinius</i>	Zebra Blue	LC	47	Indigenous	0.002938
Family name	Species name	Common Name	Red List status	No. of butterflies	Status	Population density (m ²)
1	<i>Papilio crino</i>	Banded Peacock	VU	2	Indigenous	0.000125
2	<i>Papillio polymnestor</i>	Blue Mormon	LC	3	Indigenous	0.000188
3	<i>Tirumala limniace</i>	Blue Tiger	LC	50	Indigenous	0.003125
4	<i>Ampittia dioscorides</i>	Bush hopper	LC	1	Indigenous	0.0000625



	Family name	Species name	Common Name	Red List status	No. of butterflies	Status	Population density (m ²)
5	<i>Junonia</i>	<i>iphita</i>	Chocolate Soldier	LC	7	Indigenous	0.000438
6	<i>Mycalesis</i>	<i>perseus</i>	Common Bushbrown	LC	11	Indigenous	0.001375
7	<i>Euploea</i>	<i>core</i>	Common Crow	LC	122	Indigenous	0.007625
8	<i>Taractrocer</i>	<i>maevius</i>	Common Grass Dart	LC	4	Indigenous	0.00025
9	<i>Eurima</i>	<i>hecabe</i>	Common Grass Yellow	LC	66	Indigenous	0.004125
10	<i>Papilio</i>	<i>polytes</i>	Common Mormon	LC	3	Indigenous	0.000188
11	<i>Castalius</i>	<i>rosimon</i>	Common Pierrot	LC	1	Indigenous	0.0000625
12	<i>Pachliopta</i>	<i>aristolochia</i>	Common Rose	LC	2	Indigenous	0.000125
13	<i>Neptis</i>	<i>hylas</i>	Common Sailor	LC	5	Indigenous	0.000313
14	<i>Danaus</i>	<i>genutia</i>	Common Tiger	LC	44	Indigenous	0.00275
15	<i>Pachliopta</i>	<i>hector</i>	Crimson rose	LC	17	Indigenous	0.001063
16	<i>Jumides</i>	<i>bochus</i>	Dark Cerulean	LC	1	Indigenous	0.0000625
17	<i>Euchrysops</i>	<i>cnejus</i>	Gram Blue	LC	11	Indigenous	0.001375
18	<i>Junonia</i>	<i>atlites</i>	Grey Pansy	LC	1	Indigenous	0.0000625
19	<i>Everes</i>	<i>lacturnus</i>	Indian Cupid	LC	6	Indigenous	0.000375
20	<i>Spialia</i>	<i>galba</i>	Indian Skipper	LC	4	Indigenous	0.00025
21	<i>Curetis</i>	<i>thetis</i>	Indian Sunbeam	LC	2	Indigenous	0.000125
22	<i>Delias</i>	<i>eucharis</i>	Jezebel	LC	2	Indigenous	0.000125
23	<i>Zizina</i>	<i>otis</i>	Lesser Grass Blue	LC	48	Indigenous	0.003
24	<i>Catopsilia</i>	<i>pomona</i>	Lemon Emigrant	LC	13	Indigenous	0.000813
25	<i>Junonia</i>	<i>lemonius</i>	Lemon Pansy	LC	15	Indigenous	0.000938
26	<i>Appias</i>	<i>galene</i>	Lesser Albatross	LC	11	Endemic	0.001375
27	<i>Papilio</i>	<i>demoleus</i>	Lime Butterfly	LC	7	Indigenous	0.000438
28	<i>Orsotriaena</i>	<i>medus</i>	Medus Brown	LC	3	Indigenous	0.000188
29	<i>Catopsilia</i>	<i>pyrantha</i>	Mottled Emigrant	LC	7	Indigenous	0.000438
30	<i>Lampides</i>	<i>boeticus</i>	Pea Blue	LC	78	Indigenous	0.004875
31	<i>Danaus</i>	<i>chrysippus</i>	Plain Tiger	LC	34	Indigenous	0.002125
32	<i>Neopithecops</i>	<i>zalmora</i>	Quaker	LC	1	Indigenous	0.0000625
33	<i>Talicada</i>	<i>nyseus</i>	Red Pierrot	LC	5	Indigenous	0.000313
34	<i>Dophla</i>	<i>evelina</i>	Red Spot Duke	LC	1	Indigenous	0.0000625
35	<i>Iraota</i>	<i>timoleon</i>	Silver Streak Blue	NT	1	Indigenous	0.0000625
36	<i>Clotis</i>	<i>amata</i>	Small Salmon Arab	LC	1	Indigenous	0.0000625
37	<i>Troides</i>	<i>darsius</i>	Sri Lanka Birdwing	LC	2	Endemic	0.000125
38	<i>Appias</i>	<i>libythea</i>	Striped Albatross	LC	13	Indigenous	0.000813
39	<i>Acraea</i>	<i>violae</i>	Tawny Coster	LC	16	Indigenous	0.001
40	<i>Zizula</i>	<i>hylax</i>	Tiny Grass Blue	LC	11	Indigenous	0.000688
41	<i>Ypthima</i>	<i>ceylonica</i>	White Four Ring	LC	32	Indigenous	0.002
42	<i>Leptotus</i>	<i>plinius</i>	Zebra Blue	LC	47	Indigenous	0.002938



H. Wilpattu NP area, sub basin (Thelbipuwewa) (Transect 22, 23, 24)

This area dominated by Dry Mixed Evergreen Forest also contained Scrub Forest, Tank associated habitats. During the study period, 40 species of butterflies including 1 endemic species, the Sri Lanka Lesser Albatross, *Appias galena*, was recorded.

Additionally, 2 nationally threatened species, the Banded Peacock, *Papilio crino* and the Large Guava Blue, *Virachola perse* were also found. The Shannon index (H') was 3.54. According to the density values, the Common Crow showed the highest density values (Table 64).

Table 64 List of butterfly species recorded from Wilpattu NP area (Transect 21, 22,23, and 24) with their status and population density (m²)

	Family name	Species name	Common Name	Red List status	No. of butterflies	Status	Population density (m ²)
1	<i>Ariadne</i>	<i>ariadne</i>	Angle Castor	LC	2	Indigenous	0.000125
2	<i>Papilio</i>	<i>crino</i>	Banded Peacock	VU	1	Indigenous	0.0000625
3	<i>Papillio</i>	<i>polymnestor</i>	Blue Mormon	LC	2	Indigenous	0.000125
4	<i>Tirumala</i>	<i>limniace</i>	Blue Tiger	LC	4	Indigenous	0.00025
5	<i>Ampittia</i>	<i>dioscorides</i>	Bush hopper	LC	2	Indigenous	0.000125
6	<i>Cethosia</i>	<i>nietneri</i>	Ceylon Lace Wing	LC	3	Indigenous	0.0001875
7	<i>Junonia</i>	<i>iphita</i>	Chocolate Soldier	LC	17	Indigenous	0.0010625
8	<i>Euploea</i>	<i>core</i>	Common Crow	LC	278	Indigenous	0.017375
9	<i>Taractrocera</i>	<i>maevius</i>	Common Grass Dart	LC	4	Indigenous	0.00025
10	<i>Eurima</i>	<i>Hecabe</i>	Common Grass Yellow	LC	31	Indigenous	0.0019375
11	<i>Cepora</i>	<i>Cepora</i>	Common Gull	LC	8	Indigenous	0.0005
12	<i>Graphiun</i>	<i>agamemnon</i>	Common Jay	LC	11	Indigenous	0.001375
13	<i>Papilio</i>	<i>polytes</i>	Common Mormon	LC	1	Indigenous	0.0000625
14	<i>Castalius</i>	<i>rosimon</i>	Common Pierrot	LC	4	Indigenous	0.00025
15	<i>Pachliopta</i>	<i>aristolochia</i>	Common Rose	LC	2	Indigenous	0.000125
16	<i>Danaus</i>	<i>genutia</i>	Common Tiger	LC	17	Indigenous	0.0010625
17	<i>Pachliopta</i>	<i>hector</i>	Crimson rose	LC	3	Indigenous	0.0001875
18	<i>Spialia</i>	<i>galba</i>	Indian Skipper	LC	2	Indigenous	0.000125
19	<i>Virachola</i>	<i>perse</i>	Large Guava Blue	VU	1	Indigenous	0.0000625
20	<i>Zizina</i>	<i>otis</i>	Lasser Grass Blue	LC	15	Indigenous	0.0009375
21	<i>Catopsilia</i>	<i>pomona</i>	Lemon Emigrant	LC	8	Indigenous	0.0005
22	<i>Junonia</i>	<i>lemonius</i>	Lemon Pansy	LC	4	Indigenous	0.00025
23	<i>Appias</i>	<i>galene</i>	Lesser Albatross	LC	42	Endemic	0.002625
24	<i>Chilades</i>	<i>lajus</i>	Lime Blue	LC	30	Indigenous	0.001875
25	<i>Papilio</i>	<i>demoleus</i>	Lime Butterffly	LC	9	Indigenous	0.0005625
26	<i>Orsotriaena</i>	<i>medus</i>	Medus Brown	LC	1	Indigenous	0.0000625



	Family name	Species name	Common Name	Red List status	No. of butterflies	Status	Population density (m ²)
27	<i>Catopsilia</i>	<i>pyrantha</i>	Mottled Emigrant	LC	5	Indigenous	0.0003125
28	<i>Junonia</i>	<i>almanac</i>	Peacock Pansy	LC	2	Indigenous	0.000125
29	<i>Belenois</i>	<i>aurora</i>	Pioneer	LC	2	Indigenous	0.000125
30	<i>Danaus</i>	<i>chrysippus</i>	Plain Tiger	LC	24	Indigenous	0.0015
31	<i>Anthene</i>	<i>lycaenina</i>	Pointed Ciliate Blue	LC	1	Indigenous	0.0000625
32	<i>Neopithecops</i>	<i>zalmora</i>	Quaker	LC	10	Indigenous	0.000625
33	<i>Eurema</i>	<i>brigitta</i>	Small Grass Yellow	LC	46	Indigenous	0.002875
34	<i>Clotis</i>	<i>amata</i>	Small Salmon Arab	LC	9	Indigenous	0.0005625
35	<i>Appias</i>	<i>libythea</i>	Striped Albatross	LC	15	Indigenous	0.0009375
36	<i>Acraea</i>	<i>violae</i>	Tawney Coster	LC	3	Indigenous	0.0001875
37	<i>Zizula</i>	<i>hylax</i>	Tiny Grass Blue	LC	2	Indigenous	0.000125
38	<i>Ypthima</i>	<i>ceylonica</i>	White Four Ring	LC	49	Indigenous	0.003
39	<i>marianne</i>	<i>Pieridae</i>	White Orange Tip	LC	1	Indigenous	0.0000625
40	<i>Ixias</i>	<i>pyrere</i>	Yellow Orange tip	LC	1	Indigenous	0.0000625

Table 65 Species richness and diversity of butterflies in different sub basin in the Kala Oya river basin

Sub basins	Richness (Species)	Shannon Index (H)	Simpson Index (1-D)
Eile area	29	2.551	0.8891
Eluwankulama	23	2.694	0.9.126
Suduweli Tahala	22	2.758	0.9168
Werakkodichole, Tahabbowa	30	2.71	0.9015
Horiwila/Ambagahawewa	18	2.472	0.8829
Galpaya,Hinguruwelpitiya,Ranvakannda, Nambatiwewa	55	3.39	0.9516
Manawa area	42	2.962	0.9241
Wilpattu NP area area (Thelbipuwewa)	40	2.457	0.8058



10.0 DRAGONFLY DIVERSITY ANALYSIS

10.4 Results

A total of 1,202 individual dragonflies and damselflies belonging to 7 families, 31 genera and 40 species were observed during the period of the survey. Among recorded species, *Pseudagrion rubiceps* (Orange-faced Sprite) and *Prodasineura sita* (Stripe-headed Threadtail) are endemic to Sri Lanka. Among the recorded species, 30 species were in the category of Least Concern (LC), 8 in the Near Threatened (NT) and 2 species in the Vulnerable (VU) category (IUCN 2012).

10.3.1 Species distribution according to the sub-basin/cluster level

1. Eile area (Transect 1-5) - Cluster A

The Eile area is located in Gagewadiya which consisted mainly of salt marshes and seasonal water holes. A total of 349 individuals from 26 species with a diversity index value of 2.367 (Shanon index value) were recorded from this area. The most abundant species was *Ceragrion coromandelianum*. Despite the high salinity of the water, dragonflies were found to be breeding in the area.

Exuviae of *Brachythemis contaminata* were also observed within the pencil roots of mangrove plants. Seasonal flooding and cattle grazing was noted as threats to these habitats of Odonate fauna.

2. Eluwankulama area - Cluster B

Man-made tanks, streams and paddy fields were noted as dragonfly habitats in this sub basin (B). Most sampling points were shady places with riverine vegetation. 112 individuals of 17 species were recorded and the species diversity index value was 2.317. Populations of 2 endemic species, *P. rubiceps* (Orange-faced Sprite) and *Prodasineura sita* (Stripe-headed Threadtail) were recorded in this area.

3. Morapathana, Sudu walitheeruwa area - Cluster C

Sampling points in this area were seasonal water holes and agricultural lands. Habitual areas were noted to have been destroyed for Chena cultivation and waterlogged areas were dried at the time of the survey. 37 individuals belong to 13 species were recorded with a diversity index value of 2.466.

4. Thabbova, Weerakkodichole area (Point 13, 14, 15) - Cluster D

Seasonal water holes, rocky pools and natural ponds were considered as sampling points. Point 14 in the Wilandagoda temple was identified as a point with high species richness where a total number of 18 species were recorded. *Lathrecista asiatica* and *Rhodothemis rufa*, two Nearly Threatened species, were found in seasonal water holes. A total number of 115 individual Odonates belonging to 22 species were recorded with diversity index value of 2.716.



5. Horiwila/Ambagaha Wewa area (Point 16, 17, 18) - Cluster E

Man-made tanks, seasonal water holes and Chena lands were the available sampling points in this area. Addition of agrochemicals to the water was noted to be a major threat to the habitats.

Brachythemis contaminata and *Orthetrum sabina* were the most abundant species in the area and these species are usually considered to be pollution indicators (Bedjanic et al, 2014). 97 individuals from 13 species were observed and diversity index value was 1.717.

6. Galpaya area (Point 19-25) - Cluster F

Rocky pools, ponds and man-made tanks were the available habitats to observe for Odonate fauna. Most rocks in the area have been exploited by metal crushers which has led to vast habitat destruction of *Tramea limbata* (Sociable glider) as well as *Bradinopyga geminate* (Indian rock-dweller), a rock dwelling species. 125 individuals belonging to 21 species were observed with a diversity index value of 2.683.

7. Manaewa area (Point 26-29) - Cluster G

This area consisted mainly of tanks and rocky pools. 181 individual Odonates belonging to 23 species were recorded with diversity index value of 2.4.

8. Wilpattu National Park (Point 30-33) - Cluster H

The highest diversity index value, 2.703, and species richness, 32 species, were recorded from the Wilpattu National Park. 185 individual animals were observed. The species *Aethriamanta brevipennis* was recorded only at 30th point during the survey. *Indothemis carnatica*, *Rhodothemis rufa* and *Indothemis limbata sita*, species categorized as Nearly Threatened, were recorded at the same sampling point. Invasive plant species in aquatic habitats such as *Pistia* and *Salvinia* were identified as a threat to the habitats.

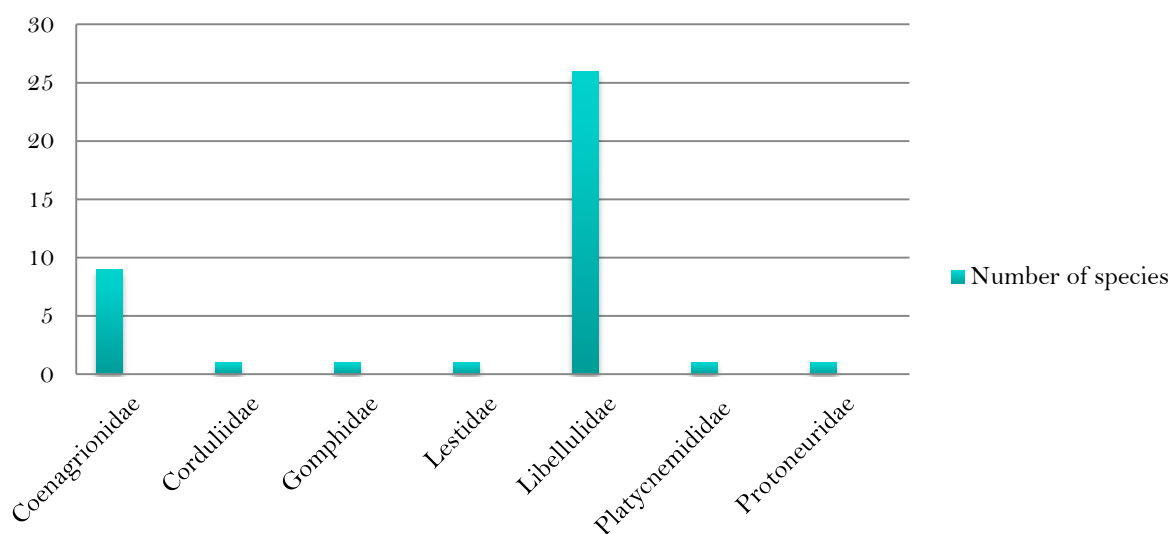


Figure 5 Number of species representing different families



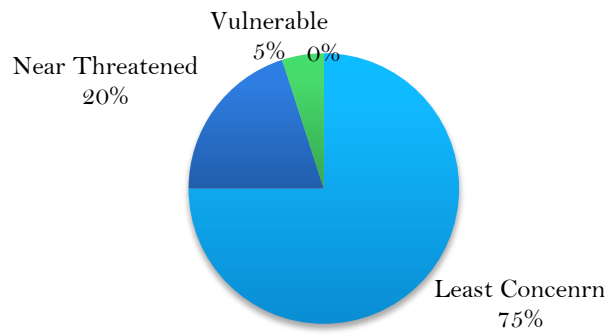


Figure 6 Conservation status of Odonata species based on IUCN Red List 2012

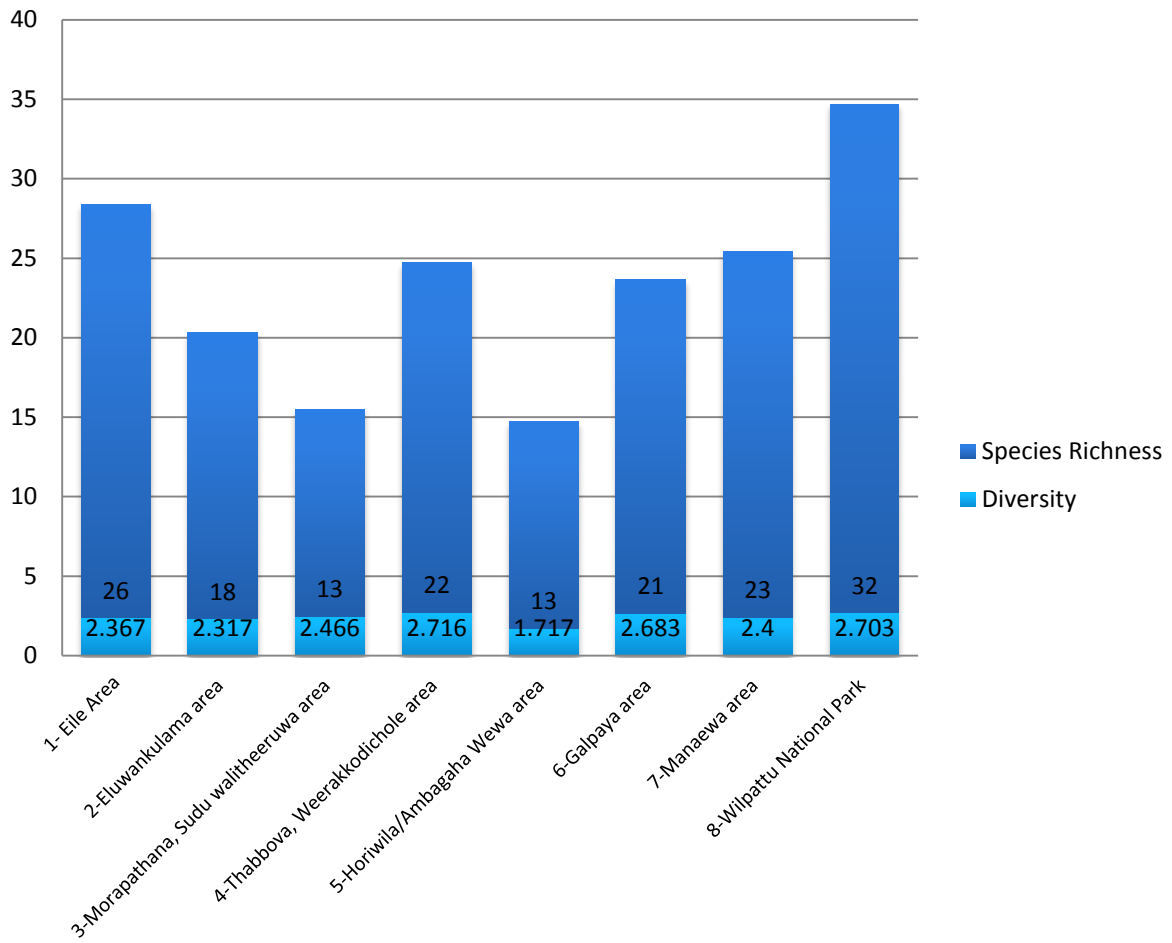


Figure 7 Species richness and diversity index values (Shannon–Wiener diversity index $S = -\sum (P_i \ln P_i)$) in each sub basin



Table 66 Species abundance in the sub-basins of Kala Oya Basin

Family	Species	Conservation status	Eile	Eluwankulama	Morapahana	Weerakodichole, Thabbowa	Ambagahawewa	Galpaya, Hinguruwelpitiya	Manaewa	Wilpaththu
1	Coenagrionidae	<i>Aciagrion occidentale</i>	VU	9	0	4	0	0	0	4
2	Coenagrionidae	<i>Agriocnemis pygmaea</i>	LC	15	1	4	0	1	1	22
3	Coenagrionidae	<i>Ceriagrion coromandelianum</i>	LC	127	25	4	18	40	10	21
4	Coenagrionidae	<i>Ischnura aurora</i>	NT	6	0	0	1	0	0	1
5	Coenagrionidae	<i>Ischnura senegalensis</i>	LC	15	2	0	4	0	2	2
6	Coenagrionidae	<i>Paracercion malayanum</i>	LC	9	2	0	2	0	0	0
7	Coenagrionidae	<i>Pseudagrion malabaricum</i>	LC	12	4	0	18	3	2	3
8	Coenagrionidae	<i>Pseudagrion rubiceps*</i>	LC	1	11	2	0	4	8	3
9	Coenagrionidae	<i>Pseudagrion microcephalum</i>	LC	21	5	0	7	2	4	7
10	Corduliidae	<i>Epophthalmia vittata</i>	LC	0	0	0	0	0	0	1
11	Gomphidae	<i>Ictinogomphus rapax</i>	LC	1	0	0	0	0	0	1
12	Lestidae	<i>Lastes elates</i>	LC	54	1	0	0	0	0	0
13	Libellulidae	<i>Acisoma panorpoides</i>	LC	0	0	0	0	0	2	10
14	Libellulidae	<i>Aethriamanta brevipennis</i>	LC	0	0	0	0	0	0	8
15	Libellulidae	<i>Brachydiplax sobrina</i>	LC	2	2	0	1	1	0	1
16	Libellulidae	<i>Brachythemis contaminata</i>	LC	16	28	4	14	31	26	65
17	Libellulidae	<i>Bradinopyga geminata</i>	LC	0	0	0	3	0	19	4
18	Libellulidae	<i>Crocothemis servilia servilia</i>	LC	9	10	0	3	3	2	6
19	Libellulidae	<i>Diplacodes nebulosa</i>	NT	1	0	0	0	0	0	0
20	Libellulidae	<i>Diplacodes trivialis</i>	LC	13	4	2	5	2	6	11
21	Libellulidae	<i>Hydrobasileus croceus</i>	NT	2	0	0	0	0	0	0
22	Libellulidae	<i>Indothemis carnatica</i>	NT	0	0	0	0	0	4	0
23	Libellulidae	<i>Indothemis limbata sita</i>	NT	0	0	0	0	0	0	0
24	Libellulidae	<i>Lathrecista asiatica</i>	NT	0	0	0	1	0	0	0
25	Libellulidae	<i>Neurothemis intermedia</i>	LC	0	1	0	0	0	0	2



Family	Species	Conservation status	Eile	Eluwankulama	Morapahana	Weerakodichole, Thabbowa	Ambagahawewa	Galpaya, Hinguruwelpitiya	Manaewa	Wilpaththu	
26	Libellulidae	<i>Neurothemis tulia</i>	LC	11	7	0	0	4	0	10	4
27	Libellulidae	<i>Orthetrum glaucum</i>	LC	0	0	0	0	0	0	0	1
28	Libellulidae	<i>Orthetrum sabina</i>	LC	9	0	3	5	3	6	6	3
29	Libellulidae	<i>Pantala flavescens</i>	LC	1	0	2	3	3	4	6	4
30	Libellulidae	<i>Potamarcha congener</i>	LC	0	0	0	4	0	6	1	0
31	Libellulidae	<i>Rhodothemis rufa</i>	NT	0	1	0	2	0	0	1	2
32	Libellulidae	<i>Rhyothemis variegata variegata</i>	LC	4	0	0	4	0	2	7	2
33	Libellulidae	<i>Tholymis tillarga</i>	LC	1	0	2	0	0	0	0	0
34	Libellulidae	<i>Tamea limbata</i>	LC	2	0	0	1	0	3	2	2
35	Libellulidae	<i>Tamea basilaris</i>	VU	0	0	1	0	0	0	0	1
36	Libellulidae	<i>Trithemis pallidinervis</i>	NT	3	4	0	0	0	3	0	0
37	Libellulidae	<i>Trithemis aurora</i>	LC	2	1	1	1	1	4	10	1
38	Libellulidae	<i>Urothemis signata signata</i>	LC	3	0	3	5	0	0	0	5
39	Platycnemididae	<i>Copera marginipes</i>	LC	0	0	5	9	0	8	0	2
40	Protoneuridae	<i>Prodasineura sita*</i>	LC	0	3	4	0	1	3	0	0
Total count				349	112	37	115	98	125	181	185
Number of species				26	18	13	22	13	21	23	32
Diversity				2.367	2.317	2.466	2.716	1.717	2.683	2.4	2.703

*Endemic species



Table 67 Species density (m²)

Family	Species	Conservation status	Eile	Eluwankulama	Morapahana	Weerakkodichole, Thabbowa	Ambagahawewa	Galpaya	Manaewa	Wilpaththu
Coenagrionidae	<i>Aciagrion occidentale</i>	VU	0.000637	0	0	0.000472	0	0	0	0.000354
Coenagrionidae	<i>Agriocnemis pygmaea</i>	LC	0.001062	0.000118	0.000354	0	0	5.06E-05	8.85E-05	0.001946
Coenagrionidae	<i>Ceriagrion coromandelianum</i>	LC	0.008988	0.002949	0.000354	0.002123	0.004718	0.000506	0.001858	0.000885
Coenagrionidae	<i>Ischnura aurora</i>	NT	0.000425	0	0	0.000118	0	0	0	8.85E-05
Coenagrionidae	<i>Ischnura senegalensis</i>	LC	0.001062	0.000236	0	0.000472	0	0.000101	0.000177	0.000177
Coenagrionidae	<i>Paracercion malayanum</i>	LC	0.000637	0.000236	0	0.000236	0	0	0	0
Coenagrionidae	<i>Pseudagrion malabaricum</i>	LC	0.000849	0.000472	0	0.002123	0.000354	0.000101	0.000265	0.000708
Coenagrionidae	<i>Pseudagrion rubiceps</i> *	LC	7.08E-05	0.001297	0.000177	0	0.000472	0.000404	0.000265	0
Coenagrionidae	<i>Pseudagrion microcephalum</i>	LC	0.001486	0.00059	0	0.000826	0.000236	0.000202	0.000619	0.000354
Corduliidae	<i>Epophthalmia vittata</i>	LC	0	0	0	0	0	0	8.85E-05	8.85E-05
Gomphidae	<i>Ictinogomphus rapax</i>	LC	7.08E-05	0	0	0	0	0	8.85E-05	0.000442
Lestidae	<i>Lastes elates</i>	LC	0.003822	0.000118	0	0	0	0	0	0
Libellulidae	<i>Acisoma panorpoides</i>	LC	0	0	0	0	0	0.000101	0.000885	0.000265
Libellulidae	<i>Aethriamanta brevipennis</i>	LC	0	0	0	0	0	0	0	0.000708
Libellulidae	<i>Brachydiplax sobrina</i>	LC	0.000142	0.000236	0	0.000118	0.000118	0	8.85E-05	8.85E-05
Libellulidae	<i>Brachythemis contaminata</i>	LC	0.001132	0.003303	0.000354	0.001651	0.003657	0.001314	0.00575	0.004777
Libellulidae	<i>Bradinopyga geminata</i>	LC	0	0	0	0.000354	0	0.00096	0.000354	0.000265
Libellulidae	<i>Crocothemis servilia servilia</i>	LC	0.000637	0.00118	0	0.000354	0.000354	0.000101	0.000531	0
Libellulidae	<i>Diplacodes nebulosa</i>	NT	7.08E-05	0	0	0	0	0	0	0.000619
Libellulidae	<i>Diplacodes trivialis</i>	LC	0.00092	0.000472	0.000177	0.00059	0.000236	0.000303	0.000973	0.001681
Libellulidae	<i>Hydrobasileus croceus</i>	NT	0.000142	0	0	0	0	0	0	8.85E-05
Libellulidae	<i>Indothemis carnatica</i>	NT	0	0	0	0	0	0.000202	0	8.85E-05
Libellulidae	<i>Indothemis limbata sita</i>	NT	0	0	0	0	0	0	0	8.85E-05



Family	Species	Conservation status	Eile	Eluwankulama	Morapahana	Weerakkodichole, Thabbowa	Ambagahawewa	Galpaya	Manaewa	Wilpaththu
Libellulidae	<i>Lathrecista asiatica</i>	NT	0	0	0	0.000118	0	0	0	8.85E-05
Libellulidae	<i>Neurothemis intermedia</i>	LC	0	0.000118	0	0	0	0	0.000177	0.000177
Libellulidae	<i>Neurothemis tulia</i>	LC	0.000778	0.000826	0	0	0.000472	0	0.000885	0.000354
Libellulidae	<i>Orthetrum glaucum</i>	LC	0	0	0	0	0	0	0	8.85E-05
Libellulidae	<i>Orthetrum sabina</i>	LC	0.000637	0	0.000265	0.00059	0.000354	0.000303	0.000531	0.000265
Libellulidae	<i>Pantala flavescens</i>	LC	7.08E-05	0	0.000177	0.000354	0.000354	0.000202	0.000531	0.000354
Libellulidae	<i>Potamarcha congener</i>	LC	0	0	0	0.000472	0	0.000303	8.85E-05	0
Libellulidae	<i>Rhodothemis rufa</i>	NT	0	0.000118	0	0.000236	0	0	8.85E-05	0.000177
Libellulidae	<i>Rhyothemis variegata</i>	LC	0.000283	0	0	0.000472	0	0.000101	0.000619	0.000177
Libellulidae	<i>Tholymis tillarga</i>	LC	7.08E-05	0	0.000177	0	0	0	0	0
Libellulidae	<i>Tramea limbata</i>	LC	0.000142	0	0	0.000118	0	0.000152	0.000177	0.000177
Libellulidae	<i>Tramea basilaris</i>	VU	0	0	8.85E-05	0	0	0	0	8.85E-05
Libellulidae	<i>Trithemis pallidinervis</i>	NT	0.000212	0.000472	0	0	0	0.000152	0	0
Libellulidae	<i>Trithemis aurora</i>	LC	0.000142	0.000118	8.85E-05	0.000118	0.000118	0.000202	0.000885	8.85E-05
Libellulidae	<i>Urothemis signata signata</i>	LC	0.000212	0	0.000265	0.00059	0	0	0	0.000442
Platycnemididae	<i>Copera marginipes</i>	LC	0	0	0.000442	0.001062	0	0.000404	0	0.000177
Protoneuridae	<i>Prodasineura sita</i> *	LC	0	0.000354	0.000354	0	0.000118	0.000152	0	0

*Endemic species

Table 68 presents Odonate species previously recorded in the area by separate studies and surveys but were not observed during this survey (note that species recorded by and included in this survey have been excluded) (Bedjanick at al, 2014).



Table 68 Checklist of Odonate species previously recorded but were not observed during the survey

Family	Species	Common Name	CS
Chlorocyphidae	Libellago adami*	Sri Lanka Adam's Gem	VU
Lestidae	Lestes praemorsus	Scalloped Spreadwing	NT
Protoneuridae	Elattonneura centralis*	Sri Lanka Dark-glittering Threadtail	VU
Aeshnidae	Anax gutattus	Pale-spotted Emperor	LC
	Anax indicus	Elephant Emperor	LC
	Gynacantha dravida	Indian Duskhawker	NT
	Cyclogomphus gynostylus*	Sri Lanka Transvestite Clubtail	CR
Libellulidae	Zygomma petiolatum	Dingy Duskflyer	NT
	Macrodiplax cora	Costal Pennant	VU
Gomphidae	Paragomphus campestris*	Lowland hooktail	VU
	Macrogomphus lankanensis*	Sri Lanka Forktail	EN

*Endemic species

CS = Conservation Status

Table 69 Areas with a high dragonfly/ damselfly species richness and their corresponding species richness

Species Richness	Cluster
12	Gage wadiya
14	Wilandagoda
26	Manaewa
30	Wilpattu National Park



11.0 MARINE FLORA AND FAUNA DIVERSITY ANALYSIS

11.2 Bar Reef and Reef Habitats

Established in 1992 and located on the north-western coast of Kalpitiya peninsular- Bar Reef Marine Sanctuary (BRMS) covers an area of sea 30,669 (ha) in extent. The area extends from the coast up to a distance of 6-9 km off shore and reaching beyond the 10m depth contour. The Buffer zone of the BRMS reaches beyond the continental shelf edge and into the continental drop off area. The area includes a wide variety of marine habitats from soft sandy floors to coral and sandstone reefs and sea grass beds.

The focal point in the BRMS is the once lush shallow coral habitats that existed in the core area of the sanctuary. Before the 1998 coral mortality event, Bar Reef Marine Sanctuary was composed of a series of extensive coral patch reefs which was critically affected by the event. Only two primary sections of the reef made recovery of coral cover and reef function from the aftermath of the event, which reduced the live coral cover from around 80% to less than 1%. (Rajasuriya et al., 1998). The recovered reef changed in structure into a table coral (*A. cytheria*) dominated habitat from the previous Staghorn coral (*A. formosa*) dominated habitats. The surviving coral areas were observed to reach mature status nearly 20 years post to the 1998 coral mortality event with re-colonization of significant areas with Staghorn corals and changing of the reef from a monotypic coral habitat to a richer species assembly.

Beyond the bar reef, the sea area contains extensive areas of scattered rock/sandstone reefs ranged at different depths and other allied habitats including sea grass beds. The year 2016 brought in the most severe El-nino related coral bleaching event on record in Sri Lanka after the 1998 event. The survey also aimed to document the level of damage to the Bar-reef complex as a result of this event and the post event status of reefs.

The main coral areas which had shown recovery from the 1998 event was observed to have suffered severely during the 2016 event with almost total coral mortality on the reef areas. The live coral cover was observed to be less than 1% of the reef surfaces. The inshore section of the reef was observed to be heavily overgrown with a diverse assemblage of algae dominated by algal genera *Padina*, *Stoechospermum*, *Caulerpa*, *Halimeda*, *Asperogopis* and *Dictyota* etc.

The sampling of the reef areas were planned to include the two main sections of the Bar-reef that recovered from the 1998 bleaching/ coral mortality event, which were affected significantly by the coral bleaching event of 2016 and was found to have suffered critical damage. Additional sampling were carried out on an area of old coral reef that had not recovered from the 1998 event which comprised of a significant area of the sea floors of the area, and a deeper reef at 10m depth and a sand stone reef areas adjacent to the Bar-reef to increase the diversity of the sample.

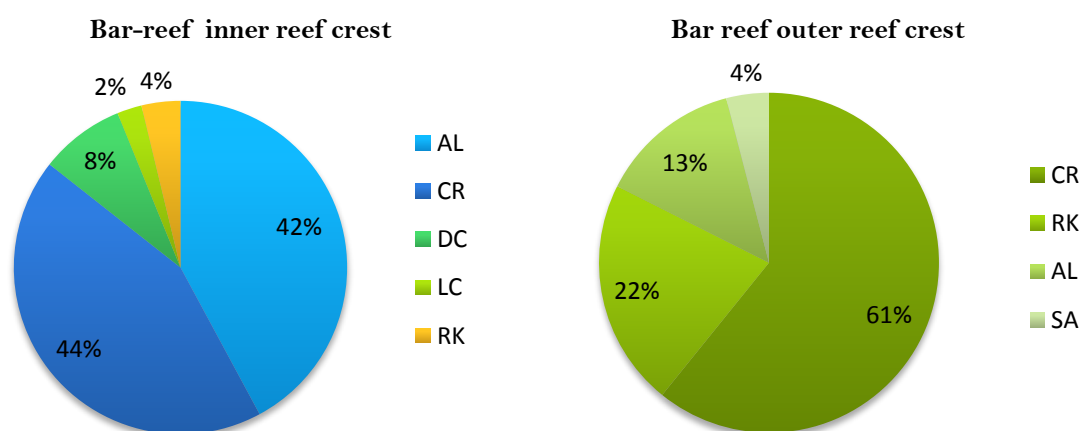


The two main sections of the reef to survive the 1998 coral bleaching event was surveyed to observe the impact of the 2016 coral bleaching event. These sections are also used for tourism where many whale watching tour boats would bring their guests to snorkel on the reef. The sections are also subjected to significant fishing pressure.

The majority of the once abundant coral reef patches in the area were killed off during the previous coral bleaching event in 1998. These areas are now degraded in to mere patches or mounds of coral rubble over grown with varying amounts of algae. Live coral cover is very low and consist of later recruits mostly of encrusting or sub-massive type coral colonies of smaller size. Fish life was also very low and mostly consisted of Parrot fishes, Sturgeon fish, Rabbit fishes, Damsel fishes and wrasses. The coral rubble is eroded, and of relatively small sized ones forming a moving unstable substrate that is not conducive for re-settlement by new coral larval recruits. The coral restoration potential of these areas is low. One dead reef site was included in the survey sites as it consists of the significantly extensive habitat within the survey area.

Additional sites were included in the survey to sample the deeper sandstone reef habitats which were less impacted by the recent climatic events. Though not true coral reefs, these reefs at present contain higher abundance of live coral compared to the two primary coral reef sites. These reefs range from 3-30m or more in depth and extend out to the end of the continental shelf area. The reefs range from scattered rocky areas to large hard reef structures and formed by non-coral hard substrates. These reefs support significant populations of fish and invertebrates and are subject to fishing using both traditional methods as well as by divers engaged in collection of marine fauna export trades including ornamental exotic species, sea cucumber and spiny lobsters.

The deeper reef sites at 10m depth sampled was an extensive area of low flat scattered coral and fragmented rocky/sandstone terrain interspaced with high coral "bommies" which would have a relief of over 2m from the substrate the area. This area contained a high abundance of algae (38%) mainly consisting of *Asperogopsis taxiformis*. The site also contained the highest surviving live coral cover (15%) as well as the highest abundance of fish, of all the sample sites.



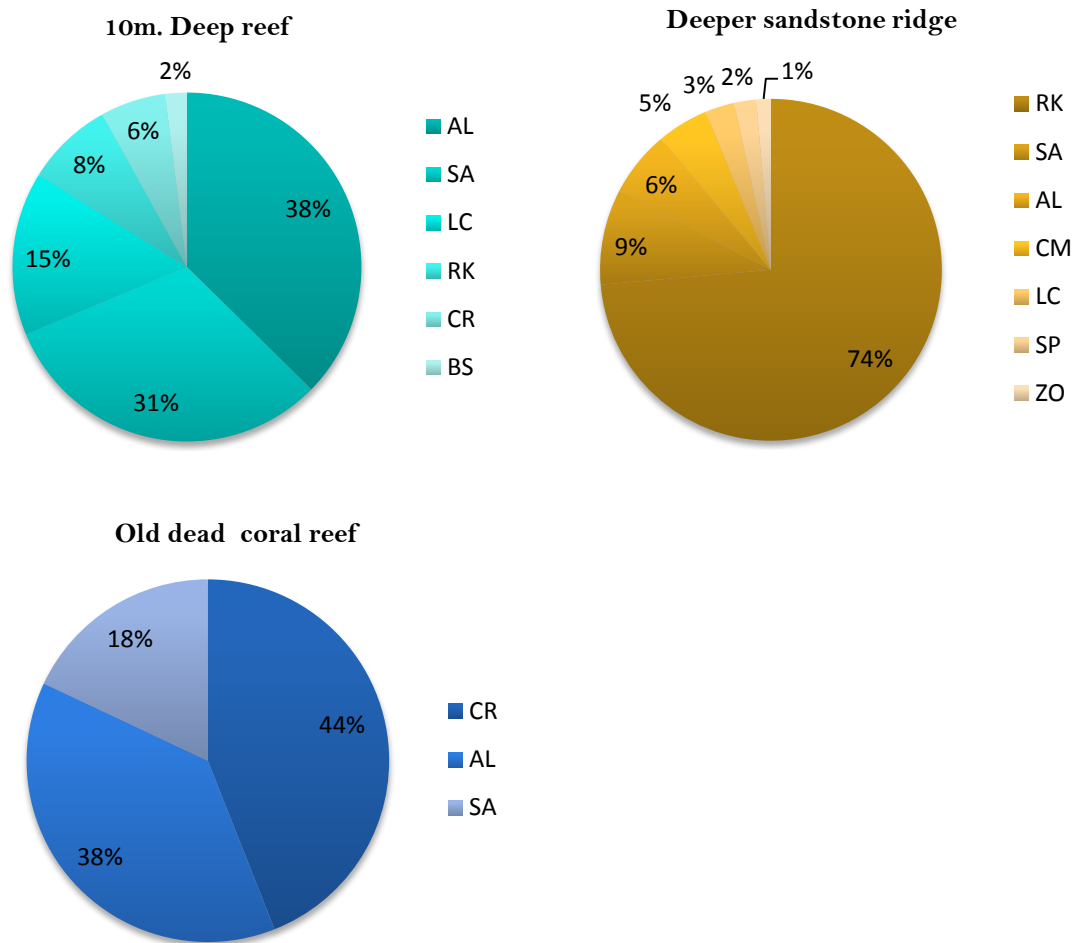


Figure 8 Substrate compositions of sample sites

11.3.1 Fish and Invertebrate counts

25m belt counts were carried out to survey the densities of indicator groups of reef fauna including both fish and larger benthic invertebrates.

Table 70 Shannon's Wiener diversity index for coral reef sample sites

Transect	Index
T1 Bar reef site 1A	H=0.99466
T2 Bar reef site 1B	H=1.22149
T3 10m.reef	H= 1.46936
T4 Bar reef site 2	H = 1.03403
T5 Deep Sandstone ridge	H = 1.0025
T6 Old dead reef	H = 1.03758



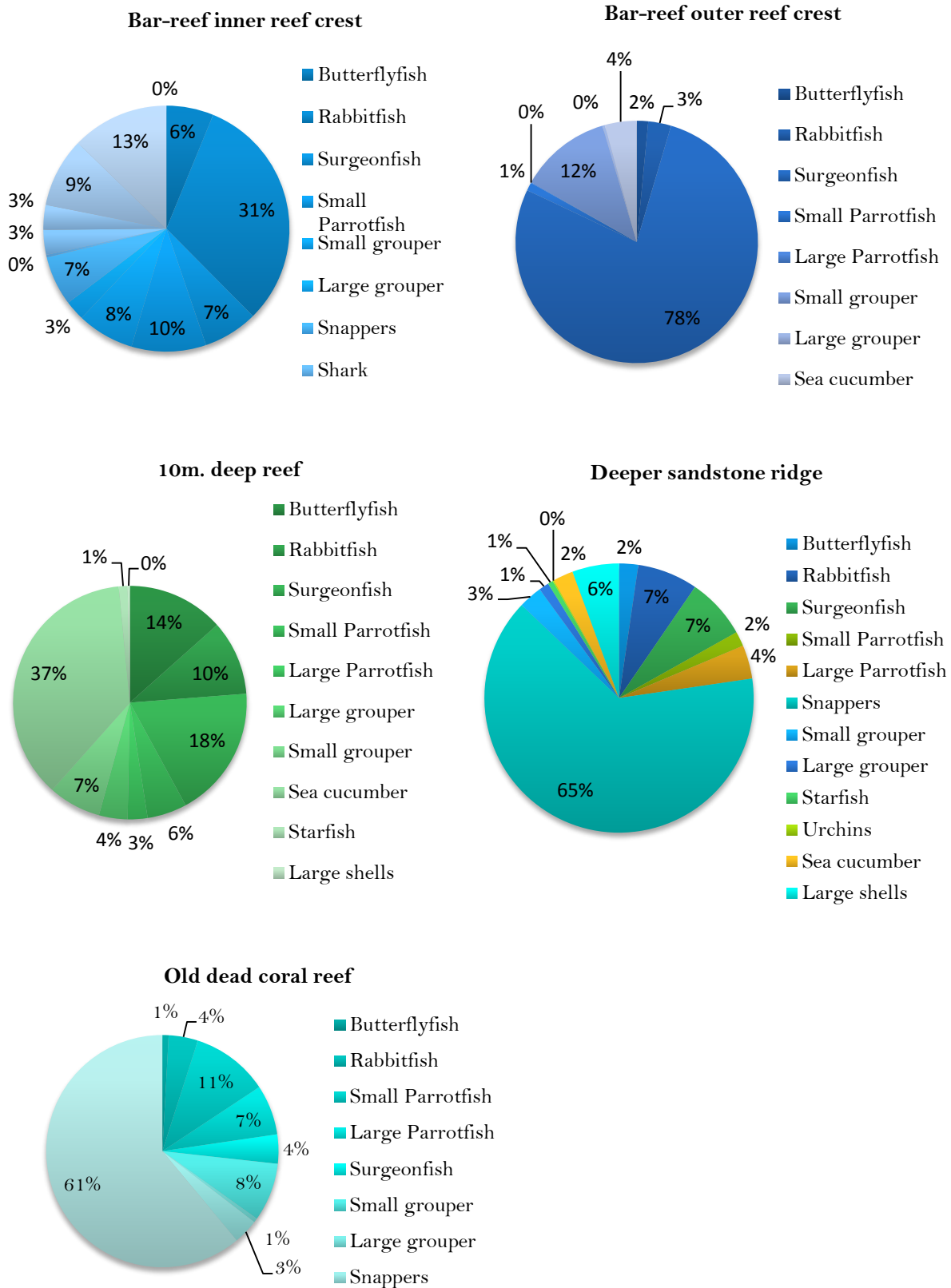


Figure 9 Fish and Benthic Invertebrate Belt counts at survey sites

The highest numbers of Butterfly-fishes were recorded from the deeper sandstone patch reef site while the Inner section of the Bar-reef still contained significant numbers of Butterfly-fishes



though mainly restricted to the deeper section to the north of the reef where many of the old populations of the reef fish seem to have found refuge from the loss of habitats.

The two bar reef sections both suffered extensive mortality from the coral bleaching event. The section 1 still contain high level of algal cover over the reef surfaces and the algal grazers populations have still not reached high enough numbers to bring the algae in to control. The percentage of grazing fish species on site one was 48% with an additional 13% included as Sea hares to increase the count of grazers to 61%. The algal cover still remains at 47% of reef substrates. At Bar-reef site 2, the grazer populations have increased to 82% with a corresponding reduction of algal cover to 13% of substrates.

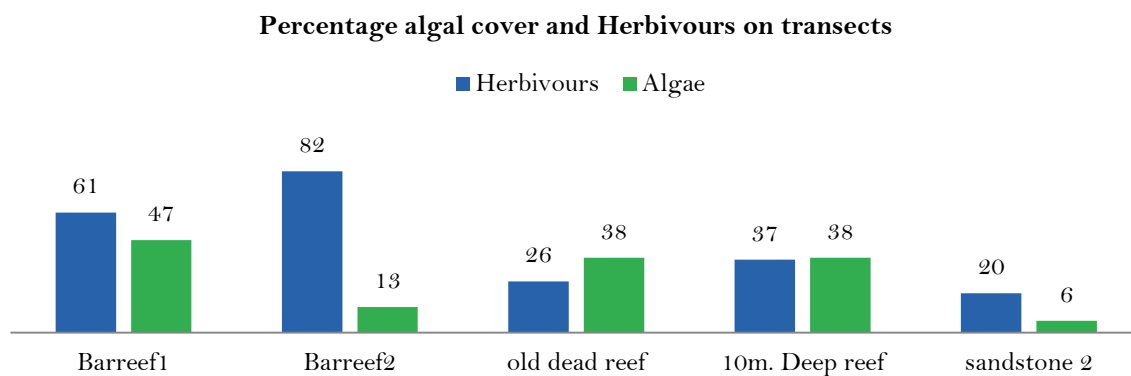


Figure 10 Percentage algal cover and herbivores on transects

11.4 Sampling sites

Bar Reef crest section 1 day 1 - N8 22.214 E79 44.799

Bar Reef crest section 1 day 2 - N8 22.308 E79 44.822

First of the two primary sections of the Bar-reef to make a significant recovery from the 1998 coral bleaching event is heavily visited by local tour boat operators for snorkel diving.

The reef consists of a reef ranging from about 4m to almost intertidal. The reef had suffered heavily in the 2016 coral bleaching /mortality event and also show signs of heavy mechanical damage at a scale which would most likely be due to heavy surf/ storm action. Most of the dead coral has been broken and has already turned into coral rubble. The area is still in post mortality event stage 1 where the reef is being heavily overgrown with algae.

The shallower reef crest areas are overgrown with macro-algae including *Ulva lactuca*, *Ulva sp.*, *Stoechospermum polypodioides*, *Padina spp.*, *Dictyota spp.*, *Asperogopsis taxifomis*, *Caulerpa racemosa*, *Caulerpa verticilliata*, *Halimeda spp.*, etc. Fish life was very low except on the deeper areas of North East corner of the reef where large aggregations of fish were observed including a diversity of species. The herbivore fish population on the reef was observed very low and the observed grazing on the algae low. Large numbers of Sea hares *Aplysia sp.* were observed on some sections of the reef crest which was the only significant grazer observed on the reef. The reef recovery needs the reef fish populations to change in to a herbivour (Sturgeon fishes, Parrotfish



etc.) before Algal cover is brought under control to allow clearing of reef surfaces for re-settlement of coral larvae.

6 nos 25m. Point transects (0.5m. interval) carried out for substrates and 6 nos. 25m.x 5m. Belt transects were carried out for fishes and large sessile benthic invertebrates.

Bar Reef crest section 2 - N8 22.777 E79 44.147

The second and outer of the two main areas of the Bar-reef that had recovered from the 1998 bleaching event was also affected by the 2016 coral bleaching event and the coral mortality has been devastating and complete.

The reef was composed entirely of dead coral and coral rubble with live coral cover less than 1% of substrates, which included mostly small colonies of Acroporid corals that had re-settled and less than 6-months in age. The reef was observed to be in secondary stage of post mortality recovery, where the populations of herbivorous fishes have increased into large shoals increasing the grazing down of algae to low levels again. The abundance of Herbivorous fish on the reef had increased to 82% with a corresponding reduction of algal cover to 13% of substrates, which allows the resettlement of coral larvae on to the reef. The reef shows very low level of algal cover compared to the other sections of the Bar-reef and also indicates some level of recent coral recruits settling in among the rubble zones.

The fish diversity was very low with only 62 species recorded. The abundance of Grazers including Surgeonfishes and Parrotfishes was high with large shoals of 200-300 surgeonfish frequent, with large shoals of mid water feeding Planktivorous damselfishes including chromids and Pomacentrids. There were notably high numbers of Queenfish (*Scomberoides sp.*) in the seaward end of the reef.

Several instances of fishing operations involving large nets deployed by two boats each using up to 4 SCUBA divers were observed laying and operating the nets on the Bar-reef. The Boats were observed to travel in and towards Battalangundu Islands.

6 nos. 25m Point transects (0.5m. interval) carried out for substrates and 6 nos. 25m.x 5m. Belt transects were carried out for fishes and large sessile benthic invertebrates.

Bar reef dead section - N8 22.268 E79 43.954

Part of the extensive patch reefs which was killed off by the 1998 Coral bleaching event. The site is composed of a large patch of old degraded coral rubble with some algal cover. Low fish diversity and abundance present.

Deeper "Bommie" reef - N8 21.082 E79 43.242



The area is composed of small rocky boulders scattered over the sandy sea floor creating a rough low relief terrain. The area is interspersed with larger rock/coral outcrops "Bommies" which form centers of high diversity and abundance of fish life. Significant, though not exert, algal cover was observed on the low relief areas dominated by algae *Asperogopsis*.

The live coral cover at the site was significantly higher than surviving in the Bar-reef area though it consisted mostly of Poritid and Mussid corals. Two transects were carried out at the site.

Deep sandstone ridge - N8 19.055 E79 41.661

The site is a high relief sand stone ridge over 50m long and 10m wide, located at a depth of 12-15m. Representative of deeper non-coral reef habitats the reef contain good diversity of fish life and abundance. Reef is in general good health with low level of pollution in some areas with minor aggregations of Corallimorphs observed. The Corallimorphs do not seem to be aggressive or pose a threat to live coral areas on the reef. The reef contained healthy fish assemblages including large Groupers and Napoleon wrasses indicating that the reef is not heavily fished.

11.5 Marine fauna recorded in Kalpitiya sea area

The continental shelf of the west coast of Sri Lanka makes a sharp turn close to Kalpitiya as it joins the Indian shelf, forming a large bay like structure with forming a terminus to the Northward flow of currents in the deeper sea regions. This feature allows creation of conditions for the formation of up-welling currents from the deep sea which feeds a system that include migration of many species of animals including marine mammals and sea birds to visit this part of the shores. Seas around Kalpitiya include areas with narrow continental shelf as well as areas that have steep shelf slopes which also help to bring many species of marine mammals to areas closer to the shore.

The area is considered a Cetacean hotspot in Sri Lanka, with 20 species of marine mammals recorded from the area; including 19 species of Cetaceans and one species of Sirenian. There are also additional unconfirmed records of the possible presence of Irrawadi dolphins and finless porpoise and the Hump-backed Whale in the area based on several recent kill records within the bay.

11.6 Marine flora recorded in Kalpitiya sea area

There are significant sea grass beds lining the inner shores of most of the islands from Kalpitiya to Battalangundu. Several quadrat samples were carried out in these areas. (Quadrats Q2, Q3, Q4, Q5). The land ward shore closer to Gangewadiya contained few and much smaller sea grass areas sheltered within cove areas of the shore, which may indicate heavy action of waves entering the bay from the Uchchimune entrance. This may restrict growth of sea grass on this part of the coast line. Two samples were carried out on sea grass areas on the land side of the Lagoon (Quadrats Q6, Q7).



11.6.1 Sampling methodology for marine fauna

Sampling was carried out based on globally accepted sea grass survey methodologies adopted by the “seagrass watch” (http://www.seagrasswatch.org/Methods/Manuals/SeagrassWatch_Rapid_Assessment_Manual.pdf) methodologies. Surveys were carried out using 0.5m quadrats with 3 replicates per plot and data was collected on the species cover at each site.

The collected data was analysed by generating mean values for each site for all vegetation cover values. Species composition of sea grass species are shown as pie charts for each site and species similarity of the sites were analysed by using non-metric multi-dimensional scaling method. Prior to analysis, data was calculated to squareroot and bray-curtis similarity method using primer 6 software.

11.6.2 Marine fauna sampling results

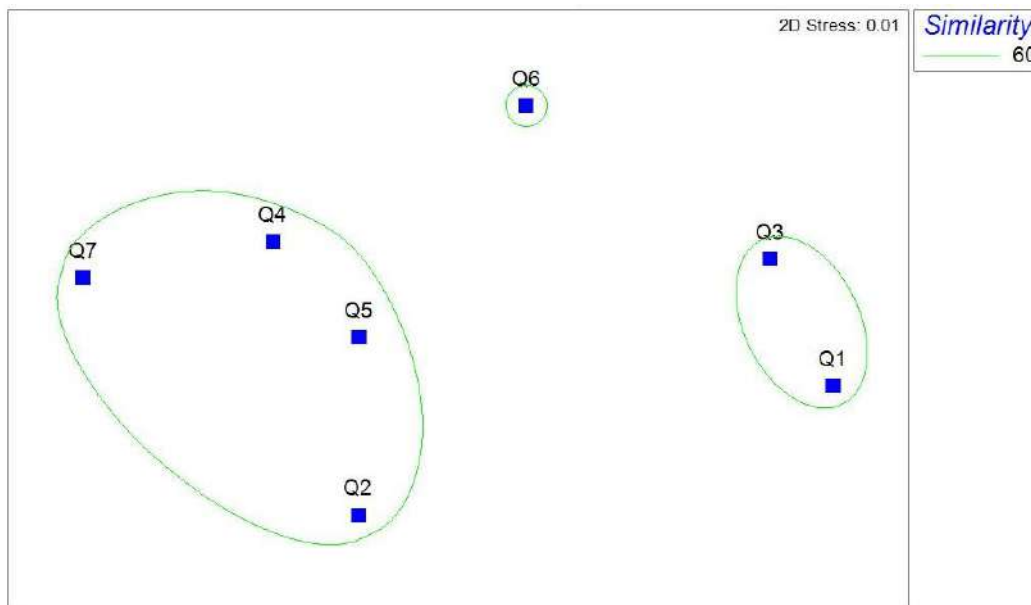


Figure 11 Non-metric multidimensional scaling ordination for seagrass sampling sites

Non-metric multidimensional scaling ordination shows results for 7 sampling sites (stress level 0.01) with the lines showing 60% of similarity of species composition. The ordination indicates that the two sites, Bar-reef inshore (Q1) located in a fully marine environment and Palliyawatta sea grass seaward end Q3, shows more similarity than other sites (which are the only sites containing Seagrass *Halophila ovalis*).

11.6.2.1 Bar-reef inner SG- N8 22.304 E79 45.071 [Q1]

An extensive marine sea grass area located inshore of the Bar reef complex at a depth of about 5 m. The area extends North in discontinuous patches to link with the large sea grass areas North of Battalangundu.

The area was composed primarily of a mixed sea grass bed of *Halophila ovalis* and *Halodule uninervis* with some *Syringodium* found in places. It is to be noted that very large quantities of dead decomposing seagrass litter was found, indicating a recent mortality event of a significant



scale from which the sea grass seem to have recovered. Sea grass beds extend north of Battalangundu Island as well. It is presumed that this may have been due to the extreme cold sea conditions experienced during the last months of 2016 and first two months of 2017.

11.6.2.2 Palliyawatta shallow- N8 26.939 E79 48.844 [Q3]

A large tract of sea grass on the inshore side of the Palliyawatta Island was observed at very shallow 0.5-1.5m depth, with crest formed about 1km east of the Island and running parallel to the Island in a North-South direction. The shallower more northern sections contain *Halophila ovalis* and *Halodule uninervis* dominated areas, with patch areas of *Enhalus acroides* encountered. Small quantities of *Syringodium* was observed while the deeper sections areas are dominated by *Enhalus acroides* dominated environments

The sites Q2, Q4, Q5, Q7 show similarity and are all located in sheltered locations on the coast and containing high levels of *Cymodocea serrulata*, *Enhalus acroides* and *Halodule uninervis* which are co-dominant.

11.6.2.3 Battalangundu Island-N8 29.859 E79 47.507 [Q2]

A moderate sized sea grass area on the lower inshore area of Battalangundu Island at 2m depth is dominated by *Cymodoce serrulata*, *Halodule uninervis* and *Halophila decipens*,

11.6.2.4 Palliyawatta outer SG- N8 25.967 E79 49.101 [Q4]

This is an extension of the same sea grass bed as in Q3, but at a site close to the outer end of sea grass bed and about 2km south of the first site. The area was structurally different to the first, in having a denser growth of *Enhalus* and *Cymodoce serrulata* interspersed with *Halodule uninervis* and *Thalassia hemprichi* and small quantities of *Syringodium isoetifolium*.

11.6.2.5 Ippanthivu inner shore- N8 19.417 E79 48.839 [Q5]

Sea grass area on the Inner shore of Ippanthivu Island Southern end is located in 0.5m shallow waters. This is primarily composed of *Cymodoce serrulata* and *Halodule uninervis* dominated environment, interspersed with *Enhalus acroides*, *Halophila ovalis*, *Thalassia hemprichi*, algae including *Padina* and a fine filament un-identified brown species. The northern sections of the sea grass area in Ippanthivu changes to a more *Enhalus acroides* dominant environments.

11.6.2.6 Wilpattu coast- N8 20.934 E79 50.438 [Q6]

The coast on the landward shore of Puttalam lagoon contains less prolific growth of sea grass than the seaward shore areas. In the area North of the Gangewadiya / Kala Oya outfall, the shore shows signs of heavy exposure to waves entering from the sea openings at Uchchimune. The sea grass areas are restricted to pockets contained within smaller sheltered coves on the coastline and are limited in extent compared to the sea grass areas on the inner shores of the Islands.

The location contained a sea grass patch enclosed in a cove on the beach on the shores of Wilpattu forest area. Thick muddy floors dominated by *Enhalus acroides*, *Halodule uninervis*, had scattered growths of other species including *Halophila ovalis*, *Halophila decipens*, *Thalassia* and few *Cymodoce*; Algae *Codium geppiorum* was common.



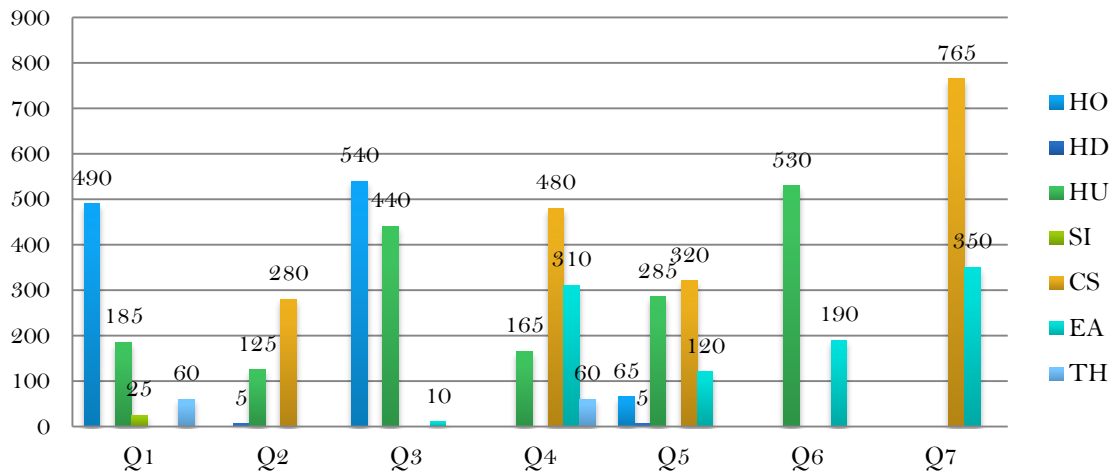
The shore line north of Gangewadiya contains extensive mangrove areas with heavy wave washing on the coast. No sea grasses were observed in the shores adjacent to the mangroves.

The Q6 is indicated as an outlier from other plots and contained only *Cymodoce serrulata* and *Enhalus acroides*. The site is muddier than other sites and is located further south within the Puttalam bay in more sheltered waters.

Aruwakkalu coast- N8 14.843 E79 48.716 [Q7]

Few small patches of Seagrass are found on the landward coast of Puttalam lagoon between Gangewadiya and Kalpitiya. These are small in extent and are usually located in small sheltered sections of the coast. The water is extremely turbid and sampling was difficult. The site is shallow with 1.3m depth and the location only contained *Enhalus* and *Cymodoce serrulata*.

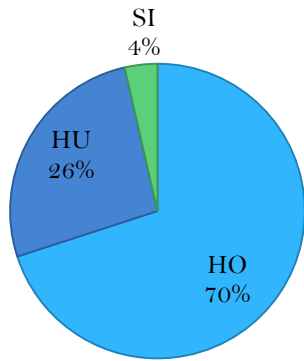
Seagrass species composition at sites



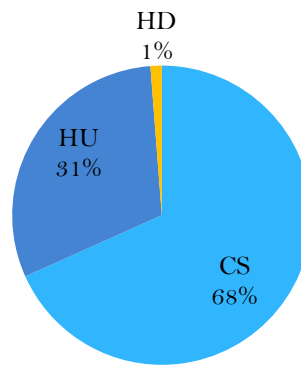
HU	<i>Halodule</i>	<i>uninervis</i>
HP	<i>Halodule</i>	<i>pinifolia</i>
CR	<i>Cymodoce</i>	<i>rotundata</i>
CS	<i>Cymodoce</i>	<i>serrulata</i>
HO	<i>Halophila</i>	<i>ovalis</i>
HD	<i>Halophila</i>	<i>decipens</i>
SI	<i>Syringodium</i>	<i>isoetifolium</i>
EA	<i>Enhalus</i>	<i>acroides</i>
TH	<i>Thalassia</i>	<i>hemprichii</i>



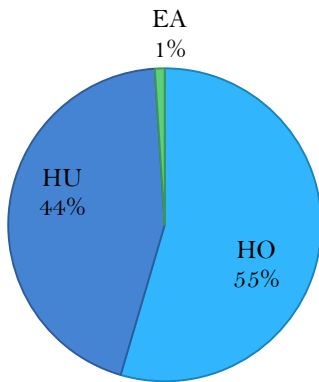
Bar-reef inshore Q1



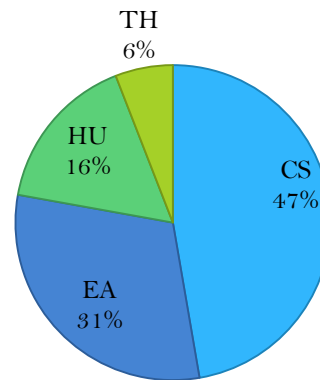
Battalangundu Is. Q2



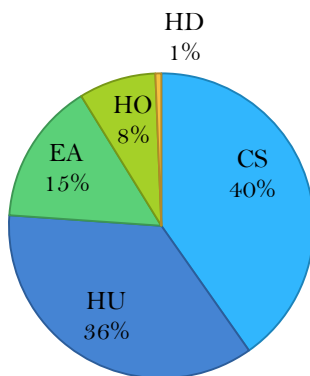
Palliyawatta shallow Q3



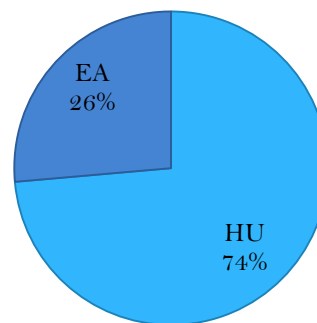
Palliyawatta outer Q4



Ippanthivu Q5



Wilpatthu coast Q6



Aruwakkalu coast Q7

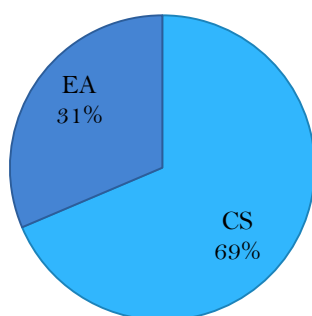


Figure 12 Seagrass species compositions in samples areas

Table 71 Shannon’s Wiener diversity index for Sea grass sample sites

Transect	Index
Q1 Bar reef SG	H = 0.72037
Q2 Battalangundu	H = 0.67633
Q3 Palliyawatta 1	H = 0.73745
Q4 Palliyawatta 2	H = 1.1789
Q5 Ippanthivu	H = 1.25607
Q6 Wilpattu coast	H= 0.57709
Q7 Aruwakkalu coast	H= 0.62219



Critical Species

Critical Species can be defined as any species that is, (i) Critically Endangered or Endangered (ii) Endemic and (iii) or a restricted range species. The table below provides a summary of critical species found in the Kala Oya basin. By the given definition, the table indicates the importance of different clusters in terms of taxonomic and conservation considerations.

Table 72 No of Critical Species in Each Habiatat Cluster or Sub Basin (No of Species in each Habiat)

Taxonomic Group	Total no of species	A	B	C	D	E	F	G	H	Total no of critical species
Plants	609	09	12	13	11	07	18	09	15	41
Mammals	39	11	10	04	09	05	09	09	11	15
Birds	188	04	11	06	07	08	06	09	09	14
Herperto Fauna										
Fish	64									8 (all endemic of which 4 are vulnerable)
Dragonflies		2	2	2	2	2	2	3	2	05
Butterflies	84	02	01	00	01	00	01	02	02	07
Mangroves	14									10 (5NT,3 EDN 2 VUL)

TOTAL

Cluster F: Galpaya sub-basin is an important area in terms of terrestrial flora, while Cluster B: Eluwankulama is a key sub-basin in terms of avifauna diversity. Cluster G: Manawa is important for dragonflies while the mouth of the Kala Oya is a crucial area for diversity of fish and mangroves as it forms the estuary that creates a critical habitat. Although parts of this estuary is already under conservation, a considerable part of the Lunu Oya and Henakachchi segments of the estuary along with associated salt marshes are essential environments for the survival of mangroves, salt marsh associated fauna and flora as well as migratory birds.

Other critical habitat clusters include the entirety of Kala Oya estuary and associated salt marshes in landward side. In terms of freshwater fauna, remaining flood plains of the river still preserved at Wilpattu and Eluwankulama areas should be given needed legislative and institutional protection.

Compared to Wilpatthu National Park localities (transect 21 – 24), Species Richness and type of Habitats are more or less similar in Locality A: Eile area sub-basin, B: Eluwakulama sub-basin, E: Horiwila/ Ambagahawewa sub-basin and F: Wilpattu NP area. Additionally, these four localities are very significant due to high levels of endemism, near threatened species, endangered



and vulnerable species compared to species distribution and species richness of other localities in the adjacent areas.

Avifauna observed during the study period included four nationally threatened species (other than breeding migrants) all of whom fell into the category “vulnerable”: *Porzana fusca* (Ruddy-breasted Crane), *Leptoptilos javanicus* (Lesser Adjutant), *Chrysocolaptes festivus* (White-naped Woodpecker) and *Lonchura malabarica* (White-throated Munia). Further two globally threatened species were recorded: *Ciconia episcopus* and *Leptoptilos javanicus*. As per the IUCN Red List of threatened species, 2016, both species are considered as “vulnerable” globally as their overall populations are seems to be in rapid decline mainly due to loss and degradation of wetlands and loss of nesting tress as well as hunting. Yet nationally, only *L. javanicus* is considered as vulnerable, while *C. episcopus* status is near threatened, indicating its population is more stable in Sri Lanka. During the present survey, records *C. cepiscopus* was high with eight individuals being observed in a dried up tank within Manawakanda area. Single individual of *L. Javanicus* was observed near to Eluwankulama Tank (Transect 6). A recent study on *L. javanicus* in the country indicated that the species’ distribution was restricted to dry lowlands (rainfall <2200mm, elevation <300m). The bird showed preference for savannah/woody savannahs, dry mixed evergreen forests, permanent wetlands, and croplands, and was prominently found within protected areas. Habitat loss and fragmentation, hunting pressure, agricultural intensification, and development projects were identified as potential threats faced by the species, which varied in magnitude across the KOB.

The highest avifaunal species diversity was recorded from transects that included a variety of habitats including both aquatic and terrestrial: Nabatayagama Tank and associated forests (Transect 14) located adjacent to Namal Uyana Conservation Forest recorded the highest diversity followed by Manawa tank associated habitats (Transect 19). Of the Dry mixed evergreen forests, highest bird diversity was recorded from Manawakanda forests (Transect 17) followed by Higuruwelpitiya (Transect 13) and Aily tank associated DMEF (Transect 1). Least diversity was observed from DMEF of Suduwelithalawa (Transects 7 & 8) and this might be due to high density of the forest cover.

Out of the habitats selected in the Kala Oya river basin, Scrub forest and Tank associated habitats stand out as the best sites for butterflies. The current study shows that the Galpaya, Hinguruwelpitiya, Ranva kannda, Nambatiwewa, Manawa area supports high levels of butterfly diversity including endemic butterfly species. The Eile area – transects T1 and T2 - is an ideal habitat for the Joker, *Byblia ilithyia*, a characteristic species of this area found only in Meadows with seasonal flooding. When considering the North West butterfly region, it is typically home to and the preferred habitat for the Large Salmon Arab- *Colotis fausta*, Crimson Tip- *Colotis danaeare*, Yellow Pansy- *Junonia hierta*, and Bright Babul Blue- *Azanus ubaldus*. However, these species were not encountered despite previous records of their existence in these habitats indicating inadequate sampling or lack of time to carry out sampling.



