

# BREEDING BIOLOGY OF POND HERON IN KERALA, SOUTH INDIA

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## Abstract

Regular intensive investigations to locate nesting colonies were carried out early monsoon of 1999 up to 2002. For detailed study a few breeding colonies were selected. The nesting trees, nest characteristics, eggs characteristics, incubation, hatching and hatchlings were investigated.

Altogether 17 plant species were used for nesting. Nest materials were collected from 24 plant species for building nest. The mean maximum size of the nest material used was 29.05 cm and the mean minimum size was 13.46 cm. The clutch size varied from 2-5 and clutches of three were very common. The maximum and minimum length and breadth of eggs were 48.0 x 32.0 and 33.3 x 24.1 respectively. The weight of eggs varied between 17.8 and 11.2 gm. Both sexes take part in incubation that extended for 18-24 days. Hatching success reached 82%. Their food consisted mainly of fishes and both parents took part in feeding the nestlings.

## Key Words

Indian Pond Heron, *Ardeola grayii*, Nest materials, clutch size, Hatching success

## Introduction

Indian Pond Heron, *Ardeola grayii* (Order Ciconiiformes, family Ardeidae) is a colonially nesting species frequenting paddy fields, ponds, reservoirs, jheels and other such natural wetlands. These chiefly solitary ground feeders feed on animal matter mainly aquatic in nature (Ali and Ripley 1968). Factors affecting distribution of heronries and breeding biology of herons are discussed widely (Krebs, 1974, 1978, Fasola et al. 1978, McCrimmon Jr. 1978, Mitchell et al. 1981, Erwin et al. 1996, Gawlik et al. 1998, Martinez 1999, Poussart et al. 2001). Information on colonial nesting birds in India include studies on nidification, breeding, distribution, status and conservation (Ali and Ripley 1968, Jenni 1969, Mukherjee and Chandra 1973, Mukherjee and Saha 1976, Naik et al. 1981, Dharmakumarsinhji 1984, Parasharya and Naik 1984, 1988, Uthaman 1990, Subramanya, 1996, Mukherjee and Parasharya 2000). However, the breeding biology of Indian pond heron is less exposed excepting for information on some aspects from certain parts of India and Bangladesh (Panday 1958, Lamba 1963, Parasharya 1985, Yesmin et al. 2001, Begum 2003). The present study was an attempt to examine the heronries and the breeding biology of pond heron in Kerala, South India.

## Study Area and methodology

The study area extends over the districts of Malappuram and Kozhikode districts of Kerala (Figure 1). The major part of the study was conducted in the breeding colonies in a residential area at Mampad (11°14' 16.8" N, 076° 11' 47.2" E) in Malappuram district. Other nest sites examined in the district were at Pathapiriyam (11° 11' 33.4" N, 076° 08' 03.2" E), Vaniyambalam (11° 11' 20.0" N, 076°15' 35.4" E), Melattur (11° 03' 02.7" N, 076° 16' 37.2" E) and Kizhissery (11° 10' 28.5" N, 076° 00' 00.3" E). Nest sites

examined in Kozhikode district were located at Ramanattukara (11°10' 32.8" N, 075° 52' 04.8" E) and Eranhipalam (11° 16' 39.5" N, 075° 47' 05.7" E).

Since 1996, attempts were made to locate breeding colonies of Pond Herons in the study area. However, regular intensive investigations to locate nesting colonies of the species at different localities of the study area were carried out early monsoon of 1999 onwards up to 2002. Of the many breeding colonies located during the survey, few mentioned earlier were selected for detailed study. In the breeding colonies, the nesting trees were numbered and numbered plates, camouflaged to the best, individually marked a number of nests. The freshly laid eggs were numbered with a felt-tipped pen, measured with digital vernier calipers and weighed to the nearest 0.5g with a Pesola spring balance, taking care to cause least disturbance, at an opportune occasion when the parent bird would not be alerted. Shape index of eggs was computed using the formula (Romanoff and Romanoff 1949, Prasanth et al. 1994)  $Si=B*100/L$ , where Si = shape index, B =breadth and L = length of the egg in centimeters.

The nests were checked every day during the egg-laying period; at four or five-day intervals during incubation and hatching periods and at weekly intervals from the time chicks are hatched, until they reached the age of 24 days. The weight of freshly hatched hatchlings was taken using a 100 gram capacity Pesola spring balance. Regular observations on the nests were made from the top of a nearest building or vantage point using 10x30 binoculars. Some preliminary observations on plumage and colour of the nestlings were also made.

## RESULTS

The nesting colonies of Pond Herons at Ramanattukara Township was on a large Tamarind tree located in 250 square meter compound at the rear of a shopping complex at the heart of the Ramanattukara town on the northern side of the Palakkad - Kozhikode National Highway. The tree is under strict vigil of nearby shopkeepers and nobody is allowed to disturb the nest or climb the tree. Little cormorants occupied the top, the inner and outer periphery of the nesting tree whereas Pond Herons occupied the outer and inner periphery of the tree crown interspersed with the nests of little cormorants. The distance between the nearest nests of Pond Herons was half a meter and that between the little cormorant and pond heron was 0.5 -1m, but never more than a meter.

At Mampad, where totally 84 nests were observed, the nests were built on different plant species, in residential areas. The nests were solitary or in colonies in company with Little Cormorants. Based on the plant species the nest height varied (Table 1). At Vaniyambalam 12 nests of Pond Herons with 7 nests of little cormorants were on a mango tree. This was in a homestead situated near a railway - cross on the Wandoor - Vaniyambalam road. At Pathapiriyam 20 nests of Pond Herons spotted were on two mango trees, the first tree having 8 nests placed within 6 -7 m height and the second 12 nests within a height of 7-8 m. There were 12 nests of little cormorants on the same tree. The nesting site located at Kizhissery had eight nests of Pond Herons, 4 of Little Cormorants and 5 of Night Herons on a mango tree in a residential area. A Tamarind tree in the same area was site for five nests of Pond Herons, 8 of Little Cormorants and 3 of Night Herons. At Melattur a mango tree, located in the Police Station yard, had 12 nests of Little Cormorants and five of Pond Herons.

### **Nesting season**

Pond herons usually breed from May to September corresponding with the onset of southwest monsoon. Occasionally, where rain starts a little early breeding is accordingly advanced. During 2000 and 2001 as there were heavy summer rains in April the birds commenced breeding in April 1<sup>st</sup> week. The peak nesting was during June and July. Prior to the onset of monsoon, at Mampad and Ramanattukara, large number of pond Herons were found roosting on some trees like *Tamarindus indicus* and *Mangifera indica* on which they were not normally seen roosting during other seasons. With the onset of monsoon, the birds established their nests on those trees.

### **Nest-site selection**

Finding a nest site is a joint effort by both male and female. After selecting a convenient site, the pair stay put in that spot for a few hours. Courtship progresses there, culminating in copulation that lasts only for 6-8 seconds. Thereafter the female remains in the vicinity of the nest site and the male flies off to collect nest materials. Males collected more nest materials than females. Female arranged the materials in a crisscross fashion to form the nest. Some of the nest materials fall during the course and no special attempt were made to retrieve them. Most of the nesting materials were collected from the vicinity of the nesting tree and even from the nesting tree itself. More materials were collected in the morning and afternoon than in the noon. Almost a week is taken to complete building the nest. Normal duration for completing a nest is 5-6 days. There was foliage cover over most of the nests. Only a few nests were exposed to the open sky.

Pond Heron nests were placed at varying heights. The nests at low heights were on *Pongamia pinnata*, *Ficus hispida* and *Acacia sp.* Nests at heights ranging from 9-10 m were observed on *Stereospermum colais* and *Terminalia paniculata* at Mampad whereas nests built at a height of 18 m were seen on *Tetrameles nudiflora* at Ramanattukara. At

Eranhipalam, 18 nests were placed on *Tetrameles nudiflora*, about 18- 20 m high. The nests were usually built on the vertical branches both inside and the periphery of the tree crown. Number of nests per tree apparently depends to an extent upon suitable forked branches available on the tree. On a tamarind tree, with high number of forked branches, situated at Ramanattukara 85 nests were seen in 2000 and 78 nests in 2001 at a height of 6- 9 m (Table 1). More than 58 nests of Little Cormorants were also present on the same tree. Most of the nests were placed on quaternary branches (N=28) and a lesser number (N=18) on the direct sub branch arising from a quaternary branch. The mean thickness of the nesting branch was  $10.8 \pm 1.91$  cm, computed by measuring 10 randomly selected nests (Table 2).

### **Nest materials**

In Pond Herons, addition of nest materials continued throughout the incubation period but not during hatching. Pieces collected from 24 different plant species or materials were used for building the nest (Table 3). The average number of pieces used for nest building was 91. Out of 12 nests analysed, one was composed of 128 pieces and other one with only 54. The mean maximum size of the nest building material used was 29.05 cm and the mean minimum size was 13.46 cm (Table 4).

### **Eggs**

The eggs of Pond Heron are broad, oval and medium in size. The eggs were laid generally during night or early morning. In total 58 eggs were examined during the study. Longer and thinner eggs had lower shape index while shorter and thicker ones had higher index. No correlation could be found between weight and shape index ( $r = -0.059$ , not significant,  $df = 58$ ). The eggs are sea green in colour with no markings or spots. The highest weight of the eggs examined during the study was 17.8 gm, the lowest 11.2 gm and the average  $15.51 \pm 1.87$  gm. The minimum length of egg was 33.3 mm and

minimum breadth 24.1 mm. The maximum egg length was 48.0 mm and breadth 32.0 mm. The mean length was  $37.36 \pm 1.91$ mm and the breadth  $28.34 \pm 1.44$ mm (Table 5).

Clutches of three were most common and had a percentage frequency of 87. Clutches of five were very rare (Figure-2). The 58 eggs examined during the present study belonged to 19 clutches.

For Pond Herons one of the major causes for egg loss, in the study area, was falling off the nest. During heavy monsoon at times, strong wind and rain upset the nests, some of the nests built on comparatively weak branches at the periphery of the tree shake violently, and the eggs fall off. However, the number of such loss was low during the present study. Five such eggs were seen fallen under the Tamarind tree at Ramanattukara during heavy monsoon. It is reported by local sources that rarely when somebody climbs up the tree negligently, the parent bird spurts out of the nest causing the eggs to role out of the nest.

### **Incubation**

The first egg was laid with the close of the nest building, which usually takes place within 5-6 days. Incubation started after laying the first egg. Once the egg was laid the nest was never left unattended except when disturbed. The incubation period, of 62 eggs observed in the present study, ranged from 18-24 days. The mean incubation period was  $20.9 \pm 1.66$  days (Figure-3). Both the parents incubate the eggs. Usually there was 3-4 changeover of duty within 12 hours of daytime. It took about 3-4 hours for each change over. While one bird sat on the eggs, the other remained very close to the nest on another branch within the reach watching over the nest.

## **Hatching**

Out of 85 eggs examined for the purpose, 70 hatched; hatching success was 82% (Table 6). Of the remaining eggs, five were lost due to nest loss, three by falling from the nest and seven remained unhatched. The unhatched eggs were those that surpassed incubation period failing the chick to emerge for several reasons such as being unfertilized or death of embryo. In one nest, two eggs were found unhatched for about 15 days after completion of the incubation period. Subsequently the nest was found deserted.

In Pond Herons, hatching was asynchronous. The freshly hatched (0 days) chick weighs an average 13.6 gm (N= 10). The chicks were almost naked with closed eyes that opened during third to fifth day after hatching. The nestlings had a bulging abdomen that is almost transparent. The body was fleshy light in colour. The natal plumage was prominent on the head. The nestlings did not take food for 1-3 days after hatching. Food of the nestlings was mainly fishes. Both the parents took part in feeding the nestlings. At one occasion, the parent bird was seen regurgitating into the nest that contained the head of a sardine that was dismembered by the parent bird.

## **DISCUSSION**

Pond Heron breed from April to September depending on the monsoon. If summer rain started earlier, they started breeding early. In Pond Heron, the nest site was also used for roosting. For example in Ramanattukara, Kozhikode district, a large Tamarind tree, which had on it 85 nests of Pond Herons and 58 nests of Little Cormorants, was also used as roosting site by Pond Herons.

The nests of Pond Herons were small and made of dry soft twigs loosely arranged, almost looking like that of a crow. Ali and Ripley (1968) describe the nest of Pond Heron as ‘an



untidy structure of twigs slightly more substantial than a dove's nest'. Henry (1971) reports the nest as rather flat and devoid of inner lining. Yesmin et al (2001), in their study in captivity found the birds using dry small branches and petiole of leaves of different trees. In the present study conducted in wild, we found the birds using dry small twigs of 24 plant species growing in the neighborhoods.

During nest building, the male collected the material and the female built the nest (Hancock and Elliot 1978). Both sexes took part in nest building; apparently the male is chiefly responsible for collecting the material which the female puts together (Ali and Ripley 1968). The rate of gathering nest material was comparatively higher in the morning than in the noon hours. The present study endorses that most of the nest materials are collected by the male during the morning and is passed on to the female for building the nest.

The nest height in Pond Heron is found to vary widely. According to certain previous workers, it was located two to ten meters above surface, on isolated large trees (Baker 1929, Ali and Ripley 1968 and Hancock and Elliott 1978). According to Begum (2003), the nests were built more frequently between 9 and 10m above the ground. In captivity, the height was considerably lesser (Yesmine et al. 2001, nest-height ranged from 0.12-3.35 m). In the present study, Pond Heron was seen to nest solitary as well as in colonies. Generally, they are less colonial than the Little and Cattle Egrets. The nest height varied from 3 meters in *Acacia* and *Pongamia pinnata* to about 10 and 18 meters in *Stereospermum colais* and *Tetrameles nudiflora* respectively. It is felt that the level where nest is placed varied with the tree species and the available nest site.

The clutch size varied from 3-5 to five (Ali and Ripley 1968). 4-5 eggs per clutch were also reported. Clutches of 4-6 was most common in Burma (Smythies 1953) and 1-4 in captivity (Yesmin et al. 2001). In the present study, clutch size varied from 2 to 5 and the majority (86.3%) was 3. The average size of Pond Heron egg was 30.0 x 28.5 mm (Baker, 1929). A longer size (38.0 x 28.5 mm) was reported by Ali and Ripley (1968), while Henry (1971) reported slightly larger 39.5 x 29.5 mm. The average size of the 76 eggs observed by Yesmin et al. (2001) was 36.38 x 29.87 mm and the average weight 19.27 gm. In the present study, the eggs were longer, thinner and lighter than that reported by Yesmin et al (2001) and of higher dimensions than that reported by Baker (1929).

The incubation period of Pond Heron (38 eggs) was reported to be ranging from 21 to 24 days, the average being 23.02 days (Yesmin et al. 2001). In the present study, the incubation period varied from 18 to 24 days, the average being  $20.9 \pm 1.7$  days. Addition of nest materials i.e., repair and maintenance continued throughout the incubation period, but stopped almost fully on hatching, similar to the observations reported by Blaker (1969). According to Yesmin et al. (2001), the hatching success of the pond Heron was 46.05%. In the present study, the hatching success was observed to be 82%.

Both the parents took part in feeding the nestling. The mean weight of newly hatched (0 days) chick was 13.6 gm. The weights of nestlings increased until two weeks after hatching. Thereafter, the weight dropped until the birds finally left the nest (Yesmin et al. 2001). The food of nestlings is mainly composed of fishes (62.5%). Other items include insects (22.5%), Tadpoles (10%), Arachnids (2.5%) and Crustaceans (2.5%). A major reason for the concurrence of breeding in this bird with monsoon may be the heavy and growing demand of the chicks for fishes and other aquatic organisms.

In captivity, 8.5% of the nestlings of Pond Heron were lost due to natural calamities, 5.71% succumbed to ectoparasitic disease, and 2.85% died of starvation (Yesmin et al. 2001). In the present study, the loss of nestlings although noticed was much less. Carcasses of three nestling Pond Herons were observed under a nesting tree, *Tamarindus indicus*, which harboured more than 100 nests in a season. All the three dead specimens were seen on the days following heavy rain and strong wind.

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### **References**

- Ali and Ripley (1968) Handbook of the birds of India and Pakistan. Vol. I Oxford University Press, Bombay.
- Baker, E.C. (1929) The fauna of British India, including Ceylon and Burma. Birds. Vol VI. Taylor and Francis. London.
- Begum, S. (2003) Colonial nesting behavior in Indian Pond Heron (*Ardeola grayii grayii*) of Bangladesh. Zoos' Print Journal 18 (6): 1113-1116.
- Blaker B.R (1969) Behaviour of the Cattle Egret *Ardeola ibis*. Ostrich 40(3): 75-129
- Dharmakumarsinhji, K.S. (1984) Some notes on the Indian Reef Heron. Journal of Bombay Natural History Society 81: 188-189.

- Erwin, R.M., Haig, J.G., Scotts, D.B. and Hatfield, J.S. (1996) Reproductive success, growth and survival of Black-crowned Night-Heron (*Nycticorax nycticorax*) and Snowy Egret (*Egretta thula*) chicks in coastal Virginia. *The Auk* 113: 119-130.
- Fasola, M., Mauro, and Barbieri, F. (1978) Factors affecting the distribution of heronries in Northern Italy. *Ibis* 120 (4): 537-540.
- Gawlik, D.E., Slack, R.D., Thomas, J.A., and Harpole, D.N. (1998) Long-term Trends in Population and Community Measures of Colonial nesting Water birds in Galveston Bay Estuary. *Colonial Water birds* 21 (2): 143-151.
- Hancock, J. and Elliot, H. (1978) *The Herons of the World*. London Editions Ltd., London.
- Henry, G.M. (1971) *A guide to the birds of Ceylon*. Oxford University Press. London, Bombay, New York.
- Jenni, D.A. (1969) A study of the Ecology of four species of herons, during the breeding season at Lake Alice. Alachua County. Florida. *Ecological Monograph* 39: 245-270.
- Krebs, J.R. (1974) Colonial nesting and social feeding as strategies for exploiting food resources in the Great Blue Heron (*Ardea herodias*). *Behavior* 51: 99-134.
- Krebs, J.R. (1978) Colonial nesting in birds, with special reference to the Ciconiiformes. In (A. Sprunt, J.C. Ogden and S. Winckler, eds.) *Wading birds*. National Audubon Society. Research Report No. 7. New York. pp 299-314
- Lamba, B.S. (1963) Nidification of some Indian birds. No.6. The Indian Pond Heron or Paddy bird *Ardeola grayii* (Sykes). *Pavo* 1(1): 35-43.
- Martinez, C. (1999) Breeding Biology of the Scarlet Ibis on Cajual Island, Northern Brazil. *J. Field Ornithol.* 70 (4): 558-566.
- McCrimmon, J.R.D.A (1978): Nest site characteristics among five species of herons on the North Carolina Coast. *The Auk* 95: 262-280.

- Mitchell, C.A., White, D.H. and Kaiser, T.E. (1981) Reproductive success of Great Blue Herons at Nueces Bay, Corpus Christi, Texas. *Bull. Texas Ornith. Soc.* 14 (1 & 2): 18-21.
- Mukherjee, A. and Parasharya, B.M. (2000) Purple Heron *Ardea purpurea* (Linn.) (Ardeidae) nesting on water hyacinth *Eichhornia crassipes* (Pontederiaceae). *Journal of Bombay Natural History Society* 97 (3): 424-425.
- Mukherjee, A.K. and Saha, S.S. (1976) Casual observations on a heronry at Kulick near Raniganj, West Dinajpur District, West Bengal- a prospective site for a bird sanctuary. *Newsl. Zool. Surv. India* 2(2): 40-43.
- Mukherjee, R.N. and Chandra, M. (1973) A heron colony in Himachal Pradesh. *Newsletter for Bird Watchers* 13 (4): 9.
- Naik, R.M., Parasharya, B.M., Patel, B.H. and Mansuri, A.P. (1981) The timing of breeding season and interbreeding between the phases in the Indian Reef Heron, *Egretta gularis* (Bosc.) *Journal of Bombay Natural History Society* 78: 494-497.
- Panday, D.J.(1958) Cormorants and Egrets fishing in co-operation. *Journal of Bombay Natural History Society* 55(1): 170-171.
- Parasharya, B.M. (1985) Pairing between pond heron and Intermediate Egret. *Pavo* 23: 103-104.
- Parasharya, B.M. and Naik, R.M. (1984) The juvenile plumage of the Little Egret compared with that of white-phase Indian Reef Heron. *Journal of Bombay Natural History Society* 81(3): 693-695.
- Parasharya, B.M. and Naik, R.M. (1988) Breeding biology of the Indian Reef Heron. *Journal of Bombay Natural History Society* 85: 251-262.
- Prasanth, J.J., Rao, V.V. and Nagulu, V. (1994) Nesting, egg size, incubation and factors affecting clutch size in Little Egret, *Egretta garzetta* at Nellore Andhra Pradesh. *Pavo* 32 (1 & 2): 67-72.

Poussart, C., Gauthier, G. and Larochele, J. (2001) Incubation behavior of Greater Snow Geese in relation to weather conditions. *Canadian Journal of Zoology* 79: 671-678.

Romanoff, A.L. and Romanoff, A.J. (1949) *The avian egg*. New York

Smythies, B.E. (1953) *The birds of Burma*. London, Oliver and Boyd.

Subramanya, S. (1996) Distribution, status and conservation of Indian heronries. *Journal of Bombay Natural History Society* 93: 459-486.

Uthamann P. K. (1990) Breeding of egrets in Kerala. *Journal of Bombay Natural History Society* 87 (1): 139.

Yesmin, R., Rahman, K. and Haque, N. (2001) The breeding biology of the Pond Heron (*Ardeola grayii* Sykes) in captivity. *Tigerpaper* 28 (1): 15-18.

Table 1. Nesting trees of Pond Heron located in two study sites (MP= Mampad and RN= Ramanattukara) during 2000 and 2001

No	Nesting tree	Nests (2000)		Nests (2001)		Height (m) (2000)		Height (m) (2001)	
		MP	RN	MP	RN	MP	RN	MP	RN
1	<i>Acacia sp.</i>	0	3	0	2	0	3	4-5	0
2	<i>Albizia lebbek</i>	3	0	4	0	5-6	0	5-6	0
3	<i>Ailanthus excelsa</i>	3	0	2	0	8	0	4-5	0
4	<i>Artocarpus heterophyllus</i>	6	12	5	16	6-9	9-12	7-8	9-12
5	<i>Bambusa arundinacea</i>	2	0	1	0	4-5	0	4-5	0
6	<i>Ficus hispida</i>	2	0	1	0	3-4	0	3-4	0
7	<i>Mangifera indica</i>	10	4	12	6	7-8	6-7	7-8	7-8
8	<i>Mimosops elengi</i>	6	0	4	0	5.5	6-7	0	8-9
9	<i>Pongamia pinnata</i>	3	0	2	0	3-4	0	5-6	0
10	<i>Stereospermum colais</i>	6	0	4	0	9-10	0	9-10	0
11	<i>Strychnos nuxvomica</i>	1	5	2	6	4-5	5-6	4-5	5-6
12	<i>Swietenia mahagoni</i>	3	0	4	0	7-8	0	6-7	0
13	<i>Sygium cumini</i>	4	5	3	6	6-7	8-9	5-6	8-9
14	<i>Tectona grandis</i>	1	0	0		6			
15	<i>Tamarindus indicus</i>	12	85	15	78	6-7	6-9	6-7	6-9
16	<i>Tetrameles nudiflora</i>	0	12	0	10	0	18	0	10-15
17	<i>Terminalia paniculata</i>	2	0	3	0	9-10	0	8-9	0

Table 2 Nest-branch location and Nest-branch thickness in Pond Heron

Nests on quaternary branch	Nests on 1st sub branch on Quaternary	No of nests studied	Mean thickness of nest-branch (cm)
28	18	10	10.8 ± 1.91

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Table 3. Nesting materials used by Pond Herons

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No.	Items
1	<i>Anacardium occidentale</i>
2	<i>Artrocarpus heterophyllus</i>
3	<i>Bambusa arundinacea</i>
4	<i>Bambusa spp</i>
5	<i>Cleome viscosa</i>
6	<i>Erythrina spp</i>
7	<i>Eupatorium odoratum</i>
8	<i>Ipomea spp</i>
9	<i>Loranthus spp</i>
10	<i>Mangifera indica</i>
11	<i>Mayflower leafless branches</i>
12	<i>Mimosa pudica</i>
13	<i>Mimosops elengi</i>
14	<i>Myrtagyna spp</i>
15	<i>Alstonia sp.</i>
16	<i>Sida acuta</i>
17	<i>Sida rhombifolia</i>
18	<i>Tamarindus indicus</i>
19	<i>Tectona grandis</i>
20	<i>Terminalia paniculata</i>
21	<i>Trema orientalis</i>
22	<i>Urena sinuate</i>
23	Unidentified creeper
24	Unidentified material

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Table 4. Characteristics of the nest materials used by Pond Heron

	Total materials	Max length (cm)	Min length (cm)
Nest-1	66	31.1	10.8
Nest-2	113	26.6	14.6
Nest-3	128	31.2	15.9
Nest-4	54	25.7	10.9
Nest-5	90	25.8	13.1
Nest-6	120	31.6	14.7
Nest-7	86	27.2	12.4
Nest-8	105	29.1	15.6
Nest-9	90	26.9	13.0
Nest-10	72	27.2	14.2
Nest-11	87	30.0	15.0
Nest-12	81	36.2	11.2
Mean	91	29.05	13.46

Table 5. Length and breadth variations in the eggs of pond Heron (N=58)

	Length (mm)	Breadth (mm)
Mean	37.36	28.34
Standard Deviation	1.91	1.44
Minimum	33.3	24.1
Maximum	48	32

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Table 6. Hatching success of Pond Heron

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	Mean	Std Deviation
Clutch Size (Numbers)	2.58	0.50
Eggs Hatched (Numbers)	2.12	1.02
Fledglings / clutch	1.67	1.05
Hatching Success (%)	0.82	0.36

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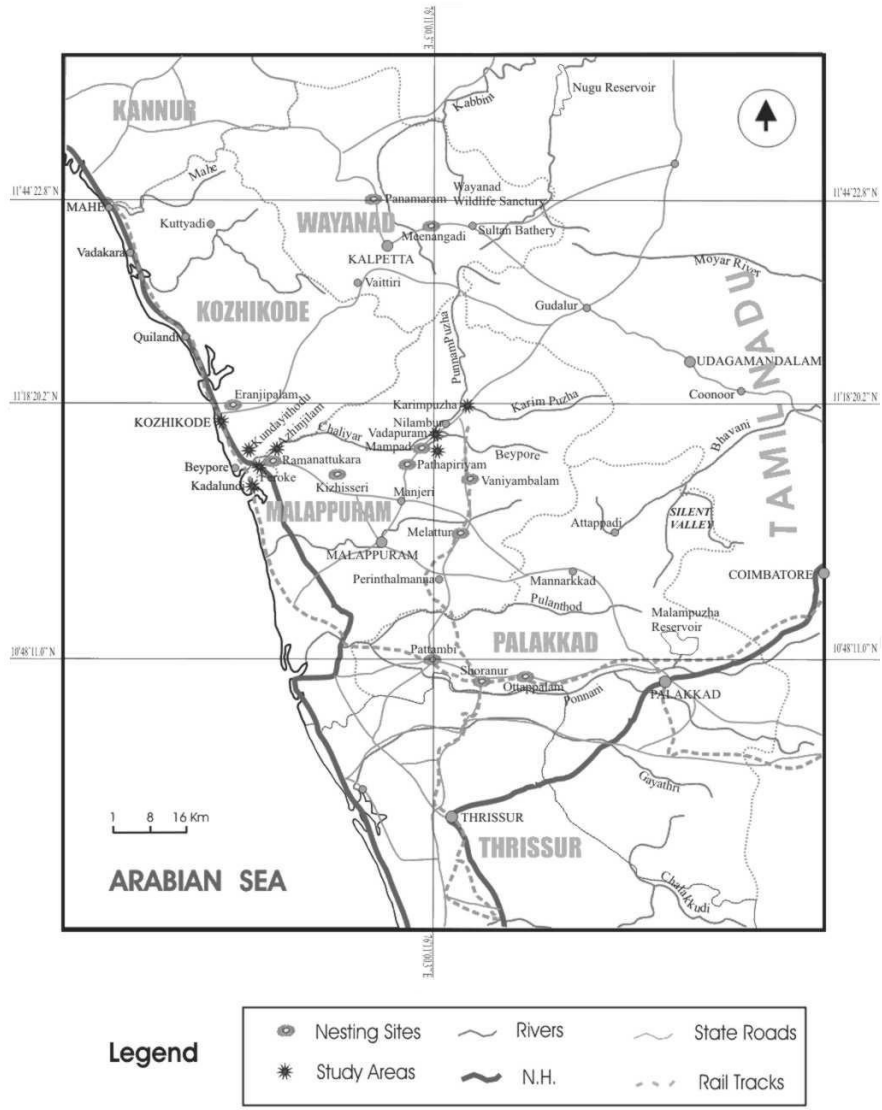
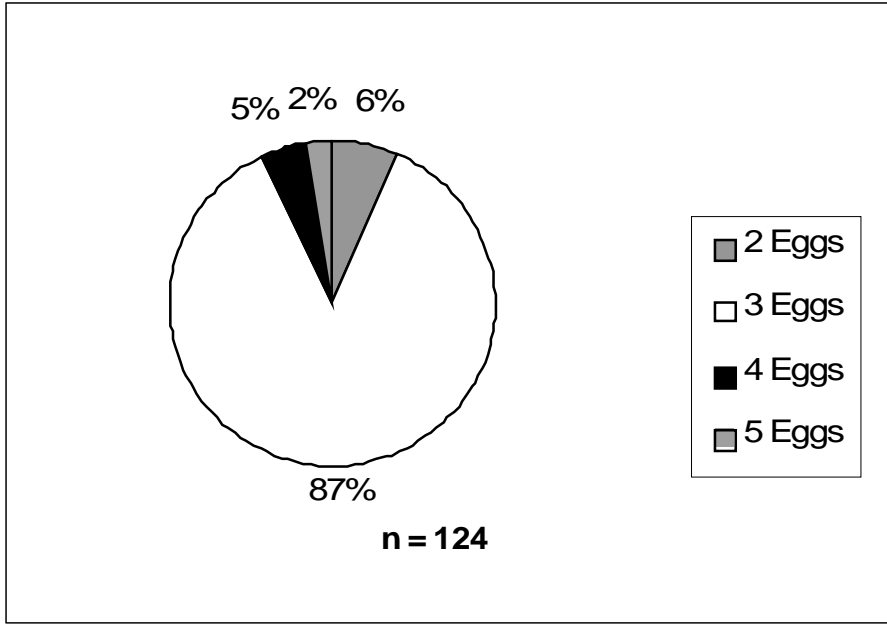
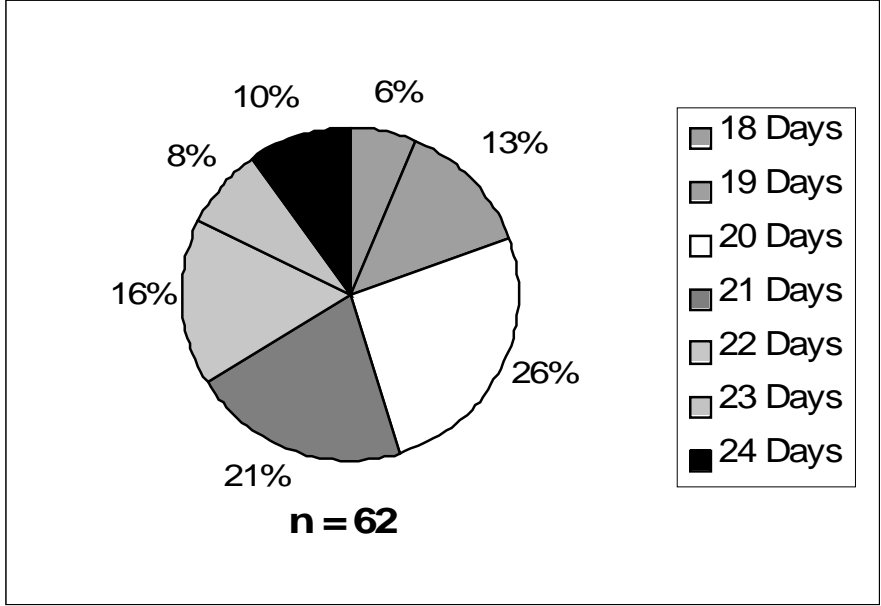


Figure-1 Study area



**Figure-2 Clutch size in Pond Heron**



**Figure-3 Incubation period of Pond Heron**