

## Terrestrial Mammals – Introduction

Alaska is famous for its large mammals, such as moose and wolves, and these species have been well studied. However, the state is also home to numerous other mammals, including the tiniest species, the bats and shrews. At meetings held in April 2004, wildlife experts were asked to identify those mammal species having important conservation concerns and to recommend a selection of them to feature in the CWCS. This task was formidable due to the paucity of information for so many of Alaska's lesser-known mammal species.

Experts pointed out that, regardless of their conservation status and available funding, many of Alaska's nonmarine mammals are technically considered game species and covered in the annual Alaska Hunting Regulations booklet. These include a number of species that many, if not most, Alaskans typically do *not* consider to be game, such as shrews, mice, crows, and snowy owls. Also, Alaska's legal definition of game covers all birds, reptiles, and mammals, except those that are domesticated; thus, it appears that there are no *nongame* birds, reptiles, or mammals. Animals classified as game by state regulations can be used in both game-related (e.g., hunting) and nongame-related (e.g., viewing) ways.

Ultimately, the experts focused on conservation concerns for terrestrial mammals without regard to their technical status. For example, under the state's trapping regulations, there is no bag limit for hoary marmots (*Marmota caligata*). But then consider the Montague Island marmot (*M. c. sheldoni*), which was last seen at the turn of the 20<sup>th</sup> century and was described as an endemic of Montague Island. Even though they are technically a "game" species, marmots on Montague Island are considered a species of conservation concern due to their limited range (endemism), risk of extinction (because they are a small population on an island), and lack of recent sightings (possibly extinct or cryptic).

The Montague Island marmot also provides a good example of other major issues regarding the inventory of terrestrial mammals of conservation concern in Alaska: endemism and uncertain taxonomy. Many of the state's land mammal species have been described as island endemics, which by definition are at higher risk of extinction than other species. However, the taxonomic validity of these species has not been investigated or confirmed/refuted. Until the phylogeographical history of these species or populations is understood, we cannot understand their distribution. This information, together with abundance and productivity data, is essential for comprehensively identifying species at risk.

The experts began by considering and melding 2 previously compiled lists: 1) a comprehensive list of species and subspecies of conservation concern including their known distribution and agency classification (MacDonald et al. in prep), and 2) a proposed species of concern list developed by experts for the USFWS in May 2003. This combined list (Table 4.1, below) represents species, subspecies and species groups that merit consideration of their taxonomy, distribution, abundance, productivity, and risk factors. Achieving better understanding of the status of these taxa will bring us closer to the overall goal of maintaining biodiversity among Alaska's terrestrial mammals.

Table 4.1 Land mammal taxa of conservation concern. Compiled from MacDonald et al. in prep, experts consulted by the USFWS in 2003 and expert opinion during the April 2004 CWCS meeting. (See Appendix 7 for a key to abbreviations.)

Land mammal taxa of conservation concern	Alaska distribution	Heritage Ranks		USFWS	IUCN	CITES	COSEWIC	BC
		SRANK	GRANK					
<b>INSECTIVORA - shrews</b>								
<i>Sorex alaskanus</i>	SE	SH	G5THQ					
<i>Sorex pribilofensis</i> ( <i>hydrodromous</i> )	W	S3	G3		EN			
<i>Sorex jacksoni</i>	W	S3	G3		EN			
<i>Sorex monticolus alascensis</i>	SE, SC	SNR	G5					
<i>S. m. ellassodon</i>	SE	SNR	GNR					
<i>S. m. malitiosus</i>	SE	S3Q	G5T3Q					
<i>Sorex palustrus</i>		SNR	G5					
<b>CHIROPTERA – bats</b>								
<i>Myotis californicus caurinus</i>	SE	S1S2	G5				DD	Yellow
<i>Myotis keenii</i>	SE	S1S3	G2G3					Red
<i>Myotis volans longicrus</i>	SE	S2?	G5					Yellow
<i>Myotis alascensis</i>								
<b>CARNIVORA - carnivores</b>								
<i>Canis lupus ligoni</i>	SE	S2S3Q	G4T2T3Q			A2		
<i>Gulo gulo katschemakensis</i>	SC	S3?	G4T3?					
<i>Lontra canadensis mira</i>	SE	S3S4	G5T3T4			A2		
<i>Martes americana kenaiensis</i>	SC							
<i>Martes caurina caurina</i>	SE							
<i>Mustela erminea alascensis</i>	SE		G5					
<i>M. e. celenda</i>	SE	S4?	G5T4?					
<i>M. e. haidarum</i>	SE?	SNA	G5T2				T	Red
<i>M. e. initis</i>	SE		G5T?					

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Land mammal taxa of conservation concern	Alaska distribution	Heritage Ranks		USFWS	IUCN	CITES	COSEWIC	BC
		SRANK	GRANK					
<i>M. e. kadiacensis</i>	SW	S4?	G5T4?					
<i>M. e. salva</i>	SE	SNR	GNR					
<i>M. e. seclusa</i>	SE	S2?Q	G5T2?Q					
<i>Ursus arctos kenai</i>	SC							
<b>ARTIODACTYLA – even-toed ungulates</b>								
<i>Rangifer tarandus caribou</i>	C, SC	SNR	G5T4	(PS:LE)			(PS)	Blue
<b>RODENTIA - rodents</b>								
<i>Clethrionomys gapperi phaeus</i>	SE							
<i>C. g. solus</i>	SE	S3Q	G5T3Q		DD			
<i>C. g. stikinensis</i>	SE	S2S3	G5T2T3					
<i>C. g. wrangeli</i>	SE	S2S3	G5T2T3					
<i>Clethrionomys rutilus albiventer</i>	W	S3	G5T3					
<i>C. r. insularis</i>	SC	S3	G5T3					
<i>Dicrostonyx groenlandicus exsul</i>	W	S4	G5T4		DD			
<i>D. g. peninsulae</i>	SW							
<i>D. g. stevensoni</i>	SW							
<i>D. g. unalascensis</i>	SW	S3	G5T3		DD			
<i>Glaucomys sabrinus griseifrons</i>	SE	S2?Q	G5T2?Q		EN			
<i>Lemmus trimucronatus harroldi</i>	W	S4	G5T4					
<i>L. t. nigripes</i>	W	S3	G5T3					
<i>Marmota broweri</i>	N, C, W?	S4	G4					
<i>Marmota caligata sheldoni</i>	SC	S2S3	G5T2T3		DD			
<i>M. c. vigilis</i>	SE	S3?	G5T3?		DD			

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Land mammal taxa of conservation concern	Alaska distribution	Heritage Ranks						
		SRANK	GRANK	USFWS	IUCN	CITES	COSEWIC	BC
<i>Microtus abbreviatus abbreviatus</i>	W	S3Q	G3QT3		DD			
<i>M. a. fisheri</i>	W	S3Q	G3QT3		DD			
<i>Microtus longicaudus littoralis</i>	SE	SNR	G5					
<i>M. l. coronarius</i>	SE	S3Q	G5T3Q		DD			
<i>Microtus oeconomus amakensis</i>	SW	S2Q	G5T2Q		DD			
<i>M. o. elymocetes</i>	SC	S2	G5T2		DD			
<i>M. o. innuitus</i>	W	S3	G5T3		DD			
<i>M. o. popofensis</i>	SW	S3	G5T3		DD			
<i>M. o. punukensis</i>	W	S1	G5T1		DD			
<i>M. o. sitkensis</i>	SE	S3	G5T3		DD			
<i>M. o. unalascensis</i>	SW	S3	G5T3					
<i>M. o. yakutatensis</i>	SE	S4	G5T4					
<i>Microtus pennsylvanicus admiraltiae</i>	SE	S3	G5T3					
<i>Peromyscus keeni</i>	SE	S3	G5					Yellow
<i>P. k. algidus</i>	SE							
<i>P. k. hylaeus</i>	SE							
<i>P. k. macrorhinus</i>	SE							
<i>P. k. oceanicus</i>	SE							
<i>P. k. sitkensis</i>	SE							
<i>Spermophilus parryii ablusus</i>	W, SW, SC							
<i>S. p. kodiacensis</i>	SW	S3	G5T3		DD			
<i>S. p. lyratus</i>	W	S3	G5T3		DD			
<i>S. p. nebulicola</i>	SW	S3	G5T3		DD			
<i>S. p. osgoodi</i>	C	S3?	G5T3?					
<i>Tamiasciurus hudsonicus kenaiensis</i>	SC							
<i>Zapus hudsonius alascensis</i>	SE, SC, SW, C	SNR/ SNA?	G5T4T5					Yellow

Land mammal taxa of conservation concern	Alaska distribution	Heritage Ranks						
		SRANK	GRANK	USFWS	IUCN	CITES	COSEWIC	BC
<b>LAGOMORPHA – pikas and hares</b>								
<i>Lepus othus</i>	SW, W	S3S4q	GG34					
<i>L. o. othus</i>	W							
<i>L. o. poadromus</i>	SW							
<i>Ochotona collaris</i>	SC, C, N?	S5	G5					Yellow

Ultimately, the experts identified featured mammal species or species groups by first considering rarity, followed by natural risk or stochastic factors, and then anthropogenic risk. Rare taxa included island endemic species and subspecies, disjunct populations, and/or populations believed to be in decline. Natural and stochastic risk included genetic drift, natural disasters, disease, and climate change. Anthropogenic risk included habitat modification, human encroachment, defense of life or property, and introduction of exotic species.

Experts generated conservation objectives, targets, measures, and actions for each featured mammal species or species group. The experts applied the criteria shown in Section II(C), and also selected the Chisana caribou herd and the Kenai Peninsula population of brown bears as being of concern. The experts felt that existing management plans for these populations did not adequately address the populations' long-term conservation needs.

#### *Chisana caribou herd*

The Chisana caribou herd is a small population of caribou inhabiting east-central Alaska, USA, and southwest Yukon, Canada. The herd summers almost entirely in Alaska and winters in Yukon. The herd began an abrupt decline in 1989 from about 1800 animals to an estimated 360 in 2001. While recent, more extensive surveys indicate that the population size may be higher than indicated by earlier surveys, observations of extremely low calf survival (5–10%) substantiate significant continued decline and possible extirpation.

The taxonomy of the herd is somewhat uncertain. In Canada the herd falls under the classification of woodland caribou (*Rangifer tarandus caribou*), but in Alaska all caribou populations have been classified as barren-ground caribou (*R. t. granti*). They are designated as Northern Mountain ecotype based on ecological behavior and body characteristics, as are all other woodland caribou of Yukon and northwestern British Columbia by the Committee on the Status of Endangered Wildlife in Canada.

Information on the genetic status of the herd, using microsatellite DNA (msDNA) analysis, indicates that they are a genetically distinct population exhibiting msDNA far distant from that of adjacent caribou herds in Yukon and Alaska (Zittlau et al.). This information suggests that there are 2 subspecies in Alaska, rather than one, and it ascribes special significance for this herd. These events prompted designation of the herd as a specially protected wildlife population under the Yukon Wildlife Act in 2002. This action includes a prohibition on all hunting, including subsistence harvest. All hunting of this herd is also prohibited in Alaska. A conservation plan was developed that included an ongoing effort to reduce predation on newborns through predator exclusion during periods of high vulnerability. This effort includes capturing, penning, and feeding of parturient females in Canada for 10 weeks beginning just before calving. Cows and calves are released after calves obtain sufficient size to avoid predation.

Several other small caribou herds in the state of Alaska are thought to be at historically low population sizes. For example, the Mentasta, Sunshine Mountains, Beaver

Mountains, Rainy Pass, Tonzona and Big River-Farewell herds each likely consist of only a few hundred animals. Biologists suspected that the remnants of one such herd (Kilbuck Mountains) was recently assimilated into a larger herd, or was extirpated by other factors, and in 2002 recommended that management efforts cease (ADF&G 2003). Although management plans exist for all current populations, there is insufficient information for the long-term conservation of these populations. This is because: 1) genetic, taxonomic, and population identity information is weak or nonexistent for many small herds; 2) basic population data is weak or absent; 3) the ultimate causes and magnitudes of continued population declines are unknown; and 4) the potential for caribou to naturally recolonize these areas is unknown as are the conditions and mechanisms under which such recolonization might occur. If an appropriate funding source can be identified, additional work to address these conservation concerns is recommended.

*Brown bear, Kenai Peninsula population*

Brown bears on the Kenai Peninsula were designated as a state species of concern in 1998. This administrative designation proactively focused attention and research efforts on an area where steady human population growth and increased human activities had potential to negatively impact the bears. A Kenai Brown Bear Conservation Strategy was created (ADF&G 2000), and great strides have been made in accomplishing some of the strategies' goals. The Kenai Brown Bear Committee has recently outlined an action plan for addressing the most critical issues affecting Kenai brown bears.

The many uncertainties regarding the health and size of the brown bear population, the influence of growing human development, the potential insular qualities of the peninsula, and an apparent increase in human-bear interactions warrant an aggressive approach toward managing for the conservation of the brown bear population on the Kenai Peninsula. Four steps are critical to improving Kenai brown bear conservation:

- First, managers must assess population size, distribution, and structure of brown bears across the peninsula so that a Population Viability Analysis can be conducted.
- Second, Kenai residents and visitors must continue to be informed about special requirements of brown bears and how to minimize human-bear conflict.
- Third, a strategic garbage-management policy must be developed on the peninsula to minimize bear-human conflicts.
- Finally, land use management strategies that consider brown bear foraging and habitat requirements and minimize potential for human-bear interactions are needed to ensure the conservation of this bear population. Agencies or organizations that could play a role in developing and implementing such strategies include the DOT&PF, Kenai Peninsula Borough planning division, and Cook Inlet Region Inc., which owns a large piece of property along the Kenai River.

**Literature Cited**

ADF&G. 2000. Kenai Peninsula Brown Bear Conservation Strategy, June 2000.

<http://www.wildlife.alaska.gov/management/planning/kenaibb3.cfm>

ADF&G. 2003. Caribou Annual Survey and Inventory Federal Aid Performance Report W-33-1 Project No. 3. 17 p.

MacDonald, S.O., E. Lance, and J.A. Cook. Conservation Status of Selected Alaska Mammals. Unpublished working draft. 88 p.

Zittlau, K., J. Coffin, R. Fennell, G. Kurzyk, and C. Strobek. 2000. Genetic relationships of three Yukon caribou herds determined by DNA typing. Rangifer Special Issue 12: 59–62.

## Southcoastal Alaska Bats

### A. Species group description

**Common name:** southcoastal Alaska bats

**Scientific names:** little brown bat (*Myotis lucifugus*; Alaska population probably represents 2 separate species—Joseph A. Cook, pers. comm. 2004), Keen's bat (*M. keenii*), California myotis (*M. californicus*), Long-legged myotis (*M. volans*), silver-haired bat (*Lasionycteris noctivagans*)

### B. Distribution and abundance

**Range:**

Global range comments: North America (Hall 1981; van Zyll de Jong and Nagorsen 1994; Nagorsen and Brigham 1993). *M. keenii* may have the most restricted range of any North American bat (van Zyll de Jong 1985).

State range comments: All are limited to Southeast Alaska, except for *M. lucifugus*, which has also been documented in Southcentral, northern Southwestern, and Central Alaska (MacDonald and Cook 1996; Parker and Cook 1996; Parker et al. 1997).

**Abundance:**

Global abundance comments: Keen's bat is represented in museum collections by only 59 specimens (van Zyll de Jong and Nagorsen 1994) and is Red-listed in British Columbia (precursor to listing as endangered or threatened), as SC (particularly sensitive to human activities or natural events) by COSEWIC, and as G2G3 (imperiled or rare or uncommon) by the AKNHP. All other species are ranked G5 (widespread, abundant, and secure) by AKHNP.

State abundance comments: Unknown. *M. keenii* is known only from 2 records in the Alexander Archipelago of Southeast Alaska, *M. californicus* by 5 records, *M. volans* by 5 records, and *L. noctivagans* by only 4 records. *M. lucifugus* may be relatively common in the narrow belt of temperate forest along the state's southern coasts as far west as Kodiak Island and adjacent Alaska Peninsula.

**Trends:**

Global trends: Unknown.

State trends: Unknown.

### C. Problems, issues, or concerns for species group

- Lack of information on these species' life history, population structure, migration patterns, distribution, and habitat use
- Destruction of karst and old-growth habitat due to timber harvests
- Changes in foraging, roosting, breeding, and hibernaculum habitat associated with timber harvest
- Pesticide use

**D. Location and condition of key or important habitat areas**

- Karst features, such as caves, on Prince of Wales and other islands (unknown and variable conditions; substantial degradation in heavily harvested areas). Some of the caves may harbor maternity colonies
- Commuting and feeding activity is greatest in old-growth forest and riparian habitats; bat activity in clearcuts and second growth is low to very low (Parker et al. 1996)
- Decaying standing trees may provide roosting habitat (winter, summer, maternity; Fischbach et al. in prep)

**E. Concerns associated with key habitats**

- See Section C
- Habitat is narrowly and patchily distributed
- Timber harvest focused on rare stands of largest trees
- Salvage logging is focused on possible roost trees
- Conversion to second growth; bat use of second growth is low (Parker et al. 1996)
- Karst destruction

**F. Goal:** Ensure that southcoastal bat populations remain sustainable throughout their range within natural population-level variation relative to presumed historical distribution in Alaska.

**G. Conservation objectives and actions**

**Objective:** Maintain the current distribution, diversity, and abundance of bat species and populations in southcoastal Alaska.

**Target:** Fully documented occurrence, distribution, and abundance of these species.

**Measures:** Diversity, population trends, and distribution maps of species.

**Issue 1:** Lack of information on these species' occurrence, abundance, home ranges, migration habits (e.g., whether they migrate), and destinations.

**Conservation actions:**

- a) Increase our knowledge of bat distribution and ecology in southcoastal Alaska.
- b) Document distribution and occurrence in Southeast Alaska.
- c) Inventory using techniques specific for bats; it is often economical to study multiple bat species at once.
- d) Inventory key habitats, identify critical habitat areas.
- e) Document distribution and abundance in second-growth habitat; further investigate occurrence and abundance in old-growth and second-growth habitats.
- f) Provide scientific samples to natural history museums for phylogeographic and taxonomic studies.
- g) Measure home range of each species.

**Issue 2:** Old-growth forests and karst features are presumed to be prime bat habitat.

**Conservation actions:**

- a) Measure bat use in forest types to identify important habitats (e.g., roosting, breeding, foraging habitat).
- b) Measure bat use of karst features (caves) to identify important habitats (e.g. roosting, breeding, foraging, hibernacula habitat).

**Issue 3:** Effects of some timber actions on habitat quality for bats are unknown.

**Conservation actions:**

- a) Evaluate habitat quality of forest seral stages.
- b) Evaluate the potential to manage for old-growth forest structure and function.

**Issue 4:** Effects of pesticides on bats and their prey are unknown.

**Conservation action:** Determine the effects of pesticides use.

**H. Plan and time frames for monitoring species and their habitats**

Collect all the data necessary to do a population viability study for all southcoastal Alaska bat species. Design a long-term monitoring strategy every 2 years between USFWS, USFS and ADF&G to include a trend analysis.

**I. Recommended time frame for reviewing species status and trends**

No specific suggestion made.

**J. Bibliography**

- Fischbach, A.S., S.W. Lewis, and P. Hooge. In Prep. Roost selection by bats in southeast Alaskan coastal rainforest.
- Hall, E.R. 1981. The mammals of North America. Wiley-Interscience, New York. 1181 p.
- MacDonald, S.O. and J.A. Cook. 1996. The land mammal fauna of southeast Alaska. Canadian Field-Naturalist 110:571–599.
- Nagorsen, D.W. and R.M. Brigham. 1993. Bats of British Columbia. Royal British Columbia Museum Handbook. University of British Columbia Press, Vancouver. 164 p.
- Parker, D.I. and J.A. Cook. 1996. Keen’s long-eared bat, *Myotis keenii*, confirmed in southeast Alaska. Canadian Field-Naturalist 110:611–614.
- Parker, D.I., J.A. Cook, and S.W. Lewis. 1996. Effects of timber harvest on bat activity in southeastern Alaska’s temperate rainforests. In: R.M.R. Barclay and R.M. Brigham, editors. Bats and Forest Symposium, October 19–21, 1995. Working Paper 23/1996. Victoria, British Columbia. p. 277–292.

**Bibliography** (continued)

Parker, D.I., B.E. Lawhead, and J.A. Cook. 1997. Distributional limits of bats in Alaska. *Arctic* 50:256–265.

van Zyll de Jong, C.G. 1985. Handbook of Canadian mammals. Part 2. Bats. National Museum of Natural History. 212 p.

van Zyll de Jong, C.G. and D.W. Nagorsen. 1994. A review of the distribution and taxonomy of *Myotis keenii* and *Myotis evotis* in British Columbia and the adjacent United States. *Canadian Journal of Zoology* 72:1069–1078.

## Southeast Alaska Endemic Small Mammals

### A. Species group description

**Common name:** Southeast Alaska endemic small mammals

**Scientific names:** Ermine: *Mustela erminea* complex

Marten: *Martes americana/caurina* complex

Flying squirrel: *Glaucomys sabrinus griseifrons/alpinus*

Southern red-backed vole: *Clethrionomys gapperi* complex

Long-tailed vole: *Microtus longicaudus/coronarius* complex

Sitka tundra vole: *M. oeconomus sitkensis*

Admiralty Island meadow vole: *M. pennsylvanicus admiraltiae*

Keen's mouse: *Peromyscus keeni* complex

Revillagigedo Island meadow jumping mouse: *Zapus hudsonius*

(Species is wide ranging, but geographically disjunct and may be genetically isolated on this island.)

Montane shrew: *Sorex monticolus* complex

Glacier Bay water shrew: *Sorex alaskanus*

Admiralty Island beaver: *Castor canadensis phaeus*

Glacier Bay marmot: *Marmota caligata vigilis*

### B. Distribution and abundance

**Range:**

Global range comments: N/A

State range comments: Variously distributed throughout and isolated within Southeast Alaska.

**Abundance:**

Global abundance comments: Unknown

State abundance comments: Unknown

**Trends:**

Global trends: N/A

State trends: Unknown

### C. Problems, issues, or concerns for species group

- Invalid taxonomies fail to adequately reflect the region's diversity; preliminary studies suggest existing taxonomic frameworks underestimate or incorrectly characterize diversity in some cases
- Incomplete distributional and status information
- Need to better evaluate assumptions of the Tongass National Forest - Forest Plan (TLMP) conservation strategy to maintain viable and well-distributed populations
- Timber harvest and road construction leading to habitat loss and fragmentation
- Increased access and potential overexploitation by trappers (marten, ermine, beaver)
- Isolated endemics of presumed small population size (higher probability of

<p>extinction than mainland)</p> <ul style="list-style-type: none"> <li>• Genetic swamping of island endemics by the introduction of nonnative species (e.g., <i>Martes americana americana</i> occurring on islands where the <i>Martes americana caurina</i> is endemic)</li> <li>• Pesticide contamination related to forest management practices</li> <li>• Introduction of potential competitors/predators (e.g., red squirrel, raccoon, brown rat)</li> </ul>
<p><b>D. Location and condition of key or important habitat areas</b></p> <p>Marten are closely affiliated with high quality, old-growth forests (particularly the rare big-tree stands). Flying squirrels are associated with mature forests and likely limited by large trees and snags in less productive peatland mixed-conifer forest associations. Condition of these habitats in Southeast Alaska ranges from very degraded across broad areas of the archipelago that have experienced industrial timber harvest to very good or pristine in forest stands unaffected by timber harvest or community and road development.</p>
<p><b>E. Concerns associated with key habitats</b></p> <ul style="list-style-type: none"> <li>• Stands of big trees are rare and disproportionately harvested over time; species associated with stands of big trees may be disproportionately impacted by past and future harvest.</li> <li>• Connectivity may be disrupted by habitat fragmentation.</li> </ul>
<p><b>F. Goal:</b> Ensure Southeast Alaska endemic small mammal populations remain sustainable throughout their range within natural population-level variation and historical distribution across Alaska.</p>
<p><b>G. Conservation objectives and actions</b></p> <p><b>Objective:</b> Maintain distribution and diversity of endemic taxa and distinct population segments.</p> <p><b>Target:</b> Maintenance of endemic populations in current distribution and/or restoration of populations impacted by anthropogenic causes.</p> <p><b>Measure (1):</b> Survey of island occurrence.</p> <p><b>Measure (2):</b> Determination of taxonomic status.</p> <p><b>Issue 1:</b> <u>Invalid taxonomies and insufficient distribution data.</u></p> <p><b>Conservation actions:</b></p> <ol style="list-style-type: none"> <li>a) Conduct surveys.</li> <li>b) Collect and archive samples for taxonomic and genetic analyses.</li> <li>c) Support phylogeographic studies of endemic taxa.</li> </ol> <p><b>Issue 2:</b> <u>Habitat loss and fragmentation.</u></p>

**Conservation actions:**

- a) Evaluate habitat relationships.
- b) Evaluate dispersal (linkage and corridors).
- c) Recommend management strategies (based on above information).
- d) Make the southern outer islands subregion (Prince of Wales Island complex) with its elevated levels of endemism a priority area of conservation concern and action.

**Issue 3: Pesticide contamination.**

**Conservation action:** Evaluate impacts of pesticide contamination on small endemic mammal populations.

**H. Plan and time frames for monitoring species and their habitats**

Studies should be initiated within the next 2 years. Potential partners include ADF&G, USFS, USFWS, and universities.

**I. Recommended time frame for reviewing species status and trends**

Every 5–6 years.

**J. Bibliography**

- Arbogast, B.A., Bidlack, A.L., and J.A. Cook. (In Prep). Intraspecific phylogeography of northern flying squirrels (*Glaucomys sabrinus*) across North America.
- Bidlack, A.L. and J.A. Cook. 2001. Reduced genetic variation in insular northern flying squirrels (*Glaucomys sabrinus*) along the North Pacific Coast. *Animal Conservation* 4:283–290.
- Bidlack, A.L. and J.A. Cook. 2002. A nuclear perspective on endemism in northern flying squirrels (*Glaucomys sabrinus*) of the Alexander Archipelago, Alaska. *Conservation Genetics* 3:247–259.
- Conroy, C.J. and J.A. Cook. 1998. *Microtus longicaudus* (Merriam 1888), long-tailed vole. In: D.J. Hafner, E. Yensen, and G.L. Kirkland, Jr., editors. North American rodents: status survey and conservation action plan. IUCN/SSC Rodent Specialist Group. Gland, Switzerland and Cambridge, UK. p. 93–95
- Conroy, C.J. and J.A. Cook. 2000. Phylogeography of a post-glacial colonizer: *Microtus longicaudus* (Rodentia: Muridae). *Molecular Ecology* 9:165–175.
- Cook, J. A. 1998. *Marmota caligata* (Eschscholtz 1829), hoary marmot. In: D.J. Hafner, E. Yensen, and G.L. Kirkland, Jr., editors. North American rodents: status survey and conservation action plan. IUCN/SSC Rodent Specialist Group. Gland, Switzerland and Cambridge, UK. p. 39–30

**Bibliography** (continued)

- Cook, J.A., A.L. Bidlack, C.J. Conroy, J.R. Demboski, M.A. Fleming, A.M. Runck, K.D. Stone, and S.O. MacDonald. 2001. A phylogeographic perspective on endemism in the Alexander Archipelago of Southeast Alaska. *Biological Conservation* 97:215–227.
- Cook, J.A. and G.L. Kirkland, Jr. 1998. *Clethrionomys gapperi* (Vigors 1830), southern red-backed vole; Gapper's red-backed vole. In: D.J. Hafner, E. Yensen, and G.L. Kirkland, Jr., editors. North American rodents: status survey and conservation action plan. IUCN/SSC Rodent Specialist Group. Gland, Switzerland and Cambridge, UK. p. 87
- Cook, J.A. and S.O. MacDonald. 2001. Should endemism be a focus of conservation efforts along the North Pacific Coast of North America? *Biological Conservation* 97:207–213.
- Cook, J.A., A.M. Runck, and C.J. Conroy. 2004. Historical biogeography at the crossroads of the northern continents: molecular phylogenetics of red-backed voles (Rodentia: Arvicolinae). *Molecular Phylogenetics and Evolution* 30:767–777.
- Demboski, J.R., B.K. Jacobsen, and J.A. Cook. 1998. Implications of cytochrome b sequence variation for biogeography and conservation of the northern flying squirrels (*Glaucomys sabrinus*) of the Alexander Archipelago, Alaska. *Canadian Journal of Zoology* 76:1771–1777.
- Demboski, J.R. and J.A. Cook. 2001. Phylogeography of the dusky shrew, *Sorex monticolus* (Insectivora, Soricidae): insight into deep and shallow history in northwestern North America. *Molecular Ecology*, 10:1227–1240.
- Demboski, J.R., J.A. Cook, and G.L. Kirkland, Jr. 1998. *Glaucomys sabrinus* (Shaw 1801), northern flying squirrel. In: D.J. Hafner, E. Yensen, and G.L. Kirkland, Jr., editors. North American rodents: status survey and conservation action plan. IUCN/SSC Rodent Specialist Group. Gland, Switzerland and Cambridge, UK. p. 37–39
- Fleming, M.F. and J.A. Cook. 2002. Phylogeography of endemic ermine (*Mustela erminea*) in Southeast Alaska. *Molecular Ecology* 11:795–808.
- Flynn, R.W. and G. Blundell. 1992. Ecology of martens in southeast Alaska. ADF&G, Federal Aid in Wildlife Restoration Research Progress Report, Project W-23-5, Study 7.16, December. 32 p.
- Lucid, M.K. and J.A. Cook. (In Prep). Phylogeography of Keen's mouse (*Peromyscus keeni*) in a naturally fragmented landscape.
- MacDonald, S.O. and J.A. Cook. 1996. The land mammal fauna of southeast Alaska. *Canadian Field-Naturalist* 110:571–599.

**Bibliography** (continued)

- MacDonald, S.O. and J.A. Cook. 1998. *Castor canadensis* Kuhl 1820, beaver; American beaver. In: D.J. Hafner, E. Yensen, and G.L. Kirkland, Jr., editors. North American rodents: status survey and conservation action plan. IUCN/SSC Rodent Specialist Group. Gland, Switzerland and Cambridge, UK. p. 59–60
- MacDonald, S.O. and J.A. Cook. 2000. The mammal fauna of southeast Alaska. Unpublished thesis. University of Alaska Museum, Fairbanks. 141 p.
- MacDonald, S.O., J.A. Cook, Gordon L. Kirkland, Jr., and Eric Yensen. 1998. *Microtus pennsylvanicus* (Ord 1815), meadow vole. In: D.J. Hafner, E. Yensen, and G.L. Kirkland, Jr., editors. North American rodents: status survey and conservation action plan. IUCN/SSC Rodent Specialist Group. Gland, Switzerland and Cambridge, UK. p. 99–101
- Runck, A. 2001. Molecular and morphological perspectives on post-glacial colonization of *Clethrionomys rutilus* and *Clethrionomys gapperi* in Southeast Alaska [MS thesis]. University of Alaska, Fairbanks. 89 p.
- Small, M., K.D. Stone, and J.A. Cook. 2003. American marten (*Martes americana*) population structure across a landscape fragmented in time and space. *Molecular Ecology* 12:69–103.
- Smith, W.P., J.V. Nichols, and S.M. Gende. In Press. The northern flying squirrel as a management indicator species of north temperate rainforest: test of a hypothesis. *Ecological Applications*.
- Smith, W. P. In Press. Evolutionary diversity and ecology of endemic small mammals of southeastern Alaska with implications for land management planning. *Landscape and Urban Planning*. 21 p.
- Smith, W.P., J.V. Nichols, and S.M. Gende. 2004. Ecological correlates of flying squirrel microhabitat use and density in temperate rain forests of southeastern Alaska. *Journal of Mammalogy* 84(4):663–674.
- Smith, W.P. and J.V. Nichols. 2004. Demography of two endemic forest-floor mammals in southeastern Alaskan temperate rain forest. *Journal of Mammalogy* 85(3):540–551.
- Smith, W.P. and J.V. Nichols. 2003. Demography of the Prince of Wales flying squirrel (*Glaucomys sabrinus griseifrons*): an endemic of southeastern Alaskan temperate rain forest. *Journal of Mammalogy* 84(3):144–158.
- Stone, K.D. and J. Cook. 2001. Molecular evolution of the Holarctic genus *Martes*. *Molecular Phylogenetics and Evolution* 24:169–179.

**Bibliography** (continued)

- Stone, K., R. Flynn, and J. Cook. 2002. Post-glacial colonization of northwestern North America by the forest associated American marten (*Martes americana*). *Molecular Ecology* 11:2049–2063.
- Keister, A.R. and C. Eckhardt. 1994. Review of wildlife management and conservation biology on the Tongass National Forest: a synthesis with recommendations. USDA Forest Service Pacific Northwest Research Station, 3200 SW Jefferson Way, Corvallis, OR 97331.
- West, E.W. 1991. Status reports on selected Alaskan mammals of ecological concern. Unpublished report. AKNHP, Anchorage. 122 p.

## **Southwest Alaska/Bering Sea Insular Endemic Small Mammals**

**A. Species group description**

**Common name:** Southwest Alaska/Bering Sea insular endemic voles, lemmings and shrews.

**Scientific names:** *Sorex pribilofensis*, *S. jacksoni*, *Dicrostonyx groenlandicus stevensoni*, *D. g. unalascensis*, *D. g. exul*, *Lemmus trimucronatus harroldi*, *L. t. nigripes*, *Microtus abbreviatus abbreviatus*, *M. a. fisheri*, *Microtus oeconomus amakensis*, *M. o. innuitus*, *M. o. punukensis*, *M. o. unalascensis*, *Clethrionomys rutilus albiventer*

**B. Distribution and abundance**

**Range:**

Global range comments: Not found outside Alaska.

State range comments: Taxa restricted to islands within western Alaska and Bering Sea.

**Abundance:**

Global abundance comments: NA

State abundance comments: Unknown; anecdotal information suggests substantial fluctuations.

**Trends:**

Global trends: NA

State trends: Presumably at undisturbed levels, population levels likely cyclical and/or irruptive.

**C. Problems, issues, or concerns for species group**

- Species or subspecies with naturally restricted distributions and therefore small populations.
- Relictual, cold-adapted (tundra) populations that will likely be compromised by warmer climate.
- Limited data on population distinctness, habitat requirements, and population size.
- Possible threat from proposed efforts to control Norway rats with poisoned baits.
- Introduction of exotic species to islands.

**D. Location and condition of key or important habitat areas**

Specific islands in the Bering Sea, including the eastern Aleutian Islands and the western Gulf of Alaska. Habitat areas largely pristine but threatened by warming climate and possible human activities.

**E. Concerns associated with key habitats**

- Possible threat from feral or introduced predators or competitors.
- Possible habitat degradation from livestock grazing and/or other introductions on some islands.
- Warming climate may threaten habitat.

**F. Goal:** Ensure Southwest Alaska/Bering Sea insular endemic small mammals remain sustainable throughout their range within natural population-level variation and historical distribution in Alaska.

**G. Conservation objectives and actions**

**Objective:** Acquire a full understanding of population and/or taxonomic distinctness and habitat use to conserve these taxa.

**Target:** Measures of the genetic distinctness of the known taxa and screening for potentially undetected subpopulations; delineation of the habitat requirements.

**Measure:** Estimates of genetic divergence with small confidence intervals. Populations maintain present and historical distributions. (Absolute population size and/or density will likely be difficult to understand even with several years' data.)

**Issue:** Population densities are cyclical and/or irruptive, and extent of habitat use is greater at higher population densities; therefore, short-term estimations of density and extent of habitat are not predictive.

**Conservation actions:**

- a) Collect and archive material for genetic analyses.
- b) Conduct genetic and taxonomic analyses.
- c) Develop fine-scale delineation of the geographic occurrence.

**H. Plan and time frames for monitoring species and their habitats**

An immediate intensive effort of 4 years duration to (a) acquire material for genetic analysis and (b) establish the extent of variability in population density and habitat use. USFWS is a potential partner because most species occur on the Alaska Maritime National Wildlife Refuge. Determination of extinction risk to the southernmost populations of collared lemmings is a priority, because of global climate change.

**I. Recommended time frame for reviewing species status and trends**

Every 5 years.

**J. Bibliography**

- Cook, J.A. 1998a. *Dicrostonyx exsul* G.M. Allen 1919, St. Lawrence Island collared lemming and *Dicrostonyx unalascensis* Merriam 1900, Unalaska collared lemming. In: D.J. Hafner, E. Yensen, and G.L. Kirkland, Jr., editors. North American rodents: status survey and conservation action plan. IUCN/SSC Rodent Specialist Group. Gland, Switzerland and Cambridge, UK. p. 87–89.
- Cook, J.A. 1998b. *Microtus abbreviatus* Miller 1899, insular vole. In: D.J. Hafner, E. Yensen, and G.L. Kirkland, Jr., editors. North American rodents: status survey and conservation action plan. IUCN/SSC Rodent Specialist Group. Gland, Switzerland and Cambridge, UK. p. 89–90.
- Fay, F.H. and J.L. Sease. 1985. Preliminary status of selected small mammals. Unpublished final report, Endangered Species Office, USFWS. 53 p.
- Galbreath, K.E. and J.A. Cook. 2004. Genetic consequences of Pleistocene glaciations for the tundra vole (*Microtus oeconomus*) in Beringia. *Molecular Ecology*, 13:135–148.
- Lance, E.W. and J.A. Cook. 1998. *Microtus oeconomus* (Pallas 1776), tundra vole. In: D. J. Hafner, E. Yensen, and G. L. Kirkland, Jr., editors. North American rodents: status survey and conservation action plan. IUCN/SSC Rodent Specialist Group. Gland, Switzerland and Cambridge, UK. p. 97–99.
- MacDonald, S.O. and J.A. Cook. In Prep. Catalog of the recent mammals of Alaska. 323 p.

## Montague Island Marmot

**A. Species description**

**Common name:** Montague Island Marmot

**Scientific name:** *Marmota caligata sheldoni*

**B. Distribution and abundance**

**Range:**

Global range comments: Montague Island

State range comments: Montague Island

**Abundance:**

Global abundance comments: N/A

State abundance comments: Extremely rare or extinct

**Trends:**

Global trends: N/A

State trends: Unknown (last seen in mid 1970s)

**C. Problems, issues, or concerns for species**

*Potential*

- Extirpation or extinction
- Predation by brown bears
- Forest habitat modification
- Isolation: island endemic
- Vulnerability to population effects due to disease or other stochastic factors

**D. Location and condition of key or important habitat areas**

- Believed to be restricted to timberline regions of Montague Island (NatureServe 2000), Montague Island marmots also may use talus slopes at lower elevations (Holbrook 1999). However, hoary marmots on neighboring Hinchinbrook Island, Prince William Sound, are typically found on the beach during the summer months.
- Vancouver Island marmots prefer subalpine meadows but also have been found occupying steep cliffs, talus, open meadows with southern exposure, and logging-slash areas (Bryant and Janz 1996; Dearden 1986; Heard 1977).
- Condition of key or important habitat areas for this species is unknown.

**E. Concerns associated with key habitats**

Since the late 1980s, Vancouver Island marmot populations have undergone a documented population decline of 60–70 percent (Bryant 1998). Bryant (1996) found reduced persistence of Vancouver Island marmots occupying clearcuts, and survival rates were significantly lower in second-growth stands more than 11 years old (Bryant 1998). Moreover, the population “sink” phenomenon exhibited in clearcuts limited sources for recolonization of natural habitats. Vancouver Island marmot populations became concentrated, further reducing the probability of survival by making colonies more susceptible to predators and disease (Bryant 1998).

**F. Goal:** Determine if Montague Island marmot populations exist, and if so, ensure that they remain sustainable throughout their limited range within natural population variation.

## **G. Conservation objectives and actions**

**Objective:** Determine if any Montague Island marmots still exist, and if so, obtain sufficient population, distribution, trend, habitat, and taxonomic information to assist in conservation of the species.

**Target:** Complete understanding of occurrence, distribution, population size, trends, habitat use, and taxonomy.

**Measure(1):** Validation of occurrence and documentation of distribution

**Measure(2):** Index of population size and monitoring of trends

**Measure(3):** Determination/delineation of habitat use

**Measure(4):** Validation of taxonomy.

**Issue 1:** The current status is unknown; Montague Island marmots are possibly extinct or extirpated.

### **Conservation actions:**

- a) Conduct helicopter surveys in spring and foot surveys in early summer to validate occurrence and document distribution.
- b) Collect genetic material to validate taxonomy.

**Issue 2:** Habitat use by marmots is unknown. Montague Island habitat modification has been underway for some time and may continue; timber is on a rotation schedule.

**Conservation action:** Determine habitat associations and islandwide distribution.

**Issue 3:** Predation, hunting, and disease may or may not be an issue, and scale of this may be dependent on hunting regulations; inflated brown bear populations and deer introductions may cause adverse effects. Hoary marmots are managed by ADF&G as a furbearer (Alaska Board of Game 1998-99); there is no closed season or bag limit.

**Conservation action:** Consider regulatory actions related to hunting and trapping seasons for marmots on Montague Island.

**Issue 4:** Introduction of exotics (past and future) can adversely affect genetics and survival of indigenous marmots.

**Conservation action:** Restrict any further mammalian introductions on Montague Island until marmot issues are resolved.

**Issue 5:** Marmots may act as reservoirs for diseases, such as tularemia and sylvatic plague, and may harbor the tick vectors of other diseases, such as Lyme disease and babesiosis (Eadie 1954).

**Conservation action:** Conduct parasitology study on Montague Island marmots.

**H. Plan and time frames for monitoring species and their habitats**

- Helicopter survey to verify existence should be conducted as soon as possible, e.g., as early as spring of 2005.
- Population trend should be monitored annually for 10 years.
- Habitat study and taxonomic evaluation should be conducted upon verifying that these marmots still exist.
- The USFS, USFWS, University of Alaska Museum, and Chugach Alaska Corporation are possible partners.

**I. Recommended time frame for reviewing species status and trends**

Ten years, or at more frequent intervals in response to additional information.

**J. Bibliography**

- Alaska Board of Game. 1998–1999. Alaska trapping regulations. Juneau, AK: ADF&G. 48 p.
- Bryant, A.A. 1996. Reproduction and persistence of Vancouver Island marmots (*Marmota vancouverensis*) in natural and logged habitats. *Canadian Journal of Zoology*. 74:678–687.
- Bryant, A.A. 1998. Metapopulation ecology of Vancouver Island marmots (*Marmota vancouverensis*) (endangered species). Unpublished Ph.D. dissertation. Canada: University of Victoria. 125 p.
- Bryant, A.A.; Janz, D.W. 1996. Distribution and abundance of Vancouver Island marmots (*Marmota vancouverensis*). *Canadian Journal of Zoology*. 74:667–677.
- Cook, J.A. 1998. *Marmota caligata* (Eschscholtz 1829) Hoary marmot. Pages 39-41 in: Hafner, D., Yensen, E., Kirkland, G.L., Jr., editors. North American rodents. Status survey and conservation action plan. Gland, Switzerland, and Cambridge, UK: International Union for Conservation of Nature and Natural Resources.
- Dearden, P. 1986. Status of the Vancouver Island marmot—an update. *Environmental Conservation*. 13:168.
- Eadie, W.R. 1954. Animal control in field, farm, and forest. New York: Macmillan Co. 257 p.
- Heard, D.C. 1977. The behavior of Vancouver Island marmots *Marmota vancouverensis*. Unpublished Ph.D. dissertation. University of British Columbia Vancouver. 129 p.
- Holbrook, K. 1999. Personal communication. Oil spill liaison, Chugach National Forest, 3301 “C” Street, Suite 300, Anchorage, AK 99503.
- Howell, A.H. 1915. Revision of the American marmots. *North American Fauna* 37:1–80

**Bibliography** (continued)

Lance, E.W. 2002. Montague Island marmot: a conservation assessment. Gen.Tech. Rep. PNW-GTR-541. Portland, OR: USFS, Pacific Northwest Research Station. 12 p.

NatureServe. 2000. NatureServe: an online encyclopedia of life [Web application]. Version 1.0. Arlington, VA: Association for Biodiversity Information. <http://www.natureserve.org/>. November 21, 2000).

## Kenai Peninsula Endemic Smaller Mammals

### A. Species group description

**Common names:** Kenai red squirrel and Kenai marten

**Scientific names:** *Tamiasciurus hudsonicus kenaiensis*, *Martes americana kenaiensis*

### B. Distribution and abundance

**Range:**

Forested habitat of Kenai Peninsula (red squirrel, marten).

**Abundance:**

Unknown for red squirrels; presumably abundant where they occur. Marten are considered rare west of the Kenai Mountains in Game Management Unit (GMU) 15 on the Kenai Peninsula (ADF&G 1978). In GMU 7, east of the Kenai Mountains, approximately 70 marten are harvested on an annual basis (T. McDonough, ADF&G, personal communication).

**Trends:**

No data for red squirrels or marten. Based on trapping data, marten populations fluctuate every 3 to 5 years (T. McDonough, ADF&G, personal communication).

### C. Problems, issues, or concerns for species group

**Existing**

- Forest loss due to bark beetle infestation on unprecedented scale

**Potential**

- Replacement of standing forest with grasslands.
- Different forest management practices may have different effects on red squirrels and marten and their forage and prey species (e.g., salvage logging vs. burning).
- Declines in squirrel population could adversely affect predators (e.g., goshawk).
- Small, isolated populations of marten may be at risk from habitat loss and overtrapping.

**D. Location and condition of key or important habitat areas**

Spruce forests (existing and historical); habitat condition is degraded to very degraded as a result of extensive bark beetle infestation on the Kenai Peninsula.

**E. Concerns associated with key habitats**

See section C above.

**F. Goal:** Ensure Kenai Peninsula endemic small mammals remain sustainable throughout their range within natural population-level variation and limited historical distribution in Alaska.

**G. Conservation objectives and actions**

**Objective:** Acquire a full understanding of population and/or taxonomic distinctness and a delineation of habitat usage to inform management decision-making.

**Target:** Complete understanding of red squirrel and marten distribution and demographics on the Kenai Peninsula.

**Measure(1):** Index of genetic and/or taxonomic uniqueness relative to mainland populations of red squirrels and marten.

**Measure(2):** Determination of density of red squirrels and marten by habitat type.

**Issue 1:** The current distribution and abundance of red squirrels or marten on the Kenai Peninsula is unknown, particularly in relation to forest landscape change.

**Conservation actions:**

- a) Conduct inventories for red squirrels throughout the Kenai Peninsula, saving voucher specimens for archival in an accredited natural history collection.
- b) Gather harvest information on Kenai marten and obtain carcasses and tissue samples from trappers for archival at a natural history museum.
- c) Conduct studies that estimate density of red squirrel and marten in various habitat types; a landscape level analysis can then be conducted to determine effects of change in forested habitats.

**Issue 2:** The level of genetic isolation and taxonomic distinctness are unknown for Kenai populations.

**Conservation action:** Conduct standard phylogeographic and/or population genetic assessment.

**H. Plan and time frames for monitoring species and their habitats**

Conduct inventory for red squirrels across the Kenai Peninsula. Gather harvest information on Kenai marten. Collect voucher specimens of both species to be archived (including frozen tissues), and perform phylogeographic and population genetics studies. ADF&G, USFWS, and USFS should share responsibility.

**I. Recommended time frame for reviewing species status and trends**

Every 5 years.

**J. Bibliography**

ADF&G. 1978. Alaska's wildlife and habitat. Vol. 2. Anchorage, AK. 74 p. + maps.

MacDonald, S.O. and J.A. Cook. In Prep. Catalog of the recent mammals of Alaska. 323 manuscript pages.

## Alaska Marmot and Barrow Ground Squirrel

### A. Species description

**Common names:** Alaska marmot and Barrow ground squirrel (the North Slope population of arctic ground squirrel ) (Howell 1938, Dufresne 1946)

**Scientific names:** *Marmota broweri* and *Spermophilus parryii kennicottii*

### B. Distribution and abundance

**Range:**

Alaska marmot: Northern Alaska, possibly northern Yukon Territory. Known from only a dozen or so localities, including relatively recent records [University of Alaska Museum (UAM)] south of the Brooks Range in the Ray Mountains northwest of Rampart and in the Kokrines Hills on the north side of the Yukon River northeast of Ruby (MacDonald and Cook, in prep.)

Barrow ground squirrel: Northern Alaska, Yukon Territory, and northwestern Northwest Territory (MacDonald and Cook, in prep.).

**Abundance:**

Marmot: Patchily distributed and widely scattered as individuals or in loose colonies (Hoffman 1999).

Ground Squirrel: Uncertain.

**Trends:**

No data.

### C. Problems, issues, or concerns for species

**Existing**

- Marmot: Uncertain
- Barrow ground squirrel: Uncertain

**Potential**

- Marmot:
  - a) Low population densities
  - b) Patchy distribution
  - c) Skyward retreat of alpine habitat and northerly expansion of tree line
  - d) Major industrial coal and hard rock mining development with the potential for habitat fragmentation
- Barrow ground squirrel:
  - a) Taxonomy of arctic ground squirrels at intraspecific level is uncertain; North Slope population may represent cryptic endemic and/or genetically isolated lineage (Eddingsaas 2001; Eddingsaas et al., in press).

**D. Location and condition of key or important habitat areas**

- Boulder fields, talus slopes, rocky outcrops in alpine and subalpine tundra habitat (marmot).
- Mountains, foothills, and coastal plains of Northern Alaska (ground squirrel).
- Habitat condition overall thought to be very good to pristine except in areas of disturbance associated with major resource development.

**E. Concerns associated with key habitats**

See Section C above.

**F. Goal:** Ensure Alaska marmot and Barrow ground squirrel populations remain sustainable throughout their range within natural population-level variation and historical distribution across Alaska.

**G. Conservation objectives and actions**

**Objective A:** Conserve and maintain marmot distribution and abundance of Alaska marmot.

**Target:** Fully documented distribution and abundance of Alaska marmots.

**Measure:** Abundance and mapped distribution of Alaska marmots as determined by surveys of index areas in potential habitat.

**Issue 1:** Current distribution of marmots is poorly known.

**Conservation actions:**

- a) Conduct aerial and ground surveys to identify populations throughout known and suspected range.
- b) Collect voucher specimens for archival in an accredited natural history museum.

**Issue 2:** Effects of patchy habitat distribution on marmot population subdivision and genetic isolation are unknown.

**Conservation action:** Conduct phylogeographic and population genetic studies.

**Issue 3:** Alpine tundra habitat used by marmots may be retreating both northward and skyward as a result of global climate change.

**Conservation action:** Establish long-term monitoring program to identify marmot population shifts in these habitats.

**Objective B:** Maintain the current distribution of Barrow ground squirrels after first determining the species' taxonomic status.

**Target:** Fully documented distribution of Barrow ground squirrels.

**Measure:** Distribution of Barrow ground squirrels as determined by surveys of index areas in potential habitat.

**Issue:** Taxonomic status and distribution of ground squirrels occurring in northern Alaska is uncertain (e.g., may be a distinct species or genetically isolated population).

**Conservation action:** Conduct molecular and morphological taxonomic assessment and survey to determine their range.

**H. Plan and time frames for monitoring species and their habitats**

Potential partners include the mining industry, NPS, BLM, DOI - MMS and USFWS, whose holdings in northern Alaska support populations of both species, and an accredited natural history museum as a research partner and repository for archived voucher material. Complete taxonomic assessment and survey within 10 years.

**I. Recommended time frame for reviewing species status and trends**

No specific suggestion made.

**J. Bibliography**

Dufresne, F. 1946. Alaska's animals and fishes. A.S. Barnes and Co., New York. 297 p.

Eddingsaas, A.A. 2001. The effects of Pleistocene glacial processes on Beringia: the evolutionary history of the arctic ground squirrel (*Spermophilus parryii*). Unpublished thesis. Idaho State University, Pocatello. 43 p.

Eddingsaas, A.A., B.K. Jacobsen, E.P. Lessa, and J.A. Cook. In Press. Evolutionary history of the arctic ground squirrel (*Spermophilus parryii*) in Nearctic Beringia.

Howell, A.H. 1938. Revision of the North American ground squirrels, with a classification of the North American Sciuridae. North American Fauna 56:1–256.

MacDonald, S.O. and J.A. Cook. In Prep. Catalog of the recent mammals of Alaska. 323 manuscript pages.