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DOCUMENTATION OF VERTEBRATE FAUNA IN MANGALAVANAM MANGROVE AREA

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ABSTRACT

Vertebrate fauna of Mangalavanam mangrove area was studied from May 1998 to May 1999 mainly based on observational methods. Three species of reptiles and seven species of fishes were collected from the area. Forty-two species of birds were recorded, representing 12 Orders and 24 Families. The most common bird species found at Mangalavanam were little cormorant *(Phalacrocorax niger)* and night heron *(Nycticorax nycticorax).* Highest species richness of birds was found in the months of May and July. Nesting of little cormorant and night heron was observed from February to July. House crow was the main predator of eggs and nestlings of these two species.

The area is an ideal roosting site for little cormorant and night heron. Total roosting population was the highest in the month of December and lowest in June. Peak time of arrival of little cormorant was from 1720 to 1800 hours, and in the case of night heron, maximum number of birds left the roost between 1845 and 1900 hours. Five species of mammals were recorded from the area. The major factors which are detrimental to the ecosystem are: 1. Proposal to lease part of the land to a Trust. 2. Parking of oil tankers in the Salim Ali Road, 3. Dumping of waste in the lake. 4. Air pollution due to the unloading of cement. 5. Encroachment of puramboke land on the eastern side and 6. Uncontrolled growth of weeds in the lake. Recommendations for better management of the Mangalavanam have been

1. INTRODUCTION

Mangrove is a comples ecosystem consisting of all examples of plants of unrelated species converged in a similar habitat. The vegetation consists of evergreen trees and shrubs belonging to several unrelated Families and share similar habitat and similar physiognomy (Chand Basha, 1992). Mangroves occur in two formations *viz.* Western formations consisting of the coasts of America, the West Indies and West Africa and eastern formation along the coasts of India, East Africa, Malay and so on.

In Kerala, mangroves are distributed in Keeryad Islaiid. northern part of Kochi Port and Research farm at Puthuvypu. Mahe to Dharmadam coastal belt, Mallikkad, Ashram, Pathiramanal. Mangalavanam and in several other bits (Chand Basha. 1991). Mangrove area in Kerala is estimated to be about 17 km2 in 1992. of these 36% are in degraded/degrading condition (Chand Basha. 1992). This is in comparison to the 700 km^2 of mangroves which existed in Kerala earlier (Ramachandran *et al.*, 1985). The development of timber industry (mainly plywood industry), alternative land use and the establishment of fishing ports were the major reasons for the degradation of the mangroves in Kerala.

Mangrove vegetation is important because a variety of marine organisms and fresh water forms depend on mangroves for feeding and also as nursery grounds. According *to* a study by Snedaker (1978).90% of marine fish pass some stages of their life cycle in mangrove habitats. There were many attempts to study this complex ecosystem. Chand Basha (1992) assessed the status and gave information on the potential mangrove areas in Kerala. Certain amount of research has been done on the vegetation and mapping aspects of mangroves in Kerala (Chand Basha. 1991). Similarly. some studies are also available on the fishery potential of mangroves in the State (Purushan, 1989). Apart from these, no serious attempts have been made to study this complex ecosystem and hence this study.

Objectives of the study are:

1. To document the vertebrate fauna of the Mangalavanam mangrove, and
2. To document the threats to the mangrove ecosystem at Mangalavanam

1.1. REVIEW OF LITERATURE

Previous studies on the mangrove fauna of Kerala and related studies in other parts of the world are reviewed below. Ramachandran *et al.* (1985) attempted mapping, inventory and some environmental aspects of mangrove ecosystems in the State.

Fishes

Fifty-two species of fishes are known to occur in Kerala in association with the mangroves. Purushan (1989) generated much of the data from Puduvypu mangroves. This area is considered as brackish water fish seed source also. It is noted that fry and fingerlings of milkfish *(Chanos chanos).* mullet *(Mugil cephalus),* kalava *(Lates calcarifer),* Indian salmon *(Eleutheronema tetradactylum)* and tilapia *(Sarotherodon mossambicus)* were collected in large numbers from here for restocking of commercial fish farms. In addition to this, 16 species of fishes occurring in the Asramam mangroves of Kollam were reported by Mohandas *et al.* (1994). Fish and fish resources in the mangrove swamps of Sunderbans, West Bengal were studied in depth by Chakrabarti (1986).

Reptiles

Not much information is available on the reptiles of the mangroves in Kerala. From personal discussions (Ajith kumar), it was given to understand that python *(Python molurus),* dogfaced water snake *(Cereberus rhynchops),* turtles, and lizards occur in the mangroves of the State.

Birds

Many authors have reported on the avifauna of mangroves of other countries (Cawkell, 1964; Field, 1968; French, 1966; Haverschmidt, 1965; Nisbet, 1968). A number of studies have been made on the birds of mangroves of India. Samant (1985)listed 121 species of birds occurring in the mangroves around Ratnagiri, Maharashtra. Kurup (1996) reported several species of birds occurring in the mangrove patches all along the Kerala coast. Based on available information, 76 species of birds are known to occur in association with the mangroves of Kerala. NEST (1993) published a list of birds found at Kumarakam. Mohandas *et al.* (1994) reported 57 species of birds occurring in the Asramam mangroves of Kollam.

Mangroves serve the birds in different ways. Herons. storks, raptors and owls use them as nesting sites. Wintering palaeartic waders use them as roosting sites after feeding in the tidal mud flats. It has been noted that, when compared with other areas. bird diversity is rather poor in the mangroves of Kerala (Table 1). This could be partly due to lack of detailed studies on the avifauna of mangroves.

Table 1. Number of bird species reported from the different mangrove forests of other countries and India

Place	No. of species	Source
Gambia-Africa	45	Cawkell (1964)
Surinam-South America	87	Haverschmidt (1965)
Sierra Leone- Africa	76	Field (1968)
Malalya- Asia	121	Nisbet (1968)
Trinidad-Central America	94	Ffrench (1966)
Ratnagiri-India	121	Samant (1985)
Kerala -India	76	Jayson (1997)

Many reports are available on the related species of wetland birds found at Mangalavanam. Some of the works are reported below. Pond herons are chiefly ground foragers and mainly feed on aquatic fauna. but they are known to feed on bees also (Prasad and Hemanth. 1992). Nesting of pond heron in Madhya Pradesh is from April to June (Pandey, 1991). Birds seen in the Thattekkad Bird Sanctuary have been described by Sugathan and Varghese (1996). Distribution, status and conservation of Indian herons have been studied in detail by Subramanya (1996). He has reported information gathered on 533 sites of 26 species of water birds. Similarly the breeding of large cormorant *(Phalacrocorax carbo)* was reported from the Nilgiris by Nair (1996).

Mammals

Mangrove provide habitat for a vide variety of fauna. No serious attempt has been made to study the mammals occurring in the mangroves of Kerala. However otter *(Lutra* sp.) is known to occur in the Puduvypin area

in Ernakulam. Khan (1986) recorded 368 species of fauna from the mangroves of Bangladesh. Singh (1994) reported the bio-diversity of mangrove fauna in India mainly based on the studies conducted at Sunderbans (Table 2). Distribution of fauna in the mangroves of Kerala and India is given in Table 2.

Table 2. Distribution of fauna in the mangrove forests of Kerala in relation to those reported from India

Fauna	No. of species reported from Kerala'	No. of species reported from India'
Fishes	*52*	107
Reptiles		
a. Snakes	2	21
b. Lizards	?	4
c. Turtles	?	5
d. Crocodiles	Nil	1
e. Amphibians	?	8
Birds	76	84
Mammals	1	**34**

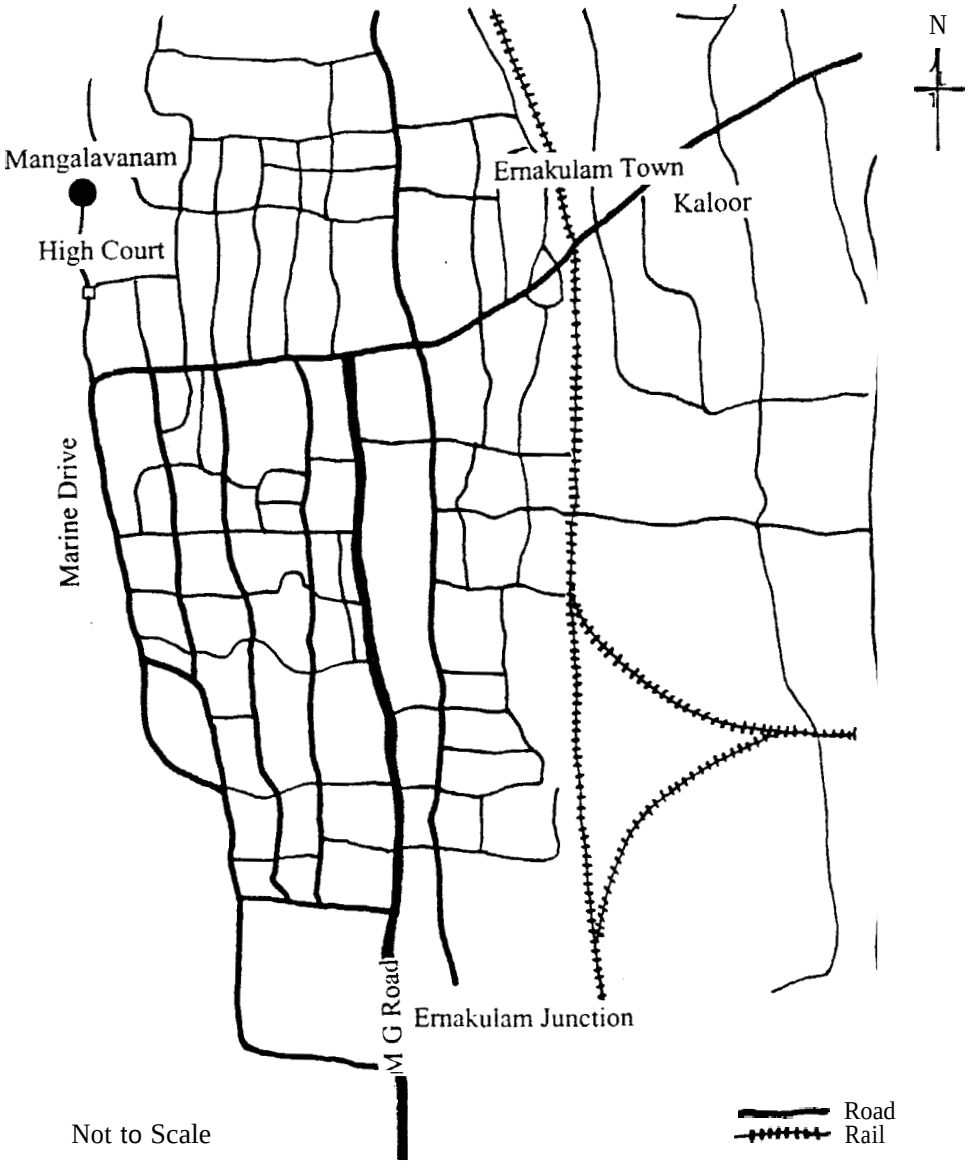
1= Jayson, 1997; 2 = Khan, 1986: ? = No

2. STUDY AREA

Mangalavanam is a small mangrove area located in the middle of Ernakulam City comprising of a shallow tidal pond in the centre with its edges covered with thick mangrove vegetation (Map 1). This water body is connected with backwaters by a canal. In the middle of the pond. there is a small island with mangrove growth. Mangalavanam gained importance because of the mangrove vegetation and also due to the congregation of communally breeding birds. Apart from these. it is considered as a 'green lung' of Eranakulam City which is polluted by effluents from many industries and also motor vehicles. A timber yard was located in the area in the yester years, exporting timber to various countries. At present no (such activity is being carried out. The guesthouse was renovated in the year 1986 and regular staff was appointed to protect the birds.

Mangalavanam is situated in the Eranakulam District of Kerala State (90^0 59' N latitude and 76^o 11' E longitude). The study area is in Eranakulam City and the total extent is 8.44 hectares. The northern and eastern portion of the area is bordered by Bharath Petroleum Company. South by Eranakulam Railway goods station, West by Salim Ali road and Central Marine Fisheries Research Institute. The ownership of the land is with various Government agencies, which is given below (GCDA, 1998).

	Agency	Area in ha
1	Southern Railway	3.74
2	Railway land leased to Bharath Petroleum	1.20
3	Kerala Forest Department	0.73
4	Corporation of Cochin	0.16
5	Police Department	0.12
6	Revenue land	0.26
7	Puramboke land	2.10
8	Private land	0.13
	Total	**8.44**



Map 1. Location of Mangalavanam in Ernakulam city

Climate

There are two distinct seasons in the study area: the monsoon starting from end of May up to middle of November and the dry summer season from December to the first half of May. There is no clearly marked winter. Rainfall in each month at Mangalavanam during the period of the study is given in Table 3. There was not much variation in temperature.

Table 3. Total monthly rainfall at Cochin Naval Base (mm)*

Months	Year 1998	Year 1999
January	0.0	0.0
February	8.1	11.7
March	4.7	52.7
April	51.2	143.5
May	215.0	502.0
June	676.0	557.9
July	370.0	-
August	266.4	-
September	652.4	-
October	475.2	-
November	107.6	-
December	41.1	-

* Source (India Meteorological Dept.. Trivandrum)
- No data collected

Vegetation

Vegetation of the area is dominated by mangrove species. Prominent species among them are *Avicennia marina. Rhizophora mucronata* and *Acanthus ilicifolilus.* Exotic species like *Eucalyptus* was also planted in the area in previous years. Other planted species is teak. It is reported that 17 true mangrove species and 23 semi-mangrove species occur in Kerala (Unni and Kumar, 1997).

2.1. METHODS

Composition and occurrence

Composition and occurrence of birds in the area were recorded from field observations. The number of species recorded is considered as species richness. The method of total count was employed to census the birds in the area. This was carried out by dividing the area into three plots. First plot was near the Rest House inside the compound wall. the second one outside the compound wail and the last one on the islands.

Whenever a bird was spotted. it was identified up to species level and details like number of birds. habitat and behaviour were recorded. Birds were identified using a pair of binoculars based on their physical features, with the help of field guides (Ali, 1969; Ali and Ripley, 1983). Three samples were taken in each month and no systematic data were collected on nocturnal birds. Species richness and composition of birds were computed from the census data and from the field observations.

Seasonal fluctuations

The information on the occurrence of birds in each month obtained from the census was used for seasonality analysis. Mean data obtained from the study period was used for this.

Breeding behaviour

Among the bird species of the area, the breeding behaviour of only two species was studied. *viz.* little cormorant and night heron. All other species were low in number. This was carried out mainly by observational methods. Number of active nests found in the area was counted thrice in a month. Nest building activity was recorded by visual observations. Mortality of nestlings was recorded by counting the nestlings falling to the ground whenever it happened. Predatory behaviour of house crow was also recorded by visual methods.

Roosting behaviour

Initially a reconnaissance was conducted to find out the prominent routes to the roosting site. The roosting studies were carried out on two prominent species i.e. little cormorant and night heron. The birds coming for roosting in the evening and morning were identified and counted in five-minute interval by locating them in the air. Pre-roosting behaviour of the species was also studied following the method described by Jayson and Mathew (1995).A survey was conducted in the surrounding areas to find out other breeding and roosting sites. For this purpose many nearby localities were visited and the stretch of backwaters from Eranakulam to Varappuzha was also surveyed.

3. RESULTS

3.1 BIRDS

Mangalavanam is primarily a bird refuge. All other species of vertebrates are present only in low numbers. Considering this. the objective of the management should be to manage the birds found in the area in a better manner. During this project period. maximum effort was made to understand the dynamics of the bird community in the area. Species richness and occurrence. seasonal fluctuations in the roosting populations, breeding and roosting behaviour of little cormorant and night heron were studied in detail.

3.1.1. Composition and occurrence of birds

Species composition of birds in an area is related to the type of vegetation. height above the sea level. availability of microhabitats and various other factors. Forty-two taxa of birds were recorded from the Mangalavanam mangroves. These species were from 12 Orders and 24 Families. Species of birds recorded from Mangalavanam with their Family and Order is given in the Table 4.

The common bird species found at Mangalavanam were little cormorant and night heron, Passeriformes were maximum followed by Ciconiiformes and Pelecaniformes (Table 5). Only two migratory species were recorded from the area, namely golden oriole and largepied wagtail. Except for little cormorant and night heron other species were low in number.

Little cormorant, night heron and house crow were seen in all the months (Table 6). Large cormorant was sighted only in May and June. Indian darter was sighted during four months and egrets were seen during half the year. Other species recorded in more than 4 months were koel and magpie robin. All other species were sighted only once or twice.

Maximum species richness was seen in the month of May during summer and then in February (Table 7). Lowest was recorded in the month of September. October and November. The area acquires the atmosphere of a bird sanctuary due to congregation of little cormorant and night heron in thousands. Sightings of night heron during the day, provide ample opportunity for the tourists to watch the birds during the day. in the

evening, after the arrival of little cormorants, the whole area reverberate with the cacophony of birds.

Table 4. Species of birds recorded from Mangalavanam (1998-1999)

Order	Family	Common name	Scientific name
Pelecaniformes	Phalacro coracidae	Large cormorant	Phalacrocorax carbo
		Little cormorant	Phalacrocorax niger
		Indian Darter	Anhinga melanogaster
Ciconiiformes	Ardeidae	Purple heron	Ardea purpurea
		Pond heron	Ardeola grayii
		Cattle egret	Bubulcus ibis
		Large egret	Ardea *alba*
		Smaller egret	Egretta intermedia
		Little egret	Egretta garzetta
		Night heron	Nycticorax nycticorax
Falconiformes	Accipitridae	**Pariah** kite	Milvus migrans govinda
Gruiformes	Rallidae	Whitebreasted Waterhen	Amauromis phoenicurus
Charadriiformes	Charadriidae	Yellow-wattled lapwing	Vanellus malabaricus
Columbiformes	Columbidae	Blue rock pigeon	Columba livia
Psittaciformes	Psittacidae	Blossomheaded parakeet	Psittacula cyanocephala
Galliformes	Phasianidae	Koel	Eudynamys scolopacea
		Crow pheasant	Centropus sinensis
Apodiformes	Apodidae	House swift	Apus affinis
Coraciiformes	Alcedinidae	Lesser pied kingfisher	Ceryle rudis
Coraciiformes	Alcedinidae	Common kingfisher	Alcedo atthis
		Storkbilled kingfisher	Pelargopsis capensis

Order	Family	Common name	Scientific name
"		Whitebreasted kingfisher	Halcyon smymensis
"		Whitecollard kingfisher	Halcyon chloris
	Meropidae	Small green Bee-eater	Merops orientalis
Piciformes	Capitonidae	Small green barbet	Megalaima viridis
	Picidae	Lesser goldenbacked woodpecker	Dinopiurn benghalense
Passeriformes	Oriolidae	Golden oriole	Oriolus oriolus
"	Dicruridae	Black drongo	Dicrurus adsirnilis
"	Sturnidae	Common myna	Acridotheres tristis
"	"	Jungle myna	Acridotheres fuscus
"	Conidae	Tree pie	Dentrocitta vagabunda
		House crow	Corvussplendens
		Jungle crow	Corvus rnacrorhynchos
	"	Magpie robin	Copsychus saularis
	Irenidae	Goldmantled chloropsis	Chloropsis cochinchinensis
"	Pycnonotidae	Redwhiskered bulbul	Pycnonotusjocosus
"	Muscicapidae	Whiteheaded babbler	Turdoides affinis
"	"	Tailor bird	Orthotornus sutorias
	Mottacillidae	Pied wagtail	Motacilla alba
"		Large pied wagtail	Motacilla rnaderaspatensis
Passeriformes	Nectarinidae	Crimsonbacked Sunbird	Nectarinia minima
	Ploceidae	House sparrow	Passer dornesticus

No migratory waders or shore birds were recorded during the study period. Most of the species seen in the area were aquatic feeders (16) followed by insectivorous species (14) (Table 5).

Table 5. Number and status of birds recorded at Mangalavanam

No.	Order	Status of species			Feeding guild						
		R	M	Total	A	I	G	N / F	C	F	O
	Pelecaniformes	3	-	3	3	-	-	-	-	-	-
2	Ciconiiformes	7	-	7	7	-	-	-	-	-	-
3	Falconiformes	1	-	1	-	-	-	-	1	-	-
4	Gruiformes	1	-	1	-	-	1	-	-	-	-
5	Charadriiformes	1	-	1	1	-	-	-	-	-	-
6	Columbiformes	1	-	1	1	-	1	-	-	-	-
7	Psittaciformes	1	-	1	-	-	-	-	-	1	-
8	Galliformes	2	-	2	-	1	-	1	-	-	-
9	Appodiformes	1	-	1	-	1	-	-	-	-	-
10	Coraciiformes	6	-	6	5	1	-	-	-	-	-
11	Piciformes	2	-	2	-	1	-	-	-	1	-
12	Passeriformes	14	2	16	-	10	1	2	-	1	2
	Total	40	2	42	16	14	3	3	1	3	2

A= Aquatic feeders: I= Insectivorous: *G*= Granivorous: N/F= Nectar and Frugivorous: *C*=Carnivorous: F= Frugivorous: *O*= Omnivorous. R= Resident: M= Migrant,

Table 6. Occurrence of birds at Mangalavanam in different months

Hand book No*	Common name	Scientific name	Months											
			J	F	M	A	M	J	J	A	S	O	N	D
963	Black drongo	Dicrurus adsirnilis	-	-	-	-	-	-	P	-	-	-	-	-
953	Golden oriole	*Oriolus* oriolus	-	-	P	-	-	-	-	-	-	-	-	-
821	Lessergoldenbacked woodpecker	Dinopium benghalense	P	-	-	-	-	-	-	-	-	-	-	-
785	Small green barbet	Megalaima viridis	-	P	-	-	-	-	-	-	-	-	P	-
750	Small green Bee-eater	Merops orientalis	-	-	-	-	-	-	-	-	-	-	P	-
740	Whitecollard kingfisher	Halcyon chloris	-	-	P	-	-	-	-	-	-	-	-	-
736	Whitebreasted kingfisher	Halcyon smyrnensis	P	P	-	P	P	-	P	-	-	-	-	P
730	Storkbilled kingfisher	Pelargopsis capensis	-	-	-	-	P	-	-	-	-	-	-	-
724	Common king fisher	Alcedo atthis	P	P	-	-	-	-	P	-	-	-	-	-
720	Lesser pied kingfisher	Ceryle rudis	-	-	-	-	P	-	-	-	-	-	-	-
703	House swift	Apus affinis	-	-	-	-	-	-	-	-	-	-	P	-
602	Crow pheasant	Cerntropus sinensis		P	-	P	-	-	P	-	-	-	-	-
590	Koel	Eudynamys scolopacea	P	P	P	P	P	-	P	-	-	-	P	-
558	Blossomhcaded parakeet	Psittacula cyanocephala	-	P	-	-	-	-	-	-	-	-	-	P
52	Night heron	Nycticorax nyclicorax	P	P	P	P	P	P	P	P	P	P	P	P
517	Blue rock pigeon	Columba livia	P	P	P	P	P	-	P	-	-	-	-	P
49	Littleegret	Egretta garzetta	P	P	P	P	P	-	-	-	-	-	-	P
47	Smaller egret	Egretta intermedia	-	-	-	P	P	P	-	-	-	-	-	-
46	Large egret	Ardea alba	P	P	P	P		-	P	-	-	-	-	P
44	Cattle egret	Bubulcus ibis	P		P	P		-	-	-	-	-	-	P
42	Pond heron	*Ardeola grayii*	-	-	P	-	-	-	P	-	-	-	-	-

Hand book No*	Common name	Scientific name	Months											
			J	F	M	A	M	J	J	A	S	O	N	D
343	Whitebreasted waterhen	*Amaurornis phoenicurus*	P	-	-	-	-	-	P	-	-	-	-	-
29	Indian darter	*Anhinga melanogaster*	-	-	-	-	P	-	P	-	-	-	P	P
28	Little cormorant	*Phalacrocorax niger*	P	P	P	P	P	P	P	P	P	P	P	P
26	Large cormorant	*Phalacrocorax carbo*	-	-	-	P	P	-	-	-	-	-	-	-
1938	House sparrow	*Passer domesticus*	-	P	-	-	-	-	P	-	-	-	-	-
1909	Small sunbird	*Nectarinia minima*	P	-	-	-	-	-	P	-	-	-	-	P
1891	Large pied wagtail	*Motacilla maderaspatensis*	-	-	-	-	-	-	-	-	-	-	P	-
1885	Pied wagtail	*Motacilla alba*	-	-	-	-	P	-	-	-	-	-	-	-
1662	Magpie robin	*Copsychus saularis*	P	P	P	-	P	-	P	-	-	-	-	P
1535	Tailor bird	*Orthotomus sutorius*	-	-	-	-	-	-	-	-	-	-	-	-
133	Pariah kite	*Milvus migrans govinda*	-	-	-	-	-	-	-	-	-	-	P	-
1267	Whiteheaded babbler	*Turdoides affinis*	-	-	-	-	-	-	P	-	-	-	-	-
1120	Redwhiskered bulbul	*Pycnonotus jocosus*	-	-	-	-	-	-	-	-	-	-	P	-
1107	Goldmantled Chloropsis	*Chloropsis cochinchinensis*	-	-	-	P	-	-	-	-	-	-	P	-
1059	Jungle crow	*Corvus macrorhynchos*	-	-	-	-	-	-	-	-	-	-	P	-
1050	House crow	*Corvus splendens*	P	P	P	P	P	P	P	P	P	P	P	P
1033	Tree pie	*Dentrocitta vagabunda*	-	-	-	-	-	-	-	-	-	-	P	-
1010	Jungle myna	*Acridotheres fuscus*	-	P	-	-	-	-	-	-	-	-	-	
1006	Common myna	*Acridotheres tristis*	-	P	-	-	P	-	P	-	-	-	-	-

P-Present; (-) not recorded. * Hand Book of Salim Ali and S.D. Ripley (1983).

One little cormorant with white feathers was recorded from the area. The bird was seen on the island many times. Occurrence of little cormorant with white and brown feathers was reported earlier also from other areas (Ripley. 1962).

3.1.2. Seasonal fluctuations

Species richness and total number of birds varied in different months. Species richness recorded in different months is given in Table 7. An increase in species richness is visible during the months of summer. Highest number of species *i.e.* 18 is recorded during the months of March and July. August, September and October showed lowest species richness.

Table 7. Number of species of birds observed in different months at Mangalavanam

Months	J	F	M	A	M	J	J	A	S	O	N	D
Number of species	15	17	13	13	18	4	18	3	3	3	13	13

3.1.3. Breeding behaviour

Breeding behaviour of little cormorant and night heron was studied as described earlier. Number of nests of these two species recorded in different months at Mangalavanam is given in Table 8. Birds were building nests in the months of February, March, April, May, June and July. Highest number of little cormorant and night heron nests was recorded in May. Nest building was initiated in the month of February and most of the nests were abandoned by August. Maximum nests of little cormorant were found in the month of May whereas that of night heron in April.

Table 8. Number of active nests recorded in different months at Mangalavanam

Species	J	F	M	A	M	J	J	A	S	O	N	D
Little Cormorant	Nil	9	67	168	239	199	116	Nil	-	4	Nil	Nil

- = No data collected.

Nest building:

Night heron

,Night heron commenced nest building in the month of February. Mating of night heron was observed during these month on *Avicennia* sp. During the month of March, nest building was in full swing and most of the nests were with nestlings. Breeding plumage distinguishes a night heron actively engaged in breeding. Two long feathers grow from the crown as breeding plumage. In breeding plumage night heron males are completely black and white in colour, while the females are brownish grey. There is a previous record of night heron breeding in sub-adult plumage also (Serrao, 1981). When other individuals approach a nesting pair, they will ruffle up the body feathers to drive away the intruder. One hundred and ten nests were counted in the island during the 1998-breeding season. Both males and females took part in the process of nest building. Most of the nests were placed on tree branches. Nest building has been reported on some unusual sites also in other areas (Soni. 1991).

Little cormorant

Little cormorant also initiated nest building in the month of February. During the early period of breeding, birds were seen perching in pairs while other pairs started occupying potential nest sites. Head crouching behaviour is observed in this species. In this behaviour, the individual birds showed head-up and head-down display intermittently. When one

bird continued this head-up and down display other individual moved towards it. During the period of breeding the pairs emitted a call "Kauva - Kauva - Kauva". Little cormorants perching on the branches took a dip in the lake and returned to the branches when the wings became dry.

Being a wetland species, many of the behaviour patterns of little cormorant is adapted to survive in water logged areas. One speciality. was observed in the collection of materials for nest building They collected the nest building materials from the bottom of the lake by diving. Dry grass portions and twigs were also collected by this method for nest building.

During the month of March. nest building and brooding were in full swing. Most of the nests were with nestlings, and juveniles were seen on the ground. Both preferred to build nests on mangrove species. but when the available space was fully occupied, they built nests on other trees also.

Males and females were seen actively engaged in nest building. Along with these species, house crow was also building nests at this site. Little cormorant initiated nest building earlier than the night heron. Nests were mostly built with dry leaves and twigs in bunch form. Nests were built on triangle shaped branches initially by placing long dry branches which formed the base for future nests. During the months of August and September most of the young and juvenile night herons were seen on the ground. After leaving the nests, they congregated and took shelter around the bushes situated at the north-eastern end of the railway yard and aIso in the pond on the southern side. Sub-adults were usually seen on the ground whereas the adults were always sighted on tree branches.

Mortality

Heavy mortality of nestlings was observed during the 1998 and 1999 monsoon (Table 9). During the heavy rain, many nestlings fell down and succumbed to injuries. If they escape this fall. they have to spend few more days on the ground. as they will not be able to fly away. Body measurements of some of the nestlings fallen to the ground are given in Table 10 to show the size of the body.

Table 9. Number of nestlings fell down from nests during the monsoon of 1998

Date	Number of nestlings died	Species
02-06-98	16	Little cormorant
	8	Night heron
17-06-98	2	Little cormorant
19-06-98	2	
20-06-98	1	

Table 10. Body measurements of little cormorant nestlings died by falling down during the monsoon of 1998

No	Total length (cm)	Length of wings span (cm)	Length of legs (cm)
1	27	18	16
2	27	13	17
3	31	18	14
4	31	29	10

Predators

House crow was the main predator of the eggs and nestlings of other bird species at Mangalavanam. About 40 house crows were found at Mangalavanam during the peak breeding period. They were sighted in the area. even when the nests were absent. One peculiar behaviour of house crow is worth mentioning. House crows usuallv perch on the tree branches where the nests are located and whenever a visitor approached the nests too closely, the parent birds will leave the nests out of fear. At this time. house crows will snatch away either the eggs or nestlings. Apart lrom house crow. rat snake was a potential threat to the nestlings and eggs. But no incident of rat snake climbing and devouring eggs was noticed. Five-striped palm squirrels were seen near the nests but they were not seen feeding on eggs.

3.1.4. Roosting behaviour

As mentioned earlier, Mangalavanam is an ideal roosting site available to little cormorant and night heron in the Ernakulam City. No similar roosting or breeding sites were recorded around the vicinity of illangalavanam. Mainly three species of birds were roosting at this site *viz.* little cormorant, night heron and house crow. So Mangalavanam can be called as a communal roosting site.

Highest number of birds was seen roosting on the trees in the island. Little cormorant and night heron preferred mangrove trees for roosting. Birds approaching the roosting trees flew at high altitudes and descended to the branches suddenly. Birds reached the roost from North, North-west, South and South-east directions. But the main approach was from North-west direction. This survey revealed that not many similar sites existed in the vicinity of Mangalavanam.

Changes in the Total Roosting Population (TRP)

Little cormorant: The roost was active in all the months, and there was an obvious change in the TRP in each month. It was higher in March (7395) and lowest in August (1465) (Fig. 1). During the months of June and July the number of little cormorants coming to the roost was only around 2000. During the months of September and October no data on roosting were collected.

Night heron: Highest number of Night heron arrived at the roost during the months of April (1797). May (1784) and the lowest arrival was during November (126) (Fig. 2). The birds arrived for roosting in all the months.

Time of arrival and leaving the roost

Little cormorant: Analysis of annual data revealed that little cormorant started arriving the roost from 1500 hours onwards and it continued up to 1900 hours. Peak arrival time was 1720 *to* 1800 hours (Fig. 3). In the morning, the birds started to leave the roost from 0530 hours and it continued up to 0740 hours (Fig. 4). The peak period of leaving the roost was from 0620 hours to 0630 hours.

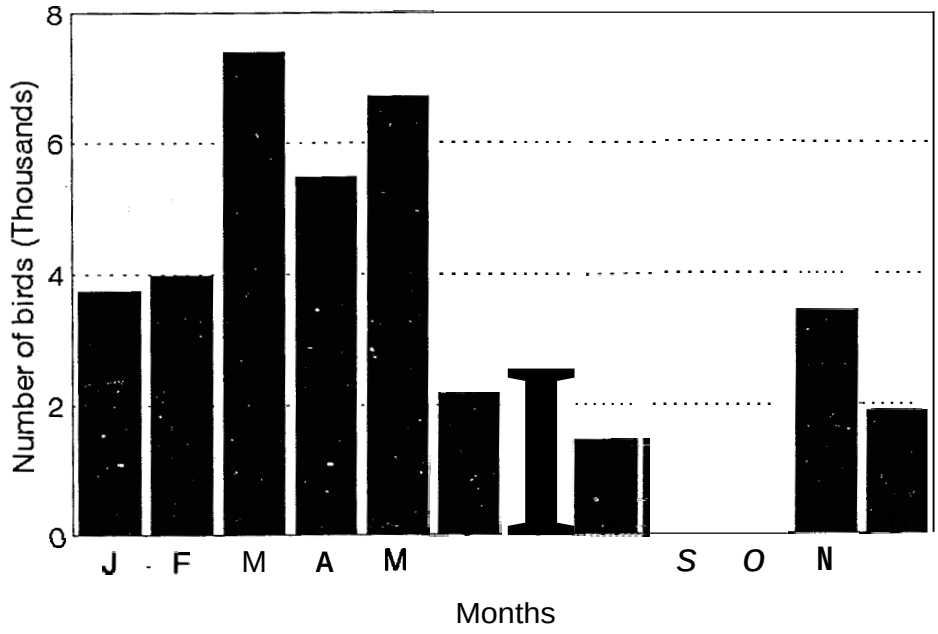


Fig. 1. Number of Little cormorants leaving the roost in the morning (1998-99)

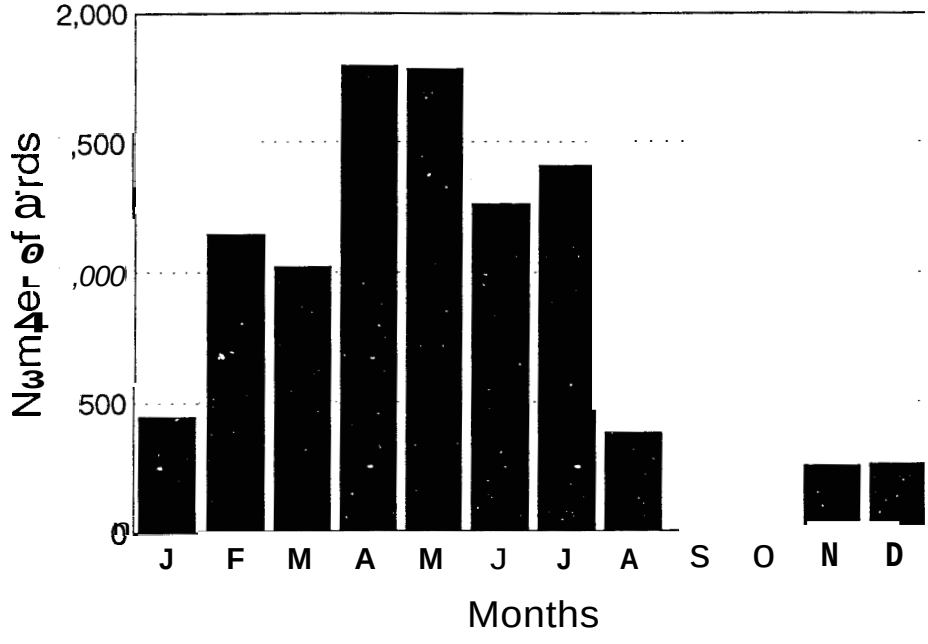


Fig. 2. Number of Night herons coming to the roost in the morning (1998-99)

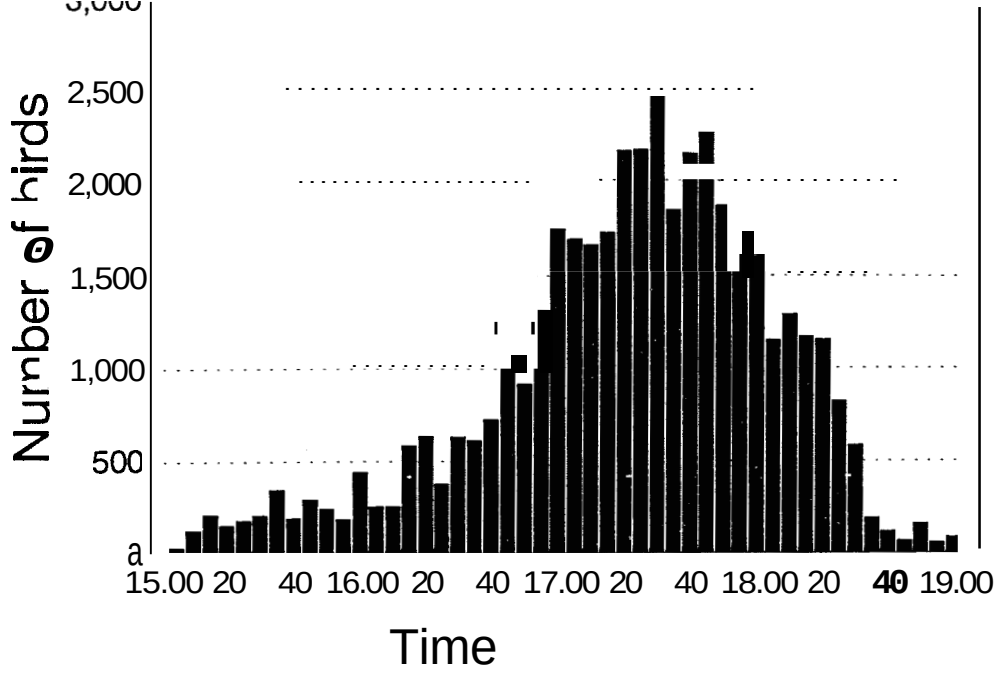


Fig 3 Number of little cormorants coming to the roost in the evening

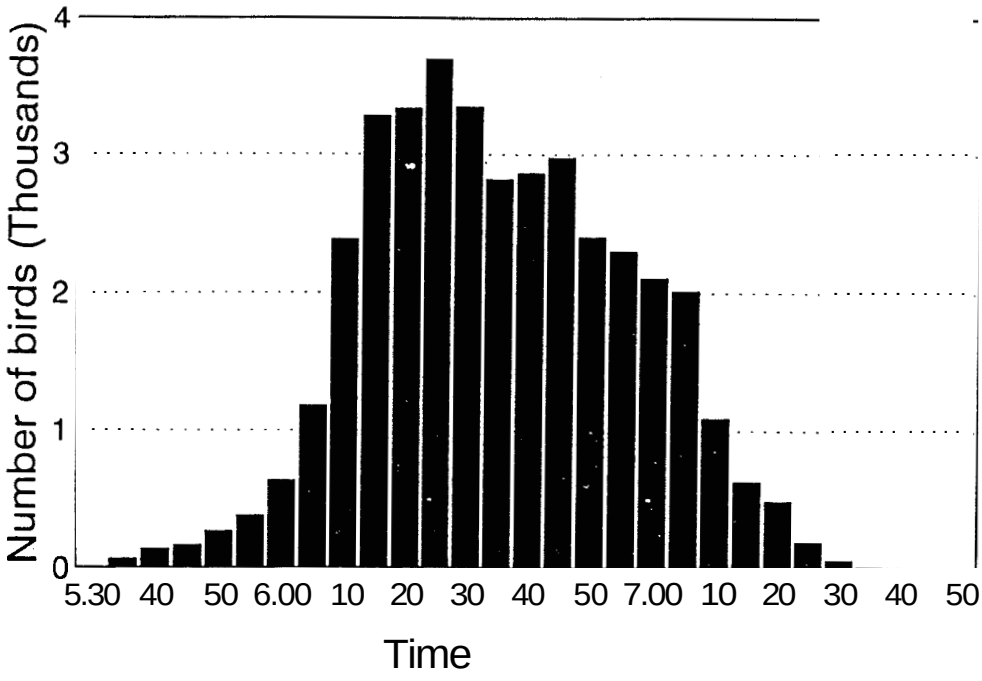


Fig. 4. Number of Little cormorants leaving the roost in the morning

Night heron: Night heron preferred to leave the roost from 1730 hours onwards and it continued up to 1910 hours. The peak period was from 1845 to 1900 hours. During this period, highest number of birds left the roost to the feeding grounds (Fig. 5). Similarly in the morning, birds started to arrive the roost from 0530 hours onwards. The peak period of arrival was from 0600 hours to 0630 hours. Birds continued to arrive the roost till 0750 hours in the morning (Fig. 6).

Monthly changes in the arrival and departure

Little cormorant: There was definite change in the arrival and departure of the roost by little cormorant during different months. In January, peak departure time was 0655 hours whereas in February. it was 0650 hours (Figs. 8 and 9). From the figures, it can be seen that peak departure time was little early in other months (Figs. 7 and 8). This trend was continued in the month of May (Fig.11). June (Fig.12). July (Fig.13), and also in August (Fig.14). But highest number of birds departed at 0700 hours both in November (Fig.15) and in December (Fig.16). Usually, departure of birds from the roost is related to the time of sunrise.

Little cormorant returning to the roost in the evening took an extended period of time to complete the arrival. In the month of February, the amval time was from 1530 hours to 1740 hours with the peak at 1710 hours (Fig.17). During April. the time period was further extended and it was from 1500 hours to 1840 hours (Fig. 18). Similar pattern was found in the month of May also (Fig. 19). But with the onset of monsoon months, the span of arrival period was between 1710 hours to 1900 hours in June (Fig. 20), 1630 hours and 1900 hours in July (Fig. 21), 1710 hours and 1900 in August (Fig. 22) and to 1540 hours and 1800 hours in November (Fig. 23).

Night heron

As observed in the case of little cormorant, there was definite change in the peak period of arrival and departure of night heron from the roost. Being a nocturnal bird, night heron arrived the roost in the morning and departed

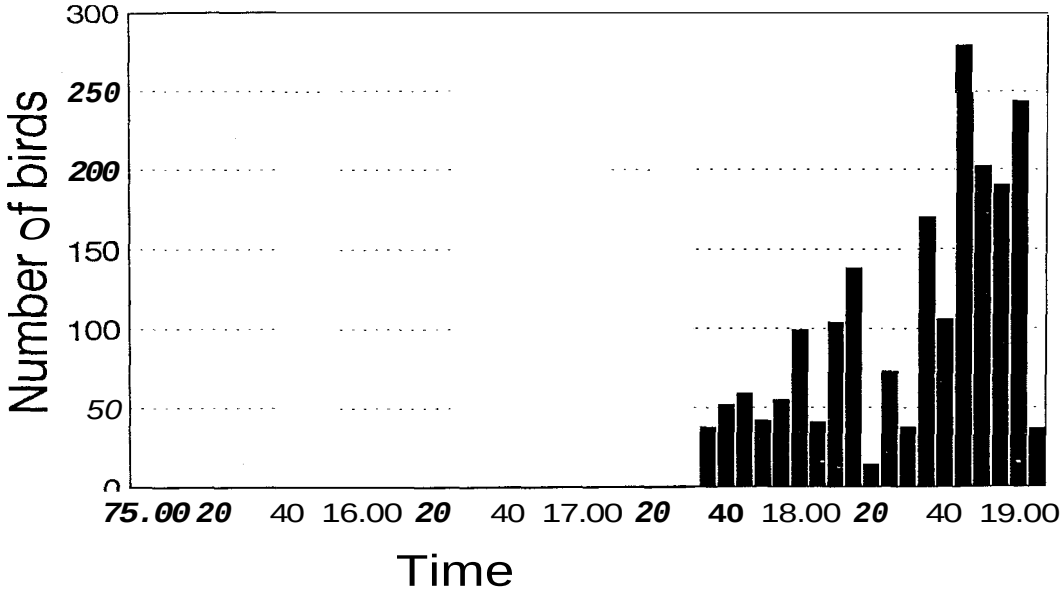


Fig. 5. Number of Night herons leaving the roost in the evening (Pooled data)

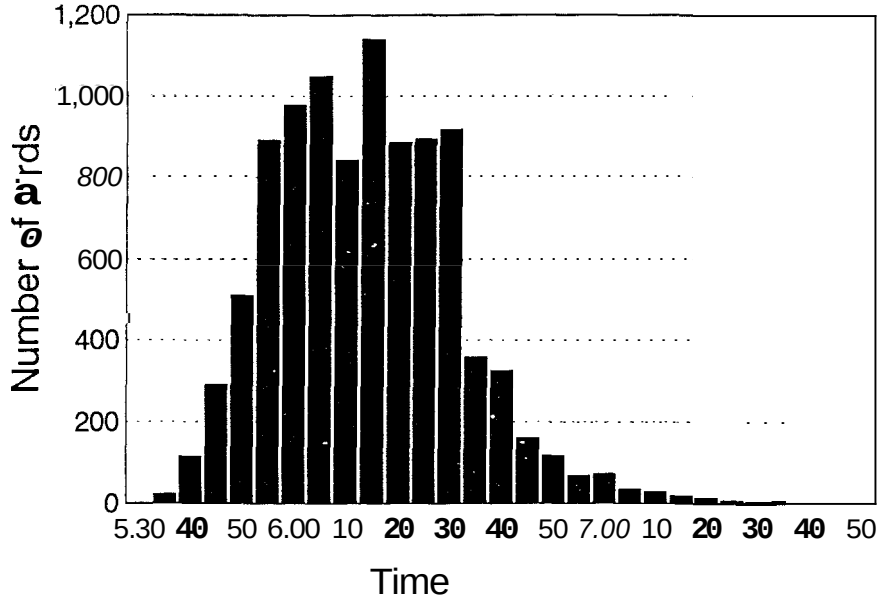


Fig. 6. Number of Night herons coming to the roost in the morning

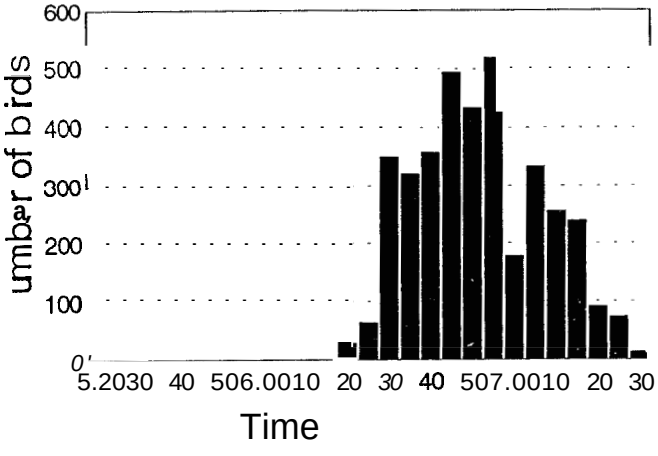


Fig.7. Number of Little cormorants leaving the roost in the morning (January)

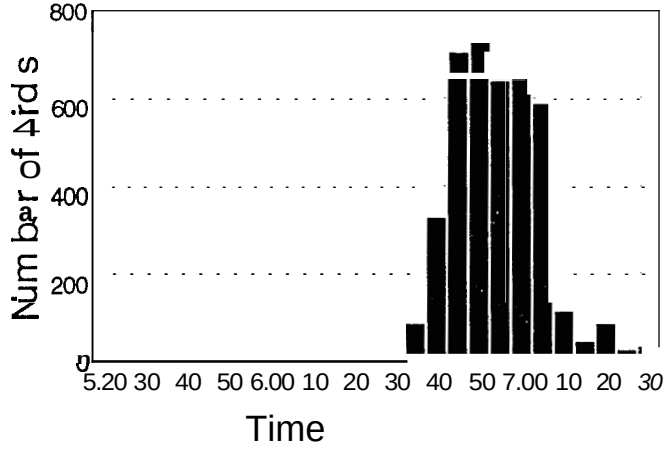


Fig.8. Number of Little cormorants leaving the roost in the morning (February)

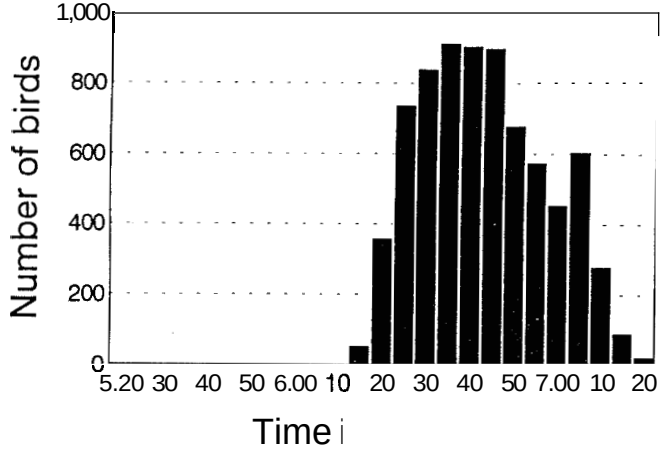


Fig.9. Number of Little cormorants leaving the roost in the morning (March)

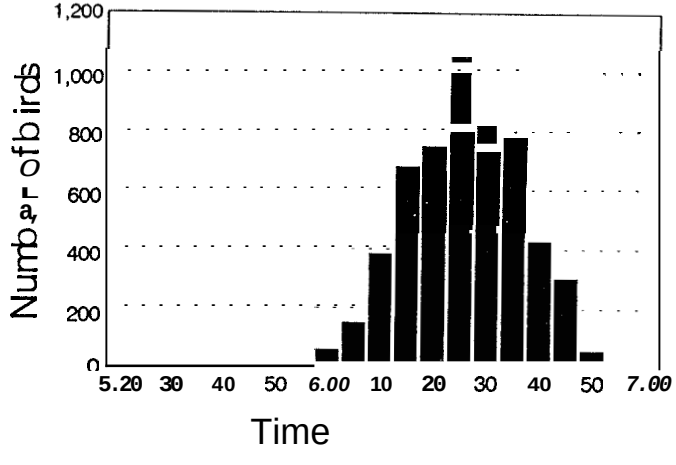


Fig.10. Number of Little cormorants leaving the roost in the morning (April)

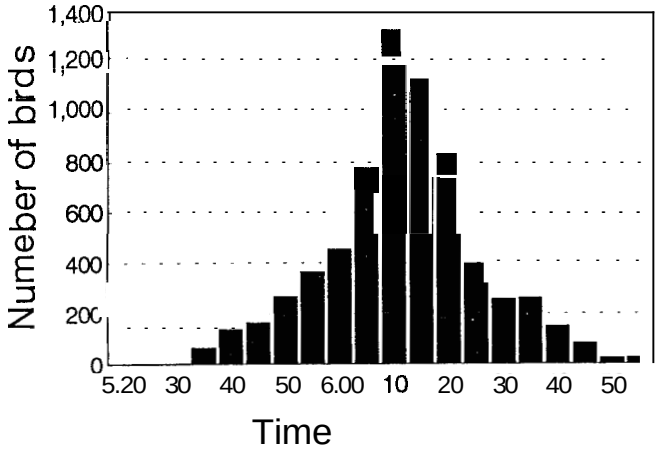


Fig.11. Number of Little cormorants leaving the roost in the morning (May)

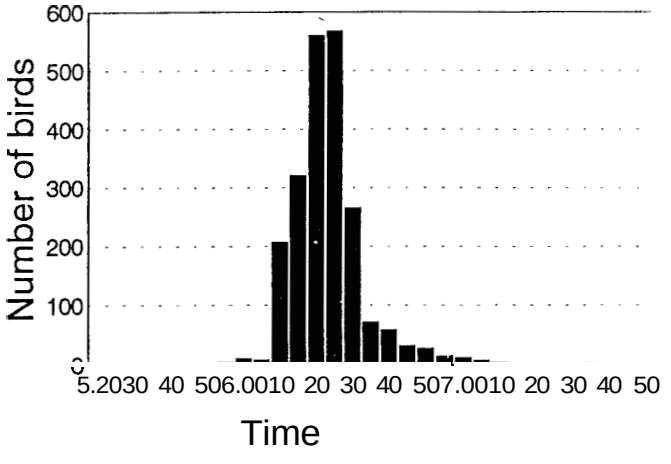


Fig.12. Number of Little cormorants leaving the roost in the morning (June)

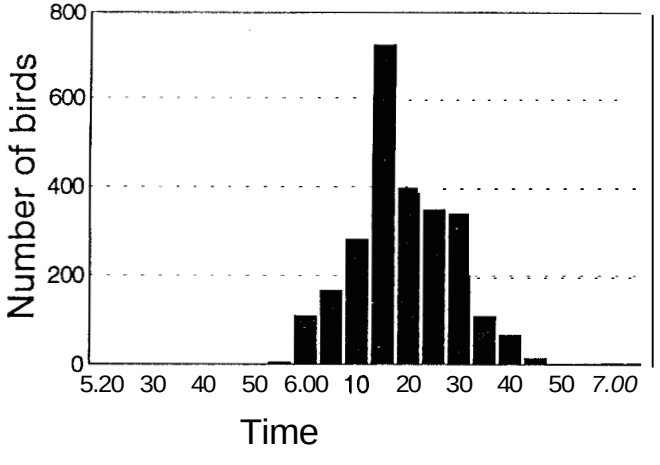


Fig.13. Number of Little cormorants leaving the roost in the morning (July)

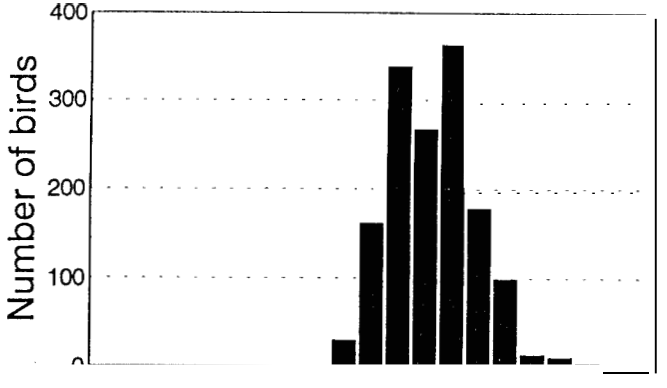


Fig.14. Number of Little cormorants leaving the roost in the morning (August)

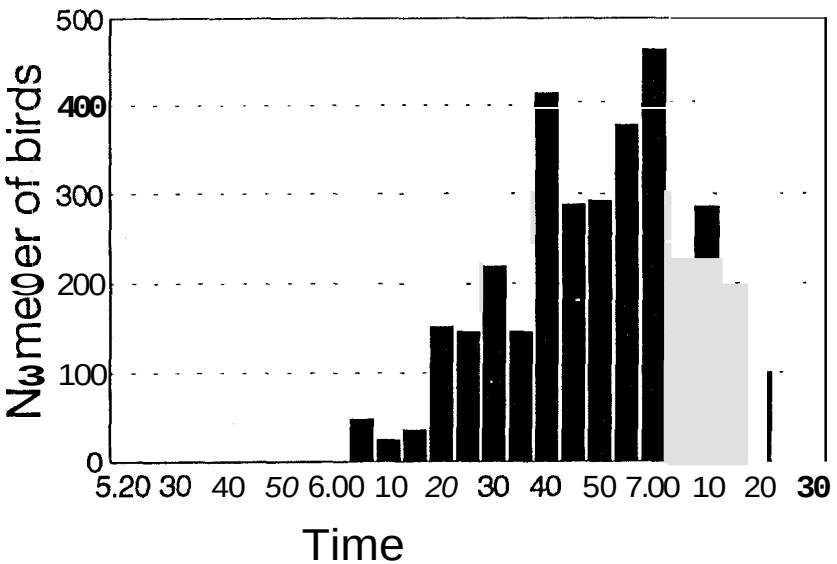


Fig.15. Number of Little cormorants leaving the roost in the morning (November)

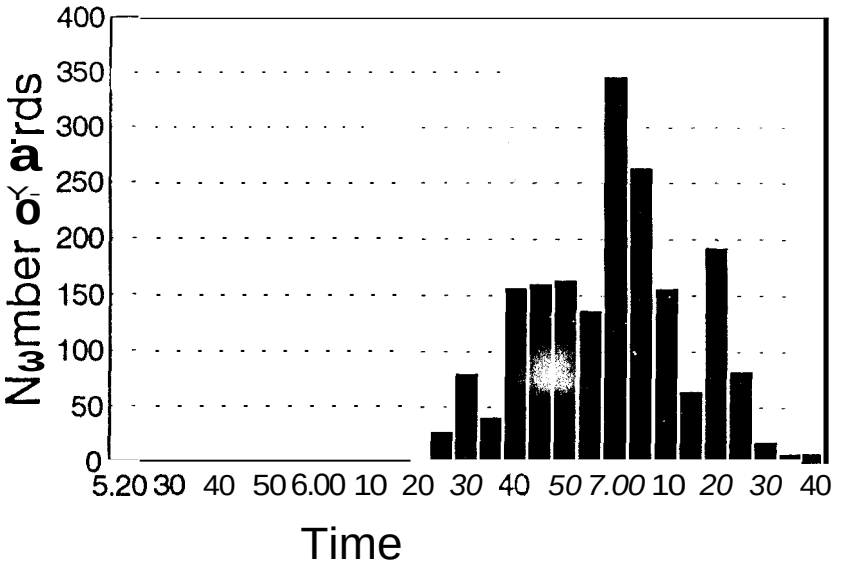


Fig.16. Number of Little cormorants leaving the roost in the morning (December)

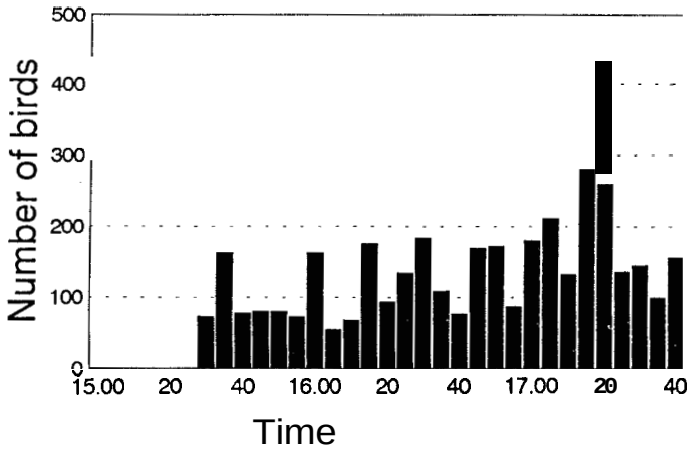


Fig.17. Number of Little cormorants coming to the root in the evening (February)

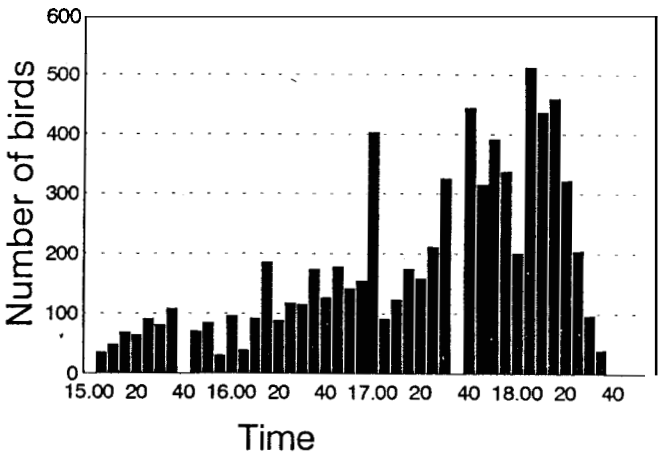


Fig.18. Number of Little cormorants coming to the roost in the evening (April)

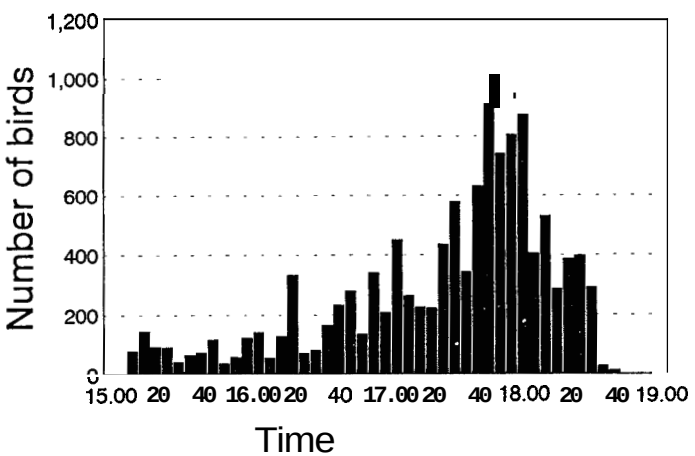


Fig.19. Number of Little cormorants coming to the roost in the evening (May)

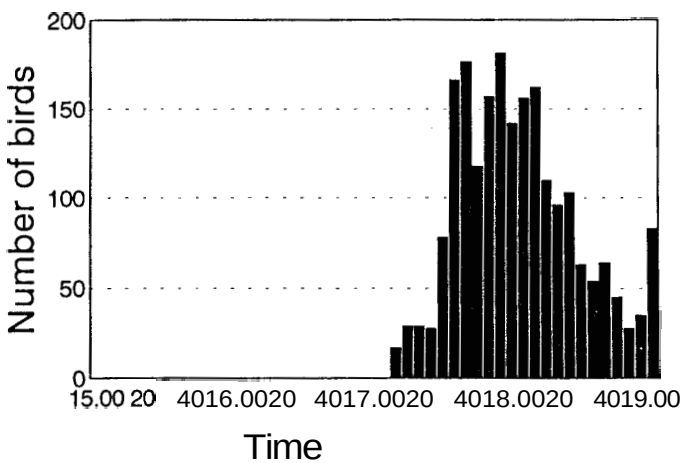


Fig.20. Number of Little cormorants coming to the roost in the evening (June)

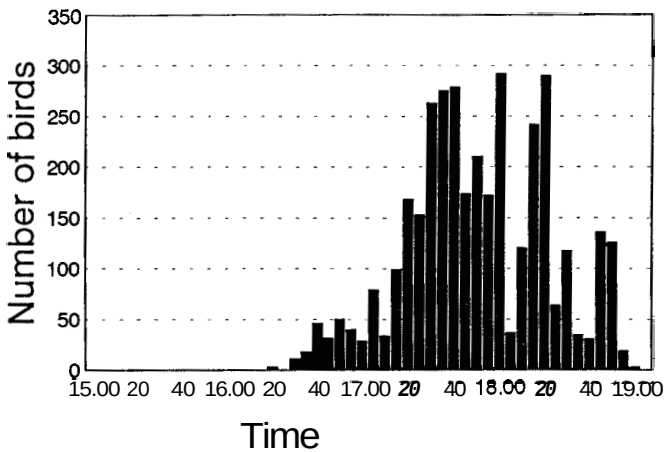


Fig.21. Number of Little cormorants coming to the roost in the evening **(July)**

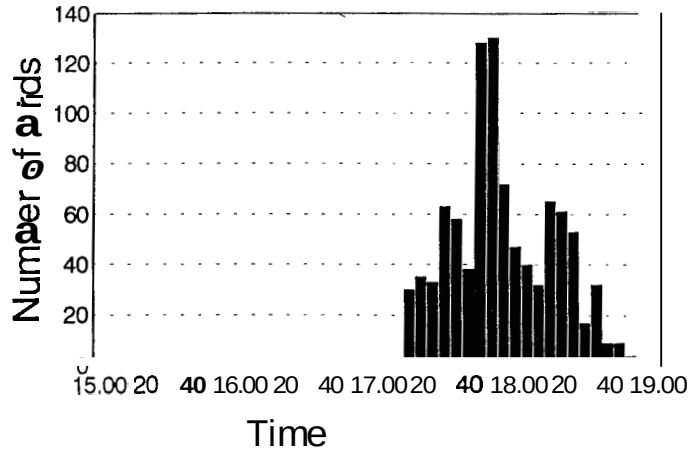


Fig.22. Number **of** Little cormorants coming to the roost in the evening (August)

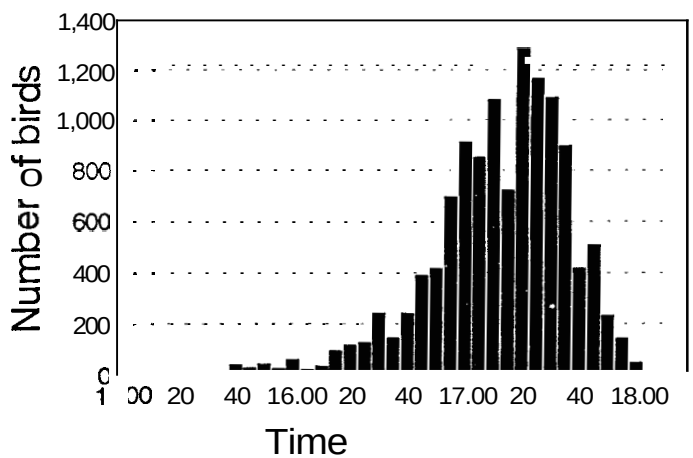


Fig.23. Number of Little cormorants coming to the roost in the evening (November)

to feeding grounds at evening. Compared to little cormorant, the arrival and departure of night heron was completed within a short span of time period. In the case of arrival at morning, the birds started to reach the roost from 0600 hours in the morning and all of them were in the roost by 0700 hours during the month of January (Fig. 24). Same trend was continued during the months of February (Fig.25) and March (Fig.26). Starting from April (Fig.27),birds arrived at 0540 hours onwards and all of them were in the roost by 0700 hours. This sequence was followed in the months of May (Fig. 28), June (Fig. 29), July (Fig. 30) and also in August (Fig. 31). During November, arrival started from 0540 hours to 0720 hours (Fig. 32) but during December the span was very short extending only up to 40 minutes (Fig. 33).

The departing night herons used the shortest time periods to evacuate the roost. During April, within a span of 30 minutes all the night herons left the roost (Fig. 34). But in May. departure was extended from 1740 hours to 1900 hours (Fig. 35). In June the departure pattern was similar to that of other months, starting from 1740 hours to 1900 hours. In July also similar pattern was obsened (Fig. 37). Not much difference was obscned in the months of August (Fig. 38) and November (Fig. 39).

Feeding

Little egrets, pond heron and cattle egret utilised the lake for feeding. They waded through the shallow water during low tide and searched the prey. Little cormorants were utilising the lake during high tide to feed on fish and other organisms by diving. Blue rock pigeons were attracted to the area mainly due to the Railway goods yard. They were seen feedinq on the left overs on the ground after the grains were unloaded from the wagons.

3. 2 Fishes and Reptiles

Fishes

Following fishes were collected from the lake using convcntional methods.

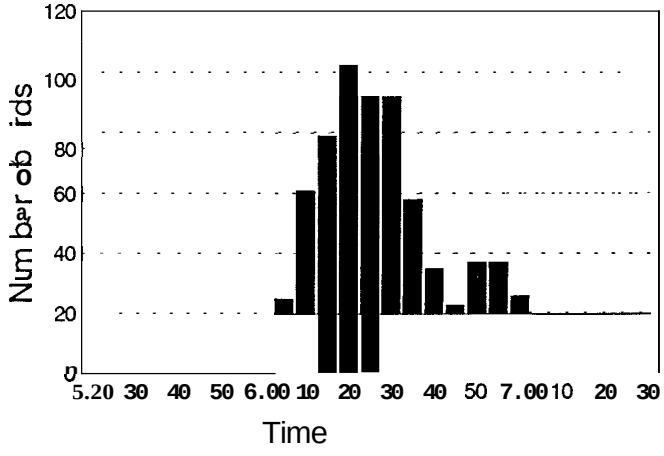
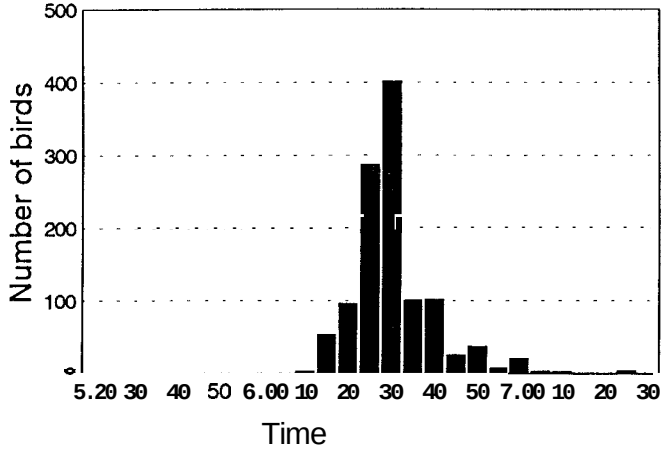


Fig.24, Number of Night heron8 coming to the roost in the morning (January)



Fig,25, Number of Night herons coming to the roost in the morning (February)

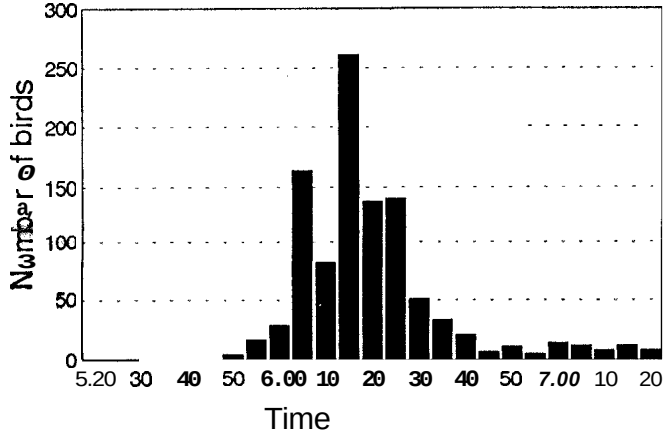


Fig.26. Number of Night herons coming to the roost in the morning (March)

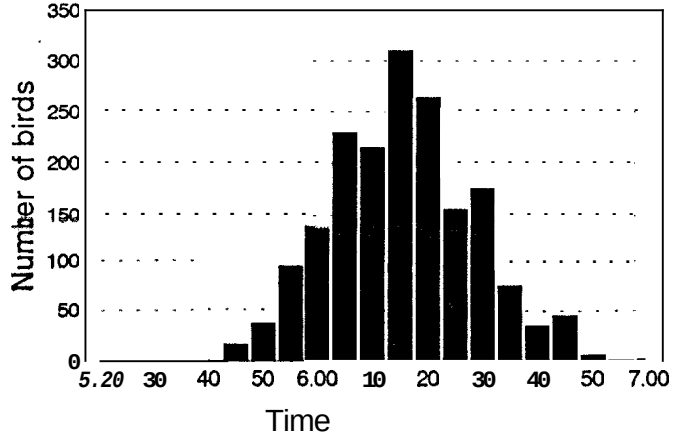


Fig.27. Number of Night herons coming to the roost in the morning (April)

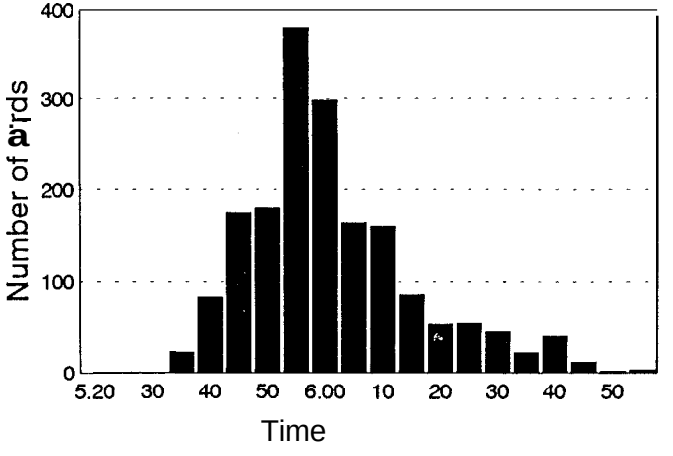


Fig.28. Number of Night herons coming to the roost in the morning (May)

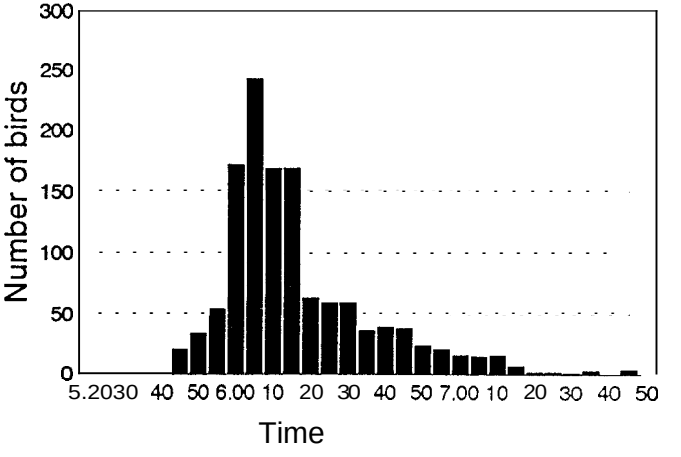


Fig.29. Number of Night herons coming to the roost in the morning (June)

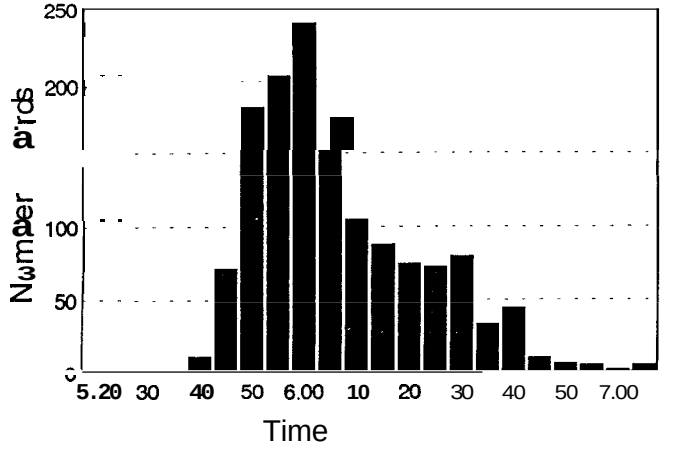


Fig.30. Number of Night herons coming to the roost in the morning (July)

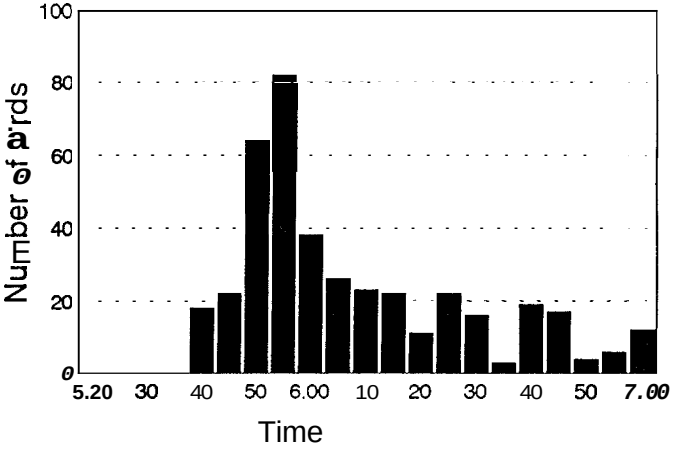


Fig.31. Number of Night herons coming to the roost in the morning (August)

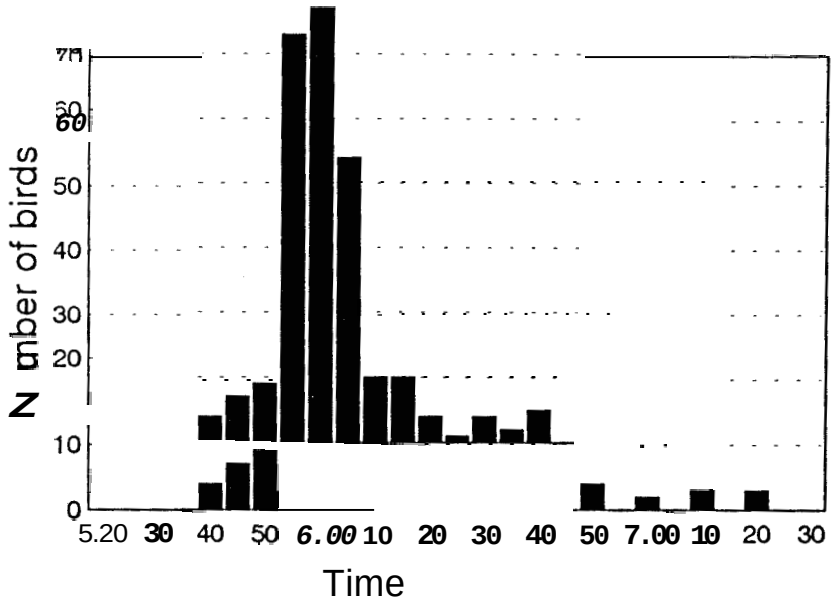


Fig.32. Number of Night herons coming to the roost in the morning (November)

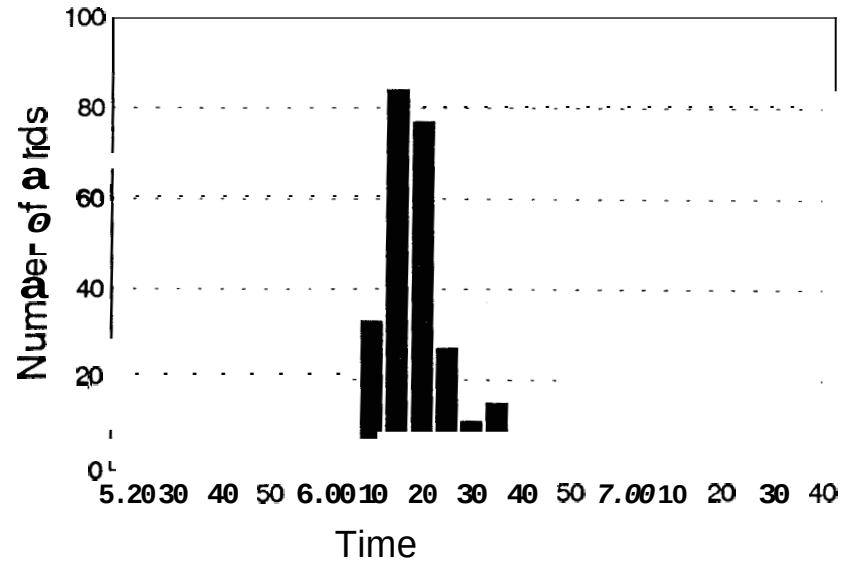


Fig.33. Number of Night herons coming to the roost in the morning (December)

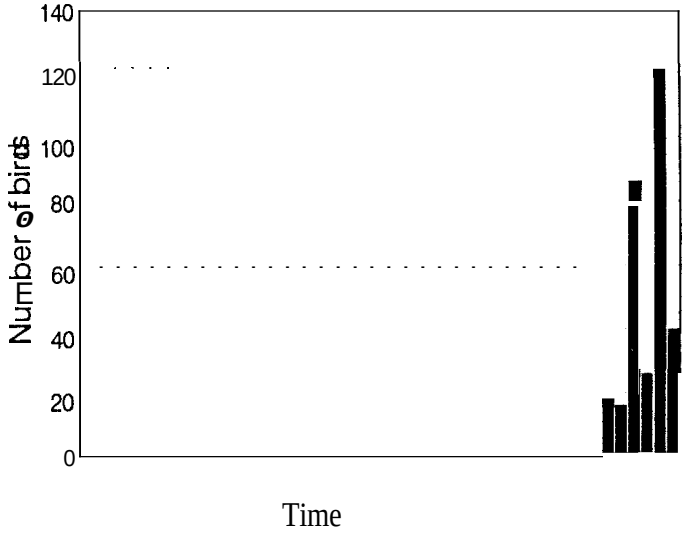


Fig.34. Number of Night herons leaving the roost in the evening (April)

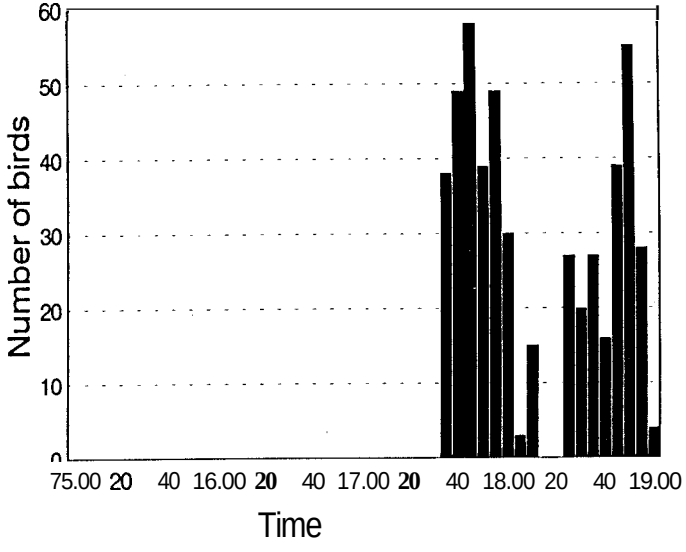


Fig.35. Number of Night herons leaving the roost in the evening (May)

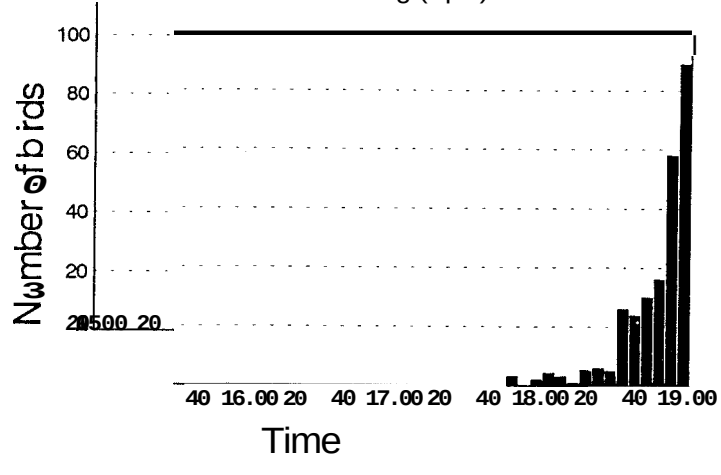


Fig.36. Number of Night herons leaving the roost in the evening (June)

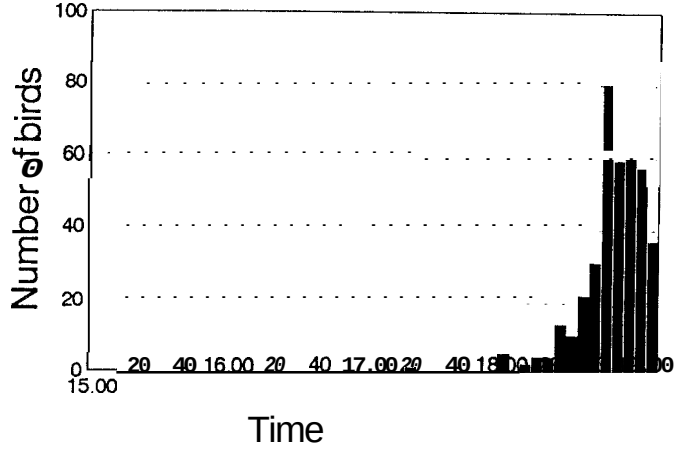


Fig.37. Number of Night herons leaving the roost in the evening (July)

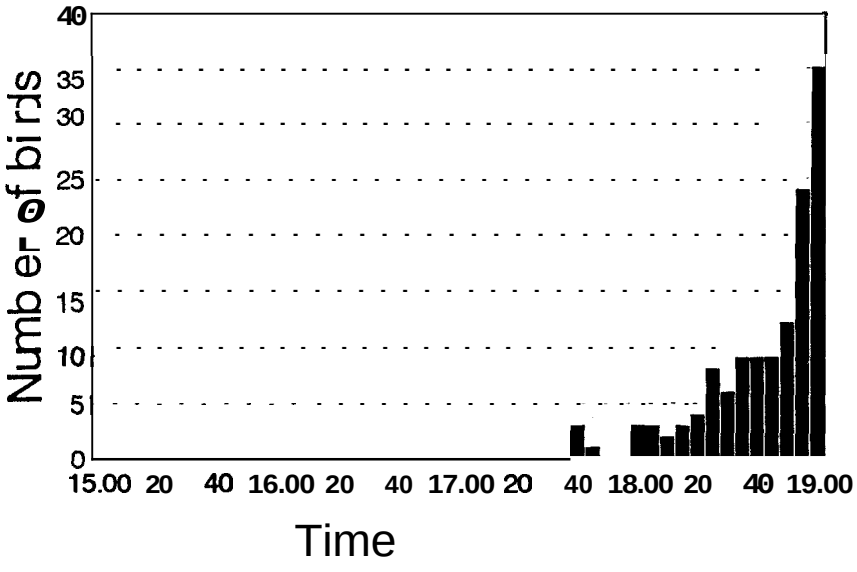


Fig.38. Number of Night herons leaving the roost in the evening (August)

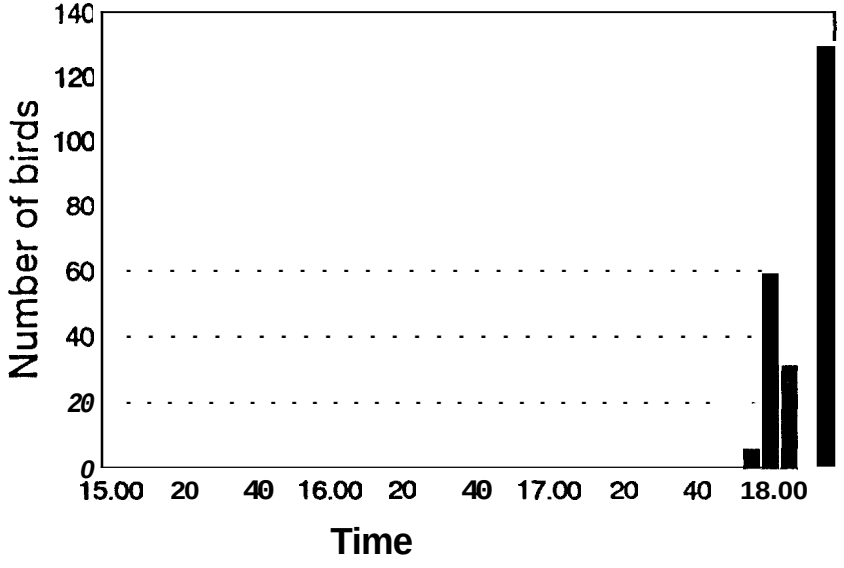


Fig.39. Number of Night herons leaving the roost *in* the evening (November)

1. *Anabas testudines*
2. *Aplocheilus lineatus*
3. *Etroplus maculatus*
4. *Etroplus suratensis*
5. *Monopterusfossorius*
6. *Rasbora daniconius*
7. *Sarotherodon mossambica*

Reptiles

Common rat snake (Ptyas *mucosus),* cobra *(Naja naja),* viper *(Vipera russelli)* were recorded from the area. Python *(Python molurus)* was reported form the area in the past.

3.3 Mammals

Only few species of mammals were recorded from the area. Indian flying fox *(Pteropus giganteus),* painted bat *(Kerivoula picta),* five-striped palm squirrel *(Funnambuluspennanti),* house rat *(Rattus rattus),* bandicoot rat *(Bandicota indica)* were seen in the mangroves. Otter *(Lutra* sp.), though was reported from the area five years ago, was not sighted during the period of study.

More than 400 Indian flying fox were sighted in the study site in all the months. They preferred *Polyalthia longifolia* and *Delonix regia* behind the Guest house. Severe competition was observed between the bats and birds for breeding places on the trees. During the initial period of the study (April 1998) all the bats were roosting on *Polyalthia longifolia* and birds were utilising *Delonix regia* for breeding. But when the birds vacated *Delonix regia* after nestlings were grown and flown away, the bats occupied those branches for roosting. And this tree was used continuously for roosting in the next few months. till the onset of the breeding season of birds.

4. DISCUSSION AND CONCLUSIONS

Twenty -three species of polycheate worms, four species of wood-borers, 24 species of crustaceans, 52 species of fishes. two species of reptiles, 76 species of birds and a single mammal species are known to occur in the mangroves of Kerala. Conservation of mangroves is urgently needed for maintaining the faunal diversity associated with it. Being a highly productive ecosystem. mangroves are ideal for aqua culture. They also help in protection of coasts against erosion and flooding. Considering the fragile nature of the ecosystem. and its specialized faunal diversity, protection of mangroves is necessary to save many of the species associated with it.

Mangalavanam is important due to many factors. The area is well protected from natural predators and not many similar communal roosting sites are available to birds in a crowded city like Ernakulam. This site is crucial to the city dwellers also because the vegetation of the area functions as a carbon sink or we can call it as the "Lungs" of the city. The area serves as a greenery in the middle of the urban expanse. Apart from the much needed breeding and roosting site for birds, the rare and threatened mangrove vegetation is preserved here.

For a small area like Mangalavanam. the occurrence of 42 taxa of birds representing 24 Families is worth mentioning. In the whole of Kerala only 64 Families were so far recorded. Even though considered as a wetland area, the representation of maximum number of species from passerine group is important. Mangalavanam qualifies the criteria for declaring it as a International IBA (Important Bird Area) of the Birdlife International due to the presence of more than 1500 little cormorant and the presence of more than 1000 night heron which form 1% of the total global population.

Trans-continental migratory species were absent in the area. Migratory ducks and waders were conspicuous by their absence. The absence of

migratory birds can be explained to the non-availability of suitable habitats in the area. Shallow water spread was very low in extent, which was preferred by the migratory ducks and waders. As reported in a previous study (Jayson. 1994), maximum species richness was observed during the summer months. The high species richness during summer months, and the reduction of species during the south-west monsoon are generally observed in the other areas of the Western Ghats also.

Two common species found in the area are little cormorant and night heron. These two species are found all over Kerala and distributed throughout the subcontinent except parts of north-west, north-east and the Himalayas (Grimmett *et al.*. 1998). Feeding guild analysis exposed the true nature of the bird community existing in the area. Sixteen species were aquatic feeders and 14 insectivorous. Carnivores were very few in number. The presence of species over an year indicated that the area is essentially inhabited by the species such as, little cormorant, night heron. few species of egrets and house crows. This showed that the bird community is dominated by a few species and others are represented only in small numbers. This mode of species-abundance distribution was reported from evergreen forests also (Jayson, 1996).

Breeding strategy of little cormorant and night heron is different from that of land birds. In land birds, the young ones are out of the nest before the onset of south-west monsoon. But in the present case, the breeding was active even in the midst of south-west monsoon. Highest number of nests was recorded in the months of May and June. One advantage of this strategy is the maximisation of the available food to the young ones. After the south-west monsoon. most of the areas were inundated and naturally the prey base was maximum during these days. Most of the nests were placed on the trees situated in the island. The island was free from most of the natural nest predators. Compared to this. the threat from predators was high on the trees situated outside the island. Snakes can find easy access to these trees. Disturbance from the humans is also less in the island.

The important factor contributing to the mortality of nestlings was heavy south-west monsoon combined with fast winds. During heavy rain, many nestlings fell down and were soft prey to the ground predators. Mortality of similar nature has been reported from Kokkaru Bellu. near Bangalore also (Subaramanya and Mani. 1996). At Kokkera Bellu, the endangered spotted pelican nestlings were falling down from trees and the nestlings were saved by an unique experiment. A volunteer group with the help of Forest Department started a nursery for the fallen spotbilled pelicans. An artificial pen was constructed and all the nestlings collected from the ground were protected and maintained on artificial food. A pool was also constructed in the pen. When the young ones were able to fend for themselves, they escaped from the pen and joined the wild birds. A similar experiment may be initiated at Mangalavanam to save the nestlings falling from the nests.

Field studies revealed that there is a shortage of available space for building nests. There was heavy competition to acquire suitable nest sites. To provide additional nest sites, more mangrove saplings can be planted in the area. Possibility of providing artificial nest platforms also can be experimented in future studies.

Egrets were not breeding at Mangalavanam. No suitable explanation could be put forward for this behaviour. As no residential houses are located in the vicinity, the roost is no disturbance to human habitation. Apart from functioning as a breeding site, another important feature of the Mangalavanam is its role as a communal roosting site.

Communal roosting is found in many species of birds. Common myna and house crow are other species which roost communally. Many studies were reported on these two species (Jayson and Mathew, 1995: Mahabel. 1993). The factors which usually influence the selection of sites for roosting are proximity to the food source and water (Haneda *et al.*, 1966) and isolation from human activity (Ross, 1973). Gadgil (1971) suggested the hypothesis of protection against predators as the function of communal roosting. Protection from natural predators and increased feeding efficiency due to

the proximity to the food source may be the two factors which favour the Mangalavanam as a preferred roosting site for little cormorant and night heron.

Mammalian fauna was rare. This is natural because of the small extent of the area. Otters were reported earlier but the species was not recorded in this study. Introduction of otter to the area may be considered. It was noted that, fish and amphibian fauna were rare. We presume that it was due to the pollution of lake in the past. The six threats identified are detrimental to the ecosystem and grave in nature. If these threats are not ameliorated in future, the ecosystem will not improve. Future studies should concentrate on the roosting and breeding biology of little cormorant and night heron. predator pressure, availability of trees. Introduction of artificial nest platforms and protection of fallen nestlings using artificial pens also need investigations. Apart form these. rigorous and intensive surveys should be conducted in the surrounding areas to locate possible similar roosting and breeding sites. Any protected area will provide ample opportunity for eco-tourism. Ways and means to attract more tourists should be explored. The proximity of the area to city enhances its tourist potential.

4.1. THREATS TO THE MANGALAVANAM

People in the surrounding areas heavily depend on Mangalavanam for various resources. Fishery potential is exploited by the local people and crab hunting, using lines is a regular practice. Chicken waste is hooked on the lines and used as bait for hunting. Ten to 15 such lines were operated at a time and crabs were caught from the lake. Adverse factors, which may have a deleterious effect on the existence of Mangalavanam mangroves. are discussed below.

4.1.1. Proposal to lease land from Mangalavanam

There is a proposal to lease part of land to a Memorial Trust. This will adversely affect the birds of Mangalavanam. Many lofty trees used by the

birds for breeding and roosting are available in the proposed land. If these trees are cut and any building is constructed the serenity of the area will be lost and the birds will lose their nesting and breeding grounds. As the extent of Mangalavanam is already small it is advisable not to divert any more land for other purposes. Alternative land can be allotted to the Trust instead of the crucial area from the Mangalavanam bird sanctuary.

4.1.2. Parking of oil tankers in the Salim Ali Road

At any given time, about 35 oil tankers can be seen parked in the Salim Ali road, which is running close to and parallel to the Mangalavanam. Data on the number of oil tankers parked on the road waiting for their turn to fill petrol from Bharat Petroleum Depot in some selected days are given in Table 11. The drivers and cleaners of the tankers utilise Mangalavanam for their toilet purpose as no other facility is available. Two temporary tea shops also function on the road, which is further blocking the smooth vehicular traffic and is a source of disturbance.

Table 11. Number of oil tankers and trucks parked near the Mangalavanam

Month	Day	Number of oil tankers	Number of trucks with cement
January	11-01-99	15	
	12-01-98	17	74
February	08-02-99	5	55
	10-02-98	22	67
March	03-03-99	27	75
April	08-04-99	17	
	06-04-99	5	65
May	18-05-99	12	
	17-05-99	21	
	26-05-99	27	70

Greater Cochin Development Authority has a proposal to shift the parking area from Salim Ali Road to the newly built road which is going through the front portion of the Central Marine Fisheries Research Institute. If this is implemented, the approach to the Mangalavanam will get a much needed aesthetic uplift and the disturbance to the birds also will be minirnised.

4.1.3. Dumping of waste in the lake

The lake situated in the middle of the Mangalavanam is used for dumping the waste of the locality. Unwanted materials, both bio-degradable and non-degradable, were thrown in the lake. Apart from these, the hardened cement bags found in the railway wagons were also discarded into the lake. Floating waste materials also enter the water during high tide and get entangled among the weeds in the lake. Due to these activities, the lake is slowly filled up and this should be stopped immediately. Conversion of the lake into terrestrial land will seriously affect the food availability of water birds.

4.1.4. Air pollution due to the unloading of cement bags

On an average, 70 trucks operate in the goods yard at a given time. The cement dust produced from the unloading of cement is deposited on the vegetation of the area. This may lead to the death or retarded growth of plants and trees. To avoid this problem, the proposal to shift the goods yard to some other suitable place outside the city may be implemented.

4.1.5. Encroachment of Puramboke land in the vicinity

Encroachment of revenue land near the eastern portion of the area is a serious problem to the mangrove and its bird community. If alternative land is distributed to the encroachers, the disturbance to the area will be reduced.

4.1.6. Growth of weeds in the lake

Invasion of the lake by various weeds, particularly by *Eichomia* sp. during the months of monsoon when the salinity of water is the lowest. is another disturbance to the mangrove community. From June to January the lake surface gets filled with *Eichomia* sp. When the water front is closed, due to the growth of weeds, the diving birds are deprived of the opportunity to feed in the lake. By December the weed is completely dried and the lake is devoid of weeds.

5. RECOMMENDATIONS

One of the broad objectives of the study was to suggest suitable recommendations. which may help in the better management of Mangalavanam. With this perspective. some recommendations are made here.

1. Visitors should not be allowed to go near the nesting trees

When visitors go near the nesting trees. the parent birds will leave the nest and the house crows waiting for a chance to snatch away the nest contents will succeed in their attempt. Strict instructions should be given to prevent visitors from approaching the trees too closely.

2. Preferred tree species

When protected area managers search for species of trees, which are beneficial to birds, fruit bearing and nectar providing species are generally recommended. But at Mangalavanam as the birds mainly arrive for roosting and breeding, the question of providing fruits and nectar does not arise. Here the objective should be to provide trees which may provide good shelter at night and strong platforms for building nests. Presently most of the nests are placed on the mangrove species. Considering the preference showed towards the mangrove species, future afforestation programmes should be oriented towards planting more mangrove trees.

3. Removal of waste

Huge quantity of waste materials was dumped into the lake during the previous years when the sanctuary was in a neglected state. Waste materials deposited in the lake include hardened cement bags, polythene bags and floating materials. Efforts may be initiated to remove the waste

materials from the lake and to clean the area. This should be carried out only during the months of November or Decembcr when breeding activity is low.

4. Silt removal

If the silt accumulated in the lake is removed and the lake is deepened. the fish fauna will flourish. This will help in providing adequate food to the young and juvenile birds. If sufficient food is available in the close vicinity. the chances of survival of nestlings will be higher. As the lake is not deep, the fish fauna found in the lake is meager. This was revealed while collecting fish from the lake. Only few species of fishes were collected from the lake and the abundance was also very low.

5. Facilities for visitors

Primary facilities for tourists are lacking in this area. Tourists visiting the area would like to know more about the details of the birds inhabiting the swamps. But except for the few photographs exhibited in the Guest house, no information is provided to the tourists. Attractive leaflets with information on the area and birds will satisfy most of the visitors. Display boards depicting the picture of birds are also necessary. Primary facilities like urinal and a cafeteria are essential.

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Appendix 1

List of birds found in the mangroves of Kerala

Common name	Scientific name
Phalacrocoracidae	
Little Cormorant	*Phalacrocorax niger* (Vieillot)
Indian Darter or Snake-bird	*Anhinga melanogaster*
Ardeidae	
Eastern Green Heron	*Ardea cinerea rectirostris* Could
Eastern Purple Heron	*Ardea purpurea manilensis* Meyen
Indian Pond Heron or Paddy Bird	*Ardeola grayii grayii* (Sykes)
Cattle Egret	*Bubulcus ibis coromandus* (Boddaert)
Little Egret	*Egretta garzetta garzetta* (Linnaeus)
Eastern Large Egret	*Egretta alba modesta* Gray
Indian Smaller Egret	*Egretta inrermedia intermedia* Wagler
Night Heron	*Nycticorax nycticorax nycticorax* (Linnaeus)
Black Bittern	*Dupetor flavicollis flavicollis* (Latham)
Indian Little Green Bittern	*Butorides striatus chloricepsy* Bonaparte
Chestnut Bittern	*lxobrychus cinnarnorneus* Gmelin
Ciconiidae	
Openbill stork	*Anastornus oscitans* (Boddaert)
Whitenecked Stork	*Ciconia episcopus eouscioys* Boddaert
Anatidae	
Lesser. or Common Whistling Teal	*Dendrocygnajavanica* (Horsfield)
Garganev or Bluewinged Teal	*Anas querquedula* Linnaeus
Accipitridae	
Pale Harrier	*Circus macrourus* (S.G. Gmelin)
Marsh Harrier	*Circus aeruginosus* (Linnaeus)
Brahminy Kite	*Haliastur indus indus* Boddaert

Common name	Scientific name
Crested Serpent Eagle	Spilornis cheela melanotis Jerdon
Falconidae	
Eastern Peregrine Falcon	Falco peregrinusjaponensis Gmelin
Rallidae	
Whitebreasted Waterhen	Amaurornis phoenicurus phoenicurus (Pennant)
Indian Moorhen	Gallinula chloropus indica Blyth
Purple Moorhen	Porphyrio porphyrio poliocephalus Lathum
Jacanidae	
Bronzewinged Jacana	Metopidius indidus (Scopoli)
Pheasanttailed Jacana	Hydrophasianus chirurgus (Latham)
Charadriidae	
Sub Family: Charadriinae	
Redwattled Lapwing	Vanellus indicus indicus (Boddaert)
Kentish Plover	Charadrius alexandrinus Alexundrinus Linnaeus
Sub Family: Scolopacinae	
Whimbrel	Numenius phaeopus phaeopus (Linnaeus)
Common Sandpiper	Tringa hypoleucos Linnaeus
Blacktailed Godwit	Limosa limosa limosa (Linnaeus)
Laridae	
Brownheaded Gull	Larus brunnicephalus Jerdon
Blackheaded Gull	Larus ridibundus Linnaeus
Indian Whiskered Tern	Chlidonias hybrida indica (Stephens)
Psittacidae	
Roseringed Parakeet	Psittacula krameri manillensis Bechstein
Cuculidae	
Indian Koel	Eudynamys scolopacea scolopacea Linnaeus

Common name	Scientific name
Strigidae	
Sub Family: Tytoninae	
Barn Owl	*Tyto alba stertens* Hartert
Sub Family: Striginae	
Collared Scops Owl	*Otus balclcarnoena bakkamoena* Pennant
Malabar Jungle Owlet	*Glaucidiurn radiatum malabaricum* Blyth
South lndian Hawk-Owl	*Ninox scutulata hirsuta* Temminck
Alcedinidae	
Brownheaded Storkbilled Kmgfisher	*Pelargopsis capensis capensis* (Linnaeus)
Travancore Pied Kmgfisher	*Ceryle rudis travancoreensis* Whistler
Common Kingfisher	*Alcedo atrhis taprobana* Kleinschmidt
Indian Whitecbreasted Kingfisher	*Halcyon srnyrnensisfusca* Boddaert
Blackcapped Kingfisher	*Halcyon pileata* Boddaert
Meropidae	
Bluetailed Bee-eater	*Merops philippinus philippinus* Linnaeus
Small Green Bee-eater	*Merops orientalis orientalis* Latham
Coraciidae	
Southern lndian Roller	*Coracias benghalensis indica* Linnaeus
Capitonidae	
Small Green Barbet	*Megalaima viridis* Boddaert
Crimsonbreasted Barbet	*Megalaima haemacephala indica* Latham
Picidae	
Malabar Goldenbacked Woodpecker	*Dinopium benghalense* Whiltler & Kinnear
Malabar Pigmy Woodpecker	*Dendrocopos nanus cinereigula* Malherbe

Common name	Scientific name
Oriolidae	
South Indian Blackheaded Oriole	*Oriolus xanthomus maderaspatanus* Franklin
Dicruridae	
Black Drongo	*Dicrurus adsimilis macrocercus* Vieillot
Sturnidae	
Common Myna	*Acridotherus tristis tristis* Linnaeus
Southern Jungle Myna	*Acridotheres fuscus mahrattensis* Sykes
Corvidae	
Tree Pie	*Dendrocitra vagabunda parvula* Kinnear &Whistler
Ceylon House Grow	*Corvus splendens protegalus* Madarasz
Indian Jungle Crow	*Corvus macrorhynchos culminatus* Sykes
Pycnonotidae	
Southern Redwhiskered Bulbul	*Pycnonotus jocosus fuscicaudatus* Gould
Muscicapidae	
Sub Family: Timaliinae	
Malabar Jungle Babbler	*Turdoides striatus malabaricus* Jerdon
Muscicapidae	
Sub Family: Muscicapinae	
Brown Flycatcher	*Muscicapa latirostris* Raffles
Southern Whitebrowed Fantail Flycatcher	*Rhipidura aureola compressirostris* Blyth
Muscicapidae	
Sub Family: Monarchinae	
Paradise Flycatcher	*Terpsiphone paradisi paradisi* Linnaeus

Common name	Scientific name
Muscicapidae	
Sub Family: Sylviinae	
Travancore Streaked Fantail Warbler	*Cisticola juncidis salimalii* Whiltler
Tailor Bird	*Orthotomus sutorius guzurata* Latham
Sub Family: Turdinae	
Southern Magpie-Robin	*Copsychus saularis ceylonensis* Sclater
South Indian Blackbacked Robin	*Savicoloidesfulicata fulicata* Linnaeus
Motacillidae	
Forest Wagtail	*Motacilla indica* Gmelin
Large Pied Wagtail	*Motacilla maderaspatensis* Gmelin
Nectariniidae	
Purplerumped Sunbird	*Nectarinia zeylonica sola* Vieiilot