

OTTER (*LUTRA LUTRA* L.) DAMAGE IN COMMERCIAL CARP PONDS OF SOUTHERN POLAND

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ABSTRACT - The diet of the otter *Lutra lutra* was studied at 198 commercial carp *Cyprinus carpio* ponds (total area 811.9 ha) located near Zator, an Experimental Fish Farm in southern Poland. The food habits of the otter were determined by the analysis of 344 spraints collected monthly from December 2000 to December 2001. Data were expressed as frequency of occurrence and per cent of biomass. Fish represented the main food resource of otters, occurring in 97.4% of faecal samples. Carp occurred in 9.3% of faecal samples. Percentage share of carp in biomass of food consumed by otters averaged 14.2% per year. The 97.6% of eaten carp was classified as carp fry production, ranging between 3.0 cm and 7.9 cm in body length (mean: 5.7 ± 0.92 SD). The economic consequences of otter predation on fish are discussed.

Keywords: *Lutra lutra*, diet, *Cyprinus carpio*, damage to commercial ponds, Poland

RIASSUNTO - *Danni causati dalla Lontra (Lutra lutra) sulla produzione di carpe allevate in bacini idrici della Polonia meridionale.* La dieta della Lontra *Lutra lutra* è stata studiata in 198 bacini idrici (superficie totale 811,9 ha; Polonia meridionale) utilizzati per l'allevamento di carpe *Cyprinus carpio*, tramite l'analisi di 344 feci, raccolte mensilmente da dicembre 2000 a dicembre 2001. I dati ottenuti sono stati espressi sia come frequenza percentuale (F%) sia come percentuale di biomassa (B%). La principale categoria alimentare è costituita dai pesci (F%: 97,4%), di cui le carpe rappresentano il 9,3% e il 14,2% in F% e B% rispettivamente. Il 97,6% delle carpe mangiate è costituito da avannotti di lunghezza compresa tra 3 e 7,9 cm (media: $5,7 \pm 0,92$ SD). L'impatto economico della Lontra sulla produzione delle carpe è discusso.

Parole chiave: *Lutra lutra*, dieta, *Cyprinus carpio*, danni agli allevamenti ittici, Polonia

INTRODUCTION

From the beginning of the 1990s, in Poland there has been an increase in otter *Lutra lutra* numbers and range (Brzeziński *et al.*, 1996; Bobek *et al.*, 1997; Goszczyński, 2004; Romanowski, 2006). Currently, the species is distributed throughout the country,

being more common in the north, south and south-east (Brzeziński *et al.*, 1996). Only in the Sudety Mountains is the otter scarce (Goszczyński, 2004).

Otter population expansion, coupled with the increase in the number of commercial fish operations, has resulted in conflict between otters and man. Damage caused by otters is not

compensated in Poland, but the pressure is mounting on local authorities to establish a compensation scheme. In some regions where damage by otters occurs frequently, fish pond owners shoot or trap otters illegally, making the introduction of monetary compensation for fish farmers urgently required. The other option is to allow legal reduction and control of the otter populations inhabiting areas where fish production takes place (Wiśniowska, 2002). The aim of this paper is to evaluate the damage caused by otters to fish production in commercial carp *Cyprinus carpio* ponds, regarding prey size and overall wasted fish biomass.

STUDY AREA

The research was carried out on 198 farm ponds (total area 811.9 ha) located near Zator, an Experimental Fish Farm in southern Poland. The size of carp ponds ranges from 0.04 ha to 50 ha. Commercial production of carp, together with a limited production of big head carp (*Aristichthys nobilis*), crucian carp (*Carassius carassius*), goldfish (*Carassius aureatus*), grass carp (*Ctenopharyngodon idella*), ide (*Leuciscus idus*), pike (*Esox lucius*), tench (*Tinca tinca*) and wels (*Silurus glanis*), takes place there. Many other fish species - i.e. able (*Leucaspis delineatus*), bleak (*Alburnus alburnus*), chub (*Leuciscus cephalus*), dace (*Leuciscus leuciscus*), gudgeon (*Gobio gobio*), moroco (*Pseudorasbora parva*), perch (*Perca fluviatilis*), roach (*Rutilus rutilus*), ruffe (*Gymnocephalus cernua*), silver bream (*Abramis brama*), stone loach (*Barbatula barbatula*) - also live in these ponds, but they have no economic importance. According to official records obtained from the Experimental Fish Farm, the number of otters in the study area amounted to 27 individuals.

METHODS

From December 2000 to December 2001, otter spraints were collected once a month along five line transects (total length = 30 km; mean length = 7.5 ± 3.06 SD) distributed in the study area. Altogether 673 spraints were collected (98 in spring, 86 in summer, 338 in autumn and 151 in winter). For each season, except for summer, 86 spraints were chosen at random. Final evaluation of otter diet was based on 344 spraints.

Fish were identified according to the characteristics of well preserved scales and parts of the skeleton - i.e. vertebrae, pharyngeal teeth (cyprinid species) and bones of the *operculum* (percid species) (Horoszewicz, 1960; Webb, 1976; Libois *et al.*, 1987b). Personal collections of fish skeletons collected in the research area were used for minor families.

To estimate length and body mass of eaten fish by regression formulas, the height of pharyngeal teeth for cyprinids, preopercula for Percidae and the length of pike vertebrae, were measured with 0.1 mm accuracy. Data from Mann and Beaumont (1980), Wise (1980), Hallet-Libois (1984), and Libois *et al.* (1987b), as well as unpublished data from Amirowicz, were applied to assess length and body mass of carp, roach, perch, pike, dace and gudgeon. For other cyprinids the formulae proposed by Horoszewicz (1960) were used to obtain body length. When two pharyngeal teeth (left and right) of the same length were found in otter spraints, it was assumed that they belong to the same specimen. The same procedure took place when two preopercula or two interopercula belonging to Percidae were found. Biomass for these species as well as for dace, gudgeon, ruffe and pike was calculated according to Rolik and Rembiszewski (1987) and Brylińska (2000). Unpublished data from Amirowicz were used for moroco.

Otter predation on carp in Poland

The body mass of eaten amphibians was assumed to be equal to the average body mass of *Rana* sp. (Libois *et al.* 1987a) and *Bombina variegata* (Juszczyk, 1987). That of eaten birds was assessed according to data on bird species living in fish ponds (Wiśniowska, 1996). For mammals, data from Pucek *et al.* (1984) were used. Being difficult to estimate, the biomass of invertebrates was omitted in further calculations. Moreover the presence of invertebrates in otter spraints could also have been caused by the presence of this food category in the stomachs of preyed fish (Mason and Macdonald, 1986). The results of faecal analysis were expressed as per cent frequency of occurrence (%F):

$$\%F_x = (N_x / N) \times 100$$

where N_x is the number of spraints containing the x food category and N is the total number of analyzed faeces, and as per cent of biomass (B%):

$$B\%_x = (B_x / B) \times 100$$

where B_x is the biomass of the x food category and B is the total biomass consumed by otters.

In order to assess damage caused by otter predation on carp, information on yearly fish production was compared to data about carp consumption as inferred by diet analysis, assuming a daily food consumption of 1.25 kg of fish per otter (Erlinge, 1967).

RESULTS AND DISCUSSION

Fish occurred in 97.4% of samples and amphibians in 7.3%. Birds, mammals and unidentified vertebrates were found in 1.4%, 3.2% and 0.6% of samples, respectively. Among fish the highest %F was recorded for roach and bleak (12.5% and 11.9% respectively). The lowest %F was found for gudgeon, moroco, ruffe and chub (0.3% for all). Carp occurred in 32 (9.3%) faecal samples with the following seasonal variations in %F: 3.5% in spring, 9.3% in summer, 10.4% in autumn and 13.9% in winter.

In terms of biomass ingested, fish constituted 64.1% of the consumed food (Fig. 1).

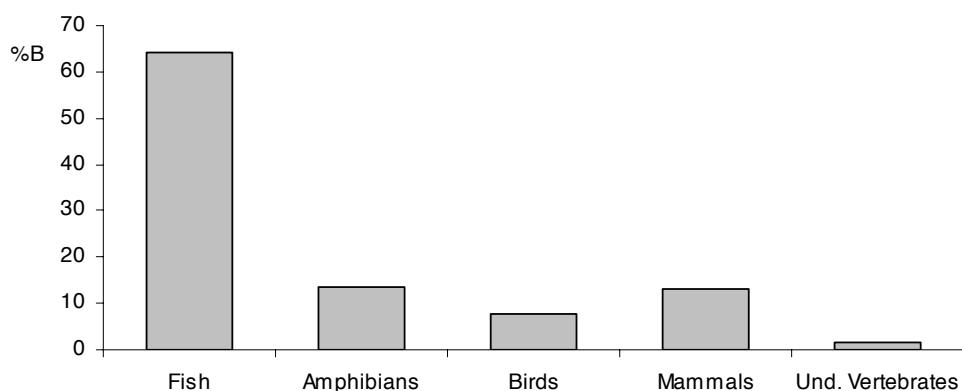


Figure 1 - Annual diet of the otter at Experimental Fish Farm, Zator. Data (N=344) expressed as per cent of biomass (%B).

Carp was a major food for otters only in summer (%B = 32.37; Tab. 1), averaging 14.2% per year.

According to calculations, the body length of 97.6% of eaten carp ranged between 3.0 cm and 7.9 cm (mean 5.7 ± 0.92 SD; Fig. 2). This category of fish is classified as carp fry production. The carp ponds of the study area produce 422.6 tons of carp per year, of which 8.85 tons are carp fry. Undoubtedly, the level of damage caused by otters to carp fry production

depends on the population size of this species in the study area. According to Erlinge (1967), one otter is expected to eat about 65 kg of carp per year and a population of 27 otters (3.33 ind/100 ha of study area) would use about 20% of the overall carp fry production. The above calculation does not include indirect impact of otter upon carp production such as mortality of wounded animals or extra energetic expenditures of carp in wintering ponds.

Table 1 - Seasonal variation of the per cent of biomass of otters' main food items.

	Spring	Summer	Autumn	Winter
Carp	6.92	32.37	15.75	7.87
Other fish	70.73	26.21	51.00	51.67
Amphibians	22.35	23.98	13.01	3.88
Birds	-	14.21	7.71	7.67
Mammals	-	3.23	12.53	24.98
Unidentified Vertebrates	-	-	-	3.93

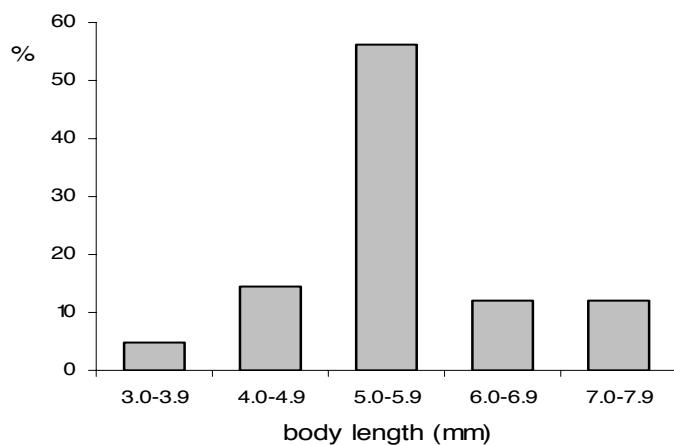


Figure 2 - Distribution of body length of carp consumed by the otter in carp ponds.

REFERENCES

- Bobek B., Frąckowiak W., Goździeński J., Harna G., Kasperek B., Merta D., Nowicki P., Płodzień K., Wierzbowska I. and Wiśniowska L. 1997. Large carnivores in Poland: over-protection or sustainable use? *J. Wildl. Res.*, 2 (4): 282-295.
- Brylińska M. 2000. Ryby słodkowodne Polski. [Freshwater fish of Poland]. PWN, Warszawa.
- Brzeziński M., Romanowski J., Cygan J.P. and Pabin B. 1996. Otter (*Lutra lutra*) distribution in Poland. *Acta Theriol.*, 41:113-126.
- Erlinge S. 1967. Food habits of the fish-otter (*Lutra lutra L.*) in south Swedish habitats. *Viltrevy*, 4:371-443.
- Goszczyński J. 2004. Liczebność oraz perspektywy koegzystencji z człowiekiem wybranych gatunków ssaków drapieżnych. Prace Komisji Nauk Rolniczych PAU. 5:9-27.
- Hallet-Libois C. 1984. Modulations de la stratégie alimentaire d'un prédateur: Eco-éthologie de la prédation du martin-pecheur, *Alcedo atthis* (L. 1758), en période de reproduction. Ph. D. Diss. Facultes Universitaires Notre-Dame de la Paix-Namur.
- Horoszewicz L. 1960. Wartości kości gardłowych dolnych jako kryteriów gatunkowego oznaczania ryb karpiowatych. *Roczn. Nauk Roln.*, 75 B, 2: 238-256.
- Juszczyk W. 1987. Płazy i gady krajowe. PWN, Warszawa.
- Libois R. M., Hallet-Libois C. and Rosoux R. 1987b. Elements pour l'identification des restes craniens des poissons dulcaquicoles de Belgique et du nord de la France. Centre de recherches Archéologiques du CNRS. APDCA. Juan-les-Pins., 3: 1-15.
- Libois R.M., Hallet-Libois C. and Lafontaine L. 1987a. Le régime de la loutre *Lutra lutra* en Bretagne intérieure. *Rev. Ecol.*, 42: 135-144.
- Mann R. H. K. and Beaumont W. R. C. 1980. The collection, identification and reconstruction of lengths of fish prey from their remains in pike stomachs. *Fish. Manage.*, 11: 169-172.
- Mason C.F. and Macdonald S. M. 1986. Otters: ecology and conservation. Cambridge University Press, Cambridge.
- Pucek Z., Ferens B., Gaśowska M., Kowalski K., Mlynarski M., Mulicki Z., Rydzewski W. and Serafiński W. 1984. Keys to Vertebrates of Poland Mammals. PWN – Polish Sci. Publ., Warsaw.
- Rolik H. and Rembiszewski J. M. 1987. Ryby i kraigouste. PWN, Warszawa.
- Romanowski J. 2006. Monitoring of the otter recolonisation of Poland. *Hystrix It. J. Mamm.* (n.s.) 17 (1): 37-46.
- Webb J.B. 1976. Otter spraint analysis. An Occasional Publication of the Mammal Society, London.
- Wise M. H. 1980. The use of fish vertebrae in scats for estimating prey size of otters and mink. *J. Zool.*, London, 192: 25-31.
- Wiśniowska L. 1996. Diet of the otter (*Lutra lutra*) in fish pond in southern Poland. *J. Wildl. Res.*, 1: 272-277.
- Wiśniowska L. 2002. Wpływ wydry na produkcję ryb karpiowatych na terenie stawów hodowlanych w rejonie Zatora. Ph. D. Diss. Kraków, Uniwersytet Jagielloński, Polska.