Aquatic vegetation of Pelican Lake

June and July, 2010

ID# 18-0308-00

Crow Wing County, Minnesota

Emergent plants in Crey Bay, northwest shore of Pelican Lake, 2010.

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Summary

Pelican Lake is the largest lake in Crow Wing County, with a surface area of about 8,300 acres. Relatively high water clarity and broad shallow zones provide extensive potential habitat for aquatic vegetation but windswept shorelines limit the amount of rooted vegetation.

In 2010, vegetation was sampled at 984 sites within the 0 to 25 feet depth zone and 46% of the sites contained vegetation. Plants were found to a depth of 25 feet and were most frequent in the 11 to 20 feet depth zones, where 72% of the sites were vegetated.

A total of 42 native aquatic plant species have been recorded in Pelican Lake, including 33 species found in 2010 and an additional nine species found during previous surveys. These included 27 submerged, 2 free-floating, 4 floating-leaf and 9 emergent species. The non-native submerged plant, curly-leaf pondweed (*Potamogeton crispus*), was present in the lake in 2010, but occurred infrequently and was not found in any sample sites.

Macroalgae dominated the submerged plant community, occurring in 38% of the sample sites. Muskgrass (*Chara* sp.) was the dominant plant in the 0 to 15 feet depth zones and stonewort (*Nitella* sp.) was the most frequent plant in depths greater than 15 feet.

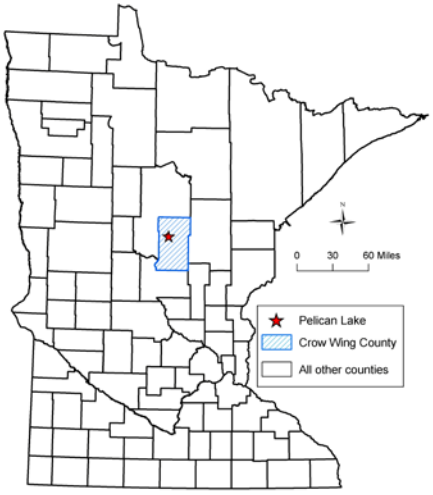
Rooted submerged plants were found in only 18% of the sites and were most frequent in the 16 to 20 feet depth zone, where they occurred in 33% of the sites. The most frequent species (those found in at least five percent of the sites) were coontail (*Ceratophyllum demersum*), bushy pondweed (*Najas flexilis*), broad-leaf pondweeds (*Potamogeton* spp.), and narrow-leaf pondweeds (*Potamogeton* spp.).

Emergent and floating-leaf plants occupied 207 acres, but were restricted to water depths less than six feet and within that shallow zone, they occurred in 11% of the sample sites. Bulrush (*Schoenoplectus* spp.) was the most common emergent plant and occurred in 5% of the shallow water sites (0-5 feet). Other emergent and floating-leaf plants included spikerush (*Eleocharis* sp.), arrowhead (*Sagittaria* sp.), three-square bulrush (*Schoenoplectus pungens*), narrow-leaf cattail (*Typha angustifolia*), white waterlily (*Nymphaea odorata*) and yellow waterlily (*Nuphar variegata*).

Introduction

Pelican Lake is located east of the city of Breezy Point in Crow Wing County, north central Minnesota (Figure 1). The lake is named for the pelican, one of Minnesota's largest birds, which were once frequent in the area (Upham 2001). It is a popular lake for fishing, boating and other water recreation activities.

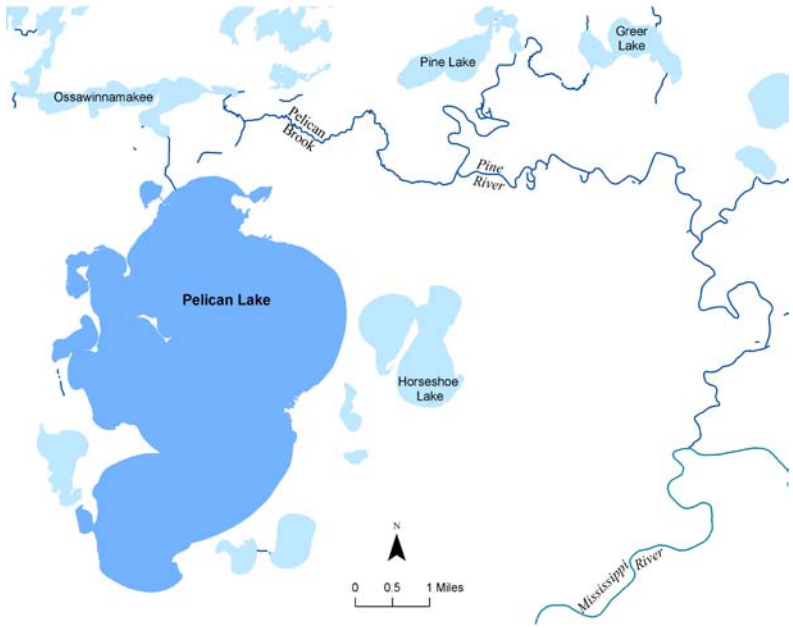
Figure 1. Pelican Lake, Crow Wing County, Minnesota.



Lake Characteristics

Pelican Lake occurs within the Pine River Watershed but it is not naturally connected to the Pine River. The lake is classified as a seepage lake because it receives most of its flow from precipitation and groundwater flow. There are no natural inlets but in 1938, a ditch was constructed from Lake Ossawinnamakee (Figure 2) and the ditch can be used as an inlet or outlet depending on the water levels in both lakes. In recent years there has been no flow between the two lakes. 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 in turn reflects the amount of rain water and snow melt. Because Pelican 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. Pelican Lake and intermittent connection to Lake Ossawinnamakee and Pine River.



With a surface area of 8,367 acres, Pelican Lake is the largest lake in the county and the watershed. It has 28 miles of shoreline and stretches about five miles long, from north to south, with an average width of about three miles. The lake is roughly oval in outline, with several small bays along the west and north shores (Figure 3). Gooseberry Island (Figure 4) is 16 acres and occurs in the northwest end of the lake.

Pelican Lake has a maximum depth of 104 feet but nearly half of the lake is shallow (15 feet or

Figure 3. Pelican Lake depth contours (Based on 2010 data).

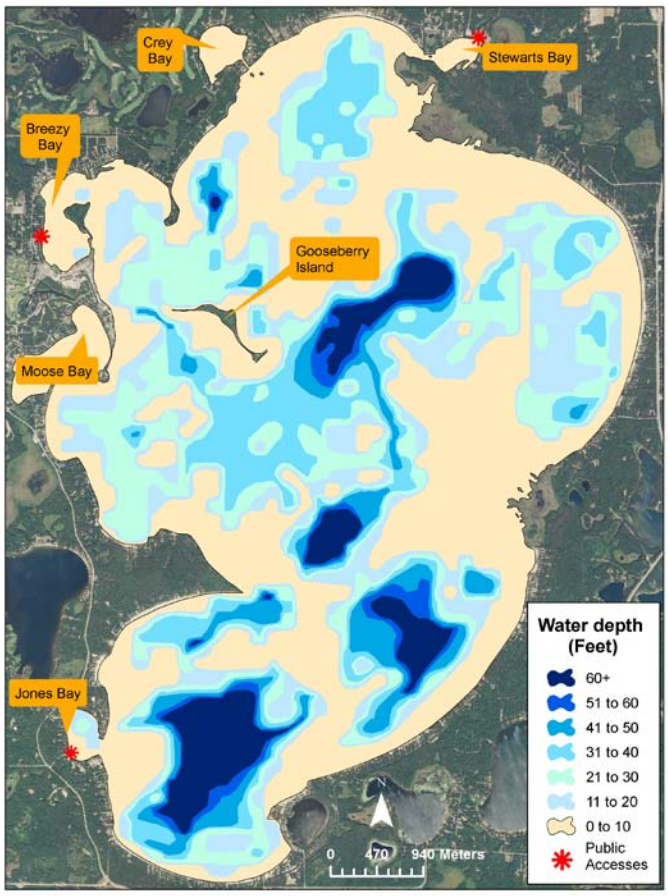


Figure 4. Gooseberry Island, 2010.

less in depth). Along the east shore, broad shallow zones extend up to one mile from shore, while the south shore and portions of the west shore have much steeper depth contours (Figure 3).

Pelican Lake is characterized as an oligotrophic (low nutrients), hard water lake, with relatively clear water. The Secchi disc transparency measures the depth to which a person can see into the lake and provides a rough estimate of the light penetration into the water column. Water clarity can fluctuate annually and depends on the amount of particles in the water. Since 2004, clarity has been above the long term mean in Pelican Lake and this may be related to low water levels (RMB 2008). In 2008, mean summer (June through September) water clarity, as measured by Secchi disc readings, was 17 feet in Pelican Lake (MPCA 2010). 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 half times the Secchi depth. Based on Secchi disk measurements alone, aquatic plants have the potential to reach depths of 25 feet in this lake.

The majority of Pelican Lake shoreline is privately owned (and developed as residential homes). There are several resorts and one youth camp on the lake. Public accesses are located at Stewarts Bay on the north shore, Breezy Bay on the northwest shore and Jones Bay on the southwest shore.

Historic aquatic plant community

Previous lakewide, aquatic plant surveys of Pelican Lake were conducted in 1955, 1971, 1983, 1988, and 2009 (MnDNR Lake files). Rare species searches of two bays of the lake were conducted in 1996 and 1998 (Myhre 1996, Myhre 1998). Emergent plant beds were delineated in 2009 by MnDNR Fisheries Biologists. These previous surveys found a total of 19 wetland emergent, 13 emergent, 3 floating-leaf, 2 free-floating and 25 submerged species (Appendix 1). Submerged plants were found to a depth of 24 feet and include 6 different native pondweeds

(*Potamogeton* spp.), northern watermilfoil (*Myriophyllum sibiricum*), coontail (*Ceratophyllum demersum*), bushy pondweed (*Najas flexilis*), and Canada waterweed (*Elodea canadensis*).

The non-native submerged plant, curly-leaf pondweed (*Potamogeton crispus*), has been documented in Pelican Lake. In the Spring of 2008, MnDNR Invasive Species Program staff found relatively small beds of curly-leaf pondweed in Jones Bay and Breezy Bay.

Objectives

The purpose of this vegetation survey was to provide a quantitative description of the 2010 plant population of Pelican Lake. Specific objectives included:

1. Describe the shoal sediments of the lake
2. Estimate the maximum depth of rooted vegetation
3. Estimate the percent of the lake occupied by rooted vegetation
4. Record the aquatic plant species that occur in the lake
5. Estimate the abundance of common species
6. Develop distribution maps for the common species

Methods

Mapping floating-leaf and emergent vegetation beds

Field surveys to map emergent plant beds were conducted in 2009 by MnDNR Fisheries biologists. Surveyors mapped these plant beds in the field by motoring around the perimeter of each bed and recording their track with a handheld GPS. Field data were uploaded to a computer and a GIS software program was used to estimate acreage. Waterlilies and cattails were mapped for Crey Bay, Stewart's Bay and Moose Bay using 2008 Farm Service Administrative (FSA) true color aerial photographs.

Lakewide vegetation survey

A lakewide vegetation survey was conducted using a point-intercept survey method (Madsen 1999, MnDNR 2008). Survey waypoints were created using a Geographic Information System (GIS) computer program and downloaded into a handheld Global Positioning System (GPS) unit. Survey points were placed across the entire lake and spaced 150 meters (492 feet) apart.

In the field, surveyors sampled sites where water depth was less than 26 feet. To minimize damage to vegetation, surveyors did not survey sites if they occurred in dense beds of emergent or floating-leaf plants. A total of 994 sites were surveyed in Pelican Lake and 984 of those sites occurred in the 0-25 feet depth zone (Figure 5, Table 1).

Pelican Lake was surveyed on June 7, 10, 16, 24, and July 8, 12, 2010. The survey was conducted by boat and a GPS unit was used to navigate the boat to each sample point. One side of the boat was designated as the sampling area. At each site, water depth was recorded in one-foot increments using a measured stick in water depths less than 7 feet and an

electronic depth finder in deeper water.

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 was used to survey vegetation not visible from the water surface (Figure 6). 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 nomenclature followed MnTaxa (2010).

At each sample site where water depths were 7 feet and less, surveyors described the bottom substrate using standard substrate classes (Table 2). 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 depth greater than 7 feet, surveyors collected depth and vegetation data and then motored into shallower water and recorded the substrate type adjacent to the actual survey point.

Figure 5. 2010 vegetation survey sites on Pelican Lake.

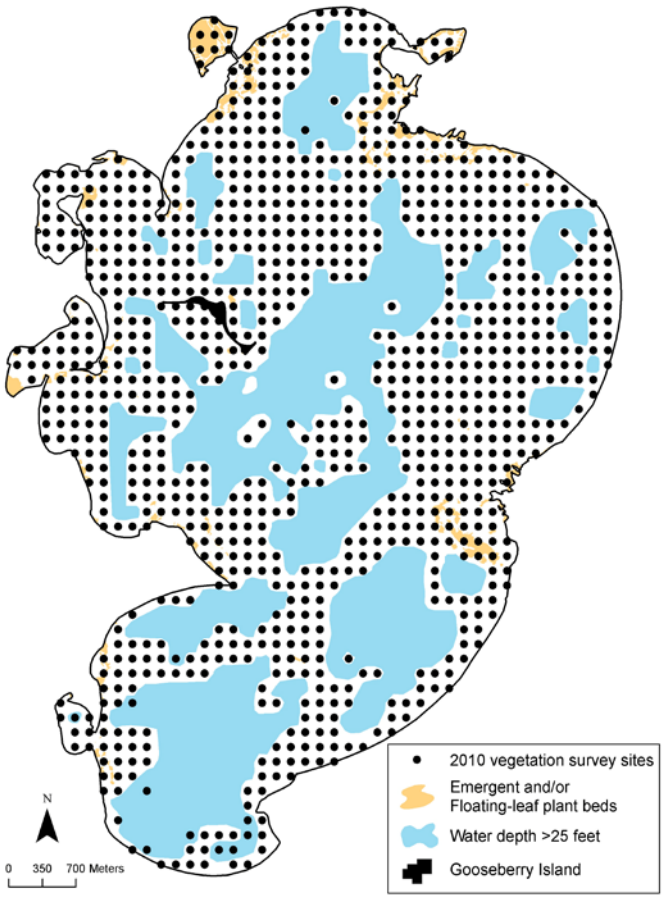


Figure 6. Survey rake.

Table 1. Survey effort by depth interval.

Water depth (feet)	Number of sample sites
0 to 5	418
6 to 10	257
11 to 15	92
16 to 20	79
21 to 25	138
Total (0 to 25)	984
26 to 30	10
total	994

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 25 feet and sampling points were also grouped by water depth and separated into five depth zones for analysis (Table 1).

Example:
In Pelican Lake there were 984 samples sites in the 0-25 feet depth zone.

Muskgrass occurred in 305 sites.

Frequency of Muskgrass in 0 to 25 feet zone = (305 / 984)*100 = 31%

Table 2. Substrate classes

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

Results and Discussion

Shoal Substrates

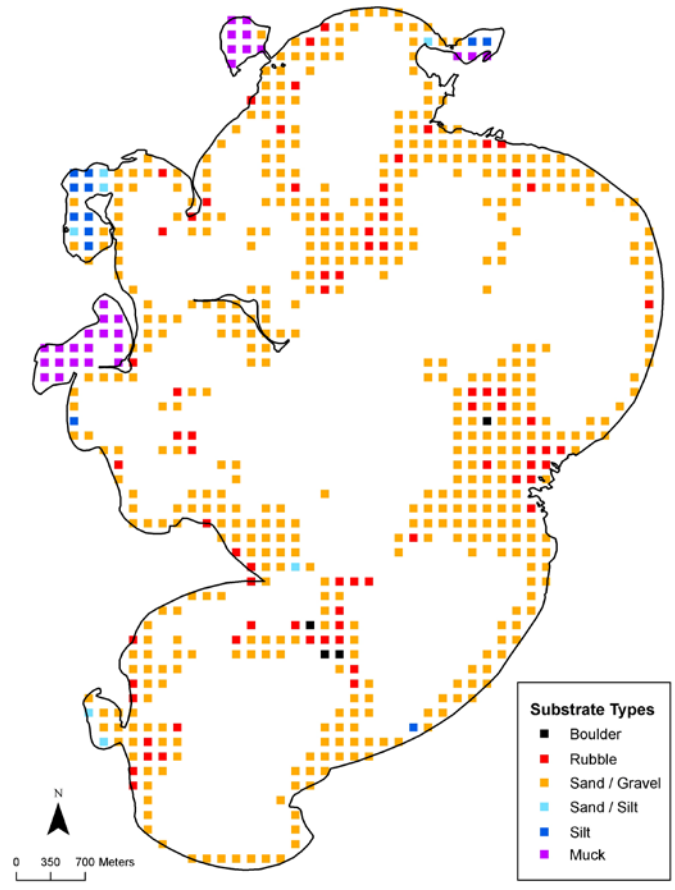
The shoal substrates of Pelican Lake were primarily hard substrates of sand (Figures 7, 8), gravel, and rubble with a few areas of large boulders (Figure 9). Softer substrates of silt and muck were found in shallow, protected bays (Figure 10).

Figure 7. Sand substrate of Pelican Lake

Figure 8. Sandy shores at north end of Pelican Lake.

Figure 9. Boulder pile on Pelican Lake.

Figure 10. Shoal substrates of Pelican Lake, 2010.



Types of plants recorded

A total of 42 native aquatic plant species have been recorded in Pelican Lake, including 33 species found in 2010 (Table 3) and an additional 9 species found during previous surveys (Appendix 1). These included 27 submerged, 2 free-floating, 4 floating-leaf and 9 emergent species. Submerged plants included macroalgae, and a diversity of rooted 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 in Pelican Lake in 2010, but not found in any of the sample sites.

In 2010, two submerged plant species, Fries pondweed (*Potamogeton friesii*) and southern naiad (*Najas guadalupensis*) were recorded for the first time in Pelican Lake. These species can be difficult to distinguish from other fine-leaved plants that occur in Pelican Lake. It is likely that they were present during previous surveys, but were not located or not identified to the species level.

Similarly, 4 plant species were reported during the 1998 Pelican Lake survey but were not found in 2010. Straight-leaved pondweed (*Potamogeton strictifolius*), small pondweed (*P. pusillus*) and filiform pondweed (*Stuckenia filiformis*) are all types of narrow-leaved pondweeds that were likely present in 2010, but grouped together and not identified to the species level. Green-fruited burreed (*Sparanium chlorocarpum*) was only reported in 1998 and this emergent plant is likely uncommon along the heavily developed shores of Pelican Lake.

The 2010 survey did not include an inventory of upland or wetland plants but surveyors did record the presence of several non-native shoreland plants (Appendix 1).

Table 3. Frequency of aquatic plants in Pelican Lake, June and July 2010.

[Frequency is the percent of sample sites in which a plant species occurred within the 0 to 25 ft water depth).

Life Form		Common Name	Scientific Name	Frequency (%) 984 sites
SUBMERGED	Macroalgae	Muskgrass	*Chara* sp.	31
		Stonewort	*Nitella* sp.	7
	Dissected-leaf rooted plants	Coontail	*Ceratophyllum demersum*	5
		Northern watermilfoil	*Myriophyllum sibiricum*	2
		Water marigold	*Bidens beckii*	1
		White-water buttercup	*Ranunculus aquatilis*	<1
		Greater bladderwort	*Utricularia vulgaris*	<1
		Flat-leaved bladderwort	*Utricularia intermedia*	<1
	Small-leaf rooted plants	Bushy pondweed	*Najas flexilis*	5
		Canada waterweed	*Elodea canadensis*	3
		Southern naiad	*Najas guadalupensis*	<1
	Narrow-leaf pondweeds	Fries' pondweed	*Potamogeton friesii*	5
		Narrow-leaf pondweed	*Potamogeton* sp.	
		Sago pondweed	*Stuckenia pectinata*	
	Broad-leaf pondweeds	White-stem pondweed	*Potamogeton praelongus*	2
		Large-leaf pondweed	*Potamogeton amplifolius*	1
		Variable pondweed	*Potamogeton gramineus*	1
		Illinois pondweed	*Potamogeton illinoensis*	1
		Clasping-leaf pondweed	*Potamogeton richardsonii*	1
		Curly-leaf pondweed (I)	*Potamogeton crispus*	*Present
	Grass-leaf rooted plants	Flat-stem pondweed	*Potamogeton zosteriformis*	4
		Robbin's pondweed	*Potamogeton robbinsii*	1
		Water star-grass	*Heteranthera dubia*	<1
		Wild celery	*Vallisneria americana*	1
Free-floating	Duckweed	Star duckweed**	*Lemna trisulca*	<1
FLOATING-LEAVED		White waterlily	*Nymphaea odorata*	<1
		Yellow waterlily	*Nuphar variegata*	<1
		Floating-leaf pondweed	*Potamogeton natans*	*Present
EMERGENT (includes only in-lake emergents and not wetland plants)		Bulrush	*Schoenoplectus* sp.	2
		Spikerush	*Eleocharis* sp.	1
		Arrowhead	*Sagittaria* sp.	<1
		Three-square bulrush	*Schoenoplectus pungens*	<1
		Narrow-leaf cattail	*Typha* sp.	<1
		Wild Rice	*Zizania palustris*	<1

*Present = Present in Lake but not found in any sample sites

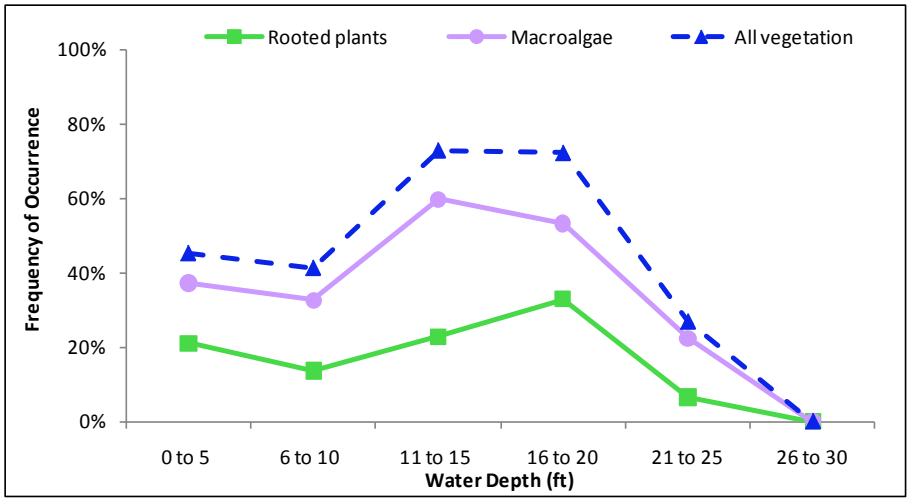
**Star duckweed = is a free-floating plant that often accumulates on the lake bottom

I = introduced species

Distribution of aquatic plants by water depth

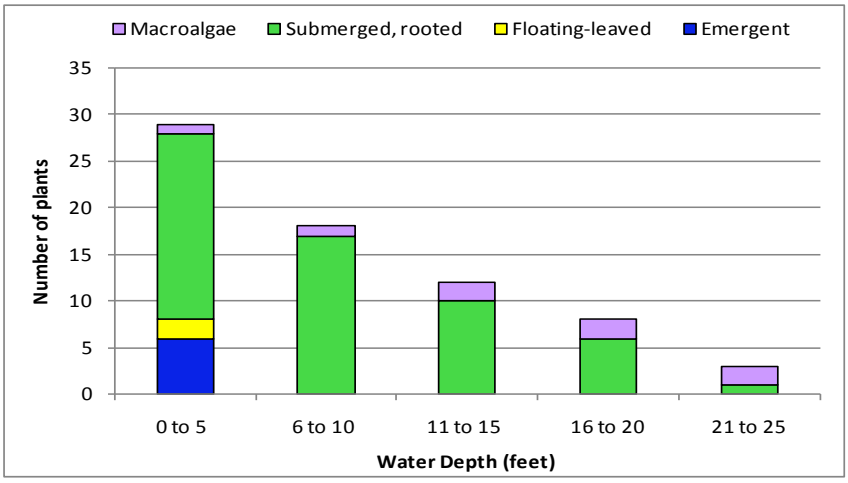
Plants were found to a depth of 25 feet in Pelican Lake and in the 0-25 feet depth zone, 46% of the survey sites contained vegetation. Vegetation was most common in the 11 to 20 feet depth zones, where 72% of sites contained plants (Figure 11). In water depths of 21 to 25 feet, 27% of sites contained plants and at the 25 feet depth, only 9% of sites were vegetated. Plants may have been present at low frequency beyond the 25 feet depth.

Figure 11. Aquatic plant frequency vs. water depth.



The highest number of plant species was found in shallow water, from shore to a depth of five feet (Figure 12). Emergent plants were restricted to water depths of 5 feet and less and floating-leaved plants were most common to a depth of 5 feet. Submerged rooted plants were found to a maximum depth of 25 feet but only three species occurred in depths greater than 20 feet. Macroalgae were found at all depths to 25 feet.

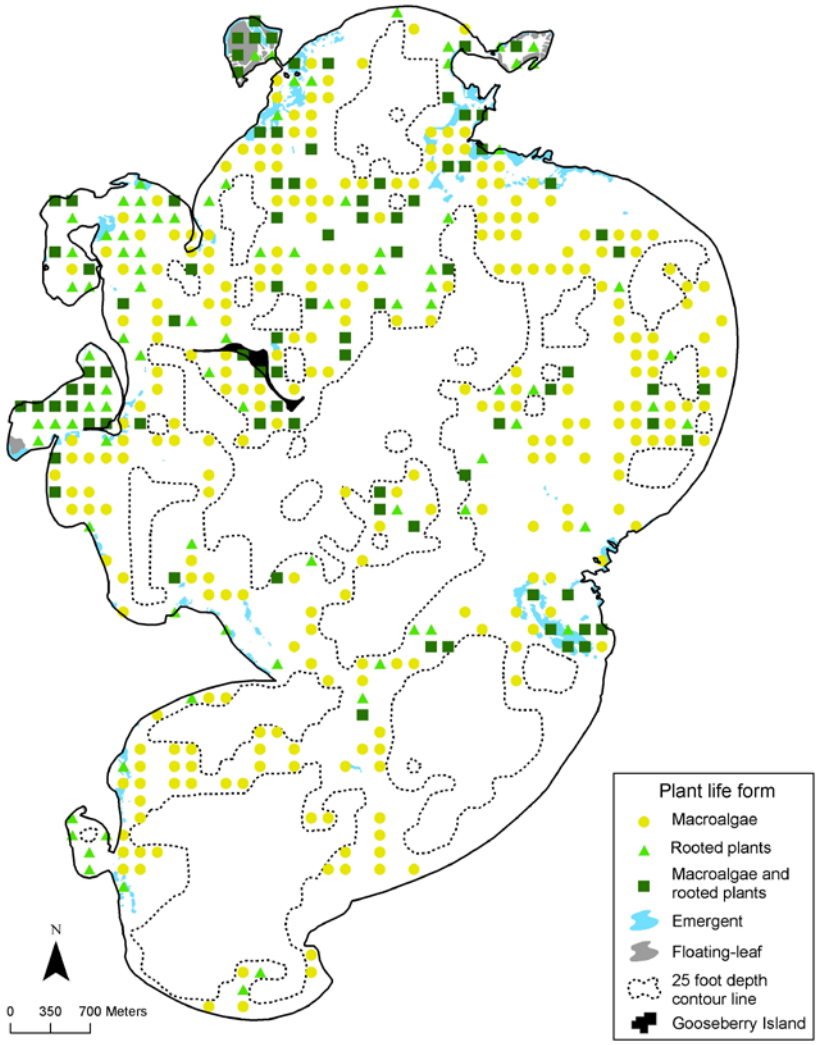
Figure 12. Number of plant species vs. water depth. Pelican Lake, 2010.



Distribution and richness of plant communities around the lake

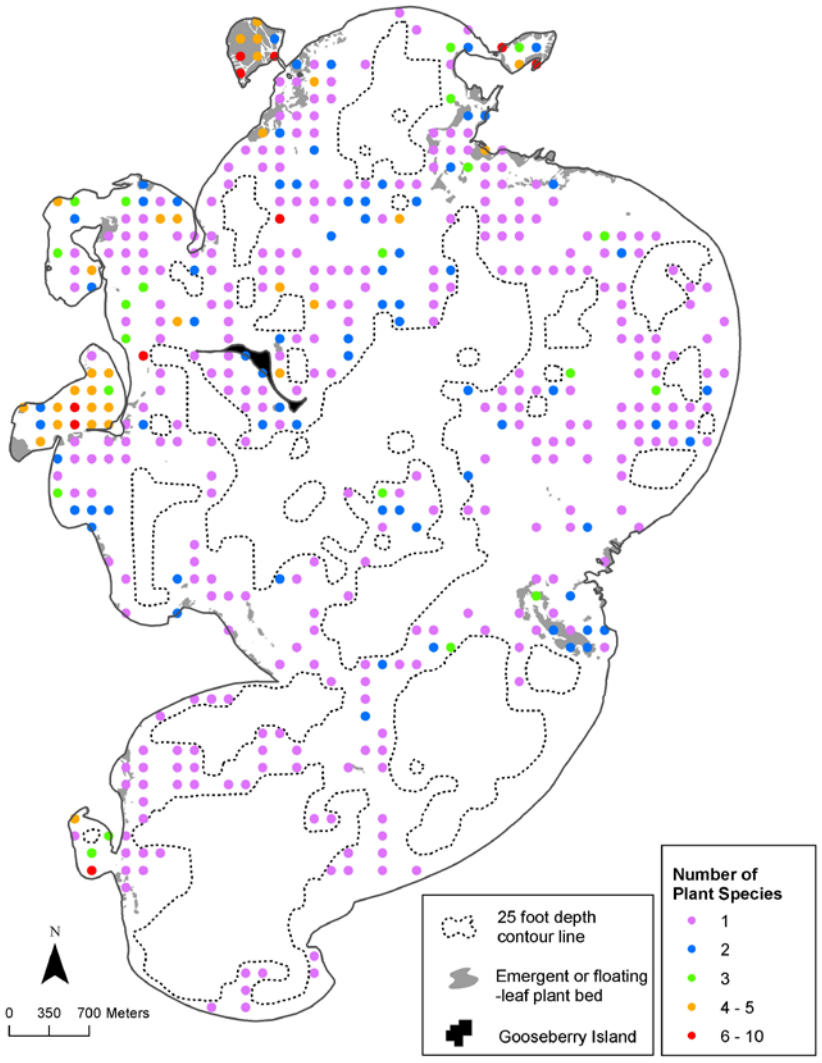
Plants were most common in protected bays, where 82% of the sites were vegetated (Figure 13). Shallow, windswept areas, such as the southeastern and north shore, were sparsely vegetated.

Figure 13. Distribution of aquatic plants, Pelican Lake 2010



The number of plant species found at each one square meter sample site ranged from 0 to 10 and most sites contained no plants. The greatest number of species was found in protected bays with a mean of 3 species per site. Most sites in the main lake contained only one plant species or no vegetation (Figure 14). Of the 33 plant species found, 9 occurred only in the bays and 23 were found in the main basin.

Figure 14. Number of species per site, Pelican Lake 2010.

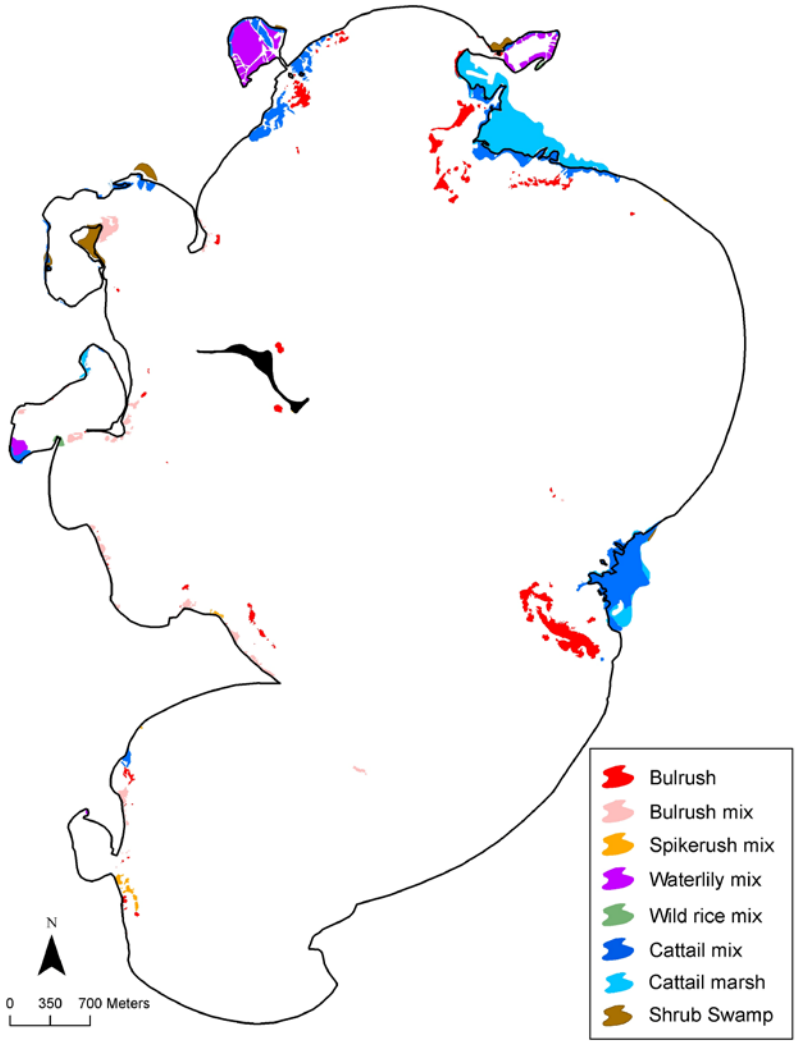


Emergent and Floating-leaf Plant Beds

Emergent and floating-leaf aquatic plants offer food, cover and nesting material for waterfowl, marsh birds and muskrats, and provide shelter and shade for insects, young fish, and amphibians. The root systems of emergent and floating-leaf plants protect shorelines against erosion by buffering the wave action and by holding soil in place.

Approximately 207 acres of emergent and floating-leaf plant beds were mapped in Pelican Lake. Emergent and floating-leaf plants were restricted to the 0-5 feet depth zone and within that area, 11% of the Pelican Lake sites contained at least one emergent or floating-leaf plant. Plant beds were classified by the dominant species (Figure 15).

Figure 15. Emergent & floating-leaf plant beds, Pelican Lake 2003.



Bulrush (*Schoenoplectus spp.)* (Figure 16) was the most common emergent in Pelican Lake (Table 3). Bulrush beds, or bulrush beds mixed with waterlilies, covered about 89 acres in Pelican Lake (Figure 15). Bulrush was found in 2% of all sample sites and in 5% of the shallow water sites (0- 5 feet). Bulrush was typically found on sandy sites and the largest beds occurred on the east shore adjacent to a large wetland.

Figure 16. Great blue heron in bulrush bed, Pelican Lake, 2010.

Other emergent plants found included wild rice (*Zizania palustris)*, cattail (*Typha* spp.) and spikerush (*Eleocharis* sp.).

Floating-leaf plants included yellow waterlily (*Nuphar variegata*), white waterlily (*Nymphaea odorata*) and floating-leaf pondweed (*Potamogeton natans*).

Waterlily beds often contained scattered bulrush plants, and submerged plants (Figure 17). Waterlily beds, or mixed beds of waterlilies and emergent plants, covered about 41 acres in Pelican Lake (Figure 15). The largest beds of waterlilies occurred in Crey Bay and Stewart's Bay.

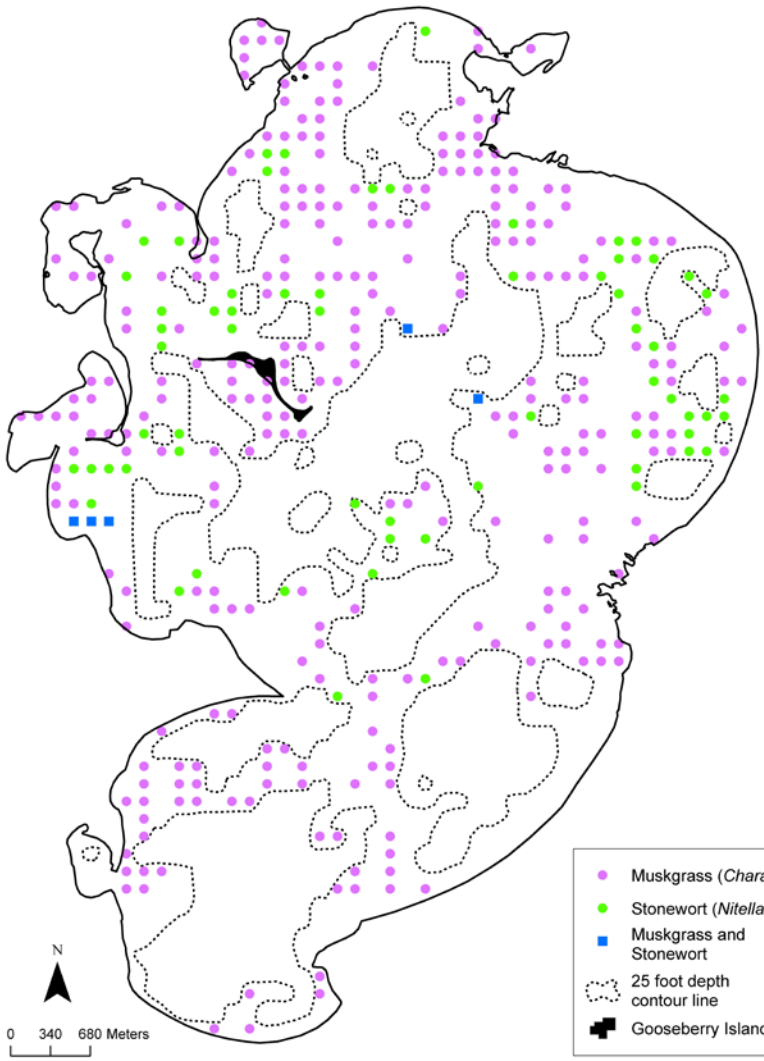
Figure 17. Mixed bed of white waterlily and bulrush, Pelican Lake, 2010.

Submerged Macroalgae

Algae are primitive forms of plants that do not form true roots, flowers or vascular tissue. They range in size from single cell to giant seaweed. Freshwater algae that live in Minnesota lakes include tiny, free-floating planktonic algae, filamentous algae, and macroalgae. Macroalgae often resemble rooted plants and provide similar habitat and water quality benefits and were therefore included in this survey.

Macroalgae were the most common plant type in Pelican Lake and occurred in 38% of the sites (Figure 18). Of the sites that contained plants, 80% contained macroalgae. Macroalgae were found to a depth of 25 feet and likely occurred at scattered locations beyond the 25 foot depth.

Figure 18. Distribution of Macroalgae in Pelican Lake, 2010.



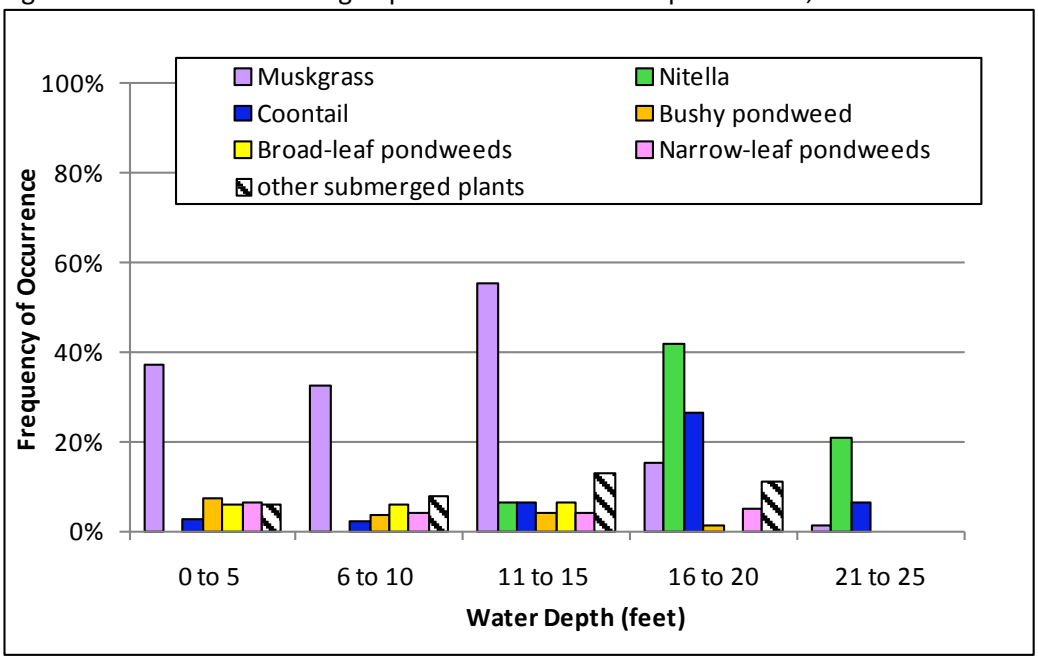
Muskgrass (*Chara* sp.) (Figure 19) is a freshwater macroalgae and is common in many hard water Minnesota lakes. It has a brittle texture and a characteristic "musky" odor. Because muskgrass does not form true stems, it is a low-growing plant, often found entirely beneath the water surface where it may form low "carpets" on the lake bottom. Muskgrass is adapted to variety of

substrates and is often the first species to colonize open areas of lake bottom where it can act as a sediment stabilizer. Beds of muskgrass can provide important fish spawning and nesting habitat.

Figure 19. Muskgrass

In Pelican Lake, muskgrass was the most frequently occurring plant with a frequency of 31% (Table 3). It occurred throughout the vegetated zone of the lake in depths from 1 to 24 feet and was the dominant plant in the 0 to 15 feet depth zone (Figure 20).

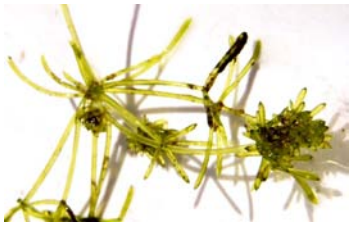
Figure 20. Common submerged plants at each water depth interval, Pelican Lake 2010.



Stonewort (*Nitella* sp.)(Figures 21, 22) is also a large algae but lacks the brittle texture and musky odor of muskgrass. It is often bright green in color and resembles strands of hair. Stonewort is often found in deeper water than muskgrass. In Pelican Lake it occurred in 7% of the sample sites (Table 3) and was found in depths of 13 to 25 feet. Stonewort was the most commonly occurring plant in depths of 16 to 25 feet depth zone where it was present in 29% of the sample sites (Figure 13).

Figure 21. Stonewort.

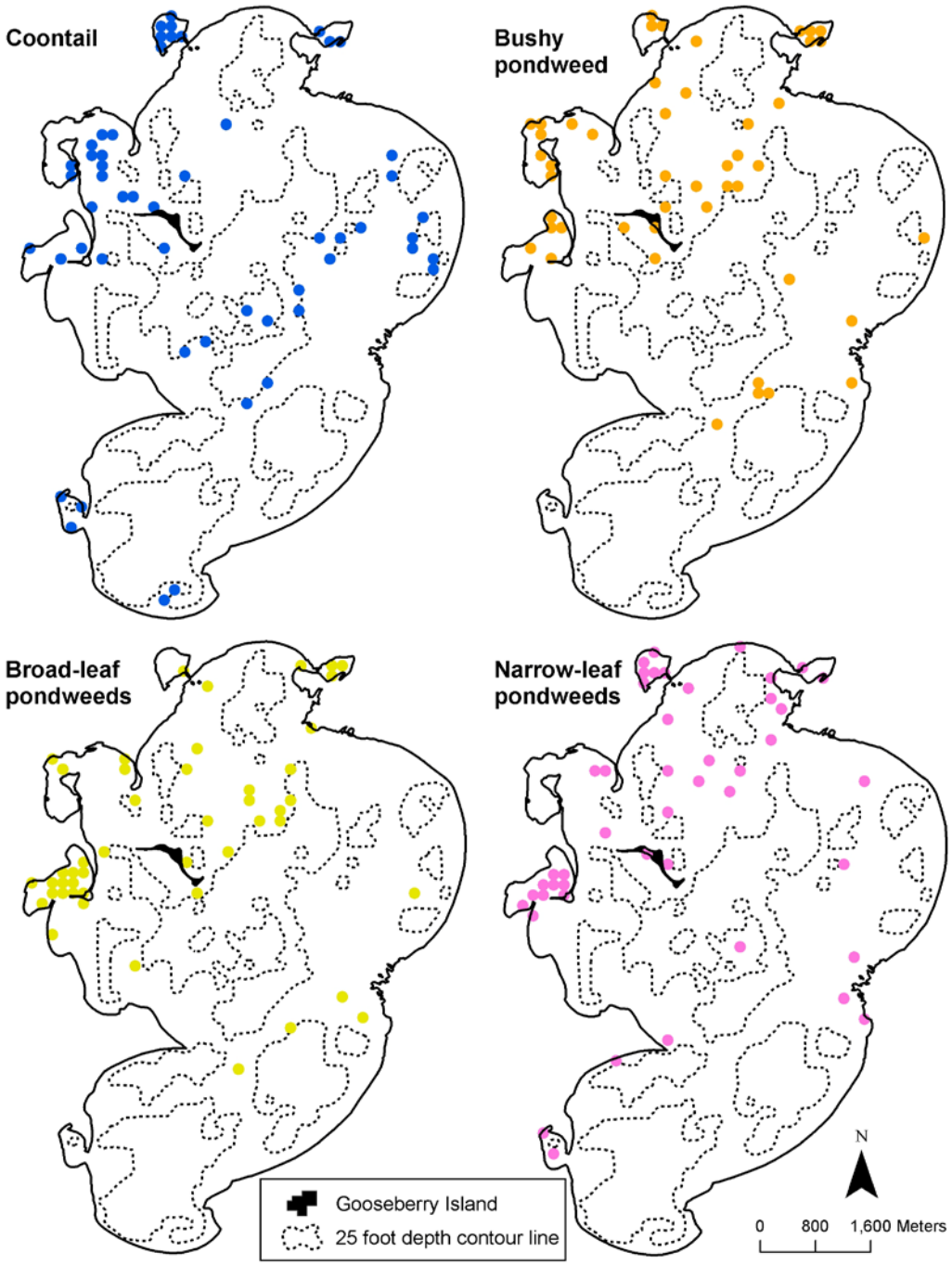
Figure 22. Close-up of Stonewort.



Submerged rooted plants

Rooted submerged plants occurred in 16% of the Pelican Lake sample sites and were concentrated in the northwestern half of the lake (Figure 23). The most frequently occurring species, or species groups, were coontail (*Ceratophyllum demersum*), bushy pondweed (*Najas flexilis*), narrow-leaf pondweeds (*Potamogeton* spp.), and broad-leaf pondweeds (*Potamogeton* spp.).

Figure 23. Distribution of commonly occurring rooted, submerged plants in Pelican Lake, 2010.



Coontail (Figure 24) grows entirely submerged and its roots are only loosely anchored to the lake bottom. It is adapted to a broad range of lake conditions and is tolerant of higher turbidity and can grow in muck substrates. Coontail is perennial and can over winter as a green plant under the ice and then begins new growth early in the spring, spreading primarily by stem fragmentation. The finely divided leaves of this plant provide a home for insects valuable as fish food. Coontail was found in 5% of the sample sites in Pelican Lake and was most common in the 16 to 20 feet depth zone where it occurred in 26% of the sites (Figure 13).

Figure 24. Coontail

Bushy pondweed (Figure 25) is unique because it 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 Pelican Lake, bushy pondweed occurred in 5% of the sample sites (Table 3, Figure 13).

Figure 25. Bushy pondweed

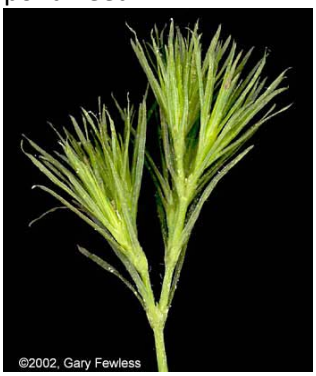


Photo by Gary Fewless (UW Green bay)

There are over 20 native species of pondweed (*Potamogeton*) in Minnesota and 10 were found in Pelican Lake. Seeds and tubers of pondweeds are an important source of waterfowl food (Fassett 1957). The foliage of pondweeds is food for a variety of marsh birds, shore birds and wildlife and provides shelter, shade and spawning sites for a range of fish species (Borman et al. 2001).

Figure 26. White-stem pondweed

Broad-leaf pondweeds are a group of wide-leaved submerged plants that are often called "cabbage" by anglers. Broad-leaf pondweeds found in Pelican Lake include large-leaf pondweed (*Potamogeton amplifolius*), Illinois pondweed (*P. illinoensis*), variable pondweed (*P. gramineus*), white-stem pondweed (*P. praelongus;* Figure 26), and clasping-leaf pondweed (*P. richardsonii*). These perennial plants produce tubers and fruits that are a favorite duck food and their broad leaves provide food and shelter for fish. In Pelican Lake 6% of the sites contained at least one broad-leaf pondweed (Table 3, Figure 20). Broad-leaf pondweeds were found most often in the shallow, soft-substrate bays and were common in depths of 15 feet and less (Figure 23).

Figure 27. Fries' pondweed

(Photo by O Angerer)

Narrow-leaf pondweeds are rooted, perennial submerged plants with small, thin leaves. Leaves grow entirely below the water surface but flowers extend above the water. There are several species of narrow-leaf pondweeds and they can be difficult to identify if not found in flower or fruit. Fries' pondweed

(*Potamogeton friesii*; Figure 27) was positively identified in the lake, but additional narrow-leaf species may have also been present. For analysis, all narrow-leaf pondweeds including sago pondweed (*Stuckenia pectinata*) were grouped together. In Pelican Lake, narrow-leaf pondweeds were found in 5% of the sites and were most frequently found in depths of 0 to 5 feet (Table 3, Figure 20).

Non-native submerged plant

Curly-leaf pondweed (*Potamogeton crispus*; Figure 28) 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 more than 750 Minnesota lakes. It is not known when it first entered Pelican Lake because previous vegetation surveys have been conducted in July and August, after this plant has naturally died back.

Figure 28. Curly-leaf pondweed

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).

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.

Curly-leaf pondweed was not found in any of the survey sites during the 2010 Pelican Lake survey but a few plants were observed outside of some survey sites, including scattered plants in Stewart’s Bay and Breezy Bay.

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 2010 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 Pelican Lake increases, submerged vegetation may be more common at depths greater than 20 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 Pelican Lake provide critical fish and wildlife habitat and other lake benefits. (Click here for more information on: value of aquatic plants).

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Appendix 1. Historical aquatic and wetland plants of Pelican Lake

Historical and current plants of Pelican Lake

Submerged plants

	Common Name	Scientific Name	1955	1971	1983	1988	1996	1998	2009	2010
Macro algae	Muskgrass	*Chara* sp.		X	X	X				X
	Stonewort	*Nitella* sp.							X	X
Dissected-leaved plants	Water marigold	*Bidens beckii*						X	X	X
	Coontail	*Ceratophyllum demersum*	X	X	X	X		X		X
	Northern watermilfoil	*Myriophyllum sibiricum*	X	X	X	X		X	X	X
	White water buttercup	*Ranunculus aquatilis*		X	X	X			X	X
	Flat-leaved bladderwort	*Utricularia intermedia*					X	X		X
	Minor bladderwort	*Utricularia minor*					X	X		
	Greater bladderwort	*Utricularia vulgaris*						X		X
Small-leaved plants	Canada waterweed	*Elodea canadensis*	X	X	X	X		X		X
	Bushy pondweed	*Najas flexilis*		X	X	X	X	X	X	X
	Southern naiad	*Najas guadalupensis*								X
Narrow-leaved pondweeds	Fries pondweed	*Potamogeton friesii*							X[1]	X
	Blunt-leaved pondweed	*Potamogeton obtusifolius*					X			
	Small pondweed	*Potamogeton pusillus*					X	X		X[1]
	Straight-leaved pondweed	*Potamogeton strictifolius*						X		
	Blunt-tipped pondweed	*Stuckenia filiformis*						X		
	Sago pondweed	*Stuckenia pectinata*			X			X	X	X
Broad-leaved pondweeds	Large-leaf pondweed	*Potamogeton amplifolius*		X	X	X	X	X	X	X
	Curly-leaf pondweed (I)	*Potamogeton crispus*							X	X
	Variable pondweed	*Potamogeton gramineus*							X	X
	Illinois pondweed	*Potamogeton illinoensis*							X	X
	White-stem pondweed	*Potamogeton praelongus*		X	X	X		X	X	X
	Clasping leaf pondweed	*Potamogeton richardsonii*	X	X	X	X		X	X	X
Grass-leaved plants	Robbin's pondweed	*Potamogeton robbinsii*						X	X	X
	Flat-stem pondweed	*Potamogeton zosteriformis*		X	X	X		X	X	X
	Water star-grass	*Heteranthera dubia*					X	X	X	X
	Wild celery	*Vallisneria americana*		X	X	X		X	X	X
Total			4	11	12	11	7	19	17	24
Max depth of vegetation (feet)			15	23	23	23	n/a	n/a	24	25

[1]Narrow-leaved pondweeds were not identified to species.

Floating-leaved plants

Common Name	Scientific Name	1955	1971	1983	1988	1996	1998	2009	2010
Floating-leaf smartweed	*Persicaria amphibia*					X			
Floating-leaf pondweed	*Potamogeton natans*		X	X	X	X		X	X
Small burreed	*Sparganium natans*					X	X		
White waterlily	*Nymphaea odorata*		X	X	X	X	X	X	X

Yellow waterlily	*Nuphar variegata*		X	X	X	X	X	X	X
	Total	0	3	3	3	5	3	3	3

Free-floating plants

Common Name	Scientific Name	1955	1971	1983	1988	1996	1998	2009	2010
Star duckweed	*Lemna trisulca*						X	X	X
Turion-forming duckweed	*Lemna turionifera*						X		
	Total	0	0	0	0	0	2	1	1

Emergent plants

Common Name	Scientific Name	1955	1971	1983	1988	1996	1998	2009	2010
Spikerush	*Eleocharis palustris*[1]		X	X	X	X	X	X	X
Needlegrass	*Eleocharis acicularis*						X		
Broad-leaved arrowhead	*Sagittaria latifolia*					X	X	X	X[2]
Stiff Wapato	*Sagittaria rigida*						X		
Hard-stem bulrush	*Schoenoplectus acutus*	X	X	X	X			X	X[3]
Soft-stem bulrush	*Schoenoplectus tabernaemontani*		X	X	X	X	X	X	
Three-square bulrush	*Schoenoplectus pungens*		X	X	X			X	X
Green-fruited burreed	*Sparganium emersum*					X	X		
Wild rice	*Zizania palustris*		X	X	X				X
Broad-leaved cattail	*Typha latifolia*		X	X	X	X	X	X[4]	X[4]
Narrow-leaved cattail or hybrid	*Typha angustifolia*		X	X	X		X		
	Total	1	7	7	7	5	8	6	6

[1]Spikerush was identified to only the genus level (*Eleocharis* sp.) in most surveys.
[2]Arrowhead was identified only to the genus level (*Sagittaria*) in the 2010 survey.
[3]Hard-stem (*S. acutus*) and soft-stem (*S. tabernaemontani*) were not distinguished in the 2010 survey.
[4]Cattail was identified to only the genus level (*Typha* sp.) in the 2009 and 2010 surveys.

Wetland emergent plants

Common Name	Scientific Name	1955	1971	1983	1988	1996	1998	2009	2010
Swamp milkweed	*Asclepias incarnata*						X	X	
Nodding bur-marigold	*Bidens cernua*						X		
Water arum	*Calla palustris*					X	X		
Bottlebrush sedge	*Carex comosa*					X	X		
Tussock sedge	*Carex (haydenii/stricta)*						X		
Wiregrass, woolly sedge	*Carex lasiocarpa*					X	X		
Bulb-bearing water hemlock	*Cicuta bulbifera*					X	X		
Three-way sedge	*Dulichium arundinaceum*					X	X		
Barnyard grass	*Echinochloa muricata*						X		
Willow-herb	*Epilobium*						X		
Common boneset	*Eupatorium perfoliatum*						X		
Grass-leaved goldenrod	*Euthamia graminifolia*						X		
Small bedstraw	*Galium trifidum*						X		
Touch-me-nots	*Impatiens capensis*						X		
Blue flag iris	*Iris versicolor*						X	X	
Rush	*Juncus* sp.					X	X		
Rice cut-grass	*Leersia oryzoides*						X		
Purple loosestrife (I)	*Lythrum salicaria*							X	X
Water smartweed	*Persicaria amphibia*						X		
Dot-leaved smartweed	*Persicaria punctata*						X		
Reed canary grass (I)	*Phalaris arundinaceae*	X						X	
Giant cane	*Phragmites australis*			X				X	
Bushy knotweed	*Polygonum ramosissimum*			X					
Great water dock	*Rumex britannica*						X		
Willow	*Salix* sp.						X		
Sand-bar willow	*Salix interior*						X		
Skullcap	*Scutellaria latiflora*						X		
Gold moss Stonecrop (I)	*Sedum acre*								X
Total		1	0	2	0	6	23	5	2

I = introduced

Sources:

1955 (August, 15): DNR Fisheries Survey

1971 (August, 16-21): DNR Fisheries Survey

1983 (August, 9-11): DNR Fisheries Survey

1988 (August, 8-12): DNR Fisheries Survey

1996 (August, 8): Karen Myhre, MnDNR Ecological and Waters Resources Division, Minnesota County Biological Survey Program (survey was focused on selected sites in Stewart's bay)

1998 (September, 03): Karen Myhre, MnDNR Ecological and Waters Resources Division, Minnesota County Biological Survey Program (survey was focused on selected sites in Moose bay)

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2010 (June, July): Simon, Perleberg, VanDyne, Whichello, Point Intercept survey, MnDNR Ecological and Water Resources Division