TRANSACTIONS, ILL. STATE ACAD. SCI.
Vol. 69, No. 4 (1977)

DISTRIBUTION OF *HYDROPSYCHE* AND *CHEUMATOPSYCHE* (TRICHOPTERA: HYDROPSYCHIDAE) IN RELATION TO THE THICKNESS OF AN ALGAL MAT

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ABSTRACT

The number of caddisfly larvae in the Fox River, Illinois, were found to decrease as the thickness of an algal mat decreased. The mat apparently provides support for larval retreats and possibly increased food availability. Algal mat thickness was postulated as a means of estimating caddisfly populations.

INTRODUCTION

The relationship between benthic invertebrates and plant detritus has recieved considerable attention. Egglishaw (1964) found 70 per cent of the river invertebrate fauna associated with plant detritus. Recently numerous investigators have associated the type and amount of detritus with the feeding activity of various macroinvertebrates (Fahy, 1972; Cummins et al., 1973; MacKay and Kalff, 1973; Wallace, 1975a). Many of these researchers, as well as Cummins (1964) and Wallace (1975b), have indicated that trichopteran presence and abundance may be related to detritus both as a source of food and for material for construction and attachment of larval retreats. These investigations have delt with detritus which usually collects in protected areas behind or under rocks or other debris, however, the Fox River, Illinois, has a thick layer of alga-bound detrital debris on the substrate below flood control weirs. In this study we investigated the occurrence of two genera of Hydropsychidae in relation to the quantity, as measured by thickness, of the algal mat.

STUDY SITE AND METHODS

Seven sites were sampled including, from the northern-most site to the mouth of the river: Waterford, Wisconsin, and Algonquin, Elgin, South Elgin, Geneva, Montgomery, and Dayton, Illinois. Samples were

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taken from late June to early August of 1973 and 1974. Since emergence of most Hydropsychidae reported from the Fox River takes place from April to September (Ross, 1944) the caddisfly larval population included both early and late instars. All sampling sites were in the riffle-rapid areas below small flood control weirs located in the previously mentioned cities. Samples were taken in 40 to 60 cm of water. Water chemistry of the sites was similar. The substrate was predominantly gravel with small rocks. A minimum of five samples were taken at each sampling site with a 0.1 m^2 Surber net. The net was used as a gathering devise with all the substrate to a minimum depth of 6 cm collected in the net. The substrate and debris were then placed in plastic trays and covered with water. After the collected material was allowed to stand in the trays for 30 minutes, which resulted in the movement of the larvae out of their retreats since there was no current, the rocks and large pieces of gravel were scraped. A flotation technique described by Anderson (1959) using a sucrose solution with a specific gravity of 1.12 was used to collect the caddisfly larvae. The larvae were identified, counted, and the number per meter squared determined for each sample and site. Ten measurements of the algal mat were taken at each sampling site in a transect, 10 meters from the dam face, across the section of the river bottom which was always under water and approximately in the same area where the Surber samples were taken. The thickness of the algal mat was measured by inserting a metal ruler through the mat to the surface of a rock or to the gravel substrate and the depth of the mat surface marked with a moveable marker on the ruler.

RESULTS AND DISCUSSION

The algal mat was composed of small pieces of plant debris, primarily deciduous tree leaves and twigs, and sand which had collected in the filamentous algae *Cladophora*. It has been referred to as an algal mat in this paper since the basis for its formation was the *Cladophora* and it occurs on substrate subjected to currents. The caddisflies incorporated this material into their net-spun larval retreats. The densities of caddisfly larvae were the highest where the mat was the thickest, Table 1. The activity of larval retreat and pupal case construction would tend to aid in the process, along with the *Cladophora*, of binding the detrital material and sand into a thick mat on the substrate surface. As indicated by the high correlation coefficients, r values in Figure 1, this was particularly advantageous to *Hydropsyche* which have been found to construct their retreats and straining nets on the top of rocks (Wallace, 1975a). Thus through the support provided by the mat this caddisfly was able to construct its collection nets in areas where the current would carry more material into the nets. Some grazing on the *Cladophora* may also have occurred. Where algae were not available for the formation of a mat or as a food source, caddisfly larvae were not abundant. It was also noted that the composition of the caddisfly population changed as the mat depth decreased, *Cheumatopsyche* dominated the sites where little or no mat occurred, Table 1.

The regression analysis of algal mat thickness and caddisfly larval numbers showed a positive relationship between the numbers and

Table 1. Number of caddisfly larvae and thickness of the algal mat at each of the sampling sites, plus or minus one standard deviation. The sites are listed in order from the northern most site to the mouth of the Fox River.

Sampling Sites	No. of Surber Net Samples	Total Caddisfly Larvae per m^2	±	*Hydropsyche* Larvae per m^2	±	*Cheumatopsyche* Larvae per m^2	±	Algal Mat Thickness mm	±
Waterford	5	11024	652	6021	226	5003	630	5	1.3
Algonquin	8	18124	1648	11894	467	6230	394	30	4.2
Elgin	6	4935	287	2037	375	2898	125	8	2.1
South Elgin	8	13555	771	10315	411	3240	244	22	3.5
Geneva	8	15464	1082	13806	687	1658	384	26	6.3
Montgomery	5	2223	314	740	108	1483	262	1	0.8
Dayton	5	836	141	45	6	791	137	trace	

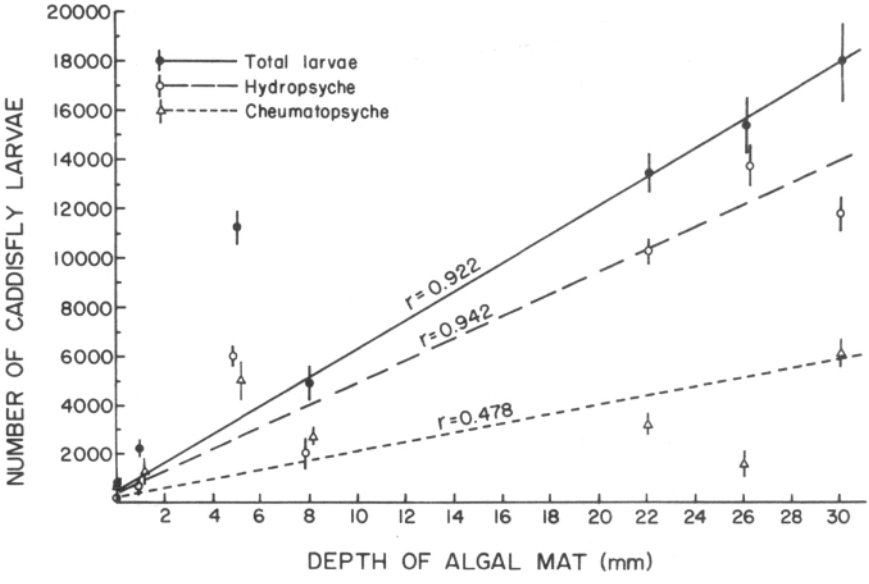

Figure 1. Regression analysis of algal mat thickness verses number of caddisfly larvae per meter squared of river bottom. The bars at each point represent one standard deviation and points are means of from 5 to 8 Surber sampler and 10 mat thicknesses.

mat thickness for *Hydropsyche*, *Cheumatopsyche*, and the total caddisfly cummunity. As in Figure 1, the strongest positive relationship was for total larval numbers and *Hydropsyche* numbers. *Cheumatopsyche* only had an r of 0.478 but the relationship was positive. Therefore, it may be possible to use mat thickness as an estimate of caddisfly larval numbers particularly for *Hydropsyche* and or the total caddisfly population. Application to other river systems will require further testing.

ACKNOWLEDGEMENTS

This research was partially supported by NSF-SOS Grant GY-10814. Thanks is also given Anita Jozefiak for help in the separation and counting of some samples and to Dr. James Brower for advice.

LITERATURE CITED

Anderson, R. O., 1959. A modified flotation technique for sorting bottom fauna samples. Limnol. Oceanog. 4:223-225.

Cummins, K. W., 1964. Factors limiting the microdistribution of larvae of the caddisflies *Pycnopsyche lepida* (Hagen) and *Pycnopsyche guttifer* (Walker) in a Michigan stream (Trichoptera: Limnephilidae). Ecol. Mono. 34:271-295.

Cummins, K. W., R. C. Petersen, F. O. Howard, J. C. Wuycheck, and V. I. Holt, 1973. The utilization of leaf litter by stream detritivores. Ecology 54:336-345.

Egglishaw, H. J., 1964. The distributional relationship between the bottom fauna and plant detritus in streams. J. Animal. Ecol. 33:463-476.

Fahy, E., 1972. The feeding behaviour of some common lotic insect species in two streams of differing detrital content. J. Zool., Lond. 167:337-350.

MacKay, R. J. and J. Kalff, 1973. Ecology of two related species of caddisfly larvae in the organic substrate of a woodland stream. Ecology 54:499-511.

Ross, H. H., 1944. The caddisfies, or Trichoptera, of Illinois. Ill. Natural History Survey Bull. 23:1-326.

Wallace, J. B., 1975a. Food partitioning in net-spinning Trichoptera larvae: *Hydropsyche venularis*, *Cheumatopsyche etrona*, and *Macronema zebratum*, (Hydropsychidae). Ann. Ent. Soc. Am. 68:463-472.

Wallace, J. B., 1975b. The larval retreat and food of *Arctopsyche* with phylogenetic notes on feeding adaptations in Hydropsychidae larvae (Trichoptera). Ann. Ent. Soc. Am. 68:167-173.