2004 Bat Survey

Bats comprise a potentially important guild of forest insectivores in the upper-montane, mixed-conifer forests of the southern Rockies, yet we know surprisingly little about their habitat use. The need for a better understanding of our bat fauna, particularly with regard to the roost site requirements of different species, was recently highlighted by studies suggesting that critical tree-cavity resources in our upper-montane forests may be dependent upon the heartrot fungus *Phellinus tremulae*, which is specific to aspen trees. A survey of 600 hectares of mixed-conifer forest revealed that aspen provided two-thirds of the total cavity resource in this area, with 87% of live cavity trees visibly infected by *P. tremulae.* Not insignificantly, during our last breeding bird survey, 93% of the cavity-nesting birds observed in 9 census plots at CBFS (29 pairs representing 9 species – all insectivores) utilized aspen.

The importance of fungus-infected aspen in maintaining insectivore populations within these forests may extend to bats as well. Recent studies in conifer forests of southern British Columbia have revealed a decided preference on the part of Big Brown bats for aspen cavities as maternity sites, even when conifer cavities are present nearby (Parsons, et. al. 2003). Were this to prove the case in the southern Rockies as well, it would strengthen our hypothesis that the heart-rot fungus *P. tremulae* plays a keystone role in the maintenance of ecosystem integrity. At present, however, we know very little about tree-roosting bats in the Pikes Peak region.

Bat Conservation International's regional data base, coupled with surveys in Rocky Mountain National Park, suggested that as many as 7 bat species may inhabit the upper-montane, mixed-conifer forests of this region. Should we be able to confirm this, we will have identified another important guild of insectivores essential to the health of our forests, and whose conservation would likely become a critical forest management issue. The immediate objective of this study was, therefore, to conduct a survey of all bat species in our area, with the longer-term goal of evaluating the importance of tree cavities, especially in aspen, to the conservation of bats throughout the region.

Methods

We conducted an initial acoustic inventory of bats on June 23, using an Anabat II detector coupled to a zero-crossing analysis interface module (Titley Electronics, NSW Australia) and an IBM 701c Thinkpad PC Notebook. The recording of echolocation calls was accomplished from a stationary location on the south shore of the upper pond, with frequency-time sonograms of calls viewed as they were intercepted to assure that we were logging high-quality data. Highest-quality calls were stored if they met all of the following parameters: (1) background noise and echoes were minimal, (2) at least 6 clear, smooth, consecutive echolocation pulses were recorded in a call sequence, and (3) the call sequence represented a single bat. The monitoring effort continued from dusk until 2400h, under clear, calm, and cool conditions, with a start-time temperature of 50F and an end-time temperature of 38F.

To confirm the identity of bat species 'captured' acoustically in June, and to pick up any additional species during the summer, we live-trapped bats along flyways utilizing a 1.5m x 2m harp trap (BCM 'Forest Strainer') and two 16-meter mist nets. A portable pole-and-pulley system enabled us to raise one net to a height of 5 m (top of net). Forest flyways were located by monitoring acoustic signals along old logging roads, clearings and forest edges with Pettersson D-200 heterodyne bat detectors tuned to 40 kHz. Captured bats were identified, measured, and released unmarked.

Results

Sonograms A thru D below exhibit typical *Myotis* species characteristics. In Figure A the short duration, broadband calls (downward sweeps from >84kHz to ~35kHz) are suggestive of *M. evotis*, though this species often produces calls with lower minimum frequencies (<35kHz). Minimum frequencies at or around 40kHz, suggest *Myotis ciliolabrum*, *M. lucifugus*, or *M. volans*. Figure B could be indicative of *M. volans*, due to the longer duration and call interval features (note that the duration and interval in A, C, and D are very similar). Figure C and D calls are very typical of *M. ciliolabrum*. They are more narrow in bandwidth, often have a well developed "toe" at the end of the call, and fall within the average minimum frequency and duration ranges for this species.

Calls in Figure E exhibit a distinct "knee" in the downward sweep, with pulses showing a slight bulge at around 57.5kHz. This is typical of *M. volans*. This species also produces calls that are very broad-band in nature, often exceeding 80kHz in maximum frequency. (Note that this call is expanded at a slightly higher ratio (F8 vs. F7) than the previous calls. This allows a greater detail of the call, notably the knee feature, to be shown.)

Figure F calls strongly resemble those of *M. lucifugus*. The minimum frequency often dips below 40kHz, and calls are more curvilinear than those of most *Myotis* species. There is no "knee" as in the sequence in E, nor is there much of a "toe" at the end of the calls, as there is in the sequences A through D. Again, this call is expanded at a slightly higher ratio (F8 vs. F7).

Sequences G and H are typical of the search-phase calls of *Lasionycteris noctivagans*, though with the quasi-constant frequency (QCF) calls at the end of the sequence in figure G they could easily be confused with *Tadarida brasiliensis*. Without longer sequences and/or direct observation of the bats as they are producing the calls, it would be difficult to provide a definite identification based on these two sonograms alone. Both species produce calls with similar minimum frequencies, and both bats regularly have QCF components to their calls. The sequence in figure H, however, tends to exhibit typical *L. noctivagans* characteristics, notably the very consistent minimum frequency in the sequence and bi-linear features hinted at especially by the last 4-6 call pulses in the sequence. Often the higher, FM sweeps of an echolocation call are not captured with a frequency-division bat detector, in part because of the atmospheric attenuation of shorter wavelengths coupled with the reduced sensitivity of the FD microphone. In these cases, the distinct FM sweep at the beginning of the call would be lost, especially if the bat were intercepted at a greater distance from the microphone. Under this circumstance, the only character recorded would be the QCF portion of the call as it swept down into lower frequencies. Typical *L. noctivagans* calls are composed of an initial FM-sweep paired with a distinct QCF sweep.

Though fragmentary in nature, Figure I, with its varied minimum frequency, is indicative of *Lasiurus cinereus.* This sonogram might also be confused with the search-phase call of *T. brasiliensis*; however the extremely low minimum frequency (15-18 kHz) exhibited in sequence J is further indicative of *L. cinereus*. No other bat (excepting the larger *Nyctinomops* and *Eumops*, which do not occur in this area) has such a low minimum frequency component in its echolocation call. *Tadarida brasiliensis* does not approach this lower minimum frequency. The upward trend of the calls in J likely represents the beginning of a feeding or drinking buzz. Alternatively, it could simply indicate a change in call structure associated with approach towards the forest edge as the bat turned away from the area (and the bat detector microphone).

Acoustic analysis thus reveals a likely fauna of 6 species, with *Tadarida brasiliensis* a possible seventh. *Eptesicus fuscus* is also a likely possibility, based on a tentative sighting, though we were unable to confirm its presence by either acoustic or live capture. Harp trap and mist net captures yielded only two species, confirming *M. lucifigus* and *M. ciliolabrum.*

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