



Short Communication

The Spectrum and Dynamics of the Egyptian Vulture (*Neophron percnopterus*, Linn.) Diet in the Gobustan Region of Azerbaijan

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ABSTRACT

One of the breeding territories of Egyptian vulture in Azerbaijan is located in Gobustan region. A decrease of 45.5% was observed during 2019-2021 in the number of Egyptian vulture. We conducted a study for learning the trophic conditions' impact on this process. 568 food remnants belonging to 25 birds were collected around the nests in 2019-2021. Ten percent of decrease in the diet base was observed during three years. It was found out that population boost and increasing economic activities influenced the number of wild and household animals, level of death and diet ration as well as its dynamics. In order to keep track of the negative impact of anthropogenic factors on the food resources and stability of the diet of the Egyptian vulture in Gobustan region, regular environmental monitoring is required, and, when necessary, supplementary feeding of the birds in their natural habitat can contribute to neutralizing these negative impacts.

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Authors' Contribution

AGE: Developed the research methodology and edited the article. TAK: He collected literature, conducted statistical analyses, and wrote the article. HHM: He recorded vulture nests in the area, collected food remains and determined what species they belonged to. RAH: Participated in field research, collected and identified fodder remains.

Key words

Avian scavenger, Diet composition, Factors, Azerbaijan

Egyptian vulture is categorized as endangered (EN) owing to a population decline of 12,400-36,000 mature individuals by direct and secondary poisoning, electrocution (by powerlines), collisions with wind turbines, reduced food availability and habitat change are currently impacting upon European populations (Zuberogaitia *et al.*, 2008; Dzhamirzoyev and Bukreev, 2009; Sara and Di-Vittorio, 2009; Donázar *et al.*, 2002, 2010; Angelov *et al.*, 2012; Carrete *et al.*, 2013; Veleviski and Stoyanov, 2015; Oppell *et al.*, 2016). Declines in Africa are likely to have been driven by loss of wild ungulate populations and, in some areas, and improvements in slaughterhouse sanitation (Mundy *et al.*, 1992; Ogada *et al.*, 2016). A similar negative trend has been observed for the Egyptian vulture populations in

Azerbaijan where it is a migratory-nesting species. Egyptian vulture were relatively abundant in the past century i.e., 80-100 pairs (Patrikeyev, 2004; Mustafayev, 2012). Population size has dramatically decreased in only a few decades to 59 pairs (Karimov and Mamedov, 2019). The primary factors responsible for the decline, particularly that related to human activities (hunting, removal of chicks from the nest, keeping in restaurants, trade in stuffed birds), have now been neutralized. However, the potential contribution of reduced food availability to the declines of the Egyptian vulture populations in Gobustan region remains unclear. In this region, in 2019-2021, the number of vultures decreased by 45.5%. Considering the above, we studied the spectrum and dynamics of the Egyptian vultures' forage diets in the Gobustan region, where anthropogenic transformation is intensifying.

Materials and methods

The study was held in the Gobustan district (40°07'30"N. 49°22'30" E) located in the South-East of Great Caucasus. Its relief is made of mountains, ravines, dry hills and plains. Altitude of the area is 300-1500 m above the sea. Gobustan is bordered with Absheron peninsula and Caspian Sea in the east. Jeyrankechmez and

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Pirsaat rivers enter the Caspian Sea. There are over 100 mud volcanoes. Its climate is dry sub-tropical. Short rainfalls happen in spring and autumn. Following this, there is revival in the plants and animals' lives. The region's flora is comprised of desert and semi-desert plants. Red fox (*Vulpes vulpes*), golden jackal (*Canis aureus*), grey wolf (*Canis lupus*), brown hare (*Lepus europaeus caucasicus*), European badger (*Meles meles*), various snakes and reptiles are dominant species in the area. Oil, natural gas and construction materials are produced in the region.

Our method of diet identification, based on food remains collected around the nest has also been used in other areas (Cortés-Avizanda *et al.*, 2009; Donazar *et al.*, 2010; Margalida *et al.*, 2012). We collected food remains (bones, cutis, wool, feathers, nails, etc.) within a radius of 10 m around the vultures nests. Fodder residues were registered every 10 days in June-July 2019-2021. Ornithologists, theriologists, herpetologists and other scientists from local ecological agencies were mostly able to visually identify the species to which the animal remains belonged. For the rest of the food remains, identification guides were used for identifying the species. It was not possible to collect remains of all the food items eaten at the nest sites by the vultures. For example, softer parts are not found, as they are not disposed around the nest or because they are consumed by mammalian scavengers. Therefore, we also recorded animal carcasses consumed by vultures further away from nests. The Egyptian vulture's nests are located in small caves in the rocks. The distance between the nests is 500-4000 m. The nests are located at minimum 169 m and maximum 750 m above sea level.

To quantify the general food conditions near the vultures' nests, we collected data on the number of dead animals that were available to the vultures within a 10–15 km radius of the studied breeding locations. Besides carrying out surveys in river valleys, pastures, along roads and at garbage dumps, we also used information from the local veterinary services and shepherds to locate dead animals. During our searches, we covered a total of 2800 km by car and 14 km on foot.

Results

During 2019-2021 we logged 568 food remnants belonging to 25 animals around the nests- 202 out of these in 2019, 185 in 2020 and 181 in 2021. The diet rations included 19 mammals (eight household, 11 wild), three reptiles, one amphibious and one fish (Table I).

Number of wild animals in the diet rations in 2019 constituted 91.37%, 89.90% in 2020 and 92.60% in 2021. As seen from the Table I, the share (2019-61.9%; 2020-67.4%; 2021 -62.0%) of carnivorous mammals (red fox, golden jackal, grey wolf) was more. The total share of all remaining animals (Goitered Gazelle *Gazella*

subgutterosa, brown hare *Lepus europaeus*, Southern white-breasted Hedgehog *Erinaceus concolor*.

Table I. Overview of the diet composition (percentage of food items) of Egyptian vulture in Gobustan region. The main food species in the diets are in bold.

Food items	Egyptian vulture		
	2019	2020	2021
Domestic mammals			
Cattle (<i>Bos taurus domesticus</i>)	1.0	0.4	0.3
Domestic buffalo (<i>Bubalus b. bubalis</i>)	0.1	-	-
Horse (<i>Equus ferus caballus</i>)	1.0	0.6	0.7
Donkey (<i>Equus africanus asinus</i>)	0.9	0.5	0.6
Domestic sheep (<i>Ovis aries</i>)	2.5	0.6	0.4
Domestic goat (<i>Capra aegagrus hircus</i>)	1.6	0.4	0.5
Domestic dog (<i>Canis lupus familiaris</i>)	0.6	0.5	0.4
Domestic cat (<i>Felis catus</i>)	0.4	-	0.3
Wild mammals			
Goitered gazelle (<i>Gazella subgutturosa</i>)	0.2	-	0.1
Grey wolf (<i>Canis lupus</i>)	16.4	13.2	10.1
Golden jackal (<i>Canis aureus</i>)	18.4	24.0	21.8
Red fox (<i>Vulpes vulpes</i>)	26.2	30.2	30.1
Brown hare (<i>Lepus europaeus caucasicus</i>)	12.5	12.0	13.0
Southern white-breasted hedgehog (<i>Erinaceus concolor</i>)	1.6	0.5	0.7
European badger (<i>Meles meles</i>)	1.4	1.0	1.5
Indian porcupine (<i>Hystrix indica</i>)	6.0	5.0	7.0
Caspian seal (<i>Phoca caspica</i>)	2.0	2.4	2.0
Mountain jerboa (<i>Allactaga williamsi</i>)	1.0	1.4	1.4
Mouse (<i>Mus spp.</i>)	3.0	3.2	4.0
Other			
European pond tortoise (<i>Emys orbicularis</i>)	1.0	1.6	1.8
Grass snake (<i>Natrix natrix</i>)	0.4	0.4	0.8
Scheltopusik (<i>Pseudopus apodus</i>)	-	0.3	0.4
Fish spp.	1.6	1.6	2.0
Common toad (<i>Bufo variabilis</i>)	-	0.1	0.1
Large insects (e.g. locusts) ¹	-	-	-
Total (%)	99.9	99.9	99.9
Total number of food items	202	185	181
Number of nests	5	5	5

¹an unidentified number of insects was observed to be eaten.

European badger *Meles meles*, Indian porcupine *Hystrix indica*, caspian seal *Pusca capsica*, mountain jerboa *Dipus sagitta*, mouse *Mus sp.*) was 25.5-29.8%, reptiles– 1.4-2.9%; fish– 1.6-2.0%, amphibians – 0.1%.

During three years, increase in some wild animals share in the diet ration but decrease in others' share were observed. We found a drop in the share of four species

(grey wolf, goitered gazelle, southern hedgehog, caspian seal). The share of wild animals weighing less than grey wolves dropped or stayed stable.

The share of domestic animals in the diet rations in 2019 was 8.1%, 3.0% in 2020, 3.2% in 2021. Decrease took place both in diet share and the number of animals. If in 2019 there were found remnants of eight species, in the coming years.

Discussion

It is worth noting that population increase during the last 30 years (there is one town, 32 villages, 60 thousand inhabitants) and enhancement of economic activities impacted on the number of wild and domestic animals, death rate, contents and dynamics of diet ration. For example, although the number of domestic animals (cattle, horse, donkey, sheep, goat) in the Gobustan region was over 201 thousand, their share in the diet ration was low. Climate is hot (June-July +30-32 °C) and pasture areas (short-living ephemeral plants) are minimal.

Therefore, farmers take their animals to the sub-alpine pastures in Great Caucasus (Guba district) in May and return in September. Egyptian vulture arrives in Gobustan region in early April and leaves for wintering in August. Due to these reasons, the share of large domestic animals in the diet is low. Both these processes and also disappearance of some wild animals (goitered gazelle, wild goat - *Capra aegagrus*; wild boar - *Sus scrofa*; brown bear - *Ursus arctos*; striped hyena - *Hyaena hyaena*; Eurasian lynx - *Lynx lynx*) in Gobustan negatively affects the diet base of Egyptian vulture (Hajiye, 2004). Diet shortage forces these vultures seek food in neighboring areas. They locate corpses of goitered gazelles, caspian seal and fish in the Shirvan National Park and Caspian Sea shores. The share of goitered gazelles in their diet was tiny (0.1-0.2%). Waste from fishing industries constitutes 1.6-2.0% of the share in the diet. One of the diet items for Egyptian vulture was corpses of Caspian seals that die from diseases and perished by humans on Caspian shores (small share of 2.0-2.4%).

The share of European badger, brown hare, Indian porcupine (included in the red book of Azerbaijan) and Southern hedgehog belonging to medium weight species in the ration made 0.5-13.0%. However, number of these species has been observed to lower in Gobustan region. The reason is illegal hunting (their meat is consumed) and sale to mini zoos.

The drop in the numbers of large and medium-sized domestic and wild animals and limited consumption of their corpses has resulted in an increase of small animals' (mice species fish species, Mountain Jerboa, European pond tortoise *Emys orbicularis*, grass snake *Natrix natrix*, scheltopusik glass and legless lizard *Pseudopus apodus*,

common toad *Bufo variabilis* share in the diet. Their part in the diet ration increased from 7.0% to 10.1% during 2019-2021. Our observations showed Egyptian vultures hunting those small-sized animals and large insects.

In the Andalusian region of Spain, 54.0% of the mammals of the Egyptian vulture's diet was occupied by rabbits (*Oryctolagus cuniculus*). 20.8% of the forage was birds, 13.1% was reptiles and small sized animals. It was observed that they hunt small sized animals, even though they are given additional feed (Cortez-Avizanda et al., 2012; Margalida et al., 2012).

Hunting of these animals indicates limited diet base in the Gobustan region. Switching from social feeding habits (food located and consumed in groups) to hunting small domestic animals for necrophage birds like Egyptian vulture is not sufficient (birds spend much time and energy for hunting and mostly remain hungry). Because, just like other scavenger birds (griffon vulture- *Gyps fulvus*, black vulture- *Aegypius monachus*, bearded vulture *Gypaetus barbatus*) Egyptian vultures switching to consuming animal corpses was influenced by megafauna (large grass-fed and predator mammals). Development of megafauna in Pleistocene enabled Egyptian vulture to settle in the Gobustan region (Burchak-Abramovich, 1972). During the next periods, following ecological processes, there happened quantitative and qualitative changes as a result of ecological processes and several taxons vanished (Hajiye, 2004). Therefore, the modern fauna of Gobustan is not rich.

At present, the diet for Egyptian vulture in the Gobustan region is comprised of golden jackal, red fox and grey wolf corpses. Within three years, their share in the diet was in the region of 61% in 2019, 67.1% in 2020 and 62.1% in 2021. Consumption of these animal corpses is not due to their large numbers but killings by humans. For instance, in 2013, hunting of grey wolves was banned. As a result, its share in the diet dropped from 16.4% to 10.1%. Perishing of golden jackals and red foxes is due to various reasons. Because of lowering of living biotopes and diet objects in the region they attack the household animals kept in yards. Lately, rabies infection of domestic animals (sheep and dogs) by red foxes and golden jackals increased. Attacks to humans by diseased red foxes, golden jackals and dogs are noticed. This is why, those animals get killed by farmers and hunters (with traps and shooting). Hence, during 2014-2016, Egyptian vultures could eat more red fox and golden jackal corpses.

Intensive anthropogenic transformation of natural landscapes as well as increasing economic activities not only in Gobustan but also in the entire South Caucasus has negatively impacted the trophic processes. For this reason, scavenger birds of Caucasus seeking food in Iran and Arabian Peninsula was registered. Not all of these

birds may return to their nests in Azerbaijan, which could contribute to the degradation of the vulture populations in the Caucasus region (Gavashelishvili, 2011). In 2019-2021, the number of breeding pairs of Egyptian vultures in the in three years) as well as wild ungulate populations in African wintering zones (Mundy *et al.*, 1992; Ogada *et al.*, 2016).

Conclusion

Human economic activity directly and indirectly affects the formation of the Egyptian vultures forage sources in the territory of Gobustan region. The number of wild animals in the region is gradually decreasing. Food sources, caused by human economic activities, are not stable. The current state of the forage reserve requires regular monitoring in the feeding area of the Egyptian vulture and, if it is necessary, it requires additional forage. (Recommendations on additional feeding of necrophagous birds in nature.

DECLARATIONS

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Generative AI and AI-assisted technology statement

The authors declare that no generative AI and AI assisted technology was used in this manuscript.

Statement of conflict of interest

The authors have declared no conflict of interest.

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