

Effects of Artificial Light at Night on San Bernardino Kangaroo Rat Behavior

SAN DIEGO ZOO
INSTITUTE FOR
CONSERVATION
RESEARCH.

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San Diego Zoo Institute for
Conservation Research
Recovery Ecology

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Introduction – Artificial Light

- Artificial light at night – ALAN
- Rapidly expanding environmental pollutant
 - Amount of light
 - Intensity of light
- Astronomy

Negative Consequences

- Loss of darkness has negative effects
 - Behavior: navigation
reproduction
 - Physiology: suppressed immune function
impaired stress response
- Decrease biodiversity
- Disrupt ecological and evolutionary processes



Nocturnal Small Mammals

- Particularly vulnerable to increased levels of artificial light
- Evolved to avoid predators under low light conditions.
- Increased moonlight and artificial light
 - increased predation risk by visual predators such as owls.

- **San Bernardino Kangaroo Rat – (SBKR; *Dipodomys merriami parvus*)**
- Endangered - Federally listed and CA under consideration
- 95% habitat lost



Experimental Study Sites

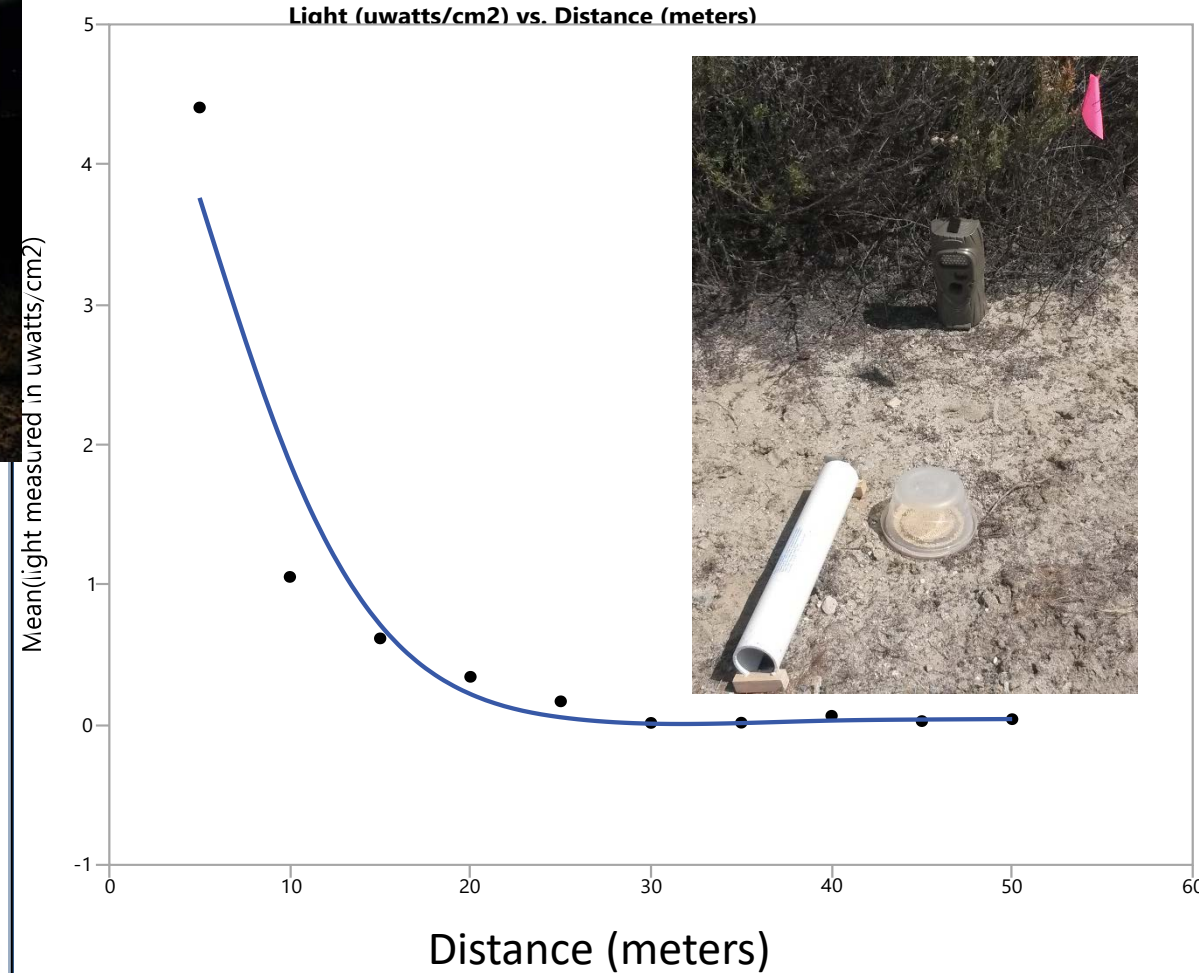
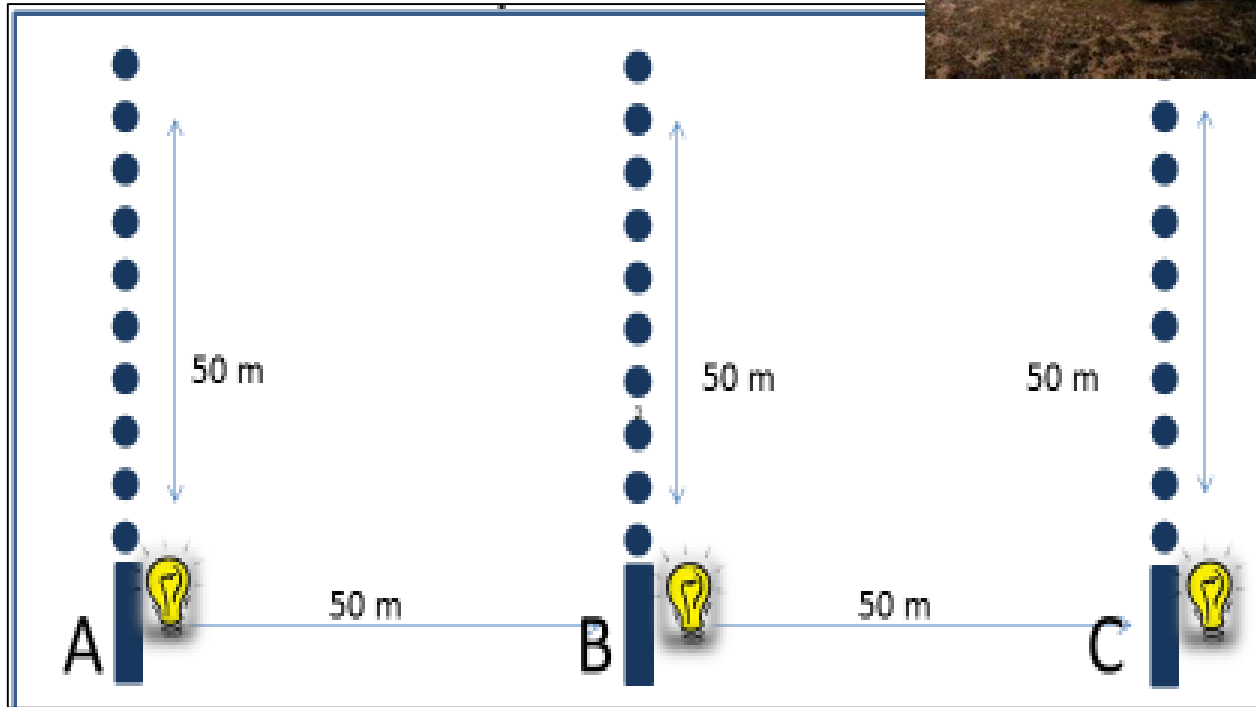


- ★ Foraging Behavior (1,2)
- ★ Fitness and Persistence (3)



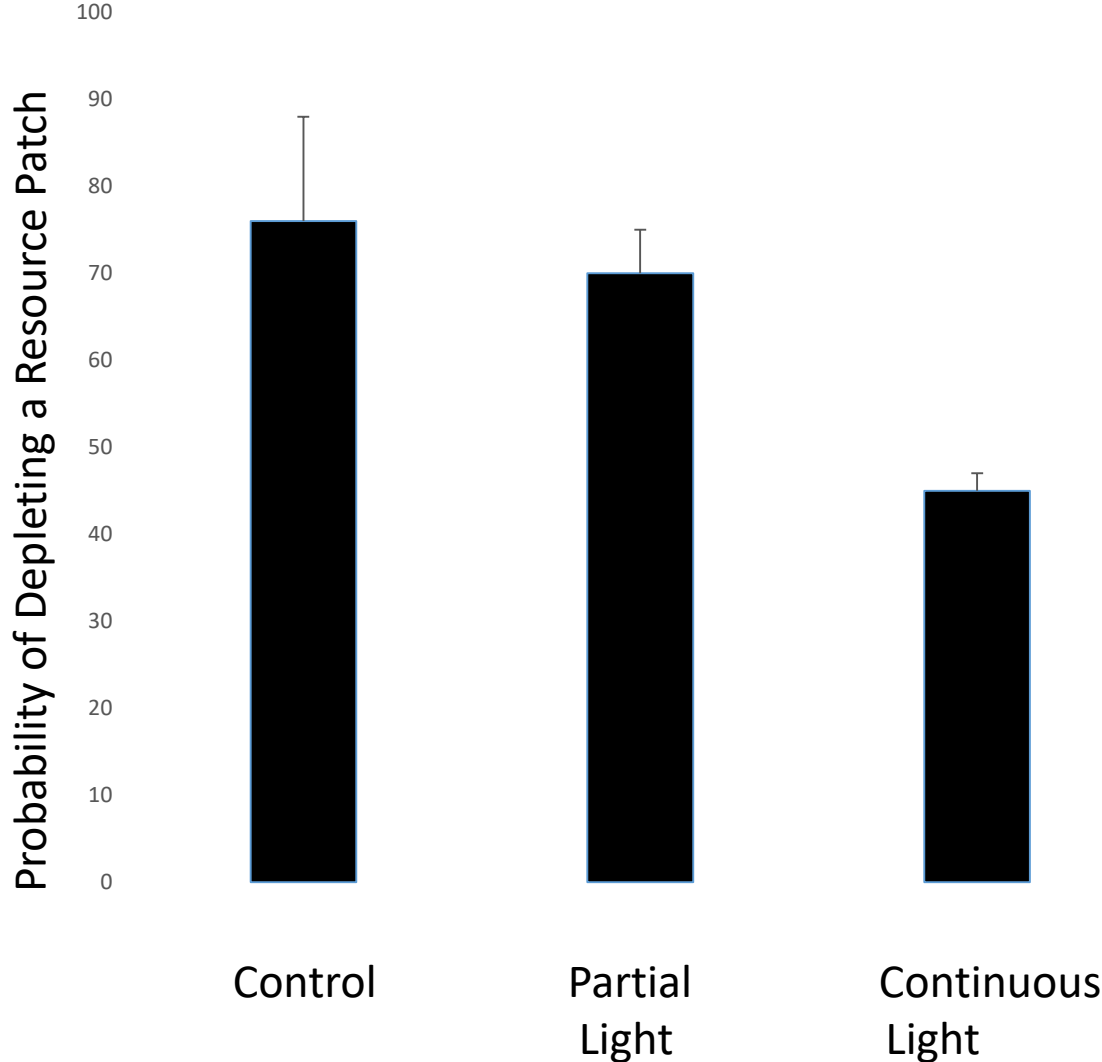
Methods – Foraging Behavior

- Light treatments, 3 nights
- Control, Partial, Continuous
- GUD – Giving Up Density
- Cameras and Track Tubes

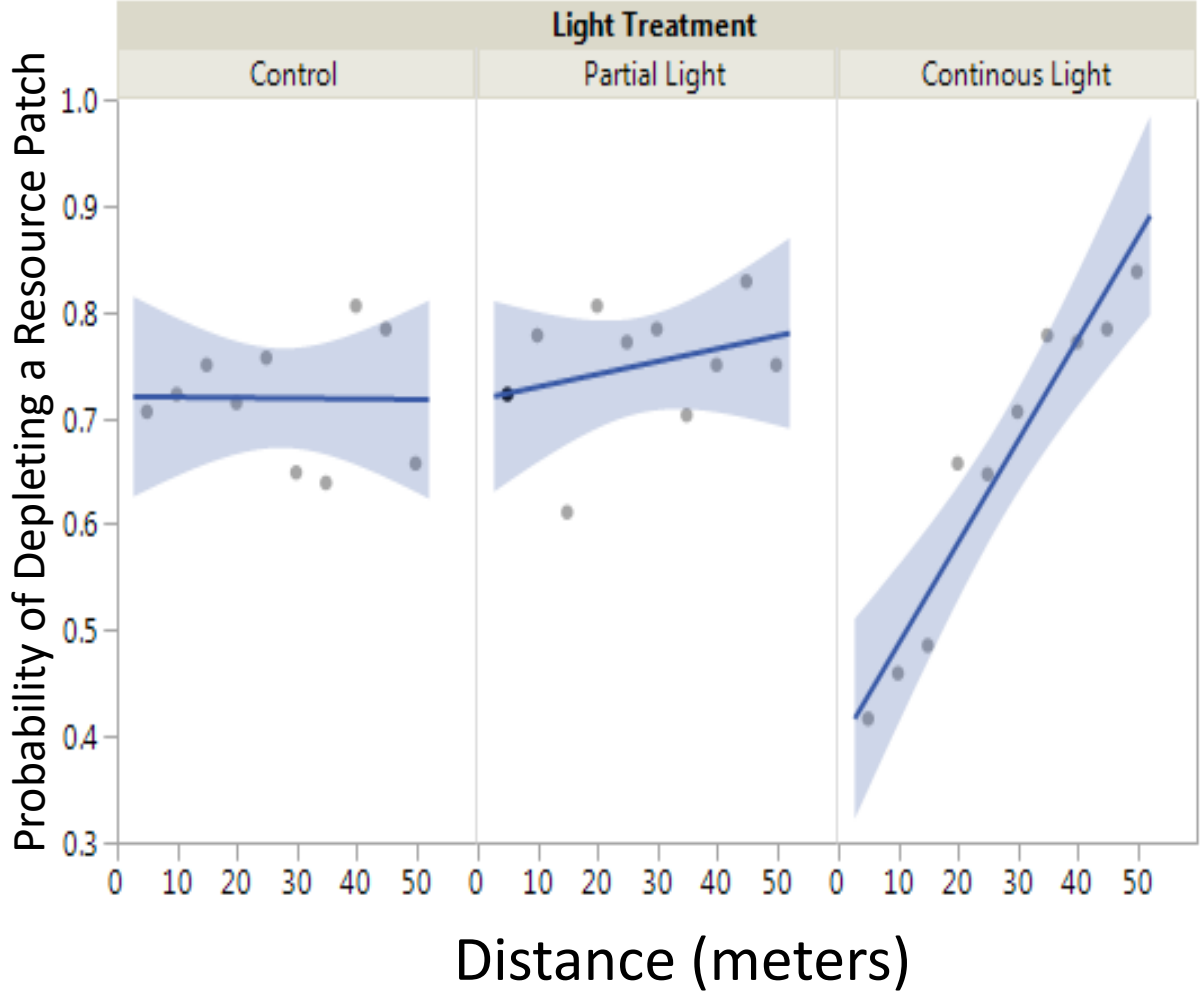




Results - Light Type

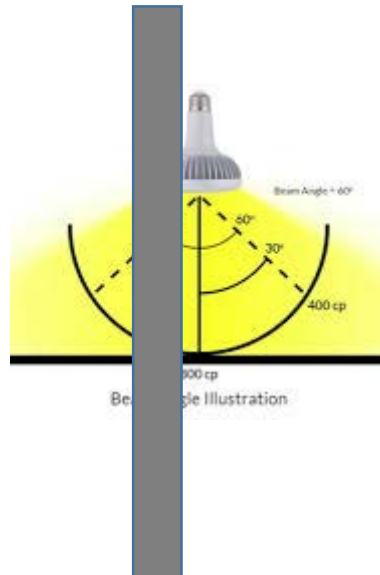


(Logistic Regression, Wald $\chi^2 = 61.63$, $p < 0.001$)

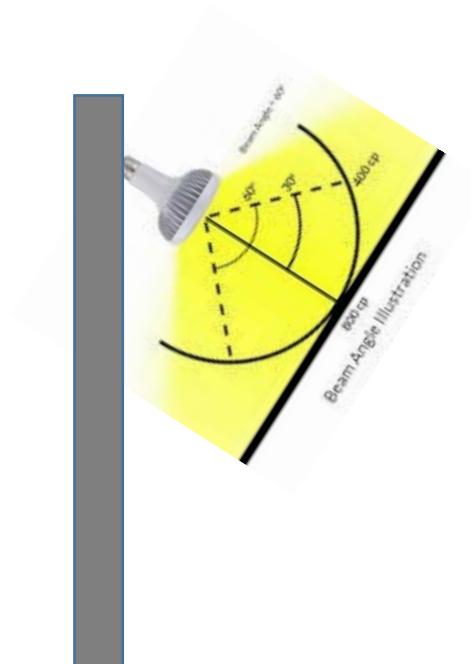


Light Orientation

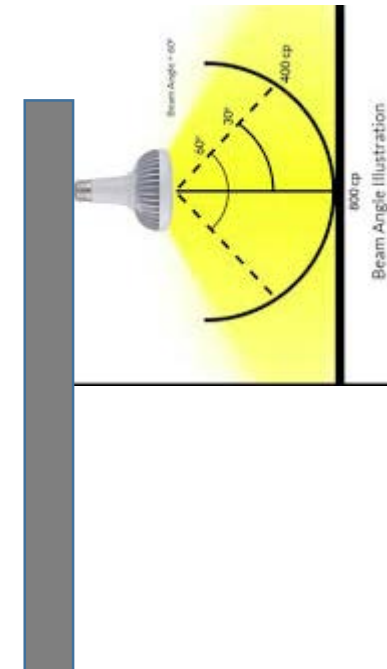
0 degrees



45 degrees



90 degrees

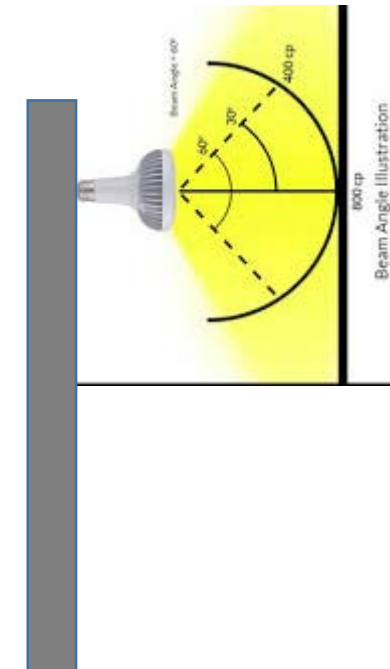
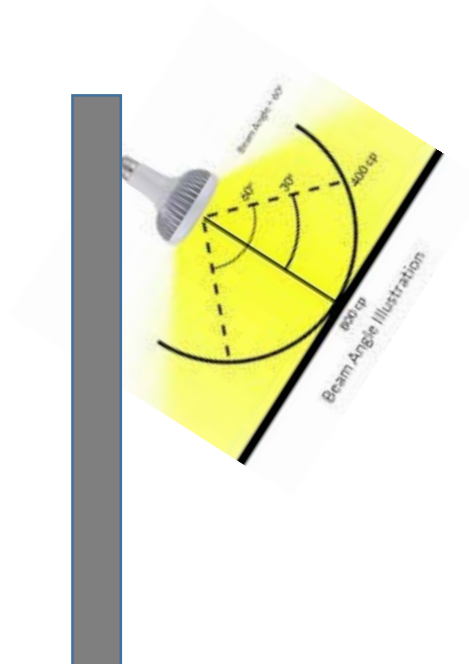
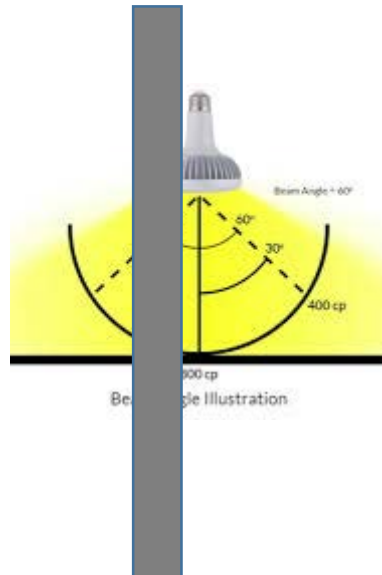
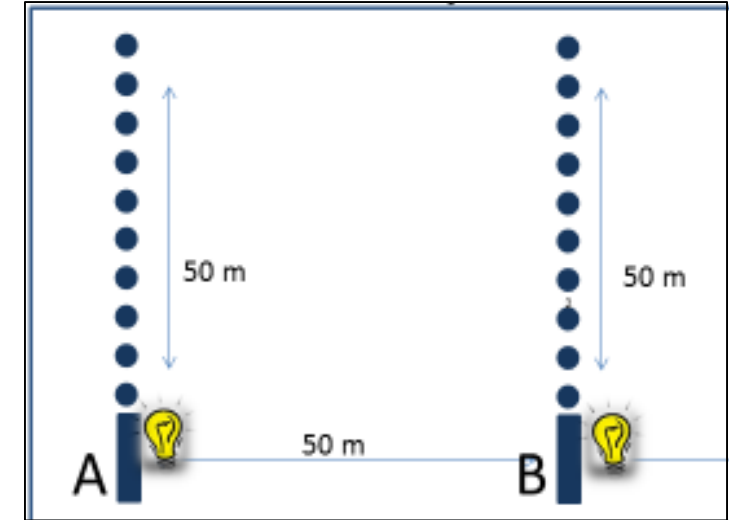


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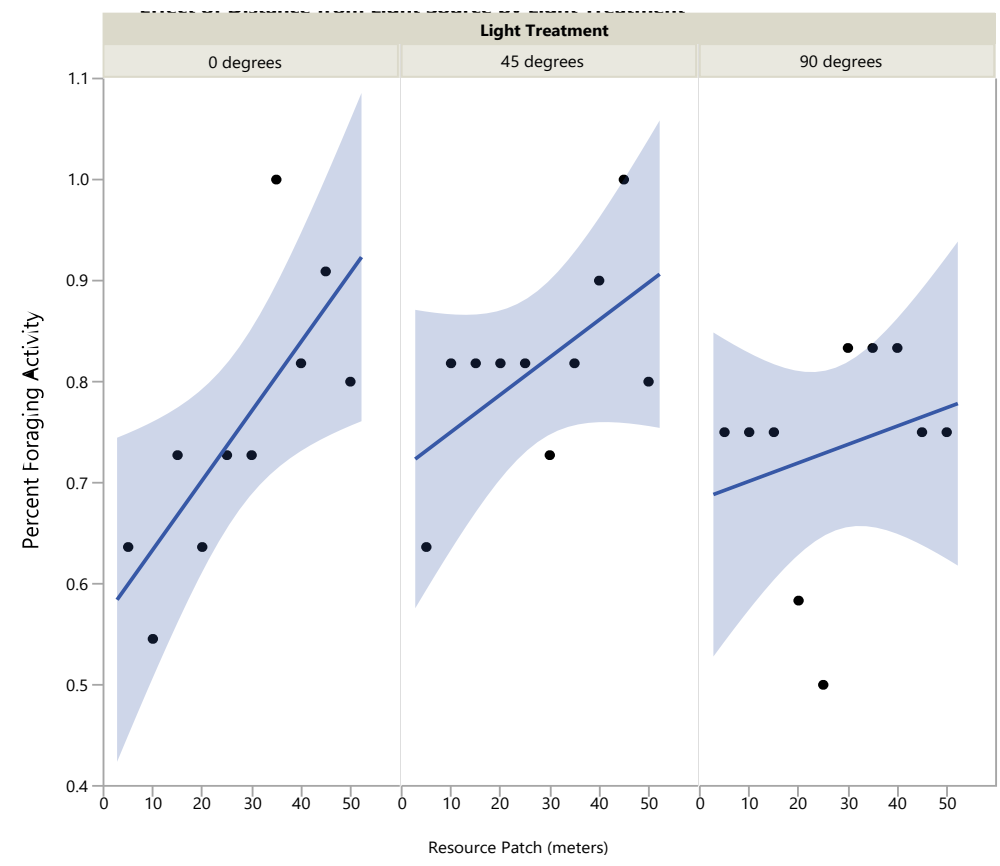
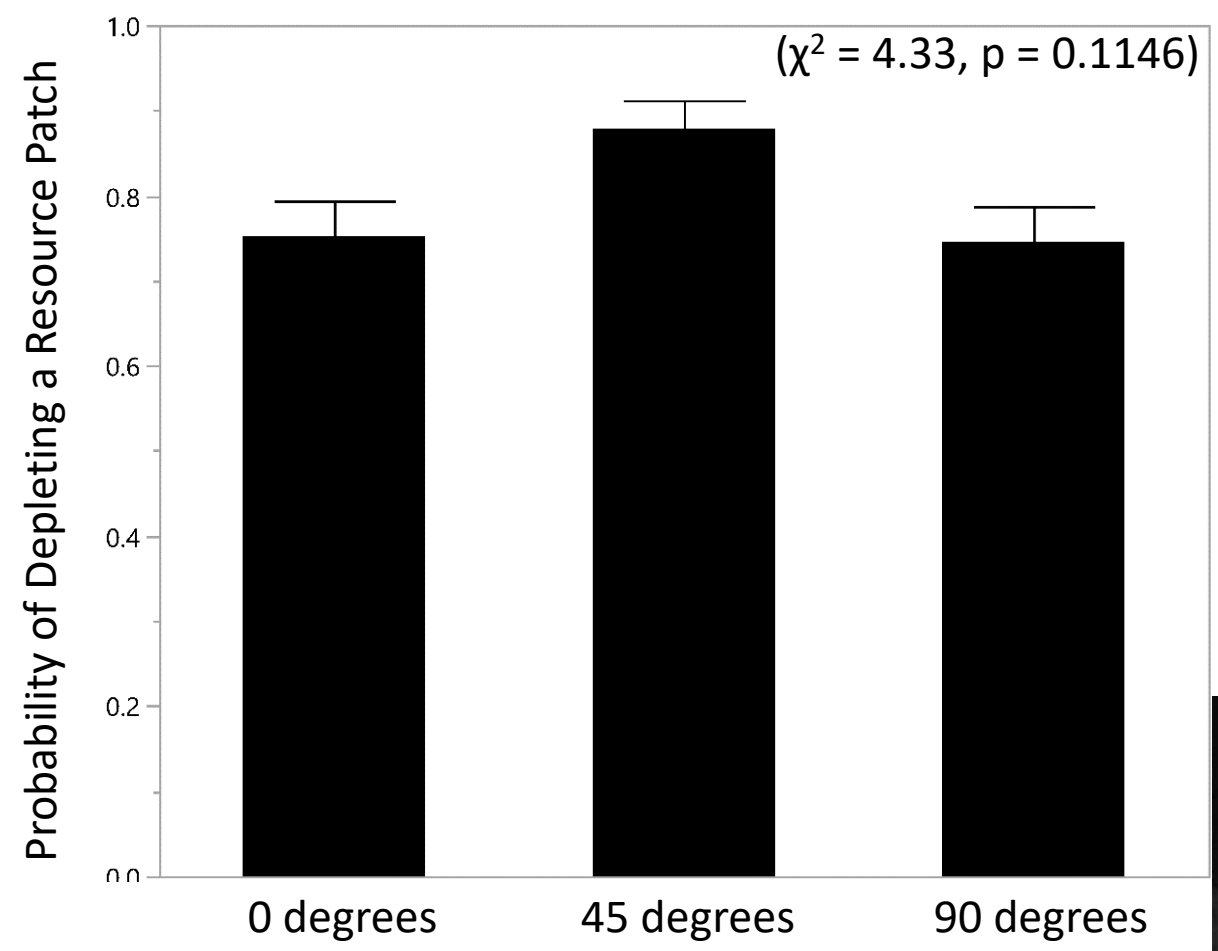
90 degrees





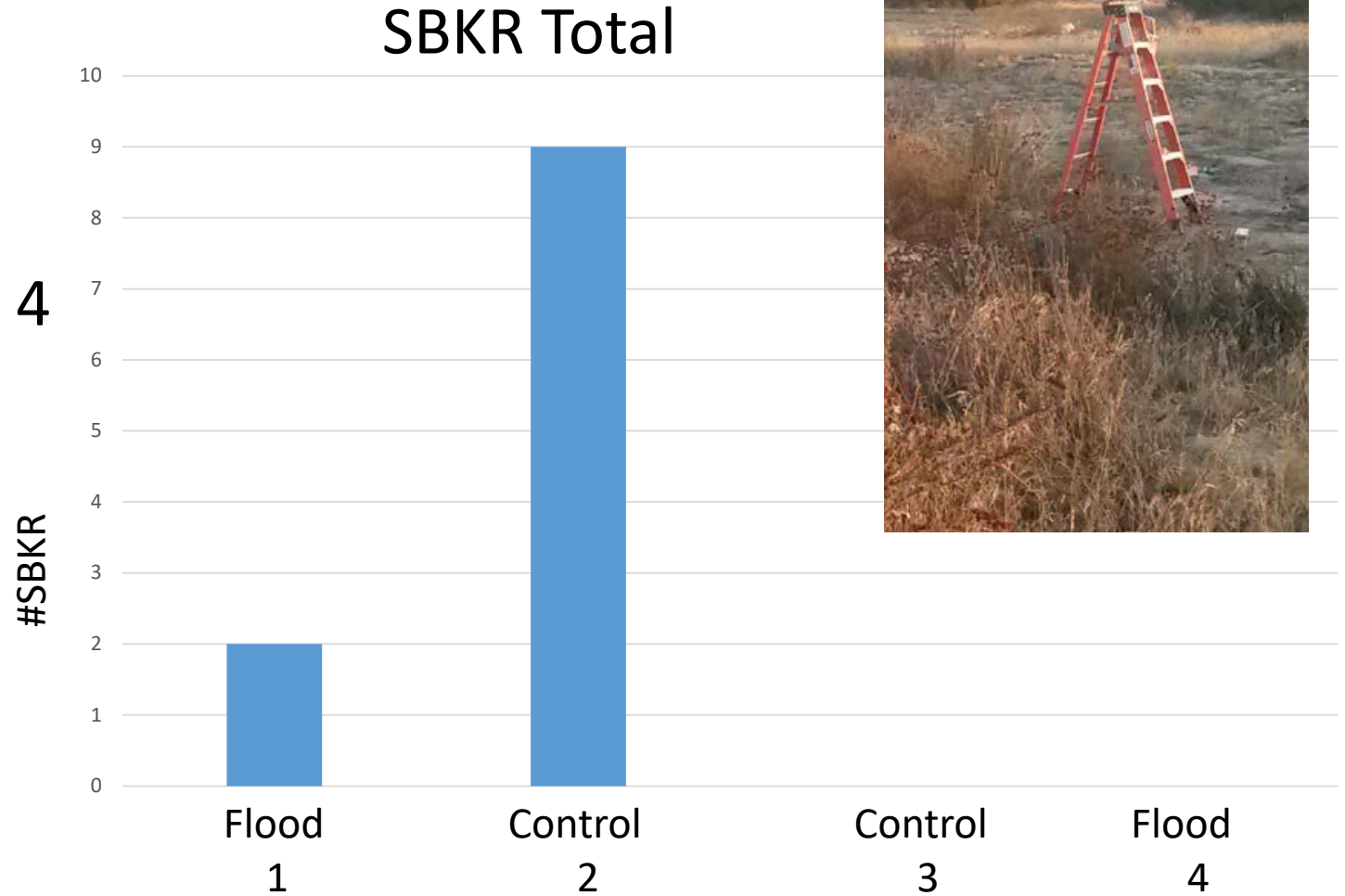
(z = 2.01, p = 0.044)

Results – Light Orientation



Persistence and Fitness

- Flood Light/Control
- 3 months
- No SBKR at Sites 3 and 4
- Inconclusive



Conclusion

- Significant changes in foraging behavior
 - Light type (Continuous)
 - and distance (35m)
- May have fitness consequences
 - ultimately influence persistence.
- SBKR
 - Endangered
 - Habitat destruction and fragmented
- Forefront of urban expansion.
 - Sustainable refuges for SBKR





Management Recommendations

- **Avoid/Reduce** lighting in/near SBKR occupied habitat.
- **Motion sensor** lighting or an on/off switch to allow for periods of darkness.
- **Shield** lighting to reduce light dispersion, and orienting lights away from SBKR habitat
- **Buffer area** of native vegetation (at least 35m)
- Temporary lighting disturbances should coincide with the **full moon**
- Reduce the **number** of lights needed



Thank you

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- Land Access

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- San Bernardino Valley Water Conservation District