

The Goldilocks Approach:

Use of bat boxes in a changing landscape and climate

The Story of What Bats Need from a Roost and How We Can Help



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Goldilocks and the Three Things Bats Need to Survive

- Sufficient Stored Fat
- Sufficient Water Supply
- Appropriate Shelter

BUT WHAT IS **APPROPRIATE** SHELTER?

BAT BIOLOGY IN BRIEF:

- Bats are mammals
- Flight is energetically expensive
- Fat storage is limited due to flight
- But body temperatures can vary drastically
- Use of torpor allows bats to cool to save precious fat

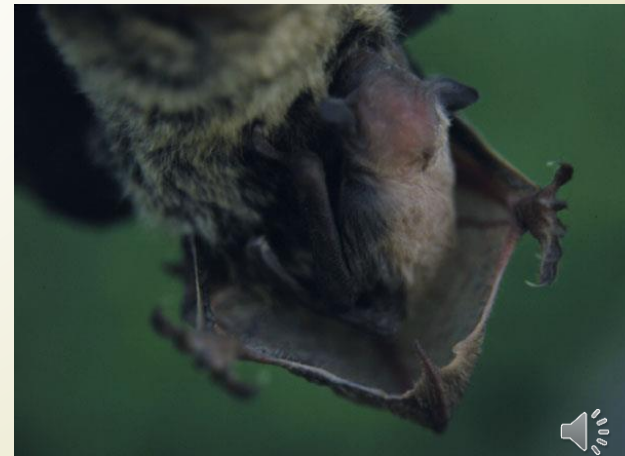


Goldilocks and the Three Things Bats Need to Survive

What a bat needs from a roost differs depending on:

- ▶ Male vs Female

- ▶ Raising a Pup vs Not Raising a Pup



Goals of a Mom Bat

- ▶ Give birth to pup ASAP in spring! – needs time to get big and fatten for hibernation
- ▶ Select roost that keeps pup warm day and *night*
 - ▶ *Pups need warmth for growth*
- ▶ Nurse pup with a lot of milk -- so it will grow fast.



What Female Bats Look for in a Roost

➤ **Mothers To Be**

- Females develop fetus in spring
- This requires a warm roost.

What if she can't find a warm roost in spring?...

Her body will cool (*Torpor*)
-ie. longer gestation



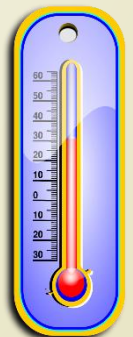
What Female Bats Look for in a Roost

➤ **Moms**

- Roost must keep her:
 - body warm so she can make milk
 - pup warm at night so it can continue to grow

So female bats need **WARM** roosts to raise young.

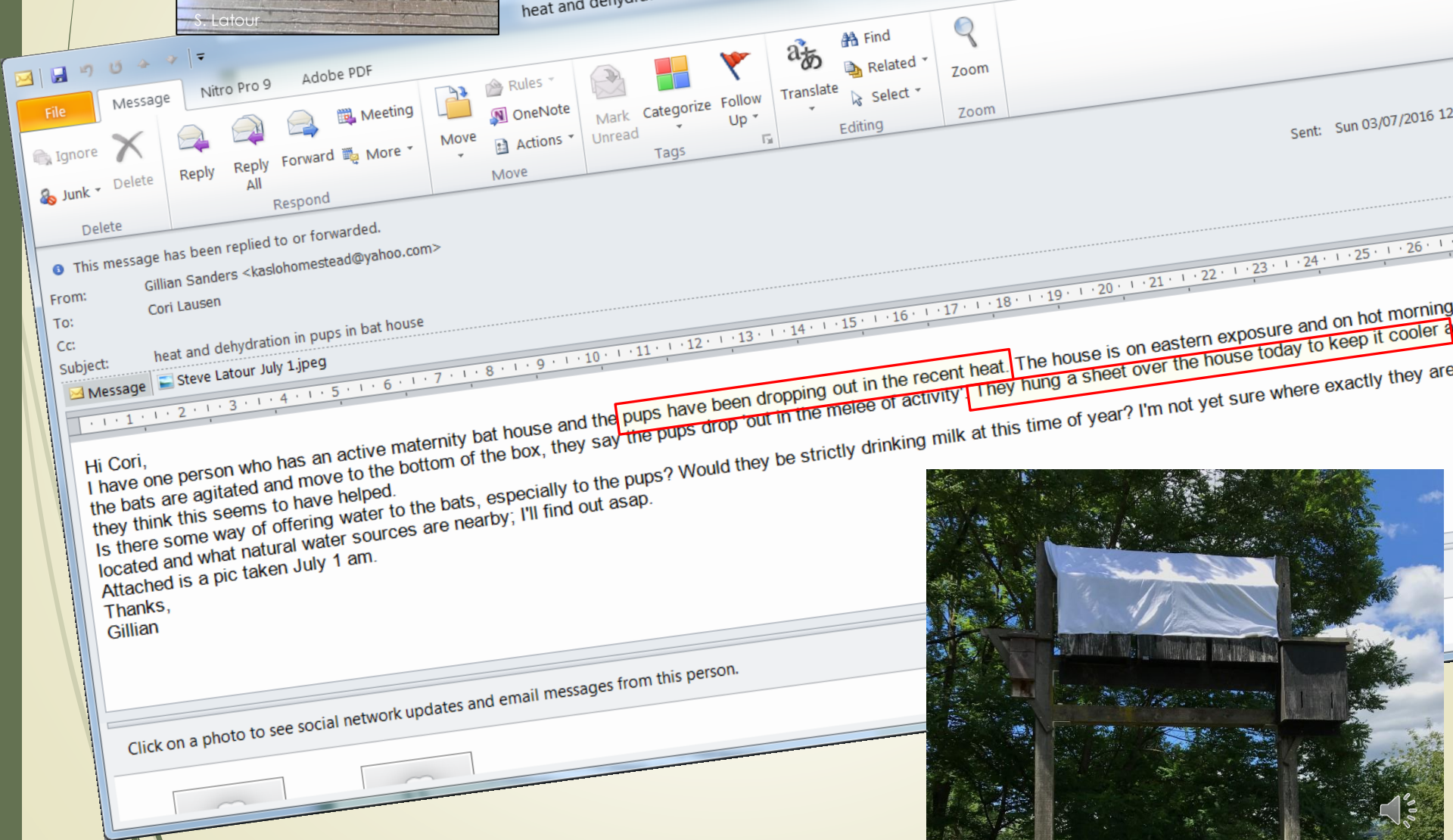
How warm is **WARM**?





B.C. – 9 confirmed sites of mass mortalities at roosts

heat and dehydration in pups in bat house - Message (HTML)



J. Saremba

California

Long-Term Use of Artificial Roosts by Maternity Colonies of Pallid Bat *Antrozous pallidus* and Mexican free-tailed Bats *Tadarida brasiliensis* Including Cautionary Notes

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Though generally considered a successful bat house design, negative impacts have occurred as a result of increasing bat populations using the bat houses described above. During periods of elevated temperatures have resulted in three mass evacuations of the houses by infants and adults, followed by mortality of large numbers of infants. Unfortunately, no funding has been available for thermal dataloggers to be installed in the bat houses. These episodes have prompted several actions in response. First, entrances into the bat houses were enlarged to increase airflow. Later, front panels were extended to allow fecal matter to more easily drop from the boxes, and to permit added airflow. In the winter of 1998, the boxes were removed from the side of the building and placed back-to-back on metal poles in an area partially shaded by trees. Occupancy of the bat houses by *Tadarida* was reduced to ca. 100 individuals during the reproductive season of 1998, but the *Antrozous* population seemed only slightly reduced (ca. 200 individuals). Counts during the 1999 season showed ca. 150 *T. brasiliensis* and 200 *A. pallidus*. Modifications made in 2000 provided more complete drainage of fecal matter from the boxes.

Cautionary Notes; potential negative impacts from the use of bat houses

Some important questions arise from the use of bat houses, especially when located in sites for which no management or monitoring plan exists. For example: A) Can bat houses provide the long-term stability necessary for bat conservation considering their susceptibility to being removed



“bulging bats” – heat stress response seen in Florida

Photos by: Laura Finn.



Spain



Photo of BC bat box mortalities -- John Saremba

Could overheating turn bat boxes into death traps?

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Abstract: The placing of bat boxes has become a traditional tool used by conservation groups and government societies. As a result, thousands of bat boxes have been installed in the past decades. However, very few papers have evaluated the risk of overheating in light of the expected effects of climate change. We tested the effect of extreme heat on bats roosting in boxes.

ORIGINAL PAPER

Bat boxes and climate change: testing the risk of over-heating in the Mediterranean region

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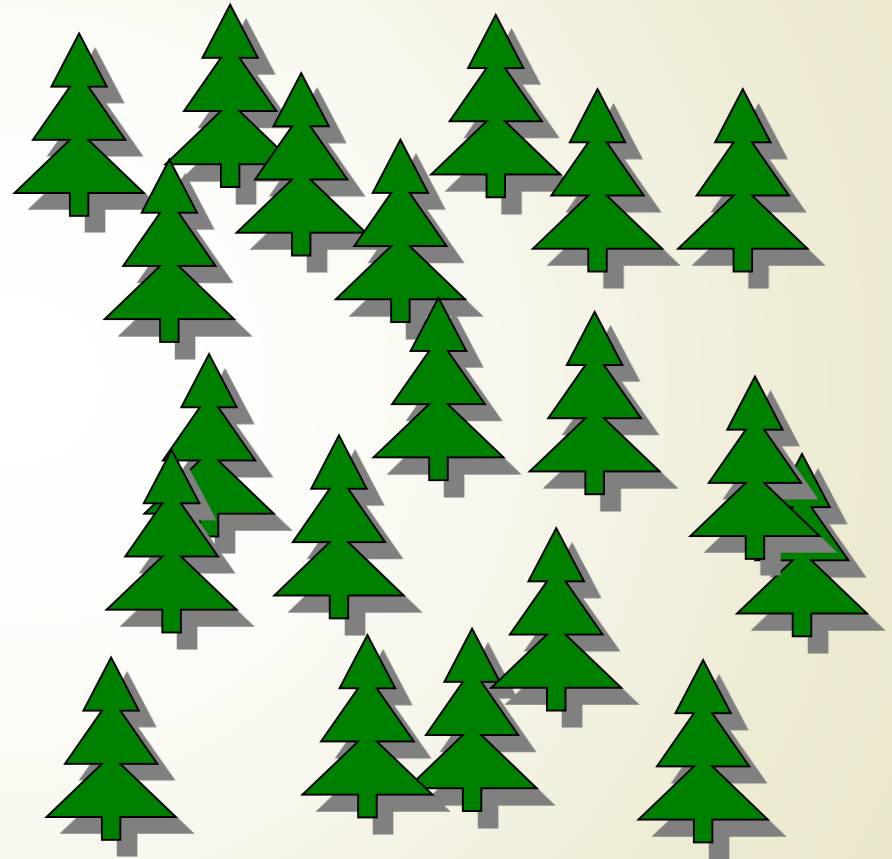
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Abstract

Habitat loss and forest fragmentation are currently substantially reducing the availability of natural bat roosts worldwide. However, since bat populations have been recognized as important ecosystem service providers, bat boxes have become one of the most popular measures employed to protect them. Evidence exists that in arid regions bat boxes act as ecological traps due to abrupt rises in summer temperatures. Several reported mortality events highlight the lack of appropriate guidelines in temperate areas, which might be putting bat conservation in jeopardy. We aimed to explore which bat box features might cause mortality so we compare temperatures in bat boxes, modelling the influence of the orientation and model, and quantifying the risk of extreme heat episodes. A total of 797 overheating events were recorded during a bat-box monitoring program in Catalunya (2014–2015). In 2016, we compared temperatures in up to 15 models side-by-side in the Ebro Delta National Park. Bat-box model and orientation clearly affected the number of overheating events. Bat-box south-facing boxes recorded the highest temperatures, including the

Bats Naturally Switch Roosts

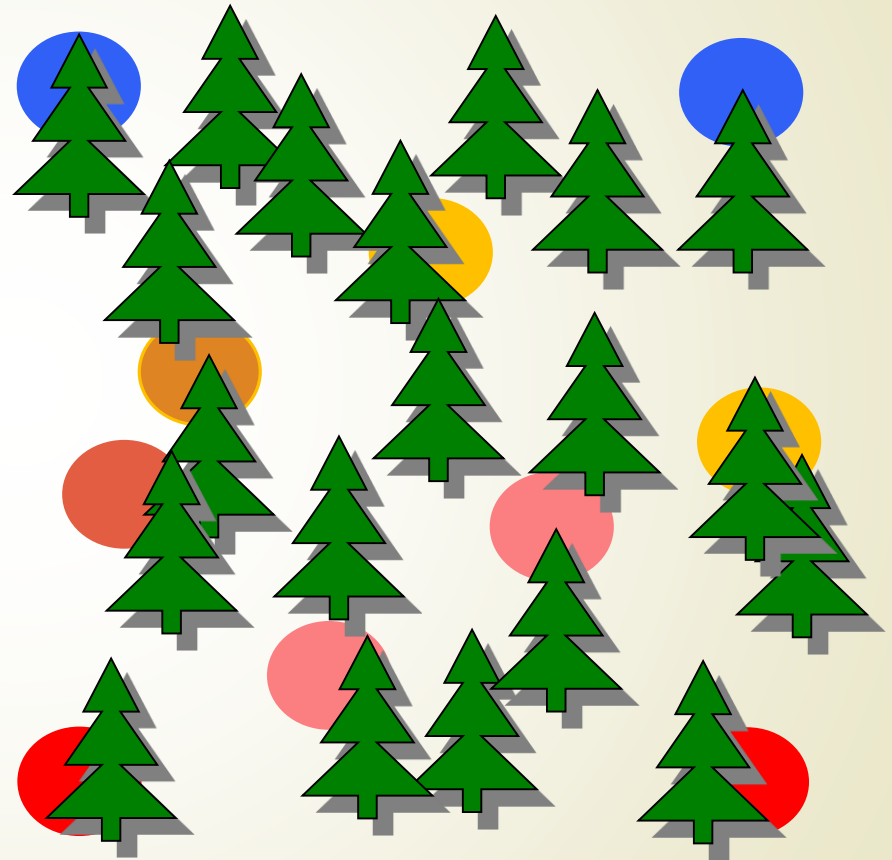
Roosting **Area**



Bats Naturally Switch Roosts



Roosting **Area**



Too **cold**?

Just **right**?

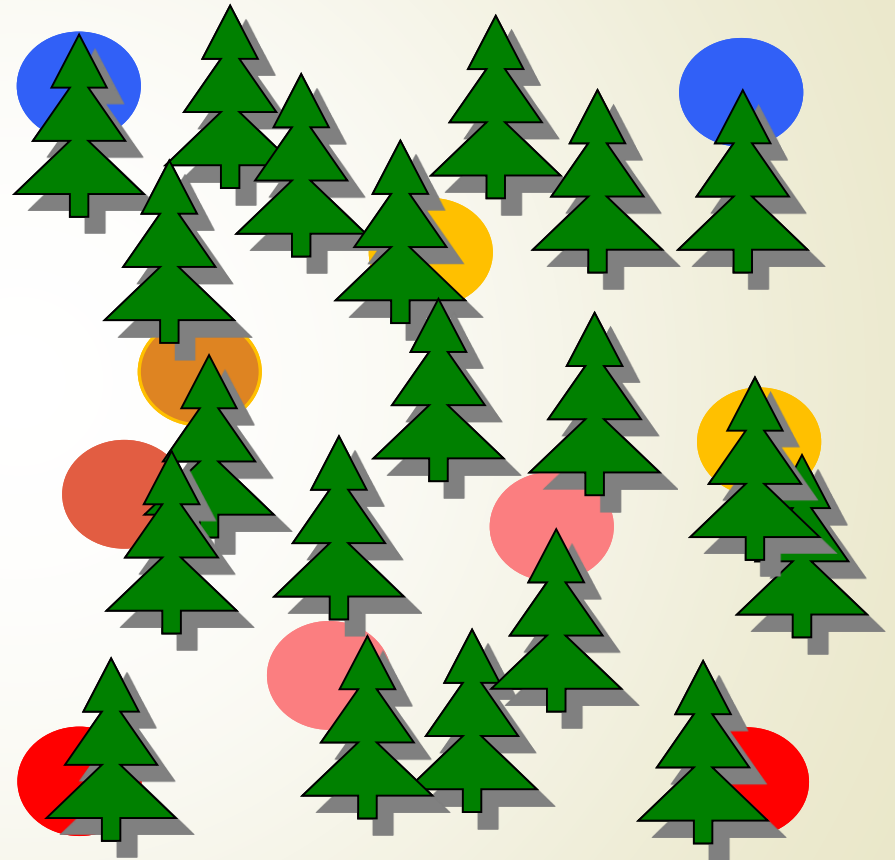
Too **hot**?

*Natural roosts
overheat too!*

Natural roosts of maternity colonies



Box = tree crevice



A single tree doesn't meet the needs of a bat colony in the summer – so why would we expect a bat box to?



The Goldilocks of Bat Roosts



The All Inclusive Roost!

Is it any wonder: Why bats generally prefer these over bat boxes?



How can we:

1. use bat boxes to meet the needs of a maternity colony – through the *entire* reproductive season?
2. ensure boxes do not become ecological sinks?



The mystery....

- ▶ Why don't bats just **MOVE** when the roost gets too hot?

HYPOTHESES:

- climate change – not adapted yet to realize temperatures can become lethal?
- day-time moves are risky
- confounding virus? – lowering heat tolerance?
- no nearby roost to go to?
- roost is an **ecological sink**?



What is an ecological sink/trap?

- ▶ “A sudden change that leads to organisms settling in poor quality habitat”

Post-eviction from a building:

Bats look for the most immediate place to roost near their old roost.

Most likely to use bat boxes in absence of other suitable roosts in immediate area.

**-long-lived
-philopatric**



Could **timing** be an issue? YES.

The perfect storm....



The perfect storm: ecological sink

Many bat boxes may be just fine most of the time, but timing and distance to alternative sites might become a problem.

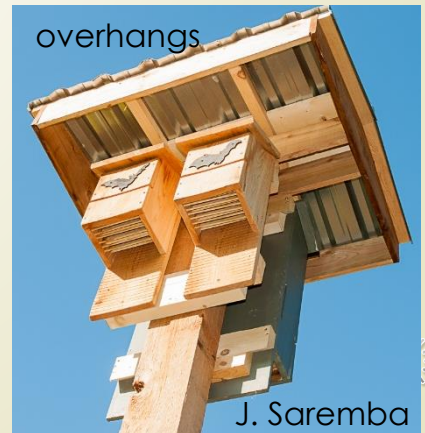
e.g., a few bat box case studies in BC we can learn from



What is within our control....

- ▶ Replace a lost building roost.
- ▶ Take the *cautious* approach...
 - ▶ Many bat boxes to provide options (not too far from each other)
 - ▶ mix it up! styles, colours, shade/solar, sizes
 - ▶ or appropriately designed and positioned condo
 - ▶ Coordinate with neighbors

Examples:



FOR MORE DETAILED PRESENTATIONS:

www.wcsbats.ca/Lectures

WCS Canada Bat Program – B.C. Funders and Collaborators



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