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Effects of Underwater Clipping of Purple Loosestrife in a Southern Ontario Wetland

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INTRODUCTION

Since its introduction from Europe in the early 1800's, purple loosestrife (*Lythrum salicaria* L.) has been expanding its range across mid-latitude wetlands of North America (Thompson et al. 1987). It is an aggressive perennial and a prolific producer of tiny wind- and water-borne seeds (Stuckey 1980). Under favourable environmental conditions it can form dense, monospecific stands, quickly filling open water areas and out-competing native plants. Purple loosestrife-dominated wetlands have little value as wildlife habitat (Rawinski 1982).

Past attempts to control purple loosestrife with herbicides (Smith 1964, Balogh 1986), burning (Evans 1982), or mowing (Malecki and Rawinski 1979, Rawinski 1982) have had mixed success. Flooding established stands of adult plants may slow growth and reduce stand densities (Malecki and Rawinski 1979), but has not proved to be a successful means of control (McKeon 1959, Smith 1964). The plant develops stem roots and new layers of aerenchyma within the first few days of submergence, allowing it to withstand periodic flooding (Rawinski 1982).

Underwater cutting has been shown to be an effective control technique for a number of emergent vegetation species. Experiments with *Typha latifolia* L. showed that mowing and flooding the cut ends (Beule 1979) or underwater cutting (Murkin and Ward 1980, Sale and Wetzel 1983) severely reduced plant densities. With the cut stems under water the plants cannot transport oxygen from the surface to the rhizomes and die before new shoots reach the surface (Sale and Wetzel 1983). Stands of *Phragmites australis* L. have also been controlled by clipping under water (Martin et al. 1957, Husak 1978). A stand of purple loosestrife at Montezuma National Wildlife Refuge in New York State was successfully controlled by clipping adult plants under water at the soil surface (G. Hocutt, unpublished data).

The objective of our study was to assess the effectiveness of underwater cutting as a means of eliminating established adult purple loosestrife plants in southern Ontario marshes, and to determine the influence of season of cutting on the degree of control achieved.

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METHODS

Clipping experiments were conducted during summer, 1987 at Green Gables Marsh, near Kingston, Ontario, (44° 46′N, 76° 01′ W). The wetland has an established population of purple loosestrife with no other emergent macrophytes.

A 30 m by 30 m study area was selected in a stand of adult purple loosestrife plants and divided into 100 plots measuring 3 m by 3 m each. Ten randomly selected plots were assigned to each of four treatments: uncut controls, and three experimental treatments in which all purple loosestrife plants within the plots were clipped a minimum of 10 cm below the water surface using hand-held clippers. The three experimental treatments differed in the date of clipping: early summer (16 June), mid-summer (15 July), and late summer (18 August). Water depth at the marsh was 40 to 50 cm until the late fall, when water levels fell to 20 to 30 cm.

The number of live stems in each control plot was counted monthly from 16 June to 15 October 1987, and from 15 June to 15 August 1988. Monthly counts began in the treatment plots following cutting. A two-way ANOVA was used to determine if treatment and date of count had any significant effect on densities.

RESULTS AND DISCUSSION

The mean numbers of stems per plot for each treatment are shown in Figure 1. There was no significant effect of the clipping treatments ($F = 0.45$, $P = 0.942$). The 15 June clipping took two months to attain control densities, whereas the 15 July and 15 August treatments were at control densities within one month.

Linde et al. (1976) suggested that mowing should be done when the below-ground reserves of the species under consideration are lowest. In cattail and other aquatic plants this occurs just before peak above-ground biomass and flowering, and before the plant begins to translocate carbohydrates to the rhizomes (Linde et al. 1976). Peak flowering in purple loosestrife is reached by early August in Ontario (Keddy 1988). We found there was no one time of the summer during which the purple loosestrife was more vulnerable to underwater clipping in spite of potentially different belowground reserves at different times of the season. There has been no research on the phenology of belowground reserves in loosestrife species.

Water levels at Green Gables Marsh did not vary over 1987 and 1988 by more than a few centimeters. The reason for decline in densities in the control plots over the two years is unclear.

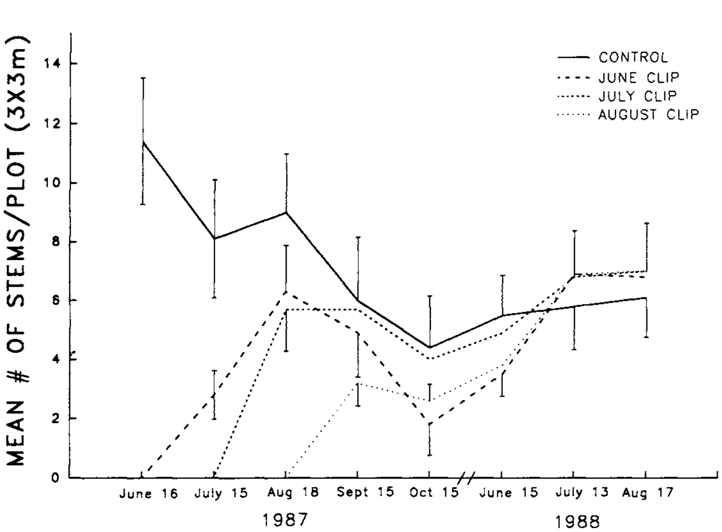

Figure 1. Mean numbers of purple loosestrife stems counted in experimental plots at Green Gables Marsh, Ontario.

Gabor and Murkin (1990) found that most clipped seedlings more than 21 days old sprouted two new shoots from the cut stem. Plant stems in our study did not double after clipping, however new stems were quickly produced and proceeded to grow through the water column. Greenhouse experiments in which uncut purple loosestrife seedlings were flooded to various depths (R. T. Clay, unpublished data) showed that seedlings would continue to grow through the water column. Once a stem broke through the water surface, overall growth accelerated.

Purple loosestrife seedlings and adults seem able to withstand the stress of being submerged and can withstand the disturbance of clipping while submersed. Thompson et al. (1987) noted that purple loosestrife is able to adapt easily to disturbances in its immediate environment, enabling it to adjust to a wide range of changes in water levels and giving it a competitive advantage over other plants.

In summary, submerged clipping of purple loosestrife at different times in the summer showed no effect in controlling the plant in southern Ontario. Cut plants grew new stems and returned to control densities shortly after clipping. Mowing large established stands of purple loosestrife does not appear to be a feasible means of control. The effect of multiple cuts within one growing season should be investigated. Future research should also address the issues of resource allocation and deposition in purple loosestrife.

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