

Montague Island Marmot: A Conservation Assessment

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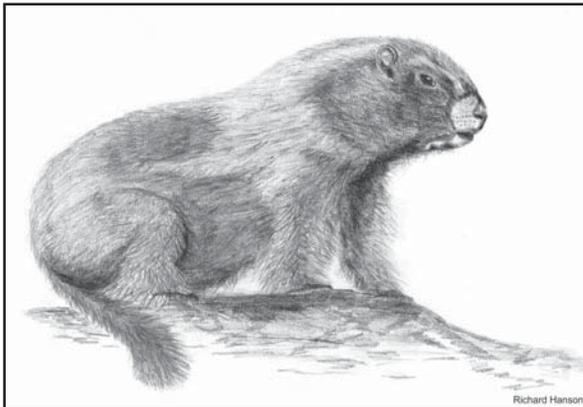
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Abstract

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The hoary marmot, from Montague Island, south-central Alaska, was classified as a distinct subspecies based on smaller size and skull characteristics relative to other island and mainland populations. The taxonomic validity of the Montague Island marmot (*Marmota caligata sheldoni*) is questionable, as conclusions were based on the analysis of no more than eight specimens. With the exception of one relatively recent sight record, Montague Island marmots have not been reported or collected since the early 1900s. A conservation concern exists, particularly owing to the unknown population status and questionable taxonomy of this island endemic subspecies that may be negatively affected by land management practices.

Keywords: Hoary marmots, island endemics, *Marmota caligata sheldoni*, Montague Island, Montague Island marmot, taxonomy.



Montague Island Marmot

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The Prince William Sound region has generally heavy annual precipitation and cool mean annual temperatures. During a year of extremely high rainfall, 840 cm of precipitation was recorded from southeastern Montague Island, and mean annual precipitation in the Montague Island vicinity ranged from 236 cm at Latouche Island to 216 cm at Hinchinbrook Island (Brower and others 1988). In addition, mean annual maximum temperatures ranged from 7.3 °C at Latouche Island to 9.6 °C at Hinchinbrook Island, and mean annual minimum temperatures ranged from 3.1 °C at Latouche Island to 4.1 °C at Hinchinbrook Island (Brower and others 1988).

Vegetation was described following Viereck and others (1992), and varies by altitude (Lance and Cook 1995, Weintraub and Cook 1991). Beach-rye (*Elymus arenarius* Linnaeus) dominates the shorelines and Sitka spruce (*Picea sitchensis* (Bongard) Carriere) and alder (*Alnus* spp. Mill) on alluvial deposits; sedge-moss bog meadows, sweetgale (*Myrica gale* Linnaeus)-graminoid bogs, and willow (*Salix* spp. Linnaeus)-graminoid shrub bogs are interspersed among Sitka spruce and western hemlock (*Tsuga heterophylla* (Rafinesque-Schmaltz) Sargent) forests at mid-elevation; and mountain hemlock (*Tsuga mertensiana* (Bongard) Sargent) and mountain-heath (*Phyllodoce aleutica* (Sprengel) Heller) tundra dominates high-elevation community types. (Species names are according to Hulten 1968.)

Where previous timber harvest has occurred, forest stands regenerate naturally and currently contain even-aged stands of western hemlock and Sitka spruce (USDA Forest Service 1989, Weintraub and Cook 1991).

A Brief History of Human Use of Montague Island

Historically, Montague Island supported small populations of humans from as early as 2000 years BP (Yarborough 1999). Local Eskimos used Montague Island's southeastern coast as a hunting ground for sea otters. The Eskimos referred to Montague Island as Sukluk, which translates to the terrible island (Johnson 1999), presumably because of its violent eastern shoreline. Although,

a village at Zaikof Bay persisted for some unknown length of time (Johnson 1984), currently, there are no human inhabitants on Montague Island.

Montague Island is largely federally owned (787 km²) (USDA Forest Service 1993); however, 63 km² were conveyed to the Chugach Alaska Corporation, under the authority of the Alaska Native Claims Settlement Act (ANCSA 1971). A 56-km-long road, constructed in 1993, which linked the deep-water port at McLeod Harbor to Chugach Alaska Corporation land at Patton Bay (USDA Forest Service 1989), was obliterated in 1997. Public lands on Montague Island are managed by the USDA Forest Service, Chugach National Forest, Cordova Ranger District. Private lands are managed by the Chugach Alaska Corporation, Anchorage, Alaska.

Between 1947 and 1973 about 12 km² of high-volume timber was harvested along the western coast of Montague Island (USDA Forest Service 1989). Those stands regenerated naturally and currently contain uniform stands of western hemlock and Sitka spruce that are densely vegetated by salmonberry (*Rubus spectabilis* Pursh) (USDA Forest Service 1989, Weintraub and Cook 1991). In 1992, 55.5 km of road was constructed across public land to access about 48.5 km² of privately owned forest near Patton Bay. Within the 48.5 km², about 16 km² of merchantable timber was clearcut during a 6-year period. Additionally, 3 million board feet of timber was harvested from the McLeod Harbor area in 1998 (Jandro 1999). Recreational cabins, maintained by the USDA Forest Service, are located at Port Chalmers, San Juan Bay, and Nellie Martin River.

Sitka black-tailed deer (*Odocoileus hemionus* Rafinesque), introduced to Prince William Sound in the early 1950s (Burriss and McKnight 1973), and brown bear (*Ursus arctos* Linnaeus) have been heavily hunted on Montague Island. As a result, bear populations were seriously depleted. In 1990, the Alaska Department of Fish and Game closed the fall bear hunting season (Alaska Board of Game 1990) and in 1994 completely closed Montague Island to bear hunting by emergency order followed by an Alaska Board of Game ruling (Alaska Board of Game 1994). Bear

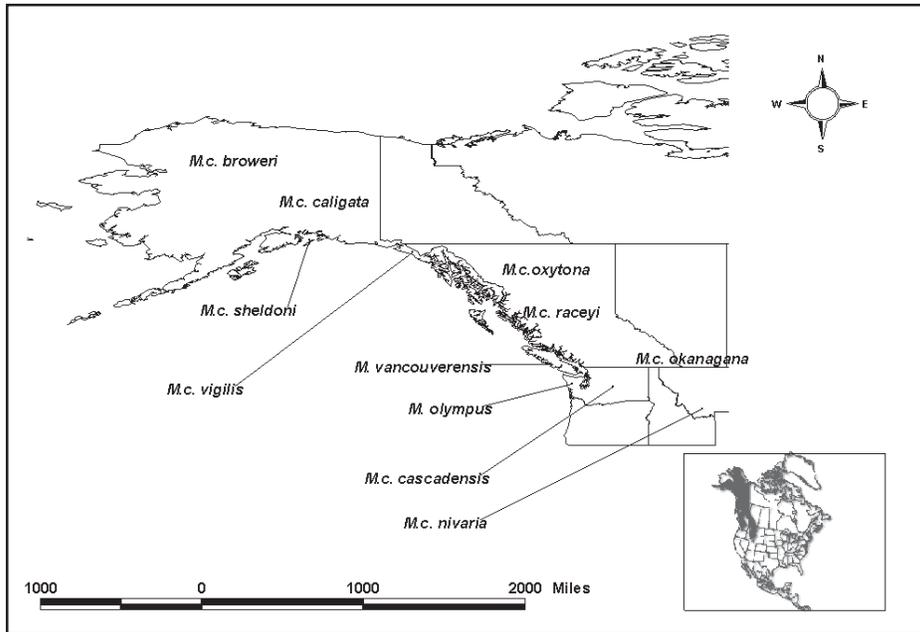


Figure 2—Distribution of hoary marmots in North America (insert), with subspecies locations identified.

hunting on Montague Island remains closed at this writing (Crowley 1999). Additionally, mink (*Mustela vison* Schreber) were introduced to Montague Island in the early 1950s and are present today at an unknown density (Burriss and McKnight 1973).

Current Status of the Montague Island Marmot

Population status—Specimens of Montague Island marmot have not been collected since 1905 and 1908 (Cook 1998). One adult male, collected in May 1905, is housed at the U.S. National Museum, District of Columbia (Howell 1914). Five adult males and two adult females collected in summer 1908 by Heller (1910) are housed at the Museum of Vertebrate Zoology, Berkeley, California (Howell 1915).

During the early zoological expedition in south-central Alaska, hoary marmots (*M. caligata* Eschscholtz) were reportedly “everywhere on the mainland along the shores of Prince William Sound” and less abundant on the islands (Heller 1910). Heller (1910) reports no marmots were present on Hawkins Island; however, the subspecies *M. c. caligata* (Eschscholtz) later was

reported there (Klein 1965), and marmot bones have been found in 2,000-year-old middens at an archaeological site on Hawkins Island (Yarborough 1999).

On Vancouver Island, endemic marmots (*M. vancouverensis* Swarth) are endangered and typically are found at elevations above 1000 m (Bryant and Janz 1996). Searches for marmots in subalpine and alpine habitats of Montague Island within the last decade have been unsuccessful (Cook 1999, Fay and Sease 1985, Youkey 1999). The recent sight records of four vocalizing Montague Island marmots were made in May 1978 along the northwestern coast near sea level (Holbrook 1999). Moreover, it is not uncommon to see hoary marmots on the beach on Hinchinbrook Island in Prince William Sound (Lance 1991).

Currently, the Montague Island marmot is not provided any protective status. It has been assigned the threat category data deficient by the International Union for the Conservation of Nature (Cook 1998) and classified s2s3 by the National Heritage Program because it occurs only on one island, its population size and trends are unknown, and there is a potential threat of habitat loss from logging (NatureServe 2000).

Population concerns—Based on their limited, known distribution and questionable taxonomic status, Montague Island marmots are a population of concern. It is unknown how development will affect the population, because there are no recent data to support a decision.

Review of Technical Knowledge

Distribution

Hoary marmots occur throughout much of Alaska, and south along the coast through western Canada and into high elevations of the Northwestern United States, including western Montana (fig. 2) (Cook 1998, Nowak 1991). Isolated populations of hoary marmots are known from two islands in Prince William Sound, Alaska: Hinchinbrook Island (*M. c. caligata*) and Montague Island (*M. c. sheldoni*).

The endemic Montague Island marmot was reported in July of 1908 in alpine habitat, near timberline (approximately 300 m), at Hanning and Zaikoff bays (Heller 1910). Since those first records, the Montague Island marmot has not been reported, except by Holbrook (1999) along the northeastern coastline, on talus slopes.

Systematics

Marmots are the largest of the ground squirrels (subfamily Scuririnae), and in North America they are separated into six distinct species. Hoary marmots are thought to have originated in North America (Kruckenhauser and others 1999, Steppan and others 1999), but are allied closely with the Old World alpine marmots (*M. marmota* Linnaeus) (Steppan and others 1999); in fact, Rausch and Rausch (1971) described hoary marmots as a subspecies of Eurasian alpine marmots. Hoffman and others (1979) placed hoary marmots within the amphiberian group, closely related to *M. camtschatica* (Pallas) of northeastern Eurasia, based on cranial characteristics (Lee and Funderburg 1982); however, this hypothesis recently has been rejected (Steppan and others 1999). Eight subspecies of hoary marmots are recognized, with Montague Island marmots occurring only on Montague

Island in Prince William Sound, south-central Alaska (Lee and Funderburg 1982). The extensive distribution of the mainland form (*M. c. caligata*) includes other Prince William Sound islands and the surrounding mainland (Howell 1915).

The smaller size of the Montague Island marmots is the basis for their separate subspecies designation. Skull character differences included more narrow premaxillae and shorter nasals than those of mainland subspecies of hoary marmot (Cook 1998, Howell 1914). Moreover, Hoffmann and others (1979) concurred with Howell (1914) that Montague Island marmots were a smaller subspecies than the mainland population.

Breeding Biology and Demography

Marmots are sexually dimorphic; adult males are larger than females (Godin 1977, Jackson 1961). Periods of mating, gestation, parturition, appearance of young from the burrow, and litter size differ as a result of latitude and altitude (Lee and Funderburg 1982). In south-central Alaska, hoary marmots are monogamous and breed biennially or triennially (Holmes 1979, 1984). Young are born in burrows under rock jumbles or talus slopes in late June to mid-July (Holmes 1979).

Movements

Hoary marmots are highly social (Barash 1974a). Colonies of hoary marmots in south-central Alaska are composed of a single adult male-female pair and their two to five young (Holmes 1979). Old World marmot males allow females and yearlings to enter their territory but are agonistic toward other adult males (Barash 1976). Hoary marmots in Alaska, however, do not appear agonistic toward any colony resident, but intercolonial encounters may be aggressive (Holmes 1979). In general, young marmots disperse sometime between the first and fifth year (Arnold 1990, Lee and Funderburg 1982), but hoary marmots have not been reported in their natal colony past year three (Holmes 1984). Dispersal in Olympic marmots (*M. olympus* Merriam) is gradual and initiated by the young (Barash 1973). A dispersal distance of 7.4 km has been reported for Vancouver Island marmots (Bryant 1996).

Habitat Use

Marmots generally occupy open habitats, such as alpine meadows and forest edge. Hoary marmots occur at high elevations, near timberline, on talus slopes and alpine meadows (Lee and Funderburg 1982). Vancouver Island marmots typically are found above 1000 m (Bryant and Janz 1996), and Old World alpine marmots inhabit elevations from 800 to 3200 m, possibly because of thermo-regulatory constraints (Turk and Arnold 1988). Montague Island marmots have been observed at much lower elevations (Heller 1910, Holbrook 1999). The northern latitude and maritime climate of Montague Island may temper thermoregulatory constraints and allow Montague Island marmots to avoid overheating.

Marmots excavate burrows with several entrances in well-drained soil. Burrows are usually more than 1 m deep, but hibernation burrows may be 5 to 7 m deep (Nowak 1991). Burrows may be located on open, grassy slopes (Svendsen 1974), in a wooded area in winter and open less sloped area in summer (Godin 1977), or under the border of a rock slide (Banfield 1974).

Information collected about habitat preference of marmots is varied. Hoary marmots dwell in alpine tundra, open-rolling meadows, rocky talus, and cliffs (Banfield 1974). In south-central Alaska, hoary marmots were studied in flat meadows about 300 m above tree line (Holmes 1984). 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).

Food Habits

Marmots feed mainly on green vegetation, especially grasses and forbs. Hoary marmots from the Kenai Peninsula, south-central Alaska, commonly eat legumes (*Oxytropis* Candolle, *Astragalus* Linnaeus), sedges, fleabane (*Erigeron* Linnaeus), and fescues (*Festuca* Linnaeus) (Barash 1989). Other genera, such as *Dryas* Linnaeus, *Salix*, and *Vaccinium* Linnaeus, are

avoided (Hansen 1975). Dietary studies of Vancouver Island marmots indicate that as summer progresses, the proportion of grasses eaten declines and forb consumption increases (Martell and Milko 1986).

The areas surrounding their dens often are heavily grazed (Banfield 1974). During summer, marmots accumulate fat reserves, and weight loss during hibernation can be as much as 37 percent of total body weight (Lee and Funderburg 1982).

Effects of Land Management and Other Human Activities

Some marmot species, such as the woodchuck (*M. monax* Linnaeus), are considered pests because of depredations on crops and hazards posed by burrows to farm machinery and livestock (Nowak 1991). Furthermore, population numbers of woodchucks may have been reduced locally in Wisconsin through shooting during a pest eradication effort (Jackson 1961). Woodchucks are important game animals in some areas; in Kentucky, about 267,500 were taken from 1964 to 1971 (Barbour and Davis 1974).

Some marmot populations seem to benefit from deforestation (Barash 1989), maintenance of pastures, and elimination of large predators (Banfield 1974). Other species of marmots, such as Vancouver Island marmots, however, have suffered drastic population declines, possibly owing to environmental disruption (Dearden 1986, Thornback and Jenkins 1982). Since the late 1980s, Vancouver Island marmot populations have undergone a documented population decline of 60 to 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).

Conservation Concerns

Demographics

Reproductive potential—Marmots are generally sexually mature at 2 to 4 years old (Banfield 1974; Barash 1973, 1974b; Bryant 1996; Dearden and Hall 1983; Lee and Funderburg 1982), but Bryant (1996) reports sexual maturity in Vancouver Island marmot ranges from 3 to 5 years old. Marmots are monestrous, having one estrous cycle per year (Lee and Funderburg 1982), and hoary marmots in Alaska are reported to breed every 2 to 3 years (Holmes 1984). Mating typically occurs within the first 2 weeks of emergence from hibernation (Holmes 1984). Gestation lasts 25 to 30 days. Litter size averages four to five in hoary marmots (Banfield 1974), but Holmes (1979, 1984) found litter size of hoary marmots in south-east Alaska averaging two to five.

Population density—Population density is difficult to measure and is variable among marmots, ranging from 2 to 15 animals per km² (Jackson 1961, Nowak 1991).

Survival

Natural mortality—Marmots are relatively long lived. The average lifespan is 3 to 5 years in Old World marmots (Nowak 1991), and 3 to 6 years in woodchucks (Godin 1977, Lee and Funderburg 1982). Vancouver Island marmots also have been documented to have a relatively long lifespan, the oldest being 9 years (Bryant 1996).

Naturally occurring predators on Montague Island may include raptors and brown bears. Mink were introduced to Montague Island in the early 1950s (Burriss and McKnight 1973) and are present today at an unknown density. River otters (*Lontra canadensis* Schreber) also occur on Montague Island, but there is probably little habitat overlap with marmots.

Bald eagles (*Haliaeetus leucocephalus* Linnaeus) are common on Montague Island, and are probably the marmot's main predator (Banfield 1974). In 1991, I observed great horned owls (*Bubo virginianus* Gmelin) on the island. Even though there are only a few hours of darkness during summer

at northern latitudes, there may be little overlap between diurnal marmots and nocturnal owls.

Brown bears are known to feed on marmots, putting out great efforts digging them out at their dens (Banfield 1974). Because coastal Alaska brown bears feed heavily on the salmon (*Oncorhynchus* spp. Walbaum) that return to their natal freshwater streams, it is not known how much predation pressure might be placed on the marmot. However, predation on marmots may occur in spring before the first salmon runs. This protein source may be vital to bear survival after winter denning.

Fleas, mites, ticks, and nematodes parasitize marmots (Godin 1977); however, there are no data addressing the extent or implications of parasitism on Montague Island marmots. Marmots infested with ticks carrying spotted fever have been isolated (Eadie 1954). Rausch and Rausch (1971) identified fleas (*Thrassis pristinus* Stark) and cestodes (*Diandrya composita* Darrah and *Catenotaenia reggiae* Rausch) occurring on hoary marmots.

Direct human-related mortality—Hunting, trapping, and domestic dogs (*Canus familiaris*) contribute to marmot mortality in areas populated by humans (Jackson 1961). In the northern reaches of the continent, Indians and Eskimos used hoary marmots for food and to make fur garments (Banfield 1974).

Seasonal survival rates—The rate at which stored fat is used dictates survival during months of hibernation (Lee and Funderburg 1982). The earlier young marmots are weaned, and the more they weigh at hibernation, the more likely they are to survive their first winter (Anderson and others 1976). Mortality during hibernation is probably an important factor for adults as well (Lee and Funderburg 1982).

Proportional Use of Habitat

Home ranges—Home ranges of woodchucks are reportedly 0.004 to 0.03 km² (Hayes 1977) and about 0.02 km² for Olympic marmots. Home range size is affected by food availability, population density, and habitat availability. Reportedly, the

size and shape of home ranges depend on the terrain and location of feeding areas relative to the burrow (Lee and Funderburg 1982).

Seasonal differences—Marmots may hibernate up to 8 or 9 months per year (Banfield 1974, Nowak 1991, Zimina and Gerasmov 1973), beginning in September and emerging in early May in Alaska (Holmes 1979, Howell 1915).

Movement patterns—Marmots may travel hundreds of meters to feed (Banfield 1974); however, unless they are dispersing, they appear to maintain distinct colonial territories (Nowak 1991). Even during peak activity season, marmots spend a large part of their day resting or sleeping (Lee and Funderburg 1982). Marmots are good swimmers, crossing rivers 1 km wide (Barbour and Davis 1974).

Relation to food sources—Marmots can overgraze vegetation surrounding their dens (Banfield 1974). In south-central Alaska, the female-to-male breeding ratio of hoary marmots may be directly related to vegetation biomass within a colony's home range (Holmes 1984). Marmots are not known to cache food, but voraciously eat succulent plants in summer and accumulate fat (Godin 1977).

Relation to human activities and management actions—Hoary marmots are managed by the Alaska Department of Fish and Game as a furbearer (Alaska Board of Game 1998-99). There is no closed season or bag limit. 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).

Relation to landscape—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). Alpine habitat is widely available, but availability of talus slopes on the exposed coast of Montague Island has not been assessed.

Management Issues

Montague Island Marmot Response to Management Actions

Montague Island marmots may be subject to habitat loss and fragmentation by clearcut logging and road building. Population numbers of Vancouver Island marmots have declined in direct temporal and spatial association with large-scale clearcutting (Bryant 1996, 1998).

Risk Assessment

Because there is no current information regarding population levels, or even persistence of this endemic population, the level of concern is high. Alpine habitats on Montague Island, however, have been unaffected by recent logging or road building, and marmot habitat may be untouched.

Approaches to Montague Island Marmot Conservation

Documentation of recovery efforts for Vancouver Island marmots indicate that great effort is required for an accurate count of marmot numbers (Dearden 1986). Counts of Vancouver Island marmots at known colonies repeated two, three, and four times successfully counted 66, 73, and 78 percent of known animals, respectively (Bryant and Janz 1996). Moreover, count success was higher in May, June, and July than in August.

Information Needs

Clarification of taxonomic status, using increased sample sizes, molecular data, and intensive morphometric analysis, will provide a basis for further concern. A survey of Montague Island to determine the distribution and relative abundance of marmots would provide a baseline from which management alternatives can be generated. Mapping marmot colony occurrence on Montague Island would provide information regarding preferred habitats. Analysis of the effects of human disturbance (that is, timber harvest, road building) on marmot viability should be conducted.

Conclusion

Based on the current understanding of the taxonomy and distribution of Montague Island marmots, it is clear that more information must be gathered.

Because only a small number of specimens have been collected and examined, and because marmots have been sighted once on Montague Island since the early 1900s, effort should be made to identify marmot colonies on Montague Island and collect samples for genetic analyses. Once it is established that marmots still occur on Montague Island, and that they are taxonomically distinct, the question then can be asked: Do land management activities affect the population?

It has been established in other island endemic marmot populations that clearcut logging has a detrimental effect on population numbers. Population numbers of the endangered Vancouver Island marmot have declined dramatically, probably as a result of population “sinks” caused by clearcut logging. Clearcut logging practices have occurred on Montague Island in the past, both on federal and private lands, and it remains unknown if there were similar detrimental effects to the marmot population there.

English Equivalents

When you know:	Multiply by:	To find:
Centimeters (cm)	0.39	Inches
Meters (m)	3.28	Feet
Kilometers (km)	0.62	Miles
Square kilometers (km ²)	0.38	Square miles
Hectares (ha)	2.47	Acres
Square meters (m ²)	10.76	Square feet
Celsius (°C)	1.8 and add 32	Fahrenheit

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