Aquatic Vegetation Survey of

Little Pine Lake (ID #18-0266-00) and Daggett Lake (ID #18-0271-00)

Crow Wing County, Minnesota

2009





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Lakewide sampling (2009):

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Summary

A Spring 2009 vegetation survey was conducted in the eastern-most waterbodies of the Whitefish Chain of Lakes: Little Pine Lake, Daggett Lake, and a bay of the Cross Lake Reservoir. The survey assessed the distribution and abundance of the non-native plant, curly-leaf pondweed (*Potamogeton crispus*). Information on vegetation and water depth was recorded at over 350 sample sites.

Submerged plants were found to a depth of 17 feet in Little Pine, to 18 feet in Daggett Lake, and to nine feet (the maximum depth sampled) in the bay of Cross Lake Reservoir. Within the 0 to 20 feet depth zone, 74% of the Little Pine Lake sites and 53% of the Daggett Lake sites contained plants.

A total of 13 native aquatic plants were recorded in these lakes. Native plants dominated the lakes and were found in at least 61% of the survey sites. Coontail (*Ceratophyllum demersum*), was the most common submerged plant and was found in at least 40% of the survey sites in each lake. Other common submerged taxa included star duckweed (*Lemna trisulca*), northern watermilfoil (*Myriophyllum sibiricum*), flat-stem pondweed (*Potamogeton zosteriformis*), muskgrass (*Chara* sp.), white-stem pondweed (*Potamogeton praelongus*), and Canada waterweed (*Elodea canadensis*).

The non-native submerged plant, curly-leaf pondweed (*Potamogeton crispus*), was documented during the survey and occurred with a frequency of 21% in Little Pine, 15% in Daggett and 9% in the bay of Cross Lake Reservoir. It was found in water depths from three to 18 feet. It was present at scattered locations around the lakes and often co-occurred with native plants.

Introduction

Little Pine, Daggett and Cross Lake Reservoir Lakes are located in Crow Wing County, north central Minnesota (Figure 1). These lakes lie in the center of the Pine River Watershed and are the eastern-most waterbodies in the Whitefish Chain of Lakes. This chain of waterbodies was connected in 1886 when the Pine River Dam was completed. The Pine River flows east through the Whitefish Chain. Daggett Brook flows into the north end of Little Pine Lake then continues southwest through Daggett and Cross Lake Reservoir and to the Pine River (Figure 1).

Little Pine has a surface area of 387 acres and Daggett has a surface area of 225 acres. Cross Lake Reservoir includes 1,751 acres but only the northeast bay (25 acres) was included in this survey.

These basins are relatively shallow lakes with maximum depths of 36 feet in Little



Pine, 23 feet in Daggett and 9 feet in the bay of Cross Lake Reservoir. All three waterbodies are described as eutrophic (high nutrients). In 2008, the average summer <u>secchi disk</u> reading was 8 feet for Little Pine and Daggett lakes (MPCA, 2008). The Cross Lake Reservoir had an average summer secchi disk reading of 15 feet in 2008 (MPCA, 2008).

Previous vegetation surveys recorded a diversity of native plants in these lakes with more than 28 types of lake plants. Bulrush (*Schoenoplectus* spp.) an important emergent plant for fish and invertebrate habitat, was common in past surveys (DNR Fisheries lake files). Submerged plants, such as sago pondweed (*Stuckenia pectinata*), coontail (*Ceratophyllum demersum*) and northern watermilfoil (*Myriophyllum sibiricum*), were commonly found to a depth of 10 feet in Little Pine and Daggett lakes.

The non-native plant, Eurasian watermilfoil (*Myriophyllum spicatum*), has **NOT** been found in Little Pine, Daggett or Cross Lake Reservoir but has been located in two lakes in the watershed: Washburn Lake (Cass County) and Ossawinnamakee Lake (Crow Wing County). Eurasian watermilfoil has also been found in nearby Bay, Upper Mission and Lower Mission lakes (Crow Wing County), and Mille Lacs (Mille Lacs County). The non-native plant, curly-leaf pondweed (*Potamogeton crispus*), has been present in these lakes since at least the 1990's (DNR Fisheries lake files).

Objectives

This survey provides a quantitative description of the 2009 curly-leaf pondweed population in Little Pine and Daggett lakes and a bay of the Cross Lake Reservoir. Information on native plants was also collected but may be incomplete because many native plants do not reach peak growth until mid to late summer.

Objectives included:

- 1. Estimate the maximum depth of rooted vegetation
- 2. Estimate the percent of the lake occupied by rooted vegetation
- 3. Record the aquatic plant species that occur in the lake
- 4. Estimate the abundance of curly-leaf pondweed and common native plant species
- 5. Develop distribution maps for curly-leaf pondweed and native plants

Methods

Lakewide vegetation survey

Little Pine Lake was surveyed on May 7 and June 2, 2009, Daggett Lake was surveyed on May 5 and 6, 2009 and a bay of the Cross Lake Reservoir was surveyed on May 12, 2009. A point-intercept survey method was used and followed the methods described by Madsen (1999). Survey waypoints were created using a Geographic Information System (GIS) computer program and downloaded into a handheld Global Positioning System (GPS) receiver. Survey points for all three waterbodies were placed across the entire lake and spaced 65 meters (213 feet) apart, resulting in about one survey point per acre. Surveyors sampled sites within the shore to 20 feet depth zone in Little Pine Lake (155) and Daggett Lake (177) (Figure 2, Table 1). Sites were sampled from shore to 10 feet depth zone in the bay of Cross Lake Reservoir (22). Surveyors avoided sites that occurred within dense beds of floating and/or emergent vegetation to minimize damage to these plants.

The survey was conducted by boat and surveyors used the GPS unit to navigate to each sample point. One side of the boat was designated as the sampling area. At each site, water depth was recorded in one-foot increments using a measured stick or electronic depth finder. Surveyors recorded all plant taxa found within a one square meter sample site at the pre-designated side of the boat. A double-headed, weighted garden rake, attached to a rope was used to survey vegetation not visible from the surface (Figure 2). Plant identification and nomenclature followed MnTaxa (2009).

Data were entered into a Microsoft Access database and frequency of occurrence was calculated for each taxon as the number of sites in which taxa occurred divided by the total number of sample sites. Frequency was calculated for the entire area from shore to 20 feet in Little Pine and Daggett lakes and from shore to 10 feet in the bay of Cross Lake Reservoir. Sampling points were also grouped by water depth and separated into depth zones for analysis (Table 1).

Emergent and floating-leaf plant bed delineation

2008 true color aerial photographs (Farm Service Administration) were used to delineate the major beds of floating and emergent vegetation in these lakes. This analysis did not map bulrush (*Schoenoplectus* spp.) beds because these plants are not usually detectable from aerial photos.



Example calculation of frequency:

There were 155 samples sites in the 0-20 feet zone in Little Pine Lake. Coontail (*Ceratophyllum demersum*) occurred in 95 sites. Coontail frequency in 0-20 feet zone = (95/155) *100 = 61%

Results

Number of plant taxa recorded

A total of 13 native plants were recorded in these lakes and included one floating-leaf, and 12 submerged taxa (Table 2). One non-native submerged plant, curly-leaf pondweed (*Potamogeton crispus*), was documented in all three lakes during the survey. Eurasian watermilfoil (*Myriophyllum spicatum*), was not found during the May and June 2009 surveys.

Table 2. Frequency of aquatic plants in Little Pine, Daggett and Cross Lake Reservoir Lakes Point-intercept survey, May and June 2009.

(Frequency is the percent of sample sites in which a plant taxon occurred within the shore to 20 ft water depth except in the Cross Lake Reservoir where plants occurred to 10 feet.)

			Frequency (N= number of sample sites)		
					Cross
			Little		Lake
			Pine	Daggett	Reservoir
Life Form	Common Name	Scientific Name	N = 155	N = 177	N=22
Native Submerged	Coontail	Ceratophyllum demersum	61	41	82
	Star duckweed	Lemna trisulca	20	5	
	Northern watermilfoil	Myriophyllum sibiricum	15	10	18
	Flat-stem pondweed	Potamogeton zosteriformis	14	7	
	Canada waterweed	Elodea canadensis	11	3	5
	White-stem pondweed	Potamogeton praelongus	3		9
	Muskgrass	Chara sp.	3	2	9
	White-water buttercup	Ranunculus aquatilis	2	2	
	Sago pondweed	Stuckenia pectinata	1		
	Robbins' pondweed	Potamogeton robbinsii	1		
	Bushy pondweed	Najas flexilis		1	5
	Greater bladderwort	Utricularia vulgaris			5
Non-native Submerged	Curly-leaf pondweed	Potamogeton crispus	21	15	9
Floating- leaf	Yellow waterlily	Nuphar variegata	1		

"---"= may be present in lake but was not found within any sample site

N= number of sample sites

Distribution of aquatic plants

A total of 85 acres of emergent and floating-leaf plants were delineated from aerial photographs. The most extensive beds occurred in the southwest arm of Little Pine Lake (Figure 4). Submerged plants were abundant in the shallow protected areas, but were sparse in the main part of Little Pine and Daggett lakes (Figure 4).

Aquatic vegetation of Little Pine Lake and Daggett Lake, Crow Wing County, MN, 2009





Submerged plants were found to a depth of 17 feet in Little Pine, 18 feet in Daggett and nine feet in the bay of Cross Lake Reservoir. Within the shore to 20 feet depth zone, vegetation occurred in 74% of the Little Pine sites and in 53% of the Dagget sites. Within the shore to 10 feet depth zone, vegetation occurred in 95% of the Cross Lake Reservoir sites. In water depths greater than 10 feet in Little Pine and Daggett lakes, vegetation was found in less than 30% of the sites (Figure 5).



Native plants dominated all three lakes and in the 0 to 20 feet depth zone, 71% of the Little Pine sites and 49% of the Daggett sites contained only native plants (Figure 5).

The number of plant taxa found at each one square meter sample site ranged from zero to five. Sites with the highest number of plant taxa were found in the shallow protected bays of all three waterbodies (Figure 6).

Figure 6. Number of plant species at each sample site, Little Pine and Daggett lakes and bay of Cross Lake Reservoir, May and June 2009.



Common native submerged plants

<u>Coontail</u> (*Ceratophyllum demersum*) (Figure 7), was the most common species found in all three lakes. Coontail grows entirely submerged and its roots are only loosely anchored to the lake bottom. It is adapted to a broad range of lake conditions and is tolerant of higher turbidity and can grow in muck substrates. Coontail is perennial and can over winter as a green plant under the ice and then begins new growth early in the spring, spreading primarily by stem fragmentation. The finely divided leaves of this plant provide a home for insects valuable as fish food.



It occurred with a frequency of 61% in Little Pine, 41% in Daggett and 82% in the bay of Cross Lake Reservoir (Table 2). It was commonly found throughout the vegetated zone, but was most frequent in the 6 to 10 feet depth zone in all three lakes (Figure 13). Coontail was found to a depth of 17 feet in Little Pine and 16 feet in Daggett and was often found in mixed beds with flat-stem pondweed and northern watermilfoil.

<u>Star duckweed</u> (*Lemna trisulca*) (Figure 8) is a freefloating species that often occurs submerged near the lake bottom but it does not anchor to the substrate and can float freely with the current. It occurred in 20% of the survey sites in Little Pine and 5% in Daggett (Table 2). It was the most frequent in the 0 to 5 feet depth zone (Figure 13). Star duckweed was not found in the bay of Cross Lake Reservoir.

Figure 8. Star duckweed (*Lemna trisulca*) photo by Robert Freckman-Univ of WI – Stevens Point



Northern watermilfoil (*Myriophyllum sibiricum*) (Figure 9) was found in 15% of the Little Pine sites, 10% of the Daggett sites and 18% of the Cross Lake Reservoir bay sites (Table 2). In Little Pine and Daggett Lakes northern watermilfoil was most frequent in the 6 to 10 feet depth zone (Figure 13). This native, submerged plant is a rooted perennial with finely dissected leaves. Particularly in depths less than ten feet, this plant may reach the water surface and its flower stalk will extend above the water surface. It spreads primarily by stem fragments and over-winters by hardy rootstalks and winter buds. Northern watermilfoil is not tolerant of turbidity and grows best in clear water lakes.



<u>Flat-stem pondweed</u> (*Potamogeton zosteriformis*) (Figure 10) occurred with a frequency of 14% in Little Pine and 7% in Daggett (Table 2). It was found to a depth of nine feet in Little Pine and seven feet in Daggett (Figure 13). Flat-stem pondweed is named for its flattened, grass-like

leaves. Flat-stem pondweed is a perennial plant that is anchored to the lake bottom by underground rhizomes. Depending on water clarity and depth, these plants may reach the water surface and may produce flowers that extend above the water. These pondweeds are anchored to the lake bottom by rhizomes and over winter by winter buds.

<u>White-stem pondweed</u> (*Potamogeton praelongus*)

(Figure 11), is one of several species that are often called "cabbage" plants by anglers. The leaves are lance to oval shaped and clasp the stem and the leaf tips are boat shaped. The fruits of pondweeds are a favorite duck food and the broad leaves provide food and shelter for fish. White-stem pondweed is an indicator of good water clarity in lakes. In Cross Lake Reservoir bay white-stem pondweed was found in 9% of all survey sites and 3% in Little Pine Lake (Table 2). White-stem pondweed was found most frequently in the 0 to 5 feet depth zone in both lakes (Figure 13). White-stem pondweed was not found in Daggett Lake.

Canada waterweed (Elodea canadensis) (Figure 12) was

found in 11% of the Little Pine Lake sites, 3% of the Daggett Lake sites and 5% of the Cross Lake Reservoir bay sites (Table 2). In all three lakes Canada waterweed was found in depths below seven feet (Figure 13). This perennial submerged species is widespread throughout Minnesota. It is adapted to a variety of conditions and is tolerant of low light and prefers soft substrates. Canada waterweed can overwinter as an evergreen plant and spreads primarily by fragments.









Curly-leaf pondweed

<u>Curly-leaf pondweed</u> (*Potamogeton crispus*) (Figure 14) was found in 21% of the survey sites in Little Pine, 15% of the survey sites in Daggett and 9% of the survey sites in Cross Lake Reservoir bay (Table 2). In Little Pine and Daggett Lakes curly-leaf pondweed was most commonly found in the 6 to 10 feet depth zone (Figure 13). Curly-leaf pondweed was found at scattered locations throughout all three lakes (Figure 5).



This is a non-native, submerged plant that has

been present in Minnesota since at least 1910 (Moyle and Hotchkiss 1945) and is now found in more than 700 Minnesota lakes (Invasive Species Program 2008). Like many native submerged plants, it is perennial but has a unique life cycle that may provide a competitive advantage over native species. Curly-leaf pondweed is actually dormant during late summer and begins new growth in early fall. Winter foliage is produced and continues to grow under ice (Wehrmeister and Stuckey 1978). Curly-leaf reaches its maximum growth in May and June, when water temperatures are still too low for most native plant growth. In late spring and early summer, curly-leaf plants form structures called "turions" which are hardened stem tips that break off and fall to the substrate. Turions remain dormant through the summer and germinate into new plants in early fall (Catling and Dobson 1985).

The foliage of curly-leaf pondweed does provide some fish and wildlife habitat, but it may also create problems in some lakes, or in areas of some lakes. During its peak growth in spring, curly-leaf may reach the water surface at certain depths and create dense mats. These dense growths may compete with native vegetation and can also cause problems for recreational lake users.

The types and amounts of aquatic vegetation that occur within a lake are influenced by a variety of factors including water clarity, water chemistry, depth, substrate type, and wave activity. The abundant and diverse native aquatic plant communities found in Little Pine, Daggett, and Cross Lake Reservoir Lakes provide critical fish and wildlife habitat and other lake benefits. (Click here for more information on: <u>value of aquatic plants</u>).

Literature Cited

Catling, P. M. and I. Dobson. 1985. The biology of Canadian weeds. 69. *Potamogeton crispus* L. Canadian Journal of Plant Science 65:655-668.

Madsen, J. D. 1999. Point intercept and line intercept methods for aquatic plant management. *APCRP Technical Notes Collection* (TN APCRP-M1-02). U.S. Army Engineer Research and Development Center, Vicksburg, MS. <u>www.wes.army.mil/el/aqua</u>

MnDNR Fisheries Lake Files. Little Pine and Daggett Lakes, Crow Wing County, MN, ID#'s 18026600 and 18027100. Vegetation surveys were conducted for Little Pine Lake in 1950, 1955, July 1987 and July 1990 and Lower South Long Lake in 1955, July 1987 and July 1990. 500 Lafayette Rd., St. Paul, MN.

MnDNR Invasive Species Program. 2008. Invasive Species of Aquatic Plants and Wild Animals in Minnesota: Annual Report for 2004. Minnesota Department of Natural Resources, St. Paul, MN. <u>http://www.dnr.state.mn.us/eco/pubs_invasives.html</u>

MnTaxa. 2009. Minnesota State checklist of vascular plants. Minnesota Department of Natural Resources, Division of Ecological Resources, St. Paul.

MPCA. 2008. Minnesota Pollution Control Agency. St. Paul, MN. Lake Water Quality Assessment Program. Lake Water Quality Data Search website: http://www.pca.state.mn.us/water/lkwqSearch.cfm (accessed November 2009)

Moyle, J. B. and N. Hotchkiss. 1945. The aquatic and marsh vegetation of Minnesota and its value to waterfowl. Minnesota Department of Conservation. Technical Bulletin 3. 122 pp.

Wehrmeister and Stuckey. 1978. The life history of *Potamogeton crispus* with emphasis on its reproductive biology. Ohio Journal of Science. 78 (April program and abstract) supplement: 16.