6. ECOLOGICAL AND BEHAVIOURAL ASPECTS OF FOOD AND FEEDING OF LITTLE CORMORANT (*PHALACROCORAX NIGER*) AND NIGHT HERON (*NYCTICORAX NYCTICORAX*)

6.1 INTRODUCTION

Food and foraging behaviour is one of the most important aspects in the life of an animal. Mac Arthur and Pianka (1966) introduced a model on "Optimal foraging theory", in essence it states that animals conciously or unconciously endeaviour to maximize net energy gain per unit feeding time. However, net energy gain is not the only issue associated with foraging pattern or foraging strategy. Animals may choose to take less energy food items leaving high energy food items aside because of palatability of the item concerned. Foraging behaviour of animals is heavily influenced by season, prey-density and conflicting demands (Cerri and Fraser, 1983) from other behavioural activities such as aggression(Medeiros *et al*,2000), reproduction (Krebs, 1978 ; Nur, 1987), parental and so on. For example, it may be stated that most parent birds get little to eat for themselves during the parental phase when they are busy feeding the nestlings almost throughout the day. Thus time invested on feeding behaviour also varies depending on various other requirements in avian life.

Again, various authors such as Darling (1938); Fisher (1954) ; Crook (1965); Lack (1968) observed that birds which feed in flocks and breed in colonies greatly benefit in locating food sources and in reducing risk of predation (Gadgil and Ali, 1974). Roosts and breeding colonies may act as "information centers", wherein unsuccessful birds follow successful ones to better feeding sites (Ward and Zahavi, 1973 ; Krebs 1974). In this connection it may be stated that multispecies prey complexes often are exceedingly profitable. When these complexes are associated with particular easily locatable microhabitat such as ponds, pools and puddles and partially

dried out canals then such habitats serve as excellent foraging centers for both Little Cormorants and Night Herons.

This chapter attempts to discuss and analyse behavioural ecology of feeding of Little Cormorants and Night Herons specifically on :

1. Traditional foraging grounds
2. Distance of foraging grounds
3. Time of foraging
4. Food items based on observations and stomach content, and techniques of food capture both in the breeding and non-breeding season.

6.2 METHODS

Observations on foraging were made from January 1998 to December 2005. A major portion of the observations were made during the breeding season and only a minor portion during the non-breeding season. A total of 1480 hours of observations were made on this aspect. The usual observation schedule was 0600 to 0900 hrs. and 1500 to 1800 hrs. However, on occasions observations were made throughout the whole day particularly on weekends.

Data included field observations as well as those obtained from the examination of regurgitatates of the adults at the sanctuary. Because of this queer habit of vomitting out of their stomach content on the least provocation, it was possible to analyse the food items without sacrificing or injuring the birds. However, during the course of the study period extending over seven years the stomach contents of sixteen morbid (due to malnutrition, disease or injury) and five dead adult birds were analyzed in order to substantiate data obtained from observations. Food items supplied by the parents to their youngs were also collected. Such collections were quite easy because just-fed youngs regurgitated almost all the food when alarmed. The food samples were identified, weighed and preserved in different percentages of formaldehyde, depending on their nature.

Field observation data were taken by 'focal sampling' and 'instantaneous scan sampling' (Altmann, 1974) and also by continuous observations. Each focal bird was followed for as long as it was in sight, but not longer than 15 minutes. After each observation period another focal bird was chosen. Observations were made with the help of a field binocular (SAMSUNG, 7-15 x 35 with Zoom), a Tape recorder (Philips) and a Stopwatch.

6.3 RESULTS AND DISCUSSION

6.3.1. Traditional foraging grounds

Little Cormorants and Night Herons traditionally forage at certain water bodies year after year.Only some of this water bodies are perennial most others partially or completely dry out in the non-breeding season. For example, rivers and canals may dry up at certain parts of their stretch ; some pools and puddles, submerged cultivated lands, swamps etc. may completely dry up in the dry non-breeding season. While some deep, large ponds ; parts of rivers and canals and even certain ditches are perennial but there is a definite reduction in surface area in the non-breeding season.

Table 6.1. shows the traditional foraging grounds along with their total surface area in the breeding and non-breeding season and distance from the sanctuary. It is observed that there is a reduction in the surface area in all categories of water bodies except ponds in the non-breeding season. This is because the birds visited several distant perennial ponds in the non-breeding season in order to compensate dried out foraging grounds not visited earlier. It is also seen that the range of distance of water bodies foraged increases considerably in all categories during the non-breeding season. Most feeding sites, however, were within the 10 km. radius of the sanctuary.

In otherwords the birds tended to forage close to the sanctuary in the breeding season when they had to find food not only for themselves but also for their nestlings. In the breeding season area of the water bodies

increased by more than 56% in comparison to non-breeding season. The dried up waterbodies and some low-lyaing land areas around the sanctuary filled up to the brim in the monsoon. Thus, there was a significant increase in size of waterbodies in the breeding season which provided enough food materials for both the adults and the nestlings. It was not necessary for the parent birds to forage at distant waterbodies leaving the nest and nestlings unattended for a long time.

Further, it was observed that shallow water bodies such as submerged cultivated lands, swamps and marshes were solely foraged by Night Herons. Other water-bodies were foraged by both the avian species. However, the Little Cormorant tended to forage more in deep water bodies such as perennial ponds, rivers, canals etc.

6.3.2. Distance of foraging grounds from sanctuary

6.3.2.1. Feeding in non-breeding season

Both Little cormorants and Night Herons are in the habit of forming single and mixed species communal roosts which were small (5-20 individuals) in size. However, they also foraged in groups. An fifteen member group of Little Cormorant and a eight member group of Night Heron was observed in an area about 8.5 Km and 7 Km away from the sanctuary. In a 10 Km radius around the sanctuary twelve such groups (6-10 individuals) of Little Cormorants and five groups (10-15 individuals) of Night Herons were found during the study period.

Group movements were oriented centering mainly perennial ponds and rivers in Little Cormorants but perennial swamps, marshes, ponds and ditches in case of Night Herons. During this period they not only foraged at these water bodies but they also spent the whole day and night in nearby trees. As a result some waterbodies become heavily depleted of their re-

sources after supporting the groups over three early months of the dry season and can no longer support the group at the driest part of the season. Consequently, the groups were forced to leave the place in search of better foraging grounds.

6.3.2.2 Feeding in breeding season

In the early phase of the breeding season (upto mid-August) all the birds of both the species whether paired or unpaired, considerably restrict their foraging activities. During the early and mid-hatchling phase they mostly forage in waterbodies inside the sanctuary and adjacent ones within about 2 km radius of the sanctuary. As chick development progresses the requirement for food increases rather dramatically and the water bodies inside and those close to the sanctuary are no longer sufficient to meet the requirements adequately. The parents in the later phases of chick development and at the fledgling stage forage over much longer areas outside the sanctuary. It may be pointed out that nest attendance and foraging distance are governed by two major factors i.e. protection requirement of chick and amount of feed needed. In essence when the chicks are young the parents need to attend them for much linger periods but the requirement for food is small that can be procured from adjacent water bodies. On the otherhand, in the late phases the parents need to attend the nest only for short whiles and thus they get sufficient time to forage in distant water bodies in order to collect increased amounts of feed required by the grown up chicks. In the late phase the birds were even found to feed at distances of 5 km from the sanctuary.

6.3.3. Time of foraging

6.3.3.1 During non-breeding season

Most animals feed or forage at some particular periods which depends not only on the counteracting demands of other vital activities or to avoid competition from other species but also on the availability of feed species and their temporal activity patterns.

Little Cormorant is a diurnal bird. It usually takes five principal meals on an average during the day-time. On the other hand, Night Heron is nocturnal and mainly forage throughout the night and in the twilight hours.

Although the Little Cormorants feed throughout the day most frequent feeding were observed at five periods of the day i.e. Phase-I 6.00 - 7.30 ; Phase II 9.00 to 10.30, Phase- III 11.30-13.00 ; Phase- IV 14.00 -15.30 and Phase -V 16.00 -18.00 during the non-breeding season. No such clearly demarked hours of intense feeding could be ascertained for Night Herons except that they were observed to hunt more in the late afternoon and early morning hours.

6.3.3.2 During breeding season

During breeding period, due to high energy demands for egg laying by female and collecting the food for nestlings by both the sexes feeding activity becomes more intense and extends beyond the usual schedule in both the species. Night Herons were observed to forage frequently during the day.

In about two or three days of their arrival in the sanctuary birds were found to change their foraging pattern. Their investment of time in foraging decreased abruptly until aquisition of a suitable mate and a nest site. The decrement is considerably more in males than the females probably because they had to invest more time in search of nest site and conflict with other males. But after pair formation and with the initiation of laying females

became much more attached to the nest and invested lesser time in foraging than the male until the first half of incubation period. Thereafter their foraging time increased which attained a rapid momentum about the third week of hatching.

Males of both the species were observed (N=21) to provide food to their females during the laying and hatching period.

6.3.4. Depth of foraging

The Night Herons mostly foraged on food items that remain close to the surface while they stay above water. The Little Cormorants in contrast tended to forage more on food items that remain in mid and bottom water while they are under water. The spotting of prey items is done mainly from above water position in case of Night Heron whereas Little Cormorants mostly find their victims while they are under water. Thus the prey items of Night Herons are mainly surface water fishes with accessory respiratory devices and frogs and tadepoles. While those of Little Cormorant include column feeders much as *Labeo rohita*, *Labeo bata* and bottom feeders such as *Cirrhinus mrigala*, *Labeo calbasu* and so on. In the breeding season, however, the necessity of procuring large amount of food to feed the nestlings force the bird of both species to capture any suitable food items available and the species difference in food items of the two species becomes narrow.

6.3.5. Food items based on observations and stomach content and techniques of food capture both in the breeding and non-breeding season

6.3.5.1. Food items

The spatial distribution pattern of fish species in water bodies vary considerably during breeding and non-breeding seasons due to various bi-

otic and abiotic factors such as difference in temperature, volume and depth of water, oxygen and carbondioxide content in the water and the fact that most fishes themselves breed in the monsoon,all of which influence the food composition of the birds. Again it must be remembered that Night Herons usually feed only by the night in the non-breeding season but almost round the clock in the breeding season whereas Little Cormorants feed solely by the day in both breeding and non-breeding season.

A. Food of adults

Both Little Cormorants and Night Herons are mainly piscivorous. The food items include a number of fishes, amphibians, reptiles and arthropods.

The main fish feed items of Little Cormorants viz. *Cirrhinus mrigala, Labeo calbasu, Labeo rohita, Labeo bata, Puntius ticto, Channa punctatus, Channa gachua, Rhynchobdella aculeate, Amphipnus cuchia, Heteropneustes fossilis, Anabus testudenus, Lepidocephalichthys guntea, Mystus vittatus, Paleomon sp. etc.*Besides these Little Cormorants also consume crabs, Frogs (*Rana tigrina*), Tadepoles of frogs and toads and snake (*Enhydris enhydris*) in varying degrees depending on season.

Night Herons, on the other hand, mainly consumed *Catla catla, Labeo rohita, Labeo bata, Labeo gonius, Puntius sarana, Channa punctatus, Channa gachua, Clarias batrachus, Heteropneustes fossilis, Anabus testudenus, Paleomon sp.* etc. They also took frogs, tadepoles, crabs, terrestrial and aquatic insects, some snake (*Enhydris enhydris*) etc.

The stomach contents of ten Little Cormorants and eleven Night Herons during premating period (May-June) are presented in Table 6.2 and Table 6.3 respectively. It is observed that four species i.e. *Channa punctatus, Channa gachua, Rhynchobdella aculeate and Heteropnentes fossilis* are consumed by both the bird species while *Cirrhinus mrigala, Puntius ticto, Mystus vittatus and Paleomon sp.* are consumed only by Little Cormo-

rants. On the other hand *Labeo bata, Anabus testudenus and Rana tigrina* are consumed only by Night Herons. This data is in no way a complete picture of their food composition. However, it appears that Little Cormorants feed on larger fishes than Night Herons (eg.*Channa punctatus* and *Channa gachua*).

Analysis of the fresh regurgitates of Night Herons revealed that this nocturnal birds at least occasionally feed on crabs, beetles, grasshoppers and certain aquatic bugs. They were occasionally found to collect food items from dry and irrigated cultivated land. It was assumed that they collected mostly insects and or annelids under these conditions. Although the items collected could not be observed even with best efforts.

Table 6.4 and 6.5 show food items reported by various authorities for Little Cormorants and Night Herons respectively. Capture and intake of molluscs as reported for both the species by Mukherjee (1976), Davis (1993) and others were never observed in the present study although they were present in plenty in their foraging sites. Similarly consumption of algae and small rodents in case of Night Herons as reported by Dekay (1844), Davis (1993) and others were never observed in the present study.

Probably it was not necessay for Little Cormorants and Night Herons of this region to feed on molluscs, algae and small rodents because of rather abundant supply of choice food items i.e. fish in the water bodies in and around the sanctuary.

B. Food of Nestlings

Early nestlings of Little Cormorants and Night Herons were fed exclusively with semidigested fish, hatchlings and fingerlings of fish, Tadepoles, fleshy part of toads, frogs, crabs and *Paleomon* sp. etc. Gross (1923) reported similar observation in Night Herons.Detailed data on the food items of the developing nestlings are discussed under the chapter on parental care.

6.3.5.2. Techniques of food capture and intake

6.3.5.2.1. Structural adaptations for food capture

The bill, the tongue and associated epidermal structures form the main complex of feeding apparatus and together play a major role in the capture and ingestion of food. It may be mentioned here that at least fourteen species of finches live on the Galapagos and there is a precise match between a particular species beak dimendions and the type of food it consumes (Grant, 1986 ; Weiner, 1995). The epidermal structures which come in contact with the food, demonstrate seemingly obvious adaptations for a particular food habit. It may be pointed out that the hook-like structures on the palate and tongue of piscivorous birds not only assist in holding the prey, but also help in moving the food towards the oesophagus (Storer, 1960). The feeding apparatus of both species essentially consist of the bill, rhinotheca, gnathotheca, tongue and jaw muscles.

In Little Cormorants the bill is a stout structure that tapers gradually towards the tip. The maxilla is sharply hooked at the tip. It is horny brown to blackish at the tip and livid purple at the base. The males have a slightly longer bills (38.3 mm) than the females (33.5 mm).

The bill of the Night Heron is much longer, stouter and thicker than that of Little Cormorants. It is forcep-like the upper bill is redish brown while the lower beak is brownish yellow at the base. The males have a slightly longer and stouter bill (72.5 mm.) than the females (70.5 mm). Both the maxillary and mandibular tomia are very sharp and serreted anteriorly which ensures firm grip on the live prey.

The Little Cormorants and the Night Heron are predominantly fish-eaters. The fish-eaters are required to counter the force exerted by the struggling live prey. The large-sized beak and massive jaw muscles of the two birds are ideally suited for holding the prey. The movement of the live

prey i.e. sliding forward coupled with their technique of engulfing the prey head first assist the intake operation.

6.3.5.2.2. Techniques

Little cormorant and Night Heron employ a host of techniques to capture food depending on various factors such as : prey size and species, its density, time of the day / night, breeding or non-breeding season and many others. Some of the techniques are common to both species and some others are unique possessions of the species concerned. Terminology of techniques are mostly based after Kushlan (1976).

The techniques are described under two main categories such as :-

A. Stand or Stalk B. Aerial and deep water feeding

Each technique, however, contained several sub-components which varried widely between the two species studied.

A. Stand or Stalk

i) Stand and Wait

The bird stood motionless in shallow water or on land ; watching and waiting for the prey to appear. Two basic postures were observed. In Upright posture the body was held erect with fully extended head and neck angled away from the body. In the Crouched posture, the body was held horizontal to the perch or the water surface with the bent legs while the head and neck were partially retracted.In this technique birds with a quick thrust of its bill into the water, caught small fish.

ii) Bill vibrating

The bird creates a disturbance or vibration in water by rapidly closing

and opening the submerged bill while standing in a crouched posture i.e. stooping over the water surface for luring prey. After that it graps the prey with its bill.

iii) **Walk slowly**

The bird moves leisurely, stalking prey. Walking slows down as the bird inspects items or areas of interest.

B. Aerial and deep water feeding

i) **Hovering**

The bird hovers and remains static in the air above the water surface for a while and suddenly swoops down on the prey in the surface water. A variant of this pattern is "hovering stirring" in which a bird hovering above the surface of water stretches one foot and pats the surface of water stirring or raking surface vegetation and debris.

ii) **Plunging**

The bird suddenly plunges into the water surface to catch prey from a hovering or foward flight position. After plunging the bird may either fly away or stay at the water surface. It is assumed that the birds generally plunges in water bodies that are less than 2.5 m deep.

iii) **Diving**

The bird perched on shore or on branches of trees overhanging the water bodies dives precipituously head first from its perch deep into the water bodies that are more than 2.5 m. deep.

iv) **Feet first diving**

The bird alights on the water feet first, usually from a hovering position and stabs at prey immediately on landing.

v) **Swimming feeding**

The bird swimming at the surface of the water, suddenly stretches its neck and capture nearby prey with the beak.

Table 6.6 shows presence (P) or absence (A) of different techniques of food capture in Little Cormorants ande in Night Herons in the premating season (i.e. May-June).

A total of about 32 hours over six days incase of Night Herons and about 70 hours over thirteen days in case of Little Cormorants were solely devoted in determining the different feeding techniques used by the two birds in the sanctuary.

It was observed that although the two bird species lived in the same area and even on the same tree species and feed in the same waters ; there exists significant differences in their food capture techniques and in percent time employed to different techniques. This is probably one of the reasons that enabled the two species to coexit in the same habitat.

It is clear from the data presented in the table that while Night Herons predominantly depended on stand and stalk (85%) techniques for prey capture the reverse is true for Little Cormorants which almost always employed aerial and deep water feeding (98%). Thus there is a clear cut nieche segregation between the two bird species in regards to prey capture techniques.

The swimming feeding technique was observed both in Night Herons and Little Cormorants on rare occasions at seasons other than the specific period mentioned specifically for this section. Swimming feeding technique in Night Heron was also observed many others (Hancock and Elliott, 1978 ; Kushlan, 1978 and Parasharya, 1982).

Table 6.7 shows various activities in the different periods of daily feeding of Little Cormorant in premating stage. The commonest techniques used by Little Cormorants to catch prey was to dive into the water. From the table we find that number of dives /m in five phases are 2.4,2.3,2.27,2.13, and 2.28. Number of dives/m decreased continually with progress of the day except the last phase. This is because of more intense feeding during early

morning and late afternoon phases. Duration of plunging are 21.90,20.19,21.36,22.07 and 21.09 and of deep dives are 27.70,32.81,30.37,34.72 and 33.29. Duration increased continually with progress of the day in the plunging as well as deep dives. Interval between plungings are 10.76,11.19,10.18,9.45 and 8.57 and those in deep dives are 9.70,10.37,10.44,8,88 and 9.75. These shows that interval between plungings & deep dives decreased with the day. Catches were distinctly high in phase I and V with little difference in plunging (31) and deep dives (28) with regard to number of catches. Number of catches in plunging and deep dives were almost the same (.0496 and .0482). Duration of both decreased with day. Chases were found only in the early morning and late afternoon.Duration of wing and tail shaking decreased in Phase II and Phase III but increased in Phase IV & V. Wing drying duration also increased with the day. Preening duration increased with the day, with a maximum in Phase IV.

Food items vomitted out by adults and nestlings of both the species are often collected back by parent birds who occasionally consume those food items themselves or feed those to their chicks. In fact a competition ensues particularly in the early morning hours among all the resident bird species of the sanctuary to collect those food items from the ground beneath the nests.

Table 6.1 **Traditional foraging grounds along with their total surface area in the breeding and non-breeding season and distance from the sanctuary.**

Traditional foraging grounds	Observed area of foraging water bodies			
	Breeding / Monsoon		Non breeding / Dry	
	Area (meter^2)	Range of Distance (meter)	Area (meter^2)	Range of distance (meter)
1. Ponds	1237.64	50 – 2000	1533.16	1500 – 7000
2. River	4461.78	120 -250	3246.34	200 – 550
3. Canals / Ditches	629.28	60 -200	308.98	200 - 300
4. Pools and Puddles	380.36	150 -200	76.36	150 - 300
5. Submerged cultivated Lands	1540.76	200 -1000	344.80	500 - 2000
6. Swamps or Marshes	2480.96	300 - 700	1331.32	500 - 2000
Total surface area of water bodies	10730.78		6840.96	

Table 6.2 : **Stomach content during May – June of Little Cormorant (N = 10)**

Food species	Number	Total weight (gm)	Average weight (gm) ± SE
Cirrhinus mrigala	04	85.20	21.30 ± 1.05
Puntius ticto	09	65.90	7.32 ± 0.67
Rhynchobdella aculeata	12	68.82	5.73 ± 0.52
Channa punctatus	08	187.32	23.41 ± 1.47
Channa gachua	02	40.50	20.25 ± 1.95
Heteropneustes fossilis	01	11.50	11.50 ± 00
Mystus vittatus	02	16.40	8.20 ± 0.18
Paleomon sp.	10	11.78	1.18 ± 0.01

Table 6.3 Stomach content during May – June of Night Heron (N = 11)

Food species	Number	Total weight (gm)	Average weight (gm) ± SE
Labeo bata	02	27.5	13.75 ± 0.22
Channa punctatus	12	138.6	11.55 ± 1.47
Channa gachua	13	160.16	12.32 ± 0.93
Anabus testudenus	09	80.7	8.96 ± 0.46
Rhynchobdella aculeata	09	80.28	8.92 ± 0.49
Heteropneustes fossilis	01	11.28	11.28 ± 00
Rana tigrina	02	88	44 ± 0.84

Table 6.4 : Food items of Little cormorant as reported by various authors

Food Items		Authority
Fish, Small Crabs, Tadpoles, Frogs		Blanford (1898), Mason & Maxwell – Lefroy (1912), Whistler (1928)
Rana sp.	Amphibia (14.14%)	Mukherjee (1975)
Mystus gulio *Mystus vittatus* *Puntius sarana* *Puntius ticto* *Catla catla* *Labeo bata* *Anguilla bengalensis* *Oryzias melastigmus* *Mugil parsia* *Channa punctatus* *Anabus testudenus* *Lates calcarifer* *Nandus nandus*	Fish (83.00%)	
Melanoides scabra *Lymnea acuminata*	Mollusca (1.37%)	
Macrobrachium lamarrei *Metapneus brevicornis*	Arthopoda (.85%)	
Vegetable matter	0.06%	
Fish, Tadpoles, Frogs, Crustaceans		Lack (1945), Ali & Ripley (1968), Gere and Andrikovies (1992)

Table 6.5 Food items of Night Heron as reported by various authors

Food Items		Authority
Alga, Sea Lettuce *(Ulva latissma)*		Dekay (1844)
Fish, Shrimps, Tadpoles, Frogs, Leeches		Jasper (1878)
Fish, Frogs		Blanford (1898)
Eels		Chapman (1900)
Water dogs *(Ambystoma)*, Frogs, Axolotls		Wetmore (1920)
Merluccius bilinearis *Clupea harengus* *Tautogolabrus adspersus* Sculpin, Puffer, Sea-Robins	80%	Gross (1923)
Nereis virens, Shrimp, Sand-hoppers, Crabs, Beetles, Dragon fly (nymph) Squids, Frogs, Salamander, Tadpoles, Adult of fowler's toad	20%	
Small Fish, Amphibia, Crustacea, Aquatic insects		Whistler (1928)
Fish, Frogs, Crabs, Crustacea, Worms		Baker (1929)
Natrix sp., Rana sp. (tadpoles), Mystus gulio, Anguilla bengalensis, Periopthalmus koelreuteri, Lymnaea sp., Viviparus bengalensis, Macrobrachium sp., Uca sp., Acrydium sp., Chrotognus sp., Pantala sp., Gerris sp., Nepa sp., Notonecta sp., Corixa sp., Pheretima sp.		Mukherjee (1975)
Cray Fish, Mussels, Squid, Amphibians, Lizards, Snakes, Rodents, Birds.		Davis (1993)
Dropped Open-bill stork nestling of 3 – 4 days old		Present study

Table 6.6 **Presence (P) or absence(A) of food capture in Little Cormorants and in Night Herons in the pre-mating season (May – June).**

Techniques	Little Cormorant		Night Heron	
	Present / Absent	Percent Times Employed	Present / Absent	Percent Times Employed
1. Stand or stalk feedings:-				
a) Stand and wait	P	2	P	67
b) Walk slowly	A	--	P	12
c) Bill vibrating	A	--	P	07
	Total	2	Total	86
2. Aerial and deep feeding ;-				
a) Hovering	A	--	P	4
b) Plunging	P	42	P	3
c) Diving	P	56	A	--
d) Feet first diving	A	--	P	7
e) Swimming feeding	P	*	P	*
	Total	98	Total	14

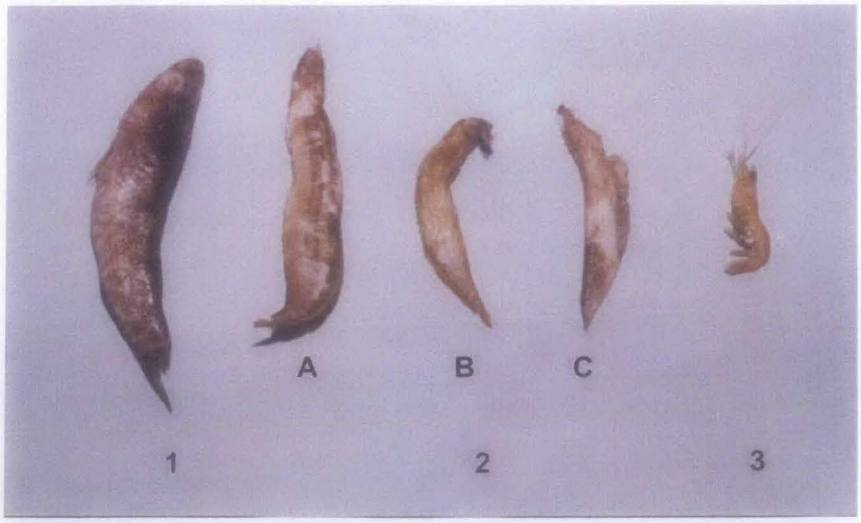
* Indicates swimming feeding was observed in other seasons.

Table 6.7 Phases of daily feeding of Little Cormorant in pre-mating period

	Activity		Phase I (6.00 – 7.30)		Phase II (9.00 – 10.30)		Phase III (11.30 – 13.00)		Phase IV (14.00 – 15.30)		Phase V (16.30 – 18.00)	
			Below 2.5 m	Above 2.5 m	Below 2.5 m	Above 2.5 m	Below 2.5 m	Above 2.5 m	Below 2.5 m	Above 2.5 m	Below 2.5 m	Above 2.5 m
On Water	Plunging and Dives/bird	Total duration (Sec)	460	665	424	525	470	820	618	868	696	799
		$\bar{X}$ + SE	21.90 ± 3.21 N = 21	27.70 ± 6.34 N = 24	20.19 ± 2.59 N = 21	32.81 ± 7.43 N = 16	21.36 ± 3.40 N = 22	30.37 ± 5.41 N = 27	22.07 ± 3.8 N = 28	34.72 ± 4.2 N = 25	21.09 ± 3.64 N = 33	33.29 ± 4.50 N = 24
	Interval between Plunging and Dives/bird	Total duration (Sec)	226	233	235	166	224	282	265	222	283	234
		$\bar{X}$ + SE	10.76 ± 1.07 N = 21	9.70 ± 0.93 N = 24	11.91 ± 1.16 N = 21	10.37 ± 2.05 N = 16	10.18 ± 1.29 N = 22	10.44 ± 2.37 N = 27	9.45 ± 2.83 N = 28	8.88 ± 1.7 N = 25	8.57 ± 1.0 N = 33	9.75 ± 1.41 N = 24
	Catches	Number	7	8	5	4	4	6	7	4	8	6
		$\bar{X}$ N = 5	3.0		1.8		2.0		2.2		2.8	
	Baths	Total duration (Sec)	140		100		136		112		80	
		$\bar{X}$ + SE	10 ± 1.64 N = 15		9 ± 0.94 N = 10		7.5 ± 1.6 N = 22		18 ± 1.2 N = 14		10.83 ± 0.96 N = 12	
Outside Water	Chases by Conspecifics	Number	2		-		-		-		1	
	Wing and tail Shaking	Total duration (Sec)	150		90		165		252		130	
		$\bar{X}$ + SE	10 ± 1.64 N = 15		9 ± 0.94 N = 10		7.5 ± 1.6 N = 22		18 ± 1.2 N = 14		10.83 ± 0.96 N = 12	
	Wing spreading or Drying	Total duration (Sec)	1265		627		1260		1764		2672	
		$\bar{X}$ + SE	84.33 ± 3.75 N = 15		57 ± 2.83 N = 11		126 ± 3.45 N = 10		147± 3.31 N = 12		167 ± 2.64 N = 16	
	Preening	Total duration (Sec)	1315		1425		1836		2720		2360	
		$\bar{X}$ + SE	87.66 ± 3.80 N = 15		95 ± 2.68 N = 15		102 ± 3.20 N = 18		170 ± 3.92 N = 16		118 ± 2.75 N = 20	
	Excretion	Number	-		-		1		-		1	

Plate 5.i A foraging group of Little Cormorants perched on bamboo poles and fences in the pond outside the sanctuary.

Plate 6.2



1. *Channa punctatus,* 2. (A,B,C) *Rhynochobdella aculeate*
3. *Paleomon sp.*

Plate 6.2

1. *Enhydris enhydris*

Plate 6.2

1. *Amphipnus cuchia* 2. *Rana tigrina*

Plate 6.2 Food of adult of Little Cormorants

Plate 6.3

Channa punctatus

Plate 6.3

Heteropneustes fossilis

Plate 6.3

1. Crab 2. *(A, B) Puntius sp.*
3. *Channa gachua*

Plate 6.3 Food of adult Night Heron

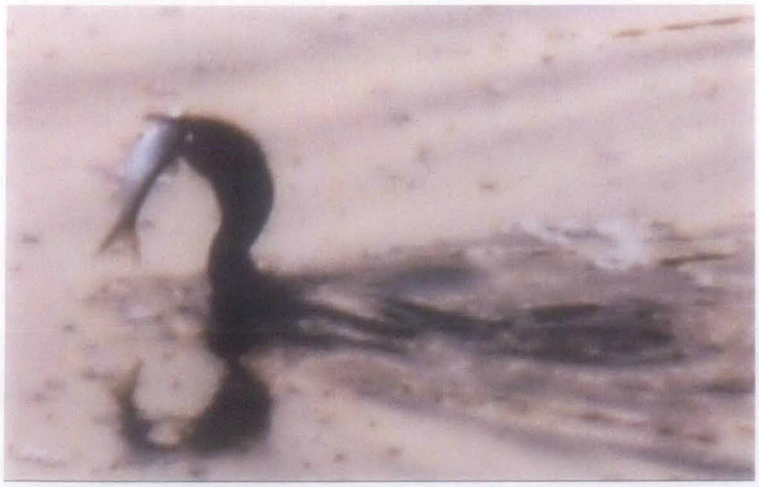


Plate 6.4
Adult Little Cormorant with a live *labeo bata* just captured in its bill.

Plate 6.5
Adult Night Heron in a stand and wait posture for capturing food.

Plate 6.6
Adult Night Heron collect food from the ground beneath a nesting tree.

Plate 6.7 Wing spreading(A) and preening (B) of Lilttle Cormorants after feeding while sitting on bamboo poles. outside the sanctuary.

Plate 6.8 Resting of Little Cormorants after feeding outside the sanctuary.