1997
Interim Report

Environmental Parameters and Use of Abandoned Trailer and 'Bat-condo' by the Southeastern Big-eared Bat *Corynorhinus rafinesquii macrotis* on the Disney Wilderness Preserve.

Fly By Night, Inc.: The Bat Specialists
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INTRODUCTION

In Florida, the Southeastern big-eared bat *(Corynorhinus rafinesquii macrotis)* is considered rare (Florida Committee on Rare and Endangered Plants and Animals 1992). This species was formerly classified as C2 by the USFWS, but that protective category was dropped in 1995 (Federal Register Vol. 50, No. 181, p. 37965). At the present time this species has no legal protection and not enough is known about its' population status (either range-wide or statewide) to determine if protection is warranted. In 1993, a colony of bats roosting in an abandoned trailer on South Florida Water Management District property (formerly owned by the McKinney family), adjacent to the Disney Wilderness Preserve (DWP), was confirmed as *Corynorhinus rafinesquii*. This was the first confirmed maternity colony of the species in Florida, and the DWP site remains the southern-most location for a maternity colony in this species range.

Beginning 1 May 1997, under a contract between The Florida Nature Conservancy and Fly By Night, Inc., the Walt Disney Company funded research to collect information about the roosting ecology of the DWP population of *Corynorhinus rafinesquii* and the environmental parameters in both the occupied trailer and a new 'bat-condo' .This project will continue until 30 April 1998 and a final report will be submitted by 30 June 1998. In April 1997, a bat-condo was erected by the South Florida Water Management District (SFWMD) in an attempt to provide the DWP *Corynorhinus* population with a suitable alternate roost site. The bat-condo was also placed in hopes the bats would use it and the badly dilapidated trailer could be removed from the site. The bat trailer is not only an 'eye-sore', but also a potential liability. As part of this contract, environmental parameters (temperature, humidity, and light level) are being monitored in both the trailer and the bat-condo in an attempt to learn more about the importance of these factors on the roosting behavior of this population of bats. This data will assist us in providing the best roost structure possible in the bat-condo.

MATERIALS AND METHODS

Bat Condo Design and Placement:

In April 1997, I met with Bill Helfferich of the SFWMD and we agreed upon a design for a new structure to be built near the occupied trailer. I also solicited and received input on this design from other biologists working with *Corynorhinus* in the Southeast. SFWMD purchased the needed materials and provided the person-power to build the structure.

The bat-condo was built 63 meters (206 ft) North of the occupied trailer, on the DWP side of the fence line. It is within the same contiguous live oak (*Quercus virginiana*) hammock where the trailer is located. After its placement on 27 April, several modifications were made. These included: attachment of metal sheeting on the lower 2 feet of the structure to prevent entry of rat snakes (a conspicuous predator of *Corynorhinus*). Since the mean temperature of the trailer was found to be significantly warmer than ambient (Finn 1996), the bat condo was painted with a dark stain to increase solar warming (Behr Natural Seal Plus no. 84, Brown-pressure treated wood). A soffit was not included in the bat condo design and due to a high light level inside the

bat condo; three of the four areas on each side of the condo (North and South) were closed. One space was left open on each side to provide alternate entry and exit sites for the bats.

Environmental Parameter Monitoring:

The new bat condo was equipped with copper-constantan thermocouple wires attached to a Campbell CR10 datalogger and AM416 multiplexer. HOBO (Onset Corp.) humidity and light level dataloggers were placed in the bat condo and at an ambient site chosen nearby. In the occupied trailer HOBO temperature, humidity and light level recorders were placed throughout. Every two weeks (when possible) the site was visited and datalogger information was uploaded onto a laptop computer (Epson ActionNote 4SLC/33) using Campbell PC208 and Onset Box-car2 software and all dataloggers were reset.

Structure Monitoring:

During the twice monthly visits, both structures were entered to remove and upload datalogger information. At this time notes were taken as to number and position of bats in the trailer (Table 1). Notes were also taken as to evidence suggesting bat activity in the new bat-condo.

RESULTS

On 27 April, the bat condo was built 63 meters (206 ft) north of the trailer on the DWP side of the fence. It is within the same contiguous live oak hammock where the trailer is located. The opening to the bat condo faces west. It was originally intended that the opening face north similar to the opening to the trailer, but a miscommunication prevented this.

Locations and numbers of bats in the trailer roost are shown in Table 1. The population size remains stable and pups were born the week of 4 May 1997. Visits to the bat-condo uncovered an almost immediate interest by the bats. After two weeks, two *Corynorhinus* guano pellets were seen on the floor in the bat condo. On each subsequent visit, 2 - 15 guano pellets were seen in the bat condo and on 25 August alone *Corynorhinus rafinesquii* was seen inside the bat condo near the roof on the west side. On each visit since this date a single *C. rafinesquii* has been present in the same location.

Preliminary examination of environmental data collected at this site indicates that the bat condo should provide an adequate alternate roost site for these bats. The serial nature of these data makes the use of standard ANOVA tests difficult; therefore, all p-values presented here are for Kruskal-Wallis tests of medians unless otherwise noted.

The relative humidity (RH) in the bat condo was significantly higher than both ambient RH and RH in the trailer. The range of humidity was significantly lower ($p=0.00$, Figures 2 and 3). Bats generally prefer higher humidity conditions and a stable humidity level would be most desirable (Barbour and Davis 1969).

Analysis of light levels reveals that ambient light level was significantly different from light levels in both the bat-condo and the trailer. The light level was the lowest (p=0.00) in the trailer and the ranges in both the bat-condo and the trailer were significantly lower than the ambient range (Figure 4). *Corynorhinus* has been thought to roost in higher light level conditions than other bat species (Barbour and Davis 1969). No clear conclusions can be made yet concerning light level and the behavior of this population of bats.

The median temperature in the bat-condo was significantly warmer than ambient in all monitored locations except the south west ridge. All temperature ranges were lower than ambient range. In the trailer the temperatures in all monitored locations were significantly warmer than ambient, but only the west and middle rooms were significantly different from each other. When examining mean trailer and bat-condo temperature on a time-series graph (Figure 5) it is obvious that significantly warmer temperatures occur only during the night-time hours when the bats are active and generally away from the roost. Temperatures in both roost structures are lower than ambient during the day when the bats are present in the roosts and less active.

DISCUSSION

Figure 5 illustrates that when analyzing roost microclimate data a simple analysis of means or medians is not always sufficient to describe the complexity of roost microclimate. Much data is yet to be analyzed and the complexity of the data and analysis should simplify our understanding of how to meet the needs of these animals when placing artificial roost sites for management purposes. Environmental parameters examined in the bat-condo so far compare well with parameters monitored in the occupied trailer and presumably fall within the range for a roost likely to be occupied by *Corynorhinus.* No plans exist for major bat-condo modifications at this time.

The presence of guano pellets in the bat condo indicates that bats are, at the very least, flying into and out of the structure. No culled insect parts have been found, discounting the site as a feeding roost. Culled insect parts illustrate that the trailer is a feeding roost as well as a day roost.

Due to the sensitivity of *Corynorhinus* to disturbance at the roost site, no effort has been made to capture the bat found roosting in the bat-condo. It is presumed this is the same individual and that it is a male, but without capturing and banding the animal this can not be confirmed. Plans to place a mist net outside the condo opening may result in capturing this bat without risk of disturbing it in the roost site or causing roost abandonment.

CONCLUSION

There remains much about these animals that is a mystery: where do they forage, what is their home range, where are alternate roosts and how important are they, what is their distribution in the state, how many colonies are present and how big are they? I urge TNC and Disney to

consider future work on the DWP *Corynorhinus* colony and other bat species in Florida, potentially the entire Southeastern region. Florida's human population is undergoing rapid increases that may result in the decrease of natural areas that support viable roost sites and foraging areas. It is not known how well many species adapt to these increases in the human population.

Abandoned structures used as roost sites for bats are potential liability factors and are generally removed quickly. Placement of structures like the DWP bat-condo can have positive effects on populations by providing secure, stable roost sites. The more we learn about the needs of this population of *Corynorhinus*, the more likely it will be that we can manage other populations in the region, now and in the future. Without this knowledge, we may lose a population or entire species before we know anything about it.

LITERATURE CITED

Barbour, R.W. and W.H. Davis. 1969. Bats of America. The University Press of Kentucky, Lexington. 286 p.

Florida Committee on Rare and Endangered Plants and Animals (FCREPA). 1992. Humphrey, S.R. (ed). Rare and Endangered Biota of Florida. Volume 1. Mammals. University Press of Florida, Gainesville. 392 p.

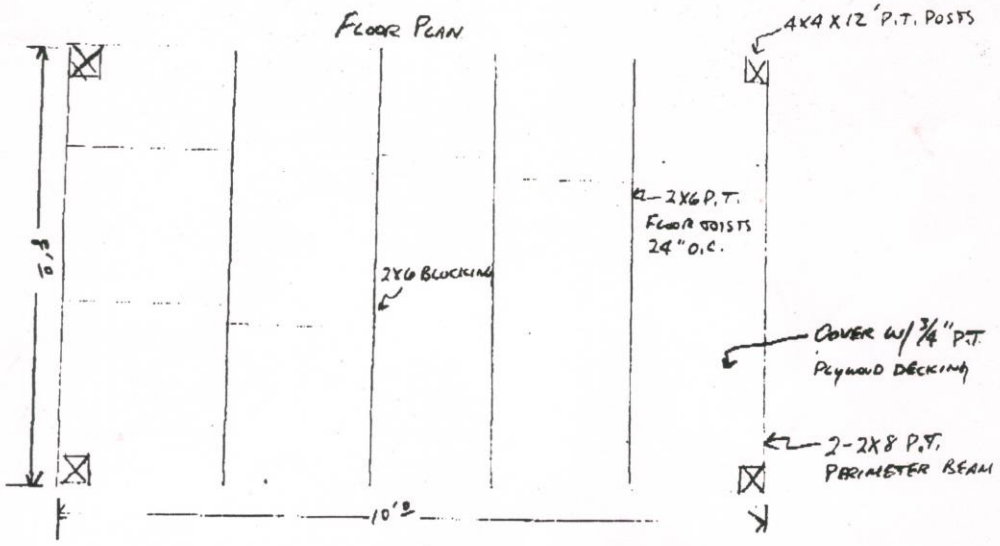
Finn, L.S. 1996. Roosting and Foraging Ecology of a Southeastern Big-eared bat, *Corynorhinus rafinesquii macrotis,* Maternity Colony in Central Florida. Final Report to the FL Nature Conservancy. 1 January 1996. 18 p.

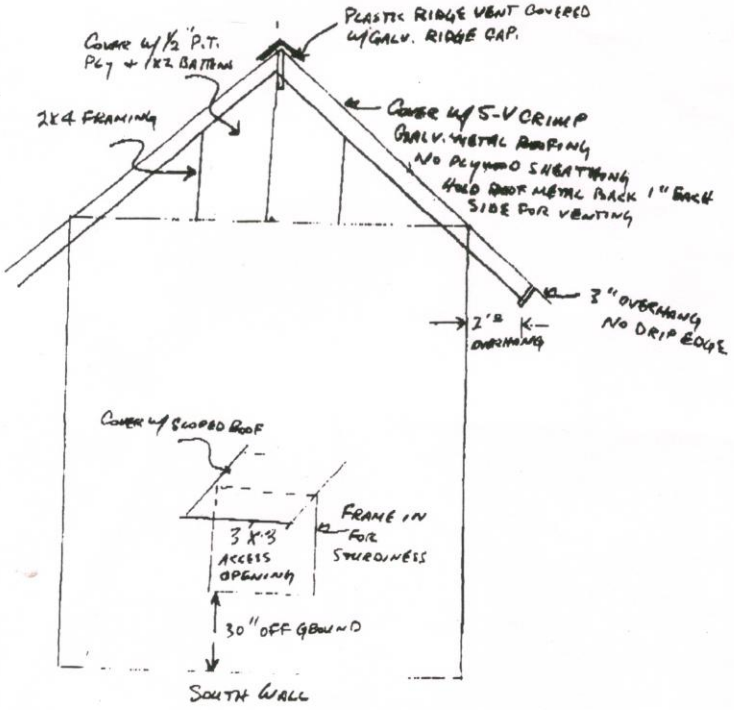
Table 1: Location and numbers of bats in DWP bat trailer

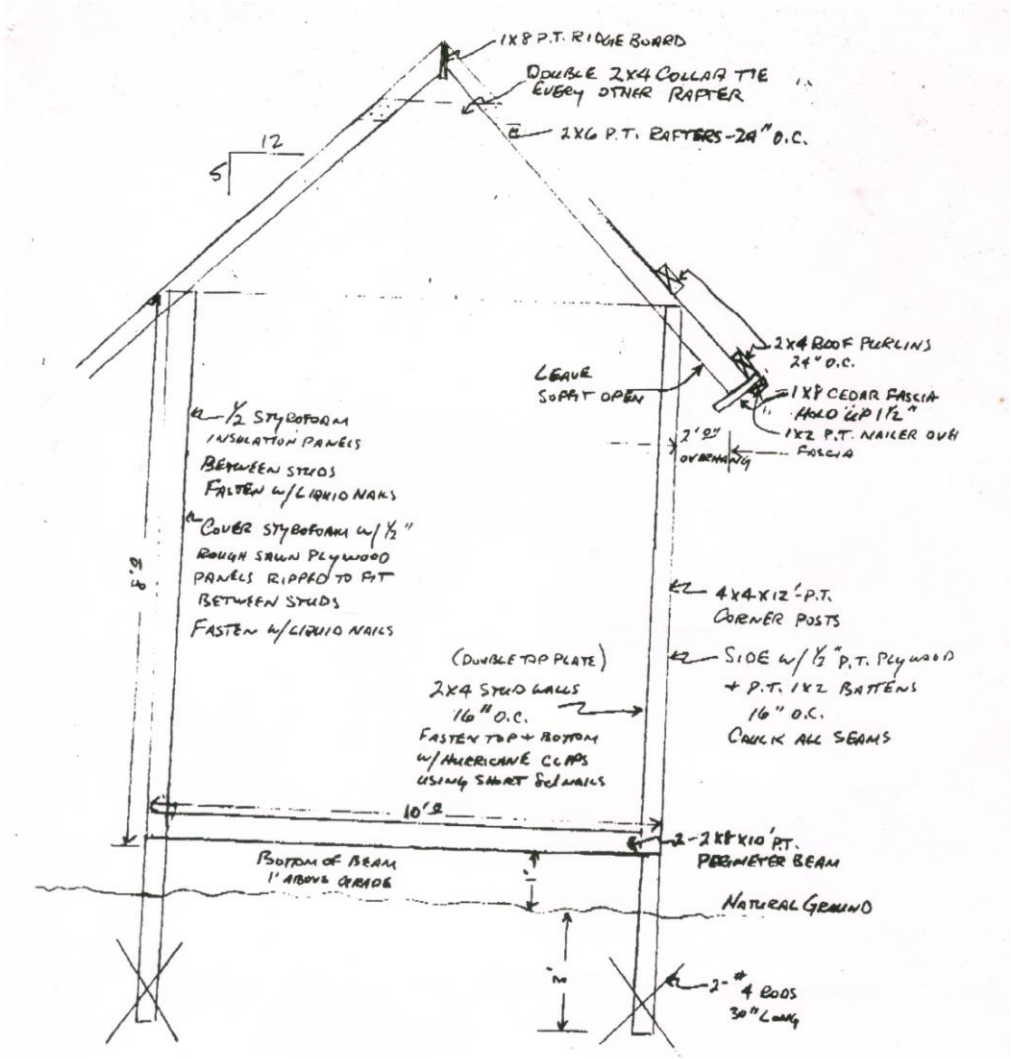
Date	Number of bats	Location in trailer	Total number
1-7-96	40-50	4	40-50
1-15-96	23	4	23
1-20-96	1	1	3
	1	4	
	1	5	
1-27-96	8	1	8
2-3-96	6	1	7
	1	4	
2-10-96	1	2	14
	13	4	
2-20-96	13	1	15
	1	4	
	1	5	
3-16-96	1	1	23
	22	4	
3-24-96	7	3	33
	25	4	
	1	5	
4-22-96	1	1	27
	11	3	
	15	4	
5-11-96	1	1	26-31
	25-30	4	
5-20-96	4	1	37
	14	3	
	19	4	
5-30-96	4	1	34-39
	10	2	
	10-15	3	
	10	4	
6-8-96	1	1	30-40
	30-40	5	
7-4-96	30-40	4	30-40
5-5-97	1	1	27-32
	1	3	
	25-30	4	
5-11-97	1	1	29-34
	5	2	
	3	3	
	20-25	4	
7-7-97	35-40	1	35-40
7-22-97	17	1	30
	13	4	
8-5-97	30-40	4	30-40
8-25-97	29-31	1	29-31
9-18-97	1	1	34
	31	2	
	2	3	
10-19-97	40-45	2	42-47
	2	3	

1: east room
2: middle room
3: bathroom
4: west room
5: other (hall or kitchen cabinet)

DWP *Corynorhinus* Bat House







Add:
1. Since soffit is open, close spaces between wall and roof, 3 of 4 spaces on each side. This decreases the light level.
2. Attach metal sheeting around bottom of to deter predators (i.e. snakes)
3. Paint or stain house medium color
4. Caulk all seams to prevent drafts and entry of moisture
5. Score interior walls to add roughness

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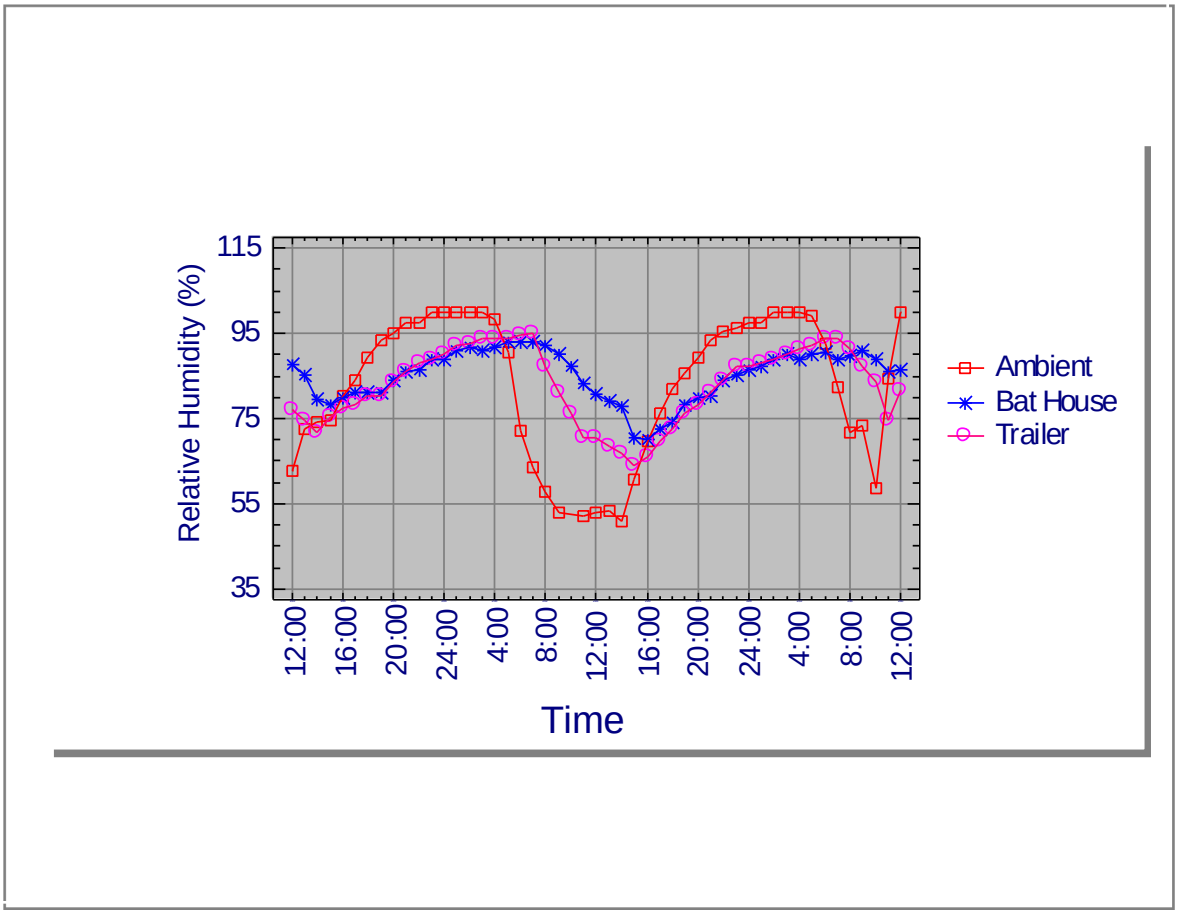

Figure 2. Relative humidity measured at the DWP bat condo site. Data shown are from periods monitored from 1-22 July 1997.

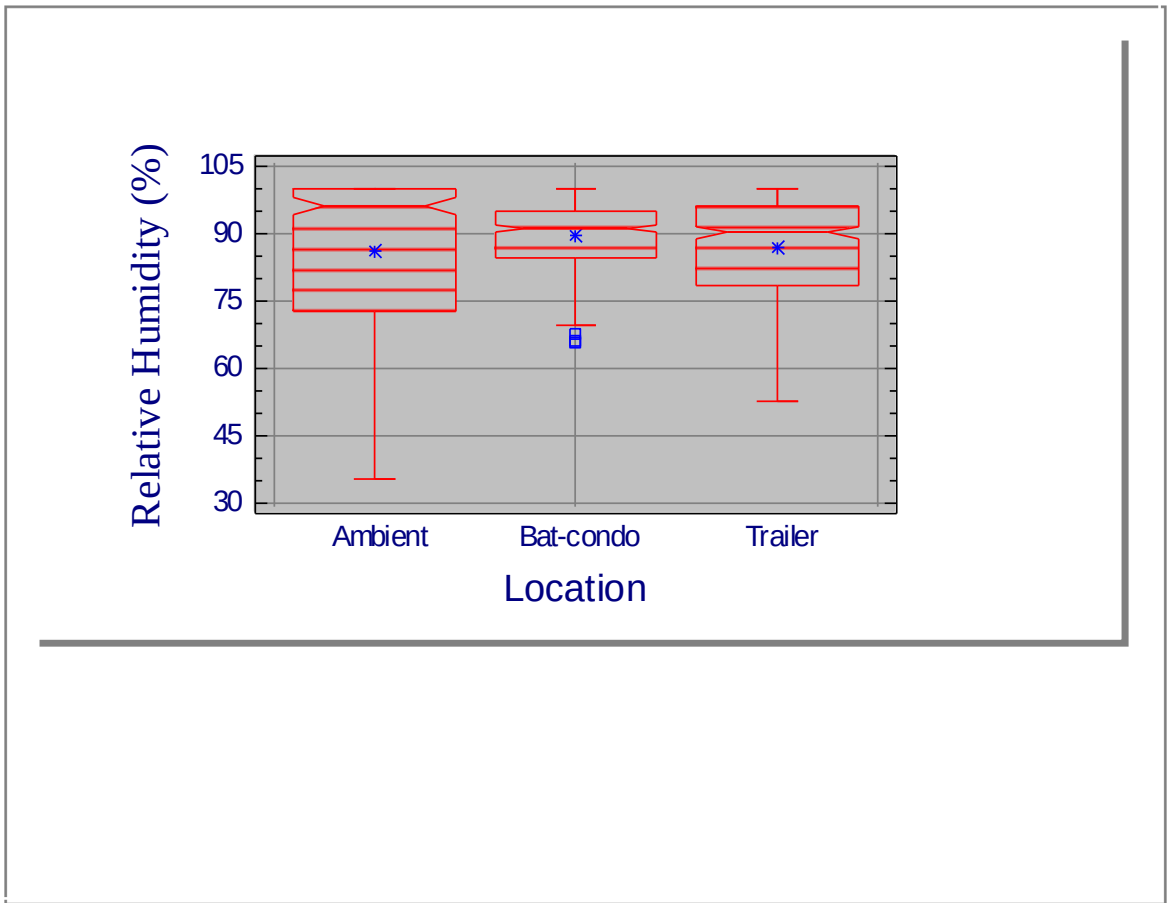

Figure 3. Box and Whisker plot illustrating relationship between relative humidity in roost structures at the DWP bat condo site. Data are from 1-22 July 1997. Asterisks (*) indicates mean values and notches indicates median values.

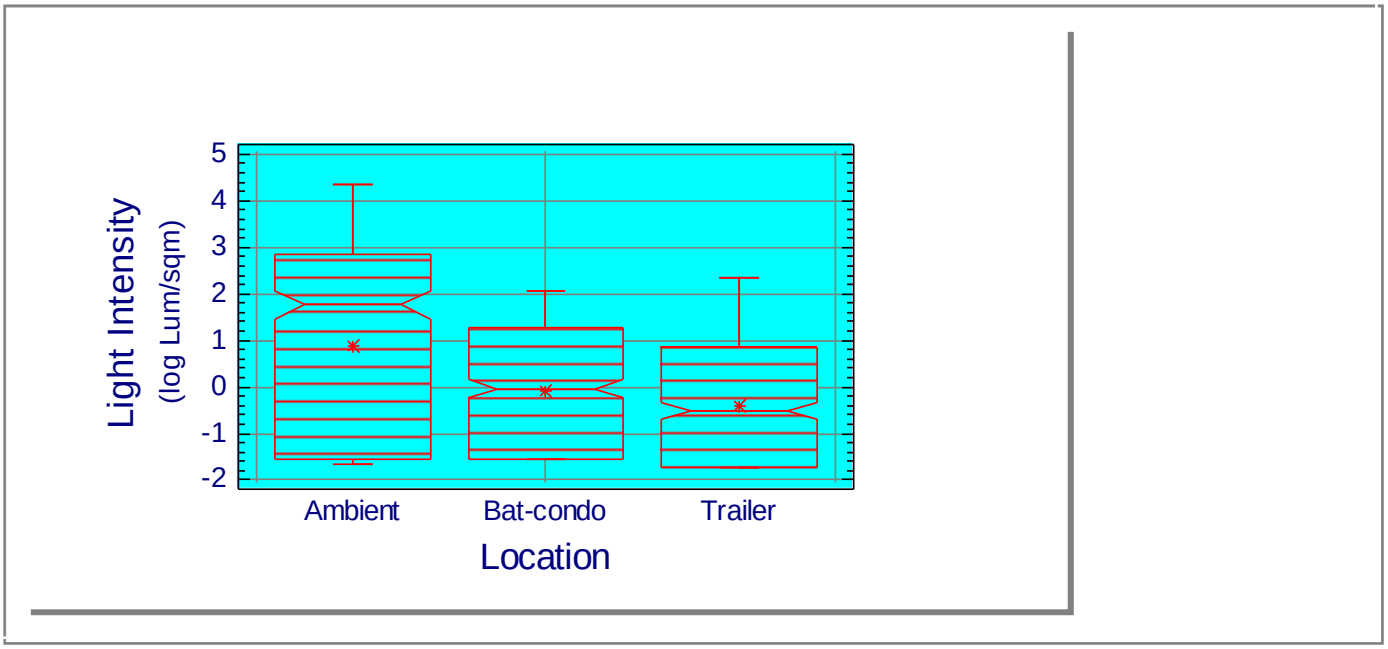

Figure 4. Box and Whisker plot illustrating light intensity (log lumens/sqm) measured at the DWP bat condo site. Data shown are from period monitored from 1 - 22 July 1997. Asterisks (*) indicate mean values and notches indicate median values.

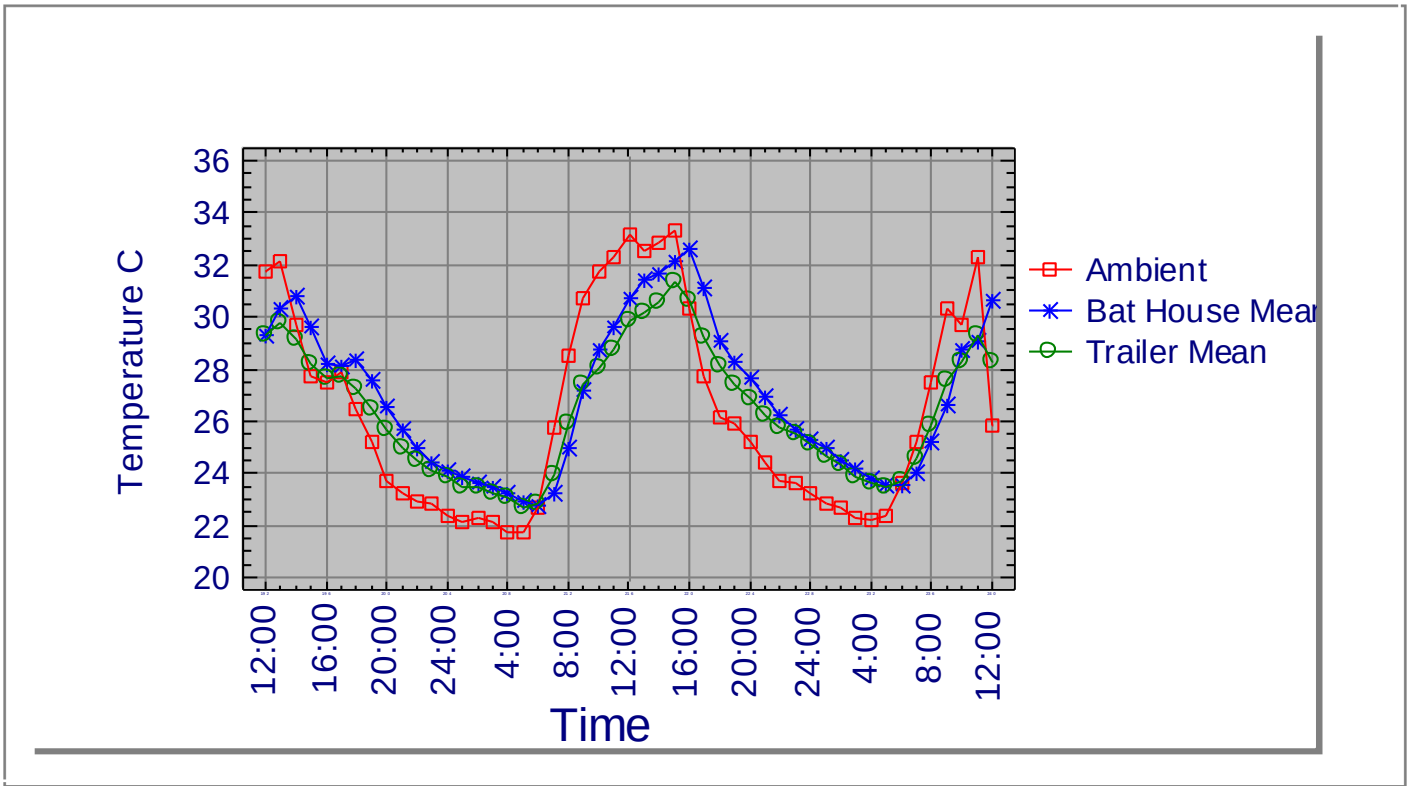

Figure 5. Mean temperatures measured at DWP bat site. Data shown are from a period monitored from 1-22 July 1997. Median temperature in both roost structures is above median ambient temperature (Kruskal-Wallis p=0.00).