

Insight into the Dietary Habits of the Eurasian Otter, *Lutra lutra*, in the East of Algeria (El-Kala National Park)

Aperçu du régime alimentaire de la loutre d'Europe, Lutra lutra, dans l'est de l'Algérie (Parc national d'El-Kala)

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Abstract

In 1997, faeces samples (spraints) ($n = 175$) from the European otter (*Lutra lutra*) were taken in seven localities of the El-Kala region. This is a restricted eco-geographic complex in which freshwater hydrographical systems, comprising rivers, ponds and wet coastal zones (brackish lagoons, shipping channels), are highly interwoven. The frequency of occurrence and relative abundance of consumed taxons were calculated on the basis of 493 identified prey. Fish made up more than 88% of the otter's catch (relative abundance), with a strong predominance of *Pseudorasbora parva*, *Luciobarbus callensis* and undetermined Cyprinidae. Anuran amphibians made up 9% of the prey. The remainder were represented, in order of significance, by mullets, eels (*Anguilla anguilla*), bleaks (*Alburnus alburnus*), perciformes, gobies, insects, birds, crustaceans, etc. However, Cyprinidae, the eel and the barbel dominated in terms of ingested biomass. The otter's diet varies with local conditions: lagoons and channels have marine or migratory fish; rivers are dominated by barbels; ponds by Cyprinidae. Finally, small-sized

fish (topmouth gudgeon and barbel) dominated the diet in terms of numbers: 62% are smaller than 12.5 cm. The introduction of the topmouth gudgeon into the region could have catastrophic consequences for endemic fish, such as *Pseudophoxinus callensis*.

Résumé

En 1997, des échantillons de fèces (épreintes) ($n = 175$) de la loutre d'Europe (*Lutra lutra*) ont été récoltés dans sept localités dans la région d'El-Kala. C'est un complexe écogéographique restreint où les systèmes hydrographiques dulcicoles, constitués de rivières, d'étangs et de zones humides littorales (lagunes saumâtres, chenaux maritimes), sont assez imbriqués. Les fréquences d'occurrence et l'abondance relatives des taxons consommés ont été calculées à partir des 493 proies identifiées. Les poissons constituent plus de 88 % des prises (abondance relative) avec une très large prédominance de *Pseudorasbora parva*, *Luciobarbus callensis* et des cyprinidés indéterminés. Les amphibiens anoures constituent 9 % des proies. Le reste

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est représenté, selon l'importance, respectivement par des mugilidés, des anguilles (*Anguilla anguilla*), l'ablette (*Alburnus alburnus*) des perciformes, des gobiidés, des insectes, des oiseaux, des crustacés... Cependant, les cyprinidés, l'anguille et le barbeau dominant pour la biomasse ingérée. Le régime alimentaire est fonction des conditions locales : les lagunes et chenaux avec des poissons marins ou amphihalins ; les rivières où dominent les barbeaux ; les étangs avec les cyprinidés. Enfin, les poissons de petite taille (*pseudorasbora* et barbeau) dominant le régime en nombre : 62 % font moins de 12,5 cm. L'introduction de *pseudorasbora* dans la région pourrait être catastrophique pour des poissons endémiques, comme *Pseudophoxinus callensis*.

Introduction

Since the beginning of the 1980's, whether it is related to fresh, brackish or marine waters, the diet of the Eurasian otter (*Lutra lutra* L.) has been described in numerous publications. Broyer & Erome (1982) and then Mason & Macdonald (1986) and Kruuk (2006) summarised the findings of most of these publications. In its category of specialised, semi-aquatic predators, the Eurasian otter has been shown to be relatively opportunistic and euryphagous, feeding mainly on fish, but also on various animals found in aquatic environments, such as cyclostomes, crustaceans and amphibians.

Only two studies have been published on the diet of otters in North Africa, on the basis of their spraints: the first of these was carried out in Morocco (Broyer *et al.* 1988) and deals with 389 droppings collected mainly in Saharan river wadis, and wadis of the High Atlas and Middle Atlas. This data is characterised by strong variations in the class of prey, depending on seasons and localities. Although fish traditionally play a major dietary role, the analysis made by these authors was limited to the identification of specimens up to the level of zoological classes (fish, amphibians, etc.). The second study was carried out in the Beth river wadi, which is a typical river of the Middle Atlas (Morocco) (Libois *et al.* 2015). It was based on 760 droppings, methodologically collected at six stations, over two annual cycles, derived from one collection campaign per season (2,442 identified prey). Fish made up more than 70% of the catches (relative abundance) with a very strong predominance of barbels (*Luciobarbus labiosa* [Pellegrin], *Labeobarbus fritschii* [Günther]

and *Labeobarbus paytoni* [Boulenger]). The remaining prey corresponded to (in decreasing order): anuran amphibians, insects, ophiurians, Mediterranean tortoises (*Mauremys leprosa* Schweigger), birds, crustaceans and small mammals. Over time, the otter's diet has evolved for various reasons, of both climatic and anthropogenic origins: major floods and their consequences profoundly modified the composition of the fish population and leading to the local extinction of the small barbels; then, in the autumn of 2010, fishermen introduced *Cichlidae* into the river. In addition, fish of small size dominated their diet in terms of numbers: 80% are less than 10 cm in size.

The present study deals with the dietary habits of the Eurasian otter, in the rivers and wet brackish zones of El-Kala in Algeria. It is proposed to provide an overview of the otter's choice of prey in a restricted eco-geographical complex, in which freshwater hydrographical systems, comprising rivers, ponds and wet coastal zones (brackish lagoons, shipping channels) are highly interwoven.

Study area

In the spring of 1997, in the region of El-Kala, a series of spraints was collected around the Mellah lagoon (860 ha; 36.9°N 8.34°E) (n = 18), the Oubeira (2,174 ha; 36.8°N 8.4°E) (n = 19) and Tonga (2,392 ha; 36.9°N 8.5°E) (n = 17) ponds, in the Messida channel (36.88°N 8.53°E) (n = 26), as well as in the El-Kébir (36.7°N 8.4°E) (n = 20), Bougous (36.66°N 8.39°E) (n = 74) and El-Areug (36.86°N 8.33°E) (n = 7) river wadis (Ghalmi 1997). The brackish Mellah lagoon collects the waters of a small number of rivers that flow directly into the sea, *via* a relatively narrow channel. The lagoon is lined with a coastal strip colonised by French Tamarisk (*Tamarix gallica* L.), where the otter leaves its droppings on large branches at a height of approximately 1.5 m above ground. The vegetation in the Oubeira pond is dominated by helophytes (*Phragmites australis* [Cav.]) and hydrophytes (*Potamogeton* sp. and *Myriophyllum* sp.). In order to restrict the development of aquatic plants, some species of fish have been introduced, grass carp in particular (*Aristichthys nobilis* [Richardson], *Ctenopharyngodon idella* [Valenciennes], *Hypophthalmichthys molitrix* [Valenciennes]). The Tonga pond is a vast *P. australis* and *Scirpus lacustris* L. reed bed, which is becoming

silted and communicates with the sea *via* the Messida channel, a backwater blocked by fallen trees, in which the banks are covered by a dense shrubby vegetation. The tailrace of the El-Kebir wadi, slightly downstream from the Mexena dam, is lined with dense riverside vegetation comprising ash (*Fraxinus angustifolia* Vahl), alder (*Alnus glutinosa* [L.]) and oleander (*Nerium oleander* L.). Its course and flow rate are highly irregular, with violent flooding in winter. Faecal matter was collected in a zone that is strongly disturbed by the dam site. The Bougous wadi, a tributary of the El-Kebir wadi, is a torrential river whose bed comprises large pebbles or rocky slabs. Its banks are covered by a degraded forest of cork oaks (*Quercus suber* L.) and zeen oaks (*Quercus canariensis* Willd.), accompanied by oleander (*N. oleander*) and tamarisk (*T. gallica* and *Tamarix africana* [Poir.]). The El-Areug wadi flows through a narrow ravine, with a width not exceeding one meter. This river, with its torrential regime, is situated in a highly degraded cork oak forest and feeds the Mellah lagoon.

Methods

In the laboratory, the analysis of the spraint contents involved the identification of undigested remains of various prey. For this, a standardised method for dropping treatment was followed (Libois *et al.* 1987a). Teleosts were determined through the recognition of characteristic bone fragments, using reference collections and previous studies: Libois *et al.* (1987a, b); Libois & Hallet-Libois (1988). Finally, reference collections were prepared for barbels from the El-Kala region, ophidians and amphibians. The feathers were identified by Dr. R. Rosoux, on the basis of the ornithological reference collection of the natural sciences museum in Orléans, France.

To optimise data processing, three methods were used: occurrence, abundance and relative biomass, in accordance with the recommendations of Libois *et al.* (1987a, 1991); Libois & Rosoux (1989, 1991) and Libois (1995, 1997). The characteristic bone fragments were methodically measured, and the size of the biomass of the consumed fish was thereafter estimated on the basis of the studies of Wise (1980) for vertebrae, and the studies of Libois & Hallet (1988) for cephalic fragments. In the case of amphibians, their

mass was estimated to be 10, 15, 20, 30 and 40 g, depending on the estimated size. We estimated the weighted mass of ophidians to be 100 g and that of birds, depending on the species: the respective values were consulted in the “Handbook of the birds of the world” (Anatidae: Carboneras 1992; Rallidae: Taylor 1996).

Results

A total of 493 prey are identified for a total of 294 occurrences (Tables 1, 2).

In general, the El-Kala otters have a “classical” diet with diversified prey: this can be broken down into fish, amphibians, reptiles, birds, arthropods and even molluscs. In terms of occurrence and abundance, fish are by far the main type of prey: barbels (*Luciobarbus callensis* [Valenciennes]), undetermined Cyprinidae and an introduced fish: the topmouth gudgeons (*Pseudorasbora parva* [Schlegel]). The biomass represented by the undetermined Cyprinidae, barbels and eels (*Anguilla anguilla* [L.]) make up two thirds of the prey found in the otter’s droppings (Figure 1).

The dietary intake is specific to the seven sites. Indeed, in the surroundings of the Mellah lagoon, mainly small mullets (< 225 mm), eels, and also other diadromous fish: gobies (*Gobiidae*), big-scale sand smelts (*Atherina boyeri* Risso) and some *Sparidae*. Near to the Oubeira pond, large *Cyprinidae* dominate, although the species could not be identified. On the other hand, on the Tonga pond, the dominant prey are *P. parva* and anuran amphibians.

In terms of biomass, birds predominate, with purple swamp hens (*Porphyrio porphyrio* [L.]) and two other rallidae, followed by eels (5 individuals more than 45 cm in length). The specific prey richness is greater in the Messida channel: 12 taxons were counted, including the *P. parva*, which makes up the main component of the food (70%). However, as a consequence of the small size of this invasive species, the corresponding food intake is low. The biomass is dominated by large eels, perciformes and mullets. As the channel feeds into the sea, marine prey (chitons, crustaceans, decapods) or diadromous fish (mulletts and perciformes) can be found there. In the rivers (El-Kebir and Bougous),

Table 1 – Prey occurrence of otter's spraints by locality in the El-Kala National Park

	Total	Mellah	Oubeira	Tonga	Messida	El Kebir	Bougous	El Areug
<i>Polyplacophora</i>	1				1			
Crustacea	3	1			1			1
Insecta	4			2	1			1
<i>Anguilla anguilla</i>	25	11		5	5			4
<i>Cyprinidae ind.</i>	57		15		2	12	26	2
<i>Alburnus alburnus</i>	7			1			5	1
<i>Carassius sp.</i>	3			1		2		
<i>Ctenopharyngodon idella</i>	1	1						
<i>Cyprinus carpio</i>	1		1					
<i>Luciobarbus callensis</i>	70			1		8	59	2
<i>Pseudorasbora parva</i>	43		3	11	20		9	
<i>Atherina boyeri</i>	2	2						
<i>Gambusia sp.</i>	2	1		1				
Mugilidae	20	11		1	6			2
Perciformes	8	3	1		4			
Gobiidae	2	2						
Teleostei ind.	5	2	1		2			
Anoura	36	3	5	9	9	5	3	2
Ophidia	1		1					
Aves	3			2	1			
	294	37	27	34	52	27	102	15

Table 2 – Prey abundance of otter's spraints by locality in the El-Kala National Park

	Total	Mellah	Oubeira	Tonga	Messida	El Kebir	Bougous	El Areug
<i>Polyplacophora</i>	1				1			
Crustacea	3	1			1			1
Insecta	5			2	1			2
<i>Anguilla anguilla</i>	25	11		5	5			4
<i>Cyprinidae ind.</i>	65		16		2	14	30	3
<i>Alburnus alburnus</i>	12			1			9	2
<i>Carassius sp.</i>	3			1		2		
<i>Ctenopharyngodon idella</i>	1	1						
<i>Cyprinus carpio</i>	1		1					
<i>Luciobarbus callensis</i>	112			1		10	99	2
<i>Pseudorasbora parva</i>	162		12	54	69		27	
<i>Atherina boyeri</i>	2	2						
<i>Gambusia sp.</i>	2	1		1				
Mugilidae	30	21		1	6			2
Perciformes	9	4	1		4			
Gobiidae	5	5						
Teleostei ind.	5	2	1		2			
Anoura	45	3	7	12	9	5	3	6
Ophidia	1		1					
Aves	4			3	1			
	493	51	39	81	101	31	168	22

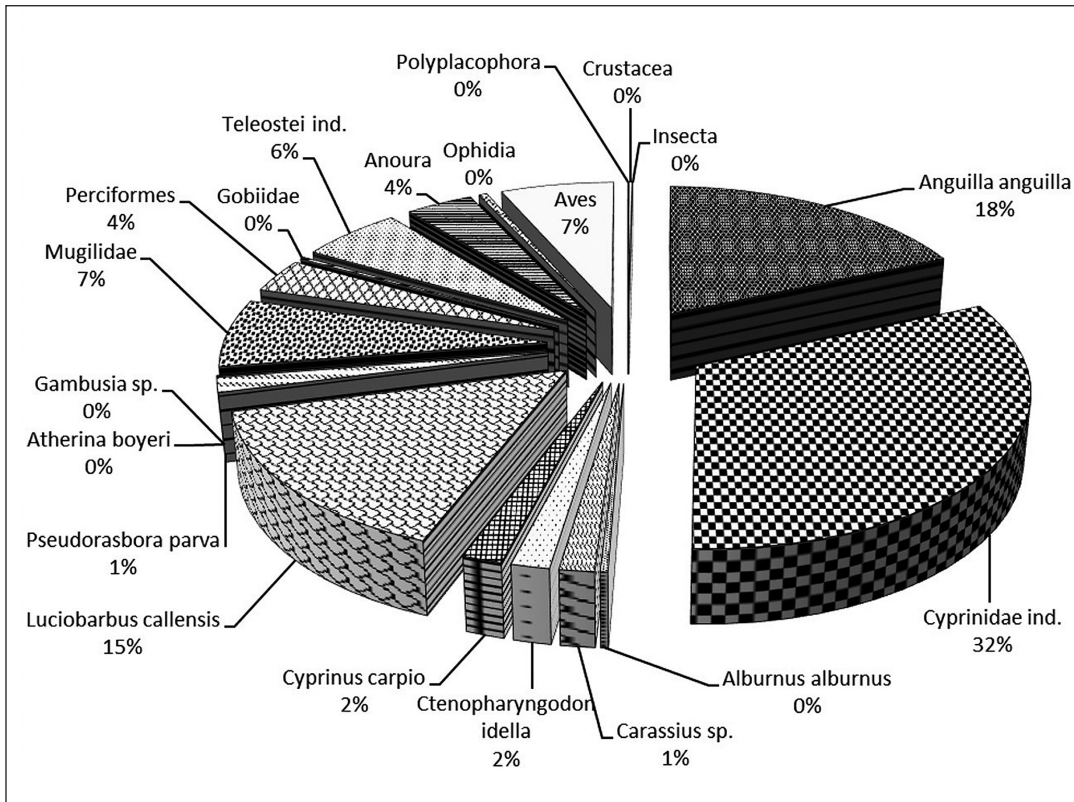


Figure 1 – Prey relative biomass of otter's spraints (El-Kala National Park) (21.5 kg).

barbels play a key role in the otters' diet. In the El-Areug wadi, close to the Mellah lagoon, the brackish waters receive prey, such as mullets from the marine environment, and prey such as barbels from the freshwater environment. The frequency distribution of size

classes has been studied for the fish that are most abundantly consumed by the otter: *L. callensis*, *P. parva*, *A. anguilla*, mullets and other *Cyprinidae* (Figure 2). A very high proportion of the fish are small in size: 62% are smaller than 125 mm.

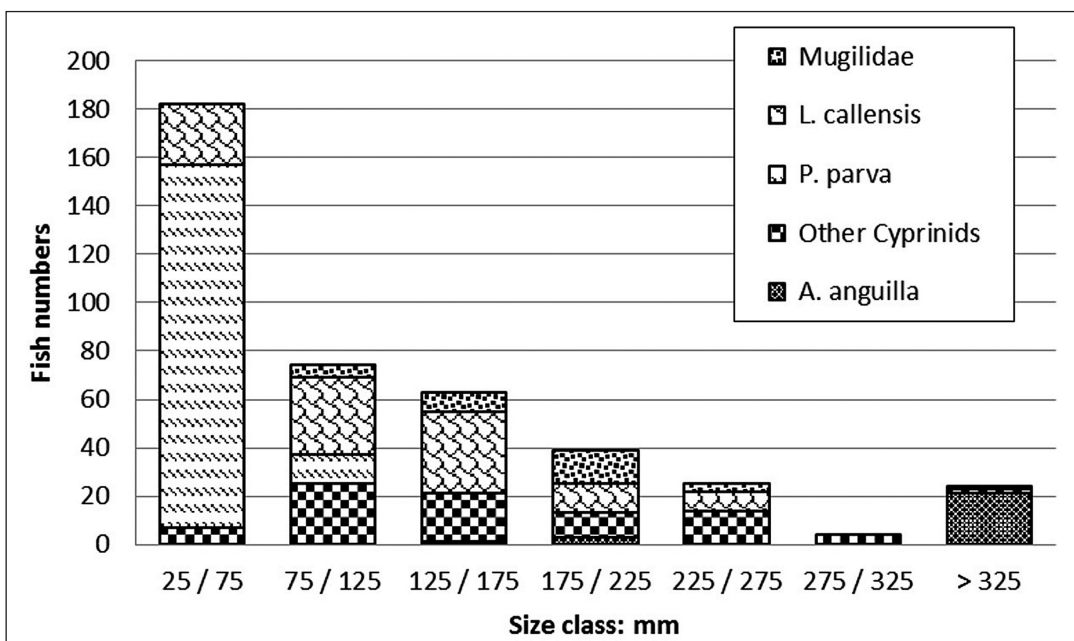


Figure 2 – Fish distribution size in the otter's spraints (El-Kala National Park).

Discussion

In the El-Kala region, the otter's diet basically resembles that found in studies carried out in Europe (Broyer & Erome 1982; Mason & Macdonald 1986; Libois 1995) and in Morocco (Broyer *et al.* 1988; Libois *et al.* 2015). In fact, it is made up essentially from fish, but also amphibians, reptiles, birds, mammals, crustaceans and insects, most of which are aquatic or semi-aquatic animals, or animals that are temporarily related to water in their biological cycle, as in the case of the artificial studies carried out by Heptner & Naumov 1974; Mason & Macdonald 1986; Libois 1995; Kruuk 2006.

Although aquatic habitats can be highly diverse, ranging from small rivers to ponds and lagoons, the otter demonstrates considerable trophic plasticity, as well as a remarkable adaptive capacity, depending on the various environments in which it lives, which provide a large variety of prey.

It demonstrates a clear pattern of opportunistic behaviour, since the proportions of prey classes remain the same, whether the results be expressed in terms of presence or relative abundance. This confirms the conclusions of similar studies carried out in Europe: Erlinge (1967); Fairley & Wilson (1972); Webb (1975); Callejo-Rey *et al.* (1979); Jenkins *et al.* (1979); Chanin (1981); Wise *et al.* (1981); Gormally & Fairley (1982); Green *et al.* (1984); Bouchardy (1986); Delibes & Adrian (1987); Libois *et al.* (1987a); Callejo (1988); Libois & Rosoux (1989); Libois (1995, 1997).

In the El-Kala region, we observed strong variations at different sites, like for example in Scotland (Kruuk & Moorhouse 1990) or in the French Massif Central (Libois 1997).

On the other hand, we are not able to draw clear conclusions concerning the otter's possible preference for one particular class of size. We have noticed that most of the fish it catches, barbels and *P. parva* in particular, are small in size (less than 10 cm), an observation that had already been made in other regions by various authors (Webb 1975: stickleback, *Gasterosteus gymnurus* [Cuvier], loach, *Barbatula barbatula* [L.], and sculpin, *Cottus gobio* L.; Jenkins & Harper 1980: pike, *Esox lucius* L. and perch, *Perca fluviatilis* L.; Jenkins *et al.* 1979: pike, perch, salmonidae; Chanin 1981; Green *et al.* 1984; Libois 1997; Libois *et al.* 2015: barbels, *Luciobarbus labiosa* and *Labeobarbus fritschii*). In

hydrosystems, small-sized fish generally dominate in terms of numbers. Nevertheless, it is necessary to compare the frequency distributions of the size of a prey-species in a predator's food intake and in its habitat (capture using electro-fishing, traps or fishways), which was not possible to implement in the context of the present study.

The introduction of *P. parva* appears to have had significant repercussions within the El-Kala fish community. Although *Pseudophoxinus callensis* (Guichenot) lives in the Oubeira pond (Paris: MNHN-16-2000-5725, det. Daget), its absence in the otter droppings could be indicative of competition between the two species, to the advantage of *P. parva*. The latter species is zooplanktivorous, but consumes the eggs and fry of other fish and at the international level it is thus considered to be noxious (Keith *et al.* 2011; Witkowski 2011). For the El-Kala region and the Kroumirie, where *Pseudophoxinus* are endemic, this poses a serious problem for the conservation of biodiversity.

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References

- Bouchardy C., 1986. *La loutre*. Sang de la terre, Paris. 174 p.
- Broyer J. & Erome G., 1982. Eléments d'écologie de la loutre *Lutra lutra* (L). Premières données bibliographiques. *Bièvre* 4 : 33-58.
- Broyer J., Aulagnier S. & Destre R., 1988. La loutre, *Lutra lutra angustifrons* Lataste, 1885, Maroc. *Mammalia* 52: 361-370.
- Callejo A., 1988. Le choix des proies par la loutre (*Lutra lutra*) dans le nord-ouest de l'Espagne, en rapport avec les facteurs de l'environnement. *Mammalia* 52: 11-20.
- Callejo-Rey A., Rivera J.G., Bas-Lopez S., Sanchez-Canals J.L. & De Castro-Lorenzo A., 1979. Primeiros datos sobre la dieta de la Nutria, *Lutra lutra* (L.), en aguas continentales de Galicia. *Donãna Acta Vert.* 6: 191-202.

- Carboneras C., 1992. Family Anatidae. In: del Hoyo J., Elliott A. & Sargatal J. (eds.), *Handbook of the Birds of the world, vol. 1*. Lynx Edicions, Barcelona, 536-628.
- Chanin P., 1981. The diet of the Otter and its relations with the feral Mink in two areas of Southwest England. *Acta Theriol.* 26: 83-95.
- Delibes M. & Adrian I., 1987. Effects of crayfish introduction on otters, *Lutra lutra*, food in the Doñana National Park, SW. Spain. *Biol. Conserv.* 42: 153-159.
- Erlinge S., 1967. Food habits of the fish otter, *Lutra lutra*, in South Swedish habitats. *Viltrevy* 4: 371-443.
- Fairley J.S. & Wilson S.C., 1972. Autumn food of otter (*Lutra lutra*) on the Agiverry river, Co. Londonderry, Northern Ireland. *J. Zool.* 166: 468-469.
- Ghalmi R., 1997. *Étude préliminaire du régime alimentaire de la loutre (Lutra lutra) dans le nord-est algérien (Parc national d'El-Kala)*. DES Sciences Naturelles, Université de Liège, Liège. 57 + 13 p.
- Gormally M.J. & Fairley J.S., 1982. Food of otters, *Lutra lutra*, in freshwater lough and an adjacent brackish lough in the West of Ireland. *J. Zool.* 197: 313-321.
- Green J., Green R. & Jefferies D.J., 1984. A radiotracking survey of otters, *Lutra lutra*, on a Pertshire river system. *Lutra* 27: 85-145.
- Heptner V.G. & Naumov N.P., 1974. Die Säugetiere der Sowjetunion. Band II. *Fischer Verlag*, Iena. 1009 p.
- Jenkins D. & Harper R.J., 1980. Ecology of otters in Northern Scotland. II. Analyses of otter and mink faeces from Deeside (N.E. Scotland) in 1977-1978. *J. Anim. Ecol.* 49: 737-754.
- Jenkins D., Walker J.G.K. & Mccowan D., 1979. Analyses of otter (*Lutra lutra*) faeces from Deeside, NE Scotland. *J. Zool.* 187: 235-244.
- Keith P., Persat H., Feunteun E. & Allardi J., 2011. *Les poissons d'eau douce de France*. Biotope et Muséum national d'histoire naturelle, Mèze et Paris. 552 p.
- Kruuk H., 2006. *Otters: ecology, behaviour and conservation*. Oxford University Press, Oxford. 265 p.
- Kruuk H. & Moorhouse A., 1990. Seasonal and spatial differences in food selection by otters (*Lutra lutra*) in Shetland. *J. Zool.* 221: 621-637.
- Libois R.M., 1995. Régime et tactique alimentaire de la loutre (*Lutra lutra*) en France : synthèse. *Cahiers Ethol.* 15: 251-274.
- Libois R., 1997. Régime et tactique alimentaire de la loutre (*Lutra lutra*) dans le Massif central. *Vie et Milieu* 47: 33-45.
- Libois R.M. & Hallet-Libois C., 1988. Eléments pour l'identification des restes crâniens des poissons dulçaquicoles de Belgique et du nord de la France. II. Cypriniformes. Fiches d'ostéologie animale pour l'archéologie. *Sér. A. n° 4*. CRA-CNRS. Valbonne, 24 p.
- Libois, R.M. & Rosoux R., 1989. Écologie de la loutre (*Lutra lutra*) dans le marais poitevin. I. Étude de la consommation d'anguilles (*Anguilla anguilla*). *Vie et Milieu* 39: 191-197.
- Libois R.M. & Rosoux R., 1991. Ecologie de la loutre (*Lutra lutra*) dans le marais poitevin. II. Aperçu général du régime alimentaire. *Mammalia* 55: 35-47.
- Libois R.M., Hallet-Libois C. & Lafontaine L., 1987a. Le régime alimentaire de la loutre (*Lutra lutra*) en Bretagne inférieure. *Rev. Ecol. (Terre & Vie)* 42: 135-144.
- Libois R.M., Hallet-Libois C. & Rosoux R., 1987b. Eléments pour l'identification des restes crâniens des poissons dulçaquicoles de Belgique et du nord de la France. I. Anguilliformes, Gastérostéiformes, Cyprinodontiformes, Perciformes. Fiches d'ostéologie animale pour l'archéologie. *Sér. A. n° 3*. CRA-CNRS. Valbonne, 15 p.
- Libois R.M., Rosoux R. & Deloos E., 1991. Écologie de la loutre (*Lutra lutra*) dans le marais poitevin. III. Variation du régime et tactique alimentaire. *Cahiers Ethol.* 11: 31-50.
- Libois R., Fareh M., Brahimi A. & Rosoux R., 2015. Régime alimentaire et stratégie trophique saisonnière de la Loutre d'Europe, *Lutra lutra*, dans le moyen-Atlas (Maroc). *Rev. Ecol. (Terre & Vie)* 70: 314-327.
- Mason C.F. & Macdonald S.M., 1986. *Otters: ecology and conservation*. Cambridge University Press, Cambridge. 236 p.
- Taylor P.B., 1996. Family Rallidae. In: del Hoyo J., A. Elliott A. & Sargatal J. (eds.), *Handbook of the Birds of the world, vol. 3*. Lynx Edicions, Barcelona: 108-209.
- Webb J.B., 1975. Food of the Otter (*Lutra lutra*) on the Somerset levels. *J. Zool.* 117: 486-491.
- Wise M.H., 1980. The use of fish vertebrae in scats for estimating prey size of otters and mink. *J. Zool.* 192: 25-31.
- Wise M.H., Linn I.J. & Kennedy C. R., 1981. A comparison of feeding biology of Mink, *Mustela vison* and Otter, *Lutra lutra*. *J. Zool.* 195: 181-213.
- Witkowski A. 2011: NOBANIS – Invasive alien species fact sheet – *Pseudorasbora parva*. – From: Online Database of the European Network on invasive alien species – NOBANIS www.nobanis.org. Date of access 1/2/2015.