Acta Zoologica Lituanica, 2004, Volumen 14, Numerus 2
ISSN 1392-1657

PRODUCTIVITY AND DIET OF LESSER SPOTTED EAGLE (*AQUILA POMARINA*) IN LITHUANIA IN 2001–2003

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Abstract. In 2001–2003, the data on the productivity and diet of Lesser Spotted Eagle (*Aquila pomarina*) were collected in Central, Northern and Eastern parts of Lithuania. Though during the mentioned period productivity varied greatly, mean productivity of 0.61 was very similar to that more than 10 years ago. During the study period successful breeders made up 59%; 3% of all successful breeding attempts resulted in two nestlings. The productivity correlated with the share of small rodents in the diet. With a decrease of the diet share of small rodents, the diet share of amphibians increased. Therefore we assume that Lesser Spotted Eagle in the study area behaves partly according to the alternative prey hypothesis. It is also likely that during the last decade small rodents became predominant in the diet of eagles, whereas the role of other kind of prey became less significant. Extensive agriculture can be one of the possible reasons for this. We also suggest that changes in agriculture during the last decade did not have direct influence on mean productivity. Due to the lack of data we are not able to judge about changes in population abundance.
Key words: *Aquila pomarina*, productivity, diet change

Introduction

Since 1991 the Lithuanian agriculture has undergone dramatic changes. Over a very short period farming has become very extensive and the forestry use – intensive. Such changes in the landscape inevitably affect lives of various organisms, including rare species of birds of prey.
Lesser Spotted Eagle (*Aquila pomarina*) is one of the most numerous eagle species in Europe (Väli 2003). Its conservation status there is considered to be unfavourable (Tucker & Heath 1994), because during the last century Lesser Spotted Eagle's habitat and populations decreased in many European countries (Bergmanis *et al*. 1997). Because of low productivity and a small distribution range as well as high sensitivity to habitat changes, wintering in other continents and hunting during migration (Bergmanis 1999; Meyburg *et al*. 2001), this species deserves environmentalists' attention.
Lesser Spotted Eagle is protected in Lithuania, though it is common there (900–1,200 pairs; Kurlavičius & Raudonikis 2001). As Lesser Spotted Eagle breeds within mosaic landscape, the previously mentioned changes in its use can bring unpredictable results to the population. Habitat changes can influence Lesser Spotted Eagle's: (a) productivity, (b) abundance (Scheller *et al*. 2001), and (c) changes in the diet (Lõhmus & Väli 2001). Applying these criteria, the paper looks for answers to the following questions: (a) what was the state of the Lesser Spotted Eagle population in 2001–2003, (b) have the main population indicators changed since 1991, (c) has intensive agriculture had any influence on the population?

Material and methods

The data were collected in 2001–2003 in Central, Northern and Eastern parts of Lithuania (Fig. 1). Productivity, evaluated as fledglings per occupied nest per year (Väli 2003), was evaluated every year. The number of control nests was different, because new nests were discovered each year, namely 26 nests in 2001, 71 in 2002, and 88 in 2003.
The data on the diet were obtained during nest checking and searching. During the checking of nests, new food items or their parts were recorded. During the searching of nests, eagles supplying their nests with food were observed. When conditions were favourable for observation, food items were identified with the help of a 15–45× telescope. During the study period, 290 food items were recorded and grouped into three categories: (a) small rodents, (b) amphibians, and (c) others (birds and some mammals: mole (*Talpa europaea*), water vole (*Arvicola terrestris*), weasel (*Mustela nivalis*), and European hare (*Lepus europaeus*), etc.).

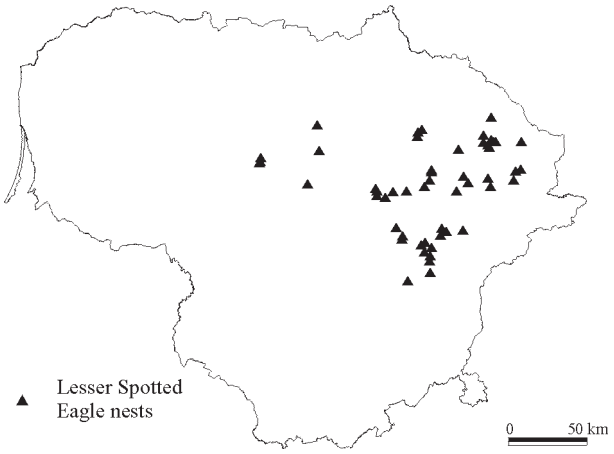

Figure 1. Locations of investigated Lesser Spotted Eagle nests (situation in 2003).

Results and discussion

Productivity

During the three-year monitoring period, Lesser Spotted Eagle's breeding attempts totalled to 185 (26 attempts in 2001, 71 – in 2002, and 88 – in 2003) of which 99 were successful. In 2001–2003, the mean productivity was 0.61, whereas before 1990 – 0.6 (Drobelis 1990). Similar productivity was recorded in neighbouring countries: Estonia – 0.62 (Väli 2003), Latvia – 0.58 (Bergmanis *et al*. 2001), and Poland – 0.6 (Rodziewicz 1996). Because of small-size samples and a short-time monitoring, we can not precisely answer the question whether productivity has changed. Nevertheless, our assumption that the productivity of Lesser Spotted Eagle has not changed is based on the data previously recorded in Lithuania and productivity indicators recorded in the neighbouring countries.

In Lithuania, of 99 successful breeding attempts three resulted in two nestlings, what made 3%, whereas Estonia accounted for 1.8% (Väli 2003), Latvia and Poland – 2.5% (Rodziewicz 1996; Bergmanis *et al*. 2001), and Belarus – 3.4% (Ivanovsky 1996a). Successfully breeding pairs made up on average 59%, whereas territorial and unsuccessful pairs – 41%. Latvia showed a similar percent of successfully breeding pairs – about 54% (Bergmanis *et al*. 2001).

Abundance

Over the last decade the assessment of national population abundance has changed (Table 1).

Lithuania does not carry out a long-term monitoring of Lesser Spotted Eagle abundance at sample plots, and the assessment of population is based on the data obtained during various projects. The numbers presented in Table 1 reflect not the changes in abundance, but only a higher-level investigation of population (Kurlavičius & Raudonikis 2001). Therefore, while analysing population dynamics we cannot take these numbers as a reference.

Table 1. Change in assessment of Lesser Spotted Eagle abundance in 1994–2001.

Year	Pair number	Data source
Up to 1994	300–500	Tucker & Heath 1994
1996	500–750	LRC 1996
1996–1998	700–1,000	Kurlavičius & Raudonikis 1999
2001	900–1,200	Kurlavičius & Raudonikis 2001

The territories monitored in 2001–2003 were occupied every year (at least in spring). A significant variation of pair number depends on conditions of the landscape (Bergmanis *et al*. 2001), whereas the abandoning of territories due to eagles' site tenacity is a long process (Scheller *et al*. 2001). Recognising these facts we presume that a three-year period is too short to arrive at certain conclusions with regard to changes in population abundance. In southern Lithuania, several territories have not been used in recent years (E. Drobelis, pers. comm.). Such disappearance from some areas in Lithuania coincides with the documented and sharp decrease in the number of migrating Lesser Spotted Eagles (Väli 2003).

Changes in diet

In 2001–2003, it was established that in the investigated areas small rodents constituted the major share in the diet – 67.4%, amphibians – 20.4%, whereas other preys – 12.2%. The significance of small rodents in the diet during the period of 18 years (1985–2003) has become markedly greater than that of other preys (Fig. 2). It is difficult to assess changes in the diet share made of amphibians, though the data suggest that its significance has decreased over quite a short period. The neighbouring countries report the same tendencies. The influence of habitat quality changes on the diet (rodents being the dominant prey) was observed in Estonia, when Lesser Spotted Eagles dispersed into the cultural landscape (Lõhmus & Väli 2001). In 1972–1987, in Belarus amphibians made up 62% of the diet and mammals – 29%. In 1992–1998, the share of amphibians decreased to 54%, whereas that of mammals increased to 38% (Ivanovsky 1996b; Ivanovsky *et al*. 1999). Nevertheless, other authors' data can be influenced by differences in foraging habitats (Väli 2003) and a prey base of a particular year.

The species composition of prey established in 2001–2003 did not significantly change compared to the data

of previous years (Mažiulis 1985; Drobelis 1990). Still, neither big birds, such as Black Grouse (*Tetrao tetrix*), nor a single reptile was found. We do not emphasise this fact too much, because Lesser Spotted Eagle is not specialised on prey (Drobelis 1990), and the diet composition of a species can depend on different foraging habitats (Väli 2003).

Alternative prey hypothesis, diet, and productivity in 2001–2003

According to the alternative prey hypothesis, birds of prey alter their diet by changing a dominant prey to the alternative one, when the population of a dominant prey decreases, and *vice versa* (Reif *et al*. 2001), though the pooling of data collected in different years can hide the interaction between birds of prey and the investigated (e.g. landscape, climate) factors (Lõhmus 2003). The share of prey groups in the diet was unequal: in the diets in 2001 and 2002, small rodents were dominant (about 70%), whereas in that of 2003 their share barely made up 43% (Fig. 3). Still, in 2003 the number of amphibians increased nearly twice in comparison with 2001 and 2002. The share of other preys remained the same.

In 2001–2003, productivity was fluctuating, what is typical of the population in other parts of distribution range (Bergmanis *et al*. 2001; Scheller *et al*. 2001; Väli 2003). Productivity correlated only with the share of small rodents in the diet (Fig. 3, $r_s = 0.994$, $n = 3$, $p < 0.05$). In Estonia, the reproduction of Lesser Spotted Eagle is characterised by a three-year cycle of voles (Lõhmus 2003). During the population peak of voles, the productivity of Lesser Spotted Eagle exceeds 0.8, whereas during the depression period it falls bellow 0.3 (Väli 2003). Considering the obtained data (Fig. 3), we presume that the productivity of Lesser Spotted Eagle in Lithuania can be related to the population dynamics of small rodents. Though, such a relation between the abundance of rodents and the productivity of eagles was not found in Latvia, still a reliable relation with weather conditions during the breeding season was discovered (Bergmanis *et al*. 2001). Considering this and also the fact that different factors predetermine productivity of birds of prey during different years (Lõhmus 2003), we cannot exclude the possibility that Lesser Spotted Eagle's productivity in different years can depend on both weather conditions and the population dynamics of small rodents or the interrelation between these factors.

Though samples are small, but the relationship between the shares of rodents and amphibians in the diet (Fig. 3) allows the presumption that Lesser Spotted Eagle in the study areas behaves according to the alternative prey hypothesis. In other words, the share of small rodents during their depression period is compensated for by the increased share of amphibians in the diet. The significance of the share of rodents and amphibians in the eagle's diet in different years was established in Belovezh Forest (Cramp & Simons 1980). Nevertheless, in Estonia the share of voles in Lesser Spotted Eagle diet did not change during their depression and peak periods, what makes the authors believe that breeding eagles did not behave according to the alternative prey hypothesis (Lõhmus 2003).

Lesser Spotted Eagle distribution in the landscape is unequal (Bergmanis *et al*. 1997), local density can be quite high in some places (Bergmanis *et al*. 2001), and, with increase in density, habitat selectivity becomes lower (Lõhmus 2003). This can be linked with the fact that in NE Lithuania only 25% of all investigated (n = 55) Lesser Spotted Eagle territories significantly differed from the landscape (Treinys 2004). We suggest that because of high breeding density and low selectivity Lesser Spotted Eagle has occupied optimal and sub-

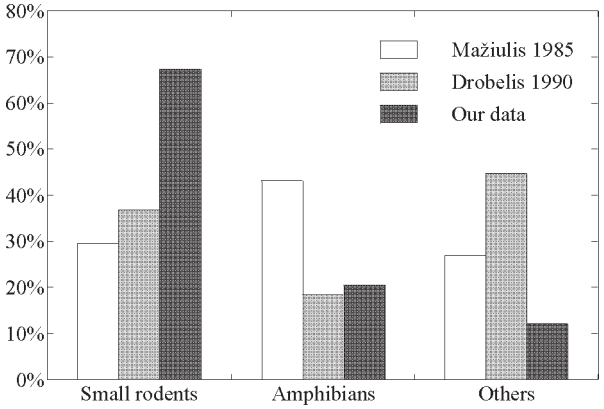

Figure 2. Comparison of Lesser Spotted Eagle's diets in different years according to different authors.

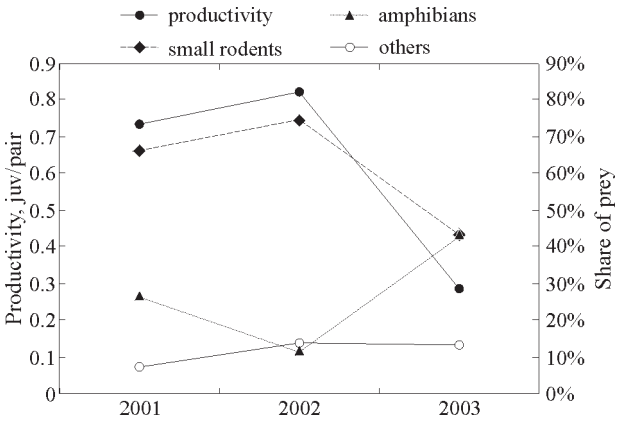

Figure 3. Share of prey and Lesser Spotted Eagle's productivity in 2001–2003.

optimal habitats in Lithuania. It is likely that the feeding behaviour of pairs breeding in optimal habitats can prove the alternative prey hypothesis, while pairs in suboptimal habitats are successful in breeding attempts only when the density of small rodents is high (Shepel 1981). Resolving of this issue still needs further investigation.

Conclusions

Generalising the results, an assumption could be made that changes in habitat quality due to agriculture extension after 1991 could have doubled the share of small rodents and decreased the share of other preys in the diet of Lesser Spotted Eagle. Probably, total population productivity at least is dependent on the population dynamics of small rodents. Still, we suggest that mean productivity has not changed. At present we cannot explain changes in abundance.

Since factors affecting population can differ from country to country, we assume that conservation measures cannot be directly based on experience of other countries. We believe that in order to sustain the current productivity and abundance it is vital to ensure the proper use of the landscape suitable for Lesser Spotted Eagle. Above all, environmentalists should direct their attention to optimal territories (i.e. where eagles can successfully breed year after year, regardless of population dynamics of small rodents) with a view of maintaining the same structure and quality of the landscape.

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Erelio rėksnio (*Aquila pomarina*) produktyvumas ir mityba Lietuvoje 2001–2003

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Santrauka

2001–2003 m. rinkti duomenys apie erelio rėksnio mitybą ir produktyvumą C, Š ir R Lietuvos dalyse. Produktyvumas ženkliai svyravo, o vidutinis produktyvumas buvo 0,61. Per tyrinėjamąjį laikotarpį sėkmingai perėjo apie 58% porų, 2 jaunikliai išaugo 3% sėkmingų perėjimo atvejų. Produktyvumas koreliavo su smulkiųjų graužikų dalimi mityboje. Kadangi, sumažėjus smulkiųjų graužikų procentui mityboje, amfibijų dalis žymiai išaugo, manome, kad erelių rėksnių elgsena tyrimų regione iš dalies patvirtina alternatyviųjų aukų hipotezę. Tikėtina, kad per paskutinį dešimtmetį erelių rėksnių mityboje pradėjo dominuoti smulkieji graužikai, o kitų aukų svarba sumažėjo. Tai sietumėme su žemės ūkio suekstensyvėjimu. Manome, kad tokie pokyčiai tiesiogiai neįtakojo vidutinio produktyvumo, tačiau dėl duomenų stokos negalime spręsti apie populiacijos gausumo pokyčius.

Received: 20 October 2003
Accepted: 23 February 2004