Aquatic Vegetation of
Shamineau Lake (DOW 49-0127-00)
Morrison County, Minnesota

June 23, 28, 29, 2005

Shamineau Lake, Morrison County, MN.

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Summary

An aquatic vegetation survey of Shamineau Lake (49-0127-00), Morrison County, Minnesota, was conducted June 23, 28 and 29, 2005.

A total of 30 native aquatic plant species were recorded, making Shamineau Lake among the richest lake plant communities in the state. Aquatic plants were well distributed around the shoreline and occurred to a depth of 20 feet. Plants were most common in depths less than 16 feet.

Cattail (*Typha* sp.), bulrush (*Scirpus* sp.), white waterlily (*Nymphaea odorata*) and yellow waterlily (*Nuphar variegata*) were common near shore. Common native plant species included bushy pondweed (*Najas flexilis*), Canada waterweed (*Elodea canadensis*), coontail (*Ceratophyllum demersum*), muskgrass (Chara sp.), and northern watermilfoil (*Myriophyllum sibiricum*) and a variety of native pondweed (*Potamogeton* spp.). The non-native plant, curly-leaf pondweed (*Potamogeton crispus*) was present in the lake but was found in only ten percent of the sample sites.

Shamineau Lake, Morrison Co, MN

Introduction

Shamineau Lake (DOW 49-0127-00) is located in northwestern Morrison County, Minnesota. It occurs at the transition of two ecological regions: the Laurentian Mixed Forest and the Eastern Broadleaf Deciduous Forest (Fig. 1). This area represents the zone between the northern pine forests and the central hardwood forests. Much of the uplands around Shamineau Lake remain forested but about a third of the land within the immediate watershed basin has been converted to agricultural land.

The lake lies in the northeastern end of the Long Prairie River Watershed (Fig. 2). It is the eighth largest lake in the watershed with a surface area of 1428 acres. Shamineau Lake receives intermittent flow from small tributaries but does not have an outlet.

Figure 1. Location of Shamineau Lake in Morrison County, MN.

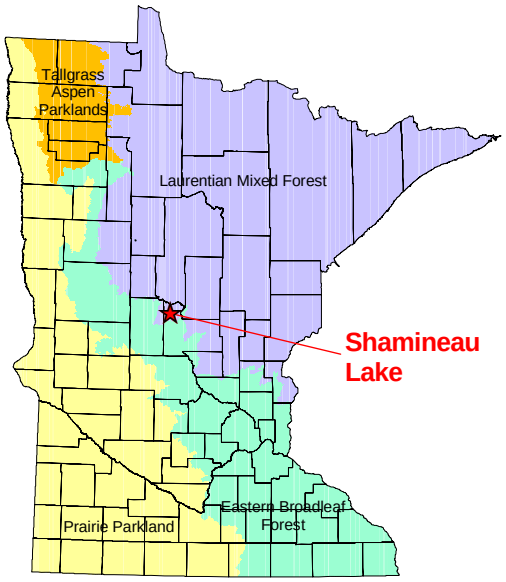


Figure 2. Location of Shamineau Lake in the Long Prairie River Watershed.

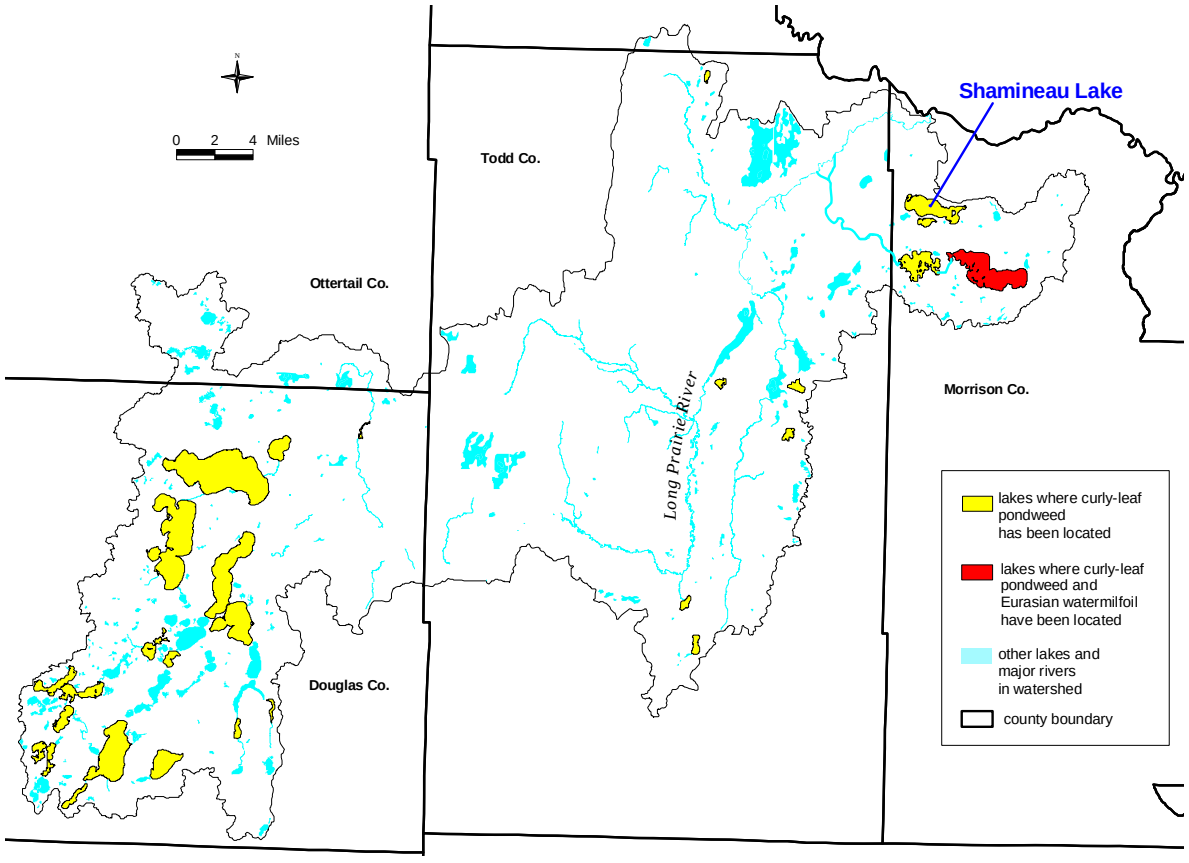
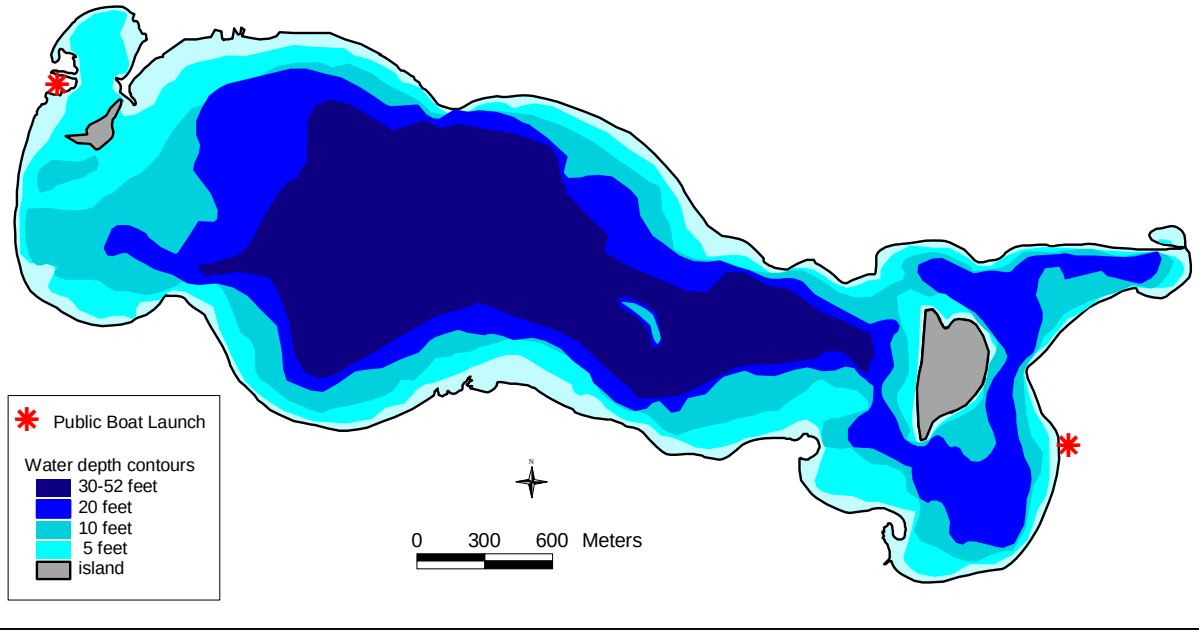


Figure 3. Depth contours of Shamineau Lake, Morrison County. (Based on 2005 data).



About half of Shamineau Lake is shallow (less than 15 feet in depth) and the maximum depth is 52 feet. Shallow areas extend lakeward at least 500 feet along most shores and the west end is mostly shallow (Fig. 3). There is a small (approximately four acre) island on the northwest end of the lake and an approximately 25 acre island on the east side. There are public boat launches on the west and east shores.

Shamineau Lake is described as a moderately fertile, hardwater lake, with relatively good water clarity. Between 1990 and 2006, the mid-summer Secchi disc reading (a measure of water clarity) ranged from 13 to 17 feet, with a mean of 15 feet (MPCA 2007).

Previous vegetation surveys of Shamineau Lake conducted by DNR Fisheries provide a general description of the aquatic plant communities. Plants that were commonly found include muskgrass (*Chara* sp.), wild celery (*Vallisneria americana*), northern watermilfoil (*Myriophyllum sibiricum*), a variety of pondweeds (*Potamogeton* spp.), white waterlily (*Nymphaea odorata*), yellow waterlily (*Nuphar variegata*), and hardstem bulrush (*Scirpus acutus*) (DNR Fisheries Lake Files).

The non-native plant, curly-leaf pondweed (*Potamogeton crispus*) has been recorded in most of the lakes in the Long Prairie River Watershed, including Shamineau (Fig. 2). As of 2007, Lake Alexander, located to the southeast of Shamineau, is the only lake in the watershed where the non-native plant, Eurasian watermilfoil (*Myriophyllum spicatum)* has been documented.

Objectives

The purpose of this vegetation survey was to provide a quantitative description of the 2005 plant population of Shamineau Lake using a method that can be repeated in future years. 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 common species

Methods

Floating-leaf and emergent vegetation

Bulrush and mixed emergent plant beds were mapped in 2002 by DNR Fisheries. Cattail beds were digitized from 1991 aerial photography and floating-leaf plant bed boundaries were estimated from 2003 aerial photography.

Submerged vegetation survey

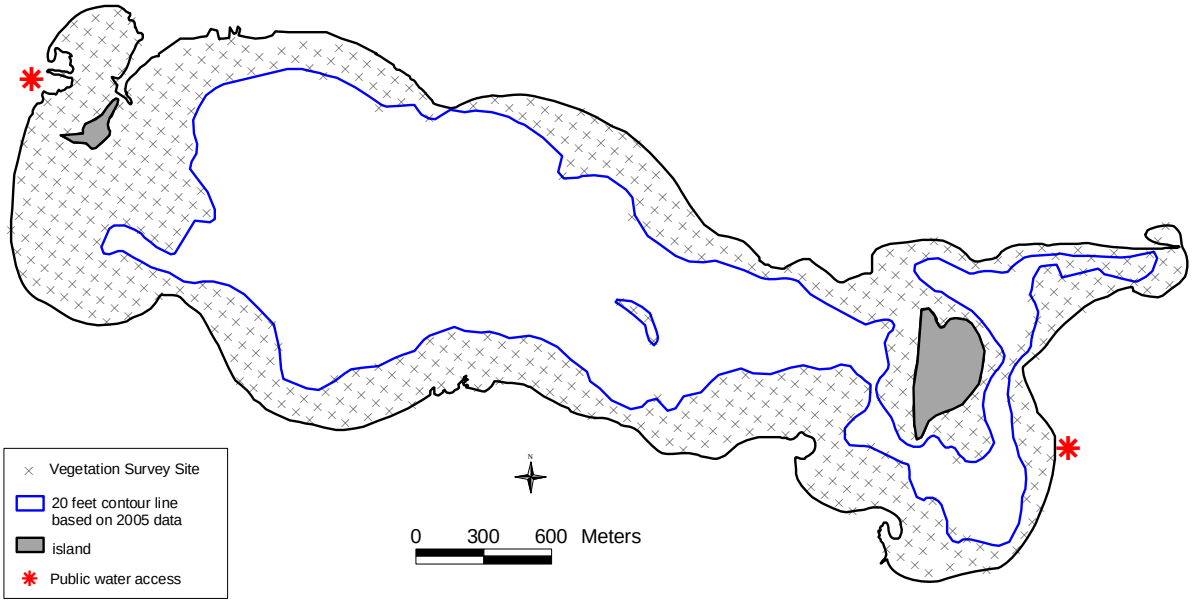
A vegetation survey of Shamineau Lake was conducted on June 23, 28 and 29, 2005. A Point-intercept survey method was used and followed the methods described by Madsen (1999). Survey waypoints were created using a Geographic Information System (GIS) computer program and downloaded into a GPS receiver. Survey points were spaced 75 meters apart, resulting in about one survey point per 1.5 acres. Surveyors began sampling to a depth of 25 feet but found no plants in depths greater than 20 feet. A total of 573 sites were sampled and 561 of these occurred in the vegetated zone from shore to 20 feet (Table 1, Fig. 4).

Table 1. Sampling effort by water depth Shamineau Lake, 2005.

Depth interval in feet	Number of sample points
0 to 5	137
6 to 10	195
11 to 15	104
16 to 20	125
21 to 25	12
Total number of sample points	573

The 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

Figure 4. Vegetation survey sites in Shamineau Lake (49-0127-00) Morrison Co, 2005.



using a measured stick in water depths less than eight feet and an electronic depth finder in water depths greater than eight feet. 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, attached to a rope was used to survey vegetation not visible from the surface (Fig. 5,6).

Figure 5. Sampling rake.

Figure 6. Surveyors on Shamineau Lake, June 2005.

Plant identification and nomenclature followed Crow and Hellquist (2000). Voucher specimens were collected for most plant species and are stored at the MnDNR in Brainerd. Data were entered into a Microsoft Access database and 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 the entire area from shore to 20 feet and sampling points were also grouped by water depth and separated into six depth zones for analysis (Table 2).

Example:

In Shamineau Lake there were 561 samples sites in the zone from shore to the 20 feet depth.

Bushy Pondweed (*Najas flexilis*.) occurred in 155 of those sites.

Frequency of bushy pondweed in the shore to 20 feet depth zone =155/561 (*100) =28%

Results

Number and types of plants recorded
A total of 30 native aquatic plant species were recorded in Shamineau Lake including five emergent, four floating-leaved, one free-floating and 20 submerged plants (Table 2). One non-native submerged plant, curly-leaf pondweed (*Potamogeton crispus*) was identified in the lake.

Distribution of plants by water depth
Plants were found to a maximum depth of 20 feet in Shamineau Lake and within the vegetated zone (shore to 20 feet), 73 percent of sample sites contained vegetation (Fig. 7). Plant occurrence was greatest in depths from shore to 15 feet, where vegetation was found in more than 80 percent of the sample sites (Fig. 8).

The highest number of plant species was found in shallow water, from shore to a depth of five feet (Fig. 9). Emergent, floating-leaved and free-floating plants were restricted to water depths less than ten feet. Submerged plants were found to a maximum depth of 20 feet but only ten species occurred in depths greater than 15 feet. Curly-leaf pondweed was found at all water depths between shore and 20 feet.

The number of plant species found at individual sites ranged from zero to nine with a mean of two species per site. Shallow, protected bays usually contained sites with the highest number of species while most off-shore deeper water sites had only one to three species (Fig 10).

Table 2. Frequency of aquatic plants in Shamineau Lake Point-intercept survey, June 2005.
* Frequency is the percent of sample sites in which a plant species occurred.

Life Form	Common name	Scientific name	Frequency
Submerged	Bushy pondweed	*Najas flexilis*	28
	Canada waterweed	*Elodea canadensis*	17
	Coontail	*Ceratophyllum demersum*	16
	Muskgrass	*Chara sp.*	13
	Northern watermilfoil	*Myriophyllum sibiricum*	12
	Flat-stem pondweed	*Potamogeton zosteriformis*	11
	Robbins Pondweed	*Potamogeton robbinsii*	11
	Curly Leaf Pondweed	*Potamogeton crispus*	10
	White-stem pondweed	*Potamogeton praelongus*	8
	Narrow-leaf pondweed	*Potamogeton freisii**	8
	Large-leaf pondweed	*Potamogeton amplifolius*	8
	Wild Celery	*Vallisneria americana*	6
	White Water Buttercup	*Ranunculus aquatilis*	5
	Stonewort	*Nitella sp.*	4
	Illinois pondweed	*Potamogeton illinoensis*	4
	Variable pondweed	*Potamogeton gramineus*	4
	Water marigold	*Megaladonta beckii*	4
	Water stargrass	*Heteranthera dubia*	2
	Clasping-leaf pondweed	*Potamogeton richardsonii*	2
	Sago Pondweed	*Stuckenia pectinata*	1
	Greater Bladderwort	*Utricularia vulgaris*	<1
Free-floating	Star Duckweed	*Lemna trisulca*	2
Floating-leaved	White water lily	*Nymphaea odorata*	1
	Yellow water lily	*Nuphar variegata*	<1
	Watershield	*Brasenia schreberi*	<1
	Floating-leaved pondweed	*Potamogeton natans*	present
Emergent	Bulrush	*Scirpus sp.*	4
	Needlegrass	*Eleocharis sp.*	3
	Arrowhead	*Sagittaria sp.*	present
	Three square Bulrush	*Scirpus americanus**	<1
	Cattail	*Typha sp.*	<1
		Percent of sites with vegetation	71

Highlight indicated non-native species.

Figure 7. Distribution of aquatic plants in Shamineau Lake, June 2005.

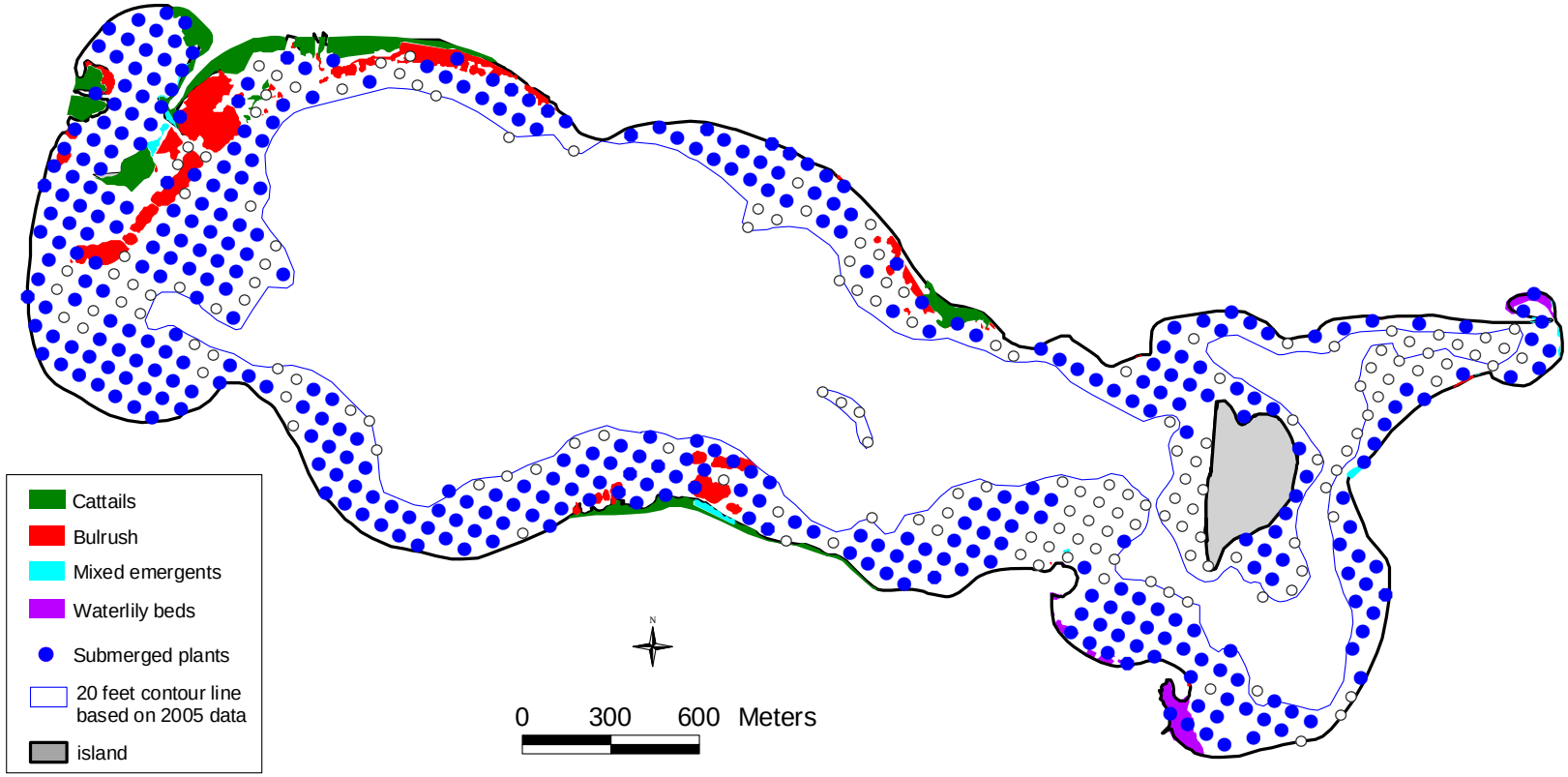


Figure 8. Plant abundance vs. water depth. Shamineau Lake, June 2005.

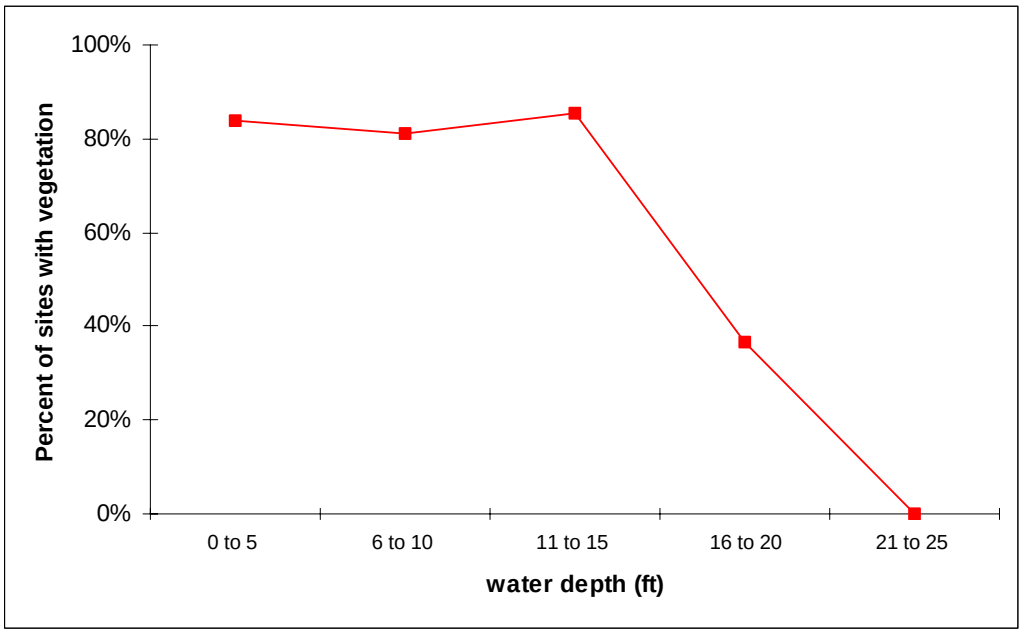


Figure 9. Number of plant species vs. water depth. Shamineau Lake, June 2005.

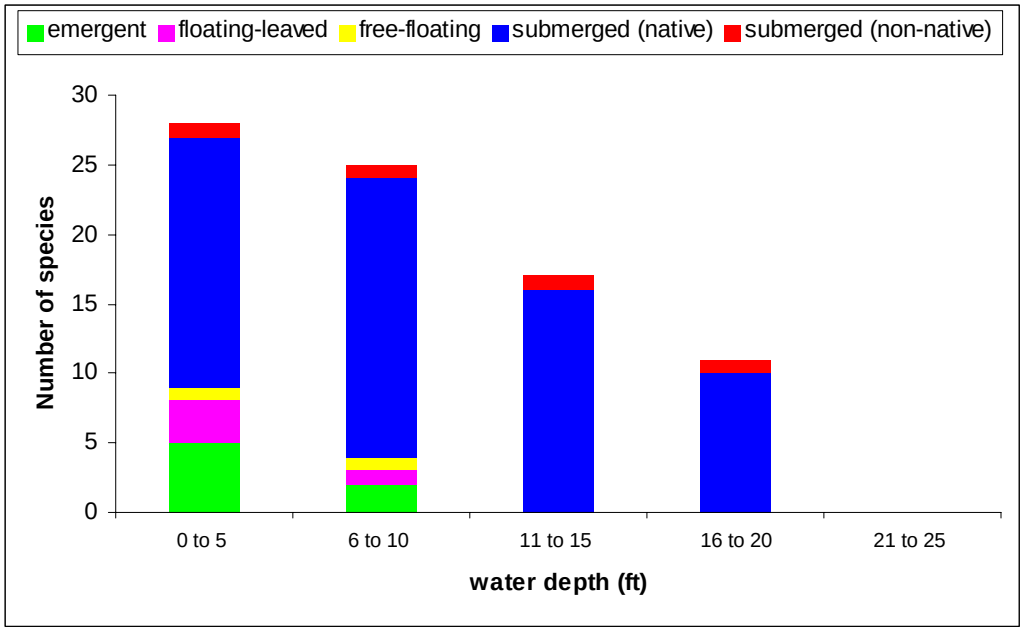
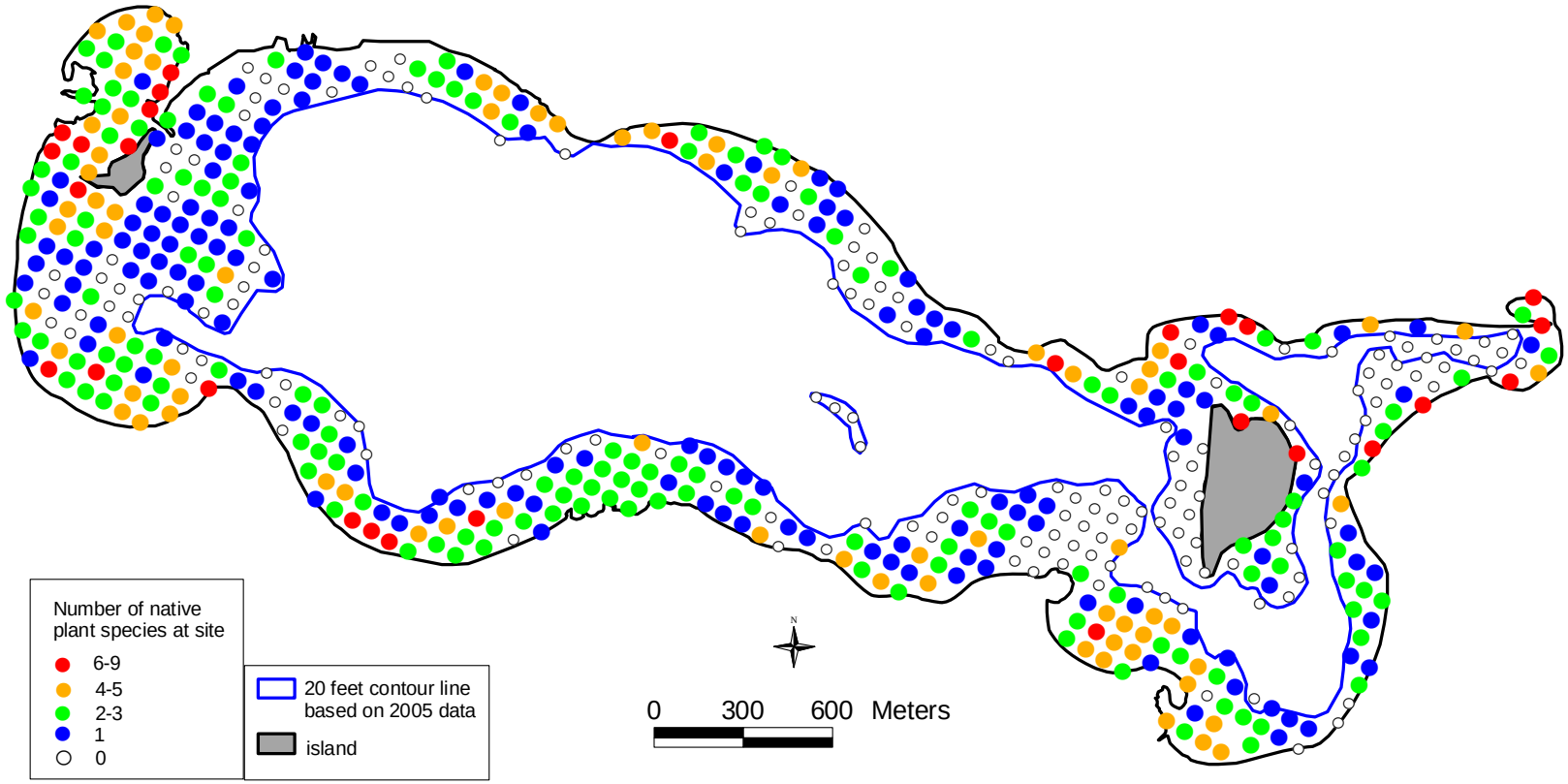


Figure 10. Number of plant species found at each sample site. Shamineau Lake, June 2005.



Emergent and floating-leaf plants

Cattails (*Typha* sp.) and bulrush (*Scirpus* spp.) (Fig. 11) were the most common emergent plants in Shamineau Lake and extensive beds grew along the northwest shore (Fig. 7). Approximately 30 acres of cattail, 35 acres of bulrush and two acres of mixed emergent plant beds were delineated.

Figure 11. Emergent vegetation on Shamineau Lake

Floating-leaf plants included white waterlily (*Nymphaea odorata*) (Fig. 12), yellow waterlily (*Nuphar variegata*) (Fig. 13), and floating-leaf pondweed (*Potamogeton natans*). The largest beds of floating-leaf plants occurred in the southeast and far northeast bays (Fig. 7) and totaled about six acres in area.

Bulrush, cattails and other emergent aquatic plants offer shelter for insects and young fish as well as food, cover and nesting material for waterfowl, marsh birds and muskrats. Water lily beds provide similar benefits and also provide shade for fish and frogs. The root systems of emergent and floating-leaf plants act to stabilize the lake bottom and beds of these plants help buffer the shoreline from wave action.

Figure 12. White water lily (*Nymphaea odorata*)

Figure 13. Yellow water lily (*Nuphar variegata*)

Submerged plants

Submerged plants occurred in 69 percent of Shamineau sample sites and included a wide variety of forms including large algae, grass-leaved plants, broad-leaved plants, and plants with finely dissected leaves.

The most common submerged plant species was Bushy pondweed (*Najas flexilis*) (Fig. 14). This is one of the few annual submerged species in Minnesota and must re-establish every year from seed. The seeds and foliage of this plant are an important duck food and beds of this plant provide good fish cover. In Shamineau Lake, bushy pondweed was found in 28 percent of the sample sites and occurred to a depth of 19 feet. It was most common in depths of 11 to 15 feet where it was found in 54 percent of the sites (Fig. 15). Bushy pondweed was widespread around the lakeshore and often co-occurred with other plants (Fig. 16).

Figure 14. Bushy pondweed (*Najas flexilis*)

Figure 15. Distribution of common submerged species by water depth, Shamineau Lake, June 2005.

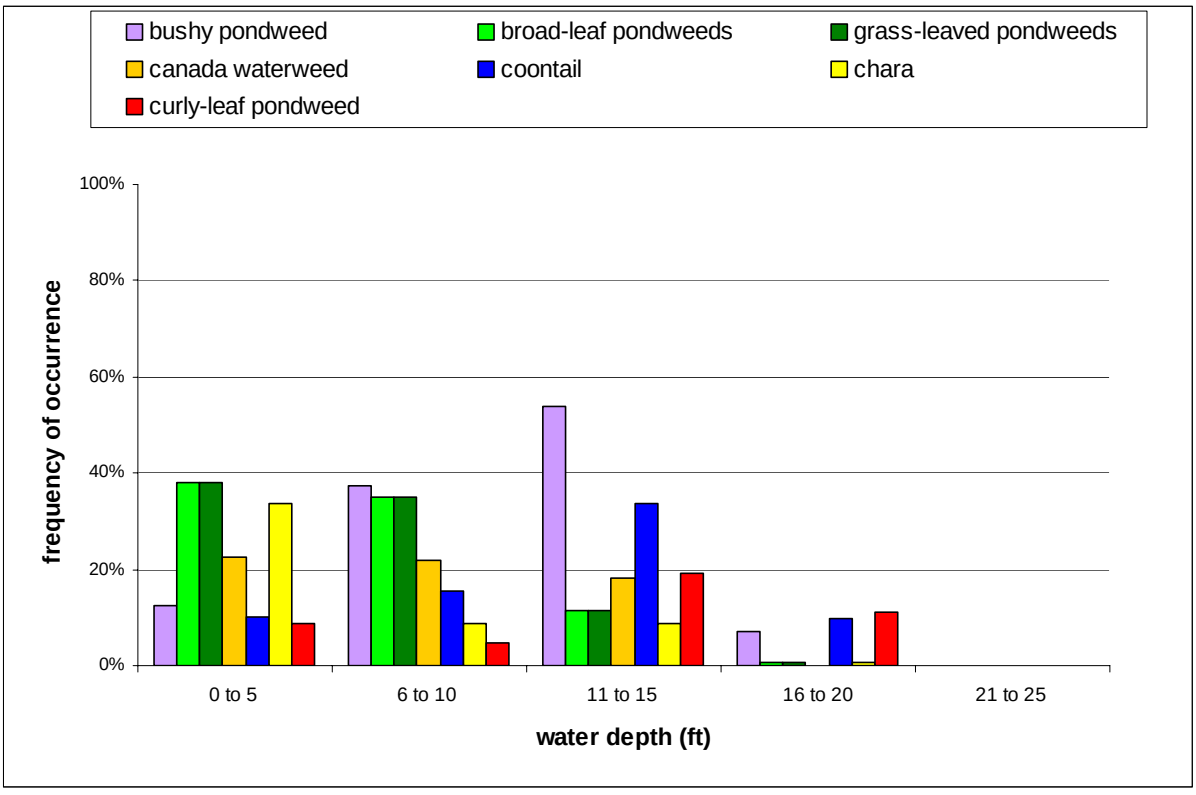
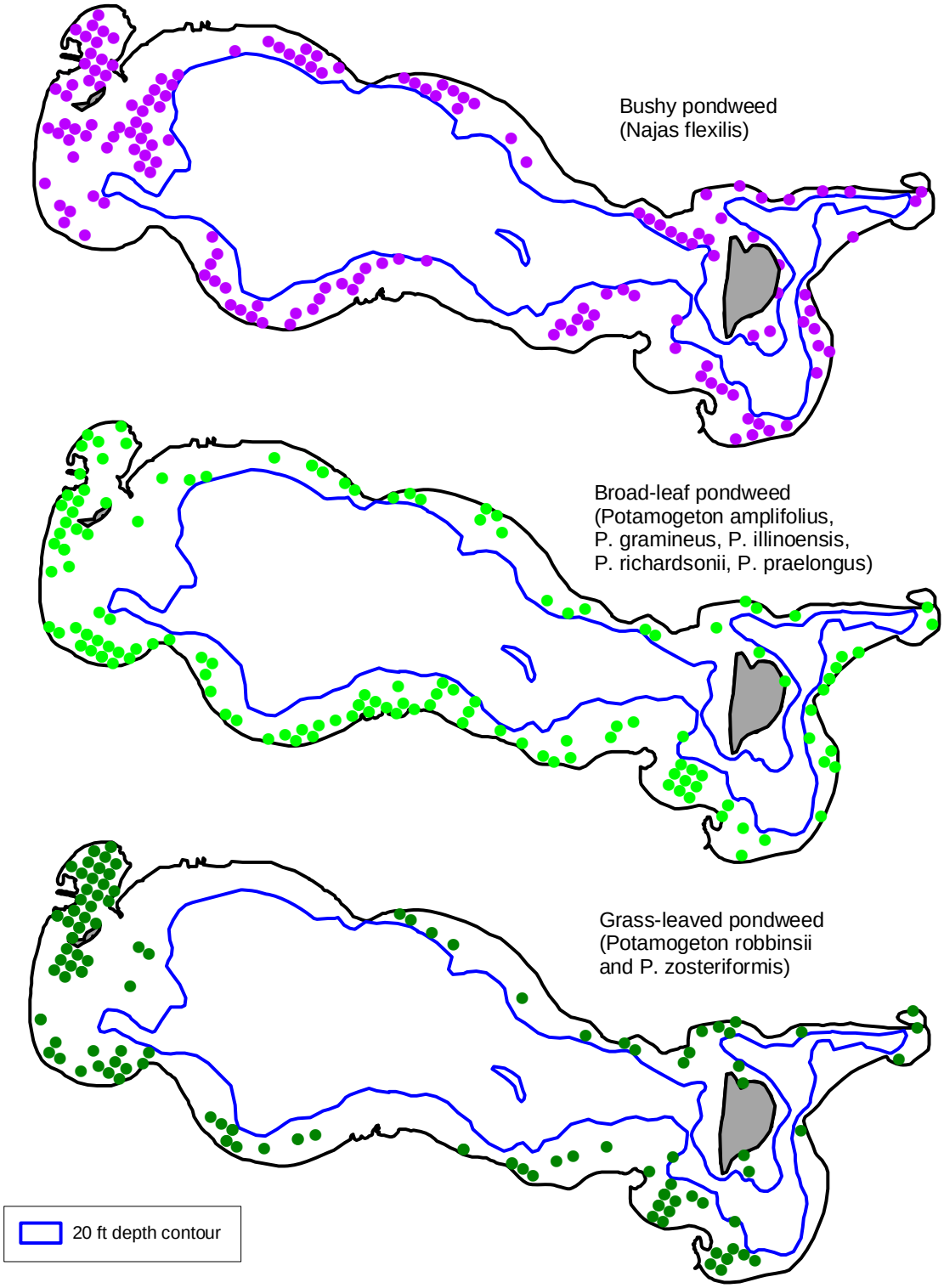


Figure 16. Distribution of common flowering plants in Shamineau Lake, June 2005.



Broadleaf pondweeds in Shamineau Lake include large-leaf pondweed (*Potamogeton amplifolius*), variable pondweed (*P. gramineus*), Illinois pondweed (*P. illinoensis)*, white-stem pondweed (*P. praelongus*), and clasping-leaf pondweed (*P. richardsonii*). These rooted, perennial plants with wide leaves are often called "cabbage" plants by anglers. These plants are primarily submerged but many will form floating leaves in shallower water (Fig. 17).

Figure 17. Broad-leaf pondweed or "cabbage" (*Potamogeton amplifolius*)

Twenty-four percent of the survey sites contained at least one species of broad-leaf pondweed. White-stem pondweed was the most abundant broadleaf pondweed in Shamineau Lake and was found in eight percent of all sample sites (Table 2). Broad-leaf pondweeds were more common in depths of 10 feet and less (Fig. 15) but were found around the entire shoreline (Fig. 16).

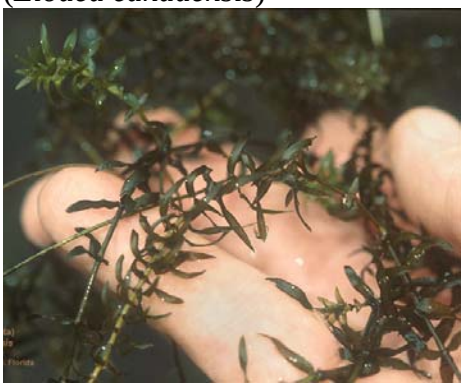
Grass-leaved pondweeds found in Shamineau Lake were flat-stem pondweed (*Potamogeton zosteriformis*) (Fig. 18) and Robbin's pondweed (*P. robbinsii*). These plants have flattened, grass-like leaves. Depending on water clarity and depth, plants may reach the water surface and may produce flowers that extend above the water. These pondweeds are anchored to the lake bottom by rhizomes and overwinter by winter buds.

Figure 18. Flat-stem pondweed (*Potamogeton zosteriformis*)

Grass-leaved pondweeds were found in 19 percent of the Shamineau Lake survey sites and were mostly found in water depths less than eleven feet (Fig. 15). These plants were concentrated at the west and east ends of the lake (Fig. 16).

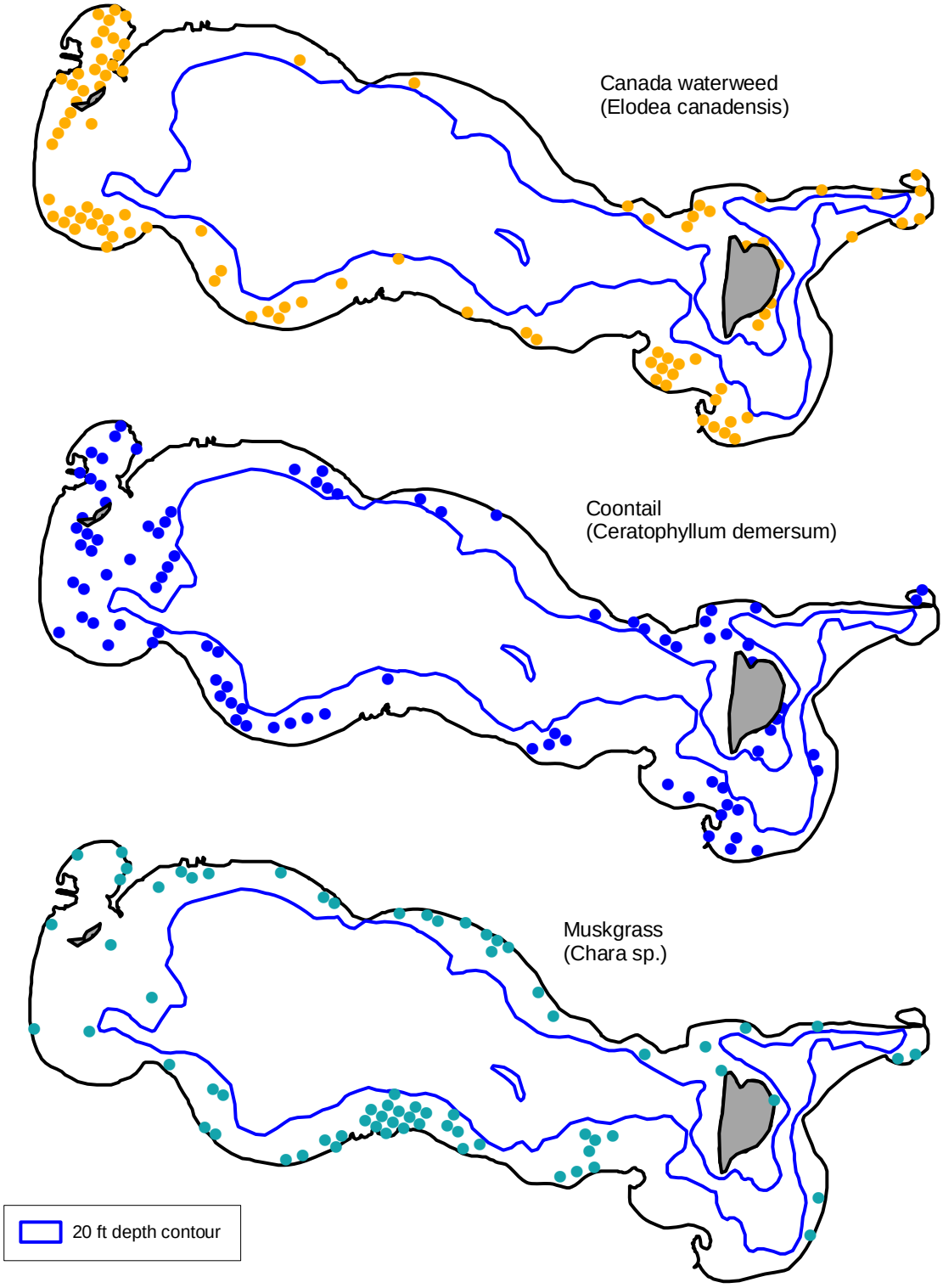
Canada waterweed (*Elodea canadensis*) (Fig. 19) is a rooted, perennial submerged species that is widespread throughout Minnesota and is adapted to a variety of conditions. It is tolerant of low light and prefers soft substrates. This species can over winter as an evergreen plant and spreads primarily by fragments. The branching stems of this plant can form thick underwater plant beds that are valuable habitat for a variety of fish and invertebrates.

Figure 19. Canada waterweed (*Elodea canadensis*)



In Shamineau Lake, Canada waterweed occurred in 17 percent of the sites (Table 2). It was restricted to depths of 15 feet and less and was evenly distributed around the lakeshore (Fig. 20).

Figure 20. Distribution of common flowering plants in Shamineau Lake, June 2005.



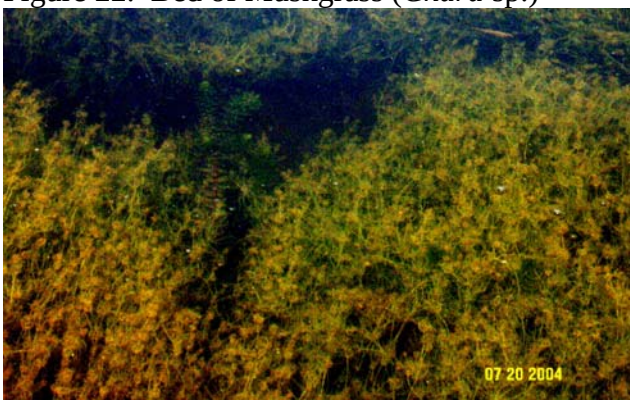
Coontail (Fig. 21) is native to Minnesota and is the most common submerged flowering plant in the state. It grows entirely submerged and is adapted to a broad range of lake conditions, including turbid water. Coontail is perennial and can overwinter as a green plant under the ice and then begins new growth early in the spring. It is loosely rooted to the lake bottom and spreads primarily by stem fragmentation.

Figure 21. Coontail (*Ceratophyllum demersum*)

In Shamineau Lake, coontail occurred in 16 percent of the sites sampled (Table 2). It was found at all depth zones and was most frequent in depths less than 16 feet (Fig. 11). Along with curly-leaf pondweed, it was one of the few species found in depths greater than 15 feet (Fig. 20).

Muskgrass (*Chara* sp.) (Fig. 22) 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.

Figure 22. Bed of Muskgrass (*Chara* sp.)

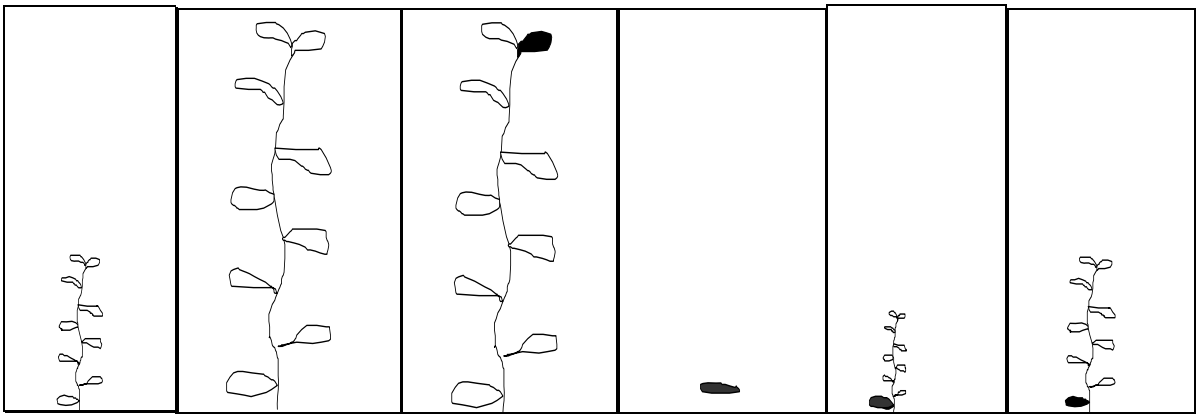


In Shamineau Lake, muskgrass occurred in 13 percent of all survey sites (Table 2) and was found around the entire lake (Fig. 20). Muskgrass grew to a maximum depth of 17 feet but was most common in depths from shore to five feet where it occurred in 34 percent of the sites (Fig. 15).

Curly-leaf pondweed (*Potamogeton crispus*) (Fig. 23) 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 at least 700 Minnesota lakes (Invasive Species Program 2005). Like many native 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 (Fig. 24). Winter foliage is produced and

Figure 23. Curly-leaf pondweed (*Potamogeton crispus*)

Figure 24. Life cycle of Curly-leaf pondweed (*Potamogeton crispus*).



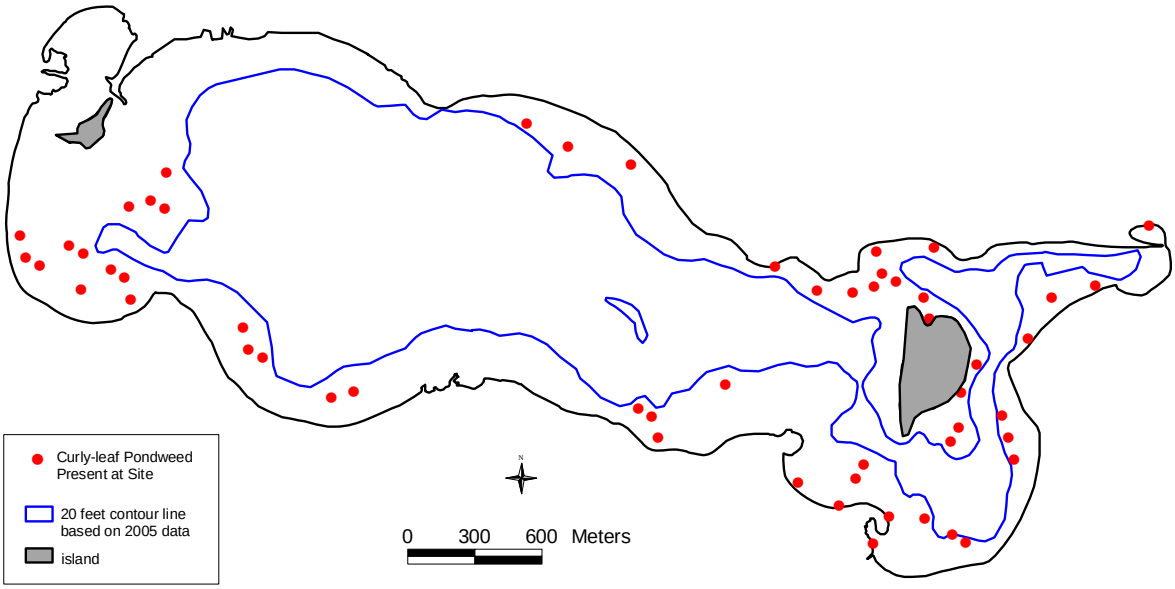
Winter	**Spring**	**Late Spring**	**Summer**	**Fall**	**Winter**
Plants Continue Growing under ice	Plants reach maximum growth	Plants begin to die back and form turions	Turions remain dormant	Turions germinate	Newly sprouted plants continue growth

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).

During the late spring, 2005 survey of Shaminaeu, curly-leaf pondweed was identified in 10 percent of the survey sites (Table 2). It occurred at all water depths to a maximum depth of 20 feet. It reached its maximum abundance in depths of 11 to 15 feet of water where it occurred in 19 percent of the sample sites (Fig. 15). In water depths greater than 15 feet, it was the most commonly found species, but occurred in only 11 percent of those sites. Curly-leaf was scattered around the Shamineau Lake shoreline (Fig. 25).

In many Minnesota lakes, curly-leaf forms dense surface mats, usually in water depths less than 15 feet. During the 2005 vegetation survey of Shamineau Lake, curly-leaf was not found to form extensive surface mats.

Figure 25. Distribution of Curly-leaf pondweed (*Potamogeton crispus*) in Shamineau Lake, June 2005.



Discussion

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 and wave activity. Much of Shamineau Lake supports abundant and diverse native aquatic plant community that in turn, provides critical fish and wildlife habitat and other lake benefits. (Click here for more information on: value of aquatic plants).

The high number of plant species found in Shamineau Lake is a reflection of the excellent water clarity. Many of the plants found require clear water and are not found in lakes with higher turbidity. Another reason for the high diversity of plant types is that Shamineau Lake has a variety of sediment types and a mix of protected bays and open water sites. Plant species with different habitat requirements can exist within this system.

A review of past vegetation surveys indicates that the general aquatic plant community has not changed greatly in Shamineau Lake. In all survey years, a relatively high number of native plants have been recorded and rooted plants remain well distributed throughout the bays. Data collected in 2005 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. 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.

In general, factors that may lead to change in the aquatic plant communities include:

- Change in water clarity
  If water clarity in Shamineau Lake decreases, submerged vegetation may be restricted to shallower water.
- Change in water level
  Many aquatic plants are adaptable to water level fluctuations and in low water years, aquatic plants may expand in distribution. The extent and duration of these distribution changes can be difficult to predict.
- Snow and ice cover
  Many submerged plants 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, some 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.
- Invasive species
  Curly-leaf pondweed may be more abundant in some years than others and may occur in different parts of the lake in different years. Eurasian watermilfoil (*Myriophyllum spicatum*) has not yet been found in the lake but may be easily transported to the lake from nearby Lake Alexander. The impact of these invasive species varies among lakes but the presence of a healthy native plant community may help mitigate the harmful effects of these exotics.
- Natural fluctuation in plant species
  Many submerged plants are perennial and regrow in similar locations each year. However, a few species such as bushy pondweed (*Najas flexilis*) are annuals and are dependant on the previous years seed set for regeneration.
- Aquatic plant management activities
  Humans can impact aquatic plant communities directly by destroying vegetation with herbicide or by mechanical means. For information on the laws pertaining to aquatic plant management, click here: MnDNR APM Program or contact your local DNR office. Motorboat activity in vegetated areas can be particularly harmful for species such as bulrush. Shoreline and watershed development can also indirectly influence aquatic plant growth if it results in changes to the overall water quality and clarity. Herbicide and mechanical control of aquatic plants can directly impact the aquatic plant community. Limiting these types of activities can help protect native aquatic plant species.

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