BAT BOX PREFERENCE STUDY ON FORT LEWIS, WASHINGTON

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Abstract

Ten bat species are found in the Puget Trough of western Washington, five of which have federal or state conservation status. Recent research on Fort Lewis has documented all ten species present, providing impetus for conservation action. The loss of historical roosting habitat (old growth snags), has forced numerous bat species to adapt to human structures and artificial roosts as primary roosting habitat. Over the past two years, we tested three bat box designs to determine which was most preferred by resident bats. Ten boxes of each design were built and placed in arrays at ten sites across Fort Lewis. In 2008, the Uncle George (UG) design had the most use (50%) as assessed by guano traps and bat observations, followed by the dual chambered rocket box (DCR) (40%), and lastly the mammoth box (10%). In 2009, the UG received the most use (80%), followed by the DCR (50%), and lastly the mammoth (10%). Although the UG had the most use, the DCR received more extensive use at several sites (large amounts of guano), indicating numerous bats residing in the structure. Cost breakdown is as follows, DCR- 63$; UG-50$; Mammoth- 25$, not including mounting hardware and post. The most labor intensive box was the DCR, followed by the UG and the Mammoth. This research suggests the UG may receive the most use by area bats and is reasonable in cost and construction time, although the DCR showed promise for use by aggregations of bats and may provide maternity roosting habitat.

Scientific name	Common name	Fed. conservation status	State conservation status
Corynorhinus townsendii	Townsend's Big-eared Bat	Species of Concern	Candidate species
Lasionycteris noctivagans	Silver-haired Bat	-	-
Lasiurus cinereus	Hoary Bat	-	-
Eptesicus fuscus	Big Brown Bat	-	-
Myotis californicus	Myotis	-	-
Myotis evotis	Long-eared Myotis	Species of Concern	-
Myotis lucifugus	Little Brown Myotis	-	-
Myotis volans	Long-legged Myotis	Species of Concern	-
Myotis yumanensis	Myotis	Species of Concern	
Myotis keenii	Keen's Myotis	Species of Concern	Candidate species

Table 1. Resident bat species with federal and state conservation status.

Bat Habitat Requirements

- **Maternity Roosting Structures-** highly dependant upon species, often times incorporates matrilineal assemblages. Examples include attics, large decadent snags with cavities, under bridges with large crevices, and barns with secluded sections.
- **Foraging Habitat-** foraging habitat varies with species and time of year but often includes edges between mature forest and water or riparian areas, where there are highly productive invertebrate communities (Lacki, et al 2007).
- **Day Roosting Structures-** Outside of the reproductive season, bats often utilize solitary roosting structures to reside in during the day, which were historically rock crevices or cavities in snags or large decadent trees. Today, man made structures are replacing many of the lost snags. Common day roosting man made structures include roofing (cedar shake, corrugated metal), siding, attics, bridges, and bat boxes.
- **Night Roosting Structures-** During foraging episodes each night, bats commonly rest for periods in night roosts. These may be less secure and secluded than day roosts, but are often times similar structures located in close proximity to foraging resources (Lacki et al 2007)
- **Hibernacula-** Most species migrate in the winter to hibernacula to escape extreme temperatures. In this area, it usually means retreating to higher elevations and congregating in lava tubes or caves where they find cool, stable temperatures, although several species have been shown to overwinter and remain active in the Puget Sound lowlands (Falxa 2008).

Figure 1. (left) Example of typical roost tree. This snag housed a colony of long-eared myotis (unknown if Keen's or Western long-eared).

Bat Box Preference Study

In the spring of 2008, a study to determine which bat box was most preferred by resident bats was initiated. Following bat surveys on McChord Air Force Base in 2007 and Fort Lewis in 2008 (Falxa 2008), managers were interested in creating bat habitat and the question arose as to which bat box design was preferred by resident bats. Currently employed box designs were investigated, and two standardized designs were chosen for comparison, as was a box of our design.

Methods

Ten boxes (Figures 2-4) of each design were built (the dual chambered rocket box, the mammoth box, and the Uncle George), caulked to close gaps, and stained dark to increase solar heating.

- Ten locations were identified across Fort Lewis that contained accepted bat habitat characteristics including open water and an adjacent, mature forest edge (Figure 5).
- At each chosen location, the array was erected conforming to the riparian edge (Figure 6).
- After the array was erected, a tray was attached to each post to collect guano.
- UTM coordinates of the bat box arrays were recorded, including general site characteristics and array details.
- Arrays were monitored systematically twice each year, plus opportunistically when personnel were near an array site.

Figure 2. Dual Chambered Rocket Box (DCR).

Figure 3. Mammoth Box.

Figure 4. Uncle George Box (UG).

Results

USE, determined by visual confirmation of a bat roosting (day or night) in the box, or the presence of guano on the tray:

- **2008:** Uncle George (50%); Dual Chambered Rocket Box (40%); and Mammoth (10%).
- **2009:** Uncle George (80%); Dual Chambered Rocket Box (50%); and Mammoth (10%).
- **Overall:** Uncle George (65%); Dual Chambered Rocket Box (45%); Mammoth (10%)

COST, pre-tax cost of materials during the winter of 2009:
Dual Chambered Rocket Box- $63.00
Uncle George- $50.00
Mammoth Box- $25.00

LABOR: The most labor intensive box to construct was the DCR (3.5 hours), followed by the UG (1.5 hours) and Mammoth (1 hour).

Figure 6. The array at Pipeline Marsh.

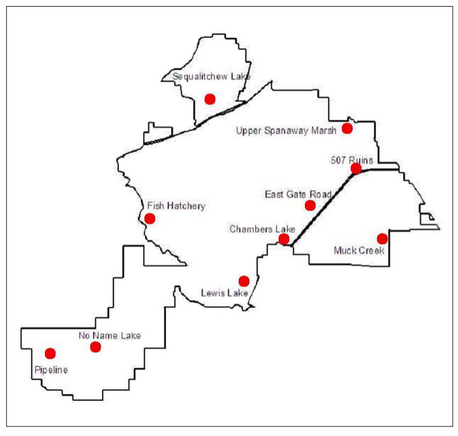

Figure 5. Map showing locations of bat box arrays distributed on Fort Lewis, WA, spring of 2008.

Discussion

The high rates of use, including first year use of over half of the Uncle George boxes was encouraging, given it is common for boxes that eventually get used to remain unused for the first year. The authors thoughts regarding the success of the Uncle George design focus on the 'slatted' face which may be a search image bats are accustomed to, analogous to slabs of peeling bark or loose shingles on a building. Since the experiment, the Uncle George design has evolved to incorporate more of this slatted look. The success of several of the Dual Chambered Rocket boxes was also of note, given these regularly received extensive use at several locations as indicated by large piles of guano on our trays. These boxes may be large enough for certain species to utilize as maternity colonies. The authors also hypothesize that having the possibly more acoustically attractive Uncle George boxes in close proximity to the Dual Chambered Rocket boxes may speed their discovery and use.

Conclusion

The Uncle George box (Figure 7) received the most use (65%) in our experiment over the two years of monitoring, although following relatively close behind was the dual-chambered rocket box (45%). The Uncle George is likely suitable for providing adequate night roosting and day roosting for some species. The dual-chambered rocket box likely provides both day and night roosting habitat, and for some species of bat the possibility of maternity colony roosting habitat. In combination these boxes may be the most successful for bat habitat, although cost and time in construction for the dual-chambered rocket box is significantly greater than the Uncle George. This experiment showed the mammoth box to be a poor choice for bat habitat.

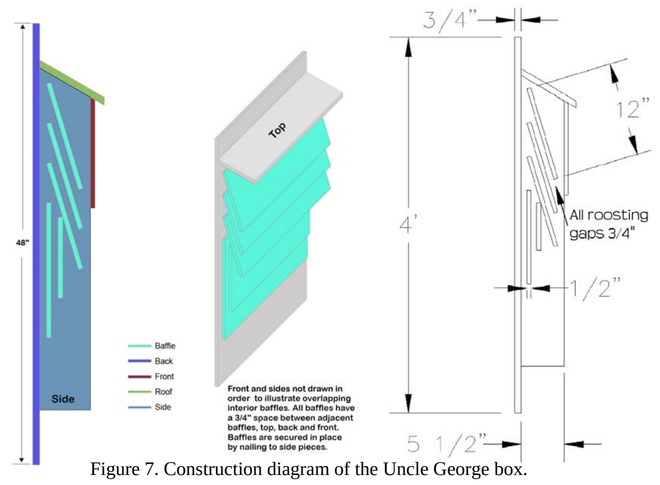

Figure 7. Construction diagram of the Uncle George box.

Future Directions and Management Implications

The success of the Uncle George bat box design has encouraged the construction of many more boxes being distributed throughout the area, although this box design is inadequate for certain species and needs. The Uncle George design may be used extensively for night and day roosting in some circumstances, but some bat species require more than just day and night roosts. Of particular concern are maternity roosts for some colonial bats, which must be large enough to house up to several thousand individuals. Local maternity colony sites include a deserted railroad pier, an abandoned barn, and a church attic. Efforts are underway to create additional maternity colony habitat exclusively for bats, given their use of human occupied structures often results in exclusion or extermination. As a middle-term fix for the lack of natural cavities and snags in our heavily managed and degraded natural environments, these maternity colony structures can provide critical habitat required to fulfill life cycle requirements. On Fort Lewis in 2009, a maternity colony structure was constructed exclusively for bats (Figure 8). An abandoned church steeple was refurbished to provide maternity colony habitat suitable for a local soon-to-be extirpated big brown bat (*Eptesicus fuscus*) colony or for Townsend's big-eared bats (*Corynorhinus townsendii*; Figure 9) present in the area.

Figure 9 (above). Townsend's big-eared bat (*Corynorhinus townsendii*) captured on Fort Lewis during the 2009 summer bat survey.

Figure 8 (left). Retrofitted church steeple for bat maternity colony (height = 5 m.)

References

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