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Original article

The Effect of Human Activities on Raptors: A Preliminary Study on Samples of Wildlife Rehabilitation Center

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Abstract. *Study Objectives:* Raptors are species playing a role in critical ecological functions, supporting human societies as the bio indicator of environmental health, and tending to be extinct. Human factors affect the entire ecosystem as well as raptors. The aim of this study was to determine why raptors were brought to a wildlife center in Turkey and to detect outcomes. In this study, records of 348 raptors within Falconiformes and Strigiformes orders admitted to a wildlife rehabilitation center between 2017-2020 were studied. *Methods:* In this study, we analyzed raptors by taking the following factors into account: year of admission; order (Falconiformes or Strigiformes); species; season; cause of admission; type of landscape; hunting season or not; raptor outcomes. The relationships between variables were determined by the Chi-Square test. The statistical significance level was taken as 0.05. *Results:* According to the results of this study, the increase in the number of raptors affected by threats over the years was considered significant ($p<0.01$). One of the anthropogenic based threats; trauma was considered carrying the highest risk (40.2%) in both orders while the second one was detected as a condition disorder. The third one was firearms injuries for Falconiformes (14.2%) and orphans (22%) for Strigiformes. Wintering season has been full of threats for both orders ($p<0.01$). While Falconiformes faced more threats in suburban areas ($p<0.01$), the locality was found to be insignificant in Strigiformes based on threats ($p>0.05$). The relation between threats and outcomes in Falconiformes was found highly important ($p<0.01$) and the highest mortality rate was stated as 75.6% by firearms injuries and the release rate 86.2% for the orphan. A crucial relation was detected between hunting season and threats ($p<0.01$) and gun shooting injuries were found the highest for both orders during this period. *Conclusion:* It was concluded that threats from human interaction on Raptors in Turkey are at a serious level.

Key words: Raptors, Turkey, Threats, Wildlife Rehabilitation

Introduction

Biodiversity crisis arises from the impact of human activities on ecosystems (1) and this crisis leads to the loss of ecosystem services and ecological processes (2). Raptors are species that play a role in critical ecological functions, support human societies as a bio indicator of environmental health, and are prone to extinction (3, 4). Birds of prey are more threatened with extinction than other animals due to their life cycles (5). In raptors, not only do late breeding age and low breeding rate but also many anthropogenic threats make high mortality rates susceptible (6, 7, 8). Raptors are generally sensitive to urbanization and habitat changes (9, 10). Habitats contain a variety of potential threats to birds of prey, such as poisoning, electrocution, gun

shooting, disturbance, collisions with vehicles, and windows and air structures (11-17). Raptor persecution is still in progress with potentially significant impacts for some species and populations (18). While 52% of the global population of birds of prey is declining, 18% is threatened with extinction (5). Globally, the population of raptor species listed as Least Concern according to the IUCN Red List is declining at an alarming rate (19). Ways should be found to reduce the incidence of anthropogenic injury in raptors to ensure sustainability (20). Turkey contains 51 raptor species, either as residents or as migrants and 11 species of raptors are under conservation concern status (21). Within this bird group, there are diurnal species such as hawks, falcons, and eagles, and nocturnal species, such as owls. Since Turkey is a hosting country rich in bird populations in Europe, this study may be an important source of information about threats on predatory birds. Assessing wildlife threats and understanding population dynamics is essential for management and conservation action planning. Anticipating future threats in a rapidly changing world is the key to reduce losses and increasing future protection (8). It is almost impossible to find dead or dying wild animals in nature and to determine the causes of death. Therefore, the wildlife rehabilitation center is a suitable place to analyze threats to animals. (22) In this study, we analyzed the causes of admission of raptors arriving at the wildlife rehabilitation center of Afyonkarahisar in Turkey from 2017 to 2020 to determine the main threats and mortality causes.

Materials and Methods

We analyzed 4 years (2017–2020) of data from AKUREM (Afyon Kocatepe University Wildlife Rescue Rehabilitation Practice Application and Research Center). The rehabilitation center is operated under the direction of Afyon Kocatepe University, which stipulates the management protocols and ethical principles according to the V. Regional Directorate of Nature Conservation and National Parks legislation. A retrospective study was conducted based on the data of 348 raptor applications. The research material, consisting of 24 different species, was divided into 2 orders: Falconiformes (diurnal) and Strigiformes (nocturnal) (Table 1). In the studied raptor species; Imperial eagle (*Aquila heliaca*) was vulnerable (VU) statues, Cinereous vulture (*Aegypius monachus*) was near threat (NT) and Saker falcon (*Falco cherrug*) was endangered (EN) and the others were considered as Least Concerned (LC) categories by the IUCN (International Union for Conservation of Nature and Natural Resources) red list.

We analyzed raptors by taking the following factors into account: [1] year of admission; [2] order (Falconiformes or Strigiformes); [3] species; [4] season: breeding (from March to July), post-nuptial period (August to October) and wintering (November to February) (12, 22); [5] cause of admission; gun shooting (raptors with gunshot wounds confirmed by radiography), trauma (all injuries that were caused by collision with cars, windows, power lines exc.), electrocution (raptors with electrocution wounds), orphaned (those with no health problems were categorized as orphans, and those without health problems according to their problems), condition disorder (when a raptor shows signs of weakness, malnutrition, infection or poisoning; since toxicological tests could not be performed within the facilities of our rehabilitation center, we could not define the cases of poisoning and debilitation correctly, so we evaluated poisonings under the general condition disorder); [6] type of landscape where the bird was found (urban or suburban; while city center accepted as urban, the others suburban); [7] hunting season or not; [8] raptor final outcomes (ex, euthanasia, captured and released back to wild). Information that was collected on the admission of raptor included rescue center number, date of admission, location found, the reason for admission, and outcomes.

Statistical Analysis

The data obtained in the study were analyzed with the SPSS 21.0 for Windows program. Relationships between variables were determined by the Chi-Square test. The statistical significance level was taken as 0.05.

Results

We analyzed a total of 348 birds belonging to 2 different orders and 24 species: 59 of them in 4 different

species from Strigiformes (17.0%) and 289 of them in 20 different species from Falconiformes (83.0%) were admitted to AKUREM (Table 1). The most frequently admitted species were *Buteo rufinus, Buteo buteo, Falco tinnunculus,* and *Asio otus.* The number of raptors admitted to the center has increased every year, with the highest number (38.2%) being observed in 2020. Wintering was the first season in which cases were most common (42.5%). The most common admission cause was determined as trauma (40.2%) and the second was condition disorder (24.7%). The location from which birds of prey are brought mostly has been determined as rural areas (71.0%). The number of cases was higher in non-migratory native birds (96.0%).

There were statistically significant relationships between order and the admission reasons (Table 2). According to the results of the chi-square test, a significant relationship was found between the order and the admission reason ($\chi 2 = 21.511$; $p < 0.001$). Trauma was the most frequent admission cause for Strigiformes (49.2%) and Falconiformes (38.4%). While no cases were observed for electrocution in Strigiformes, it ranked fourth in Falconiformes by 13.1%. In Strigiformes, the most admitted species was *Asio otus*. Among the Falconiformes, *Buteo rufinus* was the most admitted species. In addition, among the endangered species included in the IUCN red list, *Aquila heliaca* and *Falco cherrug* were affected by trauma (100%), and *Aegypius*

Table 1. Distribution of Strigiformes and Falconiformes according to some parameters

Order	Species	n	%	Variable	Groups	n	%
Strigiformes	*Asio otus*	41	11,8	Years	2017	45	12,9
	Tyto alba	5	1,4		2018	62	17,8
	Athene noctua	12	3,4		2019	108	31,0
	Otus scops	1	0,3		2020	133	38,2
Total		**59**	**17**	Season	Breeding	128	36,8
Falconiformes	*Buteo rufinus*	106	30,5		Postnuptial	72	20,7
	Buteo buteo	81	23,3		Wintering	148	42,5
	Circaetus gallicus	4	1,1	Admission causes	Gun shooting	42	12,1
	Accipiter nisus	12	3,4		Trauma	140	40,2
	Accipiter gentilis	6	1,7		Electrocution	38	10,9
	Circus cyaneus	1	0,3		Orphaned	42	12,1
	Circus aeruginosus	8	2,3		Condition disorder	86	24,7
	Circus macrourus	1	0,3	Localities	Urban	101	29,0
	Haliaeetus albicilla	1	0,3		Suburban	247	71,0
	Aquila heliaca	5	1,4	Hunting season	Hunting season	177	50,9
	Clanga pomarina	2	0,6		Not hunting season	171	49,1
	Hieraaetus pennatus	2	0,6	Final outcomes	Ex	172	49,4
	Aegypius monachus	1	0,3		Release to wild	93	26,7
	Gyps fulvus	2	0,6		Captivity	18	5,2
	Pernis apivorus	1	0,3		Euthanasia	65	18,7
	Falco naumanni	2	0,6	**Total**		**348**	**100**
	Falco tinnunculus	44	12,6				
	Falco subbuteo	1	0,3				
	Falco cherrug	1	0,3				
	Falco peregrinus	8	2,3				
Total		**289**	**83**				

Table 2. Distribution of Strigiformes and Falconiformes according to admission causes

Order	Species	Gun shooting n (%)	Trauma n (%)	Electrocution n (%)	Orphaned n (%)	Condition disorder n (%)	χ^2 / P ¥
Strigiformes	*Asio otus*	0 (0,0)	17 (41,5)	0 (0,0)	13 (31,7)	11 (26,8)	
	Tyto alba	1 (20,0)	3 (60,0)	0 (0,0)	0 (0,0)	1 (20,0)	
	Athene noctua	0 (0,0)	9 (75,0)	0 (0,0)	0 (0,0)	3 (25,0)	
	Otus scops	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)	1 (100,0)	
	TOTAL	**1 (1,7)**	**29 (49,2)**	**0 (0,0)**	**13 (22,0)**	**16 (27,1)**	
Falconiformes	*Buteo rufinus*	13 (12,3)	36 (34,0)	17 (16,0)	2 (1,9)	38 (35,8)	
	Buteo buteo	13 (16,0)	33 (40,7)	17 (21,0)	1 (1,2)	17 (21,0)	
	Circaetus gallicus	1 (25,0)	3 (75,0)	0 (0,0)	0 (0,0)	0 (0,0)	
	Accipiter nisus	1 (8,3)	6 (50,0)	1 (8,3)	0 (0,0)	4 (33,3)	
	Accipiter gentilis	0 (0,0)	2 (33,3)	1 (16,7)	0 (0,0)	3 (50,0)	
	Circus cyaneus	1 (100,0)	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)	
	Circus aeruginosus	2 (25,0)	5 (62,5)	0 (0,0)	0 (0,0)	1 (12,5)	
	Circus macrourus	0 (0,0)	1 (100,0)	0 (0,0)	0 (0,0)	0 (0,0)	
	Haliaeetus albicilla	1 (100,0)	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)	**21,511 / P = 0,000***
	Aquila heliaca	0 (0,0)	5 (100,0)	0 (0,0)	0 (0,0)	0 (0,0)	
	Clanga pomarina	0 (0,0)	2 (100,0)	0 (0,0)	0 (0,0)	0 (0,0)	
	Hieraaetus pennatus	2 (100,0)	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)	
	Aegypius monachus	1 (100,0)	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)	
	Gyps fulvus	1 (50,0)	0 (0,0)	0 (0,0)	0 (0,0)	1 (50,0)	
	Pernis apivorus	0 (0,0)	1 (100,0)	0 (0,0)	0 (0,0)	0 (0,0)	
	Falco naumanni	0 (0,0)	2 (100,0)	0 (0,0)	0 (0,0)	0 (0,0)	
	Falco tinnunculus	3 (6,8)	8 (18,2)	2 (4,5)	26 (59,1)	5 (11,4)	
	Falco subbuteo	0 (0,0)	1 (100,0)	0 (0,0)	0 (0,0)	0 (0,0)	
	Falco cherrug	0 (0,0)	1 (100,0)	0 (0,0)	0 (0,0)	0 (0,0)	
	Falco peregrinus	2 (25,0)	5 (62,5)	0 (0,0)	0 (0,0)	1 (12,5)	
	TOTAL	**41 (14,2)**	**111 (38,4)**	**38 (13,1)**	**29 (10,0)**	**70 (24,2)**	

*P<0,001 ¥: Shows the relationship between the order and the admission causes.

monachus was affected by gunshot wounds (100%). The relationship between localities and admission causes was found to be significant for Falconiformes ($p<0.001$), but not for Strigiformes ($p>0.05$) (Table 3). While only orphaned cases were seen at a high rate in urban areas, other cases were observed at high rates in suburban areas ($p<0.001$). The relationship between seasons and admission causes was found to be significant for Strigiformes and Falconiformes ($p<0.001$). While the orphaned cases were observed during the breeding season, other admission cases were mostly observed in the wintering season. The relationship between outcomes and admission causes was found to be significant for Falconiformes ($p<0.001$). The relationship between migration and admission causes was found to be significant for Falconiformes ($p<0.05$). While all admission cases were observed intensively in non-migratory Falconiformes, gun shooting (9.8%) and trauma (8.1%) were identified as intense threats in migratory birds. The relationship between hunting seasons and admission causes was found to be significant for Strigiformes and Falconiformes ($p<0.001$).

Discussion and Conclusion

The study aimed to, which examined the relationships between species, years, localities, seasons, outcomes, and causes of admission of raptors belonging to the Strigiformes and Falconiformes admitted to AKUREM in the last four years, the official records of 348 raptors were evaluated. Raptors were considered to have been affected by human-based threats, either voluntary (firearms, poisoning, illegal capturing, or traps) or involuntary (vehicles, fences, or electric shocks). It also had previously been revealed that threats that raptors underwent were human based (23-25). Research findings stated that Falconiformes species were five times more harmed compared to Strigiformes. This condition might be because Falconiformes order is rich in number of species and Strigiformes is less affected by human pressures since they are active during the night. In the study species, *Buteo rufinus* and *Asio otus* were more harmed than other raptors by human based threats. The reason behind this event for those species could be the existing at high rates in the region. When yearly admission records of raptors to AKUREM were examined, it was revealed that the number of cases increased continuously each year, and the number of cases in 2020 was three times more than that of 2017. This condition made us think about the impact of bird threats over years on one hand while on the other hand, it might be because the recognition of AKUREM, as well as denouncements about raptors, advanced by conducted projects, sharing in social media and website and printed-visual media news. When the number of cases was evaluated in terms of years, the most remarkable condition within findings was the significant decrease in injuries of raptors by firearms and the number of cases in orphans in 2020. These reductions were thought to be due to the lockdown related to the coronavirus disease (COVID 19) prevailing around the world in 2020. However, some researchers mentioned that this period had negative effects as well as positive effects on wildlife (26, 27). In the study, raptors were proved to have problems and be harmed during the winter season mostly. Because of that, although birds of prey can tolerate hunger for a long time, harsh weather conditions and fatigue that make their hunting difficult can lead to more deaths in the winter season (28). The second season in which raptors have problems was stated as the breeding season. In some studies, breeding season ranked first and the high rate was believed to stem from the orphaned problem (12).

For the birds of prey, trauma is the primary cause with the highest rate among the reasons of admission cases. Almost half of the raptors admitted to the center had trauma-based problems. This finding is consistent with many other studies, which found that trauma resulting from collisions with man-made structures was the main admission case (12, 22, 29, 30). Some studies also report that frail, sick, and poisoned birds may be more prone to collisions (31-33). The collision with vehicles ("road casualty") is in line with this species' habit of perching and hunting from light poles and fences along roads and by its feeding on road-kills (34). It was determined that one out of every four birds of prey, which are members of the Strigiformes and Falconiformes family admitted to our center, were brought in with the second highest cause, general condition disorder. The rate of Strigiformes admitted to

Table 3. Relationship between some parameters and admission causes in Strigiformes and Falconiformes.

ORDER			Gun shooting n (%)	Trauma n (%)	Electrocution n (%)	Orphaned n (%)	Condition disorder n (%)	χ^2 / P
Strigiformes	**Year**	2017	0 (0,0)	2 (66,7)	0 (0,0)	0 (0,0)	1 (33,3)	18,140 / 0,034*
		2018	0 (0,0)	3 (25,0)	0 (0,0)	1 (8,3)	8 (66,7)	
		2019	1 (5,6)	8 (44,4)	0 (0,0)	7 (38,9)	2 (11,1)	
		2020	0 (0,0)	16 (61,5)	0 (0,0)	5 (19,2)	5 (19,2)	
Falconiformes		2017	15 (35,7)	8 (19,0)	2 (4,8)	6 (14,3)	11 (26,2)	54,760 / 0,000**
		2018	11 (22,0)	13 (26,0)	4 (8,0)	6 (12,0)	16 (32,0)	
		2019	13 (14,4)	30 (33,3)	19 (21,1)	10 (11,1)	18 (20,0)	
		2020	2 (1,9)	60 (56,1)	13 (12,1)	7 (6,5)	25 (23,4)	
Strigiformes	**Seasons**	Postnuptial	1 (100,0)	4 (13,8)	0 (0,0)	1 (7,7)	6 (37,5)	33,782 / 0,000**
		Breeding	0 (0,0)	5 (17,2)	0 (0,0)	12 (92,3)	3 (18,8)	
		Wintering	0 (0,0)	20 (69,0)	0 (0,0)	0 (0,0)	7 (43,8)	
Falconiformes		Postnuptial	14 (34,1)	18 (16,2)	7 (18,4)	2 (6,9)	19 (27,1)	51,618 / 0,000**
		Breeding	11 (26,8)	39 (35,1)	10 (26,3)	27 (93,1)	21 (30,0)	
		Wintering	16 (39,0)	54 (48,6)	21 (55,3)	0 (0,0)	30 (42,9)	
Strigiformes	**Localities**	Urban	0 (0,0)	11 (37,9)	0 (0,0)	9 (69,2)	6 (37,5)	4,851 / 0,183
	Suburban		1 (100,0)	18 (62,1)	0 (0,0)	4 (30,8)	10 (62,5)	
Falconiformes	Urban		10 (24,4)	21 (18,9)	6 (15,8)	22 (75,9)	16 (22,9)	42,892 / 0,000**
	Suburban		31 (75,6)	90 (81,1)	32 (84,2)	7 (24,1)	54 (77,1)	
Strigiformes	**Hunting season**	Yes	1 (100,0)	23 (79,3)	0 (0,0)	0 (0,0)	12 (75,0)	26,382 / 0,000**
		No	0 (0,0)	6 (20,7)	0 (0,0)	13 (100,0)	4 (25,0)	
Falconiformes		Yes	25 (61,0)	60 (54,1)	22 (57,9)	1 (3,4)	33 (47,1)	28,867 / 0,000**
		No	16 (39,0)	51 (45,9)	16 (42,1)	28 (96,6)	37 (52,9)	
Strigiformes	**Final Outcomes**	Ex	1 (100,0)	22 (75,9)	0 (0,0)	5 (38,5)	11 (68,8)	12,638 / 0,180
		Euthanasia	0 (%0,0)	1 (3,4)	0 (0,0)	0 (0,0)	0 (0,0)	
		Captivity	0 (%0,0)	2 (6,9)	0 (0,0)	0 (0,0)	0 (0,0)	
		Release to wild	0 (%0,0)	4 (13,8)	0 (0,0)	8 (61,5)	5 (31,3)	
Falconiformes		Ex	31 (75,6)	62 (55,9)	9 (23,7)	4 (13,8)	27 (38,6)	221,415 / 0,000**
		Euthanasia	6 (14,6)	29 (26,1)	29 (76,3)	0 (0,0)	0 (0,0)	
		Captivity	2 (4,9)	14 (12,6)	0 (0,0)	0 (0,0)	0 (0,0)	
		Release to wild	2 (4,9)	6 (5,4)	0 (0,0)	25 (86,2)	43 (61,4)	

*P<0.05 **P<0.01

the center for trauma, general condition disorder, and orphaned was found to be significantly higher than the rate of Falconiformes. The fact that Strigiformes had a higher trauma rate than Falconiformes may be due to the owls often hunt on the roadside and are not noticed by drivers (25) or their vision is lost due to vehicle headlights (35). Since mice constitute the main food source of Strigiformes, it may be thought that poisoning may cause deterioration of the general condition. It can be said that this situation is owing to the Strigiformes live more in urban areas than Falconiformes. Especially *Asio otus* nests in the urban areas and the offspring found during flight trials are brought to the center as orphans. *Falco tinnunculus* nests in the urban area as well. Besides, the rate of Falconiformes brought in due to gunshot injuries and electrocution was higher than that of Strigiformes and this condition was supported by some researchers (24). The risk of gunshot injuries might be low because Strigiformes have a nocturnal property (23). Especially long-legged and normal buzzards are affected by electrocution intensely and it may be because they are more numerous than other raptors in the area. Because they fly low, owls probably are not affected by electrocution. Even though clinical findings were not seen clearly in rodenticide poisonings, weakness, exhaustion, and being prone to trauma might arise from this condition (36). In the study, orphaned appeared as a crucial problem, especially for Strigiformes. Young owls might leave their nests early for various reasons (problem of parasites in the nest, the nest being under threat of raptors, human interventions, etc.) (37). The source of this problem is that Strigiformes nest in areas close to humans and healthy owlet leaving their nests are thought to be orphans and removed from their locations (38-40). *Falco tinnunculus* showed the highest orphaned rate among Falconiformes. It was also detected in this study that *Falco tinnunculus* uses human-built structures as nests and is exposed to direct interaction. Falconiformes samples were examined in terms of meaningful relations between their location, years, seasons, outcomes, and reasons of arrival while Strigiformes underwent the same process in terms of years, seasons, and reasons of arrival. Due to gunshot injuries, trauma, electrocution, and general condition disorders, the rate of Falconiformes brought from rural areas was found higher than those brought from urban areas and orphans were mostly brought from city centers. However, it was determined that the rate of raptors admitted from the suburban areas was twice more than those admitted from the urban areas. This data shows similarities to Cianchetti-Benedetti et al (22) findings. Several studies (22, 41, 42) have demonstrated the existence of various threats and sources of death to raptors in urban and suburban habitats. It was determined that the cases of orphans in both orders were accepted mostly from the urban and the other cases admitted from the suburban area. This situation shows that, as we have shown in a previous study (38), orphans are still kidnapped by the kind person in urban areas intensively. However, orphan kidnapping is still seen as a major problem in city centers for raptors in Turkey. The number of raptors admitted to the center was equal to the one during hunting season and hunting ban. However, in the hunting season, firearm cases were found to be quite high in both orders compared to the period when it was prohibited. While there were no gun shooting cases in Strigiformes out of the hunting season, the number of cases in the hunting season in Falconiformes was 1.5 times higher than the number of cases out of the hunting season. The fact that birds of prey do not resemble game birds and are unlikely to be confused suggests that birds of prey are deliberately shot during hunting activities (22). It has been revealed by other researchers that the hunting season affects gun shooting injuries and that poaching is also common during periods of high bird activity, especially during migration (43, 44). There was seen only one gun shooting case in Strigiformes (*Tyto alba*). It has been revealed by Hernandez et al (24) findings that diurnal birds are shot more than nocturnal birds. Diurnal species are more visible in the day, which increases their probability of being shot (45). The nocturnal behavior of Strigiformes reduces the risk of being shot (22, 43). On the other hand, 4 species in Falconiformes, (*Circus cyaneus*, *Haliaeetus albicilla*, *Hieraaetus pennatus, Aegypius monachus),* were found to have the highest proportion (100%) of gun shooting. It was determined that gun shooting injuries were the only threat to three migratory (*Circus cyaneus*, *Haliaeetus albicilla*, *Hieraaetus pennatus*) and one endangered bird of prey (*Aegypius monachus)*.

The death rate of migratory birds of prey rises due to difficulties encountered during the migration wave (46-48). As a result of intense human activities on migration routes of migratory birds of prey, many of their habitats have been transformed into agricultural areas or buildings and works such as electrical cables and wind farms have created obstacles (11). Poaching and illegal shooting (49) are also threats. It was determined that half of the raptors admitted to the center died, one out of every 5 birds was euthanized, and one out of every four birds was treated and released back to nature. The release rate for raptors is usually below 50% in rehabilitation centers (30, 50, 51) and the high death rate (49.4%) found in this study shows how deadly raptor threats could be. Strigiformes and Falconiformes brought in due to gunshot injuries and trauma generally ended up dying, and Falconiformes having electrocution were usually euthanized. Thus, in their study in *Asio otus*, Mariacher et al (23) stated the general death rate as 47.3% and said birds brought in due to gunshot injuries and trauma showed high mortality. Despite that, birds arriving due to orphaned and general condition disorders were mostly released back to nature. Some studies stated that orphan release rates were frequently higher than those of adult birds (24, 51).

As a result, raptors were considered to be highly affected by human-based threats. Human-based threats continue to cause risks intensively in wildlife. Human pressure on raptors might be decreased slightly with training on threat factors and awareness projects. For sustainable ecology, scientific studies on wildlife in Turkey must go on, lack of information must be urgently overcome, and conservation projects must be emphasized.

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Conflicts of interest: The authors declare that there is no conflict of interest about this manuscript.

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