THE GREATER SPOTTED EAGLE (AQUILA CLANGA): PREVIOUS, CURRENT STATUS AND HYBRIDISATION IN LITHUANIA

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Abstract. The Greater Spotted Eagle (Aquila clanga) is a globally threatened species. It is included into the Lithuanian Red Data Book as extinct or probably extinct. During fieldwork in 2000–2004 four non-territorial Greater Spotted Eagles were observed. 261 spotted eagles were described in 161 breeding territories (about 15% of the Lesser Spotted Eagle (Aquila pomarina) national population). 2.7% of birds were identified as Greater Spotted Eagles in 3.7% of the studied territories. Only one territory was occupied by two birds, two territories – by solitary birds and three territories were occupied by Greater Spotted Eagles in pairs together with Lesser Spotted Eagles. Only one mixed pair raised probably a hybrid nestling in 2004. 3% of spotted eagles were difficult to identify, thus it is possible that they could be hybrids of the first or later generations. A presumption is possible that in Lithuania there are up to 15 territories occupied by pairs in which at least one mate is the Greater Spotted Eagle. About seven of these territories could have been occupied by pure pairs of the Greater Spotted Eagle in favourable years.

Key words: Aquila clanga, Aquila pomarina, mixed pairs, hybridisation, numbers

INTRODUCTION

Greater Spotted Eagles (Aquila clanga Pall.) are a globally endangered species. They are the rarest and least investigated eagles of the genus Aquila (Komischke et al. 2001). Their distribution over the vast range is scarce, the global breeding population being estimated at less than 3,000 pairs (Vali & Lohmus 2000). The species is protected under various international agreements (EU Birds Directive Annex I, Annexes II of Bern, Bonn and Washington conventions).

In Lithuania the species is included into the Lithuanian Red Data Book and is considered as ‘extinct or probably extinct’ (Balevičius 1992; Meyburg et al. 2001). The north-western range border going across the territory of Lithuania is supposed to be the cause of its rarity (Balevičius 1992; Meyburg et al. 2001). However, habitat degradation and destruction, forestry activities and human disturbance during the breeding season are considered as the most important causes of population decrease and rarity (Meyburg et al. 2001). The notoriously complicated identification of the Greater Spotted Eagle and the Lesser Spotted Eagle (Aquila pomarina) under field conditions (Nikolaev 1996), their taxonomic (Bergmanis 1996), genetic (Seibold et al. 1996; Vali 2002) and ecological (Wendland 1959) closeness, semi-sympatric distribution in Eurasia (Vali 2004) and occurring interspecies hybridisation (Lohmus & Vali 2001; Dombrovski 2002) may be the causes of incorrect assessment of the local Greater Spotted Eagle population. In Lithuania, where a strong population of the close species Lesser Spotted Eagle occurs (900–1,200 pairs: Kurlavičius & Raudonikis 2001), the problem of identification is acute too. No special investigations of the Greater Spotted Eagle were performed until 2002. In 2002 the Lithuanian Ornithological Society with the help of foreign experts launched the search for this species. In the course of short-term investigations only a few non-territorial birds were observed (V. Dombrovski, L. Demongin, pers. comm.). The European Greater Spotted Eagle action plan refers to the Lithuanian population of this species as unknown (two pairs at the maximum are mentioned) and recommends ‘initiating national investigations and monitoring if the population is found existent’ (Meyburg et al. 2001). Hence, this article is a step in this direction. On the basis of specialised investigations of spotted eagles the current article aims at estimating the number of Greater Spotted Eagle pairs in Lithuania and their taxonomic interaction with Lesser Spotted Eagle individuals.

MATERIAL AND METHODS

Species location data were collected from publicized sources and personal communications. During the fieldwork performed in April–August 2000–2004 the ma-
The quadrants to search for birds were selected in such localities of the country in which or around which (a) Greater Spotted Eagle individuals were recorded (in accordance with data from literature) and (b) potential habitats of Greater Spotted Eagle individuals are likely to be located (Wendland 1959; Cramp & Simmons 1980; Ivanovski 1996; Lohmus 2001; Drobelis 2004; Lohmus & Vali 2004).

Identification of Eagles

Adult birds were identified in one, two or all the below indicated ways (1) by describing them in the course of hunting activity, display flights or by inspecting their eyries; (2) basing on measurements and plumage description of juveniles (3) by DNA analysis (it was performed by Dr U. Vali, Tartu University, Estonia; about species identification of spotted eagles applying DNA analysis; Vali 2002, 2004; Vali et al. 2004). Observation and description of birds were made using 10 (12) × 50 binoculars and a 15–45× telescope (since 2003) and also making reference to the following publications: Cramp & Simmons 1980; Bergmanis 1996; Forsman 1999; Dombrovski et al. 2000; Lohmus & Vali 2001). Birds were identified only under proper illumination and from a proper distance, in case of necessity they were described several times. Eagle sex was determined mainly on the basis of sex-specific behaviour at different time of the breeding season (Wendland 1959; Meyburg 1970; Cramp & Simmons 1980; Komischke et al. 2001; Sheller et al. 2001; Vali & Lohmus 2002). Sex of some birds was determined by DNA analysis (Vali 2004).

RESULTS

Information on the Greater Spotted Eagle before 1988 is scarce. According to Drobelis (2004), 5–6 pairs of eagles were breeding in Central Lithuania in 1950–1955, however, no evidence of breeding has survived (descriptions of eggs and birds, measurements or suffed birds). The checking of some of the breeding territories of that period revealed that they were either destroyed due to urbanisation or were occupied only by Lesser Spotted Eagle individuals. The probable case of the Greater Spotted Eagle breeding was observed around 1970–1972 also in Central Lithuania. In that case, the nesting, raised in an artificial nest was identified in accordance with keys of that time (A. Slučka, pers. comm.). However, no reliable evidence (descriptions of bird plumage or measurements) has survived either. Greater Spotted Eagle individuals were no longer sighted in those localities (A. Slučka, pers. comm.). In 1970 a pair of birds was observed in central western Lithuania (Drobelis 1990; R. Idzelis, pers. comm.). Checking of the latter was conducted in 2000–2003 yearly, but only typical birds of the Lesser Spotted Eagle were observed. According to the confirmed data, in Lithuania the Greater Spotted Eagle was sighted 10 times in nine localities in 1988–2000 (Drobelis 2004), and, according to personal communications, in 2001–2002 it was recorded in three more localities (M. Baranovski, V. Dombrovski, L. Dementin, pers. comm.; Fig. 1). In the course of the investigation nine registry sites out of 12 were inspected and only in two of them sightings of Greater Spotted Eagle individuals were recorded repeatedly. In 2000–2004 adult birds were described from a total of 161 spotted eagle breeding territories (Fig. 1), which makes up around 15% of the national Lesser Spotted Eagle population. Both pair mates were identified in a hundred of territories. In the rest of 61 territories only one pair mate was described (most often a male). In total not fewer than 261 spotted eagles were described. It took more than a year to make descriptions of birds in part of the territories (about 40%). A presumption was made that in the course of the investigation the territories were occupied by the same pairs (Meyburg 1970; Cramp & Simmons 1980; Drobelis 1990; Ivanovski & Bashkirov 2002; Meyburg et al. 2002). Thus, if a pair of birds was described in the same territory, it was considered even for several years that only two birds had been described, with the exception of cases when an obvious replacement of one of the pair mates was recorded, e.g. an adult bird was replaced by an immature one.

1 – spotted eagle – Greater Spotted Eagle, Lesser Spotted Eagle or an interspecies hybrid. The spotted eagle population – all individuals of these taxonomic forms in Lithuania.
3% of spotted eagles proved to be difficult to identify to the species level: in two territories male species was not determined because they exhibited features specific to both species. Females from four territories and males from two territories were identified with difficulty due to unspecific features (‘Difficult to identify birds’). Greater Spotted Eagle individuals made up 2.7% of the described spotted eagles and were recorded in 3.7% of the territories: in one territory both pair mates were typical individuals, in two territories solitary eagles defending the territory were recorded, in three territories they were sighted in pairs with typical Lesser Spotted Eagles. Apart from that, there were four vagrant Greater Spotted Eagle individuals observed.

**Difficult to identify birds**

Four birds (most probably all females, see: Material and methods) were observed in a relatively small territory in eastern Lithuania. Each bird was described under different illumination and observation conditions three or more times in the course of the breeding season. The birds were very similar in silhouette (long, broad, square-shaped wings, distinct wing arch, long head, stocky build, short and broad tail) to Greater Spotted Eagle individuals, and under improper illumination – practically indistinguishable from this species.

Three birds were much darker than typical individuals of the Lesser Spotted Eagle, and contrasts between wing coverts and primaries both in the upper- and the under-wings were insignificant. Only one bird exhibited the Lesser Spotted Eagle-specific colour features.

In the course of territory marking bird voices were much harsher and more distinct (Cramp & Simmons 1980) than the typical voices of the Lesser Spotted Eagle. Only one bird was found to be breeding successfully. The juvenile looked like a typical individual of the Lesser Spotted Eagle, with the exception of the fact that in the upper-wing coverts there was no distinct contrast between primaries and wing coverts and the plumage had a clearly purple reflection (typical of Greater Spotted Eagle juveniles; Ivanauskas 1959; Forsman 1999).

One male in Eastern Lithuania was exceptionally stocky, but features of the plumage, silhouette and flight activity did not differ from those of Lesser Spotted Eagle individuals. Two juveniles described in 2003–2004 had all Lesser Spotted Eagle-specific plumage features. Another male, sighted in Northern Lithuania, was unusually dark although it did not differ from Lesser Spotted Eagle individuals in other plumage features, silhouette and size.

In the course of the investigations there were two more eagle males observed which could not be ascribed to any of these species due to controversial features.

**Territory 1**. The pair was described in 2002–2004 in the course of the breeding period. The female is a typical individual of the Lesser Spotted Eagle. The male is of a controversial phenotype. The bird is stocky, definitely larger than females or males of the neighbouring pairs (birds were visually compared in the course of territory marking). Broad square-ended wings, a distinct wing arch, a stocky body and a relatively long head, a large bill and a short tail are the features specific to the Greater Spotted Eagle. *Aquila* patches are of the intermediate type, although when looked at a distance resemble a blurred, diffuse patch. Carpal crescents are insignificant, narrow and long (typical of the Lesser Spotted Eagle phenotype). The bill was large but it did not contrast with the head as the latter was very pale (reverse *A. clanga*). The general coloration of the bird was monotonously light brown (which is not typical of the majority of Lesser Spotted Eagle individuals), the contrast between the coverts and primaries of the upper- and under-wing was insignificant. In 2002 and 2003 the pair raised one juvenile per year, whose plumage details and measurements (measurements were taken only in 2002) were specific to Lesser Spotted Eagle individuals.

**Territory 2**. Both birds were described only in 2002. The female is a typical individual of the Lesser Spotted Eagle. The male had features of both species, the intermediate ones predominating. The general impression of the bird’s coloration is that it is monotonously dark brown.

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2 – One bird is not an entirely typical Greater Spotted Eagle, see in ‘Territory 8’
The contrast between the under-wing primaries and coverts is insignificant and difficult to assess. In the upper-wing only the small coverts are mid-brown, the rest of the plumage being dark and not contrasting with primaries. Carpal crescents (two in one wing and one in another) are very distinct, although not broad or long, contrasting sharply with big, black carpal patches. Wings are broader and longer than those of a typical Lesser Spotted Eagle male. The head is dark, sharply contrasting with the bill, the nape is chestnut in colour, a distinct wing arch (typical of the Greater Spotted Eagle) was visible in flight. There was no distinct difference in size between the male and the female recorded. However, the male was definitely larger in size than the mates of the neighbouring Lesser Spotted Eagle pairs. None of the juvenile’s measurements was specific to the Greater Spotted Eagle. The juvenile was monotonously dark, almost spotless, some features of the plumage (e.g. secondaries were blackish almost throughout without pale bands) being unspecific to any of these species.

**Typical Greater Spotted Eagles**

**Territory 3.** One territorial bird was observed on 1 and 5 August, 2003. It was a typical Greater Spotted Eagle adult. Over a 10-hour observation there were no territorial display or hunting flights recorded. The bird was attached to a particular territory. One Greater Spotted Eagle was observed in May 2002 (V. Dombrovski, L. Demongin, pers. comm.). In the middle of July 2004 the territory was unoccupied and no Greater Spotted Eagles were observed.

**Territory 4.** The birds were first sighted in August 2003. Two typical representatives of the Greater Spotted Eagle were continuously observed in the territory till the middle of September. They had no juveniles. The first eagle, a little bit larger than the second one, was a typical adult individual. The smaller bird had features of an imm individual. His pale-tipped greater upper-wing coverts formed an indistinct pale broken bar. Tips of primaries were paler, therefore under a proper illumination the trailing edge of the wings looked translucent. The trailing edge of the wings was S-shaped. The lower part of the belly was pale and there were two crescents on each wing. As the birds differed in size, it was presumed that they represented individuals of different sexes.

On 22 May, 2004 in this territory an adult Greater Spotted Eagle individual soared up from the meadow with a prey in his bill, flew several kilometers and landed in the forest, having made several undulating display flights before that. In May–August the monitoring of the territory was continued for approximately 40 hours more.

Over that period the same bird was continuously observed. However, there were no sightings of another bird made. Prey delivery or active territorial display flights were not recorded and the eyrie was not found.

**Territory 5.** In May–September 2004 only one eagle, a typical adult individual of the Greater Spotted Eagle was observed. The bird was actively engaged in hunting and performed undulating display flights whenever alien eagles appeared in the vicinity of the nest. It even attacked the nearby White tailed Eagles several times. There were some new feathers found in the nest and some of the previous year – on the ground under the nest. According to DNA analysis the bird was a Greater Spotted Eagle individual.

**Mixed pairs**

**Territory 6.** In April–August 2004 there were two birds observed: a typical adult Lesser Spotted Eagle and a typical imm Lesser Spotted Eagle. Features: pale tips of the greater and median upper-wing coverts formed two continuous bands, the trailing edge of the wings had a broad translucent band, two carpal crescents per wing, the lower part of the belly was pale. In my opinion it was a 2nd calendar year bird. The birds did not differ significantly from one another in size, in contrast to silhouette. The birds had occupied the nest since spring, but they did not breed.

**Territory 7.** A typical Greater Spotted Eagle adult female and imm Lesser Spotted Eagle male were observed on 19 June, 2003. At midday a Greater Spotted Eagle individual performed active display flights above the forest when alien eagles appeared in the territory. The pair had no juveniles. Eyries known from before were checked. The 7th primary feather (counting inward) was found not far from one eyrie. The notch of the 7th primary was >90\(^3\) mm (>82 mm is typical of *A. clanga*; Bergmans 1996). DNA analysis confirmed species identity. In April–August 2004 a typical Greater Spotted Eagle and a typical Lesser Spotted Eagle individual were observed in the territory. They are likely to have been mates of the same pair. The birds had no nestlings, most probably they even had not started breeding.

**Territory 8.** In 2004 a pair of spotted eagles bred here. The female of this pair was a typical ad Lesser Spotted Eagle individual. The male was very similar to Greater Spotted Eagle individuals and did not have a single feature specific to the Lesser Spotted Eagle. However, some of the plumage features were intermediate in character. There was no contrast between the upper-wing and under-wing primaries and coverts, the head was distinct, contrasting sharply with the bill.

\(^3\) – exact length is unknown as the tip of the feather is broken
The head was dark and did not differ from coverts in colour, ‘fingers’ were long, the stocky body was monotonously brown. The latter features are more characteristic of the Greater Spotted Eagle phenotype. The bird differed from the female in silhouette, the difference in size being insignificant. The wings did not seem relatively broad, the wing angle did not form a square. Aquila-patches were very indistinct and at a distance they made an impression of a diffuse patch, although not formed only of shafts of primaries, carpal crescents were not broad. The latter features are more intermediate in character. However, in Polesie of Belarus the were not broad. The latter features are more intermediate in character. However, in Polesie of Belarus the

For further species determination of adult spotted eagles and investigation of hybridisation, juveniles were described and their measurements were taken in accordance with Bergmanis 1996; Dombrovski 2002; Lohmus & Vali 2001. The juvenile’s plumage was first described in detail in the nest on 11 July. It was described repeatedly after the eaglet had left the nest under different illumination conditions on 10 and 12 September. However, the measurements of the juvenile were not taken as during the nest checking it was still too young. The juvenile had features typical of both species as well as intermediate plumage features. Features typical of Greater Spotted Eagle individuals: the general plumage coloration was dark, monotonously brown, no contrast between the upperside coverts and primaries was recorded. Both greater and median wing-coverts ended in yellowish spots which in flight formed two distinct continuous bands. Under-wing coverts were darker than secondaries. Greyish interbands in secondaries were twice as broad as dark bands. Pale tips of the same feathers were approximately 4 cm in width (however, pale tips of feathers of Greater Spotted Eagle individuals are broader than 5 cm; Forsman 1999), and under proper illumination they formed a translucent band in flight. Features of Lesser Spotted Eagle individuals: a distinct mid-brown nape patch. This feature is widely used in distinguishing between spotted eagle species (Baumgart 1980; Bergmanis 1996; Ivanovski 1996; Forsman 1999; Vali & Lohmus in press). The bird’s silhouette was not characteristic of juveniles of any spotted eagle species.

The collected facts do not allow rejecting a presumption that a male is a hybrid of the first or the later generation. As the juvenile of this male exhibited quite a number of Greater Spotted Eagle features and the adult bird itself did not have a single feature typical of the Lesser Spotted Eagle while features of the Greater Spotted Eagle were dominating, it was possibly a Greater Spotted Eagle individual.

Basing on the above mentioned arguments, it is possible to presume that the pair of eagles observed in this territory is a mixed one. The juvenile, which has features of both species as well as the intermediate ones, must be a hybrid of the Greater Spotted Eagle and the Lesser Spotted Eagle.

**DISCUSSION**

The cases of species sighting, described in Lithuanian literature, especially those that are several decades old, raise serious doubts because at that time features, which are judged subjectively and are not necessarily species specific, were widely used for species identification (Bergmanis 1996). But if records of the species kept at that time are treated as reliable, it is possible to assert that a small number of Greater Spotted Eagle pairs could have been breeding in Central Lithuania regularly.

Habitat loss, degradation and human disturbance during the breeding period (Vali & Lohmus 2000) as well as intensive use of pesticides (Belik 1997) are thought to be the basic reasons of the Greater Spotted Eagle extinction all over the range. Hence, it is probable that the Greater Spotted Eagle became extremely rare or extinct in the 1960s or 1970s when soil reclamation and pesticides were widely applied all over the country landscape. No evidence of the Greater Spotted Eagle breeding over the last 16 years has been found in literature. Having checked the majority of eagle territories, we arrived at a conclusion that the majority of sighted birds were migrant or vagrant birds.

Not a single breeding ‘pure’ Greater Spotted Eagle pair was observed in the course of the investigation. The productivity of eagles (number of fledglings per active nest per year) which in 2003 and 2004 (when the majority of birds were described) was much lower than the average (0.28 (Treinys & Dementavičius 2004) and 0.41 (author’s data) respectively) can partly account for that. Investigation results confirm the opinion that the Greater Spotted Eagle is extremely rare in Lithuania (Drobelis 1990), but the treatment of the species as ‘extinct or probably extinct’ is not precise. Taking into consideration the fact that (a) Greater Spotted Eagle individuals were recorded in 3.7% of the checked territories, (b) the Lithuanian population of the Lesser Spotted Eagle consists of 1,000 pairs (900–1,200 pairs; Kurlavičius & Raudonikis 2001), it is possible to presume that at least one mate of a pair could be a Greater Spotted Eagle individual in approximately 37 territories. However, such a figure would be an overestimation of the real situation due to the below listed reasons. Firstly, study
sites were not selected at random (see: Material and methods). My sightings of the Greater Spotted Eagle as well as those reported in literature were made in vast wetlands: fishery ponds, big lakes, fens and wet meadows. These facts prove the attachment of birds to wetlands of different type (Wendland 1959; Cramp & Simmons 1980; Nikolaev 1996; Dombrovski et al. 2000; Vali & Lohmus 2000; Lohmus 2001; Drobelsis 2004). The Greater Spotted Eagle is recorded in the Eastern, Southern and Western parts of Lithuania (Fig. 1), where the landscape is rich in lakes, river valleys and flooded-meadows. The Greater Spotted Eagle can breed in all habitats suitable for spotted eagles its density being different (Dombrovski 2002). Therefore the probability of the Greater Spotted Eagle breeding in Central, Northern, South-western Lithuania with the waterless agrarian and woody landscape prevailing is much lower than in Eastern, Southern and Western Lithuania.

On the other hand, as the majority of eagle sighting locations are near the border, the distribution of the Greater Spotted Eagle in Eastern, Southern and Western Lithuania is most likely related not only to the landscape peculiarities but also to 'source' populations. Western Lithuania borders on the Kaliningrad region in which a relatively abundant Greater Spotted Eagle population is recorded (Beliakov et al. 1989). Meanwhile, Eastern Lithuania borders on Belarus, mainly the Vitebsk region, in which according to the data of the latest investigations up to 40 Greater Spotted Eagle pairs could be breeding (Ivanovski & Bashkirov 2002). A stable population of eagles was also found in Southern Belarus (Dombrovski et al. 2000). Taking regional – both ecological and geographical – peculiarities of Eastern, Southern and Western Lithuania into consideration, it is possible to presume that Greater Spotted Eagle individuals recorded there belong to different subpopulations (similar locations of species accumulation are reported in Belarus (Dombrovski et al. 2000), Poland (Pugacevicz 1995)). Other Lithuanian regions are relatively remote from stable Greater Spotted Eagle (sub)populations.

Taking into consideration landscape peculiarities, the level of investigation of suitable regions by 2000–2004, the abundance of unstudied potential habitats under favourable conditions there could be 15 territories in Lithuania occupied by eagle pairs with at least one mate being the Greater Spotted Eagle. It is difficult to estimate the number of 'pure' Greater Spotted Eagle pairs for some reasons. First, the formation of mixed pairs is constant (in Estonia mixed pairs make up 50% of the Greater Spotted Eagle population; Lohmus 1998) besides, it is assumed that the ratio of mixed pairs to the pure ones is unstable, as mixed pairs tend to settle in the territories previously occupied by the Greater Spotted Eagle, where pairs of the rarer 'pure' species may be formed anew; Lohmus and Vali (2004). However, taking into account investigation results and the percentage of mixed pairs in other Baltic states (Lohmus 1998), it is possible that in favourable years seven pure pairs could be breeding in Lithuania. This estimation is close to the maximum estimation of Greater Spotted Eagle pairs so far made in Lithuania (0–5 pairs; Kurlavičius & Raudonikis 2001).

Species status of spotted eagles and causes of regular hybridisation have been thoroughly discussed in a number of articles (Seibold et al. 1996; Bergmanis 1996; Dombrovski 2002; Lohmus & Vali 2001; Lohmus & Vali 2004); Zhezherin 1969; Bergmanis et al. 2001). The formation of mixed pairs established in the course of the investigation and the resultant hybridisation confirm the results of other investigations. Therefore, the hybridisation poses real threat to the rarer species – the Greater Spotted Eagle in its accumulation regions and their periphery, in particular.

Difficult to identify adult spotted eagles (3%) exhibited very similar features to those of Greater Spotted Eagle and Lesser Spotted Eagle juveniles, described by other authors (Bergmanis et al. 2001; Lohmus & Vali 2001; Dombrovski 2002). Dombrovski (2002) ascribes adult birds with intermediate features and those characteristic of both species to hybrids. V. Dombrovski’s descriptions of adult birds are similar to mine. Although it is impossible to exclude the possibility of intraspecies variation (Dombrovski 2002), these difficult to identify birds or at least part of them might be breeding hybrids of the first or later generations.

Acknowledgements

I am grateful to Frankfurt Zoological society – ‘Help for threatened wildlife’ which financially supported investigations of Greater Spotted Eagles in 2004. I am also obliged to Dr Ulo Vali for the performed genetic analysis and assistance in Greater Spotted Eagle identification, Darius Stončius, Romas Mečionis, Deivis Dementavičius, Darius and Daiva Norkūnai for the assistance rendered in the course of fieldwork.

References

The Greater Spotted Eagle: previous, current status and hybridisation in Lithuania


Didysis erelis ręksnys (Aquila clanga): ankstesnis, dabartinis statusas ir hibridizacija Lietuvoje

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Received: 12 November 2004
Accepted: 17 March 2005