Nocturnal activity of Griffon Vultures at a feeding site in Kresna Gorge, Bulgaria.

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Abstract

Over the last few decades new technologies have made it easier to observe the nocturnal behaviour of raptors and vultures. Yet, few cases of nocturnal feeding of vultures have been documented. The purpose of this study is to provide information about the nocturnal feeding of the Griffon Vulture in Kresna Gorge, Bulgaria. Sixteen cases of nocturnal feeding were observed in the period 2012–2022. The vultures spent a mean of 133.50 ± 195.35 (range 1.00–568.00) minutes on the ground between 19h02 and 07h00. The mean duration of the feeding was 12.00 ± 11.85 (range 1.00–39.00) minutes. Red Foxes, Golden Jackals, and Grey Wolves were also recorded at the feeding site during the study period. Only Red Foxes were observed feeding at the same time as vultures.

Introduction

The nocturnal behaviour of non-nocturnal bird species has been a subject of research since the mid-twentieth century (Kendeigh 1934, Moore 1945). Night flights and activity of large birds of prey were documented by DeCandido *et al*. (2006) and Riba-Hernández *et al*. (2012).

Recently, new technologies and their increasing availability have made it easier to observe the nocturnal behaviour of usually diurnal species. For example, by using GPS transmitters García-Jiménez *et al*. (2020) identified and studied in detail the night flights of the Bearded Vulture (*Gypaetus barbatus*) in the Pyrenees.

The strategy of vultures for finding food is to search large areas for carcasses or activity of other scavengers (Houston 2001). Yet, by using camera traps, Charette *et al*. (2011) found that in the presence of a predictable food source the Black Vulture (*Coragyps atratus*) may occasionally change its behaviour and feed at night. Furthermore, nocturnal feeding of Griffon Vultures (*Gyps fulvus*) was documented in Spain (Mateo-Tomás & Olea 2018). The authors suggested that the reason for the unusual behaviour of the vultures was to avoid or reduce intraspecific competition for food.

Since the reintroduction of the Griffon Vulture in Kresna Gorge, Bulgaria (Peshev *et al*. 2019) and the establishment of a feeding site, different models of camera traps have been used to observe the behaviour of the species at the feeding site. This increases the possibility of observing rarely seen aspects of the biology and ecology of the Griffon Vulture, such as nocturnal feeding.

Due to limited research on nocturnal feeding by

Griffon Vultures, this knowledge gap still needs to be filled. This study, therefore, aims to provide information about the nocturnal feeding of Griffon Vultures at the feeding site in Kresna Gorge, Bulgaria. We also discuss this unusual behaviour by suggesting some reasons for its occurrence.

Study site and methods

The feeding site is located near the village of Rakitna (Simitli Municipality, Blagoevgrad Province, Bulgaria), above Kresna Gorge. It is registered with the Bulgarian Food Safety Agency and serves as a regional site for the disposal of carcasses. The feeding site is an enclosure containing an adaptation aviary used for the release of translocated birds and is surrounded by an electric fence. The electric fence did not work consistently all of the time because of damage or very deep snow. This allowed temporary access of terrestrial scavengers or other animals to the feeding site. The aviary is made of a metal frame with mesh with 10x10 cm holes. The height of the aviary is 5 m. The characteristics of the aviary are described in detail in Peshev *et al*. (2015).

In the period from 2012 to 2022, livestock carcasses were delivered at least three to four times per week. The annual weight of deposited carrion was between 15 and 50 tons. Table 1 shows the type of food available during the observation of nocturnal feeding.

During the study period, a camera trap was used to monitor the feeding site. To allow a better reading of the patagial tags of the vultures, the camera trap was positioned on the metal frame of the aviary approximately 0.5 m above the ground and 5 m from the deposited food. The camera trap was set to record photographs at one-minute intervals if it detected movement. Data were usually downloaded every four to eight days. A second camera was placed on the top of the aviary for a limited time in 2015.

Results

From 2012 to 2022 nineteen cases of nocturnal activity of Griffon Vultures were registered (Table 1). In all of the cases, the activity exhibited was on the ground, at the feeding site. The cases from 2012 are briefly described in the reports of Stoynov & Peshev (2013) and Peshev *et al*. (2015).

The vultures spent a mean of 133.50 ± 195.35 (range 1.00–568.00) minutes on the ground between 19h02 and 07h00. Sixteen cases of active feeding were observed during 68.4% (n = 19) of the nights with nocturnal activity (Figure 1). The mean duration of the feeding was 12.00 ± 11.85 (range 1.00–39.00) minutes. Table 1 shows the number of vultures observed each night. Six of the birds were identified by recognizing their rings and wing tags. In 2015 some vultures were twice documented to spend the night on the top metal frame of the aviary. This place was also used daily by the vultures for resting and inspecting the surroundings before eating.

Red Foxes (*Vulpes vulpes*) were also observed in 84% of the nights when some of the vultures were on the ground. The mean number of foxes observed with the vultures simultaneously was 2.56 ± 0.91 (range 1–4). In 56% of these cases, both species were observed feeding at the same time (Figure 1). Only one photo showed a situation in which a vulture was trying to chase three foxes. All the other photos did not reveal any interaction between them.

A pair of Golden Jackals (*Canis aureus*) and several Grey Wolves (*Canis lupus*) were also observed. The jackals were only registered once and the wolves five times. The mean number of wolves was 2.2 ± 1.7 (range 1–5). The wolves and jackals were not observed at the feeding site at the same time as the vultures and foxes. The shortest time between the separate visits of the vultures and wolves at the feeding site on the same night was 19 minutes.

Table 1: Records of nocturnal feeding of Griffon Vultures captured by a camera trap at the feeding site above Kresna Gorge, Bulgaria, between 2012 and 2020. The date of the record, number of the vultures photographed, types of carcasses, tag or ring numbers of marked vultures, temperature, and moon phase are shown.

Date of observation (yyyy-mm-dd)	Number of vultures recorded	Types of carcasses	Patagial tag or leg ring numbers of marked vultures	Temperature (ºC)	Moon phase (percentage of full moon, %)
2012-08-06	2	Sheep	A, C	21	77.02
2012-12-09	3	Cow	-	4	30.44
2014-06-02	1	Sheep	7-B97	5	26.79
2014-06-14	1	Pig	7-B97	6	91.94
2014-07-09	1	Goat	-	16	77.37
2019-11-05	2	Cow	T73, C7-M13	12	50.16
2019-11-09	1	Cow	C7	10	77.25
2019-11-10	1	Cow	-	8	84.02
2019-11-12	1	Cow	C7	12	97.56
2020-06-02	1	Cow	-	6	72.41
2020-10-03	1	Cow	C7	17	94.56
2020-11-24	1	Cow	-	-2	57.62
2021-05-19	1	Pig remains	HE	12	49.61
2021-08-08	1	Pig	-	20	1.81
2021-08-18	1	Cow	-	15	65.92
2021-10-15	1	Cow	-	3	58.73
2022-02-11	1	Sheep	HE	6	64.67
2022-02-14	1	Cow and sheep	HE	2	84.99
2022-02-20	1	Cow	HE	6	74.37

Discussion

Our data confirm that Griffon Vultures occasionally exhibit nocturnal activity, which is strongly related to feeding events. This uncommon behaviour is probably a result of the specific conditions of the studied feeding site.

By using camera traps Charette *et al*. (2011) found that Black Vultures may sometimes feed at night. They hypothesize that this phenomenon might be to minimize competition for food from other vulture species that inhabit the same region. The authors also suggest that this behaviour additionally could be triggered by good weather conditions and moon phase during the night.

Similar to Charette *et al*. (2011), by using camera traps Mateo-Tomás & Olea (2018) registered several cases of night feeding by Griffon Vultures. They suggest that the main reason for this

unusual behaviour may be to reduce competition for food and thus increase energy net gain. As in the case with the Black Vulture (Charette *et al*. 2011), Mateo-Tomás & Olea (2018) propose that good weather conditions and sufficient moonlight may also contribute to nocturnal activity.

The main reason suggested by Charette *et al*. (2011) and Mateo-Tomás & Olea (2018) for the nocturnal feeding observed in the Black Vulture and the Griffon Vulture (i.e. to minimize or avoid competition) seems to be a very good explanation for this behaviour. However, in our study, the main reason for the nocturnal feeding observed appears to be different. During the study period, livestock carcasses were delivered at least three to four times per week (sometimes up to seven times per week). In theory, this regular provision of food should limit competition and reduce the importance of this factor for driving nocturnal feeding.

We propose that the sixteen cases of nocturnal feeding could be partly explained by the favourable location of the feeding site and the aviary. Their position and the good wind conditions in the area allow vultures quickly to escape when they detect potential threats. For example, the birds can quickly escape to the top of the aviary and thus use it as a safe place where they can remain out of the reach of potential predators. Furthermore, the food was delivered next to the aviary in which there were always between one and ten vultures present. The vultures in the aviary attract other vultures and probably make them feel safer (Le Gouar *et al.* 2008).

Figure 1: Griffon Vultures and Red Foxes feeding simultaneously at the feeding site in Kresna Gorge, Bulgaria, during the night on 5 November 2019 (top left), 12 November 2019 (top right) and 19 May 2021 (bottom).

Some abiotic factors (e.g. temperature, rainfall, moon phase) may affect the activity patterns of vultures (Watanuki 1986, Mateo-Tomás & Olea 2018), thus decreasing or increasing their nocturnal activity. In the present case, however, it seems that the moon phase and temperatures were not important factors leading to nocturnal feeding. This is because during the nights when vultures scavenged, the moon phase and the temperatures varied widely (Table 1).

Some of the other animals observed at the feeding site during the study period could have influenced the nocturnal activity of the vultures. The foxes most likely have little influence on the vultures as they fed simultaneously in 56% of the cases when both species were registered at the feeding site. In only one case a vulture tried to chase three foxes. But the vultures did seem to avoid the presence of wolves and jackals as they were never recorded together at the feeding site. However, due to the small sample size, we cannot be sure whether vultures always avoid the presence of these animals.

The camera trap data confirm that Griffon Vultures feed at feeding sites during the night, often alongside mammalian scavengers. The conditions at the feeding site (i.e. a predictable and abundant food supply; the presence of a safe roosting site provided by the aviary structure; the presence of conspecifics inside the aviary) may have facilitated the observed nocturnal activity. However, this behaviour may be more frequent and widespread than previously thought and would merit further investigation.

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