

Trends in Invertebrate Feeding Strategies Due to Light Intensity Changes in Little Niagara Creek

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Introduction

Landscapes around streams change as a consequence of natural and human development. Shading by vegetation and bridges, for example, reduces light, limits photosynthesis, and may decrease primary production (plant and algal growth) in the stream. Primary production in shaded streams can be four times lower compared to open streams (Hill *et al.* 1995). Decreased primary production may also impact benthic (streambed) macroinvertebrate communities by changing functional feeding group ratios.

Functional feeding groups (FFGs) are used to classify benthic macroinvertebrates by their method of food acquisition. Examining the relative abundance of different FFGs can be used to understand stream function (Jonsson & Malmqvist 2003). Shade typically decreases algal and macroinvertebrate abundance (Sturt *et al.* 2011) and we wanted to investigate how shading would effect the benthic community in Little Niagara Creek.

We hypothesized that:

If areas previously exposed to natural light are shaded, there will be lower algal production, and this will decrease the grazer FFG (which feed on algae) and an increase shredders (which feed on dead leaves).



Macroinvertebrates from Little Niagara Creek samples. From left to right, Net-spinning Caddisfly (*Hydropsychidae*), Darner Dragonfly (*Aeshnidae*), Aquatic Sow Bugs (*Asellidae*), Broadwinged Damselfly (*Calopterygidae*), Crayfish (*Cambaridae*), Fingernail Clams (*Sphaeriidae*)

Results

Light intensity decreased by 94% and 80% in high and medium shade treatments, respectively, compared to the unshaded treatment (Fig. 2).

Grazer and shredder FFG abundance did not differ significantly across light treatments (Fig. 3).

Collectors, which feed on fine particulate organic matter, increased in as shade increased (Figs. 3 & 4).

Algae abundance (diatoms) decreased in the shade (Fig. 4).

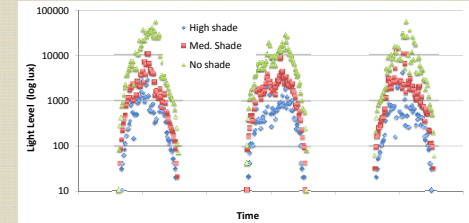


Figure 2. Light intensity (lux) measured for the three light treatments for three days at the end of the experiment. Note the log scale.

Discussion

As predicted, algal growth decreased in lower light; however, the other parts of our hypotheses were not supported.

Although there were fewer Grazers under deeper shade, the trend was not significant, and Shredder numbers did not change across light treatments.

Only collector abundance responded to the light treatments, showing a significant increase as light decreased.

Collectors may have been responding to increased food resulting from upstream disturbance. Our shade treatments were positioned downstream of each other. Upstream activity may have stirred up particulate organic matter (food for collectors) and deposited it in shade treatments downstream.

Although benthic species composition did not change as we predicted, our data suggest (e.g., less algae and fewer grazers in low light) that a longer-term experiment of several weeks may have shown more pronounced effects.

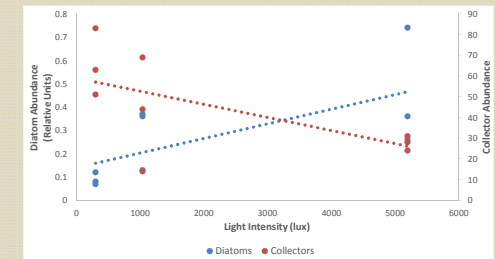


Figure 4. Algal and collector abundance across light treatments in Little Niagara Creek after 18 days. Algal abundance was measured as chlorophyll-a. A negative correlation was found between light availability and collector abundance ($r^2=0.51$, $p=0.03$), while light intensity had a positive relationship with algal abundance ($r^2=0.54$, $p=0.02$).

Methods

Two screen panels were created to decrease sunlight. High shade treatment had four layers; Medium shade treatment had two layers of screen; No shade treatment had no screen.

Three substrate baskets containing gravel were placed within each light treatment (Fig. 1). Gravel provided macroinvertebrates habitat and each basket contained a tile for measuring algal growth.

Substrate baskets and tiles remained in the stream for 18 days in October.

Light intensity was measured with a HOBO™ light logger placed in each treatment.

Baskets were collected and invertebrates were identified and sorted into their Functional Feeding Guilds (FFG): Grazer, Shredder, Collector, or Predator. FFGs represent the different feeding strategies within stream ecosystems.

A portable BenthosTorch™ fluorometer measured algal abundance as chlorophyll-a on each tile.

Figure 1. Three light treatments were created in Little Niagara Creek, Eau Claire, WI. Shades were suspended over two treatments to reduce light intensity (top photo). Each light treatment had three mesh baskets filled with rock substrate for colonization by invertebrates and a clay tile for colonization by algae (middle diagram). One light treatment was not covered by a shade and had natural light exposure (bottom photo).

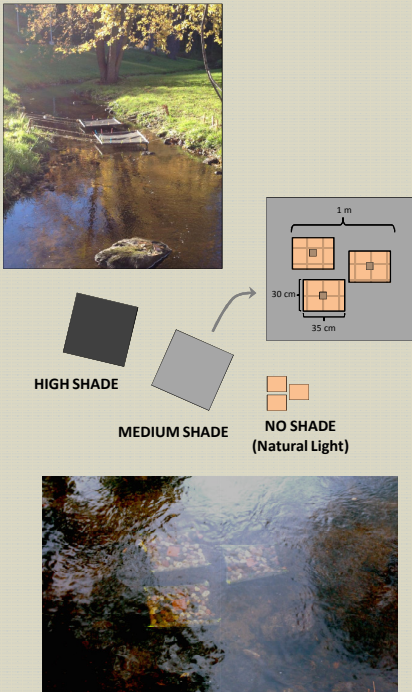
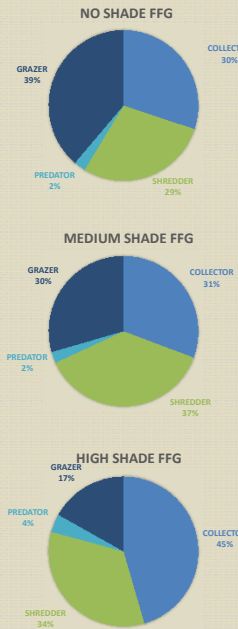


Figure 3. Invertebrates collected from baskets within three treatments of different light intensity from an 18 day study were sorted into Functional Feeding Guilds (FFG).



Literature Cited

Jonsson M & Malmqvist B. (2003). Importance of species identity and number for process rates within different stream invertebrate functional feeding groups. *Journal of Animal Ecology* 72: 453–459.

Sturt M, Jansen M & Harrison S. (2011). Invertebrates grazing and riparian shades as controllers of nuisance algae in a eutrophic river. *Freshwater Biology* 56: 2580-2593.

Hill W, Ryon M & Schilling E. (1995). Light limitations in a stream ecosystem: responses by primary producers and consumers. *Ecology* 76: 1297-1309.