

Status of the Eastern Imperial Eagle (*Aquila heliaca*) in the European part of Turkey

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Abstract: This article presents the results of the first more detailed studying on the distribution and numbers of the Eastern Imperial Eagle (*Aquila heliaca* SAVIGNY 1809) population in the European part of Turkey. Twenty territories occupied by Imperial Eagle pairs, distributed in three different regions were discovered during the period 2008-2009. The breeding population was estimated at 30-50 pairs. The study identified two main habitat types typical of the Imperial Eagles in European Turkey – open hilly areas and low mountain areas (up to 450 m a.s.l.) and low relief plain areas (50-150 m a.s.l.). Poplar trees (*Populus* sp. L) were identified as the most preferred nesting substratum (44%), followed by Oaks (*Quercus* sp. L) (40%). Breeding density was 1 pair/100 km² in both habitat types. The shortest distance between two breeding pairs was 5.8 km recorded in plain areas in the Thrace region. Productivity (number of fledglings/occupied territory), breeding success (number of fledglings/breeding pair) and fledgling success (number of fledglings/successful pair) for 2008 and 2009 were reported, including 33 breeding attempts. The threats are insufficiently studied and need further investigation.

Key words: Eastern Imperial Eagle, population, distribution, number, European Turkey

Introduction

The Eastern Imperial Eagle was classified as an endangered species with a declining population in Turkey (KIRWAN *et al.* 2008). The species was reported in low numbers as a resident, partially migrating local breeder in almost all regions of Turkey (KIRWAN *et al.* 2008). Different authors give discrepant estimates of the breeding population. HEREDIA (1996) estimated the national population at 10-50 pairs; according to DE ROECK (1993) the population totaled 50-150 pairs; and GURSAN, BILGIN (2002) reported 35-70 pairs. The scanty bibliographic data on the species distribution in the European part of Turkey reported the species as breeding in the vicinities of Istanbul at the end of the 19th C (ALLEON, VIAN, 1869). In mid 1960s, 2 breeding pairs were reported along the lower reaches of the Maritsa River (WARNCKE 1966, 1968, WIRTH

1996). GURSAN, BILGIN (2002) mentioned breeding of the species in Thrace and along the Maritsa River without providing any data on concrete localities or numbers. In the monograph on the birds of Turkey published in 2008 the Imperial Eagle was reported to be “on the brink of extinction as a breeder in Thrace” (KIRWAN *et al.* 2008).

This article presents the results of the first more detailed study on the distribution and numbers of the Eastern Imperial Eagle population in the European part of Turkey. Twenty territories occupied by Imperial Eagle pairs, distributed in three different regions, were discovered as a result of our studies carried out in the period 2008-2009. Based on this data and other observations we estimated the Eastern Imperial Eagle population in European Turkey at 30-50 pairs.

Material and Methods

Five expeditions with a total duration of 22 field days were carried out in the European part of Turkey in the period March–October 2008. In 2009 we implemented three field surveys with a total duration of 10 field days in the period April–July. The research was carried out in three main regions. The first region comprised the Strandja Mountains and the Dervent Heights near the Bulgarian–Turkish border, with a total studied area of about 2300 km². The second region we studied was a territory of Thrace, to the south of the Edirne–Kirkclareli–Pinarhisar road, covering a total area of 3000 km². The third studied territory was a region to the north of the Marmara Sea, between the towns of Tekirdag and Silivri (1000 km²). **The two localities recorded in the 1960s, situated along the lower reaches of the Maritsa River (WARNCHE 1966, 1968) were also inspected.** The inspections involved transect methods used mainly along river valleys or streams, or examination of high trees in open habitats. Another method used during the inspections was observations from view point (BIBBY *et al.* 1999, ANDERSEN 2007).

Occupied territories, breeding pairs, age structure of population and population breeding parameters were recorded on an annual basis. We estimated the productivity (number of fledglings/occupied territory), the breeding success (number of fledglings/breeding pair) and the fledgling success (number of fledglings/successful pair) for 2008 and 2009, including 33 breeding attempts.

The identification of plumage was done according to FORSMAN (2005). The birds in sixth calendar year were considered adults. The pairs were divided into **three categories: adult – consisting of two individuals in adult plumage; mixed – consisting of an individual in immature plumage (second–fifth) and an adult partner (from sixth plumage up); and immature – consisting of two individuals in immature plumage.**

Statistic processing of data was carried out using the program Statistica for Windows, Release 7.0 (STATSOFT INC., 1984–2004). The comparison of data was based on the parametric T-test for independent variables, as well as on descriptive statistics. The data was analysed for normal distribution through

the Shapiro–Wilk test (SHAPIRO *et al.*, 1968). Results with $p < 0.05$ [$\alpha = 5\%$] were considered significant.

Results

Breeding distribution and habitats

During the research we carried out in three different regions in the period 2008–2009 we recorded a total of 20¹ territories occupied by breeders, and identified a few more territories of possible breeding (Fig.1).

The most important areas were the Strandja Mountain and the Dervent Heights where 9 nests were discovered. The other two regions, where **breeding pairs were recorded – Thrace (6 occupied territories) and North Marmara (5 occupied territories),** were insufficiently studied, and the number of pairs breeding in these areas was certainly underestimated.

While visiting the Ipsala region along the **lower reaches of the Maritsa River, where breeding of the species was recorded in the 1960s,** we observed an individual in a suitable habitat. The torrential rain during the expedition impeded the tracking of the bird and the **eventual detection of its nest.** The region held large pastures and gullies with high trees, providing suitable breeding conditions. We observed an immature Imperial Eagle **in its third or fourth plumage foraging on the north side of the Kuru Mountains,** where breeding was also possible.

Based on these findings and the availability of suitable habitats in various regions, we estimated the population in European part of Turkey at 30–50 breeding pairs.

There were two main Imperial Eagle habitats in European Turkey. The first habitat was in the regions of the Strandja Mountains and Dervent Heights near the Bulgarian–Turkish border. **The terrain was characterized by open hilly areas and low mountain areas up to 450 m a.s.l.** The regions consisted of **pastures, mosaic scattered fields, mainly wheat or sunflower crops, and small Oak coppices.** In these areas, Imperial eagle nests were located mainly on single Oak trees in small fields.

¹ In 2010, 25 nests were occupied by pairs.

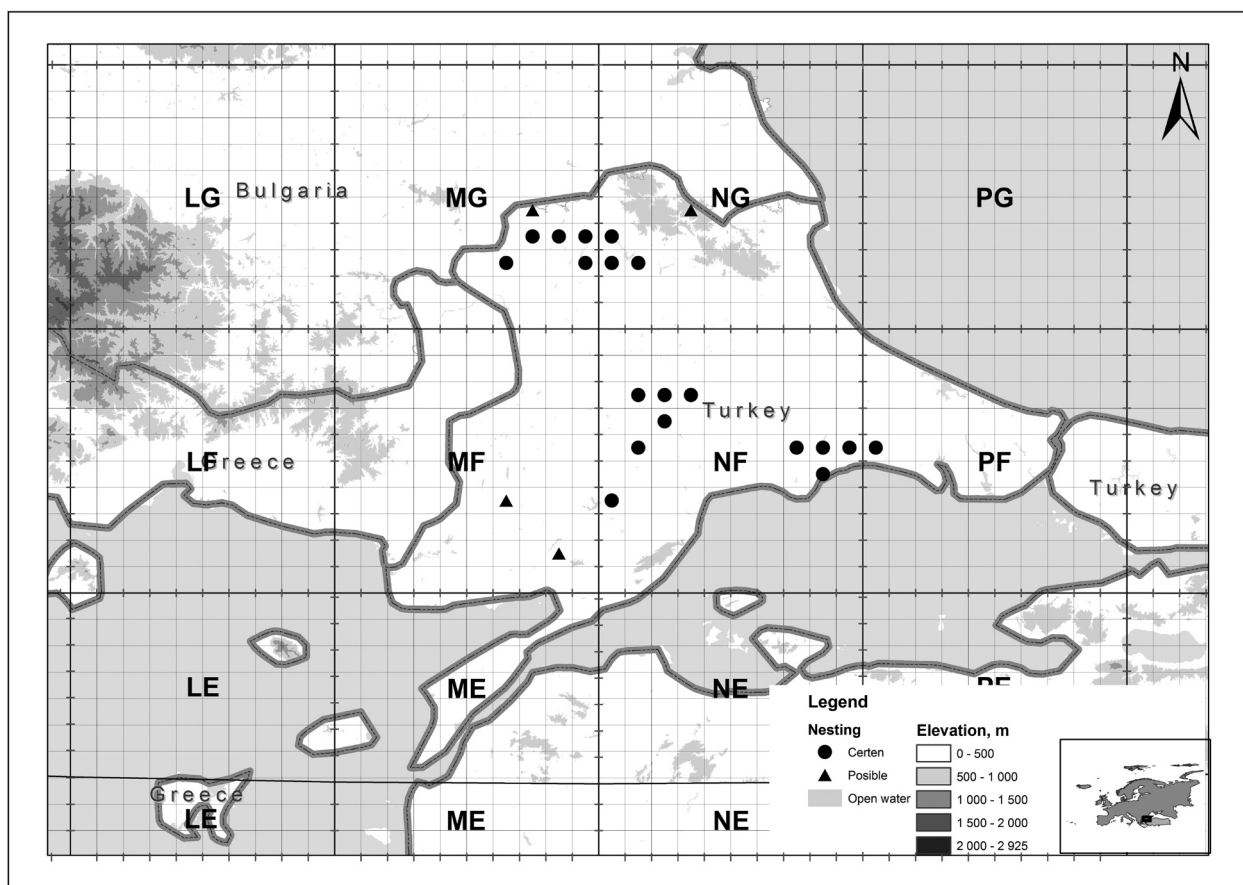


Fig. 1. Breeding distribution of Eastern Imperial Eagle in the European Part of Turkey (● – certain breeding; ▲ – possible breeding).

The second habitat type was typical of the Thrace and North Marmara regions, comprising low relief plain areas at an altitude of 50-150 m. The ground cover consisted mainly of mosaic arable lands and some pastures. The Imperial Eagle nests in these areas were located mainly on Poplar trees along small rivers and streams (Fig. 2)

Poplar trees were identified as the most preferred nesting substratum (44%), followed by Oaks (40%). One of the recorded nests was built on an Ash tree (*Fraxinus* sp. L.) and another one on a Willow tree (*Salix* sp. L.); two other nests were recorded on electric poles.

The breeding density was 1 pair/100 km² in both habitat types. The shortest distance between two breeding pairs was 5.8 km recorded in plain areas in the Thrace region. The longest distance recorded between two neighbouring pairs (n = 9) in this habitat was 12.1 km. The mean distance between the pairs was 9.5 km ± 0.67.

In hilly and low mountain areas the Imperial

Eagle nests (n=9) were situated at a mean distance of 10.36 km ± 0.86, as the shortest distance recorded between two neighboring pairs was 6.1 km, and the longest – 16 km.

Breeding parameters of the population

The mean values of the breeding parameters of the population for the study period were as follows: productivity (P)=1.01±0.06; breeding success (BS)=1.11±0.05; fledgling success (FS)=1.59± .09.

Comparing the breeding parameters of the Eastern Imperial Eagle populations in Bulgaria and European Turkey in 2008 and 2009, we did not find significant differences (Table 1). The mean productivity and the mean breeding success of the Imperial Eagles breeding in the European part of Turkey were a bit higher.

The comparison between the breeding parameters of the Bulgarian Strandja-Sakar breeding group (n=16) and the pairs breeding in the Turkish parts

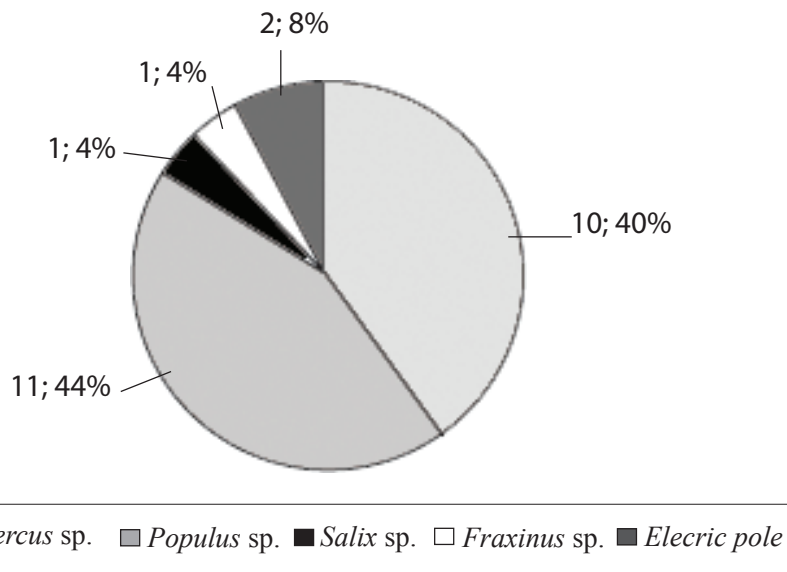


Fig. 2. Nesting substratum of Eastern Imperial Eagle in the European Part of Turkey.

of the Strandja Mountains and the Dervent Heights (n=9), did not detect significant differences between these two groups (Table 1). However, the values of the breeding parameters of the eagles breeding in Turkey were lower, probably due to higher disturbance.

The Imperial Eagles breeding in the Turkish parts of the Strandja Mountains and the Dervent Heights (n=18 breeding attempts) had lower mean productivity (0.78) and breeding success (0.93) compared to the same breeding parameters (1.3) of the pairs breeding in low plain areas in the Thrace and North Marmara regions (n=15 breeding attempts). However, **although the difference between the breeding parameters is big, the results indicate that it cannot be considered significant** (p=0.07; p=0.09).

The age structure of pairs (n=16) occupying territories or breeding in 2009 was recorded (Fig. 3).

Seventy-five per cent of the pairs were adult, consisting of two adult partners, while mixed pairs accounted for 25% of all recorded pairs. No immature pairs were recorded. In 2009, 20% of the Eastern Imperial Eagle population in Bulgaria consisted of mixed pairs (DEMERDZHIEV MANUSCRIPT). During the period 2008-2009 the presence of immature male individuals in pairs (n=4) was higher than that of immature females (n=1).

Threats and conservation

The threats to the Eastern Imperial Eagles in European Turkey are insufficiently studied. Disturbance during the breeding season is one of the recorded threats.

Table 1. Comparing the breeding parameters (Bulgaria – BG vs. European Turkey – TU; Bulgarian Strandja-Sakar breeding group (BG_part) vs. Turkish Strandja-Dervent Heights breeding group (TU_part), T- test for independent variable). P = Productivity; BS = Breeding Success; FS = Fledgling Success.

Group 1 vs. Group 2	Mean Group 1	Mean Group 2	t-value	df	p
P_BG vs. P_TU	0.9	1.01	-0.95	2	0.44
BS_BG vs. BS_TU	1.03	1.11	-0.83	2	0.49
FS_BG vs. FS_TU	1.52	1.59	-0.74	2	0.53
Group 1 vs. Group 2	Mean Group 1	Mean Group 2	t-value	df	p
P_BG_part vs. P_TU_part	1.07	0.78	2.23	2	0.16
BS_BG_part vs. BS_TU_part	1.14	0.93	2.15	2	0.17
FS_BG_part vs. FS_TU_part	1.57	1.75	-0.69	2	0.56

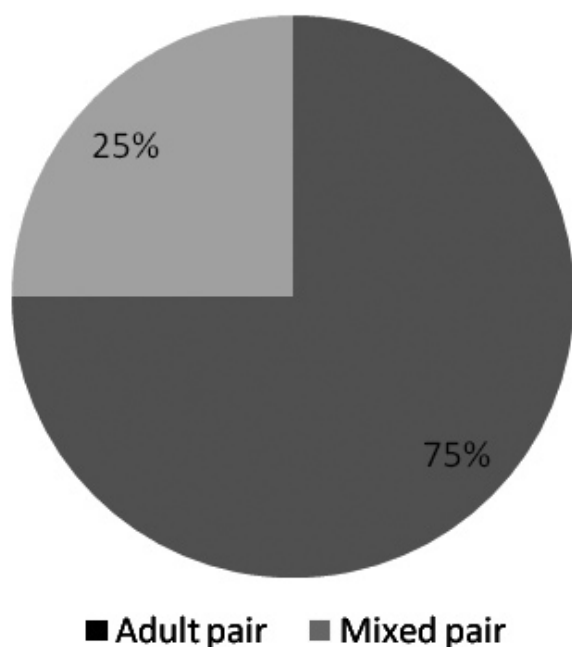


Fig. 3. Age structure of the population of Eastern Imperial Eagle in the European Part of Turkey in 2009.

Pairs breeding in the Strandja Mountains and the Dervent Heights build their nests on Oak trees in corn-fields, sometimes only 6-8 m above the ground. Crops, especially sunflower, which are sown later during **the eagle incubation period, could be the reason for brood abandonment.** Treasure-hunting could be another reason for unsuccessful breeding. In 2008, the presence of treasure-hunters under one of the Imperial Eagle nests built on a venerable Oak was the reason for the abandonment of eggs. Shooting and electrocution are some of the potential threats to Imperial Eagles. A significant part of the low-voltage power supply network in Turkey consists of structures posing an extremely high risk to birds. Such electric poles accounted for the high mortality rates of the Spanish Imperial Eagle (*Aquila adalberti* BREHM 1861) and other raptors in Spain (FERRER *et al.* 1991, GUYONNE *et al.* 2001). Natural disasters represent another important reason for mortality of chicks. In 2008 and 2009 we recorded two cases of lost brood that had fallen off the nests in storms.

The effective conservation of the Imperial Eagle in the European part of Turkey requires a monitoring program, **gathering information about the population status,** detailed studying of the threats, detection of previously unknown breeding pairs, as well as an awareness raising campaign among hunters and

local people, emphasizing the significance of the Imperial Eagle and the importance of the region for the population of this species.

Discussion

The data on the breeding distribution of the Eastern Imperial Eagles in the European part of Turkey dates back to the end of the 19th C, when the species was reported as breeding **in the vicinity of Istanbul, especially in the Belgrad Forest** (ALLEON, VIAN, 1869). In recent times breeding Eastern Imperial Eagles were recorded in the period 1965-1967 – one pair near Ipsala close to the Turkish–Greek border, and another one at the edge of the Maritsa delta (WARNCKE 1966, 1968, WIRTH 1996). GURSAN, BILGIN (2002) reported the occurrence of the species in European Turkey without **providing any concrete data on its distribution and abundance.** The monograph on the birds of Turkey published in 2008 reported the Imperial Eagle as a species on the verge of extinction in the Thracian region (KIRWAN *et al.* 2008). This estimate was the result of the lack of data at that time and the insufficient knowledge of the species in European Turkey.

The results of the studies we carried out in 2008 and 2009 **indicate a stable, well-distributed population** in European Turkey. The good status of this most numerous Imperial Eagle subpopulation on the Balkan Peninsula is crucial for the population of this species as a whole. These findings throw a new light on the estimate of the national Eastern Imperial Eagle population in Turkey.

The recorded values of the breeding parameters of the population were similar to those of the Eastern Imperial Eagles breeding in Bulgaria. On the other hand, most of the Eastern Imperial Eagle pairs breeding in Bulgaria are situated along the Bulgarian-Turkish national border, 16 pairs in total (DEMERDZHIEV *et al.* 2011). The pairs breeding on either side of the border probably belong to the same subpopulation. **The shortest distance recorded between two breeding pairs on either side of the border was 6.6 km.**

The slightly higher mean productivity and breeding success of the Eastern Imperial Eagles in European Turkey recorded during the study period were most probably due to the lack of immature

pairs, which have lower breeding potential and often fail to raise offspring at the time of first reproduction (MARGALIDA *et al.* 2008). The lower mean values of the productivity and the breeding success of pairs breeding in the Turkish parts of the Strandja Mountains and the Derwent Heights, compared to those in the Thrace and North Marmara regions, were probably due to human disturbance. With the first group, the nesting trees were located mainly in small cornfields frequently visited by local farmers.

The age structure of the population in European Turkey in 2009 was somewhat similar to that of Bulgaria. While the share of mixed pairs was almost the same for both populations, no immature pairs were recorded in the Turkish population in 2008 and 2009. In 2009, 15% of the pairs in Bulgaria were in immature plumage, which was related to the population growth and the colonization of new territories (DEMERDZHIEV *et al.* 2011). Whether the presence of non-adults in mixed pairs is a result of high mortality rates of adult breeders (FERRER 2001, FERRER *et al.* 2003, BALBONTIN *et al.* 2003) cannot be asserted at this stage. However for the period 2000-2009 the mean percentage of mixed pairs in the Bulgarian Imperial Eagle population was 20.7% ±4% (DEMERDZHIEV manuscript).

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Conclusions

This was the first detailed study of the status of the Eastern Imperial Eagle in European Turkey.

The Eastern Imperial Eagle population in European Turkey is stable, characterized as widely distributed and abundant. However, this theory calls for further research.

There are two main habitat types typical of the Imperial Eagles in European Turkey – open hilly areas and low mountain areas (up to 450 m a.s.l.), and low relief plain areas (50-150 m a.s.l.).

The threats are insufficiently studied and need further investigation.

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Състояние на Източния Царски орел (*Aquila heliaca*) в Европейската част на Турция

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(Резюме)

Настоящата статия представя резултатите от първото задълбочено проучване на разпространението и числеността на популацията на Източния Царски орел (*Aquila heliaca* SAVIGNY 1809) в европейската част на Турция. През периода 2008-2009 г. са открити двадесет територии заети от двойки царски орли, разпространени в три различни региона. Гнездовата популация се оценява на 30-50 двойки. При проучването са идентифицирани два основни типа местообитания, типични за царските орли в европейска Турция – открити хълмисти и нископланински територии (до 450 m н.в.) и равнинни територии (50-150 m н.в.). Тополите (*Populus* sp.) са най-предпочитаният гнездови субстрат (44%), следвани от дъба (*Quercus* sp.) (40%). Гнездовата плътност е 1 двойка/100 km² и в двата типа местообитания. Най-малкото разстояние между две гнездящи двойки е 5.8 km, регистрирано в равнинните територии на Тракия. Отчетени са продуктивността (брой излетели малки / заета територия), гнездовият успех (брой излетели малки / мътеша двойка) и размножителният успех (брой излетели малки / успешна двойка) за периода 2008 и 2009, включително 33 случая на размножаване. Заплахите са недостатъчно проучени и се нуждаят от допълнително изследване.

