

Some Aspects of the Nest Etology of the Eastern Imperial Eagle (Aquila heliaca) (Aves: Accipitridae) in Sakar Mountain

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Abstract. A survey was carried out for studying some aspects of nest etology of the eastern imperial eagle (*Aquila heliaca* Savigni, 1809) in Sakar Mountain. The aim of the survey was to determine apportionment of the parental care between partners in the pair. Incubation in the both studied pairs was taken mainly by the female bird, which incubated 90.8% of the time in one of the pairs corresponding to 94.1% in the other one. Male contributed significantly in food provisioning, supplying 59.2% of the food in one of the pairs and 58.3% in the second one. The survey shows similar results as obtained for the Spanish imperial eagle (*A. adalberti*). This is the first survey done regarding to distribution of parental care between sexes in the eastern imperial eagle in Bulgaria.

Keywords: *Aquila heliaca*, nest etology, parental care, Sakar Mt., Bulgaria.

Introduction

The Imperial eagle (*Aquila heliaca*) is classified as vulnerable worldwide (IUCN, 2009) and as endangered specie in Europe (TUCKER & HEATH, 1994). It is included in Application 1 of Birds Directive, Application 1 of Sites and in Application 2 of the Bern and Bonn Conventions. In Bulgaria the population of the specie is estimated on 25-30 pairs, in 2009, 20 occupied territories are

known, 10 of which in Sakar mountain (Demerdzhiev, 2009, Sofia, pers. comm.).

Apportionment of parental care is a conflict of interests between sexes and depends on food abundance (TRIVERS, 1972, EMLÉN & ORING, 1977, WESTNEAT *et al.*, 1990). There is a disputation about the theory that hunting agility of males and accumulation of the needed substances for laying eggs and rising of the chicks by females can explain the

apportionment of the parental care (ANDERSSON & NORBERG, 1981; TEMELES, 1985, NEWTON, 1986). Difference in size between sexes is that much bigger as much agile the prey is. Eastern imperial eagle (*A. heliaca*) is monogamous specie with moderate expressed difference in size between male and female birds in discrimination of raptors preying on birds (NEWTON, 1979).

Some data referring to nest behavior in different parts of the imperial eagle areal can be found in works of various authors (KUSTOV, 1981; TURCHIN, 1995; ABULADZE, 1996; MRLIK & PAVELKA, 1996; KARYAKIN, 1998, 1999; BELIK, 1999; RYBTSEV, 1999; MRLIK, 1999; PUZOVIC & STEFANOVIC, 2002; KOROVIN, 2004; BELIK, 2008). The Spanish imperial eagle (*A. adalberti*) is significantly well studied in this matter. Data about its nest behavior are published in works of: MEYBURG, 1974, 1975, 1981-1982, 1987; ALONSO *et al.*, 1987; FERRER, 1990; FERRER *et al.*, 1990; FERRER, 2001; GONZALEZ *et al.*, 2006; MARGALIDA *et al.*, 2007; GONZALEZ & MARGALIDA, 2008.

Till this moment there is no purposeful published survey on the behavior of the eastern imperial eagle referring to nesting and relations between the partners in the pair. The aim of the present study was to determine the distribution of parental care and obligation of partners in the incubation and food supplying.

Materials and Methods

The survey was carried out in the territory of Sakar mountain, Southeast of Bulgaria (Fig.1), Important bird area (IBA) BG021 (KOSTADINOVA & GRAMATIKOV, 2007). Two pairs of imperial eagles (*A. heliaca*) were observed, which equals to 20% of the population of the specie in Sakar

mountain (n=10) and 4% of the Bulgarian population (n=20) (Demerdzhiev, 2009, Sofia, pers. comm.). Observations were carried out during the breeding season of birds April-August 2008 from regular points (BIBBY *et al.*, 1999), situated on 1000m and 600m from nests. Telescopes Bushnell 45x60, Swarovski 20x60 and a binocular Minolta 10x50 were used for the observations. Field observations started at 7,00 a.m. and finished between 19,30 and 20,00 p.m. every day in dependence on birds activity. Totally observation days were 53 corresponding to 534 hours of observations (10h 07min average per day). Standard blanks were used for entering changes during incubation made by the partners in pairs, food supplying and differences in breeding obligations between partners. All insecure defined changes between partners (n=14) and cases of food supplying of some of the partners in the pair (n=3) were removed from the study. One of the studied nests is situated in the southern part of Sakar Mountain (nest A) and the other one is in the northern part of the mountain (nest B). Observations were carried out between laying of the eggs and fledging of the chicks. The age of the birds was registered (FORSMAN, 2005). Birds were considered as adults if they were in their sixth year or upward (sixth plumage). Male and female birds from pairs were individually identified according to some personal characteristics in their plumage (phases and fronts of moulting of the primaries, damaged feathers, specific coloring) and size. There is sex dimorphism in raptors in respect of their body size as females are a little bigger than males (NEWTON, 1979; FORSMAN, 1999). These differences need to be specified for more accurate defying of

the birds during the changes as well as when some of them is bringing food to the chicks.

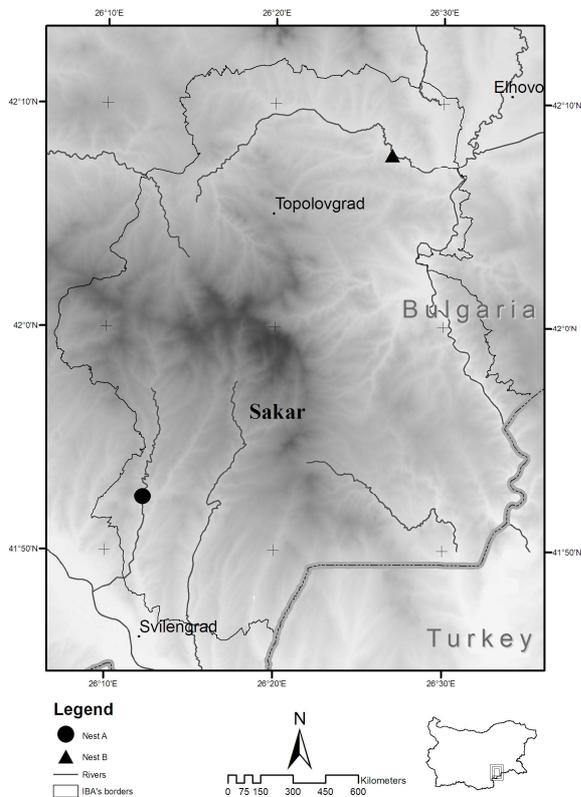


Fig. 1. Map of the studied nests.

Results

Twenty three of the days conducted with observations were for nest A and 30 days for nest B. Finally 534 hours were spent in observations (204 h for nest A and 330 h for nest B). Partners in the pair in nest A were fully adult birds (FORSMAN, 2005), while the male bird from nest B was adult in sixth plumage and the female was in fifth plumage. In nest A (Fig.2) of all 109h 10min of observations during the incubation, the female incubated 99 hours, which equals to 90.8 % corresponding to 10h 10min for the male which is 9.2 % of the time. Similar results were received for nest B: from the total 170 hours of observations during the incubation the female incubated 160h 2min, which equals to 94.1 % of the time corresponding to 9h

58min and 5.9 % for the male (Fig.2). Similar results were received for the Spanish imperial eagle (*A. adalberti*) where the female birds have incubated 89.2 % \pm 5.2 % of the time average corresponding to 5.9 % \pm 3.5 % for the males (MARGALIDA *et al.*, 2007).

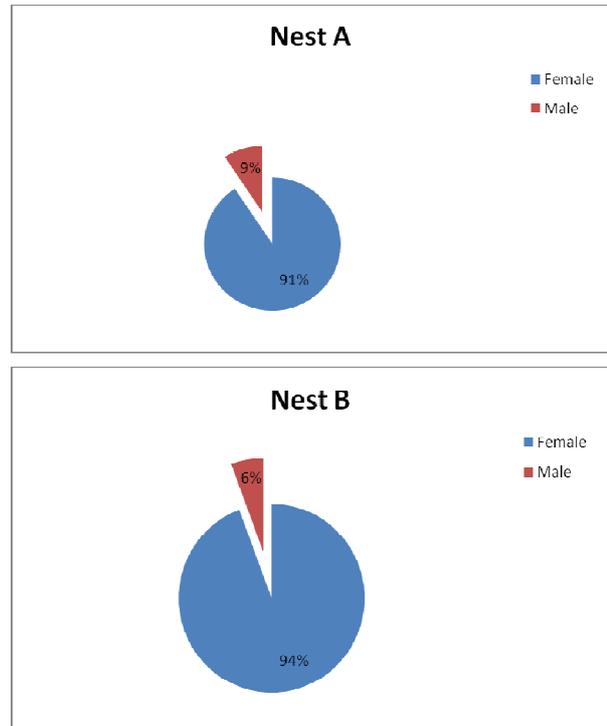


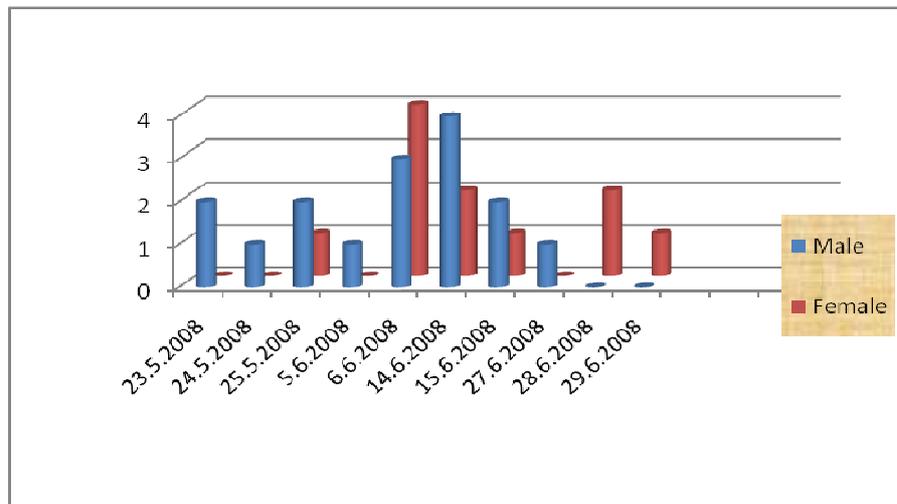
Fig. 2. Percentage distribution of time spend on incubation by sexes in the two studied nests

The major part of the incubation is taken by the female bird in both pairs. Changes reported between partners were also more or less the same. During incubation in nest A the male bird changed the female totally 20 times, while the female changed male 24 times which means that the two birds have changed 4.8 times per day in average account. In nest B the male changed the female 15 times corresponding to 12 changes for the female or they have changed 2.25 times per day which is a difference in comparison to nest A.

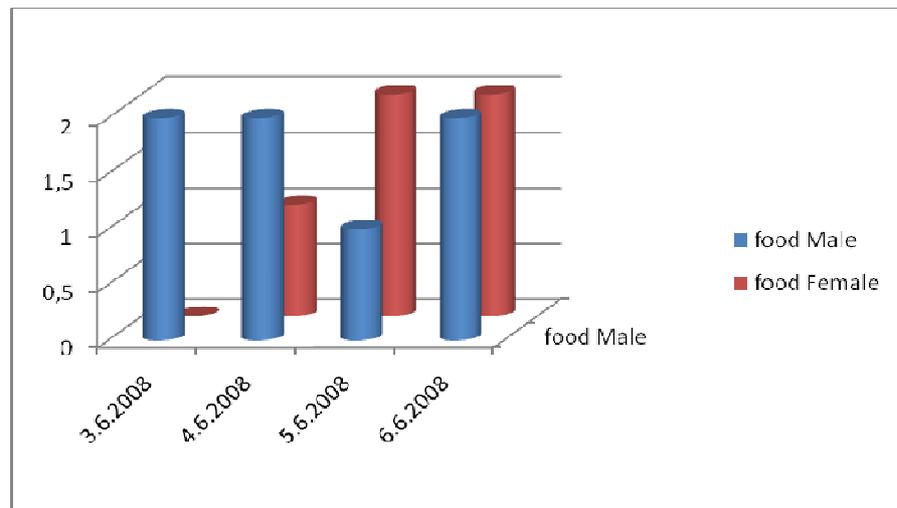
The male incubated 1h 27min totally in nest A and 2h 20min in nest B. For the whole period of observations during the incubation the female left the nest only in two cases for several minutes when the male caught a prey.

In the supplement of food for the chicks the contribution of the male bird is clearly visible in both nests (Fig. 3). In the case of nest A, the male partner was observed to bring prey in 16 cases

(59.2%) and the female in 11 cases (40.8%). In nest B male supplied food in 7 cases (58.3%) corresponding to 5 (41.7%) for the female. 65.2% of the food of the Spanish imperial eagle is supplied by the male and 34.8% by the female (MARGALIDA *et al.*, 2007). Despite of the differences found in the apportionment of parental care and nesting territories during the survey both pairs successfully raised one chick.



Nest A



Nest B

Fig. 3. Apportionment of food supplement by sexes in the studied nests

Discussion

Our study on the imperial eagles (*A. heliaca*) in Sakar shows that parental care during the breeding period is unequally divided between partners. In the both studied nests the incubation is taken mainly by the female bird. At the same time the male is responsible for the food supplement of the chicks. Similar results can be found in the works of TURCHIN (1995) and MIRLIK (1999). In the breeding process the role of the male is insignificant than the female's. The Spanish imperial eagle and other large eagle species show similar proportion of parental care (MARGALIDA *et al.*, 2007; COLLOPY, 1984; GARGETT, 1990; WATSON, 1997). Ecological appliance connected with the way of preying is the smaller size of the males (NEWTON, 1979) which premises the apportionment of parental care and the more significant role of the male in preying and food supplement and the survey shows that there is a difference between the nests in the percentage of cases in which the male bird supplied food. The time spent in the nest by the parents significantly decreases with the age of the chicks. In both cases it is clear that in their early periods of time chicks receive food more often and in the end of the period, food supplies decrease significantly. During the raising of the chicks the frequency of food provisioning is taken by the both sexes although after the second half of the period is visible more significant role of the female in the process of feeding. This could be explained with the growing of the chicks and their bigger energetically needs and lesser quantity

of female protection which gives her more opportunities in preying (BROWN, 1955; STEYN, 1972; RETTING, 1978; COLLOPY, 1984). This way the female regenerates her energy losses during the long incubation period and early phases of chicks raising (NEWTON, 1979).

Conclusions

1. In the both studied pairs of imperial eagles the incubation is taken mainly by the female bird (at the average rate of 92.45% of cases).
2. The male supplies bigger amount of food and is responsible mainly for the food provisioning (at the average rate of 58.75% of cases)

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Някои аспекти от гнездовата етология на царския орел (*Aquila heliaca*) (Aves: Accipitridae) в Сакар

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Резюме. Проведено е изследване за някои от аспектите в гнездовата етология на източния царски орел (*A. heliaca* Savigni, 1809) в Сакар планина. Целта беше да се установи разпределението на родителските грижи между партньорите в двойката. При изследваните две двойки царски орли мътенето се поемаше основно от женската птица, като при едната тя е мътила 90.8% от времето, а при другата 94.1%. Изхранването на малките се осигуряваше основно от мъжкия набавящ съответно 59.2% от храната при едната изследвана двойка и 58.3% при втората. Проучването показва сходни резултати с тези получени при испанския царски орел (*A. adalberti*). Това е първото направено изследване за разпределението на родителските грижи между половете при царския орел в България.

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