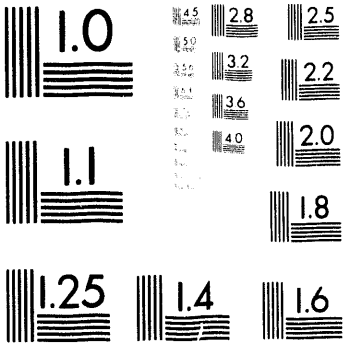
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A Preliminary Survey of Selected Structures on the Hanford Site for Townsend's Big-Eared Bat (*Plecotus townsendii*)

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MASTER

Summary

A preliminary survey of selected structures on the Hanford Site for Townsend's big-eared bat (*Plecotus townsendii*) was conducted by Pacific Northwest Laboratory (PNL) in August and September 1993. The Westinghouse Hanford Company (WHC) commissioned PNL to evaluate the potential for this bat, a candidate for federal protection, to occur in buildings potentially affected by decontamination and decommissioning operations under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The project involved identifying structures that contained bats and determining whether Townsend's big-eared bats were among those present. The survey focused on deactivated reactors, other buildings in the 100D and 100K Areas, canyon buildings in the 200 Areas, and other structures reported to contain bats.

During this six-week survey, Townsend's big-eared bat was not located. However, some structures likely to contain bat colonies were unable to be surveyed and others were only partially surveyed. These require further investigation over a longer period of time before a final determination on this species can be made. Of the buildings surveyed, the reactors and their associated buildings provided roosting sites most used by bats. No bats were found in canyon buildings in the 200 areas. These buildings are occupied, well-lighted, and offer few entrances for bats. They are also probably too distant from the Columbia River Shoreline, which constitutes the most important bat foraging habitat. We recommend that the remaining reactors and buildings, with emphasis on subterranean tunnels and basements, be surveyed during a more extended time period, i.e., June through September 1994.

Acknowledgments

The survey for Townsend's big-eared bat (*Plecotus townsendii*) involved the cooperative efforts of Westinghouse Hanford Company (WHC) and Pacific Northwest Laboratory (PNL). WHC's Auxiliary Support Services directed by Dorman Blankenship, with its support staff of Health Physics Technicians (HPTs), were invaluable in scheduling surveys of decommissioned and deactivated buildings in the 100D Area. Scott Thoren provided photos of the bat colony below the DR Reactor. WHC's Inactive Facilities Surveillance and Maintenance group, directed by Jim Hodgson, and its HPT personnel were very helpful in scheduling surveys of deactivated nuclear reactors.

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1.0 Introduction

The Hanford Site offers suitable habitat for insectivorous bats. The Columbia River and Rattlesnake Springs provide foraging habitat, and bats currently use some abandoned or little-used buildings as day roosts. Because of their nocturnal habits and a lack of formal studies of the local bat fauna, little is known about which species use these sites.

Fourteen bat species could potentially occupy the Hanford Site (Ingles 1965) (Table 1). All except the hoary bat may be present year-round (Thomas 1979). All except the Pallid bat (*Antrozous pallidus*) and Townsend's big-eared bat (*Plecotus townsendii*) forage primarily in riparian areas. The others forage primarily in upland habitats (Thomas 1979). All are nocturnal and orient themselves acoustically by ultrasonic echolocation calls. Townsend's big-eared bat, one of these 14 species, is a candidate for protection under the federal Endangered Species Act. It is a species of concern in connection with buildings scheduled for decontamination and decommissioning under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Fitzner et al. 1992). Westinghouse Hanford Company (WHC) commissioned Pacific Northwest Laboratory (PNL) to conduct a survey of Townsend's big-eared bat in abandoned buildings of the reactor areas and in canyon buildings of the 200 Areas. The objective of this survey was to identify which of these structures contained bats and determine whether Townsend's big-eared bats were among those present.

Table 1. Roosting Habitat and Frequency Ranges for Search-Phase Echolocation Calls of Bat Species that may be Found on the Hanford Site[a]

Species	Common Name	Highest Frequency (kHz)	Lowest Frequency (kHz)	Roosting Habitat[b],[c]
Antrozus pallidus	Pallid bat	49	26	Cl,B,C
Eptesicus fuscus	Big brown bat	48	27	Cl,B,C,T
Lasionycteris noctivagans	Silver-haired bat	—[d]	25-30[e]	B,T
Lasiurus cinereus	Hoary bat	39	26;20-25[e]	T
Myotis californicus	California myotis	67	37	Cl,B,T
Myotis evotis	Long-eared myotis	97	54	B,T
Myotis leibii	Small-footed myotis	—	—	Cl,B,C
Myotis lucifugus	Little brown myotis	78	38	Cl,B,T
Myotis thysanodes	Fringed myotis	49	31	B,C
Myotis volans	Long-legged myotis	90	40	B,T
Myotis yumanensis	Yuma myotis	—	—	B,T
Pipistrellus hesperus	Western pipistrel[f]	91	53	Cl,B,C
Plecotus townsendii	Townsend's big-eared bat	50	20	Cl,B,C
Tadarida molossa	Big free-tailed bat	—	—	B,C

(a) Data from Van Zyll de Jong 1985, unless otherwise noted.
(b) From Burt and Grossenheider 1980, Thomas 1979, Humphrey 1982, Jameson and Peeters 1988.
(c) B = roosts in buildings; C = caves, Cl = cliffs, T = trees.
(d) No data available.
(e) From Fenton and Merriam 1983.
(f) From Fenton and Bell 1981.

2.0 Methods

2.1 Bat Identification and the Mini Bat Detector

The nocturnal habits of bats have generally limited species identification to examinations of dead animals or individuals captured in bat traps at roost entrances or in mist nets set over small bodies of water and along flyways. Recently, however, species identification has been made less labor-intensive and time-consuming by using ultrasonic bat detection devices. Because many bat species produce echolocation calls of differing frequencies and duration, ultrasonic detectors are a useful tool for species identification. Available equipment varies in sophistication, cost, and the amount and reliability of information that can be obtained from echolocations (Thomas and West 1984).

We used three Mini Bat Detectors,[a] the device most often used in field studies. It uses a narrow-band microphone and heterodyning which "divides" intercepted frequencies by a factor of 10, reducing inaudible ultrasound into the audible range. The output can be heard with headphones or recorded on a tape recorder. The Mini Bat Detector intercepts ultrasonic signals within a ca. 3-kHz tunable window at any one time.

2.2 Recognition of Townsend's Big-Eared Bat Using Mini Bat Detectors

Sonograms, visual displays of frequency range and duration of search phase echolocations, have been constructed for various bat species. Sonograms, combined with the audible sounds produced by bat detectors, have been used to produce dichotomous keys for identification of some bat species (Fenton and Merriam 1983). However, no published dichotomous keys include Townsend's big-eared bat. Although a sonogram for this species has been published (Van Zyll de Jong 1985), the audible sounds produced by bat detectors used on this species are not well-documented.

A single search-phase echolocation from Townsend's big-eared bat may span up to a 30-kHz range (Table 1) and last only a few milliseconds. Bat "passes" (a sequence of calls emitted as an individual approaches an object) are generally less than, or equal to, 2 seconds (Thomas and West 1984). Because the Mini Bat Detector can only be tuned to one 3-kHz window at a time, it would be impossible to simultaneously scan all the tuning frequencies necessary to characterize search-phase echolocations of Townsend's big-eared bat and thus differentiate it from other species. However, its lowest frequency, 20 kHz, extends 6 kHz below any other species that may roost in buildings on the Hanford Site (Van Zyll de Jong 1985), (Table 1), making the species potentially recognizable by setting detectors from 20-24 kHz.

We conducted a preliminary survey for fecal deposits and roosting bats in selected deactivated reactors, buildings in the 100D and 100K Areas, canyon buildings in the 200 Areas, and other buildings reported to contain bats. Dead bats were collected and identified by their external features using a dichotomous key (Ingles 1965). Decomposed bats with unrecognizable external features were identified to the genus level using dental formulas (Ingles 1965). Areas that contained live bats were surveyed using Mini Bat Detectors. Additionally, a list of bats recovered as carcasses or relocated on the Hanford Site since 1991 was obtained from WHC's Animal Control Operations (see Appendix).

(a) Ultra Sound Advice, 23 Aberdeen Rd., London, England N5 2UG.

3.0 Results

Two of the easternmost basins in the 100K East Area contain shallow water with emergent vegetation and substantial insect populations. They were surveyed on August 18, 1993, using two Mini Bat Detectors. The Mini Bat Detectors, coupled to tape recorders, were placed on walkways between the two basins and were set at 23 kHz (with an accuracy of ± 1 kHz). The survey began at 2050 hours, just after sunset, and was terminated at 2250 hours. The recordings revealed no ultrasound emitted within the 22-24 kHz window, the lower end of the frequency range for search-phase echolocations of Townsend's big-eared bat (Table 1). It may be that this species was not present during sampling or, if it was present, there are other explanations for why it was not detected. For example, it could have been too far from the detector for its echolocations to be recorded. The maximum distance at which echolocations can be detected is species-specific and dependent on the intensity of the call. Species emitting low-intensity calls can be detected only within approximately 2 m of the microphone, whereas species producing high-intensity calls are detectable at least 10 m away (Fenton and Obrist 1990). Further, there is no published information on the range in which echolocations of Townsend's big-eared bat can be recorded. Again, if this species was present during sampling, its behavior may not have been "search-phase," but instead either "approach" or "feeding buzz" (the latter two stages of foraging behavior following searching), in which case it would likely have been echolocating at frequencies above 22-24 kHz. It may also be that the brief time the detector operated was insufficient to detect echolocations of this species.

A list of surveyed structures and survey results is found in Table 2. Of the buildings surveyed, bats appear to be most abundant in the F, H, DR, and D Reactors (Table 2). These reactors are unoccupied, dark, and provide entrances such as vents, pipes, and holes in exterior walls. Pallid bats seem to be most abundant, followed by bats of the genus *Myotis*, including the small-footed myotis and silver-haired bats (Table 2). No bats were located in canyon buildings of the 200 Areas, and Townsend's big-eared bat was not located in any of the surveyed structures (Table 2).

Subterranean portions of buildings where aboveground portions were completely surveyed (Table 2), particularly those known to contain bats such as the reactors, require investigation before a complete determination can be made on Townsend's big-eared bat. The F and DR Reactors were completely surveyed, including all radiologically controlled areas (RCAs) and surface contaminated areas (SCAs) (Table 2). Six dead pallid bats, 3 dead *Myotis* spp., 1 dead small-footed myotis, and 1 live unidentified bat were found in the F Reactor. Two dead silver-haired bats and 1 dead small-footed myotis were located in the DR Reactor (Table 2). Although no active colonies were found in these buildings, it is likely that they occur in tunnels and basements beneath the reactors. Areas such as caves, mines, and tunnels are typically used by bats during winter hibernation (Humphrey 1982). The process pipe tunnel between Building 190D and the DR Reactor contains an active bat colony of approximately 20 individuals, although the species has not yet been determined (Table 2).

A number of buildings were partially surveyed. These include RCAs in the H and D Reactors (Table 2). The H Reactor RCAs contained 7 dead pallid bats, 1 dead *Myotis sp.*, and 1 live unidentified bat (Table 2). Three dead *Myotis* spp. were found in the D Reactor RCAs. The SCAs and underground portions of H and D Reactors should also be surveyed as they may contain active colonies. It is possible that different species may roost in different parts of the reactor. The RCAs of KW and KE Reactors were surveyed, and although no bats were located, a further survey of their SCAs and underground portions should be performed.

Table 2. Results of Preliminary Survey for Fecal Deposits and Roosting Bats in Buildings in the 100D and 100K Areas, Deactivated Reactors, Canyon Buildings in the 200 Areas, and Other Buildings Reported to Contain Bats

Area/Reactor	Building	Portion surveyed	Date	Fecal deposits	Bats
100D	189	RCA[a]	8-12-93	No	None
	195 Test Tower	RCA	8-12-93	No	None
	190	RCA	8-12-93	No	None
	Process Pipe Tunnel from Building 190 to DR Reactor	RCA	9-2-93	Yes	1 colony of an as yet undertemined species and 1 myotis (dead)[b]
	190DR Pit	All	8-30-93	No	None
	181	RCA	8-18-93	No	None
	182	RCA	8-18-93	No	None
	183	RCA	8-18-93	No	None
	1703	Nonasbestos	8-27-93	No	None
	1713	All	8-27-93	No	None
	1722	All	8-27-93	No	None
	Intake and Outflow	none	9-1-93	–	– (pipes totally submerged)
	–	RCA	8-16-93	Yes	3 myotis (dead)[b]
D Reactor	–	RCA	8-17-93	No	None
DR Reactor	–	SCA[a]	8-25-93	No	2 Silver-haired bats (dead)[c] and 1 Small-footed myotis (dead)[c]
100K East	183.3 Filter Bay	All	9-13-93	No	None
	165 Basement	All	9-13-93	No	None
	190	All	9-13-93	No	None
100K West	165 Basement	All	9-13-93	No	None
100K East/100K West	Cross-Tie Tunnel	All	9-13-93	No	None
H Reactor	–	RCA	9-3-93	Yes	7 Pallid bats (dead),[c] 1 myotis[b] (dead), and 1 live unidentified bat
F Reactor	–	RCA and SCA	9-16-93	Yes	6 Pallid bats (dead),[c] 1 immature small-footed myotis (dead),[c] 3 myotis (dead),[b] and 1 unidentified bat (dead)[d]
K West Reactor		RCA	9-20-93	No	None
K East Reactor		RCA	9-21-93	No	None
200 West	271U	RCA	8-19-93	No	None
	221U	RCA	8-19-93	No	None
	REDOX	RCA	8-23-93	No	None
	T Plant	RCA	8-31-93	No	None
200 East	224B	RCA	8-24-93	No	None
	PUREX	RCA and SCA	8-26-93	No	None
	B Plant	RCA	9-16-93	No	None
Other	274W(Attic)	RCA	8-25-93	No	None

(a) RCA = Radiological Control Areas, SCA = Surface Contaminated Areas
(b) Identified by dental formula
(c) Identified by external features
(d) Extensive decomposition did not permit positive identification

Data from the list of bats recovered as carcasses or relocated by WHC's Animal Control Operations since 1991 (see Appendix) indicate that bats are widely distributed in buildings across the Hanford Site. However, bats were most concentrated in the 200 Areas and the reactor areas. Seven species were recovered or relocated. *Myotis* spp. and the silver-haired bat occurred most frequently, followed by the pallid bat and western pipistrel.

4.0 Conclusions

During the six-week period of this study, only some of the reactors and their support buildings were completely surveyed (Table 2). Within the reactors, subterranean tunnels, basements, and SCAs (those areas that typically reach into the highest parts of the reactors) are most likely to contain bat colonies. However, subterranean areas, often classified as confined spaces, and SCAs are often the most difficult to access for conducting bat surveys. Additionally, bat species located during this brief survey and those recovered by WHC's Animal Control Operations are relatively common compared to Townsend's big-eared bat. A greater level of effort may be required to locate this rare species. We therefore recommend that all reactors and their auxiliary buildings, or parts of reactors (particularly underground portions) that have not been surveyed, be surveyed during the primary active season of bats on the Hanford Site, i.e., June through September 1994.

Future surveys should also emphasize other buildings on the Hanford Site where bats have been located, such as those in the 200 Areas listed by WHC's Animal Control Operations (see Appendix). However, canyon buildings in the 200 Areas should be de-emphasized or excluded from future surveys. Most parts of these buildings are occupied, well-lighted, and offer few entrances for bats. The only foraging opportunities for bats in the near vicinity of the canyon buildings are the B Pond and B-63 Ditch. The B Pond and B-63 Ditch provide relatively little foraging habitat compared with the Columbia River shoreline.

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Appendix

Bats Recovered as Carcasses or Relocated by Animal Control Operations, Westinghouse Hanford Company

Appendix

Bats Recovered as Carcasses or Relocated by Animal Control Operations, Westinghouse Hanford Company

Scientific name	Common name	Number	Location	Date
Antrozus pallidus	Pallid bat	1	100F/105-F	7/26/91
Lasionycteris noctivagans	Silver-haired bat	1	200E/2101-M	3/29/91
"	"	1	300/3706	6/12/91
"	"	1	600/616	6/27/91
"	"	1	400/4790	4/20/92
"	"	1	300/313	4/23/92
"	"	1	200W/2703-WC	5/17/93
Myotis leibii	Small-footed myotis	1	400/4713-B	8/12/92
Myotis lucifugus	Little brown myotis	1	100K/105-KW	3/6/92
"	"	3	200W/277-W	6/29/92
"	"	1	200W/221-U	8/6/92
Myotis volans	Long-legged myotis	1	1100/1171	5/30/91
Myotis yumanensis	Yuma myotis	1	100F/105-F	5/21/91
"	"	1	100K/105-KW	8/19/91
Pipistrellus hesperus	Western pipistrel	1	100H/105-H	6/27/91

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