The Distribution of Macro-Invertebrates in Littoral Macrophytes in a Northern Indiana Lake

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Introduction

This study of the macroscopic invertebrate organisms which live in association with macrophytes, in the littoral zone of Dewart Lake (Indiana; Kosciusco County), is limited to the following seven aquatic plants: *Chara* species, *Potamogeton amplifolius*, *Nymphaea adorata*, *Elodea canadensis*, *Myriophyllum exalbescens*, and *Megalodonta Beckii*. These plants were chosen because of their variety in leaf exposure to the surface, amount of leaf dissection, denseness of plants in the average bed, and typical water depth.

It has been hypothesized by Gerking (1957) that the greater the leaf dissection the greater the variety in the animal population. The investigator realized that plants grow in different densities and have different surface area per length of stem.

Procedure

Exact quantitative sampling could not be done. However, since consistent methods and random collecting were used, the results should give a relative measure of the abundance of the phytomacrofauna. Organisms embedded in stems of macrophytes (such as several of the midge larvae) and those in association with roots and bottom mud are disregarded in this study.

At each collection, the habitat, water depth, and time of day were noted. Samples were taken from relatively pure beds of the plant studied, and plants collected were cut off above the roots. The collection procedure was to collect with a dipnet the surface insects seen at the site, obtain a random quantity of water from among the plants, and collect a random number of plants. Collections were made between July 10-July 27, 1964. Both time of day and water depth were varied for collections of each plant.

For analysis the water from each site was poured into a white enamel pan and the live macroscopic organisms were carefully picked out. The macroscopic invertebrates (this excludes Ostracoda, Copepoda, Cladocera, and some small Turbellaria) were identified to family and counted for each sample, with some specimens being preserved.

Results

The data showed that the majority of invertebrate groups studied appeared to form fairly constant percentages of the total macrofauna in association with a specific plant. The exceptions, which varied greatly among the different specimens of the same plant, were: Naiadidae on *Potamogeton natans* and *Megalodonta;* Trichoptera on *Chara* and *Elodea;* Tendipedidae on *Nymphaea* and *Potamogeton natans;* and Coenagrionidae on *Nymphaea*.

It was found that Elodea had the greatest percentage of total organisms and showed the greatest variety of invertebrates (22 of

the 29 groups studied), while *Potamogeton amplifolius* showed the least variety (14 groups). Figures 1 and 2 present a summary of results. The most numerous invertegrates were Diptera (primarily Tendipediate larvae) followed closely by Amphipoda. Some groups were significantly abundant on one plant and seldom occurred on another, such as: Planariidae (24.3% on *Potamogeton amplifolius;* 1% on *Chara*); and Amphipoda (47.9% on *Chara;* 3.9% on *Nymphaea*).

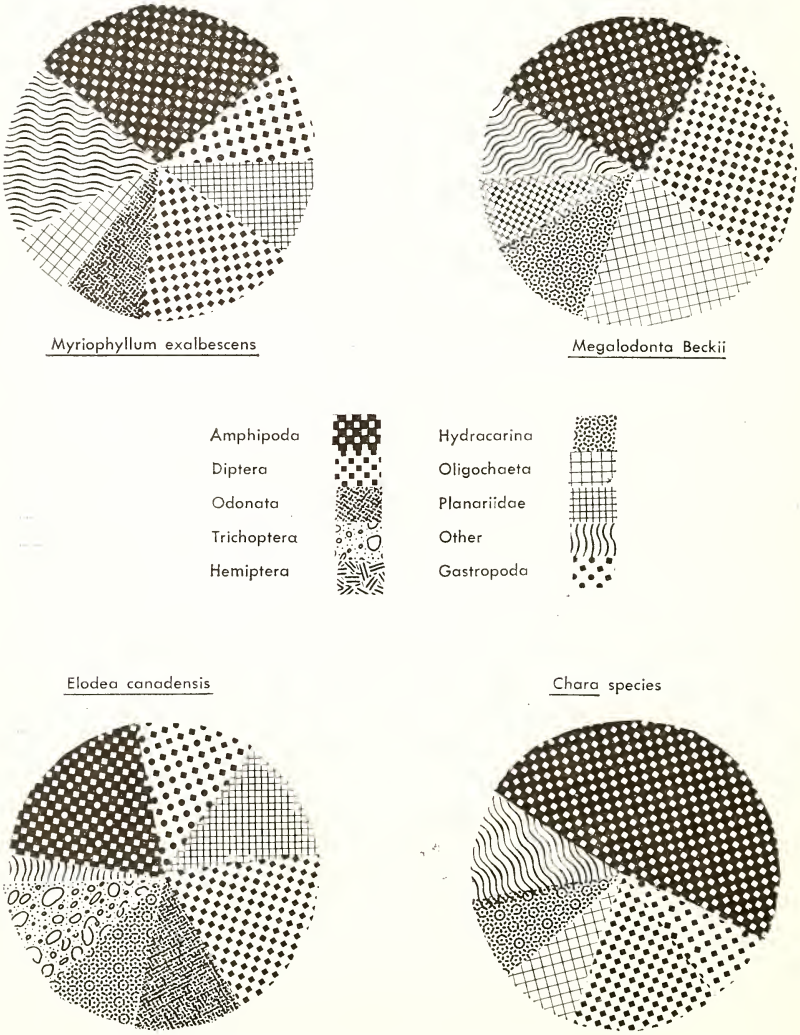

Fig. 1. Sector graphs showing animal abundance among 4 plants.

Discussion

It is interesting to speculate the reason for occurrence of particular groups on certain plants. This occurrence may be related to

plant form and function, as well as with known food and protective habits of the animals. Gastropoda—found primarily on *Myriophyllum, Elodea, P. natans,* and *P. amplifolius.* The leaves of these plants would provide ample support for the snail's attachment, while those of plants such as *Chara* would not. In addition, there may be a correlation be-

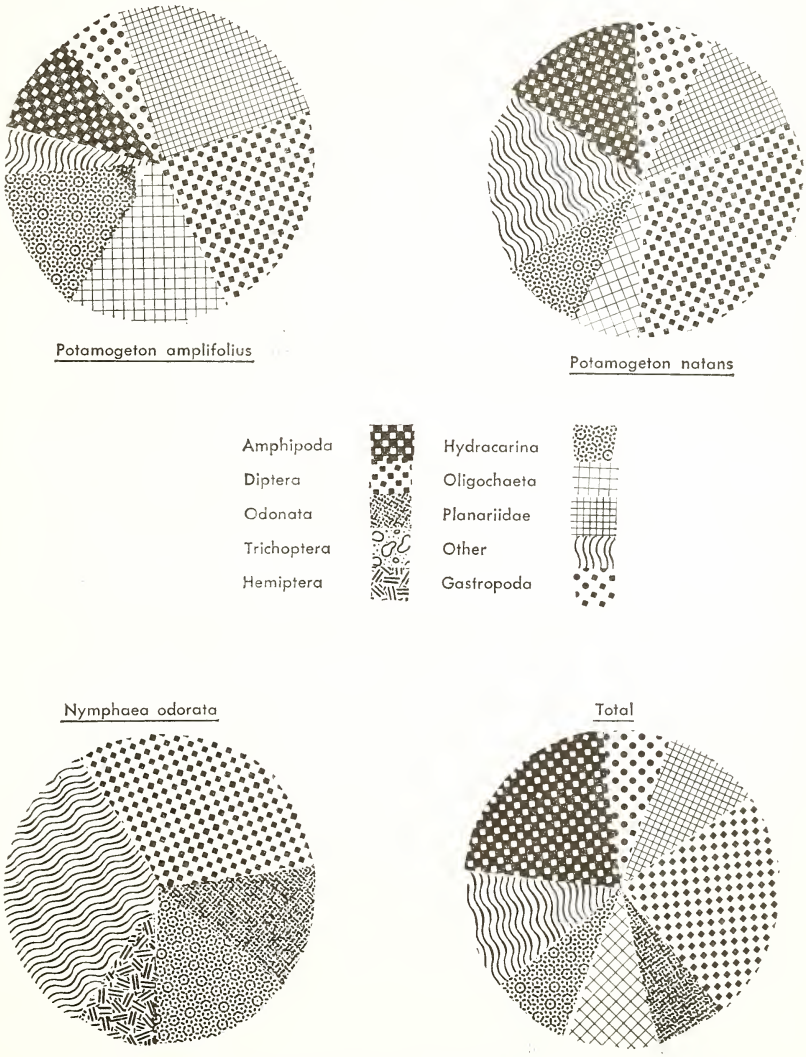

Fig. 2. Sector graphs showing animal abundance among 3 plants, and total.

tween the presence of a film of blue-green algae on these plants and the abundance of Gastropoda. This algae is the primary constituent of the snail's diet. Diptera—found primarily on *Megalodonta; Potamogeton natans,* and especially *Nymphaea.* Aside from the *Megalodonta,* this

prevalence might be explained by the requirement of the larvae to obtain most of their air by breaking the surface with their spiracles. Living in a patch of floating leaves would be advantageous. One Tabanidae larva (which typically would be buried in mud) was found, in *Chara*, a plant anchored in shallow water.

Coleoptera—found primarily on *P. natans* and *Nymphaea*, plants with floating leaves. The adults depend on atmospheric air and carry a film or layer of air on the wings while underwater.

Trichoptera—found significantly on *Elodea* and, to a lesser extent, on *Megalodonta* and *Myriophyllum*. Caddis fly larvae require a substrate for building a case as they grow.

Hemiptera—found primarily on *Nymphaea*, also on *Myriophyllum* and *Potamogeton natans*. The families represented skim about on the surface substrate. The Pleidae, which are known to swim in tangled vegetation, were found only in *Myriophyllum* and *Megalodonta*.

Odontata—found primarily on *Nymphaea*, *Myriophyllum*, and *Elodea*. A large number of empty cases from the nymphal instars were found on *Nymphaea* leaves and *Myriophyllum* fruits above the surface. These plants had an abundance also of small Gastropoda, Trichoptera, and Diptera, which make up the main diet of Odonata nymphs.

Ephemeroptera—found primarily on *Myriophyllum* and *Nymphaea*. Mayfly nymphs are vegetarian, and the families found are climbing, rather than burrowing, forms. The data gives no other correlation with the known habits of the order.

Hydracarina—found primarily on *Nymphaea*, *P. amplifolius*, and *Megalondonta*. The water mites rely upon the substrata, and if they swim far away they will eventually fall to the bottom. Since the nymphal stages parasitize both aquatic nymphs and flying forms, they are near the surface.

Amphipoda—*Chara* had by the far the largest percentage of this group, which were present significantly on all the plants except *Nymphaea*. Amphipods feed on debris of organic matter in *Chara* beds is dicates that the high concentration of organic mater in *Chara* beds is favorable. Amphipods react negatively to light, by hiding in the vegetation and their fusiform body shape may be an adaption for protection in greatly divided vegetation. Since *Nymphaea*, *P. amplifolius*, and *P. natans* have the smallest percentage, it appears that the Amphipods prefer a plant with dissected leaves.

Hirundinea—*P. amplifolius* had a small but significant quantity of leeches; the other plants had little if any. Leeches require a firm subtrate and hide during daylight, and were rarely found on plants with dissected leaves.

Oligochaeta—*Megalodonta* had the largest percentage of aquatic worms, and *Elodea* the smallest. Oligochaetes are thought to be specific to temperatures and organic pollution. They may survive in low concentrations of oxygen.

Planariidae—*P. amplifolius* and *Elodea* were leading in *Planaria*, and *Chara* had practically none. Planarians which respire through the body wall, require high concentrations of oxygen.

Hydra—The few found were primarily on *Elodea*. Hydrozoans are

carnivorous, feeding mainly on Cladocerans, Copepods, Insects, and annelids. *Elodea* had the greatest variety in organisms, and this may affect the presence of Hydras.

Conclusions

Although correlations between the invertebrate macrofauna distribution and their known habits can be made, no fast conclusions can be drawn. One of the most interesting observations, the fact that Amphipods comprise 50% of the *Chara macrofauna*, cannot be explained at this time.

This study has shown that invertebrate groups tend to have a fairly constant distribution on specific plants. In further work, it would be significant to study the invertebrate distribution in areas of different dissolved oxygen and calcium carbonate concentrations, of different temperatures, and of nature of the lake bottom. The macrofauna of a particular plant could be studied in plots of varying denseness and varying water depth. Another significant addition would be a controlled study of the time of collection and the variety of distribution found. In any such work a technique to achieve constant methods of collection would be pre-requisite.

Literature Cited

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