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The composition and dynamics of the diet of the Black Vulture (*Aegypius monachus*) and Griffon Vulture (*Gyps fulvus*) in the Talysh region of Azerbaijan

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The composition and dynamics of the diet of the Black Vulture (*Aegypius monachus* L., 1766) and Griffon Vulture (*Gyps fulvus* Hablizl, 1783) were studied in the Talysh region of Azerbaijan in 2014–2016. For this, for 3 years, in June–July, the collection and identification of the remains of food around the nests were carried out. The remains were collected every 10 days from 15 nests of the Black Vulture and 18 nests of the Griffon Vulture. A total of 820 prey items were collected. The vultures' diet comprised of the carcasses of 24 animal species, including 14 wild mammals, 6 domestic mammals, three reptiles and a fish. 401 prey items were collected at Griffon Vulture nests and 419 items at Black Vulture nests. 188 prey items (46.9%) were gathered in 2014, 117 (29.1%) in 2015 and 96 (24.0%) in 2016 around Griffon Vulture nests. 196 (46.7%) prey items were collected in 2014, 121 (29.0%) in 2015 and 102 (24.3%) in 2016 around Black Vulture nests. The share of the domestic animals was 17.0% (2014), 15.5% (2015) and 10.0% (2016) in the diet of the Black Vulture. The share of the wild animals was 83.0% (2014), 84.5% (2015) and 90.0% (2016), respectively. In the diet of Griffon Vulture these indicators were as follows: the share of the domestic animals was 17.0% (2014), 15.9% (2015) and 14.5% (2016), and the share of the wild animals was 83.0% (2014), 84.1% (2015) and 85.5% (2016). The research confirmed that the diet spectrum of both species in the region has narrowed over 3 years. The diet spectrum reduced by 48.0% in the Black Vulture and by 49.0% in the Griffon Vulture. It was found that the human economic activity has a significant impact on the spectrum and stability of diets of both species in the Talysh region. Therefore, in order to achieve the sustainable development of the populations of both species, it is necessary to organize regular monitoring and supplementary feeding stations. It would be desirable to make an announcement of these territories as natural monuments during the breeding season as well. The local environmental organizations and schools should be involved in the effective protection of such natural monuments.

Key words: avian scavengers, diet, *Aegypius monachus*, *Gyps fulvus*, Talysh region, Azerbaijan.

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Introduction

The Black Vulture is listed on the IUCN Red List as a near threatened species (*NT*), and the Griffon Vulture is listed as a Least Concern (*LC*). Although their abundance is stable in the Iberian Peninsula (Cortés-Avizanda et al., 2009; Donázar et al., 2010; Margalida, Colomer, 2012), other areas of the range have been observed to be subject to a wide variety of impacts (Kerimov, Talibov, 2010; Mustafayev, 2012; Ogada et al., 2012; Veleviski, 2014). It was revealed that a decrease in their number over most areas of their ranges is associated with a lack of food (Kalnitskaya et al., 2007; Efimenko, 2009; Zhatkanbaev, 2011; Karimov, Guliyev, 2017). One of the strongholds of the Black Vulture and Griffon Vulture in Azerbaijan is located in the Talysh region. As in the entire territory of Azerbaijan, the number of avian scavengers in this region has decreased (Mustafayev, 2012; Karimov, Guliyev, 2017; Patrikeev, 2004).

Thus, we have studied the factors influencing the food availability and the composition and dynamics of the diet of the Black Vulture and Griffon Vulture in the Talysh region.

Materials and methods

Study area and food remains

The research was carried out within the Talysh region (38°42'0", 48°18'0"; Figure 1) from 2013–2015. The landscapes of the region face intense transformation due to increased ecotourism, construction,

transportation, industry, etc.. Furthermore, the population sizes and distributional ranges of wild ungulates are shrinking, possibly also due to unmanaged hunting and poaching.

The study area is characterized by steep and rough terrain with river (e.g. Astarachay, Lankaranchay, Vilashchay, Bolgarchay) valleys, dry valleys and a canyon-type mountain landscape with altitudes ranging between 300–2977 m (with peaks such as Komurgoy at 2977 m and Gyzyurdu at 2433 m) above sea level. The climate varies substantially across the region, being mild, hot and dry-subtropical for areas below 600 m, while higher-altitude areas have cool summers and cold winters. In contrast to the Greater and Lesser Caucasus, vertical zoning is disturbed in the Talysh mountains, where the amount of precipitation decreases with increasing altitude. That is, above the mountain forests, instead of mountain meadows, a steppe zone is formed with a variety of mountain xerophytic plants. There are no semi-desert and nival-glacial landscapes in the area (Museybov, 1998).



Fig. 1. Talysh region where the research was carried out, with nesting sites of the vulture species indicated: BV: Black Vulture; GV: nesting and feeding places of the Griffon Vulture.

The nests of the Griffon Vultures are located in small rock caves (1x2 m) at an altitude of 180-1200 m above sea level. The Black Vulture builds nests in trees with diameter of 2–3 m at an altitude of 330–1200 m above sea level. Monitoring was carried out at the nests (18 Griffon Vulture nests and 15 Black Vulture nests) located in the Lerik (near the villages of Bursulum, Dillavu) and Astar (near the village of Tengerud) districts. The distance between the nests in the observed colonies was 800–2000 m (Black Vulture) and 50–2000 m (Griffon Vulture).

Our method of the diet study is based on the identification of food remains collected around the nest (Shilov, Warsawskiy, 1973; Potapov, 1989). We collected food remains (bones, cutis, wool, feathers, nails, etc.) within a radius of 10 m around the vulture nest. The collection of food remains was carried out in June–July, when the chicks in the nests were intensively fed. We surveyed the area around the nests every 10 days. We were mostly able to visually identify the species to which the remains belonged. For the rest of the remains, identification guides were used for identifying the species. During our searches 15 Black Vulture nests and 18 Griffon Vulture nests were surveyed. A total of 820 food remains were collected: 401 food items were collected around Griffon Vulture nests and 419 items around Black Vulture nests. 188 items (46.9% of all gathered remains) were collected in 2014, 117 (29.1%) in 2015 and 96 (24.0%) in 2016

around Griffon Vulture nests. 196 (46.7%) items were collected in 2014, 121 (29.0%) in 2015 and 102 (24.3%) in 2016 around Black Vulture nests.

Results and discussion

During the study period a total of 820 different food items were collected (the number of food remains the nests of the Griffon Vulture and Black Vulture). The vultures' diet comprised of the carcasses of 24 animal species, including 14 wild mammals, 6 domestic mammals, 3 reptiles and one fish (Table 1).

Since both studied vulture species feed together in the same area, their diet composition were the same. Thus, the food ration of each of the vulture species consisted of the carcasses of 6 species of the domestic animals and of the carcasses of 18 species of the wild animals. The share of the domestic animals in the Black Vulture diet was 17.0% (2014), 15.5% (2015) and 10.0% (2016). The share of the wild animals was 83.0% (2014), 84.5% (2015) and 90.0% (2016), respectively.

These indicators were as follows in the Griffon Vulture diet: the share of the domestic animals was 17.0% (2014), 15.9% (2015) and 14.5% (2016), and the share of the wild animals was 83.0% (2014), 84.1% (2015) and 85.5% (2016).

Table 1. Overview of the diet composition of 2 vulture species in Talysh region in 2014- 2016

Animal species	Black Vulture			Griffon Vulture		
	2014	2015	2016	2014	2015	2016
Domestic cattle <i>Bos taurus domesticus</i>	2.00	2.00	1.00	3.00	2.40	1.80
Domestic horse <i>Equus ferus caballus</i>	3.00	2.00	2.00	3.50	3.00	3.20
Domestic donkey <i>Equus africanus asinus</i>	2.00	1.50	1.00	2.50	2.70	2.50
Domestic sheep <i>Ovis aries</i>	4.00	3.00	1.00	3.00	3.60	3.30
Domestic goat <i>Capra aegagrus hircus</i>	2.00	2.00	1.00	2.00	2.40	1.70
Domestic dog <i>Canis lupus familiaris</i>	4.00	5.00	4.00	3.00	1.80	2.00
Goitered gazelle <i>Gazella subgutturosa</i>	0.30	0	0	1.20	0.80	0.30
Wild boar <i>Sus scrofa</i>	3.20	2.50	2.00	3.50	2.40	1.30
Brown bear <i>Ursus arctos</i>	0.50	0	0	0.30	0	0
Grey wolf <i>Canis lupus</i>	10.00	11.00	9.00	12.00	12.00	11.70
Golden jackal <i>Canis aureus</i>	22.00	23.00	23.00	19.00	20.00	21.00
Red fox <i>Vulpes vulpes</i>	25.00	19.00	26.00	23.00	22.00	23.00
European badger <i>Meles meles</i>	3.00	4.00	4.00	5.00	4.00	3.60
Common raccoon <i>Procyon lotor</i>	2.00	3.00	5.00	3.00	3.00	3.40
Marbled polecat <i>Vormela peregusna</i>	1.00	0.50	0	0.60	0	0.40
European hare <i>Lepus europaeus caucasicus</i>	4.00	8.20	10.00	6.00	7.60	7.50
Southern white-breasted hedgehog <i>Erinaceus concolor</i>	1.00	0.30	0	0.40	1.00	1.00
Beech marten <i>Martes foina</i>	1.00	1.00	0	1.00	0.40	0.50
Least weasel <i>Mustela nivalis</i>	2.00	1.00	0	1.50	0.50	0.50
Indian crested porcupine <i>Hystrix indica</i>	5.00	7.00	9.00	5.00	8.50	9.20
Spur-thighed tortoise <i>Testudo graeca</i>	1.00	1.00	0	0.50	0.50	0.30
Grass snake <i>Natrix natrix</i>	0.40	1.00	0	0	0	0.20
European glass lizard <i>Pseudopus apodus</i>	0.60	1.00	0	0	0.50	0.40
Fish <i>Pisces</i>	1.00	1.00	2.00	1.00	0.90	1.20
Total (%)	100	100	100	100	100	100
Number of nests	5	5	5	6	5	7

As can be seen, the proportion of the wild animals in the diet was higher. That is, the majority of food items of both species were wild mammals. On the contrary, the share of the domestic animals in the diet of the Black Vulture decreased over 3 years from 17.0% to 10.0%. The share of the domestic animals in the diet of the Griffon Vulture decreased from 17.0% to 14.5%. The proportion of reptiles in the diet was insignificant. This indicator was only 2.0-3.0% in food ration of the Black Vulture and 0.5-1.0% in food ration of the Griffon Vulture.

The proximity of the nests of both species to fisheries allowed them to feed on fish remains. The vultures fly to the shores of the Caspian Sea in search of food. The residues unused by fishermen comprised 1.0–2.0% (Black Vulture) and 0.9–1.2% (Griffon Vulture) in their food rations.

Factors affecting the food availability

The natural conditions of the region and the human economic activity had a significant impact on the composition of the vulture diets. Unlike the Greater and Lesser Caucasus, there are no subalpine or alpine belts in the Talysh mountains. Instead, there are mountain steppes in this zone. As a result, the domestic animals are few in number in these areas. The local population is mainly engaged in agriculture, fishing and tourism (there are many tourism and recreation centers). The construction of highways and building of processing plants also expanded in the region. All these factors affect the livestock population, and thus the proportion of the domestic animals in the diet of the vultures. The scarcity of food resources probably accounts for our observations of the vultures making flights to neighboring Iran. Other authors have found that vultures fly to Iran and the Arabian Peninsula in search of food too (Mustafaev, 2012; Gavashelishvili, 2011; Kerimov, Talibov, 2010). It was noted (using the method of radio telemetry) that some individuals died of hunger on the way or did not return (Gavashelishvili, 2011).

These factors have also led to a decline in the number of herbivorous mammals in the region. Domestic goat (*Capra aegagrus hircus*), Northern chamois (*Rupicapra rupicapra*), red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*) were identified as extinct species in the region (Guliyev, 2012).

Red fox (*Vulpes vulpes*), golden jackal (*Canis aureus*), grey wolf (*Canis lupus*), European hare (*Lepus europaeus caucasicus*) and Indian crested porcupine (*Hystrix indica*) account for the largest share in the diet. The carcasses of these animals, killed by vehicles on the roads, killed by hunters and farmers, remain on the territory. We also recorded the carcasses of the animals drowned in the river, left on the shore and destroyed by wolves. Most of them are not detected and disposed of by veterinary organizations, but are found and eaten by vultures.

The results of the study confirmed that the variability of the diet composition of both species in the region decreased over 3 years. In 2014–2016 the decrease in the food availability was 48.0–49.0%.

It was revealed that the human economic activity in the Talysh region has a significant impact on the spectrum and stability of the diet of the Black Vulture and Griffon Vulture. This is a cause of a gradual decrease in the food availability for the vultures. Therefore, the region needs an ongoing monitoring.

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Склад і динаміка харчового спектра чорного грифа (*Aegypius monachus*) і білоголового сипа (*Gyps fulvus*) Талиського регіону Азербайджану С. Раджабова, Т. Керімов

У 2014–2016 рр. було вивчено спектр та динаміку кормових раціонів чорного грифа (*Aegypius monachus*, L., 1766) та білоголового сипа (*Gyps fulvus*, Nabl., 1783) Талиського регіону Азербайджану. Для цього протягом трьох років, у червні-липні, проводили збирання та ідентифікацію залишків корму навколо гнізд. Залишки збирали кожні 10 днів навколо 15 гнізд чорних грифів та 18 гнізд білоголових сипів. Загалом було зібрано 820 залишків корму. До раціону стервятників входили туші 24 видів тварин, у тому числі 14 видів диких ссавців, 6 видів домашніх ссавців, три види рептилій та риби. Навколо гнізд білоголових сипів зібрано 401 залишок корму, а навколо гнізд чорних грифів – 419 залишків. У 2014 р. було зібрано 188 (46,9% усіх зібраних нами залишків), 117 (29,1%) у 2015 р. та 96 (24,0%) залишків корму навколо гнізд білоголових сипів. Навколо гнізд чорних грифів було зібрано 196 (46,7%) залишків корму у 2014 р., 121 (29,0%) у 2015 р. та 102 (24,3%) залишків корму у 2016 р. Частка домашніх тварин у раціоні чорних грифів становила 17,0% (2014), 15,5% (2015) та 10,0% (2016). Частка диких тварин становила 83,0% (2014), 84,5% (2015) та 90,0% (2016) відповідно. У раціоні білоголових сипів ці показники були такими: частка домашніх тварин становила 17,0% (2014), 15,9% (2015) та 14,5% (2016), а частка диких тварин – 83,0% (2014), 84,1% (2015) та 85,5% (2016). Матеріали досліджень підтвердили, що спектр кормових раціонів обох видів у регіоні знизився за 3 роки. Зниження спектра кормового раціону у чорного грифа становило 48,0%, а раціону білоголового сипа - 49,0%. Було встановлено, що господарська діяльність людини значно впливає на спектр і стабільність раціонів харчування обох видів у Талиському регіоні. Тому для досягнення сталого розвитку популяцій обох видів необхідно організувати регулярний моніторинг та підгодовування в природі. У тому числі було б доцільно оголосити ці території пам'ятниками природи в період розмноження. Місцеві екологічні організації та школи повинні бути залучені до ефективної охорони цих пам'яток природи.

Ключові слова: птахи-падальники, харчування, *Aegypius monachus*, *Gyps fulvus*, Талиський регіон, Азербайджан.

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