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Bats of Yucca Mountain, Nevada

Civilian Radioactive Waste Management System

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**Civilian Radioactive Waste Management System
Management & Operating Contractor**

Bats of Yucca Mountain, Nevada

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February 1, 1998

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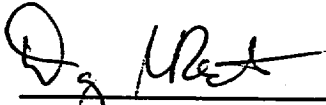
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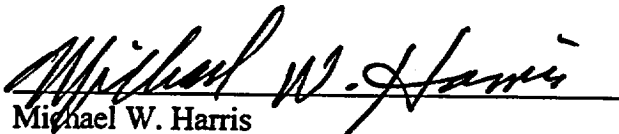
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EXECUTIVE SUMMARY

In 1989, the spotted bat was identified as a candidate for listing as threatened or endangered under the Endangered Species Act. Because the species' range includes Yucca Mountain and the species' preferred habitat is found within 40 km of that site, surveys were conducted during 1991-1993 to determine whether that spotted bats occur at Yucca Mountain.

The spotted bat was not captured or heard at Yucca Mountain. However, vocalizations of this species were heard and recorded 50 km north of Yucca Mountain near Pahute Mesa, and specimens were captured at Pahute Mesa in 1996 by other Department of Energy contractors.

While surveying for the spotted bat, seven (possibly eight) species of bats were captured at Yucca Mountain. Eight additional bat species were identified during a literature review as possibly occurring within the area. Two (possibly 3) of the species captured at Yucca Mountain, and five of the eight species identified during the literature review were added to the list of candidates in 1994.

In 1996, all bats possibly occurring at Yucca Mountain, including the spotted bat, were removed from the list of candidate species by the U.S. Fish and Wildlife Service due to a lack of information on population abundance and trends of the species. However, these species are still considered either sensitive by the U.S. Bureau of Land Management or protected by the State of Nevada. As additional biological information is obtained, the species may again become candidates for listing, therefore the Department of Energy will continue to monitor the legal status of these species.

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1. INTRODUCTION

In 1989, *Euderma maculatum* (spotted bat) was identified as a candidate for listing as a threatened or endangered species under the *Endangered Species Act of 1973* (Federal Register 54:554-562). Yucca Mountain is within the range of the species (Watkins 1977; Hall 1995) and specimens had been captured in adjacent Clark and Lincoln counties (Best 1988), but there was no information on the distribution of this species in the region around Yucca Mountain. Documentation of the presence or absence of this species at Yucca Mountain can assist DOE in minimizing future project delays in the event the species was listed as threatened or endangered. If the species was present in the area, DOE would have the necessary information to rapidly develop a biological assessment and begin consulting with the U.S. Fish and Wildlife Service (FWS). If the species was rare or not present, these potentially costly delays could be avoided. Because information about *E. maculatum* and other bats that may have occurred at Yucca Mountain was limited, surveys were conducted near Yucca Mountain in 1991, 1992, and 1993. The objective of these surveys was to determine whether *E. maculatum* occurs at or near Yucca Mountain. During these efforts, information also was collected on other bat species. This report summarizes results of those surveys and evaluates other bat species that may occur in the area but that were not detected.

In 1996, as a result of changes in policy and definitions, *E. maculatum* was removed from immediate consideration as a candidate for listing as threatened or endangered. However, *E. maculatum* is still protected by the State of Nevada as a threatened species (*Nevada Administrative Code* 503.010-503.080, July 1994) and is considered a sensitive species by the U.S. Bureau of Land Management.

Euderma maculatum roost singly in high rocky cliffs throughout their range (Easterla 1970; Woodsworth et al. 1981; Leonard and Fenton 1983; Leonard and Fenton 1984; Berna 1990). Foraging habitat is reported as open grasslands or meadows surrounded by pine (*Pinus*) forests in the southwestern states (Jones 1961; Findley and Jones 1965; Berna 1990; Navo et al. 1992) and British Columbia, Canada (Leonard and Fenton 1983). However, in southwestern deserts, *E. maculatum* has been collected over desert scrub and riparian areas near rocky cliffs (Easterla 1965, 1970; Watkins 1977; Ruffner et al. 1979). Because potential roosting and foraging habitats are found near Yucca Mountain, it is possible that these bats occur in the area as residents or transients.

Information available in the literature also was of limited value for identifying other bat species that may occur at Yucca Mountain. Burt (1934) collected 12 bat species while conducting extensive field surveys of mammals in southern Nevada, as close as 30 km south of Yucca Mountain. Bats were shot in flight and collected from roosts in buildings and caves. Though these efforts were extensive, the results may be biased toward species that are active early in the evening and those that roost communally. Hall (1995) reviewed museum specimens and conducted field surveys using methods similar to those of Burt (1934) to describe the mammals of the state. Hall (1995) reported that 17 bat species occurred, or potentially occurred, in southern Nevada. Other efforts to study bats in the region have focused on specific locations, primarily the Spring Mountains (60-100 km southeast of Yucca Mountain), and primarily in habitats substantially different from Yucca Mountain. Of these, Ramsey (1995) studied bats in several areas of the Spring Mountains, some of which were similar in elevation and habitat to Yucca Mountain, and found 13 species. The only work conducted near Yucca Mountain was by Jorgensen and Hayward (1965), who described the mammals of the Nevada

Test Site but focused primarily on rodents. They opportunistically collected four species of bats but did not systematically sample this group of animals.

2. METHODS

2.1 STUDY AREA

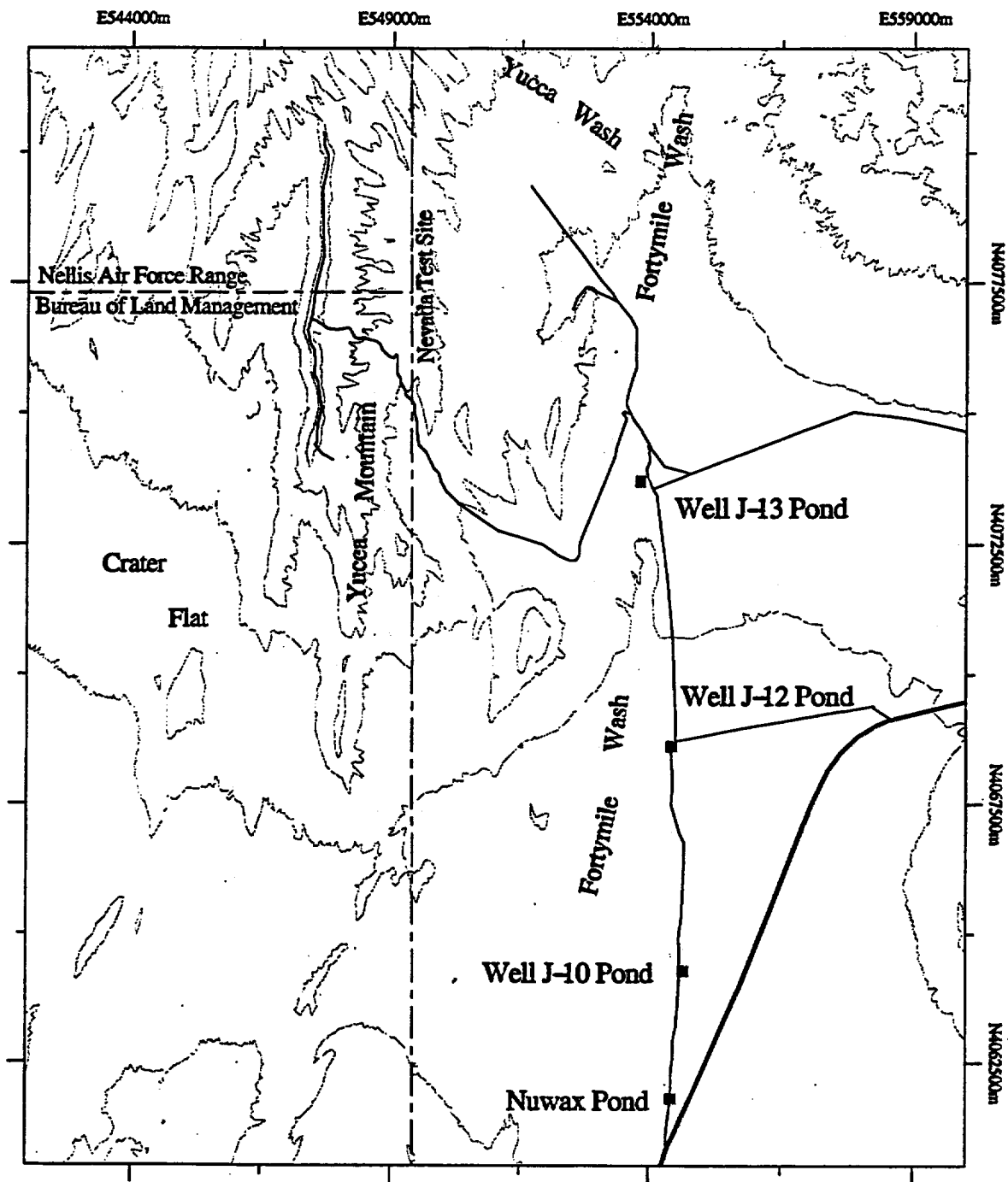
Yucca Mountain is located in Nye County, Nevada, approximately 26 km north of the town of Amargosa Valley (formerly Lathrop Wells). Yucca Mountain is a volcanic ridge oriented north to south and lies in a transition zone between the northern Mojave and southern Great Basin deserts. Elevations in the study area ranged from about 1,500 m at the crest of Yucca Mountain to about 870 m in Fortymile Wash, east of Yucca Mountain.

Two major floristic zones occurred in the study area. Vegetation below 1,200 m was dominated by Mojave Desert plant communities; at higher elevations, plant communities were influenced by Mojave and Great Basin desert floras (Beatley 1976; CRWMS M&O 1996b). Taxonomy follows Kartesz and Pankhurst (1994). Overall, the most abundant shrubs were *Larrea tridentata* (creosote bush), *Ambrosia dumosa* (white bursage), *Lycium andersonii* (Anderson desert thorn), *Coleogyne ramosissima* (blackbrush), and *Ephedra nevadensis* (Nevada ephedra).

The Yucca Mountain climate was typical of the eastern Mojave Desert, with limited and erratic precipitation, low relative humidity, and large daily and seasonal temperature fluctuations. Average annual precipitation from 1960 to 1995 was 13.9 cm, 9 to 13 km southeast of the sites surveyed for this study (DOE, unpublished data). From 1986 to 1994, average daily minimum and maximum temperatures were 2 and 10° C, respectively, during December, and 22 and 34° C, respectively, during July.

Four manmade ponds near Yucca Mountain, and portions of Fortymile Wash, were sampled (Figure 1). Well J-13 Pond (0.05 ha) was in the bottom of Fortymile Wash at 990 m elevation. Vegetation along the edges of the pond consisted of *Tamarix ramosissima* (saltcedar) and low-growing herbaceous species. Well J-12 Pond (0.03 ha) was on the cliff above Fortymile Wash at 950 m elevation. The edge of the pond was covered with *Typha domingensis* (southern cattail), *Tamarix ramosissima*, *Schoenoplectus acutus* (hard-stem bulrush), and *Baccharis emoryi* (Emory's baccharis). Well J-10 Pond (0.08 ha) was in Jackass Flats at 890 m elevation and was partially surrounded with approximately 8-m-high *Salix gooddingii* (Gooding's willow), *Tamarix ramosissima*, and *Baccharis emoryi*. The Nuwax Pond (0.04 ha) was in Jackass Flats at 870 m elevation and was enclosed on 75% of its shoreline with *Salix gooddingii*, *Tamarix ramosissima*, *Schoenoplectus acutus*, and *Typha domingensis*. The Nuwax Pond was drained in 1995. Portions of Fortymile Wash that were sampled had steep, rocky walls about 30 m high, providing potential roost sites for bats.

To fulfill the objectives of this study, surveys also were conducted in forested areas near Pahute and Rainier mesas on the Nevada Test Site, approximately 50 km north of Yucca Mountain. These mesas are of volcanic origin with relatively shallow soils, and steep cliffs along numerous canyons. This area is within the Great Basin Desert floristic zone (Beatley 1976), and was an open shrub woodland dominated by *Artemisia* spp. (sagebrush), *Pinus monophylla* (singleleaf pinyon), and *Juniperus osteosperma* (Utah juniper). The climate in this area is typical of the Great Basin Desert. Average precipitation between 1963 and 1972 was 28.6 cm (Beatley 1976). Two ponds in this area



Yucca Mountain Site
Characterization Project

Contour Interval 400 Feet

Map compiled by CRWMS M&OTDM on September 17, 1996

YMP-96-148.1

Figure 1. Yucca Mountain, Nevada, and areas surveyed for bats in 1991 and 1992.

were surveyed. Camp 17 Pond was north of Stockade Wash, just below Pahute and Rainier mesas at about 1,760 m elevation, and 19C Lower Pond was located in Silent Canyon on Pahute Mesa at 2,073 m elevation. The Universal Transverse Mercator Coordinates (UTMs; Zone 11) for Camp 17 and 19C Lower ponds were N4113080, E565510 and N4124575, E559764, respectively.

2.2 FIELD METHODS

Because of behavioral differences among bat species (Thomas and LaVal 1988), several techniques were used to detect bats. Mist nets were set at ponds to catch drinking or feeding bats. Mist nets were set in Fortymile Wash and in a narrow channel of Yucca Wash to capture bats that might have been roosting in crevices or moving through the corridors to feed. Bats also were captured opportunistically in buildings. Listening for and recording vocalizations was used to supplement mist netting because the vocalizations of some bats are detectable by the human ear, and these species may forage higher than mist nets can reach. Field surveys were conducted only on nights when maximum wind speed was expected to be less than 32 km/h.

In May, July, and August 1991, the four ponds (Well J-13, Well J-12, Well J-10, and Nuwax ponds) near Yucca Mountain were surveyed. Well J-13 Pond also was surveyed in August 1992. Mist nets were placed over water or along the shore. Fortymile and Yucca washes were surveyed in August 1991. Nets were set about one hour before dusk and monitored until dawn on most nights. Individuals captured were sexed and identified to species using nomenclature that followed Jones et al. (1992). Weight and standard measurements were taken on many individuals. These measurements are not presented in this report, but are available on request from the U.S. Department of Energy, Yucca Mountain Site Characterization Office. One or two specimens of each species were collected for educational purposes and as voucher specimens.

In addition to surveys, specimens were collected opportunistically. For example, bats occasionally were found in buildings near Yucca Mountain. When possible these bats were captured, identified, and measured prior to release.

Because *E. maculatum* was not captured at Yucca Mountain in 1991, mist-netting surveys were expanded in 1992 to include forested habitats on the mesas north of Yucca Mountain. In 1992, in addition to Well J-13 Pond, two ponds on or near Pahute Mesa (Camp 17 Pond and 19C Lower Pond) were surveyed using mist nets as described above, and 19C Lower Pond was surveyed again in 1993.

Though *E. maculatum* has been captured in mist nets (Leonard and Fenton 1983; Wai-Ping and Fenton 1989; Berna 1990), the probability of capturing them is low because they typically forage at least 10 m above the ground (Leonard and Fenton 1983; Wai-Ping and Fenton 1989). Therefore, other methods for assessing presence of this species were necessary. Echolocation calls of *E. maculatum* are audible to the human ear to at least 250 m (Leonard and Fenton 1983), so biologists listened for, and if heard, recorded echolocation calls while mist netting at all locations during 1991-1993. In addition, biologists walked through potential habitat at Yucca Mountain and on the mesas to record echolocation calls. Calls were recorded using a Teac® digital audio tape recorder equipped with a Sennheiser® hypercardioid microphone. Several other species potentially found in the area, including *Plecotus [Corynorhinus] townsendii* (Townsend's big-eared bat) and *Tadarida brasiliensis*

(Brazilian free-tailed bat), emit echolocation calls audible to the human ear, and these calls can be confused with *E. maculatum* in the field. To confirm species identification, recorded vocalizations were analyzed by the Department of Computer and Electrical Engineering Calibration Laboratory at the University of Nevada, Las Vegas, using an oscilloscope. The calls were compared to calls described by Fenton and Bell (1981), Leonard and Fenton (1984), Fenton et al. (1987), and Thomas et al. (1987).

3. RESULTS

3.1 MIST NETTING

Six, or possibly seven, species of bats, but no *E. maculatum*, were captured during nine nights of mist netting in 1991 and 1992 near Yucca Mountain (Table 1). *Pipistrellus hesperus* (western pipistrelle) was captured in all trapping sessions and was the species most often captured (604 total captures) during most trapping events (Table 1). *Antrozous pallidus* (pallid bat) was the second most commonly captured species during mist netting (34 total captures). *Tadarida brasiliensis*, *Lasiurus cinereus* (hoary bat), and *Myotis thysanodes* (fringed myotis) were captured infrequently (11, 3, and 2 captures respectively). Twenty-seven individuals identified as *Myotis californicus* (California myotis) or *Myotis ciliolabrum* (western small-footed myotis) were captured, but not separated to species. These two species may occur sympatrically in this area, but it is difficult to differentiate live specimens in the field because they are differentiated primarily by cranial shape and structure (van Zyll de Jong 1985). However, *M. californicus* is found most often in desert areas similar to those at Yucca Mountain, and *M. ciliolabrum* occur most often at higher elevations and forested habitat (Hoffmeister 1986). Thus, it is likely that those captured at Yucca Mountain were *M. californicus*. However, due to uncertainty, these individuals were referred to as *M. californicus/ciliolabrum*.

In 1991, one *Myotis volans* (long-legged myotis), was removed from a building approximately 10 km east of Fortymile Wash. Several individuals of *Tadarida brasiliensis* and *Myotis* spp. also were captured and released from buildings in the area.

No *E. maculatum* were captured during three nights of mist netting over ponds on the mesas north of Yucca Mountain. Seven, or possibly eight, other species of bats were captured, but all were in relatively low abundance (Table 2). Of these species, three had been captured at Yucca Mountain (*A. pallidus*, *M. thysanodes*, and *M. volans*). Also, several *M. californicus/ciliolabrum* were captured. Because preferred habitat for both species was found near the mesas, it is possible that both were caught. The three species captured on these ponds, but not captured at Yucca Mountain, included *Plecotus townsendii*, *Myotis evotis* (long-eared myotis), and *Eptesicus fuscus* (big brown bat).

3.2 EUDERMA MACULATUM VOCALIZATION SURVEYS

Vocalizations of *E. maculatum* were not heard or recorded during any mist-netting sessions at Yucca Mountain, nor were any vocalizations detected during walking surveys in the area.

On August 18, 1992, while monitoring nets at the 19C Lower Pond on Pahute Mesa, biologists heard and recorded a series of sounds believed to be *E. maculatum* vocalizations. The sounds were heard sporadically from 21:17 to 02:00 hours. Most series of sounds lasted 10 to 30 seconds, but the first series continued for 4-5 minutes.

Analysis of the recordings confirmed that the sounds were produced by *E. maculatum*. Individual *E. maculatum* calls last about 3-5 milliseconds (ms), the frequency varies throughout the call

Table 1. Number of bats of each gender captured in mist nets at Yucca Mountain, Nevada, during 1991 and 1992.

Date	Location	Species	Gender of Individuals Captured			
			Female	Male	Unknown	Total
5/6/91	Well J-13 Pond	<i>Lasiurus cinereus</i>	1			1
		<i>Myotis californicus/ciliolabrum</i>	2	6	3	11
		<i>Pipistrellus hesperus</i>	1	4		5
5/7/91	Well J-12 Pond	<i>Antrozous pallidus</i>	1			1
		<i>Myotis californicus/ciliolabrum</i>	4	2		6
		<i>Pipistrellus hesperus</i>		1		1
7/8/91	Nuwax Pond	<i>Antrozous pallidus</i>	10			10
		<i>Myotis californicus/ciliolabrum</i>	3			3
		<i>Pipistrellus hesperus</i>	33	6		39
7/9/91	Well J-10 Pond	<i>Antrozous pallidus</i>	4	2		6
		<i>Myotis californicus/ciliolabrum</i>	1			1
		<i>Pipistrellus hesperus</i>	25	8		33
7/10/91	Well J-13 Pond	<i>Antrozous pallidus</i>	7			7
		<i>Myotis californicus/ciliolabrum</i>	3	1		4
		<i>Pipistrellus hesperus</i>	130	24	14	168
		<i>Tadarida brasiliensis</i>		1		1
8/12/91	Nuwax Pond	<i>Antrozous pallidus</i>	2	1		3
		<i>Pipistrellus hesperus</i>	8	2		10
8/13/91	Fortymile and Yucca washes	<i>Antrozous pallidus</i>		2	1	3
		<i>Lasiurus cinereus</i>	1			1
		<i>Myotis californicus/ciliolabrum</i>		1		1
		<i>Pipistrellus hesperus</i>	1	2		3
8/14/91	Well J-13 Pond	<i>Antrozous pallidus</i>	1			1
		<i>Lasiurus cinereus</i>	1			1
		<i>Pipistrellus hesperus</i>	32	9		41
		<i>Tadarida brasiliensis</i>		5		5
8/17/92	Well J-13 Pond	<i>Antrozous pallidus</i>	2	1		3
		<i>Myotis californicus/ciliolabrum</i>		1		1
		<i>Myotis thysanodes</i>	1	1		2
		<i>Pipistrellus hesperus</i>	194	110		304
		<i>Tadarida brasiliensis</i>	3	2		5

Table 2. Number of bats of each gender captured in mist nets in 1992 and 1993 near Pahute and Rainier mesas on the Nevada Test Site.

Date	Location	Species	Gender of Individuals Captured			
			Female	Male	Unknown	Total
7/7/92	Camp 17 Pond	<i>Antrozous pallidus</i>	4			4
		<i>Myotis californicus/ciliolabrum</i>	5	2	1	8
		<i>Myotis thysanodes</i>		1		1
		<i>Plecotus [Corynorhinus] townsendii</i>		1		1
8/18/92	19C Lower Pond	<i>Myotis californicus/ciliolabrum</i>	1			1
		<i>Myotis evotis</i>	1	1		2
		<i>Myotis volans</i>	4	3		7
7/2/93	19C Lower Pond ^a	<i>Eptesicus fuscus</i>			1	1
		<i>Myotis californicus/ciliolabrum</i>			6 ^a	6
		<i>Myotis evotis</i>			6 ^a	6
		<i>Myotis volans</i>			6 ^a	6
		<i>Plecotus [Corynorhinus] townsendii</i>			1	1

^a Data from this evening were lost when the data forms fell into the pond. The list of species captured is correct, but the specific number of individuals of each species is approximate.

(8.6 to about 14.5 kHz), and the frequency with the greatest energy is about 10.9 kHz (Fenton and Bell 1981). Calls recorded at the 19C Lower Pond were about 3.9 ms long, and the lowest and highest frequencies were 8.7 and 14.5 kHz, respectively. The frequency with greatest energy was 10.6 kHz. These characteristics were substantially different from those of all other species that may occur in the area (Fenton and Bell 1981; Thomas et al. 1987).

4. DISCUSSION

4.1 *EUDERMA MACULATUM*

Euderma maculatum was not captured or heard during surveys at Yucca Mountain. Steep rocky cliffs, the preferred roost sites for spotted bats (Watkins 1977; Leonard and Fenton 1983), were present but not common at Yucca Mountain. Water sources were present at Yucca Mountain but large stands of riparian vegetation, a preferred foraging habitat for desert-dwelling *E. maculatum* (Ruffner et al. 1979), did not exist in the area. Vocalizations of *E. maculatum* were heard and recorded during surveys about 50 km north of Yucca Mountain near Pahute Mesa. Additionally, four *E. maculatum* were captured during studies conducted by other DOE biologists on Pahute Mesa in 1996 (Steen et al. 1997). This area has steep cliffs for roost sites; water sources; and open woodlands, the preferred habitat of this species throughout much of its range (Watkins 1977; Leonard and Fenton 1983).

Based on results of this study and current understanding of the distribution and habitat preferences of *E. maculatum*, it is concluded that this species is rare or absent at Yucca Mountain. However, individuals of this species may travel through the area and may forage over ponds near Yucca Mountain en route to more suitable habitats. Field efforts conducted for this study were sufficient to confirm the species was not common at Yucca Mountain, but rare occurrences of the species may not have been detected.

4.2 OTHER BAT SPECIES

Seven (possibly eight) species of bats were captured near Yucca Mountain. Six of these species (*A. pallidus*, *M. californicus/ciliolabrum*, *M. thysanodes*, *P. hesperus*, and *T. brasiliensis*) have been reported as relatively common in low-elevation, southern Nevada deserts (Burt 1934; Hall 1995; Ramsey 1995) (Table 3). The seventh, *M. volans*, has been reported as uncommon in this habitat (Ramsey 1995), but relatively common in higher-elevation woodlands (Burt 1934; Hall 1995; Ramsey 1995). Only one *M. volans* was captured near Yucca Mountain during this study (from a building), but this species was captured relatively often near Pahute and Rainier mesas (Table 2). The eighth species, *Lasiurus cinereus*, is widespread but uncommon throughout North America (Shump and Shump 1982), and has been recorded rarely in southern Nevada. Hall (1995) reported three records of this species in Nevada and stated that they likely were migrants rather than residents. Three *L. cinereus* were captured in mist nets near Yucca Mountain. *Lasiurus cinereus* typically roosts in trees 3-5 m above ground (Shump and Shump 1982). Because trees of this size only occur near Yucca Mountain at Well J-10 Pond, *L. cinereus* probably is uncommon in the area and the individuals captured likely were residents of woodlands in nearby mountain ranges.

In 1996, DOE Nevada Operations Office biologists conducted bat surveys at Well J-13 Pond and found the following five or six species: *A. pallidus*, *M. californicus/ciliolabrum*, *M. volans*, *P. hesperus*, and *T. brasiliensis* (Steen et al. 1997). All of these species had been captured near Yucca Mountain in 1991-1992. Also in the summer of 1996, the authors surveyed Well J-10 Pond, capturing 12 *P. hesperus*, and Well J-13 Pond, capturing one *M. californicus/ciliolabrum*.

Table 3. Bat species found at or near Yucca Mountain during this study or those found by other authors in southern Nevada habitats similar to Yucca Mountain. Taxonomy and common names follow Jones et al. (1992).

Family Species	Common Name	Yucca Mountain	Burt 1934	Hall 1995	Jorgensen and Hayward 1969	Ramsey 1995
Phyllostomatidae						
<i>Macrotus californicus</i>	California Leaf-nosed Bat		R ^a	R		
Vespertilionidae						
<i>Myotis yumanensis</i>	Yuma Myotis			C		U
<i>Myotis thysanodes</i>	Fringed Myotis	R	X	C		C
<i>Myotis volans</i>	Long-legged Myotis	R				U
<i>Myotis californicus</i>	California Myotis	C ^b	C	C	X	C
<i>Myotis ciliolabrum</i>	Western Small-footed Myotis	C ^b				
<i>Lasionycteris noctivagans</i>	Silver-haired Bat			C ^c		
<i>Pipistrellus hesperus</i>	Western Pipistrelle	C	C	C	X	C
<i>Eptesicus fuscus</i>	Big Brown Bat		U	U		C
<i>Lasiurus blossevillii</i>	Western Red Bat			U		
<i>Lasiurus cinereus</i>	Hoary Bat	R				
<i>Euderma maculatum</i>	Spotted Bat			C		
<i>Plecotus townsendii</i>	Townsend's Big-eared Bat		X	C	X	U
<i>Idionycteris phyllotis</i>	Allen's Big-eared Bat					C
<i>Antrozous pallidus</i>	Pallid Bat	C	C	C	X	C
Molossidae						
<i>Tadarida brasiliensis</i>	Brazilian Free-tailed Bat	U	C	C		
<i>Nyctinomops macrotis</i>	Big Free-tailed Bat			U		

^a Relative abundance of each species was subjectively based on number of individuals of each species captured or by information presented in the other reports. C = Species was common; U = Uncommon; R = Rare; X = Species was present but relative abundance could not be determined based on information presented.

^b *Myotis californicus* and *M. ciliolabrum* were not differentiated in the field.

^c Species common in low-elevation desert habitats only during winter.

Seven (possibly eight) bat species were captured in mist nets and vocalizations of another, *E. maculatum*, were heard and recorded on or near Pahute Mesa during this study. Five of the species (*A. pallidus*, *M. californicus/ciliolabrum*, *M. thysanodes*, and *M. volans*) also were captured near Yucca Mountain. The other three species captured near the mesas, but not found at Yucca Mountain (*M. evotis*, *P. townsendii*, and *E. fuscus*), are most often found in high-elevation forests throughout southern Nevada (Burt 1934; Deacon et al. 1964; Hall 1995; Ramsey 1995).

Six species of bats found during this study are new records for the Nevada Test Site. One of these species was found only at Yucca Mountain (*L. cinereus*), three were found only on the mesas (*M. evotis*, *E. fuscus*, and *E. maculatum*), and two (*T. brasiliensis* and *M. thysanodes*) were found in both areas. Relative to other mammalian families, little work has been done to document the presence of bats on the Nevada Test Site (Jorgensen and Hayward 1965; O'Farrell and Emery 1976; Medica et al. 1981; Medica 1990; CRWMS M&O 1996a), and these surveys more than double the number of documented species.

Nine nights of mist netting should have been sufficient to capture the species common in the Yucca Mountain area. However, it is possible that the rare species were not detected. Eleven species not found at Yucca Mountain during this study have been reported from studies conducted elsewhere in southern Nevada (Burt 1934; Deacon et al. 1964; Jorgensen and Hayward 1965; Hall 1995; Ramsey 1995). One of these, *E. maculatum*, was discussed above. *Myotis evotis* and *M. lucifugus* (fringed myotis) prefer mid- to high-elevation woodlands (Manning and Jones 1989; Hall 1995; Ramsey 1995); therefore, it is likely that these two species are very rare or absent at Yucca Mountain. The remaining eight species have been found in low-elevation desert habitat similar to Yucca Mountain (Table 3) and therefore may occur at the site. According to Milner et al. (1990) and Hall (1995), Yucca Mountain is at the edge of the range of the three species *Macrotus californicus* (California leaf-nosed bat), *Lasiurus blossevillei* (western red bat), and *Nyctinomops macrotis* (big free-tailed bat). Two other species (*E. fuscus* and *Plecotus townsendii*) occur at lower elevations but seem to prefer higher-elevation areas (Kunz and Martin 1982; Kurta and Baker 1990). Another, *Myotis yumanensis* (Yuma myotis), was described by Hall (1995) as being common in desert habitats, but he only observed one specimen in southern Nevada. *Idionycteris phyllotis* (Allen's big-eared bat) was frequently captured by Ramsey (1995) at elevations of 1,185-1,730 m in the Spring Mountains, between 70 and 100 km southeast of Yucca Mountain. The last species, *Lasiomycteris noctivagans* (silver-haired bat), winters in desert habitats and spends summers in high-elevation forests (Hall 1995) and therefore may be present at Yucca Mountain during winter.

In 1994, eight species of bats thought or known to occur near Yucca Mountain were added to the list of candidates for classification as threatened or endangered (Federal Register 59:58984-59028), which already included *E. maculatum*. These species included *Macrotus californicus*, *Myotis ciliolabrum*, *M. yumanensis*, *M. volans*, *M. thysanodes*, *I. phyllotis*, *P. townsendii pallescens*, and *N. macrotus*. Based on the data resulting from the surveys in 1991-1993, two of these candidate species, *M. volans* and *M. thysanodes*, and possibly a third, *M. ciliolabrum*, occur in the Yucca Mountain area and the remaining five species are either rare or absent from the area.

In 1996, the FWS modified procedures used to list species as threatened or endangered, and removed all of these bat species from the list of candidates (Federal Register 60:7596-7613), primarily due to the lack of information on population trends of the species. Although these species

are no longer officially listed as candidates, the U.S. Bureau of Land Management still considers these bats to be sensitive species. FWS continues to collect information on these species and may in the future return them to the candidate list. DOE will continue to monitor the legal status of these species.

4.3 CONCLUSIONS

Impacts of current and future activities of the Yucca Mountain Site Characterization Project on *E. maculatum* probably are not a concern because the species is absent or rare at Yucca Mountain.

Seven (possibly eight) species of bats were captured near Yucca Mountain. Eight other species that have ranges overlapping Yucca Mountain and preferred habitat in the area are either rare or do not occur there.

Three of the species caught at Yucca Mountain were candidates for listing as threatened or endangered prior to their removal from the list in 1996. Though the species are no longer being considered for listing, DOE will continue to monitor their legal status.

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