Arctic ground squirrel

Urocitellus parryii

Class: Mammalia
Order: Rodentia

Review Status: Peer-reviewed **Version Date:** 10 December 2018

Conservation Status

NatureServe:	*Agency:*		
G Rank: G5	ADF&G: Species of Greatest Conservation Need	IUCN: Least Concern	Audubon AK:
S Rank: S5	USFWS:	BLM: Watch	

Final Rank

Conservation category: **V. Orange**

unknown status and either high biological vulnerability or high action need

Category	Range	Score
Status	-20 to 20	0
Biological	-50 to 50	-40
Action	-40 to 40	4

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**

Population Trend in Alaska (-10 to 10) 0

Unknown.

Distribution Trend in Alaska (-10 to 10) 0

Trends for the last 50 years are unknown. Modeling studies estimate that the distribution of U. parryii in Alaska has increased since the Last Glacial Maximum (~21,500 years ago; Hope et al. 2015), but distribution is expected to decrease by the end of this century (Hope et al. 2015; Marcot et al. 2015).

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**

Population Size in Alaska (-10 to 10) -6

Unknown, but because Arctic ground squirrels are widely distributed in Alaska and are "locally abundant over much of [their] range" (MacDonald and Cook 2009) we suspect this population to be large and therefore rank as "E" 10,001-25,000.

Range Size in Alaska (-10 to 10) -10

Found throughout most of Alaska from Wrangell-St. Elias National Park north to the North Slope and from the Canadian border west to western Alaska and the Aleutian Islands (MacDonald and

Cook 2009; Cook et al. 2010). This species has a restricted distribution in southeast Alaska and its distribution in Prince William Sound is unknown (MacDonald and Cook 2009). Estimated range size is >400,000 sq. km., based on range map from ACCS (2017a).

Population Concentration in Alaska (-10 to 10) -10

Population does not aggregate at specific locations. Lives in small colonies of up to 50 members (Batzli and Sobaski 1980; Wheeler and Hik 2013).

Reproductive Potential in Alaska

Age of First Reproduction (-5 to 5) -5

Reaches sexual maturity within 1 year of birth (Carl 1971; Sheriff et al. 2011).

Number of Young (-5 to 5) 1

Females have one litter per year (McLean 2018). Average litter size in Alaska and southwestern Yukon range from 3 (Gillis et al. 2005) to 6.1 (Carl 1971; reviewed in McLean 2018).

Ecological Specialization in Alaska

Dietary (-5 to 5) -5

Consumes a variety of herbaceous plants and fungi, but opportunistically eats invertebrates, small mammals, bird eggs, and carrion (Cade 1951b; Batzli and Sobaski 1980; McLean 1985; Boonstra et al. 1990; Pollom et al. 2015a; Hobbie et al. 2017). Hobbie et al. (2017) compared the diets of Arctic ground squirrels at two locations in Alaska and found important differences between study sites and suggested that ground squirrels have a flexible diet that changes with food availability. Similarly, Batzli and Sobaski (1980) noted seasonal differences in diet consistent with the availability of herbaceous plants.

Habitat (-5 to 5) -5

Found in a variety of habitats including tundra, shrublands, alpine meadows, sand dunes, and by lakes and rivers where the ground is favorable for digging burrows (Carl 1971; Batzli and Sobaski 1980; Cook and MacDonald 2006; MacDonald and Cook 2009; Hobbie et al. 2017). Populations in the Yukon Flats inhabit open forest habitats such as early-succession stands, old burns, and riverbanks (Guthrie 1967).

Biological Total: -40

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**

Management Plans and Regulations in Alaska (-10 to 10) -10

Listed as unclassified game in Alaska with no closed season or bag limits (ADFG 2020a; ADFG 2020b). However, the meat or hide must be salvaged for human use (ADFG 2020b).

Knowledge of Distribution and Habitat in Alaska (-10 to 10) 2

Distribution is well-known in central and northern Alaska (MacDonald and Cook 2009; ARCTOS 2016), with knowledge of habitat associations (e.g. Guthrie 1967; Batzli and Sobaski 1980; Cook and MacDonald 2005; 2006; Barker and Derocher 2010). However, its distribution in other areas has not been well-documented e.g. southeast and southcoastal Alaska south of the Seward Peninsula (MacDonald and Cook 2009). Additional studies and specimens are needed to validate subspecies designations and determine range extents and overlap (Eddingsaas et al. 2004; Cook et al. 2010; Galbreath et al. 2011; McLean et al. 2016).

Knowledge of Population Trends in Alaska (-10 to 10) 10

Not currently monitored.

Knowledge of Factors Limiting Populations in Alaska (-10 to 10) 2

Research on Arctic ground squirrels in Alaska has largely focused on torpor, hibernation, and burrowing activity (e.g. Buck and Barnes 1999; Long et al. 2005; Sheriff et al. 2011; Williams et al. 2012; Sheriff et al. 2013; Williams et al. 2014b; Lee et al. 2016). In the Yukon, studies on population dynamics have focused on colonies living in forested habitats (e.g. Hubbs and Boonstra 1997; Byrom et al. 2000; Karels and Boonstra 2000; Karels et al. 2000; Werner et al. 2015). Food availability and predation limit these populations (Hubbs and Boonstra 1997; Byrom et al. 2000; Karels et al. 2000; Werner et al. 2015), though density-dependent factors also affect overwinter survival (Karels and Boonstra 2000). Forest colonies in the Yukon collapsed in the early 2000s and have not recovered; predation was the main reason for their initial collapse (as ground squirrels in this system become the main prey species during the low phase of the snowshoe hare cycle; Krebs et al. 2014b) and has also prevented their recovery (Werner et al. 2015). Forest habitats are considered unusual and low-quality habitats for ground squirrels (Gillis et al. 2005; Donker and Krebs 2011) and the dynamics of these colonies vary markedly from tundra colonies in the same region (Werner et al. 2015; McLean 2018).

Comparatively fewer studies have considered the factors that regulate populations in higher-quality tundra habitats. Additional research is needed to determine the role of competition, food availability, and burrow availability on populations (Carl 1971; Batzli and Sobaski 1980; Wheeler and Hik 2013). In the Yukon, Green (1977) noted that starvation is likely an important factor for overwinter survival, while dispersal of juveniles was the greatest contributor to local dynamics in the summer. Juvenile survival may be particularly low in some areas (McLean 2018), but to our knowledge data for Alaska are not available.

As a northern specialist, the Arctic ground squirrel is thought to be vulnerable to climate change (reviewed in Wheeler and Hik 2013; Werner et al. 2015; Wheeler et al. 2015) and species distribution models predict a loss of suitable habitat by the end of this century (Hope et al. 2015; Marcot et al. 2015).

Action Total: 4

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

Harvest:	Not substantial
Seasonal Occurrence:	Year-round
Taxonomic Significance:	Monotypic species
% Global Range in Alaska:	>10%
% Global Population in Alaska:	25-74%
Peripheral:	No

References

Alaska Center for Conservation Science (ACCS). 2017a. Wildlife Data Portal. University of Alaska Anchorage. Available online: http://aknhp.uaa.alaska.edu/apps/wildlife

Alaska Department of Fish and Game (ADFG). 2020a. 2020-2021 Alaska hunting regulations. Alaska Department of Fish and Game. Juneau, AK, USA.

Alaska Department of Fish and Game (ADFG). 2020b. 2020-2021 Alaska trapping 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/

Barker, O. E., and A. E. Derocher. 2010. Habitat selection by arctic ground squirrels (Spermophilus parryii). Journal of Mammalogy 91(5):1251–1260. DOI: 10.1644/10-MAMM-A-030.1

Batzli, G. O., and S. T. Sobaski. 1980. Distribution, abundance, and foraging patterns of ground squirrels near Askasook, Alaska. Arctic and Alpine Research 12(4):501-510. DOI: 10.2307/1550497

Boonstra, R., C. J. Krebs, and M. Kanter. 1990. Arctic ground squirrel predation on collared lemmings. Canadian Journal of Zoology 68(4):757–760. DOI: 10.1139/z02-115

Buck, C. L., and B. M. Barnes. 1999. Annual cycle of body composition and hibernation in free-living arctic ground squirrels. Journal of Mammalogy 80(2):430–442. DOI: 10.2307/1383291

Byrom, A. E., T. J. Karels, C. J. Krebs, and R. Boonstra. 2000. Experimental manipulation of predation and food supply of Arctic ground squirrels in the boreal forest. Canadian Journal of Zoology 78(8):1309–1319. DOI: 10.1139/z00-055

Cade, T. 1951b. Carnivorous ground squirrels on St. Lawrence Island, Alaska. Journal of Mammalogy 32(3):358–360. DOI: 10.1093/jmammal/32.3.358

Carl, E. A. 1971. Population control in Arctic ground squirrels. Ecology 52(3):395–413. DOI: 10.2307/1937623

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

Cook, J. A., A. A. Eddingsaas, J. L. Loxterman, S. Ebbert, and S. O. MacDonald. 2010. Insular Arctic ground squirrels (Spermophilus parryii) of the North Pacific: Indigenous or exotic? Journal of Mammalogy 91(6):1401–1412. DOI: 10.1644/09-MAMM-A-386.1

Donker, S. A., and C. J. Krebs. 2011. Habitat-specific distribution and abundance of Arctic ground squirrels (Urocitellus parryii plesius) in southwest Yukon. Canadian Journal of Zoology 89(6):570-576. DOI: 10.1139/z11-041

Eddingsaas, A. A., B. K. Jacobsen, E. P. Lessa, and J. A. Cook. 2004. Evolutionary history of the Arctic ground squirrel (Spermophilus parryii) in Nearctic Beringia. Journal of Mammalogy 85(4):601–610. DOI: 10.1644/BRB-204

Galbreath, K. E., J. A. Cook, A. A. Eddingsaas, and E. G. DeChaine. 2011. Diversity and demography in Beringia: Multilocus tests of paleodistribution models reveal the complex history of Arctic ground squirrels. Evolution 65(7):1879–1896. DOI: 10.1111/j.1558-5646.2011.01287.x

Gillis, E. A., D. S. Hik, R. Boonstra, T. J. Karels, and C. J. Krebs. 2005. Being high is better: Effects of elevation and habitat on Arctic ground squirrel demography. Oikos 108(2):231–240. DOI: 10.1111/j.0030-1299.2005.13535.x

Green, J. E. 1977. Population regulation and annual cycles of activity and dispersal in Arctic ground squirrels. MSc thesis, University of British Columbia, Vancouver, CAN. Available online: https://open.library.ubc.ca/cIRcle/collections/ubctheses/831/items/1.0094007

Guthrie, R. D. 1967. Fire melanism among mammals. American Midland Naturalist 77(1):227–230. DOI: 10.2307/2423443

Harper, P., and L. A. McCarthy. 2013. Furbearer management report of survey- inventory activities, 1 July 2009–30 June 2012. Page 366. Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, AK, USA.

Hobbie, E. A., J. Shamhart, M. Sheriff, A. P. Ouimette, M. Trappe, ..., and B. M. Barnes. 2017. Stable isotopes and radiocarbon assess variable importance of plants and fungi in diets of Arctic ground squirrels. Arctic, Antarctic, and Alpine Research 49(3):487-500. DOI: 10.1657/AAAR0016-062

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

Hubbs, A. H., and R. Boonstra. 1997. Population limitation in Arctic ground squirrels: effects of food and predation. Journal of Animal Ecology 66(4):527-541. DOI: 10.2307/5947

Karels, T. J., and R. Boonstra. 2000. Concurrent density dependence and independence in populations of Arctic ground squirrels. Nature 408(6811):460–463. DOI: 10.1038/35044064

Karels, T. J., A. E. Byrom, R. Boonstra, and C. J. Krebs. 2000. The interactive effects of food and predators on reproduction and overwinter survival of Arctic ground squirrels. Journal of Animal Ecology 69(2):235–247. DOI: 10.1046/j.1365-2656.2000.00387.x

Lee, T. N., F. Kohl, C. L. Buck, and B. M. Barnes. 2016. Hibernation strategies and patterns in sympatric arctic species, the Alaska marmot and the Arctic ground squirrel. Journal of Mammalogy 97(1):135-144. DOI:10.1093/jmammal/gyv163

Long, R. A., T. J. Martin, and B. M. Barnes. 2005. Body temperature and activity patterns in free-living Arctic ground squirrels. Journal of Mammalogy 86(2):314–322. DOI: 10.1644/BRG-224.1

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

McLean, I. G. 1985. Seasonal patterns and sexual differences in the feeding ecology of Arctic ground squirrels (Spermophilus parryii plesius). Canadian Journal of Zoology 63(6):1298–1301. DOI: 10.1139/z85-195

McLean, B. S. 2018. Urocitellus parryii (Rodentia: Sciuridae). Mammalian Species 50(964):84–99. DOI: 10.1093/mspecies/sey011

McLean, B. S., D. J. Jackson, and J. A. Cook. 2016. Rapid divergence and gene flow at high latitudes shape the history of Holarctic ground squirrels (Urocitellus). Molecular Phylogenetics and Evolution 102:174–188. DOI: 10.1016/j.ympev.2016.05.040

Pollom, E. L., J. P. Gorey, and N. A. Rojek. 2015a. Biological monitoring at Chowiet Island, Alaska in 2015. Report AMNWR 2015/13, Alaska Maritime National Wildlife Refuge, U.S. Fish and Wildlife Service, Homer, AK, USA.

Sheriff, M. J., G. J. Kenagy, M. Richter, T. Lee, Ø. Tøien, …, and B. M. Barnes. 2011. Phenological variation in annual timing of hibernation and breeding in nearby populations of Arctic ground squirrels. Proceedings of the Royal Society of London B: Biological Sciences 278:2369-2375. DOI: 10.1098/rspb.2010.2482

Sheriff, M. J., M. M. Richter, C. L. Buck, and B. M. Barnes. 2013. Changing seasonality and phenological responses of free-living male Arctic ground squirrels: The importance of sex. Philosophical Transactions of the Royal Society B: Biological Sciences 368:20120480. DOI: 10.1098/rstb.2012.0480

Werner, J. R., C. J. Krebs, S. A. Donker, R. Boonstra, and M. J. Sheriff. 2015. Arctic ground squirrel population collapse in the boreal forests of the southern Yukon. Wildlife Research 42(2): 176-184. DOI: 10.1071/WR14240

Wheeler, H. C., and D. S. Hik. 2013. Arctic ground squirrels Urocitellus parryii as drivers and indicators of change in northern ecosystems. Mammal Review 43(3):238-255. DOI: 10.1111/j.1365-2907.2012.00220.x

Wheeler, H. C., J. D. Chipperfield, C. Roland, and J.-C. Svenning. 2015. How will the greening of the Arctic affect an important prey species and disturbance agent? Vegetation effects on Arctic ground squirrels. Oecologia 178(3):915–929. DOI: 10.1007/s00442-015-3240-7

Williams, C. T., M. J. Sheriff, F. Kohl, B. M. Barnes, and C. L. Buck. 2012. Interrelationships among timing of hibernation, reproduction, and warming soil in free-living female Arctic ground squirrels. Pages 63-72 in Ruf, T., C. Bieber, W. Arnold, and E. Millesi, eds. Living in a Seasonal World: Thermoregulatory and Metabolic Adaptations. Springer-Verlag, Berlin, GER.

Williams, C. T., K. Wilsterman, A. D. Kelley, A. R. Breton, H. Stark, …, and C. L. Buck. 2014b. Light loggers reveal weather-driven changes in the daily activity patterns of arboreal and semifossorial rodents. Journal of Mammalogy 95(6):1230–1239. DOI: 10.1644/14-MAMM-A-062

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