

THE ROLE OF COMMON TOADS IN THE WINTER DIET OF RECOLONISING EURASIAN OTTERS (*LUTRA LUTRA*)

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RIASSUNTO - *Importanza del rospo comune nella dieta invernale di una popolazione di lontra (*Lutra lutra*) in espansione.* Tramite analisi dei resti fecali, abbiamo evidenziato il ruolo fondamentale degli anfibi nella dieta invernale della lontra *Lutra lutra* in stagni artificiali della Spagna nord-occidentale. I numerosi “laghi di cava” presenti nell’area umida di Ribeiras do Louro e Gandaras de Budiño sono stati monitorati nel 2007-2009. Il rospo comune (*Bufo bufo*) era la principale preda della lontra, costituendo l’88% della biomassa consumata, mentre il gambero americano *Procambarus clarkii* e i pesci erano prede secondarie. I nostri risultati contrastano con la ben nota preferenza della lontra per le rane rispetto al rospo. Il mantenimento della popolazione di lontra nel bacino del fiume Louro dipende strettamente dalla corretta gestione degli stagni artificiali.

Key words: *Bufo bufo*, dieta, conservazione, *Lutra lutra*, Spagna

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The Eurasian otter (*Lutra lutra*) is considered to be a fish-feeding mammal (Clavero et al. 2003; Kruuk 2006), whose population dynamics are highly dependent upon this resource (Mason and Macdonald 1986; Kruuk 1995, 2006). However, otters also inhabit and even breed in areas without sufficient fish resources. In these sites, the basic otter prey items are amphibians, which seem to assume the key role generally played by fish in the feeding ecology of otters (Weber 1990; Jedrze-jewska et al., 2001; Clavero et al., 2005; Remonti et al., 2009).

Understanding the underlying ecology of recolonisation is fundamental for otter management and conservation (Remonti et al. 2008). For several recovering populations throughout the otter’s widespread European range, and especially in the Iberian Peninsula (Delibes, 1990), prey avail-

ability may represent a crucial factor in the process of population establishment (Kruuk 1995, 2006).

In an area of NW Spain, the recent detection of otters has been related to the massive breeding of common toads (*Bufo bufo*), which are preyed upon by the mustelid (Ayres and García, 2007, 2009). This resource was not sufficient to assure the presence of the species throughout the year and otters left the area after exploiting the aggregations of toads (García et al., 2009). However, otter presence during the toad breeding period may constitute the first stage of recolonisation of the area. When preying upon toads, the otter adopts a specific technique to avoid the poisonous glands of toads, the so-called “progressive skinning” (Slater, 2002). First, the predator makes an incision in the abdomen and then turns the toad’s skin inside-out (Lodé, 1996;

Table 1 - Prey items in the winter diet of the otter expressed as relative frequency of biomass (%RB).

Prey items	%RB 2007-08	%RB 2008-09
Invertebrates	4.9	2.6
<i>Procambarus clarkii</i>	4.9	2.6
Fish	2.3	2.8
<i>Anguilla anguilla</i>	0.0	0.6
<i>Salmo trutta</i>	0.0	1.2
<i>Achondrostoma arcasii</i>	0.8	0.0
<i>Cyprinus carpio</i>	1.6	0.0
<i>Gobio lozanoi</i>	0.0	0.2
<i>Micropterus salmoides</i>	0.0	0.9
Amphibians	85.5	92.9
<i>Bufo bufo</i>	85.5	88.5
<i>Pelophylax perezi</i>	0.0	4.3
Reptiles	1.7	1.7
<i>Timon lepidus</i>	1.7	0.0
<i>Natrix</i> sp.	0.0	1.7
Undetermined rodents	5.5	0.0
H' (Shannon's diversity index)	0.5	0.4
D (Simpson's dominance index)	0.9	0.9

Slater, 2002). Interestingly, this behaviour has been reported for a large number of sites across Europe (Ruiz-Olmo *et al.*, 1998; Slater, 2002; Ayres and Garcia, 2007, 2009, 2011).

The aim of this note is to provide insights into the winter food habits of this recovering otter population of NW Spain.

The study was conducted in the Gándaras de Budiño e Ribeiras do Louro (GBRL), a 747 ha wide wetland including ponds, swamps and gallery forests associated with the basin of the River Louro. There are also many ponds created by clay extraction (for further details see Ayres and Garcia 2007, 2009, 2011). Common toads (*Bufo bufo*) and Iberian green frogs (*Pelophylax perezi*) occur in the ponds, while Iberian painted frogs (*Discoglossus galganoi*) can be found in their surroundings.

The shore of the water bodies was monitored looking for otter spraints in winter 2007-08 and 2008-09. Spraints found during the surveys (N = 21 and N = 32, respectively) were collected and stored to assess dietary patterns. In the laboratory, spraints were broken up through a sieve of 1mm mesh by pressurized water. Remains were then weighed with a digital scale (precision: ± 0.1 g), and prey were identified using keys (Felix and Montori, 1986; Conroy *et al.*, 1993; Miranda and Escala, 2002). Amphibians were identified by the ilium (Felix and Montori, 1986), which allowed us to confidently identify them to the species level. The biomass of each prey item was estimated by the correction factors proposed by Jedrzejewska and Jedrzejewski (1998). Results were expressed as percent relative biomass [%RB = (biomass of each

food item / overall estimated biomass) x 100]. Shannon's diversity index (H') and Simpson's dominance index (D') were calculated from RB values, by EcoSim 7.0 software (Gotelli and Entsminger, 2009).

Diet analysis showed that in GBRL common toads are the main prey of otters, representing 85.5-88.5 % of the biomass consumed (Tab. 1). Crayfish (*Procambarus clarkii*) and fish were food resources of minor importance in the diet of otters. Accordingly, diet diversity was very low ($H'_{2007-08} = 0.5$; $H'_{2008-09} = 0.4$), while Simpson's dominance index showed high values for both years ($D'_{2007-08} = 0.9$; $D'_{2008-09} = 0.9$).

Amphibians have been reported to be a valuable resource for Eurasian otters in several areas (Weber, 1990; Pikulik and Sidorovich, 1996; Clavero *et al.*, 2005; Remonti *et al.*, 2009).

With rare exceptions, among available species, otters prey upon frogs rather than toads (Weber 1990; Sidorovich and Pikulik, 1997; Clavero *et al.*, 2005). Observations on captive otters (Field D., comm. pers.) suggest that they do not consume the toads even though they play with them. This is not the case in GBRL (but see also Slater, 2002), where massive otter predation on toads may depend on both fish shortage (Ayes and Cordero, 2007) and exceptional toad availability during their breeding period. As pointed out by Ayes and García (2011), otter feeding behaviour in our study area fits well with optimal foraging theory (i.e. Stephens *et al.*, 2007), otters foraging most frequently on the larger female toads.

The River Louro is one of the most polluted rivers in Spain, and currently, otter recolonisation of the catchment involves only the northern parts of the wetland, including small streams and clay pits. Until the quality of the watercourse increases and fish recolonise it, the achievement of stable otter populations will depend on the correct

management of artificial ponds and restocking of autochthonous fish populations in the wetlands.

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