



Tuning LEDs to Mitigate Disturbance Across a Range of Moth Behaviours

Elliott Cornelius¹, Jolyon Trosianko²
[1] Rothamsted Research, [2] University of Exeter
Elliott.Cornelius@Rothamsted.ac.uk

ENTOMOLOGICAL NEWS

Moths provide important ecosystem services

- Pollination
- Prey items
- Herbivory

Full story at references [1-3]

And expansion of light pollution is threatening this

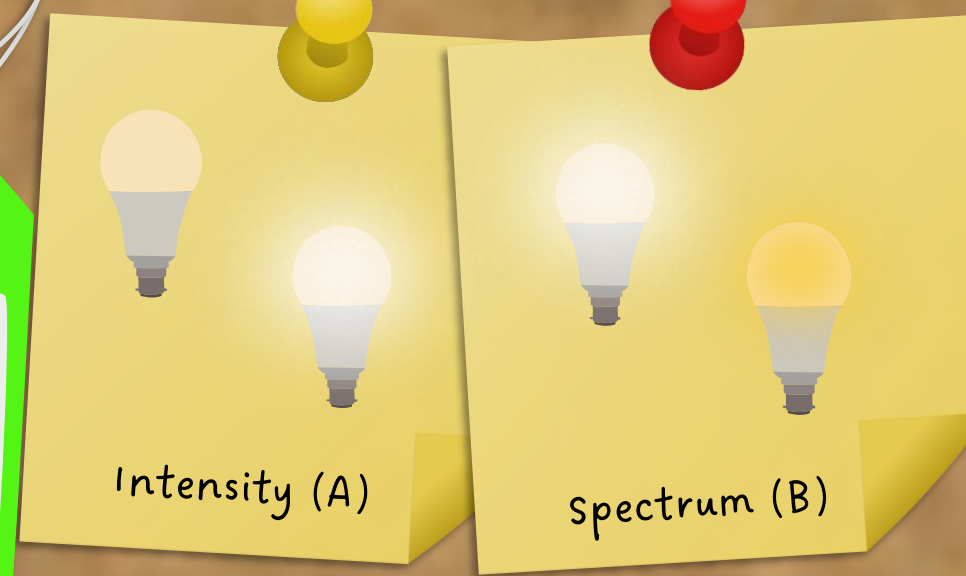
More information at [4]

But using tuned LEDs may mitigate disruption

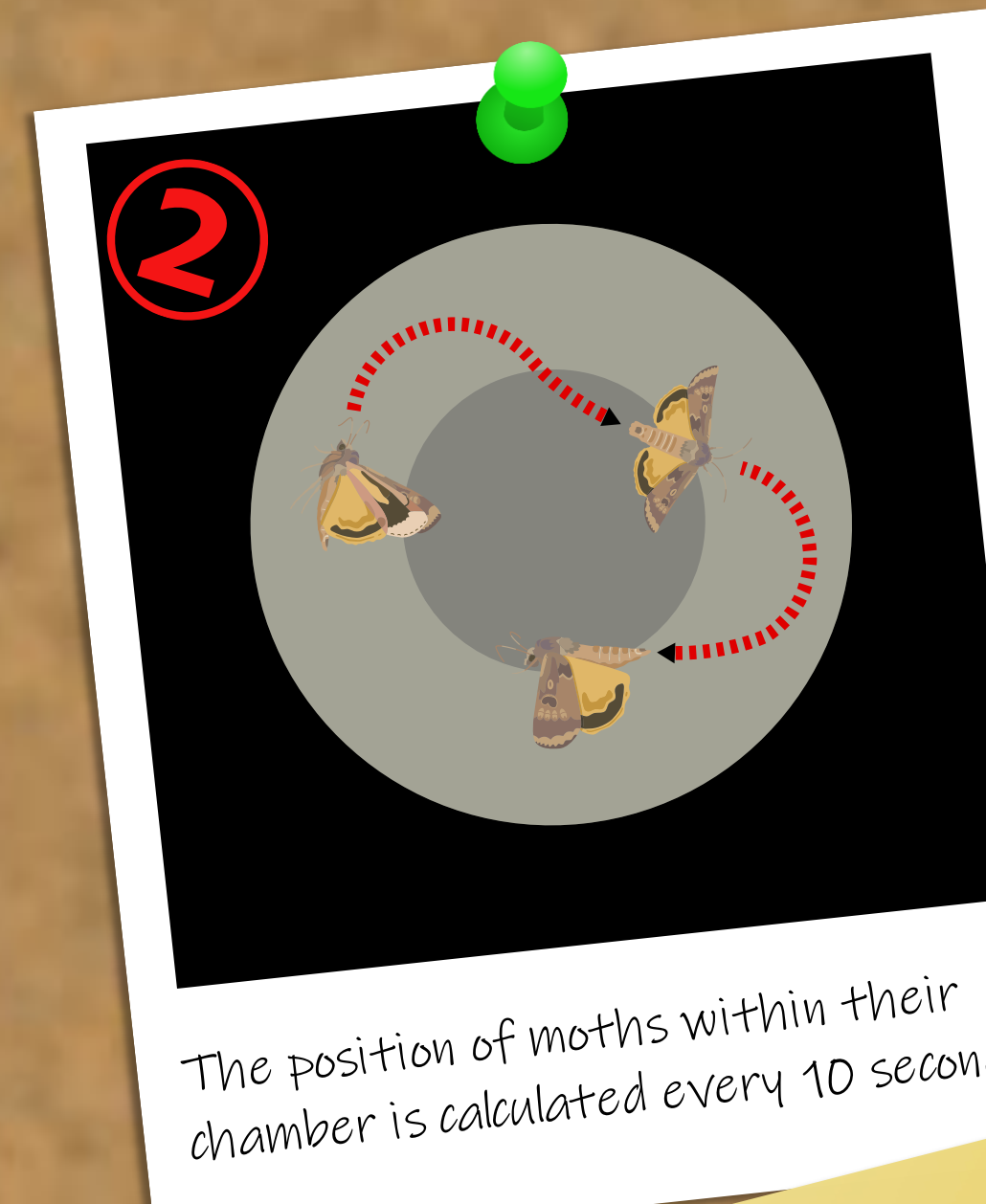
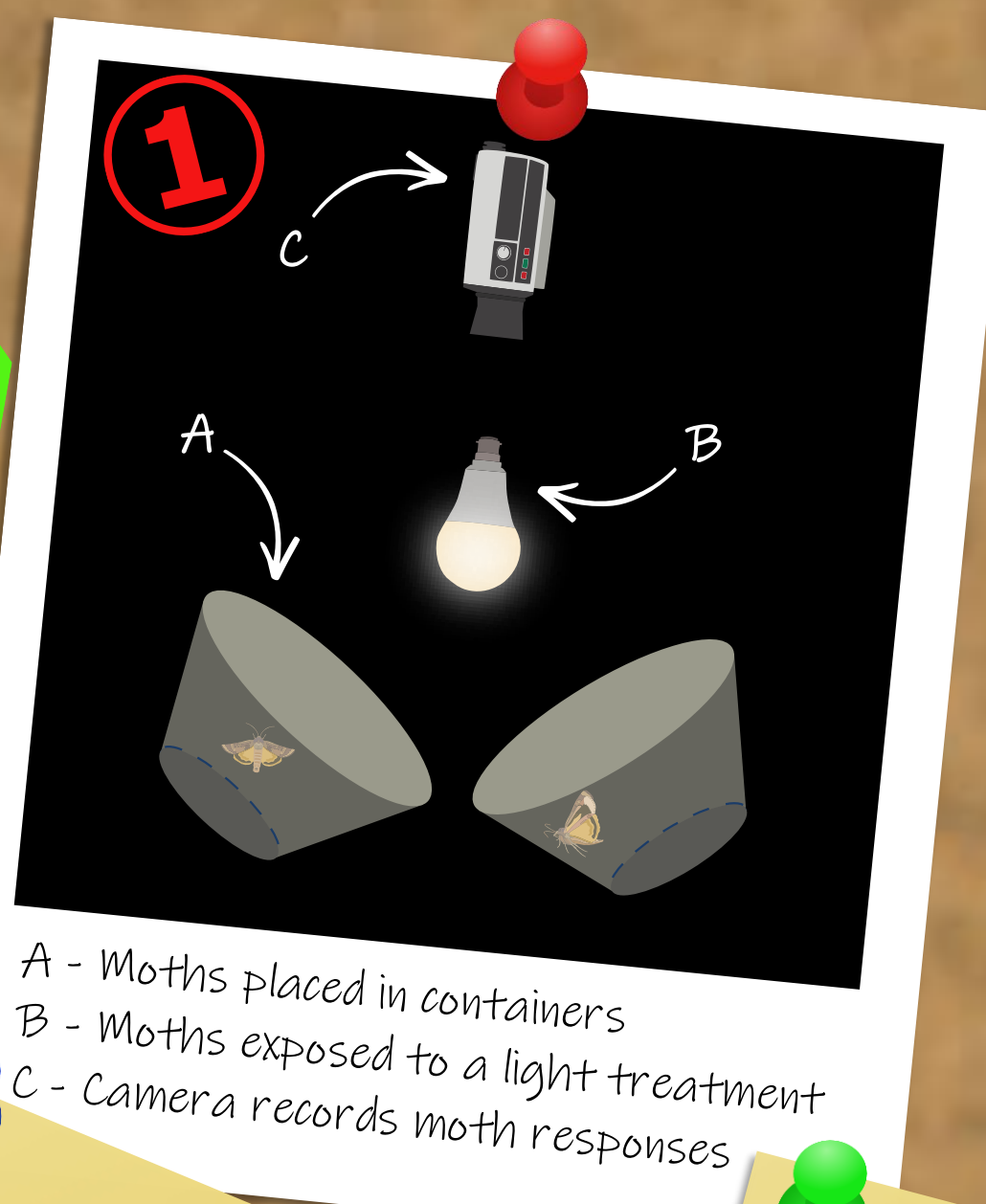
See [3] for further details

INTRO

METHODS
Factors Investigated



Experimental Setup



AIM:
I shall investigate how light intensity and spectrum impact various moth behaviours

Species:
Large Yellow Underwing
Angle Shades
Square-spot Rustic
Snout
Double-striped
Pug

Treatments:
Control (A + B)
1 lux Narrow Amber (B)
1 lux Broad Amber (B)
1 lux White (A + B)
0.1 lux White (A)
10 lux White (A)

Data Recorded:
Was the moth active?
What was the vertical position?
What was the distance from the light?

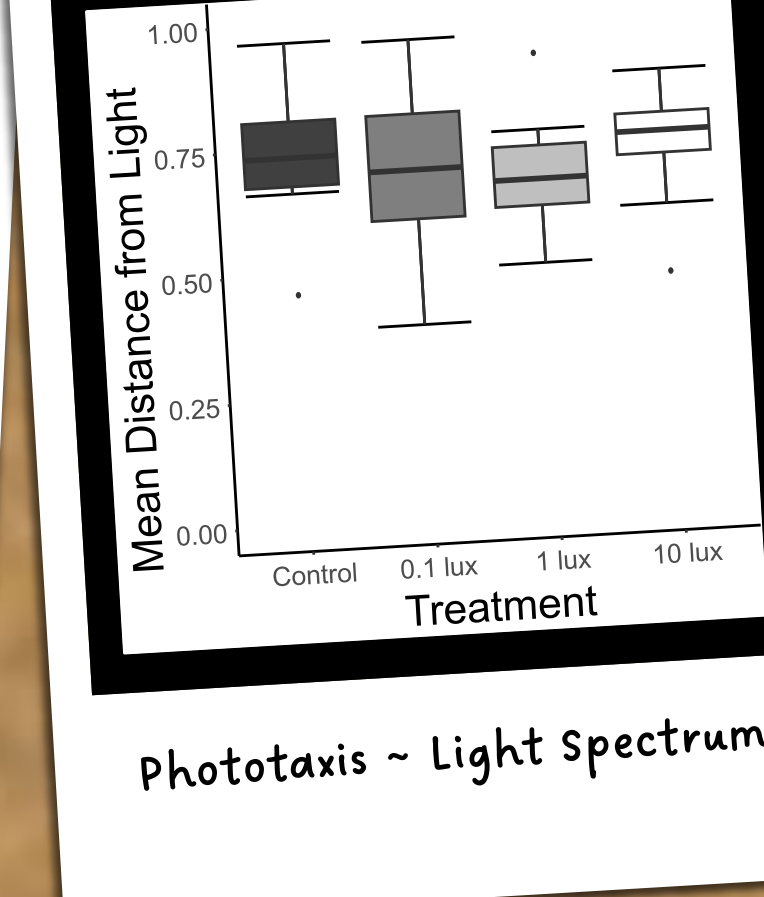
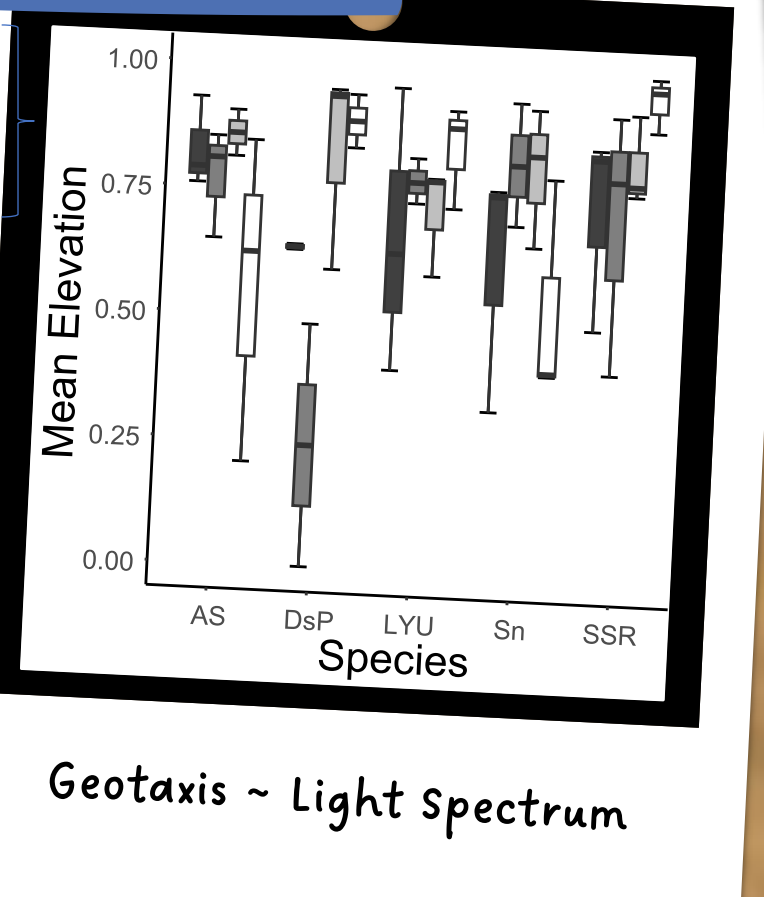
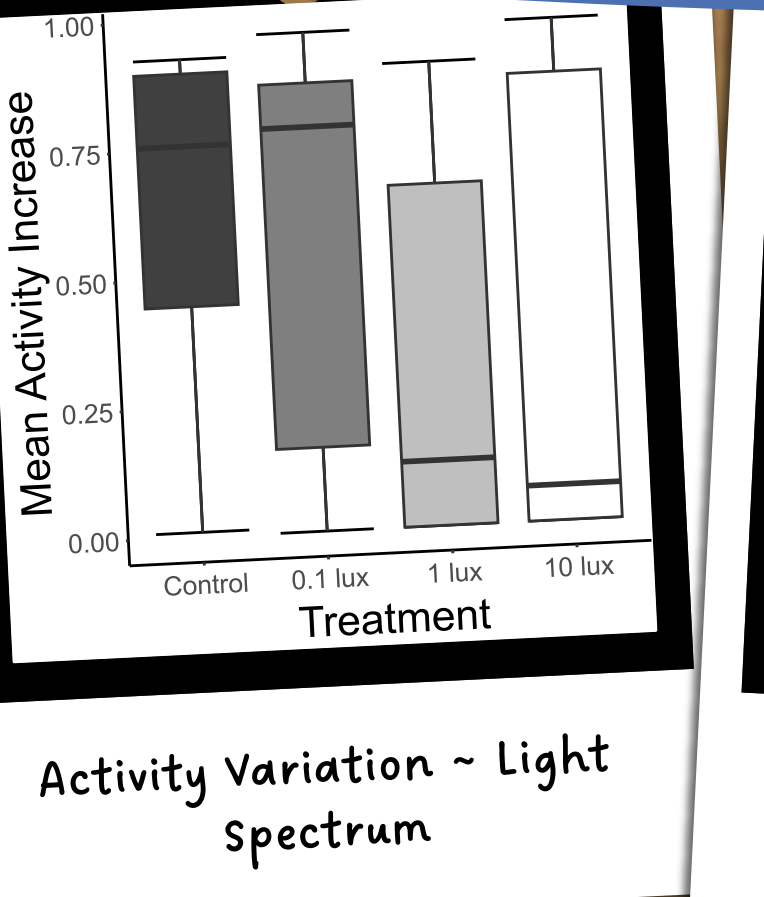
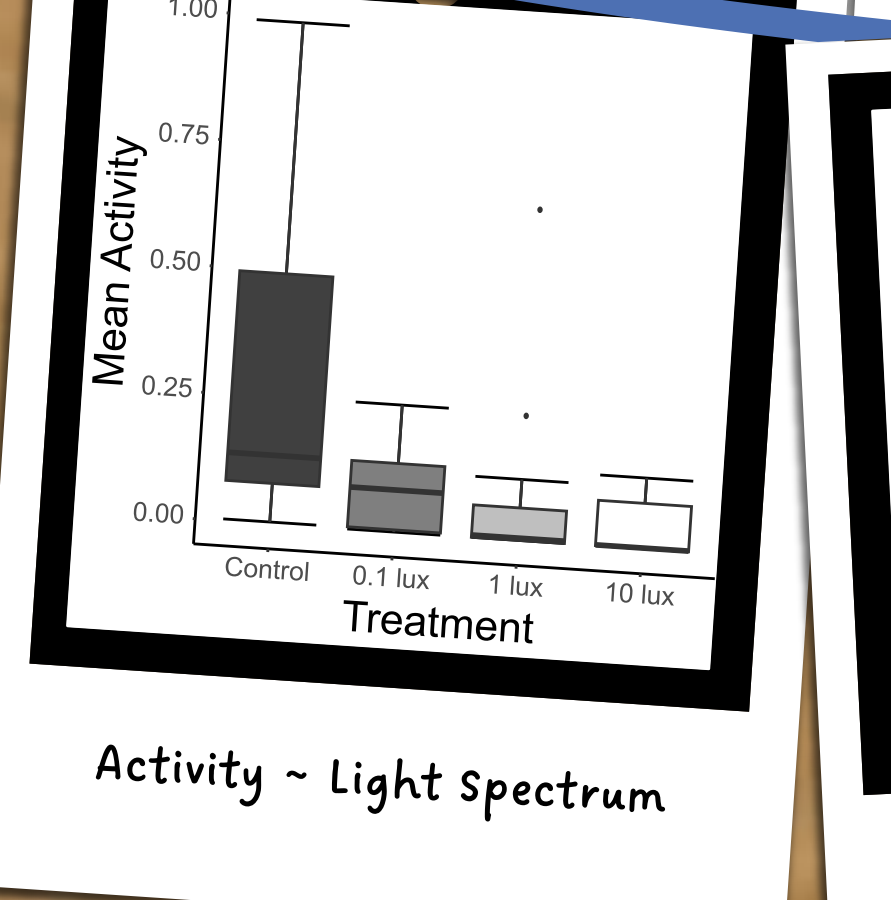
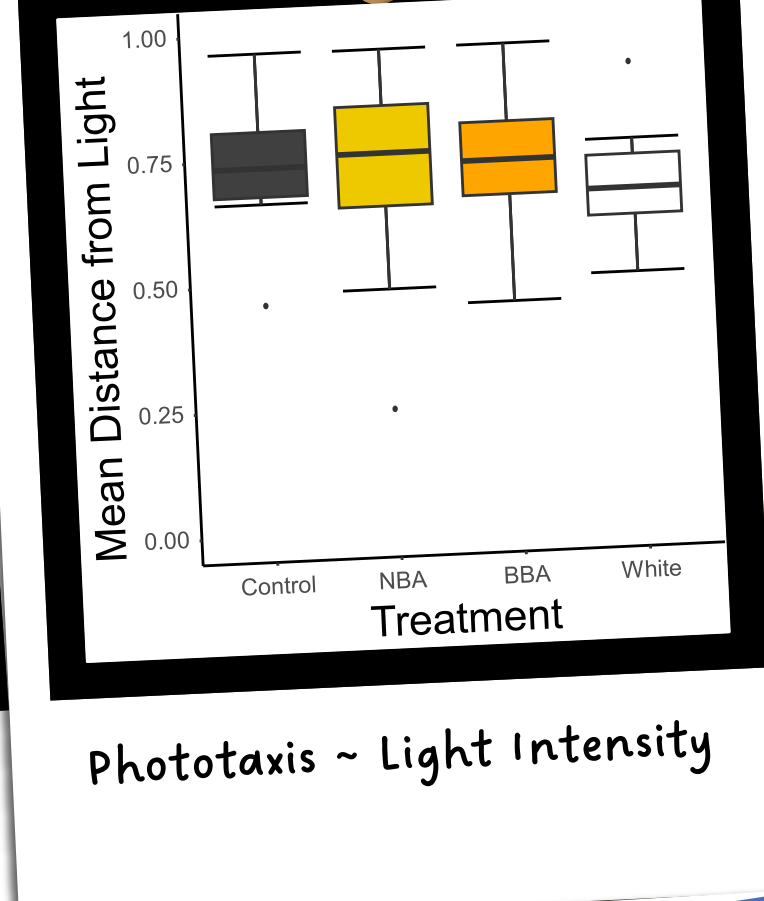
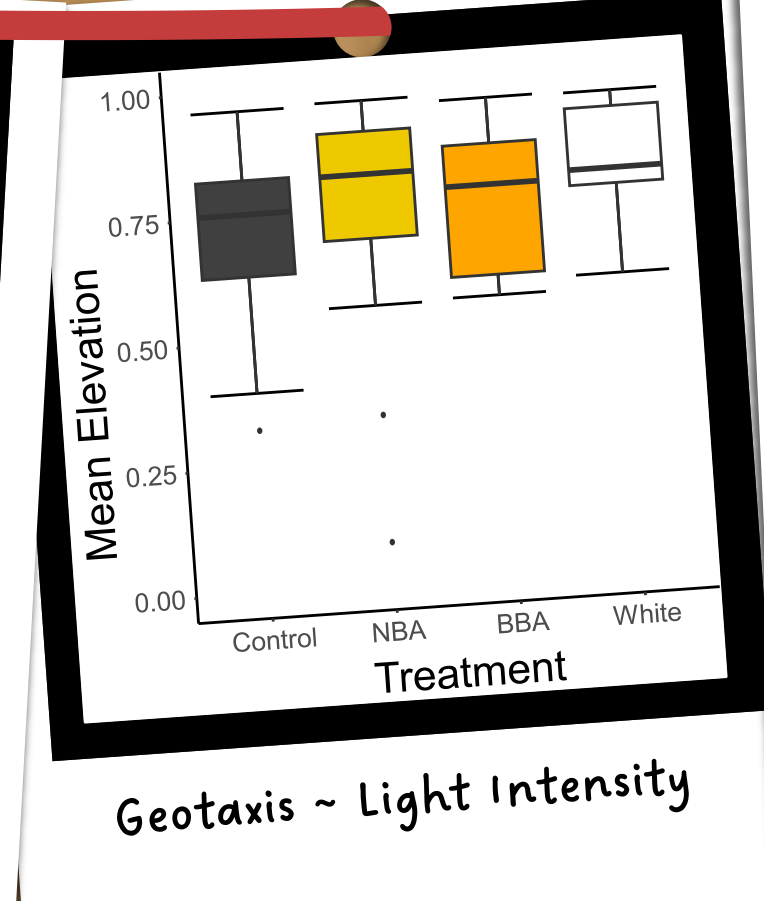
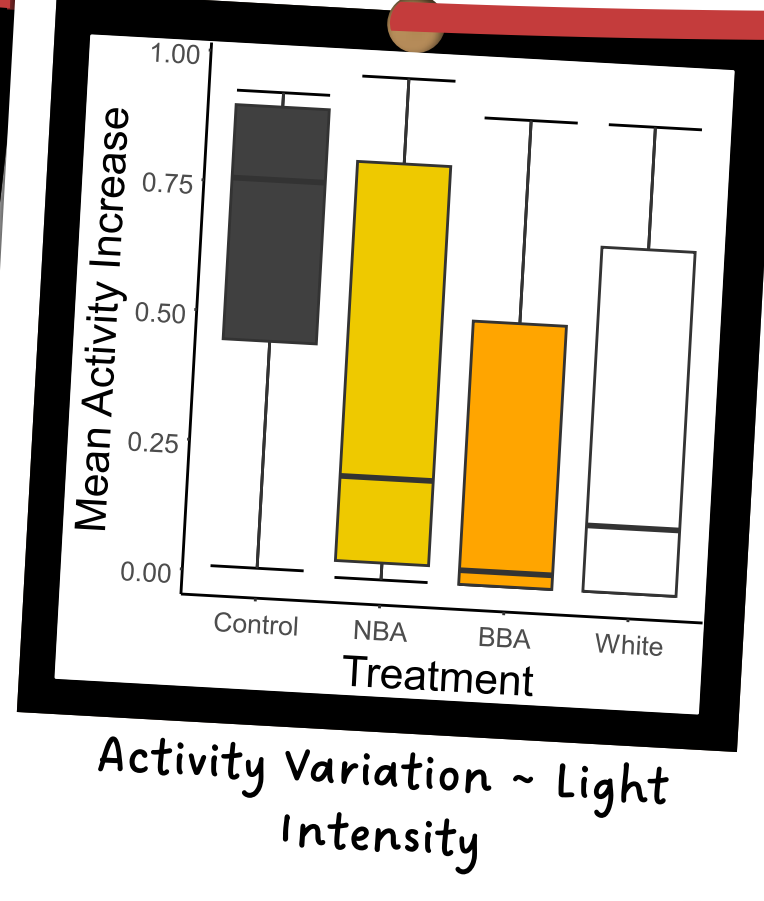
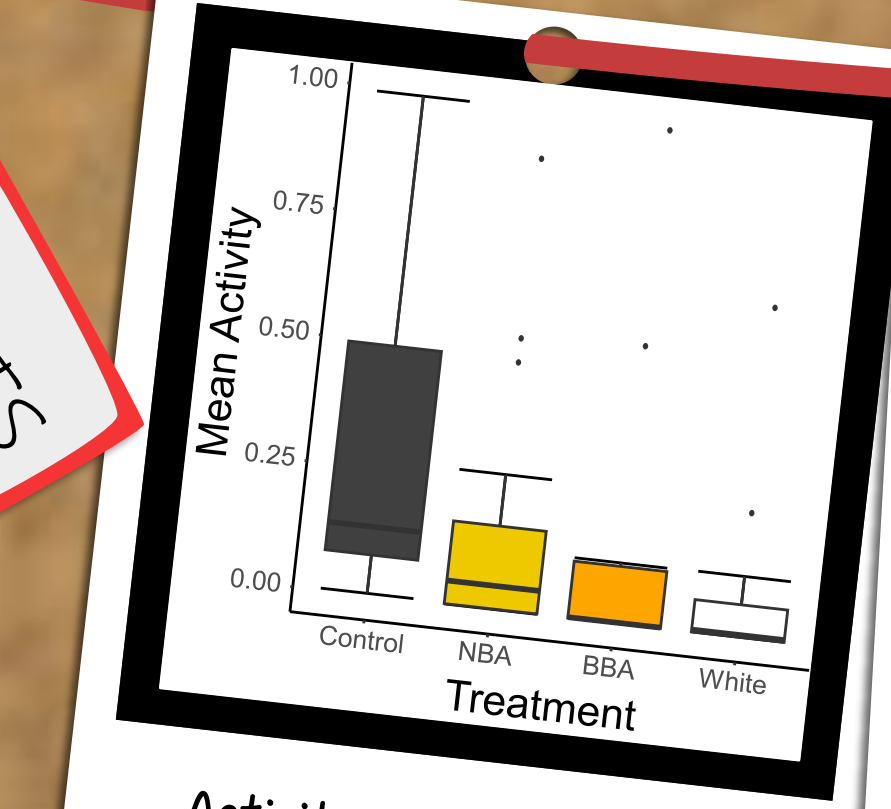
Activity levels and activity variation reduced by both intensity and spectra

Geotaxis affected by species-intensity interaction but not spectra

Phototaxis not affected by either intensity or spectra

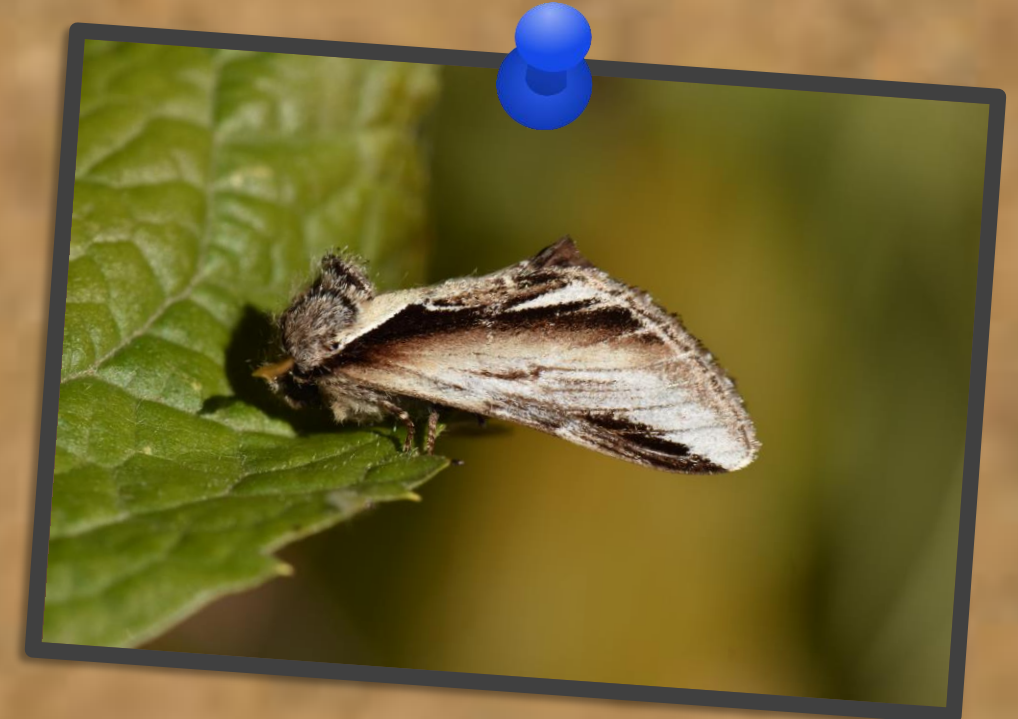
RESULTS

	Activity Levels	Peaks in activity	Geotaxis	Phototaxis
Intensity	✓	✓	✓	✗
Spectra	✓	✓	✗	✗



DISCUSSION

OUTCOME:
I show that both **spectrum** and **intensity** can impact moth behaviour
However, I also show that careful tuning of LEDs may help to mitigate these impacts
Namely, **reducing intensity** and **using narrow-banded amber lighting**
However, even at lowest intensity moth activity was still impacted



References:

[1] Macgregor, C.J., Pocock, M.J., Fox, R. & Evans, D.M. (2015) Pollination by nocturnal Lepidoptera, and the effects of light pollution: a review. *Ecological Entomology*, 40(3), 187-198.

[2] Jacobs, D.S., Ratcliffe, J.M. & Fullard, J.H. (2008) Beware of bats, beware of birds: the auditory responses of eared moths to bat and bird predation. *Behavioral Ecology*, 19(6), 1333-1342.

[3] Kaukonen, M., Ruotsalainen, A.L., Wälli, P.R., Männistö, M.K., Setälä, H., Saravesi, K., Huusko, K. and Markkola, A. (2013) Moth herbivory enhances resource turnover in subarctic mountain birch forests? *Ecology*, 94(2), 267-272.

[4] Boyes, D.H., Evans, D.M., Fox, R., Parsons, M.S. & Pocock, M.J. (2021) Is light pollution driving moth population declines? A review of causal mechanisms across the life cycle. *Insect Conservation and Diversity*, 14(2), 167-187.

[5] Longcore, T., Aldern, H.L., Eggers, J.F., Flores, S., Franco, L., Hirshfield-Yamanishi, E., et al. (2015) Tuning the white light spectrum of light emitting diode lamps to reduce attraction of nocturnal arthropods. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 370(1667), 20140125.