



# Central Coast Bats: Natural History and Conservation issues

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Carrizo Colloquium  
San Luis Obispo, California  
7 November 2014



H. T. HARVEY & ASSOCIATES  
ECOLOGICAL CONSULTANTS



# *Antrozous pallidus*

## Pallid bat

**California Species of Special Concern**

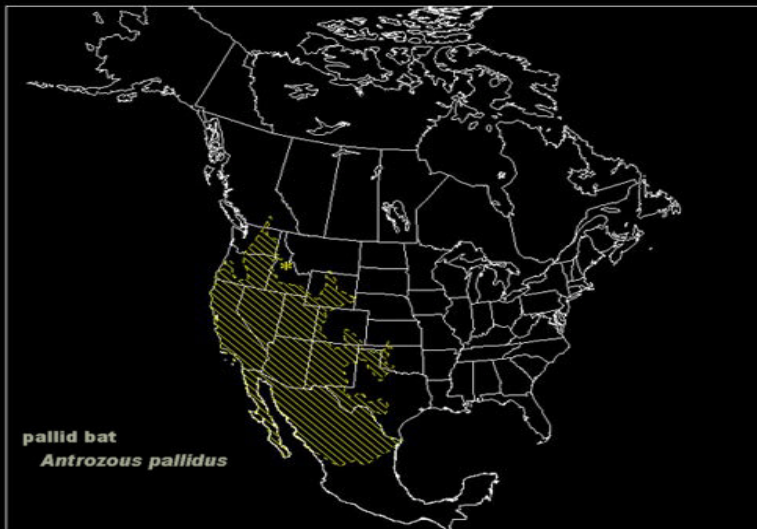
**Dry open habitats in much of Ca; often uses anthropogenic structures, Crevice roosting**

**Numbers are decreasing, especially as a result of urbanization**

**Fur light, lighter at base than at tips**

**Nostrils pig-like and face forward**

**Smells like “skunk”**

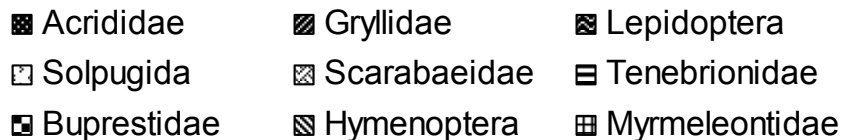
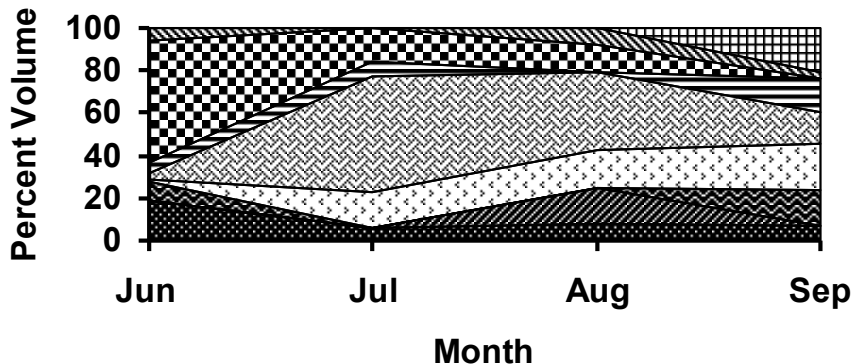
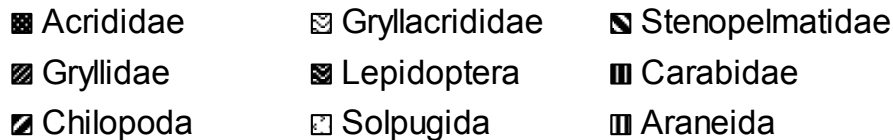
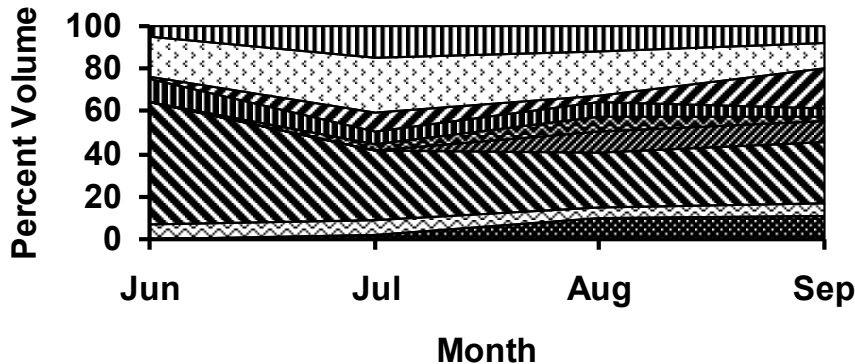


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# Diets of pallid bats over time (Johnston & Fenton 2001)

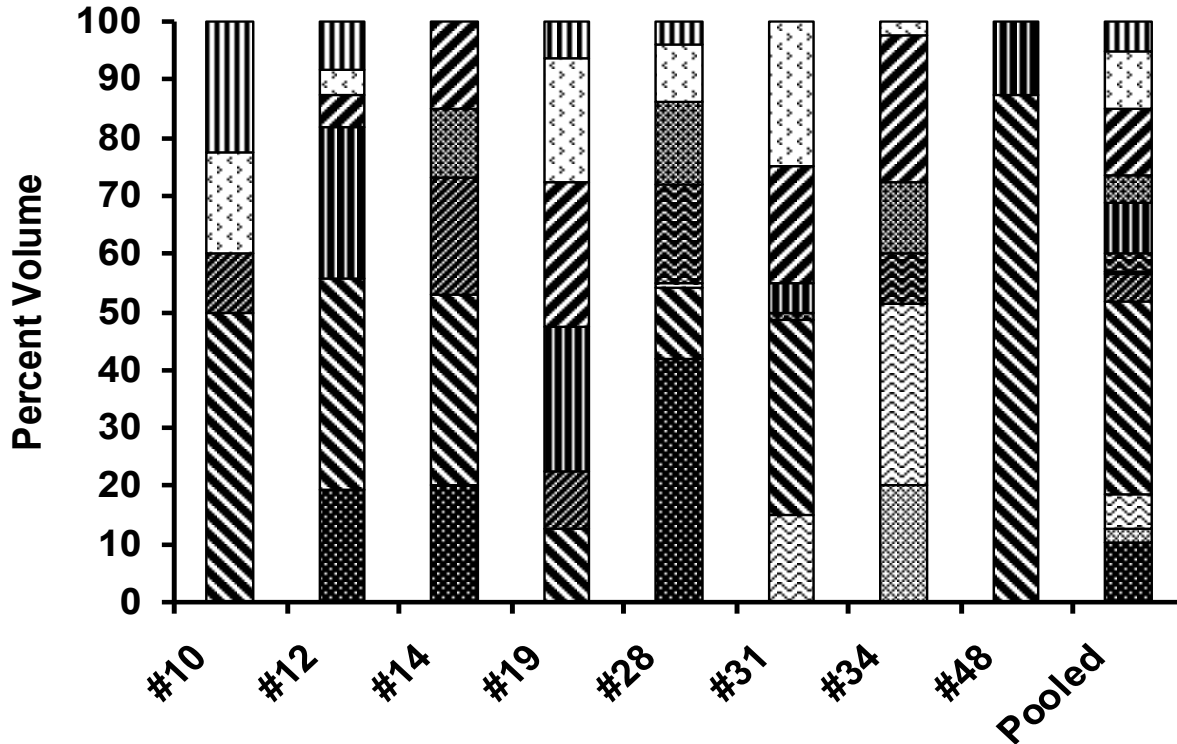
**Coastal bats** had relatively uniform diets

**Desert bats** changed their diet significantly during summer months



# Diets for individual coastal bats

(Johnston & Fenton 2001)



- |                   |                 |                  |
|-------------------|-----------------|------------------|
| ■ Acrididae       | ■ Tettigoniidae | ■ Gryllacrididae |
| ■ Stenopelmatidae | ■ Gryllidae     | ■ Diptera        |
| ■ Lepidoptera     | ■ Carabidae     | ■ Cerambycidae   |
| ■ Chilopoda       | ■ Solpugida     | ■ Araneida       |

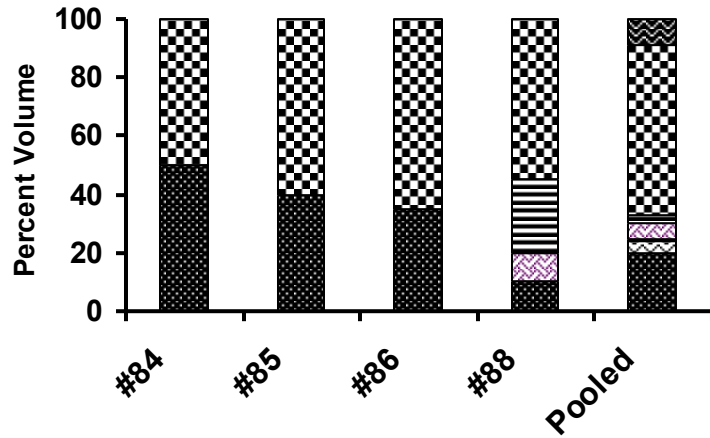
Individual dietary data for coastal pallid bats suggests individuals were specialized.

No two individuals had the same diet.

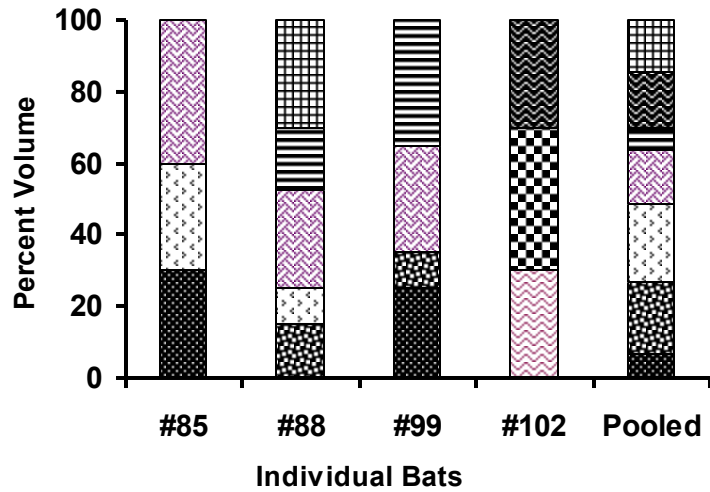
# Diets for Individual desert bats

(Johnston & Fenton 2001)

June diet – virtually the same for each individual



September diet – similar for each individual



- Acrididae
- Solpugida
- Buprestidae
- Gryllacrididae
- Scarabaeidae
- Lepidoptera
- Pentatomidae
- Tenebrionidae
- Myrmeleontidae



# Winter ecology of pallid bats in coastal California oak woodland

Johnston et al. (2004)



Pallid bats forage intermittently, and typically every 2 - 4 days, during winter months

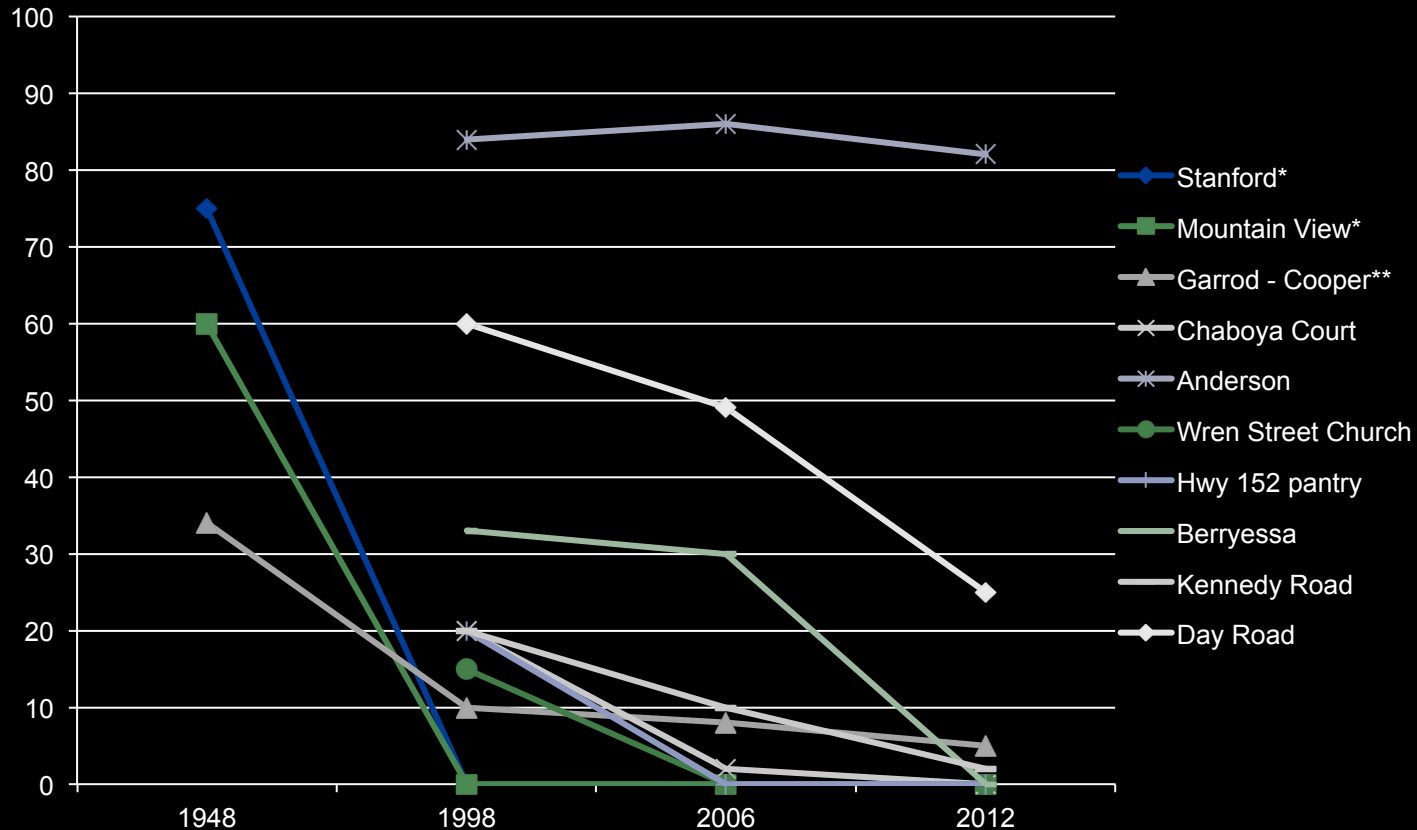
Males and females roost together in the same primary winter roost (Nov – Feb)

Both sexes switch roosts between the primary winter roost and small solitary roosts

Some individuals use ground roosts

Roosts and foraging occur under and along the riparian corridor

# Population trends: Pallid bat (*Antrozous pallidus pacificus*)



Population trends in 10 colonies in  
Santa Clara County, California



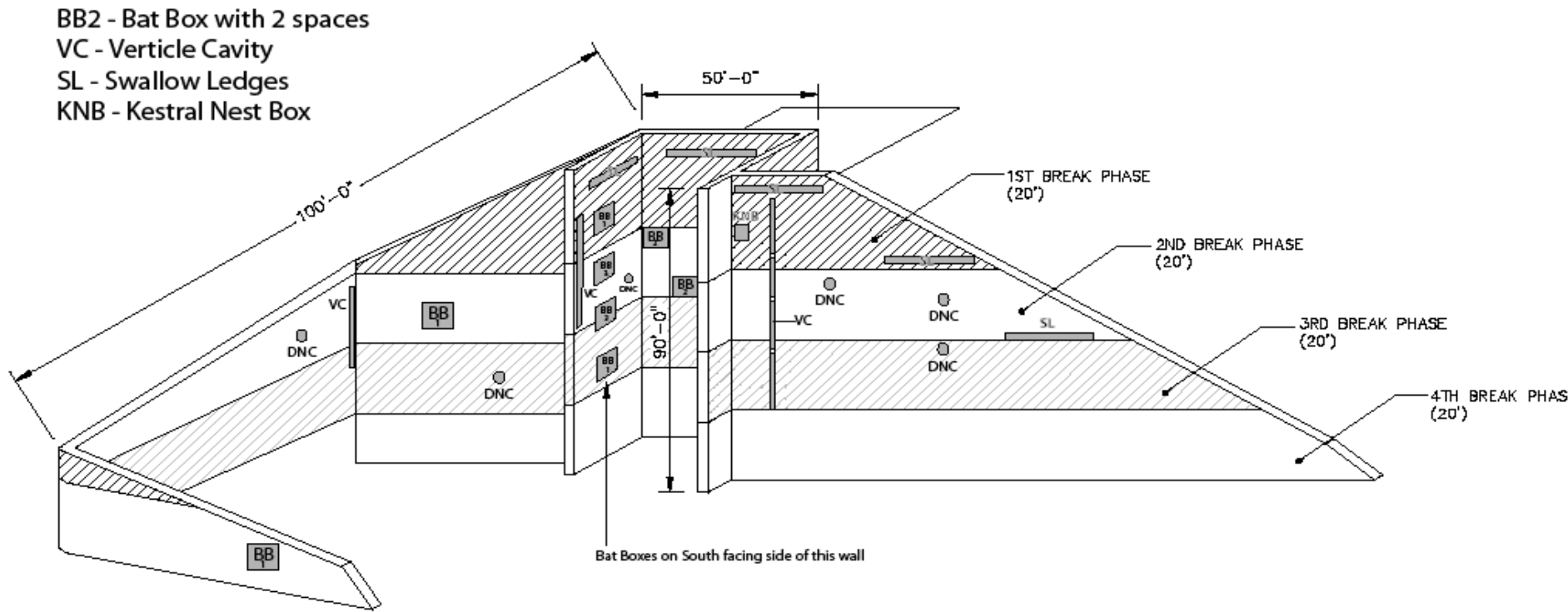
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A tall, grey concrete wall is the central focus, showing signs of construction with various markings and pipes. To the right, a complex structure of blue metal scaffolding or formwork is visible, featuring multiple levels and railings. The wall has a sloped top section. Red spray-painted lines and numbers are visible on the concrete surface. The scene is set outdoors with a clear sky and some trees in the background.

95' tall concrete wall



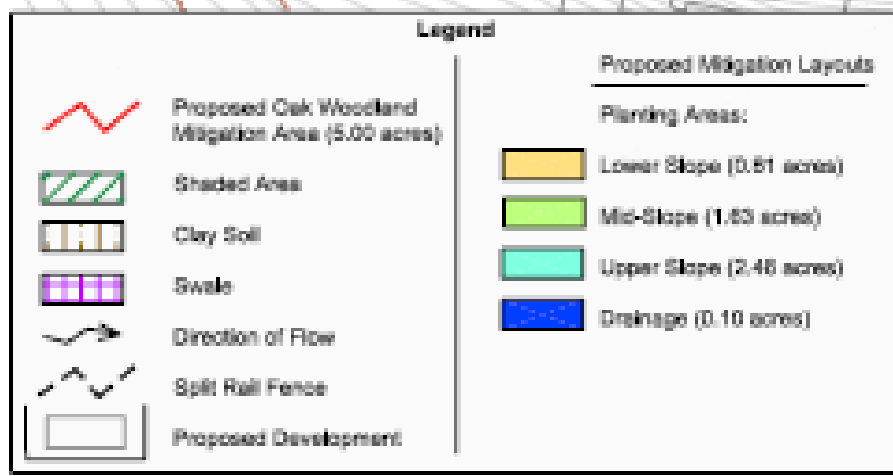
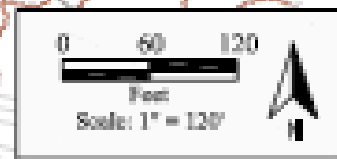
# Bat and bird habitat at 95' high wall



ST-9

OPTION 2: DEMOLITION OF ENTIRE STATION INCLUDING RETAINING WALL, FOUNDATION, BUILDING

# Conservation easement used as mitigation for pallid bat foraging habitat.



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Country Estates Phase III: Restoration Area

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# *Myotis thysanoides* Fringed myotis

California Species of Special Concern  
Population trend unknown

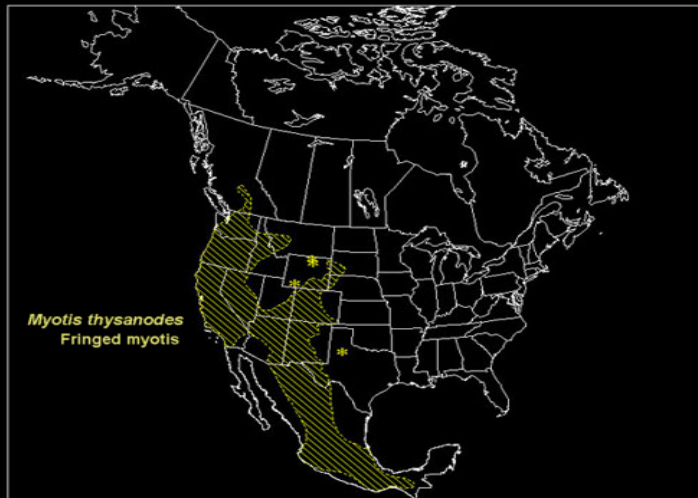
Usually in less disturbed forests

Crevice roosting

Ears bi-colored; dark at tips, lighter toward eye

Calcar un-keeled

Conspicuous fringe of hairs along edge of tail membrane





# *Myotis volans*

## Long-legged myotis

California Species of Special Concern,  
population trend unknown

Usually in less disturbed forests

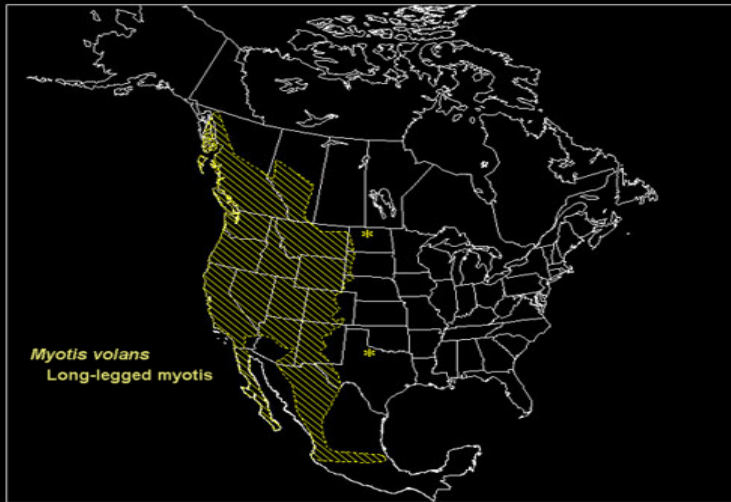
Crevice roosting

Ears and fur same color; chocolate-  
brown

Calcar keeled

Hair on underside of wing from elbow to  
knee

“Sheep-faced”





# *Myotis evotis* long-eared myotis

Proposed California Species of Special Concern

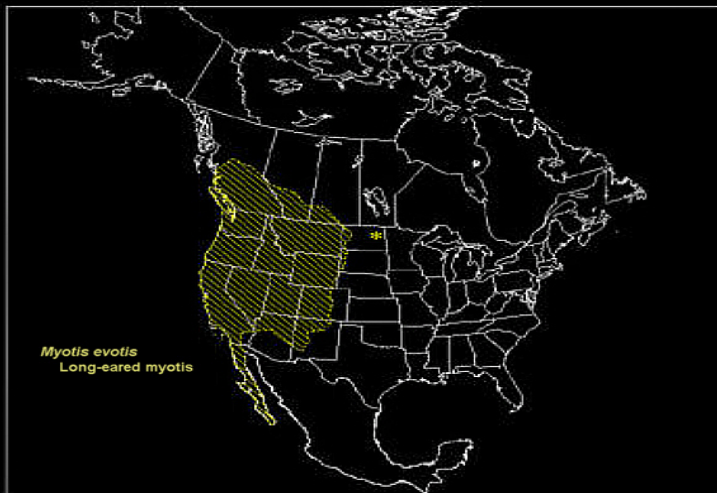
Forested areas of many types including conifer and live oak forests

Crevice roosting bat

Ears long, dark, monochromatic and opaque

Calcar un-keeled

Occasional scant fringe on edge of tail membrane, esp. in northern individuals



# *Eptesicus fuscus* big brown bat



**No Special Status**

**Population in No. Calif. is stable**

**Population in So. Calif. is declining**

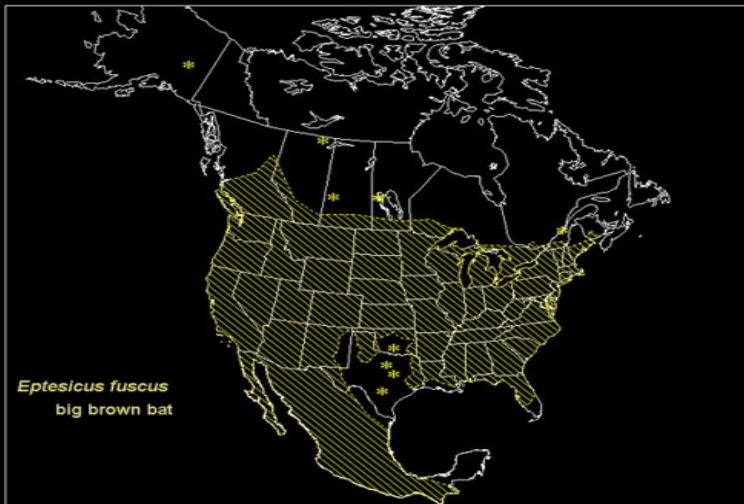
**Often uses anthropogenic structures**

**Crevice roosting**

**Ears & muzzle usually darker than fur**

**Fur variable in color; ranges from light tan to rich brown**

**Fur often appears glossy**





# *Corynorhinus townsendii* Townsend's big-eared bat

California Endangered Species Candidate  
Population trend has been in decline for many years

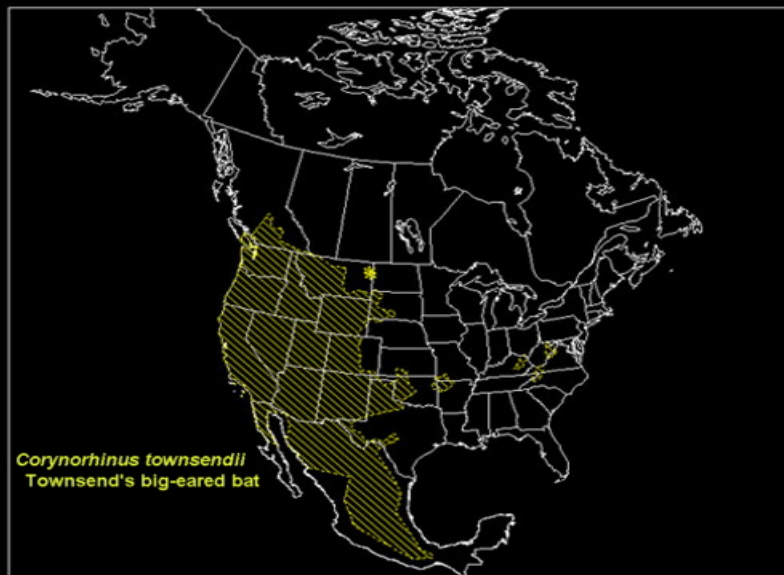
Various habitats but sensitive to disturbance

Cavernous obligate

Prominent "lumps" on sides of nose

No "lappets" above muzzle

Fc ~ 20-30 kHz; 2nd harmonic often prominent



# Roosting habitat

## Caves, Mines



Photo by Bob Strafford

## Anthropogenic Structures



Photo by Pat Brown





# Disturbance at Mines

Colonies that abandoned young after human disturbance

- Wilson Canyon 100 adult females
  - removal of seismic equip during pupping
  - Mummified juveniles hanging on ceiling
- Tungsten Hills with 200 near Bishop contained a maternity colony of over COTO in July 2008
- Channel Islands – scientific collecting likely led to demise of colony

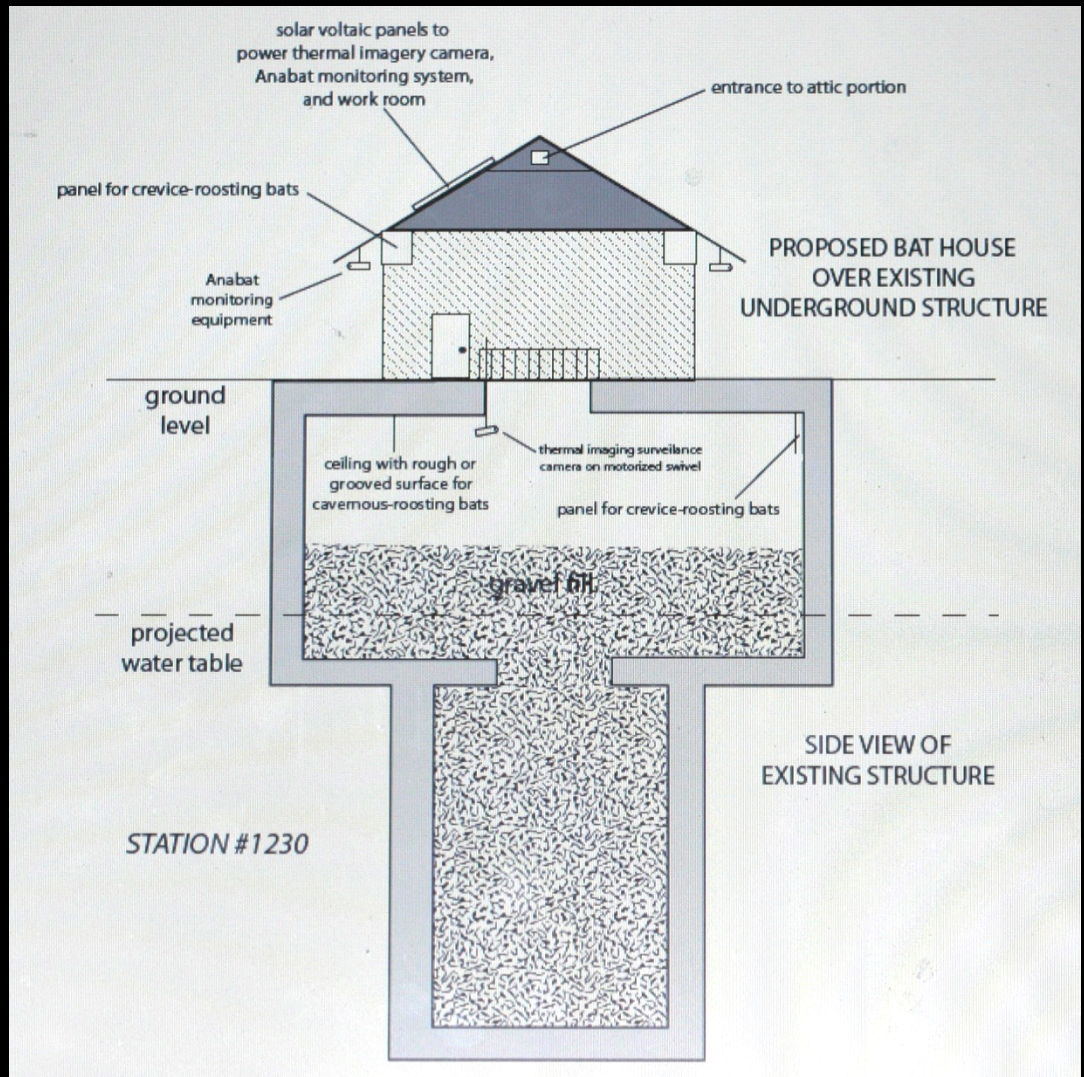


# Population trends (Pierson and Rainey 1996)



- mid 1950s - mid 1990s  
52% loss of maternity colonies
- 45% decline in #available  
maternity roosts
- 54% decline in the total number  
of animals
- 33% decrease in the average  
size of remaining colonies

Drs. Dixie Pierson and Bill Rainey 1994



# *Lasiurus blossevillii* western red bat



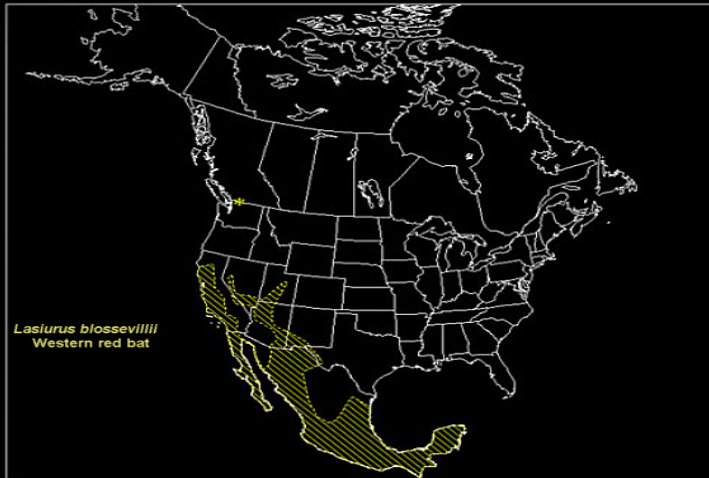
California Species of Special Concern, population is likely much smaller than previously, raises young primarily in old growth riparian habitat, 95% of habitat in Central Valley is gone.

Foliage roosting

Tail membrane scantily furred

White patches at  
shoulder, elbow,  
and thumb

Dorsal fur lightly tipped in white



## Western Red Bat Expected Female Summer Range



# Female Summer Range Jun -- Aug

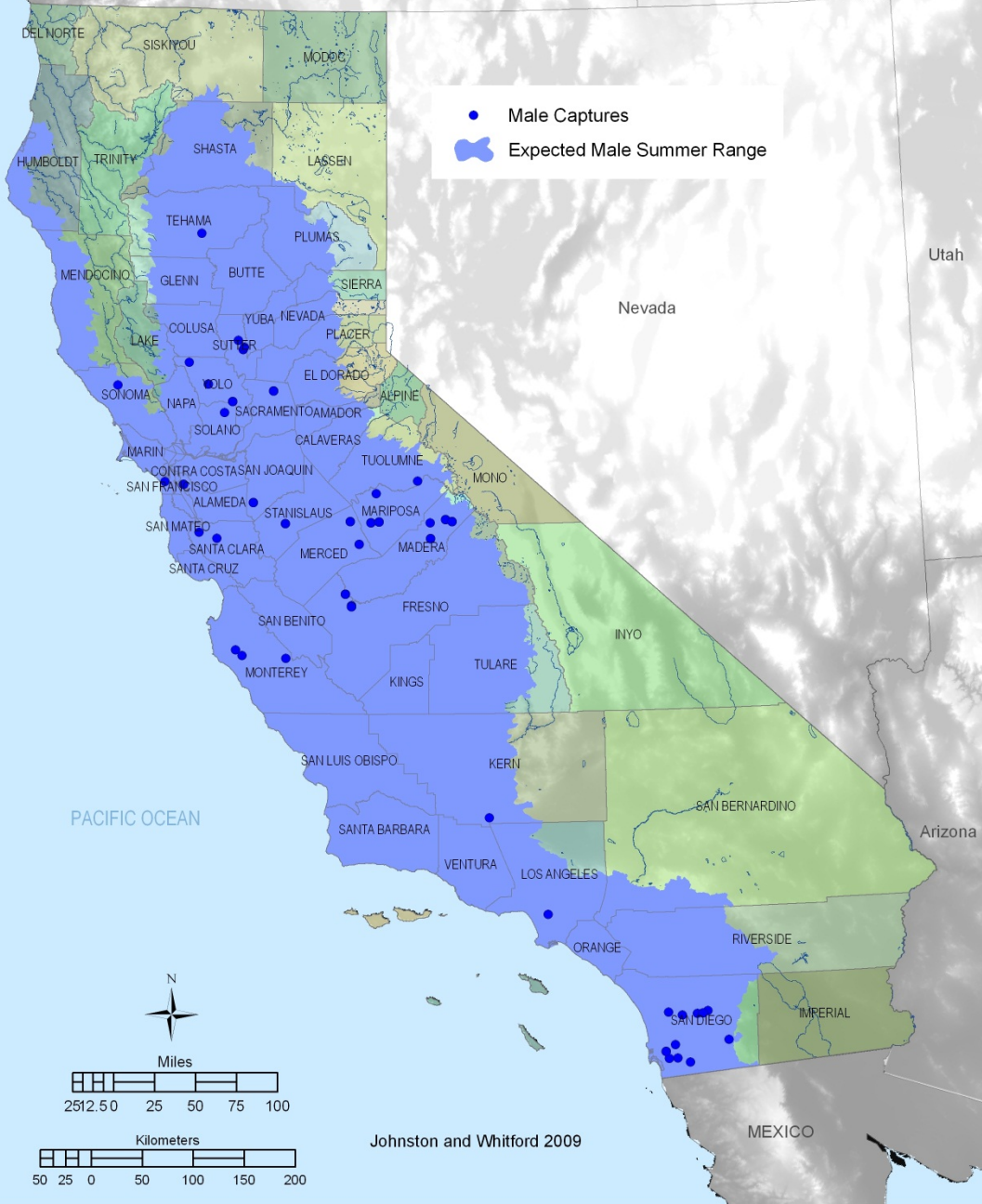
Greatly truncated from  
winter and spring months

Highly correlated to well-  
Developed riparian galleries



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## Western Red Bat Expected Male Summer Range



# Male Summer Range Jun -- Aug

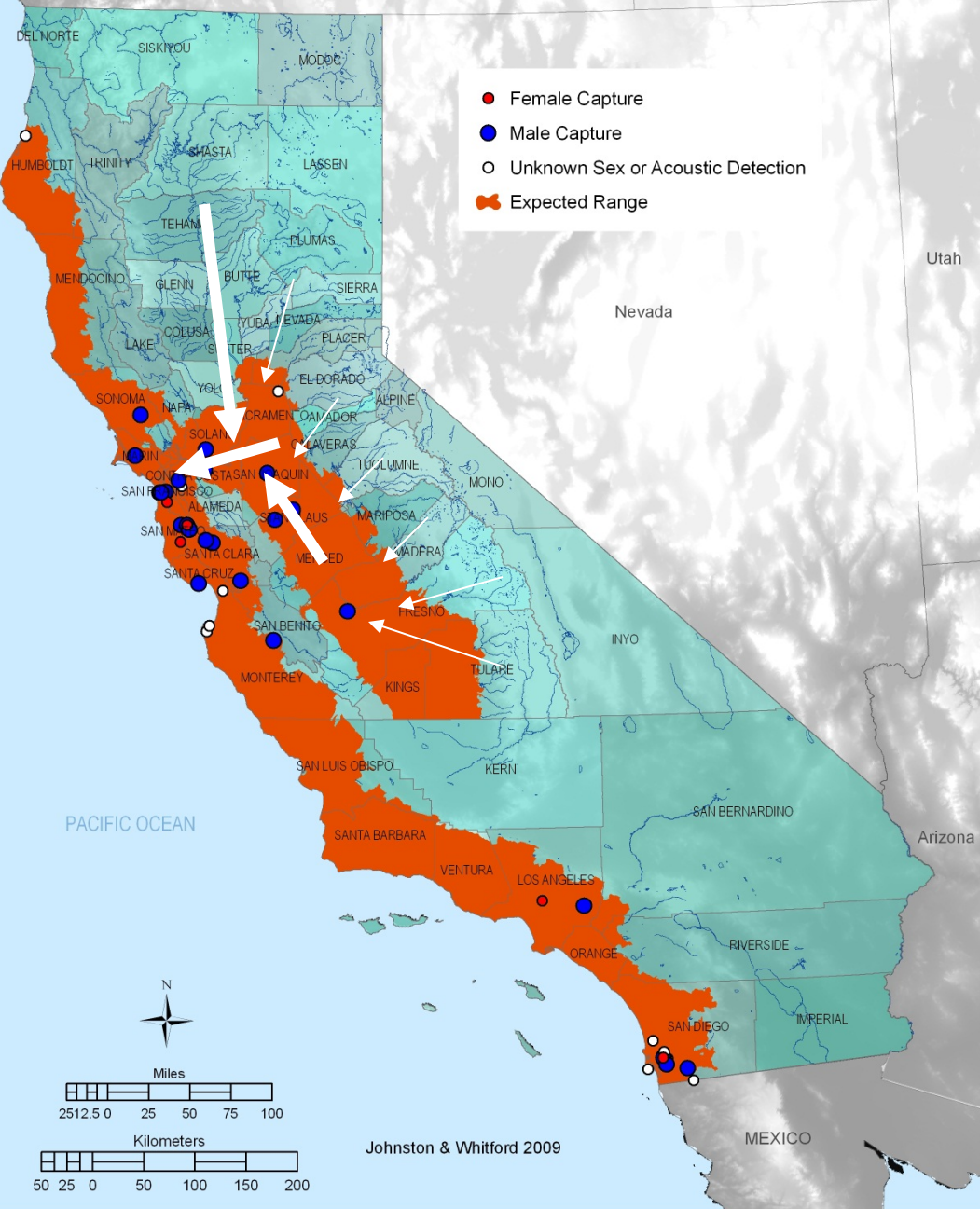
Greatly expanded from  
winter months

Males have been recorded at  
2427 meters (~7800 ft.)



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## Western Red Bat Expected Winter Range



# Migratory routes?

Where are important migratory routes for the western red bat?

How much movement is across mountain ranges?



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Courtesy: Lynn Robbins



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# ***Tadarida brasiliensis***

## **Brazilian free-tailed bat**

**No special status in California  
Population is increasing**

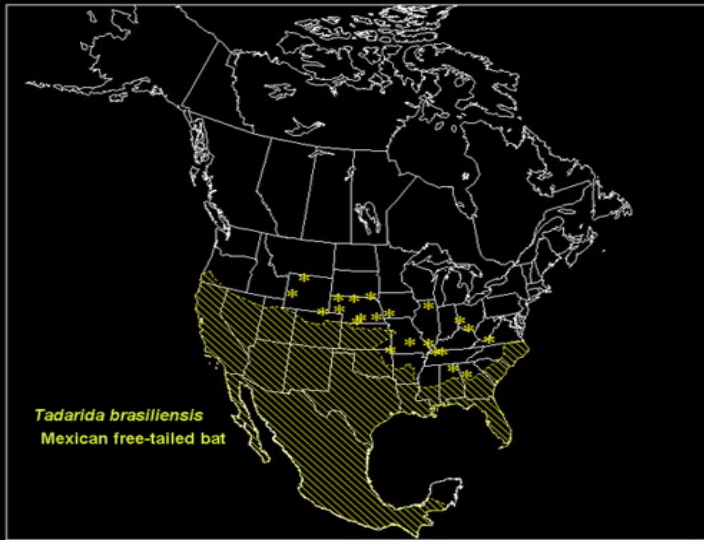
**Many situations including urban habitats**

**Migrant and local populations fluctuate**

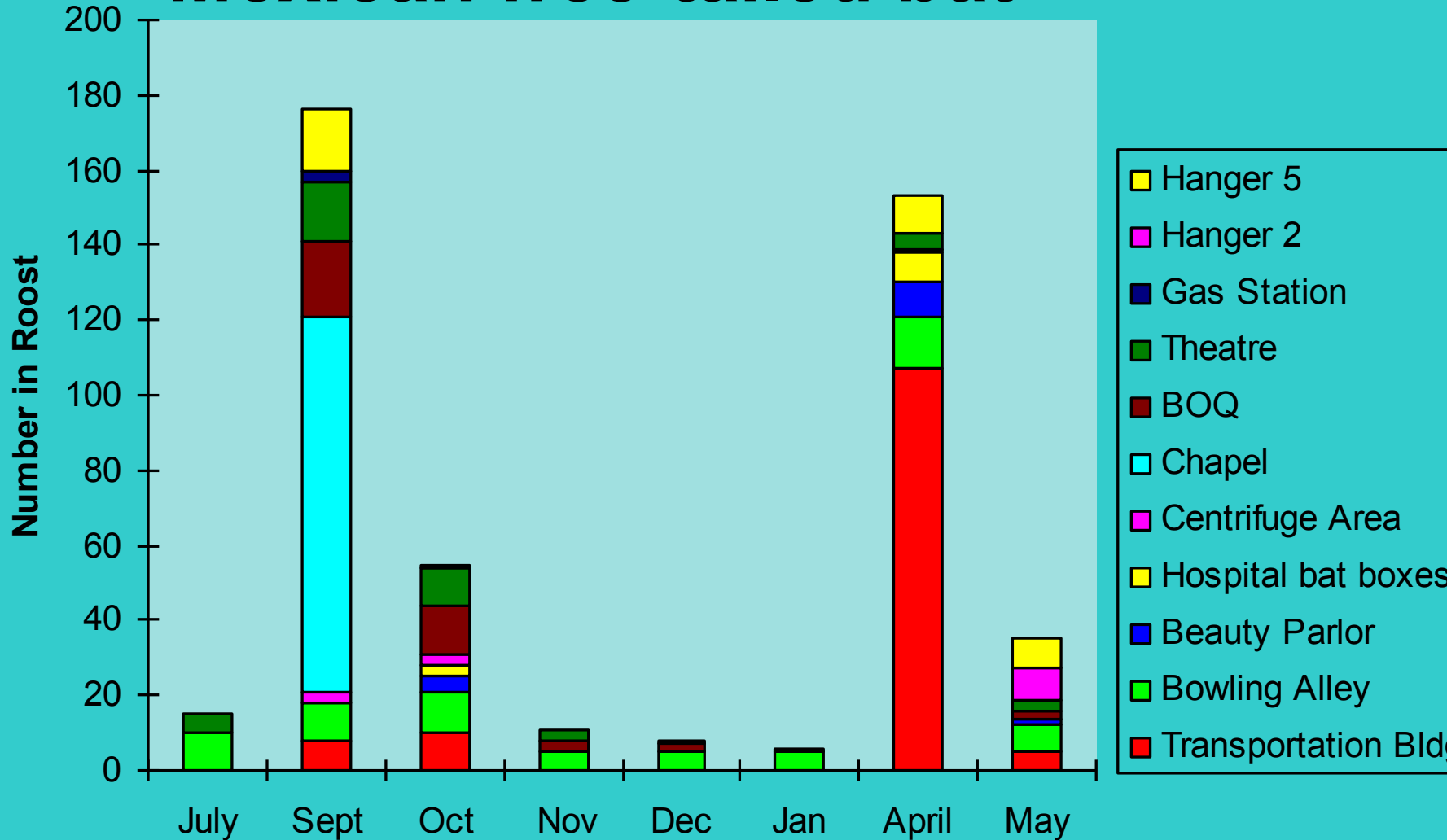
**Crevice roosting and prefers  
anthropomorphic situations**

**Tail thick and chunky, 1/3<sup>rd</sup> past TM**

**Smells like “baked corn chips”**



# Roost population for Mexican free-tailed bat



From Johnston (2001)

**Franklin Blvd Causeway and Bridge  
Bat “friendly” design  
saved \$200,000 in construction costs**



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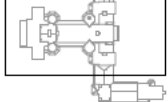
And it worked!  
About 16,500 bats moved into the bridge  
2 months after completion.  
About 68,500 August 2011



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OVERVIEW

DETAIL



**LEGEND**

- BAT LOCATIONS
- T.C. TILE ROOF (UPPER LEVEL)
- T.C. TILE ROOF (LOWER LEVEL)
- MEMBRANE ROOF
- L-XX LADDER NUMBER
- XX ROOF NUMBER
- C-XX CATWALK NUMBER

0 8 16 32  
Feet

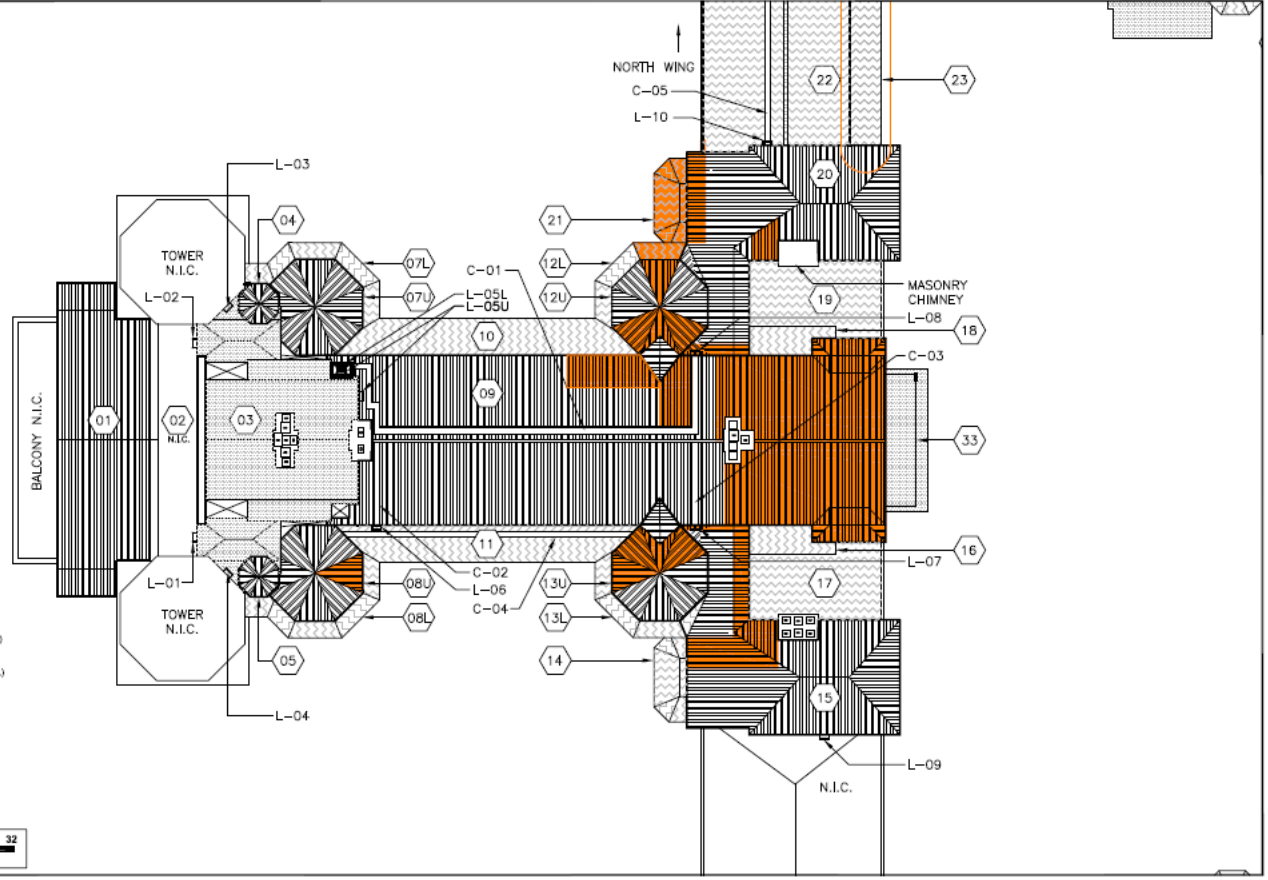


Figure 2: Bat Locations on Central Roof of Main House  
 Hearst Castle (3569-01)  
 April 2014

# *Lasiurus cinereus* hoary bat



No special status in California,  
population trend likely declining but  
this is difficult to measure

Highly migratory and widespread

Tree foliage roosting

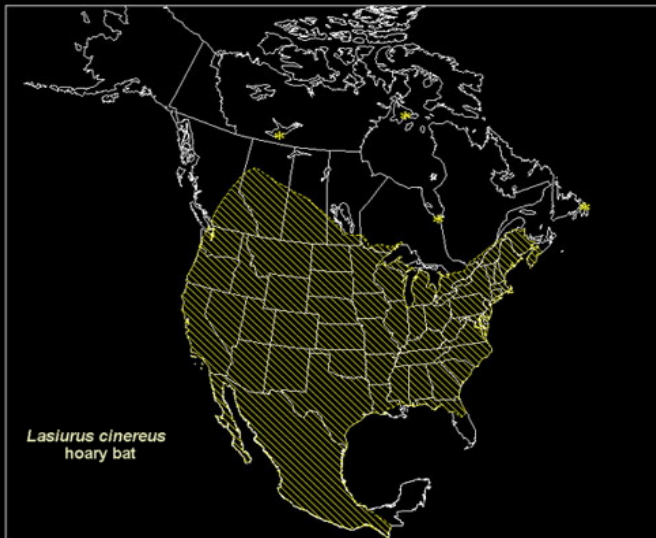
Ear ringed in black

White patches of fur at  
thumb, wrist, elbow & shoulder

Dark muzzle, light face,  
blond ear & tragus

Tail membrane heavily  
furred on entire

**dorsal surface**  
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# Research on wind energy impacts to bats and birds



# Acoustic Monitoring

- Full spectrum Avisoft recording of migratory bats and birds



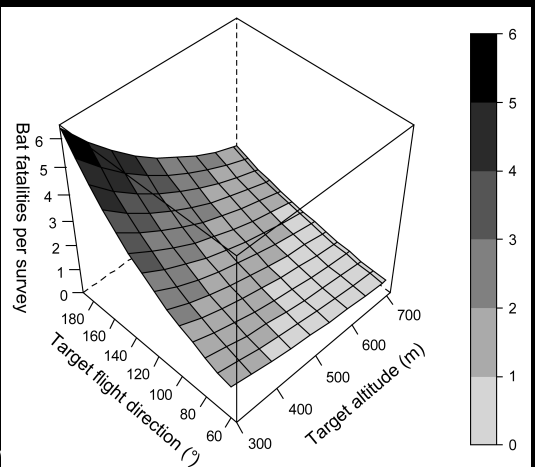
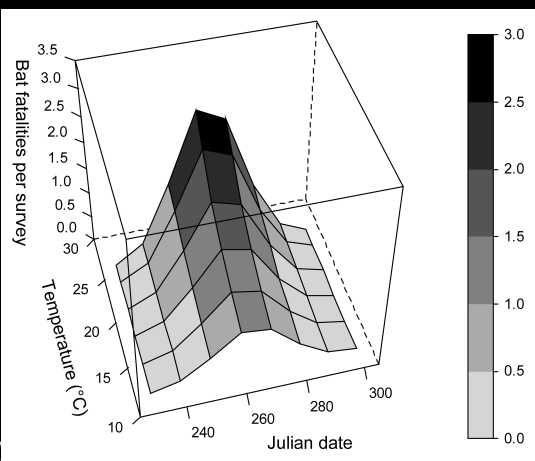
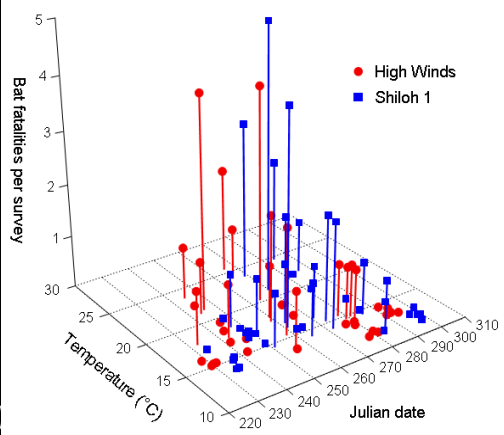


# Radar observations

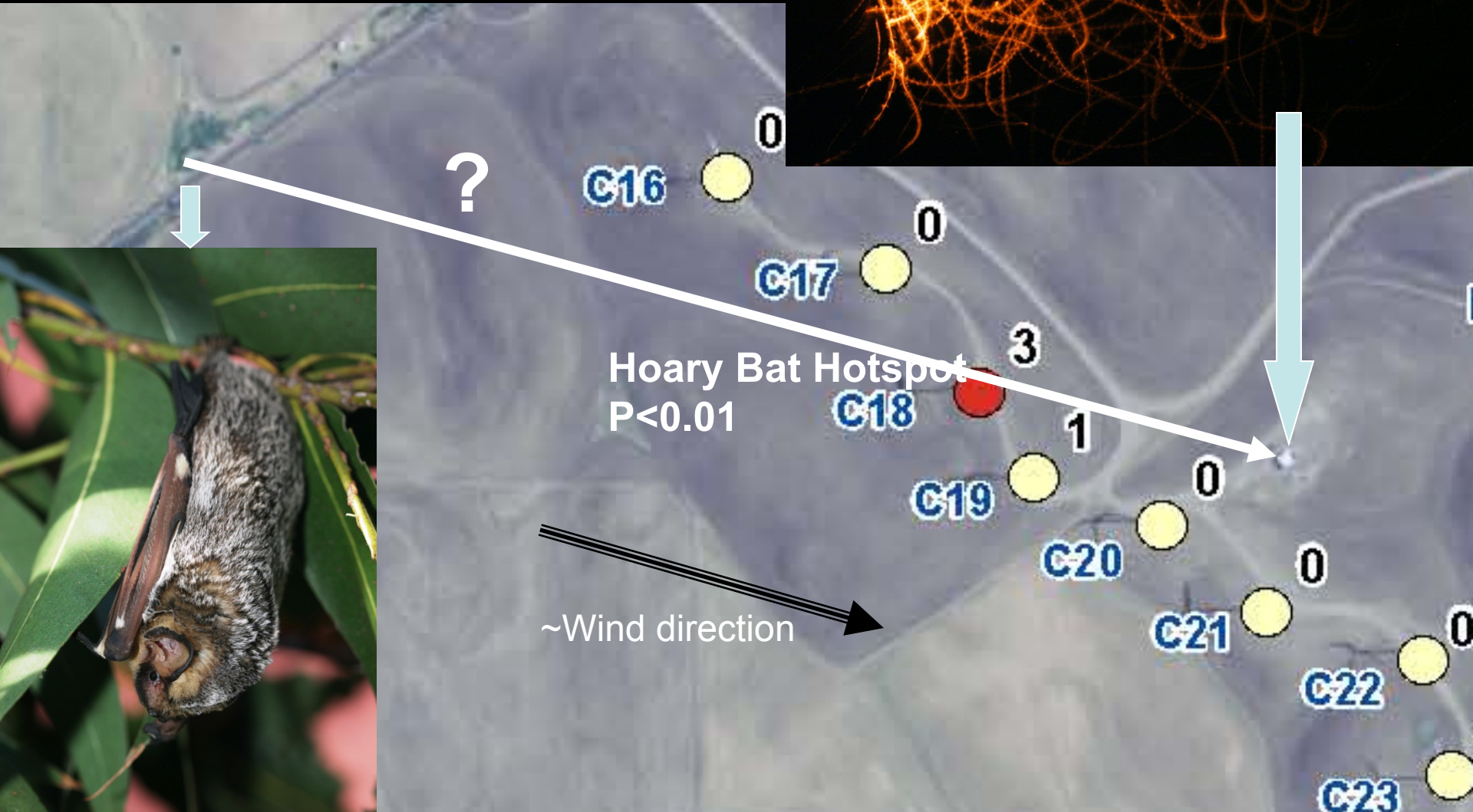


# Poisson general linear model using unadjusted bat fatalities

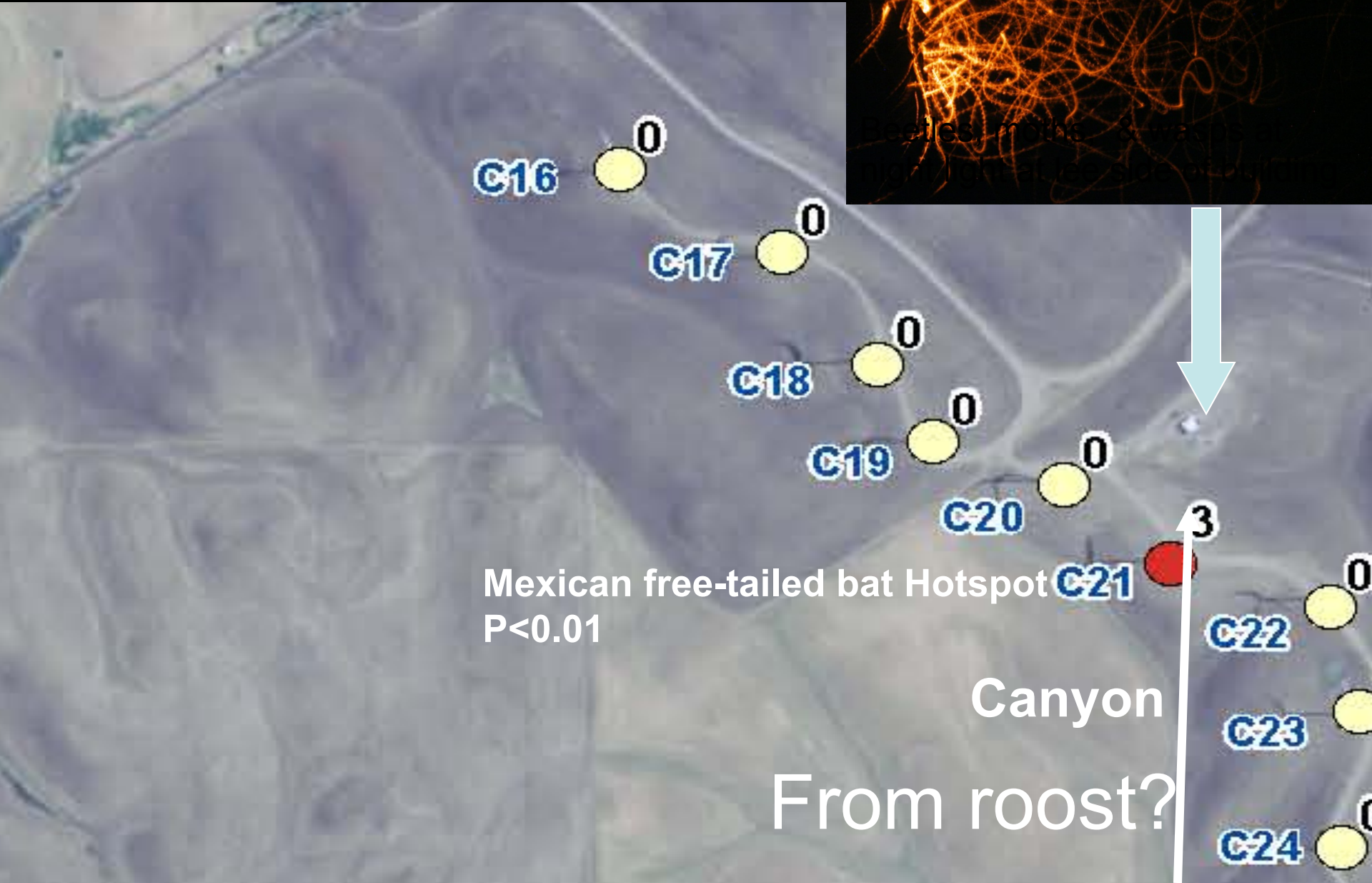
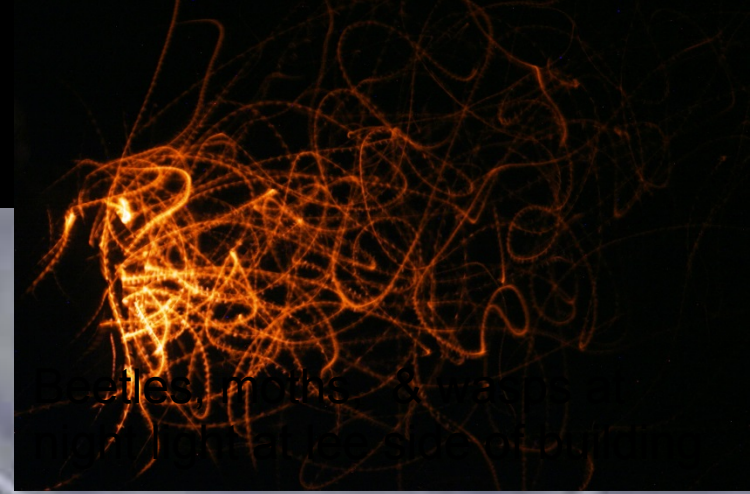
- > frequency during mid-season
- > frequency on warmer nights
- > frequency as altitude declined
- > frequency when flight direction from to East-NE to South-SE



# Did onsite buildings increase collision risk for hoary bats?



# And for Mexican free-tailed bats?





# *Eumops perotis californicus*

## California mastiff bat

California Species of Special Concern,  
Population trend unknown but likely stable

Obligate cliff roosting bat

Crevice roosting bat

Ears swept forward and joined over forehead

Lips lack vertical wrinkles

Tail thick and robust

Tail extends at least 1/3rd length past tail  
membrane



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# **Monitoring Potential Impacts to Bats at a Solar Photovoltaic Power Plant**

**Background – why is this study important?**

**Dave Johnston  
Meredith Jantzen  
Gabe Reyes  
Kim Briones**

**Greif et al. 2010**

**Bats attempt drinking off flat horizontal surfaces**

**Russo et al. 2012**

**Bats are flexible enough in the wild**

**Greif et al. 2013**

**Bats attempt flying into flat vertical surfaces**

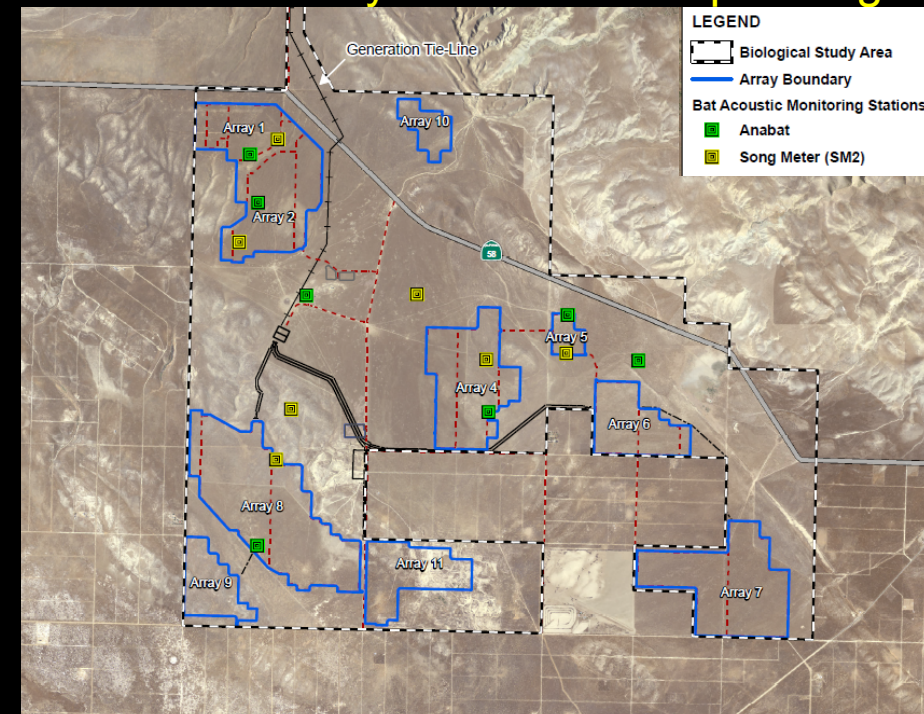


# Acoustic monitoring

Full-spectrum – and Zero crossing  
SonoBat, CallViewer, AnaLook

Wildlife Acoustics SM2+  
Titley Electronics Anabat SD2

## EME Systems' weatherproofing



# Results

## Total bat activity

Post-construction areas had significantly **higher activity** than pre-construction areas (0.41, SE=0.152,  $p<0.01$ ).



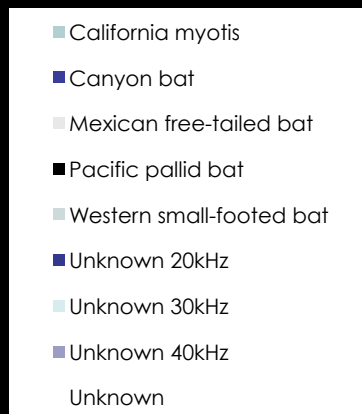
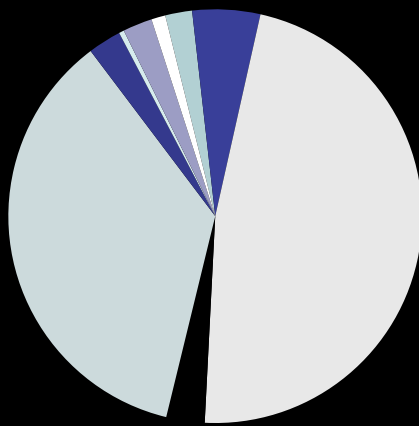
## Mexican free-tailed bats

Post-construction areas had significantly **higher activity** than pre-construction areas (0.43, SE=0.203,  $p<0.05$ ).

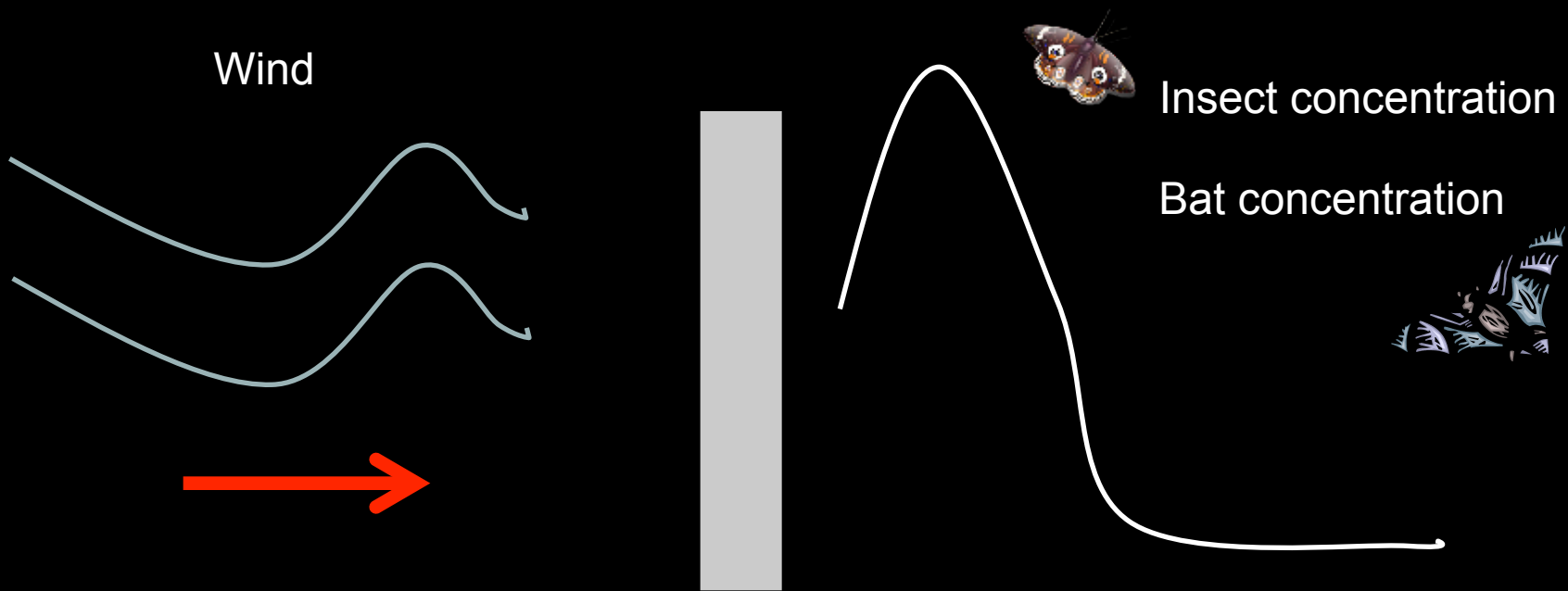


## Pacific pallid bats

Post-construction areas had significantly **lower activity** than pre-construction areas (-.23, SE=0.078,  $p<0.01$ ).







Do project fences act as barriers to low flying pallid bats?



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# Special Thanks: California Valley Solar Ranch

## Stacey Hunt Carrizo Colloquium

Gabe Reyes, Meredith Jantzen, and Kim Briones



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Murrelet Halterman  
Pat Brown  
Rebecca Fay  
Stephanie Snyder  
Wendy Knight

And many more!



SUNPOWER



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