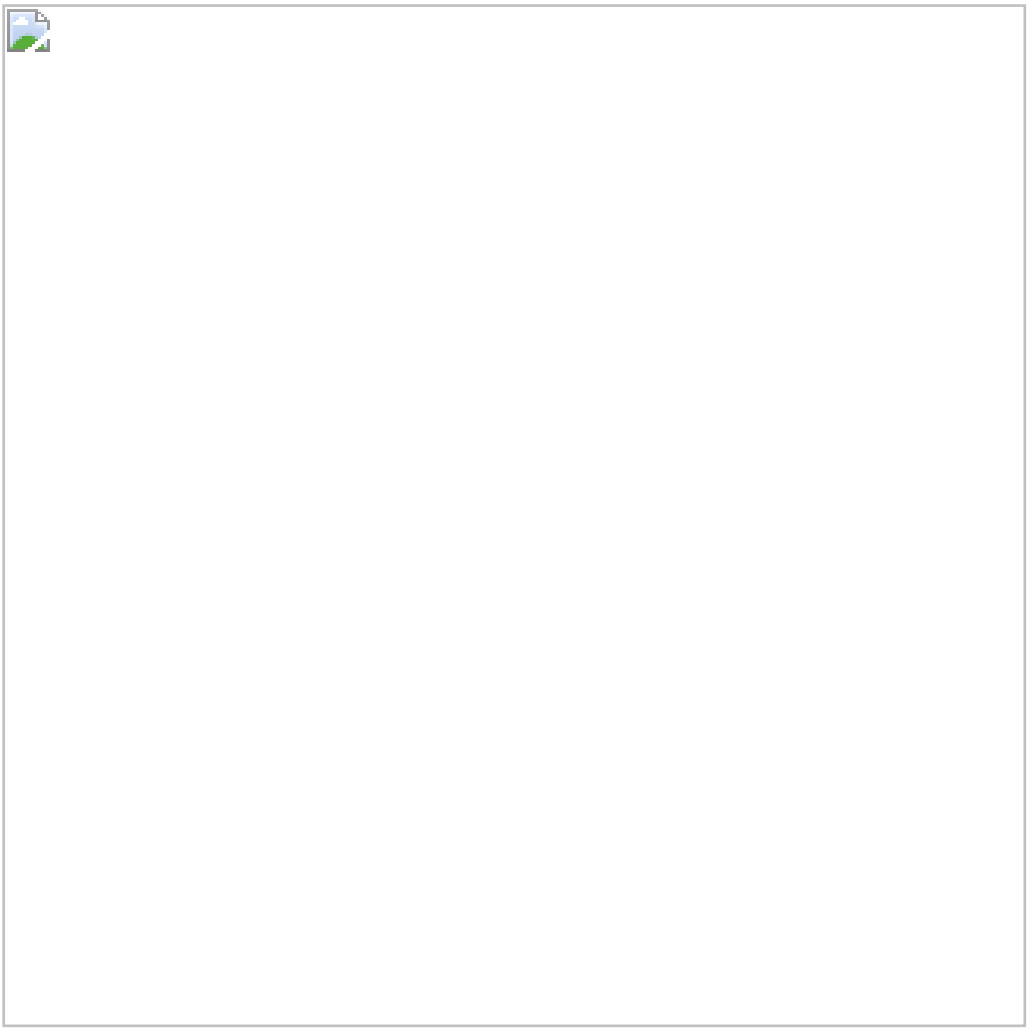

Distribution and marking intensity of the Eurasian otter, Lutra lutra, on the River Drinos (southern Albania)

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Distribution and marking intensity of the Eurasian otter, *Lutra lutra*, on the River Drinos (southern Albania)

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Abstract. Recent surveys have shown that in Albania otters occur on rivers which had been judged unsuitable in the 1980s, pointing out the need for further investigations. We assessed otter distribution on a 60 km long stretch of the River Drinos, a major tributary of the River Vjosa. Marking intensity was assessed in two seasons, spring and summer 2010, corresponding to the highest and lowest river discharge levels, respectively. Otter signs (spraints and jellies) were searched for along 300 river stretches 200 m long (sampling stations). Vegetation coverage, hydraulic pattern and human disturbance were assessed visually for the whole length of each sampling station. Both the mean number of sprainting sites and otter signs per 200 m of watercourse were higher in spring (0.81 and 2.6, respectively) than in summer (0.55 and 1.25). In spring otter signs were recorded in 118 sampling stations (39 %), while in summer, when the first 24 km of the watercourse were completely dried up, 92 sampling stations were positive for otters (31 %). Considering only the permanent river course, the variation in otter distribution was less marked (58 % *vs.* 51 % of 181 sampling stations). According to previous studies, the number of sprainting sites was correlated to vegetation cover, whilst variation in the hydraulic pattern of the permanent river stretch did not influence marking intensity. Our results suggest that pollution control and habitat restoration can favour otter expansion in the river plains of central and southern Albania.

Key words: spraints, sprainting sites, hydraulic pattern, vegetation cover

Introduction

In the second half of the 20th century, Eurasian otter, *Lutra lutra*, populations decreased in most European areas, becoming rare or extinct in much of central Europe (Foster-Turley et al. 1990, Macdonald & Mason 1994). Starting from the last decade of that century, otter populations have gradually recovered in several countries (Conroy & Chanin 2001, Prigioni et al. 2007) where persistent organic pollutants (POP) have been banned or controlled by regulations (Ruiz-Olmo et al. 2000). Currently, in continental Europe the otter range consists of three disconnected portions, the largest one including most Eastern Europe (Cianfrani et al. 2011).

Vegetation cover on river banks, water quality, food availability and human disturbance are the major factors determining otter distribution and behaviour (Macdonald & Mason 1983, Bas et al. 1984, Delibes et al. 1991, Mason 1995, Durbin 1998, Kruuk et al. 1998). Accordingly, sprainting sites have been reported to signal the active use of food resources in both coastal (Kruuk 1992) and riparian habitats (Remonti et al. 2011), whilst cover may be not an accurate predictor of marking intensity, as a positive correlation between these two parameters has not been observed in all studied areas (Prenda & Granado-Lorencio 1996).

Although many authors have discussed the reliability of marking intensity as a tool for pointing out the habitat preferences of otters since the 1980s (Kruuk et al. 1986, Kruuk & Conroy 1987, Mason & Macdonald 1987), variation in sprainting activity is believed to reflect changes in otter distribution (Chanin 2003) and the use of signs to outline patterns of habitat selection

has recently been confirmed to be effective for both otters (Clavero et al. 2006) and badgers (Balestrieri et al. 2009).

Few studies on otters have been conducted in Albania up to date. Prigioni et al. (1986) made a first attempt to assess the distribution of otters in the country, while, more recently, the status and distribution of the species were investigated in the valley of the River Drinos (Hysaj & Bego 2008) and in the watershed of the River Semani (Bego et al. 2011). Although otters appear to be widespread throughout the country (F. Bego, unpublished data), river pollution, uncontrolled fishing by dynamites and poisons and river-bed excavation for the extraction of inert materials are still considered major threats to the otter, which has been included in the Red Data Book of Albanian fauna as "Vulnerable" (Misja et al. 2006).

In all the Mediterranean area, drought each year causes periods of low river flow in summer-early autumn. Drought generally results in most streams and small rivers becoming dry or breaking up into a series of pools embedded in dry waterbeds, while large rivers suffer marked variation in their flow (Magalhães et al. 2002). Seasonal variation in river discharge has been reported to affect food availability for the otter (Clavero et al. 2003, but see Prigioni et al. 2006a for contrasting results).

The aim of this study was to provide information on otter distribution and ecology along the valley of the River Drinos (southern Albania), based on the assessment of sprainting site distribution and marking intensity. We hypothesised that, in our study area, variation in river flow and, consequently, water speed and hydraulic patterns (Hauer & Lambert 1996), was likely to affect the overall suitability of river stretches for the otter (Ruiz-Olmo & Gosálbez 1997, Prenda et al. 2001). To test for this hypothesis, otter distribution was assessed in two survey periods, corresponding to the lower and upper limits of the River Drinos' flow range.

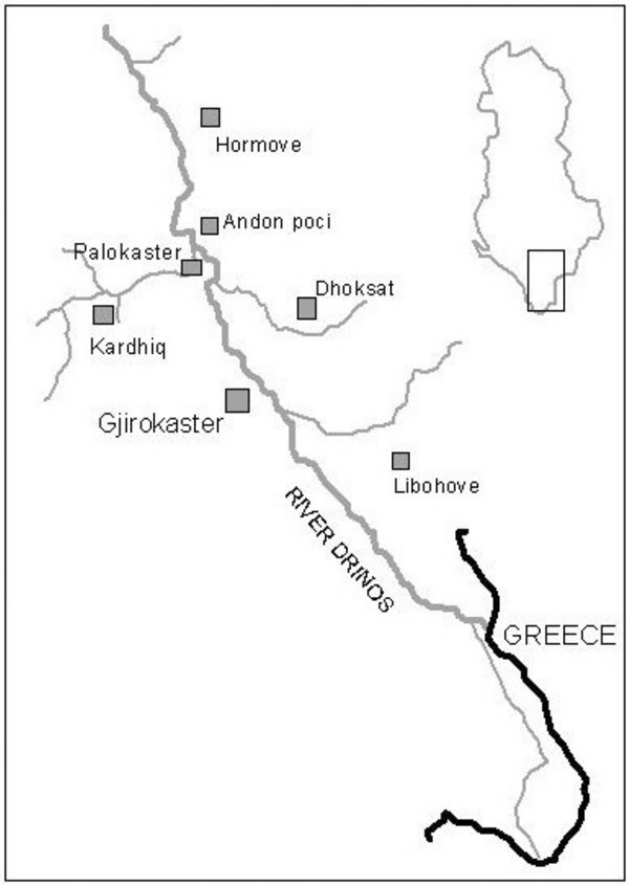

Fig. 1. Valley of the River Drinos, southern Albania.

Study Area

The study area was a stretch of about 60 km of the River Drinos, from the state border with Greece (39°55′49″ N, 20°20′18″ E) northwestwards to its confluence in the River Vjosa (40°16′56″ N, 20°02′29″ E; Fig. 1). The river runs through a wide plain (from 1-2 km near the confluence up to 10 km near Palokastra) delimited by Lunxhëri-Bureto mountain range in the north-east and Mali I Gjerë-Kurvelesh mountains in the south-west (Kabo 1990). The height above sea level of the river bed ranges between 200 and 250 m.

In the river valley, the mean temperature of the hottest month (July) is 23 °C (min-max: 15.3-31.9 °C) while that of the coldest month (January) is 5.2 °C (min-max: 0.4-10 °C). Mean yearly rainfall in the Drinos valley ranges between 1600 and 2000 mm, with a dry period in May-September (215 mm).

Mean annual flow is about 32.3 m^3/s, while maximum flow ranges between 776 and 1790 m^3/s. In the upper part of the study area mean annual flow is ca. 9 m^3/s, while next to the confluence with the River Vjosa it is 36.7 m^3/s (M. Kolaneci, pers. comm.).

The river is fed by several streams – Kserias (Sotira), Kardhiqi, Suha and Nimisa – and karstic springs – Viroi, Gurra e Picarit, Uji i Ftohtë Tepelenë and Hormova. Some water reservoirs (Dofti, Viroi, Dhoksat, Mingul, Nokovë, Dritë, and Peshkëpi) have been built for irrigation purposes. Although in summer their volumes sharply decrease, none of them dries out completely.

About 15 % of the study area is covered by Mediterranean shrubs and oak woodland. Riparian woods consists of oriental plane, *Platanus orientalis*, willows, *Salix* spp., and poplar trees, *Populus alba*. The river receives urban wastes from Gjirokastra city

(Fig. 1). Until four years ago, between kilometers 26 and 27 from the state border, toxic wastes from the leather processing industry were discharged into the river without being treated (Floqi et al. 2007).

Material and Methods

The river was divided into 300 stretches 200 m long (sampling stations), which were searched for otter signs (spraints and jellies), by walking on both riversides and around small islands as to investigate all shoreline areas. Surveys were carried out in two seasons – from 18/03/2010 to 16/05/2010 and from 10/08/2010 to 30/09/2010 – corresponding to the maximum and minimum river discharge, respectively. For each sampling station, the number of i) sprainting sites, ii) spraints and iii) jellies was recorded. A sprainting site was defined as a place with spraints lying at least 1 m from other spraints (Kruuk et al. 1986). Sprainting sites were georeferenced by a GPS device and overlaid on geographical maps as to assess otter distribution in the study area.

Three environmental variables of potential importance to otters were assessed visually for the whole length of each sampling station:

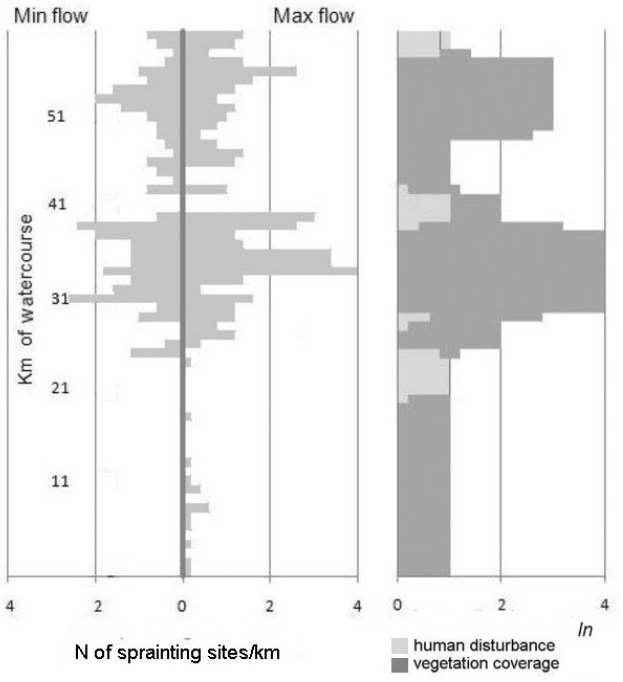

Fig. 2. Distribution and marking intensity (mean number of sprainting sites/km) of the otter during the lowest (min) and highest (max) flows (corresponding to late summer and spring, respectively) and variation in mean vegetation cover and human disturbance (*In*) on 60, 1 km long stretches of the River Drinos.

Table 1. Variation in otter marking intensity between the two study periods.

	Sprainting sites		Spraints		Jellies	
	N	Mean N/200m ± SD	N	Mean N/200m ± SD	N	Mean N/200m ± SD
Max flow (spring 2010)	243	0.81 ± 1.32	649	2.16 ± 4.26	131	0.44 ± 1.15
Min flow (summer 2010)	164	0.55 ± 0.99	313	1.04 ± 2.1	64	0.21 ± 0.73
U		40691.5		40124		40557.5
P		0.017		0.007		0.0013

1. vegetation coverage, in a 20 m large belt on both river banks (four categories: 1: 0-25 %, 2: 26-50 %, 3: 51-75 %, 4: 76-100 %);

2. hydraulic pattern, classified according to hydromorphologic units (HMU; Parasiewicz 2007), which broadly reflect the progressive increase in water speed and surface turbulence: 0: dried riverbed, 1: stagnant (backwaters and large isolated pools caused by summer drought), 2: low (runs and pools), 3: medium (fast runs and ruffles), 4: swift (cascades, rapids and riffles);

3. human disturbance: 0: negligible (no roads or urban areas within 1 km from the river banks), 1: low (distance between the river and a main road < 1 km), 2: moderate (presence of small villages on the riverside), 3: high (presence of towns with 10000-25000 inhabitants).

For each variable, mean values per kilometer of watercourse (*In*) were also calculated. Variation in the percentage of sampling stations positive for otters between the two study periods was tested by the chi-squared test (χ^2). The number of sprainting sites, spraints and jellies recorded for each survey was compared by Mann-Whitney's test (U). Then correlation analyses (Spearman's test, r_s) was carried out to evaluate the strength and direction of the relationship between the habitat variables recorded and marking intensity.

Results

In spring, water occurred in the whole monitored river stretch, with otter signs being recorded in 118 out of 300 sampling stations. During the late summer survey, the first 24 km of the watercourse were found completely dried and no otter sign was recorded. In this season, a total of 92 sampling stations was positive for otters. Variation in the percentage of sites positive for otters was significant (39 % *vs.* 31 %, respectively;

$\chi^2 = 4.95$, P = 0.026, 1 d.f.). A total of thirteen positive sites were found in spring on the river stretch which dried up during the following summer, particularly on the first 10 km (Fig. 2). If we exclude from the analysis the 119 sampling stations which totally dried up in summer, variation in the occurrence of otter sprainting sites was less marked (58 % *vs.* 51 % of 181 sampling stations; $\chi^2 = 1.88$, P = 0.17., 1 d.f.).

In contrast, both the number of sprainting sites and otter signs was the highest in spring, the number of otter signs found being more than twice that of the summer survey (Table 1).

In both seasons, the number of sprainting sites was correlated to both the number of spraints (r_s = 0.99 and 0.98, respectively, P < 0.001, N = 300) and the number of jellies (r_s = 0.67 and 0.55, respectively, P < 0.001, N = 300). Particularly, in summer the mean number of jellies (2.25) showed a marked peak at 39 km, while in spring anal gland secretions were most uniformly distributed between 31 and 40 km, their mean number ranging from 1 to 2.8.

Human disturbance was negligible or low (20.3 % of sampling stations) along the whole investigated river stretch (Fig. 2). About one third of the river (31.7 %) showed more than 50 % of river banks covered with vegetation, while riparian vegetation cover was low on about one half of the watercourse (Fig. 2). The number of sprainting sites was higher on river banks offering vegetation cover (r_s = 0.49 in spring and 0.56 in summer, P < 0.001 for both, N = 300) and increased with water speed and turbulence (r_s = 0.25 and 0.4, respectively, P < 0.001 for both, N = 300). Considering only the permanent river stretch, variation in the hydraulic pattern did not show to influence otter marking intensity (r_s = –0.07, P = 0.35 in spring and r_s = 0.06, P = 0.44 in summer, N = 181 for both).

Discussion

Marking intensity on the River Drinos was lower than the average one assessed for central and northern Albania 25 years earlier (sprainting sites/200 m = 1.7; spraints/200 m = 3.6; Prigioni et al. 1986). With respect to other Mediterranean countries, it was similar to that reported for peripheral areas of the otter range in Italy (Prigioni et al. 2006b, Balestrieri et al. 2008), while it was rather lower than that found for healthy or expanding populations (Prenda & Granado-Lorencio 1996, Ruiz-Olmo & Gosálbez 1997, Prigioni et al. 2005).

Fluctuation in water availability, reducing both environmental quality and food availability, is regarded as one of the most important factors affecting the use by otters of stretches of watercourses (Prenda et al. 2001, Ruiz-Olmo et al. 2001). On the River Drinos, otter distribution was not markedly affected by natural variation in river flow. The 24 km long stretch of the river which completely dries up in summer showed low otter occupancy in spring as well, confirming that drought can affect the suitability of river stretches for otters.

Rain and increasing water level have been reported to affect spraint persistence and thus otter detectability (Ruiz-Olmo & Gosálbez 1997); accordingly, Fusillo et al. (2007) suggested carrying out otter surveys in summer, when the reliability of otter standard survey methods would be the highest. Our results are consistent with those of Balestrieri et al. (2011), who reported that in southern Italy neither bank cover nor water discharge affected otter detectability.

In both flow regimes, marking intensity was the highest on river stretches covered by thick riparian vegetation, according to previous results reported for large Mediterranean study areas (Macdonald & Mason 1985, Delibes et al. 1991). Vegetation cover provides shelter and suitable sites for holts, and a relationship between bank cover and the use of river stretches by otters has often been pointed out (reviewed by Mason & Macdonald 1987).

Seasonal variation in marking intensity may depend on reproductive activity, as Kean et al. (2011) have recently suggested that anal scent secretions are mainly involved in mate attraction.

Both the large distances usually covered by otters (up to 39 km; see Green et al. 1984, Prigioni et al. 2006c) and mean number of spraints/200 m found suggest that the otter population occurring on the River Drinos is small, including from 2, as per the most conservative estimate (Prigioni et al. 2006b), to 12 individuals.

Judging by marking intensity, the 10 km long river stretch between the towns of Virua and Andon Poçi (30 to 40 km in Fig. 2) is the area more permanently occupied by otters. Riverbanks are densely covered by riparian vegetation, while several tributaries (Kardhiqi, Nimisë, Suhë, Sotir) and springs (Gura e Picarit and Virua) provide well oxygenated waters and suitable sites during the floods of the main river (Jiménez & Lacomba 1991, Mason 1995, Kruuk et al. 1998). Particularly, Kardhiqi stream offers a consistent flow regime and four fish-farms (*Salmo trutta*), which, in their owners' opinion, suffer damage by otters during high flood periods. The planned construction of a series of hydropower dams threatens to alter the habitat structure and quality of this stream,

with repercussions on otters which need to be assessed and monitored.

The first otter survey in Albania judged that the main rivers flowing in the plains between Tirane and Vlore, i.e. the rivers Erzen, Semani, Shkumbin and Vjosa, were unsuitable for otters as a consequence of pollution, mainly mine drainage, and industrial activities (Prigioni et al. 1986). As more recent surveys have shown that the otter occurs, although probably in low numbers, at least in some of these watercourses (e.g. the River Semani and its main tributaries, Bego et al. 2011), the currently ascertained presence of the otter on the River Drinos suggests that pollution control and habitat restoration can favour the expansion of the species in the whole catchment of the River Vjosa.

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