

Causes of Low Productivity in the Golden Eagle *Aquila chrysaetos* in the Central West Carpathians

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ABSTRACT

During 1984-1991 66 nests of the Golden Eagle were recorded in the central part of the Western Carpathians. The number of nests under observation increased from two at the start to 13-14 in the final years of the study. The number of productive nests was 26 (39.4%); unsuccessful breeding attempts ranged from 0.0-85.7%, averaging 60.6%. The mean number of young fledged was 1.00. Total average productivity per nesting pair was 0.39, and 0.33 young fledged during the last five years. Causes of loss in unproductive nests were analysed, the most important being nest-robbing by man and predation by Ravens *Corvus corax*, which together accounted for 55.0% of non-productivity. Additional known causes were infertility (7.5%), desertion and death of the young. In 22.5% of cases the causes were not determined and in 7.5% no eggs were laid.

INTRODUCTION

In comparison with data from earlier periods, the number of Golden Eagles *Aquila chrysaetos* in the Czecho-Slovak part of the Western Carpathians has to-day reached its highest value. There are at present *ca.* 60-70 breeding pairs, two to three times more than the number known in the 1960s and '70s. Hudec, Černý *et al.* (1977) listed 20-25 pairs, Sládek (1977) 25-30 pairs and Štastný *et al.* (1987) 30-35 pairs. In the 1980s the estimate was 50 pairs (Mrlik & Danko 1990). In spite of this, the trend must be considered not so much to mark an increase as to mark greater activity in the study and monitoring of this species. Another important factor is that by now almost the whole area of the eagle's breeding range in Slovakia has been investigated. As compared with the situation in other parts of Europe (Michel 1987) it is assumed that the population has now stabilised. Nevertheless, this species, like the Saker Falcon *Falco cherrug*, has an exceptionally low productivity rate, mainly due to the robbing of eggs and young by man for commercial and falconry purposes (Danko 1989). This paper analyses the main causes leading to the decline in

Golden Eagle productivity in the Western Carpathians.

STUDY AREA AND METHODS

The Golden Eagle breeding population has been investigated in the mountains of the Low and West Tatras, the Small Fatra Mts. and Choč Hills. These all form part of the high mountain ranges of the Western Carpathians, with altitudes varying from 600-1,000m to over 1,400-1,500m (up to 2,200m). Above the tree line, subalpine terrain covers the peaks of the Small Fatra Mts. and Choč Hills, merging into a truly Alpine landscape on the upper peaks of the West and Low Tatras. The number of nests investigated in separate mountain ranges varied from 0-1 to 2-5 per annum (Table 1).

The investigations were carried out between 1984 and 1991, during which years 66 breeding attempts were recorded. After the first years more intensive investigations were conducted during 1986-1991 (62 breedings = 93.3%). Occupied nests were located during March, when the adults are relatively conspicuous during courtship flights and nest-building. Only a few nests were located later, during the first weeks of rearing the young (May). Nests were observed through powerful telescopes and the young checked by climbing the nest tree. Eggshells and dead chicks were collected for laboratory analysis.

Table 1. Numbers of breedings of the Golden Eagle *Aquila chrysaetos* in separate mountain ranges.

<i>Year</i>	1984	1985	1986	1987	1988	1989	1990	1991	<i>Total</i>
Low Tatra	1	1	2	2	2	4	5	5	22
West Tatra	1	1	2	4	3	3	3	4	21
Small Fatra	-	-	1	1	1	2	3	3	11
Choč Mts.	-	-	2	2	2	2	2	2	12

RESULTS

The number of breeding attempts recorded during the study period was 66 (Table 2) ranging in individual years from two at the start to 13-14 later on. Due to lack of time and the difficult terrain, some pairs were not located in particular years, so their productivity could not be assessed.

Table 2. Successful breedings of the Golden Eagle *Aquila chrysaetos* in the central Western Carpathians.

Year	No. of recorded breedings	No. of successful breedings	Percentage of unsuccessful breedings	No. of fledged young	Young per occupied nest	Young per nest
1984	2	1	50.0	1	1.0	0.50
1985	2	2	0.0	2	1.0	1.00
1986	7	5	28.6	5	1.0	0.71
1987	9	5	44.4	5	1.0	0.56
1988	8	4	50.0	4	1.0	0.50
1989	11	2	81.8	2	1.0	0.18
1990	13	5	61.5	5	1.0	0.39
1991	14	2	85.7	2	1.0	0.14
Total	66	26	60.6	26	1.0	0.39

The total number of successful breedings was 26, with unsuccessful ones ranging from 0.0-85.7% (average 60.6%) during 1986-1991, i.e. 28.6-85.7% overall. The number of young fledged per occupied nest varied within individual years from 0.14 to 1.0, averaging 0.39 over the eight-year period. A relatively marked decline in productivity was found during the last years (Fig. 1) in which it sank to 0.37.

LOSSES IN UNPRODUCTIVE NESTS

Of the total number of breeding attempts investigated 60.6% were non-productive, e.g. 40 cases. Analysis of individual cases (Table 3) showed that this was primarily due to the stealing of eggs or young by man (40% of all losses, 78.1% of which concerned eggs). Significant losses were also caused by Ravens *Corvus corax* – 15.0% of unsuccessful breeding attempts, 91.7% being egg-predation and disturbance. These two factors together represented 71.0% of all identified losses. Other factors included infertility (7.5%), in one case desertion due to wood-cutting, loss of parents(?) and death of young from attacks by Kestrel *Falco tinnunculus* – direct observation by M. Majda in 1991. In 22.5% of cases the female failed to lay.

LOSSES IN PRODUCTIVE NESTS

During incubation and the first stages of feeding the young the nests were visited only exceptionally on account of this species' sensitivity; thus very few data were obtained on losses in this instance. The main cause was Cainism; no case of two young fledging from the same nest was recorded. Of the total of 55 breedings, only seven cases of loss from productive nests were recorded

Figure 1. Graphic illustration of the decrease in productivity (y) during the years 1986-1991 in the central part of the Western Carpathians

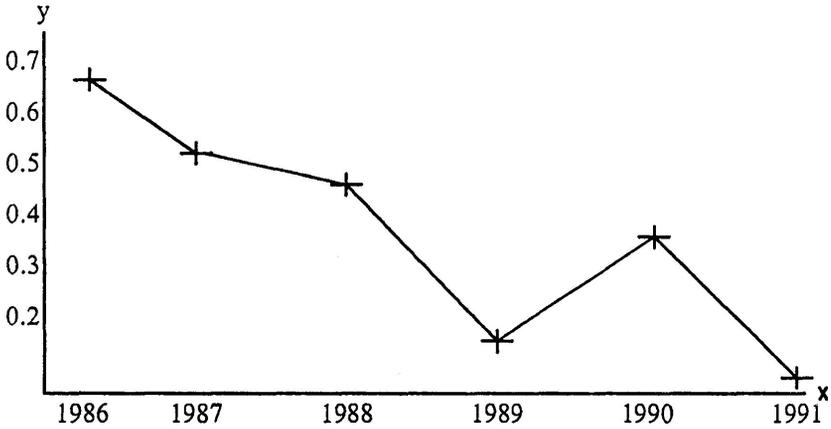


Figure 2. Number of observed breedings (n) and percentage of non-productive breedings in the central part of the Western Carpathians (CWC) and in Czecho-Slovakia (CS).

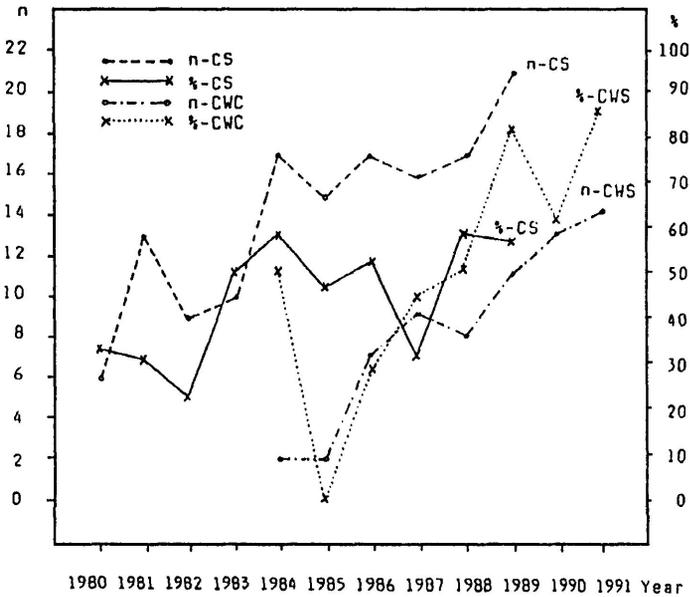


Table 3. Causes of loss in non-productive nests of the Golden Eagle *Aquila chrysaetos* in the central West Carpathians, 1984-1991.

	<i>Stealing by man</i>	<i>Raven</i>	<i>Kestrel</i>	<i>Death</i>	<i>Infertility</i>	<i>Desertion</i>	<i>No eggs laid</i>	<i>Other</i>
Eggs	12-13	5-6	-		3	1		7-9
Young	3-4	0-1	1	1				0-2
Total	16	6	1	1	3	1	3	9
(%)	40.0	15.0	2.5	2.5	7.5	2.5	7.5	22.5

(10.6%). Only one infertile egg was identified and in six cases death of the young was due to sibling aggression.

DISCUSSION

The Golden Eagle is not at present acutely threatened in northern and western Europe, despite a number of negative factors influencing breeding (Mebis 1989). According to Haller (1982), Michel (1987) etc. a productivity rate of 0.5 young per breeding pair is sufficient to sustain the population. In Czecho-Slovakia the species has been granted legal protection since 1965 and most of the population inhabit the national parks and protected areas. Nevertheless, it is one of the most threatened raptor species due to nest-robbing. In the past, productivity in the Slovak part of the Western Carpathians reached relatively high values (Voskar *et al.* 1969) and the decline only began in the 1980s, due to the increased number of unproductive breeding attempts, as shown in this paper and in the findings of the "Group for Research and Protection of Birds of Prey and Owls in the CSFR" (Fig. 2, data according to Danko, 1980-1989). The main causes are nest-robbing and predation by Ravens, whose population is to-day at optimum level. These factors account for 71.0% of identified cases of non-productivity in the central West Carpathians. In other parts of Europe they do not significantly influence the Eagle's productivity (Michel 1987). At the same time the rate of 0.39 young fledged per successful pair is low in comparison with other countries in Europe. Of the other reasons for non-productivity, 7.5% of observed pairs built or adapted nests and even mated, but no eggs were laid, possibly due to one or both partners being sub-adult (Bergo 1984) or due to disturbance. Because of avoiding visits during the early stages of breeding, losses in productive nests could not be ascertained in greater detail. Of those known, infertility and death of the young from sibling aggression were the usual causes. At the same time it is significant that there was no record of a successful fledging of two young out of a total of 26 productive nests, this phenomenon being quite usual in other parts of Europe (Stemmler 1955; Glutz von Blolzheim *et al.* 1971 etc.).

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