

Summer Food Habits of Voles, *Clethrionomys rutilus* and
Microtus pennsylvanicus, on the Kenai Peninsula, Alaska
OECONOMUS

EDWARD E. BANGS

Recent examination of Microtus skulls from the Kenai Peninsula, Alaska by myself and then Gordon Jarrell from the University of Alaska-Fairbanks determined that voles captured since 1977 were Tundra Voles Microtus oeconomus and not Meadow Voles Microtus pennsylvanicus as previously reported. This discovery indicates that Meadow Voles are probably not indigenous to the Kenai Peninsula, Alaska. The following publications were also affected by this error.

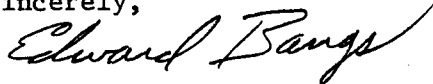
Bangs, E.E. 1979. The effects of tree crushing on small mammal populations in Southcentral Alaska. M.S. Thesis, Univ. of Nevada-Reno. 80pp.

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Fuller, T.K. 1981. Small mammal populations on the Kenai Peninsula, Alaska. Northwest Science 55(4):298-303.

I apologize for any inconvenience my error may have caused.

Sincerely,



Edward E. Bangs
29 June 1988

Notes

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Bangs, Edward E. 1984. Summer food habits of voles, *Clethrionomys rutilus* and *Microtus pennsylvanicus*, on the Kenai Peninsula, Alaska. *Canadian Field-Naturalist* 98(4): 489-492. OECONOMUS

Food habits of Northern Red-backed voles (*Clethrionomys rutilus*) and Meadow Voles (*Microtus pennsylvanicus*), captured on the Kenai National Wildlife Refuge in 1977, were examined by microhistological techniques. Red-backed Voles ate epigeous and hypogeous fungi, berries, and lichens while Meadow Voles ate primarily grass and hypogeous fungi. Red-backed Voles, captured in recently disturbed sites, utilized the same foods but in different proportions as voles captured in undisturbed sites. TUNDRA OECONOMUS

Key Words: Northern Red-backed Voles, *Clethrionomys rutilus*, Meadow Vole, *Microtus pennsylvanicus*, food habits, histological. TUNDRA OECONOMUS

Food habits of small mammals in Alaska have received little attention until recently (West 1982). As part of a study on the effects of habitat disturbance on small mammal populations on the Kenai Peninsula, Alaska (Bangs 1979), I documented the summer food habits of Northern Red-back Voles (*Clethrionomys rutilus*) and Meadow Voles (*Microtus pennsylvanicus*) using microhistological techniques. Microtine food habits are of interest to wildland managers, since rodent damage can be an important economic consideration in reforestation programs (Pank 1974), and rodent dispersal of fungi spores is important in promoting the symbiotic relationships between mycorrhizal fungi and higher plants (Maser et al. 1978).

Study Sites

Study sites were located on the Kenai National Wildlife Refuge in south-central Alaska. Overstory species at all sites were White Spruce, (*Picea glauca*), Black Spruce (*Picea mariana*), Paper Birch, (*Betula papyrifera*), and aspen, (*Populus tremuloides*). Understory vegetation is dominated by Lowbush Cranberry, (*Vaccinium vitis-idaea*), moss (*Sphagnum* spp.), and lichens, (*Peltigera* spp. and *Cladonia* spp.). Common species also include willow, (*Salix* spp.), Calamberry, (*Cornus canadensis*), grass, primarily (*Calamagrostis canadensis*), and various forbs and epigeous fungi, (mushrooms).

Voles were collected from six lowland boreal forest stands representing three paired habitat types: 1) 30-year old Black Spruce regrowth, 2) 30-year old Black Spruce-Paper Birch regrowth, and 3) 80-100-year old

mature Paper Birch-White Spruce stand. Three stands in each habitat were mechanically treated in the winter of 1975 by three crushers to provide browse for moose, and three were untreated. Winter tree crushing initially affected overstory species by knocking down, and crushing, standing woody vegetation. Since the ground was frozen during treatment, understory species were affected by the loss of shade and change in microclimate. Habitat types were lumped into disturbed and undisturbed sites for food habits analysis. Understory vegetation was similar in both sites, although mechanically-disturbed sites had fewer berries, mosses, lichens, and mushrooms, and more shrubs, grass, and debris than undisturbed sites (Bangs 1979), a situation similar to that reported by Martell (1981) in Canadian selectively cut spruce stands. Red-backed Voles and Masked Shrews (*Sorex cinereus*) dominated the small mammal community regardless of stand age. Densities of Red-back Voles were positively correlated to protective cover in the form of aerial debris (Bangs 1979).

Methods

Northern Red-backed Voles were captured in modified snap traps (Bangs 1981) during July, August, and September of 1977. Disturbed and undisturbed sites were trapped simultaneously during four separate trapping periods totaling 5760 trap nights. One hundred thirteen Red-backed Voles, 131 Masked Shrews, 11 Dusky Shrews (*Sorex monticolus*), 29 Meadow Voles, and 1 Bog Lemming (*Synaptomys borealis*) were captured in disturbed sites. One TUNDRA

hundred fifty eight Red-backed Voles, 118 Masked Shrews, 3 Dusky Shrews, 4 Pygmy Shrews (*Sorex hoyi*), 1 Meadow Vole, and 2 Bog Lemmings were captured in undisturbed habitats.

A sample of 113 Red-backed Voles, 45 from disturbed and 68 from undisturbed sites, and 19 Meadow Voles, all from disturbed sites, were frozen for approximately four months before their stomachs were removed and examined. A sample of the stomach contents from each vole was prepared and permanently mounted on a microscopic slide, using standard techniques for food habits analysis (Dusi 1949; Williams 1962). Twenty observations (fields of view) per slide were viewed under a 100x compound microscope to determine the presence or absence of food items. Each observation was randomly selected with no repeats. When a field of view did not contain plant fragments, it was disregarded (Williams 1962). If material was present, but unidentifiable, it was so recorded. Approximately 15% of the fields of view contained all unidentifiable material. An average of 1.14 food types were identified in each of the 2640 fields of view examined. It was assumed that the relative occurrence of a food type on the slide was proportional to its volume in the diet (Sparks and Malecheck 1968).

Results and Discussion

Food habits of Red-backed Voles and Meadow Voles were different as also reported by Getz (1961) and Whitney (1976) (Table 1). Red-backed Voles fed on fruits, fungus, and succulent green plants (Schloyer 1977, Martell 1981, Merritt and Merritt 1978), while Meadow Voles fed on grass (Zimmerman 1965).

Stomach analysis indicated that Red-backed Voles on the Kenai Peninsula primarily ate fungi, berries, and lichens rather than succulent green plants (Table 1). The occurrence of the hypogeous fungus (*Endo-*

gone fasciculata) in the diet remained constant throughout the summer. *Endogone* is reportedly an important small mammal food in North America (Bakerspigel 1956; Maser et al. 1978, and Schloyer 1977) and was an important part in the diet of voles on the refuge. The fruiting bodies of other epigeous fungi species (mushrooms) were generally not available in July or early August, and were absent in the diet at that time. As mushrooms became available later in the summer, they were used at an increasing rate by Red-backed Voles, as Martell (1981) also reported in Canada.

Cranberry use declined as the summer progressed even though berry abundance increased. This suggested that mushrooms were preferred over berries, a finding also suggested by Martell (1981). Insect use also declined as the summer progressed. Since observations of insect abundance were not made, it is difficult to determine whether insects were less preferred or less available later in summer. Other items in the Northern Red-backed Vole diet did not change appreciably through time, except for lichens which were used more frequently as summer progressed. The pattern of seasonal use of food items by Northern Red-backed Voles in Alaska was very similar to the pattern Martell (1981) observed for Southern Red-backed Voles (*Clethrionomys gapperi*) in Canada.

Food eaten by Red-backed Voles in disturbed and undisturbed sites were similar but their frequency of occurrence in the diet was different, ($\chi = 491.5$, $P < 0.0005$) (Table 2). Fungi epigeous, and hypogeous combined, were a major food in disturbed and undisturbed sites. Red-backed Voles living in disturbed sites utilized more *Endogone*, while voles living in undisturbed sites used more mushrooms. Berries comprised a larger percentage of the diet of voles living in undisturbed sites than those living in disturbed sites. However, berries did not appear to be eaten as frequently as

TABLE 1. Summer food habits of voles on the Kenai Peninsula lowlands in 1977 presented as the percentage a food item occurred in the total number of identifiable food items. Numbers of animals examined are given in parentheses below the dates.

Species	Northern Red-backed Voles					Meadow Voles
	July 20-23 (36)	August 3-6 (23)	August 24-27 (22)	September 13-16 (32)	All Dates (113)	TUNDRA (19)
Berry	22	15	8	8	13	0
Mushroom	3	18	33	34	23	0
<i>Endogone</i>	25	27	32	25	27	20
Moss	10	3	5	1	5	15
Lichen	7	8	11	23	14	1
Insect	16	18	4	3	9	1
Grass	7	3	1	1	3	42
Other	9	6	4	4	5	21

TABLE 2. Summer food habits of Northern Red-backed Voles in disturbed and undisturbed sites on the Kenai Peninsula lowland in 1977 presented as the percentage a food item occurred in the total number of identifiable food items. Numbers of animals examined are given in parentheses.

Food Item	Disturbed Sites (45)	Undisturbed Sites (68)
Berry	7	18
Mushroom	11	32
<i>Endogone</i>	47	11
Moss	3	6
Lichen	18	12
Insect	6	11
Grass	3	3
Other	5	6

West (1982) reported for Northern Red-backed Voles in interior Alaska. Table 1 or 2 do not include data from snap trapping in May of 1978. Stomachs from these Red-backed Voles were visually examined for the presence of lowbush cranberry. Berries from the previous fall were commonly used by these voles. Of 104 Red-backed Voles examined, at least 47% had a noticeable amount of purple material in the stomach, indicating cranberry use. Red-backed Voles captured in undisturbed sites ate cranberries more often (55%) than voles caught in disturbed sites (37%).

The preferred food of ~~Meadow~~ Voles was grass (Table 1). All ~~Meadow~~ Voles caught and examined in this study were caught in recently disturbed areas in thick grass, the typical habitat of Meadow Voles (Zimmerman 1965; Richens 1974). ~~Meadow~~ Voles did not eat berries or mushrooms probably because both occur infrequently in grass stands. Zimmerman (1965) also reported little mushroom use by Meadow Voles. Although it was possible that mushrooms were not a preferred food item, it is unlikely since ~~Meadow~~ Voles frequently ate the fungus *Endogone* (Table 1).

The only food used frequently by both Red-backed and ~~Meadow~~ voles were moss and *Endogone*. Although moss comprised only a small portion of the Red-backed Vole's diet, it was commonly used by ~~Meadow~~ Voles (Table 1). Chitty (1967) also reported that Meadow Voles ate moss, but that the diet was primarily grass, as indicated by this study. West (1982) reported that moss was an important part of Red-backed Vole summer food habits in Interior Alaska. Prinz (1981) suggested that herbivores may utilize moss in northern environments to obtain polyunsaturated fatty acids. *Endogone* is reportedly an important winter food for small mammals (Bakerspigel 1958) and was the only major food item used by both Red-backed and ~~Meadow~~ voles during this study.

Tundra

Possible competition for this food may help explain the reported intolerance of these two species to one another (Turner et al. 1975).

The feeding strategies of Northern Red-backed Voles and ~~Meadow~~ Voles on the Kenai Peninsula were similar to those of Southern Red-backed Voles in Canada (Martell 1981), Northern Red-backed Voles in Interior Alaska (West 1982) and Meadow Voles in Interior Alaska (Whitney 1976). ~~Meadow~~ Tundra Voles were more specialized, fed primarily on grasses and *Endogone*, and were found only in localized thick grass stands. Red-backed Voles were generalist feeders utilizing whatever fungi, fruit, or lichen was available at that location, during that particular time of the summer, although preference for fungi, particularly *Endogone fasciculata*, was shown. This probably explains why Northern Red-backed Voles have so successfully adapted to spruce forest successional stages in Alaska (West 1982; Bangs 1979). Since neither species of voles appeared to feed on tree seeds or seedlings during the summer, it is doubtful that they had any detrimental affect on the reforestation of recently disturbed sites. Since small mammals are the primary means by which hypogeous fungi spores are dispersed (Maser et al. 1978) the extensive use of hypogeous fungi by voles promotes the symbiotic relationship between mycorrhizal fungi and higher plants in disturbed forest areas on the Kenai Peninsula, Alaska.

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