

Griffon Vulture *Gyps fulvus* nest surveillance project at the Gamla Nature Reserve, Golan Heights, Israel: 1996 conservation report

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Abstract

Griffon Vultures *Gyps fulvus* are protected by law in Israel. Despite this protection they are considered endangered, and the total breeding population in Israel declined from approximately 120 pairs in 1986 to less than 60 pairs in 1996. Many traditional nesting colonies in northern and southern Israel were deserted, probably due to human disturbance and development

The Gamla Nature Reserve is one of the last and the biggest of the nesting and roosting colonies left in northern Israel. Within the reserve there are several archaeological sites which attract approximately 100 000 visitors annually. In addition, there is an active military training zone close by. It is estimated that 10–30 Griffon Vulture pairs nest at the colony every year and as many as 80–100 additional birds use the cliffs to roost. Although increased conservation activities were conducted in the reserve during the past decade, the reproductive success of Griffon Vultures has consistently declined. Thus, a preliminary study was conducted between 1994–1996 to record cause(s) of breeding failure in order to enforce management and conservation actions and to provide baseline data that will allow a better understanding of the Gamla Nature Reserve ecosystem.

During the 1996 nesting season (December 1995–August 1996), 29 pairs laid eggs and commenced incubation. Seven nests (24%) were deserted during incubation and 13 nests (45%) were deserted after the young hatched. Only nine chicks (31%) were fledged successfully. Our results indicate that the Griffon Vulture colony at Gamla is in a very poor condition and that recruitment of young from the colony, at 0.3 young/pair, is low. In comparison to the rest of Israel, the relatively large number of breeding pairs at the Gamla colony suggests that, although the breeding population is still viable, extraneous factors negatively influence their reproductive success. A low success rate also suggests that the population may be unable to sustain itself and might soon reach a point-of-no-return.

Introduction

The Griffon Vulture *Gyps fulvus* is resident in Europe, Asia and North Africa. It is a large bird, with a wingspan of up to 2.7 m and body mass of 6.2–8.5 kg. Griffon

Vultures are gregarious and forage in flocks, and roost and breed in colonies (Brown & Amadon 1968, Cramp & Simmons 1980). Griffon Vultures feed exclusively on carrion, which requires them to forage over extensive areas, sometimes as far as 50—60 km from the nest or roost site (Cramp & Simmons 1980; Houston 1974, 1975, 1979, 1980).

Griffon Vultures, like most other large raptors, have almost no known enemies besides man. Their breeding rate is low (at best one offspring per pair per breeding season) and the young reach breeding maturity at 5—6 years of age. Consequently, they are limited in their ability to recover from stochastic events or human persecution, and to adapt to rapid changes in their environment. An additional difficulty in the conservation of this species is its tendency to forage over very large areas. It is therefore not enough to protect only small or local nature reserves but, rather, large tracts of land and potential foraging areas have to be taken into consideration (Newton 1979, Mundy *et al.* 1992).

The Griffon Vulture, once numerous throughout its breeding range, has suffered a severe decline, due mainly to decreased food supplies caused by improved pastoral hygiene, secondary-pesticide poisoning, and direct persecution by man (Newton 1979, Cramp & Simmons 1980, Wilbur 1983).

In Israel, Griffon Vultures are resident in the Mediterranean and the desert regions, and although protected by law, they are considered endangered throughout the country. Surveys of reproductive success at Griffon Vulture colonies were conducted during the years 1986—1996 by ornithologists of the Society for the Protection of Nature in Israel (SPNI) and the Israel Nature Reserves Authority (INRA) (Mendelssohn & Leshem 1983; Bahat 1986a,b; Bahat *et al.* 1988; Regev & Kaplan 1994; Regev 1996). The results of these surveys indicate that the total breeding population in Israel declined from approximately 120 breeding pairs in 1986 to less than 60 breeding pairs in 1996. By comparison, over 1000 breeding pairs were estimated in the same area in the second half of the nineteenth century (Tristram 1885). Moreover, traditional nesting colonies in northern and southern Israel were deserted probably due to human disturbance and development (Bahat 1986a,b).

This dramatic decline in Griffon Vultures is a result of direct persecution, extensive use of pesticides (Mendelssohn 1972), increasing land-use changes by man both in the breeding and on the foraging grounds, which leads to a drastic reduction in the number of carcasses of ungulates previously available to the vultures (Mendelssohn & Leshem

1983). Increase in modern agricultural practices has led to an accumulation of heavy metals in the food chain (O. Bahat, unpubl. data). This problem has been further complicated by the defense requirements of Israel and the disturbances by low-flying supersonic aircraft and helicopter training of the Israeli Air-Force and increased levels of human activity in the vicinity of the major nesting colonies.

The Gamla Nature Reserve (2262N/2579E) protects one of the last and the biggest of the nesting and roosting colonies in northern Israel. The reserve consists of a 250 m deep canyon with high cliffs and two waterfalls, 51 m and 20 m in height. The area is mostly characterized by an open highland basalt plateau, divided by deep gorges with scattered trees (*Quercus* and *Pistacia* spp.) Within the reserve there are several archaeological sites which attract approximately 100 000 visitors annually. In addition, there is an active military training zone close by.

It is estimated that between 10–30 Griffon Vulture pairs nest at the colony every year and as many as 80–100 additional birds use the canyon cliffs for roosting (Court *et al.* 1996). Although conservation activities in the reserve have increased during the past decade, the number of successful nesting attempts has declined. This was investigated during a preliminary study at Gamla from 1994–1996. It is essential for the planning of a successful conservation and management programme to understand the factors causing a population decline (Mangel *et al.* 1996). We therefore recorded all causes of breeding failure in order to be able to address these causes in future, to ensure proper management and conservation actions to prevent further declines of the Griffon Vulture population, and to provide baseline data that would allow a better understanding of the Gamla Nature Reserve ecosystem.

The major objectives of this research were to investigate the causes of disturbance to the Griffon Vulture colony at Gamla Nature Reserve, to investigate the causes that lead to a decrease in reproductive success, and to use this information to implement management measures needed to successfully conserve the Griffon Vulture population in the reserve

Methods

Volunteers were recruited to assist the staff of the Gamla Nature Reserve to observe the nesting Griffon Vultures. Although egg laying occurs mainly in December, January and February, observations by the volunteers started in mid-February and continued until mid-August 1996. Pairs of volunteers each spent approximately two months on the project, with one week overlap with the next pair. Observations were made from a

concealed hide, located on the eastern cliff of the gorge, approximately 200 m opposite the observed nests, in an area closed to visitors. A telescope (60x) and binoculars (10x) were used. Fifteen nests could be observed simultaneously throughout the day, during the whole nesting season. Observations lasted on average for 9 h per day, covering most of the day-time period at the beginning of the season, and was divided into two shifts during the height of the summer. Records included information on general behaviour in the nest, times of shift changing between parents, feeding and caring for the chick, flying practice, and response to disturbances. All other nest sites were checked every 7–14 days. Data for 29 nests from the 1996 season were analyzed in order to determine the causes for disturbances and nest failures. Volunteers also assisted the Gamla Nature Reserve staff to guard sensitive nest sites and to prevent disturbances by visitors to nesting Griffon Vultures and other raptors in the reserve.

A thermal imaging camera (Opgal Inc., Israel) was used during two night watches to observe the behaviour of young chicks at one nest site and record any potential predators in the vicinity

Results

During the 1996 nesting season (December 1995–August 1996), 29 pairs laid eggs and started incubating. Seven nests (24%) were deserted during the incubation period and 13 nests (45%) were deserted after the young hatched. At the end of the breeding season, only nine chicks (31%) fledged successfully (Figure 1)

There was no evidence of predation on eggs during the incubation stage. One deserted egg was retrieved from a nest 36 hours after it was last attended by the parent vultures. It was transferred to the Tel-Aviv University Zoological Garden for artificial incubation, resulting in the successful hatching of a healthy chick. It is planned that this chick will be released back into the wild.

All nestlings that did not fledge disappeared from the nests during the night without leaving any trace. Disappearances occurred when parents did not attend the nest and roosted elsewhere. There were no precedent signs of illness or abnormal behaviour in the chicks or adults before the disappearance, except for one chick which was previously attacked by its parents and another chick which had showed signs of weakness. The former vanished when it was 40–90 days old. No signs of predatory activity at the nests were found. The nestling which exhibited signs of weakness fell from the nest to a lower cliff-ledge and was retrieved dead the next day. It was trans-

-ferred to the Veterinary Institute in Beit-Dagan for a post-mortem (PM) examination. The PM operation revealed that this chick choked on fragments of stones ingested with food that the parents had supplied. However, the PM also indicated that the nestling was in a good physical condition and had thick layers of fat.

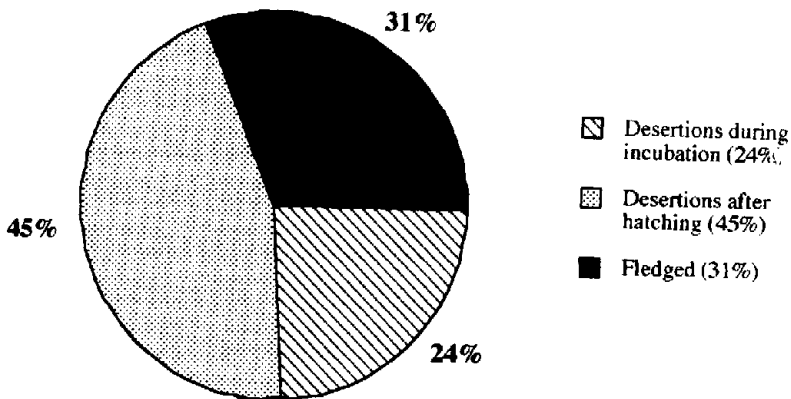


Figure 1 The effect of army aircraft training and high number of visitors (>700) on Griffon Vultures nest failures in Gamla Nature Reserve during the 1996 nesting season

The results of the 1996 study indicated a possible negative effect on the nesting success of Griffon Vultures at the reserve as a result of aircraft training in the area and massive human presence (mostly hikers along the cliff edge in the nature reserve). Following exceptionally high numbers of visitors (more than 700 per day) at least four different instances of desertion of active nest sites by Griffon Vultures occurred (Figure 2). On at least five different occasions training of military aircraft and helicopters at low altitude over the nesting canyon also led to nest desertions.

It appears that during certain years (e.g. 1990, 1992, 1996) there is a stronger negative correlation between the total annual number of visitors to Gamla Nature Reserve and the total number of chicks that reached fledging state (Chi-square = 2.9199, 6 DF, $P = 0.0001$; Figure 3). This issue requires further attention and intensive research, in order to precisely evaluate the effect of visitors on the breeding success of Griffon Vultures in the Gamla Nature Reserve.

The nocturnal observations, using thermal imaging equipment during two nights, did not record any activity of avian or terrestrial predators near the nest sites, or on the nesting cliffs.

Discussion

Our results indicate that the Griffon Vulture colony at Gamla is in serious decline and that recruitment of young from the colony is low, at 0.3 young/pair/year. In comparison to the rest of Israel, the large number of breeding pairs at the Gamla colony suggests that although the breeding population is still viable, extraneous factors are negatively influencing their reproductive success. A low success rate also indicates that the population is unable to sustain itself and might soon reach a point-of-no-return. Our study has documented and identified the critical stages in the reproductive cycle of the Griffon Vulture population. This is particularly important in light of the fact that the population throughout Israel has been severely depleted in the last decade and many of the traditional colonies have been abandoned (Bahat 1986a,b; Bahat *et al.* 1988; Regev & Kaplan 1994; Regev 1996).

The causes for nesting failures are not yet clear and further research is needed in order to implement the proper management and conservation measures needed to protect the birds and prevent their further decline. The present study reveals that the reproductive process of Griffon Vultures has at least two major vulnerable stages which are subject to high levels of disturbance. The first is during the incubation stage. Among seven nests deserted during the incubation stage, in one the adult birds deserted their egg soon after laying and it disappeared two days later. This is an unusual and alarming indication of possible strong disturbance.

The second vulnerable stage in the breeding cycle occurs when the nestlings are between 40—90 days of age. At this stage the parents leave the nest before dusk and roost elsewhere. As most chick disappearances (12 out of 13) occurred during the night, we consider natural predation a possibility. The most obvious potential predator in the Gamla Nature Reserve is the Eagle Owl *Bubo bubo interpositus* (Bahat &

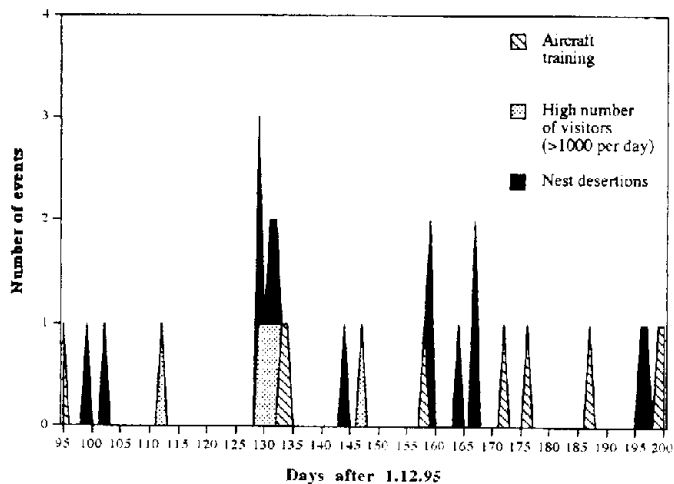


Figure 2 Desertions of nest sites at different stages of breeding in Gamla Nature Reserve during the 1996 nesting season

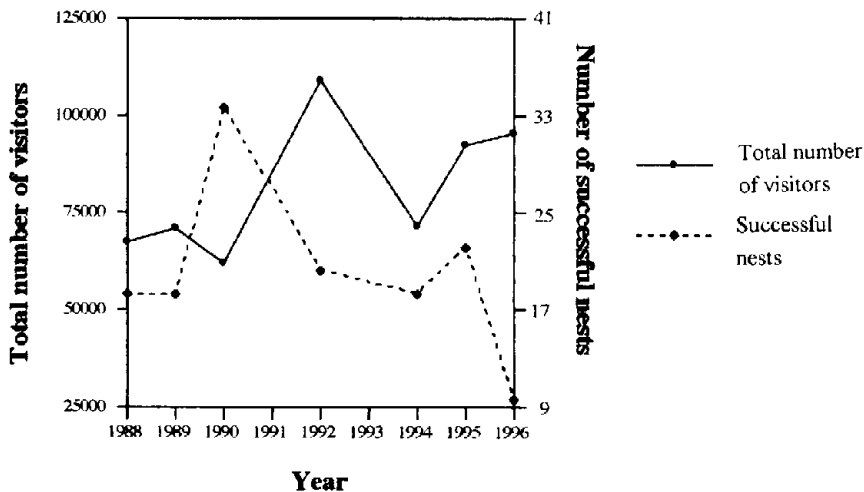


Figure 3 Nesting success (nestlings which reached fledging state) versus annual number of visitors in Gamla Nature Reserve during the years 1988-1996.

Leshem 1991). Three pairs of Eagle Owls were known to live at Gamla Nature Reserve in the 1996 breeding season (L. Court, unpubl. data), two of which nested in proximity to the core nesting area of the Griffon Vulture colony. It is of interest that Eagle Owls usually begin their hunting soon after sunset and forage till approximately one hour before sunrise (Cramp 1985). This owl is known to kill relatively large birds such as ducks, and other prey items that weigh up to 3 kg have been found in Eagle Owl nests (Cramp 1985). Therefore it is also capable of snatching a 40–50 days old Griffon Vulture nestling (approximately 3 kg; O. Hatzofe, pers. comm.) from its nest. Mikkola (1983) reported that Eagle Owls frequently kill other nocturnal or diurnal raptors which are present in the vicinity of their nest, but do not feed on the prey. In Israel, juvenile Long-legged Buzzards *Buteo rufinus* were found in pellets of Eagle Owls soon after being radio-tagged at the nest (Y. Sela, pers. comm.). Another possible predator is the Marten *Martes foina syriaca*. However, our nocturnal observations did not show any evidence of predator activity at the nest. We recommend that during the next nesting season, 1996–7, a more intensive nocturnal survey be conducted using thermal imaging equipment.

The post-mortem of three Griffon Vulture chicks recovered from nests in 1993, 1994 and 1996 showed that they choked on artifacts which included fragments of land mines, glass, stones and a cattle ear-tag. All were ingested with food that the parents had supplied. This phenomenon is well documented elsewhere: chicks of the Cape Vulture *Gyps coprotheres* were found dead underneath the nesting cliffs after they choked on artifacts which included fragments of stones and cattle ear-tags (Mundy *et al.* 1992).

The post-mortem of the Griffon Vulture chick, recovered from its nest in 1993, showed extremely high levels of heavy metals, including Nickel and Magnesium (Z. Tzuk-Rimon & O. Bahat, unpubl. data). This indicates environmental pollution of the food sources of the Griffon Vultures. High levels of heavy metals are known to cause death or abnormal behaviour in raptors (Newton 1979), including in young chicks, and such abnormal behaviour might result in their falling out of nests. Hence, we suggest that a possible large-scale cause of death could originate due to this phenomenon at Gamla as well. This issue requires further investigation which should include radio-tagging of chicks at nests in order to locate them in case of disappearance. Consequently, we suggest the use of leg ring radio-tags to monitor the survival of ten chicks at the nests in Gamla during the 1997 breeding season. Further investigation of the causes of death of chicks should also include a study of the quality of food intake of the Griffon Vultures in the Golan and Galilee regions (for residual heavy metals and

pesticides) This study should also include chemical tests of vulture corpses, and feather and blood samples from radio-tagged birds, in order to check the level of heavy metals and pesticides. A more extensive study which will require general capture and colour-ringing to determine movement patterns and foraging areas, and to look at mortality rates of immature and adult birds, needs to be undertaken at the earliest.

The results of the preliminary study stress the importance of the continuation of this project. Surveillance by the Gamla Nature Reserve staff and volunteers is critical and of great importance so as to continue to monitor the Griffon Vultures at the reserve in an increased effort to try and solve the conservation problems and implement the appropriate conservation and management measures.

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VOLUNTEERS REQUIRED

Volunteers are required for the surveillance/research of Griffon Vultures at Gamla Nature Reserve. For more information contact Dr Reuven Yosef at the International Birdwatching Centre (E-Mail: ryosef@bgumail.bgu.ac.il)