

Diet of the American mink (*Mustela vison*) in the Czech Republic (Carnivora: Mustelidae)

Potrava norka amerického (*Mustela vison*) v České republice (Carnivora: Mustelidae)

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Abstract. An analysis of 29 full stomachs of the American mink (*Mustela vison* Schreber, 1777), collected in the Křivoklátsko Protected Landscape Area and in the Horažďovice region (Czech Republic) during autumn and winter time in 2001–2006, showed a great diversity of the mink diet. Fish (Cyprinidae, Percidae, and Esocidae) were the dominant component of their diet (51.7% of occurrence, 41.0% of volume), followed by mammals (Rodentia, Insectivora) (48.7% of occurrence, 31.1% of volume) and birds (20.7% of occurrence, 13.2% of volume). Amphibians, insects, carrions and plants served only as supplementary food. Mink was found to be a typical generalist predator. Mink diet is, most probably, influenced by prey availability, prey behaviour, season, prey abundance and habitat type.

INTRODUCTION

The American mink *Mustela vison* Schreber, 1777, is a North American mustelid predator that was brought to Europe for its quality fur. The first wild living populations of American minks appeared throughout Europe in the 1930s, as a large amount of American minks escaped from captivity or were deliberately released into the wild (SIDOROVICH 1993). At the end of the 1990s, American minks became a common European species living on the banks of rivers, lakes, ponds and water reservoirs (DUNSTONE 1993, BARTOSZEWICZ & ZALEWSKI 2003). The first report on their existence in the Czech Republic comes from the 1960s (MAZÁK 1964). The species started to spread across Bohemia at the turn of the millennium. An evaluation of a national questionnaire showed that in 2003 the American mink was present on 29.3% of the area of the Czech Republic (ČERVENÝ et al. 2005). The American mink is an unspecialised predator (WISE et al. 1981, BRZEZIŃSKI & ZUROWSKI 1992, JEDRZEJEWSKA et al. 2001), hunting in water and also on land. Their presence often leads to a steep decrease in their prey population (BARTOSZEWICZ & ZALEWSKI 2003). They hunt mostly in littoral vegetation and in water (ERLINGE 1969). Water invertebrates (crayfish), as well as various types of vertebrate species are their most common prey (ERLINGE 1969, SIDOROVICH 2000, JEDRZEJEWSKA et al. 2001, BARTOSZEWICZ & ZALEWSKI 2003). Fish are a dominant component of their diet (AKANDE 1972, LODÉ 1993). The particular composition of

their diet varies throughout the year and depends on the habitat the mink lives in (GERELL 1967, CHANIN & LINN 1980, JENKINS & HARPER 1980, JEDRZEJEWSKA et al. 2001).

MATERIAL AND METHODS

The diet of the American mink was studied using an analysis of stomach content of individuals coming from Bohemia (Křivoklátsko Protected Landscape Area and Horažďovice region). In total, 51 stomachs were analysed. The samples were continuously collected during autumn (September–November) and winter seasons (December–February) in 2001–2006.

All minks were caught in accordance with nature conservation legislation, with the aim to protect populations of indigenous animal species. All caught minks were processed using standard zoological methods.

Empty stomachs (22 samples, 43%) were not included in further analysis. Stomach contents were analysed using standard methods (HAMMERSHØJ et al. 2004). Each stomach content was mixed with water on a Petri dish and individual components separated into groups. Various identification guides as well as comparative material were used to determine the prey remains (bones, scales, feather, teeth, fur or hair or other body parts) (GAFFREY 1961, BROM 1986, TEERINK 1991). Results are showed as a percentage of volume (V %), indicating the volume percentage of a certain food component in all of the analysed full stomachs. In order to compare our results with those analysing American mink faeces, we also used frequency of occurrence (F %), indicating the occurrence percentage of a certain food component in all of the analysed full stomachs

RESULTS AND DISCUSSION

The analysis of 29 stomach contents showed that fish with the body length of up to 30 cm (F=51.7%; V=41.0%) were the dominant component in the American mink diet. The most frequently found species were from the families of Cyprinidae (similar to ERLINGE 1969, DAY & LINN 1972), also Percidae (ERLINGE 1969, BARTOSEWICZ & ZALEWSKI 2003) and Esocidae (ERLINGE 1969). It is clear that low activity of fish, caused by low water temperature during winter months, was the main reason for their high abundance in the mink diet (GERELL 1967, ERLINGE 1969, CHANIN & LINN 1980, CHANIN 1981, WISE et al. 1981). The list of food components is shown in Table 1.

Mammals (Rodentia, Insectivora) were the second most important food component (F=48.7%; V=31.1%). Considering that most predators avoid eating insectivorous mammals (LOCKIE 1961, MACDONALD 1977), occurrence of the lesser white-toothed shrew *Crocidura suaveolens* (F=6.9%; V=3.8%) in mink stomachs was very interesting. Similar findings are very rare and if there are some insectivores identified in the mink diet, it is usually only in small amounts (WISE et al. 1981, BRZEZIŃSKI & ZUROWSKI 1992, MARAN et al. 1998, JEDRZEJEWSKA et al. 2001). The presence of a roe deer fur (*Capreolus capreolus*) in the stomachs proves the ability of minks to use large mammal carcasses as a food source (F=3.5%; V=3.5%).

In comparison with other literature data, the richness of mammal species found in the diet of minks in Bohemia is very low. This could be caused not only by the limited amount of analysed samples and by the season of sample collection, but also, and mainly, by food availability in the study area. For example, *Lepus*, *Rattus* or *Apodemus* species were totally absent from the diet of minks in Bohemia, whereas they are very often hunted by mink populations living elsewhere (DAY & LINN 1972, CHANIN & LINN 1980, DUNSTONE & BIRKS 1987, BARTOSEWICZ & ZALEWSKI 2003). Exceptionally, small weasel predators such as the ermine *Mustela erminea* and weasel *Mustela nivalis* (AKANDE 1972, CHANIN & LINN 1980) can also be a prey of the American mink, but neither these were recorded in our study. On the other hand, muskrats (*Ondatra zibethicus*)

Table 1. Diet of the American mink based on the analysis of stomach content. For explanations see Material and methods

Tab. 1. Potrava norka amerického podle analýzy obsahu žaludků. Vysvětlivky viz Material and methods

component / složka	F [%]	V [%]
<i>Crocidura suaveolens</i>	6.90	3.79
<i>Talpa europea</i>	3.45	1.21
<i>Ondatra zibethicus</i>	3.45	3.41
<i>Microtus</i> sp.	3.45	3.45
<i>Glis glis</i>	3.45	2.76
<i>Rodentia</i> sp.	21.05	13.03
<i>Capreolus capreolus</i>	3.45	3.45
Mammalia unidentified	6.90	3.45
mammals	52.10	27.55
birds	20.69	13.24
amphibians	3.45	1.72
Cyprinidae	27.59	19.81
Esocidae	6.90	4.13
Percidae	10.34	9.01
Pisces unidentified	10.34	6.86
fish	55.17	41.00
invertebrates	17.24	0.91
plant material	41.38	9.76
unidentified	6.90	0.01

are known to be hunted more often than we recorded (BARTOSEWICZ & ZALEWSKI 2003). It is obvious from the literature that mammals are a significant part of the American mink diet. The frequency of mammal component in mink diet ranges from 28.0% (AKANDE 1972) up to 61.8% (BRZEZIŃSKI & ZUROWSKI 1992).

Bird remains (Passeriformes, Galliformes) were recorded in 20.7% of cases (V=13.2%), whereas BARTOSEWICZ & ZALEWSKI (2003) found bird remains, during the same season, only in 4–16% of cases. Birds happen to be the most common prey during breeding or migrating seasons (GERELL 1967, ERLINGE 1969, AKANDE 1972, WISE et al. 1981, BRZEZIŃSKI & ZUROWSKI 1992, MARAN et al. 1998). Therefore, in spring and summer birds can become the dominant component of the mink diet (BARTOSEWICZ & ZALEWSKI 2003).

Frogs are another significant component of the American mink diet (GERELL 1967, BRZEZIŃSKI & ZUROWSKI 1992, HAMMERSHØJ et al. 2004), especially bullfrogs. Minks avoid eating toads (SIDOROVICH & PIKULIK 1997). Despite the fact that minks often dig up wintering frogs (JEDRZEJEWSKA et al. 2001), we found frog remains in our samples only once.

Remains of invertebrates were found in 17.2% of samples (V=0.9%). They were mostly water arthropods and insects, although some of these could have already been present in the guts of the consumed fish. Unlike water arthropods, especially crabs (GERELL 1967, CHANIN & LINN 1980, DUNSTONE & BIRKS 1987, BRZEZIŃSKI & ZUROWSKI 1992, SIDOROVICH et al. 2001), insects are consumed by minks very rarely (ERLINGE 1969, JEDRZEJEWSKA et al. 2001).

Plant remains (grass, twigs, leaves, roots) were found in 41.38 % of samples (V=9.76%). In six cases they formed the majority of the stomach content (V=20%=100%) and therefore it is highly unlikely that they were eaten by accident. A similar feeding behaviour was described in the pine marten (*Martes martes*) by LOCKIE (1961) who found plant remains only in some faeces samples during spring and autumn.

The season of sample collection and, in some cases, the used methods of stomach analysis did not allow to prove the presence of bird eggs, earthworms or slugs in the American mink diet, which are common food components of mink populations living elsewhere (CHANIN & LINN 1980, BRZEZIŃSKI & ZUROWSKI 1992, MARAN et al. 1998, JEDRZEJEWSKA et al. 2001).

The most significant factors influencing the American mink diet are season (JEDRZEJEWSKA et al. 2001, BARTOSEWICZ & ZALEWSKI 2003) and the food availability in the given area (CHANIN & LINN 1980, BARTOSEWICZ & ZALEWSKI 2003). Other factors include prey behaviour, its abundance and the structure of mink habitat (CHANIN & LINN 1980). For example, mammals, fish and amphibians are the most important food sources in riverine habitats, whereas birds and fish are dominating prey of minks living near lakes and ponds (JEDRZEJEWSKA et al. 2001, BARTOSEWICZ & ZALEWSKI 2003).

Considering our small material of stomach samples collected mostly in autumn, it was not possible to evaluate seasonal changes of the diet, sex differences in the diet nor differences between sites. Our results show that food composition of American minks living in the Czech Republic is almost identical with that of minks living in Scotland (all year round) (AKANDE 1972) and very similar to that of minks living in Poland (autumn and winter) (BARTOSEWICZ & ZALEWSKI 2003).

SOUHRN

Potrava norka amerického, *Mustela vison* (Schreber, 1777), v České republice byla studována analýzou žaludků pocházejících z podzimního a zimního období z let 2001–2006. Norci pocházeli z území Čech (Horažďovicko, CHKO Křivoklátsko). Celkem bylo získáno 51 žaludků, prázdné (43 %) byly z dalších analýz vyloučeny. Ryby z čeledí Cyprinidae, Percidae a Esocidae tvořily nejvýznamnější část potravy (frekvence výskytu [F] =51.7 %; objemové procento [V] =41.0 %), následované savci (Rodentia, Insectivora) (F=48.7 %; V=31.1 %) a ptáky (F=20.7 %; V=13.2 %). Obojživelníci, hmyz, kadávery velkých savců a rostlinné zbytky doplňovaly potravu. Zajímavý je výskyt bělozubky *Crocidura suaveolens* a naopak velmi vzácná přítomnost obojživelníků v potravě zkoumaných norků. Z našich výsledků vyplývá, že norek americký se na území Čech živí poměrně širokým spektrem živočišných druhů (tab. 1). Potravní složení je pravděpodobně ovlivněno ročním obdobím, potravní nabídkou, početností a chováním kořisti a strukturou biotopu, který norek obývá.

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