



Road kills of mammal species in the Van Lake Basin (Turkey)

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Abstract

This study was conducted on the road surrounding Lake Van (D300-D975-E99 roads) between February 2016 and January 2017. It is aimed to identify the species and mortality rates of the mammals that die as a result of car crash in the highway. As a result of the study, 57 cases which belong to 8 species in Eulipotyphla, Lagomorpha, Rodentia and Carnivora orders of the Mammalia class were recorded. The primary mammal species killed in car crashes are stone marten (*Martes foina*) (n=19), hedgehog (*Erinaceus concolor*) (n= 17) and red fox (*Vulpes vulpes*) (n=13) respectively. Mortality for mammal species was calculated as 0.276 ind/km/year. In addition, a solution to reduce deaths has been proposed.

Key words: Traffic, mortality, road, mammals, Van Lake

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Van Gölü Havzası'ndaki (Türkiye) memeli türlerinin yol ölümleri

Özet

Bu araştırma Şubat 2016 ve Ocak 2017 tarihleri arasında Van Gölü'nü çevreleyen karayolunda (D300-D975-E99 karayolları) gerçekleştirilmiştir. Bu karayolunda araç çarpması sonucu ölen memeli türlerinin ve ölüm oranlarının tespiti amaçlanmıştır. Çalışma sonucunda memeli sınıfının Eulipotyphla, Lagomorpha, Rodentia ve Carnivora takımlarına mensup 8 türe ait toplam 57 vaka kaydedilmiştir. Araç çarpması sonucu ölen memeli türlerinin başında sırasıyla kaya sansarı (*Martes foina*) (n=19), kirpi (*Erinaceus concolor*) (n= 17) ve tilki (*Vulpes vulpes*) (n=13) gelmektedir. Memeli türleri için ölüm oranı 0.276 ind/km/year olarak hesaplanmıştır. Ayrıca ölüm vakalarını azaltmaya yönelik çözüm önerileri sunulmuştur.

Anahtar kelimeler: Trafik, ölüm oranı, karayolu, memeliler, Van Gölü

1. Introduction

Wildlife populations are subject to habitat fragmentation due to some reasons such as roads, railroads and energy lines (Rico et al., 2007). In addition, roads affect the habitats of many animal groups adversely (Trombulak and Frissell, 2000; Coffin, 2007; Fahrig and Rytwinski, 2009). The most important effects are increasing mortality rates as a result of road kills, restriction of animal mobility as barriers, changing animal behaviours, changes in the physical and chemical environment and decrease in the quantity and quality of habitats of animals (Trombulak and Frissell, 2000; Jaeger and Fahrig, 2004).

Animal road kills have increased greatly depending on the fact that vehicles are faster and roads are longer in parallel with the increasing number of vehicles and the developments in technology (Seiler et al., 2004; Caceres, 2011; Kızıroğlu et al., 2013). Caceres (2011) has stated that mammals are the animal group which is investigated the most since they have larger bodies and dead individuals can be observed easily. In addition, various studies have been conducted on vertebrates, primarily mammals throughout the world (Oxley et al., 1974; Clarke et al., 1998; Trombulak and Frissell, 2000; Clevenger, 2003; Seiler et al., 2004; Jaeger and Fahrig, 2004; Pinowski, 2005; Rico et al., 2007;

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Coffin, 2007; Fahrig and Rytwinski, 2009; Van Langevelde, 2009; Benítez-López et al., 2010; Tok et al., 2011; Caceres, 2011; Saklaurs and Baltmanis, 2014; Özcan and Özkazanç, 2017).

The aim of this study is to present the intensity of the mammal species that die as a result of road kills on the road surrounding Lake Van and offer solutions to take necessary measures.

2. Materials and methods

This study was conducted between February 2016 and January 2017 on the road surrounding Lake Van which is approximately 430 km long (D300-D975-E99 roads) (Figure 1.).

It is a four-lane road and the maximum speed limit outside settlement areas is 110 km/h. Field studies were carried out by driving around the lake once a week and 4 times every month in total. To be able to identify the animals involved in car crashes, the average driving speed was 70 km/h. The animals involved in car crashes were photographed and GPS coordinates of the crash sites were taken. The species involved in crashes are given in table and their status was reported according to IUCN criteria. Results were evaluated as mammal/km/year.

3. Results

During monitoring studies, 20640 km were covered in total. Mortality rate of the mammal species died as a result of road kills was calculated as 0.276 ind/km/year. It was determined that road kills involving mammals took place after sunset and before sunrise. With monitoring studies, 57 cases involving 8 species from insectivore (Eulipotyphla), rabbits (Lagomorpha), Rodentia and Carnivora orders of the mammal class were recorded (Figure 1., Figure 2., Table 1.). While the species in Carnivora order were on the top rank with 63.16% mortality rate, they were followed by Eulipotyphla with 29.82%, Rodentia with 5.26% and Lagomorpha with 1.76%. The primary mammal species killed in car crashes are stone marten (*Martes foina*) (n=19), hedgehog (*Erinaceus concolor*) (n= 17) and red fox (*Vulpes vulpes*) (n=13) respectively. It was determined that the months in which the mortality rates peak are April-May-September (Table 2.).

The records of cases involving stone marten and red fox, which have the highest numbers of cases, are encountered in various habitat types divided by roads such as wetlands, forestlands and steps. It was determined that the habitats in which hedgehog cases were recorded are the wetlands and forestlands divided by roads.

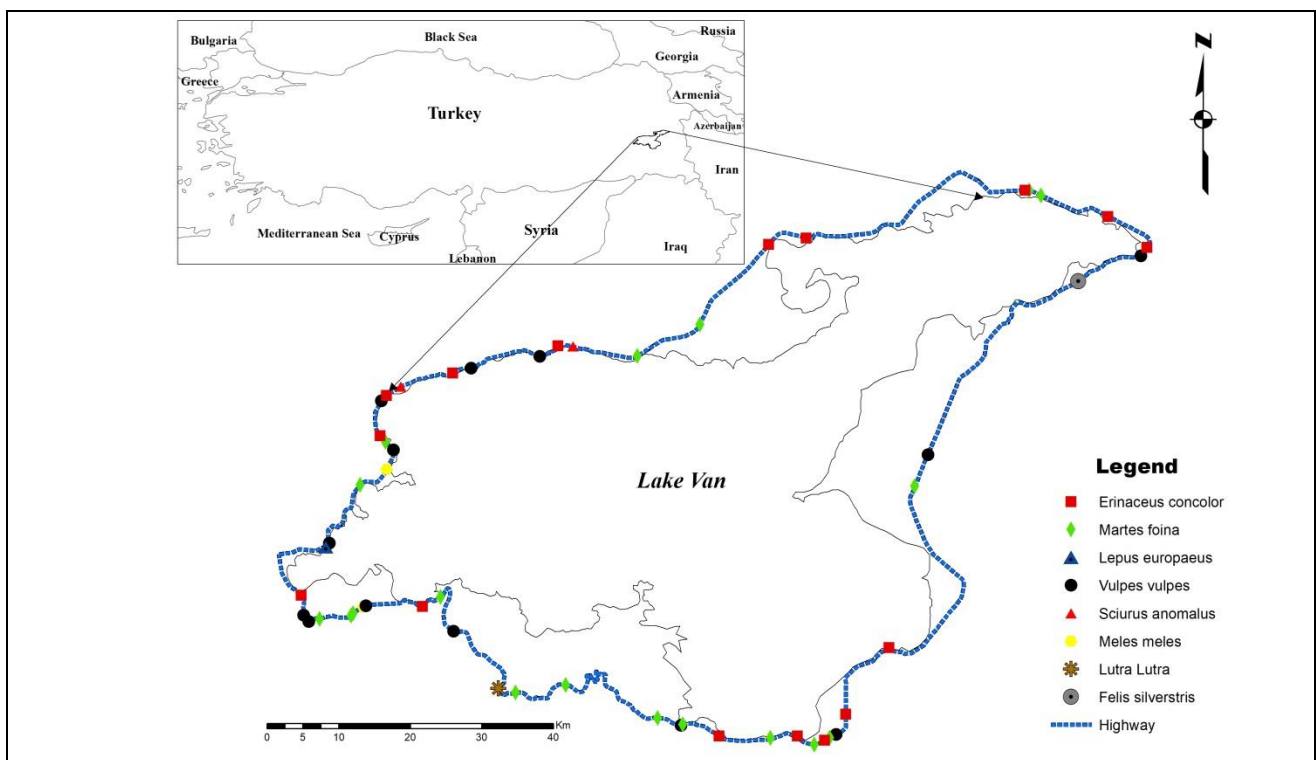


Figure 1. Study area and localities of the identified mammal species

Table 1. Distribution of killed mammal species monthly

Month	Mammal species								Total
	<i>Erinaceus concolor</i>	<i>Lepus europaeus</i>	<i>Sciurus anomalus</i>	<i>Lutra lutra</i>	<i>Felis silvestris</i>	<i>Meles meles</i>	<i>Martes foina</i>	<i>Vulpes vulpes</i>	
January	-	-	1	-	-	-	1	-	2
February	-	-	-	-	-	-	1	1	2
March	-	-	-	-	-	-	-	1	1
April	3	-	-	-	-	1	3	2	9
May	7	-	-	1	-	-	8	5	21
June	2	-	-	-	-	-	2	-	4
July	1	1	-	-	-	-	-	-	2
August	1	-	1	-	-	-	-	-	2
September	3	-	1	-	1	-	3	1	9
October	-	-	-	-	-	1	1	-	2
November	-	-	-	-	-	-	-	2	2
December	-	-	-	-	-	-	-	1	1
Total	17	1	3	1	1	2	19	13	57

Table 2. Mortality rates of mammal species and the months in which mortality rates are the highest

Species	Total	%	Highest occurrence	Status according to IUCN
<i>Erinaceus concolor</i>	17	29.82	April-May-September	Least Concern
<i>Lepus europaeus</i>	1	1.76	July	Least Concern
<i>Sciurus anomalus</i>	3	5.26	January-August-September	Least Concern
<i>Lutra lutra</i>	1	1.76	May	Near Threatened
<i>Felis silvestris</i>	1	1.76	September	Least Concern
<i>Meles meles</i>	2	3.51	April-October	Least Concern
<i>Martes foina</i>	19	33.33	April-May-September	Least Concern
<i>Vulpes vulpes</i>	13	22.80	April-May-November	Least Concern
Total	57	100		

4. Conclusions and discussion

Human activities pose a significant threat for vertebrates and the most important one of these activities is the roads which are quite important for cargo and passenger transportation. Roads and vehicle traffic which provide great convenience for people causes various negations for mammals, birds, reptiles and amphibian vertebrates. Restriction of animal mobility as a barrier; change in animal behaviours as a result of the noise, light and toxic gases caused by traffic; changes in the physical and chemical environment; shrinking of habitats and decrease in the quality of habitats are the major examples to these negations (Trombulak and Frissell, 2000; Jaeger and Fahrig, 2004; Akay et al., 2012).

Orlowski and Novak (2006) stated that more than 80% of the road kills take place between May and October. In addition, various researchers have presented that most of the mammal deaths occur in summer months (Fuellhaas et al., 1989; Orlowski and Novak, 2006; Grilo et al., 2009). Orlowski and Novak (2004) also stated that deaths of hedgehogs, which is one of the mammal species with the highest mortality rates, mostly occur in summer months. Furthermore, they reported that death cases of the species included in Carnivora order occur in late May and during June. In this study, it was determined that road kills involving hedgehogs occurred in April, May and September. It is thought that hibernation of the hedgehog, which is an insectivore species, might be a significant factor in this. Road kills involving species in Carnivora order were encountered in April, May, September and October.

Özcan and Özkazanç (2017) have identified 58 cases of 6 mammal species killed in car crashes (Çankırı-Kırıkkale highway). They have stated that the species which have the highest mortality rates in these cases were hedgehog (n=27) and fox (n=21). In this study that we have conducted around Lake Van, 57 cases involving 8 species were recorded. It was determined that the species which have the highest mortality rates among these species were marten (n=19), hedgehog (n=17) and fox (n=13).



Figure 2. Mammal species identified (**a**: *S. anomalus*, **b**: *V. vulpes*, **c**: *E. concolor*, **d**: *L. europaeus*, **e**: *F. silvestris*, **f**: *M. foina*, **g**: *M. meles*, **h**: *L. lutra*)

Haigh (2012) reported that mortality rate for mammal species involved in road kills was 0.012 ind/km/year (in Irish), while Özcan and Özkazanç (2017) reported that this was 0.68 ind/km/year (Çankırı-Kırıkkale highway, in Turkey). In this study, mortality rate for mammal species involved in road kills was determined as 0.276 ind/km/year.

While Hedlund et al. (2004) stated that warning signs on the road are quite effective on the driver, Krips and Durot (2007) have emphasized that overuse and misuse of the road signs may reduce effectiveness on drivers. It was observed that there is no warning signs to warn the drivers for wild animals on the road where we have carried out the study.

In their study on mammal species involved in road kills on various roads in Turkey, Yorulmaz et al. (2012) have identified species such as red deer, roebuck, bear, wolf, fox, badger, marten, otter, rabbit, squirrel and hedgehog. Researchers have also emphasized that there is no protective measure to ensure a safe crossing of the mammal species and a detailed work is required in that respect and stated that there should be structures such as habitat bridges, underpass, overpass and tunnel which may ensure safe crossing of mammals from the roads. In this study, species such as hedgehog, wild rabbit, squirrel, otter, wild cat, badger, stone marten and fox were identified in road kill cases on the road surrounding Lake Van. In addition, it was seen that structures such as habitat bridges, underpasses or overpasses to facilitate the crossing of species are not available on the road.

Solution proposals;

1. Road crossing of mammals should be investigated before and after road construction.
2. The existing culverts for the transition of wild animals must be rehabilitated.
3. Suitable road crossings should be made at hot spots where the mortality rate is high.

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