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# The Use of Spraints for Surveying Otter *Lutra lutra* Populations: An Evaluation

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*ABSTRACT*

*Spraint surveys have been widely used over the last decade to assess the distribution of otters* Lutra lutra, *and sometimes to indicate population status, in broad terms, as well as to identify habitat features considered of importance to otters. A study in Shetland has recently been used to cast doubt on this methodology. The methodology is evaluated here and shows that spraint surveys give a reliable picture of otter distribution. It is also shown that, with care, the density of signs can be used to make a broad comparison of populations, while the relationship between spraint density and measures of cover is a functional one, of value in conservation programmes. Reasons for the anomalous conclusions of the Shetland study are suggested.*

## INTRODUCTION

Over the last three decades, the otter has suffered severe declines in both range and numbers, but due to its secretive and nocturnal nature, decreases went largely unnoticed (for review, see Mason & Macdonald, 1986). The last ten years have seen surveys carried out in a number of countries, survey methods being based on those developed by the Nature Conservancy Council (e.g. Lenton *et al.*, 1980). The methods depend on finding evidence for otters (largely droppings or spraints, occasionally footprints) within a maximum search of 600 m of waterway, the search being terminated as soon as signs of otters are found. Sprainte, which appear to be used by otters for signalling (e.g. Trowbridge, 1983), are often deposited in conspicuous



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places, which considerably aids survey work. The method has been modified for more specific purposes, for example to attempt to identify those features of habitat of importance to otters (e.g. Jenkins & Burrows, 1980; Macdonald & Mason, 1983*a*).

In a recent paper, Kruuk *et al.* (1986) suggest that, in a study of diurnal, coastal-dwelling otters in Shetland, they could find no relationship between the number of spraints, nor the number of spraint sites, and the amount of time otters spent in particular blocks of shore-line. This led them to criticise the value of spraint surveys for assessing both distribution and habitat utilisation by otters. Jefferies (1986) has vigorously defended the use of spraints as a survey and conservation tool, using mainly data collected during the British national surveys. In this paper we aim to demonstrate the reliability of the survey technique and its use in habitat evaluation, using information gathered during our own survey work.

## DISTRIBUTION SURVEYS USING SPRAINTS

Work in north-east Greece in 1983 (Macdonald & Mason, 1985) and in Andalucia, Spain and Wales in 1986 (unpublished data) included recording all signs of otters in 100 m stretches over distances of 1000 m, a total of 92 km being surveyed. Within the first 600 m (i.e. the standard survey distance) 73% of sites proved positive, the additional 400 m adding a further 6% of positive sites. Of the positive sites, 79% were confirmed within the first 200 m.

During a survey for otters in Wales (Andrews & Crawford, 1986), one of us (SMM) examined 329 sites using the standard survey method; 44% of sites proved positive, 74% of positive sites being confirmed within the first 200 m. By plotting the cumulative frequency against distance walked (Fig. 1) it is possible to fit a linear regression which can be used to predict the additional positive sites which may have been recorded had the survey been extended to 1000 m. The relationship between positive sites ($y$) and distance ($x$) could be described by the equation $y = 93 + 0{\cdot}09x$ ($r = 0{\cdot}97$) and an additional 11·7% of positive sites were predicted if the survey had been extended to 1000 m.

A similar survey technique has been used by us to determine the distribution of otters in the Mediterranean region (see Mason & Macdonald, 1986, for an overview), but we always surveyed a minimum of 200 m. Of 712 sites surveyed, 44% were proved positive, 69% of positive sites being confirmed within the first 200 m (Fig. 2). Fitting a regression to the cumulative frequency yields the relationship $y = 148 + 0{\cdot}23x$ ($r = 0{\cdot}99$) and it can be predicted that extending the survey distance to 1000 m would have resulted in a further 7·5% of positive sites.

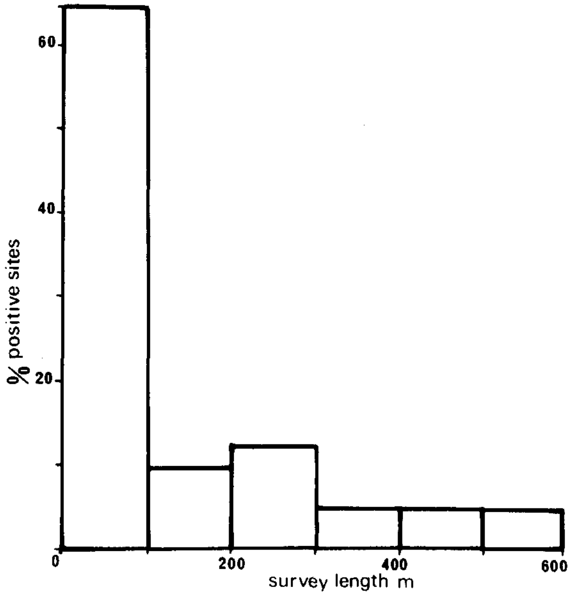


**Fig. 1.** At any site a maximum of 600 m was searched for signs of otters, the search being terminated as soon as signs were found. Shown is the percentage of sites found to be positive within the first 100 m searched or after a further 200 m, 300 m, 400 m, 500 m or 600 m (data derived from a survey of Wales, n = 146).

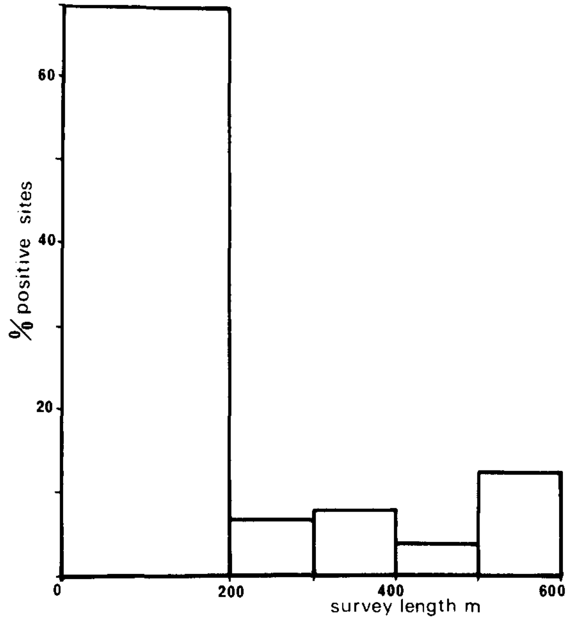


**Fig. 2.** At any site a maximum of 600 m was searched for signs of otters. Shown is the percentage of sites found to be positive within the first 200 m of search, or after a further 300 m, 400 m, 500 m or 600 m (data derived from surveys for otters in the Mediterranean region, where a minimum of 200 m was searched at each site, n = 313).

From the evidence above, we would suggest that extending the standard 600 m survey for a further 400 m might increase the positive registrations by 6–12%, though the majority of positive sites are confirmed within the first 200 m. However, it must be remembered that survey points are distributed throughout a catchment and it is the catchment or sub-catchment, rather than the individual survey point, which is of importance from the conservation point of view. It is therefore highly unlikely, with the degree of accuracy suggested above, that a catchment would be erroneously recorded as negative using current survey techniques. Furthermore, if the survey technique were missing large numbers of sites habitually used by otters, then one might expect a random distribution of positive sites to emerge. However, this is not the case. For example, in Greece, considered generally to hold a thriving otter population, the distribution map reported in Macdonald & Mason (1982*b*) shows negative sites clustered in distinct sub-catchments. Conversely, in Italy, where the otter is considered to be close to extinction, the distribution map shown in Macdonald & Mason (1983*b*) shows that positive sites are clustered. It is of interest to note that Cassola (1986), surveying 1300 sites throughout Italy, reported a distribution of otters very similar to that found by Macdonald & Mason (1983*b*) for 188 sites, while the surveys respectively found 6·2% and 8·5% of sites positive.

## SPRAINT DENSITIES AS INDICATORS OF POPULATION STATUS

Jefferies (1986) discusses the problems associated with using spraint numbers as indicators of otter numbers. It has, for example, been shown that there are seasonal cycles in sprainting activity (Erlinge, 1968; Mason & Macdonald, 1986), which would, at first sight, appear to invalidate any proposed relationship between spraint numbers and otter populations. It would certainly invalidate any direct relationships, but we believe that the level of variation in sprainting at sites between catchments can be such that, providing the sample size is sufficient, the technique can be used broadly to define the status of an otter population.

In our surveys of the Mediterranean basin we walked a minimum of 200 m at all sites, so that for all positive sites an index of number of spraints per 200 m can be calculated. If spraint numbers broadly reflect the status of the population, few spraints per 200 m might be expected in study areas with few positive sites overall, while a greater spraint density could be expected from study areas with many positive sites. If spraint density is completely unrelated to otter numbers, then no relationship between spraint density and proportion of positive sites would be expected. The relationship

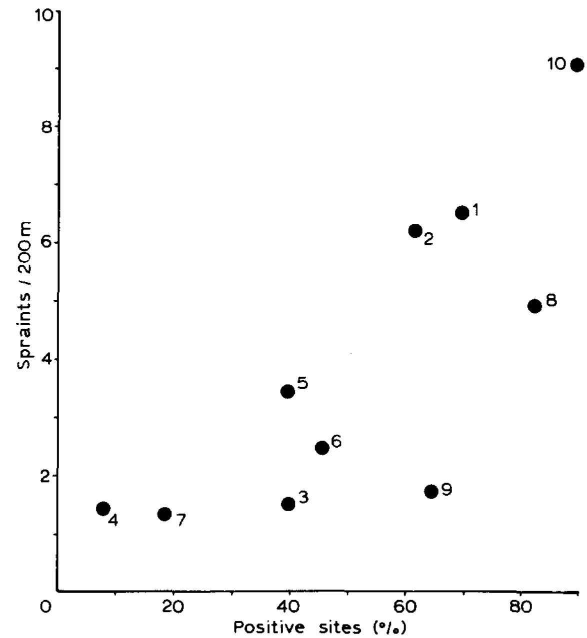


**Fig. 3.** The relationship between spraint density (mean no. per 200 m at positive sites) and the overall percentage of positive sites in ten surveys for otters (1, Portugal; 2, Greece; 3, Spain; 4, Italy; 5, Tunisia; 6, Morocco; 7, Algeria; 8, Northeast Greece; 9, Central Wales; 10, Andalucia, southwest Spain).

between spraint density and proportion of positive sites is shown in Fig. 3, based on seven extensive and three intensive surveys. The extensive surveys were of Portugal (surveyed in July; Mason & Macdonald, 1982*a*), Greece (March/April; Macdonald & Mason, 1982*b*). Italy (March/April; Macdonald & Mason, 1983*b*), Spain (June; Elliot, 1983), Tunisia (July; Macdonald & Mason, 1983*c*), Morocco (April; Macdonald & Mason, 1984) and Algeria (March/April; Macdonald *et al.*, 1985). The three intensive surveys included searches for spraints in 52 km of north-east Greece (July/August; Macdonald & Mason, 1985), 20 km of central Wales (September; unpublished data) and south-western Spain (September; unpublished data). The relationship between mean number of spraints per 200 m and the percentage of positive sites is significant ($r_s = 0{\cdot}84$, $P < 0{\cdot}01$). The main outlier is for the intensive study in central Wales, which was carried out, not only at a time when marking intensity is at its lowest (Mason & Macdonald, 1986) but also immediately after a period of unseasonably heavy rain, which resulted in extensive flooding in the catchment. Surveys after unseasonable spates should, wherever possible, be avoided.

In Greece, a total of 200 sites was surveyed over a period of three weeks in early spring (Macdonald & Mason, 1982*b*), giving sufficient data for some

**TABLE 1**
Average Spraint Density (mean number per 200 m search) and Percentage of Positive Sites in Three Regions of Greece

| *Region* | *Spraint density* | *Standard error* | *n* | *% positive* |
|---|---|---|---|---|
| Thrace | 10·04 | 2·02 | 24 | 92·3 |
| Peloponnese | 9·90 | 2·68 | 24 | 85·0 |
| Central Greece | 2·69 | 0·51 | 22 | 56·4 |

regions with different percentages of positive sites to allow a statistical comparison between spraint densities. Thus, the western Peloponnese and Thrace (east of Kavala) were both, on the distribution of positive sites, considered to hold thriving otter populations, while in central Greece (catchments of the Sperchios and Pinios rivers) a lower distribution of positive sites suggested a declining population. The comparisons are shown in Table 1. An analysis of variance shows the mean spraint densities to be significantly different ($F = 4{\cdot}95$, $P < 0{\cdot}01$). Comparisons between the sites show that the mean spraint density in central Greece was significantly lower than that for the Peloponnese ($t = 2{\cdot}58$, $P < 0{\cdot}01$) and Thrace ($t = 3{\cdot}32$, $P = 0{\cdot}01$)) but the means for Peloponnese and Thrace were not significantly different ($t = 0{\cdot}04$, ns).

From these data we believe that spraint densities can be used *with care* to *broadly* define the status of otter populations. Regular monitoring of contrasting sites by similar techniques could allow for a refined definition of status.

## SPRAINT DENSITIES AS INDICATORS OF HABITAT UTILISATION

Although Kruuk *et al.* (1986) did not measure any parameter of habitat they concluded that spraint numbers cannot be used to assess habitat utilisation, stating that 'it would be erroneous, for instance, to conclude from spraint distribution alone that river banks with woody vegetation are more important than banks without'. While the relationship between spraint numbers and habitat utilisation may be circumstantial, there is now a substantial body of such evidence. The evidence is listed below:

(1) Macdonald *et al.* (1978), working on the River Teme in the West Midlands, found more signs of otters on stretches of river containing more potential holt sites, more riverside ash *Fraxinus excelsior* and sycamore *Acer pseudoplatanus* trees, and more woodland abutting river banks.

(2) Jenkins & Burrows (1980), working in north-east Scotland, concluded, after an analysis of variance, that sprainting activity was related to the extent of bankside and hinterland woody vegetation.
(3) Jenkins (1982), working in west Wales, found a positive association between spraint density and good vegetation cover, especially where woodland or *Rhododendron* thickets were present. Fewer spraints were found along stretches of improved pasture with bare banks.
(4) Macdonald & Mason (1982*b*), in a survey of Greece, found significantly more sprainting sites in stretches graded as having good habitat than in stretches with poor habitat.
(5) Macdonald & Mason (1983*a*), in a survey of 250 km of river in Wales and the West Midlands, were able to show a strong statistical relationship between sprainting activity and the number of potential holts, and the number of mature ash and sycamore trees along the banks.
(6) Bas *et al.* (1984) counted spraints and quantified habitat in 50 m units along 20 km of the River Dee, north-east Scotland, and found a statistical relationship between the number of spraints and spraint sites and the degree of tree cover along the river bank.
(7) Macdonald & Mason (1985), working in north-east Greece, found statistically significant relationships between sprainting intensity and the amount of bankside cover, *Rubus* being especially important on upland rivers, *Salix* scrub on both upland and lowland rivers and *Phragmites* along canals.
(8) Crawford (1985), based on 110 km of the River Wye, Wales, found a significant correlation between spraint density and the amount of scrub cover.
(9) Adrian *et al.* (1985), in a study in south-western Spain, showed a highly statistically significant relationship between the presence of otter spraint and the presence of both bankside cover and natural vegetation in the immediate hinterland.

Thus, although the relationship between spraint distribution and habitat quality may be circumstantial, it is statistically demonstrable in the nine studies that have sought such relationships. Confirmation for the relationship is provided by the three published radio-telemetry studies on river otters.

Green *et al.* (1984), working in Perthshire, Scotland, with radio-tagged otters injected with $^{65}Zn$ found that labelled spraint distribution tended to be concentrated at centres of activity or on the approach to such centres, as shown by radio-telemetry. Thus spraints were deposited at frequencies related to the value of a segment of habitat to individual otters in sites where they were most likely to be discovered by other otters. Green *et al.* (1984) also found that the roots of ash and sycamore trees were the most frequent tree holts used by radio-monitored otters, the very sites identified as being of particular importance in the multi-variate analysis of Welsh data by Macdonald & Mason (1983*a*).

Jefferies *et al.* (1986) have radio-tracked otters released as part of a restocking programme in East Anglia and found that the animals spent 53% of their time in woodland, again emphasising the importance of cover to otters.

Melquist & Hornocker (1983) made observations totalling 4888 h on 39 radio-tagged *Lutra canadensis* in Idaho, USA. While food was the main factor influencing habitat use by otters, adequate cover was also essential. Stretches of habitat with ample food were virtually unused by otters in the absence of sufficient cover and resting sites. Otters could tolerate humans if shelter was adequate and Melquist & Hornocker (1983) suggested that the preference otters exhibited for streams over lakes, reservoirs and ponds was due to the greater availability of adequate cover.

A final line of evidence is provided by Claus Reuther (pers. comm.), who has experimentally manipulated the waterside cover in an enclosure. A tame, captive otter entered and left the water significantly more often by bankside bushes and, when the distribution of this cover was altered around the pool, so did the points of entry and exit by the otter.

The value of cover to otters is therefore proven and the statistical correlations between spraint distribution and habitat features described in the nine studies listed above would appear to be genuine relationships, of value to programmes aimed at conserving otters. This is not to say that these are the only features of importance to otters. For example, in our study area in Wales, one extensive stretch of grazed pasture, with little cover, is heavily marked with spraint, especially in winter. This site is opposite the confluence of two major tributaries with the main river and the marking may have an important social significance at this crossroads.

## CONCLUSIONS

From the discussion above it can be concluded that surveys of spraints, using standard methodology, give a reliable picture of the distribution of otters. Furthermore, spraint density can be used as a *broad* indication of the status of populations, provided sample sizes are large enough for statistical comparison. Such data may become more valuable when part of a monitoring programme, rather than a single survey. The relationship between spraint density and cover has also been validated, allowing the identification of features of habitat of importance to otter conservation.

There remains the problem as to why Kruuk *et al.* (1986) found no relationship between spraint density and otter activity, i.e. the amount of time otters spent in stretches of coast. Kruuk *et al.* (1986) were studying a mainly diurnal population at high density, living on the sea coast, a different situation to that of a river population, living a largely nocturnal existence at a lower density in a linear habitat. Kruuk *et al.* (1986) made no attempt to assess features of habitat other than holts, with which they found a significant positive correlation with spraint density. It may be worth noting that cover along river banks is generally equated with providing safe refuges for resting and breeding, i.e. it serves the same function as holts in coastal areas. Macdonald & Mason (1983*a*) found the highest correlation between spraint density and potential holts, which were mainly situated in the roots of ash and sycamore trees.

The absence of any other significant relationships, however, in Kruuk *et al.*'s (1986) study may be due to a fault in the design of their investigation. They made observations of the time otters spent in each of 21 blocks of coast over a five-month period, May to September. Observations, however, were made irregularly, rather than randomly or systematically, and the observation time within blocks varied more than fifteen-fold. This could result in a considerable scaling error when observations of activity were standardised. Thus no otter activity was recorded in the three blocks with the shortest observation time, though spraints were collected from these, so that otters had been present but were missed. Indeed, there is a significant correlation between the amount of activity (standardised) recorded in a block and the amount of time spent making observations ($r_s = 0{\cdot}63$, $P < 0{\cdot}01$), suggesting that the observers spent more time in areas they expected to find otters. This measure of otter activity is probably therefore a poor estimator of the real total time spent by otters within each block.

The collections of spraints were made systematically on three occasions, in May, July and September. According to Kruuk *et al.* (1986), exposed spraints weather in four weeks on Shetland, while Mason & Macdonald (1986) reported that 50% of marked spraints disappeared within three weeks on their Shropshire study sites. Kruuk *et al.* (1986) would therefore have missed a substantial number of spraints which could have been associated with periods of activity recorded by direct observation. Because the spraint collections can be related to only part of the time period over which observations on otters were made, the lack of a relationship between spraint density and otter activity is at best circumstantial. A proof of a lack of relationship would require observations of radio-tagged otters producing labelled spraints, i.e. the type of observations which led Green *et al.* (1984) to suggest a good relationship between spraint density and otter activity.

Finally, it should be stressed that the majority of field surveys, especially those carried out in countries where otter distribution was previously largely unknown, have been made as a first step towards otter conservation. The surveys are not designed to locate every otter population, but to identify areas where otters are widespread, to create an awareness in local biologists, so that species and habitat conservation measures can be developed before problems arise. That local otter groups have now been formed, for example, in Iberia, Italy and Greece, suggests that at least this initial objective is being achieved.

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