

# **Monitoring of the Golden Eagle *Aquila chrysaetos* Population in the Central Apennines (Italy) in 1982 - 1991**

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## **ABSTRACT**

Up to the 1960s 40-42 territorial pairs were likely to be present in the Central Apennines. In 1982 at least 24 pairs were still present, while many territories were deserted because of hunting, poaching, road construction. A slight recovery has been observed in the most recent years leading to 27 known breeding pairs. 166 breeding attempts have been checked. Factors influencing breeding parameters are discussed.

## **INTRODUCTION**

In recent years the population of the Golden Eagle in the Central Apennines has been claimed to be in severe decline. In 1980 a research with the aim of assessing density, breeding parameters and conservation issues of this species was started by the Italian Committee for Protection of Birds of Prey (CIPR). Actions have since been taken in order to sustain the present population and eventually reinforce it.

## **STUDY AREA & METHODS**

The study area covers all the mountain massifs of Central Italy (Central Apennines) from the Sibillini Mountains (North) to the Mainarde Range (South). All mountains are calcareous except for the Laga Mts., which are sandy. The mean altitude is about 1300 m with the highest peaks at 1900-2500 m.

This area harbours a well-defined Golden Eagle population. North and south of it only a few scattered pairs can be found. The first consistent populations northwards are met in the Alps and southwards in Calabria and Sicily.

All the breeding areas were found by means of a literature review, study of suitable places on the maps, and checks in the field. Information gained from local observers was carefully verified.

Most of the detected pairs have been the subject of annual checks to verify pair presence, age of individuals, egg-laying, hatching and fledging. At the beginning of the breeding season a whole day with fine weather spent in view of the nests (most pairs all have nests in the same valley) enabled the observer to determine if eggs had been laid. Actually in most cases when eagles were incubating, half a day was enough to observe a change of partner, considered a good proof of the presence of eggs. Later on, nestling presence was deduced from observing eagles carrying food to the nest or, later in the season, by direct observation of the brood.

Egg counts were not performed in order to minimize disturbance to the nest and any required data which could involve even a minimal disturbance were not pursued. Indirect observations were always satisfactory for our aims.

## RESULTS

### Distribution and density in the past

From a literature review and information from old villagers a picture of the distribution and density of the Golden Eagle in the years during and after the II World War (1940-'50) in the study area has been made possible. At least 40-42 pairs held territories. They were evenly scattered over the region and every major mountain range was a breeding ground for two or three pairs at least. The mean distance between territories was 13 km.

A decrease in the Golden Eagle populations occurred in Italy and other European countries in the 1950s and '60s (Chiavetta 1981; Austruy & Cugnasse 1981). In the Central Apennines a severe decrease took place between 1960 and 1970. The last desertions were in 1979 and 1980. Later on no further territory was abandoned and 24 pairs at least were left in 1982. Roughly 40 %, i.e. 18 pairs, had been lost.

Most of the nests used by the extinct pairs are decaying but still visible on the cliffs. According to Brown (1976) the time-lapse for a nest to be destroyed is 7-10 years. In a milder climate such as the Mediterranean, this figure could be doubled, explaining why the old and abandoned nests are still in place.

Several reasons can explain the loss of breeding pairs. Hunting, poaching, road construction are the major issues. Road construction can be considered the ultimate reason for a definitive habitat depletion which eventually eliminates the eagles. The Golden Eagle has been found to be a species

sensitive to human disturbance (Pedrini, in press; Donazar Sancho *et al.*, 1989). Mountain road construction allowed hunters easy access to hunting grounds of the eagles, and therefore to kill either the eagles or their prey species. This activity led to an ever-increasing human presence in the vicinity of nest sites and in the hunting territories. Out of 32 nesting areas, 14 are still used with no road present in the vicinity, 10 are abandoned and a road exists, but only five with a nearby road are used and only three abandoned areas are free of roads. On at least eight occasions a new road has been the clear-cut direct cause that made the eagle vanish. The presence of a road can be unimportant when it merely passes through and does not allow people to invade the natural environment (motorways, viaducts, etc.).

### **The present situation**

At the beginning of the field research at least 24 pairs were still breeding. This value has been stable during the ten years of the study and three breeding areas have been reoccupied in the last 3-4 years, leading to 27 known pairs holding territories. A greater assessment of the total population may predict two or three pairs more.

The mean distance between two occupied nests is 18 km. Compared with other populations this can be considered a high figure, representing the low population density (Zocchi 1987).

Pairs continue to be evenly distributed over the territory. Factors influencing density are prey and nest site availability (Newton 1979, 1986). Prey density and its increase in certain areas is the likely cause of the recovery events. The availability of nest sites decreased in the last years and some are now definitely unsuitable. Others are potentially usable but are not yet occupied because of human activity, roads, or shortage of prey. They could be reoccupied if some of the limiting factors are removed. In one well-studied area two pairs were present before the beginning of the field research. One pair only was left in 1982 and it enlarged its traditional hunting area to include that of the former pair. A road allowed hunters to get to the top of the valley. In 1988 a natural reserve was established over the entire area, with a ban on hunting activity and prohibition of car access to the hunting territory of the eagles. Probably due to the increase of prey density and less disturbance a new pair of eagles (composed of an adult and a subadult) settled in the area, restoring the former density. The new pair has not bred yet but is expected to do so in the coming years. In a Scottish population density was found to be related to the availability of carrion during winter and not to the quantity of live prey, which influences only the breeding parameters (Watson & Langslow 1987). It might be significant that the availability of carrion in the recovered area in the Apennines has surely not changed, since large mammals such as deer and

chamois were and are still absent. In Mediterranean climates it is possible that density is less linked to winter availability of carrion in comparison with the Scottish situation reported by Watson & Langslow.

### **Breeding rates and population structure in 1982-1991**

In Table 1 the breeding parameters of the Golden Eagle population in 1982-1991 are reported. In this paper we shall consider only the 21 best studied pairs as a sample with a total figure of 166 breeding attempts checked. Occasional data for a number of pairs were irregularly gained before 1982, leading the total of checked breeding attempts to 181.

In Figure 1 the trends of the breeding parameters during the research period are represented.

Out of 166 checked pairs 110, i.e. 66%, were successful in the fledging of at least one juvenile. This can be considered a normal value compared with others from the literature (Zocchi 1987).

Annual differences in percentage of successful breeding pairs ranges from 38% to 89%. These are in part due to the increase of mixed pairs (i.e. pairs composed of one adult and one juvenile or immature) in 1985-'86-'87, years with specially severe winters. The percentage of mixed pairs reached 28% in 1986. Only 10% of mixed pairs can be regarded as natural in Golden Eagle populations (Fasce & Fasce 1984), higher percentages bring indicative of human influence (Sandeman 1957; Brown 1976; Mathieu 1981).

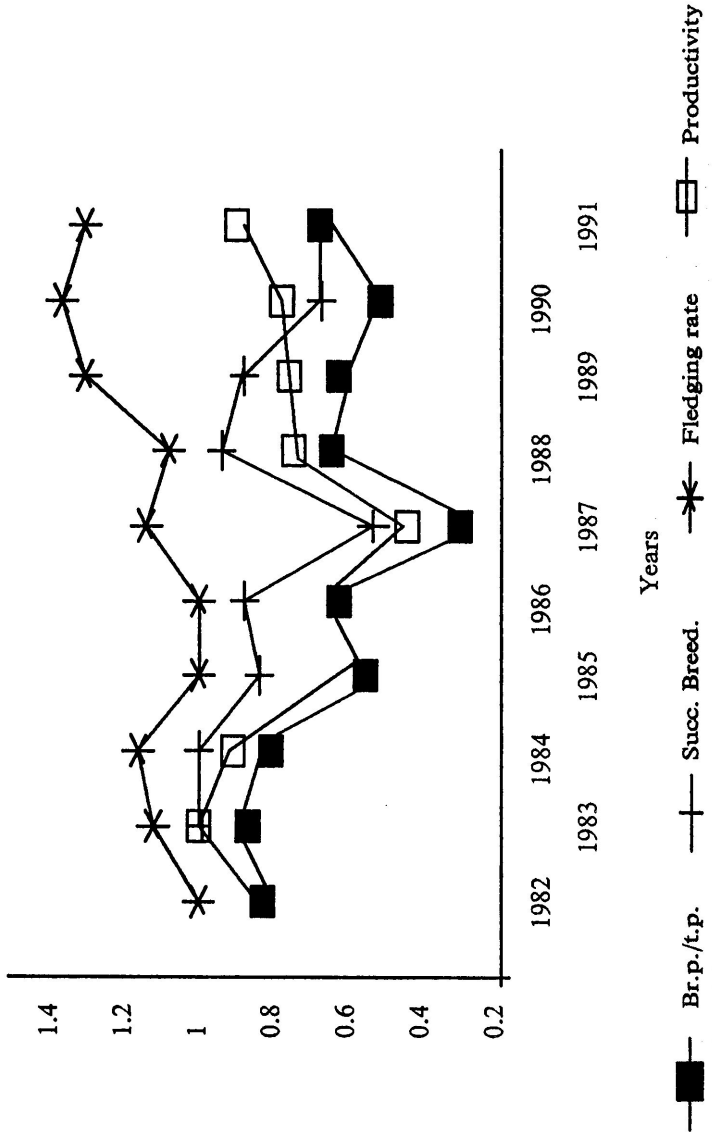
In the Central Apennines the replacement of adult members of pairs by immatures is circumstantial evidence of lack of a surplus of adult non-territorial eagles. This is likely due to severe poaching activity. Each year 4-5 eagles, mostly immature, are known to be killed but in the last 3-4 years shooting eagles in the Central Apennines has possibly declined. Generally, we found that newly-formed mixed pairs are not able to breed but will do so about two years after.

The productivity rate has a mean in ten years of 0.75. In the Swiss population the lower productivity (0.43) is due to a density that reached what is reckoned to be saturation point (Haller 1982, 1987). Evidence for a link between density and productivity was found by Clouet & Pompidur (1987) in the French Pyrenees. In the Central Apennines on the contrary a low density is related to a high productivity. The food availability is probably enough to sustain a low density population but not enough to allow many double-broods as illustrated by the fledging rates. The main prey species by weight are hare, fox and domestic hen (Ragni 1987; Novelletto & Petretti 1980) underlining the relative scarcity of food. The population optimizes the exploitation of

Table 1. Breeding trend of Golden Eagle in the Central Apennines

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Tot
(a) No. of pairs	16	18	16	17	18	16	18	18	14	15	166
(b) No. of juv.-ad. pairs	0	2	1	4	5	2	3	1	0	0	18
(c) No. of non-breeding pairs	0	2	3	5	6	5	5	5	2	0	33
(d) No. of successful nests	13	16	13	10	11	6	12	11	8	10	110
(e) No. of failed nests	3	0	0	2	1	5	1	2	4	5	23
(f). No.of young produced	13	18	15	10	11	7	13	14	11	13	125
(g) No. of nests producing 2 young	0	2	2	0	0	1	1	3	3	3	15
Breed. pairs/tot. pairs (d/a)	0.81	0.89	0.81	0.59	0.61	0.38	0.67	0.61	0.57	0.67	
Juv.-ad. pairs/tot. pairs (b/a)	0.00	0.11	0.06	0.24	0.28	0.13	0.17	0.06	0.00	0.00	
Breeding success (d/d+e)	0.81	1.00	1.00	0.83	0.92	0.55	0.92	0.85	0.67	0.67	
Fledging rate (f/d)	1.00	1.13	1.15	1.00	1.00	1.17	1.08	1.27	1.38	1.30	
Productivity (f/a)	0.81	1.00	0.94	0.59	0.61	0.44	0.72	0.78	0.79	0.87	
Failure rate (e/(a-c))	0.19	0.00	0.00	0.17	0.08	0.45	0.08	0.15	0.33	0.33	

Figure 1. Breeding trend of Golden Eagle in the Central Apennines



available resources with a depressed density.

Throughout the decade, the variation in productivity ranged between 0.44 and 1.00. Two main factors can be evoked to explain this. One is the increase of "mixed" pairs unable to reproduce, as previously discussed. The other is the percentage of breeding failures.

In 1987, 45% of breeding attempts failed and led productivity to a low of 0.44. The desertion of clutches is related to weather conditions mostly during the first part of the breeding period, a rainy March-April being linked with a low productivity rate (Clouet & Pompidur 1987). On the other hand in populations with a high level of human disturbance a lowered productivity also resulted. In the case of the Central Apennines, out of 23 breeding failures 11 took place in the three best-known eagle territories. Worth mentioning is that nine out of 14 cases of failure occurred after hatching, five of them towards the end of the fledgling period. This induces one to take human interference, including nest-robbing, into consideration, since most cases of natural breeding failures in birds of prey occur in the first part of the breeding period (Newton 1979, 1986).

Public attention to the breeding sites of Golden Eagles is a major concern regarding its breeding success. Disturbance to the nests is caused by photographers, inexperienced naturalists, and even unheeding tourists enabled to reach remote places by means of mountain roads. Nest-robbing has possibly taken place in some areas. Till now disturbance has been proved to be a factor affecting productivity but not density of pairs. However, unsuccessful pairs have a tendency not to breed in the same nest (Newton 1979) and disturbance must be regarded as a force leading to the abandonment of territories in the long term.

The mean productivity per pair shows a trend towards higher productivity of pairs holding territories at the base of the biggest and wildest mountain ranges.

## CONCLUSIONS

The Golden Eagle population in the Central Apennines has nowadays a low density but shows chances of recovery when the environmental limiting factors are removed. The population is able to adjust its density, reaching a balance with the availability of nest sites and food. Main limiting factors are related to human presence and linked with the facilities built in the last 20-30 years and their consequences.

Removing these limiting factors is a priority if a viable population is to be

maintained. About three-quarters of the breeding sites are inside either protected areas or national parks, some of them very recently established. Though not always very effective, measures such as a ban on hunting and regulation of access to protected areas have positive effects. Moreover, reintroduction of ungulates in some new national parks is being planned with a future positive impact on eagles.

Out of a number of non-protected breeding areas some have been chosen to be specially watched and given some form of protection in agreement with local authorities.

Awareness of the general public on conservation issues is slowly growing, even in the interior and the South of Italy. Promoting campaigns with the aim of spreading principles of raptor conservation, especially among key groups (hunters, farmers, etc.), is too costly for small conservation associations but should be surely worth pursuing.

Either ownership or direct management of the nesting areas is regarded as a priority and this has been put into effect in three areas by the CIPR, one of which harbours the pair of Golden Eagles closest to Rome. Voluntary nest-watching has been organized by several conservation associations for 15 years and has proved useful over the breeding period for both short-term protection and, in the longer term, for engendering a positive response of the local people towards raptors.

## ACKNOWLEDGEMENTS

We are very grateful to the many ornithologists who provided information on the Golden Eagle in the Apennines. Special thanks are due to Stefano Allavena, President of CIPR, and to Fabio Borlenghi and Massimo Pellegrini.

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