DETECTION OF OTTER (*Lutra lutra* L.) SIGNS IN A SURVEY OF CENTRAL AND EASTERN POLAND: METHODOLOGICAL IMPLICATIONS

ABSTRACT: Searching for spraints (excrements) and tracks is widely used for monitoring of European populations of otters *Lutra lutra*. Data collected in Central and Eastern Poland were analysed in order to evaluate the environmental factors affecting the detection of otter signs during field surveys. At each out of 1111 sites studied from 1996–1998 numbers of otter spraints and tracks as well as distance searched to detect first sign were noted. At each site several environmental variables were recorded to identify factors that may have affected the survey results. The variation in numbers of spraints and tracks found at each positive site was not related to the habitat quality and any other habitat features (including tree and shrub cover, presence of potential shelters) analysed, except the number of tracks was positively related to bridge potential. The distance searched was the most variable indicator of otter occurrence. It increased with the width of river and at sites with few potential sprainting sites, with bridges of poor potential or with no bridges at all, and where many signs of human and domesticated animals activity were noted. The results indicate that detection of otter signs is partially affected by specific elements unrelated to habitat potential and therefore numbers of spraints should not be used as an indicator of otter habitat preference. At a regional scale variation in number of spraints and tracks, as well as distance searched was related to otter occupancy expressed in the form of percentage of positive sites at three study areas. This study shows that measuring the distance searched provides additional indication of otter status at a regional scale and could be used to identify specific habitats where detection of otter signs during surveys is difficult.

KEY WORDS: *Lutra lutra*, spraint survey, monitoring, scent marking, survey techniques

1. INTRODUCTION

Surveys for excrements and other signs have been successfully implemented to study ecology of many carnivores (Gese 2001). Searching for spraints (excrements) and tracks were especially widely used in monitoring European populations of otters *Lutra lutra* after the approach was developed for parallel studies in England, Wales and Scotland (Crawford *et al.* 1979, Green and Green 1980, Lenton *et al.* 1980). The technique is recommended as a standard method and described in detail by Reuther *et al.* (2000). While it has been debated whether spraint surveys provide reliable data on otter activities and habitat use (Kruuk *et al.* 1986, 1987, Mason and Macdonald 1987), it is now widely accepted that this technique is adequate for studying otter distribution and identification.
of population trends (Reuther et al. 2000).
The technique with some modifications is also widely used for otter monitoring in NATURA 2000 areas (Chanin 2003) and for studying other semiaquatic mammals including beaver *Castor fiber* and American mink *Neovison vison* (Romanowski 2007, Melero et al. 2012). However, the method was subjected to critical reviews (Romanowski and Brzeziński 1997, Balestrieri et al. 2011) and evaluation with the non-invasive molecular methods (Hájková et al. 2008). Several authors have shown that numbers of otter signs found during survey can be influenced by factors such as population numbers, season, weather, and human activity (Lenton et al. 1980, Jeffries 1986, Macdonald and Mason 1987). Expanding on this research, in this paper, data collected in Central and Eastern Poland are analysed in order to evaluate which environmental factors affect the detection of otter signs during field surveys. In addition, variation in number of signs is assessed as a potential indicator of otter status at a regional scale.

2. STUDY AREA

The study area located in Central and Eastern Poland is mostly lowland country. Agriculture is the most dominant land use in the area, with the most intensively cultivated fields in the western and south-eastern part. The main rivers, Vistula, Bug, Narew and Bzura, include extended seminatural sections with well preserved bank vegetation. Throughout the area many small rivers, drainage ditches and canals are linked to the rivers. An exception are the most western and south-eastern parts that lack a well structured hydrological net. Despite pollution of many rivers, existing seminatural riparian vegetation provides good habitats to many types of wildlife, e.g. waterfowl, beaver and otter. The complete study area covers ca 32000 km², which was divided into three parts: W (west and south-west of River Vistula), E (east of River Vistula and south of river Narew), and N (north of Vistula and Narew) (Fig. 1). Part E was characterized by the highest and part W by the lowest otter occurrence in a previous survey (Brzeziński et al. 1996).

![Fig. 1. Western (W), eastern (E) and northern (N) parts of the otter survey study area and main rivers in Poland.](image-url)
3. METHODS

Between January 1996 and May 1998 a total of 1111 sites (sample points) in 353 UTM 10x10 km squares (average 3.2 sites per square) in Kujawy and Mazovia (Central Poland) and Podlasie (Eastern Poland) were surveyed. The standard otter monitoring method was used (Reuther et al. 2000). At each site a maximum distance of 600 m was searched along the river bank looking for spraints and tracks of otters. As soon as otter signs were found, the search was stopped and the site was confirmed as positive. If no otter signs were found then the site was recorded as negative. Searching usually started at a bridge. At each site the total number of spraints and tracks found under the bridge and along the bank was recorded. This corresponded to initial number of signs that are used in several other surveys, as opposed to total number detected at 600 m searches (Strachan and Jeffries 1996). In addition, the distance searched to detect the first sign (called “distance searched”) was recorded. If the search began at a bridge and spraints or tracks were found under it, then distance searched was set to 1 m. During the search, 20 environmental variables were recorded in order to identify factors that could have affected survey results (Romanowski 2000). The variables with the strongest positive (percentage of tree cover and river width) and negative (water pollution and regulation of river banks) effects on the occurrence of otters (Romanowski 2000, Romanowski et al. 2012) were used to evaluate habitat quality for otters at each site as good, average or poor (Romanowski 2006). In addition several specific habitat features that could affect deposition and/or detection of signs at each site were also evaluated:

  Potential sprainting sites: presence of sandy and gravel deposits, boulders and tree trunks was noted in two categories: few (<1/100 m), many (>1/100 m).

  Buildings: number of buildings within 30 m from banks.

  Presence of humans: intensity of human penetration (number of any signs of the presence at river banks) noted in three categories: low (<1 sign/100 m), average (1–10 signs/100 m), high (>10 signs/100 m).

  Presence of domesticated animals: intensity of penetration of river banks by domesticated species (number of any signs for presence of cattle, dogs and cats) noted in three categories: low (<1 sign/100 m), average (1–10 signs/100 m), high (>10 signs/100 m).

  Bridge “potential”: the presence of sandy, muddy and gravel deposits, boulders, concrete debris and other structures adequate for sprainting was documented. The potential was classified as poor (<10% of banks under the bridge allows for detection of signs), average (10–50% of banks allows for detection of signs), good (>50% of banks allows for detection of signs).

To investigate the effect of habitat features on the number of otter signs at three study areas ANOVA and nonparametric $\chi^2$ tests were used. Number of tracks, signs and distance searched were transformed using function ln(x+1) to achieve normality of error variances. A two way ANOVA was used to investigate how number of otter signs was affected by habitats of different potential in three parts of the study area.

4. RESULTS

The initial numbers of spraints and tracks found at a positive site during survey of Central and Eastern Poland were negatively correlated with the distance searched (spraints: $r = -0.115$, $F = 10.36$, $P <0.01$; tracks: $r = -0.237$, $F = 45.92$, $P <0.001$). The variation in the initial numbers of spraints and tracks found at each positive site was not related to the habitat quality and any other habitat features (including tree and shrub cover, presence of potential shelters) analysed, except the number of tracks was positively related to bridge “potential” (Table 1). The number of spraints per positive site was negatively related to river width in the part E ($r = -0.144$, $F = 9.29$, $P <0.01$), but not in the other parts of the study area. The distance searched was the most variable indicator of otter occurrence. It increased if bridges were absent or if bridges had poor potential, and if many signs of humans and domesticated animals were noted (Table 1). The distance searched was positively correlated with number of sprainting sites, river width ($r = 0.400$, $F = 83.23$, $P <0.001$) and to lesser degree with tree coverage of river banks ($r = 0.135$, $F = 8.24$, $P <0.01$).
Signs of otters were found at 790 sites, which are 71% of all sites surveyed in 1996–1998. The percentage of positive sites in the part E of the study area was two times higher than in the part W (Table 2). Numbers of signs recorded differed significantly between the parts of study area: the average numbers of spraints and tracks found at a positive site in the part E were significantly higher while the distance searched was lower, as compared to the other parts (W and N) (Table 2). The average distance searched differed between parts of the study area, being the shortest at part E, and the longest at part W (Fig. 2). However, the effect of habitat quality was strongly expressed over all the study area, and distance searched was two times higher at the positive sites where the habitat was classified as good as compared to poor at all parts of the study area.

5. DISCUSSION

Spraints together with urine and gland secretion are a way of olfactory marking in otters and many other Mustelidae species that is influenced by many factors such as population density and structure, social status, reproductive cycle, dispersion and food availability (Erlinge 1967, 1968, Kruuk 1992, Prigioni et al. 1995, Rostain et al. 2004, Barrientos 2006). No relationship was found in this study between number of spraints and tracks found at sites inhabited by otters and habitat features usually known to influence habitat capacity and food availability, such as vegetation cover of river banks or river regulation. However, the present study identified several habitat features, e.g., bridge “potential” and presence of buildings, that influenced detection of otter signs. Such structures could have a very limited effect on the carrying capacity of otter habitats and are most likely to influence the likelihood of signs detection. Many authors of earlier otter surveys noted that detection of otter signs could be affected by season and weather (reviewed in Reuther et al. 2000), presence of potential sprainting sites, bridges and human activity (Lenton et al. 1980, Jahrl 1996, Romanowski et al. 1996). The positive correlation between the initial number of tracks and the bridge “potential” at the sites surveyed in this study is in accordance to earlier observations on the positive role of presence of “spraintable bridges” (here called “high potential bridges”) for the otter surveys (Romanowski et al. 1996). However, a similar relationship between initial number of spraints and bridge “potential” at the study site was not detected in the present data set. A potential explanation of this difference might
be found in the special function of spraints in the marking behavior of otters (Kruuk 1992). Tracks indicate otters’ movements on the river bank, where their number is proportional to the available area of substrate under the bridge. In contrast the number of spraints depends more on motivation of individuals to mark the site, and in some cases several spraints can be deposited on a single boulder available under the bridge. In the present study the initial number of spraints recorded at a site was unrelated to the number of tracks. This confirms the special role of spraints in olfactory communication, as opposite to tracks, which probably represent a general indicator of movement activity of otters on the bank.

Data presented in this paper confirm earlier results (Romanowski et al. 1996) indicating that some habitat structures that are unrelated to otter densities and habitat potential affect detection of signs. The distance searched for signs was longer where potential sprainting sites were rare, bridges were absent or had low potential. Though spraints are durable marks (Macdonald and Mason 1988), it was shown that the rate of spraint disappearance on mountain rivers was the highest on sections with camping sites and human settlements (Brzeziński and Romanowski 2006). The data collected in present survey document that not only human, but also domesticated animals activity on river banks decreases the detection of otter signs, most probably by accelerating destruction of the tracks and spraints.

In this survey the distance searched was used to evaluate the effectiveness of surveying for otter signs. The correlation between the distance searched and the river width documented in this paper is in agreement with earlier data of Romanowski et al. (1996) on decreased effectiveness of the survey technique on large rivers as compared to small. This relationship most probably explains the unexpected observation that detection of otter presence at sites with good potential (by definition sites with wider river channel) required longer search during the survey. River sections with good potential (e.g. with tree cover on banks, without embankment reinforcement) are recognized as optimal otter habitats (Macdonald and Mason 1983, Baranauskas and Mickevicius 1995). According to the general ecological model of habitat selection (Fretwell 1972) optimal habitats are expected to be inhabited by relatively high numbers of otters. Indeed, higher otter densities on large rivers as compared to smaller tributaries were noted in Belarus (Sidorovich 1991). Problems with surveying otters on large rivers should thus be ad-

Fig. 2. Variation of the distance searched for otter signs in relation to habitat quality in three parts of the study area in Central and Eastern Poland. Two way ANOVA; habitat quality: $F = 29.56, P < 0.001$, study area: $F = 7.71, P < 0.001$. To evaluate the habitat quality of each site as good, average or poor the percentage of tree cover, regulation of river banks, river width and water pollution were used (see Romanowski 2000, 2006).
dressed in terms of high probability of reporting false negative sites (Balestrieri et al. 2011). Factors that negatively affect detection of signs in this type of habitat are high penetration of banks by humans and vegetation present under bridges, as well as decreased activity of otters along banks, that was recorded on streams of larger size in Scotland (Kruuk et al. 1993). The regional variation in initial numbers of spraints and tracks found at positive sites in this study can be primarily attributed to different percentage occupation of sites in three parts of the study area: the highest in Eastern, and lowest in Central Poland. The observed differences are consistent with an earlier evaluation of otter status in these regions (Brzeziński et al. 1996) and presumably reflect higher otter numbers in Eastern Poland. High numbers of spraints were reported in several regions inhabited by dense otter populations (Jefferies 1986, Kruuk and Conroy 1987). There is a substantial amount of evidence that data collected in field surveys could be used as an index of population status of otters in the area, and as such the method is of primary interest for otter conservation (Mason and Macdonald 1987). The results of this study demonstrate that the initial number of spraints and tracks recorded during survey at each site was related to the presence of specific habitat elements that influence sign detection (e.g. presence of bridges with high potential) and therefore can not be used as an indicator of otter habitat preference, as stated earlier by Kruuk et al. (1986). However at the regional scale the variation in number of spraints and tracks, as well as the distance searched, was related to the percentage occupation of sites, as shown for the three areas W, N, E, which is in agreement with results of surveys in England and Scotland (Strachan and Jefferies 1996, Green and Green 1997). These observations led Mason and Macdonald (2004) to develop an otter population index that combines two parameters: the percentage of sites where signs of otters were detected and the mean number of spraints per site. In two independent studies it was found that as otter populations expanded, more sites were occupied and the intensity of sprainting at sites increased (Mason and Macdonald 2004, Prigioni et al. 2007). Thus variation in number of spraints and tracks recorded in regional surveys can be considered a practical indicator of changes in the population status of otters. The current study shows that measuring the distance searched for signs provides additional indication of the otter status that may be of interest for monitoring and conservation programmes. In addition, the search length could be used to assess probability of false negative results, which would allow the identification of specific habitats where the detection of otter signs during survey is problematic. Considering the large geographical range of the species it could be expected that several other types of such habitats could be identified in further otter surveys.

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6. REFERENCES


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