



Photo Credit: G. Ortiz

The Effect of Water Level on Burial in Beetle Family Haliplidae

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Background

- Climate change is causing droughts to increase in frequency and severity
- Drought directly affects aquatic ecosystems by changing water quality and availability¹
- Aquatic invertebrates have many diverse adaptations to respond to these changes, including dispersal and burial.
- In drying streams, aquatic invertebrates have been observed using sediment as a refuge from extreme environmental condition². However the specific drivers of this behavior are unknown.
- This study will examine how decreasing water level affects burial behavior in a widely distributed family of aquatic beetles, Haliplidae³.



Photo credit: M. Platt

Figure 1: One of the species used in the study, *Haliplus punctatus*.

Research Question

How does water level influence burial behavior in Haliplidae?

Sampling & Husbandry

- Haliplid beetles were collected from Corte Madera Pond, San Diego County, CA
- Beetles were maintained at 16°C with aerators and fed brine shrimp every 2 days



Experimental Design

- In each 2-ounce cup there was a toothpick for perching, 1.0cm of sediment and one of three water levels
- 90 beetles were randomly assigned to 2-ounce cups and placed in an incubator at 8°C (Figure 2)
- We observed burial every 24 hours for 10 days

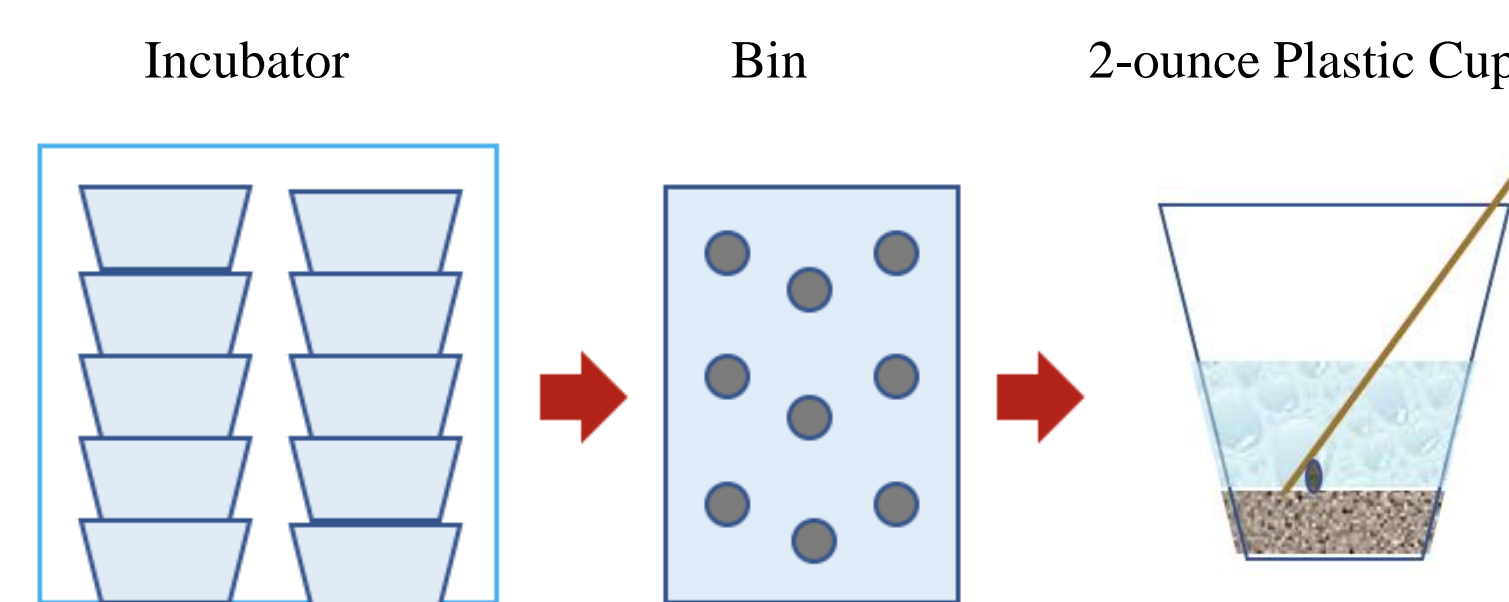


Figure 2: Experimental design including the incubator (side view), plastic bins (top view), and the 2-ounce plastic cup with toothpick as perch (side view).

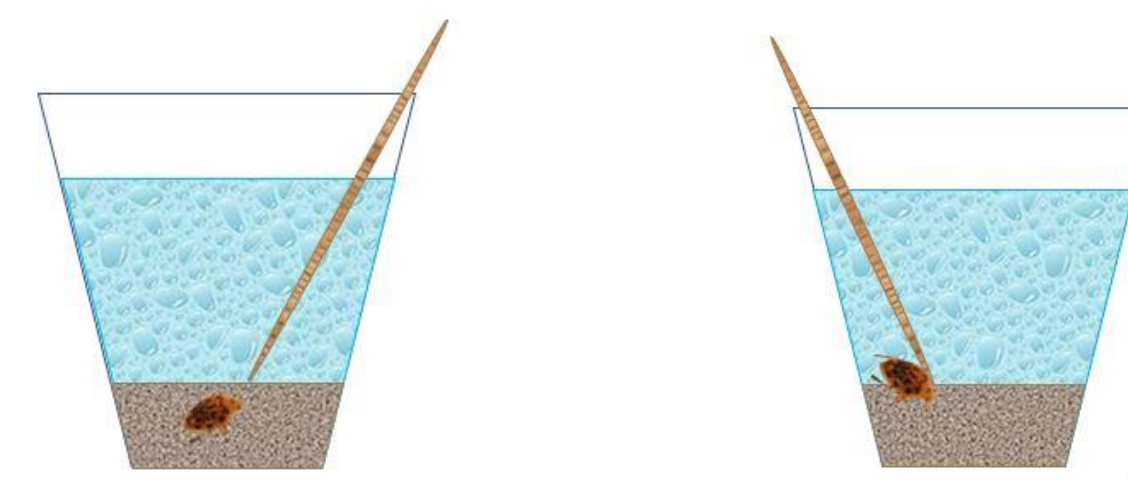


Figure 3: Burial was defined as fully covered by the sediment (left) or wedged between the sediment and toothpick (right)

Data Analysis

- All data analysis was preformed in SPSS
- ANOVA: proportion buried ~ water level x temperature
- ANOVA: proportion buried ~ water level
- Bonferroni post hoc comparison: proportion buried ~ water level
- Linear regression: proportion buried ~ day + water level

Results

As water level increases, burial also increases

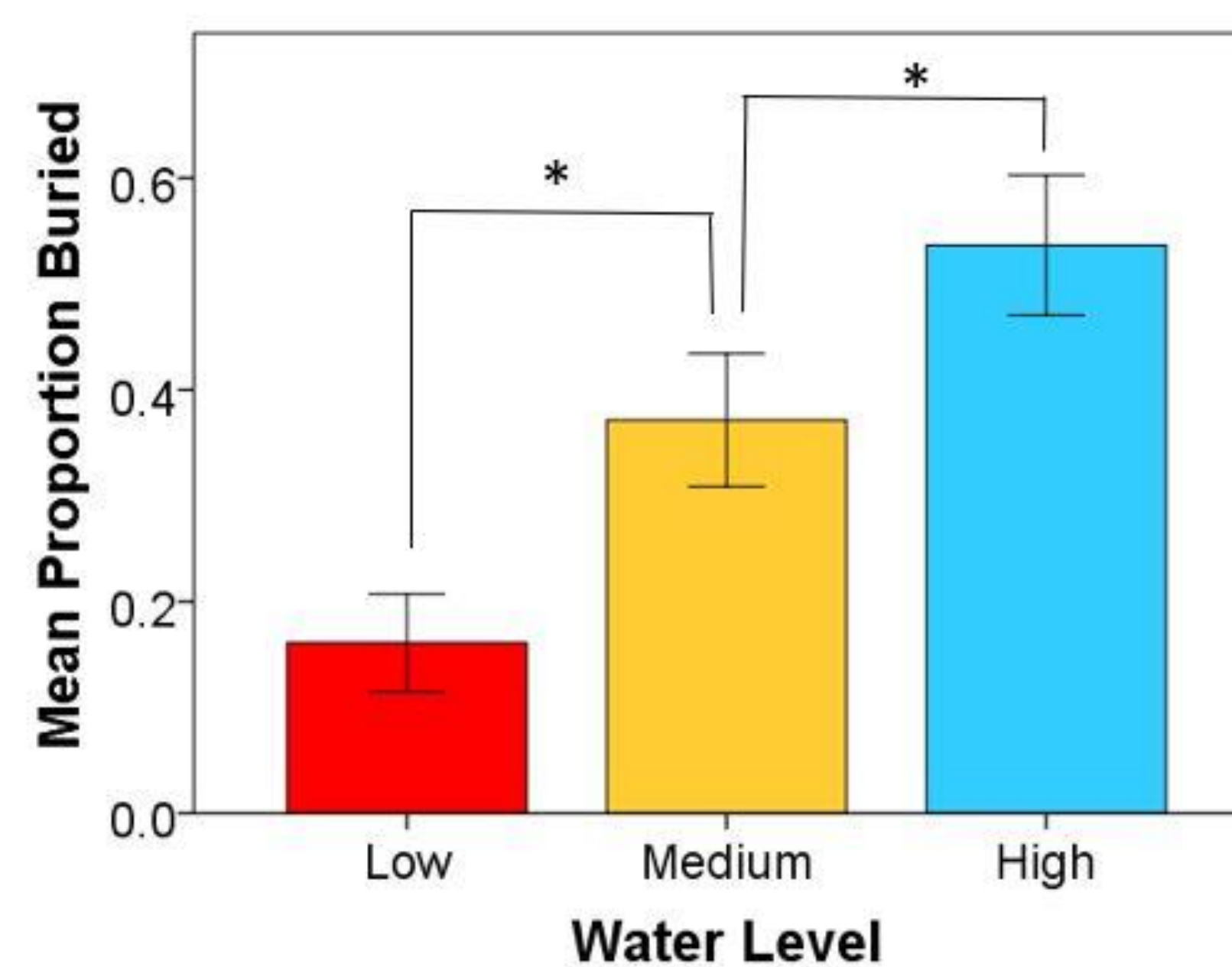


Figure 4: The Effect of Water Level on Mean Proportion of Beetles Buried. ANOVA: $f = 40.738$, $d.f. = 2$, $p < 0.001$. Bonferroni post hoc: low<medium; $p < 0.001$, medium<high; $p < 0.001$, low<high; $p < 0.001$

Results

Time does not affect burial

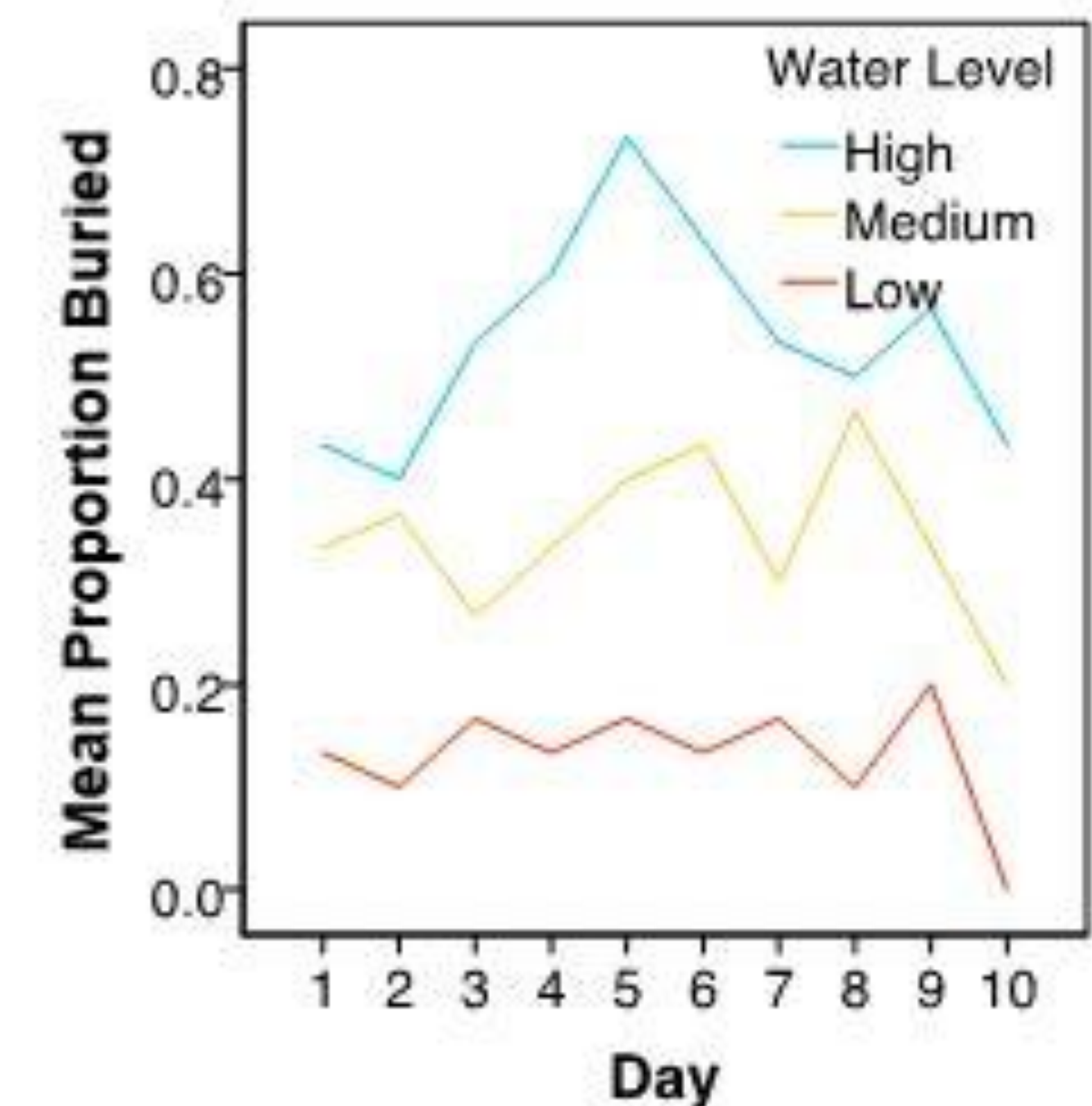


Figure 5: The Effect of Time in Days on the Proportion of Beetles Buried. Linear Regression: $f = 0.299$, $d.f. = 1$, $p = 0.586$

Conclusion

- Contrary to literature regarding burial in other aquatic invertebrates⁴, Haliplidae was observed burying more with increasing water level (Figure 4), regardless of time (Figure 5)
- Burial is often an important resistance behavior for many aquatic invertebrates⁴, but might not be a drought response of Haliplidae
- Haliplidae may instead employ other drought resistance behaviors

Implications

- It is important to understand how aquatic invertebrates respond to drought conditions in order to predict how these changes may affect aquatic ecosystems
- Further research is needed to investigate the resistance behaviors of Haliplidae, and what environmental factors influence different behaviors

References

- Lake, P. S. Ecological effects of perturbation by drought in flowing waters. *Freshwater Biology* 48, 1161–1172 (2003).
- Storey, R. & Quinn, J. *Survival of aquatic invertebrates in dry bed sediments of intermittent streams: Temperature tolerances and implications for riparian management*. 32, (2013).
- Durfee, R. S., Knight Jasper, S. & Kondratieff, B. C. Colorado Haliplidae (Coleoptera): Biogeography and Identification. *Journal of the Kansas Entomological Society* 78, 41–70 (2005).
- Gough, H. M., Gascho Landis, A. M. & Stoeckel, J. A. Behaviour and physiology are linked in the responses of freshwater mussels to drought. *Freshwater Biology* 57, 2356–2366 (2012).