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BREEDING ECOLOGY OF NIGHT HERON (*Nycticorax nycticorax* Linne,1758) IN THE LAKE VAN BASIN, TURKEY

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ABSTRACT

A study on breeding ecology of night heron (*Nycticorax nycticorax*) was conducted in the Lake Van Basin between 16 February 2006 and 04 October 2007 on four big islands inside the lake and sorrounding wetlands.The night heron only breeds on islands inside the lake in this region because it finds food in wetlands. Trees which numbers had been given previously were observed and, starting from pre-breeding period into March and June, data on nests and breeding were taken. The breeding period was about seven months (March – September). During this period, it was frequently observed that nests from the previous year were repaired and re-used. Both the male and the female repair the nest.Average dimensions of eggs laid on nests were measured as 49.33±3.2 mm in length, 32.19±1.35 in width, and with a weight of 29.66±5.01 grams. The number of eggs laid ranged from 1 to 6 per nest. In 1364 active nests observed within the entire breeding region, 4206 (92 %) of 4576 eggs hatched and 3923 (93 %) of all chicks managed to leave the nest. Brooding periods in 50 nests were observed separately in each breeding season. In 2006, average brooding period during the first period was 25.62±2.03 and it was 26.22±1.18 during the second period; in 2007, average brooding period during the first period was 26.10±1.69 and it was 25.60±1.76 during the second period. Juvenile growth periods for *N. nycticorax* have been observed as follows: in 2006, average 39.98±2.47 days during the first breeding period and 32.68±1.25 days during the second breeding period; in 2007, average 42.18±2.60 days during the first breeding period and 34.64±1.15 days during the second breeding period. A significant statistical difference has been observed between years and even periods in question ($P < 0.01$).

Key words: *Nycticorax nycticorax,* The Night Heron, Ecology, Birds, Breeding, Lake Van, Turkey.

INTRODUCTION

Factors such as geographical location, habitat variety, abundance of wetlands and being located on bird migration routes account for the fact that Anatolia has a rich ornithofauna. As a result of this, the number of bird species in Turkey, together with those accidental and disputed ones, has been determined as 502 (Kiziroğlu, 2008 and 2009).

One of the three most important migration routes in the Western Palearctic is the Northeast-South Migration Route, which includes Lake Van Basin, the study area. This route starts from the Eastern Black Sea Region in Turkey, runs through the River Çoruh and extends to the Eastern Anatolia (Erdem, 1994). The night heron, native to Turkey, starts entering the research area for the purpose of breeding from spring (March-April) onwards.

Of 49 species of herons (*Ardeidae*) in the world, nine are found in Turkey (Kiziroğlu, 1989; 2008; 2009 ; Roselaar 1995). These nine species can be observed in the Lake Van Basin as well (Adızel, 1998).

Night heron is one of these nine species, measuring about 57-68 cm in length. Its wingspan can reach to 112 cm. In adult members, sides of the body and wing tips are gray in color and the back is black. Two or three white and delicate feathers extend from the back of the head to the back. Although sexual dimorphism is not observed, there is a slight difference in terms of color between the male and the female during the breeding season. Juveniles can easily be distinguished due to their plumage. The 2008 update by the IUCN classifies this species as "Least Concern" (IUCN, 2008). Kiziroğlu (2008, 2009) stated that the species falls into A.3.1, and III-SPEC (Unfavourable) according to theBird Life International (2004).

Nycticorax nycticorax builds its nest in areas close to waters and covered with reeds and trees. Studies carried out elswhere reported such vegetation types as *Borrichia frutescens*, *Phragmites australis*, *Opuntia cactus*, *Schoenoplectus pungens*, *Cyperus papyrus*, as well as rice fields as nesting locations (Burger, 1979; Ashkenazi and Yom-Tov, 1996; Chriptophe *et al*. 2004). Studies carried out in Turkey have revealed that the species builds its nest on such species as *Salix spp., Populus spp.* (Ayaş, 2008), as well as meadows that are flooded (Turan and Göktaş, 2000). Uzun and Tabur, compered nest size, nutrition and growth of night heron with two egrets (Uzun and Tabur, 2006). Uzun, studied height of nest and location affect breeding success or not (Uzun, 2009).

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MATERIALS AND METHODS

The present study on night heron (*Nycticorax nycticorax*) was carried out in the Lake Van Basin between 16 February 2006 and 04 October 2007 (Figure 1).

Lake Van lies at an altitude of 1646 meters (NN) and covers an area of 3712 km^2 (38^o 24$'$ N, 42^o 55$'$ E). Lake Van is a saline and soda lake with 0.244% salinity, 9.8 pH and average depth of 151 meters. In southern parts of the lake, the depth can reach to 451 meters (Degens and Kurtman, 1978).

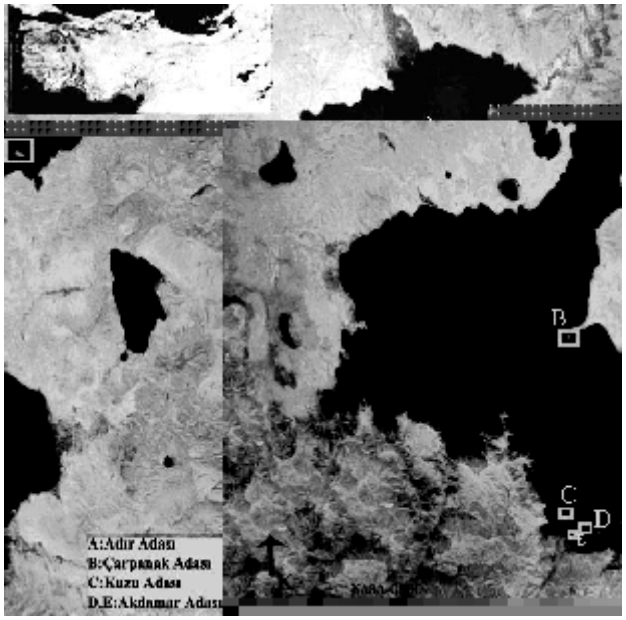

Figure 1. Photo of the research area (NASA-GSFC).

Egg and Chick Measurements: For measurements of length concerning eggs, adults and juveniles, tape measures and compass (Vernier Caliper, with minimum 0.05 mm sensitivity) were used. To measure weights, sensitive scales (Arçelik, with minimum 1 gr. sensitivity) were used.

Research work was carried out with gloves and masks on. In order that no physical harm would be given to juveniles, all measurements were carried out after about seven days the eggs hatched (Kiziroğlu, 1981). Juveniles in predetermined nests were ringed and daily measurements were taken.

Statistical analysis of egg measurements and data on brooding was carried out by using Minitab software. In addition, graphical analyses were also carried out for data evaluation. In order to determine differences between islands, years and periods, the ANOVA method was used.

Determining Population Density: For determining population intensity, line transect and point observation methods were used (Bibby and Burgess, 1992).

Incubation Biology: Within the sampling area, trees to which numbers had been given previously were observed and, starting from pre-breeding period into March and June, data on nests and breeding were taken (Weller, 1961). The data obtained were used to determine the breeding biology of the species.

Concerning the nest, information about the structure of the area of nesting, type of tree on which the nest is built, the number of trees, tree height, number of nests of each tree, nest locations, type of nest building, time span for building the nest, material, and nest temperature was collected.

Concerning breeding, information about mating behavior, time for laying eggs, size of the egg cluster, egg measurements (size and weight), brooding period, numerical data on juvenile growth (bill, head, torso, wings, length, midfinger, total weight, tail, body temperature), number of individuals hatching, number of individuals leaving the nest, and the length of juvenile growth was collected.

Throughout the juvenile growth period, the time period between hatching of the first egg and flight of the final juvenile was taken as the basis.

RESULTS AND DISCUSSION

In the Lake Van basin, *N. nycticorax* used four big islands for breeding, building its nests in groves where human activity is minimum. From the beginning till the end of the nest-building process, the male keeps performing its courtship display. This display is in the form of providing the female with material for building the nest. The male stands close to the nest and, protruding its neck and displaying its feathers, gets really slowly closer to the branch on which the female rests. It slowly moves its neck up and down (Figure 2). In the meantime it utters a guttural “kvakk” “kvakk” sound to attract the attention of the female. The female responds with a similar sound. Mating takes place by the male getting on top of the female. In the meantime, the female rests on its abdomen and does not display any reaction. Mating can be on the nest or in a place close to the nest. When mating in over, the male jumps to an adjacent branch and trims its feathers with its bill, while the female shakes and trims its feathers. The mating period can be between March and the beginning of April. The second mating period can last from the end of June to mid-July. This period can be longer if the weather is warm and rainy.

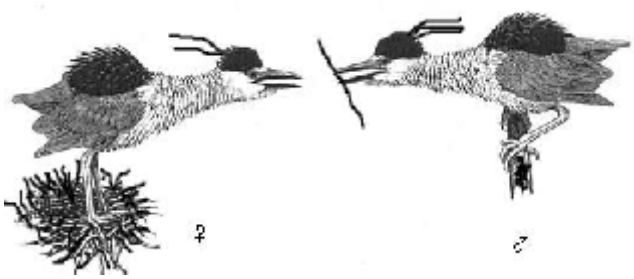

Figure 2. Courtship display of the night heron.

The night heron arrived in the basin on 17 March the earliest and its brooding period in the basin started in the end of March. Because weather can suddenly become cold in some years in the basin, breeding period can last longer, as a result of which both the second breeding period and fall migration are delayed. Some of those eggs that are laid in the beginning of spring are harmed because of sudden changes in weather conditions and sudden rains. The brooding period of the species lasts about 7 months and the date for migration is subject to small changes due to changes in weather conditions and delays in brooding periods. In 2007, it was observed that the migration date was 12 days later than that in 2006.

As *N. nycticorax* is a species that is dependent on water, it builds its nest in areas close to waters and covered with reeds and trees. Studies carried out abroad reported such vegetation types as *Borrichia frutescens*, *Phragmites australis*, *Opuntia cactus*, *Schoenoplectus pungens*, *Cyperus papyrus*, as well as rice fields as nesting locations (Burger, 1979; Ashkenazi and Yom-Tov, 1996; Chriptophe *et al*. 2004). Studies carried out in Turkey reported that the species builds its nest on such species as *Salix spp.,* and *Populus spp.* (Ayaş, 2008).

In the Lake Van Basin, distribution of trees in which the species builds its nest is as follows: 74 cherry plum (*Prunus divaricata subsp. divaricata*) trees (39.3%), 61 bitter almond (*Amygdalus trichamygdalus trichamygdalus*) trees (32.4%), 33 almond (*Amygdalus communis* L.) trees (17.5%), 15 pistacia (*Pistacia eurycarpa*) trees (8.2%), 5 dog rose (*Rosa canina*) trees (8.2%). A total of 1327 nests observed in the basin were built on five species of trees. The reason for prefering these tree species is that they are commonly found on islands where night heron breeds. Because the number of trees is scarce on Kuzu Island, some members build their nest on the harmal plant (*Peganum harmala*).

In *N. nycticorax*, the nest is built by both sexes. Material for the nest is presented to the female during the breeding period. These nests are repaired and reused in following periods or years. Average time span to build a nest was calculated as 4.92±0.72 days in 2006 and 5.42±1.07 days in 2007.

Material for the nest is provided the green cover on islands that constitute breeding areas. A major part of the base section of the nest is made up of dry branches on trees. Such soft material as hair, feather, wool, strings, plant fibers, and cloth has not been found in nests. It has been observed that 94% of the total structure of the nest is composed of dry branches. The remaining 6% consists of dry grass and pieces of plants.

It was observed that such grassy plants as bachelor's button (*Centaurea triufettii*) and wild rye (*Hordeum bulbosum*) are placed with their thorny parts remaining outside and nest and forming a shield for protection; this suggests an attempt to prevent attacks from outside.

In addition, it is believed that sirmo (*Allium cardiostemon*) and garlic mustard (*Alliaria petiolata*) is used as material in building nests because of foul smell they have, so that they will keep humans away.

According to measurements, nests built by *N. nycticorax* are 42.4±8.2 cm. across; 45.53±9 cm. along; 8.73±3.13 cm in depth; 24078±2709 cm^3 in volume and 426.2±51.2 gr in weight.

Egg cluster size was calculated as the total number of eggs laid on a single nest within one breeding period. The number of eggs within the 1st and 2nd breeding periods, as well as the number of eggs in nests, within the period of 2006-2007 has been presented in Figure 3.

Egg cluster sizes range from 1 to 6. In 1364 active nests observed, a total of 4576 eggs were counted. No statistically significant difference was observed ($P > 0.05$) in terms of interrelations and of years between breeding areas in the whole of the basin.

Average number of eggs per nest was calculated as follows: for Adır Island, 3.32±0.86 in 2006 and 3.41±0.76 in 2007; for Çarpanak Island 3.36±0.79 in 2006 and 3.40±0.90 in 2007; for Akdamar Island, 3.33±0.98 in 2006 and 3.12±0.91 in 2007; for Kuzu Island, 3.61±0.79 in 2006 and 3.28±0.81 in 2007.

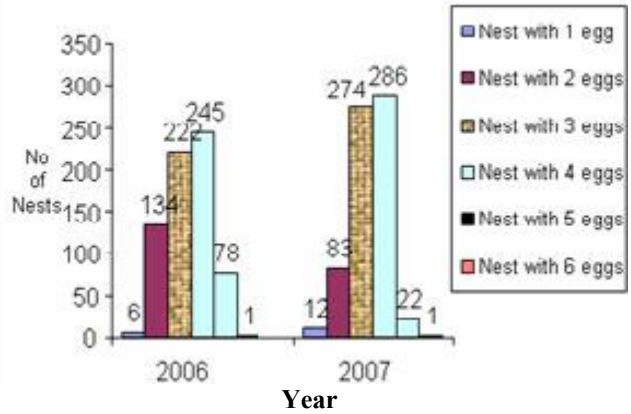

Figure 3. Egg cluster sizes in night heron during 2006 and 2007

Generally, the female lays one egg a day. The night heron starts brooding after the first egg has been laid (Table 1).

Brooding periods in 50 nests were observed separately in each breeding season. In 2006, average brooding period during the first period was 25.62±2.03 and it was 26.22±1.18 during the second period; in 2007, average brooding period during the first period was 26.10±1.69 and it was 25.60±1.76 during the second period. A statistical evaluation of these figures indicates that there is no significant difference between brooding periods in 2006 and 2007 ($P > 0.05$).

Juvenile growth periods for *N. nycticorax* have been observed as follows: in 2006, average 39.98±2.47 days during the first breeding period and 32.68±1.25 days during the second breeding period; in 2007, average 42.18±2.60 days during the first breeding period and 34.64±1.15 days during the second breeding period. A significant statistical difference has been observed between years and even periods in question ($P < 0.01$). It is believed that the main reason for this difference can be seasonal differences, availability of food, location of breeding regions, and activities.

Average egg sizes obtained through egg measurements in a total of 4 breeding areas during the two-year study are presented in Table 2.

Of 4576 eggs in breeding areas, 4206 (92%) hatched. The number of juveniles per nest annually are as follows: 3.149±0.38 in 2006 and 3.140±0.76 in 2007. During the two-year study, 284 of all 4206 juveniles died of various reasons either in or outside the nest. The average number of juveniles that left the nest was 3.14±0.78 per nest in 2006 and 3.14±0.74 per nest in 2007. While the number of juveniles in breeding nests and the number of those that leave nests was statistically different ($P < 0.05$), in terms of average annual figure these numbers are quite close to one another.

Table 1. Periodic incubation durations of the night heron during 2007 and 2007

	Incubation period in 2006		**Incubation period in 2007**	
Statistical Value	First Breeding Period (Days)	Second Breeding Period (Days)	First Breeding Period (Days)	Second Breeding Period (Days)
n	50	50	50	50
Min.	20	22	22	21
Max.	28	27	28	27
average±sd*	26.22±1.18	25.62±2.03	26.10±1.69	25.60±1.76
	DF:1, F: 3.24, P>0.05		DF:1, F:3.24, P>0.05	

n: number of nests; *average± standard deviation

Table 2. Egg sizes in different breeding sites within study area

Location	**Statistical Value**	**Length (mm)**	**Width (mm)**	**Weight (gr)**	**Egg Volume ($mm^{3)*}$**	**Egg Index****
Adır A.	n	40	40	40	40	40
	Min.	42.60	30.20	24.623	38892.9	57.54
	Max.	53.40	33.50	36.392	59928.2	74.41
	ort±sh	48.59±3.44	31.71±1.07	31.96±3.02	48934±5012	65.57±5.02
Akdamar A.	n	45	45	45	45	45
	Min.	42.20	30.10	21.628	38233.6	64.15
	Max.	54.60	35.60	37.309	69197.8	72.94
	ort±sh	49.50±4.05	33.33±1.46	29.66±5.01	55503±9128	67.55±2.77
Çarpanak A	n	40	40	40	40	40
	Min.	50.00	30.30	30.245	45904.5	60.60
	Max.	52.20	33.30	35.617	57884.1	63.79
	ort±sh	50.98±0.71	31.71±0.82	32.70±1.79	51347±3381	62.20±0.83
Kuzu A.	n	20	20	20	20	20
	Min.	44.50	30.00	28.454	40050.0	64.87
	Max.	50.10	32.50	32.312	52918.1	68.22
	ort±sh	47.10±1.71	31.53±0.67	30.62±1.32	46915±3664	66.96±1.12
	n	145	145	145	145	145
Toplam	Min.	42.20	30.00	21.628	38233.6	57.54
	Max.	54.60	35.60	37.309	69197.8	74.41
	ort±sh	49.33±3.2	32.19±1.35	29.66±5.01	55503±9128	65.57±5.02
		P<0.01	P<0.01	P<0.01	P<0.01	P<0.01

n: number of eggs, ort±sh= Average ± standard deviation, Egg volume ($mm^{3)*}$: Length x $width^2$ (Eden, 1984), Egg Index**: 100 x width/length (Winkel, 1970)

In the night heron, the tail starts to appear from the nineteenth day onwards. It has been observed that a juvenile that is thirty seven days old is quite similar to an adult in terms of morphometry and weight. In this basin, the onset for flight for juveniles appears to be day 25-27.

Juvenile growth period for *N. nycticorax* was as follows: in 2006, average 39.98±2.47 days during the first breeding period and 32.48±1.25 days during the second breeding period; in 2007, 42.18±2.60 days during the first breeding period and 34.64±1.15 days during the second breeding period.

It was observed that jackdaws (*Corvus monedula*) and magpies (*Pica pica*) often attacked juveniles when they were alone in the nest. Quite rarely, common kestrels (*Falco tinnunculus*) that live in the region attack juveniles that fall from nests. The species gets on quite well with other species that live in the region.

Studies carried out abroad report such types of vegetation as *Borrichia frutescens, Phragmites australis, Opuntia cactus, Schoenoplectus pungens, Cyperus papyrus* and rice fields as nesting locations (Burger, 1979; Ashkenazi and Yom-Tov, 1996; Christophe *et al*., 2004; Hilton *et al*., 2004).

In the study area, it was observed that the species built its nests only in areas covered with trees which could be due to safety factor. Islands are chosen as breeding places because of their relatively isolated situation and their proximity to wetlands. In addition, presence of fish in the lake is yet another important factor.

In the Van Lake basin, the number of eggs in each nest ranges from 1 to 6. Yet, nests with six eggs are an exception. A study by Yom-Tov (1980) indicated the nests with 7 eggs. He stated that this number was due to fact that there existed nest-parasitic behavior within the species (some members lay their eggs on other nests).

According to egg measurements in four breeding regions, average egg length was 49.33±3.2 mm., width was 32.19±1.35 mm., weight was 29.66±5.01 gr., egg volume was 55503±9128 mm^3, and egg index was 65.57±5.02. Measurements in terms of islands revealed that the difference was statistically significant ($P < 0.01$).

It was assumed that this difference stems from the difference in size of eggs of members that have just started breeding, feeding conditions, the fact that eggs laid first was much bigger than those laid last, and seasonal differences. These comments are in agreement with the study of Custer and Frederick (1990)The overall success level for brooding relative to the number of eggs laid was 85.40% in 2006 and 86.25% in 2007, with a general success level of 85.82%. The overall success level for brooding relative to number of juveniles was 93.12% in 2006 and 93.41% in 2007, with a general success level of 93.27%. An analysis of breeding success rates revealed that both the number of eggs in terms of brooding success and the number of juveniles in terms of breeding success run parallel in both years. Brooding success figures of present study were almost similar to those of 87.5% (Teal1965) and 80% (Erwin, and Custer, 982). Ashkenazi and Yom-Tov (1996) calculated this figure as 56.6% for 20 juveniles, which was quite lower than thatin the current study. In addition, in a study they carried out in Israel, Ashkenazi and Yom-Tov (1997) observed the level of brooding success among members with rings as 12.%. They stated that this figure was lower than any other in literature for the simple reason that juveniles were hard to see in the reeds.

According to Acquarone *et al*. (2004) and Hatzofe and Yom-Tov (2002), eggs laid during the start of spring would go bad due to sudden changes in weather and the migration would be delayed which can be explained as the influence of changing seasonal factors on the breeding pattern of the species.

In 2006, brooding period was 25.62±2.03 days in the first and 26.22±1.18 days in the second brood in 2007, it was 26.10±1.69 days in the first and 25.60±1.76 days in the second period.

The length of brooding displays differs among various studies. It was 24 days in Allen and Mangels (1970) 23.4 days in Inoue (1985), 23.5 days in Custer *et al*.(1992) 22-27 days in Ashkenazi and Yom-Tov (1997). In the present study, the average brooding period was higher than recorded in previous studies. This difference can be explained in terms of climatic and geographic differences.

Differences that the juvenile growth period displays within the field of study in terms of brooding periods and years can be expressed through differentiation of climatic and feeding conditions. Also, juvenile growth in ecological conditions of the basin in general runs parallel to a study by (Cramp and Simmons, 1983).

The fact that the number of predators that can pose a threat for the species is small is an advantage. Climate in the basin is mild because of the existence of the lake and this is an important factor in maintaining a stable egg temperature. Average temperature during summer is 22.5 C°, which does not disturb juveniles. On the contrary, it has been revealed that an increase in temperatures leads to an increase in the number of eggs laid, and the level of brooding success. Yet, human activities in breeding regions in recent years are a matter of concern.

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