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Activity of Little Brown Bats in Coastal Forests

Abstract

Activity of little brown bats was over 75 times greater in lacustrine (lake) habitat than in forest or cutover. Few bats were detected in forest and almost no bats in cutover. Bats were present all night with three peaks of activity in lacustrine habitat. Bat activity was not correlated with insect density.

Introduction

Of the 12 species of bats known from coastal British Columbia, the little brown bat (*Myotis lucifugus*) is the most common and widely distributed. It roosts in trees with cavities or loose bark but readily uses buildings. Roosts provide shelter and protection, and are essential elements in the natural history of temperate bats. Much of the old growth forest containing suitable roosting habitat has been modified by intensive forestry practices. Our objectives were to describe the activity patterns and habitat use of little brown bats in coastal forests. This information would identify habitats important to bats and assist in the development of management plans.

Study Area and Methods

Field work was conducted at the University of British Columbia Research Forest near Maple Ridge, British Columbia. The area contains several small lakes and numerous creeks. Low mountains reach altitudes of up to 1025 m. The study area lies within the Coastal Western Hemlock Biogeoclimatic Zone. Forest harvesting and fires have resulted in a mosaic of seral stages. Although logging has occurred since 1924 in the Research Forest, some stands of conifers older than 100 years still remain. One monitoring site in each of a forest, cutover, and two lacustrine habitats were selected.

Forest: A representative forest stand was selected 2 km south of Loon Lake. The stand was approximately 100 ha, 50 years old and dominated by Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), and western red cedar (*Thuja plicata*). We sampled bat activity from a logging road within the stand.

Cutover: A 30 ha, 2-year old, unburned clearcut was chosen as representative of logged habitat. Dominant vegetation was fireweed (*Epilobium angustifolium*) and hardhack (*Spirea douglasii*). Bat activity was monitored from a logging road that passed through the cutover.

Loon Lake: A 44 ha lake was chosen as representative of lacustrine habitat. Activity was monitored from a small beach. Loon Lake is surrounded by forest with a few small open areas. Log buildings near the lake provided roosting sites for maternity colonies of little brown bats. The largest known colony was in a dormitory 300 m from the monitoring site.

Jacobs Lake: Another small lake (13 ha) was chosen as a second lacustrine habitat. Bat activity was monitored from a short float along the shore. Jacobs Lake was selected because it lacked buildings suitable for maternal roosts and was 2.8 km from Loon Lake. The lake was surrounded by forest similar to that near Loon Lake.

On 23 May 1983, little brown bats were caught in mistnets at Loon Lake and observed at the maternal colony in the dormitory. Bat activity was monitored from 7 June to 20 July using a QMC Mini Bat Detector set for receiving 40 khz signals (Fenton and Bell 1981, Thomas and West 1984). The bat detector was calibrated by releasing little brown bats in a room and setting the detector at the frequency which provided the loudest signal. The bat detector was placed on a tripod or automobile roof 1.5 to 3 m above the ground, heights commonly used by this species (Whitaker *et al.* 1977, Fenton and Bell 1979).

In each habitat, activity was monitored for four nights from 2030 to 0530 PDT. Nights were staggered to ensure a representative sample. Times were recorded when bats passed and ultrasonic signals were detected. Relative activity was measured as the number of bat passes/hour at the various monitoring sites.

Insects were sampled hourly for two nights each in the forest and cutover habitats, four nights at Loon Lake, and for the first two hours of one night at Jacobs Lake. Insects were sampled concurrently with bat activity. Insects were sampled by sweepnetting for 10 minutes near a portable fluorescent lamp. The sweepnet was 43.5 cm in diameter and moved over a 180° arc 1.2 m above the ground at approximately one sweep/sec. Length of the arc and velocity of the sweeps were constant to ensure that the number of insects caught were a measure of relative density. All insects were classified to order.

Results

Bats were active throughout the night at Loon Lake, with three peaks of activity each night (Fig. 1). The first peak of activity, from 2030 to 2230 PDT, was the most intense. A second, smaller peak of activity occurred around midnight, from 2330 to 0130 PDT. A third peak in activity occurred just before daylight, from 0330 to 0530 PDT.

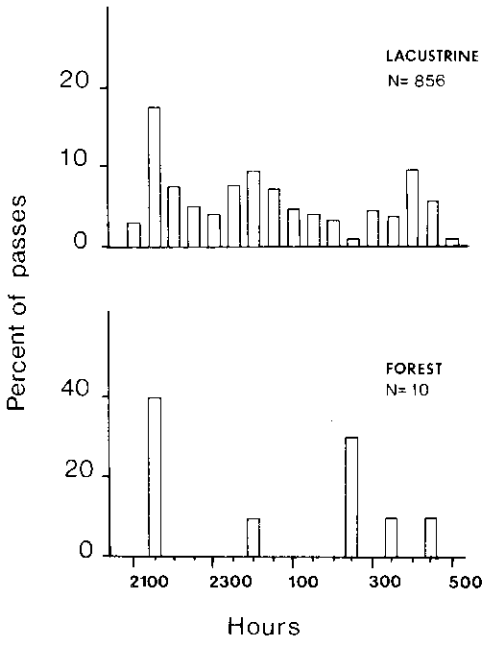

Figure 1. Bat activity in lacustrine and forest habitats. The mean percent activity for Loon Lake was calculated from four nights of monitoring. Percent activity for the forest was based on one night. N is the total number of bat passes recorded.

In the forest, bat activity on 19 June consisted of one pass and on two other nights no bats were detected. Bat activity for 13 June was bimodal and involved 10 passes (Fig. 1). Bat activity within the cutover consisted of a single bat visit during four nights of monitoring. The single pass at the cutover site occurred on 15 July at 2338 PDT.

Bat activity, as measured by the mean number of bat passes/hour, was compared among the three habitats (Table 1). Of the total bat activity, 98.7 percent occurred in the lacustrine habitat. Activity at Loon Lake was significantly greater than in the forest ($t = 6.83$, $p \leq 0.05$) and cutover ($t = 6.91$, $p \leq 0.05$) habitats. Although more bats were detected in the forest than in the cutover, bat activity was not significantly different between these habitats ($t = 1.88$, $p > 0.05$). Bat activity was examined by analysis of variance to determine the importance of time of night and habitat. Although time of night was significant ($F = 2.6$, $p \leq 0.05$), habitat was the most important variable contributing to bat activity ($F = 14.8$, $p \leq 0.05$).

TABLE 1. Bat activity in three coastal habitats.

Habitat	Hours Monitored	Activity ± SE (passes/hour)
cutover	36	0.03 ± 0.03
forest	36	0.30 ± 0.14
lacustrine	36	23.47 ± 3.39

Bat activity at Jacobs Lake was measured to determine if the high activity at Loon Lake was just the result of the proximity of bat roosts in buildings. At Loon Lake (with buildings), there was a mean (± SE) of 32.8 ± 6.9 bat passes/hour in the early evenings. At Jacobs Lake, there was 46.0 ± 20.6 bat passes/hour in the early evening. Bat activity was not significantly different at these lakes ($t = 0.61$, $p > 0.05$).

Flying insects were sampled hourly in each habitat during sampling of bat activity. Diptera comprised 90 to 96 percent of the insects netted next to the fluorescent lamp. The next most abundant order was Lepidoptera which comprised 1 to 9 percent. Relative density of flying insects at Loon Lake was greatest near dusk at about 2130 PDT when 43 percent of the night's insects were sampled. For the rest of night, insect density was relatively low. In the forest, insects were

most abundant at dawn, from 0430 to 0530 PDT, and on average comprised 52 percent of total. Relative insect density in the cutover was greatest at dusk, when on average 87 percent of the total was sampled between 2030 and 2130 PDT.

Relative densities of insects in the cutover and lacustrine habitat were significantly different ($t = 2.76$, $p \leq 0.05$, Table 2). Bat activity was not correlated to relative insect density for the various nights and habitats that were monitored ($R^2 = 0.29$, $p > 0.05$). However, the first peak of bat activity did coincide with the peak on insect activity during the early evening in lacustrine and forest habitats.

TABLE 2. Relative density of flying insects at night in three coastal habitats.

Habitat	Nights Monitored	Total Insects	Mean ± SE (insects/night)
cutover	2	661	330.5 ± 155.5
forest	2	215	107.5 ± 40.5
lacustrine	4	255	63.8 ± 11.6

Discussion

Activity of little brown bats at Loon Lake conformed to patterns reported elsewhere (Kunz 1973, Barclay 1982, Erkert 1982). The middle activity period at Loon Lake may result from female bats returning to the maternity roost to nurse their nonvolant young since it occurs 1.5 to 3 hours after initial emergence (Anthony and Kunz 1977).

Fenton (1970) reports that little brown bats prefer rural areas to forests lacking buildings with roost sites and that lakes are preferred to open fields. Patterns of habitat use in the Research Forest suggest that the affinity of little brown bats to lacustrine habitats is consistent among different geographic regions. The Loon Lake forestry camp had the greatest bat activity measured in the Research Forest.

We do not know if bats using Jacobs Lake were resident or came from Loon Lake. Although little brown bats will travel up to 3 km from their day roost to a feeding site (Anthony *et al.* 1981), their travel time would delay their arrival at Jacobs Lake. Since bat activity at both lakes commenced at about the same time, bats at Jacobs Lake were probably resident in the area. There were no buildings at Jacobs Lake, but bat activity was similar to that at Loon Lake. Hence, the intensities of activity at Loon Lake likely reflect use of lacustrine habitats rather than the presence of buildings for roosts.

Roosts of little brown bats, most common in buildings, also occur in hollow trees or natural crevices with appropriate temperature regimes (Fenton and Barclay 1980). The relatively low bat activity at the forest site may be the consequence of a lack of natural and man-made structures. More likely, bats were roosting in the forest and the few bats detected were travelling to foraging areas in lacustrine habitat. The lack of bat activity in the cutover is consistent with observations reported by Kunz (1973). Clearcutting of forests removes potential roost sites and although insects are abundant the habitat was not used by little brown bats.

Most of the insects sampled in each habitat were species commonly eaten by little brown bats (Anthony and Kunz 1977). Although other studies report that bat activity is directly related to insect abundance (Kunz 1973, Anthony *et al.* 1981, Erkert 1982), no such correlation existed among the habitats we examined. Bat activity was greater in lacustrine habitat than in the forest although insect density was not different. Habitat use may reflect differential foraging success among habitat types.

Lacustrine areas had the greatest amount of bat activity among the habitats we monitored. Because "feeding buzzes" were frequently heard during monitoring of bats at Loon and Jacobs Lakes, lacustrine habitat was used primarily for foraging. Although forests are not heavily used by little brown bats for foraging, they are likely important in providing natural roosts.

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Received 18 October 1985
Accepted for publication 27 March 1986