Aquatic vegetation of Roemhildts Lake

2004 and 2011

ID# 40-0039-00

Le Sueur County, Minnesota

White waterlilies, bulrush and cattails in Roemhildts Lake, June 2011.

Report by:
Donna Perleberg, Aquatic Plant Ecologist
Stephanie Simon, Aquatic Biologist

Minnesota Department of Natural Resources
Division of Ecological and Water Resources
Lakes and Rivers Program
1601 Minnesota Drive, Brainerd, MN 56401

Surveyors:
2011: Stephanie Simon and Michelle Dickson (Central Lakes College, Intern with MNDNR)

2004: Donna Perleberg and Joe Backowski (Central Lakes College, Intern with MNDNR)

A note to readers:
Text that appears in blue underline is a hypertext link to a web page where additional information is provided. If you are connected to the Internet, you can click on the blue underlined text to link to those web pages.

This report is also available online at:
http://www.dnr.state.mn.us/eco/pubs_aquatics/veg_reports.html

This report should be cited as:
Perleberg, D. and S. Simon. 2012. Aquatic vegetation of Roemhildts Lake (ID# 40-0039-00) Le Sueur County, Minnesota, 2004 and 2011. Minnesota Department of Natural Resources, Division of Ecological and Water Resources, Lakes and Rivers Unit, 1601 Minnesota Drive, Brainerd, MN 56401. 20 pp.

Summary

Roemhildts Lake is a 73 acre, relatively undeveloped lake in southern Minnesota where relatively high water clarity has been maintained through good shoreland management practices. Plant surveys were conducted in June 2004 and June 2011 to assess the relative abundance of native and non-native plants.

Aquatic plants ringed the entire shoreline of Roemhildts Lake. Beds of floating and emergent plants extended 20-50 meters lakeward to a depth of about five feet and covered about 13 acres. Submerged plants extended to a depth of 17 feet in some locations. In both survey years, vegetation was present in at least 75% of the sample sites and was most frequent in the shore to 10 feet depth zone.

A total of 24 native aquatic plant species were recorded, making Roemhildts Lake of the richest lakes in the watershed in terms of aquatic plants. The plant community included four emergent, three floating-leaved and 17 submerged plants. Native submerged plants occurred in 60% of the sample sites and the most frequently occurring species were northern watermilfoil (*Myriophyllum sibiricum*), muskgrass (*Chara* sp.), coontail (*Ceratophyllum demersum*), flat-stem pondweed (*Potamogeton zosteriformis*) and narrow-leaf pondweeds (*Potamogeton* sp.).

The non-native plant, curly-leaf pondweed (*Potamogeton crispus*), was found in 17% of the sample sites in 2004 and occurred to a depth of 17 feet. In 2011, it was found in 10% of the sample sites and was found to a depth of 10 feet. In both survey years, curly-leaf pondweed was found within native plant beds and was not dominating the plant community.

The non-native plant, Eurasian watermilfoil (*Myriophyllum spicatum*) was reported in the lake in 2007 but was not located during the 2004 or 2011 surveys. If it was present during either of those years, it likely occurred at low abundance.

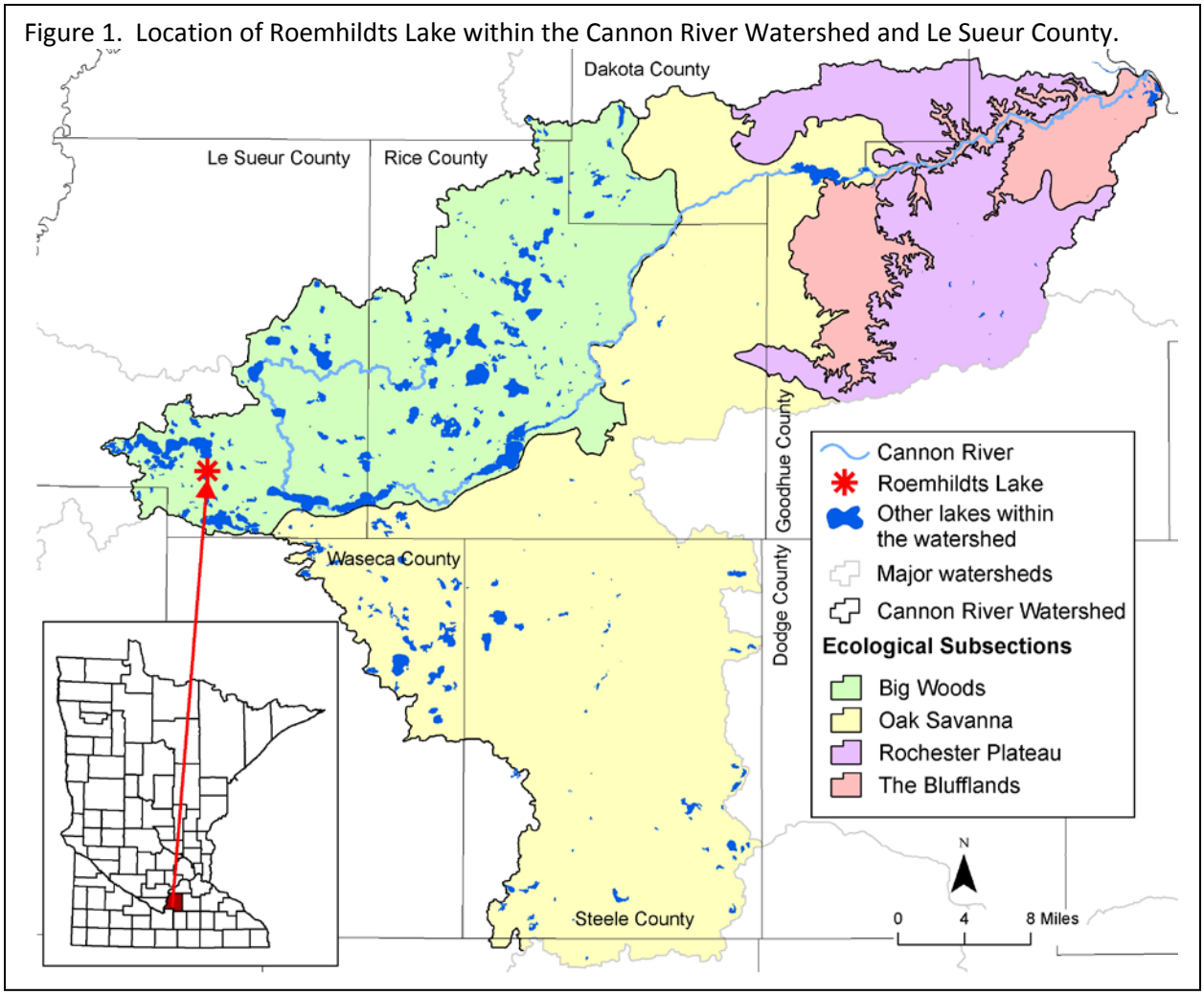
Introduction

Roemhildts Lake is located in Le Sueur County, in southern Minnesota at the western edge of the Cannon River Watershed (Figure 1). The Cannon River drains the watershed to the northeast, but many of the lakes, including Roemhildts Lake, are not directly connected to the river; they are groundwater controlled with no inlets or outlets. The watershed contains about 130 lakes that are 50 acres or larger in area and Roemhildts Lake is one of the smallest, with a surface area of 73 acres.

The lake occurs within the Big Woods ecological subsection where large blocks of oak woodland and maple-basswood forest were once common. Much of the original forested land has been converted to agricultural land, but the immediate shoreland bordering Roemhildts Lake remains forested and mostly undeveloped. This forested upland edge provides a buffer zone that helps filter nutrients and sediment from surface water before entering the lake.

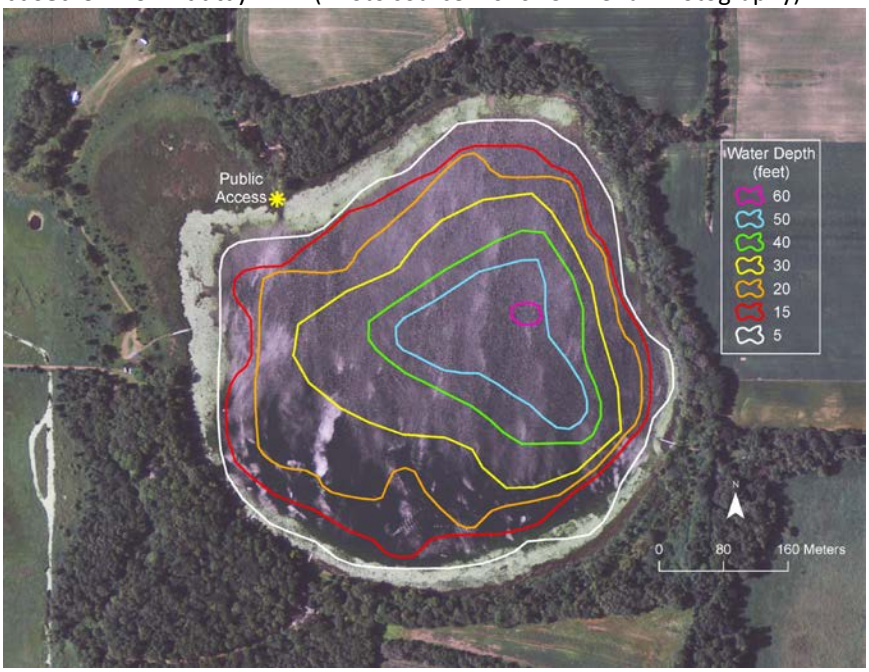
Roemhildts Lake can be described as a seepage lake because it receives most of its flow from precipitation and groundwater flow. Water levels on seepage lakes can fluctuate seasonally and annually because their water level is a reflection of the elevation of the water table, which

Figure 1. Location of Roemhildts Lake within the Cannon River Watershed and Le Sueur County.



in turn reflects the amount of rain water and snow melt. Because the lake is not a flow-through lake, it is particularly susceptible to increased nutrient and particle input that may result from poor shoreland management practices.

Figure 2. Depth contours of Roemhildts Lake (5, 15 and 20 foot contours based on 2011 data). (Photo source: 2010 FSA Aerial Photography).



Roemhildts Lake is round in outline with gently sloping shores. About half of the lake has water depths less than 15 feet and the maximum depth is 60 feet (Figure 2). A public access is present on the northwest shore.

The trophic, or growth, status of the lake is characterized as mesotrophic, based on phosphorus (nutrients), chlorophyll a (algae concentration) and Secchi[1] depth transparency. The depth to which rooted aquatic plants grow is largely dependent on water clarity and Roemhildts Lake has relatively high water clarity, with a mid-summer Secchi disc reading of 6.5 feet (MPCA, 2011). Based on summer water clarity readings alone, aquatic plants have the potential to reach depths of about 15 feet in this lake[2]. Other factors that influence the depth of plant growth include wind fetch, substrate type and the types of plants present in the lake.

Historic aquatic plant communities

Previous lakewide, aquatic plant surveys of Roemhildts Lake were conducted in 1975, 1983, 1988, 1993 and 2001 (MNDNR Lake files). These surveys recorded a total of 23 native aquatic plant species: four emergent, three floating-leaf and 16 submerged species (Appendix 1). Submerged plants included a diversity of native pondweeds (*Potamogeton* spp.), muskgrass (*Chara* sp.), coontail (*Ceratophyllum demersum*), and northern watermilfoil (*Myriophyllum sibiricum*). The lake was surveyed in 2006 and 2007 and an additional five native species were documented.

[1] The Secchi disc transparency measures the depth to which a person can see a white disc lowered into the lake and provides an estimate of the light penetration into the water column. Water clarity is influenced by the amount of particles in the water column and can fluctuate seasonally and annually.

[2] As a general rule, sunlight can penetrate to a depth of two times the Secchi depth and aquatic plants can grow to a depth of one and a half times the Secchi depth.

The non-native submerged plant, curly-leaf pondweed (*Potamogeton crispus*), has been present in the Cannon River Watershed for decades and was first documented in Roemhildts Lake during the 1983 survey. Floating fragments of the non-native submerged plant, Eurasian watermilfoil (*Myriophyllum spicatum*) were found during a 2007 survey but rooted plants have not been located in the lake.

Objectives

These surveys were conducted to provide quantitative descriptions of the curly-leaf pondweed population in Roemhildts Lake. Surveys were conducted in June because curly-leaf pondweed reached its maximum growth in early summer. 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. Specific 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 common species
5. Develop distribution maps for the native and non-native species
6. Compare how plant communities may change annually

Methods

Emergent and floating-leaf Plant Bed Delineation

The boundaries of major plant beds were delineated from review of 2003 FSA Color Aerial photographs with in-field verification. This provides a general estimation of plant bed location and size but detailed mapping of plant beds using global positioning system (GPS) was not conducted.

Lakewide (Point-intercept) vegetation survey

Roemhildts Lake was surveyed on June 16, 2004 and June 15-16, 2011 using a point-intercept method (Madsen 1999, MNDNR 2009). Because curly-leaf pondweed occurs in the lake and typically dies back by mid-summer, surveys were conducted in mid-June so that both curly-leaf and most native aquatic plants could be assessed.

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 40 meters (131 feet) apart, resulting in about one survey point per acre. Within the 0-20 feet depth zone, 76 sites were surveyed in 2004 and 81 sites were surveyed in 2011 (Figure 3, Table 1). Sites were surveyed within the 21-25 feet zone, but because surveyors found no plants in those depths, frequency was only calculated for the 0-20 feet depth zone.

Figure 3. Vegetation survey sites (20 foot contour based on 2011 data)

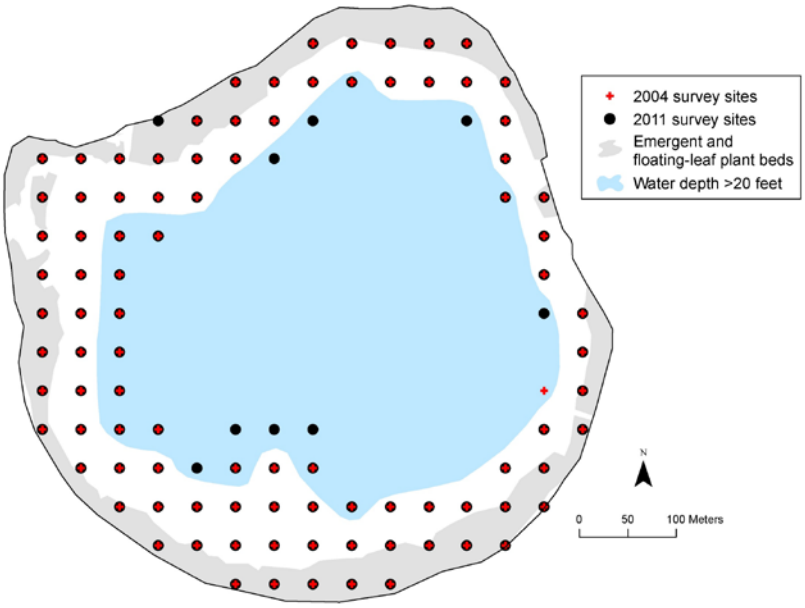


Table 1. Number of samples by water depth.

Water depth interval (feet)	Survey Year	
	2004	**2011**
0 to 5	36	33
6 to 10	11	15
11 to 15	9	11
16 to 20	20	22
Total 0-20 ft	76	81
21 to 25	18	21
total	94	102

Figure 4. Survey rake.

A GPS unit was used to navigate the boat to each sample site and 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 species 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 4) was used to survey vegetation not visible from the water surface. Any additional plant species found outside of sample sites were recorded as "present" in the lake but these data were not used in frequency calculations. Plant identification followed Crow and Hellquist (2000) and Flora of North America (1993+) and nomenclature followed MNTaxa (2011).

Data were entered into a Microsoft Access database and frequency of occurrence was calculated for each species as the number of sites in which the species occurred divided by the total number of sample sites. 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 (Example calculation shown in Appendix 2).

Table 2. Substrate classes

boulder	diameter >10 inches
rubble	diameter 3 - 10 inches
gravel	diameter 1/8 - 3 inches
sand	diameter < 1/8 inch
silt	fine material with little grittiness
marl	calcareous material
muck	decomposed organic material

Substrate sampling

In 2011 surveyors used standard substrate classes (Table 2) to describe the near-shore, shallow water (< 7 feet) substrates. If more than one substrate

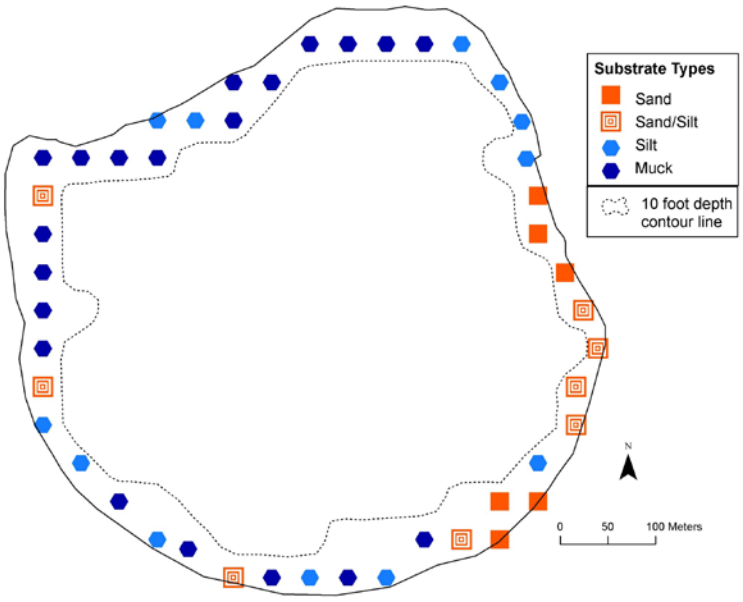
type was found, surveyors recorded the most common type. Surveyors attempted to record a substrate description at the shore side of each row of points. If a sample site occurred near shore but in water depths greater than seven feet, surveyors collected depth and vegetation data and then motored into shallower water and recorded the substrate type adjacent to the actual survey point.

Results and Discussion

Shoal Substrates

Soft substrates of silt and muck were found around much of the shoreline and sand and sand/silt substrates occurred along the east shore (Figure 5).

Figure 5. 2011 shoal substrates



Types of plants recorded

In 2004 and 2011, a total of 24 native aquatic plant taxa (types) were recorded in Roemhildts Lake (Table 3), making it one of the richest lakes in the watershed in terms of number of plant species. About 80 other lakes in the watershed have been surveyed for aquatic plants and the average number of plant species found in those lakes was 11. The Roemhildts Lake plant community included four emergent, three floating-leaved, and 17 submerged plants. Descriptions of these plants can be found in Appendices 3 and 4. Submerged plants included macroalgae and a diversity of rooted, flowering plants that can be grouped by leaf shape and size: dissected, small, narrow, broad and grass-leaved plants. The non-native submerged plant, curly-leaf pondweed (*Potamogeton crispus*) was present during both surveys but Eurasian watermilfoil (*Myriophyllum sibiricum*) was not found.

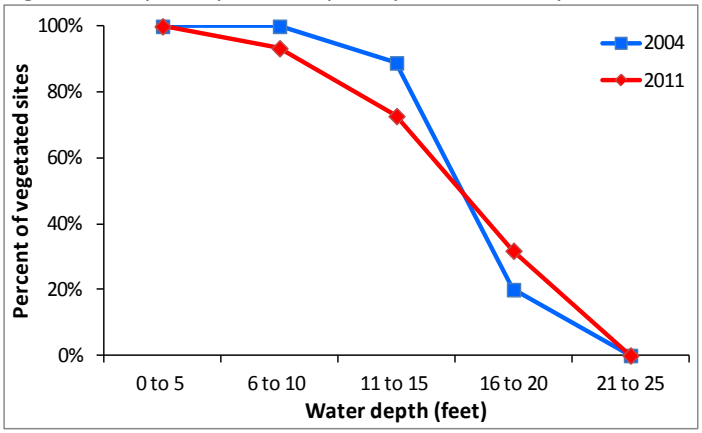
Distribution of aquatic plants

Plants were found to a depth of 17 feet in both years and vegetation was most common in the 0-10 feet depth zone, where an average of 93% of sites contained plants in both years (Figure 6). In both survey years, vegetation was present in at least 75% of the sample sites and was most frequent in the shore to 10 feet depth zone. Plants declined with increasing water depths and in the 10-20 feet depth zone, less than half of the survey sites contained plants.

Table 3. Frequency of occurrence for plant taxa found in Roemhildts Lake, 2004 and 2011.

	Common Name	Scientific Name	2004	2011
Submerged - Native	Coontail	*Ceratophyllum demersum*	50	21
	Muskgrass	*Chara* sp.	30	38
	Water star-grass	*Heteranthera dubia*	9	5
	Northern watermilfoil	*Myriophyllum sibiricum*	32	12
	Bushy pondweed	*Najas flexilis*	1	0
	Stonewort	*Nitella* sp.	1	5
	Large-leaf pondweed	*Potamogeton amplifolius*	1	2
	Fries' pondweed	*Potamogeton friesii*	0	1
	Small pondweed	*Potamogeton pusillus*	0	P
	Narrow-leaf pondweed	*Potamogeton* sp.	4	14
	Variable pondweed	*Potamogeton gramineus*	P	0
	Illinois pondweed	*Potamogeton illinoensis*	12	0
	White-stem pondweed	*Potamogeton praelongus*	1	2
	Robbin's pondweed	*Potamogeton robbinsii*	0	1
	Flat-stem pondweed	*Potamogeton zosteriformis*	33	37
	White water buttercup	*Ranunculus aquatilis*	3	2
	Sago pondweed	*Stuckenia pectinata*	12	5
	Greater bladderwort	*Utricularia vulgaris*	0	4
Submerged Non-native	Curly-leaf pondweed (non-native)	*Potamogeton crispus*	17	10
Floating-leaved	White waterlily	*Nymphaea odorata*	21	25
	Yellow waterlily	*Nuphar variegata*	20	12
	Floating-leaf pondweed	*Potamogeton natans*	7	0
Emergent	Horsetail	*Equisetum fluviatile*	P	0
	Arrowhead	*Sagittaria* sp.	4	0
	Bulrush	*Schoenoplectus* sp.	7	2
	Cattail	*Typha* sp.	3	P

Figure 6. Aquatic plant frequency vs. water depth



Aquatic plants ringed the entire shoreline of Roemhildts Lake. Beds of floating and emergent plants extended 20-50 meters lakeward to a depth of about 5 feet and covered about 13 acres. Submerged plants extended to a depth of 17 feet in some locations (Figure 7).

Commonly occurring native species

In both survey years, native plants were present in all vegetated sites and at least 60% of sites contained only native plants (Figure 7). The most frequently occurring species were coontail (*Ceratophyllum demersum)*, muskgrass (*Chara* sp.), northern watermilfoil (*Myriophyllum sibiricum)* and flat-stem pondweed (*Potamogeton zosteriformis*). Each of these species occurred in at least 30% of the sites during one or both survey years. Thirty percent of the sites also contained white waterlilies (*Nymphaea odorata*) and/or yellow waterlilies (*Nuphar variegata*). The frequencies of several species differed between survey years but this may largely be because these surveys were conducted in June, before most natives reached peak growth. Most native species were restricted to water depths of 10 feet and less. Flat-stem pondweed and coontail were the only commonly occurring native species that were found in deeper water (Figure 8).

Non-native species

Curly-leaf pondweed was found in 17% of the sites in 2004 and 10% of the sites in 2011. In both years it was found at scattered locations around the lake and co-occurred with native species (Figure 7). In 2004, it was found in depths from 4 to 17 feet but in 2011, it was only found to a depth of 10 feet. It did not dominate any depth zone in either survey year

Figure 7. Curly-leaf pondweed versus native submerged plants, Roemhildts Lake, 2004, 2011.

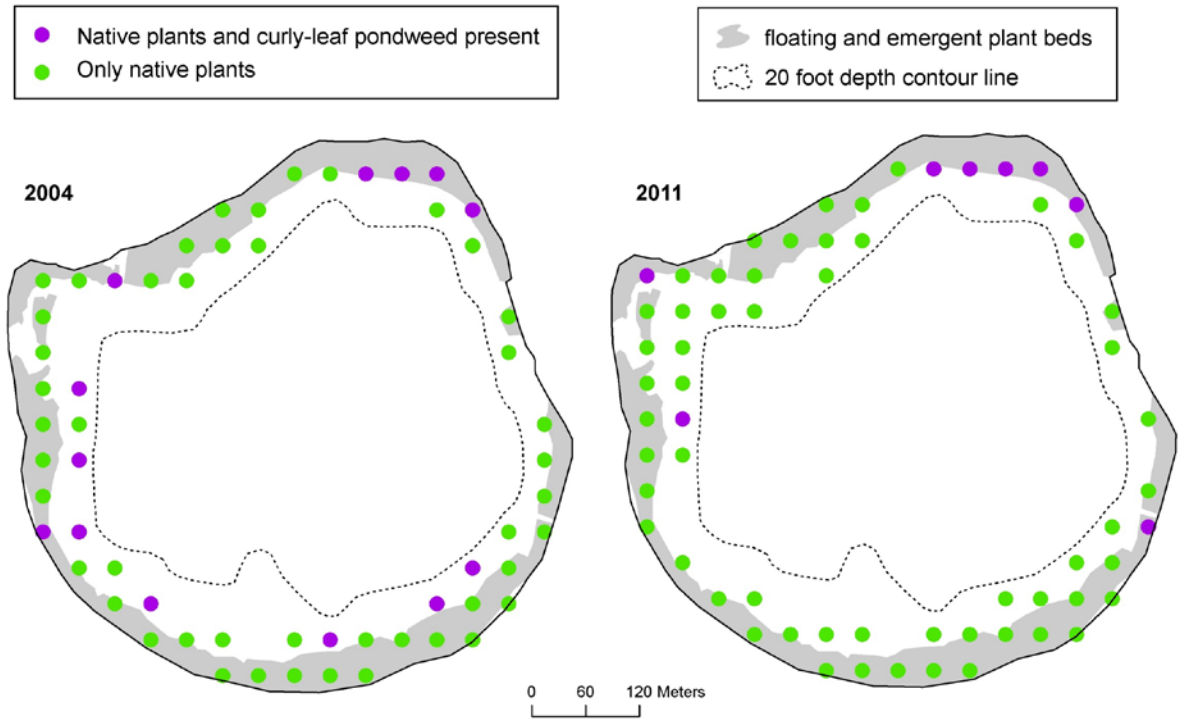
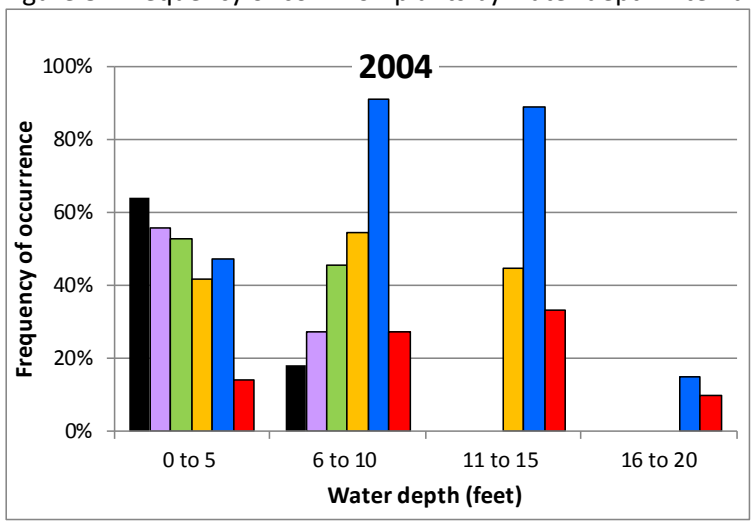
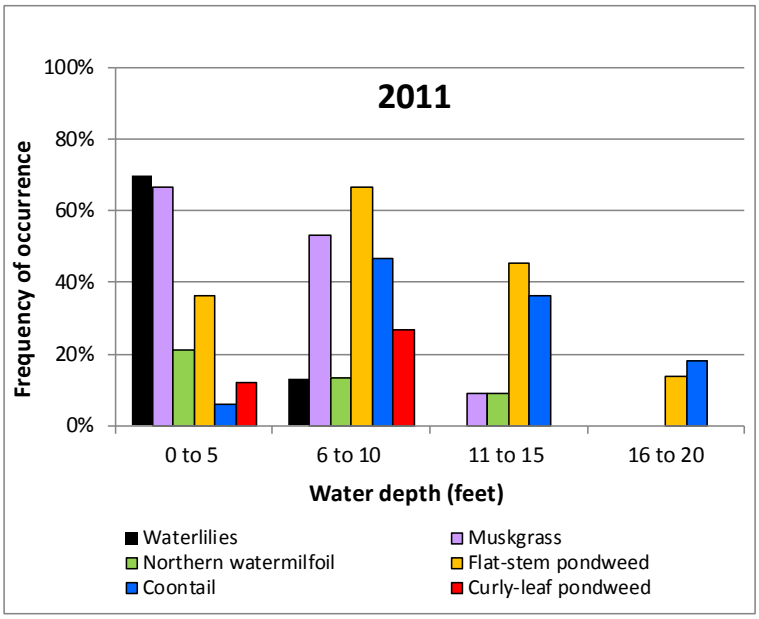


Figure 8. Frequency of common plants by water depth interval.





Change in aquatic plant communities

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. Monitoring change in the aquatic plant community can be helpful in determining whether changes in the lake water quality are occurring and for estimating the quality of vegetation habitat available for fish and wildlife communities. Data collected in 2004 and 2011 can be used to monitor finer-scale changes that may occur, such as an increase in a particular species or a change in the depths at which individual species occur. In general, factors that may lead to change in native and non-native aquatic plant communities include:

- Change in water clarity

  If water clarity in Roemhildts Lake increases, submerged vegetation may be more common at depths greater than 15 feet.

- Snow and ice cover

  Curly-leaf pondweed, in particular, may fluctuate in abundance in response to snow cover. Many native submerged plants also have the ability to grow under the ice, especially if there is little snow cover and sunlight reaches the lake bottom. In years following low snow cover, and/or a reduced ice-over period, curly-leaf and some native submerged plants may increase in abundance.

- Water temperatures / length of growing season

  In years with cool spring temperatures, submerged plants may be less abundant than in years with early springs and prolonged warm summer days.

- Aquatic plant management activities

  Humans can impact aquatic plant communities directly by destroying vegetation with herbicide or by mechanical means. The results of these control activities can be difficult to predict and should be conducted with caution to reduce potential negative impacts to non-target species. Motorboat activity in vegetated areas can be particularly harmful for species such as wild rice. Shoreline and watershed development can also indirectly influence aquatic plant growth if it results in changes to the overall water quality and clarity. For information on the laws pertaining to aquatic plant management: MNDNR APM Program.

The abundant and diverse aquatic plant communities found in Roemhildts Lake provide critical fish and wildlife habitat and other lake benefits. (Click here for more information on: value of aquatic plants).

Literature Cited

Borman, S., R. Korth and J. Temte. 2001. Through the looking glass: A field guide to aquatic plants. The Wisconsin Lakes Partnership. Stevens Point, Wisconsin. 248 pp.

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

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

Flora of North America Editorial Committee, eds. 1993+. Flora of North America north of Mexico. 12+ vols. New York and Oxford. www.efloras.org

Invasive Species Program. 2011. Invasive Species of Aquatic Plants and Wild Animals in Minnesota: Annual Report for 2010. Minnesota Department of Natural Resources, St. Paul, MN. http://www.dnr.state.mn.us/eco/pubs_invasives.html

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. http://el.erdc.usace.army.mil/elpubs/pdf/apcmi-02.pdf

MnDNR Fisheries Lake Files. Minnesota Department of Natural Resources. Division of Fish and Wildlife, Section of Fisheries, Lake Survey Program. 500 Lafayette Rd., St. Paul, MN 55155.

MnDNR. 2009. Minnesota's Sensitive Lakeshore Identification Manual: a conservation strategy for Minnesota lakeshores (version 2). Division of Ecological and Water Resources, Minnesota Department of Natural Resources.

MnTaxa. 2011. Minnesota State checklist of vascular plants. Minnesota Department of Natural Resources, Division of Ecological and Water Resources, St. Paul. Updated April 2011. Available on Internet: http://www.dnr.state.mn.us/eco/mcbs/plant_lists.html

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.

MPCA. 2011. 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 April 2012)

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.

Appendix 1. Historical aquatic and wetland plants of Roemhildts Lake

Submerged plants

Common Name	Scientific Name	1975	1983	1988	1993	2001	2004	2006	2007	2011
Coontail	*Ceratophyllum demersum*	C	C	O	X	X	50	X	X	21
Muskgrass	*Chara* sp.					X	30	X		38
Canada waterweed	*Elodea canadensis*				X	X				
Water star-grass	*Heteranthera dubia*					X	9	X	X	5
Northern watermilfoil	*Myriophyllum sibiricum*	C			X	X	32	X	X	12
Eurasian watermilfoil (I)	*Myriophyllum spicatum*								**X	
Bushy pondweed	*Najas flexilis*					X	1	X	X	
Stonewort	*Nitella* sp.					X	1			5
Large-leaf pondweed	*Potamogeton amplifolius*	C			X	X	1	X		2
Curly-leaf pondweed (I)	*Potamogeton crispus*		O	P	X	X	17	X	X	10
Narrow-leaf pondweeds	*Potamogeton* sp.		O	O	X	X	4			14
	Potamogeton friesii									1
	Potamogeton pusillus								X	P
Variable pondweed	*Potamogeton gramineus*					X	P			
Illinois pondweed	*Potamogeton illinoensis*					X	12	X	X	
River pondweed	*Potamogeton nodosus*								X	
White-stem pondweed	*Potamogeton praelongus*						1	X	X	2
Clasping-leaf pondweed	*Potamogeton richardsonii*					X				
Robbin's pondweed	*Potamogeton robbinsii*								X	1
Flat-stem pondweed	*Potamogeton zosteriformis*				X	X	33	X	X	37
White water buttercup	*Ranunculus aquatilis*						3			2
Sago pondweed	*Stuckenia pectinata*				X	X	12	X	X	5
Lesser bladderwort	*Utricularia minor*		O	O						
Greater bladderwort	*Utricularia vulgaris*									4
Wild celery	*Vallisneria americana*					X		X		
Horned pondweed	*Zannichellia palustris*								X	
	Total	3	4	4	8	16	14	12	14	16

Floating-leaved plants

Common Name	Scientific Name	1975	1983	1988	1993	2001	2004	2006	2007	2011
White waterlily	*Nymphaea odorata*	A	A	P	X	X	21	X	X	25
Yellow waterlily	*Nuphar variegata*	A	A	A	X	X	20	X	X	12
Floating-leaf smartweed	*Persicaria amphibia*								X	
Floating-leaf pondweed	*Potamogeton natans*	C	O	P		X	7	X		
	Total	3	3	3	2	3	3	3	3	2

Emergent plants

Common Name	Scientific Name	1975	1983	1988	1993	2001	2004	2006	2007	2011
Spikerush	*Eleocharis* sp.	C							X	
Horsetail	*Equisetum fluviatile*						P			
Broad-leaf arrowhead	*Sagittaria latifolia*	[v]O				[v]X	[v]4		X	
Bulrush	*Schoenoplectus* sp.		A	C	X	X	7	X		2
Cattail	*Typha* spp.	C	A	A			3			P
	Total	3	2	2	1	2	4	1	2	2

Wetland emergent plants

Common Name	Scientific Name	1975	1983	1988	1993	2001	2004	2006	2007	2011
Water plantain	*Alisma* sp.						P			
Sedges	*Carex* sp.						P			1
Blue-flag iris	*Iris versicolor*						P			P
Reed canary grass(I)	*Phalaris arundinaceae*						P			
Giant cane	*Phragmites australis*					X	P			
Pickerelweed	*Pontederia cordata*		O							
	Total	0	1	0	0	1	5	0	0	2

I = introduced, not native to Minnesota
P = present
O = occasional
C = common
A = abundant
[v] = plant only identified to the genus level
**= Fragments of Eurasian watermilfoil (*Myriophyllum spicatum*) were found in 2007 but no beds of Eurasian watermilfoil were found.

Sources:
1975 (July 9): Mike Albertson (crew leader), MNDNR Division of Fish and Wildlife
1983 (July 12-14): Craig Berberich (crew leader), MNDNR Division of Fish and Wildlife
1983 (July 11-15): Craig Berberich (crew leader), MNDNR Division of Fish and Wildlife
1993 (July 6): MNDNR Division of Fish and Wildlife
2001 (July 9): MNDNR Division of Fish and Wildlife
2004 (June 16): Donna Perleberg, Joe Backowski, Point-Intercept survey, MNDNR Division of Ecological Resources
2006 (June 26): MNDNR Division of Fish and Wildlife
2007 (July 12): Karen Myhre, Minnesota County Biological Survey, MNDNR Division of Ecological Resources
2011 (June 15, 16): Simon, Dickson, Point-Intercept Survey, MNDNR Division of Ecological and Water Resources

Appendix 2: Frequency of Occurrence

Frequency of occurrence was calculated as the percent of sites, within a specific depth zone, where a plant species was detected. Unless otherwise noted, frequency values were calculated for the 0-20 feet depth zone.

Example:
In the 2011 survey of Roemhildts Lake there were 81 sample sites in the 0-20 feet depth zone.
Coontail occurred in 17 sites.
Frequency of coontail in 0-20 feet zone = (17/81)*100 = 21%.

Native submerged and floating-leaved plants in Roemhildts Lake, June 2011

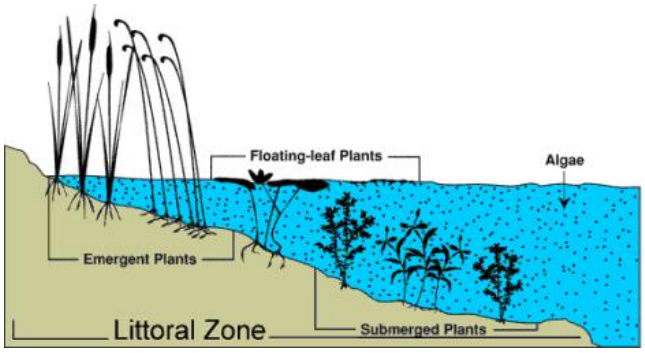
Appendix 3: Amounts and types of aquatic plants in Minnesota lakes

Within a lake, types and amounts of aquatic plants are influenced by a variety of factors including water clarity, water chemistry, water depth, substrate, and wave activity. Deep or wind-swept areas may lack aquatic plant growth, whereas sheltered shallow areas may support an abundant and diverse native aquatic plant community. The annual abundance, distribution and composition of aquatic plant communities may change due to environmental factors, predation, the specific phenology of each plant species, introductions of non-native plant or animal species and human activities in and around the lake.

Aquatic plants can be divided into four groups or "life forms" based on whether the main portion of the plant occurs above, on, or below the water surface. These life forms: emergent, floating-leaved, free-floating and submerged plants (Figure 1), often favor certain water depth zones around the lake but overlap occurs with one life form grading into another. Each life form group has unique functions and values.

Emergent plants, like cattails and bulrush, are rooted in the lake bottom with most of their leaves and stems extending above the water surface. Floating-leaf plants, such as waterlilies, are also anchored in the lake bottom with leaves and flowers that float on the water surface. Root systems of these plants form extensive networks that take up nutrients and help consolidate and stabilize bottom substrate. Beds of floating-leaf and emergent plants also help buffer the shoreline from wave action, offer shelter for insects and young fish, and provide shade for fish and frogs. These beds also provide food, cover and nesting material for waterfowl, marsh birds and muskrat. Floating-leaf and emergent plants are most often found in shallow water to depths of about six feet and may extend lake-ward onto mudflats and into adjacent wetlands.

Figure 1. Forms of aquatic plants found in Minnesota lakes.



Submerged plants have stems and leaves that primarily grow underwater but they may also form flowers, fruits and some leaves that emerge above or float on the water surface. Submerged plants are typically anchored to the lake bottom but some species do drift freely with the currents. This group includes non-flowering plants such as large algae, mosses, and fern-like plants, and flowering plants that may produce flowers above or below the water surface. Submerged plants may form low-growing mats or may grow several feet in the water column with leaf shapes that include broad ovals, long and grass-like, or finely dissected. Submerged plants release oxygen into the water column, compete for nutrients with microscopic algae, and provide food and shelter for a variety of invertebrates, fish, amphibians and other wildlife.

Free-floating plants are the smallest of Minnesota's lake plants and include small flowering plants that are commonly known as "duckweeds" as well as microscopic algae. Different survey methods are required to assess microscopic algae and they are not included in this report. Duckweeds are present in many Minnesota lakes and if present in sufficient amounts, they can accumulate into mats and create a shade barrier along protected shorelines. As their name implies, they are also an important food source for waterfowl.

Plant species richness is a term used to describe the total number of plant species present in a lake and it can be used to help describe the general health of the waterbody. In Minnesota, plant species richness can range from zero (un-vegetated lakes) to more than 40 species in a lake[3]. Species richness is generally higher in high clarity lakes than in turbid lakes and more species are usually found in moderately fertile lakes than in nutrient poor lakes. Therefore, lakes of north central Minnesota are often among the "richest" in terms of numbers of plant species. Water quality changes that result in lower clarity may also result in the loss of some plant species, or lower species richness. However, caution must be used when comparing historical and present survey data because of differences in how the surveys were conducted. For example, if a current MNDNR plant survey locates more species than found during an historical "one-day" survey, it may be due to the more extensive sampling that occurs during current surveys. If fewer species are located during current surveys, it may indicate a true decline in the plant species richness of the lake.

[3] These values are from a review of MN DNR lake vegetation surveys.

Appendix 4: Description of some of the plants found in Roemhildts Lake

Bulrush (*Schoenoplectus* spp.)

Bulrush (*Schoenoplectus* spp.) is an emergent, perennial plant that is rooted in the lake bottom with narrow stems that may extend several feet above the water. In addition to providing valuable fish and wildlife habitat, the extensive root network of these plants help to stabilize sandy shorelines. In shallow water, they may spread by underground rhizomes but these plants are particularly susceptible to destruction by direct cutting by human, motorboat activity and excess herbivory. Restoration of bulrush beds can be very difficult, making established beds particularly unique and valuable.

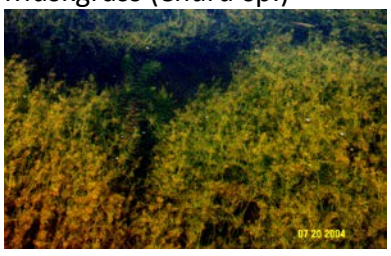
White and yellow waterlilies in Roemhildts, 2011.

The floating leaves of white waterlily (*Nymphaea odorata*) and yellow waterlily (*Nuphar variegata*) provide shade and shelter for fish, frogs and invertebrates. The showy flowers produce seeds that are eaten by waterfowl and the rhizome are a food source for muskrats and deer (Borman et al. 2001).

Coontail (*Ceratophyllum demersum*)

Coontail (*Ceratophyllum demersum)* is the most common submerged flowering plant in the state. It grows entirely submerged and is adapted to a broad range of lake conditions, including turbid water. Coontail is perennial and can over winter as a green plant under the ice and then begins new growth early in the spring. It is loosely rooted to the lake bottom and spreads primarily by stem fragmentation.

Muskgrass (*Chara* sp.)



Muskgrass (*Chara* sp.) is a macroscopic, or large, algae that is common in many hard water Minnesota lakes. It has a brittle texture and a characteristic "musky" odor. Because this species 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 species to colonize open areas of lake bottom where it can act as a sediment stabilizer. Beds of muskgrass can provide important habitat for fish spawning and nesting.

Northern watermilfoil (*Myriophyllum sibiricum)* is a rooted, perennial submerged plant with finely dissected leaves. It may reach the water surface; particularly in depths less than ten feet and its flower stalk extends above the water surface. It spreads primarily by stem fragments and over

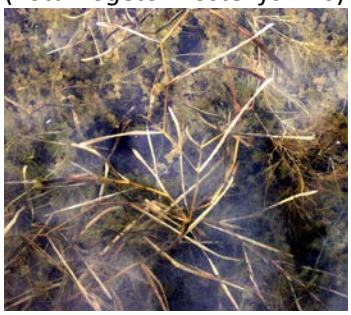
winters by hardy rootstalks and winter buds. Northern watermilfoil is not tolerant of turbidity and grows best in clear water lakes. This native plant provides fish shelter and insect habitat and the extensive root systems help stabilize near-shore sediments.

Northern watermilfoil (*Myriophyllum sibiricum*)

Photo by: Andrew Hipp (UW Madison-Wisc State Herbarium)

Flat-stem pondweed (*Potamogeton zosteriformis*) 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. Flat-stem pondweed is anchored to the lake bottom by rhizomes and overwinters by winter buds. The fruits of pondweeds are a favorite duck food and the leaves provide food and shelter for fish.

Flat-stem pondweed (*Potamogeton zosteriformis*)



Non-native submerged plant

Curly-leaf pondweed (*Potamogeton crispus*) has been present in Minnesota since at least 1910 (Moyle and Hotchkiss 1945) and is now found in more than 750 Minnesota lakes (Invasive Species Program 2011).

Like many submerged plants, it is perennial but it 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).

Curly-leaf pondweed (*Potamogeton crispus*)

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.