



Following the White Vulture: Ethno-ornithology along the Flyway of the Egyptian Vulture (*Neophron percnopterus*)

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Accepted: 28 May 2022 / Published online: 11 June 2022

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Abstract

Vultures constitute globally the most rapidly declining group of birds. Across their wide distribution range, they share common ecological functions and unfavourable conservation status while being associated with varying habitats, lifestyles, cultural standing, and threats. We reveal conceptualisations about the emblematic yet critically endangered Egyptian vulture along its migratory flyway from the Balkans through the Middle East to Africa. Information was gathered through interviews, focus group discussions, and market surveys, with 420 people in 11 participating countries contributing overall. Our results showed that all vultures are recognised primarily for the environmental cleaning services, but the level of awareness differs between countries. The Egyptian vulture has some perceptual advantages based on its white color, migratory nature, and endangered conservation status. This underlines its suitability as a charismatic flagship species that can potentially benefit other vulture species and thus enforce broader vulture conservation initiatives.

Keywords Critically endangered species · Cultural ecology · Ethno-ornithology · Old World vultures · Conservation · Egyptian vultures · Migration

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Introduction

Throughout their global range, vultures, consisting of 16 Old World and 7 New World species (McClure et al., 2018), reflect varying habitats, appearances, and cultural standing. However, despite these differences, they face common threats at the root of catastrophic population declines in most species' populations. In recent decades, vultures have become the most threatened avian functional guild due to a rapid population shrinkage not observable in any other group of birds (Buechley & Sekercioglu, 2016; Ogada et al., 2012; Safford et al., 2019). This is especially relevant to the Old World vultures, most of which are critically endangered according to IUCN criteria (Botha et al., 2017; McClure et al., 2018).

Since ancient times, vultures have been deeply rooted in human culture. Mutualism between vultures and humans can be traced back to the Late Pliocene era when early hominins used vultures as "eyes in the sky" in their quest for food (Moleón et al., 2014; Morelli et al., 2015). From once being followers of these scavengers, humans gradually exchanged roles with vultures, providing them with an abundance of food through their pastoral practices and waste (Houston, 2001; Olea & Mateo-Tomás, 2009). Over the long history, vultures have been variously perceived as gods, supernatural messengers, emperors' pets, military and political power symbols, nature's cleaners, garbage disposal servants, and charismatic emblems of conservation efforts. However, they have also been characterised as loathsome creatures, plague doctors, defilers of the dead, and connected with "vulture funds" (Alagona, 2004; Cocker, 2013; Houston, 2001; Wilbur & Jackson, 1983). The conceptualisation of vultures varies according to species, geographical region, culture, and historical period, but the bird's necrophagous nature provides a strong source of metaphors associated with death. Disposing of human corpses by allowing vultures to consume the flesh is a practice that dates back to c. 6,000 BC (Çatalhöyük, Southern Turkey). Further evidence of such traditions is also found in the prehistoric New World (i.e., New Mexico and Colorado; Sitnikov, 2016) and in modern times (i.e., Parsees' "towers of silence" in India and "sky burials" in the Himalayas; Cocker, 2013). In Ancient Egypt, the goddess of childbirth Nekhbet and the mother goddess Mut were both portrayed as vultures and therefore connected with fertility (Morelli et al., 2015; Mundy et al., 1992). However, descriptions of vultures preying on vast numbers of soldiers' carcasses on historic battlefields (Houston, 2001; Schüz & König, 1983) have condemned vultures associated with miasma, misfortune, and fear (Campbell, 2009; Cooper, 1979). In Classical Greece, in Sophocles' tragedy *Antigone* (441 BCE), the heroine wishes to bury

her dead brother rather than leave his body exposed to be devoured by scavengers. This was perceived as a cruel punishment. Similarly, in the Christian world, an unburied corpse disposed of by animals jeopardises the salvation of the deceased's soul (Alexiou, 2002; Stara et al., 2016).

In an overall narrative, vultures symbolize wilderness, uncleanness, and brutality. Alongside wildebeests, warthogs, hyenas, and marabou storks, they are considered to be among the five ugliest animals in Africa (Donaldson, 2017). They are frequently presented as evil and senseless characters in stories and cartoons, often associated with negative emotions and adverse cultural stereotypes (Morelli et al., 2015). At the same time, the mass media image of vultures around the Mediterranean in recent times has been related to economic catastrophes and political corruption, expressed through such phrases as "vulture capitalism," "vulture funds," or "vulture culture" (Aguilera-Alcalá et al., 2020).

To gain public support for locally adapted conservation strategies and policies, taking into account that vultures' mortalities are mainly anthropogenic, with the deliberate or accidental exposure to pesticides and poison being probably the main threats for most species (Plaza & Lambertucci, 2021; Plaza et al., 2019), it is vital to implement interdisciplinary studies and better understand the attitudes towards different species in different contexts (Ballejo et al., 2019; Cortés-Avizanda et al., 2018), especially for migratory species that are exposed to different political environments, socio-economic realities and cultural systems. We discuss the variety of conceptualisations for the critically endangered migratory Egyptian vulture (*Neophron percnopterus*) from its breeding to wintering areas and flyways where survival of the species is the lowest (Buechley et al., 2021). As the bird traverses three continents, we expect many cultural values to be attached to it. As a control, we used other co-existing birds. This knowledge is critical to allowing flexible conservation strategies and communication campaigns that correspond to different threats and target audiences in different countries on breeding grounds, wintering areas, and migration routes.

Materials and Methods

Study Species

The Egyptian vulture has a broad distribution range throughout the southern Palearctic (BirdLife International, 2021). Its Balkan subpopulation migrates along the Eastern Mediterranean flyway and winters in eastern and central Africa (Buechley et al., 2018; Oppel et al., 2015). Birds cover > 4000 km between their summer and winter ranges; median fall migration for adults lasts 21 days and spring 31 days, respectively (Phipps et al., 2019). The species forages over

open and often arid areas in lowland and montane regions, frequently close to or inside human settlements (Bildstein & Therrien, 2018; Oppel et al., 2016). Its diet is considerably more varied in comparison to other vultures. Besides carrion, it also consumes organic waste, eggs, tortoises, invertebrates, and small, slow-moving animals captured alive (BirdLife International, 2021; Dobrev et al., 2016; Margalida et al., 2012). Its cultural position also varies compared to other vultures. It is appreciated as a herald of spring in the Balkans and is seen as a positive omen suggestive of good health, success, and productivity (Stara et al., 2016).

Once widespread and common within its range, the Egyptian vulture is recognised as one of the fastest declining bird species globally (Botha et al., 2017). Its global rate of decline is estimated to be 50–79% over three generations or 42 years (> 10% in Europe, 91% in the resident population in Africa, and potentially > 99% in India) (BirdLife International, 2021). Its Balkan population has diminished by 80% over the last three decades, becoming fragmented

(Velevski et al., 2015). As a result, the species was up-listed from Least Concern (LC) to Endangered (EN) in 2007 (BirdLife International, 2021). Concerning this Balkan population, anthropogenic threats appear to be the primary ones that the species faces and vary geographically: poisoning is a severe problem on breeding grounds and most of the flyway, along with collision and electrocution in Turkey, Jordan, Egypt, and Ethiopia, while direct persecution is a problem in Lebanon, Syria, Niger, and Nigeria, in the latest two being associated with belief-based practices (Oppel et al., 2021).

Study Area

This study covers the eastern Mediterranean flyway of the species: from its breeding grounds in the Balkans (Albania, Bulgaria, Greece, North Macedonia), through the Middle East (Turkey, Syria, Lebanon, Jordan, Egypt), to its wintering grounds in Africa (Niger, Nigeria), consisting of 11 countries in total (Fig. 1).

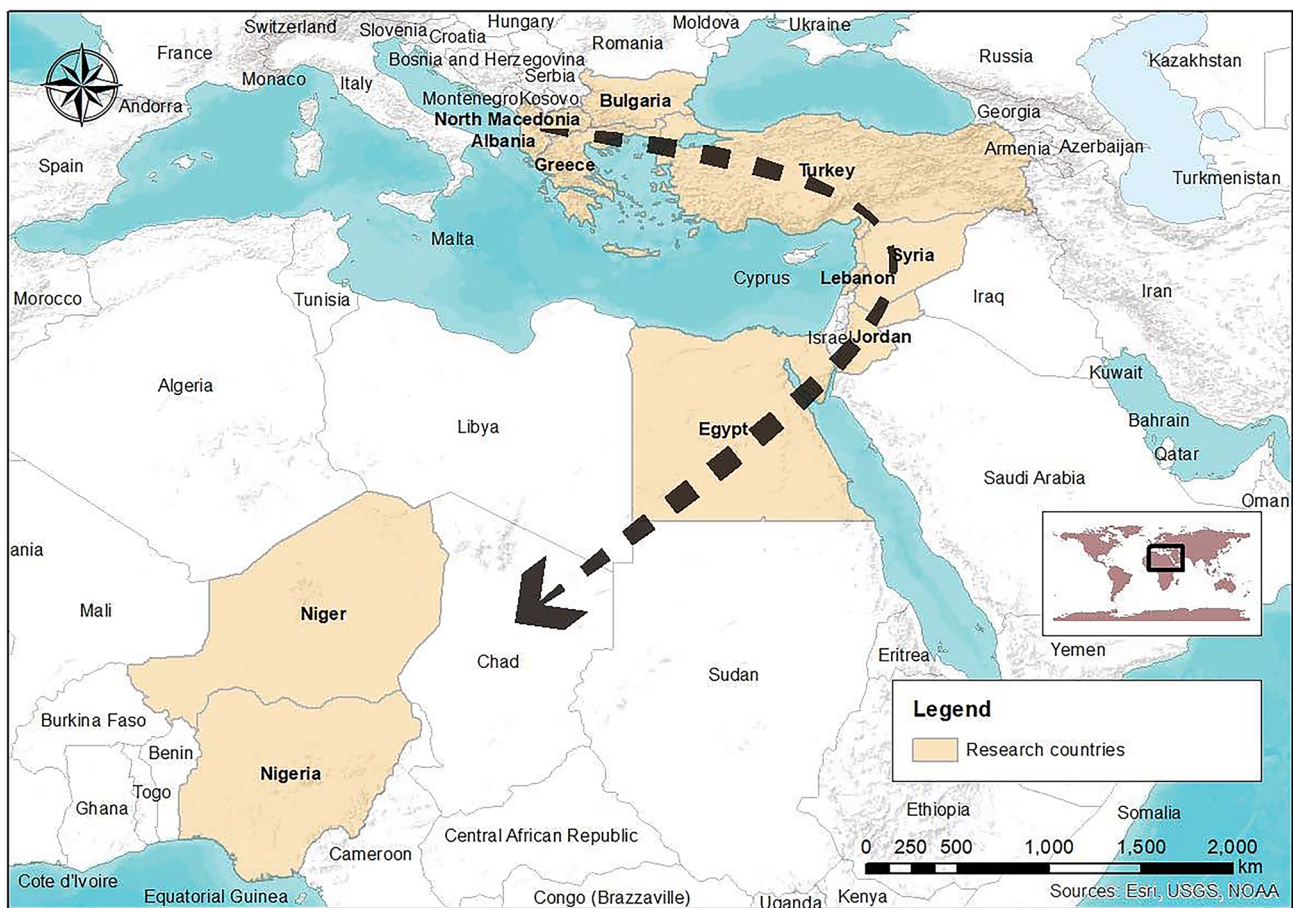


Fig. 1 Countries studied along the Egyptian vulture's Eastern Mediterranean flyway ($n = 11$)

Data Collection

Target Groups

Data was collected by field researchers in 30 different regions across 11 countries in the Balkans, Middle East, and Africa. The 30 regions consist of critical areas for the species' survival, and they were defined from the beginning. They include breeding sites (Velevski et al., 2015), territories of not breeding individuals, migration routes, and wintering grounds that have been identified through satellite telemetry (Buechley et al., 2018, 2021; Opperl et al., 2021).

Information was gathered using interviews. Those interviewed were key local conservation stakeholders for the Egyptian vulture, selected randomly from individuals in the relevant project areas. Efforts were made not to exclude women, uneducated people, younger generations, or other "shy" groups (Eriksen, 1995). Despite efforts at gender equilibrium, in the end, men dominated in the study, an outcome not unexpected as it is usually men rather than women who appear as representatives of family or community in most patriarchal societies (see also Trajçe et al., 2019; Table 1 in the Appendix).

Interviews

Most field researchers were not social scientists, so they were trained in ethnographic methods before fieldwork began in 2018. Interviews consisted of in-depth interviews lasting 20–30 min or focus group discussions based on a questionnaire (Table I in Supplementary Material) that was translated and adapted to the local or national languages. Data were collected from 2018 to 2020, except in Greece and Bulgaria. Data there was gathered from 2012 to 2016 based on a slightly different but compatible questionnaire (Table II in Supplementary Material), with only additional information compiled during 2018–2020. The data was collected in 2020 through online surveys to accommodate Covid-19 restrictions for Egypt and Lebanon.

Photo Exercise

We designed a photo exercise involving five species representing groups of similar species to compare the Egyptian vulture with other co-existing birds. Participants were first asked to list known birds of particularly personal value. We selected Old World vultures (*Gyps* spp.), which could differ between research sites (i.e., *Gyps fulvus*, *G. rueppelli*, *G. africanus*) according to their presence or abundance; we included eagles (i.e., *Aquila chrysaetos* in Europe, *A. nipalensis* or *Clanga pomarina* in the Middle East and

Milvus aegyptius in Africa) as a stimulus to highlight perceived differences between eagles and vultures. We also used ravens and crows (i.e., *Corvus corax* in Europe, *C. corone* in the Middle East and *C. albus* in Africa) because of their necrophagous nature. Finally, we included the well-known white stork (*Ciconia ciconia*), whose migratory route and distribution range are similar to those of the Egyptian vulture (BirdLife International, 2016), (Fig. 2). In order to check which of the five species was most appreciated in each country, we attempted a ranking system, asking participants to rate each species from 1 (strongly dislike) to 5 (strongly like). Although the photo exercise was not included in the 2012–2016 questionnaire in Greece and Bulgaria, the same information was gathered through interviews.

Market Surveys

In Niger, together with interviews and focus groups, market surveys were organized to gather information on using vultures in belief-based practices. Researchers visited four traditional street markets where they looked for stands selling animal parts and spoke to sellers about vulture numbers, hunting, and use. Markets in the Zinder region, with ~3000 stands in total (~2000 stands in the largest market and a few hundred in the three smaller markets), were visited in 2018.

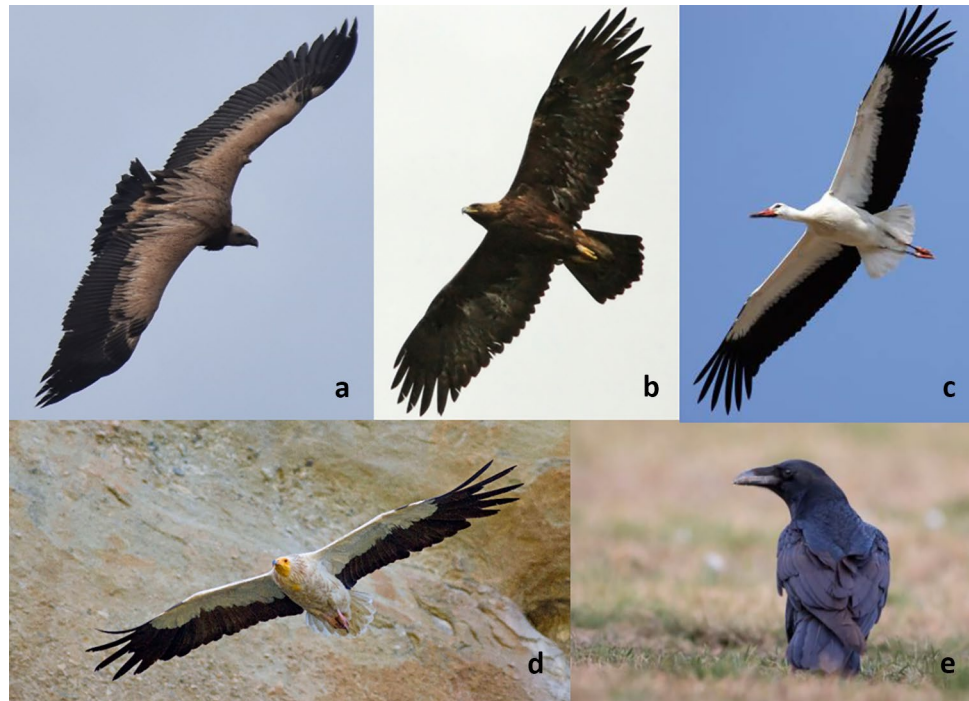
Data Analysis and Interpretation

The quantity and quality of gathered data varied among countries, from raw data translated into English from local languages to reports provided by national representatives. Because of this, some countries do not appear in all figures and tables. We used Excel and Access datasheets to organize data. During the analysis, we created lists with all of the mentioned birds and we grouped values related to specific birds or groups of birds into utilitarian values (i.e., use of birds as food, medicine or providing ecosystem services) and intangible values (aesthetic, cultural, spiritual, historical, symbolic etc.). Participants could use more than one characterisation (i.e., turtle doves in Jordan, seen as game and beautiful birds). Vultures' and Egyptian vultures' population trends and threats were included in all questionnaires, and data represent the 11 countries. However, answers from Albania, Bulgaria, and North Macedonia included no exact numerical data but only 'present / absent' responses.

Results

The number of participants totaled 420 people in 11 countries (30 regions) in the Balkans, Middle East, and Africa. Participants belonged to varied age groups (18–92 years old), religious or belief systems (Islam, Christianity, African

Fig. 2 Examples of photographs of species are used as optical stimuli to reveal conceptualisations, values, and feelings about the Egyptian culture. Photo credits: **a** Griffon vulture ©K. Stara, **b** Golden eagle ©HOS/C. Vlachos, **c** White stork ©HOS/C. Vlachos, **d** Egyptian vulture ©HOS/D. Vavylis, **e** Raven. ©HOS and RSPB/I. Zaficov



traditional religions), and occupations in the primary sector (farmers, shepherds) or secondary sector (forest service or municipal employees, hunting organisations, protected areas foundations, tourism industry, education, and energy companies) in all countries, in addition to hunters, wildlife traders and traditional healers in Africa (Table 1 in the Appendix). The presentation of the results follows the questionnaire's structure and gradually moves from general information about birds to specific knowledge about vultures with specific emphasis on the Egyptian vulture.

Level of Awareness and Appreciation of Birds

We analysed information from seven countries that provided raw data concerning the free lists of known birds. The information gathered accounted for 1,036 mentions of birds or groups of birds (e.g., birds of prey, corvids, and others [Fig. 3a] that belong to 35 genera, sub-families, families, and other categories and 77 species [Table III in Supplementary Material]).

Significant differences appear between countries, though most respondents frequently mentioned raptor species [35% = 355 mentions, including diurnal birds of prey except vultures (199 mentions), nocturnal raptors (26 mentions) and vultures (130 mentions)], corvids (10.5% = 102 mentions), other species (58% = 573 mentions) and < 1% generic (i.e., migratory species). In Greece, the question was about wildlife in general, in response to which we collected 375

mentions. Birds were the most commonly referred to: (birds = 49.1%, mammals = 42.1%, reptiles = 6.1%, fish = 2.4% and insects = 0.3, just 1 mention). The percentage of mentioned vultures per country falls from 27% in Greece to 18% in Turkey, 8% in Niger, < 4% in Jordan and Egypt, and 0% in Syria. The Egyptian vulture is mentioned only 19 times in total (8 in Turkey, 7 in North Macedonia, 3 in Egypt, and 1 in Jordan), indicating that the species is not the first that comes to mind in a free listing.

Regarding "other bird species" mentioned by the interviewees, we collected 573 mentions corresponding to 56 species and 27 genera, families or broader groups. These refer primarily to passerine songbirds (185 mentions), with the most commonly mentioned sparrows, bulbuls, blackbirds, and finches. These were followed by doves and pigeons (106 mentions); waders and water birds (121 mentions), with white storks being the most frequently mentioned; bustards, although they were only mentioned in Niger (20 mentions); partridges and quails, primarily mentioned in the Middle East (57 mentions); guinea fowls, which were again mentioned only in Niger (24 mentions); and hoopoes, bee-eaters, swallows, woodpeckers, cuckoos and nightjars (24, 19, 11, 3, 2 and 1 mentions respectively [Fig. 3b and Table III in Supplementary Material]).

Results from Turkey, Syria, Jordan, Lebanon, Egypt, and Niger showed that birds are highly appreciated for their use (204 mentions) or intangible values (192 mentions concerning beauty, beliefs, memories, and emotions). Some species

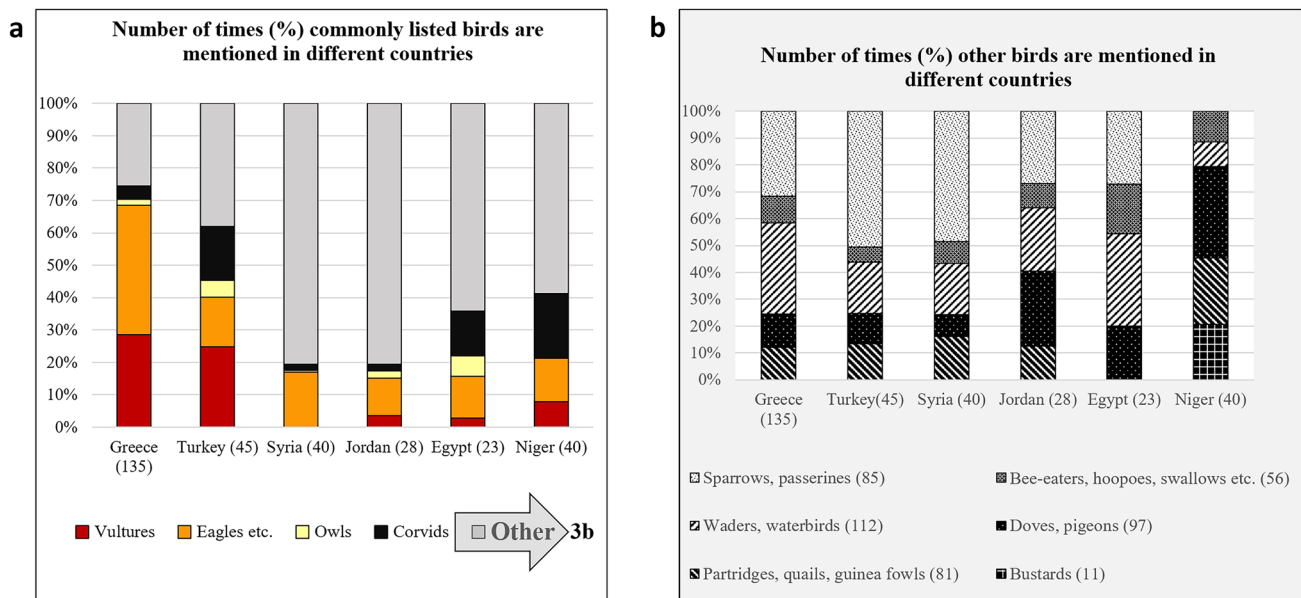


Fig. 3 **a** Frequency of times that commonly mentioned groups of birds are listed in different countries. Numbers in parentheses next to countries refer to interviews per country. North Macedonia is not included in the graph because of the small number of answers (7 participants,

23 mentions which refer only to birds of prey). **b** Other than raptors and corvids, the frequency of common bird species is listed in different countries. Numbers in parentheses next to groups of birds refer to mentions and not to species

are considered harmful (especially corvids and eagles, with 63 negative mentions) (Table 2 in the Appendix).

Recognition and Appreciation of the Egyptian Vulture based on Interviews

When explicitly asked about the Egyptian vulture, all respondents in Niger and nearly all in Syria (98%) and Greece (93%) claimed that they knew the bird and had seen it in the wild, while TV and zoos were rarely mentioned as the reason for knowing the species. Percentages of people who knew the Egyptian vulture dropped from 78% in Bulgaria and 76% in Turkey to 62% in Albania, 50% in Jordan, and only 11% in Lebanon. However, few were able to give detailed information about the species other than its name. The majority of details came from elderly shepherds, such as an 80 year' old couple in Turkey who said: "It has a nest above the sheepfold. Every year they are there from March to October." Similar details were also obtained from hunters and traders in Niger who knew roosting or nesting sites of vultures. In Lebanon, most informants confused vultures with eagles. Some perceived vultures as predators, responsible for attacking lambs in their herds or even children: "Women used to ask the children to stay inside the house when white eagles (Egyptian vultures) soared in the sky, because they were afraid that these birds would kidnap them" (municipality policeman from Lebanon, 42 years old). Several shepherds from Albania also mentioned that

Egyptian vultures could grab newborn lambs 30 min after birth.

North Macedonia, Turkey, Jordan, Syria, and Niger provided data from the ranking photo exercise answering the question: "Which species do you like the most?" Results showed that participants primarily liked "harmless" and "useful" vultures and Egyptian vultures (the latter because of its rarity too); they liked less the "beautiful" storks and even less again the "harmful" eagles and ravens/crows, which are frequently associated with bad omens (Fig. 4). Detailed reasons for their preferences are shown in Table 3 of the Appendix.

Level of Awareness Regarding Threats to Vultures

Nearly all participants were aware of the severe declines in vulture numbers [i.e., "There were more in the past, 250–300 vultures would come to a carcass, now only 30–40 vultures come" (shepherd from Turkey, 66 years old)]. In all countries except Lebanon, the majority were aware of negative trends in the Egyptian vulture population. However, in 80 out of 458 mentions (17.5%), participants were unable to explain why vultures were declining, with Turkey and Lebanon showing the highest levels of unawareness. The list of threats and the perceived importance of each varied across countries. Poaching and the use of poison baits were widely known (20% and 14.5% of all mentioned threats), followed by habitat degradation (10.5%) and food shortage related to

IMPORTANCE OF BIRDS

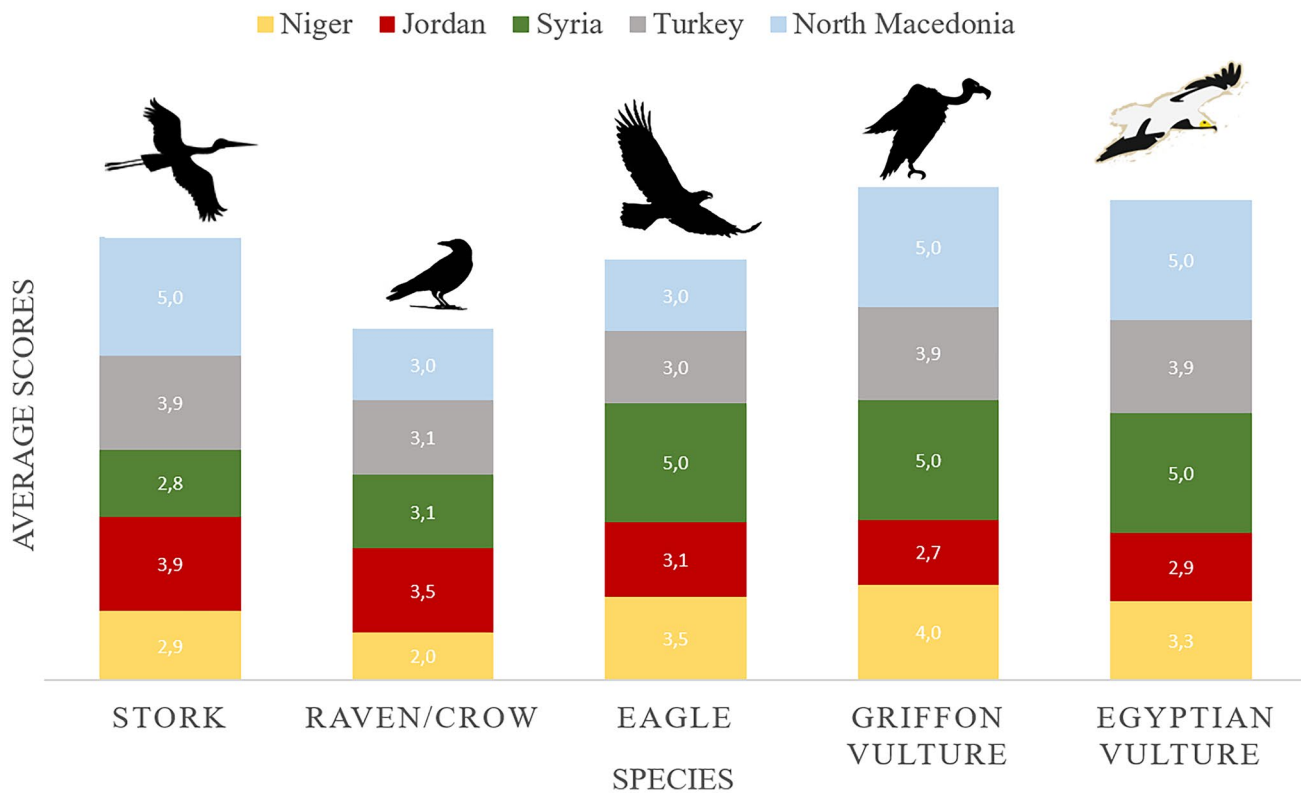


Fig. 4 Average scores (from 1–5) for the five species that were included in the ranking exercise

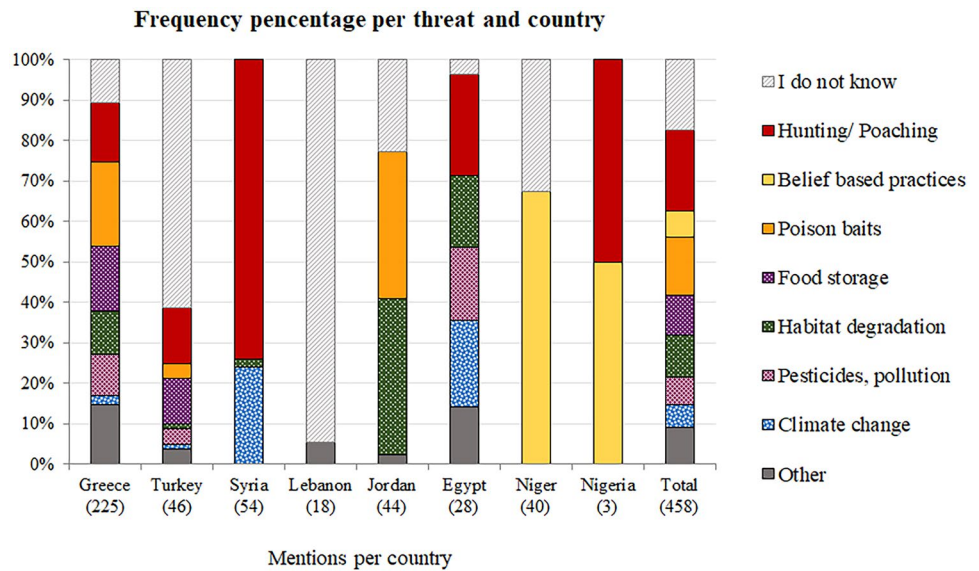
the decline of animal husbandry or changes in the management of carcasses and garbage dumps (10%). However, this awareness was not presented equally across all countries. Participants from North Macedonia, Albania, and Bulgaria mentioned poaching and poison baits; respondents from Albania and North Macedonia also mentioned changes in animal husbandry, while those from Bulgaria recognised habitat loss, degradation and desertification. In Niger and Nigeria, vulture parts in rituals and magic ceremonies were mentioned as the primary motivations for illegal killing. The category "other" included threats not frequently mentioned (> 3%): problems on the flyway and the birds' winter grounds, human irresponsibility or ignorance (Greece, Egypt); disturbance in nesting/roosting sites, diseases, and problems related to small populations (Greece, Turkey); electrocution and collision (Greece, Jordan). Interestingly, there are significant differences among countries even when the nations are neighbours, with Syria, Jordan, and Lebanon being the most notable example (Fig. 5).

Belief-based Practices and Vultures in Africa

The survey in the markets revealed seven stands in the total of ~3000 which were found selling animal parts in

a particular area in the back of the market; vulture parts were found in six of them and Egyptian vulture parts in three. Sellers, healers, and hunters (most sharing all three affiliations and some actively hunting vultures alongside other animals) claimed that all vulture species are sought for belief-based practices. However, there is no specific demand for the Egyptian vulture in these rituals. People did not consider their use illegal, and the practice seems to be widespread. They recognise that vultures have become rare, especially Egyptian vultures. Nigeria is mentioned as the country with the most significant demand (see also Saidu & Buij, 2013; Williams et al., 2014). Hunters use weapons or traps to catch the birds; one participant also mentioned poison. Healers use traps with bait (typically meat mixed with tobacco) as the bird should primarily come freely to the healer; otherwise, its supernatural power (juju) is considered weak. An elderly healer from Nigeria said that before killing the vulture, the healer should pray and ask the bird's spirit for permission to take its life to use it to save another's life. The healer should use the vulture parts he needs and bury the rest while praying at the base of an old tree protected from being cut by traditional cultural taboos. The tree and the bird's spirit can co-exist in harmony for eternity.

Fig. 5 Threats to vultures in general and the Egyptian vulture in particular as mentioned by participants in the study. Numbers in parentheses refer to mentions per country. North Macedonia, Albania, and Bulgaria do not appear in the graph as they did not provide numerical data but only 'present/absent' responses regarding threats



Mixed with feces, millet seeds, or other materials, various vulture parts and the bird's eggs are believed to magically heal a range of illnesses and ailments, remove bad energies and evil spirits, and protect the beneficiary. Nest contents are used against jinxes and bad spells; vulture fat and/or meat is used as a balm against rheumatism; the bird's head is believed to lend strength and make an individual forever rich; feathers are to protect one from enemies or antagonists and send away the uninvited; ground eyes are used to improve long-distance vision; while crushed bones are meant for winning an argument and achieving your aims (Table IV in Supplementary Material).

Discussion

Egyptian Vulture Charisma at the Root of a Positive Attitude Towards the Species

People's statements about birds referred almost equally to values of use and non-use, confirming that birds often represent intangible values, symbols, and ideas. These strong associations have been in existence for thousands of years, such as birds being seen as representative of the soul, spirits, or a messenger of the gods. Accordingly, they have regularly appeared as emblems, hieroglyphs, and symbols with a significant place in fables, morals, and metaphors. Imagination, freedom, peace, beauty, wisdom, fertility, prosperity, fidelity, and happiness are all concepts connected symbolically to various bird species (Birkhead, 2008; Cooper, 1979; Impelluso, 2004).

Our study showed that vultures are not amongst the first birds to be mentioned in free lists. However, people generally reacted positively to them, ranking "useful" vultures and

the Egyptian vulture higher than other species. They primarily appreciated their harmless nature and the hygienic role vultures played by removing animal debris prior to putrefaction, a service that vultures continue to offer in many parts of the world today (Houston, 2001; Moleón et al., 2014; Morelli et al., 2015). Vultures are ranked higher than storks, which are also characterised as valuable because they feed on generally disliked creatures, beautiful because of their white colour and elegant silhouette, and familiar because of their integration into human landscapes and their symbolic link with fertility (Cocker, 2013). However, people in the study feared the aggressive potency of "harmful" eagles while simultaneously admiring and treasuring their idealistic image as symbols of gods and emperors and emblems of victory, royalty, power, authority, and pride. Sometimes the living bird is despised while the mythical one is revered (Cooper, 1979). The term "eagle", in light of local people's understanding, is rather generic, representing many "big" raptors rather than referring to specific species. Corvids came last in the ranking system. With its black color, hoarse voice, and habit of stealing food and feeding on carrion, the raven is particularly stigmatised by the stereotype of being an evil omen. This is related to the bird's naturally acute vision, which is perceived by some as akin to the supernatural ability to foretell death, a belief compounded by the raven's habit of pecking out the eyes of the dead. In Turkey, the raven is called the "*monster's bell*," with "*monster*" being the wolf. Similarly, it is called "*vulture's spy*" in Africa (Mundy et al., 1992) and "*vulture*" in some parts of Greece (Stara et al., 2016). In Greece, its rattling call over settlements is considered a death omen, as the expression "*(someone) is calling the ravens*" means that person is nearing death, while the curse "*(go) to the raven*" is directed at either humans or animals, means to die from thirst.

Vultures' necrophagous nature also provides a strong source of metaphors associated with death, catastrophes and negative characteristics, including misfortunate, the sexual predator, the one who lurks in wait for either economic calamities, political scandals or death to happen. In dictionary definitions, the word “vulture” also means “a person of a vile and rapacious disposition” (Cocker, 2013). In Greece, gluttonous, rough, and “uncivilized” persons are disparagingly called vultures (Stara et al., 2016), while in recent Greek slang the verb “gypping” (from γύπας, or vulture) refers to sexually predatory men or women. The conceptualisation of vultures as “nature’s cleaners”, connecting them to ecosystem services offered for free, also has a hidden side to it, as the position of the cleaner is often associated with negative cultural stereotypes. On Socotra Island, the Egyptian vulture, which forages primarily in refuse dumps around settlements, is referred to as “soeydu”, which literally means “garbage bin” (Gangoso et al., 2013).

Moreover, in the late fifteenth century, early European explorers in Africa characterised vultures as gaunt, ravenous, loathsome harpies who would not allow “noble animals” (i.e., elephants) to die in peace. They were sometimes even perceived as “feared predators”. Additionally, the first ostrich farmers in Africa used strychnine to kill Egyptian vultures that often vomited on the ostriches’ water reservoirs and ate the birds’ large eggs by using stones to crack them open (Mundy et al., 1992). Thus, vultures can be characterised as contradictory in human perception: helpful cleaners that hide a “dark side” related to catastrophes. This dark side persists through the confusion about vultures and eagles, as our study revealed in Greece, Albania, and Lebanon; this misidentification often blames vultures for livestock attacks. Such stories, alongside other negative projections, are also prominent in the media; since the mid-2000s, media in Spain and France have helped fuel negative social perceptions of vultures as predators by publishing reported attacks by griffon vultures on healthy livestock without any scientific proof that they were responsible. Farmers’ demonstrations against the brown bear and the wolf because of livestock attacks in these countries have also recently included griffon vultures as a target, thereby justifying the deliberate persecution or poisoning of vultures despite the extreme rarity of recorded attacks (Ballejo et al., 2019; Craig et al., 2018; Margalida & Donázar, 2020). This negative public image is in contrast to the results of our ranking exercise in which people rated vultures higher than other bird species and conceptualised them not only as environmental cleaners but also, in Africa, as rain heralds and, elsewhere, as part of a remembered pastoral life or as rare or endangered species with fascinating life stories.

The unique characteristics of the Egyptian vulture compared to other vulture species influence human perceptions of it. Its white colour and smaller size are responded

to positively as signs of beauty and incorporated into local names for the species in Albania (white flour; Topi, 2019), North Macedonia (white eagle), Greece (white eagle, white vulture, white hawk, white chicken), Turkey (white father), Nigeria (white vulture) and Bulgaria (small vulture or white bottom). Its diet, which is considerably more diverse than other vultures and includes feces and waste found near villages and slaughter-houses in Africa and the remains of dairy products around farms in the Balkans as well as carrion, is a fact also confirmed by the many local names used in Greece to refer to the bird: fat-eater, whey-eater, milk-eagle, cheese-maker, and tortoise-eater. Furthermore, its migratory nature, bringing the bird to Europe in spring and to sub-Saharan Africa at the beginning of the rainy season, positions it as the herald of a new beginning at the end of a difficult season, in the same way that other beloved and well-known migratory species such as storks, swallows and cuckoos are seen as good omens (Stara et al., 2016). Lastly, its current unfavourable conservation status as a species globally threatened with extinction is perceived as an opportunity for eco-tourism in Turkey, Jordan, Egypt, and Bulgaria. Recent communication campaigns (2012–2016) focusing on the bird’s plight resulted in the Egyptian vulture becoming the emblem of Madzharovo in Bulgaria, described as the “pride of the region” and a tourist attraction in the Special Protection Area (SPA) of the Eastern Rhodope Mountains.

Awareness Levels of Threats to Vultures

Today, vultures are both threatened and charismatic, enabling conservationists to utilise them as flagship species to acquire financial support, raise environmental awareness, and plan systems of protected areas (Panagiotopoulou et al., 2018; Sergio et al., 2006). Once common in the past, they have recently become one of the rarest guilds of species in the world. Our results showed that 17.5% of the participants in the study were unable to explain why vulture populations are declining. In contrast, the rest of the participants were aware of various threats that vary geographically. In most countries, direct persecution was recognised as a problem, which is confirmed by Opper et al. (2021) for Syria and Nigeria.

On the contrary, in Lebanon, lack of awareness is the highest among the rest countries, while in Niger, people are aware of the use of vultures based on belief practices, but not for the means of killing them. According to Opper et al. (2021), deliberate poisoning of predators in rural areas, which ultimately kills or sickens vultures when consuming the baited carcasses, is considered a significant threat in all Balkans countries being related to the species' significant decline (BirdLife International, 2021). This is underestimated in our results.

Furthermore, electrocution and collision seem, a severe cause of mortality in Turkey, Jordan, and Egypt and less severe in the Balkans (Oppel et al., 2021), are absent from our results. Comparing mentioned threats with the free lists, we also have contradictory results. When respondents were asked explicitly about vultures, they could reply with particulars about the birds, but vultures are absent from the free lists. This is not surprising, as many rare, threatened, and endangered species tend to be forgotten about culturally. This is in keeping with the known pattern: “first, we lose detailed knowledge about a species in decline and then the ability to recognise or name it” (Stara et al., 2016). Accordingly, in North Macedonia, we found that although nearly everyone was aware of the Egyptian vulture’s local name—“*kanya*”—rarely could they recognise the bird from a photo. On the other hand, results from Greece and Bulgaria indicated that the previously unknown Egyptian vulture had gained a place on the list of known endangered species due to recent educational campaigns. These revitalised its local name of “*cuckoo’s horse*,” used in Greece and Albania, a name associated with the narrative of the “lazy” cuckoo traveling on the back of the Egyptian vulture during migration.

Belief-based Practices and Vultures

Our results confirm that most traditional treatments that include vulture parts are based on belief systems in which human health and welfare are connected to supernatural forces and relationships with ancestors, and therefore cannot realistically be scientifically screened, inhibiting the potential to prescribe alternative medicines (Nieman et al., 2019). Our study revealed that in Egypt, in the Shalateen region, people eat the liver of vultures to protect themselves against deadly scorpion bites, while in Syria and Turkey, a raven’s or wolf’s dried liver blended with salt is believed to heal sick grazing animals. Similarly, the use of vulture parts, including the Egyptian vulture, is referred to in both ancient and modern literature in Greece as remedial (Thompson, 1966). Practices incorporating amulets and spells in rituals are believed to magically transmit to people vultures’ immune defenses and purification symbolism (MaMing & Xu, 2015; Ogada et al., 2015; Porter & Suleiman, 2012; Sánchez-Pedraza et al., 2012). However, these practices are not purely remedial. They are also used to enforce contracts, ensure compliance (e.g., politicians who allegedly use vulture eggs to make charms for election purposes), correctly predict sports results, and play the lottery and win bets (Warchol, 2004). Several vulture species of the genus *Gyps*, tigers, and rhinoceros are among the endangered species (some of them Critically Endangered) used for medicinal or belief-based uses (Nieman et al., 2019). It is estimated that 1,250 vulture traders, hunters, and traditional healers

in eastern South Africa alone are involved in the vulture trade, with some 59,000 people having used vultures’ body parts there (Chara, 2016). Body parts like those belonging to an individual juvenile Egyptian vulture tagged with a satellite transmitter in Greece shot in Niger to supply a fetish market in Nigeria (Kret et al., 2018). Healers claim that, alongside vultures, traditional healing practices are also threatened by extinction (Chara, 2016) and that the blame should be placed on globalisation and commercialisation as the common causes of bio-cultural diversity loss. However, a rapidly expanded and profitable traditional industry that extends well beyond national borders gives space to fake healers driven by financial gains. At the same time, commercialisation enlarges the disconnect between patients and healers, further compounding the adverse effects on biodiversity. Considering that people in poor rural areas often have little opportunity to access modern medicine (Nieman et al., 2019), is discouraging people from using endangered species for medical purposes the best solution to the issue? The mobilisation of local authorities to promote sensitisation about poaching and strengthen control by raising awareness seems to have a positive effect, particularly as local chiefs are well respected and the concept of illegal killing (illegal killing is the number one threat in Fig. 5) is understood by people. Experience in tackling the wildlife trade in other countries suggests that educational campaigns can also be successful; for example, in China, a 50–70% decrease in shark fin consumption has been followed by educational campaigns on the issue since 2011. Lastly, the spread of zoonoses via the use of wild animals, with the most recent example being, in all likelihood, the COVID-19 pandemic, and India’s terrible vulture crisis, in which an estimated disappearance of more than 99% of the country’s vulture populations in just a single decade lead to the serious exponential growth of rabies and the consequent loss of human life, could be used in awareness campaigns concerning the importance of protecting wild species for the sake of public health (Buechley et al., 2022; Markandya et al., 2008; Nieman et al., 2019; Volpato et al., 2020).

Conservation Implications

Different vulture species inspire different feelings among the public, similar to results found in the study of Trajçe et al. (2019) concerning carnivores. Negative stereotypes spoil vultures’ harmless behaviour and the environmental cleaning services they provide. However, the Egyptian vulture has the potential to create a positive wave of perceptual change and to include other vulture species in the creation of a new identity culturally apart from the damaging stereotypes that typically accompany scavengers and could invert the use of poison or direct shooting of these harmful species. New identities for vultures are not

new in conservation. The public image of the California condor early in the twentieth century was transformed from that of a common pest and opportunistic scavenger to a living symbol of America's primordial past and the cultural icon of the country's wilderness preservation movement (Alagona, 2004). Likewise, nature conservation organisations in Europe changed the official English name of the "lämmergeier" (*Gypaetus barbatus*) in their educational campaigns (literally the bird that takes lambs in German-speaking countries) to "bearded vulture", based on the scientific name, which refers to the dark, bristling beard that adorns the head of both female and male birds. The reason for this alteration was to detach the species from the misleading reputation it has for killing live animals, a reputation which resulted in their extirpation from most of Europe (Foundation Pro Bartgeier, 2020). Today, the work of scientists and conservationists in creating a solid new identity for the bearded vulture is helping to reinforce conservation actions on the bird's behalf positively.

So, what is the best way to design a public awareness campaign for the endangered Egyptian vulture, a bird that annually moves between three different continents? We know that different stakeholders are engaged by different stories (Cortés-Avizanda et al., 2018): shepherds, for example, are drawn to stories of the species' relationship with pastoral life; people in the Balkans feel connected to stories that reference the spring rites of passage; people in the tourism industry see the species' endangered conservation status as an advantage for attracting eco-tourists; while people with internet access are emotionally touched by the vivid details of the lives of those birds given names and tagged with satellite transmitters and impressed by the perilous annual journeys (Egyptian vulture New Life, 2022). Our study also showed that awareness campaigns directed towards different threats also have different audiences. In Niger and Nigeria, collaboration with respected members of local communities, such as traditional chiefs and local healers, is essential to promote awareness regarding poaching and conservation-friendly, belief-based substitutes that do not endanger vultures. However, are these steps sufficient to stop people from using poison baits that indirectly affect all scavengers? As varied cultures integrate animals differently within their societies, education and awareness-raising campaigns need to be species-specific (even within the guild of vulture species) and particular to each country or region. Diverse conceptualisations along the flyway of migratory species can spread a strong message about the need for collaborative international partnership and bridge the gaps between nature conservation science, local communities, and relevant stakeholders.

Conclusion

The Egyptian vulture example reveals that intangible cultural heritage related to nature can create and inspire new approaches to conservation. For vultures that are highly vulnerable to negative stereotypes and for which awareness is a key to their survival, appealing new narratives can distribute a strong message featuring them as emblems of biocultural heritage conservation.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10745-022-00340-6>.

Acknowledgements The authors would like to thank Ian Fisher and Joeline Hughes (RSPB) for their contribution to the study design, John M. Halley and Martha Charitonidou (UOI), and Theodora Skartsi (WWF Hellas) for their help during the research in Greece and Branimira Vezhdarova (ESTAT) in Bulgaria, Matthew Chidozie Ogwu for his valuable help in understanding belief-based practices in Nigeria, Aris Manolopoulos and Roula Trigou (HOS) for the provision of the map and photos, Anastasios Bounas for his comments, Julian Hoffman for his valuable edits and remarks on the final manuscript and all local participants for their collaboration and time during the fieldwork.

Author Contributions Kalliopi Stara, Victoria Saravia-Mullin, Stoyan C. Nikolov and Panagiotis Kordopatis contributed to the study conception and design. Material preparation and data collection were performed by Adem Akyol, Raziye İçtepe Akyol, Nabegh Ghazal Asswad, Turan Çetin, Maher Dayyoub, Gligor Dushi, Serdar Özuslu, Nenad Petrovski, Ivalina Simeonova, Yana Spassova, Kalliopi Stara, Tareq Emad Qaneer, Cloé Pouchier, Louis Junior Saad, Hana ElSafoury, Mirjan Topi and Denada Ziu. Kalliopi Stara performed analysis and wrote the first draft of the manuscript. Rigas Tsiakiris, Victoria Saravia-Mullin, Stoyan C. Nikolov, Nabegh Ghazal Asswad, Solomon Adefolu, Samuel Tertese Ivande, Elzbieta Kret, Aleksandër Trajçe, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding This study was implemented within the framework of the Egyptian Vulture New LIFE project (LIFE16 NAT/BG/000874, www.LifeNeophron.eu), which was funded by the European Commission and co-funded by the A.G. Leventis Foundation, the MAVA Foundation, and the Green Fund. Data concerning the research in Greece and Bulgaria resulted from the LIFE project, The Return of the Neophron (LIFE10 NAT/BG/000152), which was funded by the European Commission and co-funded by the AG Leventis Foundation.

Data Availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Informed Consent Data that support this study are available from the corresponding author on reasonable request and only after blinding (anonymization). All data were collected with the consent of the participants in the study. Identifiable personal data will never be published.

Conflict of Interest The authors declare that they have no conflict of interest.

References

- Aguilera-Alcalá, N., Morales-Reyes, Z., Martín-López, B., Moleón, M., & Sánchez-Zapata, J. A. (2020). Role of scavengers in providing non-material contributions to people. *Ecological Indicators*, 117, 106643. <https://doi.org/10.1016/j.ecolind.2020.106643>
- Alagona, P. (2004). Biography of a “feathered pig”: The California Condor Conservation Controversy. *Journal of the History of Biology*, 37, 557–583. <https://doi.org/10.1007/s10739-004-2083-6>
- Alexiou, M. (2002). *O teletourgikos thrinos stin Elliniki paradosi (Ritual mourning in Greek tradition)*. National Bank of Greece Cultural Foundation (in Greek).
- Ballejo, B., Graña-Grilli, M., & Lambertucci, A. S. (2019). A long and troublesome journey: People's perceptions and attitudes along the migratory path of a scavenger bird. *Ethnobiology and Conservation*, 8. <https://doi.org/10.15451/ec2019-10-8.13-1-13>
- Bildstein, K. L., & Therrien, J. F. (2018). Urban Birds of Prey: A Lengthy History of Human-Raptor Cohabitation. In C. Boal & C. Dykstra (Eds.), *Urban Raptors Ecology and Conservation of Birds of Prey in Cities* (pp. 3–17). Island press.
- BirdLife International. (2016). *Ciconia ciconia*. The IUCN Red List of Threatened Species 2016: e.T22697691A86248677. Retrieved July 14, 2020. <https://doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22697691A86248677.en>
- BirdLife International (2021). *Neophron percnopterus*. The IUCN Red List of Threatened Species 2021: e.T22695180A205187871. Retrieved February 2, 2020, from <https://doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22695180A205187871.en>
- Birkhead, T. (2008). *The wisdom of birds. An illustrated history of Ornithology*. Bloombury.
- Botha, A. J., Andevski, J., Bowden, C. G. R., Gudka, M., Safford, R. J., Tavares, J., & Williams, N. P. (2017). *CMS Multi-species Action Plan to conserve African-Eurasian Vultures*. Coordinating Unit of UNEP/Raptors MoU.
- Buechley, E. R., Murgatroyd, M., Ruffo, A. D., Bishop, R. C., Christensen, T., Marra, P. P., Sillett, T. S., & Şekercioğlu, Ç. H. (2022). Declines in scavenging by endangered vultures in the Horn of Africa. *Journal of Wildlife Management*, e22194. <https://doi.org/10.1002/jwmg.22194>
- Buechley, E. R., Opper, S., Beatty, W. S., Nikolov, S. C., Dobrev, V., Arkumarev, V., Saravia, V., Bougain, B., Bounas, A., Kret, E., Skartsi, Aktay, L., Aghababayan, K., Frehner, E., & Şekercioğlu, C.H. (2018). Identifying critical migratory bottlenecks and high-use areas for an endangered migratory soaring bird across three continents. *Journal of Avian Biology*, e01629. <https://doi.org/10.1111/jav.01629>
- Buechley, E. R., Opper, S., Efrat, R., Phipps, W. L., Alanís, I. C., Álvarez, E., Andreotti, A., Arkumarev, V., Berger-Tal, O., Bermejo, A. B., Bounas, A., Ceccolini, A. C., Dobrev, V., Duriez, O., García, J., García-Ripollés, C., Galán, M., Gil, A., Giraud, L., Hatzofe, O., Iglesias-Lebrija, J. J., Karyakin, I., Kobierzycki, E., Kret, E., Loercher, F., López-López, P., Miller, Y., Mueller, T., Nikolov, S. C., de la Puente, J., Sapir, N., Saravia, V., Şekercioğlu, Ç. H., Sillett, S. T., Tavares, J., Urios, V., & Marraet, P. P. (2021). Differential survival throughout the full annual cycle of a migratory bird presents a life-history trade-off. *Journal of Animal Ecology*, 90, 1228–1238. <https://doi.org/10.1111/1365-2656.13449>
- Buechley, E. R., & Şekercioğlu, Ç. H. (2016). The avian scavenger crisis: Looming extinctions, trophic cascades, and loss of critical ecosystem functions. *Biological Conservation*, 198, 220–228. <https://doi.org/10.1016/j.biocon.2016.04.001>
- Campbell, M. (2009). Factors for the presence of avian scavengers in Accra and Kumasi, Ghana. *Area*, 41, 341–349. <https://doi.org/10.1111/j.1475-4762.2008.00870.x>
- Chara, T. (2016). *Vultures face extinction as betting outlets sprout*. The Sunday Mail. Retrieved July 23, 2020, from <https://www.sundaymail.co.zw/vultures-face-extinction-as-betting-outlets-sprout>
- Cocker, M. (2013). *Birds and People*. Jonathan Cape.
- Cooper, I. C. (1979). *An illustrated encyclopaedia of traditional symbols*. Thames and Hudson.
- Cortés-Avizanda, A., Martín-López, B., Ceballos, O., & Pereira, H. M. (2018). Stakeholders perceptions of the endangered Egyptian vulture: Insights for conservation. *Biological Conservation*, 218, 173–180. <https://doi.org/10.1016/j.biocon.2017.09.028>
- Craig, C. A., Thomson, R. L., & Santangeli, A. (2018). Communal farmers of Namibia appreciate vultures and the ecosystem services they provide. *Ostrich*, 89(3), 211–220. <https://doi.org/10.2989/00306525.2018.1435566>
- Dobrev, V., Boev, Z., Arkumarev, V., Dobrev, D., Kret, E., Saravia, V., Bounas, A., Vavylis, D., Nikolov, S. C., & Opper, S. (2016). Diet is not related to productivity but to territory occupancy in a declining population of Egyptian Vultures *Neophron percnopterus*. *Bird Conservation International*, 26, 273–285. <https://doi.org/10.1017/S0959270915000155>
- Donaldson, J. (2017). *The ugly five*. Scolastic U.K.
- Egyptian Vulture New Life. (2022). *Transmitters*. Retrieved February 8, 2022, from <https://www.lifeneophron.eu/#transmitters>
- Eriksen, T. H. (1995). *Small Places, Large Issues: An Introduction to Social and Cultural Anthropology (Anthropology)*. PLUTO press.
- Foundation Pro Bartegeier. (2020). *A Vulture with a beard*. Retrieved July 24, 2020 from <https://www.beardedvulture.ch/beardedvulture/biology>
- Gangoso, L., Agudo, R., Anadón, J. D., de la Riva, M., Suleyman, A. S., Porter, R., & Donazar, J. A. (2013). Reinventing mutualism between humans and wild fauna: Insights from vultures as ecosystem services providers. *Conservation Letters*, 6, 172–179. <https://doi.org/10.1111/j.1755-263X.2012.00289.x>
- Houston, D. (2001). *Vultures and Condors*. Colin Baxter Photography Ltd, Grantown-on-Spey.
- Impelluso, L. (2004). *Nature and its symbols*. The J. Paul Getty Museum.
- Kret, E., Rabeil, T., Muhammad, S. I., Shiiwua, M., Hall, P., Arkumarev, V., Dobrev, V., & Nikolov, S. C. (2018). First documented case of the killing of an Egyptian Vulture (*Neophron percnopterus*) for belief-based practices in Western Africa. *Vie Et Milieu - Life and Environment*, 68, 45–50.
- MaMing, R., & Xu, G. (2015). Status and threats to vultures in China. *Vulture News*, 68(1), 3–24.
- Margalida, A., Benitez, J. R., Sanchez-Zapata, J. A., Avila, E., Arenas, R., & Donazar, J. A. (2012). Long-term relationship between diet breadth and breeding success in a declining population of Egyptian Vultures *Neophron percnopterus*. *Ibis*, 154, 184–188. <https://doi.org/10.1111/j.1474-919X.2011.01189.x>
- Margalida, A., & Donazar, J. A. (2020). Fake news and vultures. *Nature Sustainability*. <https://doi.org/10.1038/s41893-020-0534-5>
- Markandya, A., Taylor, T., Longo, A., Murty, M. N., & Dhavala, K. (2008). Counting the Cost of Vulture Declines-Economic Appraisal of the Benefits of the Gyps Vulture in India. *Ecological Economics*, 67(2), 194–204. <https://doi.org/10.1016/j.ecolecon.2008.04.020>
- McClure, C. J. W., Westrip, J. R. S., Johnson, J. A., Schulwitz, S. E., Virani, M. Z., Davies, R., Symes, A., Wheatley, H., Thorstrom, R., Amar, A., Buij, R., Jones, V. R., Williams, N. P., Buechley, E. R., & Butchart, S. H. M. (2018). State of the world's raptors: Distributions, threats, and conservation recommendations. *Biological Conservation*, 227, 390–402. <https://doi.org/10.1016/j.biocon.2018.08.012>
- Moleón, M., Sánchez-Zapata, J. A., Margalida, A., Carrete, M., Owen-Smith, N., & Donazar, J. A. (2014). Humans and Scavengers: The Evolution of Interactions and Ecosystem Services.

- BioScience*, 64(5), 394–403. <https://doi.org/10.1093/biosci/biu034>
- Morelli, F., Kubicka, A. M., Tryjanowski, P., & Nelson, E. (2015). Human-Vulture Interaction. *Anthrozoös*, 28(3), 449–468. <https://doi.org/10.1080/08927936.2015.1052279>
- Mundy, P., Butchart, D., Ledger, J., & Piper, S. (1992). *The Vultures of Africa*. Academic Press.
- Nieman, W. A., Leslie, A. J., & Wilkinson, A. (2019). Traditional medicinal animal use by Xhosa and Sotho communities in the Western Cape Province, South Africa. *Journal of Ethnobiology and Ethnomedicine*, 15, 34. <https://doi.org/10.1186/s13002-019-0311-6>
- Ogada, D., Shaw, P., Beyers, R. L., Buij, R., Murn, C., Thiollay, J. M., Beale, C. M., Holdo, R. M., Pomeroy, D., Baker, N., Krüger, S. C., Botha, A., Virani, M. Z., Monadjem, A., & Sinclair, A. R. E. (2015). Another Continental Vulture Crisis: Africa's Vultures Collapsing toward Extinction. *Conservation Letters*, 9, 89–97. <https://doi.org/10.1111/conl.12182>
- Ogada, D. L., Keesing, F., & Virani, M. Z. (2012). Dropping dead: Causes and consequences of vulture population declines worldwide. *Annals of the New York Academy of Sciences*, 1249, 57–71. <https://doi.org/10.1111/j.1749-6632.2011.06293.x>
- Olea, P. P., & Mateo-Tomás, P. (2009). The role of traditional farming practices in ecosystem conservation: The case of transhumance and vultures. *Biological Conservation*, 142, 1844–1853. <https://doi.org/10.1016/j.biocon.2009.03.024>
- Oppel, S., Arkumarev, V., Bakari, S., Dobrev, V., Saravia-Mullin, V., Adefolu, S., Sözüer, L. A., Apeverga, P.T., Arslan, Ş., Barshep, Y., Bino, T., Bounas, A., Çetin, T., Dayyoub, M., Dobrev, D., Duro, K., El-Moghrabi, L., ElSafoury, H., Endris, A., Asswad, N. G., Harry, J. H., Ivande, S. T., Jbour, S., Kapsalis, E., Kret, E., Mahamued, B. A., Manu, S. A., Mengistu, S., Zabeirou, A. R. M., Muhammad, S. I., Nakev, S., Ngari, A., Onoja, J., Osta, M., Özusul, S., Petrovski, N., Popgeorgiev, G., Pourchier, C., Ruffo, A., Shobrak, M., Sidiropoulos, L., Skartsi, Th., Sözüer, Ö., Stara, K., Tesfaye, M., Topi, M., Vavylis, D., Velevski, M., Vorpsi, Z., Wondafraash, M., Xeka, E., Yenyiyurt, C., Yordanov, E., & Nikolov, S. C. (2021). Major threats to a migratory raptor vary geographically along the eastern Mediterranean flyway. *Biological Conservation*, 262, 109277. <https://doi.org/10.1016/j.biocon.2021.109277>
- Oppel, S., Dobrev, V., Arkumarev, V., Saravia, V., Bounas, A., Kret, E., Velevski, S. S., & Nikolov, S. C. (2015). High juvenile mortality during migration in a declining population of a long-distance migratory raptor. *Ibis*, 157, 545–557. <https://doi.org/10.1111/ibi.12258>
- Oppel, S., Dobrev, V., Arkumarev, V., Saravia, V., Bounas, A., Manolopoulos, A., Kret, E., Velevski, M., Popgeorgiev, G. S., & Nikolov, S. C. (2016). Landscape factors affecting territory occupancy and breeding success of Egyptian vultures on the Balkan Peninsula. *Journal of Ornithology*, 158, 443–457. <https://doi.org/10.1007/s10336-016-1410-y>
- Panagiotopoulou, M., Azmanis, P., Tsiakiris, R., & Stara, K. (2018). Carry on Carrion: The Fall of the Scavenger. In A. Butterworth (Ed.), *Animal Welfare in a Changing World* (pp. 57–67). CABI.
- Phipps, L.W., López-López, P., Buechley, E.R., Oppel, O., Álvarez, E., Arkumarev, V., Bekmansurov, R., Berger-Tal, O., Bermejo, A., Bounas, A., Alanís, I.C., de la Puente, J., Dobrev, V., Duriez, O., Efrat, R., Fréchet, G., García, J., Galán, M., García-Ripollés, C., Gil, A., Iglesias-Lebrija, J.J., Jambas, J., Karyakin, J.V., Kobierzycki, E., Kret, E., Loercher, F., Monteiro, A., Morant Etxebarria, J.M., Nikolov, S.C., Pereira, J., Peške, L., Ponchon, C., Realinho, E., Saravia, V., Sekercioglu, C.H., Skartsi, T., José Tavares, J., Teodósio, J., Urios, V., & Vallverdú, N. (2019). Spatial and Temporal Variability in Migration of a Soaring Raptor Across Three Continents. *Frontiers in Ecology and Evolution*. <https://doi.org/10.3389/fevo.2019.00323>
- Plaza, P. I., & Lambertucci, S. A. (2021). Governments must halt vulture poisoning. *Science*, 374, 6575. <https://doi.org/10.1126/science.abn2066>
- Plaza, P. I., Martínez-López, E., & Lambertucci, S. A. (2019). The perfect threat: Pesticides and vultures. *Science of the Total Environment*, 687, 1207–1218. <https://doi.org/10.1016/j.scitotenv.2019.06.160>
- Porter, R. F., & Suleiman, A. S. (2012). The Egyptian Vulture *Neophron percnopterus* on Socotra, Yemen: Population, ecology, conservation and ethno-ornithology. *Sandgrouse*, 34, 44–62.
- Safford, R., Andevski, J., Botha, A., Bowden, C. G. R., Crockford, N., Garbett, R., Margalida, A., Ramirez, I., Shobrak, M., Tavares, J., & Williams, N. P. (2019). Vulture conservation: The case for urgent action. *Bird Conservation International*, 29, 1–9. <https://doi.org/10.1017/S0959270919000042>
- Saidu, Y., & Buij, R. (2013). Traditional medicine trade in vulture parts in northern Nigeria. *Vulture News*, 65, 4–14. <https://doi.org/10.4314/vulnew.v65i1.1>
- Sánchez-Pedraza, R., Gamba-Rincón, M. R., & González-Rangel, A. L. (2012). Use of black vulture (*Coragyps atratus*) in complementary and alternative therapies for cancer in Colombia: A qualitative study. *Journal of Ethnobiology and Ethnomedicine*, 8, 20.
- Schüz, E., & König, C. A. (1983). Old World Vultures and Man. In R. Sanford, W. Jackson, & J. Jackson (Eds.), *Vulture Biology and Management* (pp. 461–469). University of California Press.
- Sergio, F., Newton, I., Marchesi, L., & Pedrini, P. (2006). Ecologically justified charisma: Preservation of top predators delivers biodiversity conservation. *Journal of Applied Ecology*, 43, 1049–1055. <https://doi.org/10.1111/j.1365-2664.2006.01218.x>
- Sitnikov, I. (2016). The Taiwan “Temple of Eighteen Deities” (Traces of Eurasia-Pacific cult). *Philosophical Anthropology*, 2(1), 61–78.
- Stara, K., Sidiropoulos, L., & Tsiakiris, R. (2016). Bound Eagles, Evil Vultures and Cuckoo Horses. Preserving the Bio-Cultural Diversity of Carrion Eating Birds. *Human Ecology*, 44, 751–764. <https://doi.org/10.1007/s10745-016-9864-3>
- Thompson, D. A. W. (1966). *A glossary of Greek birds*. Georg Olms Verlagsbuchhandlung Hildesheim.
- Topi, M. (2019). *Vocabulary of the names of birds of Albania Latin-English-French-Albanian*. Gent Grafik.
- Trajçe, E., Ivanov, G., Keçi, E., Majić, A., Melovski, D., Mersini, K., Mustafa, S., Skrbinšek, T., Stojanov, A., Todorovska, A., von Arx, M., & Linnell, J. D.C. (2019). All carnivores are not equal in the rural people's view. Should we develop conservation plans for functional guilds or individual species in the face of conflicts? *Global Ecology and Conservation*, 19, e00677. <https://doi.org/10.1016/j.gecco.2019.e00677>
- Velevski, V., Nikolov, S. C., Hallman, B., Dobrev, V., Sidiropoulos, L., Saravia, V., Tsiakiris, R., Arkumarev, V., Galanaki, A., Kominos, Th., Stara, K., Kret, E., Crubac, B., Lisicatec, E., Kastritis, Th., Vavylis, D., Topi, M., Hoxha, B., & Oppel, S. (2015). Population decline and range contraction of the Egyptian Vulture *Neophron percnopterus* in the Balkan Peninsula. *Bird Conservation International*, 25(4), 440–450. <https://doi.org/10.1017/S0959270914000343>
- Volpato, G., Fontefrancesco, M. F., Gruppuso, P., Zocchi, D. M., & Pieroni, A. (2020). Baby pangolins on my plate: Possible lessons to learn from the COVID-19 pandemic. *Journal of Ethnobiology and Ethnomedicine*, 16, 19. <https://doi.org/10.1186/s13002-020-00366-4>

- Warchol, G. L. (2004). The Transnational Illegal Wildlife Trade. *Criminal Justice Studies: A Critical Journal of Crime, Law and Society*, 17(1), 57–73. <https://doi.org/10.1080/08884310420001679334>
- Wilbur, S. R., & Jackson, J. A. (1983). *Vulture Biology and Management*. University of California Press.
- Williams, V. L., Cunningham, A. B., Kemp, A. C., & Bruyns, R. K. (2014). Risks to Birds Traded for African Traditional Medicine:

A Quantitative Assessment. *PLoS ONE*, 9(8), e105397. <https://doi.org/10.1371/journal.pone.0105397>

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