

WINTER FOOD HABITS OF THE PINE MARTEN IN COLORADO

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ABSTRACT.—Eighteen pine marten (*Martes americana*) stomachs and 29 intestinal tracts, collected between October 1983 and March 1984 from northern Colorado, were examined for food items. Voles (*Microtus* spp.) occurred most frequently, followed by shrews (*Sorex* spp.), insects, and vegetative matter.

The pine marten (*Martes americana*) inhabits mature stands of coniferous forests of North America (Lensink et al. 1955, Marshall 1951). Although the pine marten is an important furbearer in many states, few studies have specifically examined winter food habits (Hargis and McCullough 1984, Zielinski et al. 1983, Lensink et al. 1955, Cowan and Mackay 1950). Winter is a critical period when many food items are unavailable and prey populations reach yearly lows. Lensink et al. (1955) reported that changes in the abundance or availability of food may be reflected in movements, productivity, and choice of habitat. The objectives of this study were to identify winter foods and their frequencies in the diet with respect to availability.

STUDY AREA AND METHODS

The study area is in the Roosevelt National Forest 29 km west of Rustic, Larimer County, Colorado. Elevation ranged from 3168 to 3780 m. The trap sites were dominated by Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*). The main understory vegetation consisted of vaccinium (*Vaccinium* spp.). The study was conducted from October 1983 to March 1984. The winter was severe with greater snowfall and colder temperatures than average.

Thirty-two martens were collected using conibear and leghold traps. Food samples were taken from both the stomach and intestine. Samples were analyzed using the procedure described by Johnson and Hanson (1977). Reference collections were used to identify diagnostic bones, teeth, hair, or

feathers. Hair impressions were used when no other fragments were identifiable (Moore et al. 1974). Prey items were identified to genus whenever possible. Percent occurrence (number of occurrences of a prey item/total number of stomachs or intestines $\times 100$) was determined for each prey item.

RESULTS

Twelve different food items were identified in stomach and intestinal samples (Table 1). Mammals composed the highest percentage of items found. *Microtus* spp. were the most important food item, occurring in 83% of the samples. Although insects and vegetative materials were represented in 17% of the samples, actual amounts per scat were negligible. Birds, squirrels (*Tamiasciurus hudsonicus*), cervids, and fish were present in 11% of the diets. Mustelids constituted 10%; however this is believed to have been ingested incidentally. Both snowshoe hare (*Lepus americana*) and beaver (*Castor canadensis*) items occurred in 7%.

DISCUSSION

Microtus spp. were also the most important food item in previous studies (Douglass et al. 1983, Zielinski et al. 1983, Soutiere 1979, Weckwerth and Hawley 1962, Murie 1961, Quick 1955, Lensink et al. 1955, Cowan and Mackay 1950). The results of small mammal trapping have shown microtines to be the most abundant small mammals in the area during winter (Palmer, progress report). Although shrews were quite abundant on the

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TABLE 1. Stomach and intestinal contents from 32 Colorado pine marten, October 1983–March 1984.

	Percent occurrence in stomach (N=18)	Percent occurrence in intestine (N=29)
Mammals		
<i>Microtus</i> spp. ^a	83	79
<i>Sorex</i> spp. ^b	39	45
<i>Tamiasciurus hudsonicus</i>	11	7
<i>Lepus americana</i>	5	7
<i>Castor canadensis</i>	5	5
Cervidae	11	3
Mustelidae	5	10
Birds ^c	11	7
Fish	11	3
Vegetation	11	17
Insects	17	14
Unknown	0	3

Includes *M. pennsylvanicus*, *M. longicaudus*, *M. montanus*, *Clethrionomys gapperi*, *Phenacomys intermedius*.

Includes *S. hoyi*, *S. vagrans*, *S. cinereus*, *S. palustris*, *Cryptotis parva*.

Includes *Turdus migratorius*, *Junco hyemalis caniceps*, and two samples keyed only to Passeriformes.

study site, the high prevalence in marten diets was unusual (Palmer, progress report). Generally shrews are not taken, although they may be quite abundant, because they have musk glands that emit a strong odor (Lensink et al. 1955, Cowan and Mackay 1950). The high percentage of shrews may be directly related to the severity of the winter and prey abundance. Colder winters and deeper snows reduce aboveground activity of mammals (Ewer 1973), and the marten minimizes activity by taking the most abundant food source. *Sorex* spp. were the second most abundant food source available during winter. Birds occurred infrequently, suggesting that they were taken only when chance permitted. Similar results were reported by Weckwerth and Hawley (1962), Lensink et al. (1955), and Cowan and Mackay (1950). A relatively low percentage of the samples contained pine squirrel. Although no index of abundance was available for comparison, pine squirrels are believed to exhibit periods of torpor during winter and are virtually unavailable to the marten (Cowan and Mackay 1950). The cervid noted was most likely carrion. The fish and beaver were probably obtained from other trappers' bait or discarded portions of carcasses left in the area. Snowshoe hares, though occurring on the study area, were seldom taken by martens. Other studies have reported similar results (Douglass et al. 1983, Lensink et al. 1955, Cowan and Mackay 1950).

Marten food habits are affected by availability, preference, and availability of alternate prey (Weckwerth and Hawley 1962). Zielinski et al. (1983) reported that seasonal activity of the marten appeared to be synchronized with the activity of its prey. Marten activity varies seasonally. They are crepuscular during the summer, but the approach of winter forces them to become nocturnal as alternate food sources become less available (Zielinski et al. 1983). The availability of invertebrates, fruits, birds, and diurnal mammals increases during warm spring and summer months. During winter, insects decrease in abundance, migrant bird populations have gone, and fruit no longer remains on bushes (Weckwerth and Hawley 1962). Colder temperatures and deep snows force many mammals underground; therefore, few prey items are still available to the martens. Nocturnal activity increases the martens' interactions with prey species such as voles, shrews, or snowshoe hares. It is therefore not surprising that voles and shrews were taken most frequently. It appears that food items on the study area were taken in proportion to their abundance and availability. This study, like others, shows that martens at this particular study area are opportunistic in nature during critical periods in order to optimize net energy gained (Quick 1955, Lensink et al. 1955, Weckwerth and Hawley 1962).

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