

Table of Contents

List of figures	v
List of tables	x
Acknowledgement	xiii
Abstract	xv
Chapter 1	1
Introduction and background to the study	
1.1: Introduction to Wetlands	1
1.2: Ecological aspects of wetlands	2
1.2.1: Man and wetlands	4
1.2.2: Physical dimensions of wetlands	6
1.2.3: Chemical Parameters	7
1.2.4: Biological characters of wetlands	10
1.2.4.1: Biological integrity and Biological assessment	11
1.2.4.2: Floral composition in wetlands	12
1.2.4.3: Major faunal groups inhabiting wetlands	14
1.3: Bundala National Park	19
1.4: Objectives of the study	22
Chapter 2	25
General Limnology of Malala lagoon, Embillakala lagoon and Bundala Lewaya in Bundala National Park	
2.1: Introduction	25
2.2: Methodology	28
2.2.1: Study period and sampling criteria	28
2.2.2: Selection of transects and random sampling sites	28
2.2.3: Physico-chemical parameters	30
2.2.3.1: Water depth and sediment thickness	31
2.2.3.2: Dissolved oxygen and Gross Primary Productivity	31
2.2.3.3: Total alkalinity and salinity	31
2.2.3.4: Dissolved phosphate and nitrate	31

2.2.3.5: Water transparency	32
2.2.3.6: Water temperature	32
2.2.3.7: Suspended solids	32
2.2.3.8: Biological Oxygen Demand (BOD)	33
2.2.3.9: Chlorophyll a	33
2.2.3.10: pH	33
2.2.4: Physical characters of the lagoons	33
2.2.5: Biological characters	34
2.2.6: Man made hydrological alterations	35
2.2.7: Statistical analysis	35
2.3: Results	36
2.3.1: Lagoon morphology	36
2.3.2: Lagoon water quality along studied transects	38
2.3.3: Key biological characters of lagoons	54
2.3.3.1. Chlorophyll a, Gross Primary Productivity and Phytoplankton	54
2.3.3.2. Zooplankton	58
2.3.3.3. Benthos	63
2.3.4: Correlation among various physico- chemical parameters and zooplankton abundance	66
2.3.5: Changes in the physico-chemical and biological parameters following the man made hydrological alterations	71
2.3.5.1. Changes accompanied with the size of the water body	71
2.3.5.2. Changes in the water quality	71
2.3.5.3. Changes in the aquatic community structure	72
2.3.5.4. Fresh water influence	74
2.4: Discussion	79

Chapter 3	90
Diversity of fish fauna in selected aquatic environments of Bundala National Park and their trophic niche segregation patterns	
3.1: Introduction	90
3.2: Methodology	92
3.2.1: Sampling	92
3.2.2: Taxonomic studies, guild classification and measuring diversity	92
3.2.3: Stomach content analysis	93
3.3: Results	96
3.3.1: Species composition and the total catch	96
3.3.2: Feeding guilds	103
3.4: Discussion	111
Chapter 4	115
Abundance and composition of avifauna in relation to some habitat parameters in Malala, Embillakala and Bundala Lewaya (A case study during July 2000 to December 2001)	
4.1. Introduction	115
4.2. Methodology	117
4.2.1. Study sites	117
4.2.2. Period of study and bird counting	117
4.2.3: Physico-chemical parameters	118
4.2.4: Measuring diversity	119
4.3: Results	120
4.3.1: Species composition and bird aggregation patterns	120
4.3.2: Abundance of aquatic birds during the study period	127
4.3.3: Correlation between bird density and habitat parameters	139
4.4: Discussion	141
Chapter 5	152
The role of macrophytes as an important habitat-A study based on pondweed beds (Potamogetonaceae) in Embillakala lagoon	
5.1: Introduction	152
5.2: Methodology	156
5.2.1: Study sites	156
5.2.2: Taxonomic studies	156
5.2.3: Study of physico-chemical parameters and biological parameters	156

5.3: Results	158
5.3.1: Taxonomic features of the studied pondweed	158
5.3.2: Physico-chemical features and biological assemblages in pondweed beds	158
5.3.3: Correlation Coefficients	161
5.4: Discussion	161
Chapter 6	
Analysis of socio- ecological factors affecting Bundala National Park	165
6.1: Introduction	165
6.2: Methodology	168
6.2.1: Work Plan	168
6.2.2: Target issues	169
6.2.2.1: Knowledge on the BNP Environment	170
6.2.2.2: Education Level	170
6.2.2.3: Living condition	170
6.2.2.4: Resource utilization	171
6.2.2.5: Fishing community	171
6.2.2.6: Time period	171
6.2.2.7: Statistical applications	171
6.3: Results	172
6.3.1: Distribution pattern of human community	172
6.3.2: Knowledge on park environment	174
6.3.3: Occupation, income level and family size	175
6.3.4: Resource utilization	179
6.3.5: Issues concerned on park degradation	182
6.3.6: Drought and occupations of park inhabitants	184
6.4: Discussion	186
Chapter 7	
General discussion–Linking ecological aspects, sociological aspects and Conservation	195
Summary and conclusion	204
References	207
Annex	

List of figures

Figure		Page
Figure 1.1:	A schematic diagram indicating the important water bodies of Bundala National Park and its surroundings	24
Figure 2.1:	Schematic diagram indicating the study transects in Malala, Embillakala and Bundala Lewaya	30
Figure 2.2:	Diagrammatic representation of key morphological characters of Malala lagoon during December 2000 -January 2001	39
Figure 2.3:	Diagrammatic representation of key morphological characters of study area of Bundala Lewaya during December 2000- January 2001	40
Figure 2.4:	Diagrammatic representation of key morphological characters of Embillakala lagoon during December.2000-January 2001	41
Figure 2.5 a:	Variation of monthly mean dissolved phosphate levels recorded in the three lagoons during study period.	45
Figure 2.5 b:	Variation of monthly mean aquatic nitrate levels in the three lagoons during study period	46
Figure 2.5 c:	Variation of monthly mean water depth recorded in the three lagoons during study period.	47
Figure 2.5 d:	Variation of monthly mean Secchi depth recorded in the three lagoons during study period.	48
Figure 2.5 e:	Variation of monthly mean Dissolved Oxygen recorded in the three lagoons during study period.	49
Figure 2.5 f:	Variation of monthly mean salinity recorded in the three lagoons during study period.	50
Figure2.5: g:	Variation of monthly mean temperature recorded in the three lagoons during study period.	51
Figure 2.5 h:	Variation of monthly mean total alkalinity recorded in the three lagoons during study period.	52
Figure 2.5i:	Variation of monthly mean suspended solids recorded in the three lagoons during study period.	53

List of figures continued

Figure		Page
Figure 2.5 j:	Variation of monthly mean BOD recorded in the three lagoons during study period	54
Figure 2.5 k:	Variation of monthly mean Chlorophyll a recorded in the three lagoons during study period.	55
Figure 2.5 l:	Variation of monthly mean Gross Primary Productivity recorded in the three lagoons during study period	56
Figure 2.6:	Monthly variation of the density of major zooplankton taxa in Malala lagoon during study period	60
Figure 2.7:	Monthly variation of the density of major zooplankton taxa in Embillakala lagoon during study period	61
Figure 2.8:	Monthly variation of the density of major zooplankton taxa in Bundala Lewaya during study period.	62
Figure 2.9: A.	Variation of salinity in Embillakala lagoon towards Malala lagoon during December 2000.	75
Figure 2.9: B.	Variation of salinity towards sand bar in Malala lagoon during December 2000.	75
Figure 2.10:	Abundance of two key zooplankton species towards the sand bar of Malala lagoon.	76
Figure 2.11:	Malala lagoon with different water levels.	77
Figure 2.12:	Area covered by bare sand or grassland	78
Figure 3.1:	Transects and localities where gill nets were laid in Malala and Embillakala	94
Figure 3.2:	Diagrammatic representation of methodology for the stomach content analysis.	95
Figure 3.3:	Representation of the mean Shannon's diversity index calculated for fish catches of Malala, Bundala Lewaya & Embillakala lagoon.	97
Figure 3.4:	Mean fish catch per month in Bundala Lewaya, Malala lagoon and Embillakala lagoon during the study period	98

List of figures continued

Figure		Page
Figure 3.5:	Some economically important fish species inhabiting Malala and Embillakala lagoons of Bundala National Park.	101
Figure 3.6:	Fate of the lagoons because of the water scarcity.	102
Figure 3.7:	Mass fish kills during drought in Bundala Lewaya.	103
Figure 3.8:	Representation of mean % diet composition of pelagic fish guild of Malala, Embillakala and Bundala lewaya lagoons.	105
Figure 3.9:	Representation of mean % diet composition of demersal fish guild of Malala, Embillakala and Bundala lewaya lagoons.	106
Figure 3.10:	Representation of mean % diet composition of benthopelagic fish guild of Malala, Embillakala and Bundala lewaya lagoons.	107
Figure 3.11:	Representation of mean % diet composition of reef associated fish guild of Malala lagoon.	107
Figure 4.1:	Diagrammatic representation of the lagoons in the Bundala National Park indicating the monitoring sites chosen for bird counting during the present study	119
Figure 4.2:	Representation of bird aggregation localities of Embillakala, Malala and Bundala Lewaya lagoons	126
Figure 4.3:	Abundance of Cormorants in lagoons during study period.	128
Figure 4.4:	Abundance of Pheasant Tail Jacana in Embillakala and Malala lagoons.	129
Figure 4.5:	Abundance of Egrets, Herons and Bitterns in lagoons during study period.	131
Figure 4.6:	Abundance of Ibises and Spoonbills in lagoons during study period.	133
Figure 4.7:	Abundance of Lap Wings and Plovers in lagoons during study period	135
Figure 4.8:	Abundance of Ducks and Teals in Embillakala and Malala lagoons during study period.	136

List of figures continued

Figure		Page
Figure 4.9:	Abundance of Terns in the three lagoons during the study period.	137
Figure 4.10:	Abundance of Curlews and Sand Pipers in the three lagoons during the study period.	138
Figure 4.11:	Bundala Lewaya at its different water regimes.	145
Figure 4.12:	Important feeding and nesting habitats for birds associated with Bundala lagoons.	148
Figure 5.1.	Pondweed beds in Embillakala lagoon	157
Figure 5.2:	A close-up picture of a pondweed bed in Embillakala lagoon.	157
Figure 6.1a:	Map indicating the distribution of different types of houses adjacent to Bundala National Park.	173
Figure 6.1 b:	Housing constructions of neighboring human community of Bundala National Park.	174
Figure 6.2:	Percentage of distribution of all families according to their income.	176
Figure 6.3:	Percentage distribution of the income level of families in fishing community.	176
Figure 6.4:	Percentage distribution of people according to occupation.	177
Figure 6.5:	Representation of percentage distribution families according to number of individuals of a family.	178
Figure 6.6:	Percentage distribution of people according to their education level.	178
Figure 6.7:	Percentage distribution of people engaged in animal husbandry and their land use patterns	183
Figure 6.8:	Response of inhabitants for different issues during last 10 years.	184
Figure 6.9:	Occupation categories of inhabitants during drought period.	185

List of figures

Figure		Page
Figure 6.10:	Distribution of different income levels of inhabitants during drought period in 2001.	185
Figure 6.11:	Fire wood gatherings in houses and a villager who is carrying out a pile of wood collected from forest.	191
Figure 6.12:	Free live stock grazing in Bundala Lewaya and surrounding area.	191
Figure 7.1:	Schematic representation of possible management plan for Bundala National Park	203

List of tables

Table		Page
Table 2.1:	Comparison of various physical factors of Malala, Embillakala and Bundala Lewaya lagoons	38
Table 2.2:	Highest and lowest values of physico-chemical parameters recorded in Malala lagoon during the study period	42
Table 2.3:	Highest and lowest values of physico-chemical parameters recorded in Embillakala lagoon during the study period	43
Table 2.4:	Highest and lowest values of physico-chemical parameters recorded in Bundala Lewaya during the study period	44
Table 2.5:	Major phytoplankton species in Malala, Embillakala and Bundala Lewaya.	57
Table 2.6:	Mean % abundance of Major zooplankton taxa and species composition of each taxa in Malala, Embillakala and Bundala Lewaya during the study period.	59
Table 2.7:	Major benthic invertebrate taxa (Number of individuals per 1 kg sediments + SEM) recorded in Malala, Embillakala and Bundala Lewaya.	65
Table 2.8:	Significance of correlation among physico-chemical parameters and major zooplankton taxa in Malala, Embillakala and Bundala Lewaya	68
Table 2.9:	Mean values of the physico- chemical parameters prior to and following the sand bar opening	73
Table 2.10:	Variation of zooplankton (Key species) density following the sand bar opening	74

List of tables continued

Table		Page
Table 2.11:	Variation of benthic fauna before and after sand bar opening	74
Table 3.1:	Check list of the fish fauna recorded in Malala and Embillakala lagoons and in the Bundala Lewaya in BNP during the study period	99
Table 3.2:	Main feeding guilds of fishes identified during the study period in Malala and Embillakala lagoons	108
Table 3.3.	Diet overlaps as indicated by Schoener's similarity index.	109
Table 3.4:	Comparison of major food items of each fish species in Malala and Embillakala	110
Table 4.1.	Birds recorded in Malala, Embillakala and Bundala lagoons during the study period	121
Table 4.2:	Dominant groups of birds recorded in the three lagoons	125
Table 4.3:	Mean Shannon's diversity Index and evenness computed for the Bird population in Malala, Bundala Lewaya and Embillakala lagoon during the study period	126
Table 4.4:	Monthly bird density, Water depth, Lagoon area and Lagoon perimeter recorded in three lagoons during study period	140
Table 4.5:	Significant levels of Correlation coefficients computed for Bird density vs Lagoon perimeter, Water depth and Lagoon area.	141
Table 5.1:	Abundance of key planktonic organisms in pondweed beds and non-weedy localities	159
Table 5.2:	Physico-chemical parameters in pondweed beds and non –weedy localities	159

List of tables continued

Table		Page
Table 5.3:	Key benthic organisms in pondweed beds and non-weedy localities	160
Table 6.1:	Some indications of the knowledge of inhabitants on Park status	175
Table 6.2:	Representation of resource utilization among inhabitants	179
Table 6.3:	Economically important fish species in Malala and Embillakala lagoons and in the Bundala Lewaya in BNP.	180
Table 6.4:	Usage of water bodies for fishing.	181