

The Status and Conservation of Griffon Vulture *Gyps fulvus* in Cyprus

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ABSTRACT

Two species of vulture - Cinereous Vulture *Aegypius monachus* and Griffon Vulture *Gyps fulvus* used to breed in Cyprus. The Cinereous Vulture was a common resident, but was extirpated from island by the end of 1960s. The Griffon Vulture was abundant throughout the island and aggregated in large colonies on isolated sea cliffs and rocky areas in the Troodos and Pentadactylos mountain ranges. However, in recent decades the Griffon population has shown a massive decline as a result of various factors including poisoning, food shortage, human persecution, premature fledging and disturbances close to their breeding colonies.

The extant population of 40-45 Griffon Vultures (8 breeding pairs) is now considered to be critically endangered, and a conservation project was initiated by the Cyprus Forestry Department in 1993. This paper presents information on Griffon population trends and reproductive success in Cyprus, and discusses conservation measures (e.g. feeding station establishment, legislation, etc.).

INTRODUCTION

The Griffon Vulture *Gyps fulvus* is a colonial species that breeds throughout much of mountainous Eurasia (Cramp & Simmons 1980). In the western part of their distribution, the Iberian Peninsula and France, their populations are increasing due to successful conservation efforts (Donazar 1987; Donazar & Fernandez 1990), while in the Central and Eastern Mediterranean (including Cyprus) populations have suffered severe declines (Marinkovic & Orlandic 1994; Bahat 1997).

The factors that have been linked to their population declines included the use of poisons, food shortage, persecution by humans, disturbances close to their breeding colonies, and drowning (Tucker & Heath 1994). The aims of this study were to 1) determine the population trend of Griffon Vultures; 2) discuss

factors that contributed to their population decline; and 3) outline measures taken for the protection of the species in Cyprus.

STUDY AREA

The island of Cyprus is located in the south-eastern Mediterranean (34° 33' - 35° 41' N, 32° 16' - 34° 35' E) and this study covered approximately 60% of the island. Topographically the study area consists of hills and mountains ($\leq 2000\text{m}$) that are criss-crossed by steep-sided valleys. Cyprus has a Mediterranean climate characterized by hot, dry summers and cool, wet winters. Rainfall is usually < 400 mm per annum on the southern coast, increasing with altitude to > 900 mm per annum on Troodos Mountain. Due to the mosaic of habitats on the island, Cyprus has a rich and diverse avifauna. These include Bonelli's Eagle *Hieraetus fasciatus*, Goshawk *Accipiter gentilis*, Long-legged Buzzard *Buteo rufinus*, Peregrine Falcon *Falco peregrinus* and endemic species such as Cyprus Warbler *Sylvia melanothorax* and Cyprus Wheatear *Oenanthe cypriaca*.

METHODS

The distribution and status of Griffon Vultures in Cyprus prior to 1980 is based on unpublished data, mainly from amateur and professional ornithologists. Surveys for the distribution of the species in Cyprus were conducted from 1993 to 2002. Each year, all previously known active colonies and cliffs used by vultures were visited during the breeding season (from December to June) and breeding parameters were recorded. Observations were made all year round using a telescope 30x60, from a distance chosen to avoid disturbance to vultures. All nests were checked at least four times (during pre-laying, incubation, brooding and post-fledging period). Breeding pairs were defined as those seen carrying nesting materials (Newton 1979), and groups of nests found more than 2km apart to be isolated colonies (Donazar & Fernandez 1990). Following Steenhof (1987), a successful breeding pair was defined as one that successfully fledged a young vulture. Mean brood size at hatching or hatching success (given as percentage) was defined as the total number of eggs hatched over the number of eggs laid. Fledging success (given as percentage) was expressed as the total number of young fledged over the number of eggs hatched. Mean brood size at fledging or breeding success (given as percentage) was defined as the total number of young fledged over the number of eggs laid. Average reproductive variables were compared between years using the non-parametric Kruskal-Wallis test (Zar, 1996). All means are given ± 1 S.E., and significance was set at $P < 0.05$.

For each Griffon Vulture nest, the heights of the cliff and the nest from the base of the cliff, and the exposure of the cliff were measured. In addition, according to the shape of cliff, three types of nests were recognized. These were A: close cave from above; B: slight close cave from above; and C: open ledges.

RESULTS AND DISCUSSION

Population Trend

Since the beginning of the twentieth century, ornithologists have referred to large colonies of Griffon Vultures on the island (Bucknill 1910), and suggested that the species was very common. In the late 1950s and early 1960s up to 140 birds could be seen at single carcass (Flint & Stewart 1983). Bannerman and Bannerman (1958) stated that the species was numerous in Cyprus, and that there were several breeding colonies, both in the hills and in high cliffs near the sea.

However, the Griffon population in Cyprus has declined dramatically in the last three to four decades (Cyprus Ornithological Society 1957; Bannerman & Bannerman 1958; Gramp & Simmons 1980; Flint & Stewart 1983; Kourdelarides 1998). In many areas of the island, especially to the North, the species has become extinct (Flint & Stewart 1983; Kourdelarides 1998), and only a few pairs survive in the west.

During the 1980s there were approximately 13 colonies on Cyprus. By 1993 there were six and by 2002, only two colonies remaining (Table 1). Most of the colonies were occupied during the first three years of this study (1993-1996) and only one was used continually until 2002. During the study years the mean colony size was 4.42 ± 0.59 pairs per colony and ranged from 3 to 8 pairs. A single poisoning event in 1996 that killed 36 vultures, appeared to be the cause of the colonies' collapse.

Breeding Success

Out of 106 breeding pairs monitored, 104 (98.1%) laid eggs in the ten study years (1993 - 2002). Average breeding parameters were similar between study years ($P > 0.05$) (Table 1). Overall, mean brood size at hatching (hatching success) was 0.78 ± 0.04 young per pair (Kruskal-Wallis test: $H = 4.69$, $df = 9$, $P = 0.86$) and mean number of fledged young per eggs laid (fledging success) was 0.95 ± 0.02 (Kruskal-Wallis test: $H = 1.02$, $df = 9$, $P = 0.99$). In addition, average brood size at fledging (overall productivity) was 0.74 ± 0.04 young per pair (Kruskal-Wallis test: $H = 3.60$, $df = 9$, $P = 0.936$).

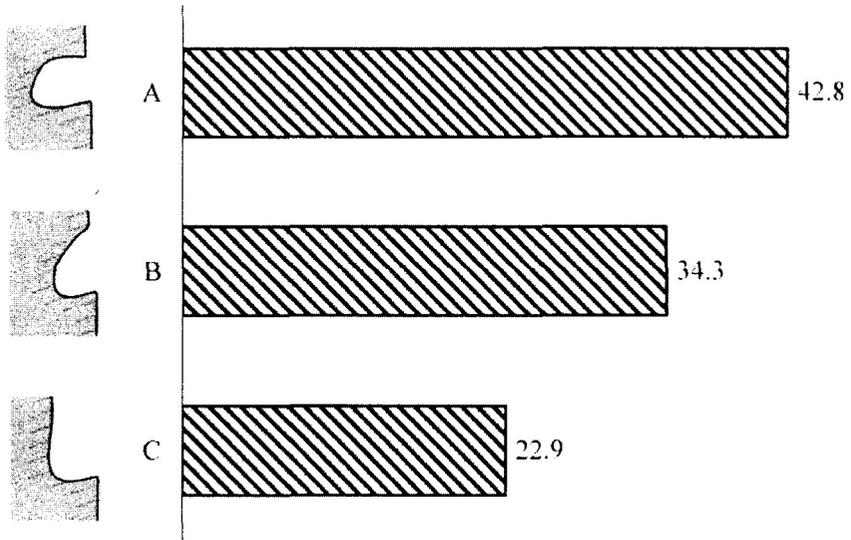
Nest-site characteristics

In Cyprus, Griffon Vultures nest on limestone and diabase cliffs. Thirty-six nests were recorded during the study period. Nest elevation ranged from 18m to 1024m above sea level. Mean height of cliffs was 49 ± 15.99 m (range: 22m - 76m). Mean height of nests above the base of the cliffs was 29 ± 8.50 m (range: 13m - 45m). Sixty four percent of nests were found in the upper third area of the cliffs. Griffon Vultures mainly built their nests in small caves (77.1%), but some pairs (22.9%) selected ledges (Figure 1). Eastern-facing cliffs were most commonly used.

Reasons for the Decline in Population

This study identified three likely causes for the decline in the Griffon Vulture population in Cyprus during the last ten years: (a) use of poison, (b) persecution by humans, and (c) nestlings falling from nests. However, other reasons such as lack of available carcasses and disturbance by humans caused some vultures to abandon their colonies. We recorded causes of death for 51 Griffon Vultures.

Figure 1. Types of nest (%) used by Griffon vultures in Cyprus.



Use of poison

Even though the use of poisons for controlling pest species (foxes, corvids etc) has been illegal since 1993, accidental use of pesticides has resulted in a decline in Cyprus' vulture population. Forty-one (80.39% of all dead vultures) vultures were poisoned by agrochemicals including pesticides such as Lanade and Furadan. Thirty-six of the poisoned vultures were found in 1996 which resulted in a 50% decline in the breeding population during the following year (Table 1).

Fall from nest

Six (11.79% of all dead vultures) fledglings were found dead having fallen from their nests during the study period. Half of these drowned in the sea during their first flight, while the remainder were found at the base of the cliffs, where they had either died from starvation or were killed by mammalian predators.

Human persecution

Although, vultures are included in the list of protected species in Cyprus, three (5.9% of all dead vultures) birds were shot by hunters.

Food supply

Food availability for scavengers has decreased rapidly over the last 30 years due to socio-economic changes in Cyprus. Numbers of livestock (goats and sheep) have declined while other animals (e.g. donkey) have disappeared. At the same time, traditional extensive herding practices have been replaced by intensive stock farms. In addition, Cyprus legislation requires that dead animals be disposed of through either burning or burying, which may have contributed towards reduced carcass availability. These factors have had a major influence on the distribution of Griffon Vulture populations, especially during the 1970s, when the species occurred throughout the island.

Table 1. Population and breeding statistics of the Griffon Vulture in Cyprus.

Year	Number of pairs per colony							Number of				Hatching	Fledging	Breeding
	A	B	C	D	E	F	G	Breeding Pairs	Eggs Laid	Eggs Hatched	Young Fledged	Success (%)	Success (%)	Success (%)
1993	3	2	6	4	2	1	?	18	18	15	14	83	93	78
1994	4	3	2	4	2	0	?	15	15	9	9	60	100	60
1995	5	4	4	0	2	1	?	16	16	13	11	81	85	69
1996	6	1	0	0	1	0	?	8	8	6	6	75	100	75
1997	8	0	0	0	0	0	?	8	8	6	6	75	100	75
1998	8	1	1	0	0	0	?	10	10	9	9	90	100	90
1999	10	1	0	0	0	0	?	11	11	8	8	73	100	73
2000	7	0	0	0	0	0	?	7	7	4	4	57	100	57
2001	5	0	0	0	0	0	?	5	5	5	5	100	100	100
2002	7	0	0	0	0	0	1	8	6	6	5	100	83	63

Human disturbances and habitat loss

The construction of new roads, operation of quarries and low-flying military aircraft near vulture breeding sites has resulted in vultures abandoning these sites. An increase in the number of tourists may also be a possible cause of disturbance, especially during the breeding season.

CONSERVATION MEASURES

A project to conserve populations of the Griffon Vulture was initiated in Cyprus in 1993, under the control of the Department of Forests in the Ministry of Agriculture, Natural Resources and Environment. Taking into account the perceived reasons for the population decline and the danger of extinction of the species from Cyprus, both public awareness and management measures were undertaken. To mitigate the problems of poisoning and lack of available carcasses, two feeding stations were established. These were strategically placed in areas where vultures usually searched for food. In addition, the use of poisoned baits has been prohibited by law since 1993.

The remaining breeding colonies were checked by forest rangers for almost two months during the fledging period. In total, 17 fledglings were rescued after they fell into the sea or at the base of the cliffs. Most of the traditional nesting sites were declared as wildlife reserves and a campaign to increase raptor awareness and to prevent the use of poisons was started in 1993. Finally, a monitoring programme has been initiated by the Forestry Department since 2000 to gather all necessary information that would significantly contribute towards the conservation of Griffon Vulture populations in Cyprus.

ACKNOWLEDGEMENTS

We would like to express our sincere thanks to many people for their collaboration in the fieldwork, especially Ch. Nikolaou, A. Antoniou, and Ch. Makris for their continuous support. We would also like to thank Mike McGrady, Todd Katzner, Munir Virani and Mark Anderson for their valuable comments on a first draft of the manuscript. Funding support for this research came from the USAID and UNDP through United Nations Office for Project Services (UNOPS).

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