RETHINKING YUMA BAT AND LITTLE BROWN BAT FORAGING ENDURANCE

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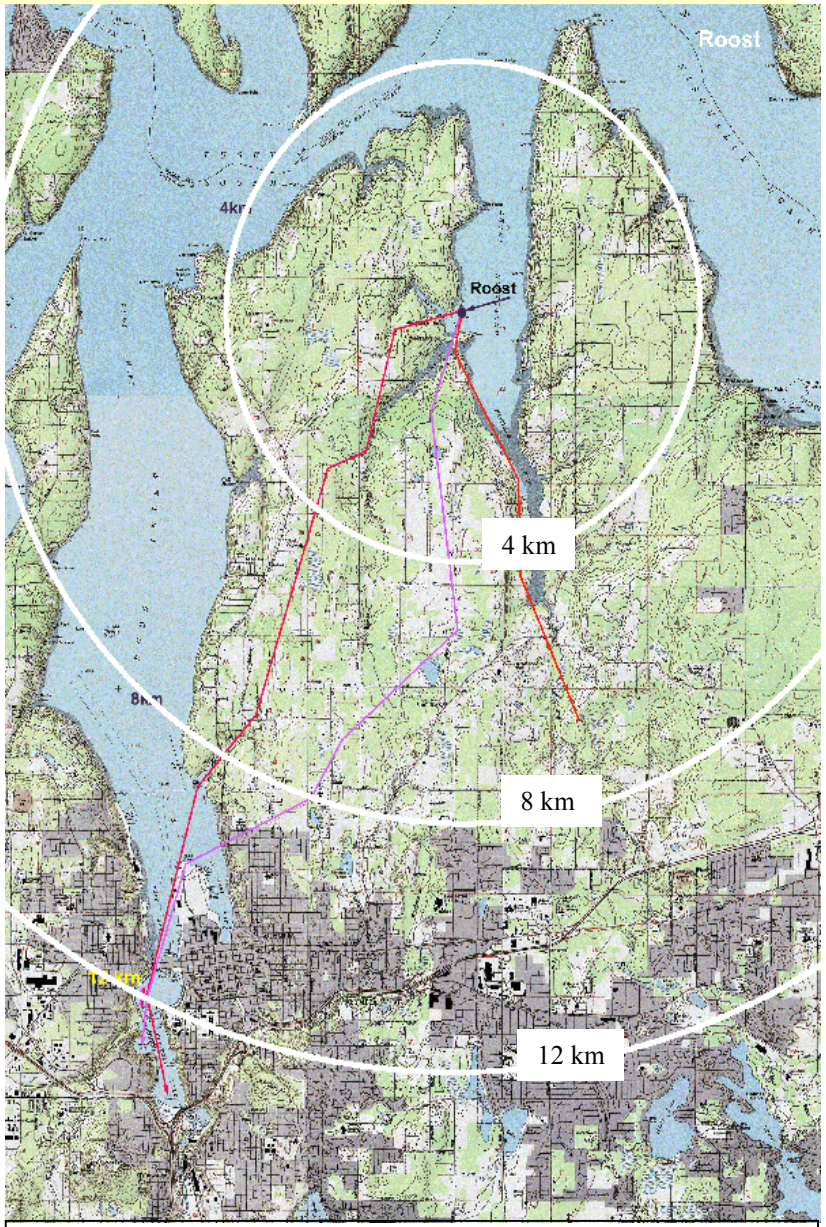
Introduction

Each spring and summer a large maternity colony of *Myotis* bats roosts in an abandoned railroad pier (Fig. 1) near Olympia, Washington. The bats begin arriving in April, have their young in June, then as the young become volant in early July the colony (now over 3.000) begins a steady decline as the bats disperse (Fig. 2). Nearly all of the bats roosting in the pier have been identified as Yuma bat *(Myotis yumanensis)* or Little brown bat *(M. lucifugus)* (Gaspari 1994; Schirato, pers. comm.; pers. obs.). In the coastal Pacific Northwest these 2 species are extremely difficult to distinguish by morphological features (Harris 1974) and misidentification is common without the aid of genetic analysis (Ormsbee, pers. comm.). Both Yuma bats and Little Brown bats forage in or near riparian areas when they are available, feeding heavily on aquatic emergent insects (Brigham et al. 1992) and use similar resources for maternity roosts (Nagorsen & Brigham 1993).

The landscape consists of saltwater inlets of Puget Sound to the north and east, semi-rural land to the south and west which then transitions into the urban areas 8-10 km from the maternity roost. We expected these bats to forage at the nearest ponds and wetlands, located between 2 and 6 km from the roost and for their nightly activity to alter between bouts of foraging and periods of night roosting, the typical pattern for insectivorous bats. Both of these assumptions proved to be wrong.

Methods

We monitored the maternity colony population with emergenc counts from 23 March to 11 October, 2003. We captured bats leaving the pier with mist nets on 11 nights between 25 April and 21 August, 2003. We attached radio-tags (.37 gr. LB-2N, Holohil Systems) to 1 pregnant, 1 lactating, and 2 post lactating bats to gain insight into their foraging range. Because the flat landscape does not offer vantage points from which to get "line of sight" bearings from distant radio tags, and to allow for intensive monitoring of nightly activities on a fine scale, only one bat was carrying a radio-tag at any time. Tracking was accomplished by outfitting a vehicle with a telemetry receiver, omni-directional antenna, preamplifier, and digital audio processor (to eliminate ignition noise) to first establish vicinity locations. The observer then switched to a handheld 3 element yagi antenna to get directional information and locate the foraging bats. The observer was limited to using public roads since the study area was nearly all rural and urban residential property. When a tagged bat's signal could not be heard, a search pattern was initiated radiating out from the last known location. One of the radio-tags which was deployed was defective and could not be detected further than approximately 100 meters. Only 1 forage location was obtained and 1 commuting location was obtained from this individual.



Several lakes are within the 13 km range from maternity roost .

Figure 5. Capitol Lake, Olympia, Washington. Destination of myotis from Woodard Bay (>12 km)

Figure 3. *Myotis volans* (hairy-winged myotis) with 0.5 gram LB-2 VHF transmitter (Holohil Systems).

Results

Two of the radio-tagged bats foraged for long periods without any resting or night roosting. All 4 radio-tagged bats were tracked flying greater than 7 km from their day roost, and 2 of the bats were found foraging at an urban lake (Fig. 5) over 12 km from the maternity roost where they were captured. These 2 bats were tracked to this distant lake on 6 consecutive nights (in July and in August), one traveled directly to the lake from the day roost, foraged up to 5.5 continuous hours at the lake, then traveled back to the roost for a total of >6.5 hours "on the wing." Our methods allowed a single observer to determine the tagged bat's location and activity type approximately 50% of the total night activity period (from emergence at dusk to final return to the day roost).

Discussion

The 12 km (one-way) commute distance is considerably greater than reported in other studies; reported distrances for these 2 species indicate distances of <1 km to 8 km between day roosts and foraging areas (Barbour and Davis 1969; Barclay, pers. comm.; Henry et al 2002; Johnson 2002). Expeting these distances, we initially searched from 0 - 7km from the roost using a spiral-out search pattern, and did not locate the bats' distant foraging area until the 5th tagged night. Possibly more unusual was the nonstop flying and foraging for up to 6.5 hours. Chruszcz & Barclay (2003) first reported insectivorous bats (Long-eared myotis, *Myotis evotis*) spending 90% of their out-of-roost time foraging. They felt this might be related to the species being near the edge of its range, and may indicate a flexible feeding strategy, gleaning insects from surfaces as well as taking prey aerially. This would allow them to take advantage of the nightly period (between midnight and shortly before dawn) when the aerial insect counts are low (Anthony et al. 1977), but insects on surfaces are still available. Since Little brown and Yuma bats are known only to be hawking (aerial) feeders, and emergent aquatic insects were likely available all night at Capitol Lake. These long uninterrupted foraging times may indicate that resources at the distant lake are not particularly abundant, as 4.5 - 5.5 hours should be enough time for a Little brown bat to fill its stomach several times (Barclay, pers. comm). It is unknown why these bats are regularly foraging greater distances than previously reported for Little brown or Yuma myotis. Possible explanations include: greater competition for resources by a larger colony; the distant lake may offer superior forage opportunities; or that the fine-scale monitoring of individual bats revealed behavior that may have been missed in earlier investigations. Finally, the sample size will need to be increased to determine the significance of these observations.

Conclusion

Our work suggests that commonly accepted foraging behavior for small *myotis* bats is not applicable in all landscapes, and they apparently have the physical endurance to sustain long daily commutes with long bouts of foraging without night roosting. Tracking radio-tagged bats in an urban landscape offers some unique obstacles such as limited public access within the study area, and decreased signal detection range due to increased electrical interference (from power lines, computers, and strong radio signals) and in flat areas like our study area from the lack of higher vantage points decreases the line-of-sight distance. Because of our experience with a defective tag, we recommend performing distance tests on all radio tags prior to deployment on study subjects.We will continue with similar effort in 2004 to increase the sample size in an attempt to better quantify the foraging range of these bats.

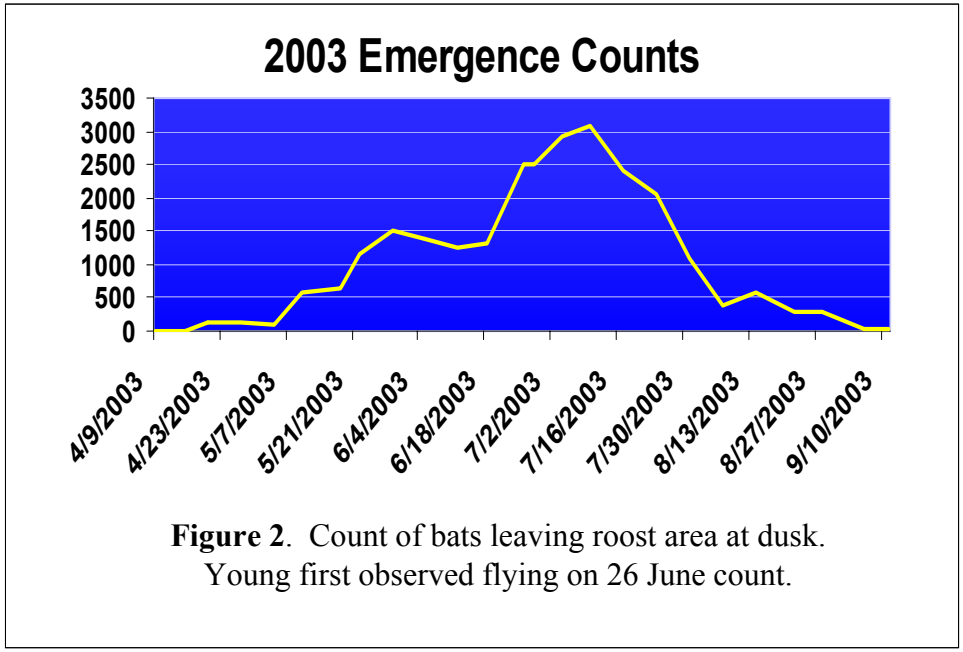


Figure 2. Count of bats leaving roost area at dusk. Young first observed flying on 26 June count.

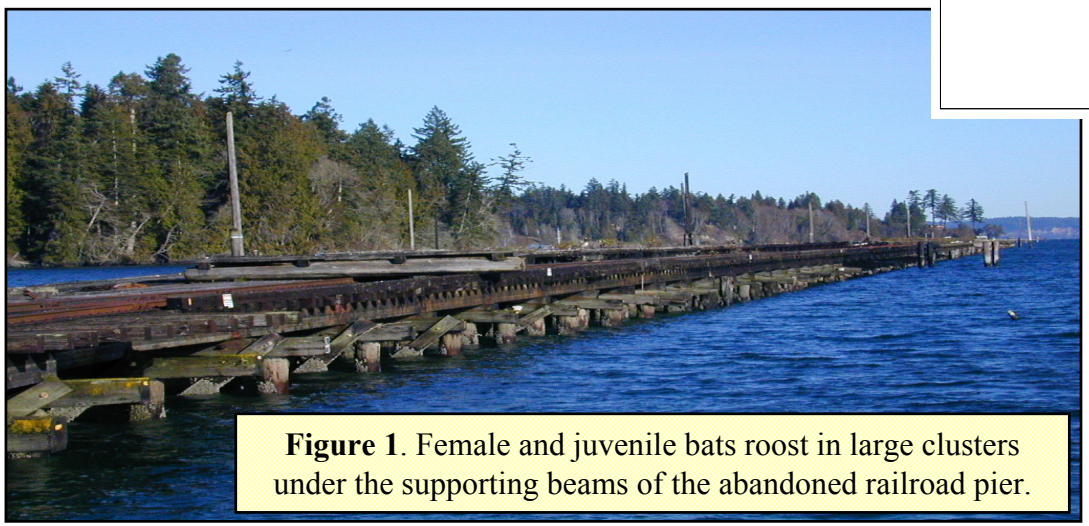


Figure 1. Female and juvenile bats roost in large clusters under the supporting beams of the abandoned railroad pier.

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