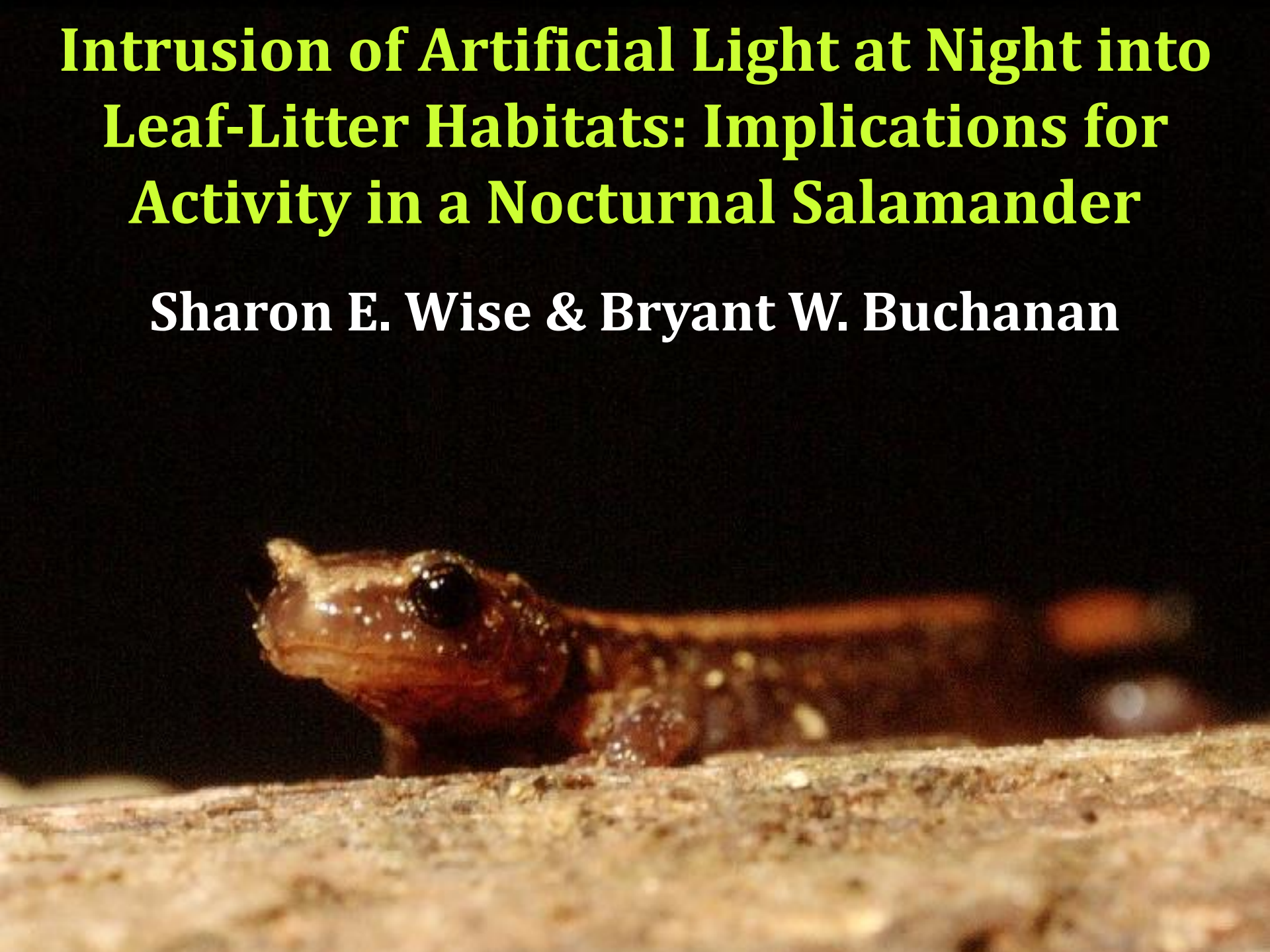
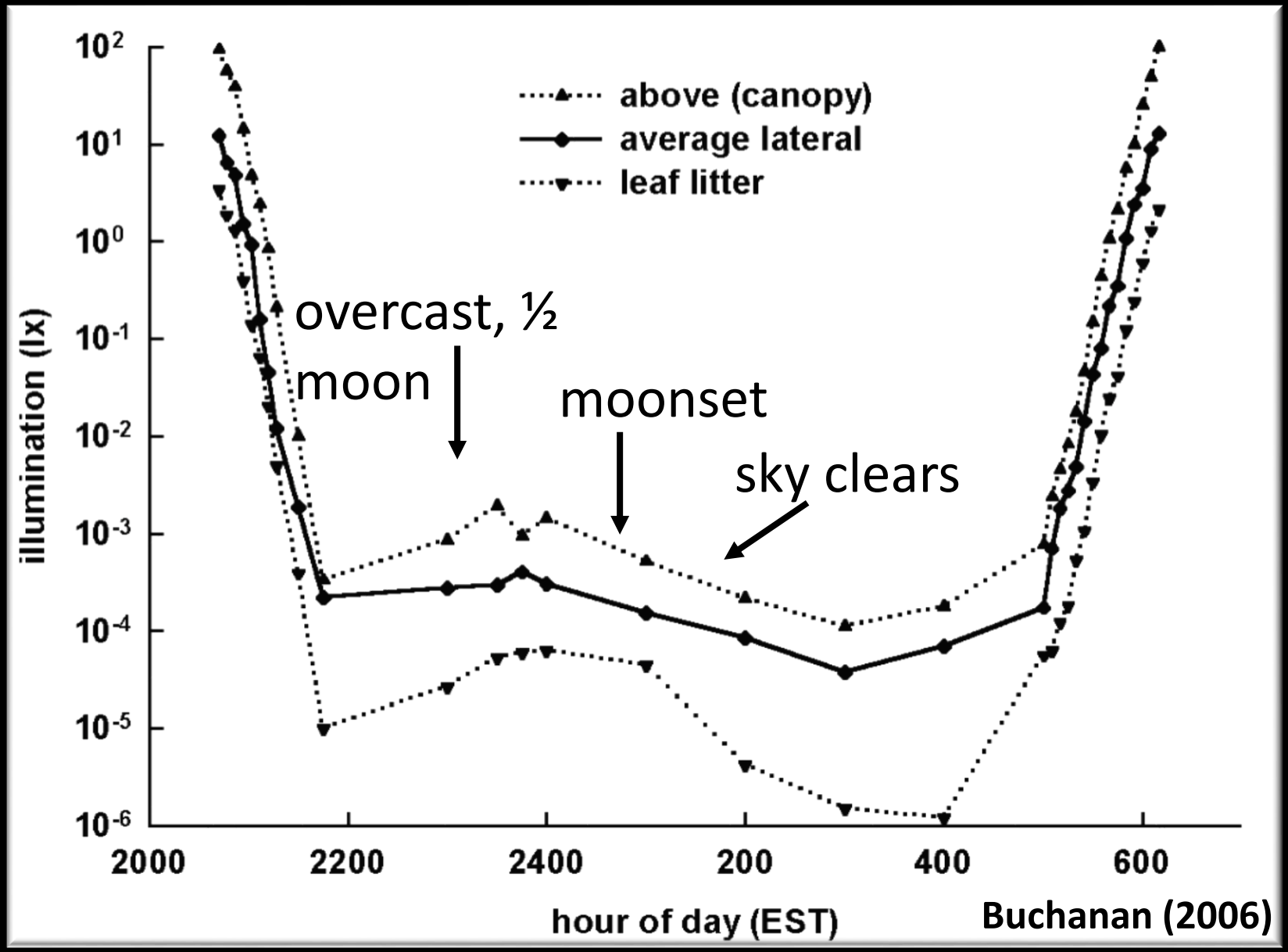
Intrusion of Artificial Light at Night into Leaf-Litter Habitats: Implications for Activity in a Nocturnal Salamander

Sharon E. Wise & Bryant W. Buchanan



Forest species adapted to low light



Forest species adapted to low light

Complex habitat

- **Tree cover (seasonal)**
- **Varying LL depth**
- **Cover objects**

Intrusion into leaf litter habitats

- Urban populations

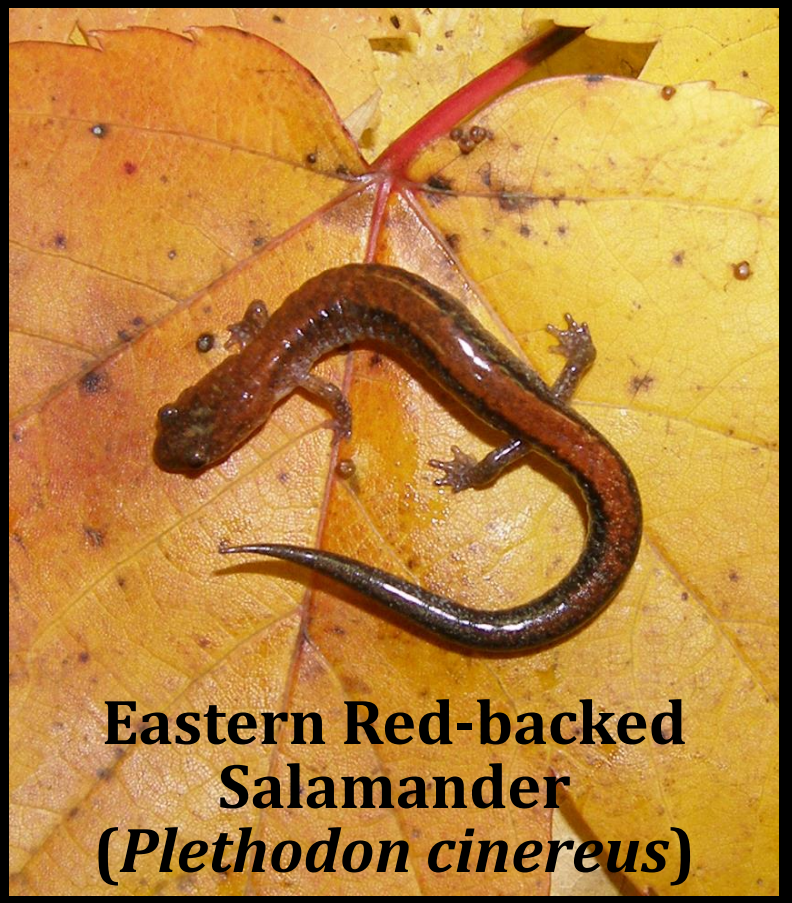
Intrusion into leaf litter habitats

- Edge habitats

Does ALAN impact salamanders?

Many species:

- **live under leaf litter in deciduous forests**
- **are active nocturnally on surface**

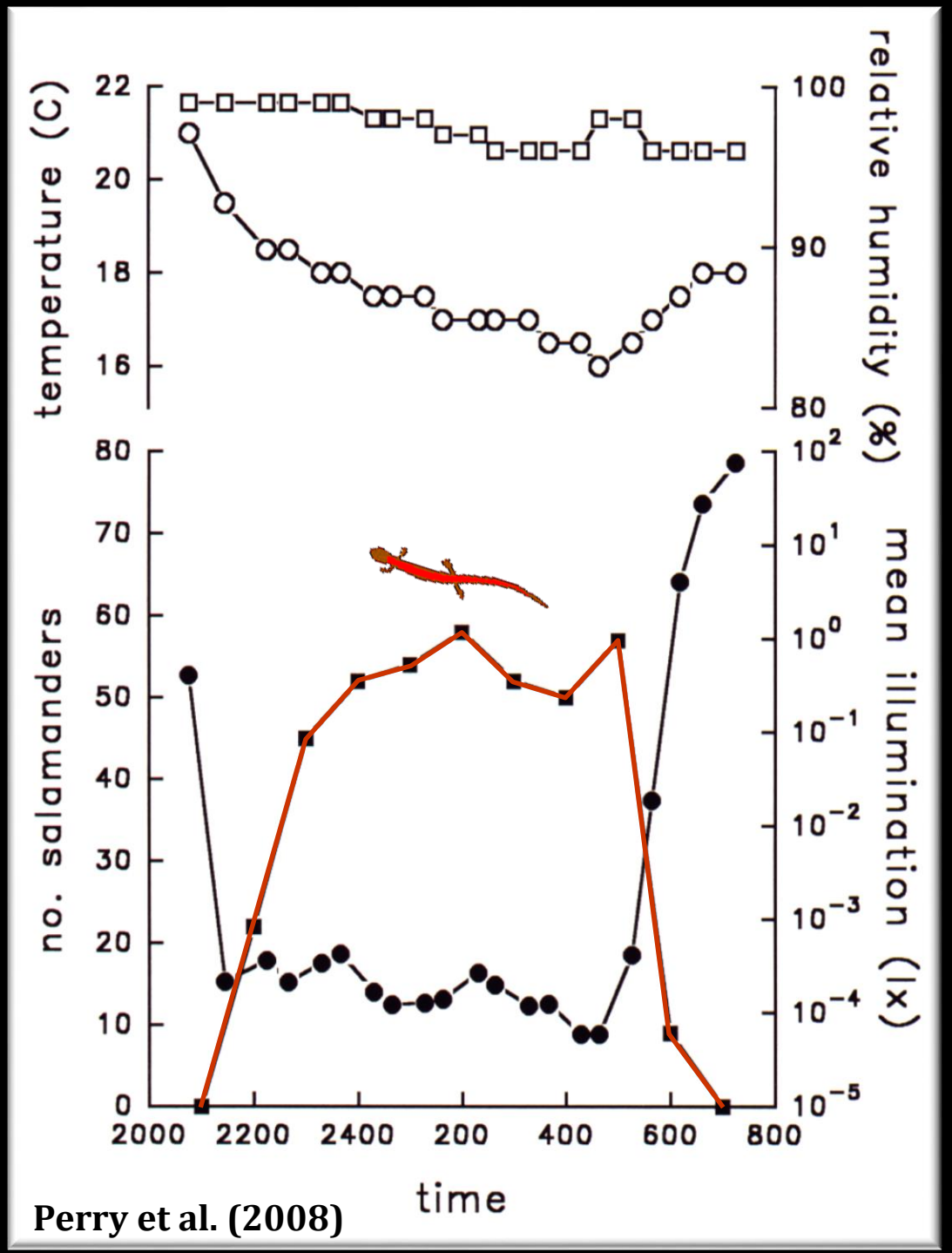


Eastern Red-backed Salamander (*Plethodon cinereus*)

Nocturnal Activity

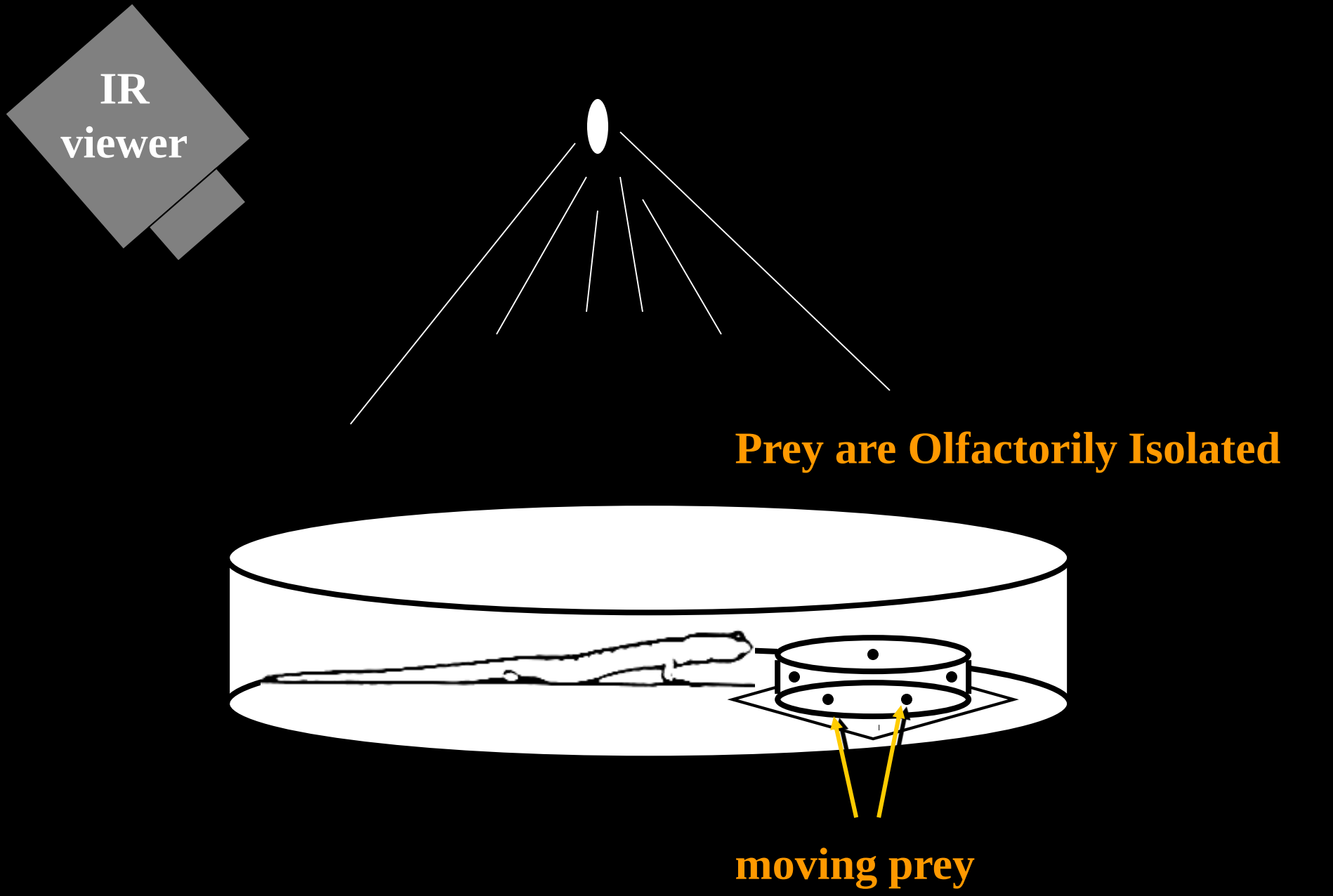
- Emerge from LL about 1 hr after dark

25 x 3 m transects: 17 nights



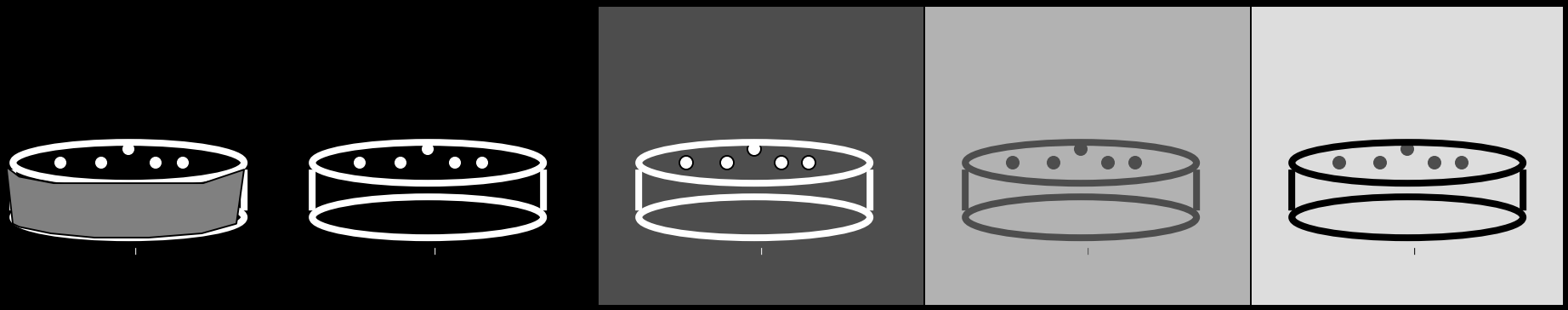
Perry et al. (2008)

Low-illumination prey detection assay



Low-light vision

low-illumination prey detection treatments

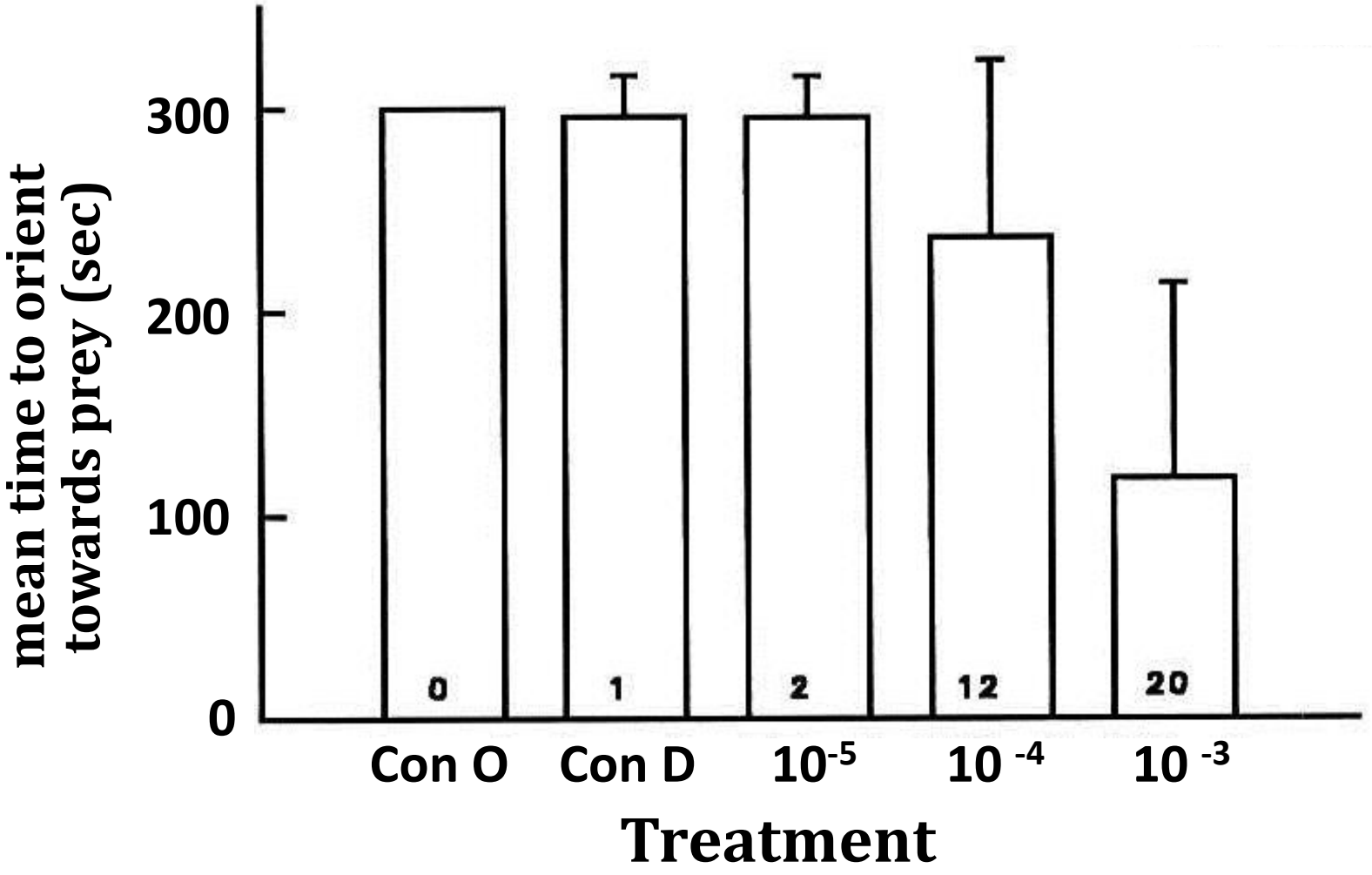


opaque Dark 10^{-5} lx 10^{-4} lx 10^{-3} lx

controls
total darkness

test illuminations

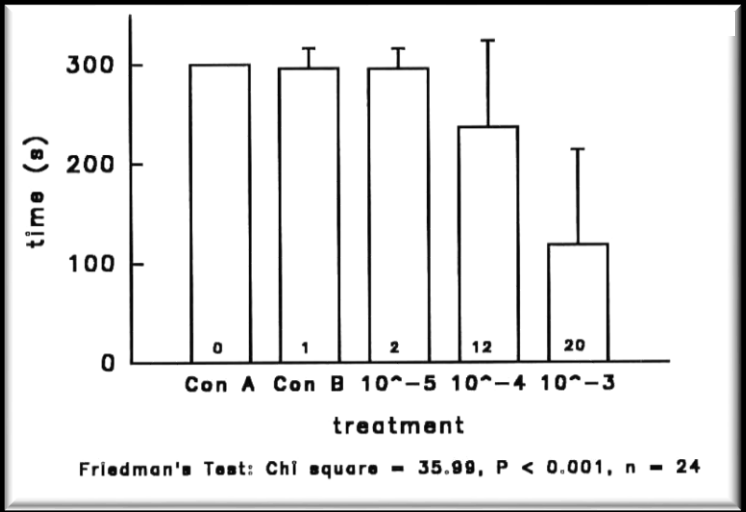
Low-light vision: ~ 10^{-4} lx

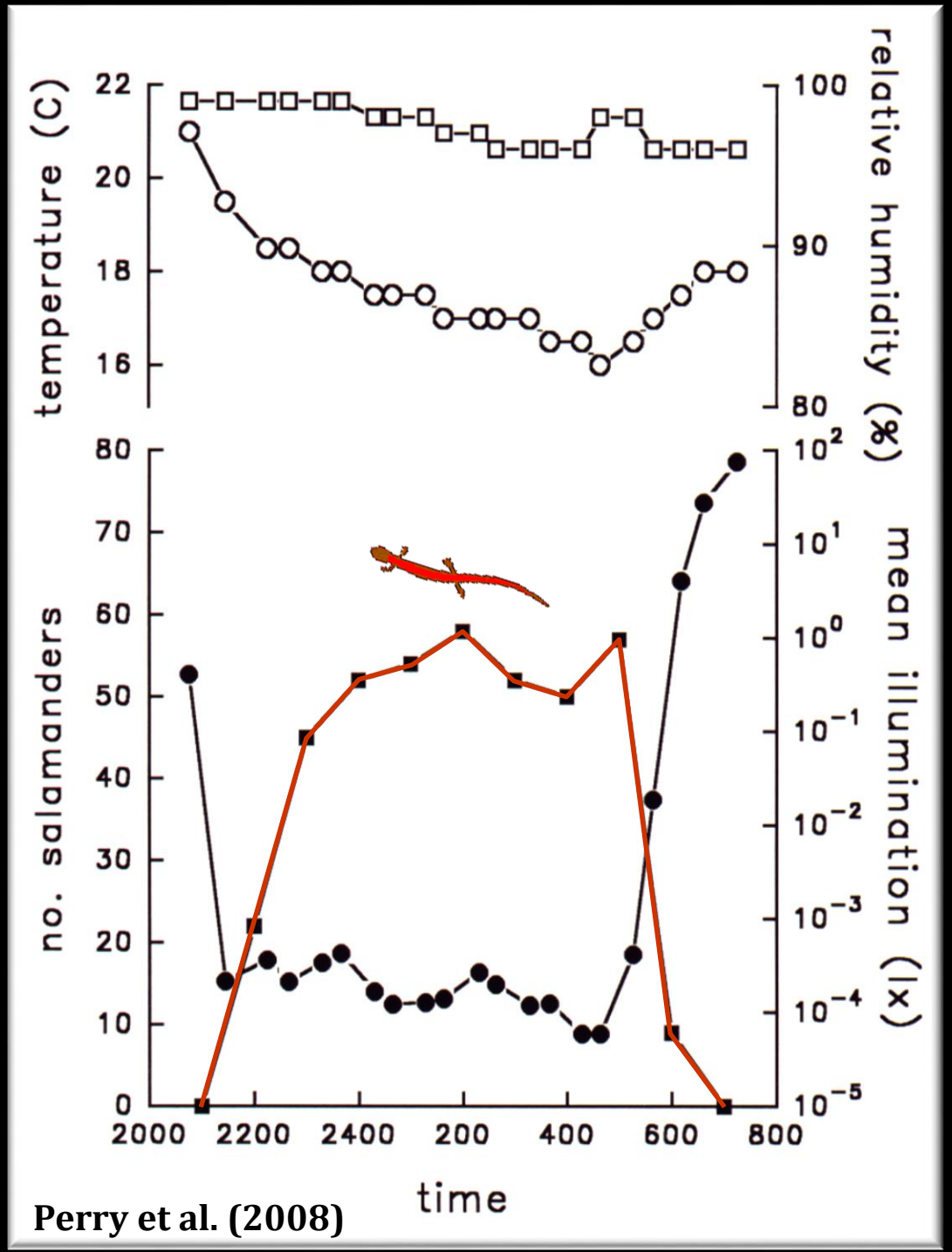


Friedman test: X2 = 35.99, P < 0.001, N = 24

P. cinereus

- Nocturnally-active
- Vision at low illuminations





Perry et al. (2008)

Effect of ALAN on Activity

Test illuminations:

Diurnal (all trials): 1 lx

Nocturnal:
10^{-3} lx
10^{-2} lx
10^{-1} lx
1 lx

Habituation:

Length of time: 5 days
Photoperiod: 12L:12D

Test duration:

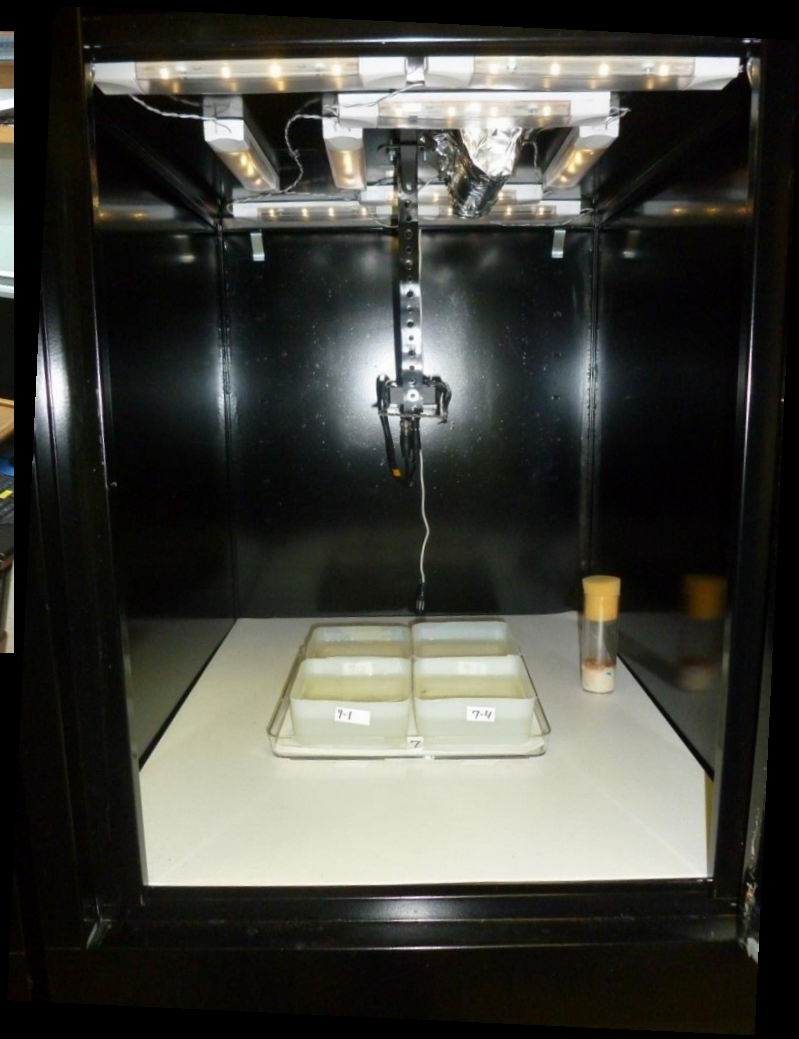
First 2 h of scotophase

Behaviors:

Time to emerge after dark
Time spent active

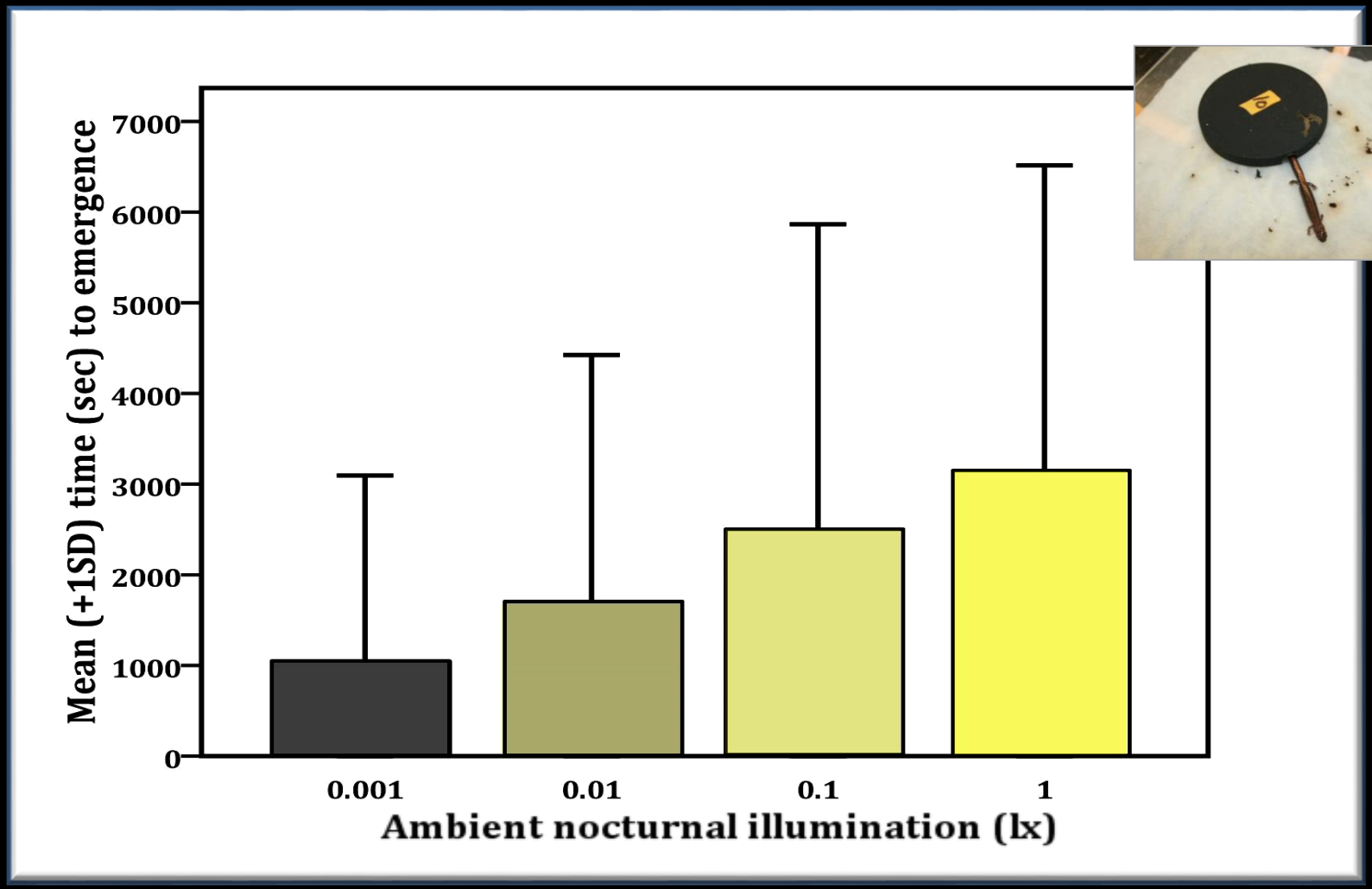
Effect of ALAN on Activity

- 4 replicates of each light treatment
- N = 16

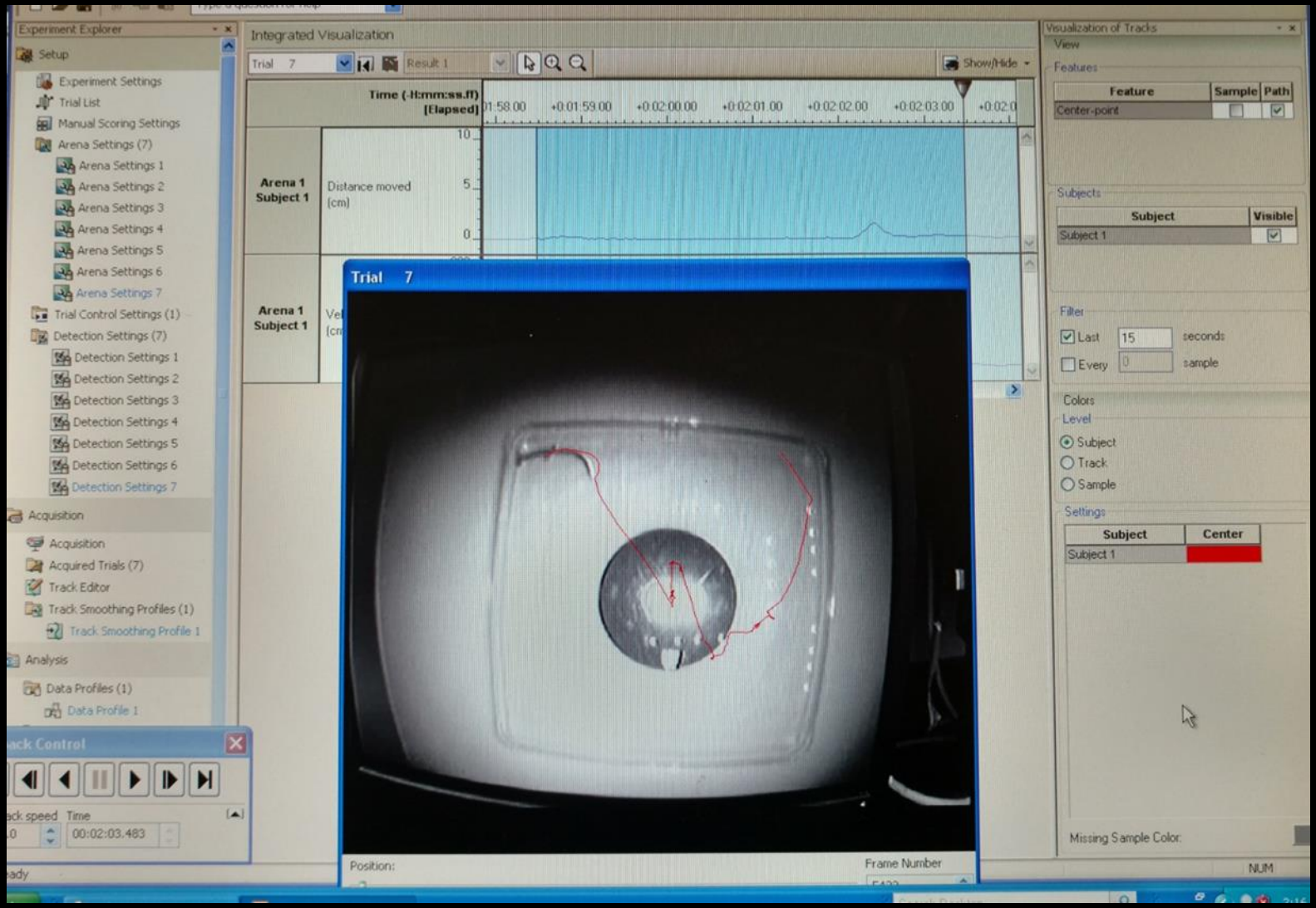


Time to Emerge from Under Cover

- Delayed with increased ambient illumination



$F_{1,15} = 7.967$, N = 16, P = 0.013


Experiment Explorer
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Trial 7
Result 1
Show/Hide
Time (-H:mm:ss.ff) [Elapsed]
Arena 1 Subject 1
Distance moved (cm)
Trial 7
Position:
Frame Number
Visualization of Tracks
View
Features
Feature
Sample
Path
Center-point
Subjects
Subject
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Sample
Settings
Subject
Center
Subject 1
Missing Sample Color:
Time
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NUM

Illumination Under the Leaf Litter

Below Leaf Litter Illuminations

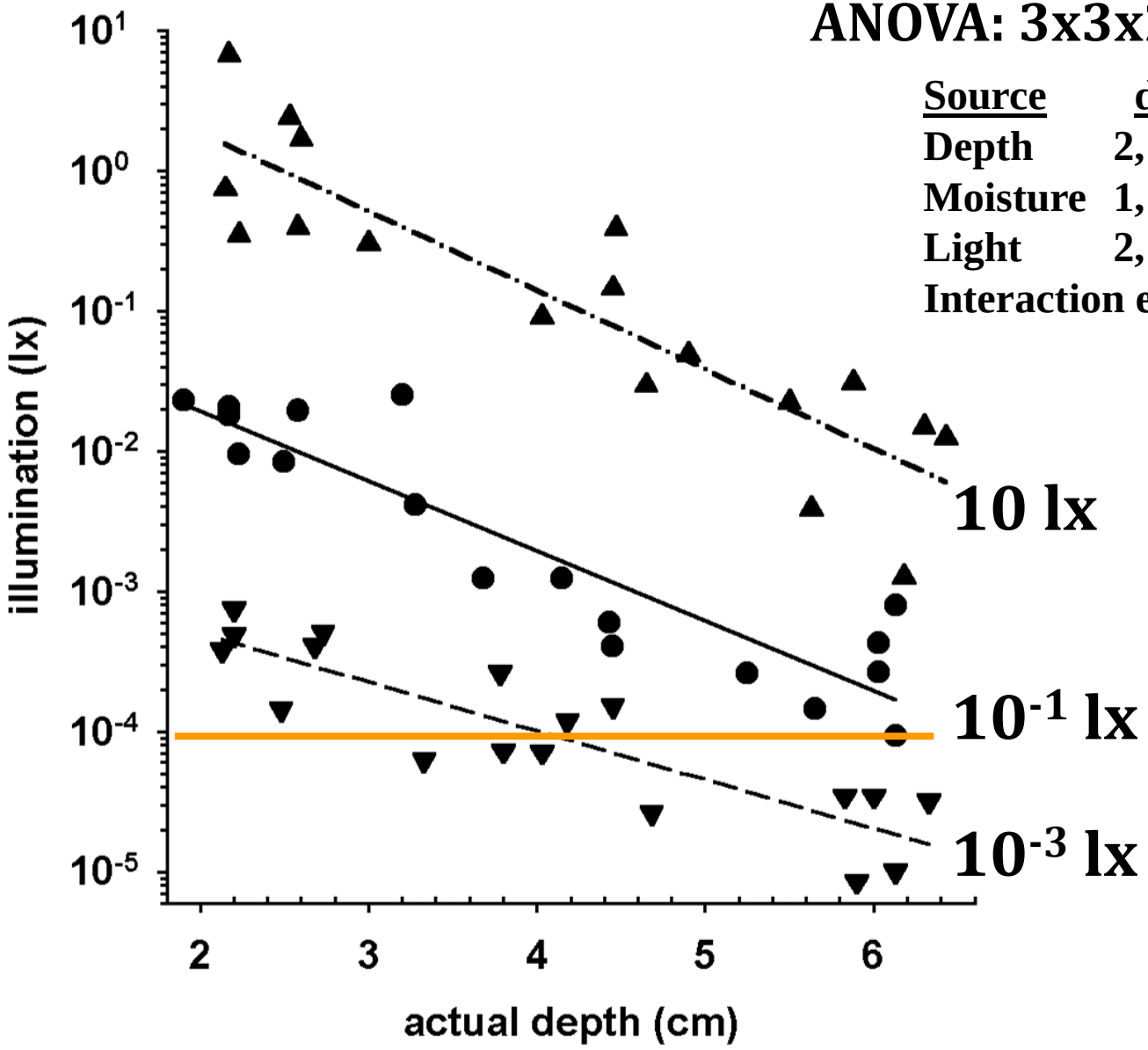
- Ambient illumination (10^{-3} lx, 10^{-1} lx, 10 lx)
- Litter depth (2 cm, 4 cm, 6 cm)
- Litter moisture (dry, wet)

60 cm

Below Leaf Litter Illuminations

- Leaf litter from 10 random plots
  (beech, maple, black cherry, red oak)
- Uniform packing:
  - lightly packed leaves into boxes, then removed and weighed (x 5)
  - used same litter mass in each trial (lightly packed)
- Wet litter soaked then drained, for 15 min

Depth and Ambient Light Affect Illumination



ANOVA: 3x3x2 (3 replicates)

Source	df	F	P
Depth	2, 36	77.1	<0.001*
Moisture	1, 36	0.1	0.735
Light	2, 36	254.8	<0.001*

Interaction effects: NS

Emergence from Leaf Litter

Emergence from Leaf Litter

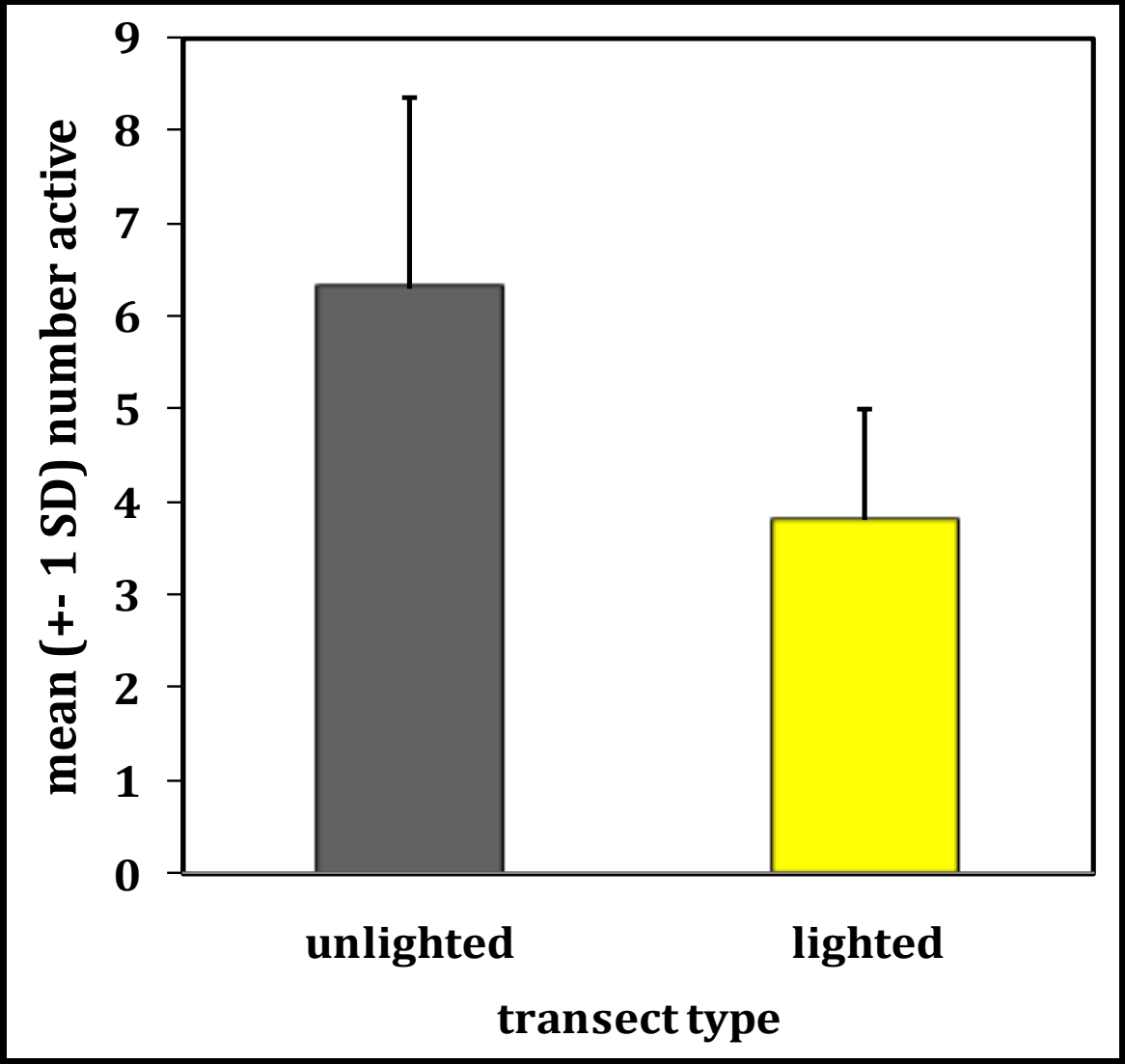
Treatments:

- lighted (10^{-2} lx)
- unlighted (10^{-4} lx)

2 x 15 m transects

Searched transects 1-2 hrs after Dark (N = 12)

Artificial Light Can Affect Emergence



Fewer salamanders active 1-2 hrs after dark

Independent t-test: t = 2.677, df = 10, P = 0.023

Intrusion of light into LL communities

- Light penetrates into leaf litter habitats
- Salamander behavior is affected by small amounts of ALAN

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Literature Cited

Buchanan, B. W. 2006. Observed and potential effects of artificial night lighting on anuran amphibian, pp. 192-220. *In*: Ecological Consequences of Artificial Night Lighting, C. Rich and T. Longcore (eds.). Island Press, Washington.

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