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Net Tending Behaviors of *Hydropsyche* (genus) (Trichoptera: Hydropsychidae) After Repeated Applications of Suspended Sediment Loads.

Aaron From

Advisor: Jeff Runde

ABSTRACT

Clay, coal and leaf particles in a gradient of sizes were loaded multiple times (within a 24 hour time period or once a day for four days) into simulated stream habitats containing *Hydropsyche* insects and silken net retreats. Significant differences in net tending behaviors between insects was observed only after application of leaf particles >250um. Overall, results and subsequent comparison of data to the work of Runde 1998 indicates that a threshold may exist near 64um at which point repeated application (within 24 hours) of greater sized particles causes net destructive behavior while smaller sized particles have no significant effect on net tending behavior. Furthermore, a similar threshold may exist near 250um at which point larger sized particles can significantly alter net tending behaviors.

INTRODUCTION

Suspended sediment pollution can directly harm stream ecology. Stream ecologists continue to focus research on the damaging and lethal effects posed by these sediments. However, the strong susceptibility of filter feeding aquatic insects of the order Trichoptera to sediment loading gives way to the research presented here.

Two families of Trichoptera, Hydropsychidae and Polycentrapodidae, construct silken retreats on rocks and decaying wood. Hydropsychidae, the focus of this study, contains the largest and most important genera of filtering Trichoptera. (Hilsenhoff,

1995). The characteristic silken nets built by Hydropsychids are used to filter food while allowing a hydrodynamically sound flow of oxygen rich water into the insect's retreat. Unfortunately, sediments can clog these nets; disrupting water flow and particle filtering. The insects respond to this suspended sediment pollution by a variety of net tending behaviors ranging from simple cleaning of the net to total net destruction (Runde, 1998).

The main objective of this study was to determine the net tending behaviors of *Hydrophsyche* (genus) after multiple applications of coal, clay and leaves of specific particle sizes. The ultimate goal of this research is to allow support and expansion of a scientific theorem which may allow for the accurate prediction of the effects caused by sediment loading.

MATERIALS AND METHODS

Hydropsyche were collected from Tenderfoot Creek Wisconsin. Five to eight insects were placed in each stream simulation chamber described by Runde 1998. Five chambers were used for each suspended sediment experiment. Chambers were filled with sand, small rocks and water from Tenderfoot Creek or Tenderfoot Lake. The water level and water temperature (19 +/- 3'C) were maintained throughout all experimentation. Insects were fed every 24 hours with ground TetraMin® Flake Food for Tropical Fish. Suspended sediment tests were begun after net position mapping.

Clay, coal, and leave particles were used in multiple loading suspended sediment tests. 250-500um clay particles and <64um

leave particles were used in multiple loading experiments, in which all treatments occurred within 24 hours. Clay was added every 4 hours, while leaf particles were added every 6 hours at a loading rate of 0.5g. The time of loading was dependent upon the minimum time required for the insects to begin cleaning the nets after the first treatment.

64-125, 125-250, and 250-500um leaf particles as well as coal dust were used in multiple loading experiments in which 0.5g treatments were added to the chambers once every 24 hours for a total of four days.

All statistical tests were done with SigmaStat 2.0 (Jandel Corp., Chicago, IL). The Repeated Measures ANOVA on ranks was used to test for destructive net testing behavior.

RESULTS

There was no significant difference in the net tending behaviors of net cleaning and net destruction between the insects after multiple application of either the clay (P=0.125) or coal (P=0.522) particles. After multiple applications of the clay particles within the 24 hour time period 100% net cleaning was observed. Furthermore, multiple applications of coal over the course of 4 days resulted in 13% total net destruction.

In the leaf particle experiments there was no significant difference between net cleaning and net destruction for the insects after multiple application of leaf particles of sizes <64um (p=0.502) , 64-125 (p=0.145) and 125-250um (p=0.257). However, there was a

significant difference in net tending behaviors after multiple treatments of the 250-500um leaf particles ($p<0.001$). Control replicates showed no destructive net tending behaviors.

Additionally, after four applications of the <64um leaf particles within 24 hours 100% net destructive behavior was observed. However, after one treatment of 64-125, 125-250 and 250-500um leaf particles within 24 hours, there were respectively 33%, 29% and 43% observed net destructive behavior (Fig. 1).

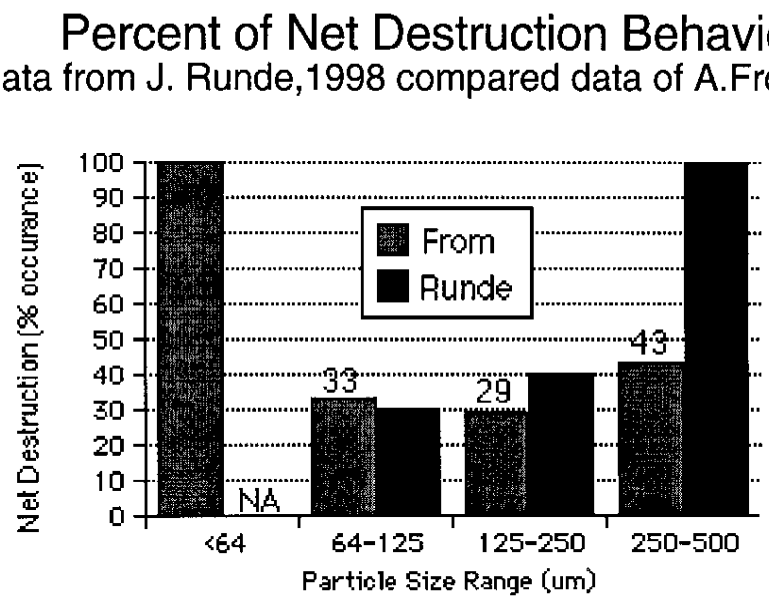

Fig.1. Percent of net destructive behavior vs. leaf particle size range (load rate=0.5g). Data from both this study (From) and the work of Runde 1998 is shown. It should be noted that all data is after 1 day of treatment. The <64um treatments were applied 4 times in the 24 hour time period while all other particle sizeswere applied one time.

DISCUSSION

Net tending behavior of *Hydropsyche* (genus) is significantly different between insects after multiple applications of 250-500um leaf particles. All other multiple sediment loading experiments resulted in no significant difference in net tending behaviors. Significant difference resulting after single application of 250-500um leaf particles (0.5g load) to the *H.sparna* retreats was also observed by Runde 1998. Furthermore, Runde 1998 did not find significant differences after single application of the <64 and 125-250um leaf particles. Overall, the correlation between both this work and the Runde 1998 experiments may indicate that a threshold may exist near 250um at which point larger sized particles can significantly alter net tending behaviors of *Hydropsyche*.

Leaf particles <64um were applied 4 times within 24 hours, while all other sized leaf particles were added once in a 24 hour period. Comparison of the net destructive behaviors after 24 hours indicates that the multiple applications of <64um leaf particles resulted in higher net destruction than would be predicted (about 30% predicted from Fig. 1). The high percentage of net destructive behavior may indicate that repeated application of leaf particles within 24 hours causes greater net destructive behavior than would be observed after one time application of leaf particles.

Repeated application of clay and coal particles resulted in no destructive net tending behaviors. These results correspond to

Runde 1998 in which net destruction was not observed after clay or coal application. Possible explanation for the innocuous effects caused by clay and coal could be the minute particle sizes of these sediments. Upon contact with water clay of all sizes dissolves into <1um particles, while coal dust, which is easily ground, is much smaller than 64um.

Additionally, <64um leaf particles, which are not easily ground, retain a size very near to 64um. These leaf particles effect a 100% net destructive behavior after multiple applications within 24 hours. Overall, a particle size threshold may exist near 64um at which point multiple application (within 24 hours) of greater sized particles causes net destructive behavior while smaller sized particles have no significant effect on net tending behavior.

BIBLIOGRAPHY

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