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NOTES

Dredging to Control Curly-Leaved Pondweed: A Decade Later

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INTRODUCTION

Curly-leaved pondweed, *Potamogeton crispus* L., (hereafter called pondweed in this paper) is a Eurasian species that was introduced to the United States in the early 1800's. First recorded in 1841, it has since spread throughout the US and southern Canada and has become a nuisance plant in many alkaline lakes in that region (Stuckey 1979). Dense populations of pondweed are not limited to North America, but occur worldwide, such as those found in Japan (Kunii 1982), South Africa (Rogers and Breen 1980), New Zealand (Wells et al. 1986) and India (Yadav et al. 1987).

Collins Lake is an urban lake in the village of Scotia, New York, with a long history of dense aquatic plant growth. It has a surface area of 24.3 ha, an average depth of 2.8 m, high alkalinity (130 to 200 mg/l) and pH (7.0 to 8.6) and an average secchi disc depth of about 1 m. Water chestnut, *Trapa natans* L. was first recorded in the lake in 1884 and covered most of the lake surface in the early 1900's. After it was controlled by herbicides and hand-pulling, pondweed expanded and has since dominated the lake. Over a century of prolific aquatic plant growth has resulted in the deposition of a thick organic sediment on the lake bottom and a virtually pure stand of pondweed in the lake to a depth of about 3 m (about 60% of the lake surface).

Pondweed has the same life cycle in Collins Lake as is found in other temperate areas (eg. Rogers and Breen 1980, Kunii 1982). Vegetative apices, or turions, germinate in early fall, and the small plant overwinters under the ice. In spring there is rapid growth so that the plants flower at the surface in early May. By late May, the plants senesce and begin to decompose so that by mid to late June, pondweed biomass is negligible. The pondweed excludes other aquatic macrophytes from all but the shallow shore margins where it cannot overwinter due to ice scour. Even after the pondweed decomposes in late June, no other aquatic plant can be found in the area it previously dominated.

Because Collins Lake is heavily used for recreation, the Village of Scotia is concerned about the dense growth of aquatic plants in the spring and the rapid rate of sediment deposition occuring in the lake. Sedimentation rates were measured in one core in the lake at 1 cm/yr (George et al. 1982). Pondweed did not grow at depths greater than 3 m, so an infested area of the lake was dredged to that depth. Financing from the EPA Clean Lakes Program permitted hydraulic dredging during the summers of 1977 and 1978. This paper discusses the effect of dredging on the pondweed population one year after dredging (1979) and compares those results with data collected 10 years later (1988) to determine the long-term effects of this restoration technique.

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METHODS

Dredging was carried out with a Mudcat Model MC-10 hydraulic dredge with a pumping capacity of 7600 l/min. Sediment slurry was pumped to a nearby settling lagoon and the supernatant was returned to the lake. Over the two summers about 20% of the lake surface was dredged to a depth of 3 m.

Plant biomass was sampled both years by divers using 0.25 m^2 quadrats. Samples in the undredged areas were collected within 20 m of the dredged/undredged interface in depths of 1.5 to 2.5 m, and those in the dredged areas were collected in a transect or grid covering a wide variety of sites. After collection, plants were returned to the lab, washed to remove sediment and the surficial $CaCO_3$ deposits on the leaves, dried at 90 C for 24 hrs, and weighed to determine oven-dry mass (ODM). The 1979 sample included roots, whereas roots were cut from the plants in the 1988 sample. However, since root/shoot ratios are very small in mature plants of this species, this would make little difference in the ODM values between the dates, and no difference at all in the dredged/undredged comparison within dates.

RESULTS AND DISCUSSION

There was a notable decrease in pondweed biomass as the result of dredging (Table 1) and this decrease has been sustained for ten years. Plants did grow back in the dredged areas and often grew tall enough to reach the surface but they were scattered with greatly diminished density and biomass. There were 168 stems/m^2 in the undredged area and only 16 stems/m^2 in the dredged area in the May 1988 sample. Plant biomass in the dredged area was greater in the quadrats closer to the dredged/undredged interface, suggesting that either sediment slump from the dredging

TABLE 1. PONDWEED (*P. CRISPUS*) BIOMASS (G ODM ± 1 SE/M^2) IN DREDGED AND CONTROL AREAS OF COLLINS LAKE. DREDGING OCCURRED IN 1977 AND 1978 AND PLANT BIOMASS WAS COMPARED IN 1979 AND 1988. (N = NO. OF SAMPLES).

Sample Date	Undredged Areas		Dredged Areas	
1979				
8-15 May	183 ± 32	n = 3	0.8 ± 0.3	n = 52
1988				
23 May	149 ± 17	n = 4	5.8 ± 5	n = 8
1 June	126 ± 12	n = 3	20 ± 13	n = 15

wall or turions from the undredged area contributed to the increased plant density.

Other studies on the growth of pondweed in relation to light and temperature predicted that dredging would decrease its biomass and density (Tobiessen and Snow 1984). This study showed pondweed to have the ability to grow in very low light intensities, but to produce fewer stems per turion and thinner, weaker stems at these low levels of illumination. Dredging decreases light intensity at the level of the growing plants by increasing the depth of the water column that light must penetrate before it reaches the germinating turion. Since the water is deeper, the plant takes longer to reach the higher light intensities near the surface, and its life cycle may be delayed. Plants in the dredged areas were still increasing in biomass on June 1st, 1988, whereas those in the undredged areas had already begun to senesce (Table 1). Plants in both areas rapidly sensesce and are eaten by insect larvae in June[3] so that neglible biomass was present in either sampled area by the beginning of July.

Dredging reduced pondweed biomass in Collins Lake with few adverse ecological consequences (George et al. 1982). However, this procedure may not be applicable to other lakes. In the first place, space must be available for the settling lagoon. In addition, the major effect of dredging in Collins Lake was light attenuation and not substrate composition, since plants grew equally well in the substrates of the dredged and undredged areas (Tobiessen and Snow 1984). In another lake with greater water clarity, dredging may not be a reasonable solution. Pondweed grows to depths of 5 m in Saratoga Lake (pers. obs.) and to 7 m in Otsego Lake (Harman and Doane 1970), both of which have greater water clarity than Collins Lake. Dredging past these depths is not economically or logistically feasable. Shallow dredging is likely to fail unless it is absolutely certain that the resultant exposed sediment will not support pondweed regrowth.

[3]Woodard, A. 1979. The relationship between macro-invertebrates and senescence, death and decay of the aquatic macrophyte, *Potamogeton crispus*, in Collins Lake. MS Thesis. Biology Department, Union College, Schenectady, N.Y.

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