

PR.15

# ECOLOGICAL ASSESSMENT OF DAMAYANTHI BIRD SANCTUARY, STEEL AUTHORITY OF INDIA, SALEM, TAMIL NADU.

*(Report submitted to Steel Authority of India Limited, Salem)*



P. A. Azeez, S. Bhupathy, R. Sivakumar  
and G. A. Thivakaran

SACON Library



PR15

Salim Ali Centre  
For Ornithology & Natural History  
Coimbatore, Tamil Nadu

March 1996

**ECOLOGICAL ASSESSMENT OF  
DAMAYANTHI BIRD SANCTUARY, STEEL  
AUTHORITY OF INDIA, SALEM, TAMIL  
NADU**

*( Report submitted to Steel Authority of India Limited, Salem)*

**P. A. Azeez, S. Bhupathy, R. Sivakumar  
and G. A. Thivakaran**

**Salim Ali Centre  
For Ornithology & Natural History  
Coimbatore, Tamil Nadu**

*March 1996*

## CONTENTS

1.0 Introduction	1	
2.0 Objectives	1	
3.0 Methods	1	
3.1 Water quality and depth profile	1	
3.2 Flora and vegetation		1
3.3 Fauna		1
4.0 Observations	2	
4.1 Water quality and depth profile	2	
4.2 Flora		3
4.3 Fauna		3
4.4 Habitat requirements of birds	7	
4.5 Water depth requirements for birds	7	
4.6 Food habits of birds		7
5.0 Recommendations	12	
Appendix - I		14
Appendix - I		17

## **1.0 INTRODUCTION**

The Salem Steel Plant, a unit of Steel Authority of India Limited, shows considerable interest in preservation of their environment. The Salem Steel Plant (SSP) has identified a bird sanctuary taking advantage of a low lying area of about 5 ha located in their campus. They propose to develop this area (Figure 1), frequented by a number of water birds, as an ideal waterfowl refuge named " Damayanthi Bird Sanctuary". Hence, SSP invited Salim Ali Centre for Ornithology and Natural History (SACON) to undertake a rapid assessment of the ecological characteristics of the water body to formulate management plan. This report is based on two surveys conducted between November 1995 and January 1996.

## **2.0 OBJECTIVES**

The specific objectives of the present study were to assess the;

- i) depth profile of the water spread area,
- ii) flora (flowering plants),
- iii) fauna (fish, amphibians, reptiles, birds and mammals), and
- iv) to suggest conservation options for creating a better habitat for wintering water birds.

## **3.0 METHODS**

The SACON team made an assessment of the ecology of the water body of Damayanthi Bird Sanctuary (DBS) in November 1995 and January 1996.

### **3.1 Water quality and depth profile**

The water quality data of the wetland, as per the understanding between SSP and SACON, were generated by the SSP. The depth profile was studied by standard methods. Depth at varying distances from the shore was measured and marked on a map.

### **3.2 Flora and vegetation**

The floral species composition and abundance of each species were recorded by intensive search and observations in the catchment of DBS.

### **3.3 Fauna**

Intensive searches were carried out in and around the wetland. Direct observation using a pair of binoculars made to study the list of the bird species. Reptiles and amphibians were recorded on locating them during the intensive search i.e., opportunistic observation. Fish samples were collected using gill and cast nets. The former were put up in the water body for a total of 33h. The total area of the nets was 40.6 m<sup>2</sup>. Samples of benthic sediments were collected and examined for the fauna.

## 4.0 OBSERVATIONS

### 4.1 Water quality and depth profile

The wetland is shallow in most places (Figure 2) with an average depth of 103 cm (10 - 190 cm). The deepest part is towards the LPG road (Figure 3). The eastern portion is very shallow where *Typha* and *Paspalidium / Panicum* are encroaching into. The water is dark brownish and is apparently rich in detritus. Phytoplankton population is negligibly low. The effluents from canteen transport considerable amount of nitrate and phosphates in the wetland (Table 1). Possible reason for the low plankton may be low concentration of certain nutrients in dissolved phase or possible chelation of the trace nutrients by the organic content in water thus reducing their bio-availability. The low number of benthic species also indicate the poor quality of water. The runoff from the catchment of the wetland carries large quantity of allochthonous (terrestrial origin) detrital matter. The treated effluents (almost 150 m<sup>3</sup>/ day) from canteen also contribute organic load to the wetland.

Parameter	DBS wetland	Canteen effluents
pH	8.42	7.37
Total Suspended Solids (mg/l)	2.00	69.00
Total Dissolved Solids (mg/l)	1068.00	504.00
BOD (mg/l)	2.60	96.00
COD (mg/l)	16.00	224.00
Dissolved Oxygen, (mg/l)	4.70	-
Alkalinity (mg/l)	668.00	-
Hardness (mg/l)	470.00	-
Nitrate nitrogen ( as N) mg/l	0.80	0.22
Phosphate (as P) mg/l	0.07	0.17

Figure 2

## 4.2 Flora

Hundred and three species of plants were located in the DBS and its catchment up to a radial distance of 50-100 m. Of these 25 are trees, 20 shrubs, 11 climbers, 10 grasses and 34 herbs (Appendix 1). A few horticultural species planted by the horticultural department of the SAIL were also present. *Prosopis juliflora* occupies more or less 85% of terrestrial vegetation of the wetland. Other species such as *Acacia nilotica*, *Pithecellobium dulce* were also present, but in very few numbers. The water body had very few species of aquatic vegetation. *Typha angustata* was the major emergent species. *Paspalidium flavidum* and *Panicum palidosum* were also seen. Submerged aquatic vegetation, very important food species for migratory waterfowls, was almost absent in the wetland. Only one species, *Ceratophyllum demersum*, was present in the shallow area close to the shores.

## 4.3 Fauna

### Benthic fauna

The benthic sediments are highly enriched with organic matter. The dominant macro benthic organism found in the sediment was *Chironomous* sp, a known detritus feeder. Two species of gastropods (molluscs) namely, *Segmentia* sp. and *Limnaea* sp. were present in the sediment samples. Among the gastropods, the dominant in number was an archaeo-gastropod, *Segmentia* sp. and the rest meso-gastropods. No neo-gastropods were encountered in the sample. Neo-gastropods are predominantly carnivorous and hence their absence in the wetland may be due to the scarcity of benthic organisms. The molluscs present in the DBS are mostly detrital feeders. One species of crab was present in the wetland. The density of benthic organism was very low; the chironomids were 1 / Kg wet weight of sediment and gastropods 5 / Kg.

### Fish

Eventhough gill nets were operated for 33h overnight and cast-nets more than six times, no other species of fish except *Tilapia mosambica*, which was reported to be introduced in the wetland 2-3 years back, could be recorded (Table 2). The size of the fishes ranged between 10 to 32 cm. *T. mosambica*, an African species, introduced in India by Central Marine Fisheries Research Institute (CMFRI) during 1952 in order to boost the inland fishery potential, is a prolific breeder and is capable of thriving under widely varying environmental conditions. It is a buccal spawner and exhibit high degree of parental care. Because of its ability to tolerate wide ranges of environmental conditions and capability to breed in prolific numbers, it is highly capable to limit occurrence of other species or to eliminate other species in its habitat. Food of the species includes molluscs, insects and other small aquatic organisms.

Table 2. Fish and amphibians in DBS (based on sightings and literature)		
	Scientific name	Common name
Fish		
1.00	<i>Tilapia mosambica</i>	Tilapia
Amphibians		
1.00	<i>Bufo melanostictus</i>	Indian Toad
2.00	<i>Microhyla ornata</i> *	Ornate Microhyla
3.00	<i>Rana tigerina</i> *	Indian Bull Frog
4.00	<i>Rana breviceps</i> *	Indian Burrowing Frog
5.00	<i>Rana limnocharis</i> *	Indian Skipper Frog
6.00	<i>Rana hexadactyla</i>	Indian Green Frog
7.00	<i>Rana cyanophlyctis</i>	Common Indian Frog
* Probable species		

### Amphibians, Reptiles and Mammals

Three species of amphibians were sighted in and around the wetland; another four species are likely to occur (Table 2). Occurrence of reptiles (Table 3) and amphibian species are underestimated due to the short duration of the survey and the cryptic and secretive nature of these animals. Three species of mammals were recorded and another two are likely to exist in the area (Table 4). The Bonnet Macaque is an accidentally introduced species.

Table 3. Reptiles in the DBS (based on sightings and literature)		
	Scientific name	Common name
1.00	<i>Hemidactylus frenatus</i>	House Gecko
2.00	<i>Hemidactylus brooki</i>	Brook's Gecko
3.00	<i>Hemidactylus leshnaulti</i> *	Bark Gecko
4.00	<i>Hemidactylus tridureus</i> *	Termite Hill Gecko
5.00	<i>Calotes versicolor</i>	Garden Lizard
6.00	<i>Sitana ponticeriana</i> *	Fanthroated Lizard
7.00	<i>Mabuya carinata</i>	Common Skink
8.00	<i>Mabuya trivittata</i>	Skink
9.00	<i>Varanus bengalensis</i> *	Common Monitor
10.00	<i>Typhlina brahminus</i> *	Common Worm Snake
11.00	<i>Ahaetulla nasutus</i>	Green Whip Snake
12.00	<i>Dendrelaphis tristis</i>	Bronzebacked Tree Snake
13.00	<i>Ptyas mucosus</i>	Dhaman or Rat Snake
14.00	<i>Xenochropis piscator</i> *	Checkered Keelback
15.00	<i>Naja naja</i> *	Indian Cobra
16.00	<i>Bungarus caeruleus</i> *	Common Krait
* Probable species		

Table 4. Mammals in the DBS (based on sightings and literature)		
	Scientific name	Common name
1.00	<i>Felis chaus</i> *	Jungle Cat
2.00	<i>Funambulus palmarum</i>	Palm Squirrel
3.00	<i>Herpestes edwardsii</i>	Common Mongoose
4.00	<i>Lepus nigricollis</i> *	Blacknaped Hare
5.00	<i>Macaca radiata</i> #	Bonnet Macaque



## Birds

Seventy six bird species have been recorded in and around the wetland during January (Appendix 2), of which 65 are resident or local migrants and 11 trans Himalayan migrants. Thirty species are aquatic, inhabiting the water spread area of the DBS. Of these, 14 species (48%) are likely to breed inside the sanctuary. However, it is to be confirmed by a survey during monsoon.

### Abundance of aquatic birds

A total of 1509 individuals of 30 species of water birds were recorded (Table 5) in the DBS during the present study. Of which nine were migratory, contributing 69 % of the total aquatic bird population (in winter). Ducks, contributed 71% while fish eating birds 25% of the total population of the water birds. Two species namely, Pintail (51%) and Night Heron (13%) dominated the aquatic bird population.

Table 5 Comparative abundance of waterbirds in the DBS

Species	Number	Status	Species	Number	Status
Little Grebe	5.00	R, B	Gadwall	2.00	M
Large Cormorant	80.00	R, B?	Garganey Teal	50.00	M
Little Cormorant	5.00	R, B?	Shoveller	100.00	M
Darter or Snake Bird	5.00	R, B?	Marsh Harrier	1.00	M
Purple Heron	4.00	R, B?	Whitebreasted Waterhen	1.00	R, B
Large Egret	3.00	R, B?	Indian Moorhen	25.00	R, B
Pond Heron or Paddy Bird	25.00	R, B?	Purple Moorhen	5.00	R, B
Cattle Egret	5.00	R, B?	Coot	1.00	M, R
Smaller (Median) Egret	30.00	R, B?	Redwattled Lapwing	4.00	R, B
Little Egret	20.00	R, B?	Marsh Sandpiper	2.00	M
Night Heron	200.00	R, B	Wood Sandpiper	1.00	M
Openbill Stork*	1.00	R	Common Sandpiper	2.00	M
Pintail	800.00	M	Lesser Pied Kingfisher	4.00	R
Common Teal	80.00	M	Small Blue Kingfisher	4.00	R
Spotbill	40.00	R, B?	Whitebreasted Kingfisher	4.00	R

\* Reported to be present, but not encountered during the survey, R = resident, B = breeding, ? Status unknown and survey during monsoon required

#### **4.4 Habitat requirements of birds**

##### **Resident birds**

Birds which occur throughout the year in an area or observed breeding in an area are considered resident. Twenty one species of water birds present in DBS may be resident (Table 6). Most of the resident species prefer habitats such as openwater (with out emergent vegetation) and shallow water with aquatic vegetation for feeding. Most of the water birds require trees for resting, roosting and breeding (i.e., nesting).

##### **Migratory birds**

Birds that use an area seasonally and visiting at regular intervals from beyond the border of the country are known as migratory birds. Most of the migratory species require shallow water with aquatic vegetation for feeding and mounds surrounded by water for resting (Table 7).

#### **4.5 Water depth requirements for birds**

Among the 30 species of water birds present in DBS, six require water depth above 50 cm (deep water), 13 between 10-50 cm (shallow water) and seven species prefer drying water body i.e., 0-10 cm water for effective feeding (Table 8).

#### **4.6 Food habits of birds**

In general, the water birds of DBS can be classified as herbivore (feeding on plant), carnivore (feeding on animals) and omnivore (feeding on both plants and animals). Majority of them (21 species) are carnivores consuming fishes, reptiles, birds and insects. Eight species were herbivores (Table 9).

Table 6. Habitat required for resident birds

Species	Required habitat for		
	Feeding	Resting	Breeding
Cattle Egret	Shallow water with vegetation	Trees	Trees
Darter or Snake Bird	Openwater	Trees	Trees surrounded by water
Indian Moorhen	Water with reeds	Trees nearby water	Trees adjacent to water
Large Cormorant	Openwater	Trees	Trees surrounded by water
Large Egret	Shallow water with sparse vegetation	Trees	Trees surrounded by water
Little Grebe	Open water	Open water	Floating vegetations
Little Egret	Shallow water with sparse vegetation	Trees	Trees surrounded by water
Little Cormorant	Openwater	Trees	Trees surrounded by water
Night Heron	Shallow water with sparse vegetation	Trees	Trees surrounded by water
Openbill Stork	Shallow water	Trees	Trees surrounded by water
Pond Heron	Shallow water with sparse vegetation	Tree / reed	Trees surrounded by water
Purple Moorhen	Water with thick mat of vegetation	Reed beds	Reed beds
Purple Heron	Shallow water with vegetation	Trees	Trees surrounded by water
Smaller (Median) Egret	Shallow water with vegetation	Trees	Trees surrounded by water
Spotbill	Shallow water with submerged vegetation	Mounds	Reed beds
Whitebreasted Waterhen	Shallow water with vegetation	Trees nearby water	Trees adjacent to water

Name of the bird	Habitat Requirement	
	Feeding	Resting
Common Teal	Shallow water with sparse emergent vegetation	Mounds
Common Sandpiper	Mud flat	Mud flat
Coot	Openwater	Mounds & reeds
Gadwall	Shallow water with submerged vegetation	Mounds
Garganey Teal	Shallow water with submerged vegetation	Mounds
Marsh Sandpiper	Mud flat	Mud flat
Marsh Harrier	*	Trees
Pintail	Shallow water with submerged vegetation	Mounds
Shoveller	Shallow water with submerged vegetation	Mounds
Wood Sandpiper	Mud flat	Mud flat
*Habitat not specific		

Species	Water depth (cm)	Species	Water depth (cm)
Cattle Egret	0-10	Common Teal	<50
Darter or Snake Bird	50-150	Common Sandpiper	0-10
Large Cormorant	50-150	Coot	40-80
Large Egret	<40	Gadwall	30-50
Little Grebe	50-150	Garganey Teal	20-40
Little Egret	10-20	Indian Moorhen	40-60
Little Cormorant	50-150	Marsh Sandpiper	0-10
Night Heron	10-60	Purple Moorhen	10-60
Openbill Stork	10-40	Shoveller	20-50
Pintail	40-60	Spotbill	30-50
Pond Heron	0-10	Whitebreasted Waterhen	0-20
Purple Heron	<40	Wood Sandpiper	0-10
Smaller (Median) Egret	10-30		
Note: Marsh Harrier and King fishers are omitted from analyses as the former hunt for prey and the latter dive at the prey.			

Table 9. Food habits of water birds observed in the DBS		
Species	Food	Category
Cattle Egret	Insect, fish	Carnivore
Common Sandpiper	Worms	Carnivore
Common Teal	Grass, seeds, insects	Herbivore
Coot	Water plants	Herbivore
Darter or Snake Bird	Fish	Carnivore
Gadwall	Water plants	Herbivore
Garganey Teal	Water plants	Herbivore
Indian Moorhen	Water plants, insects	Omnivore
Large Cormorant	Fish	Carnivore
Large Egret	Fish, reptile	Carnivore
Lesser Pied Kingfisher	Fish	Carnivore
Little Grebe	Fish, insects	Carnivore
Little Egret	Fish, insect	Carnivore
Little Cormorant	Fish	Canivore
Marsh Harrier	Fish, bird	Carnivore
Marsh Sandpiper	Worms	Carnivore
Night Heron	Fish	Carnivore
Openbill Stork	Molluscs	Carnivore
Pintail	Grass, seeds	Herbivore
Pond Heron or Paddy Bird	Fish, insect	Carnivore
Purple Heron	Fish, reptile	Carnivore
Purple Moorhen	Grass, reed	Herbivore
Shoveller	Water plants, seeds, insects	Omnivore
Small Blue Kingfisher	Fish, insect	Carnivore
Smaller (Median) Egret	Fish	Carnivore
Spotbill	Grass, seeds, insect	Omnivore
Whitebreasted Waterhen	Insects	Carnivore
Whitebreasted Kingfisher	Insect, fish, reptile	Carnivore
Wood Sandpiper	Worms	Carnivore

Species	Size (cm)	Species	Size (cm)
Cattle Egret	<15	Lesser Pied Kingfisher	<10
Darter or Snake Bird	<20	Little Egret	<15
Large Egret	<10	Little Grebe	-
Large Cormorant	<20	Marsh Harrier	-
Little Cormorant	<15	Night Heron	<15
Pond Heron or Paddy Bird	<15	Small Blue Kingfisher	<5
Purple Heron	<15	Whitebreasted Kingfisher	<15
Smaller (Median) Egret	<15		

Ref: Vijayan, V. S (1991) Keoladeo National Park Ecology study, Bombay Natuural History Society, Bombay.

Scientific name	Common Name	Remarks
1. <i>Wallagu attu</i> 00	Fresh water shark	Voraciously carnivorous. Do not breed in wetlands and population is not expected to increase.
2. <i>Clarias batrachus</i> 00	Magur	Air breather. Grows and breeds in streams, ponds and wetlands
3. <i>Mystus keletius</i> 00	Cat fish	Air breather. Facultative feeders.
4. <i>Channa orientalis</i> 00	Snake head	Air breather, inhabiting muddy bottom with vegetation. Feeds on worms, insects and other small benthic organisms.
5. <i>Channa striatus</i> 00	Striped snake head	Feeds on fishes, tadpoles and insects and zooplanktons.
6. <i>Channa punctatus</i> 00	Green snake head	Highly predatory and markedly piscivorous. Feeds on fish, insects, shrimps, molluscs. Fry feeds on phytoplanktons and planktonic larvae.
7.0 <i>Chela (oxygaster) cachinus</i> 0	Rasbora	Prolific breeder in ponds, lakes and small streams. Maximum size 6 cm. Feeds on small insects and other aquatic organisms.
8.0 <i>Ambassis nama</i> 0 ( <i>Chanda nama</i> )	-	Common in estuaries and freshwater lakes. Feeds on larvae and other small insects. Used to control mosquito
9. <i>Ompok bimaculatus</i> 00	Butter catfish	Feeds on insects and molluscs. Grows to a size of 20 cms.
10. <i>Etroplus suratensis</i> .0	Banded pearlspot	Tolerates wide range of environmental conditions. Feeds on insects, small molluscs and phytoplanktons.

0			
11 .0 0	<i>Puntius fasciatus</i>	Melan carp	
12 .0 0	<i>Puntius carnaticus</i>	Carnatic carp	

## 5.0 RECOMMENDATIONS

### Water quality

1. The residence time of the effluents from canteen in the aeration pond may be increased further to reduce the organic load.
2. Phytoplankton are negligibly low in the water. Only with a sufficient population of phytoplankton and zooplankton in the wetland, establishment of a viable animal community is possible. A rapid investigation into the water quality, with emphasis on micro-nutrients is necessary to determine the reasons for the state of plankton community in the wetland and to suggest ways to establish a viable plankton community.

### Fish

3. *Tilapia mosambica*, the only species of fish recorded in DBS during the survey, is known to hinder the growth of other fishes. *Tilapia* have almost completely eclipsed other species, which should have been present in the past, in terms of comparative abundance. As long as *Tilapia* remains in the wetland in such large numbers, it is difficult for other species to establish a viable population. Hence, *Tilapia* needs to be preferentially harvested so as to enable colonization of other fishes. This may be done by extensive gill netting.
4. After the removal of *Tilapia*, fish species which are commonly seen in the water bodies in the environs of Salem can be introduced. No exotics should be introduced, even if they are present in the water bodies outside the sanctuary.
5. The fish seeds for introduction may be collected at the onset of monsoon from the local water bodies or from the water inlet, at the source, to SAIL from river Cauveri and from available fishery sources. Non commercial species of fish are preferred for introduction in DBS.
6. Fish form a major food item for eight to ten species of water birds of DBS. The preferred size of prey for these birds are < 20 cm (Table 10), which has to be given due consideration in selecting the species for introduction. The recommended species for introduction is given in Table 11.

### Water depth

7. The ideal water depth for the birds wintering inside the sanctuary would be 20-50 cm. Hence, a major portion of the water spread area may be maintained with water less than 60 cm. *Typha* and *Paspalidium / Panicum* which have encroached the shallow water area towards the eastern side of the wetland may be partially cleared to make shallow water area with depth <60 cm available for birds (Figure 4).
8. Many migratory ducks require mounds surrounded by water or shallow water with thick vegetation cover for resting during day hours and hence, a few mounds, approximately 7-8 meter diameter, may be created and babul (*Acacia nilotica*) planted for cover. At present no suitable mounds exist in the wetland for the birds to rest (Figure 4). The babul tree (*Acacia nilotica*), which is comparatively tolerant to flood and grows satisfactorily in inundated areas would facilitate the breeding of resident birds especially, the fish eating colonial nesters.
9. The thick *Typha* and grass cover will gradually lead to siltation and detritus accumulation in the water body leading to filling up of the wetland. Hence, *Typha* and grass patch need to be controlled by partial removal.

## Flora

10. Presently the interface between the wetland and terrestrial habitat is more or less completely covered with *Prosopis juliflora*, which is comparatively less tolerant to water and hence, long inundation leads to its death. The species may be partially replaced by species such as *Acacia nilotica*, *Pithecellobium dulce*, *Ziziphus mauritiana*, *Ficus benghalensis* and *Pongamia pinnata* (Figure 4). These species may be spaced in such a way depending on their tolerance to inundation.
12. About 75% (belonging to only eight species) of the total aquatic bird populations of the DBS is herbivore. During winter, most of the migratory water birds are herbivorous and prefer submerged water plants. However, the DBS is almost devoid of submerged water plants. Only a single submerged species, namely *Ceratophyllum demersum* covering an area much less than 1%, is present in the wetland. Hence, a few common water plants such as *Nymphaea* sp., *Nymphoides* sp., *Otella* sp., *Hydrilla* sp. and *Potamogeton* sp. may be introduced to supplement the necessary habitats to retain the migratory species through out winter.
13. Visitors to the Sanctuary may be kept minimal. However, one 20 m high well hidden watch tower may be erected on the side of railway line and one 10 m high watch tower may be built on the side of CRM road towards canteen (Figure 4) for catering the need of visitors. This will also reduce disturbance to birds.
14. A short term survey during monsoon is required to identify and estimate the breeding species within the Sanctuary premises.
15. A proper inventory of bird population may be maintained using the available personnel with SAIL.
16. Any physical development activity in the wetland should be done with minimum labour and



maximum care to minimize disturbance in the area and better it must be completed before monsoon (May- June) as many resident birds start breeding with the onset of monsoon.

Appendix 1. Flora in and around the DBS			
Species		Remarks	Habitat
1.00	<i>Abrus precatorius</i>	Climber	Terrestrial
2.00	<i>Abutilon indicum</i>	Shrub	Terrestrial
3.00	<i>Acacia nilotica</i>	Tree	Terrestrial
4.00	<i>Acalypha fruticosa</i>	Shrub	Terrestrial
5.00	<i>Acalypha indica</i>	Shrub	Terrestrial
6.00	<i>Achyranthes aspera</i>	Herb	Terrestrial
7.00	<i>Aerva lanata</i>	Herb	Terrestrial
8.00	<i>Aerva javanica</i>	Shrub	Terrestrial
9.00	<i>Ailanthus excelsa</i>	Tree	Terrestrial
10.00	<i>Albizia lebeck</i>	Tree	Terrestrial
11.00	<i>Albizia amara</i>	Tree	Terrestrial
12.00	<i>Alstonia scholaris</i>	Tree	Terrestrial
13.00	<i>Alternanthera sessilis</i>	Herb	Marshy
14.00	<i>Amaranthus viridis</i>	Herb	Terrestrial
15.00	<i>Apluda mutica</i>	Grass	Terrestrial
16.00	<i>Aristida funiculata</i>	Grass	Terrestrial
17.00	<i>Azadirachta indica</i>	Tree	Terrestrial
18.00	<i>Barleria cuspidata</i>	Shrub	Terrestrial
19.00	<i>Boerhavia diffusa</i>	Herb	Terrestrial
20.00	<i>Borassus flabellifer</i>	Tree	Terrestrial
21.00	<i>Calotropis gigantea</i>	Shrub	Terrestrial
22.00	<i>Cardiospermum halicacabum</i>	Climber	Terrestrial
23.00	<i>Carica papaya</i>	Tree	Terrestrial

0			
24.0 0	<i>Casuarina equisetifolia</i>	Tree	Terrestrial
25.0 0	<i>Celosia argentea</i>	Herb	Terrestrial
26.0 0	<i>Ceratophyllum demersum.</i>	Submerged	Aquatic
27.0 0	<i>Chloris barbata</i>	Grass	Terrestrial
28.0 0	<i>Cissampelos pareira</i>	Climber	Terrestrial
29.0 0	<i>Citrulus lanatus</i>	Herb	Terrestrial
30.0 0	<i>Cleome viscosa</i>	Herb	Terrestrial
31.0 0	<i>Coccinia indica</i>	Climber	Terrestrial
32.0 0	<i>Corchorus tridens</i>	Herb	Terrestrial
33.0 0	<i>Crotalaria laburnifolia</i>	Herb	Terrestrial
34.0 0	<i>Crotalaria sp</i>	Herb	Terrestrial
35.0 0	<i>Croton bonplandianum</i>	Herb	Terrestrial
36.0 0	<i>Cymbopogon sp</i>	Grass	Terrestrial
37.0 0	<i>Cynodon dactylon</i>	Grass	Terrestrial
38.0 0	<i>Cyperus rotundus</i>	Sedge	Terrestrial
39.0 0	<i>Dactyloctenium aegyptium</i>	Grass	Terrestrial
40.0 0	<i>Datura stramonium</i>	Shrub	Terrestrial
41.0 0	<i>Delonix elata</i>	Tree	Terrestrial
42.0 0	<i>Diplocyclos palmatus</i>	Climber	Terrestrial
43.0 0	<i>Eupatorium odoratum</i>	Shrub	Terrestrial
44.0 0	<i>Euphorbia hirta</i>	Herb	Terrestrial

45.0 0	<i>Ficus religiosa</i>	Tree	Terrestrial
46.0 0	<i>Ficus benghalensis</i>	Tree	Terrestrial
47.0 0	<i>Guazuma tomentosa</i>	Tree	Terrestrial
48.0 0	<i>Heliotropium sp</i>	Herb	Terrestrial
49.0 0	<i>Hibiscus ovalifolius</i>	Shrub	Terrestrial
50.0 0	<i>Hyptis suaveolens</i>	Herb	Terrestrial
51.0 0	<i>Indigofera oblongifolia</i>	Shrub	Terrestrial
52.0 0	<i>Ipomoea Sp</i>	Climber	Terrestrial
53.0 0	<i>Ipomoea obscura</i>	Climber	Terrestrial
54.0 0	<i>Jatropha curcas</i>	Shrub	Terrestrial
55.0 0	<i>Justicia tranquebariensis</i>	Herb	Terrestrial
56.0 0	<i>Justicia sp</i>	Herb	Terrestrial
57.0 0	<i>Kedrostis foetidissima</i>	Climber	Terrestrial
58.0 0	<i>Lantana camara</i>	Shrub	Terrestrial
59.0 0	<i>Leucas aspera</i>	Herb	Terrestrial
60.0 0	<i>Madhuca indica</i>	Tree	Terrestrial
61.0 0	<i>Martynia annua</i>	Herb	Terrestrial
62.0 0	<i>Morinda pubescens</i>	Tree	Terrestrial
63.0 0	<i>Moringa oleifera</i>	Tree	Terrestrial
64.0 0	<i>Mukia maderaspatana</i>	Climber	Terrestrial
65.0 0	<i>Murraya koenigii</i>	Shrub	Terrestrial
66.0	<i>Neonotis nepitiifolia</i>		Terrestrial

0			
67.0 0	<i>Nerium odorum</i>	Shrub	Terrestrial
68.0 0	<i>Panicum notatum</i>	Grass	Terrestrial
69.0 0	<i>Parthenium hysterophorus</i>	Herb	Terrestrial
70.0 0	<i>Paspalidium flavidum</i>	Grass	Marshy
71.0 0	<i>Pavonia zeylanica</i>	Herb	Terrestrial
72.0 0	<i>Pedaliium murex</i>	Shrub	Terrestrial
73.0 0	<i>Pergularia daemia</i>	Climber	Terrestrial
74.0 0	<i>Peristrophe bicalyculata</i>	Herb	Terrestrial
75.0 0	<i>Phyla nodiflora</i>	Herb	Marshy
76.0 0	<i>Phyllanthus maderaspatensis</i>	Herb	Terrestrial
77.0 0	<i>Phyllanthus reticulatus</i>	Shrub	Terrestrial
78.0 0	<i>Phyllanthus amarus</i>	Herb	Terrestrial
79.0 0	<i>Physalis minima</i>	Herb	Terrestrial
80.0 0	<i>Pithecellobium dulce</i>	Tree	Terrestrial
81.0 0	<i>Polygonum sp</i>	Shrub	Marshy
82.0 0	<i>Prosopis chilensis</i>	Tree	Terrestrial
83.0 0	<i>Rhynchosia minima</i>	Herb	Terrestrial
84.0 0	<i>Rhynchosia viscosa</i>	Herb	Terrestrial
85.0 0	<i>Rhynchylytrum sp</i>	Grass	Terrestrial
86.0 0	<i>Ricinus communis</i>	Tree	Terrestrial
87.0 0	<i>Samanea saman</i>	Tree	Terrestrial

88.0 0	<i>Sesbania speciosa</i>	Shrub	Terrestrial
89.0 0	<i>Sida acuta</i>	Herb	Terrestrial
90.0 0	<i>Spathodea campanulata</i>	Tree	Terrestrial
91.0 0	<i>Tamarindus indica</i>	Tree	Terrestrial
92.0 0	<i>Tectona grandis</i>	Tree	Terrestrial
93.0 0	<i>Tephrosia purpurea</i>	Herb	Terrestrial
94.0 0	<i>Tridax procumbens</i>	Herb	Terrestrial
95.0 0	<i>Tylophora indica</i>	Climber	Terrestrial
96.0 0	<i>Typha angustata</i>	Sedge	Aquatic / Marshy
97.0 0	<i>Vernonia albicans</i>	Herb	Terrestrial
98.0 0	<i>Vicoa indica ?</i>	Herb	Terrestrial
99.0 0	<i>Vigna trilobata</i>	Herb	Terrestrial
100. 00	<i>Vitex negundo</i>	Shrub	Terrestrial
101. 00	<i>Wrightia tinctoria</i>	Tree	Terrestrial
102. 00	<i>Ziziphus mauritiana</i>	Tree	Terrestrial
103. 00	<i>Zoysia matrella</i>	Grass	Terrestrial

Appendix 2 Birds in the DBS			
Scientific name		Common name	Status
1.0 0	<i>Accipiter badius</i>	Indian Shikra	R
2.0 0	<i>Acridotheres tristis</i>	Common Myna	R
3.0 0	<i>Acrocephalus stentoreus</i>	Indian Great Reed Warbler	M

4.0 0	<i>Alauda gulgula</i>	Skylark	R
5.0 0	<i>Alcedo atthis</i>	Small Blue Kingfisher	R
6.0 0	<i>Amaurornis phoenicurus</i>	Whitebreasted Waterhen	R
7.0 0	<i>Anas strepera</i>	Gadwall	M
8.0 0	<i>Anas querquedula</i>	Garganey Teal	M
9.0 0	<i>Anas clypeata</i>	Shoveller	M
10. 00	<i>Anas acuta</i>	Pintail	M
11. 00	<i>Anas crecca</i>	Common Teal	M
12. 00	<i>Anas poecilorhyncha</i>	Spotbill	R, LM
13. 00	<i>Anastomus oscitans</i> *	Openbill Stork	R, LM
14. 00	<i>Anhinga rufa</i>	Darter or Snake-bird	R,LM
15. 00	<i>Apus affinis</i>	House Swift	R
16. 00	<i>Ardea purpurea</i>	Purple Heron	R, LM
17. 00	<i>Ardea alba</i>	Large Egret	R, LM
18. 00	<i>Ardeola grayii</i>	Pond Heron or Paddy bird	R,LM
19. 00	<i>Athene brama</i>	Spotted Owlet	R
20. 00	<i>Bubulcus ibis</i>	Cattle Egret	R
21. 00	<i>Centropus sinensis</i>	Crow-Pheasant	R
22. 00	<i>Ceryle rudis</i>	Lesser Pied Kingfisher	R
23. 00	<i>Circus aeruginosus</i>	Marsh Harrier	M
24. 00	<i>Clamator jacobinus</i>	Pied Crested Cuckoo	R

25. 00	<i>Columba livia</i>	Blue Rock Pigeon	R
26. 00	<i>Copsychus saularis</i>	Magpie Robin	R
27. 00	<i>Coracias benghalensis</i>	Indian Roller	R
28. 00	<i>Corvus splendens</i>	House Crow	R
29. 00	<i>Corvus macrorhynchos</i>	Jungle Crow	R
30. 00	<i>Cuculus canorus</i>	Cuckoo	R
31. 00	<i>Cypsiurus parvus</i>	Palm Swift	R
32. 00	<i>Dendrocitta vagabunda</i>	Tree Pie	R
33. 00	<i>Dicrurus adsimilis</i>	Black Drongo	R
34. 00	<i>Dinopium benghalense</i>	Goldenbacked Woodpecker	R
35. 00	<i>Egretta intermedia</i>	Smaller (Median) Egret	R,LM
36. 00	<i>Egretta garzetta</i>	Little Egret	R
37. 00	<i>Elanus caeruleus</i>	Blackwinged Kite	R
38. 00	<i>Eudynamys scolopacea</i>	Koel	R
39. 00	<i>Francolinus pondicerianus</i>	Grey Partridge	R
40. 00	<i>Fulica atra</i>	Coot	R, LM
41. 00	<i>Gallinula chloropus</i>	Indian Moorhen	R
42. 00	<i>Halcyon smyrnensis</i>	Whitebreasted Kingfisher	R
43. 00	<i>Haliastur indus</i>	Brahminy Kite	R
44. 00	<i>Hirundo smithii</i>	Wire-tailed Swallow	R
45. 00	<i>Lonchura punctulata</i>	Spotted Munia	R

46. 00	<i>Megalaima haemacephala</i>	Crimsonthroated Barbet	R
47. 00	<i>Merops philippinus</i>	Bluetailed Bee-eater	R
48. 00	<i>Merops orientalis</i>	Small Green Bee-eater	R
49. 00	<i>Milvus migrans</i>	Pariah Kite	R
50. 00	<i>Motacilla caspica</i>	Grey Wagtail	R?
51. 00	<i>Motacilla alba</i>	Pied or White Wagtail	R?
52. 00	<i>Nectarinia asiatica</i>	Purple Sunbird	R
53. 00	<i>Nycticorax nycticorax</i>	Night Heron	R
54. 00	<i>Oriolus oriolus</i>	Golden Oriole	R
55. 00	<i>Orthotomus sutorius</i>	Tailor Bird	R
56. 00	<i>Passer domesticus</i>	House Sparrow	R
57. 00	<i>Petronia xanthocollis</i>	Yellowthroated Sparrow	R
58. 00	<i>Phalacrocorax carbo</i>	Large Cormorant	R, LM
59. 00	<i>Phalacrocorax niger</i>	Little Cormorant	R
60. 00	<i>Podiceps ruficollis</i>	Little Grebe	R, LM
61. 00	<i>Porphyrio porphyrio</i>	Purple Moorhen	R
62. 00	<i>Prinia socialis</i>	Ashy Wren-warbler	M?
63. 00	<i>Psittacula krameri</i>	Rose-ringed Parakeet	R
64. 00	<i>Pycnonotus cafer</i>	Redvented Bulbul	R
65. 00	<i>Saxicola caprata</i>	Pied Bush Chat	R
66. 00	<i>Saxicoloides fulicata</i>	Indian Robin	R



67. 00	<i>Streptopelia chinensis</i>	Spotted Dove	R
68. 00	<i>Sturnus pagodarum</i>	Blackheaded Myna	R
69. 00	<i>Terpsiphone paradisi</i>	Paradise Flycatcher	R
70. 00	<i>Tringa glareola</i>	Wood Sandpiper	M
71. 00	<i>Tringa stagnatilis</i>	Marsh Sandpiper	M
72. 00	<i>Tringa hypoleucos</i>	Common Sandpiper	M
73. 00	<i>Turdoides striatus</i>	Jungle Babbler	R
74. 00	<i>Tyto alba</i> *	Barn Owl	R
75. 00	<i>Upupa epops</i>	Hoopoe	R
76. 00	<i>Vanellus indicus</i>	Redwattled Lapwing	R

\*reported to be present, but note encountered during the survey

## Water depth profile of Damayanthi Bird Sanctuary

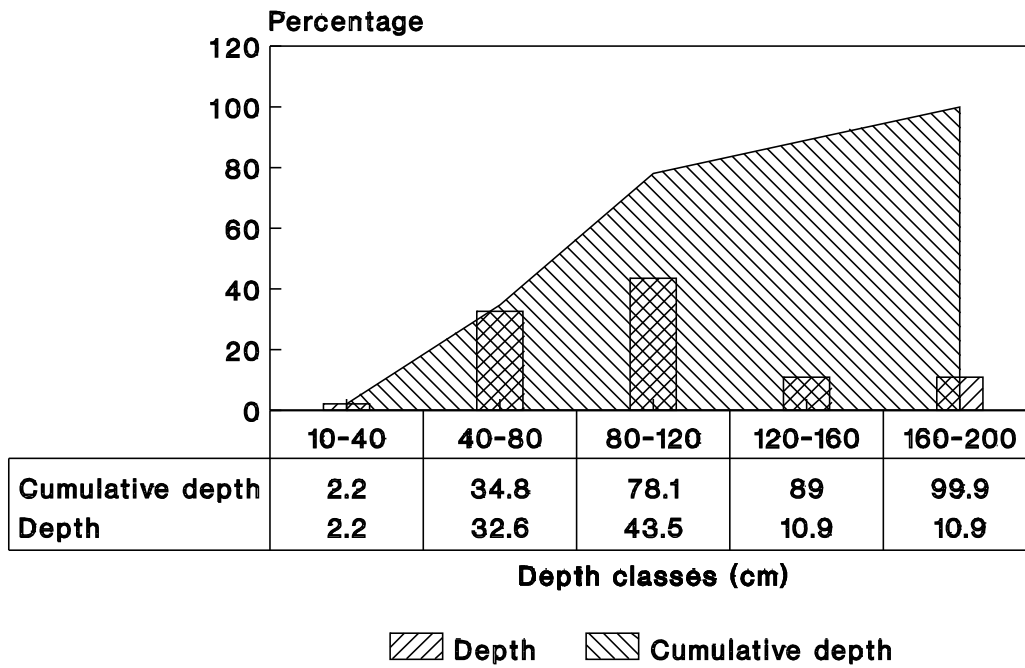


Figure 1: Damayanthi Bird Sanctuary

Figure 3: Damayanthi Bird Sanctuary - Depth profile

Figure 4: Damayanthi Bird Sanctuary - Management options (Area marked for 1 - mounts, 2 - *Typha* removal, 3 - Grass removal, 4- Watch tower, 5 - Tree planting)