



Bat Hibernacula Surveys in Craters of the Moon National Monument and Preserve

2012-2013 Status Report

Natural Resource Data Series NPS/UCBN/NRDS—2013/519



ON THE COVER

An unusually light colored bat thought to be a Yuma myotis (*Myotis yumanensis*) in the “culvert” of Arco Tunnel, Craters of the Moon National Monument and Preserve

Photograph by Devin Stucki

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Abstract

In the winters of 2012 and 2013, forty-one of Craters of the Moon National Monument and Preserve's (CRMO) 300+ caves were searched for hibernating bats. While most of these caves were apparently empty of bats, 3 new hibernacula were documented in Beauty, Needles, and One More Chance caves. Additionally, bats were also found hibernating in Arco Tunnel, which was previously known as a hibernaculum. All bats in the newly discovered hibernacula were identified as Townsend's big-eared bats (*Corynorhinus townsendii*). A new high count of 33 bats was recorded in Arco Tunnel in 2013, likely including the first CRMO record of hibernating Yuma myotis (*Myotis yumanensis*) and potentially long-eared myotis (*Myotis evotis*). These species are difficult to identify with high confidence given the height of the ceiling where bats were found and the inability to see diagnostic characteristics. These 2012-2013 surveys have reinvigorated the CRMO bat hibernacula monitoring program. A protocol documenting methods and data management strategies is in development and will ensure that the program will persist into the future and provide resource management staff with information necessary to better manage cave resources.

In an ancillary effort, April 2013, an acoustic detector was deployed outside of Arco Tunnel to try and document species emerging from hibernation. Although it is impossible to determine whether species recorded by the detector were actually hibernating in Arco Tunnel, it does provide some evidence of the possibility. During the first 17 days of deployment, only sporadic light bat activity was recorded. On April 20 between 9:00 pm and 10:00 pm, over 200 bat calls were recorded that were identified to 5 species, including Townsend's big-eared bat, little brown myotis (*Myotis lucifugus*), long-legged myotis (*Myotis volans*), western small-footed myotis (*Myotis ciliolabrum*) and long-eared myotis (*Myotis evotis*). Should such an event be recorded in subsequent years, it would add further evidence of the possibility of synchronous emergence from hibernation.

Acknowledgments

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Introduction

In 2007 bats were chosen as one of Craters of the Moon National Monument's (CRMO) "vital signs", as part of the Upper Columbia Basin Network (UCBN) inventory and monitoring program (I&M; Garrett et al. 2007). This vital sign status combined with the looming threat of the bat fungal disease known as white-nose syndrome has stimulated a renewed effort by park and I&M program staff to regularly survey caves for bat use during winter. Winter hibernation is a critical time for bats. Adult mortality is typically very low during winter (Barclay and Harder 2003), and energy savings made during winter enable female bats to raise pups during summer. However, anthropogenic disturbances in caves can disrupt hibernation and cause bats to burn through energy very quickly. White-nose syndrome, which is devastating bat populations in the eastern US and Canada and spreading westward, also causes bats to starve and dehydrate during hibernation (Bleher 2012). The fungus that causes white-nose syndrome was introduced into the northeastern US from Europe (Bleher 2012), and together these two novel stressors present serious threats to CRMO bats over the coming decades. An additional stress, accelerated climate change, is also expected to affect bats across the western US as thermal profiles of caves changes (Humphries et al. 2002) and as drought conditions reduce the availability of free water to lactating bats (Adams 2010). Regular monitoring of winter cave use by bats will enable CRMO staff to better manage cave resources, and will contribute to a regional description of bat population trends over time.

Very little is known about where and how many bats hibernate in caves in CRMO. In fact, while Craters has hundreds (if not thousands) of caves scattered over the vast lava flows (roughly the size of Rhode Island), only one hibernaculum, Arco Tunnel, had been verified and surveyed on a regular basis prior to 2012. In 2012, CRMO and I&M staff visited eight easily accessible caves to pilot test a winter cave survey protocol (Rodhouse et al. *forthcoming*) and to test white-nose syndrome fungal decontamination procedures (USFWS 2012). In the winter of 2013, surveys were conducted in 41 caves, including 6 of the 8 caves surveyed in 2012. Accessing caves in CRMO during winter is an extremely challenging endeavor, sometimes requiring snowshoeing several miles across snow covered sagebrush and lava fields to reach cave entrances. Quite often these efforts were in vain as caves turned out to be unsuitable for hibernating bats, but these efforts have expanded the knowledge of winter bat use in Craters caves and will allow biologists to better focus efforts in the future.

Methods

Identification of Caves to Survey

The CRMO cave database and paper files were searched to find caves which might provide the necessary elements for proximity, safe access and suitability as habitat for hibernating bats. The first constraint was that caves had to be close enough to gain access, survey, and return to the office within a single work day. Caves that would require specialized skills or equipment for safe entry were also excluded. This eliminated vast areas of the Monument and Preserve south of the loop road from consideration as well as known hibernacula including South Grotto, Creon's Ice Cave, and Crystal Ice Cave (Earle and Earle 2002) because of the unsafe conditions and the specialized skills required to repel into these deep pit-rift entrances. The farthest afield surveyors traveled to conduct a survey involved a 2.5 mile snowmobile ride followed by a 3.25 mile snowshoe hike out to One More Chance Cave. All of the caves surveyed were on the north end of the park in the original Monument (Figure 1).

Several cave features were also considered during search deliberations. One of the first considerations was whether cave length was sufficient to provide a dark zone for hibernating bats (generally not less than 100 feet). Entrance size was also considered. Generally, small entrances or some other constriction is beneficial for separating the interior of the cave from outside light and from hostile climate conditions outside the cave. This allows the interior of the cave to maintain a steady climate throughout winter. The third consideration is the number of skylights and entrances. Caves with numerous entrances and/or skylights generally do not make good hibernaculum, as light and outside temperature extremes influence large portions of the cave interior.

Selection of caves was often not a precise exercise due to incomplete or inaccurate cave data and maps. Some caves have highly detailed, professionally surveyed cave maps (e.g., Figure 2), but most have much less reliable information. Many cave files have no maps or only crude hand-drawn maps with approximated cave dimensions. Some caves were completely unexplored and the only information we could obtain ahead of time were GPS coordinates of one of the cave entrances. Often hand drawn maps did not include information pertinent to bat use (skylights, number of entrances etc.) which led to some wasted effort as surveyors trekked out across lava on snowshoes only to enter a cave to find it well lit by skylights or otherwise unsuitable for hibernating bats. In future years, caves with unreliable information should be field checked during summer to determine their suitability for winter bat use. Although not the main focus of this effort, cave maps and data were updated as surveyors encountered inaccuracies. Previously unexplored areas were added to current maps and sometimes entirely new maps were drawn. Cave passage lengths and heights were corrected. Skylights and other missing features were added to maps.



Caves of Craters of the Moon

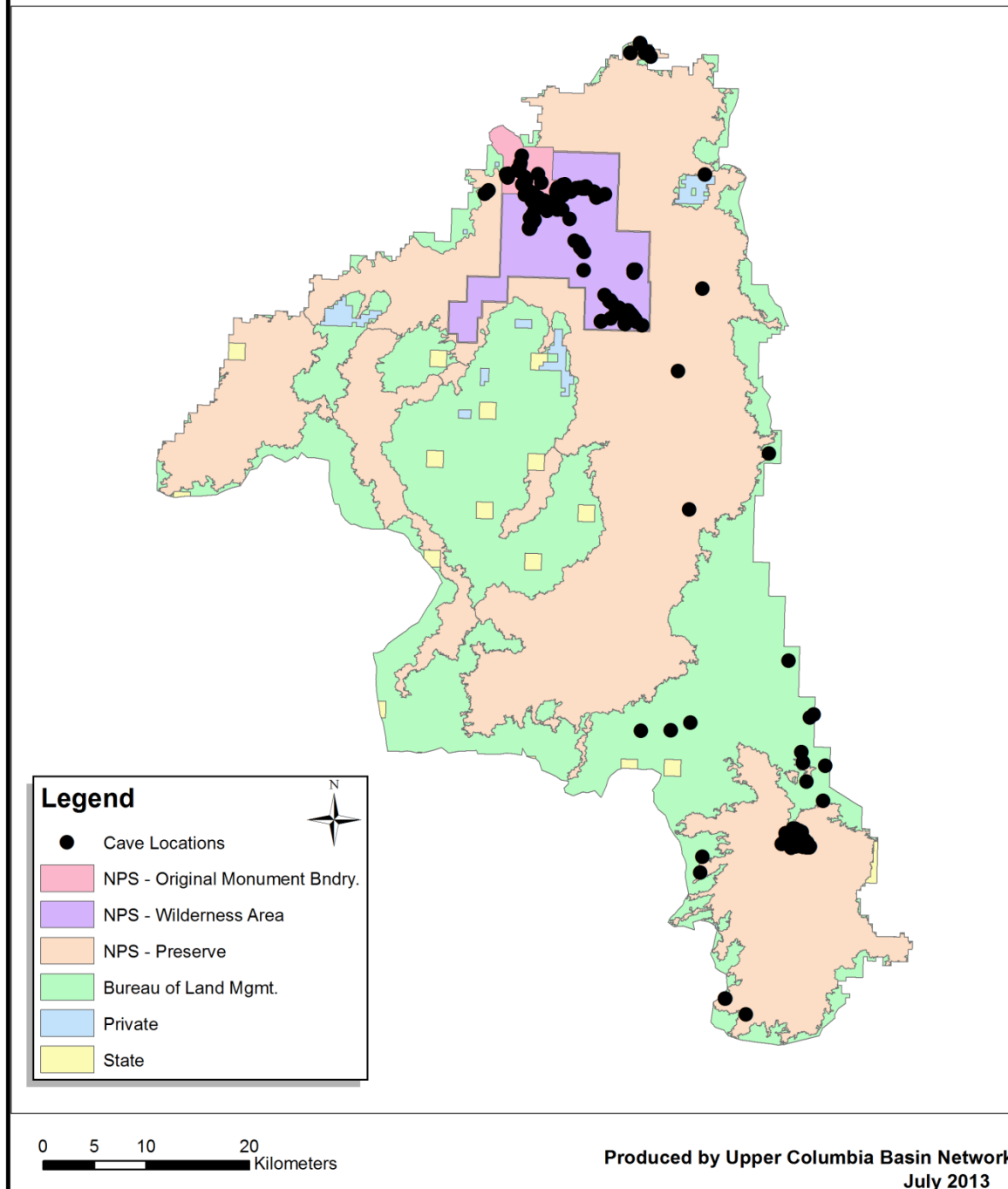


Figure 1. Map of the known caves and land ownership patterns in Craters of the Moon National Monument and Preserve.

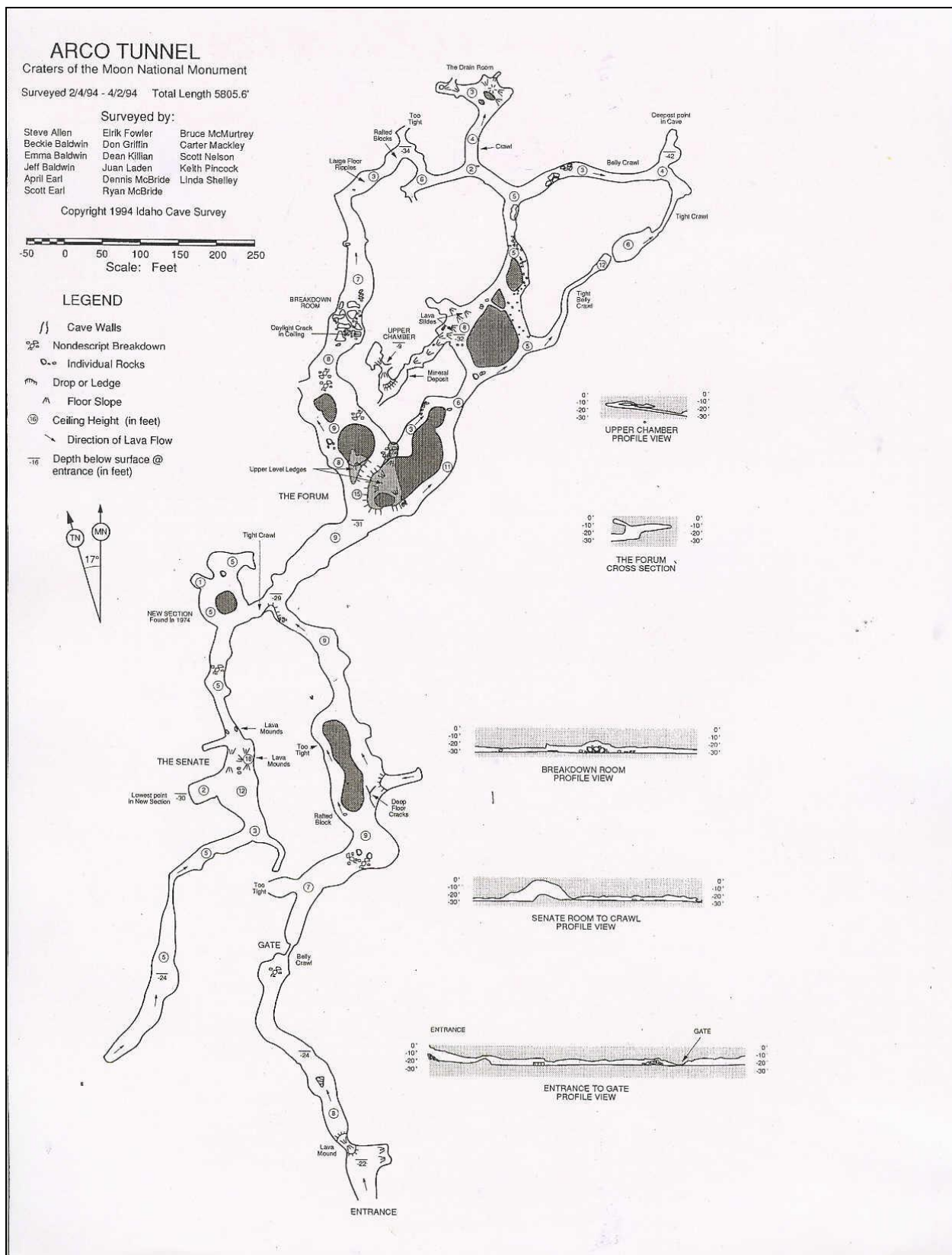


Figure 2. Map of Arco Tunnel cave in Craters of the Moon National Monument and Preserve.

Survey Methods

All surveys were conducted between January 1 and March 15 in 2012 and in 2013. Caves of sufficient length were divided into zones based on natural features or breaks in the cave. The air temperature was recorded one to three times per zone. Temperatures were not taken if upon entering a cave it was deemed to be unsuitable for hibernacula. If bats were found, temperatures were taken as close to the bats as possible. Limiting disturbance to bats was prioritized over species identification and no bats were handled or measured during surveys. In one cave, Needles Cave, about 50 feet of cave did not receive a thorough search when surveyors determined they could not easily get under a bat in a narrow crawl without potentially disturbing the bat. All hibernating bats were photographed to aid in identification and for use in counting bat clusters back in an office setting. Bat expert and wildlife biologist Bill Doering, Power Engineers Inc., was enlisted to identify species from photos. Even with photos, bat identification is imprecise and some bats had to be classified as *Myotis spp.* or simply “unknown bat”.

On April 3, 2013, an ancillary acoustic survey was conducted at the mouth of Arco Tunnel. The intent of this ancillary survey was to acoustically try and determine emergence activity and to supplement the visual searches conducted earlier in the winter. A Pettersson D500x bat detector (<http://www.batsound.com/>) was used in the deployment. An external microphone was deployed 3 meters above the breakdown pit at the cave entrance. Sonobat 3.1.4 with Great Basin Suite identification software (www.sonobat.com) was used with settings at 0.80 acceptable call quality and 0.90 decision threshold to classify species.

White-nose Syndrome Decontamination

The National White-nose Syndrome Decontamination Protocol version 06.25.2012 (USFWS 2012) was followed with the exception of the requirement to decontaminate after every cave visit. Craters of the Moon has a unique situation where there can be multiple cave entrances within very short distances, and sometimes multiple cave entrances can be within the same breakdown pit. Therefore, decontamination after every cave visit was seen as excessive and unwarranted. Previous versions of the protocols used a 10 mile radius before decontaminating was required. The author brought up these concerns on a National WNS conference call when the protocols were initially changed from the 10 mile rule to every cave visit in winter 2012. There were no concerns or objections from the USFWS or other biologists on the call to modify the decontamination procedures for this particular situation. Therefore CRMO surveyors used a modification of the protocols in which cave gear was kept separated from all other gear and packs to the extent possible until full decontamination could be completed after visiting the last cave on any given day of cave searches. Using this method, surveyors never entered caves on the same day that were more than a mile apart.

Surveyors experienced many difficulties and frustrations with decontamination procedures in winter and in remote locations. The Tyvek suits (Figure 3) often ripped on jagged rocks and lava stalagmites when crawling through smaller passages. This exposed clothing underneath and left bits of Tyvek material behind in the cave. Cavers brought multiple suits along and changed them out between caves if they became damaged. Disinfectant (Formula 409 All-Purpose Cleaner) froze solid and became unusable. Disinfecting wipes proved to be no better, as they would freeze into a solid block. Decontamination of snowshoes was an area of concern for cavers as well. Although snowshoes did not enter caves, the cavers boots did. If upon exit of a cave the 409 was frozen there was no way to decontaminate boots effectively thus creating the potential to contaminate snowshoes when cavers strapped them back on. Snowshoes are neither submersible or easily wiped down. The most effective measure proved to be lining a compartment of a backpack with a sturdy plastic garbage bag and

storing any gear that entered a cave into it between caves and until return to the office where all submersible gear could be submerged in hot water ($\geq 122^{\circ}$ F for 20 minutes) and non-submersible gear could be wiped down.



Figure 3. Surveyors in full white-nose syndrome decontamination gear prepare to enter Arco Tunnel.

Results and Discussion

Eight caves were visited in 2012 and 41 caves were visited in 2013, including 6 that were visited in 2012 (Table 1). Three new hibernacula were documented during 2013 surveys (Table 1). All bats seen in the new hibernacula are believed to be Townsend's big-eared bats (*Corynorhinus townsendii*). Sixteen caves visited were considered too light and/or too short for hibernating bats (Table 1). Six additional caves were considered marginal habitat and unlikely to support hibernating bats (Table 1). This means that approximately 20% of caves visited and thought to be suitable for hibernation contained hibernating bats. The survey of Arco Tunnel resulted in a record high count of 33 bats, and the first record of hibernating Yuma myotis (*Myotis yumanensis*) in CRMO. Arco Tunnel remains the largest confirmed hibernacula in CRMO, although anecdotal reports suggest there may be other large hibernacula in Crystal Ice Cave, South Grotto, and Creon's cave in the King's Bowl complex (Earle and Earle 2002). None of these have been surveyed yet due to remoteness, hazards and specialized skills required to descend into these caves.

Table 1. List of 41 caves surveyed for winter bat use during winters of 2012 and 2013 in Craters of the Moon National Monument and Preserve.

Cave	Surveyed		Suitable for Hibernacula (judgment of surveyors)	Bats
	2012	2013		
Sand Trap	Y	Y	possible	0
Two-Step	Y	Y	possible	0
Fire-Ring	Y	Y	possible	0
Bloody Knees	Y	Y	unlikely - too short and/or light	0
Low Tide	Y	Y	possible	0
Pond	Y	N	no - too small	0
Three Room	Y	N	no - too short and light	0
Skelebat	Y	Y	possible	0
Open Dome		Y	Unlikely – too light (skylight on far end)	0
Screaming Jaws of Death		Y	Yes	0
Spongy Floor		Y	Possible	0
Antelope		Y	no - too short and light	0
Ice Lake		Y	possible	0
Low Tide		Y	possible	0
Prickly Pear		Y	unlikely – short and too light	0
Karate		Y	no - too short and light	0
Girl Scout		Y	no - too light (skylights/multiple entrances)	0
Lobe 1		Y	no- too small	0
Lobe 2		Y	no- too small	0
Chimney		Y	yes	0
Cathedral		Y	no - too short and light	0

Table 1 (continued). List of 41 caves surveyed for winter bat use during winters of 2012 and 2013 in Craters of the Moon National Monument and Preserve.

Cave	Surveyed		Suitable for Hibernacula (judgment of surveyors)	Bats
	2012	2013		
Cathedral		Y	no - too short and light	0
Big Craters Tunnel		Y	no – too light (skylights)	0
Chapel		Y	yes	0
Rope Floor		Y	no - too short and light	0
Arched Pit		Y	no - too short and light	0
Green Crystal		Y	no – too short and light	0
Indian Tunnel (west passage)		Y	unlikely (no constriction point)	0
Dewdrop		Y	no - too short and light	0
Beauty		Y	confirmed	2
Boy Scout		Y	unlikely – too light	0
Arco Tunnel		Y	confirmed (known since 1986)	33
Hidden		Y	Yes	0
Hidden II		Y	no – too short and light	0
First Chance		Y	possible	0
Needles		Y	confirmed	1*
Tom Thumb		Y	no – too light	0
Last Chance		Y	possible in farthest reaches of cave	0

Table 1 (continued). List of 41 caves surveyed for winter bat use during winters of 2012 and 2013 in Craters of the Moon National Monument and Preserve.

Cave	Surveyed		Suitable for Hibernacula (judgment of surveyors)	Bats
	2012	2013		
Lava River Natural Bridge		Y	possible	0
Surprise		Y	unlikely – too light	0
East Teepee		Y	possible	0
One More Chance		Y	confirmed	2

*about 50 feet of cave not thoroughly searched as surveyors felt it unlikely they could get past the bat without disturbing it

Acoustic Monitoring at Mouth of Arco Tunnel

The acoustic monitor deployed outside of Arco Tunnel detected a total of 6 bat calls in the first 17 days indicating sporadic infrequent emergence from the cave. Then, on April 20 between 9:00 PM and 10:00 PM the detector recorded over 200 bat calls which may have indicated a major emergence event. Species included Townsend's big-eared bat, little brown myotis (*Myotis lucifugus*), long-legged myotis (*Myotis volans*), small-footed myotis (*Myotis ciliolabrum*) and long-eared myotis (*Myotis evotis*). The acoustically identified species largely agreed with species identifications made from photos taken during hibernacula searches. Possible exceptions were the absence of any Yuma myotis detections and the detection of Long-eared myotis. This species was somewhat of a surprise because it was not a species identified when photos were examined. However, there were 12 bats that were only identified to *Myotis* spp. so it remains plausible that long-eared myotis was present during hibernation surveys. It is also possible that hibernating bats could have been missed during the survey (in passages beyond crawls too small for humans or in yet undiscovered passages). There were bats with longer ears in *Myotis* clusters (Figure 4) but without measurements it is impossible to determine. The lack of Yuma myotis detections could be explained by the Sonobat call quality or decision threshold settings. Long-eared myotis have been documented in caves in the winter on the Idaho National Laboratory (J. Whiting, *personal communication*) and it is one of the most common species in CRMO during summer (Ave et al. 2004). While there is no way of saying definitively that these bat calls were from bats hibernating in the cave, it is suggestive of the possibility. Follow-up acoustic surveys in subsequent years may provide information to clarify this hypothesis.



Figure 4. One of two clusters of bats in Arco Tunnel found during the 2013 survey that shows bats with longer ears that may be long-eared myotis.

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