FRESHWATER Scientific Services, LLC

www.fixmylake.com
18029 83rd Avenue North
Maple Grove, MN 55311
mail@freshwatersci.com
(651) 336-8696

Abundance of Curlyleaf Pondweed Turions in Poskin Lake – *Barron County, WI* *(WBIC 20-980-00)*

October 2011

Prepared for Short, Elliott, and Hendrickson (SEH) Inc. (Spooner, WI) – December 2011

Sample Collection and Processing by:

James A. Johnson – *Aquatic Ecologist, Freshwater Scientific Services, LLC*

Data Analysis and Reporting by:

James A. Johnson – *Aquatic Ecologist, Freshwater Scientific Services, LLC*

Report available for download at http://www.freshwatersci.com/fw_projects.html

Cite this report as:

Johnson JA. 2011. Abundance of Curlyleaf Pondweed Turions in Poskin Lake – Barron County, WI. *Report to* Short, Elliott, and Hendrickson (SEH) Inc. (Spooner, WI). Freshwater Scientific Services, LLC (Maple Grove, MN). 11 pp.

Introduction

Value of Aquatic Plants

Aquatic plants play an important role in freshwater lakes. They anchor sediments, buffer wave action, oxygenate water, and provide valuable habitat for aquatic animals. Consequently, the amount and type of plants in a lake can greatly affect nutrient cycling, water clarity, and food-web interactions (Jeppeson et al. 1998). Furthermore, plants are very important for fish reproduction, survival, and growth, and can greatly impact the type and size of fish in a lake. Unfortunately, healthy aquatic plant communities are often degraded by poor water clarity, excessive plant control activities, and the invasion on non-native nuisance plants. These disruptive forces alter the diversity and abundance of aquatic plants in lakes and can lead to undesirable changes in many other aspects of a lake's ecology. Consequently, it is very important that lake managers find a balance between controlling nuisance plant growth and maintaining a healthy, diverse plant community.

Curlyleaf Pondweed: An Unwanted Invader

Curlyleaf (*Potamogeton crispus*) is an invasive aquatic plant that typically forms dense surface growth and displaces native aquatic plants (Madsen and Crowell 2002). Consequently, it has dramatically reduced the recreational and ecological quality of many lakes in the upper Midwest (Catling and Dobson 1985, Bolduan et al. 1994). Curlyleaf's ability to dominate the plant community in lakes is enhanced by its novel life-cycle (Tobiessen and Snow 1984). Although it is considered a perennial species, it behaves as a winter annual in northern lakes (Netherland et al. 2000, Madsen and Crowell 2002), sprouting from turions (reproductive buds) in the fall, persisting as small shoots under the ice during the winter, growing rapidly in the early spring (Kunii 1982, Tobiessen and Snow 1984), and forming dense surface growth and new turions in May and June (Wehrmeister and Stuckey 1992, Bolduan et al. 1994). Curlyleaf plants typically die off by mid-summer, depositing any newly-produced turions to bottom of the lake. Although this means that the dense matted growth is generally short lived and out of the way by the 4^{th} of July, deposited turions in lake sediments lead to new curlyleaf growth in subsequent years. Although curlyleaf also produces seeds, under most conditions its annual life-cycle is almost entirely dependent upon sprouting from turions in lake sediments (Rogers and Breen 1980, Sastroutomo 1981, Bolduan et al. 1994). Consequently, there is great interest in adopting management strategies that can prevent turion production, deplete accumulated turions, and thus decrease nuisance growth.

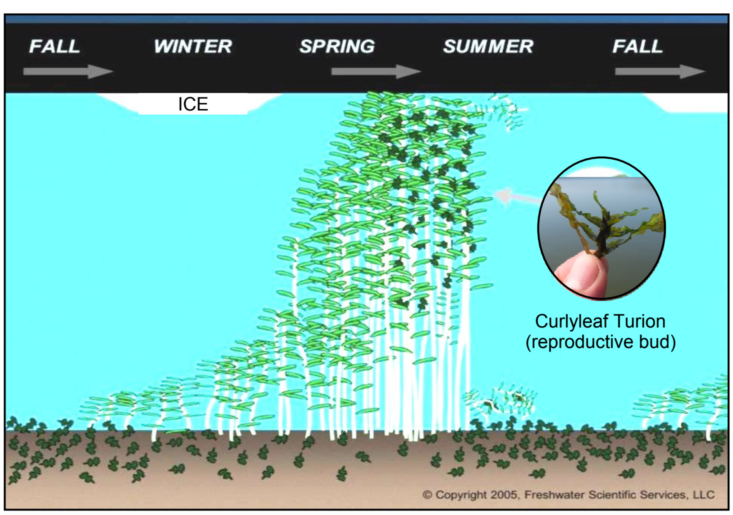


Figure 1. Curlyleaf life-cycle in northern lakes (left); curlyleaf plant (below).

Purpose of Turion Survey

This survey was designed to assess the abundance of curlyleaf pondweed turions in portions of Poskin Lake that have supported curlyleaf pondweed growth in recent years. This information will allow us to evaluate the severity of the curlyleaf infestation (compared to other infested lakes) and provide a baseline for evaluating any changes in the abundance and distribution of curlyleaf turions in the surveyed portions of the lake over the coming years.

Objectives

1) Determine turion abundance at identified sample locations
2) Map turion abundance in the surveyed areas
3) Calculate statistics for turion distribution and abundance in the surveyed areas

Description of Lake

Poskin Lake (WBIC 20-980-00) is a small (150 acres), but moderately deep lake (mean depth 16 ft) located in west-central Barron County, WI (45°25'55"N/91°58'14"W; Fig. 2 and 3).

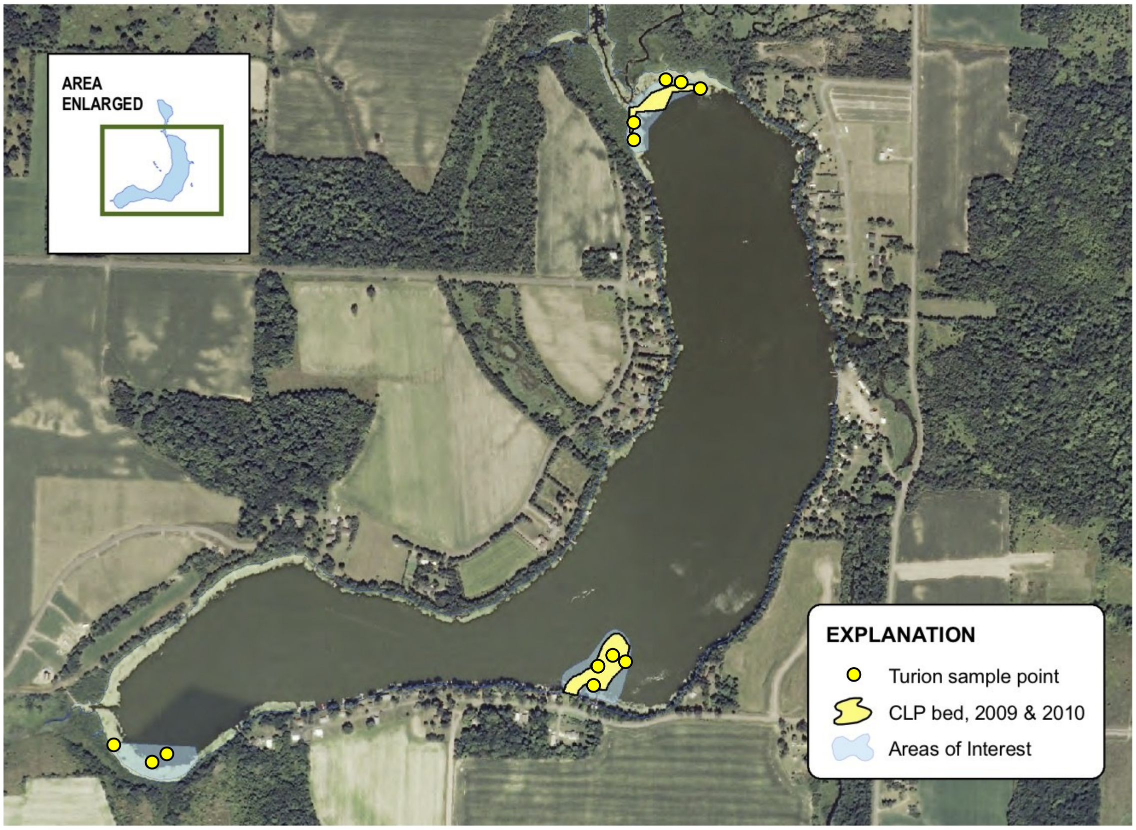
The lake is fertile (eutrophic) and typically experiences low summer water clarity (3 to 5-ft Secchi). Its sediments are primarily sand (70%) and gravel (20%), with some areas of muck (10%) in nearshore areas. The lake is known to be infested with curlyleaf pondweed (*Potamogeton crispus*), an invasive, non-native, aquatic plant. In recent years, curlyleaf growth has generally been confined to small patches on the far northern and far southern shores of the lake.

Figure 2. Location of Poskin Lake

Table 1. Identifiers and characteristics for Poskin Lake (WDNR 2011)

County	Barron
ID# (WBIC)	20-980-00
Surface Area *(acres)*	150
Maximum Depth *(ft)*	30
Mean Depth *(ft)*	16
Watershed Area *(acres)*	14,450
Trophic State	eutrophic

Figure 3. Map showing the surveyed portions of Poskin Lake and location of sample points (provided by SEH Inc.)



Sampling & Analysis Methods

Sample Collection and Processing

Previously conducted plant surveys indicated that most of the curlyleaf growth in Poskin Lake occurred in a few isolated patches. Accordingly, the 2011 curlyleaf turion survey was confined to these areas of the lake basin (Fig. 3). We randomly selected a total of 12 sample locations within the designated survey areas using ArcGIS software (locations provided by SEH Inc.). These sample locations were loaded onto a handheld GPS unit (Garmin GPSMAP-78) to enable navigation to each point while in the field.

On October 27, 2011 Freshwater Scientific Services, LLC collected sediment samples at all 12 identified sample locations (Fig. 3). At each location, we collected one sediment sample using a petite Ponar dredge (225 cm^2 basal area, sample depth ~10 cm). Upon retrieving each sediment sample, we removed any material from the outside of the closed dredge, emptied the sampler contents into a sifting bucket (1-mm screen), and gently sifted the sample to remove fine sediment. The contents remaining in the bucket after sifting were placed into a labeled plastic bag and stored in a cooler while in the field. In the lab, we manually sorted turions from other debris and recorded total turion counts for each sample. Small turion fragments (those that did not included a portion of a central turion stem) and severely decayed turions (those that did not retain their shape when lightly squeezed) were discarded and were not included in the final turion counts.

We calculated turion abundance (turions/m^2) for each sampled location (number of turions ÷ 0.0225 m^2), and then calculated average turion abundance within the sampled portion of the lake.

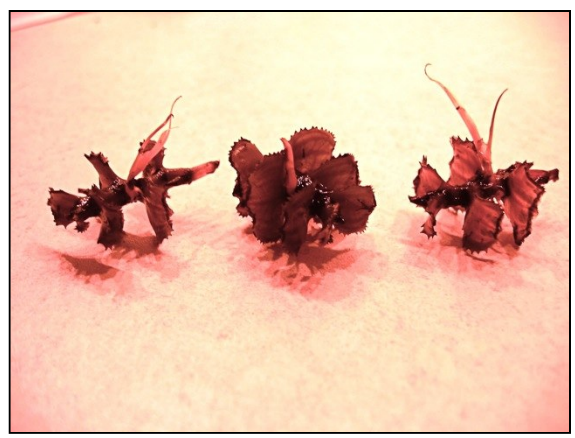


Figure 4. J. Johnson (Freshwater Scientific Services, LLC) collecting sediment samples with a petite Ponar grab sampler (left); sprouted curlyleaf pondweed turions (above)

Results & Discussion

We found turions at 42% of the sampled locations (Fig. 5, Table 2), however, the average turion abundance across the surveyed areas (56 ±36 turions/m^2) was much lower than typically seen in heavily infested lakes (400 ±90 turions/m^2, Johnson 2012). Only one of the sampled locations (in the far southwest end of the lake) had a high turion density (444 turions/m^2) that indicated a potential for dense, nuisance-level curlyleaf growth (Fig. 5). Turion abundance in all of the remaining samples was below 100 turions/m^2, with over half of the samples having no turions at all. Previous studies indicate that curlyleaf pondweed densities below 150 stems/m^2 do not generally impair lake recreation, while densities >400 stems/m^2 represent a severe nuisance (McComas 2008). This suggests that although turions may be widespread in Poskin Lake, only a few areas supported nuisance-level growth in 2011.

Figure 5. Map of curlyleaf pondweed distribution and abundance in Poskin Lake; Oct 2011

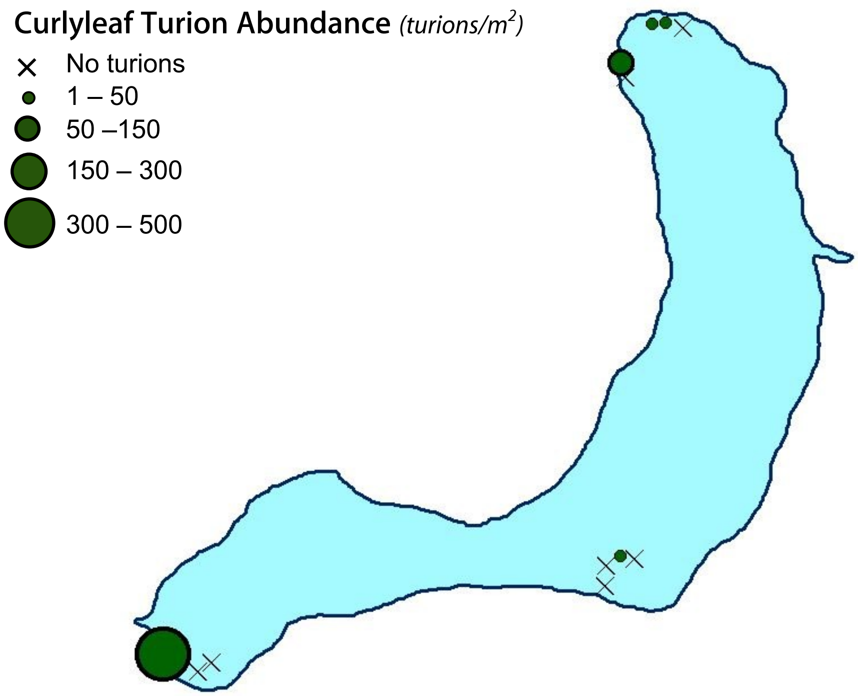


Table 2. Statistics for curlyleaf pondweed turion distribution and abundance in Poskin Lake; Oct 2011.

Total Locations Sampled	12
Number of Locations with Turions	5
% of Locations with Turions	42 %
Average Turion Abundance *(turions/m^2, ±1SE)*	56 ±36
Maximum Turion Abundance *(turions/m^2)*	444

Management Context

Most evaluations of curlyleaf pondweed in infested lakes focus on the distribution and density of curlyleaf plants in a lake. However, curlyleaf pondweed growth is highly dependent upon in-lake conditions and weather (Johnson 2012, Tobiessen and Snow 1984). Consequently, the distribution and density of curlyleaf growth in infested lakes can vary substantially from year to year, even if turion abundance and distribution remain relatively constant. Turion abundance provides an assessment of the potential for widespread dense growth under ideal growing conditions, and thus provides a more stable measure of curlyleaf infestation that is not as sensitive to weather. This allows us to track changes in the level of curlyleaf infestation and better assess the effects of any future management upon curlyleaf pondweed in the lake.

Although most studies suggest that turions are by far the most important source of new curlyleaf pondweed growth in northern lakes, emergence from seeds and persistent roots or rhizomes may also play an important role under some conditions (Bolduan et al. 1994, Rogers and Breen 1980). Additional turion surveys and detailed delineation of curlyleaf beds in Poskin Lake over the coming years would provide valuable information about the relationship between turion abundance and curlyleaf density in the lake. Furthermore, a more comprehensive turion survey (more sample locations to cover the entire littoral area) would provide a lake-wide estimate of turion density. This would be helpful in guiding future curlyleaf management decisions in Poskin Lake.

References

Bolduan BR, Van Eeckhout GC, Quade HW, Gannon JE. 1994. Potamogeton crispus - the other invader. Lake Reserv Manage. 10:113-125.

Catling PM, Dobson I. 1985. The biology of Canadian weeds. 69. Potamogeton crispus L. Can J Plant Sci. 65:655-668.

Jeppeson, E., M. Sondergaard, M. Sondergaard, and K. Christofferson (eds.). 1998. The Structuring Role of Submerged Macrophytes in Lakes. Springer-Verlag New York Inc., New York, NY. 423 pp.

Johnson JA, Jones AR, Newman RM. *Submitted for Publication 2012*. Evaluation of lake-wide, early-season herbicide treatments for controlling invasive curlyleaf pondweed (*Potamogeton crispus*) in Minnesota lakes. Lake Reserv Manage.

Kunii H. 1982. Life cycle and growth of Potamogeton crispus L. in a shallow pond, Ojaga-ika. Bot Mag Tokyo. 95:109-124.

Madsen, J. D., and W. Crowell. 2002. Curlyleaf pondweed (Potamogeton crispus L.). LakeLine Magazine 22(1): 31-32.

McComas, S. 2008. Curlyleaf pondweed and Eurasian watermilfoil growth potential based on lake sediment characteristics for Kingsley Lake, Lakeville, Minnesota. *Final Project Report*. Blue Water Science. St. Paul, MN.

Netherland MD, Skogerboe JD, Owens CS, Madsen JD. 2000. Influence of water temperature on the efficacy of diquat and endothall versus curlyleaf pondweed. J Aquat Plant Manage. 38:25-32.

Rogers KH, Breen CM. 1980. Growth and reproduction of Potamogeton crispus in a South African lake. J Ecol. 68:561-571.

Sastroutomo SS. 1981. Turion formation, dormancy and germination of curly pondweed, Potamogeton crispus L. Aquat Bot. 10:161-173.

Tobiessen P, Snow PD. 1984. Temperature and light effects on the growth of Potamogeton crispus in Collins Lake, New York State. Can J Bot. 62:2822-2826.

Wehrmeister JR, Stuckey RL. 1992. The life history of Potamogeton crispus. Mich Bot. 31:3-16.

WDNR 2011. Wisconsin Department of Natural Resources. Madison (WI). Wisconsin Lakes website: http://dnr.wi.gov/lakes (accessed Dec 2011).