Curlyleaf Pondweed: New Management Ideas for an Old Problem

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Curlyleaf pondweed (Potamogeton crispus L.) is an exotic, rooted, submersed aquatic plant. It was first noticed in Minnesota about 1910. It is similar in appearance to many native pondweeds (Potamogeton spp.) commonly found in Minnesota lakes and streams. It can be distinguished from other pondweeds by its unique life cycle. It is generally the first pondweed to come up in the spring and dies back mid-summer.

In some lakes, curlyleaf coexists with native plants and does not cause problems. In other lakes, it becomes the dominant plant and causes significant problems. The two main problems caused by curlyleaf pondweed are: 1) the formation of dense mats in late spring and early summer which may interfere with recreation and limit the growth of native aquatic plants, and 2) the mid-summer dieback of the plant which can cause rafts of dying curlyleaf to pile up on shore, increase phosphorus concentrations in the lake, or both, which could lead to an increase in algae. Like other aquatic vegetation, the abundance of curlyleaf varies from year to year depending on environmental conditions, such as winter snow depth and spring water clarity which can effect its growth.

Native to Eurasia, Africa, and Australia, curlyleaf has been found in most of the United States since 1950, and it is currently found in most parts of the world. The Minnesota Department of Natural Resources (MnDNR) Division of Fisheries has found curlyleaf pondweed in 540 lakes in Minnesota, located in 80 percent of the counties in the state. This number is based on routine surveys of 3,000 lakes in Minnesota and is probably an underestimate of the number of lakes with curlyleaf pondweed.

Despite the fact that most of the counties in Minnesota have at least one lake with curlyleaf pondweed, in many counties the number of lakes with curlyleaf is still less than 10 percent of the total number of public waters in that county. Because there are many waters in Minnesota which are not infested with curlyleaf, it is important to help prevent the spread of this exotic to new lakes and rivers. Curlyleaf can spread from plant fragments, so it is important to clean all vegetation off your boat and equipment before you leave a water access. Remember, clean boats mean clean waters!

A Unique Life Cycle

Curlyleaf pondweed's unique life cycle gives it competitive advantages over many native aquatic plants. Unlike most native plants, curlyleaf pondweed plants remain alive, slowly growing even under thick ice and snow cover. Therefore, it is often the first plant to appear after ice-out. In mid-summer, when most aquatic plants are growing, curlyleaf plants are dying back. Before they die, they form vegetative propagules called turions (hardened stem tips) that disperse by water movement. Turions lay dormant during the summer when native plants are growing, and most germinate in the fall when most native vegetation has died back. Long-term management of curlyleaf will require the reduction or elimination of turions to interrupt its life cycle. The MnDNR has been actively supporting research to improve current management approaches. We are particularly interested in management strategies that could interrupt turion production.

Potamogeton crispus (Curlyleaf Pondweed)

Management Challenges

The two main challenges associated with the management of curlyleaf are to minimize damage to native plants and to produce long-term control. Curlyleaf can be managed using mechanical methods, herbicides, and habitat manipulation. Since curlyleaf is generally gone by mid-July, management activities should be undertaken in spring or very early summer to have the maximum benefit.

Mechanical control includes raking, cutting or harvesting vegetation. Raking and hand cutting generally remove the plants at the sediment surface, while harvesting generally removes the top five feet of the plants. Mechanical methods control plants in the specific areas where they are causing a nuisance, and there is immediate relief from the nuisance. There is some evidence that early season cutting of curlyleaf at the sediment surface can prevent turion production (McComas and Stuckert, 1996). MnDNR Exotic Species Program staff monitored the results of this type of cutting in French Lake (Rice County) and Weaver Lake (Hennepin County). It appears that cutting is effective in removing curlyleaf in the cut areas, though annual cutting appears to be required.

There are a small number of aquatic herbicides that can be used to control curlyleaf pondweed. Good to excellent control of curlyleaf can be obtained using formulations of diquat (e.g., Reward™) and endothall (e.g., Aquathol, K) (Westerdahl and Getsinger, 1988). Nevertheless, these herbicides only give control in the year of treatment. There is some evidence that use of endothall- based herbicides in early spring can control curlyleaf and stop turion production. Experimental studies have shown that curlyleaf can be controlled with Aquathol K (a formulation of endothall) in 60ºF water and that treatments of curlyleaf this early in its life cycle can prevent turion formation (Netherland et. al 2000, Poovey and Skogerboe 2002).

Control Research

Staff from MnDNR and the City of Eagan are assisting U.S. Army Engineer Research and Development Center (USAERDC) researchers in field trials of the effectiveness of endothall to control curlyleaf pondweed in the spring when water temperatures are low (55ºF). Three small (15 to 40 acres) treated lakes and two reference lakes are being monitored for changes in curlyleaf pondweed biomass, plant community composition, turion formation, and water quality. The USAERDC has been treating these three small Minnesota lakes every spring since 2000 with endothall to see how long it will take to deplete the "bank" of turions in the lake sediments. These treatments have been successful in controlling curlyleaf pondweed during the year of treatment, encouraging native plant re-establishment and growth, and reducing turion production. Nevertheless, enough curlyleaf was still present in the treated lakes in the spring of 2002 to warrant treatment. In April 2002, the lakes were again treated. Spring surveys in 2003 will determine if further treatments are necessary.

Based on the USAERDC research so far, the MnDNR Exotic Species Program recommends, if herbicide treatments are planned, to use an endothall-based herbicide, such as Aquathol K, when water temperatures are 55ºF in the spring. These treatments should kill curlyleaf pondweed, reduce or eliminate turion production in the treated areas, and have less negative impacts on native aquatic plants than treatments done later in the summer. It should be noted that all herbicide treatments require a permit from the MnDNR, Division of Fisheries.

SePRO, the manufacturer of Sonar™ brand fluridone herbicide, has conducted experimental treatments using very early low dose (5–6 ppb) fluridone treatments. So far, they have found that curlyleaf pondweed turion production is completely inhibited following early season treatments. They have also noted a significant reduction in the turion bank after treating with Sonar™ two years in a row (Mike Netherland, SePRO Corp. 2001, personal communication).

Fluridone herbicide usually has to be applied to whole lakes or bays and requires over 30 days to knock down curlyleaf. This is in contrast to diquat and endothall herbicides that can be used in small areas and will usually knock down curlyleaf within two weeks of treatment. The MnDNR Exotic Species Program is currently evaluating fluridone to determine if it

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can be used to selectively control Eurasian watermilfoil. The principal reason for the MnDNR's evaluation of fluridone is a need to understand the potential to use the herbicide selectively because it must be applied to entire lakes or bays. Whole-lake treatment with herbicide is not usually allowed in Minnesota because this can result in the removal of more vegetation than is necessary to give users access to lakes.

As part of this evaluation, Eagle Lake in Carver County was treated with fluridone. Before treatment, Eagle Lake had nuisance levels of curlyleaf pondweed as well as Eurasian watermilfoil. In order to determine the effects of fluridone on curlyleaf pondweed biomass and turion production, the MnDNR provided funding to researchers at Minnesota State University (MSU) to measure plant biomass and turion production in two lakes—in Eagle Lake and an untreated reference lake (Parley) in Carver County. Eagle Lake was treated with 4.6 ppb fluridone herbicide in April 2002. Initial plant surveys indicate that the treatment reduced the amount of curlyleaf pondweed in the lake.

Habitat manipulations, such as water level drawdown and dredging, can also be used to manage curlyleaf pondweed. Fall drawdown can kill curlyleaf pondweed turions by exposing them to freezing temperatures and desiccation. Dredging can be used to control curlyleaf by increasing water depth. In deep water, rooted plants do not receive enough light to survive. Depending upon how much material is removed, dredging can prevent all rooted macrophytes from growing for many years. Dredging and drawdown projects will require special permits and coordination among lake managers, lake users, and MnDNR Divisions of Fisheries, Wildlife, and Waters, because these projects can have significant negative effects on fisheries and lake use.

Every method of curlyleaf management has specific benefits and specific drawbacks. For advice concerning your particular lake, please contact Wendy Crowell at the MnDNR Exotic Species Program, 651-282-2508, wendy.crowell@dnr.state.mn.us.

References:

McComas, S. and J. Stuckert. 1996. French Lake (Rice County) curlyleaf pondweed control using a boat-towed cutter, 1996: Status Report. Unpublished report submitted to Rice County Environmental Health Department and the French Lake Association by Blue Water Science, 550 S. Snelling Av., St. Paul, MN 55116. 22 pp.

Netherland, M.D., J.D. Skogerboe, C.S. Owens, and J. D. Madsen. 2000. Influence of water temperature on the efficacy of diquat and endothall versus Curlyleaf pondweed. Journal of Aquatic Plant Management 38:25 32.

Poovey, A.G. and J.G. Skogerboe. 2002. Spring treatment of diquat and endothall for curlyleaf pondweed control. J. Aquat. Plant Manage. 40:63–67

For more information on curlyleaf pondweed control, see the article *Curlyleaf Pondweed: Another Exotic Aquatic Plant in Minnesota* by Steve McComas, Blue Water Science at www.mnlakes.org. Choose Hot Topics/Featured Articles.