



# Effect of light intensity and near-bed current velocity on benthic community structure in a mountain stream



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## ABSTRACT

The purpose of this study was to examine the influence of light intensity and near-bed current velocity on benthic periphyton and macroinvertebrate abundance in Snodgrass Creek, a small, high-altitude stream (9700 m elevation) located near the Rocky Mountain Biological Laboratory. I hypothesized that benthic periphyton would be positively related to both light intensity and near-bed current. I further hypothesized that macroinvertebrate abundance would be reduced in treatments having lower light intensity due to decreased accumulation of periphyton, which provides food to many macroinvertebrates.

## MATERIALS & METHODS

Two sections of the stream were selected for study; one with relatively homogeneous current, another with more heterogeneous current. Light levels were manipulated by layering shade cloth over PVC frames to create a 5-step light gradient that was replicated twice (n =10). Trays containing stream cobbles were placed on the streambed under each frame and near-bed current was recorded. After 25 days, macroinvertebrate and periphyton samples were collected from the trays.



Setting up the study on Snodgrass Creek. Substrate tray in the lower right photograph.

## RESULTS & DISCUSSION

The data supported my first hypothesis in that decreased light intensity would yield less periphytic AFDM (Fig 1), but that AFDM would be positively related to near-bed current (Fig 2). Algal biomass typically increases with light and thus decreases with stream shading Wellnitz and Ward 2000; Hill et al. 2008).

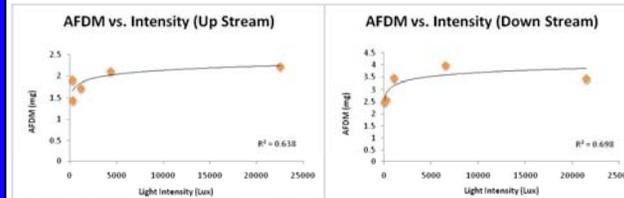


Figure 1. The effect of light intensity on AFDM for the upstream replicates (Left) (r<sup>2</sup>= 0.64) and for the downstream replicates (Right) (r<sup>2</sup>= 0.70). Note that periphytic AFDM was greater downstream.

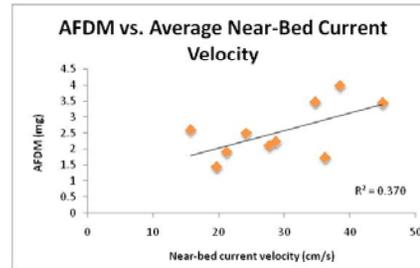


Figure 2. The effect of near-bed current velocity on AFDM for all replicates (r<sup>2</sup>= 0.37).

The data support my second hypothesis that macroinvertebrate abundance would be reduced in treatments having lower light (Fig 3).

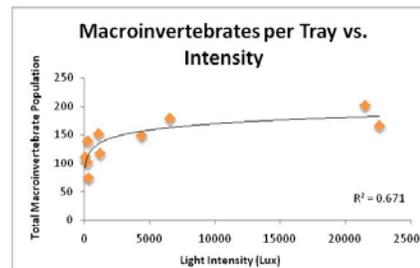


Figure 3. The effect of light intensity on the total macroinvertebrate population for all replicates (r<sup>2</sup>= 0.67).

Non-metric multidimensional scaling (NMDS) showed macroinvertebrates varied in a consistent pattern across the shade gradient (Fig 4).

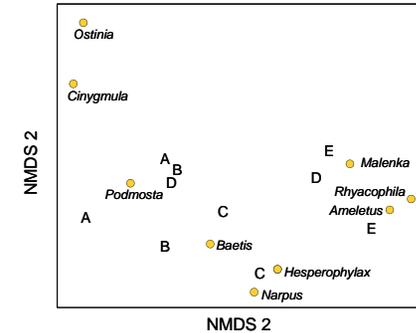


Figure 4. NMDS showing relative proportion of macroinvertebrates from least (A) to most (E) shaded replicates.

## CONCLUSIONS

My results indicate that:

- Periphyton and macroinvertebrate abundance had a positive relationship to light intensity and near-bed current velocity.
- Light intensity had no effect on the relative abundance of the different macroinvertebrate taxa.

## LITERATURE CITED

Hill, W. R., Fanta, S. E., and Roberts, B. J. 2008. <sup>13</sup>C dynamics in benthic algae: Effects of light, phosphorus, and biomass development. *Limnology and Oceanography* 53:1217-1226.

Wellnitz, T. A., and Ward, J. V. 2000. Herbivory and irradiance shape periphytic architecture in a Swiss Alpine stream. *Limnology and Oceanography* 45:64-75.

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