Aquatic Vegetation Surveys of

Fish Trap Lake (ID #49-0137-00)

Morrison County, Minnesota

2005 and 2009

Fish Trap Lake 2009.

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Summary

Fish Trap is a 1,174 acre, hard-water Lake in central Minnesota. Surveys were conducted in 2005 and 2009 to assess the distribution and abundance of the non-native plant, curly-leaf pondweed (*Potamogeton crispus*). The 2009 survey was conducted in early spring, before most native plants had begun growth. The 2005 survey was conducted in early summer and therefore includes some additional data on native plants. A characterization of near shore substrate types was conducted during the 2009 survey.

Plants were found to a depth of 19 feet in 2005 and to 16 feet in 2009. Within the shore to 20 feet depth zone, 185 sites were sampled in both years. Vegetation occurred in 77% of the sites in 2005 and in 54% in 2009. In both surveys, vegetation was most common in the shore to ten feet zone. In deeper water, lower plant abundance in 2009 was likely due to the earlier sampling dates and colder water temperatures.

Curly-leaf pondweed was the most frequently observed plant and was scattered around the entire perimeter of the lake. It was found to a depth of 19 feet in 2005 and to 16 feet in 2009. Within the shore to 20 feet depth zone, curly-leaf pondweed occurred in 41% of the sample sites in 2005 and in 26% in 2009. Again, this difference may be due to the colder water temperatures during the early spring 2009 survey. In both years, curly-leaf was most often found in mixed stands with native vegetation.

In both survey years, most vegetated sites contained native plants. In 2005, 65% of the survey sites contained at least one native plant species, compared to 39% of the sites in 2009. A total of 24 native aquatic plant species were recorded including three emergent, two floating-leaved, three free-floating and 16 submerged plants. Some of the more frequently occurring native submerged taxa included coontail (*Ceratophyllum demersum*), flat-stem pondweed (*Potamogeton zosteriformis*), narrow-leaf pondweed (*Potamogeton* sp.), clasping-leaf pondweed (*Potamogeton richardsonii*), northern watermilfoil (*Myriophyllum sibiricum*) and muskgrass (*Chara* sp.).

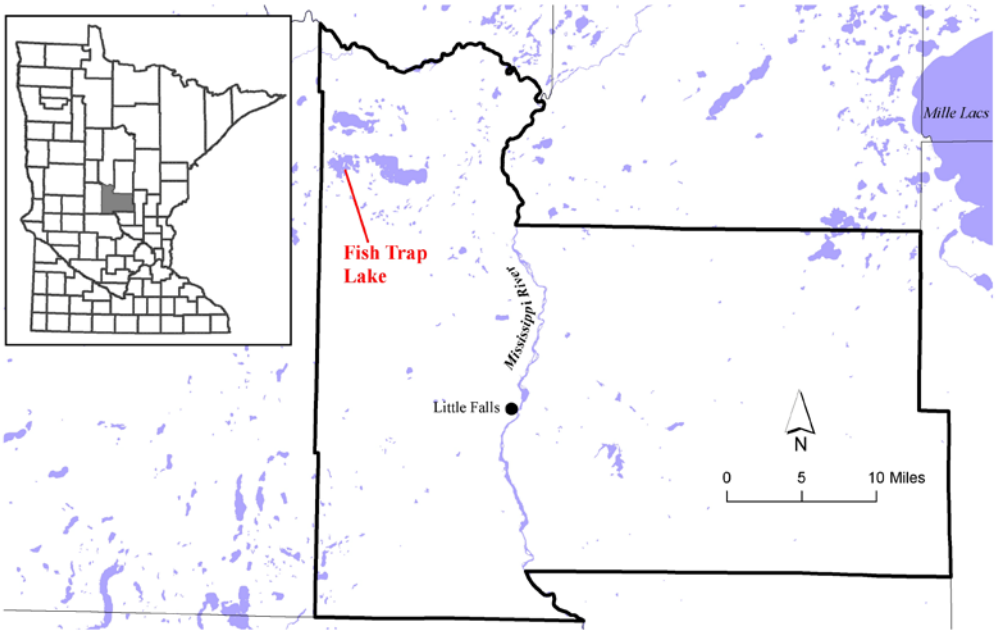
Shoreline of Fish Trap Lake, May 2009.

Introduction

Fish Trap Lake is located about 18 miles northwest of the city of Little Falls in Morrison County, central Minnesota (Figure 1). It is the third largest lake in the county with a surface area of 1,174 acres. The lake has an irregular outline with numerous bays and islands and about 14 miles of shoreline. It has a maximum depth of 42 feet and 34% of the lake basin is less than 15 feet in depth. The Minnesota Pollution Control Agency (MPCA) describes the lake as eutrophic with moderate water clarity. The average summer secchi disk reading for Fish Trap Lake in 2008 was 12 feet (MPCA, 2008).

Fish Trap Lake has historically supported a diverse native plant community with 45 different lake and shoreline plants (DNR Fisheries Files). The non-native plant, curly-leaf pondweed (*Potamogeton crispus*), occurs in Fish Trap Lake and in most lakes in the watershed. The non-native plant, Eurasian watermilfoil (*Myriophyllum spicatum*), has not been found in Fish Trap Lake but does occur in nearby Lake Alexander and Mille Lacs Lake.

Figure 1. Location of Fish Trap Lake, Morrison County, MN.



Objectives

These surveys were conducted to provide quantitative descriptions of the curly-leaf pondweed population in Fish Trap Lake. 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. Describe the shoal sediments of the lake (2009)
2. Estimate the maximum depth of rooted vegetation
3. Estimate the percent of the lake occupied by rooted vegetation
4. Record the aquatic plant species that occur in the lake
5. Estimate the abundance of curly-leaf pondweed and common native species
6. Develop general distribution maps for curly-leaf pondweed and native plants.

Methods

Fish Trap Lake was surveyed on June 7, 2005 and May 14, 18, 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 were placed across the entire lake and spaced 100 meters (328 feet) apart. Surveyors began sampling to a depth of 25 feet but found no vegetation beyond the 19 feet depth. Surveyors sampled a total of 202 sites in 2005 and 211 sites in 2009 (Figure 2). There were 185 sites that were surveyed in both years and only those sites are included in analyses (Table 1). (Note – if additional survey sites are included, frequency values may change slightly – see Appendix 1.)

Figure 2. Vegetation survey sites in Fish Trap Lake, 2005 and 2009.

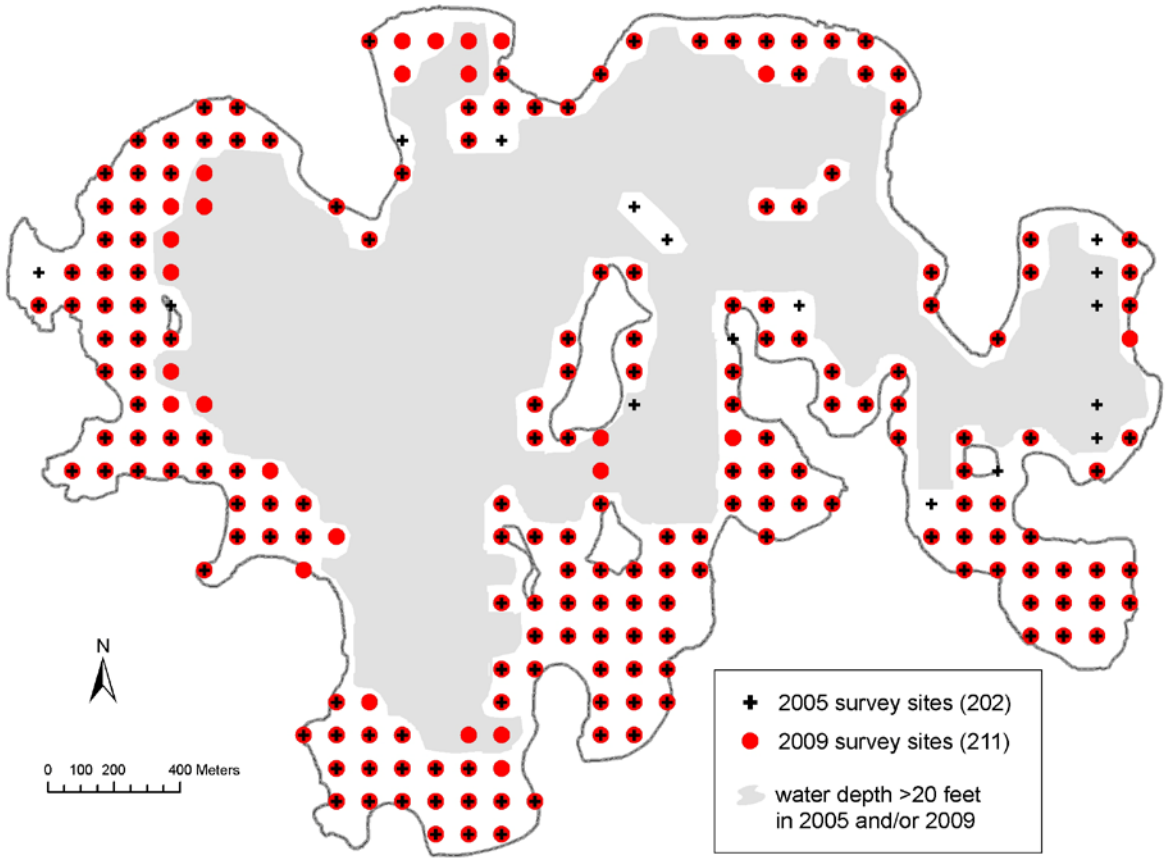


Table 1. Sampling effort by water depth. Only sites surveyed in both years are included in analyses.

Water depth interval	2005	2009
0 to 5	59	80
6 to 10	36	27
11 to 15	44	54
16 to 20	46	24
total	185	185

The surveys were conducted by boat and a GPS unit was used to navigate the boat 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 in water depths less than seven feet and an electronic depth finder in depths greater than seven feet.

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 (Figure 3) was used to survey vegetation not visible from the surface. Plant identification and nomenclature followed MnTaxa (2009).

Figure 3. Sampling rake.

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 (see example). For the 185 sites that were sampled in both years, frequency was calculated for the entire area from shore to 20 feet and sampling points were also grouped by water depth and separated into four depth zones for analysis (Table 1).

Example:

There were 185 sites in the 0-20 feet depth zone that were surveyed in both 2005 and 2009.

In 2005, coontail (*Ceratophyllum demersum*) occurred in 46 of those sites.

2005 frequency of coontail in 0-20 feet zone = (46/185)*100 = 25%

In 2009, surveyors described bottom substrate at each sample site where water depth was seven feet and less. Standard substrate classes were used (Table 2) and if several substrate types occurred at a site, surveyors recorded the most common type.

Table 2. Substrate classes

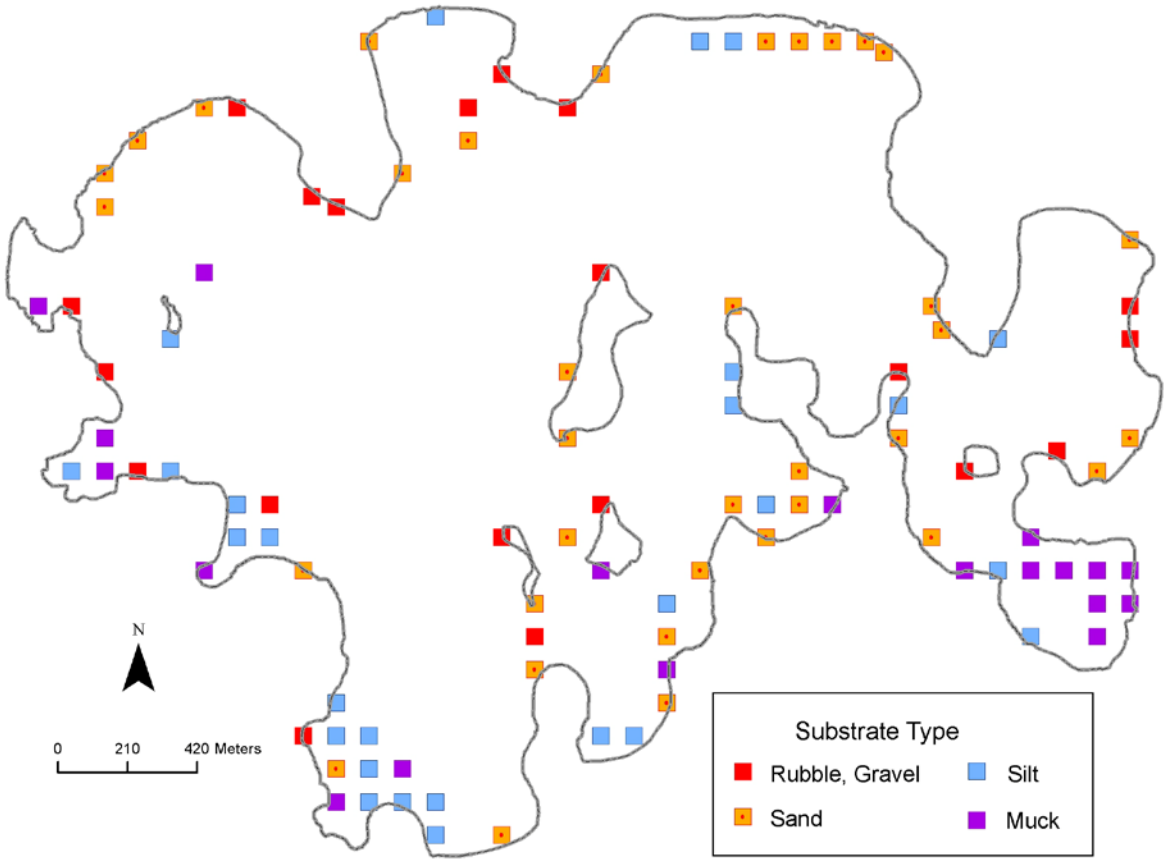
muck	decomposed organic material
marl	calcareous material
silt	fine material with little grittiness
sand	diameter less than 1/8 inch
gravel	diameter 1/8 to 3 inches
rubble	diameter 3 to 10 inches
boulder	diameter over 10 inches

Results

Shoal substrates

The shoal substrates of Fish Trap Lake were primarily hard substrates of sand, gravel and rubble. Softer substrates of silt and muck were found in the shallow bays of the south shores (Figure 4).

Figure 4. Most common substrate types at shallow water samples sites, Fish Trap Lake, 2009.



Distribution of aquatic plants

Within the shore to 20 feet depth zone, vegetation occurred in 77% of the sites in 2005 and in 54% in 2009. The broadest bands of vegetation were in the broad shallow areas of the south and west shores (Figure 5). Plants were found to a depth of 19 feet in 2005 and to 16 feet in 2009. In both surveys, vegetation was most common in the shore to ten feet zone where at least 70% of the sites contained plants (Figure 6).

Figure 5. Distribution of aquatic plants in Fish Trap Lake, 2005 and 2009.

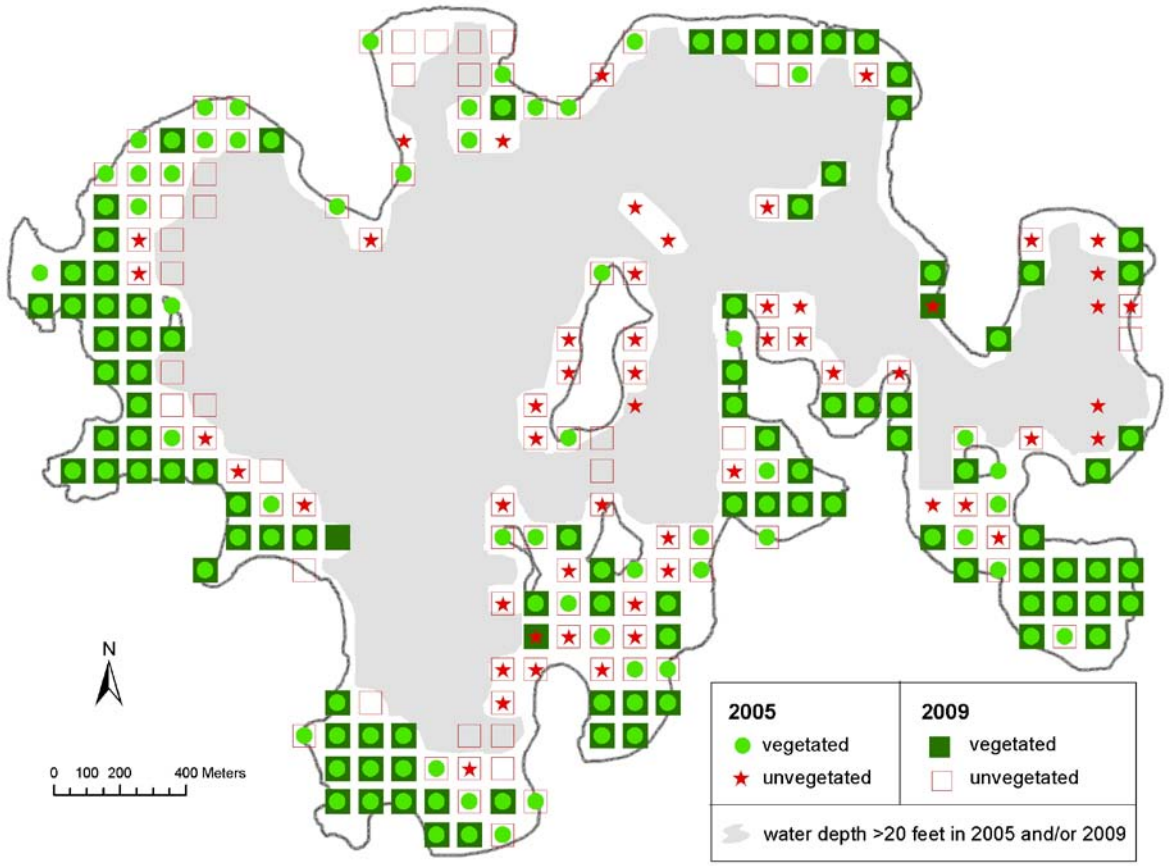
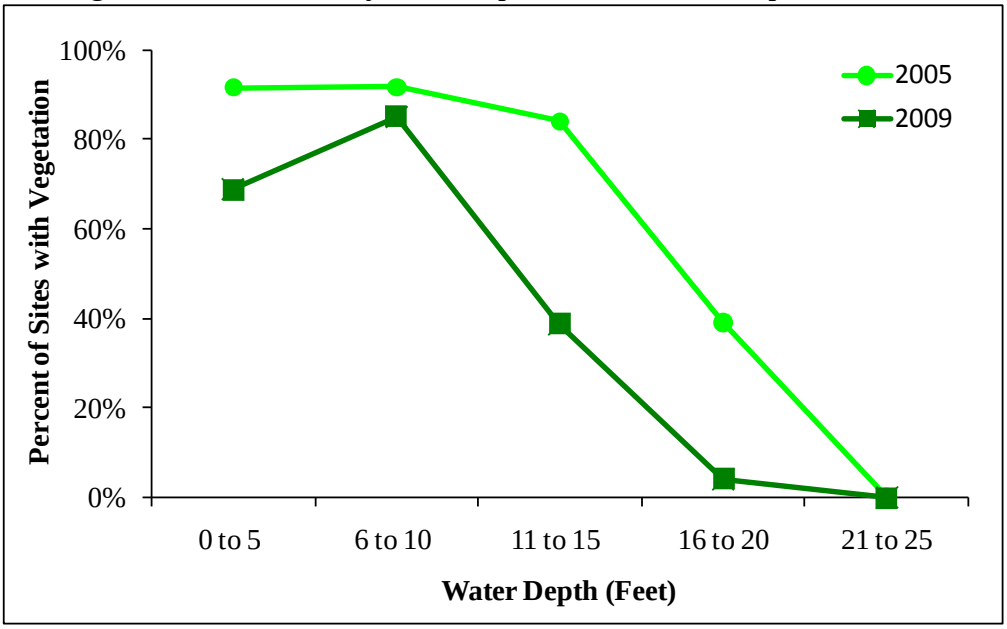


Figure 6. Vegetation occurrence by water depth interval, Fish Trap Lake, 2005 and 2009



Number of plant species recorded

A total of 24 native aquatic plant taxa were recorded in Fish Trap Lake including three emergent, two floating-leaved, three free-floating, and 16 submerged taxa (Table 3). Most of native plants were found during the June 2005 survey and many had not likely begun growth by the early May 2009 survey. One non-native plant, curly-leaf pondweed was found in both survey years.

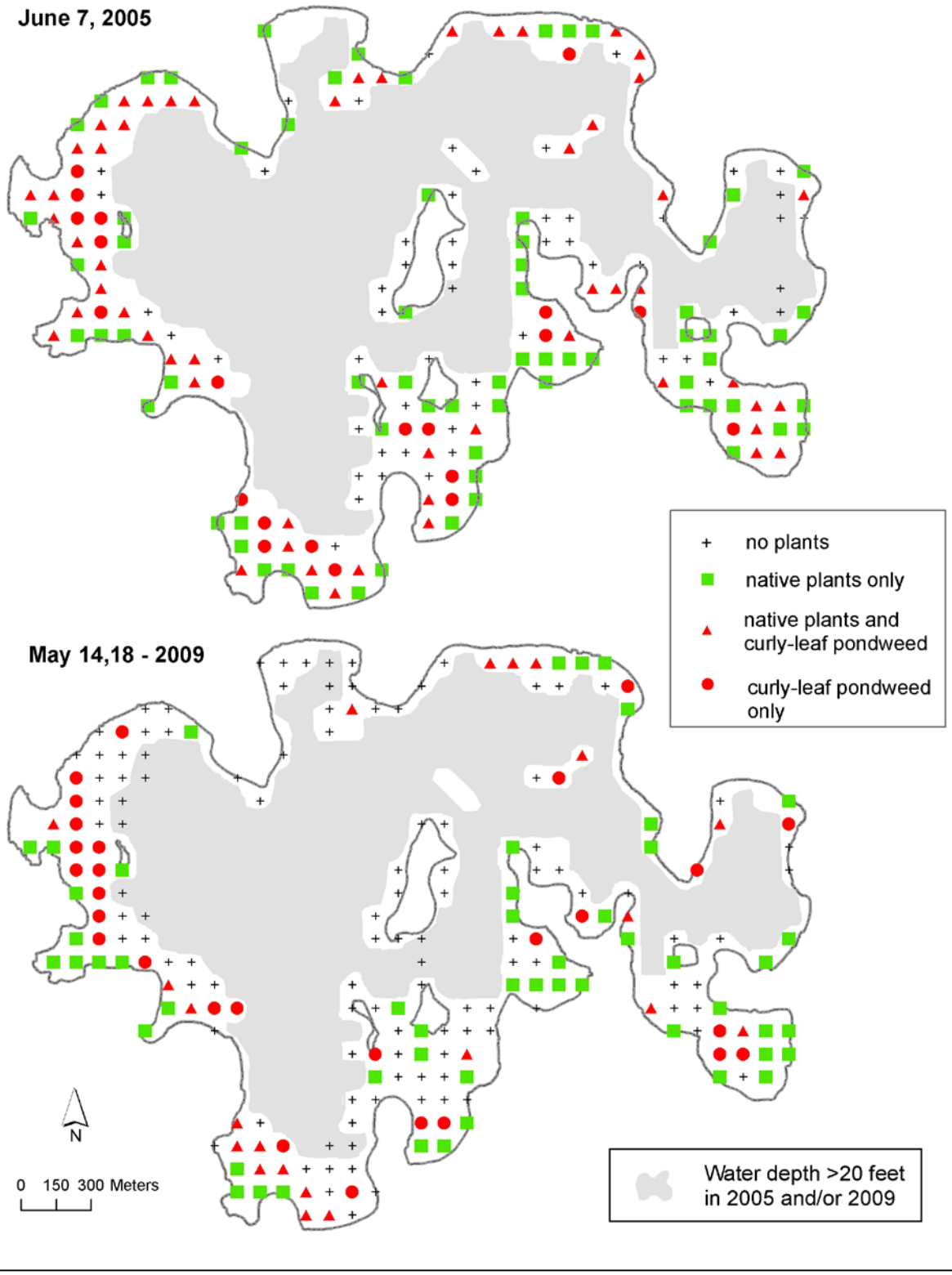
Table 3. Frequency of aquatic plants in Fish Trap Lake, June 2005 and May 2009.

Frequency is calculated for the 0-20 feet water depth interval (185 sample sites).
Frequency is the percent of sample sites in which a plant taxon occurred.

Life Form	Common Name	Scientific Name	Frequency (%)	
			2005	2009
NON-NATIVE SUBMERGED	Curly-leaf pondweed	*Potamogeton crispus*	41	26
NATIVE SUBMERGED These plants grow primarily under the water surface. Upper leaves may float near the surface and flowers may extend above the surface. Some species may also form floating leaves. Plants may or may not be anchored to the lake bottom.	Coontail	*Ceratophyllum demersum*	25	22
	Flat-stem pondweed	*Potamogeton zosteriformis*	21	10
	Narrow-leaf pondweed	*Potamogeton* sp.	14	---
	Clasping-leaf pondweed	*Potamogeton richardsonii*	14	---
	Northern water milfoil	*Myriophyllum sibiricum*	13	3
	Muskgrass	*Chara* sp.	12	10
	White-stem pondweed	*Potamogeton praelongus*	6	2
	Wild celery	*Vallisneria americana*	5	---
	Canada waterweed	*Elodea canadensis*	5	1
	White water buttercup	*Ranunculus aquatilis*	4	---
	Illinois pondweed	*Potamogeton illinoensis*	4	---
	Water marigold	*Megaladonta beckii*	3	---
	Large-leaf pondweed	*Potamogeton amplifolius*	2	---
	Bladderwort	*Utricularia vulgaris*	1	---
	Variable pondweed	*Potamogeton gramineus*	1	---
	Watermoss	*Not identified to genus*	1	1
FLOATING plants are rooted in the lake bottom with leaves that float on the water surface.	White waterlily	*Nymphaea odorata*	4	---
	Yellow waterlily	*Nuphar variegata*	2	---
FREE-FLOATING plants drift with the current	Star duckweed	*Lemna trisulca*	11	12
	Greater duckweed	*Spirodela polyhriza*	2	---
	Lesser duckweed	*Lemna minor*	2	---
EMERGENT These plants extend well above the water surface and are usually found in shallow water, near shore.	Hard-stem bulrush	*Schoenoplectus acutus*	6	4
	Wild Rice	*Zizania palustris*	5	---
	Cattail	*Typha* sp.	2	1

As a group, native plants dominated Fish Trap Lake in both survey years. The percent of sites that contained at least one native plant was 65% in 2005 and 39% in 2009 (Figure 7). This does not necessarily indicate a decline in native plants because the 2009 survey was conducted in very early spring before most native plants had begun growth.

Figure 7. Native plants vs. Curly-leaf Pondweed in Fish Trap Lake, 2005 and 2009.



Curly-leaf pondweed

The most abundant species in both years was curly-leaf pondweed (*Potamogeton crispus*) (Figure 8). This non-native, submerged plant is closely related to native pondweeds but it is not native to Minnesota. Curly-leaf pondweed has been present in Minnesota since at least 1910 (Moyle and Hotchkiss 1945) and is now found in at least 700 Minnesota lakes (MnDNR 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).

Figure 8. Curly-leaf pondweed

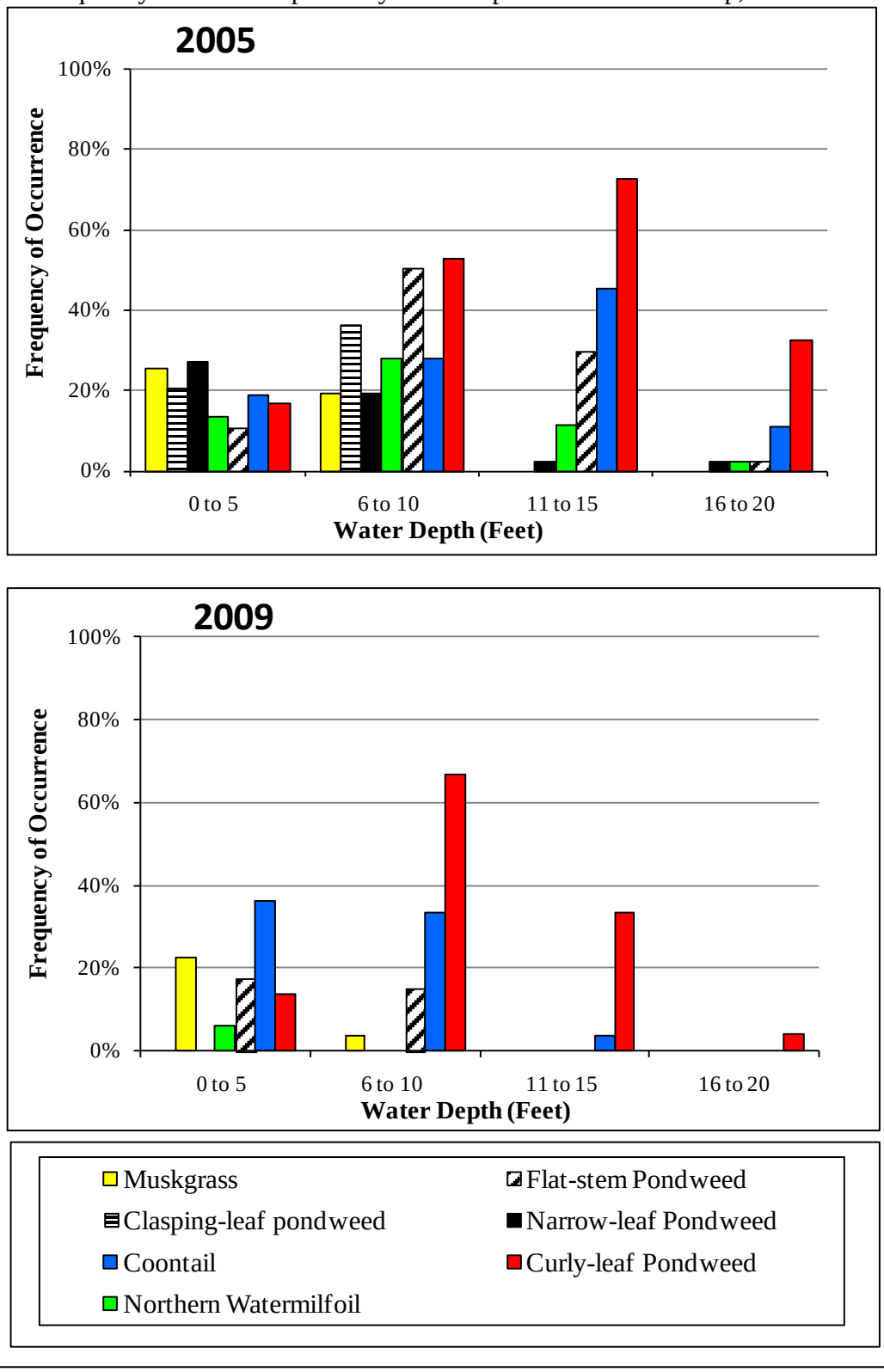
The foliage of curly-leaf pondweed does provide some fish and wildlife habitat, but it may create problems in some lakes. During its peak growth in spring, curly-leaf may reach the water surface at certain depths and create dense mats. These dense growths may compete with native vegetation and can also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

In Fish Trap Lake, curly-leaf pondweed occurred with a frequency of 41% in 2005 and 26% in 2009 (Table 3). In both years, curly-leaf pondweed was most often found in mixed beds with native plants (Figure 7). The number of sites that contained only curly-leaf pondweed remained similar in both years: 12% in 2005 and 15% in 2009. In both years curly-leaf pondweed was scattered around the entire shoreline and was the dominant plant in depths greater than five feet (Figure 9). During the June 2005 survey, it reached maximum frequency in the 11 to 15 feet depth zone. In May, 2009, it was most common in the 6 to 10 feet water depth zone, but did not reach the water surface and may not have yet reached its maximum growth for that year. The lower frequency in early Spring 2009 does not necessarily indicate a decline in curly-leaf pondweed, but may be due to delayed plant growth, especially in the deeper water depths, due to the cold spring of 2009.

Common native plants

As a group, native plants dominated Fish Trap Lake in both survey years. The percent of sites that contained at least one native plant was 65% in 2005 and 39% in 2009 (Figure 7). This does not necessarily indicate a decline in native plants because the 2009 survey was conducted in very early spring before most native plants had begun growth. The 2005 data are used to describe the native plant community.

Figure 9. Frequency of common plants by water depth interval. Fish Trap, 2005 and 2009.



Coontail (*Ceratophyllum demersum*) was the most common native species, occurring with a frequency of 25% in 2005 and 22% in 2009 (Table 3). In 2005 it occurred in all sample depths to 19 feet and was the dominant native plant in depths greater than 10 feet (Figure 9). It was found in fewer areas during the early spring 2009 survey but was still an important part of the plant community. Coontail (Figure 10) 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.

Figure 10. Coontail

Several native pondweeds (*Potamogeton* spp.) occurred in Fish Trap Lake. These plants are closely related to curly-leaf pondweed and are one of the largest groups of submerged plants in Minnesota lakes. These plants are rooted perennials and their rhizomes may form mats on the lake bottom that help consolidate soil (Arber 1920). Pondweeds have opposite, entire leaves and form "cigar-shaped" flowers that emerge above the water surface. Many pondweed species over-winter as hardy rhizomes while other species produce tubers, specialized winter buds, or remain "evergreen" under the ice. Seeds and tubers of pondweeds are an important source of waterfowl food. The foliage of pondweeds provides food for a variety of marsh birds, shore birds and wildlife and provides shelter, shade and spawning sites for a range of fish species (Borman et al. 2001). Pondweeds inhabit a wide range of aquatic sites and species vary in their water chemistry and substrate preferences and tolerance to turbidity. There are over 35 species of pondweeds in Minnesota and they vary in leaf shapes and sizes.

Figure 11. Flat- stem pondweed

Flat-stem pondweed (*Potamogeton zosteriformis*) (Figure 11) was one of seven native pondweeds found in Fish Trap Lake and occurred in 21% in 2005 and 10% of the sites in 2009 (Table 3). It is anchored to the lake bottom by underground rhizomes and over-winters by winter buds. It is named for its flattened, grass-like leaves. Depending on water clarity and depth, these plants may reach the water surface and may produce flowers that extend above the water.

Figure 12. Narrow-leaf pondweed

Narrow-leaf pondweeds (*Potamogeton* sp.) (Figure 13) are rooted, perennial submerged plants with small, thin leaves. Leaves grow entirely below the water surface but flowers extend above the water. There are several species of narrow-

leaf pondweeds and they can be difficult to identify if not found in flower or fruit. In Fish Trap Lake, narrow-leaf pondweeds were found in 14% of the survey sites in 2005 (Table 3) and were most frequently found in depths from one to five feet (Figure 10).

Clasping-leaf pondweed (*Potamogeton richardsonii*) (Figure 13) is one of many broadleaf pondweeds in Minnesota. Clasping-leaf pondweed clasps half to three-quarters around the stem and the base of the leaves are heart-shaped. It has a fibrous stipule and the leaves can be confused with white-stem pondweed. In clearer lakes clasping-leaf can form flowers above the surface of the water. Clasping-leaf pondweed was found in 14% of the 2005 survey sites and was not found in 2009 (Table 3).

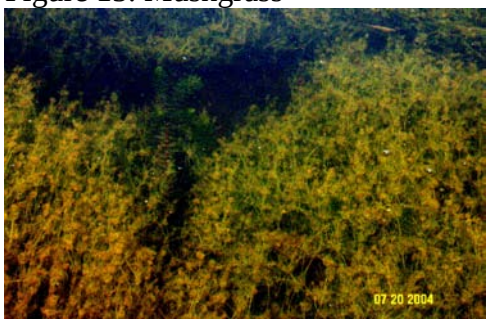
Figure 13. Clasping-leaf pondweed with waterlily

Northern watermilfoil (*Myriophyllum sibiricum*) (Figure 14) was found in 13% of the 2005 survey sites (Table 3). It occurred to a depth of 16 feet and was most common in the 0 to 10 feet depth zone (Figure 9). 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. For information on how to identify the native northern watermilfoil from the non-native, Eurasian watermilfoil, click here: identification.

Figure 14. Northern watermilfoil

Muskgrass (*Chara* sp.) (Figure 15) occurred in 12% of the survey sites (Table 3) and was an important plant in the 0 to 5 feet depth zone (Figure 10). Muskgrass is a macroscopic, or large, algae and is common in many hard water Minnesota lakes. It has a brittle texture and a characteristic "musky" odor. Because muskgrass does not form true stems, it is a low-growing plant, often found entirely beneath the water surface where it may form low "carpets" on the lake bottom. Muskgrass is adapted to variety of substrates and is often the first taxa to colonize open areas of lake bottom where it can act as a sediment stabilizer. Beds of muskgrass can provide important fish spawning and nesting habitat.

Figure 15. Muskgrass



Additional native plants that were found in previous summer surveys of Fish Trap Lake were not located during the 2005 and 2009 surveys. These plants likely still occur in the lake but were not

observed during these Spring/early Summer surveys because they had not yet germinated and/or reached maturity.

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

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Appendix. 1. 2005 Frequency values calculated using all survey sites (202) vs. only those sites surveyed in both years (185).

Frequency is the percent of sample sites in which a plant taxon occurred.

Common Name	**Scientific Name**	**2005 ALL sites (N=202)**	**2005 Only sites surveyed in both 2005 and 2009 (N=185)**
Curly-leaf pondweed	*Potamogeton crispus*	38	41
Coontail	*Ceratophyllum demersum*	23	25
Flat-stem pondweed	*Potamogeton zosteriformis*	19	21
Narrow-leaf pondweed	*Potamogeton* sp.	13	14
Clasping-leaf pondweed	*Potamogeton richardsonii*	12	14
Northern water milfoil	*Myriophyllum sibiricum*	12	13
Muskgrass	*Chara* sp.	11	12
White-stem pondweed	*Potamogeton praelongus*	5	6
Wild celery	*Vallisneria americana*	5	5
Canada waterweed	*Elodea canadensis*	5	5
White water buttercup	*Ranunculus aquatilis*	4	4
Illinois pondweed	*Potamogeton illinoensis*	4	4
Water marigold	*Megaladonta beckii*	3	3
Large-leaf pondweed	*Potamogeton amplifolius*	1	2
Bladderwort	*Utricularia vulgaris*	1	1
Variable pondweed	*Potamogeton gramineus*	<1	1
Watermoss	Not identified to genus	<1	1
White waterlily	*Nymphaea odorata*	1	4
Yellow waterlily	*Nuphar variegata*	4	2
Star duckweed	*Lemna trisulca*	11	11
Greater duckweed	*Spirodela polyhriza*	2	2
Lesser duckweed	*Lemna minor*	2	2
Hard-stem bulrush	*Schoenoplectus acutus*	5	6
Wild Rice	*Zizania palustris*	5	5
Cattail	*Typha* sp.	1	2
	ALL Vegetation	73	77