

The state of Griffon Vulture (*Gyps fulvus*) in Armenia

Stav supa bělohlavého (Gyps fulvus) v Arménii

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Abstract: The last update of conservation status of Griffon Vulture (*Gyps fulvus*) in Armenia was implemented in 2009, including data collected in 2003–2008. The current update of conservation status of the species in the country considers data collected from 2003 until 2019. Results show that the species population consists of 48–54 breeding pairs. Such trend demonstrates moderate increase of population. The annual breeding success (measured as fledglings per occupied nest) also increased from 71% in 2003 to 79% in 2019. Current threats are related to direct tracing down for trophy or to domesticate as pet. One of possible paths of domestication can be related to catching of the birds, which have been poisoned by heavy metals at municipal dumps or by use of Nonsteroidal anti-inflammatory drugs. The proposed conservation measures include (1) change in trophy policy and captive breeding, particularly meaning listing down all existing specimens and introduction of obligatory procedure of issuing a certificate of origin for each new specimen; (2) stricter penalization for illegal shooting or trapping; (3) strengthening of inspection body to improve control; (4) improving public outreach aimed at raising the value of this species; (5) study of application of Nonsteroidal anti-inflammatory drugs in livestock husbandry; (6) improving waste management. These measures should be accompanied by species' monitoring.

Key words: birds of prey, vultures, Armenia, conservation status, population dynamics, threats

Introduction

Armenia is relatively small (29,743 km²), land-locked mountainous country, where elevation varies from 375 to 4090 m above sea level. Such large difference in elevations determines variety of climatic conditions and creates many different landscapes, including semi-desert, juniper woodland, deciduous forest, mountain steppe, and sub-alpine area. The terrain is rigorous and contains number of deep canyons, cliffs, and rocky outcrops (Aghababyan et al. 2015). The fauna is quite rich including number of ungulates, such as Bezoar Goat *Capra aegagrus*, Armenian Mouflon *Ovis ammon gmelini*, Roe Deer *Capreolus capreolus*, and Wild Boar *Sus scrofa*. Also, the nomadic grazing is quite developed and widespread in the country with

the main bred species of cattle, sheep, and goat (Tumanian 2001). Therefore, the area is quite sufficient for Griffon Vulture *Gyps fulvus*, which find here both food and nesting place. The Griffon Vultures are patchy distributed in North-wester Africa, Iberian Peninsula, Southern France, and then to east through Mediterranean Basin, Balkans, Turkey, Caucasus, Middle East, Arabia and Iran, and further to Pamirs and Southern and Eastern Kazakhstan, Afghanistan, Pakistan and India (Orta et al. 2019). It is classified as Least Concern in IUCN Global Red List having an increasing population trend (BirdLife International 2017). In Europe the situation of the species is the same. It also shows increasing population trend and is classified as Least Concern (BirdLife International 2015).

Armenia is inhabited by nominate subspecies, which is one of the four representatives of Old-World Vultures living in the country (Cramp & Perrins 1993, Adamyan & Klem 1999). In Armenia the species is a year-round resident, which however makes some local movements (Adamyan & Klem 1999). This colonial breeder has quite large foraging territories: varying in different studies from up to 20 km radius in Crete (Xirouchakis & Andreou 2009) to 30 km radius in Spain (Zuberogoitia et al. 2012) and therefore becomes a problematic species for study and conservation. Those obstacles have resulted in fragmentary study of the species until 2002 (Aghababian et al. 2004). That is why in 2002–2003 the country wide monitoring program of this species was launched. Some preliminary results were published in 2004 (Aghababian et al. 2004, Aghababian & Bildstein 2004) and have been used for Red Book of Animals of Armenia (Aghasyan & Kalashyan 2010), for assessment of Emerald Sites in the country (Fayvush et al. 2016), as well as for recent multi-species action plan on the African-Eurasian Vultures (Botha et al. 2017). After over 15 years of monitoring it is necessary to update the status of species, especially considering the upcoming Red Book of Animals of Armenia, planned for implementation in 2020–2021. Thus, the current communication is aimed at describing the modern conditions of Griffon Vulture in the country, including its population trends during 2003–2019, threats that the Griffons are facing, as well as existing and needed conservation measures, which can become a foundation for assessment of its conservation status.

Material and methods

By the beginning of focused data collection on the species, there were three known colonies of Griffon Vultures in Armenia (Geilikman 1965, Adamian & Klem 1999). In 2002 we have conducted a pilot study and have determined four more colonies of the species. Having that baseline information, we have started re-inventory of Griffon Vultures in Armenia by discovering

smaller colonies during 2003 and 2004. The other colonies, which have been found later in the period of 2005–2019, were considered as new ones, because have been recorded in well-studied areas. Also, the increase was determined by appearance of new breeding pairs in known colonies. Monitoring of the species was implemented via absolute count of the breeding pairs through occupied nests, which was performed annually during March–April. Later in July of each year, we have been visiting the recorded nests again. The aim was to collect data on fledglings for further computation of breeding success. In addition, we have collected the data on location of each nest, which included type of the location (covered ledge, niche, grotto, or cave), height above ground, and face of the cliff. To understand some peculiarities of the species' feeding we have been making long-term observations of the behavior of Griffons at the nests in the period of late May through July, when the parents have been feeding the nestlings. In total, 40 people participated in the study they covered almost entire Armenia.

The mapping is implemented using ArcGIS 10.0 software (ESRI 2011). To estimate the threats, we have conducted surveys of hunters, and the main online and offline market places where the mounted specimens of raptors could be sold. We have conducted questioning of farmers and veterinarians about mortality of the livestock. In addition, an interview with the State Inspectorate for Nature Protection and Mineral Resources was conducted, aimed at identification of their potential involvement in poaching control.

To calculate population trends, we used multi-year data series and process them using TRIM 3.0 software (Van Strien et al. 2004, Voříšek et al. 2008). The Collated Index was calculated using log-linear Poisson regression; then the deviations are calculated and presented as a linear function, showing populations growth or decline. For the analysis, we have considered each colony as a site, as the survey areas were kept constant over time. Since we had data for all the years, we have used time-effects module. The TRIM output parameters have been used to

document the trend's direction and size based on the TRIM manual, which considers six possible options: strong increase (with increase of more than 5% per year); moderate increase (significant increase but less than 5% per year); stable (when the most probable trends are less than 5% per year); uncertain (with no significant increase or decline); moderate decline (with decrease of less than 5% per year); and steep decline (with decrease of more than 5% per year). Statistically significant change was stated on the $p < 0.05$ level, otherwise the population was considered stable (Pannekoek & van Strien 2005).

The breeding success was computed as a rate obtained by dividing the number of fledglings to the number of breeding pairs. The normality of "breeding success" variable (a precondition to select the regression model) was tested using Shapiro-Wilk test. The trend of the breeding success was also analysed using log-linear Poisson regression, which allows analysing both count data and rate data. The equation below is used for modelling the rate data:

$$\log(X/n) = \beta_0 + \sum i\beta_i X_i;$$

$$\log(X) = \log(n) + \beta_0 + \sum i\beta_i X_i$$

where X is the event to happen and n is the grouping (Van Strien et al. 2004). The statistical analysis was performed by TRIM 3.0 and SPSS 22.0 (I. B. M. 2013) packages.

Results and discussion

Distribution of the species and biological peculiarities in Armenia

In Armenia the species was found breeding in North-eastern, Central, Southern, and South-eastern regions (Fig. 1). At least two colonies are located at the border areas. The surveys showed that the Griffon Vultures inhabited wide variety of landscapes with availability of high cliffs. Unlike Bearded Vulture (*Gypaetus barbatus*), which avoided canyons located in the forests, Griffon Vultures were found inhabiting those as well (Fig. 2), thus occupying elevation ranges from 600 to 2,300 m above sea level. The

detected nests have been located on the covered cliff ledges and in small caves, regardless to the direction of the face of a cliff. In Armenia, number of pairs in one colony was varying from three to twelve. Depending on elevation, Griffons had started incubation from March to April, laying one egg in a clutch. The fledglings were recorded leaving the nest in July, rarely in early August. Griffons had mostly been observed showing collective behaviour of food searching and feeding on medium to large size carrion, such as wild and domestic ungulates, stray dogs, large carnivores, etc. In addition, it

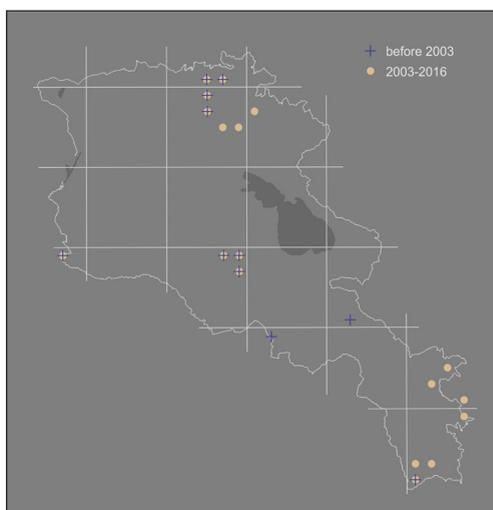


Fig. 1. Distribution map of Griffon Vulture in Armenia in 2019.
Obr. 1. Distribuce supa bělohlavého v Arménii v roce 2019.



Fig. 2. Typical breeding habitat of Griffon Vulture in Armenia. Vorotan River Gorge. Photo by K. Aghababyan.
Obr. 2. Typické hnízdní stanoviště supy bělohlavého v Arménii. Kaňon rieky Vorotan. Foto: K. Aghababyan.

was observed that in Armenia Griffon Vultures never took road kills, unlike Egyptian Vultures (*Neophron percnopterus*), which had often been observed on the asphalt roads eating the small to medium carcasses there. Our observations of Griffons' behaviour during nesting period showed that in 62% of cases the parents had been returning to the nest with food. Our questioning of local farmers showed regular mortality of livestock in the field: it dies due to snakes' attacks, falling from cliffs, from ruminal tympany and other reasons.

Population dynamics

According to our last estimations, there were 12 colonies of Griffon Vultures with total number of 48–54 pairs in 2019. Some of the colonies located close to the borders with Turkey and Iran show mobility and, in some years, can relocate their nests to the cliffs located in those neighboring countries (which are still visible from Armenian side). The population trend demonstrates moderate increase (additive = 0.0253, standard error = 0.0090, multiplicative = 1.0257, standard error = 0.0092, $P < 0.01$, confidence interval = 1.002–1.049, satisfying the criterion for moderate increase; Pannekoek & van Strien 2005), as it is shown on the Fig. 3. The statistics of breeding success also showed

positive dynamics increasing from 71% in 2003–2004 to 80–81% in recent years (Fig. 4), which is statistically significant according to the results of log-linear Poisson regression (Pearson Chi-Square = 0.59, $df = 15$, $P < 0.05$).

The recent cases of shooting of Griffons have been revealed through selling trophy at the markets. However, the cases have not been qualified as poaching, because the shooters became able to justify the case as finding of the dead birds in the nature. Also, cases of internal trade from local hunters to local restaurants have been identified. Again, they could not be qualified as illegal, as the local inhabitants were able to bring similar justifications. From another side. Our interview with the State Inspectorate for Nature Protection and Mineral Resources, shows that they have lack of financial and human resources for effective control of the poaching, such as illegal shooting and trapping of the species. Additionally, the State Inspectorate's staff informed us that local hunters are not afraid of being caught, partly because of relatively low punishment: the fee for illegal shooting or trapping of the species makes less than equivalent of 450 Euros (Parliament of RA 2017). Therefore, currently documented threats, which affect breeding population of Griffons, include direct persecution for trophy and for

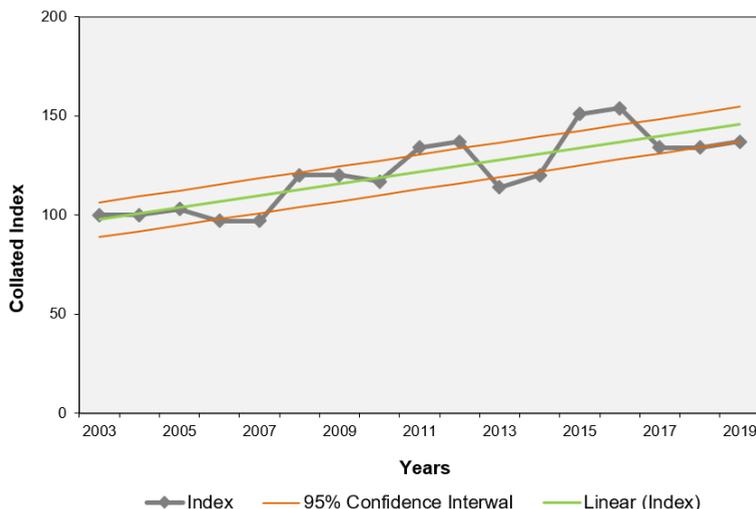


Fig. 3. Population dynamic of Griffon Vulture in Armenia during 2003–2019.
 Obr. 3. Populační dynamika supa bělohlavého v Arménii v průběhu let 2003–2019.

illegal trade inside Armenia for having animals as pets at the outdoor exhibitions.

Causes of observed population trend

The population of Griffons declined significantly in 1991–2002 (Aghababian and Bildstein 2004); however, in 2003–2019 the population shows moderate increase. In that period at least three colonies consisting on three, three, and six pairs started breeding in the Southern Armenia in the well-known territories. The increasing population trend and breeding success are most probably related to the increase of food supply throughout the species' breeding range in Armenia. Beside growing of livestock husbandry, in particular cattle and sheep (Armstat 2019), which obviously play an important role in the species' live, at current, there is also a moderate increase of population of Bezoar Goats in Armenia (WWF Armenia, personal communication), which can have a positive influence on number of Griffons in the country. Despite the ability of Griffons to cover distance over 100 km per day (Monsarrat et al. 2013), it appears that the food availability in the country still remains quite important, as the species' population steeply declined after breaking of Soviet Union, when the livestock slaughter houses became closed and wild ungulates

have been poached in mass (Aghababian & Bildstein 2004, Aghababian et al. 2004). The local food supply appears to be important also because, for example, in neighboring Turkey the loss of suitable food due to change of farming practices is documented as one of the causes of the Griffons population decline (BirdLife International 2017). Probably the same happens in other neighboring countries, since decline of food availability, namely: reduction in available food supplies (domestic ungulate populations) resulted from changes in livestock management practices) is considered a major threat in parts of Asia and eastern Europe (Botha et al. 2017). In Armenia the traditional livestock husbandry based on the outrunning of the cattle and sheep to the pasturelands still plays a significant role (Ministry of Agriculture of Armenia, personal communication).

At the moment we do not see effects of poisoning on Griffon's population; however, such threats can emerge, mainly due to two reasons: (1) the Nonsteroidal anti-inflammatory drugs (NSAIDs) are being used in livestock husbandry (although with unknown scale) and they have a potential to cause a significant decline of Griffons and other vultures (Naidoo et al. 2009); (2) the Griffons are often observed feeding at the large municipal dumps where food remains

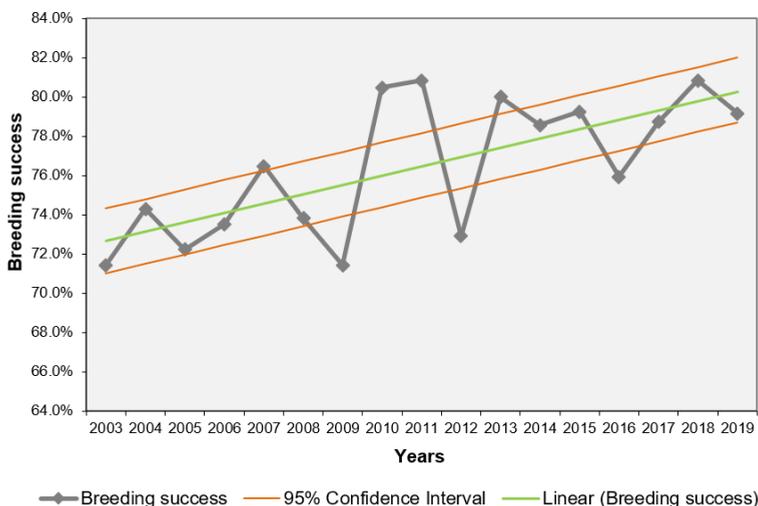


Fig. 4. Change of breeding success of Griffon Vulture in Armenia during 2003–2019.

Obr. 4. Změna hnízdního úspěchu supy bělohlavého v Arménii v průběhu let 2003 – 2019.

are thrown together with batteries and electronic devices, thus causing a danger of flow of the heavy metals into environment, polluting soil, water, and food remains, which are a food for the Griffon Vultures.

Conservation measures

The Griffon Vultures are listed in Red Book of the Animals of Armenia as Vulnerable – VU D1 (Aghasyan & Kalashyan 2010), and it appears that despite on the observed population increase, the conservation status of the species should stay the same in accordance to criteria D1: less than 1000 mature individuals (IUCN 2019). Five breeding colonies of Griffon Vultures are covered by Khosrov Nature Reserve, Zangezur Biosphere Complex, and Dilijan National Park; other colonies remain outside the national protected areas, but, most of them are included in the Emerald Network, protected under Bern Convention (Fayvush et al. 2016). Taking into account the current and potential threats, the proposed conservation measures for the species should include: (1) changes in the policy on trophy collection and having animals as pets and, particularly, introduction of an obligatory procedure of issuing a certificate of origin for every trophy or such wild animal in captivity; (2) increase of penalization for illegal hunting and trapping of the species; (3) strengthening of Inspectorate for Nature Protection and Mineral Resources and development of its cooperation with the Hunters' Unions and Conservation NGOs in the country; (4) development of a targeted educational and public outreach program aimed at Armenian Hunters; (5) study of application of NSAIDs in livestock husbandry; and (6) improvement of the waste management at municipal dumps. These conservation measures should be supported by continuous monitoring of the species with two purposes: (i) to track its further population trend, and (ii) to indicate the efficiency of undertaken conservation measures.

Acknowledgements

The inventory and monitoring of Griffon Vultures in Armenia as well as the study of its biological peculiarities

is supported by CRDF Global and NFSAT Foundations, Natural Research Ltd., International Avian Research, Hawk Mountain Sanctuary, Ministry of Environment of RA, Inspectorate for Nature Protection and Mineral Resources, Khosrov Forest State Reserve, Dilijan National Park, Arevik National Park, and Zangezur Biosphere Reserve. Significant help was provided by the members of Armenian Birdwatching Association. The data analysis was consulted with our colleagues from European Bird Census Council (EBCC): Sergi Herrando, Petr Voříšek, and Alena Klvaňová. Also, we thank A. Klvaňová for translation of the title and the summary into Czech language.

Súhrn

Poslední aktualizace stavu ochrany supa bělohavého (*Gyps fulvus*) v Arménii byla provedena v roce 2009 na základě údajů z let 2003–2008. Současná aktualizace stavu ochrany tohoto druhu v zemi je založena na údajích shromážděných od roku 2003 do roku 2019. Výsledky ukazují, že populaci druhu tvoří 48–54 hnízdních párů. Populace tak vykazuje mírný nárůst. Roční hnízdní úspěšnost měřená jako počet vyvedených mláďat na jedno obsazené hnízdo rovněž vzrostla ze 71 % v roce 2003 na 79 % v roce 2019. Současné příčiny ohrožení spočívají v přímém pronásledování druhu za účelem získání trofeje nebo domestikace. Jedna z možných cest domestikace může souviset s odchycením ptáků, kteří byli otráveni těžkými kovy na obecních skládkách nebo použitím NSAID (nesteroidních protizánětlivých léků). Navrhovaná ochranná opatření zahrnují (1) změnu legislativy týkající se trofejního lovu a chovu v zajetí, spočívající zejména ve vyjmenování všech stávajících jedinců a zavedení povinného vydávání osvědčení o původu pro každého nového jedince; (2) přísnější penalizaci za nelegální střelbu nebo odchyt; (3) posílení inspekčního orgánu za účelem zlepšení kontroly; (4) zlepšování veřejného povědomí o vysoké hodnotě tohoto druhu; (5) studie uplatňování NSAID v chovu hospodářských zvířat; (6) zlepšení nakládání s odpady. Tato opatření by měla být doprovázena monitoringem druhu.

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Received: 8. 12. 2019

Accepted: 28. 1. 2020

Online: 10. 2. 2020