WINTER FORAGING OF SILVER-HAIRED AND CALIFORNIA MYOTIS BATS IN WESTERN WASHINGTON

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Key words: Silver-haired Bats, *Lasionycteris noctivagans,* California Myotis, *Myotis californicus,* winter activity, Puget Sound, Washington

The wintering strategies of many species of bats in the Pacific Northwest are poorly understood (Barbour and Davis 1969; Kunz 1982). Although Silver-haired Bats (*Lasionycteris noctivagans*) and California Myotis (*Myotis californicus*) have been observed wintering in Washington State and British Columbia (Nagorsen and others 1993), the specifics of their wintering behaviors and distributions in the region are unclear. Silver-haired Bats are presumed to migrate south to warmer regions during winter (Izor 1979), although limited evidence suggests this species may not be as migratory in the Pacific Northwest as elsewhere (Schowalter and others 1978; Kunz 1982; Cryan 2003). The few observations of winter roosts used by Silver-haired Bats in the Pacific Northwest mostly involved solitary bats found in trees (Cowan 1933; Nagorsen and others 1993). California Myotis are presumed to hibernate through the winter and generally remain dormant in caves, mines, buildings or tree cavities within several hundred kilometers of their summer habitat (Christy and West 1993; WDFW 2004). During the winters of 1982 through 1989, Perkins and others (1990) surveyed 650 caves and mines and 50 buildings in Oregon and Washington for use by bats. In Washington they found 2 species of hibernating bats (*Myotis evotis* and *M. volans*) but did not encounter Silver-haired Bats or California Myotis. O'Farrell and Bradley (1970) noted several reports of winter foraging of insectivorous bats in the southwestern United States, but information on winter foraging by bats in the Pacific Northwest has not been published. Most earlier reports of wintering bats in Washington involved observations of hibernating and roosting individuals (Senger and others 1974; Izor 1979; Perkins and others 1990). A California Myotis found flying during winter inside a gymnasium at the University of British Columbia in Vancouver had insects in its stomach (Nagorsen and Brigham 1993). Additional information on the winter feeding habits of Silver-haired Bats and California Myotis in the Pacific Northwest is not available. The collection records of the Burke Museum of Natural History at the University of Washington and Slater Museum of Natural History and the University of Puget Sound include information on 22 Silver-haired Bats and 18 California Myotis collected between November and February in Washington; one Silver-haired Bat was noted as being active when collected. Johnson (1953) described recovering the latter specimen at Point Defiance Zoo after it flew from bushes and was found to have sparse fat reserves and an empty stomach.

In the present report I document foraging behavior in both Silver-haired Bats and California Myotis during the winter months in western Washington. Over the course of 2 winters, I made visual and ultrasonic acoustical observations of feeding behavior during 16 rainless evenings at 6 locations near Olympia, Thurston Co., Washington (Table 1). The sites were chosen in part because I previously observed Silver-haired Bats and California Myotis foraging there during summer months.

During the months of November through February of 2005/2006 and January through February of 2007, I monitored and recorded bat echolocation calls with a time-expansion bat detector (Pettersson D240x, Pettersson Elektronik, Uppsala, Sweden) connected to a digital audio recording unit (iRiver iFP-895, iRiver America, San Jose, California). Species identification was achieved by examination of recorded echolocation call sonograms using SonoBat software (SonoBat, Arcata, CA). Recorded calls were compared to reference calls by measuring call characteristics as described by O'Farrell and others (1999) and Szewczak (2004). Calls of California Myotis can be difficult to distinguish from those of Yuma Myotis (*M. yumanensis),*

TABLE 1. Sites sampled near Olympia, Washington, for activity of Silver-haired Bats (LaNo) and California Myotis (MyCa) during the winters of 2005 through 2007.

Location	UTM (Zone 10) Northing	UTM (Zone 10) Easting	Species observed	Dates of observations
Priest Point (Municipal) Park	5212995	507939	LaNo & MyCa	17, 18 & 21 Nov 05, 6 Dec 05, 20 & 23 Jan 06, 5 & 6 Feb 06, 26 Jan 07, 4 Feb 07, 17 Feb 07
Capitol Lake uplands	5207969	506871	LaNo	6 Feb 06
Common Ground Farm	5211200	502679	MyCa	4 & 17 Jan 06, 8 Feb 06, 23 Jan 07, 13 Feb 07
36th Ave & Baker-Ames Rd	5214446	509444	LaNo	23 Jan 06
Gull Harbor Rd & 36th Ave	5214455	508376	LaNo	18 Nov 05
Rural residence	5217060	508335	LaNo & MyCa	4 Feb 07

and calls of Silver-haired Bats can be difficult to distinguish from those of Big Brown Bats *(Eptesicus fuscus*). The call samples analyzed in this study contained unambiguous features diagnostic of both California Myotis and Silver-haired Bats (J. Szewczak, Humboldt State University, pers. comm.). Acoustic observations for both species included characteristic ''feeding buzzes'' associated with bats approaching prey (Griffin 1958; Weller and others 1998; Fenton 2003).

On all 16 evenings that bat activity was monitored Silver-haired Bats, California Myotis, or both species were observed flying and foraging. Both species were detected at Priest Point Park in Olympia and at a rural residence 3 km north of the park. Only 1 species was detected at the 4 other locations. No other species of bats were detected during the sampling period. Most observations were within 1.5 h after sunset, but 2 Silver-haired Bats were still foraging at Priest Point Park at 23:00 on 21 November 2005, when the air temperature was 6°C. Acoustic observations of the Silver-haired Bats indicated that they were flying past every few minutes, near the canopy of a stand of mature conifers, in a pattern consistent with foraging behavior. Most observations of California Myotis consisted of multiple bats flying in back-and-forth patterns with frequent feeding buzzes, indicating foraging behavior. This California Myotis activity was observed at air temperatures as low as 4.7°C.

The average maximum temperature on the days these observations were made was 11.1°C (range = 7.5–17.2°C, s = 2.5°C, n = 16) and average temperature at sunset was 9.1°C (range = 6.0–12.8°C, s = 1.9°C, n = 16). The relatively mild maritime climate of the Puget Sound region may allow some resident bats to use an alternate winter strategy to that of the prolonged dormant periods characteristic of bats that tend to occupy colder sites during winter, such as caves, mines, or those that are inland or at higher elevations. Bats in torpor derive the greatest energetic savings with an initial reduction in body temperature, and rates of energy savings diminish as body temperature approaches 0°C. The warmer conditions experienced by bats inhabiting low-elevation areas around the Puget Sound may promote more shallow, intermittent torpor and allow bats to arouse on days when insect prey is likely available. Moths and other insects are available throughout the winter months in the Puget Sound area, particularly on days and evenings with no rain and mild temperatures (GF, pers. obs.). Because it has been assumed that bats wintering in the Pacific Northwest mostly remain dormant throughout the winter, research during that season has generally been limited to studying hibernacula. Lausen and Barclay (2006) reported Big Brown Bats flying during winter at air temperatures as low as −7.9°C in Alberta, Canada. These observations of winter activity not only suggest that there is much we do not understand about the behavior of bats during certain times of year, but also that important behaviors exist that have not been reported in the literature. With more comprehensive winter monitoring efforts, we may be able to determine if observations of bats foraging during winter are local phenomena or an indication of more widespread behavior that has gone unnoticed.

Acknowledgments—I thank M Baker and P Cryan for many excellent suggestions and edits which led

to a more accurate and concise manuscript, L Carpenter, N Laich, C Maynard, and J Puhich for alerting me about the foraging bats, and T Kelleher for meteorological data. J Szewczak graciously assisted with call identification methodology, and the review comments from E Thuesen, A Douglas, R Baird, and L Schlender greatly improved this paper. I thank C Rice and J Calambokidis for ongoing encouragement and L Salzer for acceptance of my nocturnal tendencies.

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