Report regarding diet of the Eurasian otter (*Lutra lutra* L.) at selected sites on Ramsey Island Pembrokeshire

Introduction

The Eurasian otter is a semi-aquatic member of the Mustelidae. It is one of the few carnivores to have evolved the ability to actively forage in water and on land (Oliveira *et al*. 2008). Furthermore, otters can forage in both marine and freshwater environments (Kruuk, 2006). Clearly, otters are a highly adaptable carnivore, and this is reflected in the broad fundamental trophic niche of this species (Parry, 2010). In many areas of Europe, fish are the core prey of otters, however, non-fish prey are frequently an important dietary component (*op. cit.*). Importantly, in some areas non-fish prey are the predominant component of otter diet (e.g. Slater and Rayner, 1993; Cloade and MacDonald, 1995; Sidorovich, 2000; De lay Hey, 2008). Otters are opportunistic foragers, taking prey approximately according to its availability. In several areas of the UK and Europe, otter dietary studies have revealed a high consumption of avian prey (De lay Hey, 2008; Cloade and MacDonald, 1995; Ruiz-Olmo and Marsol, 2002), which typically occurs in habitats where birds are highly abundant (*op. cit.*). This study investigates whether there is evidence that otters are predating Manx Shearwater *Puffinus puffinus* on Ramsey Island.

Materials and methods

Otter spraints were collected during spot checks from six sites on Ramsey Island undertaken in July 2010. Spraints were placed into individual, sealed and labelled bags and sent to Swansea University where they were stored at – 17°C until dietary analysis was undertaken. All spraint bags returned were checked to confirm that they contained a single otter spraint. Otter diet was determined through the identification of hard prey remains in spraints. Prior to analysis, spraints were soaked individually in 250ml beakers containing a saturated solution of biological detergent for a period of at least 24 hours. The spraints were then gently rinsed through a 420µm sieve and turned out onto a sheet of blue roll, with care taken to ensure that all remains were removed from the sieve. The spraint remains were wrapped up in the blue roll and left to dry for a period of at least 24 hours. All spraints were analysed using an Olympus SZ40© dissection microscope (Olympus UK Ltd, Watford). Prey remains were identified using published keys (Teerink 1991; Conroy *et al*. 2005). A reference collection of Manx shearwater feathers was kindly supplied by wardens from the Royal Society for the Protection of Birds. Avian remains were distinguished by examining the structure and pigmentation of the feather under high magnification. In particular, structures such as the nodes, downy barbules and internodes were examined. The results of the dietary analysis were expressed using the Relative Frequency of Occurrence (RFO %) method described by Watson (1978) as

$$RFO\% = \frac{\text{Number of occurrences of a prey category}}{\text{Sum of occurrences of all prey categories}} \text{ x } 100$$

Results

In total, 17 spraints were collected and analysed. Ten prey items were identified including freshwater fish, marine fish and non-fish prey (Table 1). Birds were the most frequent prey item, with a combined RFO of 66.7%. The most frequent avian prey was gulls from the Charadiiforme family. There was no evidence that Manx Shearwater had recently been consumed by the otters represented by the spraint sample. There were two occurrences of Procellaridae, however, based on comparison with the reference feathers these were deemed not to be from Manx Shearwater. The occurrence of newt is the second record of newt predation on Pembrokeshire and one of a limited number of records throughout Europe.

Table 1: Relative frequency of occurrence (RFO %) of prey items in 17 otter spraints collected from selected sites on Diet on Ramsey Island in July 2010.

Prey item	RFO %
Blenniidae	8.3
Charadriiforme (gull)	29.2
Charadriiforme (wader)	25.0
Carcinus sp	4.2
Cyprinidae	4.2
Diptera	4.2
Insecta unspecified	8.3
Passerine	4.2
Procellariidae	8.3
Triturus sp	4.2

Discussion

This study found no evidence that otters were predating Manx Shearwaters. It is extremely difficult to identify birds to species level, as published feather keys only distinguish to family level. Furthermore, there is no published feather reference key for the Procellariidae. Access to reference feathers aids the identification process, but there are frequently few, if any, differences in feather structure between different species within a family. Manx Shearwater feathers were observed to have a similar structure to Chardiiforme feathers, but with longer spines at the nodes and a rounded expanded area beneath each node, beneath which there was a band of pigmentation. None of the feathers recovered in the spraint sample matched the structure and pigmentation patterns of the reference feathers supplied. It is, however, important to note that the spraint sample and collection period was very limited. Otter diet varies considerably in time and space (Parry, 2010). The minimum amount of carnivore faecal samples that should be analysed in order to identify all prey items with a high level of confidence is 59 (Trites and Joy, 2005). Therefore, it is unlikely that this study revealed all of the prey items consumed by otters on Ramsey Island. A regular standardised spraint collection, undertaken during the period of Manx Shearwater presence on Ramsey, may reveal predation on this species.

The evidence provided by this study suggests that on Ramsey otters predominantly consumed gulls and waders. The low occurrence of marine fish is surprising, as a previous study found that marine fish formed around two thirds of otter diet around the Pembrokeshire coast (Parry *et al*. 2010). In areas where fish are

less available abundant it is likely that non-fish prey will form a large proportion of otter diet. Clearly, marine fish are readily available around Ramsey Island, which suggests that avian predation may represent a more efficient foraging strategy for otters. Optimal foraging theory predicts that an organism will use strategies to maximise energy intake over time as this increases fitness (Macarthur and Pianka, 1966). The optimal strategy depends upon energetic requirement and the factors affecting prey availability and capture (Stephens and Krebs, 1986). The high density of breeding and juvenile birds on Ramsey during summer could make avian predation a more efficient foraging strategy for otters. Otters may also use burrows as resting sites, which could lead to opportunistic predation of nesting birds.

References

Clode, D. and Macdonald, D.W. (1995) Evidence for food competition between mink (Mustela vison) and otter (Lutra lutra) on Scottish islands. *Journal of Zoology London*, **237**, 435-444.

Conroy, J.W.H., Watt, J., Webb J.B. (2005) *A Guide to the Identification of the Prey Remains in Otter Spraint*. The Mammal Society. London.

De la Hey, D.C. (2008) The importance of birds in the diet of otter *Lutra lutra* on Shapwick Heath. *Bioscience Horizons*, **2**, 1-5.

Kruuk, H. (2006) *Otters ecology, behaviour and conservation*. Oxford University Press, Cambridge.

MacArthur, R.H and Pianka E.R (1966) On optimal use of a patchy environment. *American Naturalist*, **100,** 603-609.

Oliveira, M., Sales-Luís, T., Duarte, A., Nunes, S.F., Carneiro, C, T., Tenreiro, C.T., Tenreiro, R., Santos-Reis, M., Tavares, M.L., Vilela C.L. (2008) First assessment of microbial diversity in faecal microflora of Eurasian otter (*Lutra lutra* Linnaeus, 1758) in Portugal. *European Journal of Wildlife Research,* **54**, 2, 245-25.

Parry, G.S. (2010). Analyses of the Eurasian otter (Lutra lutra L.) in South Wales: Diet, distribution and an assessment of techniques. PhD thesis, Swansea University.

Parry, G.S., Cox, B., Burton, S., Forman. D.W. (2010) Diet of coastal foraging Eurasian otters (*Lutra lutra* L.) in Pembrokeshire south-west Wales *European Journal of Wildlife Research* (under review).

Ruiz-Olmo, J. and Marsol, R. (2002) New Information on the Predation of Fish Eating Birds by the Eurasian Otter (*Lutra lutra*). *IUCN Otter Specialist Group Bulletin,* **19**, 103-106.

Sidorovich, V. E. (2000) Seasonal variation in the feeding habits of riparian mustelids in river valleys of NE Belarus. *Acta Theriologica.* **45**, 233–242.

Slater, F.M. and Rayner, G. (1993) Austropotamobius pallipes in otter diet in the mid-Wye catchment of central Wales. *Freshwater Crayfish*, **9**, 365-367.

Stephens, D.W. and Krebs, J.R. (1986) *Foraging theory*. Princeton University Press, Princeton, USA.

Teerink, B.J. (1991) Hair of west-European mammals: Atlas and identification key. Cambridge University Press, Cambridge.

Trites, A.W. and Joy, R. (2005) Dietary analysis from fecal samples: How many scats are enough?

Journal of Mammalogy, **86**, 704-712.