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Impact of human-induced threats on the activity of the otter (*Lutra lutra*) along the Drinos valley, Southern Albania.

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Abstract

Impact of human threats on the activity of the otter along the Drinos valley has been studied during the period 2010-2012. The Drinos river and its tributaries, water reservoirs, and trout fish-farms situated in the Drinos valley were included in the study. The whole 60 km Drinos river was divided in three sections based on a set of environmental factors (vegetation cover, water regime, and human disturbance). Each of the three sections was divided in 200 m long stations. In each station the presence and/or absence of human disturbance or threats were assessed, such as destruction of food sources or feeding sites, habitat destruction, water pollution, animal persecution, roads and traffic, and human interference in hydrological regime of the river. Human disturbance was present in 19.33% of the stations in the river section Kakavie-Virua, 14.00% of the stations in the river section Virua-Andon Poçi and 25.00% of the stations in the river section Andon Poçi-Vjosë. In addition, human disturbance was higher along the western riverbank of Drinos, due to proximity of the national road passing by. Results of our study reveal significant influence of the human disturbance in the activity of the otter along the Drinos river. Thus, the values of the otter marking activity along the western (more disturbed) and eastern (less disturbed) river banks change significantly during both maximum and minimum river flow seasons, respectively (χ^2=428.7***, p<0.001) during maximum river flow season, and (χ^2=437.3***, p<0.001) during the minimum river flow.

Key words: the otter, human disturbance, Drinos river, marking activity.

1. Introduction

Threats that may have caused a drastic decline of the otter's population in Europe during '60-'70 are several and various, but all of them are either directly or indirectly linked with human activity [8, 15]. In Mediterranean countries such a decline is caused by series of threats, such as habitat destruction and fragmentation (removal of riverine habitats and vegetation coverage, gravel extraction from the river bed, construction of the concrete riverbanks), pollution and animal persecution and killing [3, 14].

Sometimes, a combined affect of the threatening factors has been verified, casuing so a multiple effect on the otter's population, more evident in proximity of the urban areas, industrial areas and those of intensive agriculture [13].

First studies on the distribution of otter in the Drinos valley, southern Albania, started after the year 2006 [12] and they provided information about distribution, status and diet of the otter in a 6 km long sector of the Drinos river. Further studies in the following years have brought in more ditailed information on the otter's activity, diet and feeding strategy in the Drinos valley [2, 10,11].

This paper is dedicated to the presence and analysis of the impacts of human-induced threats on the otter's activity in the Drinos valley. Through the assessment of otter's marking intensity, this study identifies hotspots where human disturbance and activity became a significant threat to the otter population along the Drinos valley.

2. Material and methods

The study area includes the Drinos river and its tributaries (stream of Kserias, stream of Suha, stream of Nimisa, stream of Kardhiqi), water reservoirs in proximity to the Drinos river (reservoirs of Peshkëpi, Dofti, Mingul-Nokovë-Dhoksat, Dritë and Virua), as well as the fish farms in Kardhiq, Picar, and Hormovë.

The 60 km long Drinos river was divided in three sections: section Kakavie-Virua (30 km), section Virua-Andon Poçi (10 km) and section Andon Poçi-Vjosë (20 km). River division was based on the combination of three main environmental factors: vegetation coverage along the riverbanks, water regime and human disturbance. Each river section was

divided in 200 m long river stations and in each river station average territorial marking intensity of the otter was calculated for the two water regime seasons: maximum river flow and minimum river flow. In each river station notes on the presence or absence of human disturbance and activity were taken during the two water regime seasons. Sprainting sites of the otter in each station were recorded with the use of the GPS device.

The average marking activity of the otter along the riverbanks (western riverbank and eastern riverbank) was calculated separately in both water regime seasons. To prove whether the otters' marking intensity differs by riverbank sides the statistical test χ^2 was used.

Tributaries, water reservoirs and fish farms were surveyed in different time periods in relation with water flow regime of the Drinos river, including the flood cases in some sections of the Drinos river valley.

Informal interviews with fishermen and fish farmers were conducted to assess human-otter interactions and conflicts and their impact on otter's population in the Drinos valley.

3. Results and discussions

The average territorial marking activity of the otter was calculated for both water regime seasons in the three sections of the Drinos river, and the values of marking intensity are given in the table 1.

Table 1. The average values of the otters'marking intensity in three river sections, according to water regime seasons

River Section	***Nb. of sprainting points/ 200m***		***Nb. of spraints /200m***		***Nb. of secretions/200m***	
	Maximum river flow	*Minimum river flow*	*Maximum river flow*	*Minimum river flow*	*Maximum river flow*	*Minimum river flow*
Kakavie-Virua	0.25	0.17	0.48	0.26	0.04	0.07
Virua-A.Poçi	2.24	1.58	7.46	3.14	1.66	0.52
A.Poçi-Vjosë	0.93	0.69	2.04	1.17	0.42	0.3

In both water regime seasons (maximum and minimum river flows) the river section Virua-Andon Poçi revealed to have the highest values of the marking intensity of the otter, followed by the river section Andon Poçi-Vjosë, while the lowest values where observed along the river section Kakavie-Virua. The differences in values of the otters' marking intensity among the three river sections are linked with combined effects of the environmental factors in each of the sections, including the presence or absence of the human disturbance.

The human disturbance as a threatening factor is interrelated with other environmental factors, influencing directly or indirectly on the biological activity of the species [8, 13].

Human disturbance was found presence in 19.33% of the stations in the river section Kakavie-Virua, in 14% of the stations in the section Virua-Andon Poçi, and in 25% of the stations in the river section Andon Poçi-Vjosë. Human disturbance to otter is of different types, as indicated in the Figure 1.

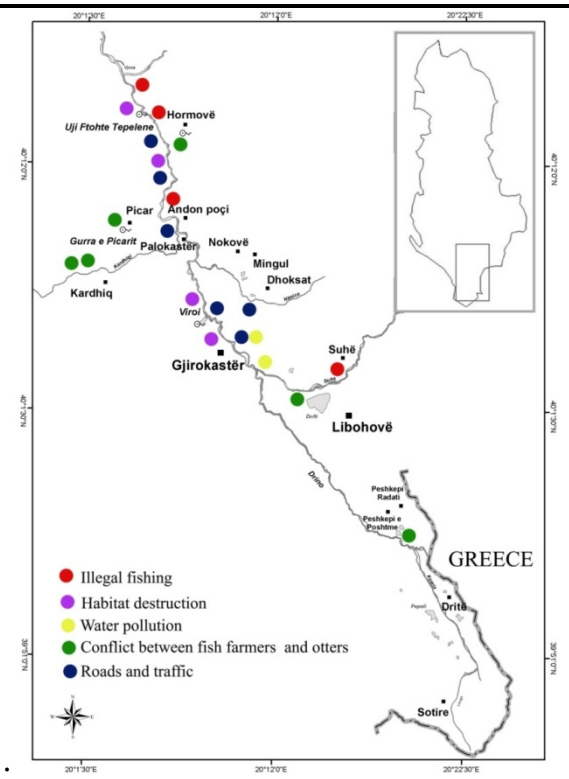

Figure 1. Distribution of human threats to otters along the Drinos valley.

In the section Kakavie-Virua the industrial activity and the discharge of industrial pollutants to the Drinos river is one of the main threat to otters. Discharge of pollutants is recorded in Kordhocë (plastmas processing factory) and Gjirokastër (former skin treatment factory), [7]. Some of the pollutants are toxic to otters due to bio-acumulation [21], and may cause lethal effects or long term effects on reproduction, renal, and immune systems [8, 17].

Discharge of untreated urban waste and sewage waters to the Drinos river, at it takes place in the location called " Ura e Lumit", is another threatening factor, especially during the season of hydric crisis (summer season), as their concentration in the river becomes higher. Organic pollution coming from human settlements directly influences water quality and decreases content of dissolved oxygen, and ultimately the fish stock as main food prey to otters in the river is reduced [16, 18, 22].

The section Virua-Andon Poçi, as the most preferred section for the otter along the entire Drinos valley, is less disturbed from human activities. Human disturbance types in this section are not so serious to otters. The human settlements are only founf in Palokastër village, but the presence of the thick and dense riverine vegetation along the riverbanks in this section can absorbe most of the human disturbance and makes it minor. This effect of vegetation coverage in diminishing human disturbance is confirmed in the studies of other authors [1, 20, 22]. Another activity taking place in the river section is the sport fishing, which is not resulting to adversely impact otter's activity, as in the same places where fishermen do fishing otter's territorial marking signs are observed.

The human disturbance is more evident in the river section Andon Poçi-Vjosë. This section of the Drinos river is impacted by the road construction activity in several places, changing riverbed and riverbanks configuration (Figure 2). Road construction related works such as dumping of excavation materials along the riverbank, construction of concrete protecting walls alongthe riverbank, may cause habitat destruction and fragmentation, and therefore reduce presence and habitat preference of otters [4]. In this river section fishing with illegal and forbiden means takes place, including the use of dynamits and electrofishing to eels and fish. Consequently, in some places along this river section such as "Uji i Ftohtë" and Lekli bridge, bunches of dead fish have been observed several times. Illegal fishing does not destroy the fish stock in the river and decrease food availability to otters, but it does pose a direct threat to otters as well. This river section is situated very close to the national road, and therefore traffic seems to have an influence on the otters' marking intensity, as it has been demostrated in similiar cases by other authors [19]. Along the riverbed and riverbanks in this river section some gravel extruction plants are operating (Figure 2). This activity does have direct impact on otters, as it changes the riverbed and river banks configuration. Gravel extraction does impact fish biota as well, as it increases turbidity and suspension of light materials that greatly influence the respiration of fish [5, 15].

Figure 2. Construction of protecting walls along the road Gjirokastër-Tepelenë (1).
Gravel extraction activity along the riverbed of Drinos river (2).

During our field survey it was noticed that human disturbance both qualitatively and quantitatively is higher along the western riverbank of the Drinos river, and consequently the otters' marking intensity is lower than along the eastern riverbank in both seasons (maximum and minimum river flow) (Figure 3)

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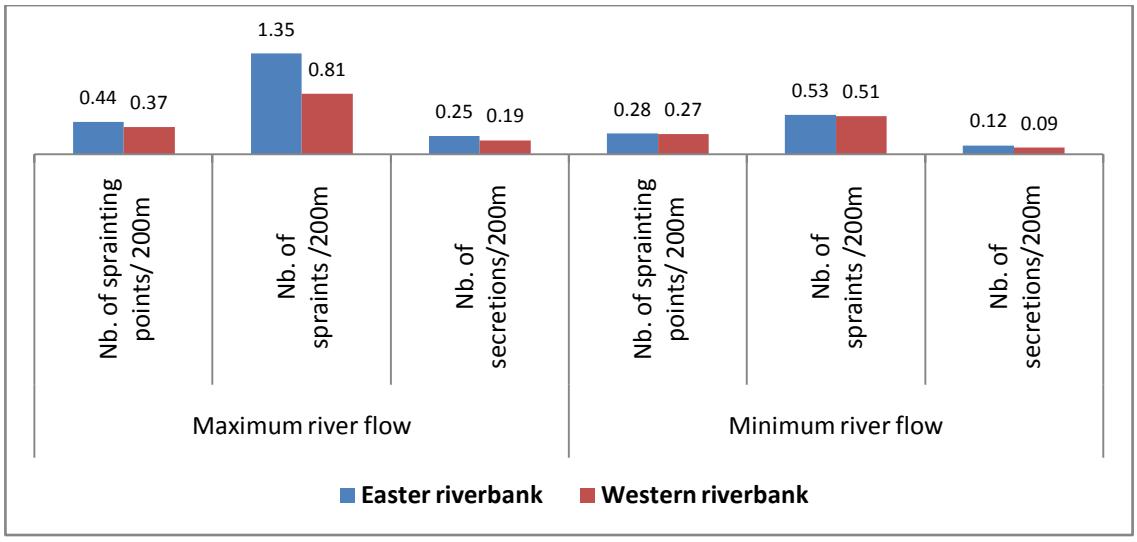

Figure 3. Otter's marking intensity along the eastern and western riverbanks of the Drinos river during the maximum and minimum river flow seasons.

The difference of the values in otter's marking intensity is very significant between eastern and western riverbanks of the Drinos river, both during minimum and maximum river flow seasons (χ^2=428.7***, p<0.001 during maximum river flow and χ^2=437.3***, p<0.001 during minimum river flow). This may be explained with the higher presence of human disturbance along the western riverbeanks. Firstly, the western riverbank of Drinos river in the river section "Ura e Labovës-Ura e Leklit" (15 km long) has been subject of interventions during the construction work of the road Tepelene-Gjirokastër, through construction of protecting walls, and dumping of excavation materials, altering so the natural conditions of the riverive vegetation. Secondly, along the western riverbank very often there are noticed illegal cutting of trees. Thirdly, human settlents and their related activities are mainly concentrated along the western river bank. Finally, gravel extraction plants are all operating along the western river bank of the Drinos river.

Human disturbance in the Drinos valley to the otter is also evidenced in the form of conflict between fish farmers and otters. Such a conflict has been verified in two water reservoirs of Peshkëpi and Dofti, whic are administrated by private firms. Cases of animal killing are recorded in trout fishfarms of Kardhiq, Picar, and Hormovë. Otters are more exposed to killing during the flood season, as they are forced to move upstream in search for food and shelter, while Drinos river valley is flooded. Thus, in January 2011 a subadult male of otter was reported and found dead in the trout fishfarm of Picari (Figure 4).

Figure 4. A subadult male of otter found dead in the trout fishfarm of Picari (January, 2011).

Irrational and un-responsible management of water resources in water reservoirs of the Drinos valley may also influence directly or indirectly on otters activity through drastical changes of water level in water reservoirs, interruption of watercources and fragmentation of otter's habitat. All these leads to reduction of feeding, safe sheltering and breeding grounds to otters [6, 9].

All the above mentioned types of human disturbance have their impacts on otter's population in the Drinos valley: they reduce the carying capacity of the aquatic system and habitats for otters; they infleunce physiological conditions and reproduction capacity of the otter; they increase vulnerability of otters to predation and persecution.

4. Conclusions

Human disturbance to otters in the Drinos river valley is present in different forms and types: damage and destruction of feeding sites for otters, habitat alteration and fragmentation, river pollution, traffic, animal persecution and killing, irrational and un-responsible water recourse management.

In the three sections of the Drinos river there were observed differences in the values of the otters marking intensity, determined by a combined effect of various environmental factors, including the influence and human induced threats in each of the three river sections.

Human disturbance was present in 19.33% of the stations of the section Kakavie-Virua, 14.00% of the stations in the section Virua-Andon Poçi and 25.00% of the stations in the section Andon Poçi-Vjosë.

The difference in the values of the otter's marking intensity between the western and eastern riverbanks of the Drinos river was highly significant in both seasons (maximum and minimum river flow), respectively (χ^2=428.7***, p<0.001) during maximum river flow and (χ^2=437.3***, p<0.001) during minimum river flow.

The human disturbance was higher along the western riverbank of the Drinos river, due to various threatening factors present there, such as habitat alteration and destruction in several places of the river section "Ura e Subashit-Ura e Leklit" during the re-construction work of the road Tepelenë-Gjirokastër; proximity of the 15 km long segment of the national road to the western riverbank; urban constructions and human settlements along the river valley; illegal cutting of woods along the riverbank; gravel extraction plants from the river.

Fish farms in water reservoirs of Peshkëpi and Dofti, as well as trout-fish farms of Kardhiq, Picar and Hormovë, revealed to be places where human-otter conflicts are present.

Rational and responsible management of water resources in water reservoirs of Drinos valley is important tool to increase carrying capacity for otters in the Drinos valley.

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