

Distribution, Parturition Dates, and Feeding of Bats in South-central British Columbia

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Between 10 June and 4 July 1979 we used mist nets, bat traps, and a hand net to sample populations of bats at 19 sites in the Similkameen and Okanagan valleys of British Columbia. A zero-crossing period meter, broadband microphone, and oscilloscope were used to monitor distribution and feeding behavior of bats by their echo-location calls. A total of 420 bats of 10 species was captured, including *Myotis thysanodes* (Fringed Bat) and *Antrozous pallidus* (Pallid Bat) previously known from few Canadian specimens. During the study all females we captured were either pregnant or lactating. Feeding behavior of, and habitat use by, some species is described. Over the Okanagan River several species of bats fed in close association with Common Nighthawks (*Chordeiles minor*).

Key Words: bats, *Myotis lucifugus*, *Myotis yumanensis*, *Myotis evotis*, *Myotis thysanodes*, *Myotis californicus*, *Myotis leibii*, *Myotis volans*, *Eptesicus fuscus*, *Antrozous pallidus*, *Plecotus townsendii*, *Lasiurus cinereus*, parturition dates, feeding behavior, habitat use.

The Osoyoos Arid and adjacent Dry forest biotic areas of the Similkameen and Okanagan valleys in southern British Columbia support the most diverse bat fauna in Canada including 12 species, two of which (*Myotis thysanodes*, the Fringed Bat, and *Antrozous pallidus*, the Pallid Bat) are known in Canada only from this area (Anderson 1946; Cowan and Guiguet 1965). The purpose of this study was to survey a number of sites in these valleys to gather information on the distribution, relative abundance, and biology of bats.

Materials and Methods

Between 10 June and 4 July 1979 we used 9-m mist nets with 381-mm mesh, a hand net, two Tuttle traps (Tuttle 1974) and one collapsible Tuttle trap (Tideman and Woodside 1978) to capture bats. Some individuals were light-tagged (Buchler 1976) and others marked with split celluloid bands (A. C. Hughes, Hampton Hill, England) covered with one of four colors of Scotchlite® reflective tape (red, yellow, white, and blue) to permit recognition of different species in flight.

The echo-location calls of the bats were detected using broadband ultrasonic microphones (QMC K1SM1 or Lincoln; for details see Simmons et al. 1979a) and displayed on a Non Linear Systems Miniscope through a zero-crossing period meter which provided a frequency-time (sonograph) picture of the calls (Simmons et al. 1979a). In some instances bats were recorded on a Lockheed Store 4D tape recorder operated at 76 cm/s, giving a frequency range of the

system (microphones, amplifiers, tape recorder) of 5–150 kHz. Using recordings and observations by microphone and period meter of known bats (light-tagged or with reflective bands), we were able to distinguish among several species of bats by their echo-location calls (see also Bell 1979; Fenton and Bell 1979; Fenton and Thomas 1980). We recognized bats attempting to catch insects by the changes in their echo-location calls (Simmons et al. 1979b) and by direct observation.

Results and Discussion

Species Distribution and Relative Abundance

The locations of our study sites are shown in Figure 1, and the relative abundance of different species at these sites are listed in Table 1. Our data indicate that *Myotis volans*, the Long-legged Bat, was relatively common although Cowan and Guiguet (1965) considered it rare. *Myotis leibii*, the Small-footed Bat, appears to be more common and widespread in the area than previously suspected. Lactating and pregnant female *M. leibii* were taken at several sites, indicating the existence of a resident breeding population. Near Okanagan Falls Provincial Park campground, *Myotis californicus*, the California Bat, was commonly caught along the river, while *M. leibii* was captured only on a rocky hillside 300 m away (Table 1). The presence of *M. leibii* in the rocky situation may reflect this species' choice of nursery sites (Tuttle and Heaney 1974).

We captured *M. thysanodes* at three of our study sites (Table 1, Figure 1); it was previously recorded

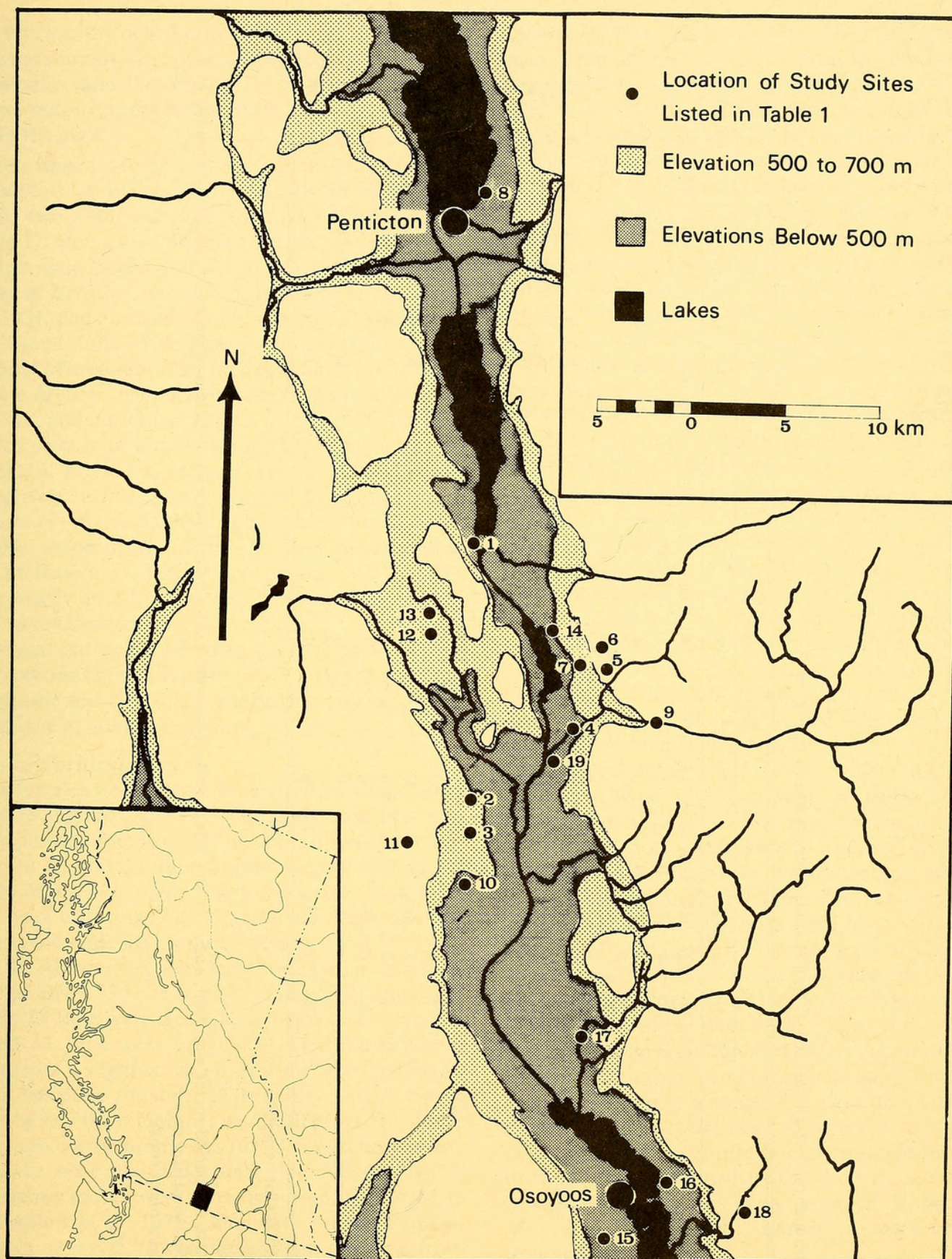


FIGURE 1. The distribution of sites in the study area (inset shows location in British Columbia). The habitat varied from location to location as follows: 1a — over the Okanagan River, running water; 1b — willow (*Salix* spp.) and alder (*Alnus* spp.) along the bank of the river; 1c — talus slope with scrub; 2 — abandoned mine adit in Ponderosa Pine (*Pinus ponderosa*); 3 — pond in Ponderosa Pine forest; 4 — mouth of canyon, fast-flowing creek bordered by alders and Ponderosa Pine; 7 — spring near meadow; 8 — night roost in garage in orchard; 9 — Vaseux canyon, fast-flowing creek lined with willows and alders; 10 — cattle tank in open Ponderosa Pine woodland; 11 — mine shaft in Ponderosa Pine and Douglas Fir (*Pseudotsuga menziesii*); 12 — pond in sage brush bordered by scattered Ponderosa Pine; 13 — cave in cliffs; 14 — talus slope; 15 — abandoned mine adit in open country; 16 — narrow strip of desert near lake; 17 — stony creek with poplar border; 18 — Ponderosa Pine near a small stream; and 19 — floor in mobile home at base of cliff.

from one locality near Vernon (Maslin 1938). As some of the individuals we captured were pregnant or lactating females, and the Maslin (1938) record was of a nursery colony, there is obviously a breeding population in the area.

There appears to be a small resident population of *A. pallidus* in the southern Okanagan valley. We caught two adult males on the night of 14–15 June (Table 1). Only two Canadian specimens are known, an adult male in the Cowan Vertebrate Museum, University of British Columbia, taken near Oliver on 17 July 1931, and an adult female collected at Okanagan Falls on 12 June 1974, now in the collection of the National Museum of Natural Sciences (NMC 42854).

Male *Myotis yumanensis*, the Yuma Bat, *M. californicus*, and *Eptesicus fuscus*, the Big Brown Bat, were more common than females at the higher elevation site 4, where they constituted 68, 60, and 100%, respectively, of the species sample. At a lower elevation site (1) males of these species constituted 0, 30, and 0%, respectively, of the samples. A preponderance of female *M. volans* occurred at site 4 (92%), while nearly equal numbers of male and female *M. leibii* were taken at various locations.

The association between captures per trap-net night and elevations below and above 500 m was significant (chi-square test $P < 0.02$), suggesting greater overall abundance at study sites below 500 m.

Dates of Parturition

The females we captured were all either pregnant or lactating and we caught enough females of four species to provide some indication of the dates of parturition. On 10 and 13 June approximately half of the female *Myotis lucifugus*, the Little Brown Bat, from site 1 were lactating (7 of 17 and 2 of 4, respectively), while at the same site on the same dates, 4 of 11 and 22 of 55 *M. yumanensis* were lactating. Two of seven *M. leibii* taken on 13 June, none of seven on 21 June, and two on 23 June were lactating, whereas two taken on 21 and 23 June were pregnant. All eight *E. fuscus* taken from a night roost on 21 June were pregnant, but at the same roost on 27 June two of eight were lactating and the remainder were still pregnant. These data imply parturition dates for *M. lucifugus* that are similar to those recorded from Ontario (Fenton 1970) and slightly earlier than those reported from Alberta (Schowalter et al. 1979). Our data on the dates of parturition for *E. fuscus* are similar to those from Alberta (Schowalter and Gunson 1979), but our dates for *M. yumanensis* are later than those reported from more southerly locations (Barbour and Davis 1969).

Feeding

We found that bats emerged and began to feed between 21:30 and 21:40. The first to appear along the

Okanagan River near Okanagan Falls (site 1) were *E. fuscus* that fed high above the trees in company with large numbers of Common Nighthawks (*Chordeiles minor*). By 21:50 both bats and nighthawks moved closer to the ground, with the *E. fuscus* feeding around the canopy, and the nighthawks over the river. We saw no evidence of agonistic interactions between these bats and the birds (cf., Shields and Bildstein 1979). By this time *M. lucifugus*, *M. yumanensis*, and *M. californicus* had emerged and were feeding along the river within 1 m of the water (mainly *M. lucifugus*), and along the banks (mainly *M. yumanensis* and *M. californicus*). Both the bats and the nighthawks foraged at close quarters close to the water surface. At higher elevations (e.g., sites 2 and 3) *E. fuscus* also emerged early and fed relatively high, but at these locations we did not observe the feeding congregations of nighthawks and bats, as both were more evenly dispersed in the habitat and foraging above the trees.

Myotis californicus emerged around 21:45 at site 1 and usually hunted along the bank about 5 m from the river's edge, chasing insects from within 1 m of ground level to the top of the canopy, and frequently hunting in the canopy as well. Some marked with reflective bands were observed to hunt over water and close to its surface. Their echo-location calls and feeding behavior, notably their repeated attempts to capture prey over short distances, agreed with the observations of Fenton and Bell (1979).

Myotis lucifugus and *M. yumanensis* fed along the Okanagan River and over adjacent banks at site 1. Over water both species foraged within 1 m of the surface and both made several attempts to capture prey over short distances. When feeding along the banks or the edge of the canopy both species hunted from about 1 m above the ground to canopy height, and both hunted under the canopy on windy nights. On 21 June from 21:45 to 22:45 we surveyed the river and bank area for bats with reflective tags. Over fast-flowing parts of the river *M. lucifugus* with reflective bands outnumbered banded *M. yumanensis* 12:1, while along the bank and near the canopy, the reverse was true, agreeing with capture data on distribution (Table 1). *Myotis lucifugus* with reflective tags were often observed to capture insects from the surface of the water. Farther downstream where the current was slower, equal numbers of light-tagged *M. lucifugus*, *M. yumanensis*, and *M. californicus* were observed feeding over the water.

At site 1, *M. volans* fed relatively high (to about 10 m over the canopy) along the river bank and over the canopy but not over the river itself. At site 10 *Myotis evotis*, the Long-eared Bat, emerged between 21:35 and 21:45, and flew down a small draw into the Okanagan valley. It was the only species observed at

this location and in flight was very manoeuvrable, appearing to either glean insects from foliage or to catch them very close to the foliage.

Myotis leibii emerged around 21:35 and fed along cliffs and rocky slopes at site 1, often concentrating its activity around vegetation or along the edges of rock faces, but apparently always pursuing flying insects. At site 12 (Figure 1) this species fed along the margin of some trees and over a small pond. In this wooded area the bats foraged from about 1 m above the ground to treetop height, while over the water they fed within 1 m of the surface.

Although we did not capture any *Lasiurus cinereus*, Hoary Bats, during our survey, they were easily recognized by their distinctive echo-location calls. This species usually emerged and began feeding around 22:00, and concentrated its foraging activity well above the trees in a variety of habitats (Table 1). They appeared to have been relatively common from lower to higher elevations, based on activity data gathered with the period meter.

Our observations indicate that there is a diverse community of bats with some high population densities in the Similkameen and Okanagan valleys of southern British Columbia clearly worthy of further field studies.

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