Aquatic Vegetation Point Intercept Survey by the Invasive Species Program
Division of Ecological Resources
Minnesota Department of Natural Resources

Lake: Margaret **DOW Number**: 11-0222-00 **Date of survey:** August 14, 2009

County: Cass **Observer[s]**: Darrin Hoverson, Ben Burggraff, & Tim Randt

Time - On Water: 0945 **Off water**: 1330

Author of report: Darrin Hoverson – Invasive Species Specialist Date of report: January 26, 2010

Introduction

Margaret Lake (DOW 11-022-00) is a medium sized, 752 acre lake located on the Gull Chain of Lakes. The city of Lakeshore, Minnesota lies on the shore of Margaret Lake and public access is via a navigable channel from Gull Lake. The maximum depth is 26 feet and 29% of the lake is littoral or 15 feet deep or less. This area is usually considered shallow enough for sunlight to penetrate the bottom to grow the majority of the lakes aquatic vegetation. Margaret Lake is heavily developed with many homes and cabins along its shoreline and is a popular recreational and fishing lake.

Margaret Lake lies just to the west of the Gull Lake chain and flows eastward into Upper Gull Lake and the rest of the Gull Lake chain. The lake lies within the Crow Wing River major watershed and receives inflow from adjacent wetlands, groundwater, and small inflows surrounding the lake. The lake is considered a flow through lake and surface water outflow is through a channel in the northeast corner of the lake.

Margaret Lake is classified as a eutrophic lake with poor water clarity as measured by mean secchi depth reading of 5 feet and ranging between 0.5-10.5 feet during 1973-2008 (MPCA, 2009). The water clarity is below average for the area. In spring and late fall, water clarity can be better with readings of 7-10 feet. Increased phosphorus levels can contribute to algal abundance associated with a decrease in water clarity throughout the summer. Total phosphorus and chlorophyll-a (a value that provides a measure of the amount of algae in the water) are considered high with mean values of 171 ppb (parts per billion) and 27.5 ppb respectively. Total phosphorus ranges 10-1500 ppb following a seasonal pattern of increased levels following ice-out, lowest levels in June, and increased levels as the summer progresses. Chlorophyll-a ranges 4-71 ppb and increases throughout the summer in response to phosphorus increases. Margaret Lake is also listed as impaired for aquatic recreation by the Minnesota Pollution Control Agency.

It is essential to protect and maintain native aquatic plants in Margaret Lake as they are important for shoreline protection, maintaining water quality, and they provide critical habitat for bass and panfish species. Submerged plants provide food and cover needed by fish and other aquatic species.

Objectives of Survey

This survey describes the aquatic plant community of Margaret Lake and includes:

1) Estimation of maximum depth of rooted vegetation
2) Record and estimation of abundance of aquatic plant species that were sampled
3) Distribution map for common aquatic plant species
4) Average number of species sampled per site

Summary:

On August 14, 2009, 239 locations were surveyed for aquatic vegetation using a point-intercept survey method (Figure 1). Twenty-two native plant species and one invasive, curly leaf pondweed (*Potamogetan crispus*) were sampled using this method. The weather was fair with clear skies, an air temperature of 76° F, winds from the northeast at 10-12 mph, and a water temperature of 63° F.

Two submersed native species made up the majority of plants sampled in depths of 15 feet or less. Coontail (*Ceratophyllum demersum*) was sampled at 34% of the locations and northern watermilfoil (*Myriophyllum sibiricum*) at 11%. Two floating-leaf native species were sampled at frequecieces greater than most submersed species. White water lily *(Nymphaea odorata)* was sampled at 14% of the locations and yellow water lily (*Nuphar variegata*) at 8% (Figure 3, 4, and Table 1).

Sampling occurred to a maximum depth of 21 feet. No plants were found to be growing beyond 14 feet with the exception of site 222 where coontail was sampled at 20 feet. Plant abundance was greatest in the first 10 feet of water and as depths increased the presences of vegetation decreased and became less dense (Figure 5). Of the 239 locations on the grid, 185 were sampled, and 179 were in 15 feet or less.

The average number of all native aquatic plants per rake sample was 0.97 for depths of 15 feet or less and 0.95 for all locations sampled. The average number of just native submersed plants per rake sample was 0.66 for depths of 15 feet or less and 0.64 for all locations sampled. Six was the maximum number of species sampled at one location while values of 1 through 4 species were sampled regularly where plants were sampled (Figure 6).

Other native plants sampled included: muskgrass (*Chara spp.),* common bladderwort (*Utricularia vulgaris.),* floating-leaf pondweed *(Potamogetan natans*), whitestem pondweed (*Potamogetan* prailongus), flat-stem pondweed *(Potamogetan zosteriformis*), clasping-leaf pondweed (*Potamogetan rishardsonii*), Illinois pondweed *(Potamogeton illinoensis),* sago pondweed (*Stuckenia* pectinata), Canada waterweed *(Elodea canadensis),* bushy pondweed *(Najas flexilis),* sago pondweed *(Stuckenia pectinata),* wild celery (*Vallesneria* americana), great duckweed (*Spirodela polyrhizai*), star duckweed *(Lemna trisulca),* common watermeal (*Wolffia columbiana*), common arrowhead (*Sagitaria latifolia*), wildrice (*Zizania spp.*), and cattail (Typha spp.), (Table 1).

Curly-leaf pondweed (CLP) was found at five locations on the lake and only single or moderate amounts of the plant were sampled.

Due to abundant and dense growth of native submersed, emergent, and floating-leaf native plants species in the southwest bay of Margaret Lake the area was not sampled using the point-intercept method. Those locations not sampled included sites 1 through 11 and site 16. This area was not-navigable with the equipment being used and visual observations were taken. Those plants visually observed included coontail, northern watermilfoil, white water lily, yellow water lily, muskgrass, floating-leaf pondweed, wild celery, common arrowhead, wildrice, and cattail. The wildrice was especially dense throughout this corner of the lake.

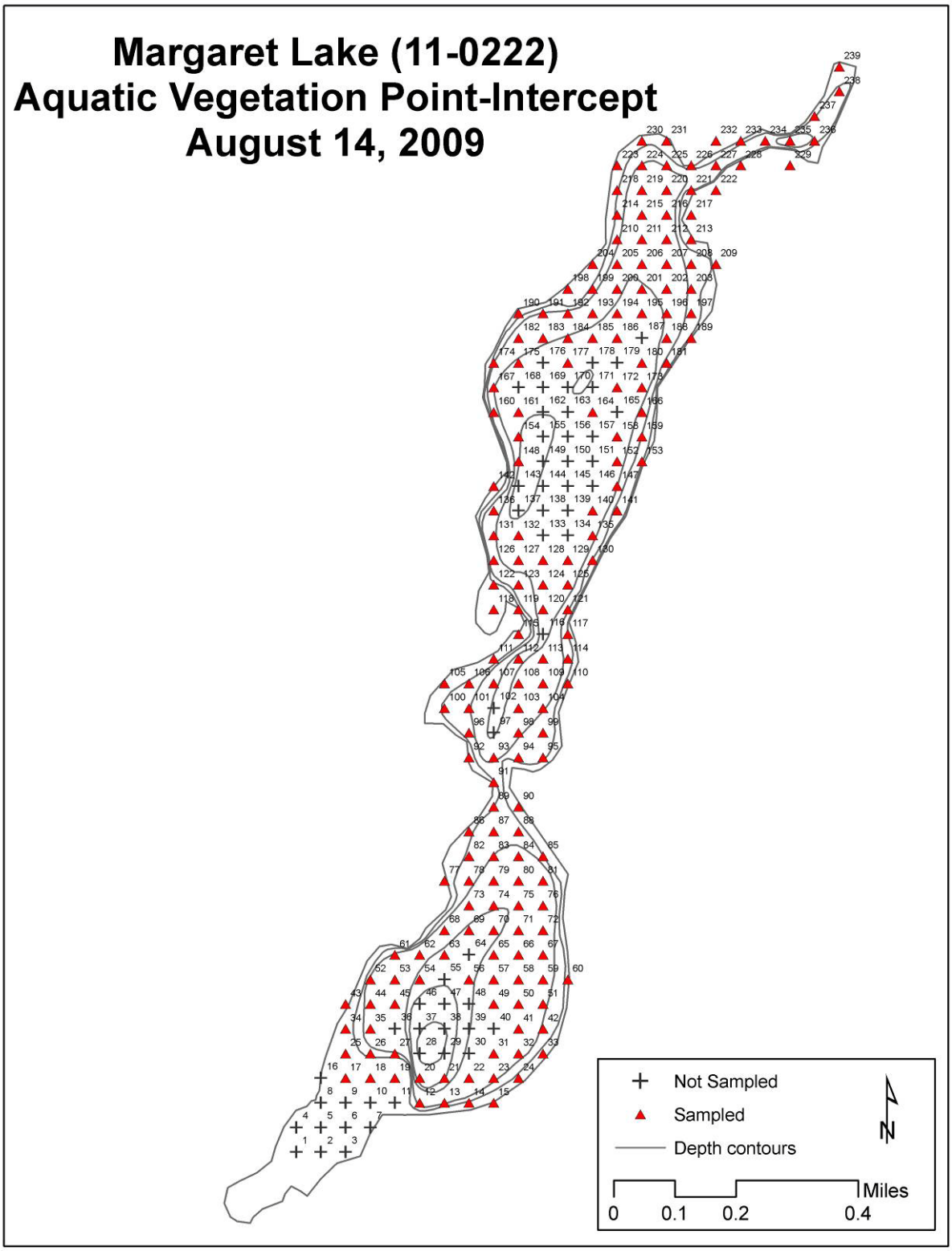

Figure 1. Point-intercept survey locations on Margaret Lake, August 14, 2009.

Methods:

The point-intercept survey followed methodology described by Madsen (1999). Geographic Information System (GIS) software was used to generate sample points across the lake surface in a 65 meter by 65 meter grid, resulting in a total of 239 potential survey points. In the field, no depths greater than 20 feet were sampled since vegetation was not found beyond 14 feet with the exception of site 222 at 20 feet. A Global Positioning System (GPS) unit was used to navigate the boat to each sample point. Water depths at each site were recorded in 1-foot increments using an electronic depth finder.

All plant species found within a one square meter sample site at the pre-designated side of the boat were recorded. A double-headed, weighted garden rake, attached to a rope (Figure 2) was used to survey vegetation not visible from the surface. Nomenclature followed Crow and Hellquist (2000).

Figure 2. Double-headed, weighted garden rake, attached to a rope used to survey aquatic vegetation.

Frequency of occurrence was calculated for each species as the number of sites in which a species occurred divided by the total number of sample sites. Frequency was calculated for all sampled locations and for those sites 15 feet or less. The average number of native submersed and all plants per rake sample was calculated as the total number of plants sampled divided by the number of sample locations.

Sampling points were also grouped by water depth and separated into five depth zones for analysis: 0 to 5 feet, and 6 to 10 feet, 11 to 15 feet, 16 to 20 feet, and 21+.

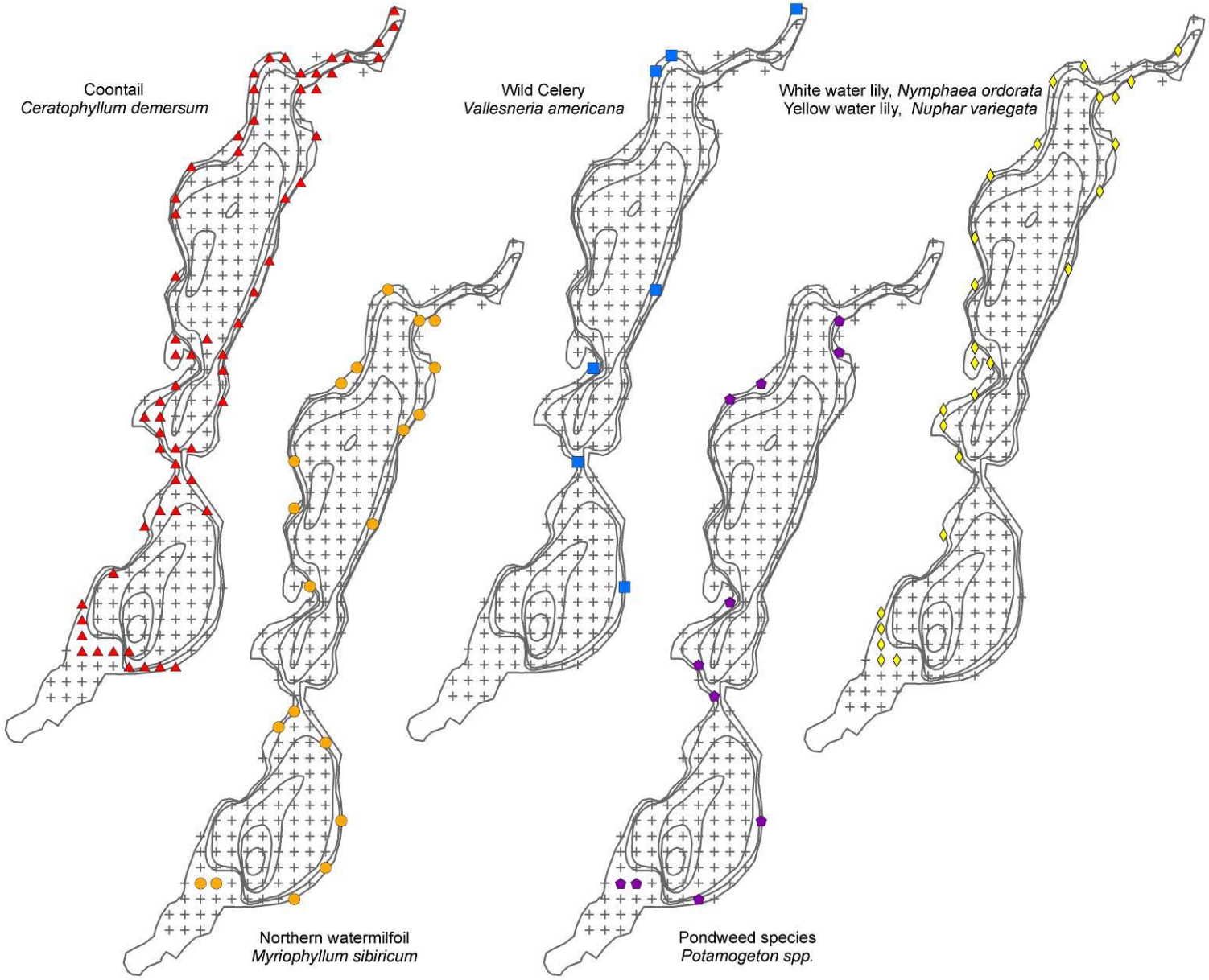

Figure 3. Distribution of common native aquatic plant species in Margaret Lake, August 14, 2009.

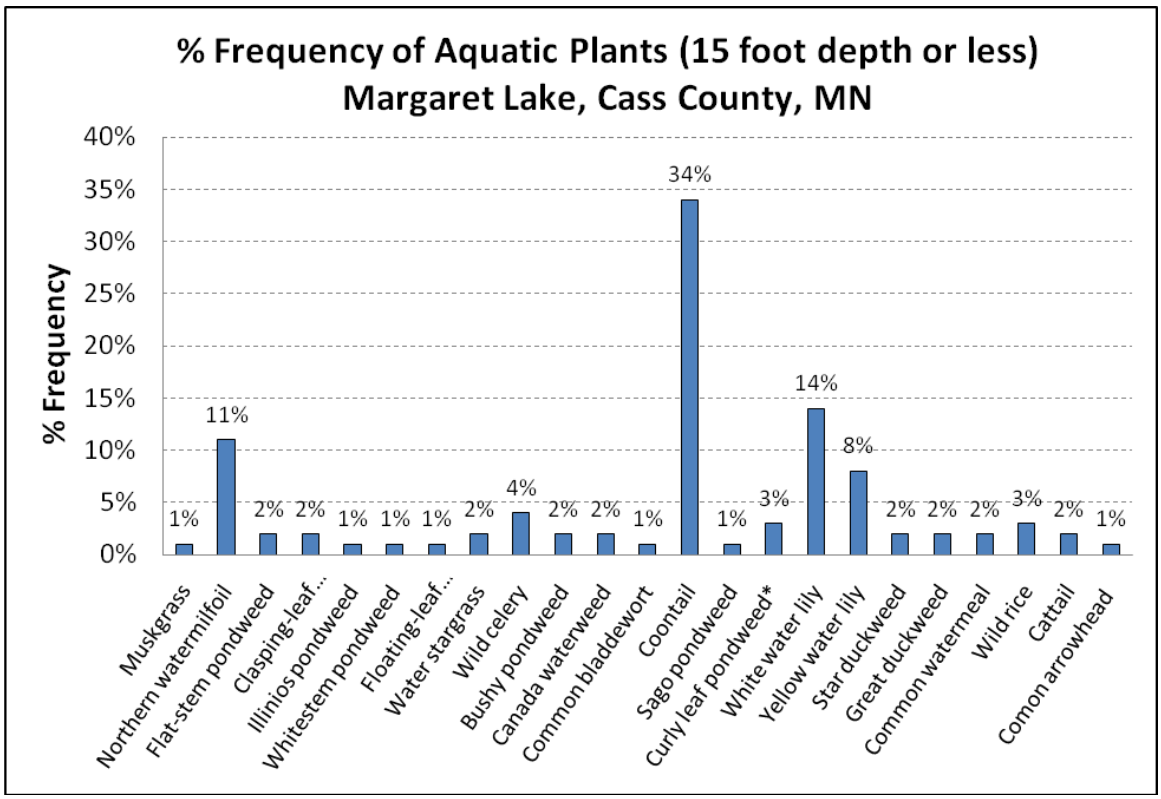

Figure 4. Frequency of occurrence for aquatic plant species in depths of 15 foot or less.

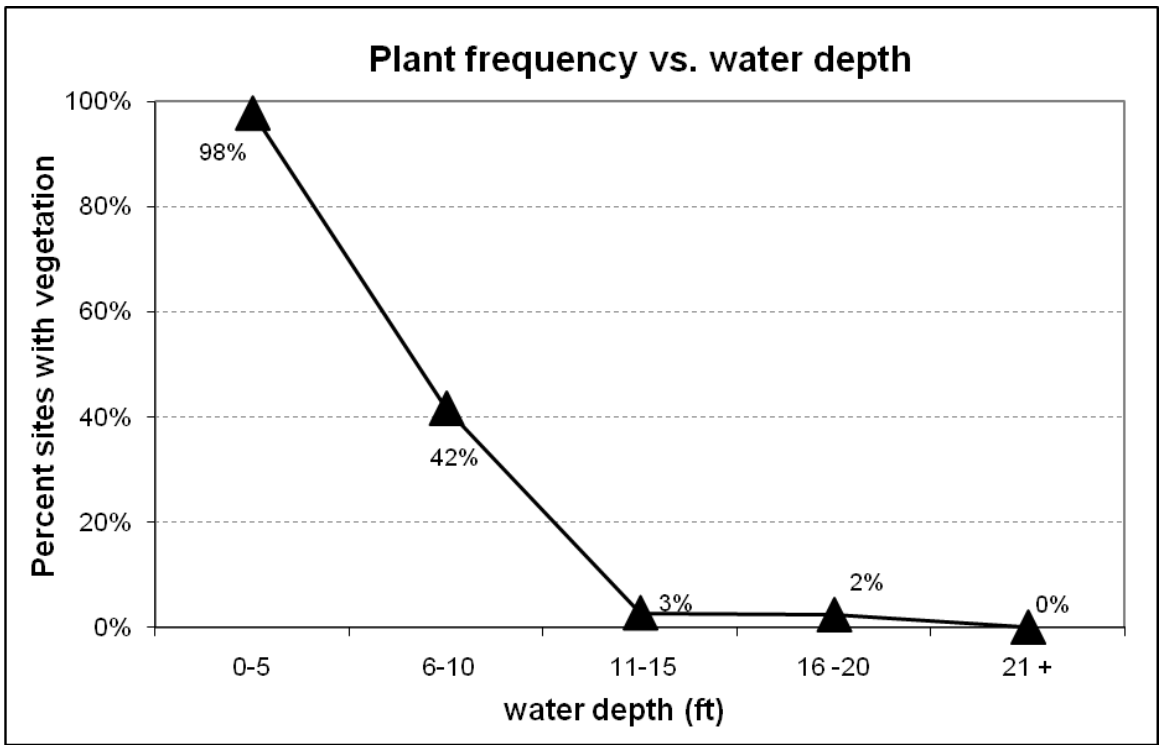

Figure 5. Frequency of vegetation vs. water depth, Margaret Lake, Cass County.

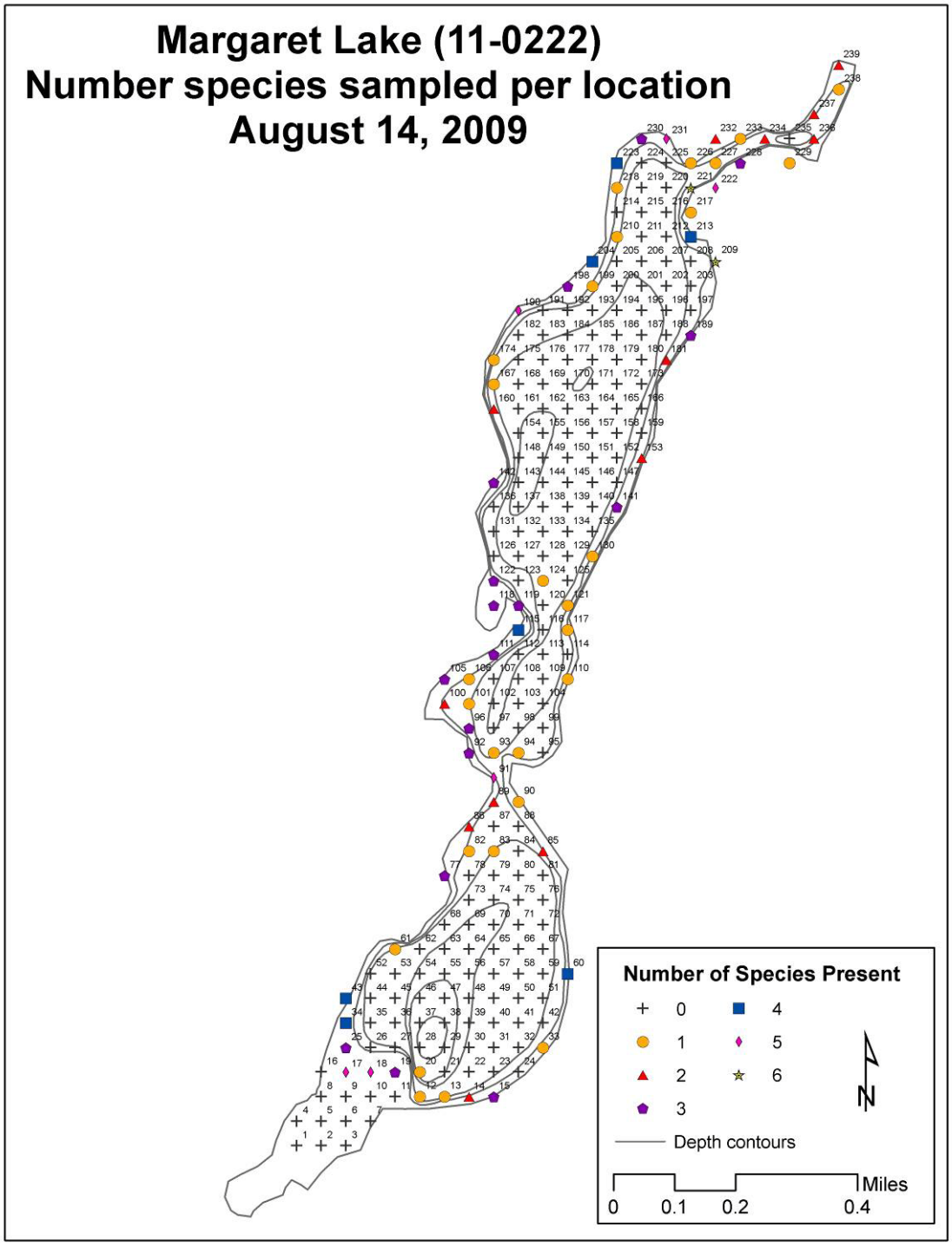

Figure 6. Species of all aquatic plants sampled per location on Margaret Lake, August 14, 2009. Sites 1-11 & 16 not sampled because of dense aquatic plant growth.

Table 1. Aquatic Plants surveyed from Margaret (DOW 11-0222-00) Cass County, August 14, 2009.

			15 ft or less		all sampled	
Life Form	**Common Name**	***Scientific Name***	**Freq. (%)**	**Count**	**Freq. (%)**	**Count**
SUMBMERGED - ANCHORED - These plants grow primarily under the water surface. Upper leaves may float near the surface and flowers may extend above the surface. Plants are often rooted or anchored to the lake bottom.	Muskgrass	*Chara. spp.*	1%	2	1%	2
	Northern watermilfoil	*Myriophyllum sibiricum*	11%	20	11%	20
	Flat-stem pondweed	*Potamogeton zosteriformis*	2%	4	2%	4
	Clasping-leaf pondweeed	*Potamogeton richardsonii*	2%	4	2%	4
	Illinios pondweed	*Potamogeton illinoensis*	1%	1	1%	1
	Whitestem pondweed	*Potamogeton prailongus*	1%	1	1%	1
	Floating-leaf pondweed	*Potamogeton natans*	1%	1	1%	1
	Water stargrass	*Zosterella dubia*	2%	4	2%	4
	Wild celery	*Vallesneria americana*	4%	7	4%	7
	Bushy pondweed	*Najas flexilis*	2%	3	2%	3
	Canada waterweed	*Elodea canadensis*	2%	3	2%	3
	Common bladdewort	*Utricularia vulgaris*	1%	2	1%	2
	Coontail	*Ceratophyllum demersum*	34%	61	34%	62
	Sago pondweed	*Stuckenia pectinata*	1%	1	1%	1
	Curly leaf pondweed*	*Potamogeton crispus*	3%	5	3%	5
FLOATING - LEAF - These plants leaves float on the water and are anchored to the lake bottom.	White water lily	*Nymphaea odorata*	14%	25	14%	25
	Yellow water lily	*Nuphar variegata*	8%	15	8%	15
FREE- FLOATING - These plants cab float on the water and drift with water currents.	Star duckweed	*Lemna trisulca*	2%	3	2%	3
	Great duckweed	*Spirodela polyrhiza*	2%	4	2%	4
	Common watermeal	*Wolffia columbiana*	2%	3	2%	3
EMERGENT - These plants extend well above the water surface and are usually found in shallow water, near shore.	Wild rice	*Zizania spp.*	3%	5	3%	5
	Cattail	*Typha spp.*	2%	3	2%	3
	Comon arrowhead	*Sagitaria latifolia*	1%	1	1%	1
	Total number of sites		--	179	--	185

Literature Cited

Crow, G.E. and C.B. Hellquist. 2000. Aquatic and wetland plants of Northeastern North America. 2 volumes. The University of Wisconsin Press.

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. www.wes.army.mil/el/aqua

Minnesota Pollution Control Agency. 2009. Margaret Lake (DOW 110222000) MPCA Lakes Water Quality Summary Information. Retrieved January 26, 2010, from MPCA website: http://www.pca.state.mn.us/water/clmp/lkwqReadFull.cfm?lakeid=11-0222