

Meadow vole

Microtus pennsylvanicus

Class: Mammalia

Order: Rodentia

Conservation Status

NatureServe:

G Rank: G5

S Rank: S5

Agency:

USFWS:

ADF&G: Species of Greatest Conservation Need

IUCN: Least Concern

Final Rank		
Conservation category: V. Orange		
V = unknown status and either high biological vulnerability or high action need		
<u>Category</u>	<u>Range</u>	<u>Score</u>
Status:	-20 to 20	0
Biological:	-50 to 50	-44
Action:	-40 to 40	32
Higher numerical scores denote greater concern		

Status - variables measure the trend in a taxon’s population status or distribution. Higher status scores denote taxa with known declining trends. Status scores range from -20 (increasing) to 20 (decreasing).

	Score
<i>Population Trend (-10 to 10)</i>	0
Unknown.	
<i>Distribution Trend (-10 to 10)</i>	0
Trends over the last 50 years are unknown. Modeling studies estimate that the distribution of <i>M. pennsylvanicus</i> in Alaska has increased since the Last Glacial Maximum (~21,500 years ago; Hope et al. 2015), but studies disagree as to whether its distribution will continue to expand (Hope et al. 2015) or retract (Baltensperger and Huettmann 2015a; Marcot et al. 2015) as the climate warms.	
Status Total:	0

Biological - variables measure aspects of a taxon’s distribution, abundance and life history. Higher biological scores suggest greater vulnerability to extirpation. Biological scores range from -50 (least vulnerable) to 50 (most vulnerable).

	Score
<i>Population Size (-10 to 10)</i>	-6
Unknown, but suspected large. This species is widely distributed across the state of Alaska and is considered "common and sometimes abundant in suitable habitat" (MacDonald and Cook 2009).	
<i>Range Size (-10 to 10)</i>	-10
Found from southeast Alaska north to just south of the Brooks Range (Cook and MacDonald 2006; MacDonald and Cook 2009), and from the Canadian border west to the Alaska Peninsula (MacDonald and Cook 2009). Has not been found in western Alaska (Cook and MacDonald 2006). Estimated range size is >400,000 sq. km.	
<i>Population Concentration (-10 to 10)</i>	-10
Does not concentrate.	
<i>Reproductive Potential</i>	
<u>Age of First Reproduction (-5 to 5)</u>	-5
< 2 years (Reich 1981).	

<u>Number of Young (-5 to 5)</u>	-3
Average litter size is 4 to 6 with a range from 1 to 11 (Reich 1981; Krebs and Wingate 1985). In southern Yukon, Krebs and Wingate (1985) recorded a mean of 4.5 litters per female per year (range: 3.1 - 5.2).	
<i>Ecological Specialization</i>	
<u>Dietary (-5 to 5)</u>	-5
Flexible, herbivorous diet consisting of graminoids, forbs, fungi, lichen, rhizomes, and bulbs (Bergeron and Juillet 1979; Gates and Gates 1980; Reich 1981; Bangs 1984; Bergeron and Jodoin 1994; O'Brien et al. 2018). A study in Quebec, Canada found that meadow voles consumed 35 of 45 plants that were present in the study area (Bergeron and Juillet 1979). Stable isotope analyses suggest a diet rich in invertebrates or fungi, but additional studies are needed (Baltensperger et al. 2015).	
<u>Habitat (-5 to 5)</u>	-5
Found in a variety of habitats including mixedwood forests, shrubland, marshes, grassland, and tundra with a high amount of low-lying cover (forbs, grasses, shrubs); often found near bodies of water (Reich 1981; Krebs and Wingate 1985; Cook and MacDonald 2006; Craig et al. 2015 and references therein). Appears largely unaffected by clearcutting and wildfires (Sullivan et al. 1999; Craig et al. 2015).	
Biological Total:	-44

Action - variables measure current state of knowledge or extent of conservation efforts directed toward a given taxon. Higher action scores denote greater information needs due of lack of knowledge or conservation action. Action scores range from -40 (lower needs) to 40 (greater needs).

Score

<i>Management Plans and Regulations (-10 to 10)</i>	10
Voles are listed as unclassified game in Alaska with no closed season or bag limits (ADFG 2018c).	
<i>Knowledge of Distribution and Habitat (-10 to 10)</i>	2
Widespread throughout much of Alaska (ARCTOS 2016), but recent surveys in northwestern Alaska indicate that our knowledge of this species' distribution remains incomplete (Cook and MacDonald 2006). Habitat associations have been described by Cook and MacDonald (2006) and distribution models have been developed (Baltensperger and Huettmann 2015a; Hope et al. 2015; Marcot et al. 2015).	
<i>Knowledge of Population Trends (-10 to 10)</i>	10
Not currently monitored.	
<i>Knowledge of Factors Limiting Populations (-10 to 10)</i>	10
Little is known about the population dynamics of the meadow vole in Alaska. Elsewhere in North America, meadow voles exhibit interannual population fluctuations, but the frequency appears to be erratic rather than cyclical (Krebs and Wingate 1985; Getz et al. 1987). In southwestern Yukon, interspecific competition does not appear to be an important driver (Galindo and Krebs 1985b). Instead, population densities were correlated with the abundance of berries the previous year; however, because <i>M. pennsylvanicus</i> is not known to consume berries, the relationship is likely suggesting that another variable (still unknown, but likely climate-related) is underlying the observed correlation (Krebs et al. 2010). Several other factors have been proposed including predation risk, forage availability, female territoriality, maternal effects, and parasites (Boonstra and Rodd 1983; Mihok et al. 1985; Boonstra and Boag 1987; Jones 1990; Hall et al. 1991; Dehn et al. 2017). It is unclear whether climate change will lead to a contraction (Baltensperger and Huettmann 2015a; Marcot et al. 2015) or expansion (Hope et al. 2015) of this species' range in Alaska.	
Additional research is needed to review subspecies designations. Jackson (2016) conducted a continent-wide assessment of <i>M. pennsylvanicus</i> . He suggested that eastern and western North American populations should be considered different species: <i>M. drummondii</i> for western populations and <i>M. pennsylvanicus</i> for eastern populations. His findings also lend support to the unique status of individuals from Admiralty Island (<i>M. p. admiraltiae</i>) and from Kadin Island and the southeast mainland (<i>M. p. rubidus</i> ; Jackson 2016).	

Action Total: 32

Supplemental Information - variables do not receive numerical scores. Instead, they that are used to sort taxa to answer specific biological or managerial questions.

Harvest:	Not substantial
Seasonal Occurrence:	Year-round
Taxonomic Significance:	Monotypic species
% Global Range in Alaska:	<10%
% Global Population in Alaska:	Unknown
Peripheral:	No

References

Alaska Department of Fish and Game (ADFG). 2018c. 2018-2019 Alaska hunting regulations. Alaska Department of Fish and Game. Juneau, AK, USA.

ARCTOS. 2016. ARCTOS database: Fish, amphibian, mammal, bird and reptile collections. University of Alaska Museum of the North, Fairbanks, AK, USA. Available online: <http://arctos.database.museum/>

Baltensperger, A. P., and F. Huettmann. 2015a. Predicted shifts in small mammal distributions and biodiversity in the altered future environment of Alaska: an open access data and machine learning perspective. *PLoS ONE* 10(7):e0132054. DOI: 10.1371/journal

Baltensperger, A. P., F. Huettmann, J. C. Hagelin, and J. M. Welker. 2015. Quantifying trophic niche spaces of small mammals using stable isotopes ($\delta^{15}\text{N}$ and $\delta^{13}\text{C}$) at two scales across Alaska. *Canadian Journal of Zoology* 93(7):579–588. DOI: 10.1139/cjz-2

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

Bergeron, J.-M., and L. Jodoin. 1994. Comparison of food habits and of nutrients in the stomach contents of summer- and winter-trapped voles (*Microtus pennsylvanicus*). *Canadian Journal of Zoology* 72(1):183–187. DOI: 10.1139/z94-023

Bergeron, J.-M., and J. Juillet. 1979. L'alimentation estivale du campagnol des champs, *Microtus pennsylvanicus*, Ord. *Canadian Journal of Zoology* 57(10):2028–2032. DOI: 10.1139/z79-267

Boonstra, R., and P. T. Boag. 1987. A test of the Chitty hypothesis: inheritance of life-history traits in meadow voles *Microtus pennsylvanicus*. *Evolution* 41(5):929–947. DOI: 10.1111/j.1558-5646.1987.tb05868.x

Boonstra, R., and F. H. Rodd. 1983. Regulation of breeding density in *Microtus pennsylvanicus*. *Journal of Animal Ecology* 52(3):757-780. DOI: 10.2307/4452

Cook, J. A., and S. O. MacDonald. 2006. Mammal inventory of Alaska's National Parks and Preserves, Arctic Network [...]. Report NPS/AKRARC/NRTR-2004/01. National Park Service, Alaska Region, Anchorage, AK, USA.

Craig, V. J., W. Klenner, M. C. Feller, and T. P. Sullivan. 2015. Population dynamics of meadow voles (*Microtus pennsylvanicus*) and long-tailed voles (*M. longicaudus*) and their relationship to downed wood in early successional forest habitats. *Mammal Rese*

Dehn, M. M., R. C. Ydenberg, and L. M. Dill. 2017. Experimental addition of cover lowers the perception of danger and increases reproduction in meadow voles (*Microtus pennsylvanicus*). *Canadian Journal of Zoology* 95(7):463–472. DOI: 10.1139/cjz-2016-0169

Galindo, C., and C. J. Krebs. 1985b. Habitat use and abundance of deer mice: interactions with meadow voles and red-backed voles. *Canadian Journal of Zoology* 63(8):1870–1879. DOI: 10.1139/z85-278

Gates, J. E., and D. M. Gates. 1980. A winter food cache of *Microtus pennsylvanicus*. *American Midland Naturalist* 103(2):407-408. DOI: 10.2307/2424643

- Getz, L. L., J. E. Hofmann, B. J. Klatt, L. Verner, F. R. Cole, and R. L. Lindroth. 1987. Fourteen years of population fluctuations of *Microtus ochrogaster* and *M. pennsylvanicus* in east central Illinois. *Canadian Journal of Zoology* 65(6):1317–1325. DOI: 1
- Hall, A. T., P. E. Woods, and G. W. Barrett. 1991. Population dynamics of the meadow vole (*Microtus pennsylvanicus*) in nutrient-enriched old-field communities. *Journal of Mammalogy* 72(2):332–342. DOI: 10.2307/1382104
- Hope, A. G., E. Waltari, J. L. Malaney, D. C. Payer, J. A. Cook, and S. L. Talbot. 2015. Arctic biodiversity: increasing richness accompanies shrinking refugia for a cold-associated tundra fauna. *Ecosphere* 6(9):159. DOI: 10.1890/ES15-00104.1
- Jackson, D. J. 2016. The molecular systematics and phylogeography of the widespread North American meadow vole (*Microtus pennsylvanicus*). MSc, University of New Mexico, Albuquerque, NM.
- Jones, E. N. 1990. Effects of forage availability on home range and population density of *Microtus pennsylvanicus*. *Journal of Mammalogy* 71(3):382–389. DOI: 10.2307/1381950
- Krebs, C. J., and I. Wingate. 1985. Population fluctuations in the small mammals of the Kluane Region, Yukon Territory. *Canadian Field-Naturalist* 99(1):51–61.
- Krebs, C. J., K. Cowcill, R. Boonstra, and A. J. Kenney. 2010. Do changes in berry crops drive population fluctuations in small rodents in the southwestern Yukon? *Journal of Mammalogy* 91(2):500–509. DOI: 10.1644/09-MAMM-A-005.1
- MacDonald, S. O., and J. A. Cook. 2009. *Recent mammals of Alaska*. University of Alaska Press, Fairbanks, AK, USA.
- Marcot, B. G., M. T. Jorgenson, J. P. Lawler, C. M. Handel, and A. R. DeGange. 2015. Projected changes in wildlife habitats in Arctic natural areas of northwest Alaska. *Climate Change* 130(2):145–154. DOI: 10.1007/s10584-015-1354-x
- Mihok, S., B. N. Turner, and S. L. Iverson. 1985. The characterization of vole population dynamics. *Ecological Monographs* 55(4):399–420. DOI: 10.2307/2937129
- O'Brien, S. L., J. A. Cook, and S. D. Newsome. 2018. Niche differentiation among small mammals of the Alexander Archipelago in southeastern Alaska. *Journal of Mammalogy* 99(1):108–116. DOI: 10.1093/jmammal/gyx141
- Reich, L. M. 1981. *Microtus pennsylvanicus*. *Mammalian Species*(159):1–8. DOI: 10.2307/3503976
- Sullivan, T. P., R. A. Lautenschlager, and R. G. Wagner. 1999. Clearcutting and burning of northern spruce-fir forests: implications for small mammal communities. *Journal of Applied Ecology* 36(3):327–344. DOI: 10.1046/j.1365-2664.1999.00408.x

Review status: Peer-reviewed

Version date: 2/10/2019

Alaska Center for Conservation Science
Alaska Natural Heritage Program
University of Alaska Anchorage
Anchorage, AK