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Food caching by a Eurasian otter

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Abstract. In early spring of 2007, unusual feeding behaviour was observed for the Eurasian otter (*Lutra lutra*) when a cache of toads (n = 18), black bullheads (n = 2) and great diving beetles (min. 58 ind.) were found in a hollow tree-trunk on the shores of an oxbow lake near the River Danube. Spraint analysis identified the primary food of otters in the area to be fish, with non-fish (buffer) prey of very low importance. As the otter consumed almost exclusively fish, and appeared to store mainly buffer food items, this may indicate that either preferred fish were less available (limited) or that non-fish items were relatively more abundant for a short period during the mild 'cold' winter and spring period. The otter had abandoned this particular cache. Food caching is an important dietary adaptation for many species, providing readily available food during periods when fresh food may be difficult to find.

Key words: *Lutra lutra*, cached food, behaviour, spraint analysis, Danube

Introduction

A number of different mammal species cache food. These include small-sized mustelids such as weasels (*Mustela nivalis* and *M. erminea*), which are known to store surplus food (e.g. small mammals, birds, frogs, and lizards) when prey is either very abundant or unusually rare (King 1990); and polecats (*Mustela putorius*), which cache frogs in winter when their preferred prey of rodents are relatively less available (Blandford 1987). The arctic fox (*Alopex lagopus*), a medium-sized canid caches goose eggs during the short nesting season to help it survive the long winter (Careau et al. 2008), while the red fox (*Vulpes vulpes*) stores sea turtle eggs to feed their offspring (Macdonald et al. 1994).

The piscivorous Eurasian otter (*Lutra lutra*) inhabits a wide variety of wetland habitats (Conroy & Chanin 2002) and is widespread in all wetlands of the Gemenc Area in Hungary. In an optimal environment, the principal food of the otter is fish (Erlinge 1967, Chanin 1985, Jedrzejewska et al. 2001, Clavero et al. 2003, Kruuk 2006) and prey are usually taken alive, the storing of dead food being a rare and unusual behaviour pattern for otters in the wild. In a previous study by Lanszki et al. (2006), however, otters were observed to cache hibernating turtles, a high-energy food source, even though they were less accessible than preferred high biomass fish prey. These caches helped the otter survive the long winter when fish proved difficult to catch.

In this paper, we present a further case of food caching by the otter, comprising primarily non-fish prey items. We then discuss 1) why the otter may have cached food, and 2) why the stored prey items were mainly non-fish items, usually assumed to be less preferred prey.

Material and Methods

Our study took place around the Forgó-tó Lake (23.7 ha) located in the Gemenc Area (Danube-Drava National Park, Hungary, N 46° 19.3 E 18° 54.1, 38 m a.s.l.), about 0.3 km from the River Danube. The surrounding area is comprised of alluvial forest, mainly willow (*Salix alba*) and poplar (*Populus alba*, *P. nigra*), and reed-beds (*Phragmites communis*). The lake is shallow (average depth 0.9 m) and largely covered by saligot (water chestnut *Trapa natans*). Water levels in the Forgó-tó Lake are maintained by water from the nearby the River Danube, though the lake only receives fresh water when water levels on the Danube exceed 630 cm (as measured at the nearest guaging station in Baja city). In order to study the diet and feeding habits of the otter, spraint (faeces) samples were collected around the lake in April of 2007, 2008 and 2009, corresponding to the cold period (partially winter and early spring). Though slightly warmer, there was no significant difference in mean temperature during the colder January–April period of 2007 and 2008/09 (mean temperatures +7.8, +5.8 and +4.3°C, respectively; ANOVA, F_2 = 0.43, P = 0.662). Coldest temperatures in 2007 were recorded in February. The lake did not freeze over during this time and the duration of snow cover was just two days (< 10 mm in January).

Details of the procedures used for otter spraint analysis and classification of fish prey species have been described elsewhere (Lanszki & Sallai 2006, Lanszki & Széles 2006).

It was not possible to determine fish populations at the study site. In order to obtain an indication of the prey that might be available, however electrofishing was undertaken at the nearby (0.8 km) Grébec-Duna oxbow lake in 2007 (Z. Sallai, pers. data; for methods see: Lanszki & Sallai 2006).

Results and Discussion

On 14 April 2007, we discovered a food store, or cache, in a hollow tree-trunk on the shores of the Forgó-tó Lake. The outer and inner diameter of the tree-trunk measured around 60–65 cm and 40–45 cm, respectively, with a hole depth of 30–35 cm. The tree-trunk was lying in shallow water among the bank-side reeds and that part of the trunk not in the water was dry. It is believed that the trunk was deposited on the lake's bank during a flood event in August 2006, and was subsequently removed by a further flood later in 2007.

A combination of characteristic bite marks on the cached prey; spraints and footprints confirmed that the food store was used by an otter (and not to by polecat, etc.). Both old and fresh spraints were found on and around the tree-trunk, indicating regular use by an otter, or otters, over some period. The cache comprised 18 toads (*Bufo bufo*), two black bullheads (*Ameiurus melas*) and at least 58 great diving beetles (*Dytiscus marginalis*). The toads were not skinned and were largely complete, with some bite marks on the body. The back third of the tails of the black bullhead, thought to weigh *ca.* 100 grams, were missing. Otters generally start eating fish at the head but, on occasion, can also begin at the tail (Erlinge 1967, Chanin 1985, Kruuk 2006). Similar marks were also found on small Siluriformes elsewhere (Authors' observations in the field and from post mortem analysis). Some beetles were complete while others consisted only of wing cases (n = 116). The stored prey items were no longer fresh.

While the cache comprised mainly non-fish items, spraint samples from all three cold periods indicated that fish were the principal prey of the otter (mainly gibel carp *Carassius auratus*), while other food items were consumed at very low levels (Table 1).

Regarding otter diet, a total of 184 spraints were analysed, corresponding to 352 food items. There was no significant difference in diet composition between years (Chi-square test, χ^2_6 = 11.29, P = 0.080). Based on remains from the spraint samples, the fish consumed were mainly small (< 100 g, min–max 68.7–95.9%, lowest value in 2007). The most frequently taken prey were eurytopic species (min–max 59.7–78.9%, highest value in 2007, Table 1). Stagnophilic species were also important (lowest value in 2007), while consumption of rheophilic species was lowest (highest value in 2007). Year-dependent differences were significant in the distribution of fish prey weights (χ^2_6 = 22.21, P < 0.01) and guilds (χ^2_4 = 11.68, P < 0.05).

While low numbers of fish were recorded at the Grébec-Duna, the main species were gibel carp (45.6%), bitterling *Rhodeus sericeus* (12.5%), roach *Rutilus rutilus* (11.0%), pumpkinseed *Lepomis gibbosus* (8.1%) and black bullhead (7.7%). Low fish numbers were also detected at other shallow oxbows in the Gemenc Area. With its more balanced water level, however, fish populations might be higher in the deeper Forgó-tó Lake (A. Mórocz, pers. obs.).

As in the case of turtle caching (Lanszki et al. 2006), it might be assumed that otters cache prey (especially non-fish prey species) to combat prolonged periods of cold when fish prey are difficult to catch (e.g. lake is frozen). The possibility that this cache was the result of a short cold period causing a lack of preferred prey, however, is only partly supported by our spraint analysis and food store data. Amphibians can be of similar importance to fish, especially during periods of cold or fish shortage and may act as buffer foods for the otter during these times (Jedrzejewska et al. 2001, Clavero et al. 2005). Toads, however, are a less preferred prey due to their poisonous dermal secretion (Weber 1990) and are often skinned before eating. Although toads made up the main biomass of stored food, they were eaten at low frequency based on spraint

Table 1. *Number of items (N) and percentage biomass of various food species consumed by otters on the Forgó-tó (natural lake) during cold period in Hungary. Fish guilds: R – rheophilic or flow preferring, E – eurytopic or tolerant for rivers and stagnant waters, and S – stagnophilic or stagnant waters preferring. Spraint samples collected in April, +: biomass under 0.05%. Empty cells mean that the given taxon was not detected.*

Food item	Fish guild	2007		2008		2009	
		N	%B	N	%B	N	%B
Common carp *Cyprinus carpio*	E	1	8.6	7	2.8	5	3.1
Gibel carp *Carassius auratus*	E	5	40.1	64	37.9	73	65.0
Rudd *Scardinius erythrophthalmus*	S	1	0.1	1	0.5	4	3.1
Roach *Rutilus rutilus*	E	1	0.9	4	2.8	1	0.8
Chub *Leuciscus cephalus*	E			4	2.3	2	1.7
Bleak *Alburnus alburnus*	E			8	4.0	1	0.6
Nase *Chondostroma nasus*	R	1	10.8	3	0.5		
Barbel *Barbus barbus*	R			1	0.3	1	1.0
Other cyprinids		1	2.4	12	1.4	4	1.4
Acipenser Acipenseridae spp.	R			2	0.1		
Black bullhead *Ameiurus melas*	S	4	9.4	47	34.1	14	14.5
Wels *Silurus glanis*	E	1	12.5			1	0.8
Pumpkinseed *Lepomis gibbosus*	E	1	0.8	6	2.2	1	0.1
Perch *Perca fluviatilis*	E	1	2.6				
Pike-perch *Sander lucioperca*	E			3	2.1		
Pike *Esox lucius*	E	6	10.6	7	6.2	2	1.7
Unidentified fish		1	0.7	5	1.7	3	1.2
Small passerines Passeriformes spp.						1	0.1
Frog *Rana* spp.		1	0.3			5	1.8
Unidentified amphibians				5	0.9	8	3.1
Water beetles (Dytiscidae/Hydrophilidae)		1	+	15	0.1	6	+
Number of spraints		21		83		80	
Number of food items		26		194		132	

analysis. Based on the evidence of the high abundance of fish in the diet and the mild winter conditions in 2007, when severe conditions lasted for a very short time, one would assume that fish availability at the study site was satisfactory for the otter. Further, the brown bullhead (*Ameiurus nebulosus*) is a common food for otters on backwaters (Lanszki & Sallai 2006). Such small-sized fish (including bullheads) are usually consumed completely, with the heads being left behind only rarely (Authors, pers. obs.). Consumption of water beetles tends to be seasonal and of low importance in the diet (Jedrzejewska et al. 2001, Clavero et al. 2003). Due to of their small size, otters usually consume them completely. The storing of whole great diving beetles, therefore, may indicate their short-term importance as a prey of otters.

It is likely that the cached food store acts as a buffer should the preferred food source, in this case fish, become relatively less available (e.g. fish may still be overwintering in deeper water). At such times, the normally non-preferred food in the cache would be is utilized. If the otter should catch a fish, however, then the cached food might be left untouched. Although the prey in the cache are not preferred items, they are relatively easy to catch and handling time is low (Kruuk 2006). Further, such items can become temporarily more available at times of high abundance, e.g. during spawning.

The relatively large number of cached food items of low calorific value shows that the otter may have spent a considerable time establishing the food store. One must assume, therefore, that caching is of importance to the otter. Although invertebrates are considered as 'low-quality' food (Kruuk 2006), their large numbers in the cache may help to survive short periods when there is an absence of fish. Lanszki et al. (2006), however, found that the energy content of frogs (and probably toads) was similar to that of fish (gibel carp). We might ask why the cache was finally left unused (or under utilized)? Careau et al. (2008) suggested that such caches may be abandoned when the contents are no longer fresh. We would also add that the winter of 2007 was not as severe as might have been expected and, for much of the cold period, fish remained relatively plentiful. With the return of spring, fish became common once again and the cache was no longer needed, resulting in its abandonment.

Food caching has rarely been observed in the wild Eurasian otters. Just how widely this rare behaviour is utilized, and the ecological background to its development, is not presently known. One obvious potential benefit may arise from caching certain prey species when they are abundant so that they can be consumed later when prey becomes less available (Blandford 1987, King 1990, Macdonald et al. 1994, Careau et al. 2008). Another explanation worth considering is that, where otter breeding is aseasonal (Chanin 1985, Kruuk 2006), the food store, especially in winter or early spring, may provide an additional emergency food source for cubs, as in the case of the fox (Macdonald et al. 1994).

While food caching appears to be an unusual behaviour pattern, this might be partially due to it occurring only in areas where otters experience cold periods, or most likely, it is due to fish populations becoming depleted over a mild winter, making it difficult to obtain sufficient preferred prey. There are currently few detailed observations of otters from such areas in winter. Indeed, caches may be more commonly used but rarely found because they are fully utilized during the cold periods. This cache was found because the cold period was not prolonged and, therefore, abandoned. In order to assess whether this is a more widespread behaviour pattern, we suggest that more detailed observations need to be made while observing otters in the field, especially in areas where the animals are likely to experience prolonged cold spells.

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