The distribution of otter faeces (*Lutra lutra* L.) on the coast of Wester Ross, Scotland (1979–1980)

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Abstract

Studied is the importance of some physical and biological factors for the distribution of otter *(Lutra lutra)* faeces along the Westcoast of Scotland. For this reason the coast was divided into parts considering physical factors (the steepness of the slopes underneath and above the waterline, the exposition to the sea in relation to the weather influences) and for otters important biological factors (vegetation type).

Within each type of habitat deposition places and faeces were mapped, counted and separeted into categories (see table 2). Besides all otter holts were mapped. The research shows that especially steep and exposed coast-slopes show a high concentration of faeces. The bigger faeces near otter and fishing places are probably mainly excreted as stools.

The smaller however serve probably as a mark of for otters important places in the territory.

As a measure for the importance of certain habitat types for otters the concentration of faeces is a useful help.

Introduction

The aim of this paper is to describe the contribution and importance of some physical and biological factors to the distribution of otter (*Lutra lutra* L.) faeces (c. q. spraint spots) on coasts near Ardban in Wester Ross, Scotland in winter 1979–1980. The reason to take faeces as an index is that these are the most easily and the most frequently found otter signs along these coasts. On different types of coast the amount of faeces (c. q. spraint spots) can differ greatly. The distribution of faeces may, in general, be useful as an index of the relative density of otters on certain types of coast. The correlation between faeces as a measurement to otter distribution and physical respectively biological factors can give some more insight in the role which these factors play in the choice of their habitat. At Ardnish, c. 100 km south of Ardban, Kruuk and Hewson (1978) saw most otters in habitats with large beds of kelp (*Laminaria* sp.) on rocks below the low tide level. They found on average 1 holt every 1.1 km of coast, and stated that spraint sites mostly occured near holts. In an earlier study around Ardban, Jenkins and Burrows (1980) found that spraints were concentrated at some stretches of coast and that 73 % of spraint sites were within a straight line distance of 100 m from the nearest holt. Holts were spaced, on average, about 746 m apart in suitable habitat. Concentrations of spraints near occupied holts are the basis for supposing that more spraints may be found where there is more otter activity. However, spraints may also occur in places on coasts where there apparently are no holts (see below) and Trowbridge (1983); Jenkins (1980) and Jenkins and Harper (1980) also recorded spraints in many places near the River Dee but no holt used for more than a few days. Although otters frequently defaecate when leaving their den most of the spraint spots (87,2 %) where not in direct relation to holts. Direct observations made it clear that otters frequently defaecate short or directly after leaving the water.

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Material and methods

A total of about 185 km coast was visited before defining a study area of 13 units of coast (called sections) of total length 54.25 km for counting spraints. About 50 % of the sections were exposed. About 50 % were on hard rock Lewesian gneiss and the rest on softer Torridonian sandstone. Hard rock shores mostly had a far steeper slope below sea level than sandstone shores. (Fig. 1)

Otter signs (holts, prey remains, spraint sites) were mapped as accurately as possible, and the habitat was described as in Table 1. On each section walked, I examined a strip above high tide mark about 5–10 m in width below steep cliffs and about 50 m wide where the slope was gradual. Several sections were visited more than once. Since tracking in snow showed that otter tracks sometimes went further inland, especially across promontories and between coasts and fresh water lochs (e.g. up streams), all well marked tracks in these places were also examined.

"Fishing places" were defined as places at the coast, not especially linked at a special holt or in their neighbourhood, where far more than average amounts of faeces were concentrated and where also prey remains like scales, skeleton parts of larger fishes and/or crustaceans could be found. In a number of cases, otters were seen there fishing and feeding or resting and grooming.

From snow tracking, I identified at least three different otters in a relatively small area near Ardban. Each individual used one or more different holts. One female used all the holts along a track of about 2.5 km.

The study area was classified according to the morphology of the coast and the vegetation found on section of coast, so that easily recognized "classes" could be distinguished. The classes "exposure" and "vegetation" were divided into two, and "sites below high tide mark" and "sites above high tide mark" into five and six respectively (Table 1).

The types of otter traces used in the field are shown in Table 2. The prey remains were not counted

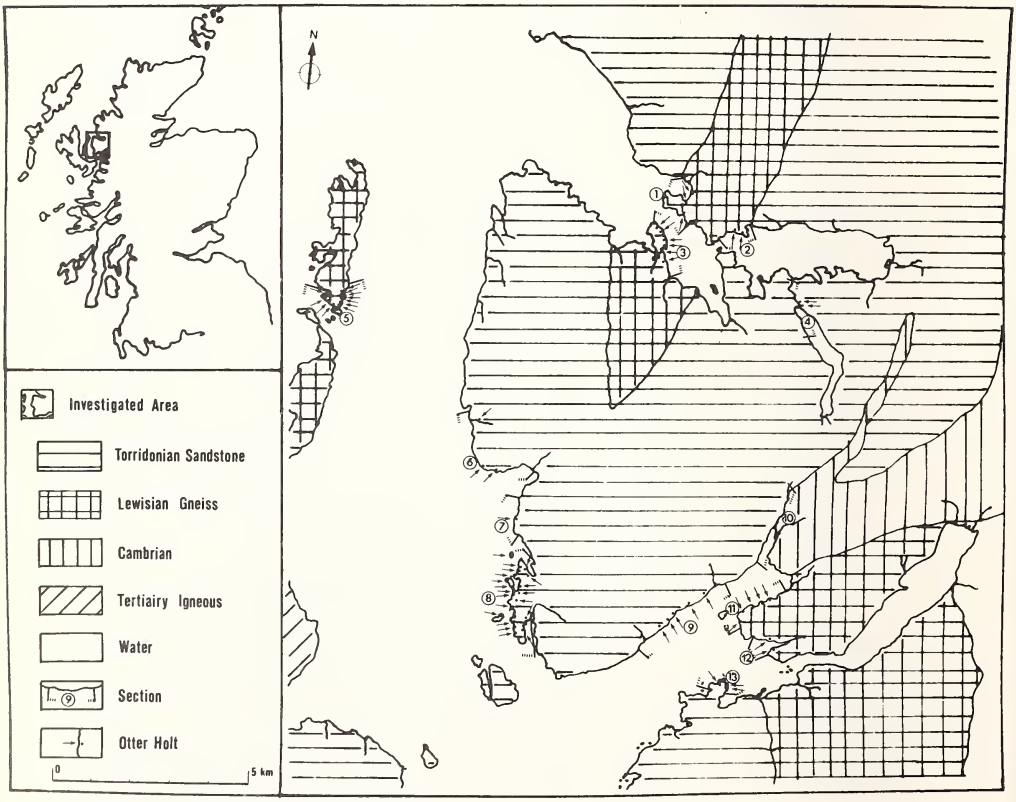

Fig. 1. Research area with geomorphological rock types, the investigated trajects, the position of the located otter holts

Table 1

Habitat criteria defined on coast lengths walked

Criteria	Classes
1. Exposure:	not exposed (< 5 km sea over > 25°)[1] exposed (> 5 km sea over > 25°)
2. Vegetation:	wooded not wooded
3. Sites below high tide mark:	more than 60°, rock between 20°–60°, rock less than 20°, rock less than 20°, sand, mud, shingle less than 20°, river habitat
4. Sites above high tide mark:	more than 60° towards sea or river, rock between 35°–60° towards sea or river, rock less than 35° towards sea or river, rock less than 35° towards sea or river, dunes less than 35° towards sea or river, estuaries less than 35° towards sea, flat river bank

[1] i.e. on looking out to sea, land occurred within 5 km over more than 25°.

Table 2

Types of otter traces

	Total %	Total n
1. Holts		62
2. Spraints sites		
– near holts (50 m)	12.8	109
– at fishing places (in concentrations)	13.6	115
– other places	73.6	624
on stones and vegetation	(37.7)	(320)
near fresh water	(24.1)	(204)
where otter tracks enter water	(1.0)	(9)
on special passing places	(10.8)	(91)
3. Faeces		4174 (± 604)

as it was often not possible to distinguish how many prey items were eaten (especially in the case of fish scales or crustecean remains).

With the chosen physical criteria, 120 theoretical combinations are possible, but only 30 occured in the sections walked. For statistical reasons, no combinations occurring over less than 500 m were used. By comparing biotopes differing in only one aspect, the number of spraints in these biotopes, will give the significance of the difference between the biotopes that could be ascertained. If two combinations varieing in one parameter were statistically different (p 0.05), the higher density class scored 1 and the lower 0. If they were not statistically different, both classes scored 0.5. For each parameter class these scores were added and divided by the total number of comparable combinations. This gives as a result for each parameter a value between 0 and 1 independent of the total number in which comparising was possible and independent of any other parameter value. The results are listed in Table 3 in which 1 means that this parameter class scored always higher than any other comparable parameter class, and 0 that all other parameter classes scored higher. The effect of the parameter on the density of spraint sites or spraints is given by the difference between the successive scores of the classes within the parameter.

Results

Holts

Holts were about 300 m apart on the Island of South Sona, and about 1600 m or even more apart at Applecross Bay (Fig. 1). Their position was sometimes localised by geographical features such as peat banks on the tops of small peninsulas in areas with hard rocks. In other places, such as caves, some holts may have been missed and it was ususally impossible to distinguish between permanent holts and those used only occasionally. Although Kruuk and Hewson (1978) and Jenkins and Burrows (1980) found spraints mainly near holts at Ardnish, in my study area only 12.8 % of 848 spraint sites (with 4174 ± 604 spraints less than aproximately 2 weeks old) were found within 50 m of a holt. From this, holts were not considered to provide a useful index of otter activity, nor were they in the fresh water studies in Dee-side (Jenkins 1980). Although otters frequently defaecate when leaving their den, most of the spraint spots (87.2 %) where found not in direct relation to holts. Direct observations made clear that otters frequently defaecate short or directly after leaving the water.

Spraint sites

In the study area, most spraint sites (73.6 %) and spraints (68.1 %, n = 2843 ± 411) were concentrated in places not related to holts or fishing places.

a. On special stones or on grass or other vegetation (37.7 %), often recognisable from a distance by their greenish appearance, mostly well above high tide. About 6.1 % were regularly flooded by the sea, but the spraints at these places were not readily washed away.

Fig. 2. Otter holt on Rona on the top of a small penninsula, with defaecation points (↑)

b. Sites near small fresh-water pools or streams (24.1 %), which when less than 10 m from the high tide mark almost invariably had spraint sites nearby.
c. Sites near places where otter tracks entered larger rivers and the lakes (1.0 %).
d. Sites on high ground where otter tracks crossed, sometimes 100 m or more from the water (10.8 %).

The remaining spraint sites were near holts or at fishing places. Spraint sites near known fishing places, often far from used holts, accounted for 13.6 % of the total, but obviously otters may have fished at other places besides those where I saw them. These 13.6 % were under boulders, in small caves, and on open, often grassy places where no holt, could be made. Thus 12.8 % of the spraint spots were found within 50 metres of a holt. As there were found 62 holts along the total traject of 54.25 km, there was an average of one holt per 875 metres. This means that if equally distributed only 5.7 % of the faeces could be expected near the holts. This is 2.25 times lower than actually found. Fishing places although less evident, as the geografical limits are not so easily made, give a comparable result. Prey remains were not always found at these places, perhaps because most prey were small and eaten whole in the water (prey analysis of the faeces resulted in predation of mainly Butterfish (*Pholis gunnellus* L.), Viviparous Blenny (*Zoarcus viviparus* L.) and small Gadoids. This is confirming with the results of Kruuk and Hewson 1978, who found mainly Butterfish as prey).

In concentrations of spraints, I counted or estimated numbers of feaces less than about 10–14 days old from the mean of a possible maximum and minimum. The estimated error was 20 % (with donfidence limits of 95 %). Individual feaces near holts or fishing places were mostly longer than those found on other places; they averaged 4.5 cm ($n = 34$) compared with 2.3 cm ($n = 63$) ($p < 0.01$). Following some ottertracks in the snow resulted in a great individual variation for using holts. So one female otter used 8 different holts during one trip (of which only two were found before the period of snow) in one night on a track of about 2.5 km length. Another female otter with her cub, living not far from the first otter, used only one large holt. The male otter in the same area used three small holts. All these otters were frequently seen in the area during the investigation period. This makes clear that there is no direct relation between the number of holts and the number of otters in an area especially not where there are enough possibilities to make holts.

Habitats

No significant differences in numbers of spraint sites per kilometer were found in sections of the same habitats, except that more feaces per spraint site tended to be found in steeper habitats. On coasts with slopes more and less than 35 degrees, the number of feaces averaged 3.1 ± 0.3 and 5.1 ± 0.8 per spraint site ($p < 0.01$) respectively, but I do not know if this has any biological significance.

The main points in the analysis of number of feaces and habitat are:

1. Taking exposure and vegetation as dependent variables, more feaces were found on exposed than on sheltered rocky coasts ($p < 0.05$). On sand, mud and shingle coasts, more feaces were found where there were woods than were not ($p < 0.05$). Exposed estuarine habitats seemed to have the same attraction as rocky areas. In the more sheltered areas, the number of feaces was rather low.
2. Comparisons below high tide mark showed more feaces on coasts with steep underwater slopes. This is well shown in the group with more than 60 degrees of slope ($p < 0.05$), but the group with 20–60 degrees also contained significantly more feaces than coasts shelving less than 20 degrees ($p < 0.05$).
3. Above high tide mark, there was a clear tendency for more feaces to be found in places with medium steep rocks ($p < 0.05$), when compared with all other habitats combined.

Table 3

Comparison of the relative density of spraint sites and spraints in relation to criteria of the habitat

Criteria and classes	spraint sites	spraints
Exposure and vegetation		
not exposed, wooded	0.50	0.50
not exposed, not wooded	0.42	0.35
exposed, not wooded	0.58	0.67
Habitat below high tide mark		
more than 60°, rock	0.88	1.00
between 20°–60°, rock	0.80	0.75
less than 20°, rock	0.32	0.32
less than 20°, sand, mud, shingle	0.18	0.29
less than 20°, river	0.92	0.67
Habitat above high tide mark		
more than 60° towards sea or river, rock	0.23	0.30
between 35°–60° towards sea or river, rock	0.69	0.86
less than 35° towards sea or river, rock	0.75	0.56
less than 35° towards sea or river, dunes	0.33	0.42
less than 35° towards sea or river, estuaries	0.39	0.33
less than 35° towards river, flat riverbank	0.00	0.00

The highest and the lowest scores are underlined in each group. Differences less than 0.08 are statistically not different at $p > 0.05$. – For explanation see Material and methods last alinea.

However, "dunes" and "estuaries" contained relatively many faeces, when combined with "sand, mud and shingle coasts".

Most spraints and sites were found on medium steep slopes bordering deep water ($p < 0.05$), comparing this habitat with all others. Although there was a tendency for more sites to be found in wooded than non-wooded areas, the highest densities were found in hard rock areas with little vegetation and with the least protection against rough weather conditions.

Discussion

I did not test what proportion of spraints was found (but cf. Jenkins and Conroy [1982] who claimes in a similar study to find about 78–85 % of the "findable" spraints after a single search). Assuming otters to deposite their spraints mostly on places where they normally frequent, it is clear that in favorite types of habitat most spraints are likely to be found. From this the results of this investigation shows that there is a significant tendency for otters that they prefer moderately steep shores beside deep water because food is especially available there or because of cover or escape value. This implies that on coastal habitats the number and distribution of faeces, in contrast to sightings, numbers of holts etc., can be used as an index for the local density of otters, c.q. to find the favorite habitat types. The differences in faeces size is interesting, and two kinds of defaecating activity may be a reality. While the relative large size feaces near holts and fishing places are put on pilars to evacuate the bowels and will have only a secondary social function, the on average smaller faeces found on other places and which are more equally distributed, may have a social or some kind of recognition function. A social function is demonstrated by the fact that in several cases where an otter had marked on a point a later on passing otter smelled at this spot and often put its own mark on it. A recognition function is shown by the fact that things as fesh water sources etc. where almost invariably surrounded by marking spots. These were not necessarily from different otters, for by example one female otter had a

small burn just aside the main entrance of her holt where she frequently marked although never an other otter was seen or traced there. In captivity, otters usually defaecate and urinate immediately after leaving their dens. However, the very small size of any captivity area in relation to a home range of wild otters will inflict the marking behaviour highly.

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Zusammenfassung

Die Verteilung von Otter(Lutra lutra L.)-Faeces an der Küste von Wester Ross, Schottland (1979–1980)

Untersucht wurde die Bedeutung einiger physischer und biologischer Faktoren für die Verteilung von Otter*(Lutra lutra)*-Faeces entlang der Westküste von Schottland. Hierzu wurde die Küste nach physischen Faktoren (Neigung der Küste unter und über der Hochwasserlinie, Exposition in bezug auf Wettereinflüsse) und für Otter wichtige biologische Faktoren (Vegetationstyp) in Trajekte eingeteilt.

Innerhalb eines Habitattyps werden alle Depositionsstellen und Faeces aufgezeichnet, gezählt und in bestimmte Kategorien geordnet. Zudem wurden alle Otterbauten kartiert. Insgesamt wurden 848 Depositionsstellen mit insgesamt 4174 ± 604 Faeces jünger als zwei Wochen gezählt.

Die Untersuchung zeigt, daß vor allem schräge und exponierte Küsten hohe Konzentrationen an Faeces aufweisen. Die größeren Faeces in Buchten und an Fischstellen wurden wahrscheinlich hauptsächlich zur Entlastung abgesetzt. Die kleineren dienen dagegen wahrscheinlich in stärkerem Maße als Markierung von für Otter wichtige Stellen im Revier. Als Maß für die Bedeutung von bestimmten Habitattypen für Otter gibt die Konzentration von Faeces ein wertvolles Hilfsmittel.

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