Aquatic Vegetation Surveys of

Kabekona Lake (DOW #29-0075-00)

Hubbard County, Minnesota

2005-2006

Kabekona Lake. 2005

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Summary

Kabekona Lake is a 2,252 acre, hardwater, mesotrophic lake in northwest Minnesota. An aquatic vegetation survey was conducted in July and August 2005 and included a lakewide assessment of vegetation and water depths at 328 sample stations. An additional search for rare plants was conducted in July 2006 by the Minnesota County Biological Survey Program.

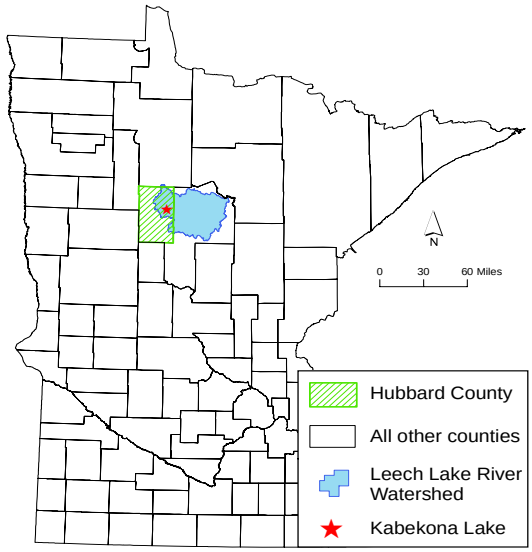
A total of 28 native aquatic plant species were recorded including seven emergent, three floating-leaved, and 18 submerged plants. Aquatic plants occurred around the entire perimeter of the lake and plants were found to a depth of 20 feet. Vegetation was present in 59 percent of the sample sites and plants were most frequent in the shore to five feet depth zone, where 73 percent of the sites contained plants.

Emergent hard-stem bulrush (*Schoenoplectus acutus*) plants and scattered bed of waterlilies (*Nuphar variegata* and *Nymphaea odorata*) were found along the north shore. Muskgrass (*Chara* sp.) was the dominant submerged plant and was found in 50 percent of the sites. Other submerged species included coontail (*Ceratophyllum demersum*), flat-stem pondweed (*Potamogeton zosteriformis*), northern watermilfoil (*Myriophyllum sibiricum*), Canada waterweed (*Elodea canadensis*) and bushy pondweed (*Najas flexilis*). No rare or invasive aquatic plant species were documented in this lake.

Introduction

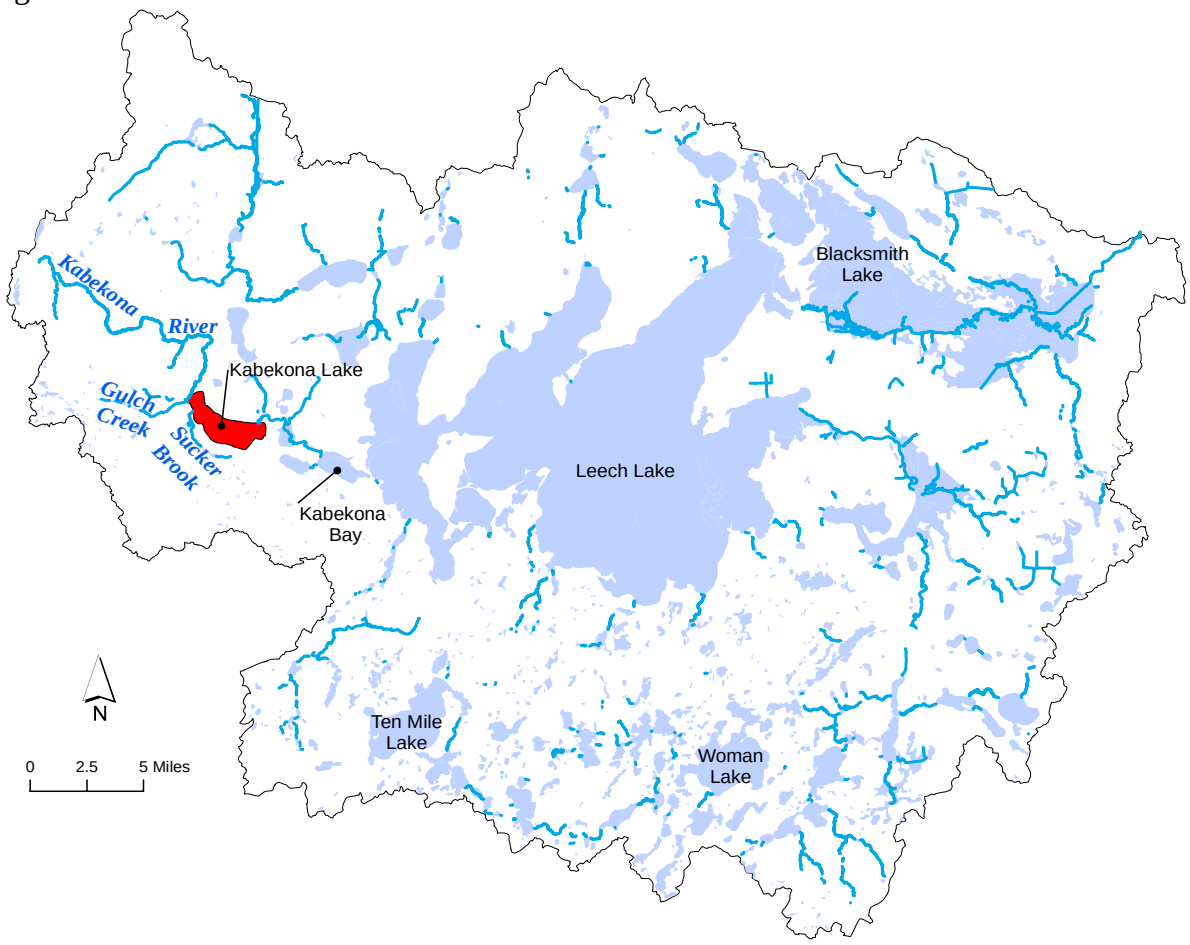
Kabekona Lake is located in Hubbard County, northwest Minnesota, in the Leech Lake River Watershed (Figure 1). There are about 227 lakes in the Leech Lake River Watershed and about 134 lakes in Hubbard County that are at least 50 acres in size. Kabekona Lake is the ninth largest lake in the watershed and the second largest lake in the county, with a surface area of 2,252 acres and about ten miles of shoreline.

Figure 1. Location of Kabekona Lake in Minnesota.



Kabekona Lake lies near the top of the Leech Lake watershed, on the west side of Leech Lake. Kabekona Lake receives inflow on the west side from Kabekona River, Gulch Creek and Sucker Brook (Figure 2). Kabekona Lake outlets to the east and flow continues through several smaller

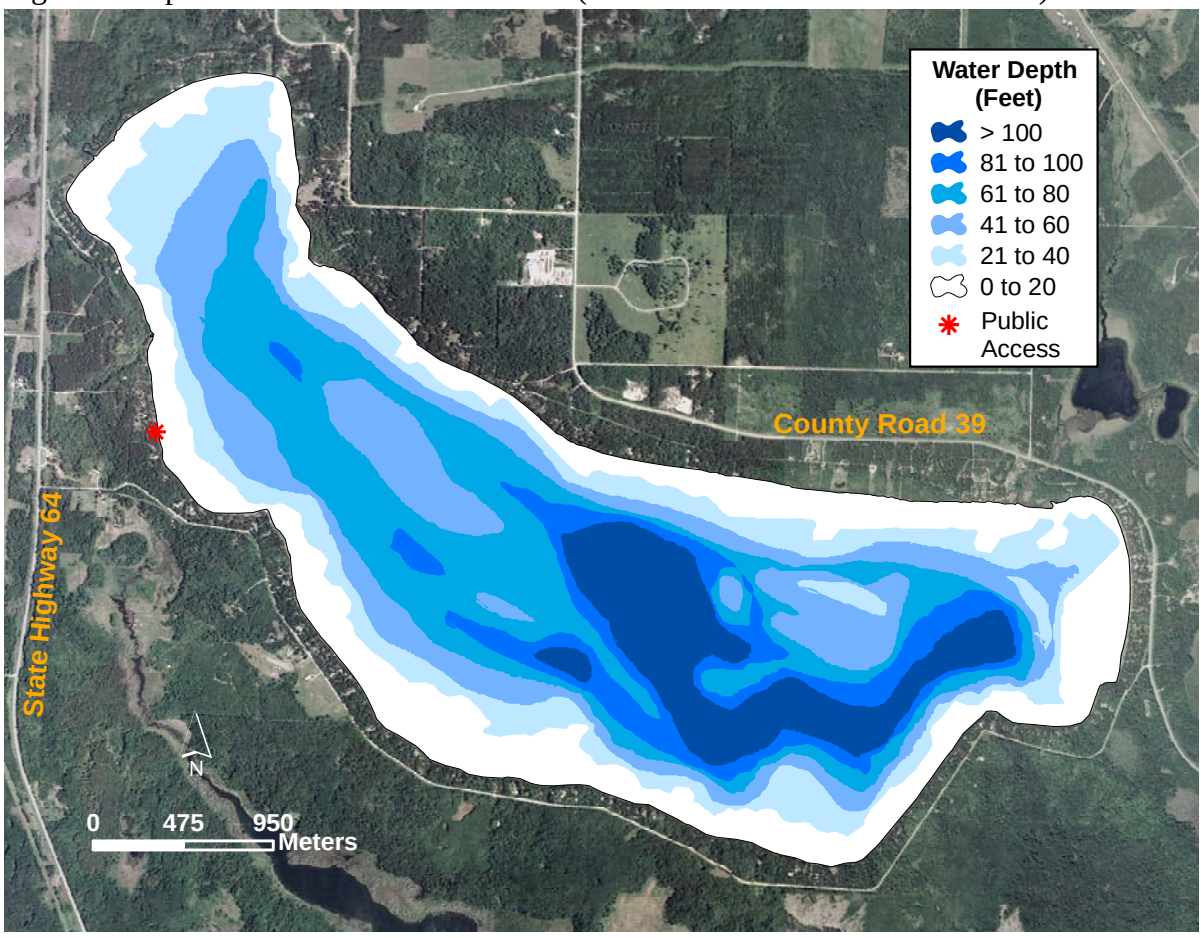
Figure 2. Kabekona Lake in Leech Lake River Watershed.



lakes and then into Kabekona Bay of Leech Lake.

The uplands surrounding Kabekona Lake are primarily privately owned. The shoreline is mostly forested but developed with residential homes. The lake is bordered by State Highway 64 on the west and County Road 39 on the north. A public access is located on the west shore (Figure 3).

Figure 3. Depth contours of Kabekona Lake (20 foot contour based on 2005 data).



Kabekona Lake was formed from ice block deposits of the Des Moines Lobe glacier (MPCA, 1996) . It is an elongated basin with about 4.5 miles from the inlet to the outlet. The maximum depth is 133 feet and about 24 percent of the lake basin is less than 15 feet in depth. This shallow area, known as the littoral zone, rings the lake shoreline (Figure 3). Rooted submerged plants are often common in the littoral zone if adequate sunlight reaches the lake bottom.

The Secchi disc (Figure 4) 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. Kabekona Lake is considered one of the clearer lakes in the Park Rapids Area. Between 1986 and 2008, mean summer water clarity, as measured by Secchi disc readings, ranged from 11 feet to 16 feet (MPCA, 2009). 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 are expected to grow to about 17 to 24 feet in

Kabekona Lake. Other factors that may influence the depth of plant growth include substrate type, wind fetch, and plant species composition.

Figure 4. Measuring Secchi Disc transparency

Kabekona Lake is described as hardwater, mesotrophic lake. Previous vegetation surveys of the lake found plants growing to depths of 15 feet with abundant plant growth described throughout the shallows (MnDNR Fisheries Lake Files, 1946, 1963, 1988). More than 25 different aquatic plant taxa have previously been recorded in Kabekona Lake including muskgrass (*Chara* sp.), flat-stem pondweed (*Potamogeton zosteriformis*), Canada waterweed (*Elodea canadensis*), coontail (*Ceratophyllum demersum*), marestail (*Hippuris vulgaris*), and hard-stem bulrush (*Scirpus acutus*).

Objectives

The purpose of this vegetation survey was to provide a quantitative description of the 2005 plant population of Kabekona Lake. 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

Lakewide survey, 2005

Kabekona Lake was surveyed on July 26-28 and August 4, 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 handheld Global Positioning System (GPS) receiver. Survey points were placed across the entire lake and spaced 80 meters (262 feet) apart.

In the field, surveyors began sampling all sites that occurred in water depths less than 26 feet but determined that vegetation was sparse in depths over 15 feet. Therefore, surveyors sampled only a portion (22) of sites in the depth zone of 21 to 25 feet. Within the shore to 20 feet zone, all accessible sites (328) were surveyed (Figure 5, Table 1).

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 using a measured stick in water depths less than eight feet and an electronic depth finder in depths greater than eight feet.

Figure 5. 2005 vegetation survey sites

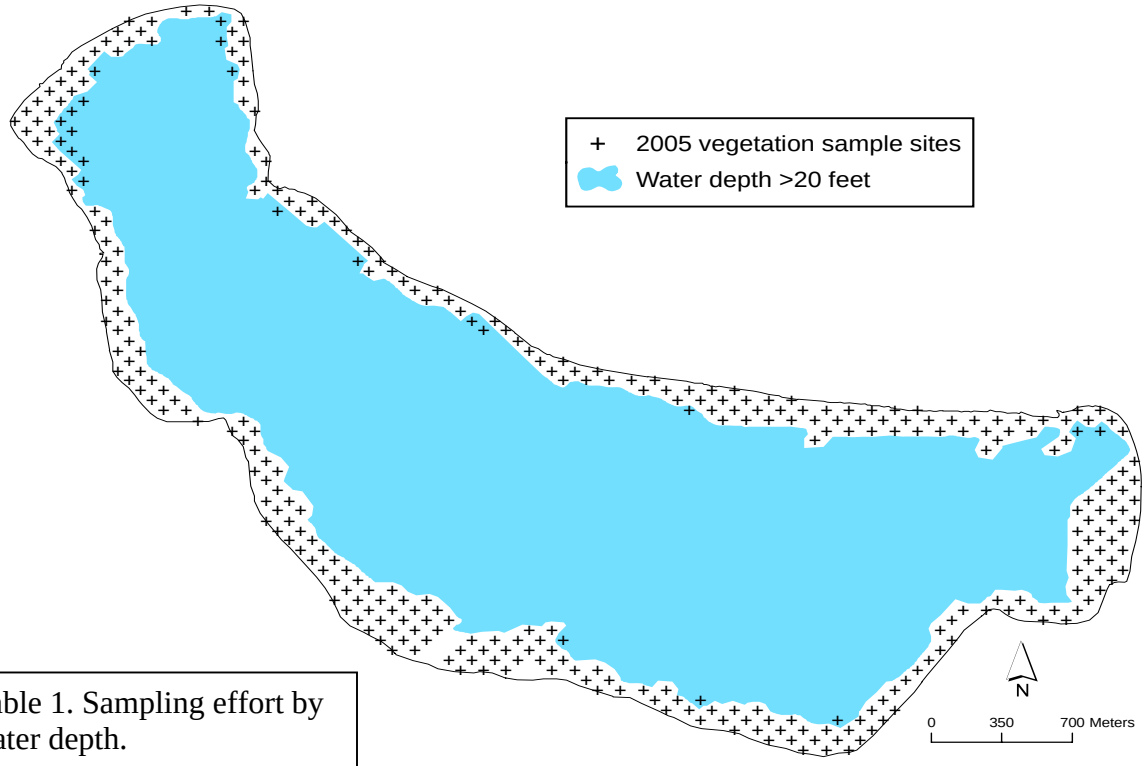


Table 1. Sampling effort by water depth.

Water depth interval (feet)	Sample sites
0 to 5	212
6 to 10	64
11 to 15	26
16 to 20	26
0 to 20	328
21 to 25	22
Total sample sites	350

A double-headed, weighted garden rake, attached to a rope was used to survey vegetation not visible from the surface (Figure 6). Surveyors recorded all plant taxa found within a one square meter sample site at the pre-designated side of the boat. Voucher specimens were made to document locations of some species and are stored at the MnDNR in Brainerd or were submitted to The Herbarium of the University of Minnesota Bell Museum of Natural History, St. Paul, MN.

Figure 6. Sampling rake.

Data were entered into a Microsoft Access database and frequency of occurrence was calculated for each taxon as the number of sites in which taxa 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 (Table 1). Twenty-two sites occurred in water depths greater than 20 feet and were not included in the analysis.

Example:
In Kabekona Lake there were 328 samples sites in the 0-20 feet depth zone.

Muskgrass (*Chara* sp.) occurred in 164 sites.

Frequency of muskgrass in 0 to 20 feet zone = 164 / 328 (*100) = 50 %

Rare plant search (2006)

A targeted search for rare aquatic vascular plants in Kabekona Lake was conducted by the Minnesota County Biological Survey Program on July 12, 2006 (Myhre 2006). This search focused on sites that were most likely to contain rare plant species. Botanists used professional experience to select rare species search sites and included factors such as shoreline development, substrate type, water depth, and native plant community type in their site selection. To gain access to shallow vegetated areas, searches were conducted by slowly kayaking, canoeing and/or wading through the site. A brief habitat description and a list of all plant taxa found in the search area were recorded. Plant nomenclature essentially follows The Flora of North America (1993+). When necessary, plant specimens were sent to the authority in the field for identification verification and annotation. Voucher specimens were made to document locations of some species and were submitted to The Herbarium of the University of Minnesota Bell Museum of Natural History, St. Paul, MN.

Results

Distribution of aquatic plants

Aquatic plants occurred around the entire perimeter of Kabekona Lake, with the exception of the south east shoreline where only a few sites contained vegetation (Figure 7). The vegetation band extended 100 to 200 meters into the lake along most shores.

Plant occurrence by water depth

Plants were found to a depth of 20 feet and within the shore to 20 feet depth, 59 percent of the sites were vegetated. Vegetation was most common in the shore to five feet zone where 73 percent of the sites contained plants (Figure 8). In the six to 20 feet zone, only 33 percent of the sites were vegetated.

Number of plant species recorded and distribution by water depth

A total of 28 native aquatic plant taxa were recorded in Kabekona Lake including seven emergent, three floating-leaved, and 18 submerged taxa (Table 2). No rare or invasive aquatic plant species were found. Plant identification and nomenclature follows Flora of North America (1993+).

The zone from shore to a depth of five feet contained the greatest number of plant taxa and all life forms (emergent, floating-leaf, and submerged) occurred at this depth interval (Figure 9).

Figure 7. Distribution of aquatic plants in Kabekona Lake, 2005.

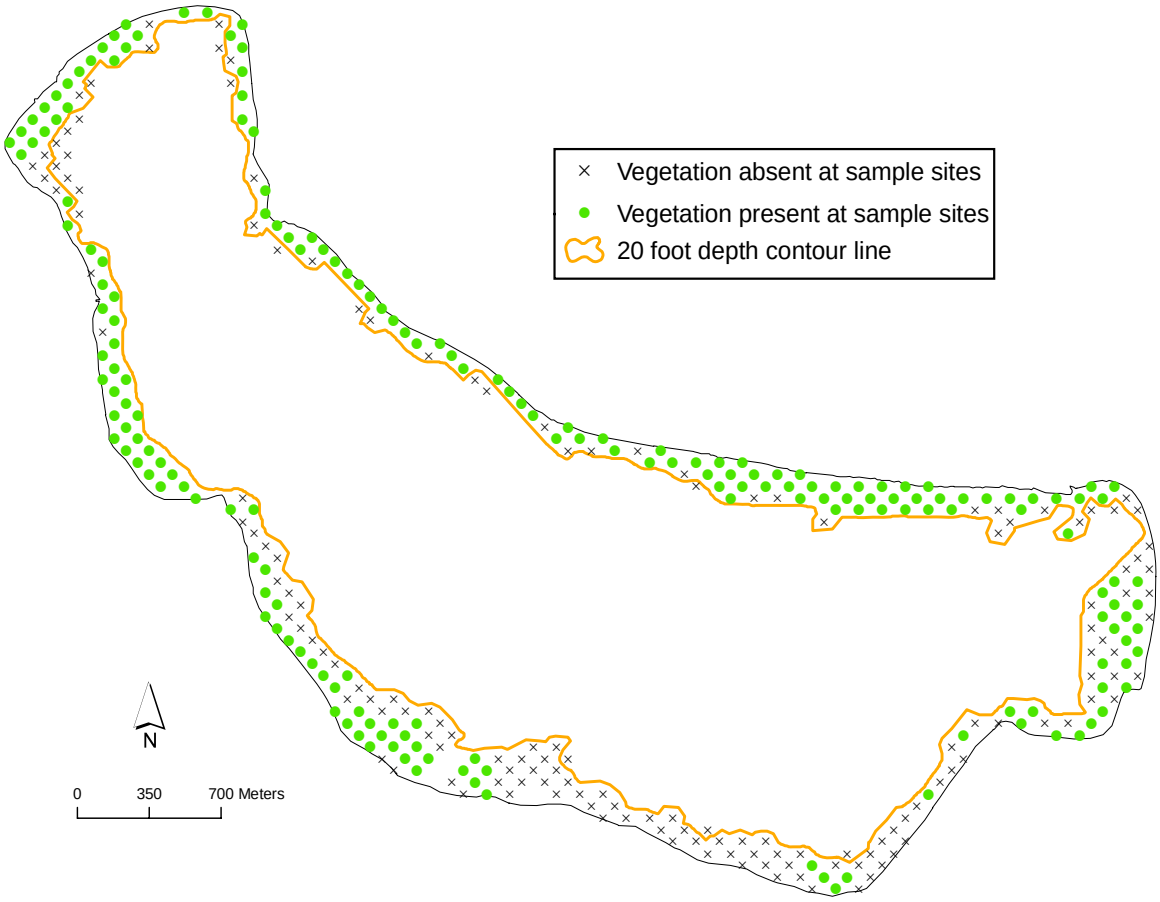


Figure 8. Percent frequency of vegetation by water depth interval.

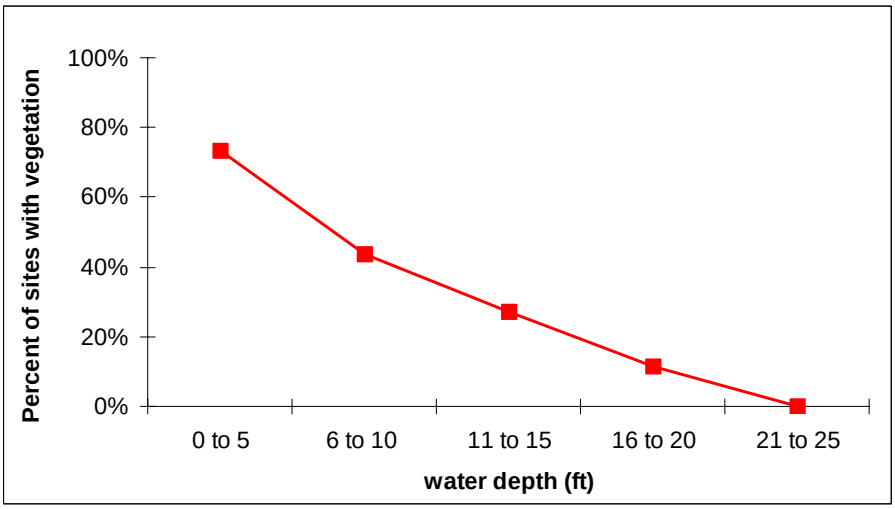


Table 2. Frequency of aquatic plants in Kabekona Lake Point-intercept survey, July and August 2005.

(Frequency is the percent of sample sites in which a plant taxon occurred within the shore to 20 ft water depth.)

328 sample sites

Life Form		Common Name	Scientific Name	Frequency
SUBMERGED These plants grow primarily under the water surface. Upper leaves may float near the surface and flowers may extend above the surface. Some species may also form floating leaves. Plants may or may not be anchored to the lake bottom.	Large Algae and moss	Muskgrass	*Chara* sp.	50
		Watermoss	Not identified to genus	<1
	Dissected-leaf plants	Coontail	*Ceratophyllum demersum*	7
		Northern water milfoil	*Myriophyllum sibiricum*	4
		Bladderwort	*Utricularia vulgaris*	3
		White water buttercup	*Ranunculus aquatilis*	<1
	Grass-leaf plants	Flat-stem pondweed	*Potamogeton zosteriformis*	5
		Wild celery	*Vallisneria americana*	2
	Bushy-leaf plants	Bushy pondweed	*Najas flexilis*	4
		Canada waterweed	*Elodea canadensis*	4
		Marestail	*Hippuris vulgaris*	2
	Broad-leaf pondweeds ("cabbage")	White-stem pondweed	*Potamogeton praelongus*	2
		Clasping-leaf pondweed	*Potamogeton richardsonii*	1
		Variable pondweed	*Potamogeton gramineus*	1
		Large-leaf pondweed	*Potamogeton amplifolius*	Present[2006]
		Illinois pondweed	*Potamogeton illinoensis*	Present[2006]
	Narrow-leaf pondweeds	Sago pondweed	*Stuckenia pectinata*	2
		Fries' pondweed	*Potamogeton friesii*	1
		Narrow-leaf pondweed	*Potamogeton* sp.*	<1
FLOATING These plants are rooted in the lake bottom with leaves that float on the water surface.		Yellow waterlily	*Nuphar variegata*	1
		Floating-leaf pondweed	*Potamogeton natans*	1
		White waterlily	*Nymphaea odorata*	Present[2006]
EMERGENT These plants extend well above the water surface and are usually found in shallow water, near shore.		Hardstem bulrush	*Schoenoplectus acutus*	7
		Needlerush	*Eleocharis acicularis*	<1
		Spikerush	*Eleocharis* sp.	Present[2006]
		Brown-fruited rush	*Juncus pelocarpus*	Present[2006]
		Arrowhead	*Sagittaria* sp.	Present[2006]
		Burreed	*Sparganium* sp.	Present[2006]
		Wild rice	*Zizania palustris*	Present[2006]

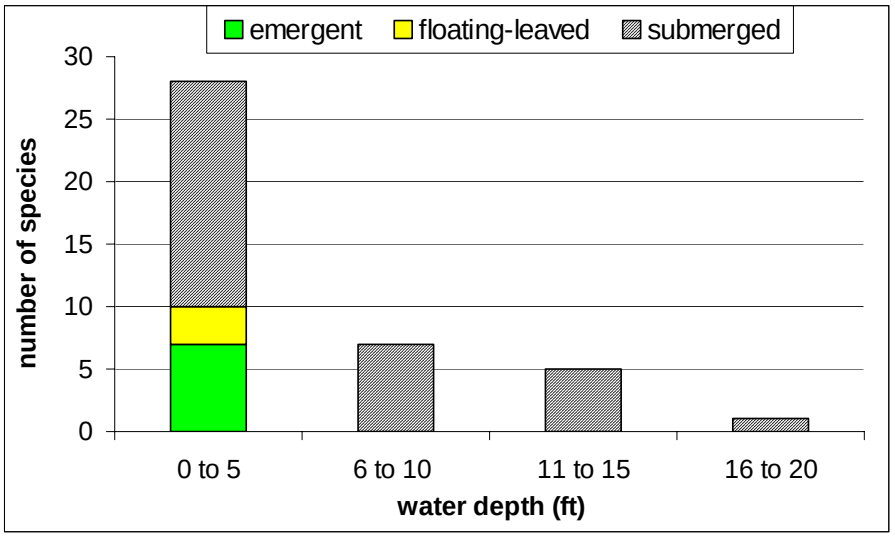
*Some specimens of "narrow-leaved pondweeds" were positively identified as *Potamogeton freisii* (Fries pondweed). However, it is not known whether other "look-a-like" narrow-leaf pondweed species occurred in the lake. Therefore, a separate group of "unidentified narrow-leaf pondweeds" (*Potamogeton* sp.) are reported here but not counted in species tally.

Present[2006]= located during Minnesota County Biological Survey, 12 June 2006

Nomenclature follows Flora of North America (1993+).

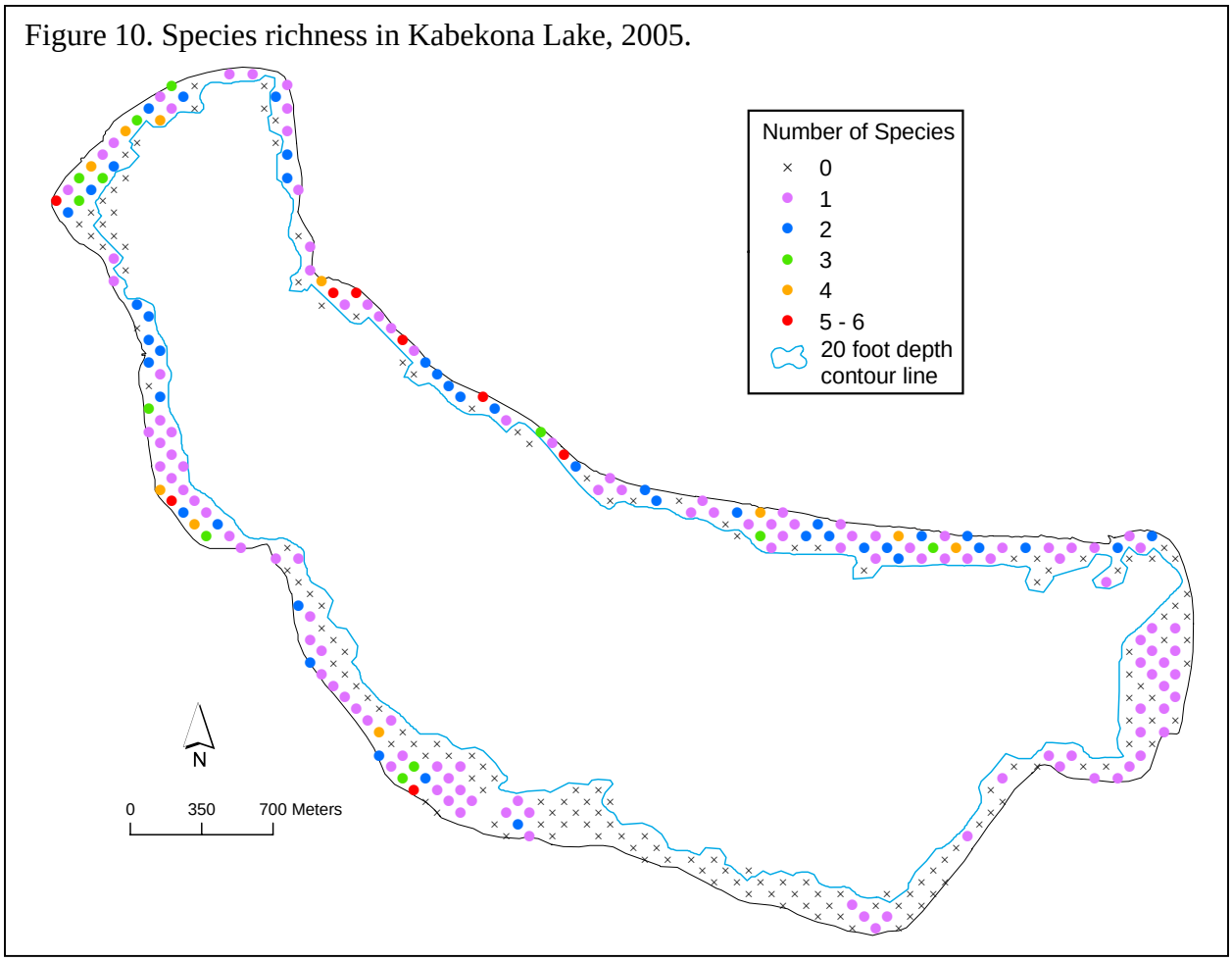
Emergent and floating-leaf plants were generally restricted to water depths of five feet and less. Only five submerged plant taxa occurred in depths greater than 10 feet.

Figure 9. Number of taxa found at each water depth interval.



The number of plant taxa found at each one square meter sample site ranged from zero to six, with a mean of one (Figure 10). Sites with the greatest number of taxa were found in depths less than five feet.

Figure 10. Species richness in Kabekona Lake, 2005.

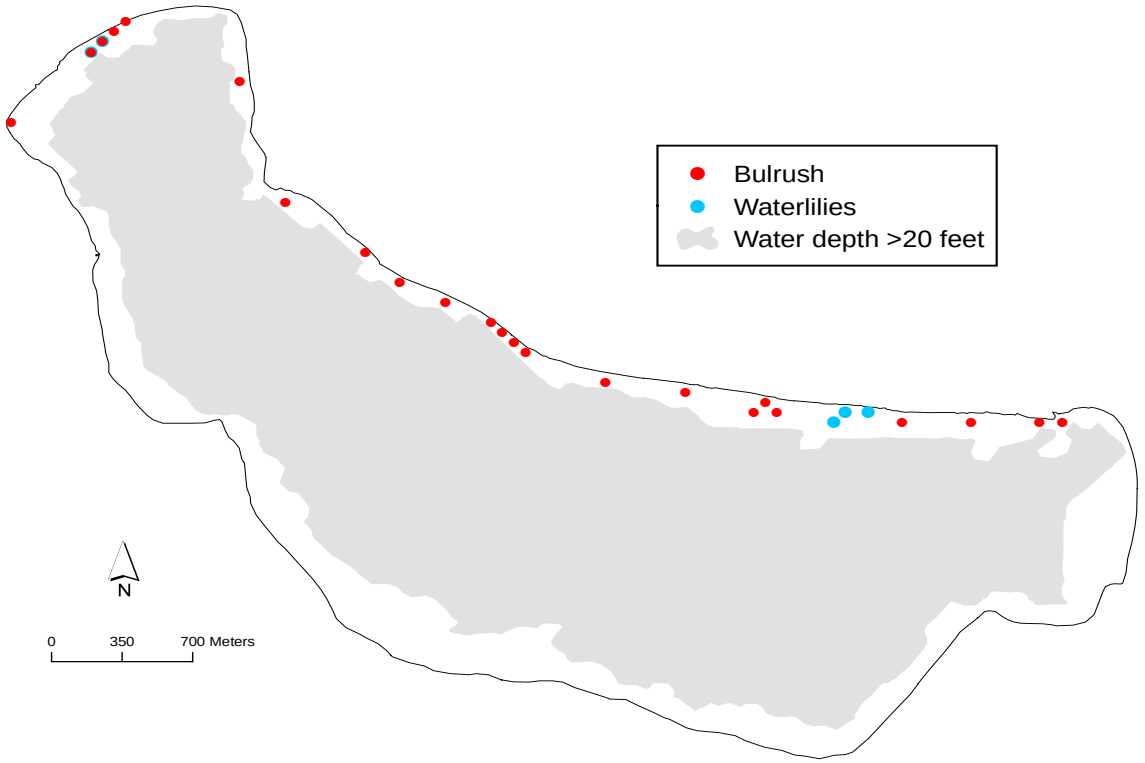


Emergent and floating-leaf plants

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.

Within the shore to five feet depth zone of Kabekona Lake, 13 percent of the sample sites contained at least one emergent or floating-leaf plant. The most common types were emergent bulrush and floating-leaf waterlilies. These plants were most frequent along the north shore (Figure 11).

Figure 11. Common emergent and floating-leaf plants in Kabekona Lake, 2005.



Hard-stem bulrush (*Schoenoplectus acutus*) (Figure 12) is an emergent, perennial plant that occurs in lakes and wetlands throughout Minnesota (Ownbey and Morley 1991). Bulrush stems are round in cross section and lack showy leaves. Clusters of small flowers form near the tips of long, narrow stalks. This emergent may occur from shore to water depths of about six feet and its stems may extend several feet above the water surface. In low water conditions it can grow outside of water. Bulrush stands are particularly susceptible to destruction by excess herbivory and direct removal by humans. Bulrush was found in seven percent of all sites (Table 2) and usually

Figure 12. Bulrush

occurred in sand. Within the 0 to 5 feet depth zone, bulrush occurred in 11 percent of the sites.

Figure 13. Yellow waterlily

Yellow waterlily (*Nuphar variegata*) (Figure 13) was the most frequent floating-leaved plant found. Other floating-leaved plants were white waterlily (*Nymphaea odorata*) (Figure 14) and floating-leaf pondweed (*Potamogeton natans*). Within the shore to 5 feet depth zone, two percent of the sites contained at least one floating-leaf plant.

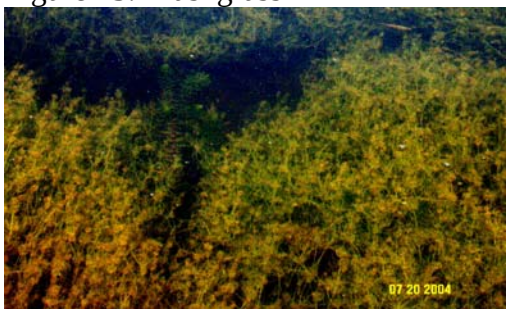
Submerged plants

Figure 14. White waterlily

Submerged plants have leaves that grow below the water surface but some species also have the ability to form floating and/or emergent leaves, particularly in shallow, sheltered sites. Submerged plants may be firmly attached to the lake bottom by roots or rhizomes, or they may drift freely with the water current. This group includes flowering plants that may produce flowers above or below the water surface, as well as non-flowering plants such as large algae and mosses.

Submerged plants occurred in 57 percent of the samples sites within the 0 to 20 feet depth zone. The most frequently sampled submerged taxa were muskgrass (*Chara* sp.), coontail (*Ceratophyllum demersum*), and flat-stem pondweed (*Potamogeton zosteriformis*).

Figure 15. Muskgrass



Muskgrass (*Chara* sp.) (Figure 15) is a macroscopic, or large, algae that is common in many hard water lakes in Minnesota. 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 a variety of substrates and is often the first taxa 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. Muskgrass was the most common taxa in Kabekona Lake and was found in 50% of the sample sites (Table 2, Figure 16). It was the most common plant in depths of 0 to 15 feet water depth zones (Figure 17).

Figure 16. Distribution of muskgrass (*Chara* sp.), coontail (*Ceratophyllum demersum*), and flat-stem pondweed (*Potamogeton zosteriformis*).

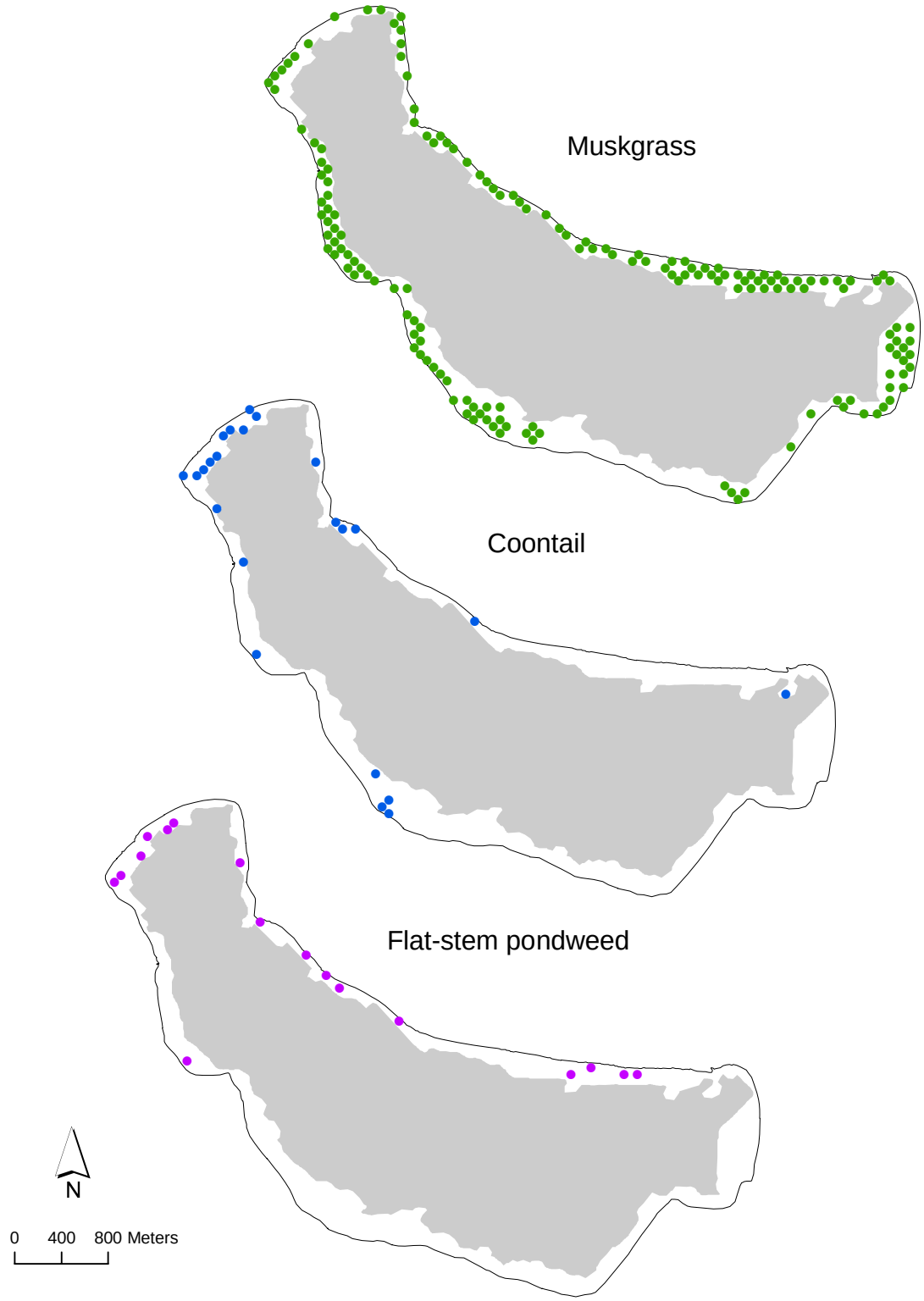
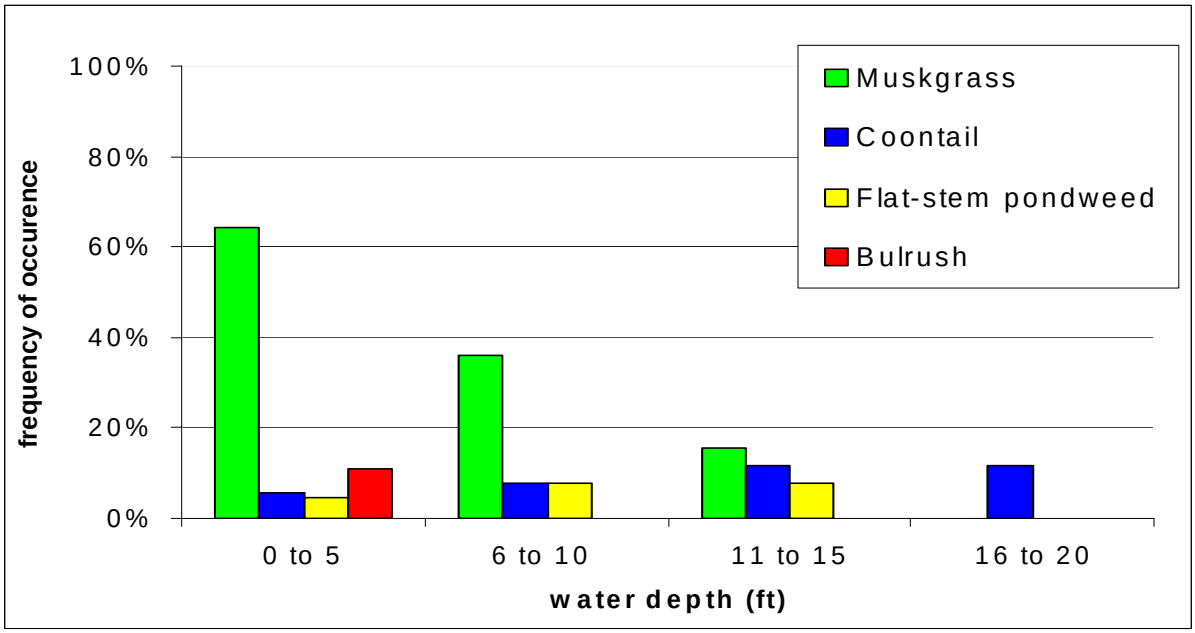


Figure 17. Frequency of common plants by water depth interval. Kabekona Lake, July and August 2005.



Coontail (*Ceratophyllum demersum*) (Figure 18) 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 occurred in seven percent of the survey sites (Table 2, Figure 16). It occurred at all depth zones sampled and was common in 11 to 20 feet water depth (Figure 17). Coontail was the only plant found over 15 feet.

Figure 18. Coontail (*Ceratophyllum demersum*)

Flat-stem pondweed (*Potamogeton zosteriformis*) (Figure 19) is a perennial plant that is anchored to the lake bottom by underground rhizomes and over-winters by winter buds. It 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 was distributed around the north and west

Figure 19. Flat- stem pondweed

half of Kabekona Lake (Figure 16) and it occurred in five percent of the Kabekona lake survey sites (Table 2). In Kabekona Lake, it was common to depths from six to 15 feet (Figure 17).

All other submerged species occurred in less than five percent of the sample sites and were most common in depths less than 11 feet.

Figure 20. Marestail

Several submerged species found are plants that do not grow in turbid water and their presence in Kabekona Lake is indicative of its relatively clear water. One example is marestail (*Hippuris vulgaris*). Marestail was found in two percent of the survey sites. Marestail is a submerged plant that can emerge above the water in shallow depths (Figure 20). This plant is native in Minnesota but not commonly found. It is often associated with cold-water streams or springs and may be present in Kabekona Lake because the river flowage through the lake provides the habitat conditions required for their growth. This species is also present downstream from Kabekona Lake in areas of Leech Lake. Its presence in Kabekona Lake indicates relatively good water clarity.

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 type and wave activity. The water clarity of Kabekona Lake is sufficiently high to allow aquatic plant growth to a depth of 20 feet. The predominance of hard substrates in the near-shore area may limit the types of aquatic plants within that zone. Plants like muskgrass and bulrush are more typically found along these types of sandy shores. Lake Thirteen (Cass County) and areas of Leech Lake have similar plant communities where muskgrass is the dominant plant. These submerged plant beds provides critical fish and wildlife habitat and other lake benefits. (Click here for more information on: value of aquatic plants).

A review of past vegetation surveys of Kabekona Lake indicates that the general aquatic plant community has not likely changed greatly in this lake. In all survey years, a relatively high number of native plants have been recorded and muskgrass (*Chara* sp.) a non-rooted plant and rooted plants remain well distributed throughout the lake Data collected in 2005 can be used to monitor finer-scale changes that may occur, such as an increase in a particular taxa or a change in the depths at which individual taxa 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 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
  Non-native plant species, such as curly-leaf pondweed (*Potamogeton crispus*) or Eurasian watermilfoil (*Myriophyllum sibiricum*) may form dense surface mats that may shade out native plants. The impact of 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 abundance
  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 in a variety of ways. Motorboat activity in vegetated areas can be particularly harmful for species such as bulrush and 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. Herbicide and mechanical control of aquatic plants can directly impact the aquatic plant community. For information on the laws pertaining to aquatic plant management, click here: MnDNR APM Program or contact your local DNR office. Limiting these types of activities can help protect healthy aquatic ecosystems.

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