Aquatic Vegetation of Wild Rice Reservoir
St. Louis County, Minnesota
(DOW 69-0371-00)
July 12-14, 2004

Report by: Report by: Donna Perleberg[1] and Nicole Brown
MNDNR Ecological Services Division
1601 Minnesota Dr.
Brainerd, MN 56401

[1] Aquatic Plant Ecologist, *Phone* 218.833.8727 *Email* donna.perleberg@dnr.state.mn.us

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Lake sampling: Nicole Brown and Josh Knopik, MnDNR Division of Ecological Services

Data Entry/ Analysis / Maps: Nicole Brown, Donna Perleberg, Patrick McGowan, MnDNR Division of Ecological Services

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Summary

Wild Rice Lake is a large (2127 ac), shallow reservoir where water level manipulations have recently been changed in an effort to mimic more natural conditions. Emergent and floating-leaved vegetation remain limited in abundance and distribution with scattered stands of Wild Rice *(Zizania palustris)*, Bulrush *(Scirpus spp.)* and Spikerush (*Eleocharis sp.).* Submerged vegetation has historically been recorded as sparse in distribution and abundance and limited to depths of five feet or less. In 2004 submerged vegetation was found across the entire basin and occurred in 81 percent of the survey sites. A total of 28 aquatic plant species were found and submerged species that are tolerant of lower light levels dominated including narrow-leaf pondweed (*Potamogeton* sp.), water stargrass (*Zosterella dubia*) and Canada waterweed (*Elodea canadensis*).

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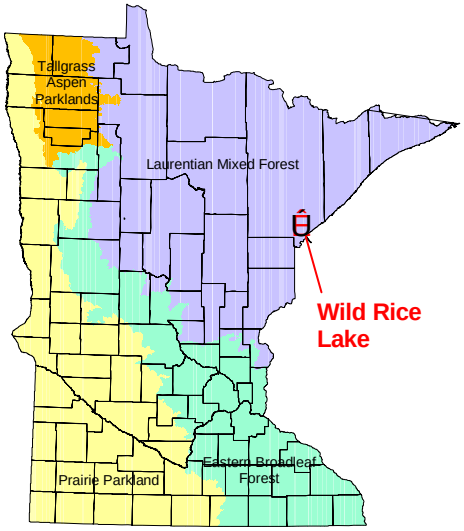
Introduction

Wild Rice Lake (DOW 40-0051-00) is a reservoir located about eight miles northwest of the City of Duluth in Lake County, Minnesota, within the ecological region known as the Laurentian Mixed Forest Province (Fig. 1).

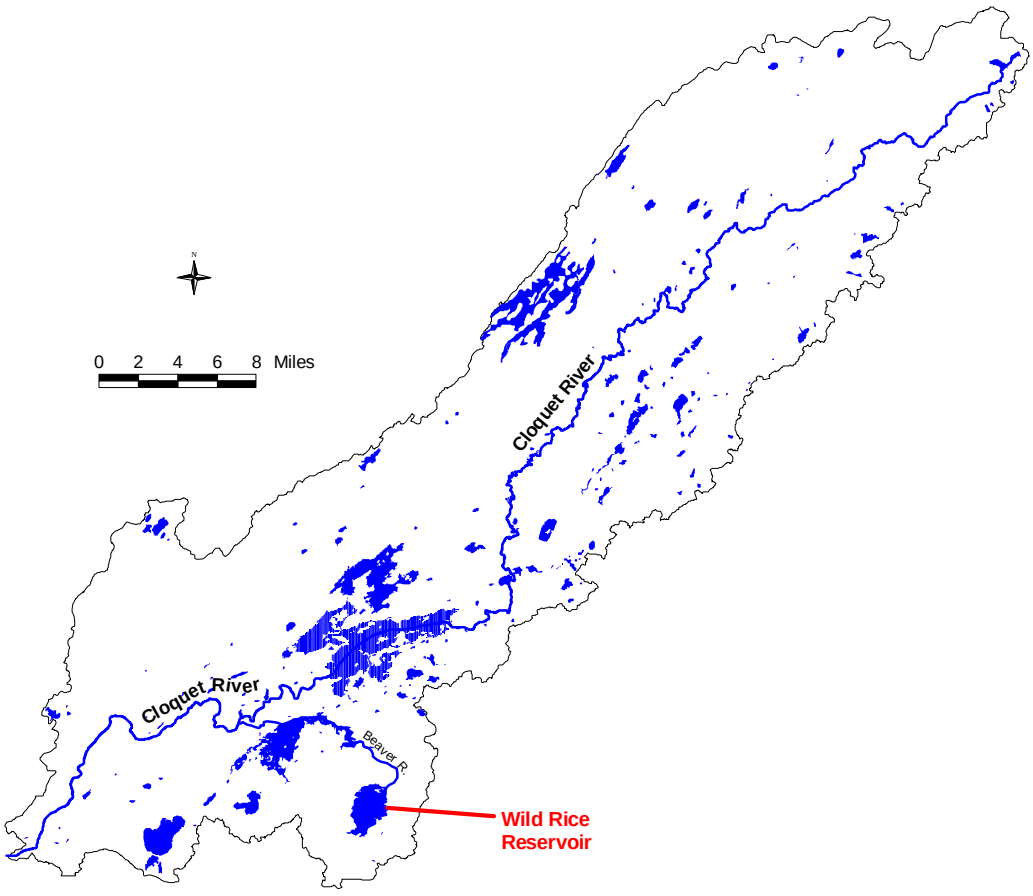
Figure 1. Location of Wild Rice Lake (40-0051-00), Lake County, MN



Wild Rice is one of five headwater storage basins created by Minnesota Power Company in 1908 as part of the Cloquet-St. Louis River hydropower system (MnDNR 2005). This 2,127 acre reservoir lies within the southern portion of the Cloquet River Watershed (Fig. 2). Water leaves the north end of Wild Rice Lake through Beaver River, continues into Fish Lake Reservoir to the west and then into the Cloquet River.

Wild Rice has a relatively small watershed (22 square miles) relative to its surface area (Wilson et al. 1991). Land use within that watershed impacts the water quality of the lake, which in turn affects the abundance and composition of the aquatic plant community. The watershed remains

Figure. 2. Location of Wild Rice Reservoir in Cloquet River Watershed.



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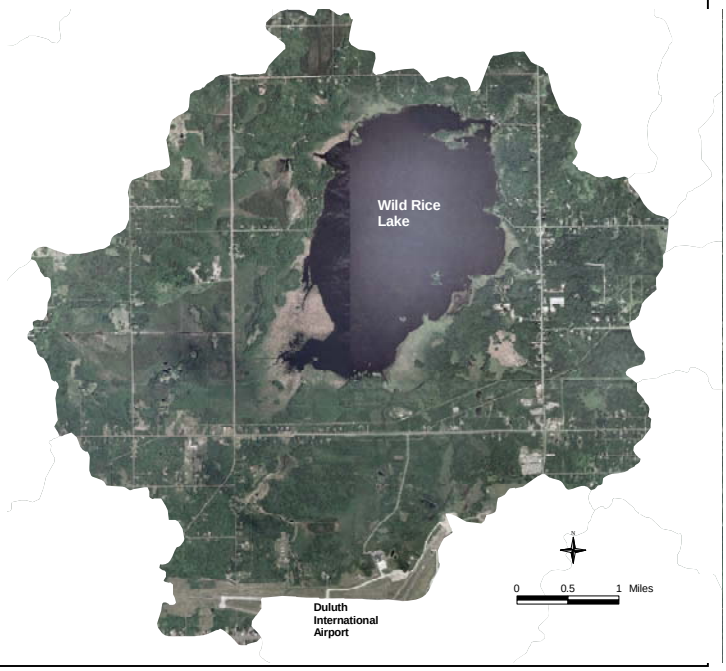
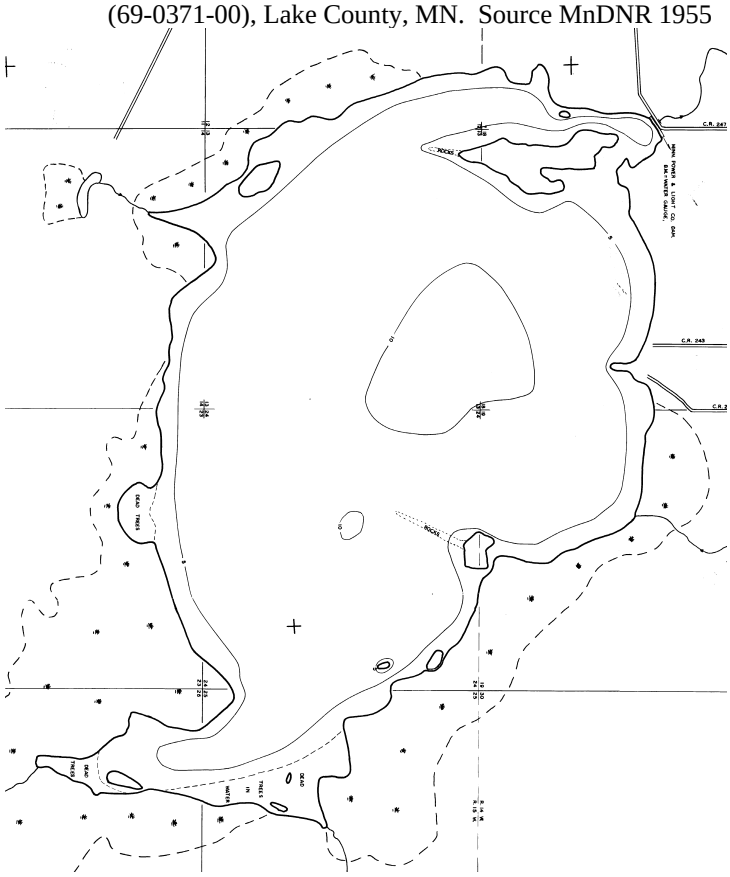
primarily forested (Fig. 3) but beginning in the 1920's it was manipulated with ditching for farming and road construction; more recent development south of the lake includes the Western Lake Superior Sanitary District landfill, the Duluth Disposal Site, and the Northwest Airbus Maintenance site (MnDNR 2005). While residential homes on the immediate shoreline are limited, development within a half mile on the east side of the lake is extensive (Wilson et al. 1991). A public boat launch is located on the northeast shore.

Figure 3. Minor watershed that includes Wild Rice Reservoir. Photo Source: Farm Service Admin. 2003



Wild Rice Lake is shallow with a recorded average water depth of seven feet and a recorded maximum depth of 11 feet (Fig. 3). However, water level is manipulated by Minnesota Power and in 1995 water levels were altered to resemble more natural annual water level fluctuations (MnDNR 2005). Previously, water levels were kept lower and near shore areas were dewatered during the winter, likely limiting aquatic plant growth.

Figure. 4. Depth contour map of Wild Rice Reservoir (69-0371-00), Lake County, MN. Source MnDNR 1955



Wild Rice Lake is classified as a soft water, eutrophic (high nutrient levels) lake. Limited water quality data is available but in 1997, the mean summer water clarity level (as recorded by Secchi disc) was about six feet (MPCA 1997).

Vegetation surveys of Wild Rice Lake were conducted in 1942, 1954, 1968, 1977 and 1995 (MnDNR Lake Files). In general, these surveys found limited aquatic vegetation, likely due to

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fluctuating water levels and dark water color. Emergent vegetation occurred in a narrow fringe along shore, with heavier stands in the southeast and southwest end. Common emergent species included cattail (*Typha* sp.), bulrush (*Scirpus* sp.), and spikerush (*Eleocharis* sp.), and wild rice (*Zizania aquatica*) was rare. Floating-leaved species were also sparse and included yellow waterlily (*Nuphar variegata*) and floating-leaf burreed (*Sparganium* sp.). Submerged vegetation has consistently been recorded as sparse in distribution and abundance with scattered small patches of clasping-leaf pondweed (*Potamogeton richardsonii*) and several other native submerged species. In 1995, the maximum depth of vegetation was recorded as five feet.

Survey Objectives

In recent years, lake users and managers have perceived an increase in the abundance and distribution of submerged aquatic vegetation in Wild Rice Lake (MnDNR 2005). The purpose of the 2004 survey of Wild Rice Lake was to describe the current aquatic plant community including:

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 frequencies of occurrence of individual species
5) Develop maps of the distribution of the common species

Methods

A Point-Intercept vegetation survey of Wild Rice Lake was conducted on July 12-14, 2004 following the methodology described by Madsen (1999). A Geographic Information System (GIS) was used to generate sample points across the lake surface in a 150 meter by 150 meter grid, resulting in a total of 418 potential survey points. Shallow areas, large rocks and stump fields prohibited surveyors from reaching every survey point. As a result, 402 sites were actually sampled (Fig. 5).

After the survey points were generated in the GIS, they were uploaded into a Global Positioning System (GPS) unit, which 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 rod. The surveyors recorded all plant species found within a one meter squared sample site at the pre-designated side of the boat. A double-headed, weighted garden rake (Fig. 6), attached to a rope was used to survey vegetation not visible from the surface.

Nomenclature followed Crow and Hellquist (2000). Voucher specimens were collected for most plant species however the a mold infestation destroyed the majority of the specimens. The remaining specimens are stored at the Minnesota DNR in Brainerd.

Data were entered into a Microsoft Access database and frequency of occurrence was calculated

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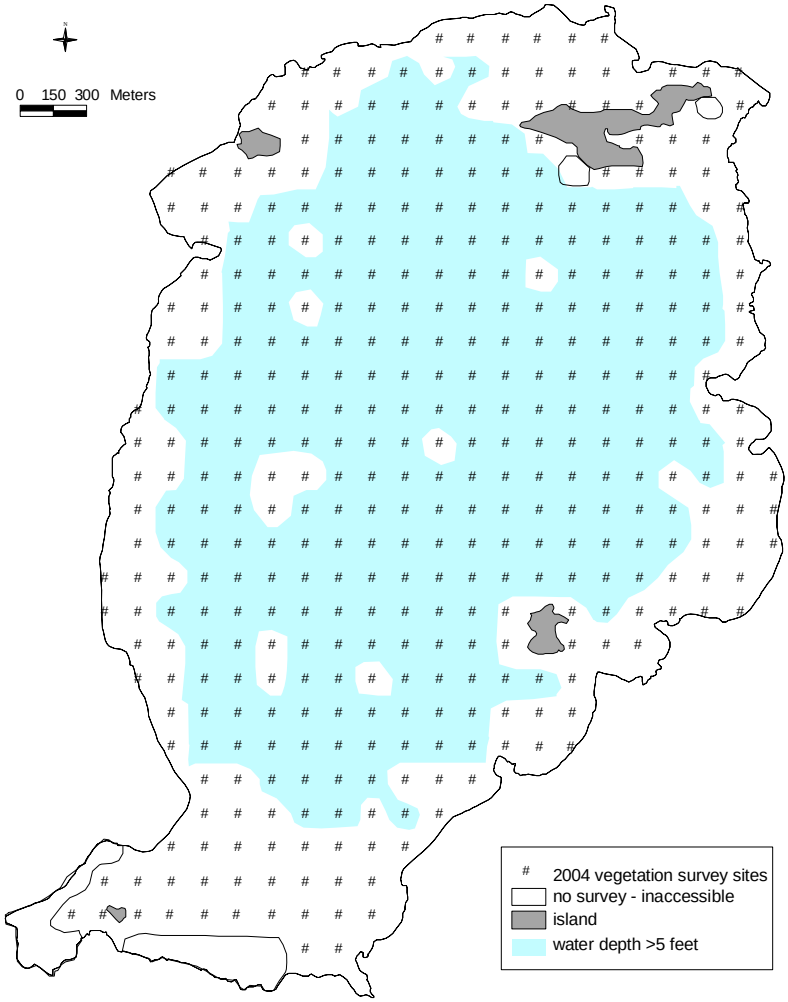
Figure. 5. 402 vegetation survey sites on Wild Rice Lake, St. Louis Co., MN (69-0371-00). July 2004.



for each species as the number of sites in which a species occurred divided by the total number of sample sites.

Example:
There were 402 sample sites.

Water stargrass occurred in 133 of those sample sites.

Frequency of water stargrass = 133 / 402 = 33%

Frequency was calculated for the entire basin and sampling points were also grouped by water depth and separated into four depth zones for analysis: 0 to 3 feet, and 4 to 5 feet, 6 to 7 feet, and 8 feet.

Figure 6. Sampling rake used for vegetation survey.

Results

In Wild Rice Lake, aquatic plants occurred to eight feet, the maximum depth recorded during the July 2004 survey. Plants were found in 81 percent of the sites surveyed and were evenly distributed across the basin (Fig. 7) and with water depth (Fig. 8).

Twenty-eight plants species, including ten emergent, two floating-leaved and 16 submerged species, were found during the survey (Table 1). Only six species occurred with a frequency greater than 10 percent and on average, only one or two species were found at each individual site.

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Figure 7. Distribution of vegetation on Wild Rice Lake, St. Louis Co., MN (69-0371-00). July 2004.

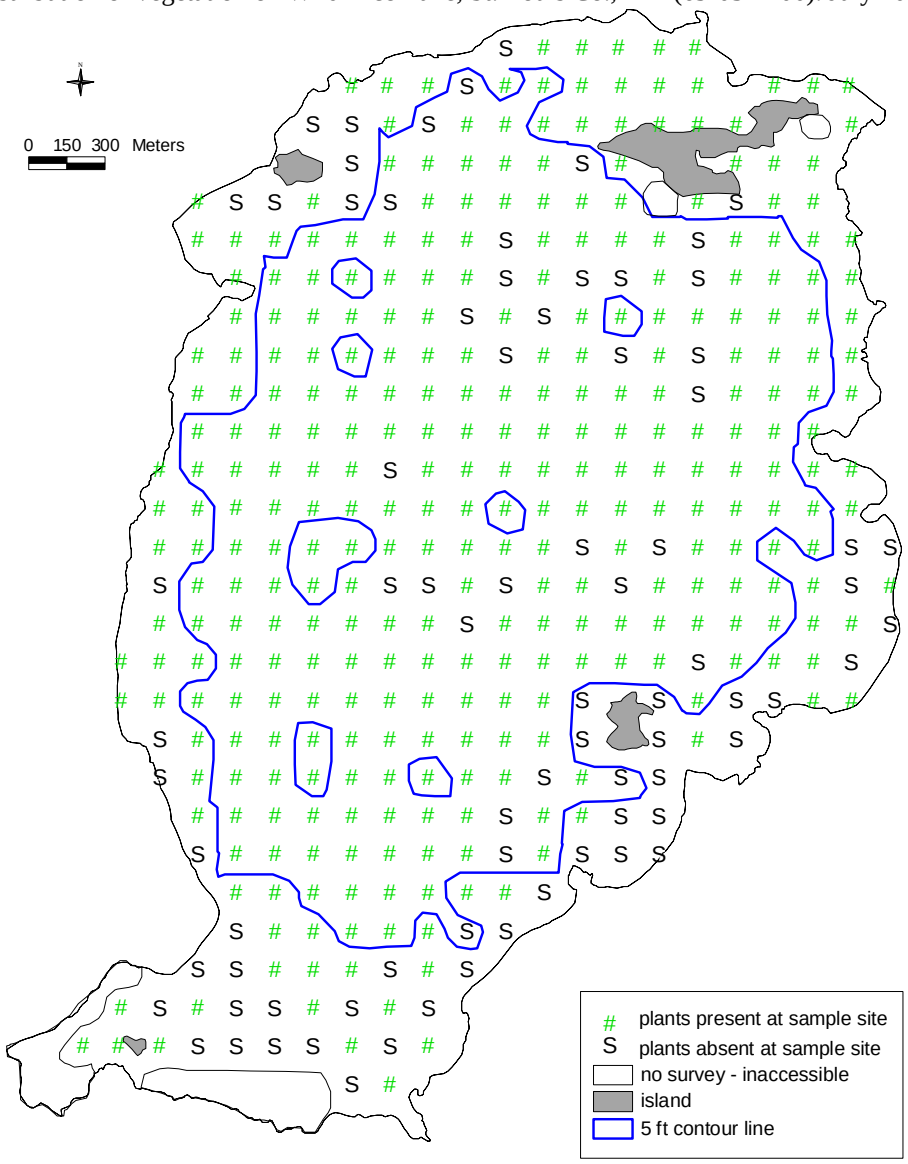

Figure 8. Aquatic plant abundance vs. water depth
Wild Rice Lake., St. Louis Co., MN (69-0371-00) 2004

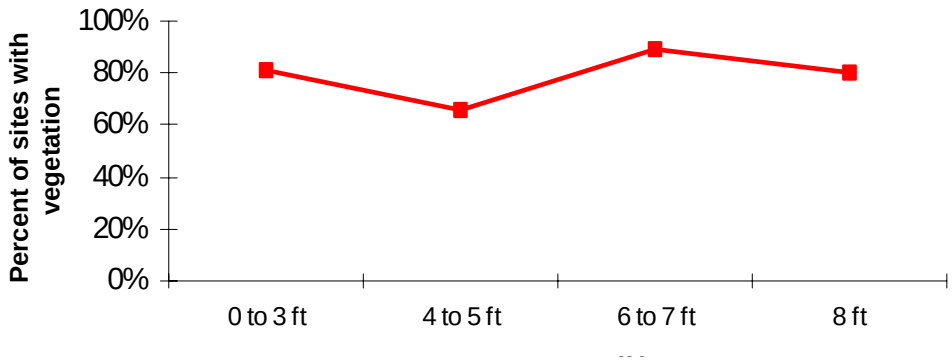

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Table 1. Aquatic Plants of Wild Rice Lake, St. Louis Co. 2004 (69-0371-00) July 12, 13, 14, 2004

Frequency calculated for entire basin
Frequency = percent of sites in which species occurred
402 sample sites

Life Forms	Common Name	Scientific Name	Voucher	Frequency
SUBMERGED 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.	Narrow-leaf pondweed	*Potamogeton sp.*		50
	Water stargrass	*Zosterella dubia*		33
	Bushy pondweed	*Najas flexilis*		14
	Canada waterweed	*Elodea canadensis*	x	11
	Northern watermilfoil	*Myriophyllum sibiricum*	x	11
	Stonewort	*Nitella sp.*		11
	Clasping leaf pondweed	*Potamogeton richardsonii*		8
	Water marigold	*Megaladonta beckii*	x	2
	Flatstem pondweed	*Potamogeton zosteriformis*		1
	Whitestem pondweed	*Potamogeton praelongus*		1
	Greater bladderwort	*Utricularia vulgaris*		1
	Coontail	*Ceratophyllum demersum*		<1
	Water moss	*Drepanocladus sp.*		<1
	Sago pondweed	*Stuckenia pectinata*		<1
	Ribbon-leaf pondweed	*Potamogeton epihydrus*		present*
	Water celery	*Vallisneria americana*		present
FLOATING These plants are rooted in the lake bottom and have leaves that float on the water surface. Many have colorful flowers that extend above the water	Yellow waterlily	*Nuphar variegata*	x	<1
	Floating-leaf burreed	*Sparganium angustifoilium*	x	present
EMERGENT These plants extend well above the water surface and are usually found in shallow water, near shore.	Wild Rice	*Zizania palustris*		1
	Bulrush	*Scirpus sp.*		1
	Spikerush	*Eleocharis sp.*		1
	Threesquare	*Scirpus pungens*		<1
	Cattail	*Typha sp*		<1
	Needlerush	*Eleocharis acicularis*		<1
	Arrowhead	*Sagittaria sp.*	x	present
	Giant Cane	*Phragmites sp.*		present
	Reed Canary Grass	*Phalaris arundinaceae*		<1
	Pickerelweed	*Pontederia cordata*		present

* present indicates plant was found during survey but did not occur within a specific sample site.

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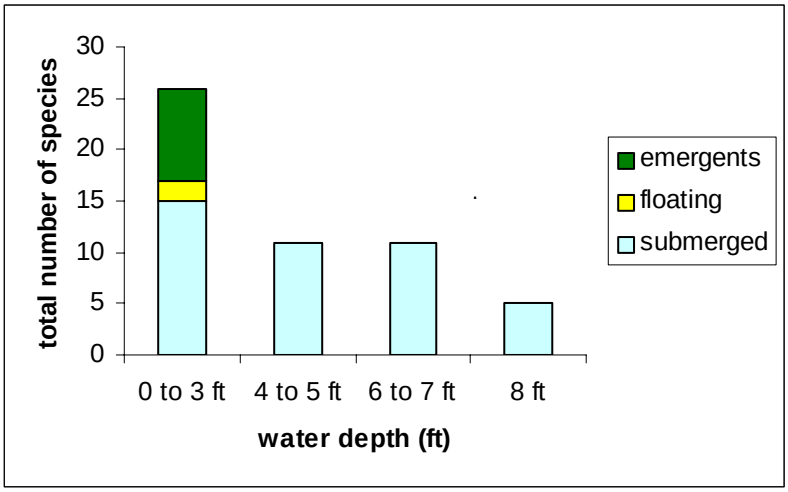
Emergent and floating-leaved plant species

Emergent and floating-leaved plants in Wild Rice Lake were restricted to water depths of three feet and less (Fig. 9).

Figure 9. Types of plant species found at each depth zone in Wild Rice Lake, St. Louis Co., MN (69-0371-00). July 2004.



Lakewide, emergent species occurred in only one percent of the sample sites but also occurred in a narrow fringe along shore (Fig. 10). The most common emergent species were Wild Rice *(Zizania palustris)*, Bulrush *(Scirpus spp.)* and Spikerush (*Eleocharis sp.).*

Figure 10. Emergent vegetation along shores of Wild Rice Lake, St. Louis Co., MN (69-0371-00) July 2004.

The floating-leaved species were yellow waterlily (*Nuphar variegata)* and floating-leaf burreed (*Sparganium angustifoilium*) (Fig. 11). These species formed small beds near shore and were found in less than one percent of ths sample sites (Table 1).

Figure 11. Floating-leaf burred (*Sparganium angustifolium*) on Wild Rice Lake, St. Louis Co., MN (69-0371-00) July 2004

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Submerged plant species

Submerged plants dominated the aquatic plant community of Wild Rice Lake and were found at all water depths (Fig. 9). The most common submerged species are described here.

Narrow-leaf pondweed (*Potamogeton* sp.) (Fig. 12) is a rooted, perennial submerged plant with flowers that extend above the water surface. This species is common throughout Minnesota and is adapted to lower light levels than many other submerged plants. It can form thick mats that reach the water surface. In 2004, it was the most common plant founding Wild Rice Lake. It occurred in half of the sites surveyed (Table 1) and was found at all water depths, but reached its maximum abundance in depths of six to eight feet (Fig. 13). Narrow-leaf pondweed was found throughout the lake except in the shallowest zone along the east shore (Fig. 13.).

Figure. 12. Narrow-leaf pondweed (P*otamogeton* sp.)

Water stargrass (*Zosterella dubia*) is also a rooted, grass-like perennial plant and is typically found entirely submerged beneath the water. It also is adapted to low light levels. It was the second most common species in Wild Rice Lake, occurring in 33 percent of the sample sites (Table 1). Water stargrass was most common in four to seven feet of water (Fig. 13.) and was distributed throughout the lake (Fig 14).

Figure 13. Distribution of common submerged species by water depth.
Wild Rice Lake, St. Louis Co., MN (69-0371-00). July 2004

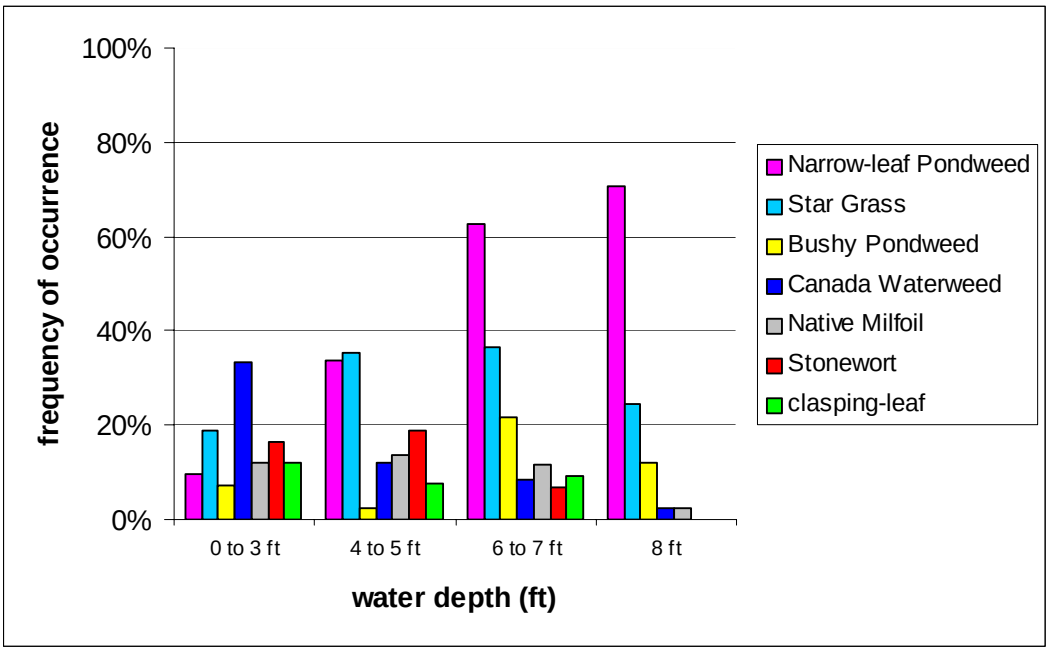

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Figure 14. Distribution of common plant species in Wild Rice Lake, St. Louis Co., MN (69-0371-00) July 2004.

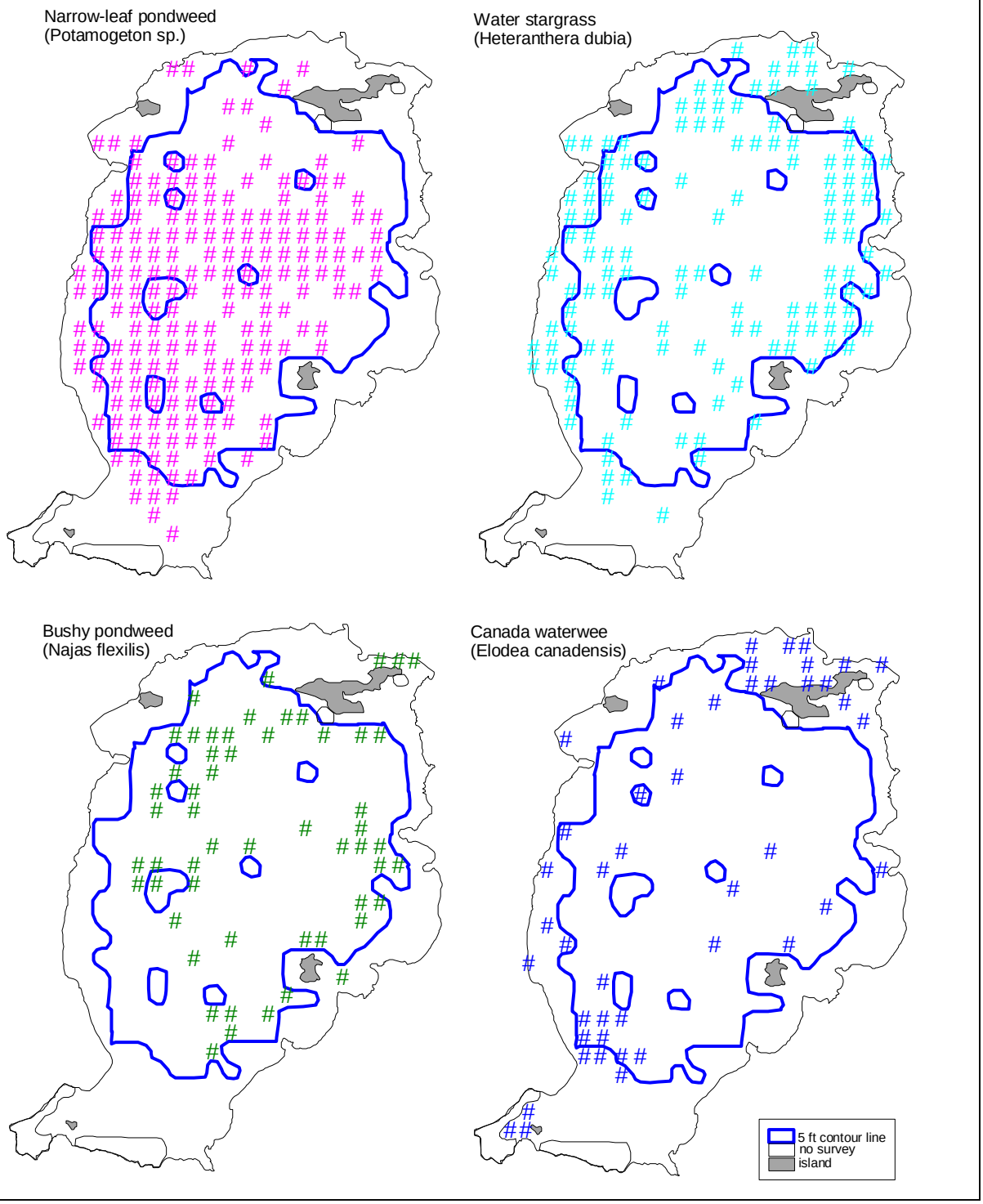

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Figure 15.Bushy pondweed (*Najas flexilis*)

Bushy pondweed (*Najas flexilis*) (Fig. 15) is a low-growing, annual submerged species that grows from seed each year. In 2004 survey, bushy pondweed occurred in 14 percent of the sample sites (Table 1). It was most common in depths greater than five feet (Fig. 13) and was most common in the northern third of Wild Rice Lake (Fig. 14).

Canada waterweed (*Elodea canadensis*) is a submerged, rooted perennial plant and was found in 11 percent of the Wild Rice Lake survey sites (Table 1). This species was most common in depths less than four feet and was the most common plant in this shallow zone (Fig. 13 and 14).

Northern watermilfoil (*Myriophyllum sibiricum*) is another submerged, rooted perennial plant and it occurred in 11 percent of the survey sites (Table 1). It did not dominate at any depth (Fig. 13) and was widely distributed around the lake (Fig. 14).

Figure 16. Stonewort (*Nitella* sp.)

Stonewort (*Nitella* sp.) (Fig. 16) is a large algae that resembles a vascular plant but does not form true stems, leaves, roots or flowers. Because it is not strongly anchored to the lake bottom, it may drift with the water current. In Wild Rice Lake, stonewort occurred in 11 percent of the sites and was primarily in depths less than six feet (Fig. 13) along the north and east shores (Fig. 17).

Clasping-leaf pondweed (*Potamogeton richardsonii*) is a broad-leaved, rooted, perennial plant that grows beneath the water surface and forms "cigar-shaped" flowers that extend above the water. It was found in eight percent of the Wild Rice survey sites (Table 1) and occurred to a depth of seven feet (Fig. 13). Clasping-leaf pondweed primarily occurred on the northern and western ends of the lake (Fig. 17).

All other submerged species occurred in less than three percent of the survey sites (Table 1).

Discussion

While the vegetation frequency data collected in 2004 are not directly comparable to data collected by other methods, there is still enough information to discuss change in the aquatic plant community of Wild Rice Lake. A similar group of emergent and submerged species has been reported in the historical and the 2004 surveys. The emergent community remains dominated by cattail and bulrush and is primarily restricted to a narrow fringe along shore and the protected southwest bay. Yellow waterlily and floating-leaf burreed, which have historically been recorded as the common floating-leaved species, remain limited in distribution.

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Figure 17. Distribution of common plant species in Wild Rice Lake, St. Louis Co., MN (69-0371-00) July 2004.