Environ Monit Assess (2019) 191: 645
https://doi.org/10.1007/s10661-019-7833-1

The habitat, ecological life conditions, and usage characteristics of the otter (*Lutra lutra* L. 1758) in the Balikdami Wildlife Development Area

Nuri Kaan Ozkazanc · Emir Ozay · Halil Baris Ozel · Mehmet Cetin · Hakan Sevik

Received: 11 July 2019 / Accepted: 22 September 2019 / Published online: 15 October 2019

Abstract The study was conducted to determine the habitat usage characteristics of the otter, which provides important information on the status of aquatic and coastal ecosystems. The Balikdami (Fish House) Wildlife Development Area, where the study was carried out, was registered in 1994 and was declared a natural site in 1998. The total area of the site is 1470 km^2. In order to determine the habitat usage characteristics of the otter, photo traps were placed according to the assumed habitat characteristics between the river and the terrestrial areas near the river. Previous research suggested that there should be at least 15 days of observation. In this study, 11 photo traps were left in the study area at a ratio of 1463 camera traps/day. A total of 37 different otter images were obtained in 3, 4, and 5 points at the end of the study. The data indicated that the otters preferred to use places that were close to the aquatic aquarium. They did not prefer densely vegetated areas, open areas, and places where there was human intervention, large construction, water borders, water pump edges, and areas with high human activity. The otters were active at night. While the number of otters is increasing in Turkey, according to the International Union for Conservation of Nature (IUCN) Red List, otters are in the NT (near threat) category. The otter is protected in all countries where it is increasing in number. Therefore, a better understanding of the habitat preferences of the otter will help us to better protect it.

Keywords Environmental influences · Human disturbance · Spatial structure · Otter disturbance · Habitat structure · Ecosystem · Protect

N. K. Ozkazanc · H. B. Ozel
Department of Forest Engineering, Faculty of Forestry, Bartın University, Bartin, Turkey

E. Ozay
Directorate of Eskisehir Zoo, Responsible of Species, Eskisehir, Turkey

M. Cetin (✉)
Department of Landscape Architecture, Faculty of Engineering and Architecture, Kastamonu University, Kastamonu, Turkey
e-mail: mcetin@kastamonu.edu.tr

H. Sevik
Department of Environmental Engineering, Faculty of Engineering and Architecture, Kastamonu University, Kastamonu, Turkey

Introduction

The otter (*Lutra lutra* L., 1758) is a mammal species from the Mustalidae family and is on the red list of International Union for Conservation of Nature (IUCN) and is in the near threat category. In particular, this species shows a decreasing population tendency (URL-1 2015). The otter is also known as an ecological indicator species and is on the list of species protected under the Bern Convention (Annex List II) (URL-2 2015).

The otter has spread from Europe to Japan, excluding the regions of Iceland, Corsica, and Sardinia. Throughout the world, it is scarcely found in most rivers and lakes. With the appropriate living environment, it is also found in Turkey. The head of the otter is flat on the top,

its mouth is round and blunt, its ears are small and round, and its eyes are small and naked. The head of the otter is connected to its long and cylindrical body by a thick and long neck. Its legs are short and thick, and its feet have webbed digits and strong, non-retractile claws. Because its footplate is naked, it leaves a clear footprint. The pedestal of the tail is thick and tapered towards the tip. With these body features, the otter is highly flexible and mobile, and it is also a fast swimmer (Demirsoy 1996) (Fig. 1).

In general, the otter's body is covered with homogenous dense and short hair that exhibits various shades of brown, with a darker surface on the back and a much lighter color on the underside, and the neck is light gray in color. In addition, there are white spots under the jaw. The female mates from April–May, delivering 2–4 puppies after a 1–2-month pregnancy. Otters are nocturnal, which often makes them difficult to observe. The otter has a semi-aquatic life (Uysal 2002), does not store food (Albayrak 1995) and actively obtains food at night from the aquatic environment (Erlinge 1968; Bonesi et al. 2004).

The Balikdami (Fish House) Wildlife Development Area, where the study was carried out, was registered in 1994, and was declared a natural site in 1998. The total area of the site is 1470 km^2. The area between the Kurtseyh and Ahiler villages, which is considered the main fish house, is 503 km^2 and consists of reeds, swamp, and lakes (URL-3 2015).

In this area, which has a rich fauna and flora integrity, the otter is the most important species of water fauna. To ensure the sustainability of the otter in this area, it is necessary to determine their type of settlement and feeding places, population density, preference in running habitat, and environmental pressure. It is only possible to observe habitat characteristics through surveys and research. As such, this study was carried out in order to determine the habitat usage characteristics of the otter living in the wetlands of the Balikdami (Fish House) Wildlife Development Area.

Materials and methods

Materials

Photo traps were used to capture activities of the otter, and these were the primary data for the study to determine the habitat characteristics. GPS was used to determine the geographic coordinates that the photo traps were placed in the field.

Methods

In order to determine the habitat usage characteristics of the otter, photo traps were placed according to the assumed habitat characteristics between the river and the terrestrial areas near the river. Previous research suggests at least 15 days of observation are required for such a study (Erlinge 1968; Hus 1974; Albayrak 1995; Strachan and Jefferies 1996; Erdogan et al. 2000; Veryeri and Yerli 2002;

Fig. 1 The adult otter (*Lutra lutra* L. 1758)

Suseven 2005; Suseven and Schmitz 2005; Veryeri and Yerli 2008; Toyran 2010). After searching for signs that are considered to belong to the otter species, it was necessary to search for areas covered with short vegetation, nest entrances, stool droppings, nutrient surplus, tail evidence, and footprints. Subsequently, the photo traps were placed at these points.

Preliminary studies were done in the proposed area to find footprints, nest entrances, feces, nutrient surplus, etc. (Fig. 2). The areas likely used by the otters were determined, and these points were used as sampling points and as the photo trap mounting points.

In line with the obtained data, at 11 different points, photo traps were set up to best exemplify the field. The GPS coordinates of the installed photo traps are shown in Table 1, and the satellite images of the locations of the photo traps are also shown in Fig. 3.

Fig. 2 Some tracks belonging to the otter that are spotted on the field. **a** Field of use. **b** Entrance of the nest. **c**, **d** Stool samples. **e** Nutrient residues

Table 1 Coordination of the 11 photo traps mounted

Photo trap no.	East (E)	North (N)	Height (m)
1	031° 37.502′	39° 11.532′	749
2	031° 37.770′	39° 11.622′	849
3	031° 37.508′	39° 11.727′	878
4	031° 37.647′	39° 11.815′	877
5	031° 37.958′	39° 11.779′	827
6	031° 39.090′	39° 11.842′	796
7	031° 39.175′	39° 12.356′	797
8	031° 38.699′	39° 12.151′	795
9	031° 38.671′	39° 12.520′	795
10	031° 36.934′	39° 10.548′	850
11	031° 36.844′	39° 10.560′	849

Results

The study area consisted of three areas, namely the aquatic, riperian (coastal), and other areas. The aquatic areas included the water surfaces of the rivers and lakes, which are seasonally covered by locally grown crops (*Juncus* sp.), reeds, and other aquatic plants. The riperian areas consisted of reeds, willows, and other aquatic plants and trees, with a water area of up to 15 m from the waterfront line. The other areas included meadows, marshes, or structures that are formed by combining these, with no more than 15 metric tons of water. In this area, there were also pastures, farmland, water pumps, and monumental structures.

During the field studies, 11 photo traps were placed in the field, with a frequency of 1463 photo traps/day. During this period, 37 images of an otter were obtained. These images were obtained at only points 3, 4, and 5 of the 11 different points. The otters frequently used these three points, which are close to each other and have similar habitat characteristics (Fig. 4).

The three points that captured the otter activity were mostly under human intervention, both ecologically and in terms of their structural characteristics. However, these three points were the most preferred destinations of the otters in the area as landing points. Another common feature of these three points was that the coastline was mostly composed of open spaces.

Point number 3, with its coastal and mud vegetation, was the most common habitat of the species. This spot was about 150 m away from the Ahiler village bridge on the river.

Point number 4 consisted of wet meadow vegetation, and there was no intensive human activity in the immediate vicinity.

Although point number 5 was a habitat with coastal and mud vegetation, sugar beet farming is done extensively about 300–500 m away.

The data obtained indicated that the otters in this vicinity preferred these points at different parts of the day, but at certain time intervals. The active terrestrial habitat usage hours and frequency of the otters are shown in Table 2 and a graphical representation is given in Fig. 5.

Table 2 and Fig. 5 indicated that the otters started becoming active after 19:00, and after being active during the night, they stopped their activities at 07:00 in the morning. Although this is a nocturnal species, it is expected that the otter, especially during the daytime, will be seen near the nest. However, the otters were never seen during the day at these three spots, which may be due to the nearby human settlements in the area and the agricultural activities.

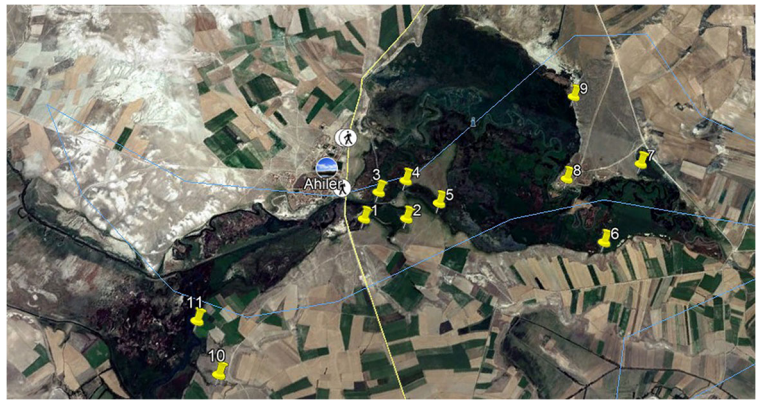

Fig. 3 Satellite images of 11 photo traps mounted (Google Earth 2018)

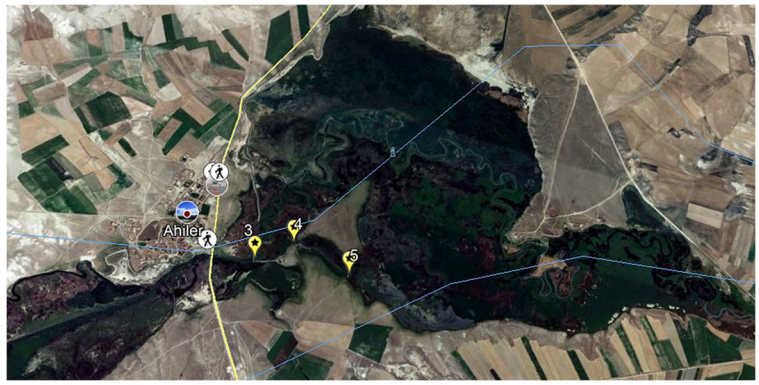

Fig. 4 Points where the otters are detected (Google Earth 2018)

The habitat use changed due to the daily human activities, which was a result of life in the area and its immediate vicinity and the agricultural activities and was especially due to the motorized and noisy farming tools. In addition, there were large and small livestock grazing and shepherd dogs in the area. Furthermore, the intense hunting activities in the area affected the quality of life of the otter and their habitat use preferences in the area (Fig. 6).

Table 2 Time for the otter to use the terrestrial ecosystem

Hour	Photo trap 3	Photo trap 4	Photo trap 5
00:00–00:59		1	
01:00–01:59		1	
02:00–02:59	5		
03:00–03:59		3	
04:00–04:59		1	
05:00–05:59			3
06:00–06:59	4	1	
07:00–07:59			
08:00–08:59			
09:00–09:59			
10:00–10:59			
11:00–11:59			
12:00–12:59			
13:00–13:59			
14:00–14:59			
15:00–15:59			
16:00–16:59			
17:00–17:59			
18:00–18:59			
19:00–19:59	1		1
20:00–20:59	3		1
21:00–21:59	6	3	
22:00–22:59			
23:00–23:59	3		
Total	22	10	5

Discussion and conclusion

This study found otter activity at only three points (3, 4, 5) of the photo traps established in 11 different places where otters were expected to live. These three points had similar characteristics to each other in terms of the habitat characteristics and spatial structure. The general characteristics of these three areas were coastal, sand dune, and mud vegetation, which was consistent with the general living preferences of the otter. In a similar study, it was noted that the otters prefer areas where non-voluminous plant coverings are found rather than open areas dependent on aquatic mediums (Erlinge 1968). In addition, another study demonstrated that otters use these places for nesting, hiding, and feeding activities (Albayrak 2002). McCafferty (2005) stated that there must be water-edge ecosystems for the otter to spend the day, reproduce, and reach food sources easily.

In the studies we conducted in this region, which is parallel to the information in the literature, we found that otters were more likely to use open areas that were not covered with plants and in places with human intervention. In addition, the otters were also seen beside coastal ecosystems, where they predominantly preferred monumental constructions, water bodies, and water pump sides. It is thought that the most important reason why otters choose these points is that many fish species come here to consume human waste, and the fish are an important food source for the otters.

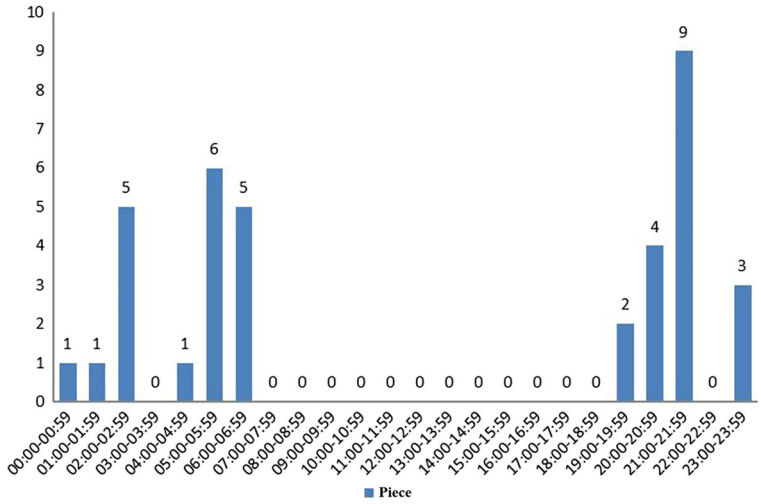

Fig. 5 Time intervals at which the otters are detected

Conforming to the general biology of the species, the otter in the study area showed nocturnal characteristics and were not observed during the daytime. This is explained by the fact that the otter is functional day and night, but they may be constantly active at night, because they are uncomfortable in areas where there is human activity, being easily disturbed (Demirsoy 1996). As such, they only land at certain points in such places. Güven (2000) notes that the otter is semi-aquatic and active at night, and they land when people are not active (Güven 2000). Our data was in agreement with previous studies, showing that otters only land at night in areas that, during the daytime, had heavy human activity.

When aquatic ecosystem preferences are taken into consideration, our observations revealed that the otters preferred the stream ecosystem over the lake and marsh ecosystem in this study area. The fact that the lake and marsh ecosystems in the study area were frequently covered with reeds is an important reason why the otters did not prefer these habitats. As such, the otters chose the river and coastal ecosystems in the study area. Moreover, the river basin that feeds the water resources in the study area is quite large and has enough water to meet the food, hunting, and daily activity needs of the otter. Again, the coastal accumulation of sand dunes near the river supports the establishment of the otter. This situation resulted in the species' preference for the stream banks rather than the lake and swamp in the study area.

When Turan et al. (2015) studied the habitat preferences of the otters around Lake Abant, they determined the habitat preferences of the otters as reed + bushes, reeds, construction areas, bushy herbaceous plants, and woody bushes (Turan et al. 2015). In the same study, the aquatic area was determined to be in the order of lake +

Fig. 6 The shepherd's dog and the remains of hunting press in the study area

edge and river + edge. The fact that the otter's aquatic preferences differed from what we found was due to changes in Lake Abant, which now has a wider area. Thus, the otter felt more secure in the remote areas of the lake far away from human activities.

An important indicator of otter habitat preferences is found in stool and nutrient residues. These traces also show how the otter uses the food that is caught, apart from the feeding regime. We found that the nearest aquatic feces from the otter was 40 cm away, while the furthest was found at a distance of 5 m from an aquatic medium. Thus, in our study, the otter used a 5-m terrestrial area from the aquatic environment. However, in the direction of the density of the remains we detected, the otters preferred places closer to the river, as indicated by feces and nutrition evidence.

Wetlands provide education and recreation opportunities for people as well as for wildlife, flood water management, and water quality improvement. Wetlands are considered valuable international ecosystems for their contribution to improving environmental quality, supporting biodiversity, and socio-economic development (Kaya et al. 2019; Yucedag and Kaya 2017; Yucedag et al. 2018; Kaya et al. 2018). The Balikdami Wildlife Development Area Wildlife Wetland Area is a transit point between Central Anatolia and the Aegean region and is a very important spot for wildlife. It is home to many migratory birds, and it is an important habitat for the otter due to this location. Although the area is important for the otter, human pressure in this area is gradually destroying the necessary habitat characteristics, and this threatens many wild animals, and in particular, the otter. The most important causes threatening the life of the otter are pollution, environmental deterioration, and hunting (Demirsoy 1996). These three reasons also pose a serious threat to the otter in our study area. In this context, it is important to implement effective conservation and rehabilitation work in the Balikdami Wildlife Development Wetland Area to improve the otter habitat characteristics in the area. This is important for both sustaining and increasing the otter population.

References

Albayrak, İ. (1995). Otter and Akyaka. *Tubitak, Science and Technical Ankara, 28*(337), 97.

Albayrak, İ. (2002). Population of otter (*Lutra lutra* L. 1758) in Kırıkkale Kızılırmak, (Mammalia: Carnivora). 1-14. In İ. Albayrak (Ed.), *Situation in Turkey II of otter. Symposium, 21-22 September 2002, Beymelek, Antalya* (pp. 1–94). Ankara: TUBITAK Printing House.

Bonesi, L., Chanin, P., & Macdonald, D. W. (2004). Competition between Eurasian otter (*Lutra lutra*) and American mink (*Mustela vison*) probed by niche shift. *Oikos, 106*, 19–26 ISSN 0030-1299.

Demirsoy, A. (1996). Vertebrates mammals turkey. Ministry of Environment, General Directorate of Environmental Protection Project No: 90-K-1000-90 ISBN: 975-7746-24-X Ankara.

Erdogan, A., Öz, M., & Sert, H. (2000). The situation of otter in Antalya region and in the world. *Journal of Nature and Human, Ankara, 34*(1), 11.

Erlinge, S. (1968). Territoriality of the otter (*Lutra lutra* L.). *Wiley-Oikos, 19*, 81–98. https://doi.org/10.2307/3564733.

Google Earth. (2018). Google Maps and Google Earth imagery Image © 2018 Digital Globe.

Güven, N. (2000). Turkey otter project. *Journal of Nature and Human, Ankara, 34*(1), 32–36.

Hus, S. (1974). *Hunting animals and hunting* (Vol. 1(1), pp. 170–173). Istanbul: Kutulmuş Press.

Kaya, L. G., Kaynakci-Elinc, Z., Yucedag, C., & Cetin, M. (2018). Environmental outdoor plant preferences: a practical approach for choosing outdoor plants in urban or suburban residential areas in Antalya, Turkey. *Fresenius Environmental Bulletin, 27*(12), 7945–7952.

Kaya, E., Agca, M., Adiguzel, F., & Cetin, M. (2019). Spatial data analysis with R programming for environment. *Human and Ecological Risk Assessment: An International Journal, 25*(6), 1521–1530. https://doi.org/10.1080/10807039.2018.1470896.

McCafferty, D. (2005). Ecology and conservation of otters (*Lutra lutra*) in Loch Lomond and The Trossachs National Park. *Glasgow Naturalist, 24*(3), 29–35 ISSN 0373-241X.

Strachan, R., & Jefferies D. J. (1996). Otter Survey of England, 1991-1994: a report on the decline and recovery of the otter in England and on its distribution, status and conservation. Vincent Wildlife Trust; 1st Ed. Edition 222 pp. ISBN: 978-0946081318

Suseven, B. (2005). Otter status in Tirebolu district. Gökova-Akyaka Lovers Association (G.A.S.-Der) Science Series 2, 2005 ISBN: 975- 98483-3-3

Suseven, B., & Schmitz, T. (2005). The situation of the Eurasian Fishotter (Lutra lutra) at Lake Uluabat. Gökova- Akyaka Lovers Association (G.A.S.-Der) Science Series 1, ISBN: 975- 98483-2-5

Toyran, K. (2010). Kırıkkale Kızılırmak otter (Lutra lutra Linnaeus 1758) determination of distribution areas, Kırıkkale University, Institute of Science, Department of Biology, PhD Thesis.

Turan, İ., Keten, A., Yorulmaz, T., Doğan, C., & Baştar, F. (2015). The habitat of the otter (Lutra lutra) in Lake Abant. *Journal of Forestry Research, 1*(2), 51–56.

URL-1. (2015). http://www.iucnredlist.org/search (Accessibility on 10.12.2015).

URL-2. (2015). http://www.uhdigm.adalet.gov.tr/sozlesmeler/coktaraflisoz/ak/turkce/104_tur.pdf (accessibility on 15.12.2015).

URL-3. (2015). http://www.turkiyesulakalanlari.com/balikdami-sazliklari-eskisehir/ (Accessibility on 10.12.2015).

Uysal, İ. (2002). Fish farming and sea otter relations, the situation in Turkey II of the otter. Symposium booklet, page 64, Antalya 2002.

Veryeri, N.G., & Yerli S.V. (2002). Otter study in the Eastern Mediterranean Region. In the case of the otter in Turkey. Symposium book.p73-83, Eskisehir

Veryeri, N. G., & Yerli S. V. (2008). The method used in otter research and the sample of the Eastern Mediterranean. III. Status of otters in Turkey. Symposium book. p.27, Eskisehir.

Yucedag, C., & Kaya, L. G. (2017). In H. Arapgirlioglu, A. Atik, & R. L. Elliott (Eds.), *Chapter 104. Recreational trend and demands of people in Isparta-Turkey, Book: Researches on science and art in 21st Century Turkey*. Edward Turgeon, Gece Publishing ISBN: 978-605-180-771-3.

Yucedag, C., Kaya, L. G., & Cetin, M. (2018). Identifying and assessing environmental awareness of hotel and restaurant employees' attitudes in the Amasra District of Bartin. *Environmental Monitoring and Assessment, 190*(2), 60. https://doi.org/10.1007/s10661-017-6456-7.