HNF-53759
Revision 0

Summer Bat Monitoring Report for Calendar Year 2012

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-09RL14728

P.O. Box 650
Richland, Washington 99352

Approved for Public Release
Further Dissemination Unlimited

This page intentionally left blank.

HNF-53759
Revision 0

Summer Bat Monitoring Report for Calendar Year 2012

Date Published
October 2012

Prepared by
Cole Lindsey, John Nugent, Rainer Luhrs, and Garth Malin

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

P.O. Box 650
Richland, Washington 99352

APPROVED
By Janis D. Aardal at 7:15 am, Nov 02, 2012

Release Approval Date

Approved for Public Release
Further Dissemination Unlimited

TRADEMARK DISCLAIMER

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy.

Printed in the United States of America

The cover photo is courtesy of Cole Lindsey.

Contents

1.0 INTRODUCTION 1

2.0 METHODS 3

3.0 RESULTS 5

4.0 DISCUSSION 8

5.0 REFERENCES 11

Figures

Figure 1. Pettersson D500x and Battery Inside of Ammunition Box Weather Enclosure 4
Figure 2. Ammunition Box with Weatherproofing Cork and External Microphone Cord 4
Figure 3. Pettersson D500x Deployed Near Potential Bat Roosting Habitat 5
Figure 4. Survey Locations Completed During 2012, and Locations Identified for Future Surveys 6
Figure 5. Bat Passes per Qualifying Recording Night by Monitoring Location 7
Figure 6. Total Number of Bat Passes Recorded by Species Across All Monitoring Locations 7
Figure 7. Number of Sites where Each Species was Detected (17 total sites) 8
Figure 8. Bat Detector Microphone with Wind Screen and Protective Plastic Tubing 10

Tables

Table 1. Species Encountered during the Study Performed by TNC on the Hanford Site 1
Table 2. Known Bat Roost Locations on the Hanford Site 2

1.0 Introduction

Bats belong to the order *Chiroptera*, which means "hand-wing". They use a thin membrane of skin stretched between their fingers to fly. All bat species known in the state of Washington are insectivorous, and each bat can consume 600-1000 insects per hour while feeding. Unlike rodents, who give birth to multiple litters of several young each year, bats typically give birth once per year to only one pup, making bat populations extremely vulnerable to impacts and slow to recover. Several species of bats have been documented on the Hanford Site, with nine species identified during the Nature Conservancy (TNC) surveys in 1997 and 1998, and an additional eight species are listed as potentially present (Soll 1999, Table 1).

Table 1. Species Encountered during the Study Performed by TNC on the Hanford Site

Common Name	Scientific Name	Abbreviation	Acoustic	Captured
Pallid bat	Antrozous pallidus	Anpa	X	
Big-brown bat	Eptesicus fuscus	Epfu	X	
Silver-haired bat	Lasionycteris noctivagans	Lano	X	
Hoary bat	Lasiurus cinereus	Laci	X	
California myotis	Myotis californicus	Myca		X
Western small-footed myotis	Myotis ciliolabrum	Myci		X
Little brown myotis	Myotis lucifigus	Mylu		X
Yuma myotis	Myotis yumanensis	Myyu		X
Canyon bat	Parastrellus hesperus	Pahe	X	

Of the species confirmed on the Hanford Site, pallid bats, small-footed myotis, and canyon bats are listed as Washington Department of Fish and Wildlife (WDFW) State Monitor Species. In addition, roosting concentrations of big-brown bats, pallid bats, and all roosts for bats in the genus *Myotis* are considered Priority Habitats by the WDFW. Roosting congregations can be maternity colonies, winter roosts, or night roosts. Males typically day-roost alone or in small groups, and do not have the same strict roosting habitat requirements as maternity colonies. Maternity colonies are specialized locations where groups of female bats roost together to give birth and raise their young, and are vital to successful reproduction. Individuals show strong fidelity to these roosting locations, and the same roosts are used year-after-year. These locations are selected for proximity to food and water resources, as well as appropriate temperature, humidity, and light conditions. The bats congregate to share body heat in order to conserve energy. Night roosts are located close to feeding areas and are used by bats for resting and digestion between feeding bouts. Bats are known to habitually use night roosts from night-to-night and from year to year (Ormsbee et al. 2007). Although some species are migratory (silver-haired bat, hoary bat), most bats remain in the region during the winter, roosting alone or in small groups. Due to cold temperatures and lack of available food (insects), bats must use winter roosts to survive. Winter roosts are selected for cold and constant temperatures so bats can down-regulate their body temperature, slowing their metabolism and conserving energy, to survive through the winter. Bats select all communal roost types for very specific conditions, which may not be otherwise available in the same area.

Identification and protection of roosting locations is becoming increasingly important with the outbreak of the fungal infection referred to as White Nose Syndrome (WNS). White nose syndrome is affecting bats in the eastern United States, and is rapidly expanding westward. Bats save energy during the winter by reducing their body temperature and entering a state of hibernation called torpor. They break these torpor bouts by warming their body temperature back up at regular intervals through the winter; these events are termed "arousals". Bats are thought to use these arousals for depuration, defecation, grooming, breeding, and possibly drinking. Although these arousals represent a relatively small portion of the time the bats spend winter roosting, a large amount (up to 80%) of their energy stores for the season are burned during arousals (Thomas et. al. 1990). Bats are thought to increase the number of arousals due to WNS, likely for additional grooming. This causes the bats to exhaust their energy stores prior to the end of the winter, resulting in starvation. This disease spreads quickly through roosting colonies and causes fatality rates up to 100% at infected winter roosts (more information available at whitenosesyndrome.org). Because of the collapse of these bat colonies and the potential expansion of this disease westward, it is extremely important to identify and characterize roosts to provide a baseline in case the disease reaches this area. Bat researchers must follow strict WNS Protocols established by the U.S. Fish and Wildlife Service (FWS) and other agencies when working with bats (WNS 2012).

Bats are sensitive to disturbance, especially while pregnant and lactating. Early identification of roost areas can help avoid impacts to these sensitive species. The U.S. Department of Energy Richland Operations Office (DOE-RL) has shown a commitment to protecting bats on the Hanford Site, providing protection for known roost sites and mitigating for unavoidable impacts to other roosting locations. Table 2 identifies known bat roost locations on the Hanford Site, including maternity colonies of yuma myotis and pallid bats located in the 100-F and 100-D Areas of the Hanford Site (West et al. 2011, Table 2). However, little data are available on the location of maternity colonies or night-roost locations on the remainder of the central Hanford Site.

Table 2. Known Bat Roost Locations on the Hanford Site

Description	Primary Roost Type	Primary Species Present
105-F Reactor Bat Boxes	Maternity	Pallid Bats
105-H Reactor Bat Boxes	Unknown	Unknown
183-D Facility	Maternity	Pallid Bats
183-F Clearwell	Maternity	Yuma myotis
190-D Pipe Tunnel Entrance	Maternity	Yuma myotis
190-DR Pipe Tunnel Entrance	Maternity	Yuma myotis
Cornelius Pump House	Unknown	Pallid Bats
Hanford Townsite School	Unknown	Unknown

The Mission Support Alliance (MSA), Public Safety and Resource Protection (PSRP) staff proposed a graded approach to determine whether bat activity exists in other areas across the Hanford Site. Acoustic surveys, mist netting, and infrared cameras can be used together to determine the species present and to document bat roosting areas.

2.0 Methods

Potential roosting or activity centers (e.g. water sources) were identified initially using aerial photography and walking surveys. It was not necessary for bats to be present during these initial habitat surveys; therefore, work was performed prior to the "bat season". Bats form maternity colonies from mid-March through October on the Hanford Site.

Initial evaluation of the identified survey locations was performed with an acoustic detector (Pettersson D500x Bat Detector). The Pettersson D500x Bat Detector was selected for its ability to operate remotely and make high-resolution (full spectrum) recordings over extended periods (e.g. >1 week). The detector was placed inside of a 50-caliber ammunition box, used as a weatherproof enclosure, along with a 6-volt 14-amp battery (Figure 1). An external microphone was used by threading a cord through a hole in the side of the ammunition box and sealing it with a cork (Figure 2). A windscreen was placed over the external microphone to minimize noise recordings that occur during high winds, and a tripod was used to extend the microphone off the ground by approximately 6 feet to increase recording quality (Szewczak (N.D.) (Figure 3).

Detector settings were selected using recommendations from Tyburec 2011, and adjusted for local conditions. The settings were generally:

Sampling Frequency: 500
Pre-Trig: Off
Recording Length: 1.0 second
High Pass Filter: Yes
Auto Record: Yes
Trigger Sensitivity: High
Input Gain: 80
Trigger Level: 200

The detector was deployed at each location for a minimum of three qualifying weather nights, to minimize weather-related impacts on the level of activity calculations. A qualifying weather night, for the purposes of this project, had average wind speed of less than 15 mph, minimum temperature greater than 50 degrees Fahrenheit, and no measurable precipitation, as recorded by the Hanford Meteorological Station's (HMS) nearest weather monitoring station. Acoustic recordings were analyzed, using Sonobat 3 automated analysis software and reviewed manually, to determine the species present and the relative level of activity (calls/bat-night). A bat-night, for the purposes of this project, occurred between sunset, and sunrise of the following day. Therefore, the bat detector was set to begin recording at sunset, and stop at sunrise; these times were adjusted throughout the season. Mist netting and infrared video recording was planned to help define the species present and potential roost locations.

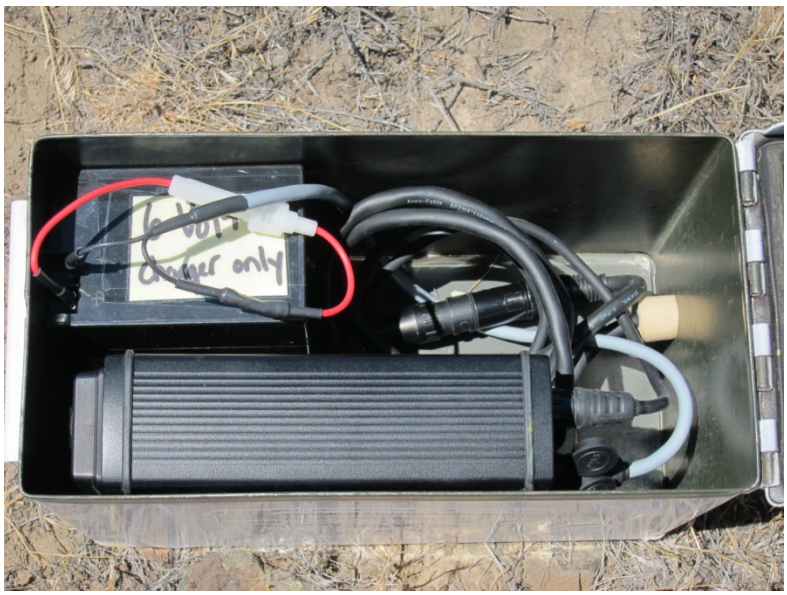

Figure 1. Pettersson D500x and Battery Inside of Ammunition Box Weather Enclosure

Figure 2. Ammunition Box with Weatherproofing Cork and External Microphone Cord

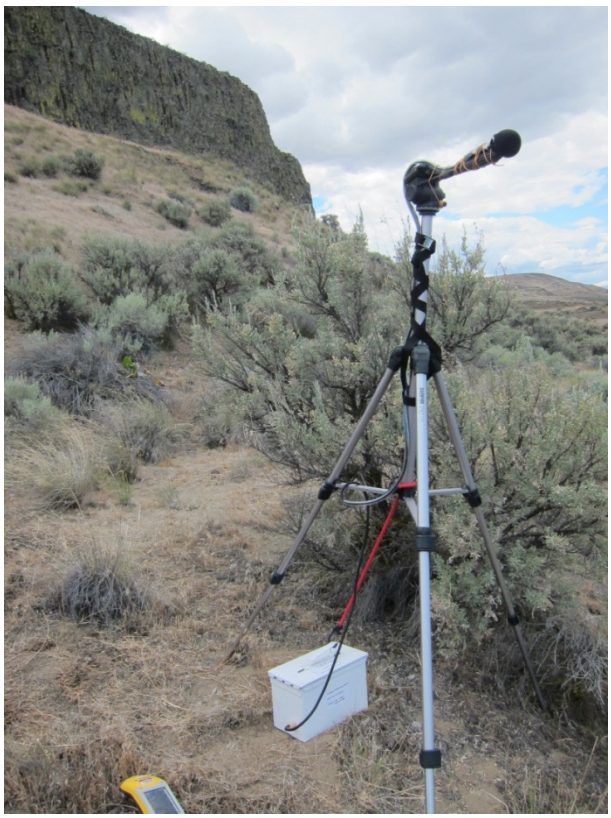

Figure 3. Pettersson D500x Deployed Near Potential Bat Roosting Habitat

3.0 Results

Thirty-five sites were identified as potential roost areas or activity centers during the aerial photograph review and walkdowns (Figure 4). Of these, 17 locations were surveyed during 2012 (Figure 1). Acoustic monitoring began on May 14, 2012 and concluded on September 10, 2012. In total, 119 nights were recorded between the 17 locations. Only one recording night was missed during the project, which was due to a damaged connection in the external microphone cord. The number of bat passes documented at each location, per suitable recording night, is shown in Figure 5. The number of bat passes for each species recorded by monitoring location is shown in Figure 6, and the number of sites where a given species was detected is shown in Figure 7.

Mist netting and infrared video recording was planned on several evenings during August; however, an extended period of high winds during the evening hours (drainage winds), prevented any mist netting from taking place during 2012.

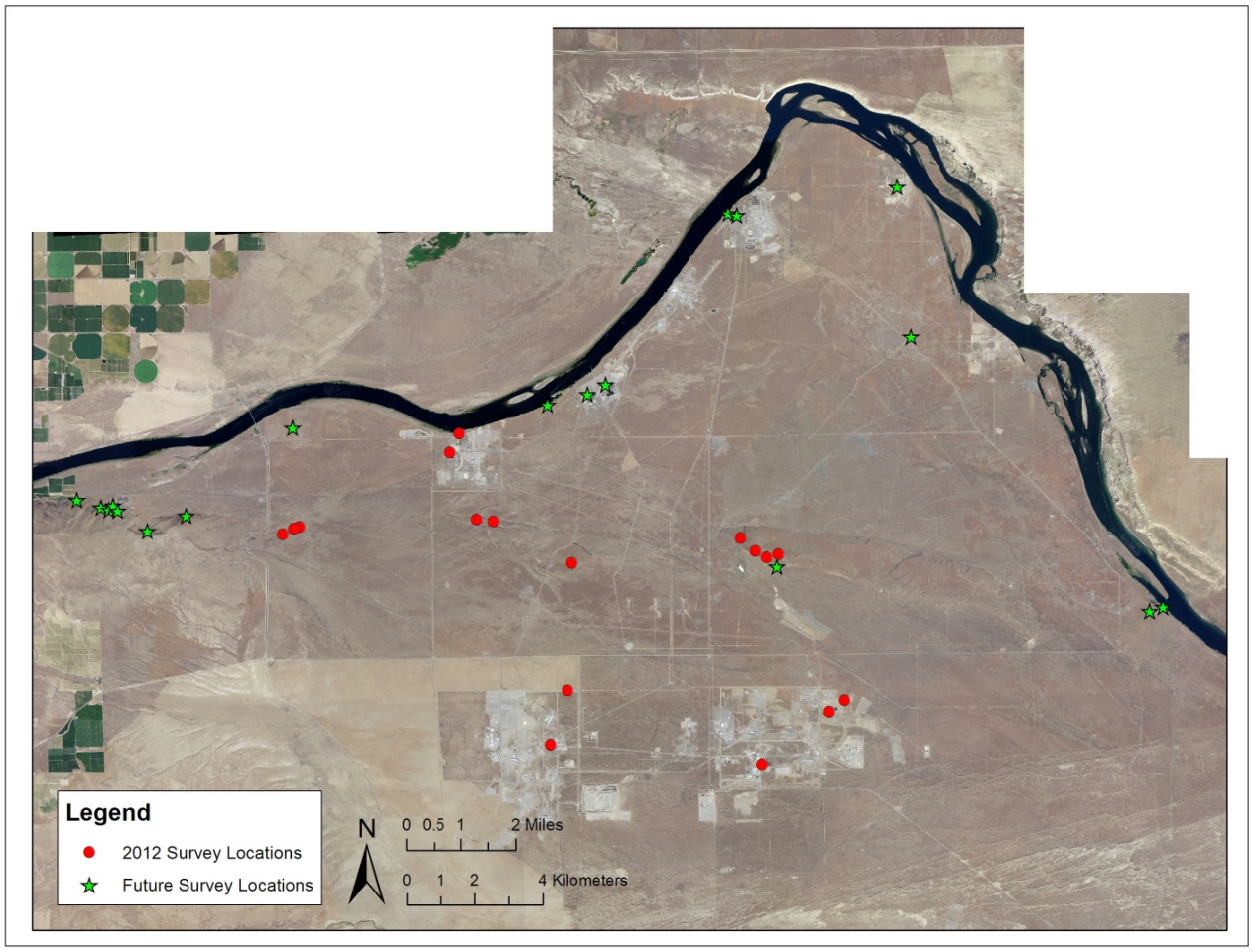

Figure 4. Survey Locations Completed During 2012, and Locations Identified for Future Surveys

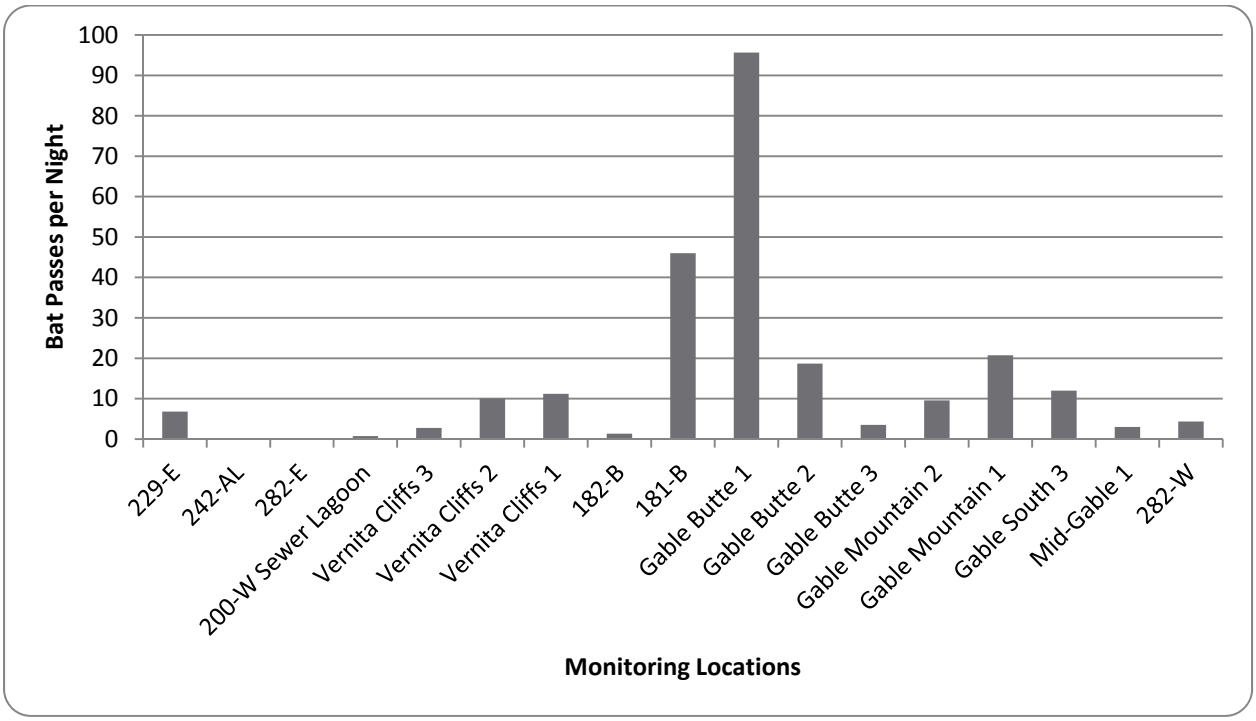

Figure 5. Bat Passes per Qualifying Recording Night by Monitoring Location

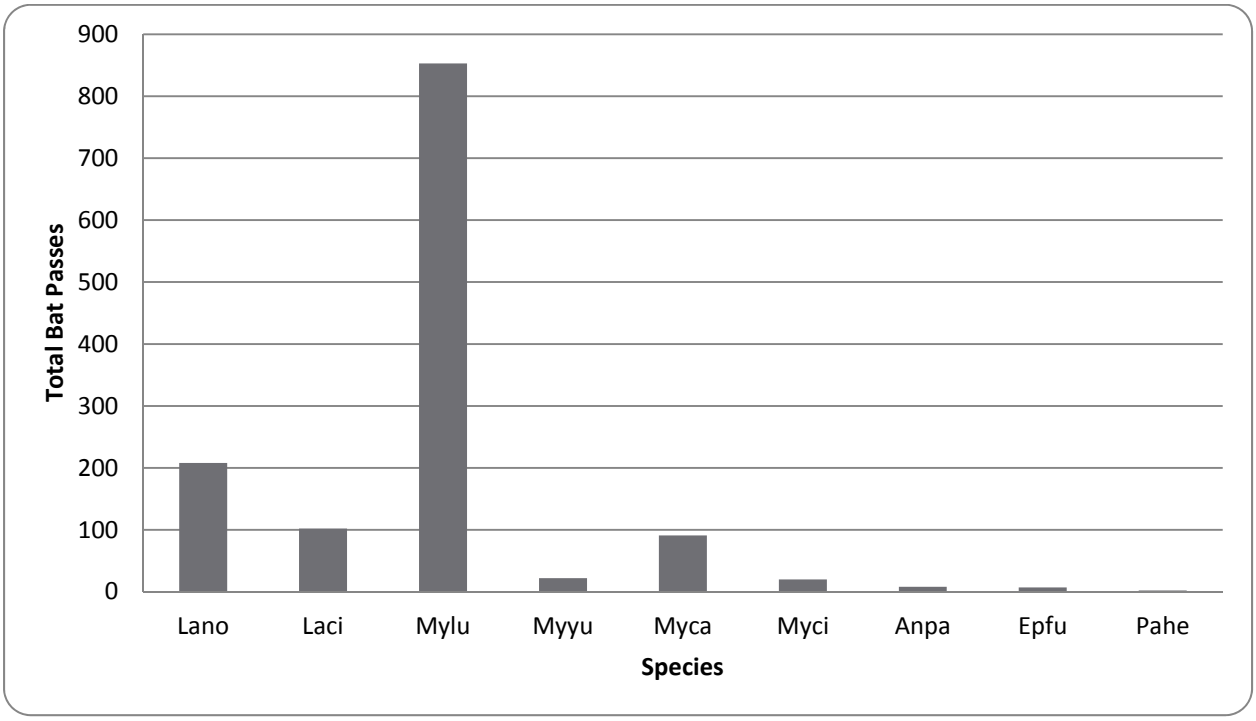

Figure 6. Total Number of Bat Passes Recorded by Species Across All Monitoring Locations

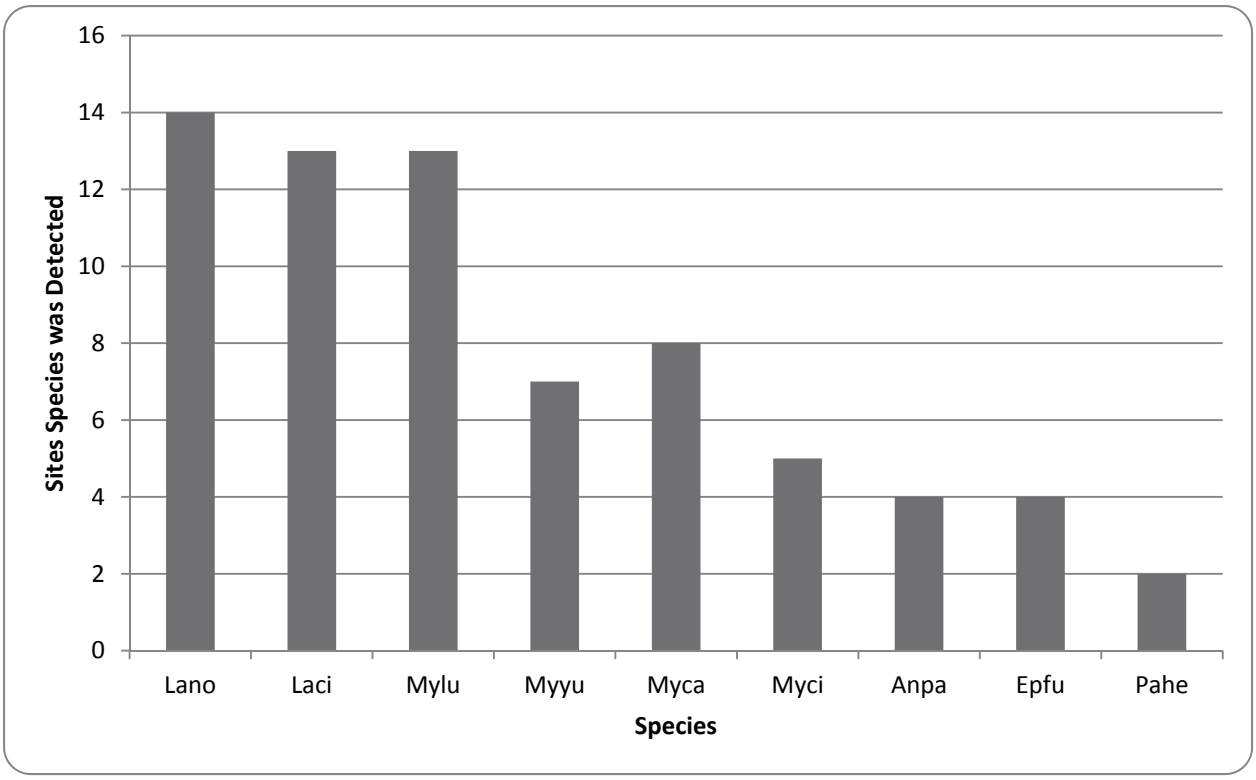

Figure 7. Number of Sites where Each Species was Detected (17 total sites)

4.0 Discussion

TNC's Biodiversity Inventory (Soll 1999), completed on the Hanford Site during 1997 and 1998, documented nine bat species using a combination of acoustics and mist netting. Our study was completed using only acoustics, and documented the same nine species, providing a level of validation for both studies. The use of a high-resolution bat detector, along with the Sonobat 3 acoustic analysis software, allowed this project to distinguish between myotis species acoustically, which was not possible during TNC's Biodiversity Index, where only zero-crossing bat detectors were used. Several other species have call repertoires that overlap significantly (e.g. silver-haired bat and big brown bat), and a combination of acoustic data and capture data is needed for confident species determinations. None of the species listed as 'potentially present' by TNC were documented during this survey.

Mist netting was planned to occur during this study over several weeks in the month of August, but an extended period of high winds prevented it from happening. Mist netting is not advisable during high winds due to lower levels of bat activity, and the movement of the net in wind increases detection and avoidance by bats. Mist netting will be useful to help distinguish between species with similar call repertoires, however the landscape of the Hanford Site will provide significant challenges to capturing bats with mist nets. Mist netting is typically conducted in flying corridors created by small streams with overhanging vegetation or over isolated open water sources. The wide-open landscape of the Hanford Site, combined with a single very large water source (the Columbia River) may make it difficult to determine a location that concentrates bats through an area where mist nets would be successful. Careful consideration of landscape features that could concentrate bats, along with the use of long (9+ meter) triple-high mist nets may be necessary to increase the likelihood of capture success. The Pettersson D500x bat detector was deployed successfully for 119 recording nights, but weather

restricted the number of locations that were surveyed during the season (i.e. low temperatures, high winds, precipitation). The reduced number of surveyed locations was the result of the decision to record for at least three suitable recording nights at each location, resulting in the detector being deployed at single locations for a week or more. It is well known that weather can significantly affect the level of bat activity observed at a location on a given night, for a variety of reasons (Burles et al. 2009). Although the total number of locations surveyed during 2012 was lower due to this requirement, the data collected at each site is more useful in calculating the relative level of activity between locations, because the weather variable was controlled. Thus, the data shown in Figure 5 describes recordings made only on nights with average winds less than 15 mph, minimum temperature greater than 50 degrees Fahrenheit, and no measurable precipitation. These data were obtained from the HMS from the closest weather monitoring station, which record the required data every 15 minutes. Monitoring locations were at most six kilometers from a weather monitoring station, and the closest location was only 400 meters from a station. The data were requested from HMS Staff after the detector was in the field for three consecutive nights and analyzed to determine whether three suitable nights were recorded, or whether any nights exceeded the defined thresholds requiring the detector to remain at the location. This high-resolution weather data increased the accuracy and comparability of the recording data. Retrieving the weather data remotely from the HMS avoided unnecessary trips to the field.

Bat passes can only be used to determine relative levels of activity; however, based on the information collected in 2012, from the 17 monitoring locations, little brown bats appeared to be the most abundant bats in the habitats surveyed (853 bat passes) (Figure 6). This data is in contrast to the known colony of yuma myotis located in the 100-F Area, which is the largest known bat colony in the state of Washington (West et al. 2011). Perhaps more surprisingly, the second and third most-recorded species were silver-haired bats (208 passes) and hoary bats (102 passes). Both of these species are migratory and are termed “tree bats” because they are typically associated with trees for roosting, so the mostly treeless Hanford Site initially seems an unlikely place to detect these species at high levels (BCI 2012). These two species also had the highest frequency of detection, 14 of 17 sites for silver-haired bats, and 13 of 17 sites for hoary bats, and little brown bats at 13 of 17 sites. In contrast, canyon bats, typically associated with talus slopes and rocky outcroppings, were expected to be abundant across those types of habitat on the Hanford Site but were detected irregularly. This contrasts with TNC’s documentation of canyon bats at all rocky locations. It is unclear whether canyon bat population levels may have changed, or whether misclassification of bat calls may have occurred due to the use of low-resolution acoustic detectors during TNC’s surveys.

Although many species were detected at several locations (Figure 7), some species were detected infrequently (Figure 6). The number of detections dropped off significantly after the first four species (Lano, Laci, Mylu, and Myca). This may be due to some species being present at low levels, or misidentification of calls of similar species due to the inherent elasticity of bat echolocation calls.

The bat detector deployment technique, developed for this survey, worked very well throughout the project. The setup was easily transported by one individual, and deployment took approximately five minutes. The design allowed the detector to be placed on uneven terrain, using the telescoping tripod legs, and deployment caused no ground disturbance. The microphone cord was wrapped with clear plastic tubing, to minimize the potential for damage from curious animals, and to further weatherproof the connection between the microphone and the cable (Figure 8). A bungee cord was used to secure the tripod to the bat detector box, preventing the tripod from tipping over even in high winds. Overall, the technique worked well and is recommended for future surveys.

Figure 8. Bat Detector Microphone with Wind Screen and Protective Plastic Tubing

Continuing bat work on the Hanford Site may include acoustic monitoring at additional locations, mist netting for species confirmation, and infrared video and mist netting for locating maternity colony locations. Acoustic monitoring is also planned for winter roosting months (November to February), as data are needed to help explain the little-known winter roosting habits, requirements, and locations of bats in the Pacific Northwest.

5.0 References

BCI. 2012. Species profile, *Lasiurus cinereus* and *Lasionycteris noctivagans*. Bat Conservation International, Inc.. Available at: http://batcon.org/index.php/all-about-bats/species-profiles.html

Burles, D.W., R.M. Brigham, R.A. Ring, and T.E. Reimchen. 2009. *Influence Of Weather On Two Insectivorous Bats in a Temperate Pacific Northwest Rainforest*. Can. J. Zool., 89:132-138.

Ormsbee, P. C., J. D. Kiser, and S. I. Perimeter. 2007. Importance of Night Roosts to the Ecology of Bats. Chapter 5 – Bats in *Forests, Conservation and Management*. The John Hopkins University Press, Baltimore, Maryland.

Szewczak, J. (No Date). SonoBat 3.1 NE Classification Notes. Available at: http://www.sonobat.com/download/SonoBatClassificationNote-NE-v3.1.pdf

Soll, J., et al. 1999. *Biodiversity Inventory and Analysis of the Hanford Site*, Final Report 1994-1999. The Nature Conservancy. Available at: http://nerp.pnnl.gov/docs/ecology/biodiversity/biodiversity_1999.pdf

Thomas, D.W., M. Dorais, J. Bergeron. 1990. *Winter Energy Budgets and Cost of Arousals for Hibernating Little Brown Bats, Myotis lucifugus*. Journal of Mammalogy, 71(3):475-479.

Tyburec, J. 2011. *Setting Up for Passive Recording Pettersson D500x Quick-Start Guide*. Available at: http://batmanagement.com/Ordering/acoustic/d500xsupport/D500xQuickStartGuide.pdf

West, W.J., J.G. Lucas, K.A. Gano. 2011. *2011 River Closure Corridor Contractor Revegetation and Mitigation Monitoring Report*. Washington Closure Hanford, Richland, Washington.

WNS Decontamination Team. 2012. National White-Nose Syndrome Decontamination Protocol, V 06.25.2012. Available at: http://whitenosesyndrome.org/sites/default/files/resource/nationalwns_revise_final_6.25.12.pdf