NOTES

Food habits of prairie mink during the waterfowl breeding season[1]

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We studied the food habits of radio-marked male mink (*Mustela vison*) in southwestern Manitoba from April through July of 1984 and 1985. Mammals were the major prey during April (99% of diet) and, to a lesser extent, May through July (44–21%). Muskrats, ground squirrels, and voles were the most important mammalian prey. Avian prey comprised from 55 to 75% of the diet during May, June, and July. Waterfowl (adults, ducklings, and eggs) accounted for 23% of the total diet. Other important avian prey included coots, grebes, and marsh-nesting blackbirds. We estimated total prey requirements for our radio-marked male mink and concluded that their predation had little impact on populations of prairie waterfowl during this study.

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On trouvera ici les résultats d'une étude sur les habitudes alimentaires d'hermines mâles (*Mustela vison*) munis d'un émetteur radio dans le sud-ouest du Manitoba, d'avril à juillet, en 1984 et 1985. Les mammifères, rats-musqués, spermophiles et campagnols, se sont avérés les proies principales en avril (99% du régime alimentaire) et ils constituaient une bonne partie du régime de mai à la fin de juillet (44–21%). Les oiseaux composaient de 55 à 75% du régime en mai, juin et juillet. La sauvagine (adultes, oisillons et œufs) composait 23% du régime. Parmi les autres oiseaux qui servaient de proies, il faut mentionner les foulques, les grèbes et les carouges. Nous avons estimé le nombre de proies nécessaires à nos hermines et devons conclure que leur prédation a eu peu d'impact sur les populations de sauvagine des prairies au cours de cette étude.

[Traduit par la revue]

Introduction

Mink are found primarily in wetland habitats (Melquist et al. 1981; Arnold 1986), and wetland organisms predominate in their diets (Gerell 1968; Melquist et al. 1981). Throughout much of their range, mink diets are dominated by fish and crustaceans (Arnold 1986). Fish and crayfish are absent from most palustrine habitats in the Prairie Pothole Region (Swanson and Nelson 1970), yet mink occur commonly there. Eberhardt and Sargeant (1977) found that female mink in North Dakota preyed heavily on breeding waterfowl. Populations of prairie waterfowl have declined markedly in recent years, and intensive predation losses during the breeding season have been a frequently cited proximate cause of this decline (Stoudt 1982; Cowardin et al. 1985). The objectives of this study were (*i*) to quantify the food habits of male mink during the waterfowl breeding season and (*ii*) to estimate the potential impact of male mink predation on waterfowl populations.

Study area and methods

Our investigation was conducted during 1984 and 1985 on a 85-km^2 study area near Minnedosa, Manitoba (50°10′ N, 99°47′ W). The study area lies on the Newdale glacial moraine in the aspen parklands of the Prairie Pothole Region. This region supports a diverse complex of Palustrine Persistent Emergent Wetlands (Cowardin et al. 1979), and constitutes some of the most productive waterfowl breeding habitat in North America (Bellrose 1979). Upland habitats are intensively farmed, primarily for small grains (wheat, barley) and oil seeds (flax, rapeseed). The Minnedosa area is described in additional detail by Stoudt (1982).

Drought conditions prevailed during both years of our study; 45% of the wetland basins on our study area were dry by midsummer 1985 (Arnold 1986). Breeding duck densities averaged approximately 55 pairs/km^2 in June 1984 and 40 pairs/km^2 in May–June 1985 (T. W. Arnold, unpublished data). Mallards (*Anas platyrhynchos*) and blue-winged teal (*Anas discors*) were the most abundant breeding ducks during both years, but 12 other duck species were present. American coots (*Fulica americana*), horned and pied-billed grebes (*Podiceps auritus* and *Podilymbus podiceps*), and red-winged and yellow-headed blackbirds (*Agelaius phoeniceus* and *Xanthocephalus xanthocephalus*) were also prominent components of the local wetland avifauna (T. W. Arnold, unpublished data). Population densities of mammalian prey were not quantified, but muskrat (*Ondatra zibethicus*) and vole (*Microtus* spp.) populations appeared to be much lower than those we have observed during wet years (personal observations). Tiger salamanders (*Ambystoma tigrinum*) and leopard frogs (*Rana pipiens*) were the dominant wetland herpetofauna.

Mink diets were estimated from scat residues collected from 22 April to 30 July in 1984 and from 1 April to 9 July in 1985. During radio-tracking observations (Arnold 1986), we visited dens that had been recently vacated by radio-marked male mink and collected fresh scats from latrines found near den entrances (Eberhardt and Sargeant 1977). We found no evidence of dens or home ranges being used by more than one mink; therefore, any additional scats found within the home range of a radio-marked male were assumed to be from that male (this is a minor assumption, because over 80% of scats were associated with individual mink through radiolocations).

After collection, scats were placed in individually labelled plastic bags and frozen until later analysis. We oven-dried each scat for 12 to 24 h, then weighed it to the nearest 0.1 g. Dried scats were placed in nylon bags (Johnson and Hansen 1979), and washed by hand until rinse water became clear. Residues were identified by macroscopic examination. Residue weights were calculated as the product of scat dry weights and the estimated volumetric proportion of each prey type in a given scat (Lockie's (1959) "weight of undigested matter" method).

Results and discussion

We collected 395 scats from the home ranges of five radio-marked male mink. Individual males were followed for 117, 103, 102, 90, and 61 days. Sample sizes of scats were highest in May (Table 1), when all five animals were radio-

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TABLE 1. Seasonal variation in foods consumed by five male mink in southwestern Manitoba, 1984–1985

	% scat residue				
	April	May	June	July	April–July
Avian	tr.	54.5	63.5	73.5	48.4
Birds	tr.	47.9	38.6	69.5	39.3
Ducks	0	10.3	14.5	50.4	19.0
Ducklings	0	0	3.0	23.2	6.6
Coots	0	12.9	8.7	4.1	6.1
Grebes	0	1.6	0	0	0.4
Passerines	0	12.2	4.2	6.3	5.7
Others and unknown	tr.	12.5	11.3	8.8	8.2
Eggs	tr.	6.6	24.9	4.0	8.8
Ducks	0	3.7	11.7	1.0	4.1
Coots	0	tr.	6.3	0	1.6
Grebes	0	tr.	0	0	tr.
Passerines	0	0.2	0.2	0.5	0.2
Others and unknown	tr.	2.7	6.6	2.5	2.9
Mammalian	99.3	43.9	34.2	21.4	49.4
Muskrats	56.8	27.1	4.2	0	21.9
Ground squirrels	23.2	5.2	1.0	0	7.3
Small mammals	9.8	8.9	16.4	20.3	13.9
Unknown mammals	9.5	2.7	12.7	1.1	6.4
Insect	0.7	1.6	2.3	5.1	2.4
Radiolocations	29	82	65	32	208
No. of scats	57	213	69	58	395
Scat residue (g)	138	503	180	150	969

marked and before vegetational growth obscured visibility of scats and reduced radio-transmitter range.

Mammals were the predominant prey of male mink during April (99% of diet), but declined in importance by July (21%, Table 1). Muskrats were preyed on extensively during April (57%) and, to a lesser extent, May (27%). Predation on ground squirrels (*Spermophilus* spp.) peaked in April when most ground squirrels emerged from hibernation (Table 1). Small mammals (mostly meadow voles (*Microtus pennsylvanicus*) and red-backed voles (*Clethrionomys gapperi*)) comprised from 9 to 20% of the monthly diet (Table 1).

Although avian prey were abundant during April, they occurred in the diet only in trace amounts. Use of avian prey rose sharply in May (when most species began nesting), and continued to increase throughout the summer (Table 1). Predation on passerines (mostly marsh-nesting blackbirds) and adult coots peaked in May, whereas predation on adult ducks and ducklings reached its peak in July (during brood rearing and molting). Thus, when birds were limited in mobility by incubation, brood rearing, or molting (ducks, coots, and grebes become flightless during wing molt), their vulnerability to predation appeared to increase (e.g., Sargeant et al. 1973; Talent et al. 1983; Cowardin et al. 1985).

Aquatic insects, primarily Dytiscidae and immature Odonates, occurred infrequently in the diet (Table 1). We found no evidence of reptiles, amphibians, fish, or crustaceans in any mink scats.

Lockie (1959) showed that the use of residue mass for scat analysis provided a more accurate description of actual ingested diets than did frequency of occurrence methods, but such data were still biased by differential digestibilities of prey types (i.e., for a given mass of ingested prey, one prey type produced a greater mass of fecal residue than did another prey type). Greenwood (1979: Table 1) conducted detailed feeding trials with captive raccoons (*Procyon lotor*), and his data suggested that residues from eggs and juvenile birds may be underrepresented in scats. The dry-mass digestibility coefficient for juvenile coots was 5.5 times higher than the coefficient for adult coots. This suggests that avian prey, particularly eggs and ducklings, may have been more important to the diets of our study animals than our Table 1 data indicate.

Cowan et al. (1957) measured prey requirements of captive mink. Based on an average male body mass of 1420 g (Arnold 1986), male mink in our study would have required approximately 0.18 kg of prey per day, or 22.04 kg of prey during the period 1 April to 31 July. Ignoring differential digestibilities of prey types (which likely underestimated the amount of avian prey consumed), we estimated that each male mink consumed an average of 2.7 kg of adult ducks, 1.5 kg of ducklings, and 0.9 kg of duck eggs during a single waterfowl breeding season (see Table 1). This corresponds to approximately 3 adults, 15 week-old ducklings, and 18 eggs for mallards, one of the largest ducks on the study area, or 7 adults, 25 week-old ducklings, and 30 eggs for blue-winged teal, one of the smallest ducks on the study area (average mass per prey item obtained from Sargeant 1978 and Arnold, unpublished data).

These estimates are speculative, but they suggest that male mink had little impact on waterfowl populations during this study. Home ranges of the five males in our study averaged 7.7 km^2, and encompassed an average of 350 pairs of breeding ducks. Prey estimates from the preceding paragraph are equivalent to two to four pairs, nests, and broods per mink, or about 1% of the waterfowl population and its potential reproductive output. These estimates would increase if August prey consumption and differential digestibility rates were incorporated into the calculations, but only the estimate for duckling consumption would be much affected.

In North Dakota, female mink consumed large numbers of waterfowl (Eberhardt and Sargeant 1977: Table 1). Because female mink were raising young at this time, they had higher absolute prey requirements than male mink did (e.g., Moors 1980), and their predation efforts were concentrated in the immediate vicinity of their dens (Eberhardt and Sargeant 1977). Thus, female mink presumably have a greater local impact on waterfowl populations than do male mink, at least when male mink occur at low densities and occupy large home ranges, as they did in our study. Prairie mink populations are known to decline during droughts (Butler 1962; Bulmer 1974). During wet years, after mink populations recovered, predation on waterfowl (especially ducklings) might become substantial.

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Erratum: The influence of microtines on polygyny, productivity, age, and provisioning of breeding Northern Harriers: a 5-year study[1]

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