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# The status and conservation of Egyptian Vulture *(Neophron percnopterus)* in Armenia

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**Abstract** The national conservation status of the globally threatened Egyptian Vulture *(Neophron percnopterus)* in Armenia was last updated in 2009, and there is an obvious need to revise it. The data collected in 2022–2024 show that there are 39–43 breeding pairs of Egyptian Vulture in Armenia, while its population trend declined by 25% in the years between 2003–2024 ($p<0.01$), which equals a decrease of 48% in 40 years (three generations of the species). The Area of Occupancy is 976 km$^2$, and the Extent of Occurrence is 19,024 km$^2$. The species' national conservation status is marginal between the categories of Vulnerable and Endangered; however, the existing conservation measures remain insufficient for either category. To improve the status of the species, it is necessary to mitigate hazardous waste management policy, to secure proper Environmental Impact Assessments of construction and other developments in the buffer zones of known nests, and to restrict outdoor activities, including drone filming or photography in the same buffer zones in the breeding season, to review the policy on burial of dead cattle, and to study the influence of electric infrastructure on Egyptian Vultures. The implementation of conservation measures should be accompanied by continuous monitoring with minimum disturbance.

Keywords: conservation status, population dynamics, threats, NSAID, conservation measures

**Összefoglalás** A globálisan veszélyeztetett dögkeselyű *(Neophron percnopterus)* státuszát Örményországban legutóbb 2009-ben frissítették, ezért szükség volt ennek felülvizsgálatára. A 2022–2024 között gyűjtött adatok azt mutatják, hogy Örményországban 39–43 költőpár él. A populáció 25%-kal csökkent a 2003–2024 évek között ($p<0,01$), ami 40 év alatt (a faj három generációja) 48%-os csökkenést jelent. Az előfordulási terület 976 km$^2$, az előfordulás kiterjedése pedig 19 024 km$^2$. A faj nemzeti természetvédelmi helyzete a sérülékeny és a veszélyeztetett kategóriák között van, azonban a meglévő természetvédelmi intézkedések továbbra sem elegendőek egyik kategória megállapításához sem. A faj állapotának javítása érdekében javítani kell a veszélyes hulladékokkal kapcsolatos politikát, biztosítani kell az ismert fészkek pufferzónáiban az építkezések és egyéb fejlesztések megfelelő környezeti hatásvizsgálatát, korlátozni kell a szabadtéri tevékenységeket, beleértve a drónokkal történő filmezést vagy fényképezést. Ugyanezen pufferzónákban a költési időszakban felül kell vizsgálni az elhullott szarvasmarhák eltemetésére vonatkozó szabályozást, és tanulmányozni kell az elektromos infrastruktúra hatását a fajra. A védelmi intézkedések végrehajtását folyamatos, minimális zavarással járó megfigyelésnek kell kísérnie.

Kulcsszavak: természetvédelmi helyzet, populációdinamika, veszélyek, NSAID, természetvédelmi intézkedések

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## Introduction

The Egyptian Vulture *(Neophron percnopterus)* breeds in Southern Europe, the Caucasus, Central and Southern Asia, Northern, Central, Southern and Eastern Africa, the Middle East, and also the Balearic Islands, Sicily, Cape Verde, Socotra, and the Canary Islands (Cramp & Perrins 1980, Orta *et al*. 2020, BirdLife International 2021). The species' conservation status in Armenia and globally is Endangered, with an estimated global population of 12,400–36,000 mature individuals and a declining population trend (Aghasyan & Kalashyan 2010, BirdLife International 2021).

In Armenia, the species was first recorded in 1907 (Satunin 1907), with gradual expansion of knowledge on its distribution (Leister & Sosnin 1942, Dahl 1954), then with country-wide surveys in the framework of quite general bird-related projects (Adamian & Klem 1999, Aghababian 2001), vulture study projects (Aghababyan & Bildstein 2004, Aghababian *et al*. 2004), and the National Bird Monitoring Scheme (BirdLinks Armenia 2019).

The data collected in 2003–2008 within the framework of the specialized vulture study and National Bird Monitoring Scheme was used for the assessment of the conservation status of the species for the second issue of the national Red Data Book (Aghasyan & Kalashyan 2010), where the population of Egyptian Vultures was estimated as 40–60 breeding pairs, and the population trend was reported as decreasing. Later, another round of population estimation was undertaken, ending with 52–56 breeding pairs (Aghababyan & Ananyan 2011). In a recent study Aghajanyan and Harutyunyan (2023) report on the states of some nests of the species in 2021 and 2023.

Considering the necessity to (1) inform the following assessment of the species' global, European, and Mediterranean conservation statuses, (2) contribute to the evaluation of the Multi-species Action Plan to Conserve African-Eurasian Vultures (Botha *et al*. 2017) and (3) provide information for the regional conservation networks on one hand and having the data accumulated in 2003–2024, the current paper aims to reassess the Egyptian Vulture's national conservation status. Evaluation of the national conservation status is implemented via (1) estimating its current distribution range, (2) determining the breeding substrate, (3) estimating number of breeding pairs, (4) assessing the population dynamics, (5) recording the species' breeding success, (6) documenting the species' foraging behaviour and diet, (7) evaluating the major threats, and (8) assessing efficiency of the conservation measures and the role of the governmental bodies in the species' conservation.

## Material and Methods

### Study area

Armenia is part of the Caucasus ecoregion and is a landlocked mountainous country with an area of 29,743 km$^2$ and an elevation range from 375 to 4,090 m above sea level. Due to the significant elevation span, various climatic conditions create a high diversity of landscapes, including semi-desert, juniper woodland, deciduous forest, mountain steppe, and sub-alpine

areas. The terrain includes flat plains, mountain plateaus, and rugged areas, such as deep canyons, cliffs, and rocky outcrops (Aghababyan *et al*. 2015).

**Data collection**

From 2003 to 2024, our surveys covered 328 10×10 km squares (88% of the territory of Armenia) out of 374 squares, while 46 squares (12%) were not surveyed due to their proximity to the state border and administrative accessibility difficulties. Within the counted squares, 57 (15%) were visited every year, 91 (24%) were visited at least every three years, and the rest, 180 (48%), were visited opportunistically, combined with other projects, at least three times during 2003–2024 *(Figure 1)*. The uneven distribution of counting was determined by the lack of human capacity and funding, and therefore was optimised in a manner to do more regular surveys in the squares with more diverse habitats, while leaving opportunistic surveys for the areas of relatively uniform habitats, such as grasslands on the mountain plateaus. Within each square, we counted birds on one to three transects, depending on the number of main habitats in the square. The data included geographic coordinates (of the beginning and end of the transect), date, time, number, and the highest breeding code (Voříšek *et al*. 2008). The breeding codes vary from 0 to 16, indicating the behaviour and attributes of the observed bird individuals, for further estimation of their breeding likelihood

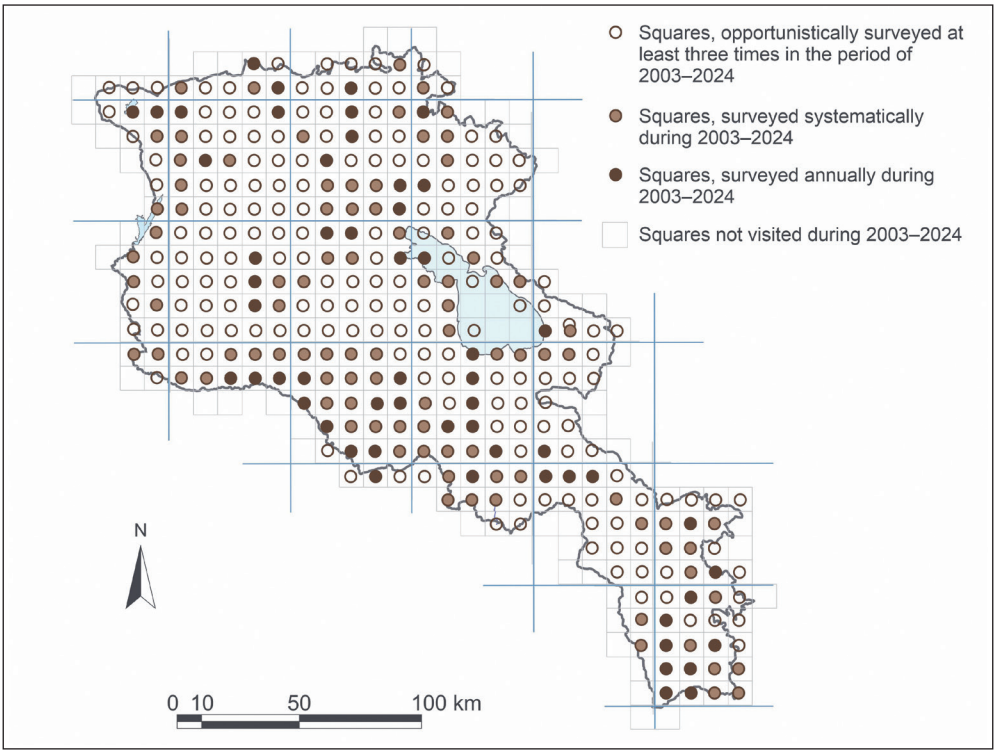


*Figure 1.* The map of the study area
*1. ábra* A vizsgálati terület térképe

*Table 1.* Breeding codes that indicate the likelihood of breeding of the observed bird species
*1. táblázat* Az adott madárfaj fészkelésének valószínűségét jelölő fészkelési kódok

| Code | Description |
|---|---|
| 0 | Species observed but suspected to be still on migration or to be a summering non-breeder. |
| 1 | Species observed in the breeding season in the possible nesting habitat |
| 2 | Singing male(s) present (or breeding calls heard) in breeding season |
| 3 | Pair observed in a suitable nesting habitat in the breeding season |
| 4 | Permanent territory presumed through registration of territorial behaviour (song, etc.) on at least two different days a week or more apart at the same place |
| 5 | Courtship and display |
| 6 | Visiting the probable nest site |
| 7 | Agitated behaviour or anxiety calls from adults |
| 8 | Brood patch on the adult examined in the hand |
| 9 | Nest building or excavating a nest hole |
| 10 | Distraction-display or injury-feigning |
| 11 | Used nest or eggshells found (occupied or laid within the period of survey) |
| 12 | Recently fledged young (nidicolous species) or downy young (nidifugous species) |
| 13 | Adults entering or leaving nest-site in circumstances indicating occupied nest (including high nests or nest-holes, the contents of which can not be seen) or an adult seen incubating |
| 14 | Adult carrying faecal sac or food for young |
| 15 | Nest containing eggs |
| 16 | Nest with young seen or heard |

and identification of occupied territories *(Table 1)*. All these data collected in the broader context were used for analysis of the distribution range and the population of the species. Additional efforts for monitoring of Egyptian Vultures were implemented via a count of the breeding pairs through occupied nests (when it was possible to find the nest) or via occupied territories, the location of which was determined by observing birds' behaviour, and was performed annually during early April to late June. These data were used for the computation of the species' population trend. Additionally, we visited the nests later in July – August to collect data on the number of fledglings, and to locate the nests opportunistically. These data were used for the estimation of the breeding success.

For better understanding the local breeding habitat requirements of the species, we collected data on each nest location (was it located on a cliff, in a niche, ledge, or cave), height above the ground (measured by triangulation from the distances to the bottom of the cliff and to the nest, which were measured by the laser rangefinder), and face of the slope (determined by compass).

To understand some peculiarities of the species' feeding behaviour, which can help in evaluating threats, we visited five selected nests (in 2003–2005, twice from three nests and three times from two nests) to document food remains. The food remains were identified visually, using consultation of mammologists and herpetologists of the Scientific Center

of Zoology and Hydrobiology of the National Academy of Sciences of the Republic of Armenia. Additionally, we documented all the sightings of the food-searching behaviour of Egyptian Vultures through direct observations from late April till mid-August. The observations included information on the geographic coordinates, date, time, behaviour of the bird (sitting on carcass, sitting in the waste dump, flying), and, if flying, approximate height of the bird from the ground, measured visually by the trained observers. Also, the visits to the nests of other raptors were recorded opportunistically. The observations were generously assisted by over 50 volunteers of the Armenian Ornithological Society.

To collect data for the evaluation of major threats, the following interviews have been conducted.

To estimate the rate of possible illegal killing in 2003–2024 we conducted 398 interviews with hunters and also surveyed the principal online and offline marketplaces where mounted bird specimens could be sold.

To identify whether the farmers use poisoned lures against wolves, 37 interviews with the local farmers were conducted in 2023.

To identify the scale of using non-steroidal anti-inflammatory drugs (NSAIDs) in livestock husbandry, seven interviews with regional chief vets and one interview with a dairy producer were conducted. The conditions of the interviews and the main questions for all the interviews are provided in *Appendix 1*.

Other conservation concerns were obtained through social networks with the help of the Armenian Ornithological Society.

To assess efficiency of the conservation measures and the role of the governmental bodies in the species' conservation the data was collected on the capacity of the State Inspectorate for Nature Protection and Mineral Resources. For this purpose, the interviews with the seven inspectors have been conducted in 2023–2024.

## Data analysis

### *Estimation of the breeding distribution of the species*

The visualisation of the species distribution range was done at the 10×10 km scope, using QGIS 3.30.2 software. For the purpose, in each 10×10 km cell, where the species was recorded, the average breeding code of all the records was calculated, and the cell was assigned with that average value. Then, the cells were graded by the following intervals of the average breeding code: 0.01–1.0 indicates a low likelihood of breeding; 1.01–3.0 indicates possible breeding, 3.01–4.0 indicates probable breeding, and 4.01 or more indicates highly probable breeding. Each interval was assigned a color in the green range: the darker the color, the higher the breeding likelihood. Considering the high level of the species' sensitivity, the visualisation was done in a manner not to disclose the cells with confirmed breeding.

The Area of species occupancy (AOO) and the Extent of Species occurrence (EOO) for the Egyptian Vultures were computed using the IUCN guidelines (IUCN Standards and Petitions Committee 2024). To calculate the AOO, in accordance to the methodology, we

applied another national grid of 2×2 km (BirdLinks 2019). Then, we summed up all the 2×2 km cells where the adult birds were observed in the breeding season, and multiplied the number of the cells by 4 km$^2$ (an area of the 2×2 km cell). To compute the EOO, the rule of minimum convex polygons (the smallest polygon in which no internal angle exceeds 180° and which contains all the sites of occurrence) was applied to the species' AOO, excluding discontinuities and disjunctions within the overall distribution inside the borders of the country.

***Estimation of the population of the species***

Considering the heterogeneity of the collected data, the estimation of the species abundance was done in several stages.

At first, the occupied nests were mapped on the 10×10 km cells and their number was computed. Then, the number of Egyptian Vultures in the probable and highly probable breeding cells was calculated, considering one pair per cell, if no more than two birds (with a territorial behaviour) were observed simultaneously. During April to June (which coincides with the period of incubating eggs and permanent patrolling the nest) the number of Egyptian Vultures observed outside the nest was considered as the number of breeding pairs, while during July to August (in the period, when both parents are searching for food) the number of observed birds was divided by two and taken as the number of breeding pairs. Those numbers were added to the known occupied nests. Then, the numbers of adult Egyptian Vultures at sites where congregations were observed (e.g. at waste dumps) were added to the previous two numbers, considering a 10 km buffer zone from the waste dump to the known breeding pairs. It should be noted that the congregations were observed in areas with numerous potential breeding localities, namely, the rocky gorges, where the cliffs contain numerous niches, caves, and covered ledges.

***Measuring reproductive success***

To measure reproductive parameters, we used the index of breeding success (Murray 2000), computed as the number of fledglings divided by the number of breeding pairs, assuming that an occupied nest with a bird staying in the nest for over an hour equals a territorial pair.

***The calculation of population trend of the species***

We used data of 26 breeding territories visited almost every year during 2003–2024 to calculate breeding population trends and processed 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 were calculated and presented as a linear function, showing population growth or decline. For the analysis, we have considered each breeding territory as a site, as the survey areas were kept constant over time. We used the time-effects module since we had data for all the years, and during the entire period 2003–2024 we had eight missing values out of 572 values (1.4%). Since these 26 breeding territories

are still a sample and do not cover the whole population of Armenia, we used the model with enabled overdispersion. 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 an 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). A statistically significant change was stated on the $p < 0.05$ level; otherwise, the population was considered stable (Pannekoek & van Strien 2005). Based on the linear trend, an average annual rate of population change was calculated, first via obtaining the change of y every year, and then computing the average value of these changes. Obtained annual rate of population change was then extrapolated to three generations of the species (IUCN Standards and Petitions Committee 2024), which is 40.23 years for the Egyptian Vulture (BirdLife International 2021).

### *Documenting the diet of the species*

To analyse the diversity of the food items found in the species nests, we used the Shannon–Wiener diversity index H (Dobrev *et al*. 2016a). The index was calculated for every breeding attempt and then averaged across the current breeding pair and the years. For the computation of the index PAST 4.03 was used. The average index and the standard errors were then computed.

To analyse the height of flight for better understanding the food searching behaviour, the range, average height, and standard error from the visual observations were computed.

## Results

### Distribution

During our surveys, the species was found to breed in 29 10×10 km squares *(Figure 2)*. It is found in the open and semi-open habitats, such as semi-desert, juniper woodland, fragmented deciduous woodland, mountain steppes, and subalpine grasslands, where suitable cliffs or rocky canyons are located *(Figure 3)*. The AOO for the species is 976 km$^2$, and the EOO is 19,024 km$^2$.

### Breeding substrate

The nesting sites are represented by various types of cliffs, with shallow caves, where the pairs build their nests *(Table 2)*. Nests were located on the cliffs, 7 to 110 meters above the ground (47.4±5.0 m, n=28), in shallow caves of 0.7–1.5 meters depth (0.9±0.03 m, n=28), with the entrance width of 0.6–1.4 meters (0.8±0.04 m, n=28), and entrance height of 0.6–1.5 meters (0.8±0.03 m, n=28). The aspect of nesting cliffs (n=28) was looking to

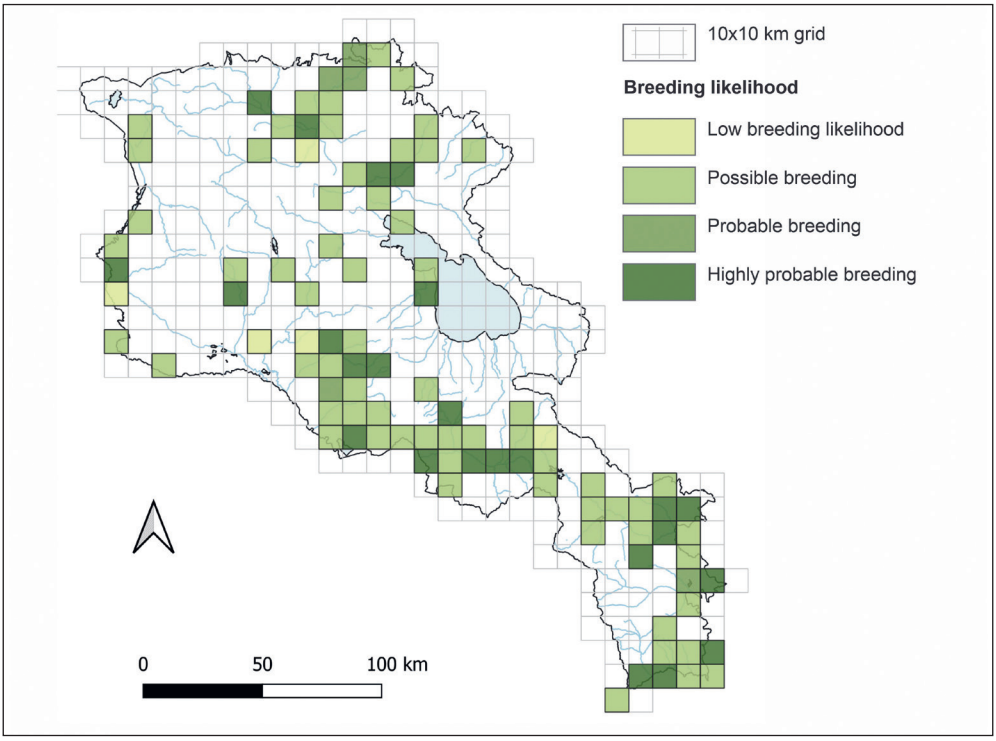


*Figure 2.* Breeding distribution of the Egyptian Vulture *(Neophron percnopterus)* in Armenia. The standard European grid cell of 10×10 km (outlined with pale grey) is applied to Armenia. The colour of the filled squares indicates the certainty of breeding: the darker the green colour, the higher the probability of breeding

*2. ábra* A dögkeselyű *(Neophron percnopterus)* költési elterjedése Örményországban. A standard európai 10×10 km-es hálózatot használtuk (halvány szürkével körvonalazva) Örményországra is. A színskála a fészkelés valószínűségét jelöli: minél sötétebb a zöld szín, annál valószínűbb a költés

*Table 2.* Summarised parameters of nesting sites of Egyptian Vulture *(Neophron percnopterus)*
*2. táblázat* A dögkeselyű *(Neophron percnopterus)* fészkelőhelyeinek összegzett paraméterei

| Parameter | Mean | Count | SD | SE | Min | Max |
|---|---|---|---|---|---|---|
| Altitude above ground (m) | 47.39 | 28 | 26.64 | 5.03 | 7 | 110 |
| Height of the niche entrance (m) | 0.82 | 28 | 0.17 | 0.03 | 0.6 | 1.2 |
| Width of the niche entrance (m) | 0.82 | 28 | 0.20 | 0.04 | 0.6 | 1.4 |
| Depth of the niche (m) | 0.93 | 28 | 0.18 | 0.03 | 0.7 | 1.5 |
| Elevation above sea level (m) | 1328 | 28 | 382 | 72.22 | 620 | 2040 |

the north-west (7%), north (14%), northeast (14%), east (21%), south-east (11%), south (4%), south-west (11%), and west (18%), thus revealing a lack of apparent preferences. The elevation range of the nest sites varied from 620 to 2,040 meters above sea level (1,328±72 m, n=28).

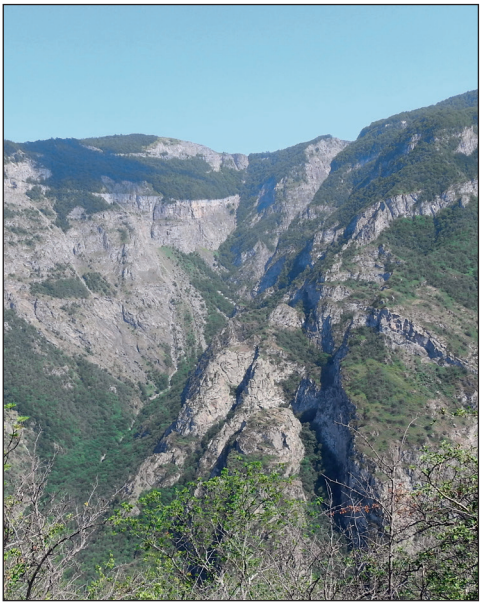

*Figure 3.* The breeding habitat of the Egyptian Vulture *(Neophron percnopterus)* in the Vorotan Canyon. Photo: Karen Aghababyan

*3. ábra* A dögkeselyű *(Neophron percnopterus)* fészkelőhelye a Vorotan kanyonban. Fotó: Karen Aghababyan

*Figure 4.* The foraging habitat of the Egyptian Vulture *(Neophron percnopterus)* in Ararat Province. Photo: Karen Aghababyan

*4. ábra* A dögkeselyű *(Neophron percnopterus)* táplálkozóterülete Ararát tartományban. Fotó: Karen Aghababyan

**Estimating the numbers and assessing the population dynamics**

The abundance of Egyptian Vultures is shown on the map *(Figure 5)*. In fact, in the last three years (2022–2024), 19 nests were recorded to be occupied by pairs and one nest by a single bird. After adding the probable breeding pairs, the estimation for 2022–2024 makes 39–43 breeding pairs in Armenia.

The breeding population trend demonstrates a moderate decline (multiplicative = 0.9880±0.0036, $p<0.01$), as shown in *Figure 6*. The breeding population of Egyptian Vultures in Armenia declined by 25% in 21 years, with an average annual rate of 1.19%, which equals a decrease of 48% in 40 years (three generations of the species). The decline over the last ten years was 11%.

**Recording the breeding success of the species**

During 2003–2024, breeding success was calculated for 195 breeding attempts from 15 pairs; however, the number of breeding attempts tracked annually varied from 5 to 15 (with an average of 8.86 per year). The breeding success fluctuated from 0.4 in 2020 (n=8) to 1.1 in 2013 (n=9), and its trend appears to be uncertain ($R^2$=0.070, F=1.511, p=0.233).

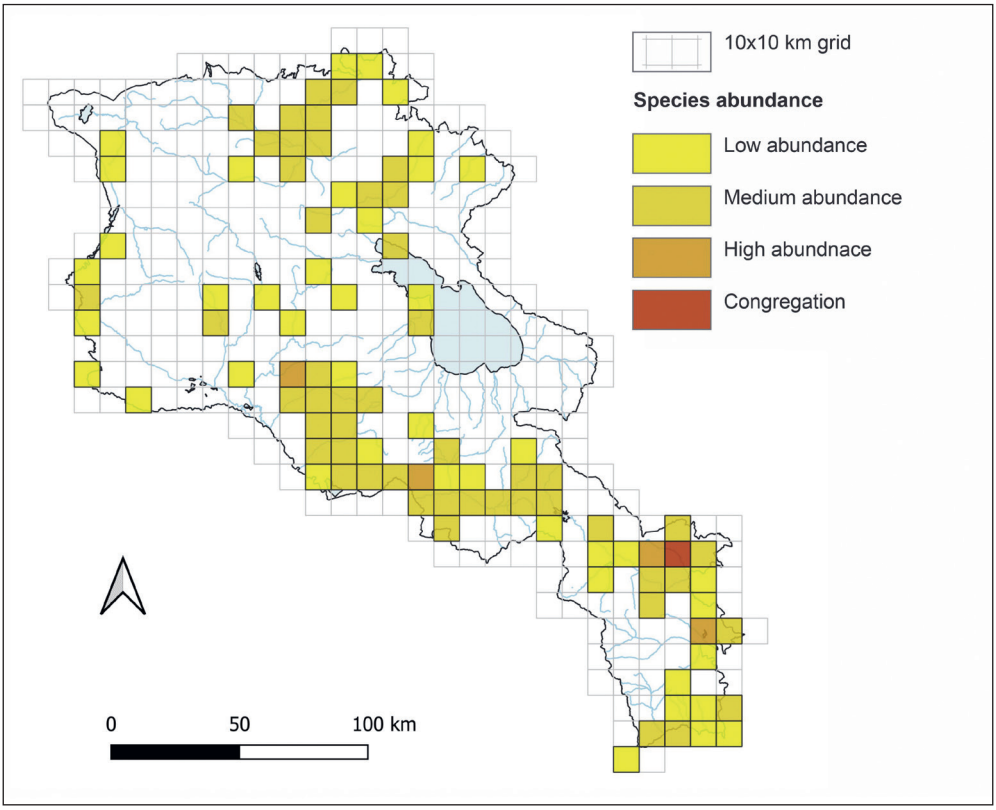


*Figure 5.* The abundance of the Egyptian Vulture *(Neophron percnopterus)* in Armenia. The standard European grid cell of 10×10 km (outlined with pale grey) is applied to Armenia. The filled squares indicate the records of the species in the breeding season and the average abundance per square: the darker the orange colour, the higher the abundance

*5. ábra* A dögkeselyű *(Neophron percnopterus)* abundanciája Örményországban. A standard európai 10×10 km-es hálózatot használtuk (halványszürkével körvonalazva) Örményországra is. A kitöltött négyzetek jelzik a faj költési időszakbeli észleléseit és a négyzetenkénti átlagos abundanciát; minél sötétebb a narancssárga szín, annál nagyobb az abundancia

## Foraging behaviour and diet

During the breeding season, the birds were observed searching for food in natural habitats, like semi-deserts, dry mountain steppes, and subalpine grasslands *(Figure 4)*; also birds often were found feeding on municipal garbage dumps, forming congregations at three dump sites (up to seven birds at Sisian municipal dump, up to 12 birds at Stepanavan municipal dump, and up to 49 birds at Goris municipal dump). When searching for food, Egyptian Vultures were mainly observed circling at 30–100 meters above the ground (63±0.88, n=687), although sometimes the birds were observed circling as high as 200 or 300 m.

Within 2003–2024, the species was observed feeding on roadkill carcasses on 13 occasions, these consisted of species such as stray dogs (6 cases, 46%), feral cats (3 cases, 23%), and snakes (4 cases, 31%).

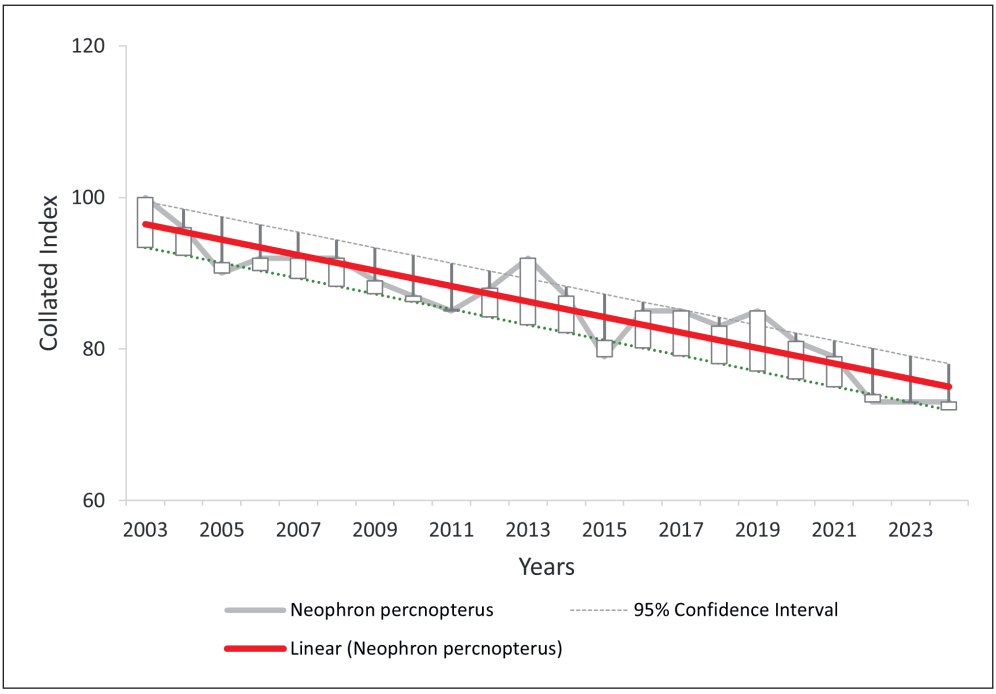


*Figure 6.* Population trend of the Egyptian Vulture *(Neophron percnopterus)* in 2003–2024. The grey lines indicate observed population dynamics throughout the years. The red line indicates a linear population trend

*6. ábra* A dögkeselyű *(Neophron percnopterus)* populációjának alakulása 2003–2024 között. A szürke vonalak az évek során megfigyelt populációdinamikát jelzik. A piros vonal lineáris populációs tendenciát jelez

The food remains recorded in five nests of Egyptian Vultures included small and medium-sized mammals, birds, and reptiles *(Appendix II)*. Among the recorded samples (n=96), 20 (21%) belong to reptiles, 34 (35%) to birds, and 42 (44%) to mammals. Also, 28 samples (29%) belong to domestic animals, such as stray dogs, feral cats, domestic goats and sheep. The Shannon–Wiener diversity index (H) varies between 1.677 to 2.811 depending on the year and the location, making on average 2.372±0.117 per year, and 2.391±0.174 per nest *(Table 3)*.

## Evaluation of major threats to the species

### *Direct persecution*

During the observed period, the illegal killing of Egyptian Vultures was reported 11 times (three in 2003, two in 2004, one in 2005, two in 2006, one in 2008, one in 2009, and one in 2012). The poaching was mainly driven by the desire to have a taxidermied raptor specimen. In 2003–2005, at least eight cases of nestlings being stolen from the nests were documented, with the main purpose of selling them.

*Table 3.* Shannon–Wiener diversity index (H') of the food remains, found in the nests of Egyptian Vulture *(Neophron percnopterus)*

*3. táblázat* A dögkeselyű *(Neophron percnopterus)* fészkeiben talált táplálékmaradványok Shannon–Wiener diverzitási indexei

| Nest location | Year | H | Mean H' per nest |
|---|---|---|---|
| Kotayk | 2003 | 2.714 | 2.712 |
| | 2004 | 2.611 | |
| | 2005 | 2.811 | |
| Vayots Dzor | 2003 | 2.795 | 2.798 |
| | 2004 | 2.802 | |
| Syunik | 2003 | 2.554 | 2.385 |
| | 2004 | 2.216 | |
| Lori | 2003 | 2.260 | 2.224 |
| | 2004 | 2.187 | |
| Aragatsotn | 2003 | 2.101 | 1.837 |
| | 2004 | 1.677 | |
| | 2005 | 1.733 | |
| Annual Mean H | 2003 | 2.485 | 2.352 |
| | 2004 | 2.299 | |
| | 2005 | 2.272 | |

### *Electrocution and collisions*

During the observed period, we documented five cases when the birds were electrocuted in 2003, 2005, 2006, 2009, and 2011.

### *Poisoning*

The use of the following non-steroidal anti-inflammatory drugs (NSAIDs) has been documented. In Shirak province, diclofenac was used for treating dogs only, at least 20 cases in 2024. In Tavush, Ararat, and Vayots Dzor provinces, ketoprofen was used by the small-scale farmers for cattle: in 2024, 17 cases of ketoprofen use in Tavush, 29 in Ararat, and 13 in Vayots Dzor were reported. In Syunik province, ketoprofen was used for pigs (37 cases in 2024), and sometimes for cattle (9 cases in 2024). No NSAIDs have been recorded to be used in Lori province. The prescription of the drugs is given by the local veterinarians. The diclofenac is widely used in industrial cattle husbandries located in Spitak (Lori), Tashir (Lori), Kapan (Syunik), Dilijan (Tavush), and Ararat (Ararat). When livestock die in industrial husbandry, it is usually utilised by the companies, which bury the carcasses without following established standards. During the slaughtering of the cattle, the internal organs are often disposed of in nature. In all the surveyed areas, specialised cattle burial grounds do not exist.

The interviews of 152 people, including 149 local households and three small scale farmers located in seven villages showed that during the five-year period (2019–2023), Grey Wolves *(Canis lupus)* attacked livestock 19 times, damaging 46 animals (10 cattle, 35 sheep, and

1 horse); the number of attacks varied from two to four per village and from two to six per year; the number of animals damaged per attack made 1–2 (cattle, sheep, and horse) in 45 cases and 23 (sheep) in one case. The local farmers do not receive any compensation from the government and protect the livestock on their own. Among protection measures, they mentioned guns, shepherd dogs, and petards, which they squib to scare the wolves. Petards have become very popular among farmers and shepherds in the last five years. None of the surveyed farmers use poisoned lures against wolves.

## Discussion

### Distribution

Considering the current knowledge of the species' distribution in Armenia and the newest criteria of IUCN Standards and Petitions Committee (2024), we can state that the EOO (19,024 km$^2$) and AOO (976 km$^2$) of the Egyptian Vulture in Armenia qualifies the category Vulnerable according to criteria B1 (EOO < 20,000 km$^2$), and B2 (AOO < 2,000 km$^2$).

### Breeding substrate

Considering the number of cliffs and rocks with the appropriate small caves, we can state that the species does not feel a shortage in the breeding substrate in the country.

The comparison of the nest site selection in the period 2003–2024 with some historical records showed that, in some cases, birds started selecting nesting sites at higher altitude from the ground, which is most probably linked to the increased human disturbance. Thus, several historical nest sites located at relatively low elevations (Adamian & Klem 1999) have been found empty in 2003, which coincided with the peak period of illegal taking of the vultures' nestlings from the nests.

### Population dynamics, and other demographic features

According to the newest criteria of IUCN Standards and Petitions Committee (2024), we can state that the population trend of the species in Armenia qualifies to the category Vulnerable according to criteria A2a (observed population reduction > 30%); however, the number of mature individuals of Egyptian Vultures in Armenia qualifies to the category Endangered according to criteria D1 (number of mature individuals is < 250).

As for breeding success, according to the existing results, only the strong fluctuation can be documented.

Since the Egyptian Vultures are migratory, they face other threats in the countries that they pass through during migration or stay during wintering (Buechley *et al*. 2018, Oltra *et al*. 2024). Therefore, their mortality can be determined by other factors outside Armenia, so the conservation of the species in the country is just a part of the protection of its national population.

Regarding the possible rescue or buffering of the declining Armenian population by the birds from neighbouring countries, there is unfortunately a lack of information on population trends: it was last reported stable in Georgia based on data from 2001–2012 (Abuladze 2013) and was last reported stable in 2009 in the Russian part of North Caucasus (Dzamirzoev & Bukreev 2009). The information on the species population trend is lacking for Iran and Türkiye (BirdLife International 2021). It means that the possible augmentation of the Armenian population of Egyptian Vultures by individuals from the Caucasus ecoregion is uncertain.

Taking into account that the continuously declining population trend is marginal to the threshold of the category Endangered (-48% in three generations) and there are few chances of population augmentation from neighbouring countries, as well as the current level of threats, we suggest considering its national conservation status as Endangered.

## Foraging behaviour and food supply

The altitude of the food searching flight of resident Egyptian Vultures is not well described, and the research, which reflect the flying altitude of the species, are mainly related to the study of their migratory behaviour (McGrady *et al*. 2022). While the species is known to be an opportunist, being able to take a wide variety of food items (Ash & Atkins 2009), our observations show that in Armenia, the Egyptian Vultures are often searching for food, flying at low elevation (30–100 meters), most probably looking for carcasses, which are invisible to the large vultures flying at higher elevations, e.g. Griffon Vulture *(Gyps fulvus)* searches for food from 248±112.3 meters above ground (Xirouchakis & Andreou 2009). This assumption is linked to the food remains that we found in the nests of the species. As a part of this behaviour, of the species was often observed flying above the roads, probably looking for the road-kills, and feeding on these. At the same time, the pairs, which live close to the large dump sites, regularly visit those to search for food. It appears that Egyptian Vultures, which live close to Griffon Vultures' colonies, find an additional food supply in those nests. When the nestling of the Eurasian Griffons is big, the parents regurgitate the food on the floor of the nest, and the nestling eats it from the floor. Most probably, Egyptian Vultures find and steal the food items by regularly inspecting the nests of Eurasian Griffons when the parents are absent.

## Threats

The following reasons could have contributed differently to the consistent decline throughout 2003–2024.

### *Direct persecution*

In 2003–2006, direct persecution could have played a significant role in this decrease. Thus, the nest, located near Nurnus village, was easily accessible for humans, and the nestlings were stolen every year in 2003, 2004, and 2005. After that one of the birds left the breeding

site in 2006, and another single bird disappeared starting from 2008. Ironically, the nestlings have been stolen to be sold for falconry, as the local people who have been stealing the nestlings did not recognize the bird species and had just heard about "white raptors which could be sold for a high price." Eventually, after several unsuccessful attempts, the stolen birds were sold as pets to local outdoor restaurants and as collection specimens to the Yerevan Zoo (Vardges Hakobyan, former taxidermist of Yerevan Zoo, *pers. com*.).

More recently, illegal killing significantly declined, mainly due to increased educational and awareness-raising activities of conservation NGOs, and (from 2018) due to the strengthened control implemented by the Inspectorate for Nature Protection and Mineral Resources. Now, the illegal shooting of Egyptian Vultures in Armenia is an occasional occurrence.

### *Poisoning*

Besides direct persecution, the decline throughout the entire period (2003–2024) can be related to the poisoning of Egyptian Vultures at dump sites. In Armenia, separate garbage collection is significantly underdeveloped in Yerevan and almost entirely lacking in other regions. This means that various electronic devices and batteries are disposed together with the food remains. It may cause a leak of lead, chromium, cadmium, mercury, and other heavy metals, as was shown for Yerevan city (Tepanosyan *et al*. 2017). The metals can penetrate food remains and poison the Egyptian Vultures and other scavengers. Indirectly, this could be proven by the fact that four out of nine known nests (44%), located in the 5 km buffer from the large waste dumps, became empty. The poisoned lures against the wolves do not represent threats to the species, as it happened in the Balkan Peninsula (Pantović *et al*. 2022). The poisoning of stray dogs and cats is prohibited in Armenia, and so far, has been reported occasionally. The efforts to eliminate rodents using various compounds on a zinc-phosphide base is applied only inside the cities, poses a very low risk of secondary poisoning, and most likely has no path to affect the Egyptian Vulture directly. It is possible though that the rodents in the cities can be consumed by stray dogs and cats, which in turn can then appear in the dump sites, presenting a danger for the scavengers, including the Egyptian Vulture. Also, the use of rodenticides in agriculture can find its way to the species, as searching for food at a low elevation the species finds carcasses of rodents *(Appendix II)*.

The use of NSAIDs in livestock husbandry in Armenia varies. Currently, only two types of NSAIDs have been identified as being used in the country, namely diclofenac and ketoprofen, which both are known to be toxic to vultures (Naidoo *et al.* 2009, Moreno-Opo *et al.* 2021). They are prescribed by newer-generation veterinarians, while the veterinarians of the old generation continue to prescribe antibiotics. Usually, the use of NSAIDs for small-scale farmers is uncommon being not affordable, and some NSAIDs are used for treating domestic dogs, but not for livestock. In industrial farming, the use of NSAIDs is widespread in Lori, Syunik, Tavush, and Ararat provinces. However, the death rate in industrial farming is much lower, because the weak animals are usually immediately designated for slaughtering. Therefore, the livestock carcasses from industrial farming are disposed of and rarely end up in the environment. The low impact of NSAIDs at present is indirectly proven by the fact that the population of Griffon Vultures, which highly depends on large domestic

ungulates, has increased in Armenia (Aghababyan *et al*. 2019). Despite that, to decrease the risk of poisoning vultures with NSAIDs, it is necessary to improve the regulations on the disposal of dead livestock.

***Human disturbance***

Another threat is related to the various types of human disturbance. At the beginning of the National Bird Monitoring program, in 2003 (BirdLinks Armenia 2019), there were 11 known nests of the species in the country (Adamian & Klem 1999, Aghababyan 2001). Among them, some nests were found empty. Those are: the nest that was found in 1980 near Kapan town and located 2.5 meters above ground; the nest that was found in the 1960s near Yerevan city and located 5–7 meters above ground; and the nest that was found in 1995 near Vedi town and located 4 meters above ground. The most probable reason is continuous disturbance of the nests by the local youths due to their easy accessibility. Such disturbance often took place because of the natural interest and a lack of education among youths in rural areas.

Next aspect of the disturbance is related to the construction of tourism infrastructure, as tourism in Armenia is developing rapidly (Armstat 2023). Urbanization and development of wild areas in conditions of a weak Environmental Impact Assessment can result in unnecessary disturbance of birds and nest abandonment. Thus, in the Vayots Dzor region, one of the well-known pairs left the nest after the construction of a 20-meter-high hotel at about 100 meters from the nest.

Another type of disturbance comes from an increase in outdoor activities, such as hiking, rock climbing, and jeep-touring, often accompanied by drone filming and photography. Such irresponsible outdoor activities can disturb the birds during the breeding season, causing the abandonment of their nests, similar to the cases described for the Egyptian Vultures in the Balkan Peninsula (Tsiopelas 2023), for the Spanish Imperial Eagle *(Aquila adalberti)* in central Spain (Gonzalez *et al*. 2006), and the Eastern Imperial Eagle *(A. heliaca)* in the Sakar Mountain, Bulgaria (Dobrev *et al*. 2021). The increase of this type of disturbance is directly related to the development of social networks and the growing number of people who are shooting videos to raise their popularity on social media and other profiles. Wildlife objects are one such topic, and the case when the local rock climber was visiting an Egyptian Vulture's nest once a day, taking a video shot (of the nestling) was recorded in 2021. Fortunately, the case was rapidly detected by the members of the Armenian Ornithological Society, and the harmful practice stopped, which does not mean, though, that this practice cannot be repeated in other areas becoming more widespread.

In addition, military activities can be another disturbing factor, which can provoke the abandonment of a breeding site, as was documented for birds and mammals (Lawrence *et al*. 2015, Mendiratta *et al*. 2021). Due to these activities, two nests located close to the eastern border of Armenia were abandoned in 2021, right after the military conflict along the Azerbaijan border. The nests were located within the critical 10 km buffer zone of the conflict (Lawrence *et al*. 2015), and it is well established that terrestrial military conflicts can impact wildlife.

### *Electrocution and collisions*

Electrocutions and collisions on powerlines have not been surveyed systematically, and the five recorded incidents in 22 years can only indicate that the threat occurs in the country. Considering the higher risk of electrocution of the Egyptian Vultures reported by Angelov *et al*. (2013) and Dobrev *et al*. (2016b), it is possible that the threat has a bigger scale, especially in post-fledgling dispersion and migration time.

## Conservation measures

Currently, the Egyptian Vulture is listed in the Red Book of the Animals of Armenia as Endangered (Aghasyan & Kalashyan 2010), included in *Appendix II* of the CITES and Resolution 6 of the Bern Convention. Currently, the nesting ranges of the species are partly covered by Dilijan and Sevan National Parks, Zangezur Biosphere Complex, Khosrov Forest State Reserve, and 12 candidate Emerald Sites (Fayvush *et al*. 2016), protected under the Bern Convention.

Taking into account the global conservation measures (Oppel *et al*. 2021) and considering the identified local trend and threats, it is suggested: (1) to develop a specific national action plan, ideally combined with other vulture species; (2) to begin revision of the policy on hazardous waste management, to develop and introduce necessary amendments on separating devices, batteries, and other goods, which can contain heavy metals and other hazards; (3) begin introducing the policy on separating waste, which can contain heavy metals and other hazards; (4) to secure proper Environmental Impact Assessment of constructions in the buffer zones of known nests of the Egyptian Vultures; (5) to restrict the outdoor activities including drone video shooting in the buffer zone of the known nests in the breeding season; (6) to continue study of the possible influence of NSAIDs on Egyptian Vultures, ideally, along with other vulture species; (7) to review the policy on the disposal of dead livestock and to suggest proper amendments; (8) to initiate a country wide study on assessing influence of electrocution and collisions on energy infrastructure on the species; (9) to contribute in strengthening cooperation of Armenia with other countries of the species range within the framework of the CMS Raptors MoU, Flyway Action Plan for the Conservation of the Balkan and Central Asian Populations of the Egyptian Vulture (Nikolov *et al*. 2017), and Multi-species Action Plan to Conserve African–Eurasian Vultures; and (10) to continue awareness raising and education of hunters aimed at further decreasing possibility of illegal killing of Egyptian Vultures.

The proposed conservation measures should be supported by continuous monitoring of the species for two purposes: (i) to track its further population trend, and (ii) to indicate the efficiency of the undertaken conservation measures.

The suggested actions can contribute implementation of the next National Biodiversity Strategy and Action Plan, which is being developed at present (Voskehat Grigoryan, Head of Division on Biodiversity and Protected Areas Policy, personal communication), considering the global targets of the Kunming-Montreal Global Biodiversity Framework (Convention on Biological Diversity 2022).

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*Appendix I.* Conditions of the interviews and the questions for hunters
*1. melléklet* Az interjúk feltételei és a vadászoknak feltett kérdések

According to Armenian legislation, there are no requirements for the ethical clearance of surveys and interviews unless they are aimed at obtaining personal information. All the interviews were designed to be confidential, with no questions on personal information. The informed consent was obtained from the interviewees before the interviews began. The interviews were open-ended, and the main questions were:

(1) have you ever seen Egyptian Vulture? (the question was supplemented with a photo);
(2) do you know about any case of its shooting;
(3) in your opinion, what was the reason of its shooting.

**Conditions of the interviews and the questions for the State Inspectorate for Nature Protection and Mineral Resources**

The interviews have no requirements to be confidential. The informed consent was obtained from the interviewees before the interviews began. The interviews were open-ended, and the main questions were:

(1) Do the body's inspectors know the Egyptian Vulture and its conservation status (the question was supplemented with a photo)?
(2) Did you ever record the mortality of the species?
(3) Do you have sufficient capacity to track illegal shootings?

**Conditions of the interviews and the questions for the farmers**

All the interviews were designed to be confidential, with no questions on personal information. The informed consent was obtained from the interviewees before the interviews began. The interviews were open-ended, and the main questions were:

(1) what type of livestock do you have?
(2) how many?
(3) do you keep the livestock in the stable or send them to the pastures for grazing?
(4) did your livestock ever get attacked by wolves?
(5) how many items of livestock did you lose?
(6) what measures do you use to keep the wolves away from the livestock?

**Conditions of the interviews and the questions for the regional chief vets and diary producers**

The interviews were structured, confidential, and with informed consent, and the questions were:

(1) Do you have livestock care in your duty?
(2) What types of NSAIDs do you use?
(3) How often do you use NSAIDs?
(4) Do you have a special cattle burial ground on your premises?

*Appendix II.* Food items of the Egyptian Vulture *Neophron percnopterus* collected from five nests in 2003–2005
*2. melléklet* A dögkeselyű *(Neophron percnopterus)* 2003–2005-ben öt fészekből gyűjtött táplálék maradványai

| Taxonomic groups and Species | Nest location | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Garni | | | Jermuk | | Goris | | Debet | | Byurakan | | |
| | Kotayk | | | Vayots Dzor | | Syunik | | Lori | | Aragatsotn | | |
| | 2003 | 2004 | 2005 | 2004 | 2005 | 2004 | 2005 | 2004 | 2005 | 2003 | 2004 | 2005 |
| **Reptiles** | | | | | | | | | | | | |
| *Eumeces schneideri* | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Ophisaurus apodus* | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 1 |
| *Macrovipera lebetinus* | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Coluber nummifer* | 2 | 2 | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Dolichophis schmidti* | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Natrix tesellata* | 1 | 0 | 1 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| Snake sp. | 1 | 2 | 1 | 2 | 3 | 1 | 2 | 0 | 1 | 0 | 0 | 0 |
| **Birds** | | | | | | | | | | | | |
| *Falco tinnunculus* | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Asio otus* | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Cuculus canorus* | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Taxonomic groups and Species | Nest location | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Garni | | | Jermuk | | Goris | | Debet | | Byurakan | | |
| | Kotayk | | | Vayots Dzor | | Syunik | | Lori | | Aragatsotn | | |
| | 2003 | 2004 | 2005 | 2004 | 2005 | 2004 | 2005 | 2004 | 2005 | 2003 | 2004 | 2005 |
| Alaudidae sp. | 2 | 2 | 1 | 2 | 3 | 1 | 2 | 0 | 0 | 3 | 3 | 2 |
| *Anthus* sp. | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 1 | 0 |
| *Hirundo rustica* | 2 | 1 | 3 | 3 | 2 | 2 | 3 | 1 | 1 | 0 | 0 | 0 |
| *Ptyonoprogne rupestris* | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 2 | 0 | 0 | 0 |
| *Oenanthe oenanthe* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Oenanthe isabellina* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| *Lanius collurio* | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Pica pica* | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 0 | 0 | 0 |
| **Mammals (wild)** | | | | | | | | | | | | |
| *Apodemus* sp. | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 1 | 3 | 2 | 1 | 2 |
| *Microtus* sp. | 0 | 1 | 2 | 0 | 2 | 0 | 0 | 2 | 1 | 3 | 1 | 0 |
| *Meriones persicus* | 2 | 3 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Vulpes vulpes* | 1 | 0 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Meles meles* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Capra aegagrus* | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Mammals (domestic)** | | | | | | | | | | | | |
| *Canis familiaris* | 2 | 3 | 2 | 1 | 1 | 2 | 3 | 3 | 3 | 1 | 2 | 1 |
| *Felis catus* | 0 | 1 | 1 | 0 | 1 | 1 | 2 | 2 | 1 | 1 | 0 | 1 |
| *Capra hircus* | 1 | 2 | 2 | 0 | 1 | 1 | 0 | 2 | 2 | 1 | 0 | 0 |
| *Ovis aries* | 0 | 1 | 1 | 1 | 2 | 3 | 1 | 4 | 3 | 2 | 1 | 0 |

## References


Abuladze, A. 2013. Birds of Prey of Georgia. – Lasha Kvichia DOI: 10.13140/2.1.1904.3208

Adamian, M. & Klem, D. Jr. 1999. Handbook of the Birds of Armenia. – American University of Armenia

Aghababian, K. 2001. Some Peculiarities of the Vertical Distribution, Breeding Biology and Ecology of Birds in Meghry Region of Armenia. – PhD Thesis, NAS RA Institute of Zoology

Aghababyan, K. & Ananyan, V. 2011. Assessment of the Conservation Status of Egyptian Vulture *(Neophron percnopterus)* in Armenia. – Abstract Book of International Conference "The Birds of Prey and the Owls of Caucasus". Abastumani, Georgia, 26–29. October 2011.

Aghababyan, K. & Bildstein, K. 2004. Assessing the Conservation Status of Armenian Vultures: Sentinels of Environmental Change. – Report to CRDF and NFSAT Foundations CRDF/NFSAT Award #12025/BI 06802

Aghababian, K., Bildstein, K. & Ghasabyan, M. 2004. Vultures of Armenia. – Environment of Caucasus. Tbilisi 2(7): 4–6.

Aghababyan, K., Khanamirian, G. & Gevorgyan, V. 2019. An update of current situation of Griffon Vultures *Gyps fulvus* (Hablitz, 1783) in Armenia. – Tichodroma – Journal of Slovak Ornithological Society 31: 3–10.

Aghababyan, K. E., Ter-Voskanyan, H., Tumanyan, S. & Khachatryan, A. 2015. First National Atlas of the Birds of Armenia. – Bird Census News European Atlas News 28(2): 52–58.

Aghajanyan, L. H. & Harutyunyan, L. A. 2023. The preliminary results of 2021 and 2023 Egyptian Vulture breeding monitoring in Armenia. – Raptors Conservation S2: 104–107. DOI: 10.19074/1814-8654-2023-2-104-107

Aghasyan, A. & Kalashyan, M. (eds.) 2010. The Red Book of Animals of the Republic of Armenia. – Ministry of Nature Protection

Angelov, I., Hashim, I. & Oppel, S. 2013. Persistent electrocution mortality of Egyptian Vultures *Neophron percnopterus* over 28 years in East Africa. – Bird Conservation International 23(1): 1–6. DOI: 10.1017/S0959270912000123

Armenia.Observation.Org. 2024. *Neophron percnopterus*. Dataset of Observation International Foundation. – https://armenia.observation.org/ (Downloaded on 19th July 2024)

Armstat 2023. Statistical Yearbook of Armenia. – Yerevan: Statistical Committee of RA (Armstat)

Ash, J. S. & Atkins, J. 2009. Birds of Ethiopia and Eritrea: An Atlas of Distribution. – Christopher Helm, London, UK.

BirdLife International 2021. Species factsheet: Egyptian Vulture *Neophron percnopterus*. – https://datazone.birdlife.org/species/factsheet/egyptian-vulture-neophron-percnopterus on 5th of January 2025.

BirdLinks Armenia 2019. Guidelines for National Bird Monitoring in Armenia. – BirdLinks Armenia NGO. Technical Report № BLA-001-2019.

Botha, A. J., Andevski, J., Bowden, C. G. R., Gudka, M., Safford, R. J., Tavares, J. & Williams, N. P. 2017. Multi-species Action Plan to Conserve African-Eurasian Vultures. – CMS Raptors MOU Technical Publication No. 5. CMS Technical Series No. 35. Coordinating Unit of the CMS Raptors MOU, Abu Dhabi, United Arab Emirates

Buechley, E. R., Oppel, S., Beatty, W. S., Nikolov, S. C., Dobrev, V., Arkumarev, V., Saravia, V., Bougain, C., Bounas, A., Kret, E., Skartsi, T., Aktay, L., Aghababyan, K., Frehner, E. & Şekercioğlu, Ç. H. 2018. Identifying critical migratory bottlenecks and high-use areas for an endangered migratory soaring bird across three continents. – Journal of Avian Biology 49(7): e01629. DOI: 10.1111/jav.01629

Cramp, S. & Perrins, C. M. (eds.) 1980. Handbook of the Birds of Europe, the Middle East and Africa. The Birds of the Western Palearctic. Vol. 2. Hawks to Bustards. – Oxford University Press, pp. 64–71.

Convention on Biological Diversity 2022. 15/4. Kunming-Montreal Global Biodiversity Framework. – Decision Adopted by the Conference of the Parties to the Convention on Biological Diversity. Agenda item 9A. Montreal, Canada, 7–19. December 2022.

Dahl, S. K. 1954. Fauna Armyanskoi SSR [Fauna of Armenian SSR]. – Yerevan: Academy of Sciences Press, Armenian SSR. (in Russian)

Dobrev, V., Boev, Z., Arkumarev, V., Dobrev, D., Kret, E., Saravia, V., Bounas, A., Vavylis, D., Nikolov, S. & Oppel, S. 2016a Diet is not related to productivity but to territory occupancy in a declining population of Egyptian Vultures *Neophron percnopterus*. – Bird Conservation International 26(3): 273–285. DOI: 10.1017/S0959270915000155

Dobrev, V., Kafetzis, A., Skartsi, T., Saravia, V., Bounas, A., Sidiropoulos, L., Oppel, S., Manolopoulos, A., Popgeorgiev, G. & Nikolov, S. C. 2016b Identifying potentially dangerous electricity infrastructure to Balkan population of Egyptian Vulture and mitigation measures. – Technical Report under Action A6 of the LIFE+ project "The Return of the Neophron" (LIFE10 NAT/BG/000152). BSPB, Sofia

Dobrev, D., Dobrev, V. & Demerdzhiev, D. 2021. Human activities can hinder the breeding of a top avian predator: preliminary results. – Ornis Hungarica 29(2): 71–80. DOI: 10.2478/orhu-2021-0020

Dzamirzoev, G. S. & Bukreev, S. A. 2009. Status of Egyptian Vulture *Neophron percnopterus* in the North Caucasus, Russian Federation. – Sandgrouse 31: 128–133.

eBird Basic Dataset 2024. Version: EBD_relMay-2024. – Cornell Lab of Ornithology, Ithaca, New York

Fayvush, G., Arakelyan, M., Aghababyan, K., Aleksanyan, A., Aslanyan, A., Ghazaryan, A., Oganesyan, M., Kalashyan, M. & Nahapetyan, S. 2016. The "Emerald" Network in the Republic of Armenia. – Ministry of Nature Protection

Gonzalez, L. M., Arroyo, B., Margalida, A., Sanchez, R. & Oria, J. 2006. Effect of human activities on the behaviour of breeding Spanish Imperial Eagle *(Aquila adalberti)*: management implications for the conservation of a threatened species. – Animal Conservation 9(1): 85–93. DOI: 10.1111/j.1469-1795.2005.00016.x

IUCN Standards and Petitions Committee 2024. Guidelines for Using the IUCN Red List Categories and Criteria. Version 16. e https://www.iucnredlist.org/resources/redlistguidelines (Downloaded on 7th May 2024)

Lawrence, M. J., Stemberger, H. L. J., Zolderdo, A. J., Struthers, D. P. & Cooke, S. J. 2015. The effects of modern war and military activities on biodiversity and the environment. – Environmental Reviews 23(4): 443–460. DOI: 10.1139/er-2015-0039

Leister, A. F. & Sosnin, G. V. 1942. Materialy po ornitofaune Armyanskoi SSR [Materials on Ornithofauna of the Armenian SSR]. – ARMFAN. (in Russian)

McGrady, M., Schmidt, M., Elahi, Z. & Meyburg, B.-U. 2022. Tracking of an Egyptian Vulture *Neophron percnopterus* as it transitions from being a floater to a territory-holder. – Sandgrouse 44: 122–133.

Mendiratta, U., Osuri, A. M., Shetty, S. J. & Harihar, A. 2021. Mammal and bird species ranges overlap with armed conflicts and associated conservation threats. – Conservation Letters 14(5): e12815. DOI: 10.1111/conl.12815

Moreno-Opo, R., Carapeto, R., Casimiro, R., Rubio, C., Muñoz, B., Moreno, I. & Aymerich, M. 2021. The veterinary use of diclofenac and vulture conservation in Spain: Updated evidence and socio-ecological implications. – Science of the Total Environment 796: e148851. DOI: 10.1016/j.scitotenv.2021.148851

Murray, B. 2000. Measuring annual reproductive success in birds. – Condor 102(2): 470–473. DOI: 10.1093/condor/102.2.470

Naidoo, V., Wolter, K., Cromarty, D., Diekmann, M., Duncan, N., Meharg, A., Taggart, M., Venter, L. & Cuthbert, R. 2009. Toxicity of NSAIDs to *Gyps* vultures: A new threat from ketoprofen. – Biology Letters 6(3): 339–341. DOI: 10.1098/rsbl.2009.0818

Nikolov, S., Barov, B., Bowden, C. & Williams, N. 2017. Flyway Action Plan for the Conservation of the Balkan and Central Asian Populations of the Egyptian Vulture *Neophron percnopterus* (EVFAP). – FINAL DRAFT. DOI: 10.13140/RG.2.2.15431.39848

Oltra, J., García, J., Carbonell, I., Jambas, J., Álvarez, E., Iglesias-Lebrija, J. J., Gil-Carrera, A., Pérez-García, J. M., Frías, Ó., González del Barrio, J. L., Blanco, G. & Carrete, M. 2024. Early life movements and mortality of Egyptian Vultures: Implications for transcontinental conservation. – Ecology and Evolution 14(9): e70291. DOI: 10.1002/ece3.70291

Oppel, S., Arkumarev, V., Bakari, S., Dobrev, V., Dobrev, D., Popgeorgiev, G., Saravia, V., Kret, E., Bounas, A., Vavylis, D., Pourchier, C., Razack, A., Onoja, J. D., Apeverga, P., Ivande, S., Muhammed, S., Hanson, H. Jr., Jbour, S., Asswad, N. G., Qaneer, T., Kostadinova, I., Skartsi, T., Kapsalis, E., El Moghrabi, L., Dayyoub, M., Osta, M., El Safoury, H., Raouf, M., Topi, M., Xheka, E., Bino, T., Duroaos, K., Xherri, X., Petrovski, N., Velevski, M., Aktay, L., Özuslu, S., Yeniyurt, C., Erkol, I. L., Chetin, T., Shobrak, M., Jaradi, G. R., Wondafrash, M., Ruffo, A., Mengistu, S., Tesfaye, M., Ngari, A. & Nikolov, S. 2021. Major threats to a migratory raptor vary geographically along the eastern Mediterranean flyway. – Biological Conservation 262: 109277. DOI: 10.1016/j.biocon.2021.109277

Orta, J., Kirwan, G. M., Christie, D. A., Garcia, E. & Marks, J. S. 2020. Egyptian Vulture *(Neophron percnopterus)*, version 1.0. – In: del Hoyo, J., Elliott, A., Sargatal, J. A., Christie, D. & de Juana, E. (eds.) Birds of the World. – Cornell Lab of Ornithology, Ithaca, NY, USA DOI: 10.2173/bow.egyvul1.01

Pannekoek, J. & van Strien, A. 2005. TRIM 3 Manual (TRends & Indices for Monitoring data). – Statistics Netherlands. https://www.ebcc.info/art-13/ (Downloaded on 16th of December 2019)

Pantović, U., Andevski, J., Duro, K., Selkegej, L., Dervović, T., Peshev, H., Dobrev, D., Fabijanić, N., Saravia, V., Sideri-Manoka, N., Petrovski, N. & Vukićević, A. 2022. Study about the illegal use of poison in the environment in the Balkan Peninsula. – Technical Report for Action A.2 of the BalkanDetox LIFE project (LIFE19 GIE/NL/001016). Vulture Conservation Foundation

Satunin, K. A. 1907. Matrialy k poznaniyu ptits Kavkazskogo kraya [Materials furthering our knowledge of the birds of the Caucasus region]. – Zapiski Kavkazskogo Otdeleniya RGO 26(3): 1–144. (in Russian)

Tepanosyan, G., Maghakyan, N., Sahakyan, L. & Saghatelyan, A. 2017. Heavy metals pollution levels and children health risk assessment of Yerevan kindergartens soils. – Ecotoxicology and Environmental Safety 142: 257–265. DOI: 10.1016/j.ecoenv.2017.04.013

Tsiopelas, N. 2023. Development of a sensitivity map and a web-based tool for the assessment and mitigation of disturbance risk for nesting birds, caused by climbing activities in Greece. Methodological approach and interaction with the climbing community. – Oral Presentation, Final Conference of LIFE Egyptian Vulture Project, LIFE 17/NAT/GR000514. 19–21 September 2023, Matera (Italy)

van Strien, A., Pannekoek, J., Hagelmeijer, W. & Verstrael, T. 2004. A loglinear Poisson regression method to analyse bird monitoring data. – In: Anselin, A. (ed.) Bird Numbers 1995, Proceeding of the International Conference and 13th Meeting of the European Bird Census Council, Pärnu, Estonia. – Bird Census News 13(2000): 33–39.

Voříšek, P., Klvaňová, A., Wotton, S. & Gregory, R. D. (eds.) 2008. A Best Practice Guide for Wild Bird Monitoring Schemes 1st ed. – CSO/RSPB

Xirouchakis, S. & Andreou, G. 2009. Foraging behaviour and flight characteristics of Eurasian Griffons *Gyps fulvus* in the Island of Crete, Greece. – Wildlife Biology 15: 37–52. DOI: 10.2981/07-090