

Protected Areas Management and Wildlife Conservation Project

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Consultancy Services Report

BIODIVERSITY BASELINE SURVEY: BUNDALA NATIONAL PARK



***Prepared for:
Department of Wildlife Conservation
Ministry of Environment and Natural Resources, Sri Lanka***



INFOTECHS IDEAS Pvt. Ltd.

IN ASSOCIATION WITH



**Specialists in Natural
Resources Management**

GREENTECH CONSULTANTS

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1. INTRODUCTION

Biodiversity Baseline Survey

The Biodiversity Baseline Survey is a discrete Contract within the Protected Area Management and Wildlife Conservation Project, funded by the Asian Development Bank, World Bank Global Environment Facility and the Government of the Netherlands. It has been undertaken by ARD Inc. for the Ministry of Environment and Natural Resources in accordance with the *Contract for Consulting Services of Biodiversity Baseline Survey* (ADB Loan No. 1767 SRI (SF)).

The overall aim of the Contract is to assess the current status of biodiversity within four protected areas¹ to inform their future management, using sound and practical scientific methods that can be repeated over time and applied more widely by the Department of Wildlife Conservation (DWC) to other protected areas under its remit. The Contract has been implemented during the period April 2006 – March 2007, with field work undertaken from the beginning of July 2007 until mid-January 2007.

A one-year extension to this Contract was awarded by the Ministry primarily to enable three additional protected areas² to be surveyed and further sampling to be conducted in Ritigala and Wasgomuwa during the wet season. This Extension has been implemented by Infotechs Ideas (Pvt) Ltd, in association with Greentech Consultants (Pvt) Ltd, during the period October 2007-October 2008, with fieldwork undertaken between November 2007 and July 2008.

Bundala National Park is one of the **seven protected areas** included in this Survey, chosen on account of its high importance for biodiversity within Sri Lanka's Dry Zone and with respect to its international importance as a Ramsar wetland. The following **six taxonomic groups** were selected for purposes of the Survey on the basis of being (a) well known and of general interest to scientists and managers; (b) relatively easy to survey systematically and identify; and (c) potentially of value to protected areas management:

- Mammals
- Birds
- Amphibians
- Reptiles
- Freshwater fish³
- Vascular plants

Purpose of this report in relation to contract objectives

This report documents the plant and animal species recorded by this Biodiversity Baseline Survey, assesses the richness of species found within the different habitats and considers the implications of these findings for the future management of the National Park. Along with reports for the other six protected areas, it addresses six of the ten objectives outlined in the Contract (Box 1.1).

This report should be read in conjunction with the Field Manual (DWC, 2008a), which documents the design of the Biodiversity Baseline Survey and methods used for sampling the different taxonomic groups in accordance with Objectives 1 and 2 of the Contract (Box 1.1). The Field Manual also describes how the field data are electronically stored and managed within a Biodiversity Information Management System and provides details about the preservation and curation of plant and animal specimens.

This report is intended for use by staff of the Department of Wildlife Conservation responsible for the management of Bundala National Park and the educational outreach of those who live around its

¹ Horton Plains, Peak Wilderness, Ritigala and Wasgomuwa

² Bundala, Minneriya and Udawalawe

³ In the case of Bundala, brackish water and marine species are included in the Survey.

perimeter or visit it. It should also be readily accessible to other professional individuals and organisations interested in adding to our knowledge of biodiversity within this site, be it through the collection of field data or further analyses.

Box 1.1 Contract objectives addressed in this report are highlighted

1. Establish baseline data and survey protocols for future biodiversity monitoring.
2. Establish sound, repeatable field methods appropriate for local conditions.
3. Establish rigorous methods for collection and management of data and specimens.
- 4. Inform management planning by defining habitat preferences and distribution of a range of fauna/flora/assemblages and threats to them.**
- 5. Identify habitats with rare, endemic and ecologically/culturally important species, guilds and assemblages.**
- 6. Identify natural assemblages of plants/animals.**
- 7. Provide natural history information on a range of species.**
- 8. Inform management practices and identification of management zones, based on #5-7 above.**
- 9. Make information, especially on the importance of each PA, available for education outreach.**
10. Improve technical skills of Departmental staff by provision of on-the-job training.

Importantly, this report, together with the Field Manual and records from this baseline survey held in the Biodiversity Information Management System (DWC, 2007a, 2007b), provide the basis for monitoring future changes to the biodiversity of Ritigala Strict Natural Reserve and informing its management in so far as the constraints of the data allow.

2. BUNDALA NATIONAL PARK

This section provides background information about the National Park that is relevant to this Survey. Unless otherwise indicated, it has been extracted from the current management plan (DWC, 2005) and further details can be found in the resource inventory of the previous management plan (DWC, 1997). Useful background information can also be found in IUCN (1990).

Designation, area and location

Bundala was designated a National Park on 4 January 1993 (Gazette Notification No. 748/3), having originally been declared a Sanctuary on 5 December 1969 (Gazette Notification No. 14,883). It was designated a Wetland of International Importance at the time of Sri Lanka's ratification of the Ramsar Convention on 15 October 1990.

Bundala lies on the coast in Hambantota District, South Province and can be accessed from the A2 highway, just east of the town of Hambantota. Its total area is 6,216 ha. The northern boundary of the National Park abuts Wilmenna Sanctuary, more recently established in June 2006 and 3,333 ha in extent.

Physical features

Three topographic zones, ranging in elevation from sea level to 20 m, can be distinguished at Bundala: beach and sand dunes, outer coastal plains with lagoons and inner coastal plains (Figure 2.1a). There are five shallow, brackish lagoons, of which three have been converted into salt pans. These lagoons are described in more detail in Section 8.1.

Geologically, Bundala lies within the Vijayan complex, represented by a variety of gneisses and granites (figure 2.1b). The coastal belt contains a thin band of Ferruginous Gravels deposited in the Quaternary period, above which are some detached Red Earths. The land between Bundala Lewaya (lagoon) and the inner coastal plains consists of fossil shell deposits originating from the Miocene and post-Miocene. Soils near the shore are Red Earths and sandy Regosols. Alluvial soils are found along the Kirindi Oya and in low-lying areas (Figure 2.1c).

Climate

Bundala lies in the Dry Zone. Mean annual rainfall ranges from 900 mm to 1300 mm, with two peaks periods of rainfall in April–May and October–November, and an extensive intervening dry period between May and September. Mean annual temperature is about 27 °C. Relative Humidity ranges between 76% and 81%. Wind speeds may reach 23 km/hour during the South-West and North-East monsoons.

Vegetation

The vegetation of Bundala National Park is very diverse, showing a natural succession from low, creeping plants that have colonised the beach and sand dunes to climax forest, referred to variously as Thorn, Dry Semi-Evergreen and Dry-Mixed Evergreen Forest. Additionally, a range of vegetation types occur in the lagoons and low-lying areas, including salt marsh, mangrove and aquatic vegetation. Seven terrestrial vegetation/habitat types (dry thorny scrubland, arid zone forests, sand dune vegetation, gentle sea shore vegetation, arid zone maritime grasslands/pastures, riverine forest, anomalous Mesquite scrublands) and six wetland types (salt marsh, mangrove, brackish water lagoons, sandy and rocky sea shore, seasonal water holes and tanks, saltern) were identified in a biodiversity survey by IUCN (Bambaradeniya *et al.*, 2001). Eight vegetation types were distinguished in a habitat mapping survey (MENR, 2005), of which the main ones are described, with images, in Box 2.

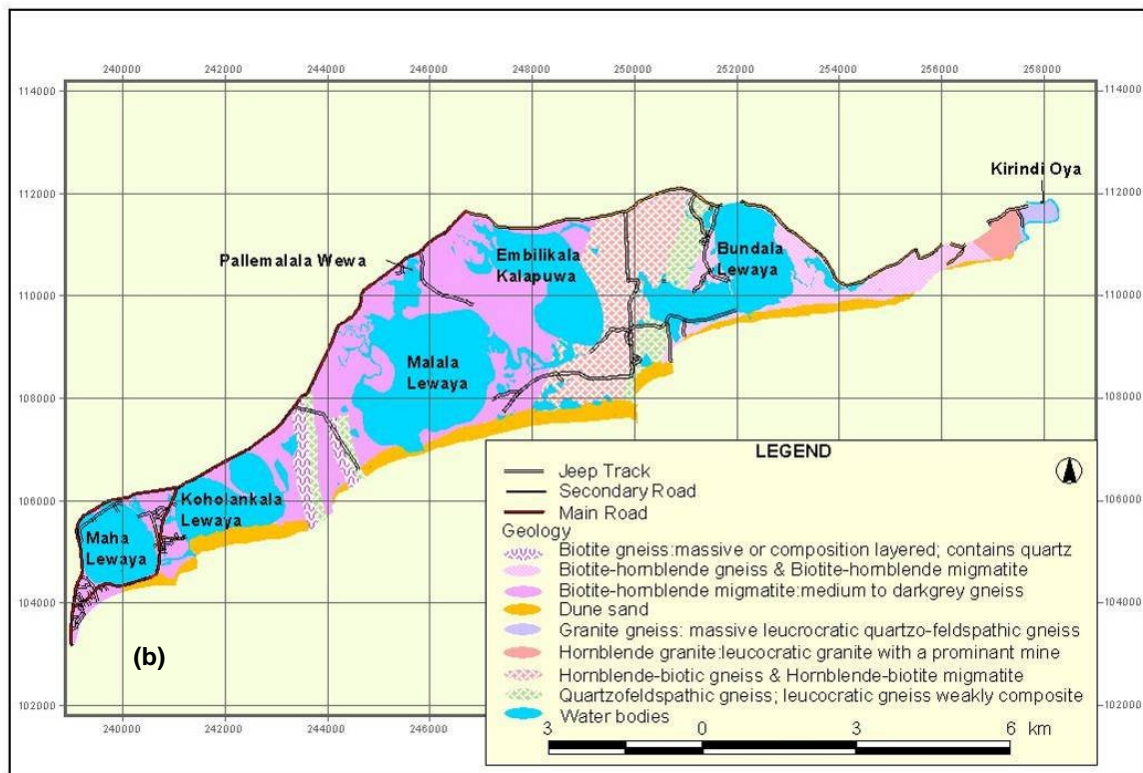
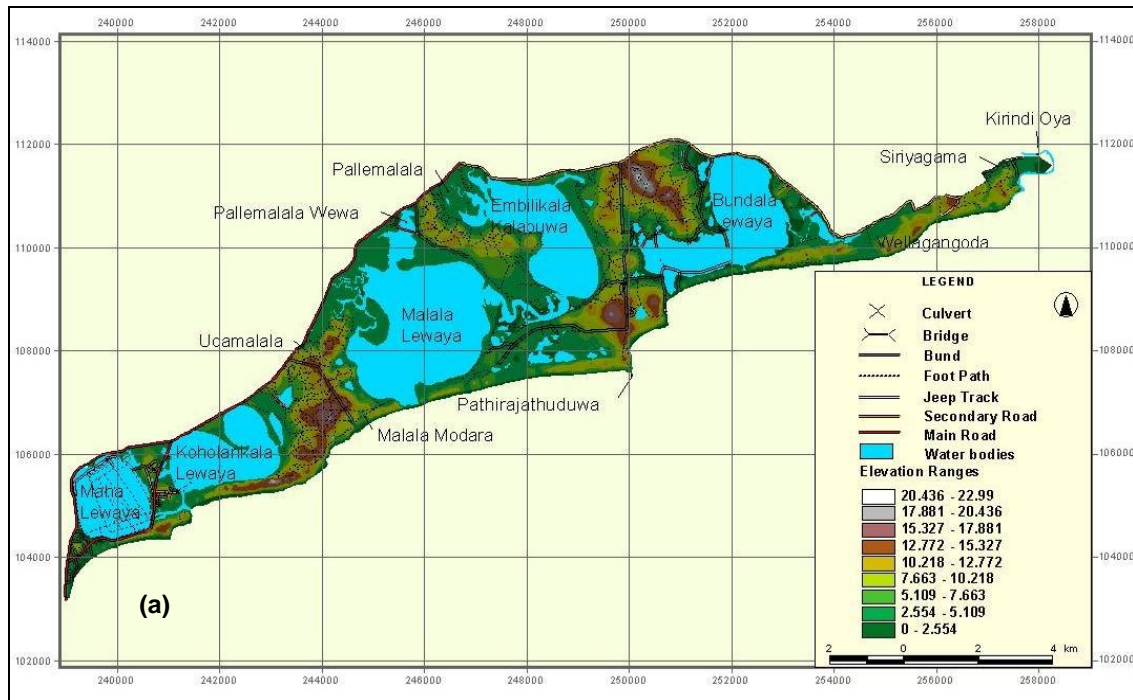


Figure 2.1 Maps of Bundala National Park showing (a) topography, (b) geology and (c) soils (Source: MENR, 2005)

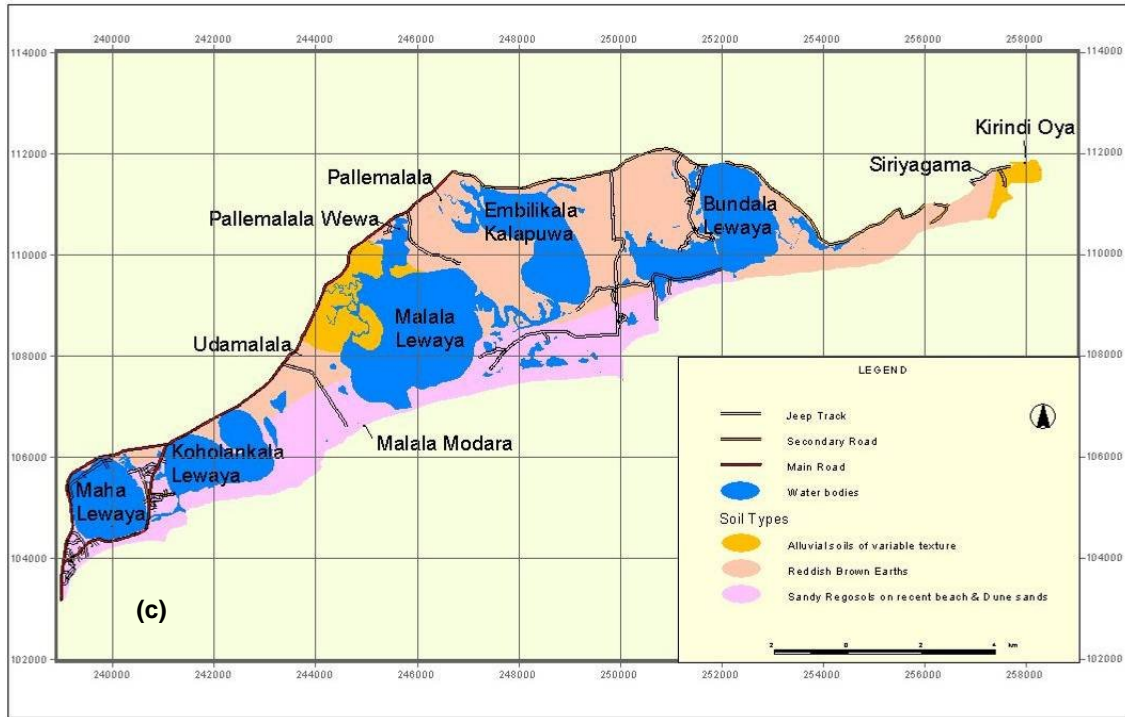


Figure 2.1 (cont.) Maps of Bundala National Park showing (a) topography, (b) geology and (c) soils (Source: MENR, 2005)

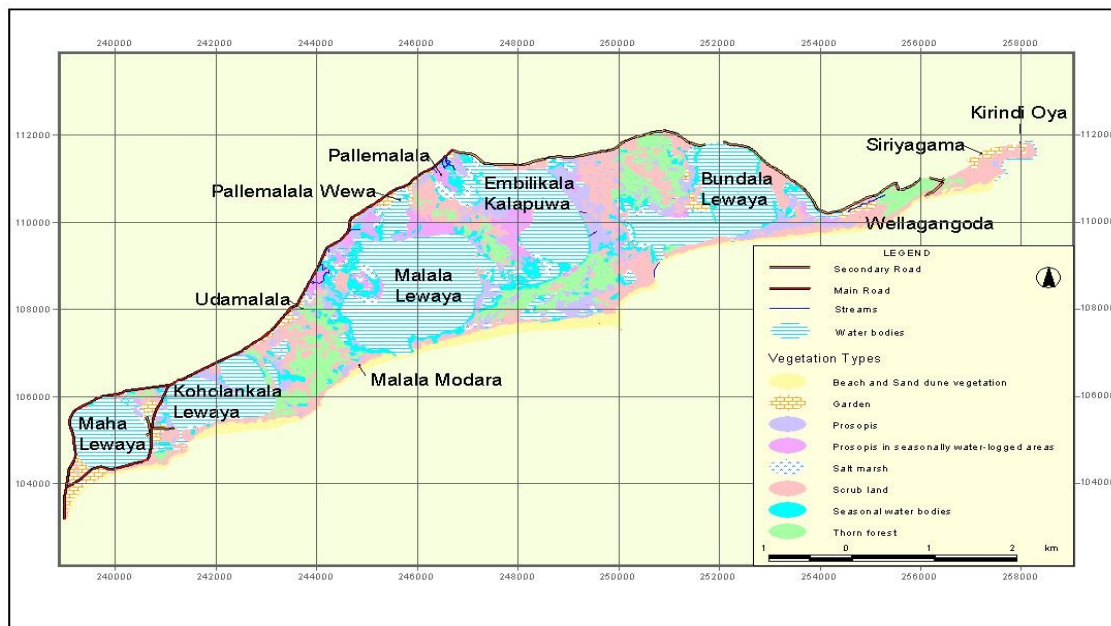


Figure 2.2 Vegetation map of Bundala National Park (Source: MENR, 2005)

Box 2.1 Descriptions and images of the main vegetation types in Bundala National Park¹ (Source: MENR, 2005)

Dry-Mixed Evergreen Forest / Thorn Forest (575.6 ha, 10.1% total area)

Undisturbed forest has the general appearance of a closed forest, with a canopy not exceeding 20 m in height. The tallest emergent canopy tree is *Manilkara hexandra* (Palu), which is scattered in its distribution and, in some areas, a large number are dead or dying. This may be due to pathogens, climatic or edaphic factors.

Other tree species in the canopy or uppermost layer include *Strychnos potatorum* (Ingini), *Suregada lanceolata*, *Salvadora persica* (Malitthan), *Limonia acidissima* (Divul), *Gyrocarpus americanus*, *Drypetes sepiaria* (Weera), *Dichrostachys cineria* (Katu Andara) and *Canthium coromendelicum* (Kara).

The lower tree layer comprises species such as *Allophylus cobbe* (Kobbe), *Benkara malabarica*, *Capparis zeylanica*, *Erythroxylum monogynum* (Agil), *Memecylon umbellatum* and *Ochana lanceolata*.



Scrub

(1,203.8 ha, 21.1%)


Scrub occurs on sand dunes along the coastal strip, where it grows to a height of 2-3 m, and further inland as scrub-woodlands in areas of degraded forest that do not revert to closed-canopy forest through natural succession. Characteristic species include *Salvadora persica*, *Catunaregam spinosa* and *Cassia auriculata* on the seaward side of sand dunes and trees such as *Bauhenia racemosa*, *Limonea accidisima*, *Azadiracta indica* and *Manilkara hexandra* on the more sheltered leeward side.

Tree species found in degraded forest areas include *Catunaregam spinosa*, *Dichrostachys cineria*, *Salvadora persica*, *Limonia accidisima* and *Azadiracta indica*. The understorey comprises species such as *Euphorbia tirucalli*, *Carissa spinarum*, *Allophylus cobbe*, *Benkara malabarica*, *Capparis* spp. and *Diospyros ferrea*.



Prosopis (620.6 ha, 10.9% of total area)

Prosopis is a small leguminous tree native to tropical America and the West Indies that has been introduced to Sri Lanka and naturalized in the dry/arid zone, especially in Bundala and its vicinity. This is a thorny shrubby tree, about 5 m in height, edible pods that are used as cattle food. It is very invasive, also colonising water-logged areas

	<p>surrounding lagoons, mud flats and abandoned paddy fields, and is a threat to native vegetation.</p> <p>Another common species in <i>Prosopis</i> dominated areas is <i>Opuntia dillenii</i> (Prickly Pear or Katu Pathok), which is also an introduced species of Mexican origins. This has spread rapidly throughout the National Park, even colonising Sand Dune habitat.</p>
<p>Sand Dune / Beach (242.4 ha, 4.3% of total area)</p> <p>Recent deposited sand dunes, beyond the limit of waves, are colonised by a low, creeping vegetation comprising only a few species, notably <i>Spinifex litoreus</i>, <i>Ipomea pes-caprae</i> and <i>Canavalia rosea</i>, with isolated bushes of two woody species, <i>Scaevola taccda</i> and <i>Calotrophis gigantia</i>. This vegetation formation, less than 30 cm in height, extends along the full 16 km length of the coastal strip, except in a few places of rock outcrops. Further inland, sand dunes are colonised by low, stunted vegetation dominated by woody species such as <i>Manilkara hexandra</i> (palu), <i>Salvadora persica</i> (Malittan), <i>Azadiracta indica</i>, <i>Cassine gluca</i> and <i>Syzygium cumini</i>. The main stems are prostrate, due to the effect of wind, and run parallel to the ground, producing shoots.</p> <div data-bbox="243 840 1383 1260">  </div> <p>¹ The other habitat types shown in Figure 2.1 are Paddy (327.9 ha, 5.7%), Garden (443.6 ha, 7.8%), Salt Marsh (84.8 ha, 1.5%), Seasonal Water Bodies (338.2 ha, 5.9%) and Water Bodies (1,857.7 ha, 32.6%) out of a total area of 5,693.7 ha, based on GIS analysis. Note that this total area is different to the notified area of 6,216 ha (see Section 2.1).</p>	

Much of the original climax forest found further inland has been degraded due to former timber and fuel wood extraction and shifting cultivation. Degraded areas do not revert back to closed-canopy forest through natural succession but tend to develop into scrub or scrubby woodland. Only a few patches of undisturbed old-growth forest remain. This degradation has led to the establishment of scrub, while also providing opportunities for colonisation by invasive, exotic species, notably *Prosopis juliflora* and the cactus *Opuntia dellenii*, that suppress natural regeneration of indigenous species.

Flora and fauna

Biodiversity surveys and related research in recent decades include the National Conservation Review (Green and Gunawardena, 1997), an inventory of natural resources that includes original field work as a part of a Global Environmental Facility Project (DWC, 1997), a biodiversity status survey by IUCN (Bambaradeniya *et al.*, 2001) and a floral survey as part of mapping the habitat of Bundala (MENR (2005). Existing knowledge about the diversity of plant and animal species is summarised in Table 2.1. It should be noted that the current management plan does not refer to the original resource

inventory (DWC, 1997), which was not available to review, but instead uses the more recent inventory by IUCN (Bambaradeniya *et al.*, 2001).

Table 2.1 Diversity of plant and animal taxonomic groups recorded by previous surveys

Survey/ Source	Taxon	Total number			
		Families	Genera	Species	Endemic species
National Conservation Review (Green and Gunawardena, 1997)	Woody plants	20	34	35	3
	Butterflies	4	7	8	0
	Molluscs	1	1	1	0
	Amphibians	0	0	0	0
	Reptiles	1	2	2	0
	Birds	15	18	20	1
	Mammals	8	8	8	0
Bambaradeniya <i>et al.</i> (2001)	Plants	90		*383	4
	Butterflies			52	2
	Fish			32	unspecified
	Amphibians			15	1
	Reptiles			48	6
	Birds			197	3
	Mammals			32	1
Habitat map (MENR, 2005)	Flowering plants	70	152	174	3

*Woody plants comprised 121 species.

Bundala is among the premier bird watching sites in Sri Lanka, with almost 200 bird species having been recorded in the National Park. Its waterfowl populations are world renowned and best seen during the winter migratory season, as Sri Lanka lies at the southern tip of the flyway from Russia and China. Other key attractions for visitors include: some of the best turtle nesting beaches in Sri Lanka, with all of Sri Lanka's five species present in good numbers; opportunities to see both estuarine and mugger crocodiles occur in the lagoons and connecting waterways; and the small resident herd of 10 to 15 elephants, with others migrating into the National Park during the months of July to September and December to January.

Management

The vision in the Management Plan (DWC, 2005) is to conserve Bundala National Park as an international Ramsar Wetland Site, with its unique ecosystem rich in biodiversity, especially providing refuge to threatened and migratory species through community participation. The management goals and objectives are reproduced in Box 2.2.

Four conservation themes have been identified, namely:

- restoration and management of the wetland ecosystem;
- restoration and management of the terrestrial ecosystems;
- provision of visitor services and opportunities for information dissemination; and
- empowerment of the community in participatory management.

Box 2.2 Management goals and objectives for Bundal National Park (DWC, 2005)*Management Goals*

- To conserve and manage the wetland ecosystem of the Bundala National Park.
- To effectively manage the terrestrial habitats and landscapes in such a manner as to enhance the values of the National Park.
- To ensure effective protection of archeological sites in the park.
- To provide visitor services compatible with conservation objectives.
- To facilitate outreach activities to enhance poverty alleviation via participatory activities for conservation.

Management Objectives

- To restore and manage the Bundala wetland ecosystem.
- To restore and manage the terrestrial ecosystem.
- To effectively administer and protect the habitats and archeological sites of the BNP.
- To provide visitor services including dissemination of information on wetland ecosystems.
- To empower the local community to participate in and benefit from the conservation of the National Park.

3. METHODS

Full details of the methodology developed for the Biodiversity Baseline Survey are provided in a separate Field Manual (DWC, 2008a). A brief overview is provided below, together with details of anything specific to the survey of Bundala.

Bundala National Park was surveyed in January and February 2008 to coincide with the end of the wet season and latter part of the bird migratory season. Field surveys lasting up to ten days, depending on the taxonomic group, were undertaken in the first half of January and second half of February. Surveys were extended to the recently designated Wilmenna Sanctuary, which lies adjacent to the National Park, at the request of the Department of Wildlife Conservation. This area is currently very degraded, due to its former cultivation, but is used seasonally by elephants during the height of the dry season in July-September.

Survey design and sampling procedures

The Biodiversity Baseline Survey covered terrestrial and aquatic habitats (i.e. rivers, streams, tanks, villus). Terrestrial habitats were identified using the outputs from the Habitat Mapping Project (MENR, 2005), based principally on the vegetation types while taking into account environmental gradients, such as altitude, aspect, geology and soils, for the location and alignment of transects. Additionally, Grassland was recognised as a distinct habitat for purposes of this Survey.

In general, terrestrial habitats were sampled systematically for plants, amphibians, reptiles, birds and mammals using quadrats (100 m x 5 m) aligned at 150 m intervals along transects (1 km length). Four replicate transects were located within each habitat type. Opportunistic observations were also recorded along transects, between quadrats, and elsewhere within the National Park and Sanctuary. In the case of Bundala, it was necessary to ensure that the narrow coastal belt and peripheries of lagoons were adequately sampled by modifying transect lines accordingly. Thus, transects began at or near the waters edge in the case dune systems and lagoons.

Freshwater and brackish water habitats were treated as a single type, which was sampled systematically for fish diversity and opportunistically for other taxonomic groups. In the case of Bundala, there were no streams to sample, only lagoons, connecting waterways and tanks/waterholes. The upper, mid- and lower reaches of the lagoons were sampled for fish and selected measures of water quality, while tanks/water holes were sampled separately. Four to six attempts were made to sample fish at each site.

The geographic coordinates of all sampling locations (i.e. quadrats and freshwater sites) are provided in Annex 1. Effort expended in sampling quadrats, aquatic and other sites using a variety of techniques is summarised in Annex 2.

Terrestrial habitats

Five vegetation types were used as a basis for sampling different terrestrial habitats for species diversity. These habitats are shown in Table 3.1, together with the number of replicate transects and quadrats located within each. Some of the 16 one-kilometre transects occupied more than a single habitat, which is why the total number of transects shown in Table 3.1 exceeds 16. This is due to the small areas of habitats at some sampling locations, making it impossible to align a transect within a single habitat.

Quadrat locations are shown in Figure 3.1. Those falling outside the boundary of the National Park are located within Wilmenna Sanctuary, for which there is no vegetation map.

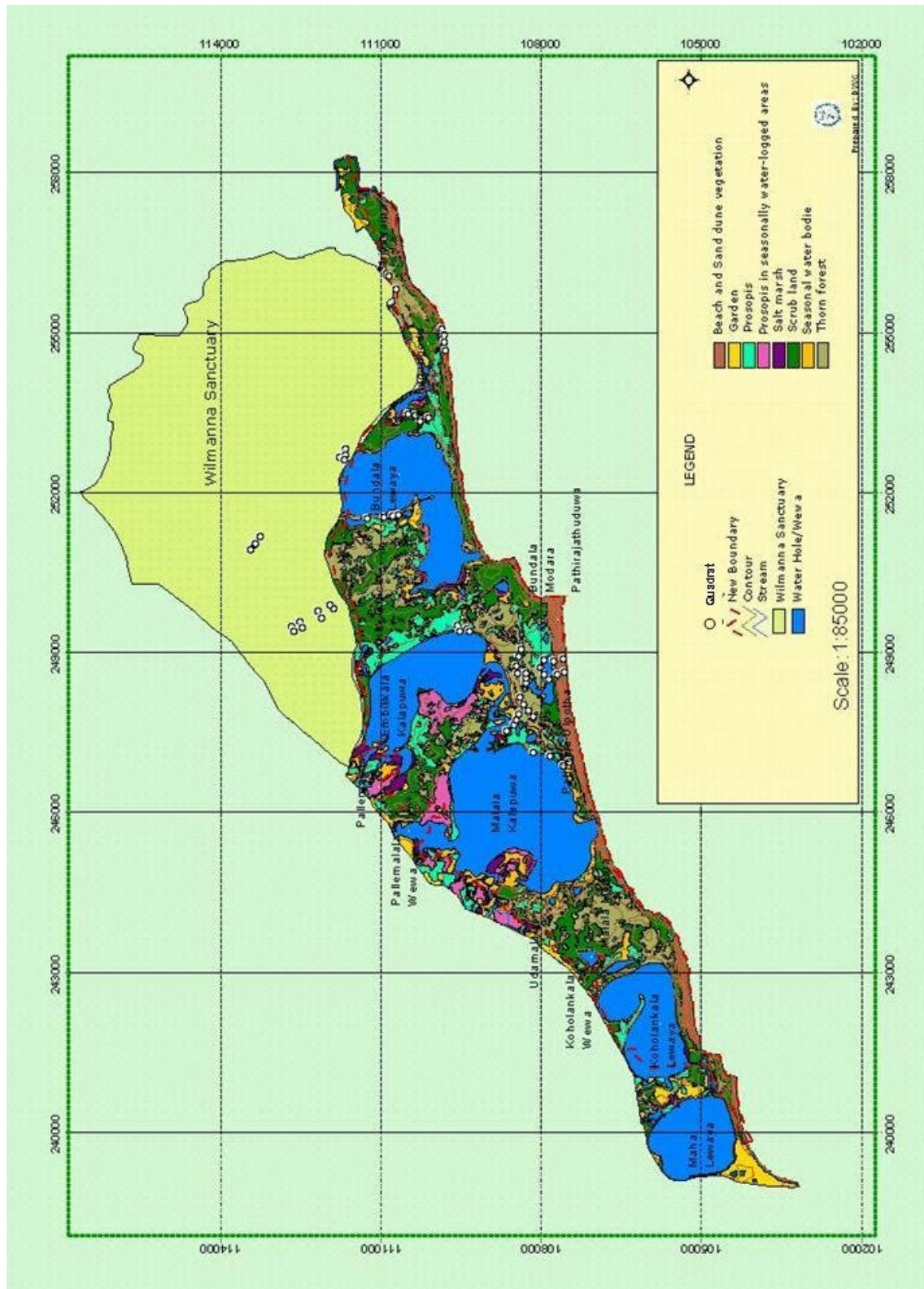


Figure 3.1 Location of 64 quadrats sampled by Biodiversity Baseline Survey

Table 3.1 Numbers of quadrats and associated transects sampled within each habitat

Habitat type	No. transects ¹	No. quadrats
Dry-Mixed Evergreen Forest	4	13
Scrub	9	29
<i>Prosopis</i>	3	8
Grassland	3	6
Sand Dune	2	8
Total	16	64

¹Conceptually, the number of transects equates to the total number of replicates in each habitat. In practice, the number of transects is 16 but the total number of replicates is 21, as some transects cover more than one habitat.

The results of a non-metric Multi-Dimensional Scaling ordination of Bray-Curtis similarities from square root transformed species abundance data for plant quadrats (Clarke and Warwick 2001) are presented in two dimensions in Figure 3.2 for woody plants and herbs/grasses. There is virtually no overlap in plant species between woody plant and grass/herb quadrats, necessitating two separate ordination analyses to examine relationships in detail. These ordinations show quadrats of the same habitat distributed in close proximity to each other, as in the case of Dry-Mixed Evergreen Forest, *Prosopis*, Scrub, Sand Dune and Grassland (Figure 3.2a). Grassland occurs in Figure 3.2a, as two quadrats within different Scrub transects, and in Figure 3.2b as four quadrats within a single Grassland transect. The two Grassland quadrats within the Scrub transect (Figure 3.2a) were evaluated only for woody plants and not grasses/herbs, hence their absence from Figure 3.2b. Floristic relationships are evaluated in more detail in Section 4.3.

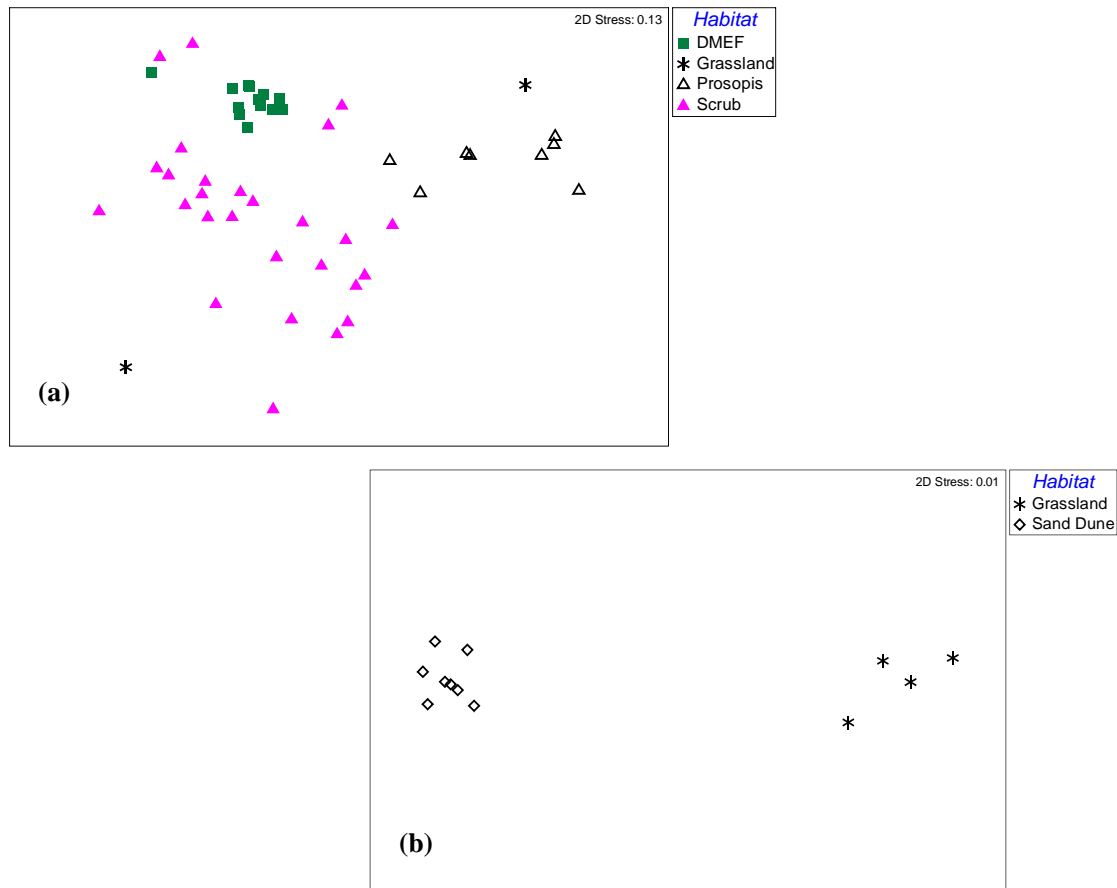


Figure 3.2 Multi-dimensional Scaling ordination of quadrats based on square root transformed abundance data and Bray-Curtis similarity for (a) woody plants and (b) grasses/herbs

Freshwater and brackish water habitat

A total of 26 sites in four lagoons, three tanks and two waterholes located in four of Bundala's six sub-basins were sampled for fish and water quality. The sub-basins were Koholankala/Kolankala, Malala, Embilikala/Ambilla and Bundala. The distribution of sample sites is shown in Figure 3.3.

Biodiversity Information Management System

Field data are held in the Biodiversity Information Management System, a database application designed specifically for the Biodiversity Baseline Survey. The application is described briefly in the Field Manual (DWC, 2007a) and full details about its design and use are documented elsewhere. (DWC, 2007b, 2007c).

Herbarium and specimen collections

Numbers of herbarium and animal specimens collected during the Biodiversity Baseline Survey are summarised in Table 3.2 for each taxon. Details of voucher specimens are provided in Annex 3. Plant and animals specimens are lodged with the National Wildlife Training, Giritale and, in the case of plants, a duplicate set is deposited with the National Botanic Gardens, Peradeniya.

Table 3.2 Numbers of voucher specimens collected and identified for each taxon

Taxon	Voucher specimens		
	Total collected	No. identified	No. unidentified
Plants	11	9	2
Fish	37	37	0
Herpetofauna	7	7	0
Birds	0	0	0
Mammals	8	8	0

Data and analyses

Sample sizes and records

Field data comprise quantitative and opportunistic records. The sizes of datasets are summarised in Tables 3.3 and 3.4 for each taxonomic group. In Table 3.3 the number of records refers to records of species within quadrats; the number of individuals is the total number of individuals recorded for each species. In the case of birds, only those recorded within Bands 1 or 2 of Variable Circular Plots are treated quantitatively; those recorded in Band 3 (i.e. >20 m from the observer) are treated as opportunistic.

Opportunistic records contribute considerably to species inventories in the case of plants and some terrestrial vertebrate groups (Table 3.4). In the case of mammals, such records are based largely on indirect observations of tracks and scats or pellets. Fisherman reported an additional six species, two of which are exotic, to those recorded during this Survey. The six species belong to six different genera and five families.

Adequacy of sample sizes

Species discovery curves were calculated to estimate the likely number of species to be found in each habitat type for each taxonomic group. Both the Chao2 and Bootstrap methods were used from the PRIMER-E 2007 analytical software package (Clarke and Warwick 2001), following the recommendations of Magurran (2004) who evaluated a wide range of different statistical approaches.

Table 3.3 Breakdown of quantitative and opportunistic records of plants and animals

Taxon	Total no. records	Total no. individuals	No. species identified	No. species unidentified
Quantitative records from within quadrats/sampling points				
Plants	434	1863	60	3
Fish	67	748	16	0
Amphibians	45	45	8	0
Reptiles	133	133	18	0
Birds	2947	2947	140	0
Mammals	242	823	23	?
Additional opportunistic records from outside quadrats/sampling points				
Plants	unavailable	unavailable	125	unavailable
Fish	0	0	0	0
Amphibians	201	201	5	0
Reptiles	216	216	8	0
Birds	2146	2146	26	0
Mammals	394	1982	6	0

Table 3.4 Breakdown of quantitative and all records of species of plants and animals

Taxon	No. families	No. genera	No. species			
			Total	Endemic	Indigenous*	Exotic
Quantitative records from within quadrats/sampling points						
Plants	28	54	60	1	57	2
Fish	12	13	16	2	12	2
Amphibians	3	7	8	2	6	0
Reptiles	9	12	18	3	15	0
Birds	44	104	140	2	?	0
Mammals	12	18	23	4	19	0
All records (including opportunistic)						
Plants	70	159	185	3	166	16
Fish	12	13	16	2	12	2
Amphibians	3	9	13	3	10	0
Reptiles	10	20	26	4	22	0
Birds	48	118	165	2	#118	0
Mammals	15	22	29	4	23	2

*Excludes endemic species.

#45 species are migrants.

These estimates, provided in Tables 4.1, 5.1, 6.1, 7.1 and 8.1 for the respective taxonomic groups, indicate that surveys in further locations are necessary to check for additional species in the case of all groups.

Analyses

Analyses were undertaken principally at the protected area and habitat or sub-basin levels. While the former provides an overview of the biodiversity values of the protected area, the latter is likely to be more useful for informing management about diversity within different habitats and sub-basins. A summary matrix of species diversity within each habitat or sub-basin is provided in Annex 4.

4. PLANT DIVERSITY ANALYSIS (Author: B.M.P. Singhakumara)

Introduction

The vegetation in Bundala National Park is very different to that surveyed in the other six protected areas due to its coastal, wetland nature. In line with Biodiversity Baseline Survey protocols, terrestrial habitats dominated by woody plants were sampled but not the aquatic habitats (lagoons, water holes and tanks) and salt marshes that comprise a large part of the National Park. The floristic composition of the different vegetation formations is described in Section 2.4.

A total area of 3.2 ha was sampled within the different habitats, details of which are summarised in Annex 2. Voucher specimens were collected and these are listed in Annex 3.

Diversity within habitats

A total of 185 species of vascular plants were inventoried during this Survey, of which three species are endemic. Species recorded within quadrats total 60, of which two are endemic, and their distribution with respect to each habitat is provided in Annex 4.

Species richness and other measures of diversity are shown in Table 4.1. They are highest for Scrub and lowest for *Prosopis*. Scrub is extensive in Bundala, possibly accounting for its relatively high diversity. In contrast, the low species diversity of Dry-Mixed Evergreen Forest, the climax vegetation, probably reflects its degraded and fragmented nature as described in Section 2.4. *Prosopis* is an exotic, invasive species which most likely accounts for the low diversity of this habitat type. Grassland and Sand Dune are moderately rich in species.

Table 4.1 Plant diversity indices and estimates for habitats, based on quadrat sampling

Habitat type (revised after MDS analysis)	Total	Dry-Mixed Evergreen Forest	Scrub	<i>Prosopis</i>	Grassland	Sand Dune
Total number of species	60	11	30	7	18	16
Number of endemic species	1	0	0	0	0	1
Diversity indices/estimates						
Species richness [S]	60	11	30	7	18	16
Shannon entropy [exp(H)]	15.75	4.68	13.55	2.15	7.21	5.74
Gini-Simpson [1/D]	9.80	3.74	9.79	1.56	5.22	3.32
Chao 2 estimate S	86.00	15.50	40.10	15.00	76.25	20.90
Bootstrap estimate S	72.60	12.20	34.90	8.50	25.30	18.90

Discussion

Significant findings

Eight floristic associations can be distinguished from statistical analysis of the 50 quadrats dominated by woody plant species that make up Dry-Mixed Evergreen Forest, *Prosopis*, and Scrub habitats (Figure 4.1). These eight associations include the two Grassland quadrats in which a small number of woody plant taxa were recorded (see Figure 3.2a). Further analysis the Grassland and Sand Dune quadrats depicted in Figure 3.2b shows that each of these habitats is represented by a single floristic association. Thus, in terms of floristics, Dry-Mixed Evergreen Forest comprises a single association, as does *Prosopis*, and Scrub comprises six associations. However, some of these identified associations are based on a small number of quadrats and reflect low species richness and abundances of woody plants above 5 cm DBH.

The high number of associations represented in Scrub is a measure of variation in topography, geology and soil types between the coast and further inland, as well as in the degree of human

influences (timber and fuel wood extraction, cultivation). It is also apparent from Figure 4.1 that much of the Scrub located in Wilmnenna Sanctuary is floristically distinct from Scrub in the National Park: all but one of the 11 quadrats that lie within Scrub association **c** are located in the Sanctuary; conversely, eight of the ten quadrats falling within Scrub association **e** are located in the National Park. The two quadrats of association **e** in the Sanctuary have individual canopy trees of *Manikara hexandra*, which would account for their similarity with vegetation otherwise found in the National Park.

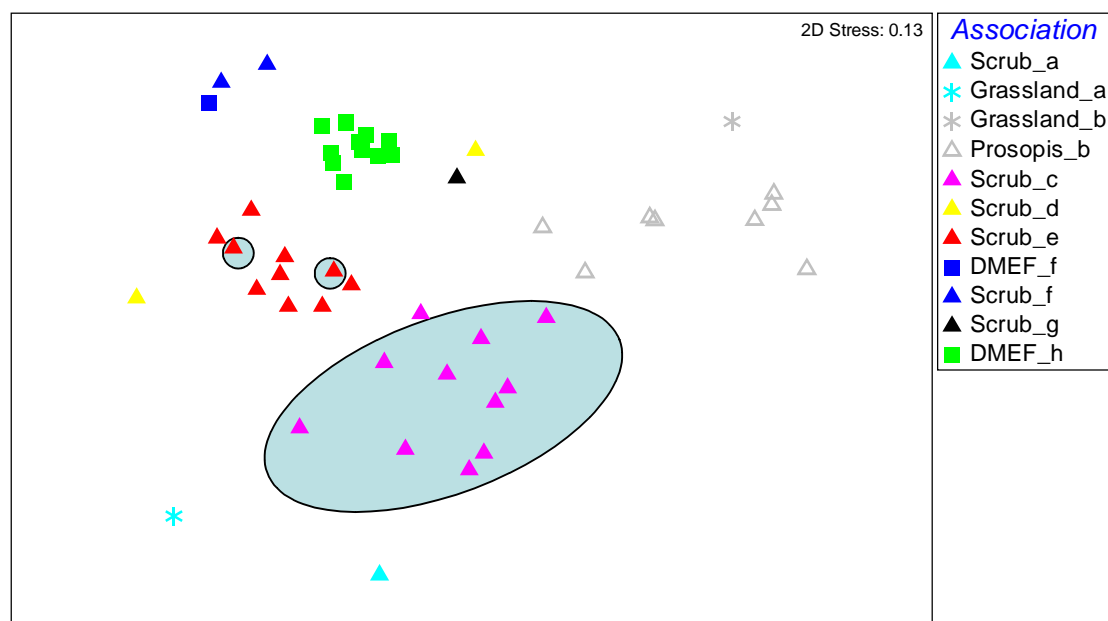


Figure 4.1 Multi-dimensional Scaling ordination of 50 plant quadrats plotted according to floristic associations in two dimensions for the three main habitats at Bundala National Park. Habitat types are represented by different symbols and associations by different colours. Quadrats sampled in Wilmnenna Sanctuary are enclosed within the ellipse and two circles. (DMEF = Dry-Mixed Evergreen Forest)

Adequacy and shortcomings of survey data

Information from other surveys indicates that this Biodiversity Baseline Survey is not comprehensive for plants. For example, the total of 60 woody plant species (> 5 cm DBH) sampled during this Survey is very much less than the 95 woody plant species⁴ inventoried by the habitat mapping project (MENR, 2005) and the 121 woody plant species⁵ recorded by Bambaradeniya *et al.* (2001). The inadequacy of sample sizes is also reflected in the Chao 2 and Bootstrap estimates of species diversity, which are much higher than what was recorded (Table 4.1). Much more sampling, therefore, is warranted.

⁴ A further 79 non-woody plant species were inventoried, making a total of 174 species of flowering plants.

⁵ A further 262 non-woody plant species were inventoried, making a total of 383 species of flowering plants.

5. HERPETOFAUNA DIVERSITY ANALYSIS (Author: P. Nihal Dayawansa)

Introduction

Species richness and abundance of amphibians and reptiles in Dry-Mixed Evergreen Forest, Scrub, *Prosopis*, Grassland and Sand Dune habitats were assessed using the Quadrat Cleaning Technique (QCT) during daytime and Visual Encounter Survey (VES) at night. A total of 160 plots (5 x 5 m²) were examined by QCT and nine plots (2.5 x 10 m²) were examined by VES. About ten pitfall traps (10 litres) were set amid the sand dunes to capture cryptic species. Also, microhabitats of amphibians and reptiles that are easily overlooked by QCT and VES were explored opportunistically. Such opportunistic observations were made without time restraints along existing pathways that were either formed by humans or other wildlife species.

Twenty one species of amphibians and reptiles were recorded from daytime QCT plots and 16 species from night time VES plots. An additional 18 species of amphibians and reptiles were recorded opportunistically. Seven voucher specimens were collected, including the endemic Athukorala's dwarf toad (*Bufo athukorali*). Further details of these are provided in Annex 3.

A total of 39 species of herpetofauna were recorded during the Survey in Bundala's terrestrial, freshwater and brackish water ecosystems: 13 species of amphibians, one crocodile species, three species of turtles, 14 species of lizards and eight species of snakes. Species not previously recorded from Bundala are the endemic Tammanna skink (*Eutropis tammanna*) and endemic Sri Lanka wood frog (*Rana gracilis*). Although some rare species of herpetofauna were not encountered in this Survey, uncommon species such as white-bellied pugsnout frog (*Ramanella variegata*) and red narrow mouthed frog (*Microhyla ornata*) were recorded opportunistically. Schneider's toad (*Bufo scaber*), synonymous with Ferguson's dwarf toad (*Bufo fergusonii*) listed by Bamabaradeniya *et al.* (2001), was also recorded.

Of the 13 amphibian species recorded at Bundala, three species are endemic and none of them is currently listed as threatened in the 2007 Red List (IUCN and MENR, 2007). Of the 26 species of reptiles, four species are endemic and two turtle species are Vulnerable. The endemic genus *Lankascincus* is represented by the common lankaskink *L. fallax*. Other endemics recorded are flowery wolf snake (*Lycodon osmanhilli*), Kandyan gecko (*Hemidactylus depressus*) and Tammanna skink.

A full list of species is provided in Annex 4, together with details of their geographic distribution, threatened status and occurrence within each of the surveyed habitats.

Diversity within habitats

The results of alpha diversity analyses and estimates are summarised in Table 5.1, based on quantitative data gathered from sampling plots using the QCT and VES methods. Key points arising from this analysis are:

- A higher diversity of amphibian species was recorded in Dry-Mixed Evergreen Forest, Grassland and, to a lesser extent, Scrub, than in *Prosopis* and Sand Dune habitats. This may reflect the relatively damp conditions prevailing in Dry-Mixed Evergreen Forest and Grassland at the time of the survey and, therefore, the ability of such habitats to retain surface moisture more effectively than *Prosopis* and Sand Dunes.
- The highest diversity of reptile species was recorded in Scrub. Fewer species were recorded in the other habitats, with only small differences in species richness between them.
- Fan-throat lizard (*Sitana ponticeriana*) was the most common reptile found in Sand Dune habitat, where 100% of captures in pitfall traps were of this species. Fifty four individuals were

recorded within a total area of 500 m² (20 plots, each 5m x 5 m), representing the highest density recorded for any reptile species during this Survey.

- Estimates of species diversity for both amphibians and reptiles suggest that much of it has been captured in the Survey but sample sizes are too small for the analysis to be robust. This is confirmed by previous inventory work that covered marine as well as terrestrial and wetland habitats: Bambaradeniya *et al.* (2001) recorded a total of 15 amphibian and 48 reptile species. Notable, uncommon species not recorded during the present Survey include trinket snake (*Elaphe helena*) and two Vulnerable species: sand boa (*Eryx conicus*), and the highly venomous saw scale viper (*Echis carinatus*).

Table 5.1 Herpetofaunal diversity indices and estimates for habitats, based on plot sampling

Habitat type (revised after MDS analysis)	Total	Dry-Mixed Evergreen Forest	Scrub	<i>Prosopis</i>	Grassland	Sand Dune
AMPHIBIANS						
Total number of species	8	6	4	1	6	1
Number of endemic species	4	2	1	0	1	0
Diversity indices/estimates						
Species richness [S]	8	6	4	1	6	1
Shannon entropy [exp(H)]	4.95	4.86	3.79	1.00	3.69	1.00
Gini-Simpson [1/D]	3.62	4.13	3.57	1.00	2.75	1.00
Chao 2 estimate S	9.00	6.00	8.50	1.00	8.30	1.00
Bootstrap estimate S	9.10	8.00	5.20	1.30	7.00	1.30
REPTILES						
Total number of species	18	8	12	7	7	6
Number of endemic species	4	1	1	1	0	1
Diversity indices/estimates						
Species richness [S]	18	8	12	7	7	6
Shannon entropy [exp(H)]	8.53	6.29	8.44	5.86	6.73	2.13
Gini-Simpson [1/D]	4.96	4.83	6.20	4.84	6.4	1.49
Chao 2 estimate S	21.20	17.00	30.00	25.00	7.00	6.70
Bootstrap estimate S	20.40	10.20	14.40	9.00	9.10	6.90

Discussion

Significant findings

- Bundala National Park is one of only a few protected areas located in the coastal zone, providing a range of wetland and terrestrial habitats that support a moderately high diversity of amphibians and reptiles, as shown by the results of this Survey and previous inventories.
- Two endemic species have been recorded in Bundala for the first time, Tammanna skink (*Eutropis tammanna*) and Sri Lanka wood frog (*Rana gracilis*). Thus, the total number of herpetofauna species recorded in Bundala National Park is 65, based on the earlier inventory of Bambaradeniya *et al.* (2001).

Adequacy and shortcomings of survey data

- Sampling effort is insufficient: estimates of the potential number of species to be recorded, calculated from the present sampling regime data (Table 5.1), indicate that sampling needs to be continued. This is confirmed by previous inventory work (Bambaradeniya *et al.*, 2001).
- Some coastal and marine habitats and areas covered with invasive plant species were not sampled during the present Survey.
- Use of larger pitfall traps, associated with leading lines, should be set in sand dunes and by water bodies to increase capture efficiency of cryptic, fossorial and nocturnal species.

6. BIRD DIVERSITY ANALYSIS (Author: Devaka Weerakoon)

Introduction

Three main sampling methods were used to record bird diversity in Bundala National Park and Wilmenra Sanctuary. They are variable circular plots (VCPs) for terrestrial habitats, block counts for aquatic habitats and opportunistic encounters. A total of 256 VCPs and 8 aquatic habitats were sampled, providing 5,093 records. No mist netting was undertaken. The distribution of sampling effort across habitats is summarised in Annex 2.

No voucher specimens or DNA samples were collected during this Survey.

Diversity within habitats

A total of 165 bird species were recorded during the Survey, including two endemic and four species nationally threatened species. None of the recorded species is listed by IUCN as globally threatened. Of the total number of bird species, only 140 were recorded in the first two bands of VCPs and, therefore, subjected to further analysis. The balance of 25 bird species was treated as opportunistic observations. A list of species recorded within each habitat is provided in Annex 4.

Levels of diversity and endemism within the different habitats are summarised in Table 6.1, accompanied by various measures of diversity. Highest species richness was recorded in Scrub, followed by *Prosopis* and Grassland in similar measure and then Dry-Mixed Evergreen Forest. Lowest species richness was recorded in Sand Dune. Other measures of diversity indicate that Grassland has the highest diversity, followed by *Prosopis*. The discrepancy between species richness and diversity measures is likely to be due to a combination of sampling biases and unevenness of distributions of abundance of species in Scrub. Sampling biases were inevitable due to the close proximity of *Prosopis* and Grassland quadrats to water bodies. Chao 2 and Bootstrap estimates indicate that species diversity is likely to be much higher than recorded in all habitats. This is confirmed by the additional 26 species recorded opportunistically in this Survey and a previous inventory of 197 species (Bambaradeniya *et al.*, 2001).

Table 6.1 Bird diversity indices and estimates for habitats, based on species recorded within 1st and 2nd bands of VCPs sampled in quadrats

Habitat type (revised after MDS analysis)	Total	Dry-Mixed Evergreen Forest	Scrub	<i>Prosopis</i>	Grassland	Sand Dune
Total number of species	140	66	103	79	78	52
Number of endemic species	2	1	1	1	2	2
Diversity indices/estimates						
Species richness [S]	140	66	103	79	78	52
Shannon entropy [exp(H)]	42.79	32.24	31.69	41.02	53.45	31.61
Gini-Simpson [1/D]	24.10	20.83	18.82	25.79	40.33	22.25
Chao 2 estimate S	176.10	82.10	139.10	91.00	110.00	64.50
Bootstrap estimate S	155.20	75.70	117.80	89.40	89.90	59.70

Discussion

Significant findings

Bundala National Park, one of the smallest protected areas in Sri Lanka, supports a rich avifaunal assemblage. It is particularly important for migrant species, including some rare winter visitors, and also breeding residents. Key points to note are as follows:

- Bundala's value as a wetland of international importance for the conservation of birds,

especially migrant species, has been known for many years and led to its declaration as Sri Lanka's first Ramsar site in 1990. This continues to be the case as shown by the results of this Survey, in which approximately 50% of Sri Lanka's migrant bird species were recorded at Bundala.

- Forty five (40%) of Sri Lanka's 112 migrant species were recorded during this Survey. This indicates that although habitat quality has deteriorated in the National Park over the past two decades, due to rapid spread of invasive plant species (e.g. *Prosopis juliflora* and *Opuntia stricta*) and changes in the salinity of some water bodies (e.g. Malala and Embilikala) caused by freshwater intrusion from agricultural runoff, it remains a very important site, especially for aquatic birds.
- Approximately 50% of birds recorded in this Survey are aquatic species or aquatic associates, indicating that Bundala remains one of the important sites for aquatic birds in Sri Lanka, especially winter visitors of which a number of species are rare, such as Small Pratincole (*Glareola lactea*), Dunlin (*Calidris alpina*) and Ruff (*Philomachus pugnax*).
- Of Sri Lanka's 220 breeding resident species, 55% were recorded in the National Park and Sanctuary, indicating the value of these two adjacent areas for long-term conservation of indigenous bird species.
- The level of endemism is low compared with other protected areas in the Wet Zone.

The long term conservation value of Bundala National Park, however, is threatened by a number of factors that include the following:

- Invasive plants species, such as *Prosopis juliflora* and *Opuntia stricta*, are rapidly spreading in many of the habitats in both the Bundala National Park and Wilmenma Sanctuary and the former species has also invaded aquatic habitats. This will accelerate succession of the vegetation from aquatic to terrestrial types and thereby possibly reduce the carrying capacity for aquatic birds.
- Increased intrusion of freshwater from the Lunugamvehera agricultural system to Malala and Embilikala lagoons has been ongoing for several decades and this has resulted in changes to the aquatic avifaunal assemblage.
- Die-back, notably of the predominant canopy species *Manilkara hexandra*, will have a long-term impact on the Dry-Mixed Evergreen Forest avifaunal assemblages.
- Continued use of the park by villagers for grazing their cattle has a number of long-term ecological impacts including: dispersal of seeds of the invasive *Prosopis* by cattle; and eutrophication of water bodies, especially during the rainy season by dung from cattle. Such impacts will influence the avifaunal assemblages associated with these habitats.

Adequacy and shortcomings of survey data

This dataset provides a reliable, geo-referenced baseline for Bundala National Park and Wilmenma Sanctuary which can be used to inform its management. However, the data should be used judiciously, taking full account of the following limitations:

- Some habitats were not systematically sampled adequately. The sampling method was inherently biased towards terrestrial habitats and, therefore, the aquatic habitats were under-represented in the Survey. This is confirmed by comparison with opportunistic records and previous inventory work, as detailed in Section 5.5.
- The entire Survey was carried out during the wet and migratory season, as was an earlier survey (February-May) by Bambaradeniya *et al.* (2001) that extended into the non-migratory but not the dry season (June - August). It is recommended that at least a selected number of transects be repeated during the dry season to enable seasonal changes in the diversity of avifaunal assemblages to be assessed.

7. MAMMAL DIVERSITY ANALYSIS (Author: Mayuri R. Wijesinghe)

Introduction

Mammals were surveyed using live trapping and both direct and indirect observations to infer the presence of animals from fresh droppings, foot prints and other signs. A total of 16 quadrats was sampled quantitatively for small mammals, using Sherman's and Tomahawk traps, and all 32 quadrats aligned along 16 km of transects were surveyed for signs of all mammals. Opportunistic observations of mammal and their signs encountered elsewhere in Bundala National Park and Wilmenna Sanctuary were also recorded. No mist netting of bats was undertaken.

The distribution of sampling effort across the different habitats is shown in Annex 2. Eight voucher specimens were collected and identified from Bundala. Details of these specimens are provided in Annex 3.

Diversity within habitats

Twenty three species of indigenous mammals were recorded from within quadrats and an additional six species were recorded opportunistically. A list of species recorded within each habitat is provided in Annex 4. Key points are as follows:

- A total of 29 species belonging to 22 genera and 14 families was recorded in this Survey. They comprise five species of rodents, including four species of squirrels, porcupine and two species of rats, hare, three cat, two civet and three mongoose species, jackal, six species of ungulates, two primate species and the elephant.
- Three species are endemic, namely Sri Lanka spiny mouse (*Mus fernandoni*), macaque (*Macaca sinica*) and Sri Lanka flame-striped jungle squirrel (*Funambulus layardi*).
- Nine species are nationally threatened, of which *Mus fernandoni* is listed as Critically Endangered, rusty-spotted cat (*Prionailurus rubiginosus*) as Endangered and six other species as Vulnerable (IUCN and MENR, 2007).
- The most commonly recorded species were the grey langur, macaque, spotted deer and hare. Feral populations of cattle and water buffalo were also commonly seen in open areas, unlike the wild buffalo (*Bubalus arnee*). Among small mammals, the antelope rat (*Tatera indica*) was commonly observed on roads at night, although it was not often caught in traps.

Table 7.1 Mammal diversity indices and estimates for habitats, based on quadrat sampling

Habitat type (revised after MDS analysis)	Total	Dry-Mixed Evergreen Forest	Scrub	<i>Prosopis</i>	Grassland	Sand Dune
Total number of species	23	6	14	8	17	6
Number of endemic species	4	1	2	2	3	1
Diversity indices/estimates						
Species richness [S]	23	6	14	8	17	6
Shannon entropy [exp(H)]	4.82	3.37	4.64	2.90	5.10	5.74
Gini-Simpson [1/D]	3.15	2.45	3.20	2.05	2.96	5.44
Chao 2 estimate S	26.60	6.00	15.00	9.00	77.50	18.50
Bootstrap estimate S	25.90	6.25	15.10	8.80	20.80	7.60

Levels of diversity and endemism, together with measures of diversity, within the different habitats are summarised in Table 7.1. The results, which are based on relatively small samples, indicate the following:

- The diversity of mammal species is relatively low in Bundala National Park and the adjacent Wilmenna Sanctuary.

- Species richness is highest in the Grassland, followed by Scrub. It is similarly low in Dry-Mixed Evergreen Forest, *Prosopis* and Sand Dune.

Discussion

Significant findings

- Current information from this Survey and previous research indicates that mammal diversity is fairly low. However, Bundala is particularly important with respect to the conservation of a number of endemic species and/or threatened species, notable species being the Critically Endangered and endemic Sri Lanka spiny mouse and the Endangered rusty-spotted cat. It is also important for elephant, particularly during the dry season when herds of 50-60 elephants move into the National Park and adjacent sanctuary from the Yala-Lunugamvehera-Udawalawe area (Bamabaradeniya *et al.*, 2001).
- *Bubalus arnee*, *Funambulus layardi* and *Felis chaus* were recorded at Bundala for the first time.
- Some small mammals listed as common (Bamabaradeniya *et al.*, 2001) were not observed in the present Survey, which is cause for concern. They include the musk shrew, bush rat and bandicoot. Other species listed as rare, namely sambar, stripe-necked mongoose, pangolin and otter, were also not recorded.
- Grassland supports the highest diversity of mammals. Sand Dune is more important for smaller mammals such as rodents and hare. Ordination analyses of quadrats surveyed for mammals show that Sand Dune harbours an assemblage of mammal species that is distinct from those in all other habitat types.
- Inadequately planned land use practices around the National Park and Sanctuary has exacerbated human-wildlife conflicts. For example, cultivation of banana and paddy in surrounding areas has led to increased crop raiding by elephants and other wild herbivores.

Adequacy and shortcomings of survey data

- The relatively low diversity of mammal species is at least partly a reflection of inadequate sampling, as indicated by Chao2 and Bootstrap estimates, particularly for Grassland and Sand Dune habitats (Table 7.1). This is confirmed by a previous inventory of 32 mammal species (Bamabaradeniya *et al.*, 2001).
- This Survey provides some tentative insights about the distribution of mammals within different habitats but further sampling is required to confirm and develop such findings.
- The identity of bat species could not be confirmed in the absence of any misting netting.

8. FRESHWATER FISH DIVERSITY ANALYSIS (Author: S.M.D. Ajantha U. De Alwis)

Introduction

The main aquatic habitats in Bundala National Park are its five enclosed, shallow, brackish lagoons that cover 36% (2,250 ha) of the total area of the National Park. The lagoons, shown in Figure 3.3, are: Maha Lewaya (260 ha), Kolankala/Koholankala Lewaya (390 ha), Malala Lewaya (650 ha), Ambilla/Embilikala Kalapuwa (430 ha) and Bundala Kalapuwa (520 ha). Maha Lewaya has been converted entirely into salterns and about 25% of Kolankala/Koholankala Lewaya is used for salt production. These two are inter-connected by a channel which links directly to the sea. Malala Lewaya is also inter-connected by a channel with Ambilla/Embilikala Kalapuwa. The western part of the Bundala Kalapuwa has also been converted into a saltern (Anon., 1993).

The lagoons are fed by surface run off, streams, drainage channel inflows from upstream irrigation schemes, and inflow and seepage of sea water through sand dunes, all of which are seasonal. The Maha and Kolankala /Koholankala Lewayas catchment is comparatively small (912ha) and fed by excess irrigated water (Anon, 1993). The Malala Lewaya receives fresh water directly from the Malala Oya and its catchment of 404 km², and indirectly via the Ambilla/Embilikala Kalapuwa (Jayawardena, 1993). The Ambilla/Embilikala Kalapuwa is fed mainly by the Embilikala Oya (also called Weligatta Ara), which drains a catchment of 60 km², and the right-bank channel of the Lunugamvehera reservoir of the Kirindi Oya Irrigation and Settlement Project. Inflows and salinity of these two lagoons fluctuate due to upstream storage and use of water for irrigation purposes throughout the year. Thus, water levels of the Malala Kalapuwa and the Ambilla/Embilikala Kalapuwa have been reported to vary between +1 msl and +2.2 msl. The salinity of Ambilla/Embilikala Kalapuwa is usually lower than that of Malala Kalapuwa because (a) it receives excess water channelled from Lunugamwehera reservoir and (b) it is located further away from the sea, resulting less sea water intrusion (Anon, 1993).

Storm water and excess irrigation water flow into Bundala Kalapuwa via irrigation channels from Weerawila tank, which is also fed by Kirindi Oya Right Bank channels. The natural outlet to the sea is normally blocked by a sand barrier, while the saltern and the largest part of the lagoon are separated from this outlet by an earthen bund. Another sea outfall has been cut through the sedimentary sandstone barrier (the dune ridge) to evacuate water from the lagoon. This sea outfall is also blocked by a naturally forming sand bar. It is breached manually or by using machinery in the rainy season when rising water causes flooding upstream.

Salinity levels in the lagoons fluctuate between 10 and 41 ppt, with a mean of 18.5 ppt (Anon., 1993), due to various influences including: the amount of sea water entering lagoons when the in/outlet is cut open; intrusion and seepage of sea water through sand dunes and percolation of rain water through saline soil; and inflows of drainage water from upstream irrigation schemes.

In the present Survey, a total of 16 species were recorded from 26 sites comprising four lagoons, three tanks and two waterholes, distributed across four of the National Park's sub-basins. The distribution of sampling effort across the different sites is shown in Annex 2 and a list of specimens collected and identified is provided in Annex 3. A list of species recorded within the different water bodies is provided in Annex 4.

The 16 species recorded in this Survey belong to 11 families and 12 genera. Only two of these species are endemic, *Puntius amphibius* and *P. singhala*. By contrast, several migratory species of as well as exotic species were recorded. Local fishermen reported that there are six additional species, belonging to 3 families, which they catch from freshwater bodies in the National Park (Annex 4).

Some information is available on the diversity of fish species of the water bodies of Bundala National Park from earlier studies. Jayakody and Jayasinghe (1992) recorded 13 species of fish and five species of shrimps from Malala Kalapuwa (Annex 4). Bamabaradeniya *et al.* (2001) inventoried 32 species

during their four-month survey.

Diversity within sub-basins

The distribution and relative abundance of fish species across the different water bodies is summarised in Table 8.1. The most abundant family recorded is Cichlidae and the most common genus is *Oreochromis*, within the same family. *O. mossambicus*, is the most abundant species followed by *Puntius singhala* and *O. niloticus*. *O. mossambicus* occurs in a variety of habitats that include lagoons, tanks and waterholes, while *O. niloticus* is recorded from lagoons, tanks and Malala Pitaela stream. Records of many migratory species of marine fish in the water bodies indicate the importance of these habitats in the National Park as breeding, nursery and feeding areas for them.

Bundala Kalapuwa has the highest total abundance of *O. mossambicus* and *O. niloticus*, which is also evident from the abundant night catches of these two species by fisherman. While no firm conclusions can be made about habitat preference, these data indicate that both these species can tolerate high saline conditions as they were also recorded from Koholankala/Kolankala Kalapuwa where salinity levels are 68-85 ppt. Both species play an important role in local fishing activities that have been going on for many years in these water bodies. Their role as a food source for a variety of birds is also considered to be very significant.

Puntius singhala is of particular conservation importance, being an endemic species that is abundant in the Malala Kalapuwa and Malala Pitaela stream. *P. singhala*, which is considered to be primarily a freshwater species, was recorded in slightly saline water (4 ppt).

Table 8.1 Distribution and abundance of fish species in different water bodies

Species	Embilikala/ Ambilla lagoon	Bundala lagoon	Koholankala/ Kolankala lagoon	Malala lagoon	Lagoon Total	Malala Pitaela (stream)	Bundala No.1 wewa (tank)	Bundala wewa (tank)	Kurulu wewa (tank)	Wewa (tank) Total	Pathirajapitiya (water hole)	Grand Total
<i>Ambasis gymnocephalus</i>	4			1	5							5
<i>Arius bilineatus</i>	1			1	2							2
<i>Chanos chanos</i>		6			6							6
<i>Oreochromis mossambicus</i>	18	150	7	4	179		93	2		95	129	403
<i>Oreochromis niloticus</i>		37	34	1	72	16		12		12		100
<i>Nematalosa nasus</i>		4		1	5							5
<i>Sardinella albella</i>			2		2							2
<i>Puntius amphibius</i>	7				7							7
<i>Puntius dorsalis</i>								1		1		1
<i>Puntius singhala</i>	6			79	85	62						147
<i>Elops machnata</i>		1			1							1
<i>Gerres filamentosus</i>		5		1	6	1		1		1		8
<i>Glossogobius giuris</i>	2			1	3						1	4
<i>Leiognathus fasciatus</i>		1			1							1
<i>Mugil cephalus</i>	1	26	8	1	36	4						40
<i>Terapon jarbua</i>		13			13	3						16

Levels of diversity and endemism, together with measures of diversity, within the water bodies are summarised in Table 8.2. Highest species richness was recorded from Bundala and Malala lagoons, followed by Embilikala/Ambilla lagoon. However, measures of species diversity (Shannon entropy and Gini-Simpson) are higher for Embilikala/Ambilla lagoon than either Bundala or Malala lagoons. This is explained by the more even distribution of abundances of the fewer species in Embilikala/Ambilla lagoon. Species richness and species diversity are comparatively low in all of the other water bodies.

Table 8.2 Freshwater fish diversity indices and estimates for water bodies, based on sampling protocol

Water body	Total	Embilikala/ Ambilla lagoon	Bundala lagoon	Bundala No.1 Wewa	Bundala Wewa	Koholankala/ Kolankala lagoon	Malala lagoon	Malala Pitacla	Pathirajapitiya
No. sampled sites with fish	23	3	5	1	2	3	3	1	5
Total number of species	16	7	9	1	4	4	9	5	2
Number of endemic species	2	2					1		1
Diversity indices/estimates									
Species richness [S]	16	7	9	1	4	4	9	5	2
Shannon entropy [exp(H)]	4.24	4.60	3.55	1.00	2.77	2.61	1.83	2.36	1.05
Gini-Simpson [1/D]	2.85	3.53	2.39	1.00	1.71	2.04	1.29	1.79	1.02
Chao 2 estimate S	17.12	7.40	10.13		8.50	4.00	33.50		2.00
Bootstrap estimate S	17.69	7.78	10.32		4.75	4.11	11.11		2.33

Water quality

Mean values of various water quality measures are given in Table 8.3 for the different water bodies. The values for pH and temperature are within recommended levels for aquatic life (CEA, 2003).

Highest salinity was recorded in Koholankala/Kolankala lagoon but comparatively lower than previous records taken by the Central Environment Authority (Anon., 1993). Bundala lagoon is also brackish. Both Embilikala/Ambilla and Malala are freshwater lagoons, except for one site in Malala lagoon with a salinity of 4 ppt. These observations differ from previous records which indicate that both lagoons were relatively brackish (Table 8.3).

Table 8.3 Selected measures of water quality for sampled water bodies compared with previous records (Anon., 1993). Values are means \pm 1SD.

Water body	Salinity ppt		pH		Temp. °C
	Present	Previous	Present	Previous	Present
Bundala lagoon	26 (\pm 8.71)		7.4(\pm 0.309)		30.2(\pm 0.427)
Bundala No.1 Wewa	5(-)		7.6(-)		29(-)
Bundala Wewa	3(\pm 0.547)		7.66(\pm 0.055)		29(-)
Embilikala/Ambilla lagoon	0(-)	7(3-14)	7.2(\pm 0.104)		29(-)
Koholankala/Kolankala lagoon	74(\pm 8)	81(81-110)	7.4(\pm 0.95)		32(-)
Kurulu wewa	4(\pm 1)		6.8(-)		28(-)
Malala lagoon	0 (\pm 1)	19(10-41)	7.1(\pm 0.07)	8.7(\pm 0.47)	28.4 (\pm 0.194)
Malala Pitacla	0(-)		7.9(-)		29(-)
Pathirajapitiya	1(\pm 2.04)		7.3(\pm 0.196)		29.9(\pm 0.204)

Possible factors contributing to these changes to less brackish conditions include the onset of monsoonal rains and the breach of sand bars, particularly the deliberate opening of the sand bar across Malala lagoon to accommodate the discharge of large volumes of excess run-off from heavy rains. By contrast, lakes (wewa) and waterholes in the area contain slightly saline waters. A firm conclusion cannot be reached on the relationship between these parameters and the occurrence of fish species but a general observation is that at least one species of brackish water/coastal marine fish was recorded from every water body, stressing the importance of these habitats for the existence of such species.

Discussion

Significant findings

- Bundala National Park contains a very important assemblage of fish including fresh, brackish and coastal marine species. Of the 16 species of fish recorded in this Survey, *Puntius amphibius*, *P. dorsalis* and *P. singhala* are essentially freshwater species, although observations indicate that *P. singhala* can tolerate low salinities. The low number of freshwater endemics⁶ is a reflection of the prevailing brackish conditions. The impact of the several exotics on endemic species is not known.
- The three lagoons, Bundala, Malala and to a lesser extent Embilikala/ Ambilla, are the most important in terms of species richness and diversity. They hold 14 of the 16 species recorded in this Survey, exceptions being the coastal marine species *Sardinella albella* and freshwater species *Puntius dorsalis*.
- The presence of the endemic *Puntius singhala* in Malala lagoon warrants attention, given that sandbar that forms naturally at the mouth of the lagoon is annually breached by fisherman on the day following the full moon in November. This allows seawater to enter the lagoon on a high tide, bringing with it fish and shrimp larvae. Usually the inlet remains open for about 5 days and gradually closes from wave action and littoral drift of sand, thereby trapping fish and shrimp larvae. This sandbar is breached once more when the heavy monsoon rains in December inundate part of Bundala road, some paddy fields and Weligatta grazing grounds (Anon.,1993). The impact of these periodic breaches on the long-term survival of this endemic species in the lagoon requires further study.
- *Oreochromis mossambicus* is a very important fishery species and it is likely to be a significant dietary item for certain bird species. This also merits further investigation to inform management.
- Access to the water bodies must be maintained for the benefit of the many migratory species of marine fish that are a component of Bundala's wetland systems.

Adequacy and shortcomings of survey data

- The Chao2 and Bootstrap estimates of potential species richness indicate that, in the case of most water bodies sampled, most species have been recorded. However, Bambaradeniya *et al.* (2001) inventoried a total of 32 species and reports from local fisherman indicate that at least six species were not encountered during the present Survey. Given the significant seasonal changes to which Bundala's wetlands are exposed and the migratory habits of certain of its species, year round study is required to comprehensively inventory the fish fauna and document seasonal changes.
- More detailed, seasonal monitoring of water quality is also required. Only a few measures of water quality were possible during this Survey because the Project's equipment became faulty and could not be repaired in-country.

⁶ A total of 44 endemic species are recorded for Sri Lanka (Bambaradeniya, 2006).

9. OVERVIEW (Authors: Michael J.B. Green, Ric How and U.K.G.K. Padmalal)

Data limitations

Examination of sampling effectiveness of plant and all vertebrate groups indicates that further sampling would be appropriate to better document the biodiversity of Bundala National Park, especially in other seasons in the case of fish and birds due to the large number of migratory species. While estimates of potential species richness indicate that sampling effort generated reasonably comprehensive sets of data for plants, birds and fish that justified further analysis of diversity, an earlier four-month study by Bambaradeniya *et al.* (2001) provides a more comprehensive inventory of species richness. This suggests that the dynamics of hydrological regimes at Bundala, climate regimes and seasonal and/or migratory behaviour of the fauna must be considered in order to fully assess species richness and diversity.

It should also be noted that the sampling programme was spread more thinly in order to include Wilmenna Sanctuary within the Survey. Albeit a compromise, the management authority now has some baseline biodiversity information for this adjacent protected area which should provide a more holistic basis for future conservation management.

Comparative analyses

Flora and fauna diversity within habitats and drainage units

Species richness and diversity indices are shown in Table 9.1 for all terrestrial taxonomic groups within the five habitats surveyed at Bundala National Park and the adjacent Wilmenna Sanctuary. Species richness is highest for plants, reptiles and birds in Scrub (the most frequently sampled habitat⁷), for amphibians in both Dry-Mixed Evergreen Forest and Grassland and for mammals species richness is highest in Grassland. Dry-Mixed Evergreen Forest has the highest species diversity for amphibians, Scrub for plants and reptiles, Grassland for birds and Sand Dunes for mammals. These data reflect the highly variable responses of terrestrial taxonomic groups to the different habitats.

Table 9.1 Flora and fauna diversity within habitats [N is the number of quadrats.]

Habitat type (revised after MDS analysis)	Total [N=64]	Dry-Mixed Evergreen Forest [N=13]	Scrub [N=29]	<i>Prosopis</i> [N=8]	Grassland [N=6]	Sand Dune [N=8]
Species richness						
Plants	60	11	30	7	18	16
Amphibians	8	6	4	1	6	1
Reptiles	18	8	12	7	7	6
Birds	140	66	103	79	78	52
Mammals	23	6	14	8	17	6
Diversity index:						
Shannon entropy [exp(H)]						
Plants	15.75	4.68	13.55	2.15	7.21	5.74
Amphibians	4.95	4.86	3.79	1	3.69	1
Reptiles	8.53	6.29	8.44	5.86	6.73	2.13
Birds	42.79	32.24	31.69	41.02	53.45	31.61
Mammals	4.82	3.37	4.64	2.90	5.10	5.74

⁷ Scrub is the predominant habitat in Wilmenna Sanctuary, which was included in the Survey. Hence the much larger number of replicates in Scrub.

Of particular significance is the markedly fewer number of plant taxa recorded in the present Survey when compared to earlier surveys by Bamabaradeniya *et al.* (2001) and (MENR, 2005), as discussed in Section 4.3. In the present Survey, grasses and herbs were recorded only in those quadrats defined as Grassland and Sand Dune habitats, and only plants with a diameter-breast-height of more than 5 cm were recorded in quadrats dominated by woody plants in Dry-Mixed Evergreen Forest, *Prosopis* and Scrub habitats.

Fish species were not particularly diverse in any of the lagoons or tanks sampled but are an essential and commercially important resource for local fishermen.

The 165 bird species recorded at Bundala National Park/Wilmenna Sanctuary is the highest of the seven protected areas covered by the Biodiversity Baseline Survey and reflects the high number of seabirds and migratory species.

The floristic relationship of 50 quadrats dominated by woody plants is presented in Figure 4.1 and eight different associations were defined statistically. Scrub is clearly separate from *Prosopis* but Scrub also show significant internal floristic structuring. The two numerically dominant Scrub associations indicated in Figure 4.1 are geographically defined as those in Bundala National Park and those in the adjacent Wilmenna Sanctuary to the north.

Faunal assemblages in the various habitats were examined, although most taxonomic groups were shown to having been inadequately sampled by examining the Chao2 and Bootstrap estimates of potential species richness (Table 4.1, 5.1, 6.1, 7.1). Mammals in Sand Dune are statistically different to those in the other habitats and birds in Sand Dune are different to those in Dry-Mixed Evergreen Forest and Scrub, with all three of these habitats being statistically distinct from Grasslands and *Prosopis*. No differentiation was found in the assemblages of amphibians, reptiles and fish in the different habitats or water bodies.

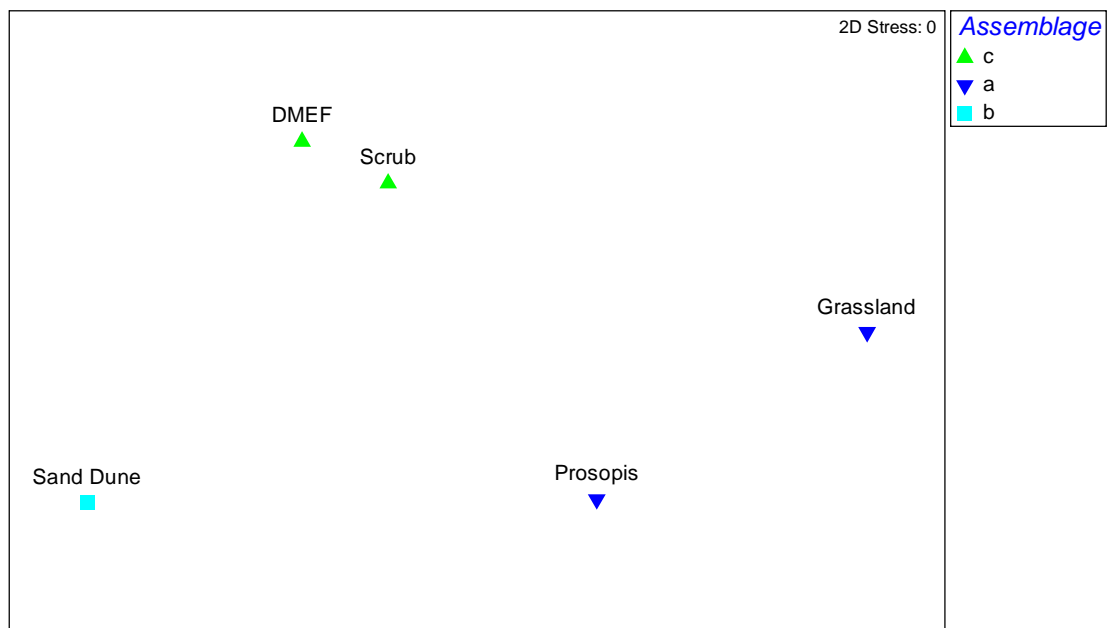


Figure 9.1 Multi-dimensional Scaling analysis of bird assemblages in the five habitat types at Bundala, using the Bray Curtis coefficient of similarity. Colours identify different bird assemblages.

Conclusions

Key findings arising from this Survey and their implications for conservation and management are summarised below. Future priorities for biodiversity monitoring and related research are identified.

Key biodiversity values

- There is an important level of variation in the floristic composition of plant associations that, together with other environmental gradients (e.g. soil, hydrology), make Bundala an important protected area for numerous plant and animal groups.
- The *Prosopis* scrub is a unique habitat, generally with lower diversity than all other habitats.
- The herpetofaunal assemblage in Bundala has several endemic taxa and has been shown to be important for conservation of this taxonomic group. Two species, both endemics, were recorded for the first time in the National Park and further sampling is predicted to add more taxa to the known list.
- Bundala National Park is of high conservation value for birds. It supports a rich and diverse assemblage, with frequent large populations of breeding species, water birds and migratory species. Although it supports few endemics, it is a wetland recognised for its international importance for bird conservation.
- Three first-time records of mammal species were made for Bundala National Park during the survey, and three endemic species were recorded.
- Only two endemic species of fish species were recorded but major populations of exotic species are present. These form the basis of an important local fishery and are of particular importance as a prey resource for the many aquatic and migratory bird species for which Bundala is renowned.

Conservation and management implications

- The field survey of different habitats shows that the vegetation formations differ floristically and in diversity within the boundary of the National Park. However, the Scrub habitat in the adjacent Wilmenna Sanctuary is floristically different to that in Bundala and needs to be considered as an independent management unit.
- The *Prosopis* scrub has lower diversity than Scrub for all terrestrial groups except birds. This almost monotypic habitat occupies extensive areas of the National Park and its continued removal, allowing for the establishment of 'natural' Scrub, should be accelerated.
- The rich and diverse bird assemblage recorded is predicated on the persistence of healthy natural ecosystems and management that encourages removal of exotic species. Decreased grazing and maintenance of natural hydrological regimes is essential to successful long-term management.
- The large populations of exotic fish species in the tanks and lagoons need to be managed with sensitivity to provide a continuing source of livelihood for the local fisher people but also to provide an essential food resource for the large number of bird species dependent on them. Potential impacts of exotic species on endemic and native species need to be monitored and managed as appropriate.
- Data gathered from this Biodiversity Baseline Survey can be used to inform management activities, notably through the management planning and implementation process, and to provide new information on biodiversity for community outreach work and for the benefit of visitors. The special importance of the National Park and surrounds as refugia in the Dry Zone for birds and endemic species of other groups should feature in such information.

Future directions and priorities

The present survey brings together the most up-to-date information on the biological resources of Bundala National Park and provides a basis for establishing a baseline for future biodiversity monitoring. Priorities are considered to be as follows:

- In the short-term, over the next five years, continue to collate and analyse available survey data to identify outstanding gaps for further surveys and research. A priority should include a detailed seasonal appraisal of plant, fish and avifaunal diversity and monitoring of water body environments.
- In the longer term (7-10 years hence), monitoring should commence with repeat surveys undertaken in the same locations covered by this Survey and any subsequent surveys completed.
- Specific research should include more detailed study of the fish fauna (notably *Puntius singhala*, an endemic freshwater species), its hydrological requirements and the anthropogenic and biological demands placed on it. Particular emphasis should be placed on the impact of sandbar breaching in Malala lagoon on water quality, endemic fish species and the maintenance of fish stocks.

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Annex 1 Geographic coordinates of sampling locations

AQUATIC LOCATIONS

NAME	NORTHING	EASTING	DATE	SITE_NO	SAMPLES ⁸
Kurulu wewa	108071	247417	4/1/2008	1	5
Kurulu wewa	108234	247346	4/1/2008	2	5
Malala lagoon	107896	245682	5/1/2008	3	5
Malala lagoon	107240	245673	5/1/2008	4	5
Malala lagoon	108398	246793	6/1/2008	5	5
Pathirajapitiya	107865	248206	7/1/2008	6	5
Pathirajapitiya	108163	248437	7/1/2008	7	6
Pathirajapitiya	108117	248376	8/1/2008	8	5
Pathirajapitiya	108084	248319	8/1/2008	9	5
Ambilla lagoon	110870	247917	9/1/2008	10	6
Ambilla lagoon	110239	249033	9/1/2008	11	5
Ambilla lagoon	110353	249103	10/1/2008	12	5
Bundala lagoon	109222	250874	11/1/2008	13	5
Bundala lagoon	109516	250730	12/1/2008	14	6
Bundala Wewa	110445	253855	15/2/2008	15	5
Bundala Wewa	110279	253933	15/2/2008	16	5
Bundala Lagoon	111726	252356	16/2/2008	17	5
Bundala Lagoon	109649	252191	16/2/2008	18	6
Bundala No.1 wewa	110354	250243	17/2/2008	19	6
Pathirajapitiya	107830	248274	17/2/2008	20	5
Kolankala lagoon	106024	243134	18/2/2008	21	5
Kolankala lagoon	106352	242929	18/2/2008	22	5
Kolankala lagoon	105542	242837	18/2/2008	23	6
Bundala lagoon	109834	252747	19/2/2008	24	6
Malala Pitaela	106570	244607	21/2/2008	25	5
Waterhole - Malala lagoon	107053	244759	22/2/2008	26	no fish

TERRESTRIAL LOCATIONS

Transect	Quadrat	Habitat	GPS start Easting	GPS start Northing	Altitude m
1	A	Sand Dune	255103	109863	2
1	B	Sand Dune	254989	109837	2
1	C	Sand Dune	254845	109822	7
1	D	Sand Dune	254692	109808	0
2	A	Dry-Mixed Evergreen Forest	247826	108154	2
2	B	Dry-Mixed Evergreen Forest	247935	108250	7
2	C	Dry-Mixed Evergreen Forest	248064	108333	4
2	D	Dry-Mixed Evergreen Forest	248195	108407	4
3	A	Grassland	253434	110118	0
3	B	Scrub	253373	110269	3
3	C	Scrub	253474	110365	0
3	D	Scrub	253503	110492	1
4	A	Grassland	246980	107488	5
4	B	Grassland	246908	107591	1
4	C	Grassland	247089	107855	2
4	D	Grassland	247149	108157	4

⁸ Number of samples refers to the number of attempts to catch fish, some of which were unsuccessful.

BIODIVERSITY BASELINE SURVEY: BUNDALA NATIONAL PARK

Transect	Quadrat	Habitat	GPS start Easting	GPS start Northing	Altitude m
5	A	Scrub			9
5	B	Scrub			10
5	C	Scrub			5
5	D	Scrub			5
6	A	Dry-Mixed Evergreen Forest	248634	108463	6
6	B	Dry-Mixed Evergreen Forest	248787	108473	6
6	C	Dry-Mixed Evergreen Forest	248949	108442	4
6	D	Dry-Mixed Evergreen Forest	249084	108380	5
7	A	Scrub	251547	111264	1
7	B	Scrub	251581	110957	2
7	C	Scrub	251590	110804	2
7	D	Scrub	251615	110685	2
8	A	Grassland	247669	108533	0
8	B	Prosopis	247557	108661	3
8	C	Prosopis	247758	108471	2
8	D	Scrub	247879	108427	0
9	A	Scrub	249849	111903	9
9	B	Scrub	249929	111973	6
9	C	Scrub	249805	112186	10
9	D	Scrub	249677	112133	8
10	A	Scrub	250962	113460	11
10	B	Scrub	251047	113381	12
10	C	Scrub	251076	113355	15
10	D	Scrub	251199	113274	16
11	A	Scrub	248537	107869	0
11	B	Dry-Mixed Evergreen Forest	248614	107967	0
11	C	Scrub	248751	108020	3
11	D	Scrub	248884	107960	5
12	A	Dry-Mixed Evergreen Forest	248462	108294	7
12	B	Dry-Mixed Evergreen Forest	248557	108297	3
12	C	Dry-Mixed Evergreen Forest	248654	108304	6
12	D	Dry-Mixed Evergreen Forest	248610	108222	2
13	A	Scrub	249604	112527	14
13	B	Scrub	249490	112477	16
13	C	Scrub	249530	112693	10
13	D	Scrub	249425	112648	10
14	A	Prosopis	252703	111780	0
14	B	Scrub	252847	111679	1
14	C	Scrub	252732	111665	1
15	D	Prosopis	252655	111705	2
15	A	Sand Dune	248924	107592	12
15	B	Sand Dune	248861	107773	7
15	C	Sand Dune	248614	107709	16
15	D	Sand Dune	248671	107578	13
16	A	Prosopis	249486	109394	1
16	B	Prosopis	249537	109575	6
16	C	Prosopis	249435	109544	4
16	D	Prosopis	249429	109362	0

ANNEX 2 SUMMARY OF SAMPLING EFFORT: BUNDALA NATIONAL PARK (Survey period: January - February 2008)

Key to habitats: D DMEF; Sc Scrub; Pr *Prosopis*; Gr Grassland; SD Sand Dune; Op Opportunistic (all habitats)

Taxonomic group	Sampling effort achieved in the field									Method: description	No./km transect	Sampling intensity per habitat type (based on 4 replicates/habitat)
	Method	Sampling effort per habitat type (N = no. quadrats)										
		D 13	Sc 29	Pr 8	Gr 6	SD 8			Op			
Small mammals	No. traps set	66	154	44	44	44				Sherman traps: located at 10 m intervals within 2 vegetation quadrats (100m x 5m), for 4 nights	22 traps	22 x 4 x 4 = 352 trap nights/ habitat
	Total no. trap nights	264	616	176	176	176						
	No. quadrats sampled	6	14	4	4	4						
Larger mammals	No. traps set	12	28	8	8	8				Tomahawk traps: located at each end of 2 vegetation quadrats (100m x 5m), for 4 nights	4 traps	4 x 4 x 4= 64 trap nights/ habitat
	Total no. trap nights	48	112	32	32	32						
	No. quadrats sampled	6	14	4	4	4						
Bats	No. mist nets set									Mist nets: 2 nets (at canopy and ground levels) manned by 2 persons at 6-9am and at 4.30-6.30pm at appropriate location along transect	2 mist nets	2 x 2 x 4 = 16 mist net sessions (totalling 40 mist net hours)/ habitat
	Total hours of mist netting											
	No. quadrats											
	No. mist nets set	Mist netting not undertaken.								Mist nets: 2 nets (at canopy and ground levels) manned by 2 persons at 6-9am and at 4.30-6.30pm along selected waterholes, trails and near roosts	2 mist nets	2 x 2 x 4 = 16 mist net sessions (totalling 40 mist net hours)/ habitat
	Total hours of mist netting											
	No. locations											
All mammals	No. quadrats									Direct observations: along 1 km transects, recording perpendicular distance from transect to mammal sighted/ spoor	1 km	4 km, variable width/ habitat
Birds on land	No. VCPs completed	52	116	32	24	32				Variable Circular Plots: 8 VCPs (radius = 0-10m, 11-20m and >20m) aligned at each end of 4 vegetation quadrats (100m x 5m): birds recorded for 10 minutes within each VCP, once at dawn and once at dusk	8 VCPs	8 x 2 x 4 = 64 VCP visits/ habitat
	No. quadrats sampled	13	29	8	6	8						
		No. transects surveyed									Direct observations: record birds along 1 km transects between vegetation quadrats	600m
Birds on water	No. locations on waterbodies counted	38								Total counts: for discrete water bodies, using one or more stations from which to record birds, as appropriate.	n/a	n/a
	Total no. waterbodies surveyed	5										
Birds	No. mist nets set	Mist netting not undertaken.								Mist nets: 2 nets (at canopy and ground levels) manned by 2 persons during daytime (total of hours)at appropriate location adjacent to transect	2 mist nets	2 x 4 x 6 = 48 mist net hours/ habitat
	Total hours of mist netting											
	No. locations											
Reptiles and amphibians	No. QCTs completed	35	75	20	10	20				Quadrat cleaning (daytime): 5 quadrats (5m x 5m) in open habitat, 10m x 2.5m in closed habitat) cleared in each of 2 vegetation quadrats (100m x 5m)	10 quadrats	10 x 4 = 40 quadrats (0.1 ha)/ habitat
	No. quadrats examined	7	15	4	2	4						
		No. nocturnal quadrats examined		6		1	2				100m x 5mm quadrats: visual encounters at night time	1 quadrat
Vascular plants	No. transects established	16 transects (each 1 km length) in total								100m x 5m quadrats: located at 150m intervals along 1km transect	4	4 x 4 = 16 quadrats (0.8 ha)/ habitat
	No. quadrats sampled	13	29	8	6	8						

Key to drainage units:

Freshwater fish	Sub-basin ref. no.								Water quality: pH, conductivity, phosphate, nitrate, dissolved oxygen, turbidity, temperature recorded at head, mid- and lower reaches of river	n/a	3 x 4 = 12 samples subcatchment
	No. fish/water quality locations	See Table 8.2 and Annex 1.									

Annex 3 List and reference numbers of voucher specimens

Family	Genus	Species	Specimen number	Date of collection
PLANTS - WOODY				
Amaranthaceae	<i>Aerva</i>	<i>lanata</i>	B013	
Boraginaceae	<i>Ehretia</i>	<i>laevis</i>	B010	
Erythroxylaceae	<i>Erythroxylum</i>	<i>monogynum</i>	B005	
Euphorbiaceae	<i>Suregada</i>	<i>lanceolata</i>	B002	
Hippocrateaceae	<i>Salacia</i>	<i>chinensis</i>	B015	
Loganiaceae	<i>Strychnos</i>	<i>potatutum</i>	B004	
Poaceae	<i>Spinifex</i>	<i>littoreus</i>	B006	
Salvadoraceae	<i>Azima</i>	<i>tetracantha</i>	B003	
Salvadoraceae	<i>Salvadora</i>	<i>persica</i>	B001	
Verbenaceae	<i>Premna</i>	sp.	B001	
Verbenaceae	<i>Premna</i>	sp.	B002	
FISH				
Ambassidae	<i>Ambasis</i>	<i>gymnocephalus</i>	BM-5	01/06/2008
Ambassidae	<i>Ambasis</i>	<i>gymnocephalus</i>	BA-5	01/09/2008
Aridae	<i>Arius</i>	<i>bilineatus</i>	BM-6	01/06/2008
Aridae	<i>Arius</i>	<i>bilineatus</i>	BA-7	01/10/2008
Chanidae	<i>Chanos</i>	<i>chanos</i>	BB6	16/2/2008
Cichlidae	<i>Oreochromis</i>	<i>mossambicus</i>	BBT-2	15/2/2008
Cichlidae	<i>Oreochromis</i>	<i>mossambicus</i>	BBW1-	17/2/2008
Cichlidae	<i>Oreochromis</i>	<i>mossambicus</i>	BM-1	01/05/2008
Cichlidae	<i>Oreochromis</i>	<i>mossambicus</i>	BP-1	01/07/2008
Cichlidae	<i>Oreochromis</i>	<i>mossambicus</i>	BA-3	01/09/2008
Cichlidae	<i>Oreochromis</i>	<i>niloticus</i>	BBT-3	15/2/2008
Cichlidae	<i>Oreochromis</i>	<i>niloticus</i>	BK -1	18/2/2008
Cichlidae	<i>Oreochromis</i>	<i>niloticus</i>	BK4	18/2/2008
Cichlidae	<i>Oreochromis</i>	<i>niloticus</i>	BB7	19/2/2008
Cichlidae	<i>Oreochromis</i>	<i>niloticus</i>	BM-9	01/06/2008
Clupeidae	<i>Nematalosa</i>	<i>nasus</i>	BM-4	01/06/2008
Clupeidae	<i>Nematalosa</i>	<i>nasus</i>	BB-1	01/11/2008
Clupeidae	<i>Sardinella</i>	<i>albella</i>	BK -3	18/2/2008
Cyprinidae	<i>Puntius</i>	<i>amphibius</i>	BA-2	01/09/2008
Cyprinidae	<i>Puntius</i>	<i>dorsalis</i>	BBT-1	15/2/2008
Cyprinidae	<i>Puntius</i>	<i>singhala</i>	BMP-4	21/2/2008
Cyprinidae	<i>Puntius</i>	<i>singhala</i>	BM-2	01/05/2008
Cyprinidae	<i>Puntius</i>	<i>singhala</i>	BA-1	01/09/2008
Gerridae	<i>Gerres</i>	<i>filamentosus</i>	BBT-4	15/2/2008
Gerridae	<i>Gerres</i>	<i>filamentosus</i>	BMP-5	21/2/2008
Gerridae	<i>Gerres</i>	<i>filamentosus</i>	BM-7	01/06/2008
Gerridae	<i>Gerres</i>	<i>filamentosus</i>	BB5	16/2/2008
Gobiidae	<i>Glossogobius</i>	<i>giuris</i>	BM-3	01/06/2008
Gobiidae	<i>Glossogobius</i>	<i>giuris</i>	BP-2	01/07/2008
Gobiidae	<i>Glossogobius</i>	<i>giuris</i>	BA-6	01/09/2008
Leiognathidae	<i>Leiognathus</i>	<i>fasciatus</i>	BB-2	01/11/2008
Mugilidae	<i>Mugil</i>	<i>cephalus</i>	BK-2	18/2/2008
Mugilidae	<i>Mugil</i>	<i>cephalus</i>	BM-8	01/06/2008
Mugilidae	<i>Mugil</i>	<i>cephalus</i>	BA-4	01/09/2008
Mugilidae	<i>Mugil</i>	<i>cephalus</i>	BB-3	01/11/2008
Teraponidae	<i>Terapon</i>	<i>jarbua</i>	BMP-3	21/2/2008
Teraponidae	<i>Terapon</i>	<i>jarbua</i>	BB-4	01/12/2008
AMPHIBIANS				
Bufonidae	<i>Bufo</i>	<i>atukoralei</i>	DWC013	16/02/2008

Family	Genus	Species	Specimen number	Date of collection
Ranidae	<i>Euphlyctis</i>	<i>cyanophlyctis</i>	DWC016	07/01/2008
Ranidae	<i>Fejervarya</i>	<i>limnocharis</i>	DWC014	07/01/2008
Ranidae	<i>Fejervarya</i>	<i>limnocharis</i>	DWC015	07/01/2008
Ranidae	<i>Fejervarya</i>	<i>limnocharis</i>	DWC017	07/01/2008
REPTILES				
Agamidae	<i>Calotes</i>	<i>versicolor</i>	DWC011	06/01/2008
Elapidae	<i>Naja</i>	<i>naja</i>	DWC012	05/01/2008
MAMMALS				
Muridae	<i>Cremnomys</i>	<i>blanfordi</i>	BU07	7/01/2008
Muridae	<i>Mus</i>	<i>booduga</i>	BU02	8/01/2008
Muridae	<i>Mus</i>	<i>booduga</i>	BU01	18/2/2008
Muridae	<i>Mus</i>	<i>fernandoni</i>	BU05	5/01/2005
Muridae	<i>Mus</i>	<i>fernandoni</i>	BU04	5/01/2008
Muridae	<i>Rattus</i>	<i>norvegicus</i>	BU08	18/2/2008
Muridae	<i>Rattus</i>	<i>rattus</i>	BU06	7/01/2008
Sciuridae	<i>Funambulus</i>	<i>palmarum</i>	BU03	8/01/2008

Annex 4 List of species recorded from Bundala National Park

Key to species geographic status:

E endemic, **I** indigenous; **M** migrant; **X** exotic

Key to species national conservation status:

EX extinct, **CR** critically endangered, **EN** endangered, **VU** vulnerable, **NT** near threatened

[N] number of quadrats sampled within each habitat. + indicates one or more records.

No information

Family	Genus	Species	Geographic status	Conservation status - national	Opportunistic records	Total no. individuals/ records for quadrats [N=64]	No. quadrats within which species recorded in habitat type					Prior records
							Dry-Mixed Evergreen Forest [N=13]	Scrub [N=29]	Prosopis [N=8]	Grassland [N=6]	Sand Dune [N=8]	
PLANTS												
Acanthaceae	Barleria	prionitis	I		+							
Acanthaceae	Hygrophila	schulli	I		+							
Acanthaceae	Justicia	betonica	I		+							
Aizoaceae	Sesuvium	portulacastrum	I		+							
Alismataceae	Limnophyton	obtusifolium	I		+							
Amaranthaceae	Achyranthes	aspera	I			4					1	
Amaranthaceae	Aerva	lanata	I			2				1		
Amaranthaceae	Alternanthera	pungens	I			8				1		
Amaranthaceae	Alternanthera	sessilis	I		+							
Amaranthaceae	Gomphrena	celosioides	X		+							
Amaranthaceae	Pupalia	lappacea	I			4					1	
Amaryliidaceaea	Crinum	zeylanicum	I		+							
Apocynaceae	Carissa	spinarum	I		+							
Apocynaceae	Thevetia	peruviana	X		+							
Aponogetonaceae	Aponogeton	natans	I		+							
Arecaceae	Borassus	flabellifer	X		+							
Arecaceae	Phoenix	pusilla	I			3		1		1		
Asclepiadaceae	Calotropis	gigantea	I		+							
Asclepiadaceae	Pergularia	daemia	I		+							
Asclepiadaceae	Tylophora	indica	I		+							
Asparagaceae	Asparagus	racemosus	I		+							
Asteraceae	Blepharispermum	petiolare	I	EN	+							
Asteraceae	Eclipta	prostrata	I		+							
Asteraceae	Elephantopus	scaber	I		+							
Asteraceae	Emilia	baldwinii	E			6					1	
Asteraceae	Eupatorium	odoratum	I			8					2	
Asteraceae	Launaea	sarmentosa	I			28					2	
Asteraceae	Sphaeranthus	indicus	I		+							
Asteraceae	Tridax	procumbens	X		+							
Asteraceae	Vernonia	cinerea	I		+							
Asteraceae	Vernonia	zeylanica	E		+							
Avicenniaceae	Avicennia	marina	I		+							
Boraginaceae	Carmona	retusa	I		+							
Boraginaceae	Cordia	sinensis	I			5	2	1	1			
Boraginaceae	Ehretia	laevis	I		+							
Boraginaceae	Heliotropium	indicum	I		+							
Cactaceae	Opuntia	dillenii	X			24					2	
Capparaceae	Capparis	rotundifolia	I		+							
Capparaceae	Capparis	sepiaria	I		+							
Capparaceae	Capparis	zeylanica	I		+							
Capparaceae	Cleome	chelidonii	I		+							
Capparaceae	Cleome	viscosa	I		+							
Capoaraceae	Crateva	adansonii	I		+							

BIODIVERSITY BASELINE SURVEY: BUNDALA NATIONAL PARK

Family	Genus	Species	Geographic status	Conservation status - national	Opportunistic records	Total no. individuals/ records for quadrats [N=64]	No. quadrats within which species recorded in habitat type					Prior records
							Dry-Mixed Evergreen Forest [N=13]	Scrub [N=29]	Prosopis [N=8]	Grassland [N=6]	Sand Dune [N=8]	
Celastraceae	Cassine	glauca	E		+							
Celastraceae	Maytenus	emarginata	I			2		2				
Celastraceae	Pleurostylia	opposita	I		+							
Ceratophyllaceae	Ceratophyllum	demersum	I		+							
Chenopodiaceae	Suaeda	maritima	I		+							
Chenopodiaceae	Suaeda	vermiculata	I		+							
Colchicaceae	Gloriosa	superba	I		+							
Combretaceae	Lumnitzera	racemosa	I		+							
Combretaceae	Terminalia	arjuna	I		+							
Commelinaceae	Commelina	sp.	I			4				1		
Convolvulaceae	Evolvulus	alsinoides	I		+							
Convolvulaceae	Ipomoea	obscura	I		+							
Convolvulaceae	Ipomoea	pes-caprae	I			6					2	
Convolvulaceae	Ipomoea	pes-tigridis	I		+							
Cucurbitaceae	Coccinia	grandis	I		+							
Cyperaceae	Bulbostylis	barbata	I			56					4	
Cyperaceae	Cyperus	arenarius	I			57					7	
Cyperaceae	Cyperus	rotundus	I			16				1		
Cyperaceae	Cyperus	sp.	I			16				2		
Cyperaceae	Fimbristylis	falcata	I			8				1		
Cyperaceae	Schoenoplectus	articulatus	I		+							
Dracaenaceae	Sansevieria	zeylanica	I		+							
Ebenaceae	Diospyros	ferrea	I			2	1	1				
Erythroxylaceae	Erythroxylum	monogynum	I			150	12	17	1			
Euphorbiaceae	Acalypha	indica	I		+							
Euphorbiaceae	Croton	bonplandianus	I			12				2		
Euphorbiaceae	Croton	laccifer	I			1		1				
Euphorbiaceae	Drypetes	sepiaria	I			52	4	12				
Euphorbiaceae	Euphorbia	antiquorum	I		+							
Euphorbiaceae	Euphorbia	sp.	I			2					1	
Euphorbiaceae	Euphorbia	tirucalli	X		+							
Euphorbiaceae	Flueggea	leucopyrus	I			5	1	2		1		
Euphorbiaceae	Jatropha	gossypifolia	X		+							
Euphorbiaceae	Mallotus	rhamnifolius	I		+							
Euphorbiaceae	Mallotus	sp.	I		+							
Euphorbiaceae	Phyllanthus	maderaspatensis	I			8					1	
Euphorbiaceae	Phyllanthus	pinnatus	I			1		1				
Euphorbiaceae	Suregada	lanceolata	I			96	11	2				
Fabaceae	Abrus	precatorius	I		+							
Fabaceae	Acacia	eburnea	I		+							
Fabaceae	Aeschynomene	indica	I		+							
Fabaceae	Bauhinia	racemosa	I		+							
Fabaceae	Bauhinia	tomentosa	I		+							
Fabaceae	Caesalpinia	bonduc	I		+							
Fabaceae	Canavalia	rosea	I		+							
Fabaceae	Cassia	auriculata	I			4		3		1		
Fabaceae	Cassia	occidentalis	I		+							
Fabaceae	Cassia	tora	I		+							
Fabaceae	Clitoria	ternatea	I		+							
Fabaceae	Crotalaria	laburnifolia	I		+							
Fabaceae	Crotalaria	retusa	I			70					6	
Fabaceae	Crotalaria	verrucosa	I		+							
Fabaceae	Derris	trifoliata	I		+							
Fabaceae	Desmodium	triflorum	I		+							
Fabaceae	Dichrostachys	cinerea	I			49		10	2			
Fabaceae	Mimosa	pudica	X		+							
Fabaceae	Neptunia	oleracea	I		+							

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Family	Genus	Species	Geographic status	Conservation status - national	Opportunistic records	Total no. individuals/ records for quadrats [N=64]	No. quadrats within which species recorded in habitat type					Prior records
							Dry-Mixed Evergreen Forest [N=13]	Scrub [N=29]	Prosopis [N=8]	Grassland [N=6]	Sand Dune [N=8]	
Fabaceae	<i>Prosopis</i>	<i>juliflora</i>	I			84		1	8	1		
Fabaceae	<i>Tamarindus</i>	<i>indica</i>	X		+							
Fabaceae	<i>Thespesia</i>	<i>populnea</i>	I		+							
Goodeniaceae	<i>Scaevola</i>	<i>taccada</i>	I		+							
Hernandiaceae	<i>Gyrocarpus</i>	<i>americanus</i>	I		+							
Hippocrateaceae	<i>Salacia</i>	<i>chinensis</i>	I		+							
Lamiaceae	<i>Leucas</i>	<i>zeylanica</i>	X			4					1	
Lamiaceae	<i>Ocimum</i>	<i>americanum</i>	I		+							
Lemnaceae	<i>Lemna</i>	<i>sp.</i>	I		+							
Lentibulariaceae	<i>Utricularia</i>	<i>aurea</i>	I		+							
Linaceae	<i>Hugonia</i>	<i>mystax</i>	I			2		2				
Loganiaceae	<i>Strychnos</i>	<i>potatutum</i>	I			1		1				
Loranthaceae	<i>Dendrophthoe</i>	<i>falcata</i>	I		+							
Lythraceae	<i>Lawsonia</i>	<i>inermis</i>	I			4					1	
Malvaceae	<i>Abutilon</i>	<i>indicum</i>	I		+							
Malvaceae	<i>Hibiscus</i>	<i>micranthus</i>	I		+							
Malvaceae	<i>Pavonina</i>	<i>odorata</i>	I		+							
Malvaceae	<i>Sida</i>	<i>acuta</i>	I		+							
Malvaceae	<i>Thespesia</i>	<i>populnea</i>	I		+							
Marsiliaceae	<i>Marsilia</i>	<i>quadrifolia</i>	I		+							
Martyniaceae	<i>Martynia</i>	<i>annua</i>	X		+							
Melastomataceae	<i>Memecylon</i>	<i>umbellatum</i>	I			7	3	2				
Meliaceae	<i>Azadirachta</i>	<i>indica</i>	I		+							
Meliaceae	<i>Walsura</i>	<i>trifoliolata</i>	I		+							
Molluginaceae	<i>Mollugo</i>	<i>pentaphylla</i>	I		+							
Moraceae	<i>Streblus</i>	<i>asper</i>	I		+							
Myrtaceae	<i>Eugenia</i>	<i>bracteata</i>	I			1	1					
Nelumbonaceae	<i>Nelumbo</i>	<i>nucifera</i>	I		+							
Nyctaginaceae	<i>Boerhavia</i>	<i>diffusa</i>	I		+							
Nymphaeaceae	<i>Nymphaea</i>	<i>pubescens</i>	I		+							
Ochnaceae	<i>Ochna</i>	<i>lanceolata</i>	I			4		4				
Oleaceae	<i>Jasminum</i>	<i>angustifolium</i>	I		+							
Oleaceae	<i>Jasminum</i>	<i>auriculatum</i>	I		+							
Onagraceae	<i>Ludwigia</i>	<i>sp.</i>	I		+							
Pandanaceae	<i>Pandanus</i>	<i>odoratissimus</i>	I		+							
Pedaliaceae	<i>Pedaliium</i>	<i>murex</i>	I		+							
Periplocaceae	<i>Hemidesmus</i>	<i>indicus</i>	I		+							
Poaceae	<i>Cynodon</i>	<i>dactylon</i>	I			98				3		
Poaceae	<i>Dactyloctenium</i>	<i>aegyptium</i>	I			8				1		
Poaceae	<i>Digitaria</i>	<i>bicornis</i>	I			4				1		
Poaceae	<i>Panicum</i>	<i>maximum</i>	X		+							
Poaceae	<i>Panicum</i>	<i>repens</i>	I			96				4		
Poaceae	<i>Paspalum</i>	<i>vaginatum</i>	I			42				3		
Poaceae	<i>Spinifex</i>	<i>littoreus</i>	I			322					8	
Pontederiaceae	<i>Eichhornia</i>	<i>crassipes</i>	X		+							
Pontederiaceae	<i>Monochoria</i>	<i>vaginalis</i>	I		+							
Rhamnaceae	<i>Scutia</i>	<i>myrtina</i>	I		+							
Rhamnaceae	<i>Ziziphus</i>	<i>mauritanica</i>	I			7		4	1			
Rhamnaceae	<i>Ziziphus</i>	<i>oenoplia</i>	I			1		1				
Rhizophoraceae	<i>Cassipourea</i>	<i>ceylanica</i>	I			186	13	1	1			
Rubiaceae	<i>Benkara</i>	<i>malabarica</i>	I		+							
Rubiaceae	<i>Canthium</i>	<i>coromandelicum</i>	I			12		4				
Rubiaceae	<i>Catunaregam</i>	<i>spinosa</i>	I			8		4		1		
Rubiaceae	<i>Hydrophylax</i>	<i>maritima</i>	I			20					2	
Rubiaceae	<i>Ixora</i>	<i>pavetta</i>	I		+							
Rubiaceae	<i>Pavetta</i>	<i>indica</i>	I		+							
Rubiaceae	<i>Psilanthus</i>	<i>wightianus</i>	I		+							

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Family	Genus	Species	Geographic status	Conservation status - national	Opportunistic records	Total no. individuals/ records for quadrats [N=64]	No. quadrats within which species recorded in habitat type					Prior records
							Dry-Mixed Evergreen Forest [N=13]	Scrub [N=29]	Prosopis [N=8]	Grassland [N=6]	Sand Dune [N=8]	
Rubiaceae	<i>Psydrax</i>	<i>dicoccos</i>	I			1		1				
Rubiaceae	<i>Spermacoce</i>	<i>hispidia</i>	I		+							
Rubiaceae	<i>Tarenna</i>	<i>asiatica</i>	I			9		5				
Rutaceae	<i>Atalantia</i>	<i>monophylla</i>	I		+							
Rutaceae	<i>Clausena</i>	<i>indica</i>	I			2		1				
Rutaceae	<i>Glycosmis</i>	<i>mauritiana</i>	I		+							
Rutaceae	<i>Limonia</i>	<i>acidissima</i>	I			4		3				
Rutaceae	<i>Pleiospermium</i>	<i>alatum</i>	I		+							
Rutaceae	<i>Toddalia</i>	<i>asiatica</i>	I		+							
Salvadoraceae	<i>Azima</i>	<i>tetracantha</i>	I		+							
Salvadoraceae	<i>Salvadora</i>	<i>persica</i>	I			51	6	9	4			
Sapindaceae	<i>Allophylus</i>	<i>cobbe</i>	I		+							
Sapindaceae	<i>Sapindus</i>	<i>emarginata</i>	I		+							
Sapotaceae	<i>Manilkara</i>	<i>hexandra</i>	I			111	13	16				
Scrophulariaceae	<i>Scoparia</i>	<i>dulcis</i>	X		+							
Solanaceae	<i>Solanum</i>	<i>melongena</i>	X		+							
Sterculiaceae	<i>Waltheria</i>	<i>indica</i>	I		+							
Tiliaceae	<i>Grewia</i>	<i>damine</i>	I		+							
Tiliaceae	<i>Grewia</i>	<i>orientalis</i>	I		+							
Verbenaceae	<i>Clerodendrum</i>	<i>inerme</i>	I		+							
Verbenaceae	<i>Gmelina</i>	<i>asiatica</i>	I		+							
Verbenaceae	<i>Lantana</i>	<i>camara</i>	X		+							
Verbenaceae	<i>Phyla</i>	<i>nudiflora</i>	I			26				2		
Verbenaceae	<i>Premna</i>	<i>latifolia</i>	I			2		2				
Verbenaceae	<i>Premna</i>	<i>sp.</i>	I			37		11				
Vitaceae	<i>Cayratia</i>	<i>pedata</i>	I		+							
Vitaceae	<i>Cissus</i>	<i>quadrangularis</i>	I		+							
Vitaceae	<i>Cissus</i>	<i>vitiginea</i>	I		+							
AMPHIBIANS												
Source of information for prior records: Bambaradeniya et al. (2001)												
Bufonidae	<i>Bufo</i>	<i>atukoralei</i>	E		7	2	1	0	0	1	0	✓
Bufonidae	<i>Bufo</i>	<i>melanostictus</i>	I		11	3	1	1	0	1	0	✓
Bufonidae	<i>Bufo</i>	<i>scaber</i>	I		2	0	0	0	0	0	0	✓
Microhylidae	<i>Kaloula</i>	<i>taprobanica</i>	I		1	1	0	0	0	1	0	✓
Microhylidae	<i>Microhyla</i>	<i>ornata</i>	I		11	0	0	0	0	0	0	✓
Microhylidae	<i>Ramanella</i>	<i>variegata</i>	I		7	0	0	0	0	0	0	✓
Ranidae	<i>Euphlyctis</i>	<i>cyanophlyctis</i>	I		58	11	1	1	0	2	1	✓
Ranidae	<i>Euphlyctis</i>	<i>hexadactylus</i>	I		11	0	0	0	0	0	0	✓
Ranidae	<i>Fejervarya</i>	<i>limnocharis</i>	I		50	20	1	1	1	3	0	✓
Ranidae	<i>Hoplobatrachus</i>	<i>crassus</i>	I		13	4	1	0	0	2	0	✓
Ranidae	<i>Polypedates</i>	<i>cruciger</i>	E		1	0	0	0	0	0	0	□
Ranidae	<i>Polypedates</i>	<i>maculatus</i>	I		25	2	0	2	0	0	0	✓
Ranidae	<i>Rana</i>	<i>gracilis</i>	E		4	2	1	0	0	0	0	□
REPTILES												
Source of information for prior records: Bambaradeniya et al. (2001)												
Agamidae	<i>Calotes</i>	<i>calotes</i>	I		5	5	1	3	0	1	0	✓
Agamidae	<i>Calotes</i>	<i>versicolor</i>	I		15	12	0	3	2	1	2	✓
Agamidae	<i>Sitana</i>	<i>ponticeriana</i>	I		43	54	1	1	0	0	5	✓
Bataguridae	<i>Melanochelys</i>	<i>trijuga</i>	I	NT	4	0	0	0	0	0	0	✓
Colubridae	<i>Ahaetulla</i>	<i>nasuta</i>	I		3	0	0	0	0	0	0	✓
Colubridae	<i>Amphiesma</i>	<i>stolatum</i>	I		1	0	0	0	0	0	0	✓
Colubridae	<i>Boiga</i>	<i>trigonatus</i>	I		1	2	0	0	0	0	2	✓
Colubridae	<i>Dendrelaphis</i>	<i>tristis</i>	I		3	0	0	0	0	0	0	✓
Colubridae	<i>Lycodon</i>	<i>osmanhilli</i>	E		1	0	0	0	0	0	0	□
Colubridae	<i>Oligodon</i>	<i>arnensis</i>	I		1	0	0	0	0	0	0	✓
Colubridae	<i>Ptyas</i>	<i>mucosa</i>	I		3	0	0	0	0	0	0	✓

BIODIVERSITY BASELINE SURVEY: BUNDALA NATIONAL PARK

Family	Genus	Species	Geographic status	Conservation status - national	Opportunistic records	Total no. individuals/ records for quadrats [N=64]	No. quadrats within which species recorded in habitat type					Prior records
							Dry-Mixed Evergreen Forest [N=13]	Scrub [N=29]	Prosopis [N=8]	Grassland [N=6]	Sand Dune [N=8]	
Crocodylidae	<i>Crocodylus</i>	<i>palustris</i>	I		21	1	0	0	1	0	0	✓
Elapidae	<i>Naja</i>	<i>naja</i>	I		1	1	0	1	0	0	0	✓
Gekkonidae	<i>Gehyra</i>	<i>mutilata</i>	I		4	0	0	0	0	0	0	✓
Gekkonidae	<i>Hemidactylus</i>	<i>brookii</i>	I		6	1	0	1	0	0	0	✓
Gekkonidae	<i>Hemidactylus</i>	<i>depressus</i>	E		8	3	0	2	0	0	0	✓
Gekkonidae	<i>Hemidactylus</i>	<i>frenatus</i>	I		24	9	2	3	1	1	0	✓
Gekkonidae	<i>Hemidactylus</i>	<i>leschenaultii</i>	I		29	14	0	5	1	1	0	✓
Gekkonidae	<i>Hemidactylus</i>	<i>triedrus</i>	I		6	6	1	0	0	1	2	✓
Scincidae	<i>Eutropis</i>	<i>carinata</i>	I		2	2	1	0	0	1	0	✓
Scincidae	<i>Eutropis</i>	<i>tammanna</i>	E		1	0	0	1	0	0	0	✓
Scincidae	<i>Lankascincus</i>	<i>fallax</i>	E		10	10	2	1	1	1	0	✓
Scincidae	<i>Lygosoma</i>	<i>punctatus</i>	I		1	2	1	1	0	0	0	
Testudinidae	<i>Geochelone</i>	<i>elegans</i>	I	VU	8	6	0	4	0	0	1	✓
Trionychidae	<i>Lissemys</i>	<i>punctata</i>	I	VU	3	1	1	0	0	0	0	✓
Varanidae	<i>Varanus</i>	<i>bengalensis</i>	I		14	3	0	1	1	0	1	✓
BIRDS												
Accipitridae	<i>Circus</i>	<i>aeruginosus</i>			1	1	0	0	0	1	0	
Accipitridae	<i>Haliaeetus</i>	<i>leucogaster</i>			2	3	1	1	0	1	0	
Accipitridae	<i>Haliastur</i>	<i>indus</i>			10	15	0	8	2	3	2	
Accipitridae	<i>Ichthyophaga</i>	<i>ichthyaetus</i>			6	0	0	0	0	0	0	
Accipitridae	<i>Pernis</i>	<i>ptilorhyncus</i>			1	0	0	0	0	0	0	
Accipitridae	<i>Spilornis</i>	<i>cheela</i>			2	1	0	0	0	0	1	
Accipitridae	<i>Spizaetus</i>	<i>cirrhatius</i>			3	2	1	0	0	0	1	
Alaudidae	<i>Eremopterix</i>	<i>grisea</i>			4	9	0	2	1	0	2	
Alaudidae	<i>Mirafra</i>	<i>assamica</i>			2	2	0	1	0	1	0	
Alcedinidae	<i>Alcedo</i>	<i>atthis</i>			7	19	0	4	4	4	1	
Anatidae	<i>Anas</i>	<i>querquedula</i>			15	3	0	3	0	0	0	
Anhingidae	<i>Anhinga</i>	<i>melanogaster</i>			18	20	1	6	5	2	2	
Apodidae	<i>Apus</i>	<i>affinis</i>				2	0	2	0	0	0	
Apodidae	<i>Collocalia</i>	<i>unicolor</i>			2	1	1	0	0	0	0	
Apodidae	<i>Cypsiurus</i>	<i>balasensis</i>			5	0	4	0	0	0	0	
Apodidae	<i>Hirundapus</i>	<i>giganteus</i>		EN	1	0	1	0	0	0	0	
Ardeidae	<i>Ardea</i>	<i>cinerea</i>			18	11	1	2	3	4	1	
Ardeidae	<i>Ardeola</i>	<i>grayii</i>			16	18	0	3	3	5	0	
Ardeidae	<i>Bubulcus</i>	<i>ibis</i>			13	13	5	4	1	2	0	
Ardeidae	<i>Butorides</i>	<i>striatus</i>			2	3	0	1	1	1	0	
Ardeidae	<i>Casmerodius</i>	<i>albus</i>			26	23	4	3	2	5	1	
Ardeidae	<i>Dupetor</i>	<i>flavicollis</i>			1	0	0	0	0	0	0	
Ardeidae	<i>Egretta</i>	<i>garzetta</i>			11	2	0	0	1	1	0	
Ardeidae	<i>Ixobrychus</i>	<i>sinensis</i>			2	2	0	0	1	1	0	
Ardeidae	<i>Mesophoyx</i>	<i>intermedia</i>			9	6	0	4	2	0	0	
Ardeidae	<i>Nycticorax</i>	<i>nycticorax</i>			5	0	1	2	1	0	0	
Burhinidae	<i>Burhinus</i>	<i>oediconemus</i>			1	4	0	1	2	0	0	
Burhinidae	<i>Esacus</i>	<i>recurvirostris</i>			14	8	0	3	2	3	0	
Caprimulgidae	<i>Caprimulgus</i>	<i>asiaticus</i>			1	0	0	0	0	0	0	
Centropodidae	<i>Centropus</i>	<i>sinensis</i>			76	16	2	3	3	0	3	
Cerylidae	<i>Ceryle</i>	<i>rudis</i>			2	8	0	2	2	3	0	
Charadriidae	<i>Charadrius</i>	<i>alexandrinus</i>			21	3	1	0	2	0	0	
Charadriidae	<i>Charadrius</i>	<i>dubius</i>			2	1	0	0	1	0	0	
Charadriidae	<i>Charadrius</i>	<i>hiaticula</i>			1	0	0	0	0	0	0	
Charadriidae	<i>Charadrius</i>	<i>leschenaultii</i>			10	1	0	0	0	0	1	
Charadriidae	<i>Charadrius</i>	<i>mongolus</i>			22	5	0	2	2	0	1	
Charadriidae	<i>Himantopus</i>	<i>himantopus</i>			31	22	0	6	4	2	0	
Charadriidae	<i>Pluvialis</i>	<i>fulva</i>			6	3	0	1	1	1	0	
Charadriidae	<i>Pluvialis</i>	<i>squatarola</i>			4	0	0	0	0	0	0	
Charadriidae	<i>Vanellus</i>	<i>indicus</i>			47	31	3	9	2	4	1	

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							Dry-Mixed Evergreen Forest [N=13]	Scrub [N=29]	Prosopis [N=8]	Grassland [N=6]	Sand Dune [N=8]	
Charadriidae	<i>Vanellus</i>	<i>malabaricus</i>				2	0	1	0	1	0	
Ciconiidae	<i>Anastomus</i>	<i>oscitans</i>			14	4	0	0	2	2	0	
Ciconiidae	<i>Mycteria</i>	<i>leucocephala</i>			16	4	2	0	2	0	0	
Cisticolidae	<i>Prinia</i>	<i>hodgsonii</i>				1	0	1	0	0	0	
Cisticolidae	<i>Prinia</i>	<i>inornata</i>			3	20	2	9	3	2	0	
Cisticolidae	<i>Prinia</i>	<i>socialis</i>				1	0	0	0	1	0	
Cisticolidae	<i>Prinia</i>	<i>sylvatica</i>			3	7	2	4	0	1	0	
Columbidae	<i>Columba</i>	<i>livia</i>		CR	5	2	1	1	0	0	0	
Columbidae	<i>Ducula</i>	<i>aenea</i>			3	3	3	0	0	0	0	
Columbidae	<i>Streptopelia</i>	<i>chinensis</i>			135	196	9	28	7	5	6	
Columbidae	<i>Treron</i>	<i>bicincta</i>			5	5	2	2	0	0	0	
Columbidae	<i>Treron</i>	<i>pompadora</i>			13	19	3	9	0	0	2	
Coraciidae	<i>Coracias</i>	<i>benghalensis</i>			1	2	0	1	0	0	0	
Corvidae	<i>Aegithina</i>	<i>tiphia</i>			63	197	13	28	8	5	4	
Corvidae	<i>Coracina</i>	<i>melanoptera</i>			14	6	1	3	1	1	0	
Corvidae	<i>Corvus</i>	<i>macrorhynchos</i>			23	27	5	5	1	5	1	
Corvidae	<i>Hypothymis</i>	<i>azurea</i>				1	0	1	0	0	0	
Corvidae	<i>Oriolus</i>	<i>xanthornus</i>			1	5	1	2	0	0	2	
Corvidae	<i>Pericrocotus</i>	<i>cinnamomeus</i>				4	1	1	0	1	1	
Corvidae	<i>Pericrocotus</i>	<i>flammeus</i>				1	0	1	0	0	0	
Corvidae	<i>Rhipidura</i>	<i>aureola</i>			10	12	0	1	5	3	1	
Corvidae	<i>Tephrodornis</i>	<i>pondicerianus</i>			9	45	7	13	2	3	4	
Corvidae	<i>Terpsiphone</i>	<i>paradisi</i>			6	21	4	5	4	0	2	
Cuculidae	<i>Clamator</i>	<i>jacobinus</i>				1	0	0	0	1	0	
Cuculidae	<i>Cuculus</i>	<i>micropterus</i>			3	0	0	0	0	0	0	
Cuculidae	<i>Eudynamys</i>	<i>scolopacea</i>			11	5	2	2	0	0	0	
Cuculidae	<i>Hierococcyx</i>	<i>varius</i>			1	0	0	0	0	0	0	
Cuculidae	<i>Phaenicophaeus</i>	<i>viridirostris</i>			4	4	0	1	1	1	0	
Dendrocygnidae	<i>Dendrocygna</i>	<i>javanica</i>			1	8	0	2	3	2	0	
Glareolidae	<i>Glareola</i>	<i>lactea</i>		VU	5	1	0	1	0	0	0	
Glareolidae	<i>Glareola</i>	<i>maldivarum</i>		EN		1	0	1	0	0	0	
Halcyonidae	<i>Halcyon</i>	<i>capensis</i>				1	0	0	1	0	0	
Halcyonidae	<i>Halcyon</i>	<i>smyrnensis</i>			25	13	5	3	1	2	0	
Hemiprocidae	<i>Hemiprocne</i>	<i>coronata</i>			14	25	5	9	1	1	3	
Hirundinidae	<i>Hirundo</i>	<i>daurica</i>				2	0	0	0	1	1	
Hirundinidae	<i>Hirundo</i>	<i>rustica</i>			30	202	12	28	8	6	8	
Irenidae	<i>Chloropsis</i>	<i>cochinchinensis</i>			5	16	2	11	0	0	0	
Jacaniidae	<i>Hydrophasianus</i>	<i>chirurgus</i>			3	1	0	1	0	0	0	
Laniidae	<i>Lanius</i>	<i>cristatus</i>			15	29	7	10	2	2	3	
Laridae	<i>Chlidonias</i>	<i>hybridus</i>			27	31	4	4	4	4	2	
Laridae	<i>Gelochelidon</i>	<i>nilotica</i>			10	3	0	1	1	1	0	
Laridae	<i>Larus</i>	<i>brunnicephalus</i>			1	0	0	0	0	0	0	
Laridae	<i>Sterna</i>	<i>albifrons</i>			2	9	1	2	1	4	0	
Laridae	<i>Sterna</i>	<i>bengalensis</i>			1	0	0	0	0	0	0	
Laridae	<i>Sterna</i>	<i>bergii</i>			3	1	0	0	1	0	0	
Laridae	<i>Sterna</i>	<i>caspia</i>			6	1	0	1	0	0	0	
Laridae	<i>Sterna</i>	<i>hirundo</i>			17	31	5	10	3	5	0	
Laridae	<i>Sterna</i>	<i>saundersi</i>		CR	1	0	0	0	0	0	0	
Meropidae	<i>Merops</i>	<i>leschenaultia</i>			1	3	0	1	0	0	1	
Meropidae	<i>Merops</i>	<i>orientalis</i>			9	47	2	13	7	3	3	
Meropidae	<i>Merops</i>	<i>philippinus</i>			64	148	8	25	8	6	6	
Muscicapidae	<i>Copsychus</i>	<i>malabaricus</i>			13	22	1	9	0	0	3	
Muscicapidae	<i>Copsychus</i>	<i>saularis</i>			11	11	1	2	4	2	2	
Muscicapidae	<i>Muscicapa</i>	<i>muttui</i>				1	1	0	0	0	0	
Muscicapidae	<i>Muscicapa</i>	<i>daurica</i>			1	0	0	0	0	0	0	
Muscicapidae	<i>Saxicoloides</i>	<i>fulcata</i>			4	37	4	15	5	2	2	
Nectariniidae	<i>Dicaeum</i>	<i>agile</i>				1	0	0	0	0	1	

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							Dry-Mixed Evergreen Forest [N=13]	Scrub [N=29]	Prosopis [N=8]	Grassland [N=6]	Sand Dune [N=8]	
Nectariniidae	<i>Dicaeum</i>	<i>erythrorhynchos</i>				11	2	5	0	0	0	
Nectariniidae	<i>Nectarina</i>	<i>asiatica</i>			8	74	3	23	5	3	3	
Nectariniidae	<i>Nectarina</i>	<i>lotenia</i>			8	83	9	21	3	4	5	
Nectariniidae	<i>Nectarina</i>	<i>zeylonica</i>			19	155	10	29	8	5	4	
Passeridae	<i>Anthus</i>	<i>rufulus</i>				15	1	2	2	2	0	
Passeridae	<i>Dendronanthus</i>	<i>indicus</i>			1	5	1	0	0	0	3	
Passeridae	<i>Lonchura</i>	<i>malabarica</i>			1	0	0	0	0	0	0	
Passeridae	<i>Lonchura</i>	<i>malacca</i>				1	0	1	0	0	0	
Passeridae	<i>Lonchura</i>	<i>punctulata</i>				2	0	1	0	1	0	
Passeridae	<i>Lonchura</i>	<i>striata</i>				1	0	1	0	0	0	
Passeridae	<i>Motacilla</i>	<i>cinerea</i>			1	0	0	0	0	0	0	
Passeridae	<i>Motacilla</i>	<i>flava</i>				2	0	1	1	0	0	
Pegalauidae	<i>Megalaima</i>	<i>haemacephala</i>				1	1	0	0	0	0	
Pegalauidae	<i>Megalaima</i>	<i>rubricapilla</i>			1	0	0	0	0	0	0	
Pegalauidae	<i>Megalaima</i>	<i>zeylanica</i>			8	1	0	1	0	0	0	
Pelecanidae	<i>Pelecanus</i>	<i>philippensis</i>			13	4	1	0	2	1	0	
Phalacrocoracidae	<i>Phalacrocorax</i>	<i>carbo</i>			1	2	1	0	0	1	0	
Phalacrocoracidae	<i>Phalacrocorax</i>	<i>fuscicollis</i>			7	16	2	6	2	1	0	
Phalacrocoracidae	<i>Phalacrocorax</i>	<i>niger</i>			8	18	0	4	4	3	0	
Phasianidae	<i>Coturnix</i>	<i>chinensis</i>			1	0	0	0	0	0	0	
Phasianidae	<i>Gallus</i>	<i>lafayetii</i>	E		148	20	2	6	1	1	3	
Phasianidae	<i>Pavo</i>	<i>cristatus</i>			164	18	5	2	3	4	2	
Picidae	<i>Dendrocopos</i>	<i>mahrattensis</i>		VU	2	1	0	1	0	0	0	
Picidae	<i>Dinopium</i>	<i>benghalense</i>			5	4	2	1	0	0	1	
Pittidae	<i>Pitta</i>	<i>brachyura</i>			34	16	4	6	0	0	2	
Podicipedidae	<i>Tachybaptus</i>	<i>ruficollis</i>			1	0	0	0	0	0	0	
Psittacidae	<i>Psittacula</i>	<i>eupatria</i>			3	1	0	1	0	0	0	
Psittacidae	<i>Psittacula</i>	<i>krameri</i>			70	54	3	15	4	2	4	
Pycnonotidae	<i>Pycnonotus</i>	<i>cafer</i>			83	248	13	29	8	6	5	
Pycnonotidae	<i>Pycnonotus</i>	<i>luteolus</i>			135	239	11	29	7	5	5	
Pycnonotidae	<i>Pycnonotus</i>	<i>melanicterus</i>			2	3	0	3	0	0	0	
Rallidae	<i>Amaurornis</i>	<i>phoenicurus</i>			12	6	1	2	0	2	0	
Rallidae	<i>Gallinula</i>	<i>cinerea</i>			1	0	0	0	0	0	0	
Rallidae	<i>Gallinula</i>	<i>chloropus</i>			3	1	0	0	1	0	0	
Rallidae	<i>Porphyrio</i>	<i>porphyrio</i>			4	3	0	0	2	1	0	
Scolopacidae	<i>Actitis</i>	<i>hypoleucos</i>			9	6	0	1	2	3	0	
Scolopacidae	<i>Arenaria</i>	<i>interprex</i>			6	0	0	0	0	0	0	
Scolopacidae	<i>Calidris</i>	<i>ferruginea</i>			12	0	0	0	0	0	0	
Scolopacidae	<i>Calidris</i>	<i>alba</i>			5	0	0	0	0	0	0	
Scolopacidae	<i>Calidris</i>	<i>alpina</i>			1	0	0	0	0	0	0	
Scolopacidae	<i>Calidris</i>	<i>minuta</i>			19	1	0	1	0	0	0	
Scolopacidae	<i>Gallinago</i>	<i>gallinago</i>				1	0	0	1	0	0	
Scolopacidae	<i>Limosa</i>	<i>limosa</i>			10	8	0	0	1	3	0	
Scolopacidae	<i>Numenius</i>	<i>arquata</i>				1	0	0	0	1	0	
Scolopacidae	<i>Numenius</i>	<i>phaeopus</i>			2	2	0	0	0	0	2	
Scolopacidae	<i>Philomachus</i>	<i>pugnax</i>			2	0	0	0	0	0	0	
Scolopacidae	<i>Tringa</i>	<i>erythropus</i>			1	1	0	0	0	1	0	
Scolopacidae	<i>Tringa</i>	<i>glareola</i>			5	1	0	0	1	0	0	
Scolopacidae	<i>Tringa</i>	<i>nebularia</i>			7	1	0	1	0	0	0	
Scolopacidae	<i>Tringa</i>	<i>stagnatilis</i>			22	8	0	2	3	1	0	
Scolopacidae	<i>Tringa</i>	<i>totanus</i>			19	7	0	2	4	1	0	
Sturnidae	<i>Acridotheres</i>	<i>tristis</i>			22	32	2	16	2	0	2	
Sturnidae	<i>Sturnus</i>	<i>roseus</i>			13	32	3	11	2	5	0	
Sylviidae	<i>Acrocephalus</i>	<i>dumetorum</i>			2	1	0	0	0	1	0	
Sylviidae	<i>Acrocephalus</i>	<i>stentoreus</i>			11	12	0	0	4	3	0	
Sylviidae	<i>Chrysomma</i>	<i>sinense</i>			1	0	0	0	0	0	0	
Sylviidae	<i>Locustella</i>	<i>certhiola</i>			2	28	1	8	7	2	0	

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Family	Genus	Species	Geographic status	Conservation status - national	Opportunistic records	Total no. individuals/ records for quadrats [N=64]	No. quadrats within which species recorded in habitat type					Prior records
							Dry-Mixed Evergreen Forest [N=13]	Scrub [N=29]	Prosopis [N=8]	Grassland [N=6]	Sand Dune [N=8]	
Sylviidae	<i>Orthotomus</i>	<i>sutorius</i>			85	194	12	28	5	5	5	
Sylviidae	<i>Pellorneum</i>	<i>fuscicapillum</i>	E		10	8	0	0	0	1	4	
Sylviidae	<i>Phylloscopus</i>	<i>magnirostris</i>				1	0	0	1	0	0	
Sylviidae	<i>Phylloscopus</i>	<i>nitidus</i>			2	5	2	0	0	2	1	
Sylviidae	<i>Rhopocichla</i>	<i>atriceps</i>				5	0	4	0	0	0	
Sylviidae	<i>Turdoides</i>	<i>affinis</i>			88	54	6	18	4	0	3	
Threskiornithidae	<i>Platalea</i>	<i>leucorodia</i>			11	4	0	3	0	1	0	
Threskiornithidae	<i>Threskiornis</i>	<i>melanocephalus</i>			13	15	1	4	3	3	1	
Turnicidae	<i>Turnix</i>	<i>suscitator</i>			1	0	0	0	0	0	0	
Upupidae	<i>Upupa</i>	<i>epops</i>			1	2	0	0	2	0	0	
Zosteropidae	<i>Zosterops</i>	<i>palpebrosus</i>			1	2	2	0	0	0	0	
MAMMALS												
Values are based on either direct observations or signs (tracks, droppings etc.) confirmed with confidence.												
Source of information for prior records: Bambaradeniya et al. (2001)												
Bovidae	<i>Bos</i>	<i>indicus</i>	X		129	0	0	0	0	0	0	
Bovidae	<i>Bubalus</i>	<i>arnee</i>	I	VU	98	0	0	0	0	0	0	
Bovidae	<i>Bubalus</i>	<i>bubalis</i>	X		297	0	0	0	0	0	0	✓
Canidae	<i>Canis</i>	<i>aureus</i>	I		12	2	0	2	0	0	0	✓
Cercopithecidae	<i>Macaca</i>	<i>sinica</i>	E	NT	315	391	2	9	3	5	0	✓
Cercopithecidae	<i>Semnopithecus</i>	<i>priam</i>	I		659	229	4	10	5	3	0	✓
Cervidae	<i>Axis</i>	<i>axis</i>	I		80	61	7	15	4	4	0	✓
Elephantidae	<i>Elephas</i>	<i>maximus</i>	I	VU	72	53	5	18	5	6	0	✓
Felidae	<i>Felis</i>	<i>chaus</i>	I	VU	1	6	0	0	0	3	0	
Felidae	<i>Prionailurus</i>	<i>rubiginosus</i>	I	EN	3	0	0	0	0	0	0	✓
Felidae	<i>Prionailurus</i>	<i>viverrinus</i>	I	VU	5	2	0	2	0	0	0	✓
Herpestidae	<i>Herpestes</i>	<i>brachyurus</i>	I		2	1	0	0	0	1	0	
Herpestidae	<i>Herpestes</i>	<i>edwardsii</i>	I		2	5	0	3	0	1	0	✓
Herpestidae	<i>Herpestes</i>	<i>smithii</i>	I		5	4	0	3	0	1	0	✓
Hystericidae	<i>Histrix</i>	<i>indica</i>	I		4	0	0	0	0	0	0	✓
Leporidae	<i>Lepus</i>	<i>nigricollis</i>	I		205	19	2	8	1	1	2	✓
Muridae	<i>Cremnomys</i>	<i>blanfordi</i>	I		0	1	0	0	0	1	0	
Muridae	<i>Mus</i>	<i>booduga</i>	I		0	5	0	0	0	1	1	
Muridae	<i>Mus</i>	<i>ferandoni</i>	E	CR	0	2	0	0	0	2	0	
Muridae	<i>Rattus</i>	<i>rattus</i>	I		0	3	0	0	0	1	1	✓
Muridae	<i>Tatera</i>	<i>indica</i>	I		58	6	0	1	1	1	1	✓
Sciuridae	<i>Funambulus</i>	<i>layardi</i>	E	VU	0	1	0	0	0	0	1	
Sciuridae	<i>Funambulus</i>	<i>palmarum</i>	I		1	1	0	0	0	1	0	✓
Sciuridae	<i>Funambulus</i>	<i>sublineatus</i>	I	VU	6	9	0	5	0	1	0	
Sciuridae	<i>Ratufa</i>	<i>macroura</i>	I	VU	0	1	0	1	0	0	0	✓
Suidae	<i>Sus</i>	<i>scrofa</i>	I		17	10	3	3	2	0	0	✓
Tragulidae	<i>Moschiola</i>	<i>meminna</i>	E		2	9	0	4	2	1	0	✓
Viverridae	<i>Paradoxurus</i>	<i>hermaphoditus</i>	I		1	0	0	0	0	0	0	✓
Viverridae	<i>Viverricula</i>	<i>indica</i>	I		8	1	0	0	0	0	1	✓

FISH														
Aquatic status: F freshwater; B brackish water; CM coastal marine; PM pelagic marine														
Opportunistic: based on reports from fisherman.														
See Table 8.1 for quantitative data.														
Source of information for prior records: Jayakody and Jayasinghe, 1992														
Family	Genus	Species	Geographic status	Aquatic status	Conservation status - national	Opportunistic - fishermen	Ambilikala lagoon	Bundala lagoon	Koholankala lagoon	Malala lagoon	Tanks	Streams	Waterholes	Prior records*
Ambassidae	<i>Ambasis</i>	<i>commersoni</i>	I	F/B										✓
Ambassidae	<i>Ambasis</i>	<i>gymnocephalus</i>	I	F/B			✓			✓				
Anabantidae	<i>Anabas</i>	<i>testudineus</i>	I	F		✓								
Anguillidae	<i>Anguilla</i>	sp.	M	B/CM		✓								✓
Aridae	<i>Arius</i>	<i>bilineatus</i>	M	B/CM			✓			✓				
Aridae	<i>Arius</i>	sp.	M	B/CM										✓
Carangidae	<i>Caranx</i>	sp.	M	B/CM		✓								✓
Chanidae	<i>Chanos</i>	<i>chanos</i>	M	B/CM				✓						✓
Channidae	<i>Channa</i>	<i>striata</i>	I	F		✓								✓
Cichlidae	<i>Oreochromis</i>	<i>mossambicus</i>	X	F/B			✓	✓	✓	✓	✓		✓	✓
Cichlidae	<i>Oreochromis</i>	<i>niloticus</i>	X	F/B				✓	✓	✓	✓	✓		
Clupeidae	<i>Nematalosa</i>	<i>nasus</i>	M	B/CM				✓		✓				
Clupeidae	<i>Opisthopterus</i>	<i>tardoore</i>	M	B/CM										✓
Clupeidae	<i>Sardinella</i>	<i>albella</i>	M	B/CM					✓					
Cyprinidae	<i>Catla</i>	<i>Catla</i>	X	-		✓								
Cyprinidae	<i>Labeo</i>	<i>rohita</i>	X	-		✓								
Cyprinidae	<i>Puntius</i>	<i>amphibius</i>	E	F	DD		✓							
Cyprinidae	<i>Puntius</i>	<i>dorsalis</i>	I	F							✓			
Cyprinidae	<i>Puntius</i>	<i>singhala</i>	E	F			✓			✓		✓		
Elopidae	<i>Elops</i>	<i>machnata</i>	M	B/PM				✓						
Engraulidae	<i>Thrissa</i>	sp.	M	B/ CM										✓
Gerridae	<i>Gerres</i>	<i>filamentosus</i>	M	B/CM				✓		✓	✓	✓		
Gobiidae	<i>Glossogobius</i>	<i>giuris</i>	I	F/B			✓			✓			✓	
Gobiidae	<i>Gobius</i>	sp.	I	F/B										✓
Hemirhamphidae	<i>Hyporhamphus</i>	sp.	M	B/CM										✓
Leiognathidae	<i>Leiognathus</i>	<i>fasciatus</i>	M	B/CM				✓						
Mugilidae	<i>Mugil</i>	<i>cephalus</i>	M	B/CM			✓	✓	✓	✓		✓		✓
Teraponidae	<i>Terapon</i>	<i>jarbua</i>	M	F/B/CM				✓				✓		
Teraponidae	<i>Terapon</i>	sp.	M	F/B/CM										✓