The Effect of Artificial Light at Night (ALAN) on Activity Patterns of a Nocturnal Salamander

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ALAN (Artificial Light At Night) has the potential to disrupt circadian rhythms and adversely affect circadian-dependent activities (Fonken and Nelson, 2014). Most amphibians are nocturnal with daily activity commencing as light levels drop and night begins. The eastern red-backed salamander (*Plethodon cinereus*) is a nocturnal amphibian that shelters under rocks and logs during the day and then emerges after dusk under moist conditions to forage until dawn (Fig. 1). In this study, we examined the effects of ecologically relevant amounts of LED ALAN on the emergence and daily activity of this nocturnal salamander.

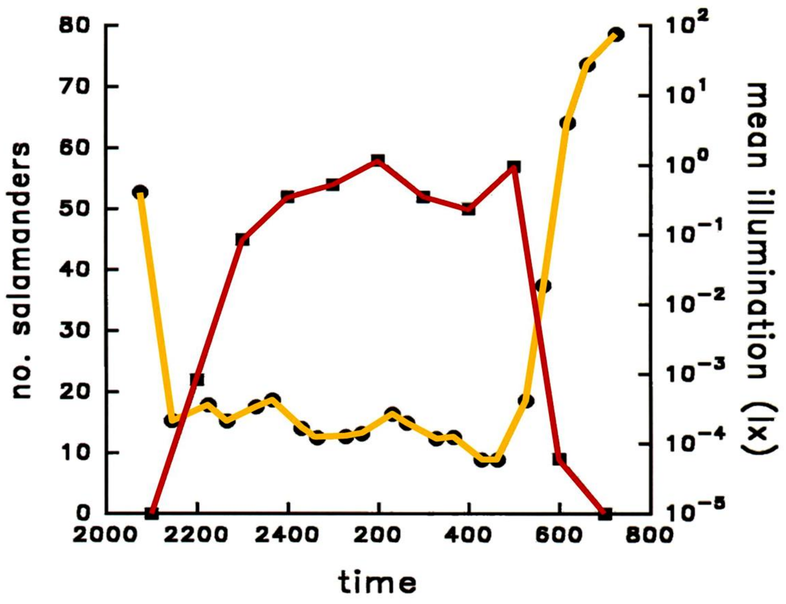

Figure 1: The number of salamanders active on the forest floor (—) during a single night (Perry *et al.* 2008).

Hypothesis: ALAN delays emergence from refugia and reduces activity of nocturnal red-backed salamanders.

METHODS

- **4 night lighting treatments, daylight equal (100 lx) for all treatments (Fig. 1)**
- **4 replicate chambers per light treatment**
- **Recorded activity using infrared video cameras**
- **Habituated to chamber for 7 d with food before testing**
- **Not fed during recording session**
- **Analyzed activity using Ethovision XT7**
- **Tracked total distance moved per hour**

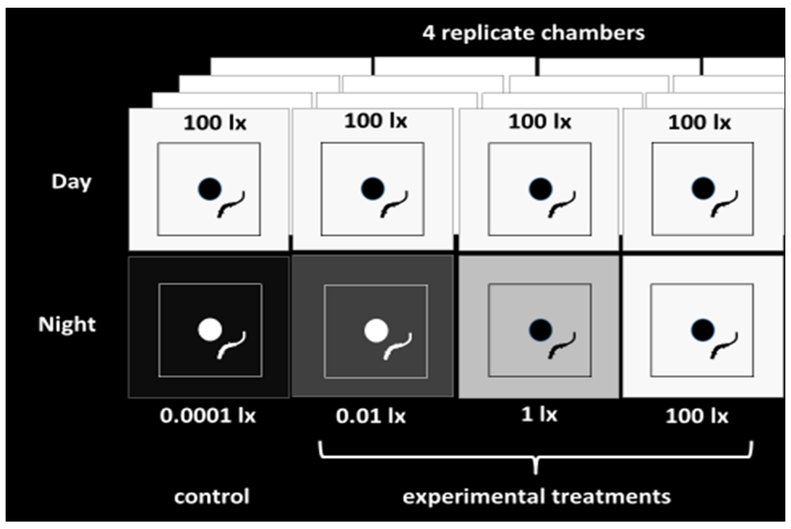

Figure 2: Experimental design and test chamber setup.

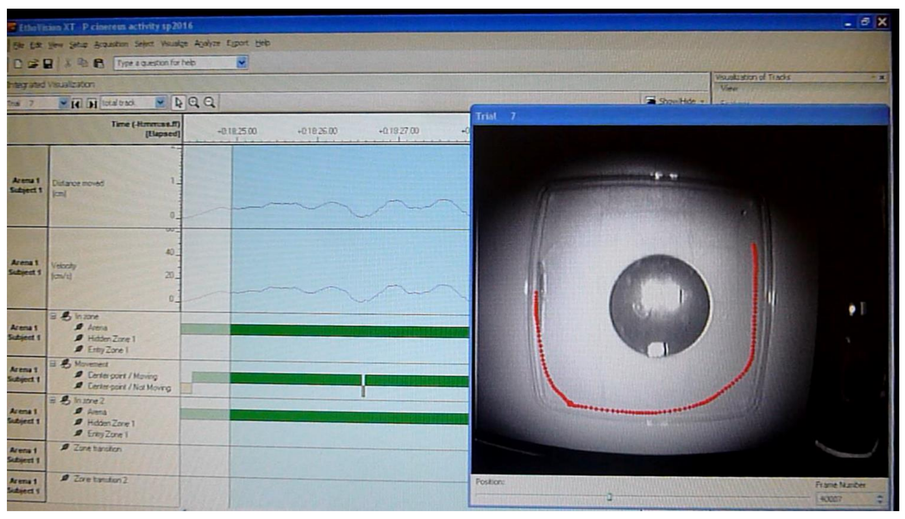

Figure 3: Tracking the distance moved per hour.

RESULTS

Effect of ALAN on Activity

- **First night:**

  More active in the dark control than in other treatments (ANOVA: $F_{3, 375} = 16.46$, $P < 0.001$)

Comparisons*	
0.0001 to 0.01 lx	P < 0.001
0.0001 to 1 lx	P < 0.001
0.0001 to 100 lx	P < 0.001
No other significant differences	

* Post-hoc Scheffe's tests

- **Subsequent activity less than first night**

RESULTS

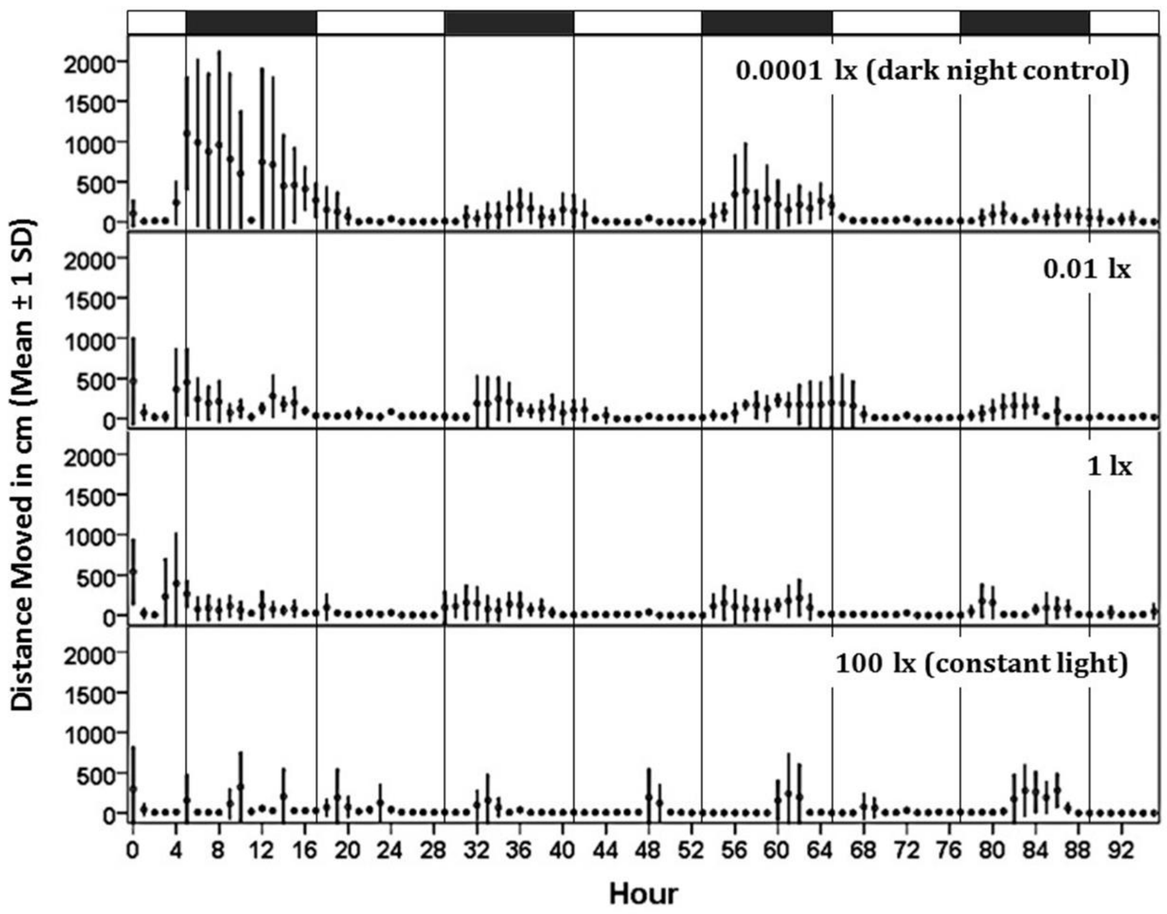

Figure 4: Salamander activity over 4 days in 4 different night lighting treatments. First night activity clearly demonstrates that night lighting disrupts normal photoperiodic behavior.

CONCLUSIONS

Low, ecologically relevant, amounts of LED artificial lighting affected activity during the first night salamanders were tested. Salamanders in the dark, control lighting were more active at night than those in all other lighting treatments, including lower and higher levels of ALAN. Salamander activity declined in the dark treatment during subsequent nights, perhaps due to familiarity with the chamber and lack of food availability.

Literature Cited:

Fonken, Nelson (2014) The effects of light at night on circadian clocks and metabolism. Endocr Rev, 35(4), 648-6670.

Perry G, Buchanan BW, Fisher RN, Salmon M, Wise SE (2008) Effects of artificial night lighting on amphibians and reptiles in urban environments In J. C. Mitchell, R. E. Jung Brown, and B. Bartholomew (Eds.). *Urban Herpetology* (pp. 239-256). Salt Lake City, UT: Society for the Study of Amphibians and Reptiles.

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