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The Effects of Harvesting Eurasian Watermilfoil on the Aquatic Weevil *Euhrychiopsis lecontei*

SALLIE P. SHELDON[1] AND L. M. O'BRYAN[2]

INTRODUCTION

The exotic aquatic weed Eurasian watermilfoil (*Myriophyllum spicatum* L.) continues to spread in lakes in parts of the United States and Canada. Various forms of weed control methods, including mechanical, chemical, and physical means are being used to manage the weed. An aquatic weevil (*Euhrychiopsis lecontei* Dietz) appears, in some cases, to be able to control Eurasian watermilfoil causing significant biomass reduction in the laboratory (Creed and Sheldon 1993), and in the field (Creed and Sheldon 1995, Sheldon and Creed 1995). The weevil preferred Eurasian watermilfoil (Sheldon and Creed 1995). Data from the six years following an Eurasian watermilfoil decline in a Vermont lake, show Eurasian watermilfoil has not regained its dominance, while native plant density has increased.

Before wide scale introductions of the weevil are made, we have been investigating a variety of factors that might influence weevil establishment. In this paper, we address use of the weevil in combination with mechanical harvesting, the most commonly used weed control method in Vermont.

STUDY SITE AND METHODS

Lake Bomoseen is a mesotrophic lake in Vermont with a surface area of ~1100 ha. Eurasian watermilfoil was first reported in the lake in 1982, and dominated the littoral zone by 1988. Eurasian watermilfoil has been managed for the last decade by mechanical weed harvesters and periodic water drawdowns.

To quantify the potential impact of weed harvesting on weevils, we set up three side by side areas of HARVEST and NO HARVEST. These areas ran 20 to 40 m along the shoreline, from the shallows to water 7 m deep. Through the study weeds were cut three times in the HARVEST area at the same time as the rest of the harvesting throughout the lake. HARVEST sites were immediately adjacent to the NO HARVEST sites. The edge of plants cut by the harvester was the point dividing the HARVEST and NO HARVEST areas.

We followed weevil density in all sites by collecting ten apical portions of plants along transects which were parallel to each other and perpendicular to shore, running shallow to deep. Two pairs of transects were located 1.5 m and ~ 5 m on either side of the line dividing HARVEST from NO HARVEST. The third pair was ~ 2/3 (13 to 25 m depending on bed) away from the dividing line. There were no significant differences in weevil density among the three parallel transects within a HARVEST or NO HARVEST site, thus n = 60 for each side by side pair for each date. Plants were examined under a microscope and the number of weevils recorded. Samples were collected weekly 5 July, after the first cut, until 25 September.

RESULTS AND DISCUSSION

Three harvesters ran continuously through the summer from late June to the last week of August. There was a significant negative effect of weed harvesting on weevil abundance

[1]Department of Biology, Middlebury College, Middlebury, VT 05753.

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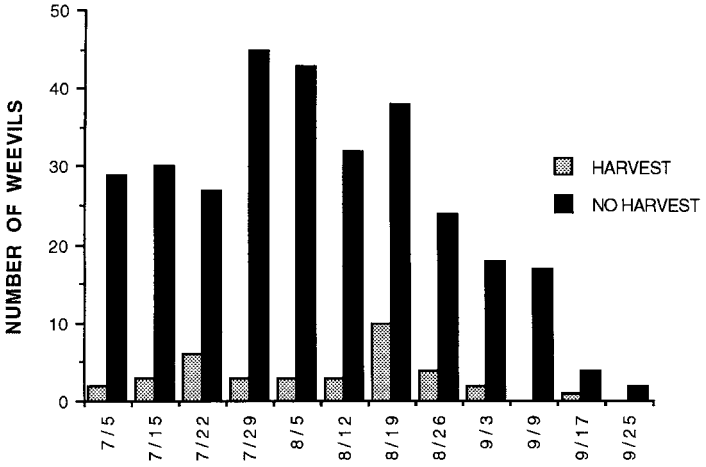

Figure 1. The total number of weevils collected in three pairs of contiguous areas where Eurasian watermilfoil was harvested, and not harvested. Values are the number of weevils per 60 stems.

(Figure 1). Over the summer there were fewer weevils found in HARVEST sites, which for the inner most transects were only 3 m apart from the NO HARVEST transect. Weevil densities remained higher in the NO HARVEST areas until the end of the summer when the weevils leave the lake to overwinter terrestrially (Sheldon and O'Bryan 1996).

Weevils spend most of their time in the 1.5 m apical portion of plants. Eggs are laid on the apical meristem, first instar larvae burrow into the meristem, larvae feed inside apical portions of stems, and adults feed on the stem and leaves (Sheldon and O'Bryan 1996). Thus, it is not surprising that there is a significant negative effect of harvesting, which removes the upper most portion of the stem, on weevil density.

Lake managers design weed control programs to fit a complex set of expectations by lake users. In many cases, such as for Lake Bomoseen, it would not be acceptable to the public to have no weed harvesting at all. In our case members of the lake association, the weed harvester coordinator and biologists from the Vermont Department of Environmental Conservation identified regions of shoreline where either there was no human activity (e.g. along undeveloped state or private land), or areas where harvesters could not effectively cut (an extended shallow area). We designated these low use areas as no harvest zones.

We have now maintained three no harvest areas in Lake Bomoseen from 1992 through 1995. In 1993 and 1994 weevils were introduced into some no harvest areas. Weevils have become established in two of the three sites, and weevil density has continued to increase through 1995, despite no additional introductions[3]. An integrated plan, combining harvesting of areas of high human activity with partitioning less used areas as no harvest zones, might be a feasible approach to Eurasian watermilfoil control in some lakes.

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