

**2003 Mammal Inventory
Craters of the Moon National Monument and Preserve**

**Report for Subagreement No. 20 to
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Executive Summary

The 2003 Craters of the Moon National Monument mammal inventory contributed new information to the existing vertebrate species list in the Craters of the Moon National Monument and Preserve of southeast Idaho. The 2003 inventory built on previous mammal work conducted in the monument and preserve. The University of Idaho Department of Fish and Wildlife Resources conducted the inventory under a cooperative agreement with the National Park Service Upper Columbia Basin Network in partial fulfillment of the first phase of the Natural Resource Challenge Inventory and Monitoring program. Inventory fieldwork was conducted from May 20-June 27, 2003. Results from bat work conducted by the Oregon Museum of Science and Industry high school bat research team are included in the species accounts. The primary goal of the inventory was to supplement existing mammal species documentation in the monument and bring the percentage of confirmed expected species as close to 90% as possible. Additional goals included developing baseline data for monitoring as well as providing the National Park Service and the research community-at-large with new and important information on the biodiversity of the region.

Expected species lists were developed from published literature, available historical sources, expert opinion, and previous fieldwork. A set of four criteria was used to determine the likelihood of detection in the reserve. Fieldwork in 2003 utilized a variety of methods to achieve the primary objective, including visual encounter surveys and trapping. Species documentation included the collection of voucher photographs, digital bat call recordings, and field observation records. Previous documentation of mammals made by monument staff, visitors, and other researchers between the period 1990-2003 were combined with 2003 fieldwork results to develop a complete list of expected and confirmed mammals in the monument.

The 2003 mammal inventory brought mammal species confirmation to 83%. Between the period 1990-2003, 47 species of mammals have been documented in or adjacent to the monument. One of those, the river otter (*Lutra canadensis*), was documented for the first time during the 2003 inventory. The moose (*Alces alces*), first documented in 1999, was observed in the monument at a greater rate in 2003 by monument and inventory staff. The deer mouse (*Peromyscus maniculatus*), Ord's kangaroo rat (*Dipodomys ordii*), and the great basin pocket mouse (*Perognathus parvus*) were the three most abundant species captured during inventory efforts in 2003.

Data from the 2003 inventory will be incorporated into an existing natural resource database at Craters of the Moon, as well as the National Park Service Inventory and Monitoring NPSspecies database. This information will also be available as "baseline" information for future vital signs monitoring. Future monitoring activities will also provide opportunities to add additional species to the inventory list as they are encountered.

I. Introduction

This report summarizes the results of the 2003 inventory of mammals, summarizes historic information, and contains brief accounts of each species present or expected to occur at Craters of the Moon National Monument and Preserve (CRMO). Information on species that are possible but unlikely to occur at CRMO is also provided.

The University of Idaho Department of Fish and Wildlife Resources conducted the 2003 mammal inventory in CRMO under a cooperative agreement with the National Park Service Upper Columbia Basin Network. Inventory fieldwork was conducted from May 20 to June 27, 2003. Additional bat work was conducted in July 2004 by the Oregon Museum of Science and Industry high school bat research team. The inventory is part of a nationwide inventory and monitoring (I & M) program initiated by the National Park Service Natural Resource Challenge. In 2000 the Upper Columbia Basin Network, in which CRMO is part, began implementing the inventory phase of the I & M program in several network parks. Historic information available on the plant and animal populations within the network were assembled and an estimate was made of the percent of species expected to occur in each park. CRMO was among the majority of parks that had a low percentage (50%) of expected mammals documented and was in need of additional work to meet the I & M goal. The 2003 inventory built on existing mammal information developed by monument staff during recent years. Previous inventories conducted in CRMO includes an extensive bird inventory conducted by CRMO staff, herpetological inventory conducted by John Lee of Idaho State University in 2000-2002, and a plant inventory completed in 2003 by Steve Popovich of Wild Horse Consulting.

The primary goal of the inventory phase of the I & M program is to document the presence of 90% of the plant and animal species expected to occur within the park boundary or within a distance to the boundary that is relevant to the biology of the organism and to park management. Secondary goals of the inventory include providing baseline information that will help guide the development of the I & M program's vital signs monitoring strategy. Tertiary goals include providing both NPS and the research community-at-large new information on the distribution, habitat association, and population status of the nation's biological resources. Ultimately, the I & M program is designed to help NPS take a leading role in the preservation of the nation's biological diversity. Completing basic biological inventories is a crucial first step in achieving that goal.

II. Study Area

Located on the eastern Snake River Plain of Idaho, CRMO encompasses parts of Lincoln, Minidoka, Blaine, Power, and Butte counties. Originally established in 1924, CRMO included 53,440 acres. In 2000 the monument was expanded by the addition of 661,000 acres of federal public lands to include the entire Great Rift Volcanic Rift Zone. In 2002, 415,000 acres of this addition were legislatively designated as a national preserve.

The National Park Service (NPS) and the Bureau of Land Management (BLM) cooperatively manage CRMO although each agency retains primary management authority in different areas. In general, the areas of younger exposed lava fields are managed by the NPS and the older sagebrush steppe dominated areas continue to be managed by the BLM. The BLM administered Monument is a unit of the National Landscape Conservation System, while the original Monument and Preserve are administered as units of the National Park System. While this inventory effort focused on the NPS administered lands, it largely represents the CRMO area as a whole.

This area consists of a rugged landscape of volcanic lava flows and sagebrush steppe. During the last 15,000 years, molten basalt has periodically flowed from the Great Rift, a 65-mile long volcanic rift zone that lies within the monument. Lava fields encompass over 450,000 acres of the monument, and include 60 lava flows and 25 cinder cones. Sagebrush steppe makes up the approximately 300,000 remaining acres, much of which exists as islands within the lava flows, known as “kipukas”. CRMO extends south from the foothills of the Pioneer Mountains to the Snake River. The elevation rises from approximately 4280 ft. in the southern tip to 7729 ft. in the north. The climate is semi-arid, with hot and dry summers and cold and wet winters. Winter snows comprise most of the annual precipitation in the monument. Snow pack usually lasts most of the winter. The 30-year mean annual precipitation is 15 inches in the north (CRMO weather station data) and less than 10 inches in the south (Minidoka Dam, weather station data). The average July maximum temperature is 84 degrees Fahrenheit and average January minimum temperature is 10 degrees Fahrenheit (CRMO weather station data). Surface temperatures on the lava flows can reach 170 degrees Fahrenheit during summer heat and winter temperatures frequently remain below freezing for long periods.

CRMO supports several different vegetation types. The harsh and barren environment of the lava flows support an unusual variety of plant communities. Spring forbs include dwarf buckwheat (*Eriogonum ovalifolium var. depressum*), silverleaf phacelia (*Phacelia hastata*), dwarf monkey flower (*Mimulus nanus*), dwarf onion (*Allium parvum*) and bitterroot (*Lewisia rediviva*). Common shrubs include tansy bush (*Chamaebatiaria millefolium*), ocean spray (*Holodiscus dumosus*), dwarf goldenweed (*Haplopappus nanus*), bitterbrush (*Purshia tridentata*), and mountain big sage (*Artemisia tridentata ssp. vaseyana*). In the northern third of the monument stands of limber pine (*Pinus flexilis*) are present. Sagebrush steppe vegetation is the most widespread plant community in the monument, growing almost everywhere outside of the lava flows, including the kipukas. Common plant species include three-tip sage (*Artemisia tripartita*), big sage

(*Artemisia. tridentata ssp. tridentata*), bluebunch wheat grass (*Agropyron spicatum*), Idaho fescue (*Festuca idahoensis*) and prairie junegrass (*Koeleria nitida*). Scarlet paintbrush (*Castilleja miniata*) and silvery lupine (*Lupinus argenteus*) are common forbs. Surface water is extremely scarce in the monument. Small ephemeral pools form during rainfall and subsurface ice lenses maintain small seeps and pools inside lava tubes and in the bottom of depressions in lava flows. The only riparian habitats in the monument are those found near the northern boundary of the monument where the lava flows and the foothills of the Pioneer Mountains meet. Small stands of aspen (*Populus tremuloides*) and Douglas' fir (*Pseudotsuga menziesei*) grow along these slopes and several semi-permanent streams flow off the mountains before disappearing beneath the lava flows. A 4-acre lake and a small hot springs complex exist along highway 20 near the northern boundary and provide important sources of water for wildlife. Vegetation along these riparian areas includes cow parsnip (*Heracleum lanatum*), stinging nettle (*Urtica dioica*), small leaf angelica (*Angelica pinnata*), Blackhead coneflower (*Rudbeckia occidentalis*), nettle leaf horsemint (*Agastache urticifolia*), and Sitka columbine (*Aquilegia formosa*).

Many species of invasive exotic vegetation have become established in the monument during recent decades. Cheatgrass (*Bromus tectorum*) and other plants have replaced native species in many areas and this has become a significant resource management issue for the monument. Leafy spurge (*Euphorbia esula*), knapweeds (*Centaurea spp.*), rush skeleton weed (*Lygodesmia juncea*), and thistles (*Cirsium spp.*) have been documented in the monument. Of particular concern is the degree to which weeds are becoming established in the kipukas. Many of the kipukas have remained undisturbed from grazing, roads, and other sources of introduced weeds. While weeds are likely having a significant impact on mammal and other vertebrate populations in the monument, this impact has not been quantified in any way.

III. Methods

The methods utilized in the 2003 inventory generally follow those laid out in the Northern Semi-Arid Network Study Plan (Wright et al. unpublished) and published literature on inventory methodologies (i.e. Wilson et al. 1996). Universal Transverse Mercator (UTM) locations given in this report were collected using Garmin 12-channel Etrex hand-held GPS units (Garmin International, Inc, Olathe, KS, USA). Most x and y coordinates (Eastings and Northings) are accurate within 10 meters. Locations taken directly from BLM topographic maps are accurate within approximately 125 meters. UTM locations are in zone 12 and the North American Datum of 1927 (NAD 27) was used as the horizontal datum for all locations.

Scientific and common names used in this report follow the Integrated Taxonomic Information System (ITIS). The ITIS follows closely the USGS Biological Resource Division's unpublished and expanded update of the 1987 Checklist of Vertebrates of the United States, the U.S. Territories, and Canada (ITIS 2003).

The monument boundary was used as the primary boundary of the inventory; however, species observed near the monument were also included. Flexibility in the boundary was necessary because dispersal abilities of many of the species enable them to move on and off the reserve.

A. Expected Species

An expected mammal species list was provided by CRMO staff for use with this inventory. The list was refined in order to meet the needs of the I & M program, by examining published range maps and species accounts, and consulting with regional experts and the CRMO staff biologist. Range, elevation, habitat, and species detectability were considered and developed into a criteria set that was used to place species into "expected" or "possible but not expected" categories. Detectability was included in the consideration in order to address species that naturally occur in low abundances or are in some way very difficult to confirm through established mammal survey protocols. Species that met all four criteria were included as "expected" species. Monument staff have been assembling a species list over the course of several years and observations from 1990 to present were accepted as documentation of the species presence in the monument. Observations prior to 1990 are considered historic and were considered in the process of determining expected species.

Published sources used to determine the range, habitat, and elevation requirements of mammal species in the monument included Mammals of Idaho (Larrison 1981), Land Mammals of Oregon (Verts and Carraway 1998), Mammals of the Rocky Mountains (Fisher and Hartson 2000), Ground Squirrels of the Pacific Northwest (Yensen and Sherman 2003), and the Digital Atlas of Idaho (2003). Several unpublished reports from previous investigations on mammals in the monument were also examined, including a series of reports on bats in the monument (Keller and Saathoff 1995, Keller 1997),

studies of mule deer (Griffith 1983, 1984), previous wildlife inventories (Fuller 1969, Hoffman 1988) and numerous observations made by monument staff and visitors.

B. Sampling Site Selection

A subjective, non-random sampling site selection procedure was adopted for the inventory. This approach was determined to be the most efficient and effective given the primary objective of the inventory and the limited number of field personnel. Specific habitats and locations were identified and targeted for sampling in order to maximize the opportunities to encounter as many previously undocumented species as possible. The landscape in the monument is extremely rugged and a majority of the inventory effort was concentrated near roads and trails due to logistical considerations.

C. Visual Encounter Surveys

The visual encounter surveys and incidental observations were important tools in the mammal inventory. Visual encounter surveys were conducted by methodically searching target habitats. Visual surveys were done early in the morning and at night using flashlights. Incidental observations made of the mammals in or near CRMO during travel and other inventory activities were included. These observations contributed significantly to the overall success of the inventory and enabled participation from volunteers and NPS staff. Ancillary information recorded during visual encounter surveys included age, time, location, habitat, and notes of interest. Visual encounter surveys were conducted for pygmy rabbits (*Brachylagus idahoensis*) in the winter of 2004 by Jim Witham and Janet Rachlow of the University of Idaho. Emphasis during these surveys was placed on locating pellets, tracks in snow, and burrows in locations of historic records or recent reported sightings by CRMO staff.

D. Road Surveys

Road surveys were conducted in the mammal inventory. Road surveys were conducted in the south part of CRMO early in the morning or late in the evenings. Because the monument is so large, road surveys allowed a single observer to cover large parts of the monument in a relatively small amount of time.

E. Trapping

A variety of trapping techniques were used to inventory small mammals and bats and generally followed procedures outlined in Jones et al. (1996), Cooperrider et al. (1986), Kunz (1988), and the Northern Semi-Arid Network Study Plan. Capture and handling procedures were consistent with those outlined by the Ad Hoc Committee on Acceptable Field Methods in Mammalogy (1987) and the University of Idaho Institutional Animal Care and Use Committee.

1. *Small Mammals*

The primary technique used for small mammals involved the use of Sherman live traps and Museum Special snap traps placed along 150-meter transects. Trap stations were established approximately every 15 meters and 2 traps were placed at each station. Both pre-baited and non pre-baited traps were set for four consecutive trap nights. Traps were placed within 2 meters of the transect center and were placed non-randomly near microhabitat features and mammal sign in order to maximize capture success. Traps were baited with peanut butter, crimped oats, and black oil sunflower seeds.

Miscellaneous trapping techniques included the use of Havahart wire cage traps targeted for skunks and weasels and Museum Special snap traps baited for shrews with liver paste and placed near water. Ancillary data collected with small mammal captures included time, date, location, weather, moon phase, topography, age, sex, and habitat.

2. *Bats*

One night of mist netting was conducted on August 10, 2003 at the hot springs along Highway 20. Mist netting was also conducted by the Oregon Museum of Science and Industry's high school bat research team at Pond Cave and along the access road in Little Cottonwood Canyon in 2004. The full report of this team's work in CRMO in 2004 is available from the monument and the Upper Columbia Basin Network office. Mist netting followed methods outlined in Kunz (1988). In 2003, one 9-meter and one 6-meter mist net designed specifically for bats (i.e. 38mm mesh size with reduced bag) were placed over the main pool of the hot spring in an attempt to capture bats coming down to drink and to forage. Nets were opened at sunset and kept open until bat activity declined significantly, at 10:30 pm. Ancillary data collected with bat captures included time of capture, date, location, weather, time of sunset, moon phase, age, sex, reproductive condition, forearm length, and habitat. An *Anabat* bat echolocation call recording and analysis system (Titley Electronics, Ballina, NSW, Australia; Corben Scientific, Rohnert, CA, USA) was used to record and analyze the ultrasonic calls emitted by bats during foraging and drinking over Lava Lake. The *Anabat* system consisted of an *Anabat II* bat detector, type 6 standards Zero-Crossings Analysis Interface Module, an IBM-compatible laptop computer, and *Anabat6* and *Ana look* software. The *Anabat* system was setup along the southern shore of Lava Lake on a narrow peninsula that allowed the bat detector to be placed as close to the central portion of the lake as possible. *Anabat* was run on August 10, 2003, simultaneously to mist netting operations at the nearby hot springs. A 12-volt 100-watt handheld spotlight was used during recording sessions to illuminate flying bats and provide visual cues to aid in species identification. Species identification of free-flying bats was the primary application of the *Anabat*, although information on bat activity was also obtained from the use of *Anabat*. Recorded calls of bats were compared with an existing library of *Anabat* call files developed by releasing and recording bats captured and identified in the hand in other parks in the network. The library was used to enhance the species identification of calls recorded from free-flying bats. A set of voucher calls for several species recorded with *Anabat* at Lava Lake is

included in Appendix A of this report. A more substantial call library is available in the Oregon Museum of Science and Industry 2004 bat team report.

F. Species Documentation Methods

Species encountered during the inventory were documented using photography, voucher *Anabat* call files, and field observation records. Mammals found dead on the road were also kept and skulls and study skins will be prepared and provided to CRMO. Photocopies have been made of all data sheets and field notes and will be permanently housed by the NPS Upper Columbia Basin Network.

IV. Results

A. Historic Information

While no comprehensive mammal inventory of CRMO has been conducted, inventory efforts of the original monument area have been made in the past and a substantial amount of effort has been made in recent years to assemble existing information from historical sources, staff and visitor sightings, and trapping results from monument staff. Several collection expeditions were conducted in the area of the current Preserve early in the twentieth century and voucher specimens of many species are contained in museums around the country. Additional information on these specimens can be found in the NPS NPSpecies and ANCS+ databases. More recently, inventory projects were conducted by graduate students from Idaho State University and University of Idaho (Fuller 1969, Hoffman 1988). The presence of Townsend's big-eared bats (*Corynorhinus townsendii*) in the lava tube caves of the monument have been the subject of research by Idaho State University and provide many species confirmations for bats in the original monument (Keller and Saathoff 1995, Keller 1997). Mule deer (*Odocoileus hemionus*) research has also been conducted in CRMO by the University of Idaho Cooperative Park Studies Unit (Griffith 1983, 1984).

B. Expected and Confirmed Species

A total of 57 species of mammals are expected to occur in or adjacent to CRMO. 47 species were documented from 1990 to 2003, one of which, the river otter, was not expected to occur in CRMO. Eighty-three percent of the species expected to be present were documented. Table 1 shows the list of expected and possible species and their current status in CRMO.

C. Pygmy Rabbit Visual Encounter Surveys

Visual surveys were conducted at Devil's Orchard, Highway 20 near milepost 239, and at Sand Kipuka on March 12-14, 2004. Snow conditions were good for surveying at Devil's Orchard, but slushy at milepost 20 and absent at Sand Kipuka, limiting the effectiveness of surveys at those locations. No evidence of pygmy rabbits was found at any of the three locations.

D. Mammal Trapping

Trapping effort for small and medium sized non-volant mammals totaled 1162 trap nights. Sherman live traps and Museum Special snap traps placed in transects represent 98% of these trap nights, but Havahart wire cage traps, and funnel traps were also used and are included in this total. Total capture of non-volant mammals was 280 individuals. Deer mice were the most abundant mammals captured, representing 79% of all captures. The Ord's kangaroo rat was the second most abundant mammal captured, representing 9% of all captures. Table 2 shows the 2003 trap locations and trapping effort information

and table 3 shows the results from the 2003 mammal trapping effort. Figure 2 shows the location of transects and miscellaneous capture locations.

E. Bat Mist Netting

One mist net session was conducted on August 10, 2003. Far fewer bats were captured than expected. One female western small-footed myotis (*Myotis ciliolabrum*) and one female little brown myotis (*Myotis lucifugus*) were captured. Several other small myotis bats were seen flying in the area. Substantial mist netting was conducted during the 1990's by Idaho State University researchers that resulted in confirmation of almost all expected species of bats, including the two species captured in 2003. Mist netting conducted in 2004 by the Oregon Museum of Science and Industry's high school bat research team at Pond Cave and Little Cottonwood Canyon resulted in the confirmation of the fringed myotis (*Myotis thysanodes*) as well as the determination that Pond Cave remains an important night-roosting locality for several species of bats.

F. Bat Acoustic Survey Results

Anabat recording was conducted simultaneously with mist netting on August 10, 2003. As with the level of activity observed at the hot springs, overall bat activity at Lava Lake was low. Only one call of the long-eared myotis (*Myotis evotis*) was recorded and the remaining calls were all made by unidentified species of myotis producing "40 Khz calls". Three species of myotis, all previously documented in the monument, produce similar calls that terminate at or near 40 Khz (O'Farrell et al. 1999). The little brown myotis, western small-footed myotis, and the long-legged myotis (*Myotis volans*) produce calls that are difficult to distinguish. The fact that all 3 species occur in the region precluded the ability to provide confident identifications from the calls recorded at Lava Lake on August 10. Recording at Lava Lake and along Little Cottonwood Canyon in 2004 led to the determination that hoary bats (*Lasiurus cinereus*) are also present.

V. Discussion

The 2003 inventory work at CRMO was based heavily upon historic mammal records provided by the monument. Because a substantial number of expected species had already been confirmed prior to 2003, the number of new species documented in 2003 was few. Nonetheless, the discovery of the river otter in the monument and reconfirmation of many other species were important additions to the vertebrate information database for the monument. The possibility that wolves may be ranging into the monument is also an important development. In February of 2004, a probable wolf sighting was made in the monument by CRMO staff, and several radio-tagged wolves have been tracked within 5 miles of the monument in the Pioneer Mountains (Mack and Hoylan 2004). These new discoveries underscore the dynamic nature of mammal distributions and populations and illustrate the open-ended nature of the species lists generated through the I & M program. These lists will continue to be updated and refined as information from vital signs monitoring and other projects become available.

Shrews (family Soricidae) were a group of interest in the 2003 mammal inventory due to the lack of documentation after 1990. Of the 2 expected species, only the dusky shrew (*Sorex monticolus*) has been confirmed in CRMO. In 2003, efforts targeting vagrant shrews (*Sorex vagrans*) along the riparian areas in Little Cottonwood Canyon were made. The Merriam's shrew (*Sorex merriami*) may occur in the monument but the species is difficult to capture and its habitat requirements are poorly known, making it difficult to effectively target this species (Kirkland et al 1997, Verts and Carraway 1998). Shrews in general are a poorly known group in Idaho and any future information collected on the family in CRMO will make a significant contribution to the understanding of their ecology and conservation (Digital Atlas of Idaho 2003). Dusky and vagrant shrews are difficult to differentiate and must be collected for identification under laboratory conditions and preserved as voucher specimens.

The Ord's kangaroo rat was rediscovered during the 2003 inventory in the southern portion of the monument near the Snake River. This species had been documented in the monument prior to 1990. The species was relatively common in suitable habitat and represented a large proportion of captures in 2003. Kangaroo rats were most common in sandy soils with a large component of perennial bunchgrasses and rabbit brush (*Chrysothamnus spp.*).

The river otter was a surprising discovery in 2003. This species was not expected to occur in the monument because of the lack of significant surface water. The animal was found dead along Highway 20 and was presumably a dispersing individual and victim of an automobile accident. It was found several miles away from Lava Lake and may have come from the Little Wood River, west of the monument or Fish Creek, north of the Monument.

Bats were studied within the original monument during the 1990's. Idaho State University researchers investigated bat use of lava tubes and conducted mist-netting

efforts along Little Cottonwood Creek. The Townsend's big-eared bat (*Corynorhinus townsendii*), a federal species of concern, was shown to utilize several caves in the monument for hibernation and summer pup rearing. Townsend's big-eared bats were observed flying circles, or "skylighting", inside the mouth of one of several caves briefly visited during a reconnaissance of caves in the North Caves Complex in 2003. In 2003, the hot spring and Lava Lake, both along Highway 20, were targeted for bat work because neither site had been included in past research. The lack of water in the area outside of these two sites is such that these should be magnets for bats. The two expected species of bats, the silver-haired bat (*Lasionycteris noctivagans*) and the California myotis, that have not been documented in the park since 1990 should utilize these water sites for foraging and drinking. However, neither of these species was encountered in 2003. Because so many Idaho bat species are listed as state or federal species of concern, and because previous work has shown that CRMO provides important resources for bats, future monitoring efforts should include this group of unique vertebrates.

The pygmy rabbit is another important species of concern in Idaho and one for which historic records exist at CRMO. The Columbia Basin subpopulation, endemic to eastern Washington, was recently listed as a threatened species under the Endangered Species Act. While the sagebrush habitat favored by this species is abundant in CRMO, the status of this species in the monument is not well known. Future investigations are planned for the winter of 2005 to better assess the status of the species in the monument as well as habitat suitability.

Finally, a number of mammal species have apparently been extirpated in the CRMO area during the last century as a result of hunting and predator controls, including the bison (*Bison bison*), grizzly bear (*Ursus arctos*), bighorn sheep (*Ovis canadensis*), and the gray wolf. More recently, several species of ground squirrels (*Spermophilus spp.*) and the Idaho pocket gopher (*Thomomys idahoensis*) have experienced range reductions and they probably no longer occur in the CRMO area. In the case of the grizzly bear, historic records from early 20th century expeditions in the area of the present-day monument and preserve indicate that the species may have been somewhat common prior to the 1930's. Sightings and collections of grizzlies were made within present-day boundaries during 1915, 1921, 1922, 1923, and 1928 (Goldman 1922, Blossom 1936). Several skulls are housed in the Smithsonian Institution's Museum of Natural History. Gray wolves were also observed and collected during several of these same expeditions, including 4 specimens collected in 1923 within the present-day monument and preserve boundary.

E. Species Accounts

This section gives a brief description of each expected or unexpected but possible species for CRMO. Species names are followed by a series of codes based on those in use by the National Park Service NPSpecies database. The first code indicates park status, the second code indicates species abundance, and the third code indicates species residency. It is important to note that abundance is based on relative estimates based on inventory results and historic sightings rather than on quantitative population estimates. A key to the codes used after the species names is located on the following page. The code “Unlikely” has been added in this report in order to allow species to remain on the list of possible but species but not considered as expected.

Park Status

- **(P) Present:**
Species occurrence in park is documented and assumed to be extant.
- **(H) Historic:**
Species historical occurrence in the park is documented, but recent investigations indicate that the species is now probably absent.
- **(PP) Probably Present:**
Park is within species range and contains appropriate habitat. Documented occurrences of the species in the adjoining region of the park give reason to suspect that it probably occurs within the park. The degree of probability may vary within this category, including species that range from common to rare.
- **(E) Encroaching**
The species is not documented in the park, but is documented as being adjacent to the park and has potential to occur in the park.
- **(U) Unconfirmed:**
Included for the park based on weak (unconfirmed) record or no evidence, giving minimal indication of the species occurrence in the park.
- **(FR) False Report:**
Species previously reported to occur within the park, but current evidence indicates that the report was based on a misidentification, a taxonomic concept no longer accepted, or some other similar problem of interpretation.

Species Abundance

- **Abundant:**
Animals: May be seen daily, in suitable habitat and season, and counted in relatively large numbers.
- **(C) Common:**
Animals: May be seen daily, in suitable habitat and season, but not in large numbers.
- **(U) Uncommon:**
Animals: Likely to be seen monthly in appropriate season/habitat. May be locally common.
- **(R) Rare:**
Animals: Present, but usually seen only a few times each year.
- **(O) Occasional:**
Occurs in the park at least once every few years, but not necessarily every year. Applicable to animals only.
- **(UNK) Unknown:**
Abundance unknown.

Residency

- **(B) Breeder:**
Population reproduces in the park.
- **(R) Resident:**
A significant population is maintained in the park for more than two months each year, but it is not known to breed there.
- **(M) Migratory:**
Migratory species that occurs in park approximately two months or less each year and does not breed there.
- **(V) Vagrant:**
Park is outside of the species usual range.
- **(UNK) Unknown**
Residency status in park is unknown

A. Expected Species

Masked Shrew *Sorex cinereus* Unlikely

The monument is outside the range of this species and the species is generally found at higher elevations and in more extensive forest habitat than what is available in the monument (Larrison 1981, Digital Atlas of Idaho 2003).

Merriam's Shrew *Sorex merriami* Probably Present

This species has not been documented in the monument since 1987. It is difficult to capture and apparently occurs in naturally low abundances throughout its range (Kirkland et al 1997, Verts and Carraway 1998). The species probably still occurs in the sagebrush habitat of the monument.

Dusky Shrew *Sorex monticolus* Present R B

This species was captured in 2001 in a funnel trap set for reptiles near Little Cottonwood Canyon.

Vagrant Shrew *Sorex vagrans* Probably Present

An unvouchered brown shrew that may have been a vagrant shrew was captured in the monument prior to 1990. It likely occurs in riparian habitats along the northern tier of the monument.

California Myotis *Myotis californicus* Probably Present

This species has not been documented in the monument since 1987. The species probably occurs sporadically in the monument.

Long-eared Myotis *Myotis evotis* Present C B

This species has been documented in the monument during research conducted by Barry Keller, Idaho State University, during the 1990's. The species has been documented using lava tube caves in the monument. One call of this species was recorded at Lava Lake in 2003.

Little Brown Myotis *Myotis lucifugus* Present UNK UNK

This species has been documented in the monument during research conducted by Barry Keller, Idaho State University, during the 1990's. One individual was captured at the hot springs in 2003.

Fringed Myotis *Myotis thysanodes* Present UNK UNK

This species has been documented in the monument during research conducted by Barry Keller, Idaho State University, during the 1990's and was captured along Little Cottonwood Canyon in 2004. This is an Idaho state species of concern.

Long-legged Myotis *Myotis volans* Present UNK UNK

This species has been documented in the monument during research conducted by Barry Keller, Idaho State University, during the 1990's, and was captured along Little Cottonwood Canyon in 2004.

Yuma Myotis *Myotis yumanensis* Present UNK UNK

This species has been documented in the monument during research conducted by Barry Keller, Idaho State University, during the 1990's and a few recordings of the species were made in 2004 at Lava Lake. This species is not common in the monument.

Hoary Bat *Lasiurus cinereus* Present

This species is widespread in Idaho and probably occurs sporadically in the monument. The species is migratory and highly transient. One unverified record does exist from CRMO from 1979 and the species was recorded at Lava Lake and Little Cottonwood Canyon in 2004.

Silver-haired Bat *Lasiorycteris noctivagans* Probably Present

This species is widespread in Idaho and probably occurs sporadically in the monument. The species is migratory and highly transient, but is found in other parks in the network and frequently occurs in habitat similar to the monument.

Big Brown Bat *Eptesicus fuscus* Present UNK UNK

This species has been documented in the monument during research conducted by Barry Keller, Idaho State University, during the 1990's.

Townsend's Big-eared Bat *Corynorhinus townsendii* Present C B

This species has been documented in the monument during research conducted by Barry Keller, Idaho State University, during the 1990's and again in 2004. The species uses lava tubes in the monument as hibernacula and as summer maternity roosts. This is an Idaho state species of concern.

Pallid Bat *Antrozous pallidus* Present UNK UNK

This species may be rare in the monument. A visitor documented it in 2002 through an acoustic bat echolocation analysis system.

Western Small-Footed Myotis *Myotis ciliolabrum* Present C B

This species has been documented in the monument during research conducted by Barry Keller, Idaho State University, during the 1990's. This species occurs throughout the monument and uses lava tubes as day roosts. One female was captured at the hot springs in 2003.

Pika *Ochotona princeps* Present C B

The pika occurs in the lava flow habitats of the northern portion of the monument.

Mountain Cottontail *Sylvilagus nuttallii* Present C B

The mountain cottontail occurs throughout the monument.

Snowshoe Hare *Lepus americanus* Present U B

This species occurs in the northern portion of the monument, especially along the foothills of the Pioneer Mountains.

White-tailed Jackrabbit *Lepus townsendii* Present R UNK

This species was documented most recently along highway 20 near the northern boundary of the monument.

Black-tailed Jackrabbit *Lepus californicus* Probably Present

This species is widespread in Idaho and has been documented in the monument prior to 1990. Its absence in the monument during recent years is conspicuous and may be a cause for concern.

Pygmy Rabbit *Brachylagus idahoensis* Probably Present

Unverified records have been established for the monument in recent years, although a winter search conducted by University of Idaho researchers in 2004 failed to find evidence of the species. Historic records for the species exist prior to 1990 as well. Suitable habitat is present in and around the monument (Rachlow and Svancava 2003). This species is listed as a species of concern by the state of Idaho and additional surveys should be conducted in the monument to assess the habitat and status of this species.

Least Chipmunk *Tamias minimus* Present C B

This species is difficult to distinguish from the yellow-pine chipmunk. The two species were distinguished by pelage coloration and habitat. The least chipmunk occurs throughout the sagebrush habitat in the monument, including the visitor center.

Yellow-pine Chipmunk *Tamias amoenus* Present C B

This species is difficult to distinguish from the least chipmunk. The two species were distinguished by pelage coloration and habitat. Yellow-pine chipmunks occur in the northern portion of the monument among stands of pine, fir, and aspen.

Yellow-bellied Marmot *Marmota flaviventris* Present C B

The yellow-bellied marmot occurs in the northern part of the monument in and near lava tubes and large lava crevices that border sagebrush vegetation.

Uinta Ground Squirrel *Spermophilus armatus* Historic

This species was collected in the CRMO area in the 1920's but is believed to be extinct north of the Snake River (Digital Atlas of Idaho 2003, Yensen and Sherman 2003, Michael Munts, CRMO, personal communication).

Piute Ground Squirrel *Spermophilus mollis* Present UNK UNK

This species has been documented in the monument. Little is known about this species and the subspecies *S. m. artemisiae* is limited to the upper Snake River Basin and is probably of conservation concern (Yensen and Sherman 2003). Suitable sagebrush steppe habitat is found throughout the monument for the species and further surveys to determine the species' status would be useful.

Columbian Ground Squirrel *Spermophilus columbianus* Present U B

This species occurs in the sagebrush steppe areas in the northern portion of the monument.

Wyoming Ground Squirrel *Spermophilus elegans* Unlikely

The species is believed to be extinct west of Interstate 15, including the entire CRMO area (Yensen and Sherman 2003, Michael Munts, CRMO, personal communication).

Golden-mantled Ground Squirrel *Spermophilus lateralis* Present A B

This species is common in the north end of the park, especially near the visitor center.

Red Squirrel *Tamiasciurus hudsonicus* Present U B

The red squirrel commonly occurs in the northern part of the monument in most limber pine stands. It also occurs in isolated Douglas-fir stands on cinders cones and along Little Cottonwood.

Idaho Pocket Gopher *Thomomys idahoensis* Unlikely

Although historic records of this species exist near CRMO, it is believed to have been extirpated from the area and is not expected to occur in CRMO (Larrison 1981, Digital Atlas of Idaho 2003, Michael Munts, CRMO, personal communication).

Northern Pocket Gopher *Thomomys talpoides* Present C B

The northern pocket gopher occurs throughout the monument.

Great Basin Pocket Mouse *Perognathus parvus* Present A B

This species was the third most common species captured during the 2003 inventory. It occurs throughout the sagebrush steppe habitats in the monument.

Ord's Kangaroo Rat *Dipodomys ordii* Present C B

This species was captured in the southern portion of the monument in 2003, particularly in areas with sandy soils.

Beaver *Castor canadensis* Present UNK UNK

This species occurs along riparian areas in the northern portion of the monument. The species was last seen in 1999 along Leech Creek. Recently, the species has been less visible in the area, which may be a response to abnormally low surface flow in the creek.

Western Harvest Mouse *Reithrodontomys megalotis* Present C B

The Western Harvest Mouse is found throughout the monument in sagebrush and grassland areas.

Deer Mouse *Peromyscus maniculatus* Present A B

This ubiquitous species was the most abundant mammal captured in the 2003 inventory. It occurs throughout the monument.

Northern Grasshopper Mouse *Onychomys leucogaster* Probably Present

This species is difficult to capture but suitable habitat is abundant in the monument, especially in the southern portion. Voucher specimens were collected in the monument in the 1920's and 30's.

Bushy-tailed Woodrat *Neotoma cinerea* Present C B

This species occurs throughout the monument, especially in the lava flows and other rocky areas.

Desert Woodrat *Neotoma lepida* Unlikely

The monument is on the periphery of this species' range (Larrison 1981, Digital Atlas of Idaho 2003).

Heather Vole *Phenacomys intermedius* Unlikely

This species was captured on Sunset Cone in 1936. The species has been trapped in Idaho as low as 5000 feet (Davis 1939, Larrison 1981) and suitable habitat still exists in the Pioneer Mountains north of the Monument.

Montane Vole *Microtus montanus* Present U B

The montane vole occurs near riparian areas of the park.

Long-tailed Vole *Microtus longicaudus* Present U B

This species was not captured in 2003 but one was regularly observed using a hole in the outside wall of a staff house near the visitor center.

Sagebrush Vole *Lemmiscus curtatus* Probably Present

This species has not been positively identified at CRMO since 1980. However, this species is difficult to capture and much of the monument is suitable habitat. It probably still occurs within the monument.

Common Muskrat *Ondatra zibethicus* Unlikely

This species may occur in riparian area near the monument but is not expected due to the lack of significant riparian habitat in the monument. The species was reported prior to 1980, but like the occurrence of the river otter in 2003, probably represents a rare event.

Western Jumping Mouse *Zapus princeps* Present U B

The western jumping mouse occurs in the riparian area of Little Cottonwood Canyon.

Porcupine *Erethizon dorsatum* Present U B

This mammal occurs throughout CRMO, especially in the conifer stands in the northern portion of the monument.

Coyote *Canis latrans* Present C B

This ubiquitous species occurs throughout the monument.

Gray Wolf *Canis lupus* Probably Present

Wolf scat and tracks have been recently reported near the northern boundary of the monument. The Nez Perce Tribe is currently radio tracking three gray wolves that may have territory overlapping the monument.

Kit Fox *Vulpes velox* Unlikely

Only 12 records exist for this species in Idaho and the Idaho Conservation Data Center shows no records of the species near the monument or preserve (Idaho Conservation Data Center. 2004).

Red Fox *Vulpes vulpes* Present R B

Red fox have been observed by some of the staff members of CRMO within the past five years. Most of the documentation has been along the northern boundary of the park, running along Highway 20. A road kill fox was found east of the town of Carey, approximately 10 miles from the monument, in August, 2003.

Black Bear *Ursus americanus* Present R UNK

Black bears are infrequently encountered along the northern boundary of the monument. An NPS employee sighted a bear in Little Cottonwood Canyon in 2001.

Common Raccoon *Procyon lotor* Present U UNK

A park intern saw a raccoon outside the park housing complex in August of 2003.

Ermine *Mustela erminea* Probably Present

This species is expected to occur along the riparian corridors in the northern boundary of the monument. The aspen and fir along Little Cottonwood Canyon is a particularly suitable area for the species. An historic report for this species exists in the monument prior to 1980.

Long-tailed Weasel *Mustela frenata* Present U B

The long tailed weasel probably occurs throughout the park, and is frequently seen in and around the visitor center.

American Badger *Taxidea taxus* Present U B

This species occurs throughout the monument, especially near ground squirrel colonies. Fresh and abandoned badger excavations and sign were encountered during the 2003 inventory and badgers were occasionally seen in the monument as well.

River Otter *Lutra canadensis* Present UNK UNK

This species was found dead on the side of Highway 20, 2 miles west of Lava Lake. The closest significant watercourse is the Little Wood River, approximately five miles away. This is probably a rare event, possibly representing a dispersal attempt.

Western Spotted Skunk *Spilogale gracilis* Probably Present

This species is secretive, but probably occurs in the monument. An historic report exists for the species in the monument prior to 1980.

Striped Skunk *Mephitis mephitis* Present O UNK

The striped skunk has been documented on several occasions during recent years in and near the monument. It has been documented through road kill and individuals have also been seen traveling along the roadside ditch of Highway 20.

Mountain Lion *Felis concolor* Present O B

Cougars are secretive and hard to document but presumed to occur periodically in the monument. Several reports of cougars have come from monument visitors and staff in recent years, including a sighting of young in 2001.

Bobcat *Lynx rufus* Present R B

Bobcats are infrequently seen in the monument but are secretive and may be more common than the infrequent sightings indicate.

Elk *Cervus elaphus* Present R UNK

This species occurs throughout CRMO, especially in the winter.

Mule Deer *Odocoileus hemionus* Present C B

Mule deer are frequently encountered throughout the monument.

Moose *Alces alces* Present U UNK

Moose were first documented within the monument in 1999, but have since been regular summer residents in the vicinity of water along the foothills of the Pioneer Mountains.

Pronghorn *Antilocapra americana* Present C B

Pronghorn occur in low numbers throughout the sagebrush and grassland habitats of the monument. Small herds are encountered at the base of the Pioneer Mountains and also in the central portion of the monument.

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Tables

Table 1. The list of expected and possible mammals species in the Craters of the Moon National Monument and Preserve and their documentation status as of 2003.

| Common Name | Scientific Name | Expected | Confirmed |
|--------------------------------|----------------------------------|----------|-----------|
| Masked Shrew | <i>Sorex cinereus</i> | 0 | 0 |
| Dusky Shrew | <i>Sorex monticolus</i> | 1 | 1 |
| Vagrant Shrew | <i>Sorex vagrans</i> | 1 | 0 |
| Merriam's Shrew | <i>Sorex merriami</i> | 1 | 0 |
| Little Brown Myotis | <i>Myotis lucifugus</i> | 1 | 1 |
| Yuma Myotis | <i>Myotis yumanensis</i> | 1 | 1 |
| Long-eared Myotis | <i>Myotis evotis</i> | 1 | 1 |
| Long-legged Myotis | <i>Myotis volans</i> | 1 | 1 |
| Western Small-footed Myotis | <i>Myotis ciliolabrum</i> | 1 | 1 |
| Fringed Myotis | <i>Myotis thysanodes</i> | 1 | 1 |
| California Myotis | <i>Myotis californicus</i> | 1 | 0 |
| Silver-haired Bat | <i>Lasionycteris noctivagans</i> | 1 | 0 |
| Big Brown Bat | <i>Eptesicus fuscus</i> | 1 | 1 |
| Hoary Bat | <i>Lasiurus cinereus</i> | 1 | 1 |
| Townsend's Big-eared Bat | <i>Corynorhinus townsendii</i> | 1 | 1 |
| Pallid Bat | <i>Antrozous pallidus</i> | 1 | 1 |
| Pika | <i>Ochotona princeps</i> | 1 | 1 |
| Nuttall's Cottontail | <i>Sylvilagus nuttallii</i> | 1 | 1 |
| Snowshoe Hare | <i>Lepus americanus</i> | 1 | 1 |
| White-tailed Jackrabbit | <i>Lepus townsendii</i> | 1 | 1 |
| Black-tailed Jackrabbit | <i>Lepus californicus</i> | 1 | 0 |
| Pygmy Rabbit | <i>Brachylagus idahoensis</i> | 1 | 0 |
| Least Chipmunk | <i>Tamias minimus</i> | 1 | 1 |
| Yellow-pine Chipmunk | <i>Tamias amoenus</i> | 1 | 1 |
| Yellow-bellied Marmot | <i>Marmota flaviventris</i> | 1 | 1 |
| Paiute Ground Squirrel | <i>Spermophilus mollis</i> | 1 | 1 |
| Uinta Ground Squirrel | <i>Spermophilus armatus</i> | 0 | 0 |
| Columbian Ground Squirrel | <i>Spermophilus columbianus</i> | 1 | 1 |
| Golden-mantled Ground Squirrel | <i>Spermophilus lateralis</i> | 1 | 1 |
| Wyoming Ground Squirrel | <i>Spermophilus elegans</i> | 0 | 0 |
| Red Squirrel | <i>Tamiasciurus hudsonicus</i> | 1 | 1 |
| Northern Pocket Gopher | <i>Thomomys talpoides</i> | 1 | 1 |
| Idaho Pocket Gopher | <i>Thomomys idahoensis</i> | 0 | 0 |
| Great Basin Pocket Mouse | <i>Perognathus parvus</i> | 1 | 1 |
| Ord's Kangaroo Rat | <i>Dipodomys ordii</i> | 1 | 1 |
| Beaver | <i>Castor canadensis</i> | 1 | 1 |
| Western Harvest Mouse | <i>Reithrodontomys megalotis</i> | 1 | 1 |
| Deer Mouse | <i>Peromyscus maniculatus</i> | 1 | 1 |
| Northern Grasshopper Mouse | <i>Onychomys leucogaster</i> | 1 | 0 |
| Desert Woodrat | <i>Neotoma lepida</i> | 0 | 0 |
| Bushy-tailed Woodrat | <i>Neotoma cinerea</i> | 1 | 1 |
| Heather Vole | <i>Phenacomys intermedius</i> | 0 | 0 |

| Common Name | Scientific Name | Expected | Confirmed |
|--------------------------------------|------------------------------|-----------------|------------------|
| Montane Vole | <i>Microtus montanus</i> | 1 | 1 |
| Long-tailed Vole | <i>Microtus longicaudus</i> | 1 | 1 |
| Sagebrush Vole | <i>Lemmiscus curtatus</i> | 1 | 0 |
| Muskrat | <i>Ondatra zibethicus</i> | 0 | 0 |
| Western Jumping Mouse | <i>Zapus princeps</i> | 1 | 1 |
| Porcupine | <i>Erethizon dorsatum</i> | 1 | 1 |
| Coyote | <i>Canis latrans</i> | 1 | 1 |
| Gray Wolf | <i>Canis lupus</i> | 1 | 0 |
| Red Fox | <i>Vulpes vulpes</i> | 1 | 1 |
| Kit Fox | <i>Vulpes velox</i> | 0 | 0 |
| Black Bear | <i>Ursus americanus</i> | 1 | 1 |
| Raccoon | <i>Procyon lotor</i> | 1 | 1 |
| Ermine | <i>Mustela erminea</i> | 1 | 0 |
| Long-tailed Weasel | <i>Mustela frenata</i> | 1 | 1 |
| River Otter | <i>Lutra canadensis</i> | 0 | 1 |
| Badger | <i>Taxidea taxus</i> | 1 | 1 |
| Spotted Skunk | <i>Spilogale gracilis</i> | 1 | 0 |
| Striped Skunk | <i>Mephitis mephitis</i> | 1 | 1 |
| Mountain Lion | <i>Felis concolor</i> | 1 | 1 |
| Bobcat | <i>Lynx rufus</i> | 1 | 1 |
| Elk | <i>Cervus elaphus</i> | 1 | 1 |
| Mule Deer | <i>Odocoileus hemionus</i> | 1 | 1 |
| Moose | <i>Alces alces</i> | 1 | 1 |
| Pronghorn | <i>Antilocapra americana</i> | 1 | 1 |
| Total | | 57 | 47 |
| Total % Confirmed^a | | | 0.83 |

Table 2. The location, date, and trap nights for transects employed during the 2003 Craters of the Moon mammal inventory.

| Transect | Date | Legal Description | UTM X | UTM Y | Trap Nights | Trap Type |
|--------------|------------|--------------------|---------|---------|-------------|-----------|
| Tran001 | May20-22 | T1N R23E S31 SW1/4 | 0274810 | 4804921 | 88 | Sherman |
| Tran002 | May 28-30 | T2N R25E S33 SE1/4 | 0298759 | 4823369 | 132 | Sherman |
| Tran003 | May 28-30 | T2N R24E S27 NW1/4 | 0290646 | 4816754 | 12 | Sherman |
| Tran004 | May 28-31 | T2N R24E S27 NW1/4 | 0290613 | 4816742 | 40 | Sherman |
| Tran005 | May 28-31 | T2N R24E S22 SW1/4 | 0290010 | 4818186 | 40 | Sherman |
| Tran006 | June 1-6 | T2N R24E S21 SE1/4 | 0290176 | 4818084 | 70 | Snap |
| Tran007 | June 2-6 | T2N R24E S27 NE1/4 | 0290701 | 4817558 | 72 | Sherman |
| Tran008 | June 2-6 | T1S R24E S19 NE1/4 | 0291737 | 4816576 | 80 | Sherman |
| Tran009 | June 16-20 | T1S R24E S19 NE1/4 | 0286613 | 4799761 | 80 | Sherman |
| Tran010 | June 16-20 | T1S R24E S19 NE1/4 | 0286671 | 4799876 | 80 | Sherman |
| Tran011 | June 16-20 | T1S R24E S19 NE1/4 | 0286729 | 4799886 | 40 | Sherman |
| Tran012 | June 16-20 | T8S R27E S2 NW1/4 | 0313391 | 4736546 | 80 | Sherman |
| Tran013 | June 23-27 | T8S R27E S2 NW1/4 | 0313438 | 4736533 | 80 | Sherman |
| Tran014 | June 23-27 | T8S R27E S2 NW1/4 | 0310408 | 4734000 | 80 | Sherman |
| Tran015 | June 23-27 | T8S R27E S17 NW1/4 | 0310309 | 4733213 | 80 | Sherman |
| Tran016 | June 23-27 | T8S R27E S22 SW1/4 | 0310122 | 4731543 | 80 | Sherman |
| Havahart N | June 16-20 | T1S R24E S19 NE1/4 | 0286729 | 4799886 | 16 | Havahart |
| Havahart S | June 23-27 | T8S R27E S2 NW1/4 | 0313438 | 4736533 | 12 | Havahart |
| TOTAL | | | | | 1162 | |

Table 3. The results of trapping during the 2003 mammal inventory at Craters of the Moon National Monument and Reserve^a.

| Transect | PEMA | MIMO | PEPA | ZAPR | TAMI | DIOR | NECI | TOTAL |
|---------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|
| Tran 001 | 22 | 1 | 0 | 0 | 0 | 0 | 0 | 23 |
| Tran 002 | 20 | 8 | 0 | 0 | 0 | 0 | 0 | 28 |
| Tran 003 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 4 |
| Tran 004 | 3 | 0 | 0 | 4 | 0 | 0 | 0 | 7 |
| Tran 005 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tran 006 | 15 | 0 | 0 | 3 | 0 | 0 | 0 | 18 |
| Tran 007 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 27 |
| Tran 008 | 22 | 0 | 4 | 0 | 3 | 0 | 0 | 29 |
| Tran 009 | 12 | 0 | 2 | 0 | 0 | 0 | 0 | 14 |
| Tran 010 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| Tran 011 | 8 | 0 | 0 | 0 | 2 | 0 | 0 | 10 |
| Tran 012 | 12 | 0 | 1 | 0 | 0 | 0 | 0 | 13 |
| Tran 013 | 18 | 0 | 0 | 0 | 0 | 0 | 2 | 20 |
| Tran 014 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 19 |
| Tran 015 | 6 | 0 | 1 | 0 | 0 | 8 | 0 | 15 |
| Tran 016 | 5 | 0 | 0 | 0 | 0 | 9 | 0 | 14 |
| Tran 017 | 17 | 0 | 0 | 0 | 0 | 8 | 0 | 25 |
| Havahart (N) | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 6 |
| Havahart (S) | 2 | 0 | 1 | 0 | 0 | 0 | 2 | 5 |
| Total | 228 | 9 | 13 | 7 | 5 | 25 | 4 | 291 |
| Relative Abundance | 0.78 | 0.03 | 0.04 | 0.03 | 0.02 | 0.09 | 0.01 | |

^a PEMA – *Peromyscus maniculatus*
MIMO – *Microtus montanus*
PEPA – *Perognathus parvus*
ZAPR – *Zapus princeps*

TAMI – *Tamias minimus*
DIOR – *Dipodomys ordii*
NECI – *Neotoma cinerea*

Figures

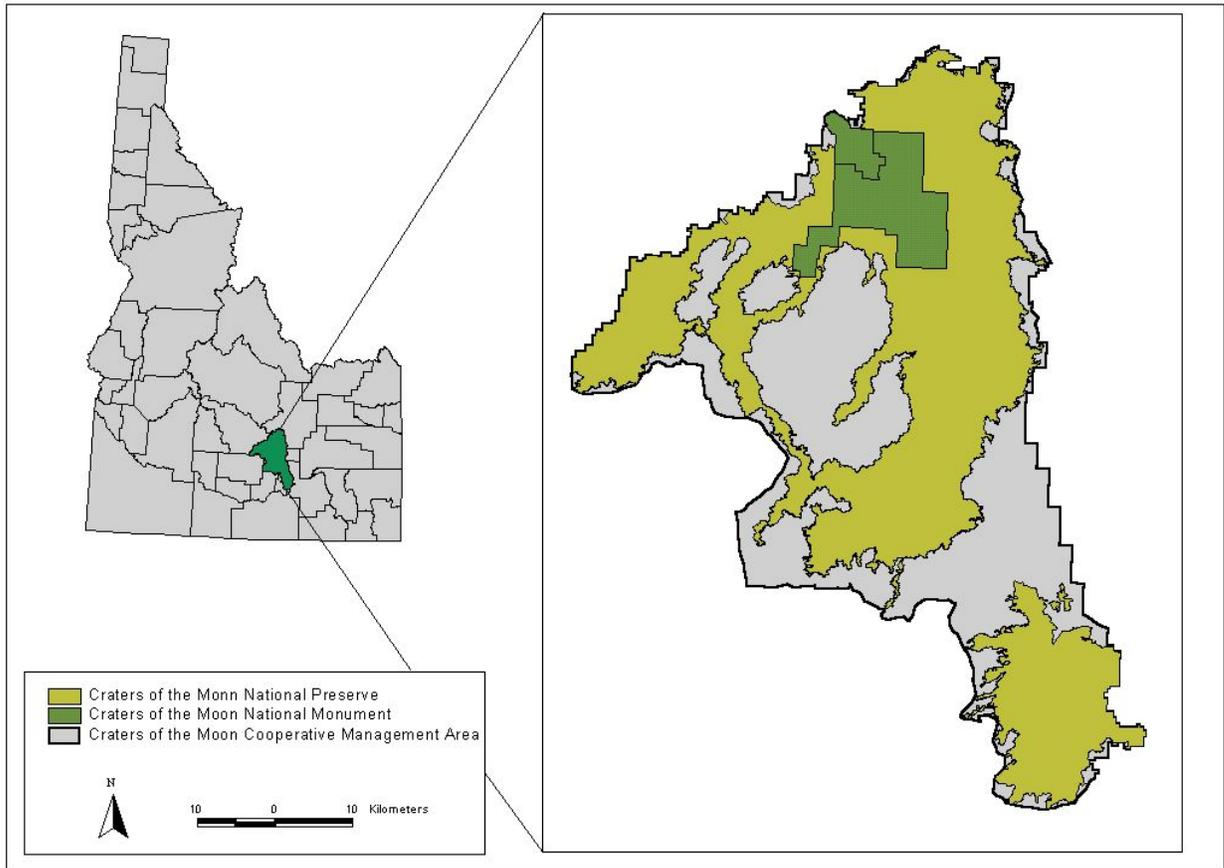


Figure 1. A map of the Craters of the Moon National Monument and Preserve.

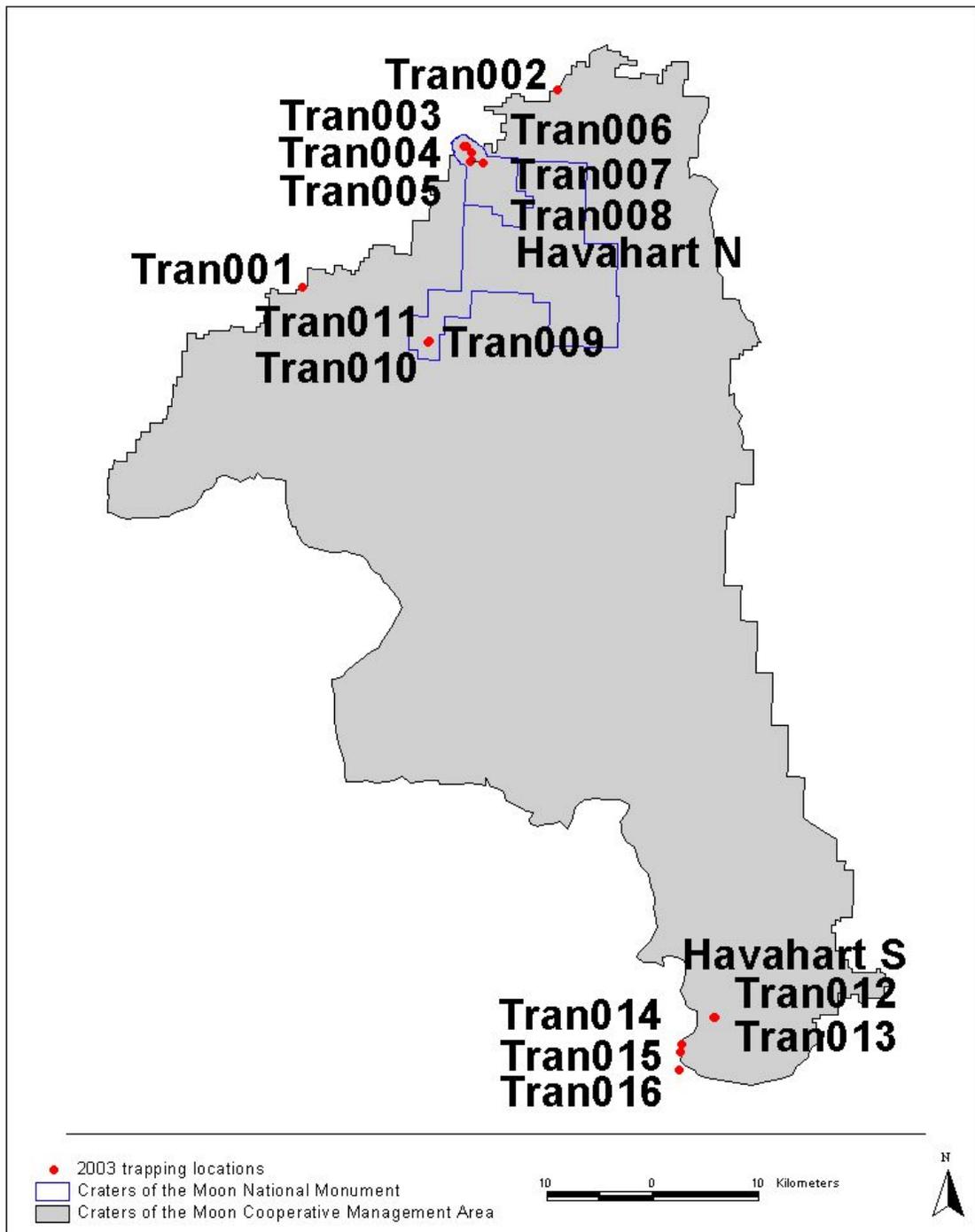


Figure 2. The location of 2003 trapping transects in Craters of the Moon National Monument and Preserve.

Appendix A

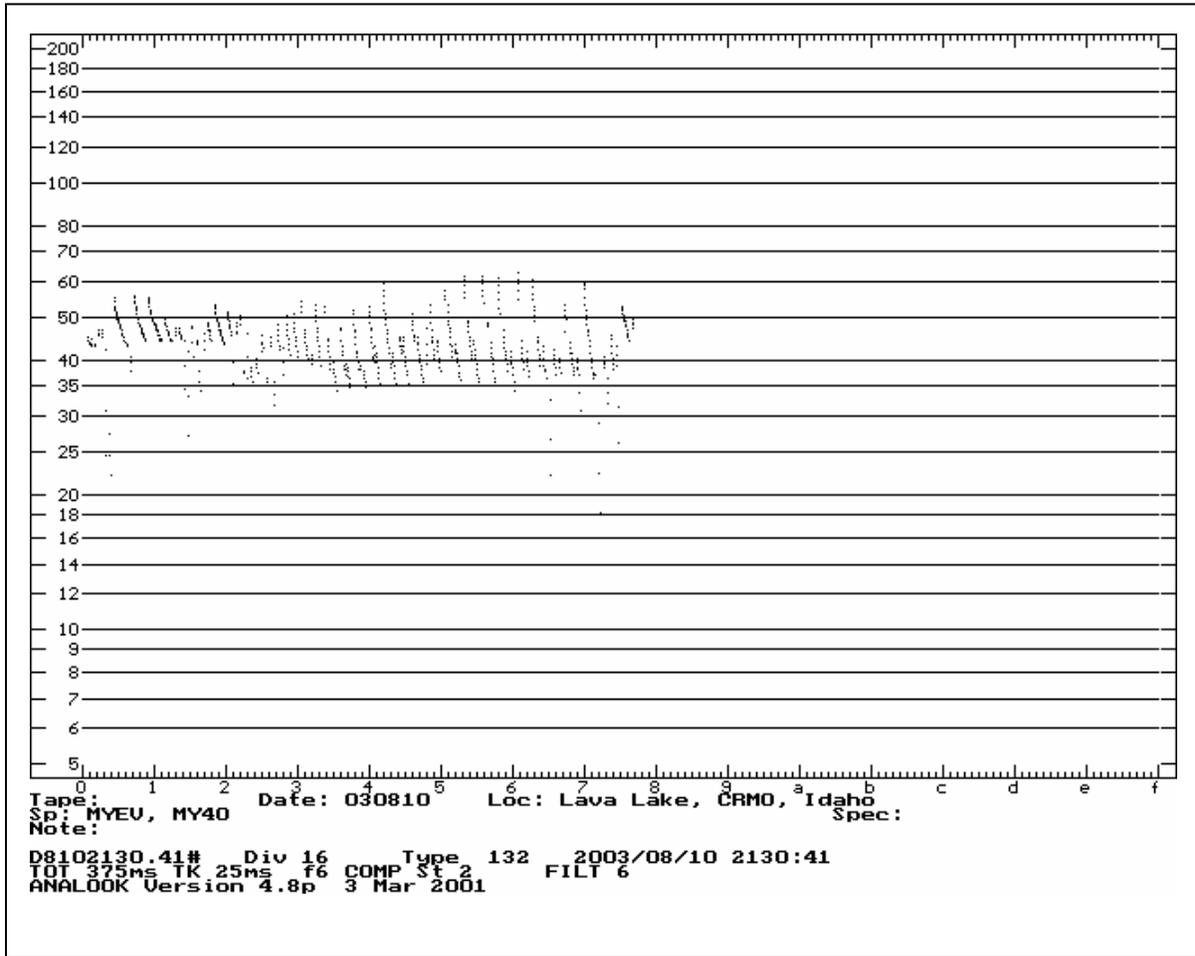


Figure A-1. A long-eared myotis (*Myotis evotis*) echolocation call recorded at Lava Lake along the northern boundary of Craters of the Moon National Monument and Preserve.

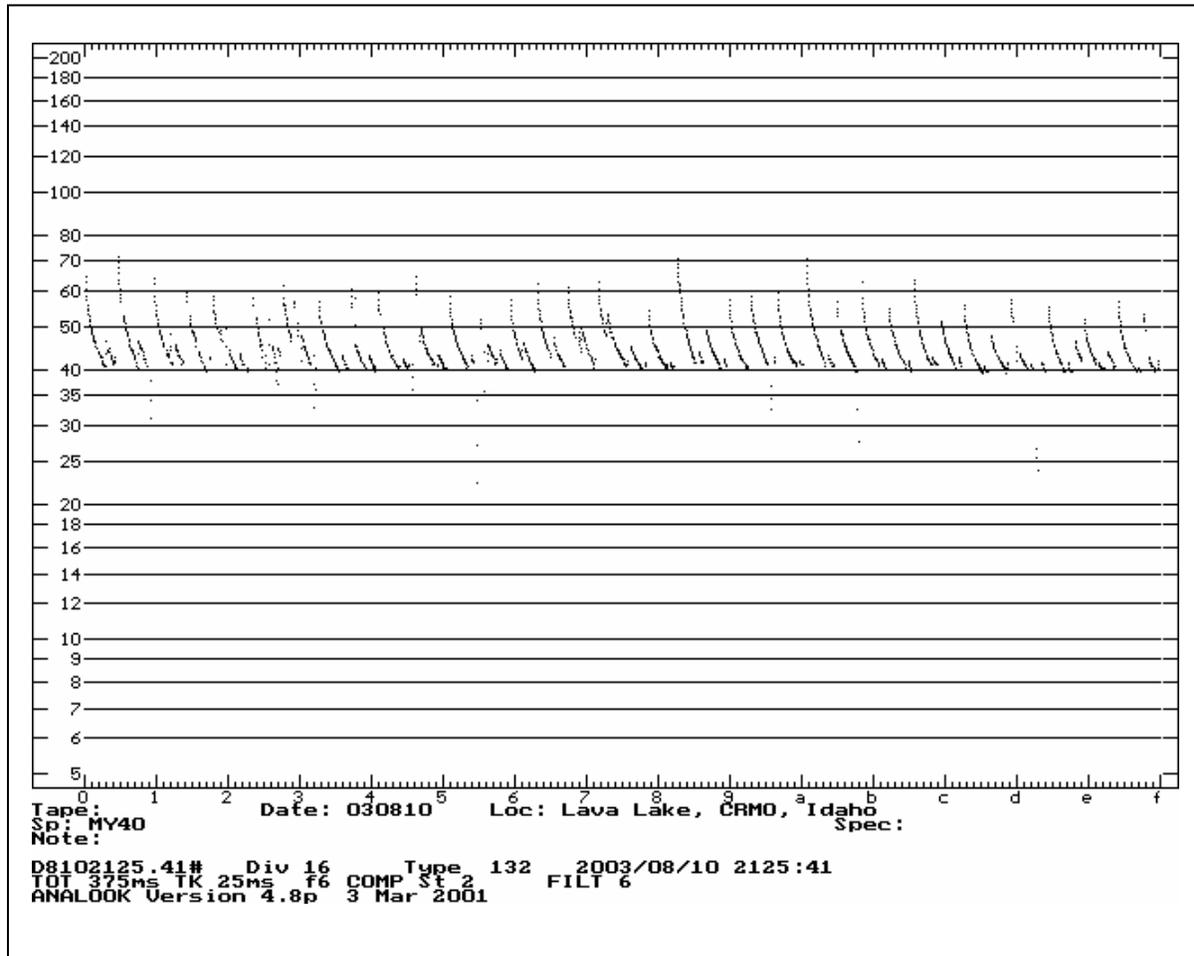


Figure A-2. A “40Khz myotis” echolocation call recorded at Lava Lake along the northern boundary of Craters of the Moon. This “40Khz” call was made by a little brown myotis (*Myotis lucifugus*), western small-footed myotis (*Myotis ciliolabrum*), or a long-legged myotis (*Myotis volans*).