

Impacts of Artificial Night Lighting on Wildlife

Arizona Game and Fish Department



Wildlife Economics

- Combined **Hunting, Fishing, and Wildlife Viewing**
- Arizona (2000-2003)
 - **\$100M** in trip items – Food, fuel, lodging
 - **1,936** positions

 - **\$829M** in non-trip items – Souvenirs, hunting supplies, entertainment
 - **16,217** positions



General Impacts to Wildlife

- Disorientation or unnatural stimulus
- Disrupt reproduction for many species
- Increase and/or decrease competition between species
- Benefit some predators to the detriment of their prey species

Mammals

- Reduction in activity, movement, and food consumption of rodents (Vasquez 1994; Kramer and Birney 2001; Brillhart and Kaufman 1991; Clarke 1983; Falkenberg and Clarke 1998)
 - Responded to 0.1 lux (half moon) and 0.3 lux (full moon)
 - Roads use minimum of 3 lux
- Seed harvest in desert rodents declined 21% (Kotler 1984)
 - Illumination from 1 camping lantern



Ords kangaroo rat



Western harvest mouse

Mammals

- Mountain lions avoided urban glow (Beier 1995)
 - Resulted in movement through unfavorable topography and habitat
- Bats avoided illuminated areas (Stone et al. 2009)
 - Increased predation
 - Disrupts normal 24hr pattern of light and dark



Mountain lion



California leaf-nosed bat

Reptiles and Amphibians

- Predation on snakes increased with elevated levels of illumination (Bouskila 1995)
- Snake prey reduced foraging activity in response to increased illumination (Bouskila 1995; Bowers 1988)
- Ability of navigation through corridors (Beier 2006) can be impaired as well as implications in the decline of reptile populations noted by Perry and Fisher 2006.
- Eastern newts orientation and homing behavior can be disrupted during migration (Phillips and Borland 1992, 1994)



Eastern newt



Shovelnose snake

Birds

- Nocturnally migrating birds disorientated by red and white light (Poot et al. 2008)
 - Mortalities from collisions with towers and buildings (Gehring et al. 2009)
- Robins initiated morning chorus on average of 116min before civil twilight (Miller 2006)
 - Light averaged 3.91 lux (0.3 lux = fullmoon)



NY Twin Tower Memorial

So How Can Light Pollution be Addressed?

- Local and regional ordinances can educate the public, and such regulations have been shown to address this challenge effectively.
- Efforts to mitigate the effects of light pollution on species and habitats should consider five essential elements of lighting:
 - Need
 - Direction
 - Intensity
 - Duration
 - spectrum

Some Options...

- Eliminate all bare bulbs and any lighting pointing upward. This is especially true for decorative lighting, and would reduce contributions to overall light pollution.
- Use only the minimum amount of light needed for safety.
- Use narrow spectrum bulbs as often as possible to lower the range of species affected by lighting.
- Shield, canter or cut lighting to ensure that light reaches only areas needing illumination and significantly reduce the glow.
- Light only high-risk stretches of roads, such as crossings and merges, allowing headlights to illuminate other areas. Where possible, use embedded road lights to illuminate the roadway.
- In Flagstaff and Coconino County, the desire to maintain dark skies for the Flagstaff Naval Observatory and Lowell Observatory has led to city and county ordinances protecting dark skies. These ordinances have coincidentally offered wildlife relief from the negative impacts of light pollution.
- All new developments should use the latest management technologies so that continued growth and expansion leads to no increase in the impact of light pollution (Salmon 2003).
- Do not install artificial lighting on rural roads that pass through areas of linkage designs for wildlife and instead consider speed bumps, curves, artificial constrictions and other traffic calming devices.

Questions or Comments?

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