

Information Sheet on Ramsar Wetlands (RIS)

Categories approved by Recommendation 4.7, as amended by Resolution VIII.13 of the Conference of the Contracting Parties.

Note for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.
2. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Bureau. Compilers are strongly urged to provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of maps.

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Designation date

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Site Reference Number

2. Date this sheet was completed/updated: November 2003

3. Country: Democratic Socialist Republic of Sri Lanka

4. Name of the Ramsar site: Maduganga

5. Map of site included: Hard copy and digital copy of a preliminary map are enclosed. At present a GIS based map is being prepared for Maduganga. This will be submitted upon completion in December 2003.

a) **hard copy** (required for inclusion of site in the Ramsar List): *yes* -or- *no*

b) **digital (electronic) format** (optional): *yes* -or- *no*

6. Geographical coordinates: 6°18' N 80°03' E.

7. General location:

Maduganga is located 88 kilometers south of Colombo and 35 kilometers north of Galle. Maduganga is situated within two Divisional Secretariat Divisions (DSD): Balapitiya DSD and the Karadeniya DSD. The connected Randombe lake area is entirely within the Balapitiya DSD. Both the DSD's belong to the District of Galle, which is located in the Southern province of Sri Lanka.

Balapitiya DSD and Karandeniya DSD have 65.335 and 54.644 inhabitants respectively. The entire Galle District has one million inhabitants with an average density of 601 people/km².

8. Elevation:

The water body of Maduganga is less than 1 meter above MSL and at the lagoon mouth it flows into the sea. The highest location of the catchment is 377 meters above MSL at a location called Hippan Kanda.

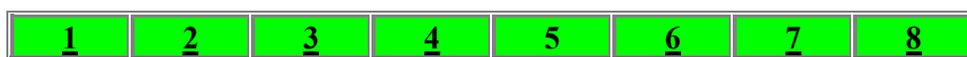
9. Area:

The total waterbody of Maduganga including Randoombe lake and islands covers about 915 ha. The total surface area of the 15 islands within Maduganga is 145 ha. Therefore the total area of the water surface is 770 ha.

10. Overview:

Maduganga is a relatively unspoiled lagoon with many important ecological characteristics like abundant mangroves, 10 major wetland vegetation types as well as a high biodiversity. The lagoon is connected to the sea by a narrow, 1.8 km long canal. The lagoon mouth is often blocked by a natural formed sand bar. In the lagoon there are 15 islands varying in size of which some are inhabited. Maduganga originates from a location on the fringe of a coastal plain about 10 kilometers from the coast. After flowing for about 6 kilometers, it forms the waterbody of Maduganga. A smaller lake, called Randoombe Lake, is located in the southwestern part of Maduganga and is connected to the channel system of Maduganga by two narrow channels. There are three major streams entering Maduganga: Boralessa Ela, Heen Ela and Magala Ela. On the island and shores of Maduganga 61 ha of relatively undisturbed mangrove habitat as well as 20 ha mangrove scrubs and 63 ha of mangrove mixed swamps can be found. The vegetation around Maduganga contains 303 species belonging to 95 species. There are 19 endemics and 8 national threatened species. There are in total 248 species of vertebrate fauna of which 20 species are endemics and 30 species are nationally threatened.

11. Ramsar Criteria:



12. Justification for the application of each Criterion listed in 11. above:

Criterion 1: According to studies, Maduganga has perhaps one of the last remaining tracts of pristine mangrove forest in both the biogeographic regions it belongs to (south-western wet coastal zone) as well as in Sri Lanka in general (Bambaradeniya et al., 2002). IUCN identified 144 ha of mangroves around Maduganga and due to its relative unspoiled state, combined with a rich biodiversity, these mangroves can be considered as internationally important. In two vegetation types (mangrove and mangrove mixed swamp) 14 species of true mangrove and mangrove associate plants are recorded (Bambaradeniya et al., 2002).

Criterion 2: According to a study by IUCN Sri Lanka there are 52 globally or nationally threatened species of flora and fauna. In table 1 only the nationally threatened species are given, but there are many more vulnerable and rare species.

Table 1: Threatened species in Maduganga (Bambaradeniya et al., 2002)

Scientific name	Family name	Common name
Flora		
<i>Salacia reticulata</i>	Celastraceae	
<i>Lumnitzera littorea</i>	Combretaceae	
<i>Cycus circinalis</i>	Cycadaceae	
<i>Shorea affinis</i> (En, IUCN)	Dipterocarpaceae	
<i>Helixanthera ensifolia</i>	Loranthaceae	
<i>Nymphoides aurantiaca</i>	Menyanthaceae	
<i>Vanilla walkerae</i>	Orchidaceae	
<i>Nypa fruticans</i>	Palmae	
Fish		
<i>Horadandiya atukorali</i>	Cyprinidae	Horadandiya
<i>Clarias brachysoma</i>	Clariidae	Walking catfish
Amphibians		
<i>Bufo atukoralei</i>	Bufoidea	Atohokorale's dwarf toad
<i>Rana gracilis</i>	Ranidae	Sri Lanka Wood Frog
<i>Polypedates cruciger</i>	Rhacophoridae	Hour-glass Tree Frog
Reptiles		
<i>Crocodylus porosus</i> (CITES)	Crocodylidae	Estuarine Crocodile
<i>Crocodylus palustris</i> (Vu, IUCN)	Crocodylidae	Mugger
<i>Lissemys punctata</i> (CITES)	Trionychidae	Flapshell Turtle
<i>Melanocheilus trijuga</i>	Bataguridae	Parker's Black Turtle
<i>Otocryptis weigmanni</i>	Gekkonidae	Sri Lanka Kangaroo Lizard
<i>Cnemidophorus tigris</i>	Gekkonidae	Rough-belly Day Gecko
<i>Hemidactylus depressus</i>	Gekkonidae	Kandyan Gecko
<i>Lankascincus taprobanensis</i>	Scincidae	Smooth Lanka Skink
<i>Xenochrophis asperrimus</i>	Colubridae	Common Pond Snake
<i>Acrochordus granulatus</i>	Acrochordidae	Wart Snake
<i>Python molurus</i> (CITES)	Boidae	Indian Python
Avifauna		
<i>Rostratula benghalensis</i>	Colubridae	Greater Painted-Snipe -
<i>Psittacula calthropae</i>	Psittacidae	Layard's Parakeet
<i>Loriculus beryllinus</i>	Psittacidae	Sri Lanka Lorikeet
<i>Apus melba</i>	Apodidae	Alpine swift
<i>Tockus griseus</i>	Bucerotidae	Grey Hornbill
<i>Micropternus brachyurus</i>	Picidae	Rufous Woodpecker
<i>Pellorneum fuscicapillum</i>	Muscicapidae	Brown-capped Babbler

Mammals

<i>Trachypithecus vetulus</i> (En, IUCN)	Cercopithecidae	Purple-faced leaf monkey
<i>Loris tardigradus</i> (Vu, IUCN)	Loridae	Slender Loris
<i>Paradoxurus zeylonensis</i>	Viverridae	Golden Palm Civet
<i>Lutra lutra</i> (Vu, IUCN)	Mustellidae	Eurasian Otter
<i>Prionailurus viverrinus</i> (Vu, IUCN)	Felidae	Indian Fishing Cat
<i>Axis porcinus</i>	Cervidae	Hog Deer

Butterflies

<i>Arhopala amantes</i>	Lycaenidae	Large Oak Blue
<i>Zizeeria karsandra</i>	Lycaenidae	Dark Grass Blue
<i>Zizula hylax</i>	Lycaenidae	Tiny Grass Blue
<i>Appias libythea</i>	Pieridae	Striped Albatross
<i>Colotis aurora</i>	Pieridae	The Plain Orange Tip

Terrestrial molluscs

<i>Euplecta emiliana</i>	Ariophantidae
<i>Acavus haemastoma</i>	Acavidae
<i>Beddomea albizonatus</i>	Camaenidae
<i>Glessula paneantha</i>	Glessulidae
<i>Aulopoma helicinum</i>	Cyclophoridae
<i>Aulopoma itieri</i>	Cyclophoridae
Ariophantidae	<i>Mariella dussimieri</i>

Criterion 3: Maduganga is extremely rich in biodiversity with 303 species of plants belonging to 95 families. Noteworthy is the presence of the rare and highly threatened species of the mangrove *Lumnitzera littorea* which can only be found in this location. Furthermore there are 248 species of vertebrate belonging to 121 families. There are 47 endemic species and 52 species which are considered as nationally threatened. The native vertebrate fauna of Maduganga represents 30% of Sri Lanka’s native inland vertebrate species. The avifauna observed in Maduganga represents about 43% of Sri Lanka’s native avifauna. Table 2 summarizes the amount of species present in Maduganga. Table 3 describes the names of endemic species. At present it is not known how many species of flora and fauna occur in the biogeographically region where Maduganga belongs to (south-western wet coastal zone). Since the majority of these species are found in Maduganga, this area should be considered as internationally important.

Table 2: Species richness in Maduganga (Bambaradeniya et al., 2002)

	Species in Maduganga	Endemics	Nationally threatened	Invasive species
Flora	303	19	8	9
Garden vegetation	98	1	1	-
Fish	70	2	2	1
Amphibians	12	3	5	-
Reptiles	31	7	11	-
Avifauna	111	6	7	-
Mammals	24	2	6	-
Butterflies	50	-	5	-
Terrestrial molluscs	14	8	8	2
Aquatic molluscs	11	-	-	-

Table 3: Endemic species in Maduganga (Bambaradeniya et al. 2002)

Flora

<i>Enicosanthum acuminata</i>	Annonaceae
<i>Walidda antidysenterica</i>	Apocynaceae
<i>Garcinia quaesita</i>	Clusiaceae
<i>Mesua ferrea</i>	Clusiaceae
<i>Dillenia retusa</i>	Dilleniaceae
<i>Wormia triquetra</i>	Dilleniaceae
<i>Antidesma pyrifolium</i>	Euphorbiaceae
<i>Cleistanthus pallidus</i>	Euphorbiaceae
<i>Scolopia acuminata</i>	Flacourtiaceae
<i>Cinnamomum zeylanicum</i>	Lauraceae
<i>Hugonia ferruginea</i>	Linaceae
<i>Memecylon rostratum</i>	Melastomataceae
<i>Memecylon sylvaticum</i>	Melastomataceae
<i>Osbeckia octandra</i>	Melastomataceae
<i>Chionanthus albidiflorus</i>	Oleaceae
<i>Jasminum angustifolium</i>	Oleaceae
<i>Phoenix zeylanica</i>	Palmae
<i>Hedyotis cymosa</i>	Rubiaceae
<i>Notothixos floccosus</i>	Viscaceae

Fish

<i>Puntius sinhalaya</i>	Cyprinidae	Filamented Barb
<i>Clarias brachysoma</i>	Clariidae	Walking Catfish

Amphibians

<i>Bufo atukoralei</i>	Bufoidea	Athokorale's Dwarf Toad
<i>Rana gracilis</i>	Ranidae	Sri Lanka Wood Frog
<i>Polypedates cruciger</i>	Rhacophoridae	Hour-glass Tree Frog

Reptiles

<i>Otocryptis weigmanni</i>	Agamidae	Sri Lanka Kangaroo Lizard
<i>Hemidactylus depressus</i>	Gekkonidae	Kandyan Gecko
<i>Hemidactylus brookii</i>	Gekkonidae	Spotted House Gecko
<i>Lankascincus fallax</i>	Scincidae	Common Lanka Skink
<i>Lankascincus taprobanensis</i>	Scincidae	Smooth Lanka Skink
<i>Mabuya carinata</i>	Scincidae	Common skink
<i>Xenochrophis asperrimus</i>	Colubridae	Common Pond Snake

Birds

<i>Gallus lafayetti</i>	Phasianidae	Jungle Fowl
<i>Psittacula calthropae</i>	Psittacidae	Layard's Parakeet
<i>Loriculus beryllinus</i>	Psittacidae	Sri Lanka Lorikeet
<i>Tockus griseus</i>	Bucerotidae	Grey Hornbill
<i>Megalaima rubricapilla</i>	Capitonidae	Small Barbet
<i>Pellorneum fuscicapillum</i>	Muscicapidae	Brown-capped Babbler

Mammals

<i>Trachypithecus vetulus</i>	Cercopithecidae	Purple-faced leaf monkey
<i>Paradoxurus zeylonensis</i>	Viverridae	Golden Palm Civet

Terrestrial molluscs

<i>Euplecta emiliana</i>	Ariophantidae
<i>Acavus haemastoma</i>	Acavidae
<i>Beddomea albizonatus</i>	Camaenidae
<i>Glessula paneantha</i>	Glessulidae
<i>Aulopoma helicinum</i>	Cyclophoridae
<i>Aulopoma itieri</i>	Cyclophoridae
<i>Leptopomoides halophilus</i>	Cyclophoridae
<i>Tortulosa thwaitesi</i>	Cyclophoridae

Criterion 4: Maduganga supports numerous species which depend on this ecosystem to complete their lifecycle. An example is the penaid prawns which are abundant in Maduganga. These prawns spawn in the sea but the post-larvae passively enter the lagoon in large quantities when the lagoon mouth is open. In the lagoon these larvae feed on plankton and find shelter between the abundant root systems of mangroves. After 4-6 months the pre-adult prawns actively migrate back to the sea. There are four species of penaid prawns in Maduganga which provide a livelihood for numerous fishermen (table 4).

Table 4: Penaid prawn species in Maduganga

Scientific name	Local name	English name
<i>Metapenaeus dobsoni</i> Miers, 1878	Malissa	Kadal shrimp
<i>Metapenaeus monoceros</i> (Fabricius, 1798)	Rathissa	Speckled shrimp
<i>Penaeus indicus</i>	Kirissa	White prawn
<i>Penaeus monodon</i> fabricius, 1798	Karandu issa	Giant tiger prawn

Criterion 6: Maduganga supports 1.2% of the biogeographic population of Little green heron (*Butorides striatus*) of which about 300 individuals occur in Maduganga. This species is uncommon in Sri Lanka.

Criterion 7: The fish biodiversity in Maduganga is extremely high with 70 species observed belonging to 41 families. Of these species there are 2 endemics and 2 nationally protected species.

Table 5: Nationally threatened, endemic and rare fish species in Maduganga

Family name	Scientific name	Common name	Status
Cyprinidae	<i>Puntius sinhalaya</i>	Filamented barb	Nationally threatened, endemic
Cyprinidae	<i>Horadandiya atukorali</i>	Horadandiya	Nationally threatened
Clariidae	<i>Clarias brachysoma</i>	Walking Catfish	Nationally threatened/endemic
Monodactylidae	<i>Monodactylus argenteus</i>	Mono	Rare
Sphyraenidae	<i>Sphyraena barracuda</i>	Great Barracuda	Rare
Sphyraenidae	<i>Sphyraena jello</i>	Pick-handle Barracuda	Rare

Criterion 8.

Furthermore there are numerous (commercially important) anadromous fish species, which rely on this lagoon since they migrate to fresh/brackish waters for reproduction. Examples of these species in Maduganga are the snappers (*Lutjanus* sp.), Trevally (*Caranx* spp.), Silber Beddy (*Gerres* spp.), Surgeon fish (*Acanthurus* spp.) and Barracuda (*Sphyraena* spp.)

Maduganga is rich in mangroves and many fish species forage on the detritus derived from leaves of mangroves that fell in the water and are decomposed by bacteria. Also the extensive root systems of the present mangroves provide a habitat for numerous adult reproductive fish as well as many juveniles. Maduganga acts therefore as an important food source, as a spawning ground and as a nursery.

13. Biogeography

a) biogeographic region: Maduganga is situated within the south western wet coastal zone of Sri Lanka

b) biogeographic regionalisation scheme: The applied biogeographic regionalisation scheme used can be found in:

Ashton P.S. and Gunatilleke C.V.S. (1987) New light on the Plant Geography of Ceylon I – Historical Plant Geography. *Journal of biogeography*, 14: 249-285.

Certain adjustment had to be made since this scheme is not completely suitable for classification of coastal regions.

14. Physical features of the site:

Geology and geomorphology

The Maduganga area is located in the south-western region of Sri Lanka where the south-western group of crystalline rocks, which is one of the upper Paleozoic rock formations, predominates. These dark coloured rocks are locally known as “Kalu gal”. This is the dominant group in the entire south-western region of Sri Lanka. In the Maduganga area, charnockite, charnockitic gneiss, biotite gneiss, hornblende-biotite gneiss and migmatitic types are the abundant geological formations. The coastal area is predominantly covered with quaternary deposits. The river alluvium and the lagoonal deposits such as clay, silt and sand, marine deposits such as beach sand, beach rock and coral debris and aeolian deposits such as dune and wind blown sand are Holocene while the partly ferruginous gravel are Pleistocene.

Soil type and chemistry range

Bog and half bog soils dominates the study area. These are very poor drained soils with a surface layer rich in dark brown to black organic matter. They occur in the lowest, poorly drained positions of the flat

coastal landscape. These soils have a high organic matter and sulphur content in the form of iron sulphide. Randombe Lake and the narrow canals of the Maduganga are bordered with sand and alluvial soils. Water logged muddy soils are characteristic of marshy lands bordering a greater part of the Maduganga and the islands. Towards the coast, large areas are also dominated by alluvial soils of variable drainage and the soil is saline. Such soils are suitable for coconut cultivation. Towards the northern and eastern boundaries of Maduganga, the stretches of land that extend to the interior have red yellow podzolic soils with soft or hard laterite and undulating terrain.

Sediments characteristic

The medium grain size (D50) of the sediments samples collected inside the Maduganga is 0.43mm (std.=0.29, n=10). Most of the samples inside Maduganga contain large amounts of carbonic and mud particles. Some samples are firmly compacted due to the presence of mud.

Near shore sampling near the lagoon mouth revealed that the average medium grain size (D50) of the sediments was 0.22 mm. (std.=0.137, n=45). Sediment samples collected along cross-shore profiles contained no carbonic particles.

Origins

Maduganga is a naturally formed lagoon.

Hydrology

The hydrology of Maduganga is influenced by the presence of the sandbar in the mouth and the amount of rainfall. For example, in March 2003 the lagoon mouth was open but current measurements revealed a very low flow of water (0.03 m/s) which resulted in an outflow of 0.25 m³/s. These low values are likely to be caused by low rainfall. On the same location the flow was 0.25 m/s in May 2003 when the sand bar was fully open. The discharge volume at this time was much higher with a maximum of 16.95 m³/s.

When the lagoon mouth is fully closed, heavy rainfalls cause floodings. This causes large problems for the inhabitants around the area as well as for the farmers. Due to frequent floods and saline conditions, only the paddy fields in the upper reaches are cultivated while 304 ha of lands, which used to be fertile, have been abandoned.

A number of natural waterways are connected with the Maduganga estuarine system. The water flow through these canals has been controlled by the construction of regulators and bunds by the Department of Irrigation. Few of these constructions are still operational these days. Currently it is not known how much water enters the lagoon via these streams but currently a study conducted on the water circulation in Maduganga will reveal this by the end of 2003.

Table 6: Streams entering Maduganga.

Sub catchment	Catchment Area km²
Magala Ela	16.56
Dambalawa Ela	5.48
Bogahawela Ela	3.27
Mahawella Ela	4.9
Unagaswela Ela	0.79
Seenigoda Ela	1.79
Boralessa Ela	1.28
Heen Ela	1.02
Mudali Heen	9.7
Nelligoda Ela	1.28
Horondu Ela	4.08

Parawatura Ela	3.2
Unclassified (direct)	7.32

The outlet structures at Maduganga consist of two groynes, which were constructed a few decades ago. These groynes were built to limit the trapping of sand at the river outlet but the intended purpose has not been fulfilled. Prior to the construction of the groynes, the variation in the beach formation in front of the river outlet was mainly caused by wave action and river flow. However, after the construction of groynes, a low energy environment was created, especially on the shadow of the southern groyne. This is mainly due to the excessive distance between the two groynes at the outlet. Hence at present the river outlet acts as a sediment sink and traps most of the northbound sediment. The sand bar across the river estuary is varying in size and in some parts it is as wide as 100m. When required, it is usual to cut open the sand bar close to the northern groyne where the width of the sand bar is minimum. When the sand bar is cut open, an approximately 15m wide tidal channel is usually formed. In the Coastal Resources Management Project, conducted by the Coast Conservation Department, there are plans to improve the situation in order to keep the mouth, at least partially, open.

Water quality

The waterbody of Maduganga is relatively clean. In some places, however, there are signs of anthropogenic pollution. A major problem for the water quality of Maduganga is the presence of numerous cinnamon plantations around Maduganga. Due to the use of excessive amounts of fertilizers the water body is enriched with vast amounts of nitrogen and phosphorus.

The temperature of the water falls within the range of 30.1-33.7°C. There is only a small difference in temperature between the top and bottom layer with a maximum difference of 1.4°C over an average difference in depth of 1.9 meters. The pH range in Maduganga is between 6.95 and 8.98. The level of salinity depends on the tides, input of fresh water via the different streams and whether the lagoon mouth is opened or closed. Near the lagoon mouth salinity levels vary between 6.7-20.8ppt and gradually decrease with the distance away from the mouth.

The amount of oxygen dissolved in the water body of varies between 3.30 and 8.91 mg/l. In general the levels of BOD₅ are within the acceptable range of 5 mg/l.

For the total suspended solids the average of 12 locations was 213 mg/l, which indicates high levels of solid particles being in suspension. This is probably caused by rains, which are likely to have occurred before measurements were taken. Another explanation can be the higher levels of algal growth observed in the period of sampling. Due to the large quantities of fertilizers used for the cinnamon plantation the levels of total Nitrogen are very high with a range of 0-12 mg/l. The levels of total phosphorus are also too high with a range of 0.01-0.24 mg/l. Total coliforms were measured only on 4 locations and were found to be high. On a few locations the water is therefore not suitable for bathing and fishing, however, on most locations in Maduganga the total coliforms are within the acceptable range so the water is suitable for fishing and bathing.

Depth, fluctuations and permanence of water

Maduganga in general is shallow, the depth being below 2.5 m at most places. The deepest point recorded has a depth of 3 m with the lowest being 1.25 m. Tidal influence is small with a maximum fluctuation in the lagoon of 10 cm. Therefore the permanence of the water is high.

Tidal range and variations

The tidal range in the sea near the lagoon varies from +0.5 m MSL to -0.4 m MSL. The tidal range in Maduganga is low and depends on the opening of the lagoon mouth and the amount of rainfall. This tidal range is therefore subject to variation. During different measurements in one location the tidal range varied from 0.471m to 0.481m MSL (0.01 m difference) and from 0.351m to 0.451m MSL (0.1 m difference).

Climate

The Maduganga basin is situated in the wet zone of Sri Lanka. During the north-west monsoon coastal river basins experience heavy rainfalls and are often subjected to flooding. The mean monthly air temperature in the period 1986-2002 is on average 27.2°C with a maximum monthly air temperature of 29.9°C and a minimum monthly air temperature of 24.5°C. Fluctuations over the year are relatively low, mean monthly temperatures range from 26.8°C to 28.5°C. In the month of March, April and May the temperatures are higher than in the rest of the year. The diurnal fluctuations can be as high as 7°C in certain months. According to data available at the meteorological station at Galle, the average rainfall is 2217 mm/yr over the period 1986-2002. The rainy months fall during October to November and during April to July. October is the wettest month with an average of 338 mm/month. The lowest rainfall is received during February to March and in August. February is the driest month with an average of 61 mm/month. In the period 1980-1990 the average windspeed was fairly constant with an average of 9.5 km/h. Mean monthly wind speeds are higher during the southwest monsoon period from May until about September. During the northeast monsoon winds are weaker and speed reduces to about 6 km/hr. From April to November predominant wind directions have been from the southwestern quarter. During this period of the northeast monsoon from December until March, wind directions had been highly variable.

15. Physical features of the catchment area:

The total area of the catchment is 6061 ha. The geomorphological features in the catchment are basically similar to those as found in the direct vicinity of Maduganga. As described in chapter 14 the south-western group of crystalline rocks predominates, which is one of the upper Paleozoic rock formations.

These dark colored rocks are locally known as “Kalu gal”. This is the dominant group in the entire southwestern region of Sri Lanka.

In the catchment area red-yellow podzolic soils with soft or hard laterite are found. Also bog and half-bog soils are present.

The most common type of land use in this area is agriculture. A very important crop in this region is cinnamon and large amounts of cinnamon plantations can be found in this region. Also paddy is cultivated abundantly in this area.

The climate in the catchment area is similar to that as described in chapter 14.

16. Hydrological values:

Maduganga has an important role in flood control. After periods of heavy rains this lagoon acts as a retention center. However, when the lagoon mouth is closed this causes floodings in some places along Maduganga. Furthermore it has an important role in nutrient retention. Since large amounts of fertilizers are used in the flourishing cinnamon industry present in this area, run-off causes the entrance of these nutrients in the water body. This prevents pollution of groundwater as it occurs in e.g. Kalpitiya where large amounts of fertilizers make the water unsuitable for drinking purposes. The high concentration of nitrogen and phosphorus in the water body has not yet resulted in algae blooms. There is, however, extensive growth of *Najas marinas*, which is stimulated by these fertilizers.

17. Wetland Types

a) presence:

Marine/coastal:

A	B	C	D	E	F	G	H	I	J	K	Zk(a)
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b) dominance:

1. J. Coastal brackish/saline lagoons: 770 ha
2. I. Intertidal forested wetlands: 156.5 ha
3. H. Intertidal marshes: 43 ha

18. General ecological features:

In Maduganga 10 different vegetation types are present (table 7). Mangroves are the most abundant vegetation type and the mangrove species *Rhizophora apiculata* is the most common species.

Table 7: Wetland vegetation types in Maduganga (Bambaradeniya et al., 2002)

Wetland Vegetation Type	Plant Community	Extent (ha)
1. Mangroves	Rhizophora-Bruguiera-Sonneratia	61
2. Mangrove scrubs	Excoecaria-Lumnitzera-Clerodendrum	20
3. Mangrove mixed swamps	Rhizophora-Dolichandrone-Hibiscus	63
4. Bank scrubs	Hibiscus-Pandanus-Derris	10
5. Tall Shrub swamps	Annona glabra assemblage	0.5
6. Palm swamps	Nypa fruticans assemblage	1
7. Tall sedge brackish marshes	Typha angustifolia assemblage	1
8. Dwarf sedge brackish marshes	Cyperus-Eleocharis-Xyris	19
9. Graminious bogs	Ischaemum-Panicum-Cyperus	23
10. Lentic macrophytes	Nymphaea-Salvinia-Utricularia	0.2
Terrestrial Vegetation Type	Plant Community	Extent (ha)
1. Remnant lowland rainforest	Alstonia-Artocarpus-Wormia-Dillenia	5-8
2. Multi-species home gardens	Cocos-Artocarpus-Mangifera	20-25
3. Perennial crops	Cinnamomum; Cocos; Hevea	190-200

This mixture of vegetation types makes Maduganga an ideal ecotone for numerous bird species. During a survey 111 species belonging to 48 families were found which is approximately 43% of Sri Lanka's native avifauna. About 10% of the total bird species in Maduganga consists of winter migrants. Due to the lack of shoreline and mudflats there is a low occurrence of waders.

19. Noteworthy flora:

Maduganga harbours a small population of a very rare, threatened mangrove species *Lumnitzera littorea*. Furthermore there are 19 endemics species and 8 nationally threatened species which are described in 12. In the surroundings of Maduganga there are 9 invasive alien species (*Annona glabra*, *Alstonia macrophylla*, *Eupatorium odoratum*, *Mikania cordata*, *Hydrilla verticillata*, *Swietenia macrophylla*, *Najas marinas*, *Lantana camara*).

As been mentioned before, the mangrove population is rather unique with 14 species of mangrove and mangrove-associates.

Also worth mentioning is the presence of 4 species of the carnivorous plant of *Utricularia* sp.

20. Noteworthy fauna:

Of noteworthy interest is the presence of the endangered estuarine crocodile (*Crocodylus porosus*) and Mugger (*C.palustris*). Other rare reptiles are the Indian python (*Python molurus*) and the Sri Lanka Kangaroo Lizard (*Otocryptis weigmanni*). The mainland area of Maduganga is one of the few refuges of the threatened Hog Deer (*Axis porcinus*). The small patch of remnant lowland rainforest in the upper reaches of Maduganga harbours three species of threatened arboreal mammals (Purple-faced Leaf Monkey - *Trachypithecus vetulus*, Golden Palm Civet - *Paradoxurus zeylonensis*, and the Slender Loris - *Loris tardigradus*). All these species have a high biodiversity value. The amount of invasive species are quite low with one fish species (Tilapia – *Sarotherodon mossambicus*), two species of terrestrial mollusks (*Laevicaulis alte*, *Achatina fulica*) and three species of mammals (Common ship rat – *Rattus rattus*, House mouse – *Mus musculus*, and feral domestic cats – *Felis catus*).

21. Social and cultural values:

Fisheries

The total fisheries community around Maduganga consist of about 3500 people of who 836 people are directly involved in fishing. The majority of the people go out to the sea while about 110 people fish in the lagoon. Furthermore there are roughly 150 people involved in prawn fishing. Some people catch ornamental fish for export purposes.

Agriculture

Cinnamon cultivation dominates in the area. More than 20% of Sri Lanka's cinnamon cultivation occurs in this region. This industry provides a livelihood to numerous people. Although there has been a slight decrease, coconut cultivation is an important source of income. Due to its saline soils, this area is very suitable for coconut cultivation. About 20% of the cultivated land is paddy; this is therefore an important crop.

Wildlife

Poaching of animals (i.e., Hog deer, mouse deer, Terrapins, Wild boar, Crocodile, Whistling teals and other water fowl) takes places regularly in Maduganga. According to local residents, this practice is now on the increase, as wild meat is purchased and served at some restaurants around Maduganga (Bambaradeniya et al., 2002).

Historic sites

The most prominent historical monument in the Maduganga area is the temple at the Kothduwa island with its sacred bo tree. According to *Bodhiwansha*, a historical chronicle of ancient Sri Lanka, the bo tree at Kothduwa is one of the 32 buds that sprang from the Sri Maha Bodhi in Anuradhapura (Dethis Maha Bodhi). This had been planted here by Minister Deva Pathiraja during the reign of the King Panditha Parakramabahu the second. At the time of planting the bo tree, the area had not been separated as an island from the mainland. According to *Lanka Deepa Warnana*, another historical chronicle, the Sacred Tooth Relic had been kept here for it to be protected from the Portuguese during the period of Weediya Bandara.

Out of eight most sacred places for Buddhists in Sri Lanka (Atamasthana) there are two places which have not been discovered; one being the "Sela Chaithya" (Chaithya made of stones) and the other being the "Diwaguhawa". It is widely believed that the sela chaithya had been built either by King

Devanampiyatissa or King Ghotabhaya in the vicinity of the temple of Kothduwa when it was still connected to the mainland. The place where this chaithya is believed to have existed is called "Galviharaya" today. There had been a rock with ancient scripts close to Galviharaya.

Religious sites

Several old Buddhist temples are found within the Maduganga environs. Some of them are of great historical significance to this area. In addition to the Buddhist temples, there is a mosque at Welithara (Jumma Masjid Mosque) which is known to be over 400 years old. An annual religious festival is held here. There are also two Christian churches at Modera and Wellawatta

Forestry

Clearing of mangroves occurs to start cinnamon cultivation or to construct houses.

22. Land tenure/ownership:

(a) within the Ramsar site

All of the islands in Maduganga are privately owned. The Department of Wildlife Conservation has gazetted one of these islands (Naiduwa – Cobra Island) as a sanctuary. Most of the lands surrounding Maduganga are also privately owned.

(b) in the surrounding area:

Most of the area in the surroundings of Maduganga is privately owned.

23. Current land (including water) use:

(a) within the Ramsar site:

The water of Maduganga is not used for drinking purposes due to its saline condition. In some places the water is used for coconut retting but this occurs on small scale. The main agricultural crops around the lagoon are paddy, coconut, cinnamon, pepper, fruit trees and vegetables. The most economically important crop is cinnamon since around the lagoon there are large areas of cinnamon plantations. According to the Balapitiya D.S.D. about 215 acres are occupied by homesteads. Homesteads are cultivated with vegetables and fruit trees such as Jack and breadfruit. Animal husbandry is of marginal importance in the area. Lack of land is the limiting factor responsible for this low profile. Only a few families engage in animal husbandry as a source of self-employment. Poultry, cattle, goats and pigs are often kept as house animals for an additional income. Coir is a major home industry in the area where Maduganga is located because well-grown coconut plantations are common in the Balapitiya DSD.

(b) in the surroundings/catchment:

The main land use in the catchment is agriculture of rice, coconut and cinnamon.

24. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

(a) within the Ramsar site:

Negative changes:

In the 70's the groynes were build which caused the blockage of the lagoon mouth for the largest time if the year. This causes floodings and prevents the water exchange with the sea.

In order to address the salinity problem of the farmers, the then Minister of Lands and Irrigation launched the Maduganga Salt Water Exclusion Scheme in 1965. Several irrigation channels and structures were made but due to insufficient maintenance most of them are currently not functioning.

The establishment of large amounts of cinnamon plantations and the extensive use of fertilizers are likely to alter the ecological processes as they occur in Maduganga.

Since Maduganga has been declared as a tourism development area, there are currently plans to construct hotels, resorts and other tourism related constructions. At present no zoning plan exists for the area although this is supposed to be produced in 2004 by the relevant authorities.

Several species of invasive alien species and unmanaged domestic animals pose a threat to the biodiversity of Maduganga. These species have been described in 20. Especially the extensive growth of the aquatic weed *Najas marina*, as well as some other aquatic weed species, causes many problems since it hinders navigation for fishermen and replaces the native vegetation. *Annona glabra* is a national problem and also grows abundant on the shores of Maduganga, thus replacing the native vegetation.

Invasive alien faunal species affect the native biodiversity as direct exploiters (ie., predators – feral cats, disease vectors – mollusks, rats and mice) and superior competitors for resources (ie. – Tilapia).

Positive changes:

Maduganga is one of the six special area management sites on the Southwest coast of Sri Lanka which are part of the Coastal Environment and Resource Management Component, Coastal Resources Management Project under the Coast Conservation project. This project is preparing and implements a management plan to address problems with the blocked water exchange, pollution, tourism development, sustainable exploitation of the natural resources etc.

25. Conservation measures taken:

As yet Maduganga has no protected status although several management plans have been prepared.

The conservation value of Maduganga is emphasized by including the lagoon as site no. 70 in a local list of wetlands, which are considered to be of national importance. Due to a mistake the site did not appear in the directory of Asian wetlands.

Maduganga was included in the list of sites for which inventories and management plans were prepared during the Wetland Conservation Project (WCP). This project was funded by the Dutch Government and prepared under the Central Environmental Authority (CEA, 1997). This plan has identified the issues occurring at the site and made suggestions for management activities. So far very few of these activities have been carried out.

The forest department prepared a mangrove conservation plan for 10 different mangrove habitats along the coast. Due to the presence of extensive amounts of mangroves, Maduganga was listed as one of them (Anonymous, 2000).

IUCN Sri Lanka conducted an intensive biodiversity assessment which was financed by the Government of the Netherlands. The results of this study have been published. In this report recommendations for further management are made.

The Dutch Government – ADB funded Coastal Resources Management Project is currently preparing a Special Area Management Plan for Maduganga. This community-oriented integrated coastal zone management plan will be implemented until the end of 2005. During this period, issues with the opening of the lagoon mouth, ecological and socio-economic problems have to be reduced or solved. In order to do so, local stakeholders, resources guardians and managers have been organized into a community coordinating community.

This group identified the issues at the site and discusses regularly about possible solutions. At the time of submitting of this RIS, the first draft of the SAM plans were finalized and several interventions, studies, campaigns and awareness programs have been conducted.

26. Conservation measures proposed but not yet implemented:

As been explained in 25, the CRMP is currently preparing a Special Area Management Plan. After finalizing this plan, numerous interventions will be conducted at the site. At present several interventions have been carried out. This project has started in 2002 and will be finalized in 2006.

27. Current scientific research and facilities:

Currently a large study is being conducted on the hydrology of the lagoon. This is done to prepare a model about the water circulation patterns in Maduganga which will be used to find the best solution for the opening of the lagoon mouth. If agreed upon, the Coastal Resource Management Project will implement the proposed solution. Apart from pure hydrological topics this studies also looks into ecological and physical aspects of Maduganga (e.g. the presence of *Najas marinas*)

28. Current conservation education:

Under the ADB-funded Coastal Resources Management Project several awareness and educational campaigns are organized. In the last year the following events were conducted. At present a Shramadana campaign was organized for cleaning of the area with 3000 people of the area as well as several workshops to educate the tourist boat operators and tour guides.

Within the Coastal Resource Management Project, money has been allocated to construct a visitors center and nature trails. This visitors center, which will be ran by the local community, has to educate local and foreign tourists about the ecological and socio-economic aspect of Maduganga.

Schoolchildren often visit Maduganga and conduct 2-hour boat trips around the lagoon.

29. Current recreation and tourism:

Maduganga has a lot of potential for nature tourism development. The Ceylon Tourist Board declared this area as a tourist development area on 21 October 2002. At present there are only about 10 small scale tourist hotels operative in the vicinity of Maduganga. However, the location is close to tourist towns like Hikkaduwa, Bentota and Ahungalla which makes Maduganga an obvious choice for tourists who are interested in seeing wetland environments.

At present the main recreational activities in Maduganga are boat tours, organized by several boat-tour operators, who take tourists around the lagoon for a two-hour trip. This is a non-seasonal activity.

At present there is not really a clear estimate about how many people visit the area but according to a report prepared by students from the University of Ruhuna every year there are about 95,000 local visitors and about 38,000 foreign visitors.

Furthermore a small book has been prepared by the Ceylon Tourist Board to attract tourists and investors to visit Maduganga (CTB, 2002). It explains about the environment of Maduganga and the potential for tourism.

There are plans for the establishment of more hotels around Maduganga. For this reason the Coastal Resource Management Project has given high priority in preparing a zoning plan to regulate further development in a environmental sustainable way.

30. Jurisdiction:

Territorial Jurisdiction

District Secretary of Galle Mr.P.Hewawasam
Galle Fort
Galle
Tel.: +94 934235

Functional Jurisdiction

There are several different authorities that have authority over some aspects of Maduganga. The most important ones are:

Department of Wildlife Conservation (DWC)
No.18 Gregory's Road, Colombo 7

Central Environmental Authority (CEA)
"Parisara Piyasa"
104, Robert Gunawardena Mw.
Battaramulla

Forest Department
82 Sampathpaya Rajamalwatta Road
Battaramulla

Irrigation Department (ID)
238 Baudhaloka Mw 7
Colombo

Coast Conservation Department
New Secretariat Maligawatta
Colombo 10

31. Management authority:

Coastal Resources Management Project
Regional office / Field Implementation Unit
Coastal Resource Management Project
Mr.U.Pushpakumara
9 TCP Fernando Mt, Ambalangoda

Mr. Ariyaradna
Divisional Secretary
Balapetiya D.S.

Mr.Wanniarachi

32. Bibliographical references:

Bambaradeniya, C. N. B., S. P. Ekanayake, L. D. C. B. Kekulandala, R. H. S. S. Fernando, V. A. P. Samarawickrama and T. G. Priyadharshana (2002). An Assessment of the Status of Biodiversity in the Maduganga Mangrove Estuary. Colombo, IUCN Sri Lanka. 49.

Central Environmental Authority and Euroconsult (1997). Wetland Site Report and Conservation Management Plan--Maduganga Estuary. Colombo, Central Environmental Authority. 78.

Central Engineering Consultancy Bureau. December 2002. Engineering study on the feasibility of preventing the formation of sand bar at the outlet of the Maduganga (Inception Report) Report to the Coastal Resources Management Project.

Central Engineering Consultancy Bureau. 2003. Engineering study on the feasibility of preventing the formation of sand bar at the outlet of the Maduganga (Final Report) Report to the Coastal Resources Management Project.

IUCN, Sri Lanka. 2000a. Conservation Management Plan for ten selected mangrove habitats South of Colombo, Sri Lanka. 96 pp.

Sri Lanka Tourist Board, 2002. Maduganga (river of islands). Ministry of Tourism, Sri Lanka

33. Other documents included

1. Floppy disk with (a) digital copy map of Maduganga, (b) electronic copy of this RIS

2. Sri Lanka Tourist Board, 2002. Maduganga (river of islands). Ministry of Tourism, Sri Lanka

3. Copy of map of Maduganga

4. Bambaradeniya, C. N. B., S. P. Ekanayake, L. D. C. B. Kekulandala, R. H. S. S. Fernando, V. A. P. Samarawickrama and T. G. Priyadharshana (2002). An Assessment of the Status of Biodiversity in the Maduganga Mangrove Estuary. Colombo, IUCN Sri Lanka. 49.

5. Central Environmental Authority and Euroconsult (1997). Wetland Site Report and Conservation Management Plan--Maduganga Estuary. Colombo, Central Environmental Authority. 78.