Identifying hatchlings mortality in the Egyptian vulture (*Neophron percnopterus*) through the means of trail cameras

TECHNICAL REPORT

Plovdiv 2021

AUTHORS:
Emil Yordanov[1], Vladimir Dobrev[1], Volen Arkumarev[1], Dobromir Dobrev[1], Stoyan C. Nicolov[1]
1 Bulgarian Society for the Protection of Birds/BirdLife Bulgaria, Yavorov complex, bl. 71, vh. 4, PO box 50, 1111, Sofia, Bulgaria

ABOUT THE PROJECT

This report is developed under the frames of action D1 of the LIFE project "Egyptian Vulture New LIFE"(LIFE16 NAT/BG/000874, www.LifeNeophron.eu), further referred as "the LIFE project" funded by the European Commission and co-funded by the "A. G. Leventis Foundation", and implemented by the Bulgarian Society for the Protection of Birds (BirdLife Bulgaria), the Hellenic Ornithological Society (BirdLife Greece), the World Wildlife Fund Greece WWF Greece, the Royal Society for the Protection of Birds (BirdLife UK) (RSPB), Doğa Derneği /BirdLife Turkey (DD), BirdLife Middle East, BirdLife Africa, A.P. Leventis Ornithological and Research Institute (APLORI), CMS Raptors MoU, Green Balkans.

RECOMMENDED CITATION:

Yordanov, E., Dobrev, V., Arkumarev, V., Dobrev, D., & Nikolov, S.C. (2021). Identifying hatchlings mortality in the Egyptian vulture (*Neophron percnopterus*) through the means of trail cameras. Technical report under action D1 of the LIFE project "Egyptian Vulture New LIFE" (LIFE16 NAT/BG/000874). BSPB, Plovdiv, 18 p.

Contents

Summary

The Egyptian vulture is a globally endangered species, declining in the most of its range. It is known that mortality due to genetic diseases, malnutrition or Cainism occurs during early chick rearing period but its magnitude is not well studied. Here we aim to find out the mortality rate of hatchlings in the nests of Egyptian vultures in Bulgaria (the strong-hold of the Eastern-European population). We used trail cameras and an online camera to describe the events around hatchling and detect any mortality afterwards. During the two years of our study, we successfully observed 5 nests each year. In both years of our study, all five couples laid two eggs per year. The average hatchling date is 3rd of June and the average duration of incubation is 41,7 ± 0,64 days. Out of the 20 eggs laid, 17 were hatched and only 15 of the chicks survived until fledgling. There were 2 losses – in the first case poisoning was the reason and in the second the reason remains unknown. Our survey demonstrates the use of trail cameras as efficient method for establishing the mortality rate in hatchlings and the replacement rate in pairs.

Introduction

The Egyptian vulture (*Neophron percnopterus*, Linnaeus 1758) is distributed throughout southern Europe and the African continent except for South Africa, the Middle East, Transcaucasia, Central Asia and the Indian subcontinent (Ferguson-Lees & Christie 2001). The species is declining in most of its range. In the Balkans it declines by about 7% per year over the past three decades (Velevski *et al.* 2015). The main causes for that fast decline are electrocution, illegal use of poison baits, illegal shooting on the migration route and the high juvenile mortality during the first migration (Oppel *et al*.2015, Velevski *et al.* 2015)

Aims and objectives

The aim of this study is to find out the mortality rate of hatchlings in the nests of Egyptian vultures in Bulgaria. The Egyptian vulture is a monogamous species. The female usually lays 2 eggs with about 2-4 days interval in between (Cramp & Simmons 1980). Both parents take shifts for incubation which lasts 40-42 days. Incubation starts in April (Newton 1977, Cramp 1980, Mendelssohn 1983, Elosegi 1989, Morant *et al*. 2019). The first 14 days after hatching are critical for the chicks. Mortality occurs during this early chick rearing period but its magnitude is not well studied. The main causes for mortality could be diseases, predation, malnutrition or Cainism. Cainism is found in large raptors, it is a taxonomically widespread avian phenomenon. (Simmons 1988). A case of Cainism was recorded in a nest of an Egyptian vulture observed through an online camera in 2018. This case lead to the development of the current study.

Material and methods

Study area. The study was carried out in the Eastern Rhodopes, Bulgaria where the core of the Balkan population is (Arkumarev *et al.* 2018) and in northeast Bulgaria where one nest is monitored by online streaming camera.

Nests selection crteria. The selection of the nests was made in accordance to two main criteria: (1) nest occupied by a pair which have successfully bred in the previous breeding

season, (2) accessibility of the nest in regard to installation and maintenance of the trail camera. We aimed to monitor at least 5 nests per year.

Data collection. The trail cameras were installed in early March before the return of the birds from Africa, in two consecutive breeding seasons (2019-2020). We installed 10 trail cameras and one online camera in 2019. Two pairs changed their nests, the nest niches of these pairs were small and the trail cameras were installed inside them and were very well disguised (KRA,ROG; Table 1). We removed other trail cameras from 3 nests due to recorded disturbance of the birds. Two of these three cameras were placed inside the nests and were not disguised (CHA, GUR; Table 1), while the other one was placed outside of the nest and was not good disguised (DCH; Table 1). One territory remained unoccupied. Finally, we successfully observed 4 nests with trail cameras and one nest with an online camera. In 2020, 8 trail cameras were installed. Three of the pairs changed their nests. Two out of the pairs were in small nest niches and the trail cameras were very well disguised and installed inside of them (GUR, KRA; Table 1). The other one was installed outside of the nest and masked (DCH-Table 1). One territory was not occupied and again we successfully observed 4 nests with trail cameras and one with an online camera. (Table 1). In average for both years, we observed 20% of the population of the Egyptian vulture in Bulgaria. To avoid disturbance of the birds we covered the trail cameras using natural materials such as small stones, leaves, branches, moss and wool. We used Body Guard trail cameras with MMS function, Scout Guard trail cameras and one HikVision online camera in one nest in northeast Bulgaria. The trail cameras were set to take one still image when activated by movement, with a trigger interval of 30 seconds between shots. The infrared option was set off to avoid disturbance during the night. The MMS trail cameras were set to send 50 pictures per day to an email address using the GSM network. The online camera was set to record videos when there is movement in the nest in order to avoid hours of empty records when the birds were not present. Once the cameras were installed, the nest was accessed once or twice during the breeding season to change the battery pack and SD card. The first entry was delayed until after the chicks were at least 3 weeks old to minimize the risk of abandonment by the

parents, and to ensure the chicks were sufficiently mature and won't be exposed to a threat due to the absence of an adult bird. In the first year we used AA 'Duracell batteries' (8 batteries per trail camera), but on the second year we started using external rechargeable UPS batteries to optimize the energy supply and cost, and to avoid the possibility of battery exhaustion before entering the nests to change the SD memory cards. The cameras were collected after the breeding season and the images analyzed. The methodology of montaging trail cameras is following Yordanov & Dobrev (2021).

Data analyses. After the photos were downloaded from the SD cards, only the ones showing the birds were considered for analysis. The data is filled in a predefined excel table according to the purpose of the study, using the functions of excel descriptive statistic for conducting the analyses. Means values are presented ± Standard Deviation (SD). In total 78 420 pictures were processed - 37 015 pictures in 2019 and 41 405 in 2020.

We calculated breeding success and productivity as follows: for productivity - number of fledglings divided by the number of occupied territories; for breeding success - number of fledglings divided by the number of laying pairs and for hatchling rate – number of hatched chicks divided by the number of laid eggs.

Table 1- *The sizes of the nests and degree of masking of the photo traps.*

year	nest	nest size			Inside of the nest	outside of the nest	distance of the trail camera from the nest	not masked	best masked	disturbance by the trail camera	change of nest
		height in cm	depth in cm	width in cm							
2019	ARK	100	220	130		X	4m	X			
2019	DZA				X				X		
2019	GAB	144	290	130	X				X		
2019	KON	77	105	180	X				X		
2019	VPO				X			X		territory was not occupied	
2019	CHA	95	122	125	X			X		X	
2019	KRA	53	90	85	X				X	X	X

2019	ROG				X				X	X	X
2020	ARK	100	220	130		X	4m		X		
2020	DZA				X				X		
2020	GAB	144	290	130	X				X		
2020	KON	77	105	180	X				X		
2020	VPO				X			X		territory was not occupied	
2020	GUR	95	100	120	X				X	X	X
2020	DCH	135	85	100		X	2,5m		X	X	X
2020	KRA	53	90	85	X				X	X	X

Results

Breeding performance and phenology

During the two years of our study, we successfully observed 5 nests each year. The productivity of the nests for both years was 1,5 ± 0,1 (1,6 in 2019 and 1,4 in 2020), breeding success for both years was 1,5 ± 0,1 (1,6 in in 2019 and 1,4 in 2020) and the hatchling rate for both years was 0,85 ± 0,05 (0,8 in 2019 and 0,9 in 2020). The average date of arrival of the adults is 3rd of April (23th March – 15th April), incubation started on average on 19th April (1th April - 6th May). In both years of our study, all five couples laid two eggs per year (**Table 2**). The average hatchling date is 3rd of June (19th May-10th June) and the average duration of incubation is 41,7 ± 0,64 days (**Table 3**). All 17 hatched chicks were raised and fledged successfully except for two in two different nests in 2020.

Table 2. *Results per year.*

	2019	**2020**	**total**
Number of installed cameras	10	8	18
Number of observed nests	5	5	10
Number of layed eggs	10	10	20
Number of hatched eggs	8	9	17
Number of hatchlings	8	7	15
Number of perished chicks		2	2
Number of fledglings	8	7	15

Table 3. *Results per surveyed territory.*

Territory	Year	Eggs	Incubation	Hatchlings	Fledglings	Losses	Reason
ARK	2019	2		2	2		
DZA	2019	2		1	1		
GAB	2019	2		1	1		
KON	2019	2		2	2		
PRO	2019	2	42 days (egg I), 41 days (egg II)	2	2		
DZA	2020	2	42 days (egg I),42 days (egg II)	2	2		
GAB	2020	2	41 days (egg II)			1	Poisoning
KON	2020	2	41 days (egg I) 42 days (egg II)	2	2		
ARK	2020	2	42 days (egg I) 41 days (egg II)	1	1	1	Unknown
PRO	2020	2	43 days (egg I) 42 days (egg II)	2	2		

Eggs loss

In 2019, 2 out of 10 eggs in two different nets had unknown faith. In these two nests (GAB and DZH) the memory of the SD cards was already full before the hatching and we could not know what exactly happened with the eggs or the hatchlings. There are several probable scenarios, (1) the eggs were unfertile, (2) the second chick hatched but died during the first week after the hatching due to starvation or Cainism, or (3) predation of the eggs/hatchlings.

Photo 1. DZH (2019) - *The female with the two eggs.*

Photo 2. DZH (2019) - The *young in the nest.*

The trail camera's memory card was full before the eggs hatch, and no remains of the second egg were found in the nest. An egg is not visible on the photos after the hatching period, so it is possible that it hatched and died in the first two weeks or that it did not hatch and the adults displaced the remains (**Photos 1 & 2**).

The trail camera's memory card was full before the eggs hatch, and no remains of the second egg were found in the nest. An egg is not visible on the photos after the hatching period, so it is possible that it hatched and the chick died in the first two weeks or that it did not hatch at all and the adults displaced the remains (**Photos 3 & 4**).

The pair GAB laid two eggs in 2020. The first egg was laid on 31th of March, just 2 days after the first photo (probably the arrival date) of the male inside the nest. The second egg was laid on 05th April. The first egg did not hatch on the expected date and remained in the nest until 23th of June. Most probably it was not fertilized since the male appeared just two days prior to its laying. The second egg hatched after 41 days on 16th of May (**Photos 5 & 6**).

Photo 3. GAB (2019) - *The female with the two eggs.*

Photo 4. GAB (2019) - *The young in the nest.*

In 86.7% of the cases (n=15) the hatched chicks fledged successfully. However, 2 chicks in two different nests died prior fledgling.

Photo 5. GAB (2020) - *The two eggs in the nest.*

Photo 6. GAB (2020) – *The young with the unhatched egg. Here the first egg is 55 days old.*

Poisoning case revealed by the camera traps in 2020 (Photos 7-14)

The chick raised by the monitored pair died on 15th June at age of 30 days. The most probable cause is poisoning. The exact chain of events revealed by the camera trap is as follows: On 15th June at 13:44 one of the adult Egyptian Vultures brings food to the nest. Unfortunately, the food item could not be identified. It drops the food in front of the chick. At 14:01, the adult helps the chick to feed. At 14:17, the chick starts behaving unusually and moves backwards towards the side of the nest. At 14:51, the chick drops its head and afterwards only moves its wings slightly. It is positions with a head down and back up towards the edge of the cliff. At 15:23, the chick is no longer moving and seems dead. The two adults are in the nest and walk around but seem in good health. After 16:04, there are no more photos. The next photo is on 16th June at 13:38 when both adults are again in the nest but the chick is in the exact same position as the previous day when it died. At 13:49, the adult lies down next to the chick in an attempt to

warm it. It stays in this position until 16:35. Until the end of the day, both adults remain in the nest. On 19th June at 10:33 the female starts feeding from the body of the dead chick and at 10:50 it is already with a full crop. At 10:54, she leaves the nest and never returns. At 11:21, the male brings a dead Starling to the nest and feeds on it. At 12:01, the male starts feeding on the body of the dead chick and feeds until 12:15. At 12:17 on 19th June the male leaves the nest and never returns back. The female was found dead on 22st June about 2.6 km from the nest. The body posture is typical for a poisoning incident. The necropsy revealed that the bird has died about 3 days before it was found which coincides with the last photo from the camera trap in the nest. Based on these facts we can conclude that the chick and the two adults were poisoned by unknown agent.

Photo 7. *The chick active in the nest in the morning on 15th June.*

Photo 8. *The adult bringing food to the chick.*

Photo 9. *The chick showing strange behavior after feeding.*

Photo 10. *The two adults with the dead chick in the nest.*

Photo 11. *The adult lying down in an attempt to warm the dead chick.*

Photo 12. *The female feeding on the chick's carcass*.

Photo 13. *The female with full crop after feeding on the dead chick.*

Photo 14. *The male feeding on the chick's carcass*.

The second case of a perished chick (Photos 15 - 19)

In the second case, the younger chick died 8 days after the hatching. It hatched on the 6th of June and died on the 13th June during the night. The number of photos is quite insufficient and it is difficult to draw a specific conclusion about the cause of death of the chick. The trail camera took 104 pictures from the hatching to the death of the chick which is quite few for 8 days. From the photos it is visible that the younger chick looks smaller than the regular body size of the hatchlings and looks frail. The younger chick does not look very active on the few photos that we have. It lies down in most of the photos. There are only a few of them with its head upright. Out of 104 photos, the young chick is clearly visible only on 30. On only 11 of these 30 pictures, the second one is notably moving. It doesn't stand on its feet, it sits with its head upright, there are almost no pictures of it standing up.

In comparison during the first 8 days after the hatching of the first chick the trail camera took 110 pictures out of which the chick was clearly visible on 31 of them. On 21 of them, it was

moving, on some of them it was standing on its feet and on others, it was sitting with its head in an upright position. On the 13th of June between 14:23 and 16:36, the second chick moved backwards towards the side of the nest, at about 30-40 centimeters away from the bigger one and laid there until the evening when it died. Its body was not visible in the photos from the next day (14th of June). There could be different reasons for the death of the chick such as diseases, malformation or other health issues that cannot be detected and investigated with the trail camera. None of the photos show aggression by the bigger one or a fight between them. The number of photos is significantly small for this period, but if there was any display of aggression between the chicks which can cause the death of the second chick, then there would be at least a few photos showing aggression. Predation also seems unlikely for a number of reasons that are excluding it. And finally, malnutrition is less probable because the pair is supplementary fed twice per week and also was daily visiting the central supplementary feeding station in the area.

Photo 15. *The first chick at the age of 8 days.*

Photo 16. For comparison: *The second chick at the age of 7 days. It looks smaller than the regular body size of the hatchlings and it looks frail.*

Photos 17-18. *The last two photos of the second young alive - 13.6.2020.*

Photo 19. *14.6.2020: the 1st chick is laying in the nest, while the second is no longer visible.*

Lessons learned

If placed outside the nest, the trail camera should either not be far away (not more than 3,5-4 m from the nest) because the motion sensor will detect movements rarely, which will significantly reduce the number of photos taken during the day or the sensitivity should be set to high. If the nest niche is small, then the trail camera should not be placed/mounted inside it, because no matter how well it is masked, it will still bother them and the pair could shift the nest. The trail cameras should be camouflaged as good as possible with natural materials. It is better to use small stones from the cliff on which the nest is. Wool is not recommended, because in strong winds it peels off and the birds also pull it. One of the trail cameras was knocked down by an animal and part of the wool was obviously pulled by it. Another encountered problem is that due to strong wind the wool activates the motion sensor. It is best to use rechargeable UPS batteries. One UPS battery lasts one season for one trail camera. MMS trail cameras require two batteries connected in parallel as they consume much more power. This will prevent the purchase and disposal of about 80 batteries per season (in our case). Memory cards (SD Cards) have to be 32GB, if the specifications of the trail cameras allow it, because in some of the nests the SD cards were filled before the hatching. Since the memory cards cannot be replaced until at least 3 weeks after hatching of the chicks, the most critical moment of chick development might remain unrecorded. This was the case with two of our monitored nests in 2019.

Conclusions

By use of trail cameras we identified two cases of chick losses in two Egyptian Vulture pairs in the Eastern Rhodopes for the period 2019-2020. The loss of young in one case was poisoning, and in the other case it is not clear, the possible reason is a disease or other health problem. Thus, trail cameras can be used for establishing the hatchling rate, mortality and in some cases for identifying the mortality causes. Also, it is a very good method for better understanding of breeding behavior of the birds. Furthermore, the use of cameras in the nest can account for the replacement rate in the pair and help to better understand the mortality in the

adults. Even some characteristics in the plumage to draw markers for building up a guide for the sexual dimorphism in the birds. Likewise it can be helpful for establishing breeding parameters - date of laying, date of hatching, size of the clutch, etc.

References

Arkumarev, V., Dobrev, V., Stoychev, S., Dobrev, D., Demerdzhiev, D., & Nikolov, S. C. (2018) Breeding performance and population trend of the Egyptian Vulture Neophron percnopterus in Bulgaria: conservation implications. Ornis Fennica 95: 115–127.

Cramp, S. & Simmons, K. (1980) Birds of Europe, the Middle East and North Africa. Vol II. Oxford University Press, Oxford.

Elosegi, I. (1989) Vautour fauve (Gyps fulvus), Gypaète barbu (Gypaetus barbatus), Percnoptère d'Egypte (Neophron percnopterus): Synthèse bibliographique et recherches. Acta biol. Mont. Serie documents de travail, 3.

Fergusson-Lees, J. and Christie, D. (2001) Raptors of the world. London: Christopher Helm.

Etxebarria, J.M. López-López P. & Zuberogoitia I. (2019) Parental investment asymmetries of a globally endangered scavenger: unravelling the role of gender, weather conditions and stage of the nesting cycle. Bird Study 66(3): 329-341.

Mendelssohn, H. & Leshem, Y. (1983) Observations on reproduction and growth of Old World Vultures. In: Wilbur S.R. & J.A. Jackson (eds) Vulture Biology and Management: 214-241. University of California Press, Los Angeles.

Newton I. (1977) Breeding strategies in birds of prey. The living Bird, 16.

Simmons, R. (1988). Offspring quality and the evolution of cainism. Ibis 130(3): 339-357.

Oppel, S., Dobrev, V., Arkumarev, V., Saravia, V., Bounas, A., Kret, E., Velevski, M., Stoychev, S., Nikolov, S.C. (2015) High juvenile mortality during migration in a declining population of a long-distance migratory raptor. Ibis 157: 545–557.

Velevski, M., Nikolov, S.C., Hallman, B., Dobrev, V., Sidiropoulos, L., Saravia, V., Tsiakiris, R., Arkumarev, V., Galanaki, A., Kominos, T., Stara, K., Kret, E., Grubac, B., Lisichanec, E., Kastritis, T., Vavylis, D., Topi, M., Hoxha, B.&Oppel, S. (2015) Population decline

and range contraction of the Egyptian vulture Neophron percnopterus in the Balkan Peninsula. Bird Conserv Int, 25(4): 440 - 450.

Yordanov, E. & Dobrev, V. (2021) Guidelines for installing trail cameras in nests of Egyptian vultures (Neophron percnopterus) in Bulgaria. Under action D1 of the LIFE project "Egyptian Vulture New LIFE" (LIFE16 NAT/BG/000874). BSPB, Plovdiv. 10 p.