2006 Summary and Comparisons of Clark Lake - Door County Aquatic Macrophyte Community Surveys

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Summary

Clark Lake is an oligotrophic/mesotrophic lake with good water quality and good to fair water clarity. The nutrient concentrations remain low over the growing season and water clarity fluctuates from day to day with changes in wind speed and direction and boating activity.

The aquatic macrophyte community of Clark Lake is characterized by good species diversity, good quality, and abundant frequency of plants and low density of growth. In 2006 a total of 60 species of aquatic plants were identified in Clark Lake and upstream Logan Creek to Highway 57 (Appendix 1). Not all species were present in line/transect sample sites but are included and noted as existing in Clark Lake. The aquatic macrophytes that were not collected along transects where collected while moving from site to site and while surveying Logan Creek. In the 2006 transect survey six species of previously identified aquatic macrophytes from 1986, 1989, and 1992 were absent, while ten species were newly identified. A total of 28 species were identified in the transect survey for all survey years (Table 5). The dominant species has shifted from *Ceratophyllum demersum* in 1986 to *Ceratophyllum demersum*, *Chara* and *Potamogeton richardsonii* in the 1989 to *Myriophyllum spicatum*, *Chara* and *Potamogeton pectinatus* in 1992 and *Najas flexis, Chara*, *Potamogeton illinoinesis* and *Myriophyllum heterrophyllum* in 2006.

Two non-native species have been identified in Clark Lake: *Potamogetan crispus* and *Myirophyllum spicatum*. These species have been observed since 1989 and have yet to drastically influence the overall aquatic macrophyte community in Clark Lake. *Myriophyllum spicatum* has become less dominant since 1992 but is still a potentially problematic species. *Potamogetan crispus* has yet to establish itself as a dominant species. Continued annual monitoring should be conducted to track these non-native species.

An endangered species of pondweed was identified in the 2006 survey, *Potamogeton pulcher*. This is significant because it is an endangered species of pondweed and has never been identified on Clark Lake before. Further monitoring will be needed to track the progress of this endangered species of pondweed.

Plant growth is most abundant in the north bay and in 2006 was in greater abundance and density at deeper depths throughout the lake than previous surveys. The predicted depth of around 10 feet fell short of actual depth of growth in which plants were sampled at depth zone 4 (10-20 ft). Aquatic plants were distributed throughout the lake up to a maximum rooting depth of 16 feet. Depth zones 3 (5-10 ft) and 4 (10 – 20 ft) were zones of the most abundant plant growth. Shallower near-shore regions had less growth than

previous surveys, in particular hardstem bulrush (*Schoenplectus acutus,* formally *Scirpus acutus)* which is a species of concern. This change should be monitored and if further decline occurs a rehabilitation plan should be considered. The Clark Lake aquatic macrophyte community has changed significantly and the total occurrences, diversity, and density have all increased while a shift in dominance has occurred from 1986 to 2006 for multiple aquatic macrophytes.

Recommendations

1) Minimize the removal of aquatic macrophytes to reduce the opportunities for establishment of invasive species.

2) Routinely identify and monitor for exotic invasive species and participate with WDNR's Clean Boats/Clean Waters Program.

3) Replace riprap and concrete shoreline reinforcements with native emergent vegetation that are more beneficial to water quality, wildlife, and shoreline stabilization. Emergent vegetation acts as a buffer from near shore wave and will dampen the effects of wave and wind induced erosion and sediment disturbance which will in turn promote shallow growth of other aquatic macrophytes.

4) Establish a plan to re-establish *Schoenplectus acutus* and other native shallow species in regions of the lake that are experiencing a decline in population. This may be done by means of water level manipulation, manual planting, establishing no-wake or no-motor zones in regions of concern, or creating buffer barriers where wind and waves are problematic.

5) Establish a no-wake or no-motor zone in the north bay of Clark Lake and into Logan Creek to help preserve the diversity and abundance of aquatic macrophytes in this ecologically significant part of the lake.

Introduction

Clark Lake is an 868 acre lake located in the towns of Jacksonport and Sevastopol, Door County. It is an impounded drainage lake that receives water from direct precipitation, groundwater, and stream flow from Logan Creek that drains Lost Lake. Clark Lake drains to Lake Michigan after passing through a small dam. The south shore of Clark Lake includes Whitefish Dunes State Park, one of the most popular parks in Wisconsin. Clark Lake and the surrounding Door County is a prime tourist destination in the upper Midwest. As a result, Clark Lake is a highly used body of water.

Clark Lake has a maximum depth of 25 feet, with a mean depth of 7 feet. There are approximately 7 miles of shoreline. Two public boat ramps are present on the lake. Common fish species include northern pike, walleye, smallmouth bass, and panfish, with largemouth bass and trout also present (Hogler, 2005). Land use in the Clark Lake watershed and the entire Lake Shore Basin is dominated by agriculture, particularly the dairy industry; however, much of this area is currently being converted to residential developments, a trend which has been continuing over the past decade.

The aquatic plant surveys for Clark Lake were conducted on August 8-9, 1986; August 4-5, 1989; July 20-22, 1992; and August 20-21, 2006 (Rasman, 1986, 1989 and 1992). The 1986, 1989, and 1992 surveys were completed by WDNR water resource professionals from the Green Bay office. The 2006 survey was conducted by University of Wisconsin-Stevens Point (UWSP) water resource professionals and students. Together these surveys reveal changes to the Clark Lake plant community as well provide information valuable for decisions involving the fishery, sensitive wildlife areas, water quality, and aquatic plant management.

Methods

Field Methods

Using established WDNR protocol for long-term trend lake monitoring (WDNR, 1987), the objective was to describe in-lake aquatic macrophyte populations by species present, species distribution, species abundance, species frequency and occurrence, and maximum rooting depth of aquatic plants. This aquatic macrophyte sampling methodology was selected to enable comparison results with historic surveys.

Previous surveys established reference transects perpendicular to the shoreline; these transect and approximate sample locations were used in 2006 (Figure 1). Eleven transects were surveyed in 2006 shown as “A”

through “K”. Transect “K” was established in the northwest corner of Clark Lake in 2006. In 1992 ten transects were surveyed and nine transects were surveyed in 1986 and 1989. The line/transect survey was performed using reference points in Figure 1 and an established bearing across depth contours (Rasman, 1992). Samples were collected at 5 depth ranges (Table 1). Transect ID, GPS location, depth, depth class code, plant species, species density rating and sediment type were recorded at each sampling site.

Table 1. Sample collection depth ranges.

Depth Range	Depth of Water (m)	Depth of Water (ft)
1	0 – 0.5	0 – 1.6
2	>0.5 – 1.5	>1.6 – 5
3	>1.5 – 3	>5 – 10
4	>3 – 6	>10 – 20
5	> 6 if plants are present	> 20

A macrophyte sampling rake was used to sample the vegetation. Each site was split into four quadrants surrounding the boat and the rake was cast once into each quadrant. Upon retrieval, species were identified and given a density rating in accordance with the criteria in Table 2.

Table 2. Density rating criteria for aquatic macrophytes samples.

Rake Recovery of Species	Density Rating
Rake teeth full, taken all 4 casts	5
Teeth partly full, taken all 4 casts	4
Taken 3 casts	3
Taken 2 casts	2
Taken 1 cast	1

Logan Creek on the north end of Clark Lake up to State Highway 57 was also included in the survey. Aquatic macrophyte species were identified and included in voucher samples to be sent back to UWSP. This region was included because it is directly affected by the water level fluctuation of Clark Lake and included plants were not found elsewhere on the lake.

In addition to the transect survey, aquatic macrophytes that were not collected along transects but in location while moving from site to site as well as in Logan Creek were identified and included with the voucher specimens to determine additional species present. All vouchers species were confirmed by Dr. Robert Freckmann of UWSP. All species vouchers were stored cold in

transport to UWSP where they were pressed, dried and are now housed in the UWSP, Robert Freckmann Herbarium.

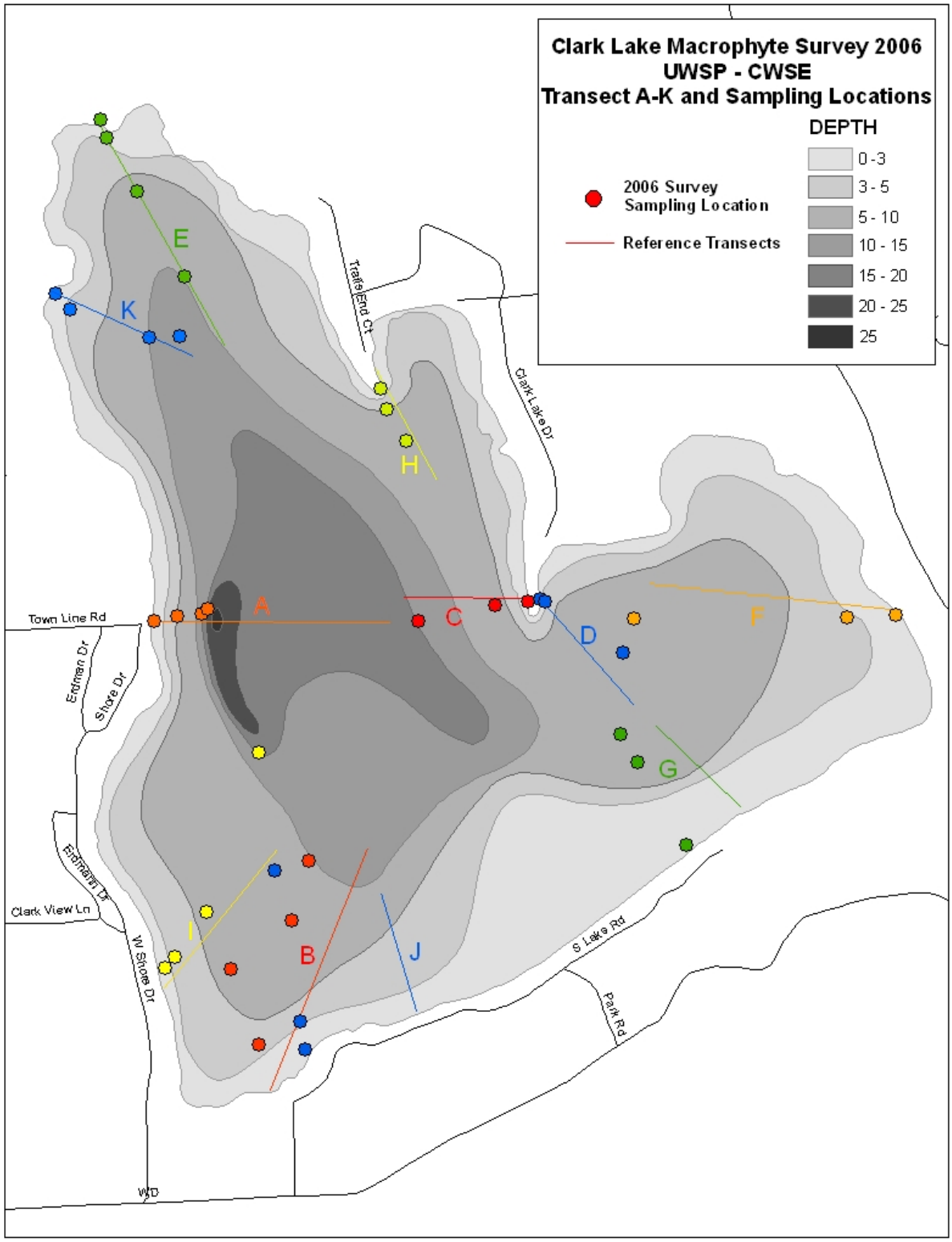


Figure 1. Aquatic macrophyte reference transects and sampling sites (2006). Sampling sites are GPS locations.

Data Analysis

The data for each survey was analyzed and compared. Following are the calculations used in this paper.

- The percent frequency of occurrence of each species was calculated (number of sampling sites at which it occurred / total number of sites) (Appendices 4a-d).
- Relative frequency was calculated (number of occurrences of a species / all species occurrences) (Appendices 4a-d).
- The mean density was calculated for each species (sum of a species' density ratings/number of sampling sites) (Appendices 5a-d).
- Relative density was calculated (sum of a species' density ratings / sum of all plant densities).
- A "mean density where present" was calculated (sum of a species' density ratings / number of sampling sites at which it occurred) (Appendices 5a-d).
- The relative frequency and relative density were summed to obtain a dominance value (Appendix 6).

Simpson's Diversity Indices (1-sum (relative frequencies)^2) were calculated for each sampling year. Each sampling year was compared by a Coefficient of Community Similarity which measures the percent similarity between two communities.

The Aquatic Macrophyte Community Index (AMCI) (Nichols, 2000) was used to access the biological quality of the aquatic macrophyte community in Clark Lake and compare it to other Wisconsin lakes and lakes within the same ecoregion. It summarizes a number of attributes including maximum rooting depth, % littoral zone vegetated, Simpson's Diversity Index, relative frequency of submersed species, relative frequency of exotic species, and the number of taxa present. The Max AMCI value is 70 with the average for all Wisconsin Lakes of 50.

The Average Coefficient of Conservatism and Floristic Quality were calculated to measure disturbance in the plant community (Nichols 1998). A coefficient of conservatism is an assigned value, 0-10, the probability that a species will occur in a relatively undisturbed habitat. The Average Coefficient of Conservatism is the mean of the coefficients of the species found in a lake and the Floristic Quality Index is the ((average coefficient of conservatism) x square root (number of species)).

A predicted rooting depth (yearly secchi disc average x 1.22)-2.73) for years 2000-2006 were calculated to measure how deep plant growth was predicted to be growing.

Results

A healthy plant community can provide many valuable benefits to a lake. Plant communities can improve water quality by trapping nutrients and pollutant, stabilizing shorelines and banks from erosion, stabilizing bottom sediments and absorbing wave action. Native plant species also prevent non-native species from overtaking a community while providing essential fish, wildlife, and invertebrate habitat, and use and remove nutrients that may otherwise be available for algae blooms.

The aquatic plant surveys for Clark Lake were conducted on August 8-9, 1986; August 4-5, 1989; July 20-22, 1992; and August 20-21, 2006 (Rasman, 1986, 1989 and 1992). The 1986, 1989, and 1992 surveys were completed by WDNR water resource professionals from the Green Bay office. The 2006 survey was conducted by University of Wisconsin-Stevens Point (UWSP) water resource professionals and students. Together these surveys reveal changes to the Clark Lake plant community as well as provide information valuable for decisions involving the fishery, sensitive wildlife areas, water quality, and aquatic plant management.

Sediment Composition / Influence

Sediment influence upon plants in a lake will determine what type, their abundance and if a certain species is able to survive at that location. Because of Clark Lake's hardness, high enough levels of carbonate (CO_3^{-2}) and calcium, marl or calcium carbonate ($CaCO_3$) is formed and can dominate sediment composition in a lake and may even be observed as a white precipitate on plant leaves (Shaw, 1993). This characteristic of Clark Lake is one in which the aquatic macrophyte species are limited to their tolerance to hard water conditions.

Marl was the dominant sediment type in Clark Lake, especially in depths greater than 5 feet which is approximately 60% of the lake. In the regions less than 5 feet of water marl was frequently mixed with many of the other sediment types in the lake but was more of a background component to sediment more dominated by sand and rock, which cover the remaining 40% of the lake (Table 3 and Figure 2).

Nutrients and organic matter (which are needed for aquatic plant growth) are usually plentiful in muck or silt sediment types. Clark Lake exhibited only one region of the lake with these sediment types. This was located just outside of Logan Creek and was dominated by muck and silt sediment along with the most abundant and diverse macrophyte community on the lake. Sites with muck, marl, and sand along with their combinations all supported high occurrences of being vegetated (Table 4). Sand, also common in Clark Lake,

was usually found in combination with a portion of marl. Sand and rock were the dominant near shore shallow sediments, while sand supports the majority of the *Schoenplectus acutus* beds in Clark Lake. This is significant because of a declining bulrush population that may be attributed to increased marl accumulation in the near-shore shallow regions around the lake.

Table 3. Clark Lake sediment composition by depth zone.

Depth Zone		0-1.5 ft	1.5-5 ft	5-10 ft	10-20 ft	> 20 ft	Total
Acres		97	266	287	211	7	868
Soft Sediments	Muck	9.1%	9.1%				4.9%
	Marl		9.1%	81.8%	43.9%	100.0%	43.9%
Mix Sediments	Sand/Marl		18.2%				4.9%
Hard Sediments	Sand	27.3%	27.3%	9.1%			17.1%
	Sand/Rock	18.2%	18.2%				9.8%
	Rock	45.5%	18.2%	9.1%			19.5%

Table 4. Macrophyte occurrence and % vegetated at sediment.

		n	% Occurrence at Sites	% Vegetated
Soft Sediments	Muck	1	2.4%	100.0%
	Marl	19	46.3%	94.4%
Mixed Sediments	Sand/Marl	2	4.9%	50.0%
Hard Sediments	Sand	6	14.6%	57.1%
	Sand/Rock	5	12.2%	100.0%
	Rock	8	19.5%	25.0%

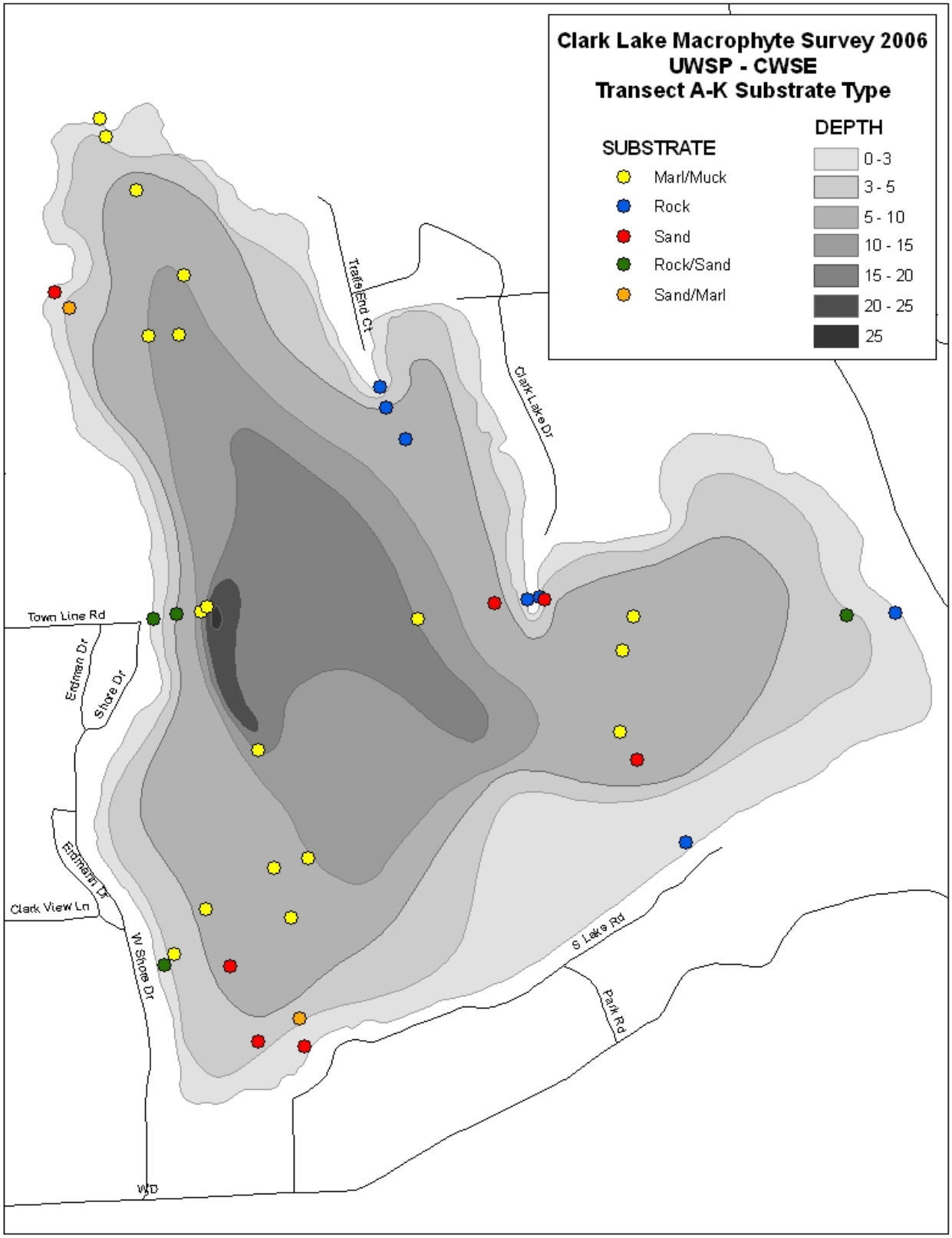


Figure 2 Dominant substrate type at sampling locations.

Aquatic Macrophyte Data

In 2006 a total of 60 species of aquatic plants were identified in Clark Lake and upstream Logan Creek to Highway 57 (Appendix 1). Not all species were present in line/transect sample sites but are included and noted as existing in Clark Lake. The aquatic macrophytes that were not collected along transects where collected while moving from site to site and while surveying Logan Creek. In the 2006 transect survey six species of previously identified aquatic macrophytes from 1986, 1989, and 1992 were absent, while ten species were newly identified in 2006. A total of 28 species were identified in the transect survey for all survey years (Table 5).

One endangered species of has been identified as existing in Clark Lake, *Potamogeton pulcher*, otherwise known as Spotted Pondweed. This is significant because it is an endangered species of pondweed and had never been identified in Clark Lake. This information has been provided to the WDNR for their further monitoring which will be needed to track this endangered species of pondweed.

Two non-native species have been identified in Clark Lake; *Potamogetan crispus* (Curly leaf pondweed) and *Myriophyllum spicatum* (Eurasian water-milfoil). These species have been identified since 1989 and 1992, respectively and have yet to drastically influence the overall plant community of Clark Lake however, continued monitoring is essential to track these non-native invasive species.

Scientific Name	**Common Name**	**I.D.Code**	**1986**	**1989**	**1992**	**2006**
Submergent Species						
Bidens beckii	marsh marigold	bidbe				X
Ceratophyllum demersum	coontail	cerde	X	X		
Chara vulgaris	muskgrass / chara	chara	X	X	X	X
Elodea canadensis	elodea	eloca	X	X	X	X
Heteranthera dubia	water stargrass	hetdu			X	
Hippuris vulgaris	common mares-tail	hipvu				X
Isoetes sp.	quillwort	isosp	X	X		
Myriophyllum heterrophyllum	various-leaved water milfoil	myrhe				X
*Myriophyllum spicatum**	eurasian water milfoil	myrspi		X	X	X
Najas flexis	slender naiad	nahfl	X	X	X	X
Nasturtium offcinale	water cress	nasof				X
Potamogeton amplifolius	large-leaf pondweed	potam		X	X	X
*Potamogeton crispus**	curly-leaf pondweed	potcr			X	X
Potamogeton gramineus	variable-leaf pondweed	potgr				X
Potamogeton illinoensis	illinois pondweed	potil			X	X
Potamogeton natans	floating-leaf pondweed	potna	X		X	X
Potamogeton pecinatus	sago pondweed	potpe			X	X
Potamogeton poerlongus	white stem pondweed	potpo	X			X
*Potamogeton pulcher***	spotted pondweed	potpu				X
Potamogeton richardsonii	clasping-leaf pondweed	potri		X		
Potamogeton robbinsii	fern Pondweed	potro		X		X
Potamogeton zosteriformis	flatstem pondweed	potzo	X	X	X	
Scirpus subterminalis	water bulrush	scisu				X
Utricularia vulgaris	common bladderwort	utrvu				X
Vallisneria americana	wild celery	valam		X		
Emergent Species						
Schoenplectus acutus (formally Scirpus acutus)	hardstem bulush	sciac	X	X	X	X
Sparganium chlorocarpum	short-stemmed bur-reed	spach				X
Floating leaf species						
Nuphur variegata	spatterdock	nupva	X	X	X	X

* = non-native species
** = endangered species

Table 5. Aquatic macrophyte species that were identified in transect survey in 1986, 1989, 1992, and 2006.

Frequency of Occurrence

Najas flexis, Chara, and *Potamogeton illinoinesis* were the three most frequent species collected in 2006. *Najas flexis* and *Chara* have been frequent in all 4 surveys while *Potamogeton illinoinesis* was present and common only in the last two surveys (Figure 4).

Six species were absent from the 2006 transect survey since the last survey in 1992; *Ceratophyllum demersum, Heteranthera dubi, Isoetes sp., Potamogeton richardsoni, Potamogeton zosteriformis and Vallisneria Americana*.

Ceratophyllum demersum and *Potamogeton richardsoni* were the most frequently occurring aquatic macrophytes in the 1986 and 1989 surveys, respectively. Ten additional species were identified in the 2006 transect survey and one in particular, *Myriophyllum heterrophyllum,* was identified and occurred frequently across Clark Lake (Figure 4).

Species richness is a sum of the number of species at a site. In Clark Lake species richness ranged from 0 to 19. The richest areas were located in the north, northeast, and west sides of lake. Figure 3 indicates the species richness as the total occurrence of species at sampling locations.

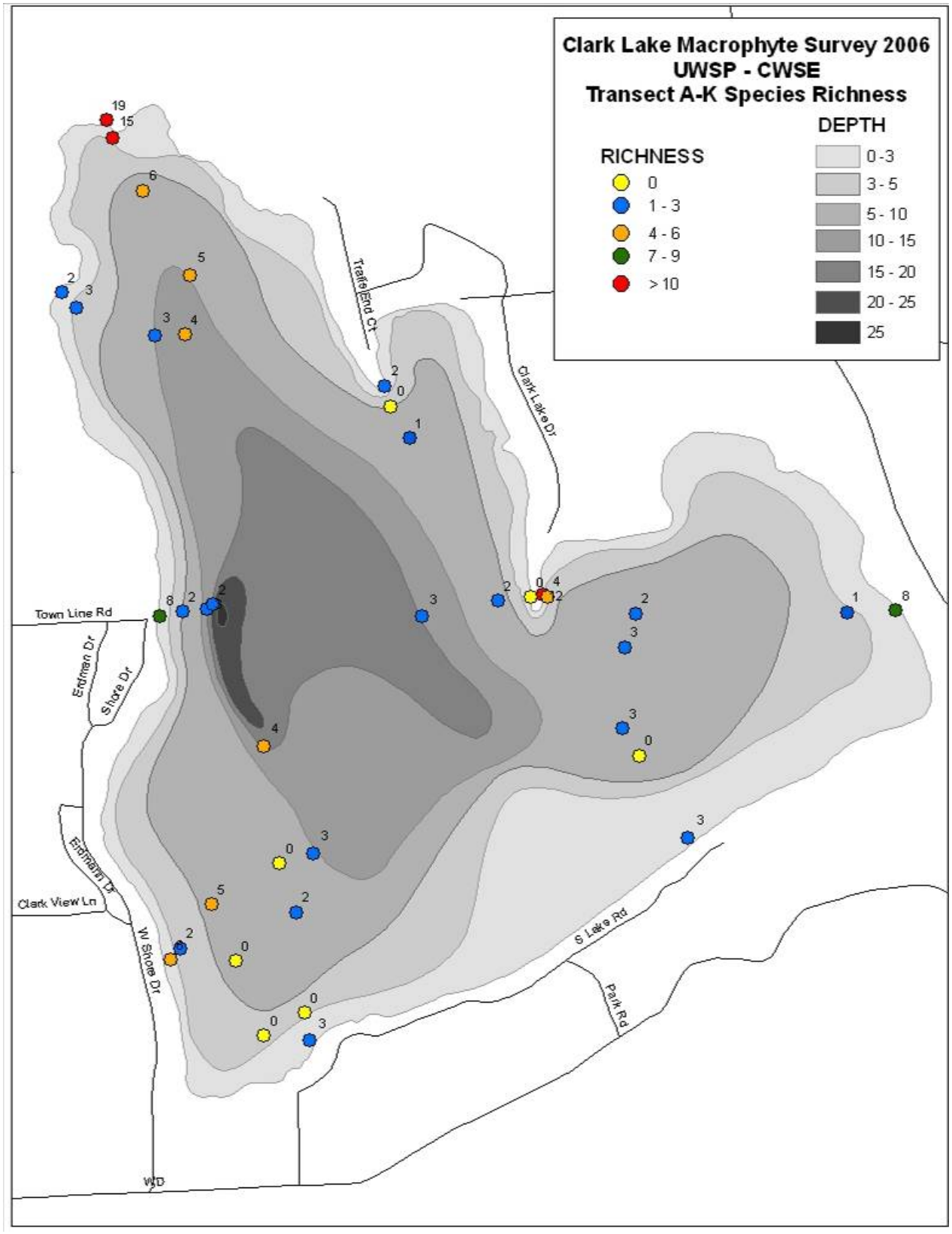


Figure 3. Species richness at each sampling location in Clark Lake (2006).

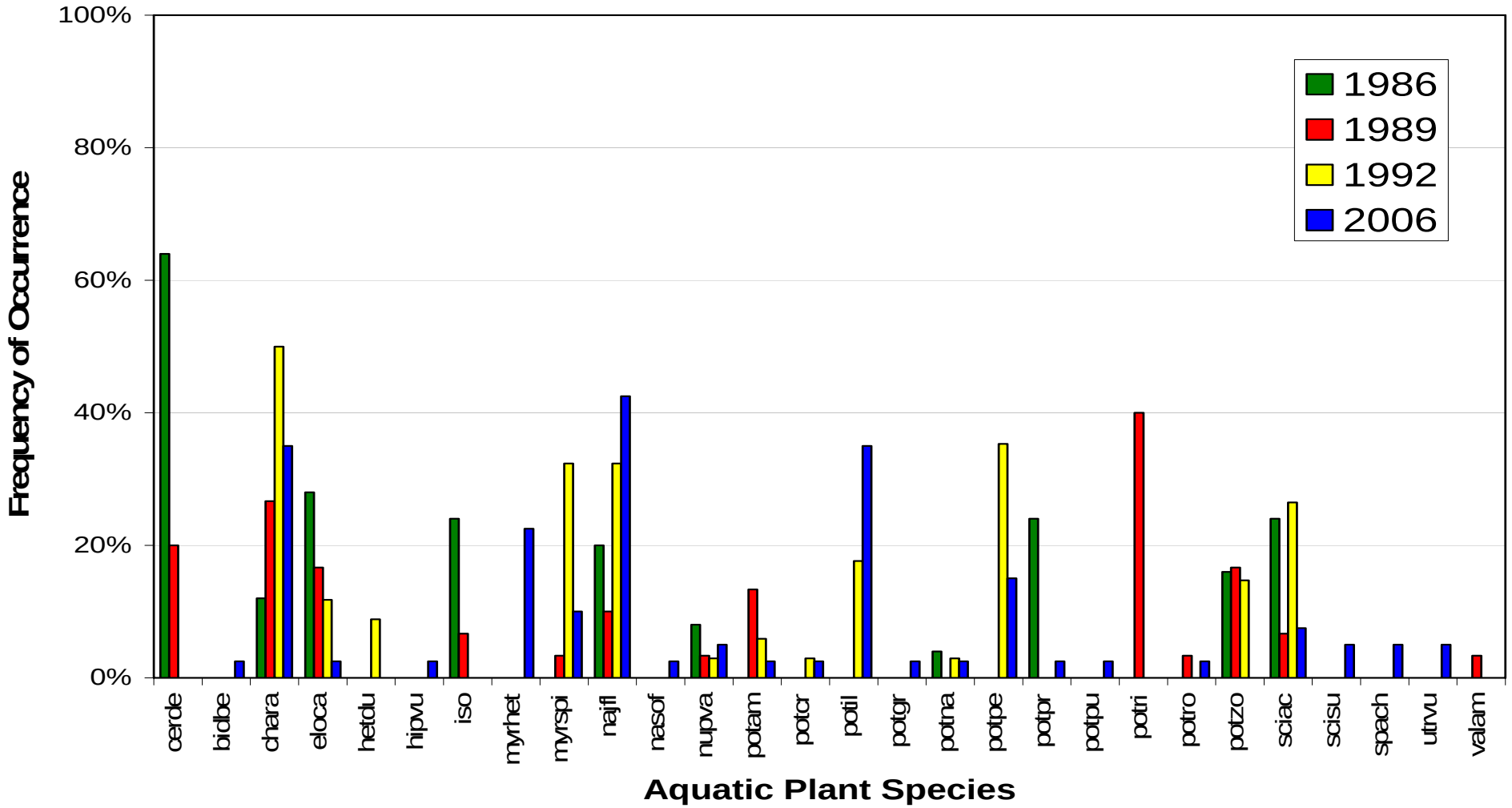


Figure 4. Percent frequency of aquatic macrophytes species in Clark Lake 1986, 1989, 1992 and 2006

Density

Mean plant densities were low in Clark Lake for all the years surveyed. The 2006 survey had an increase in density for many species and exhibited an overall increase across the lake compared to the past surveys. The most frequent occurring species (mentioned previously) are also those that exhibited the greatest density; *Najas flexis, Chara*, *Potamogeton illinoinesis* and *Myriophyllum heterrophyllum* (Figure 5). *Myriophyllum spicatum,* a non-native invasive species residing in Clark Lake was noted as being less dense in 2006 when compared to the 1992 and 1989 survey. It did have a small increase in frequency (Figure 4), but was less dense across Clark Lake in 2006 (Figure 5).

Density where present is a measure of how dense a species is growing at locations at which it is identified. A species may occur only a few times in a lake, but can be dense when it does occur. Naphur variegata, a floating leaf plant was the only species that exhibited a dense form of growth across all survey transects. This species was only identified at two sites and was relatively dense at those locations. The 2006 survey did have additional species that exhibited this dense growth. These are *Schoenplectus acutus*, *Sparganium chlorocarpum*, and *Potamogeton amplifolius* (Figure 6. *Density where present* of aquatic macrophytes in Clark Lake 1986, 1989, 1992 and 2006).

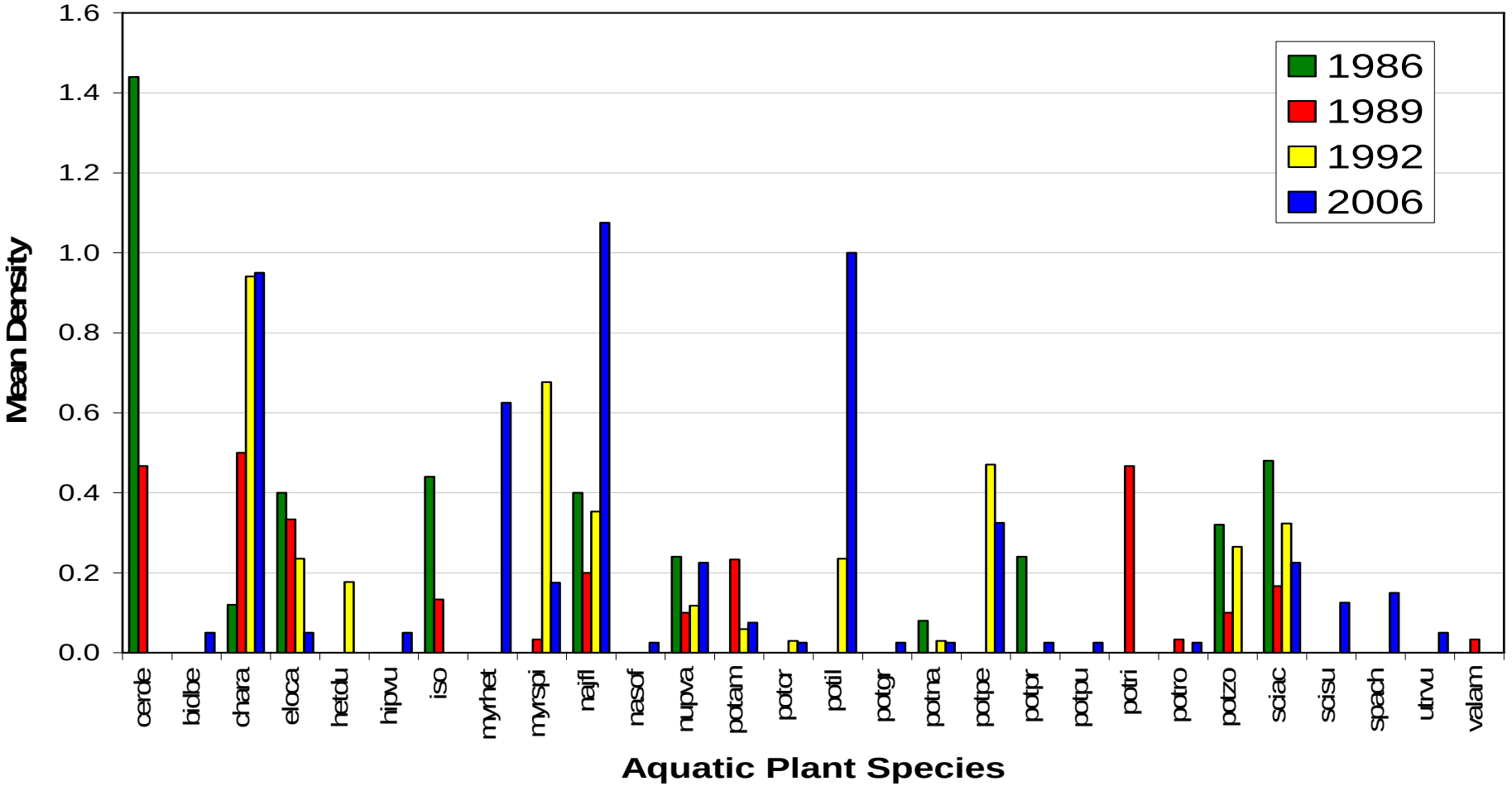


Figure 5. Mean density of aquatic macrophytes in Clark Lake 1986, 1989, 1992 and 2006

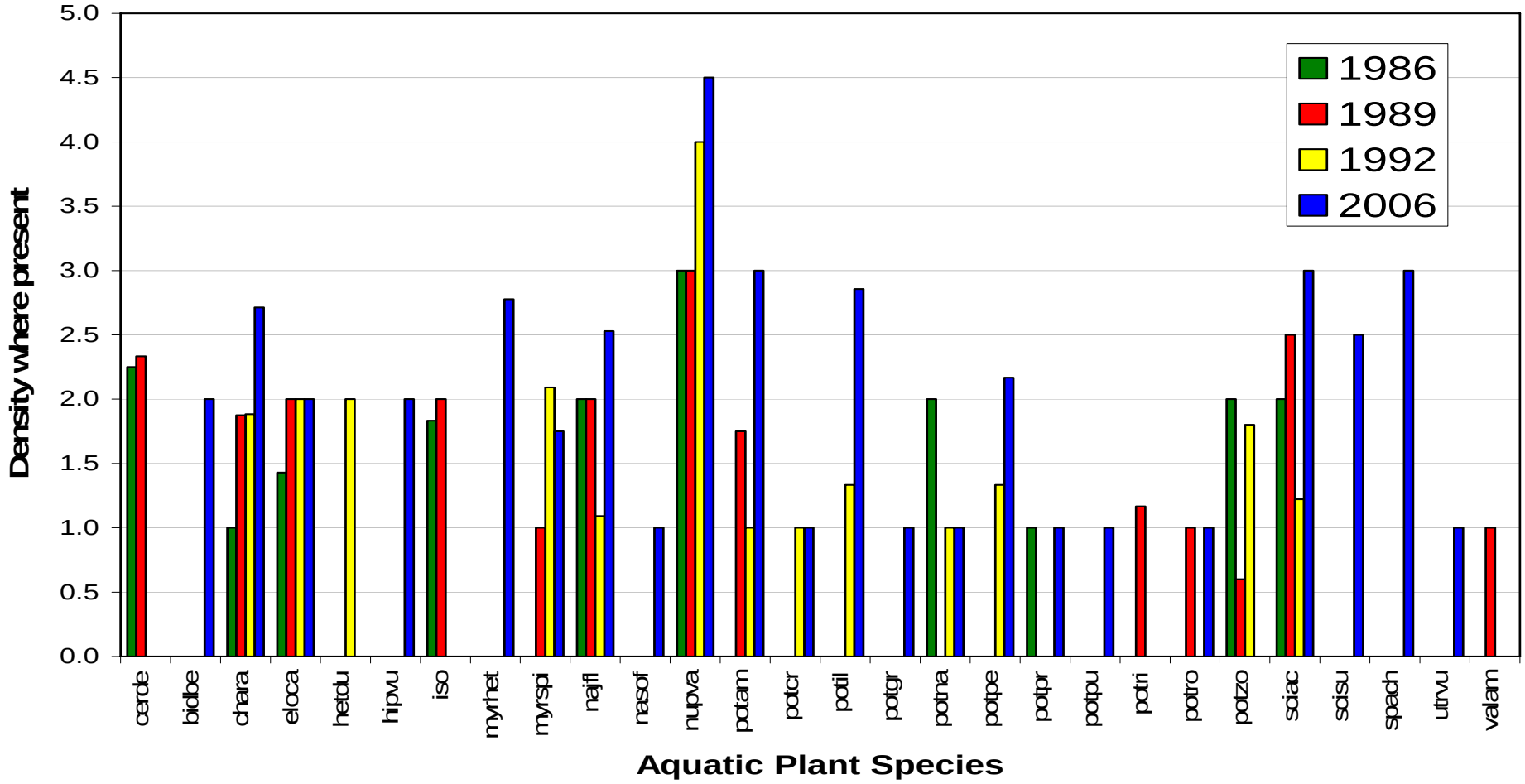


Figure 6. *Density where present* of aquatic macrophytes in Clark Lake 1986, 1989, 1992 and 2006

Dominance

Combining relative frequency and relative density gives a value of dominance that is an indicator of how dominant a species is in its community. In Clark Lake the prevalence of species that dominated was different in all four surveys. This may be indicative of a changing macrophyte community, or just due to the four surveys taken during parts of the summer, or other reasons.

The 2006 survey splits the dominance among four species: *Najas flexis, Chara*, *Potamogeton illinoinesis*, and *Myriophyllum heterrophyllum* (Figure 7). *Ceratophyllum demersum* was the dominant species in the 1986 survey and has not been observed since the 1989 survey. *Ceratophyllum demersum*, *Chara* and *Potamogeton richardsonii* were the dominant species in the 1989 survey. Strangely, *Potamogeton richardsonii* was the most dominant species in this survey but is absent from the other three surveys. *Myriophyllum spicatum*, *Chara* and *Potamogeton pectinatus* were the dominant species in 1992. It is important to take note that one of the most dominant species is a non-native, *Myriophyllum spicatum*, which became less dominant in the 2006 survey.

Distribution

Aquatic macrophytes in Clark Lake occurred in depth zones 1-4 (0–20 ft) in 2006. However, the frequency of aquatic macrophyte growth appears to be higher in 2006 (Figure 8) and may be associated with an increased water clarity and a deep predicted rooting depth calculated using WDNR Self-Help volunteer monitoring and UWSP secchi disc measurements (Figure 10). Depth zones 3 (5- 10 ft) and zone 4 (10-20ft) both exhibited higher than previous occurrence and density compared to previous surveys (Figures 8 and 9). The predicted depth of around 10 feet fell short of actual depth of growth in which plants were sampled at depth of 16 feet. Another change was that the shallower near-shore regions showed a decrease in aquatic macrophyte growth, in particular *Schoenplectus acutus* and other near-shore plants.

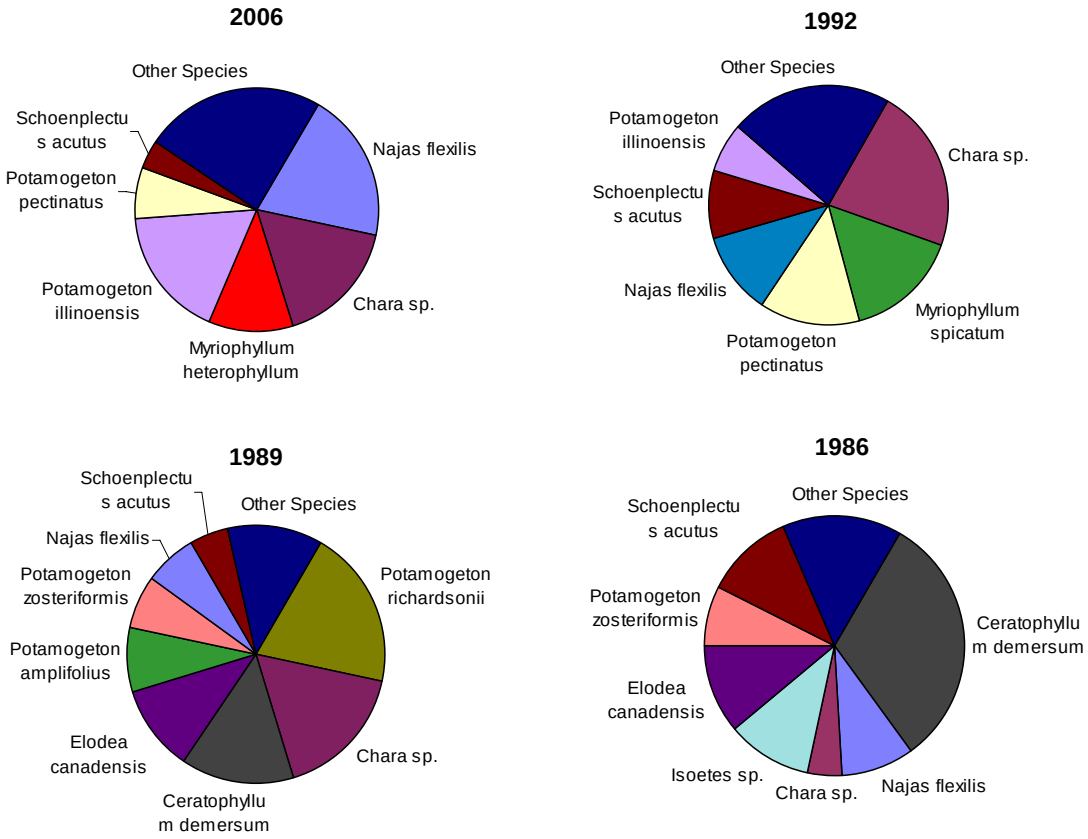


Figure 7. Dominance of prevalent species in Clark Lake 1986, 1989, 1992 and 2006

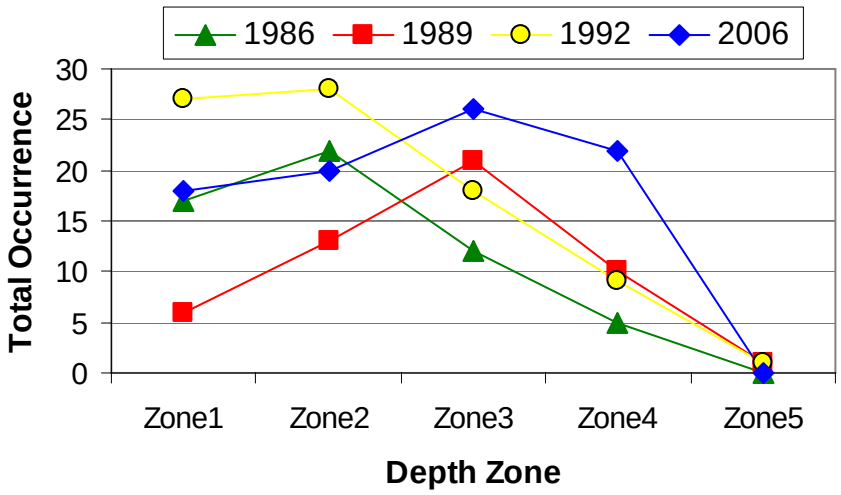


Figure 8. Total occurrences by depth zone in Clark Lake 1986, 1986, 1992 and 2006

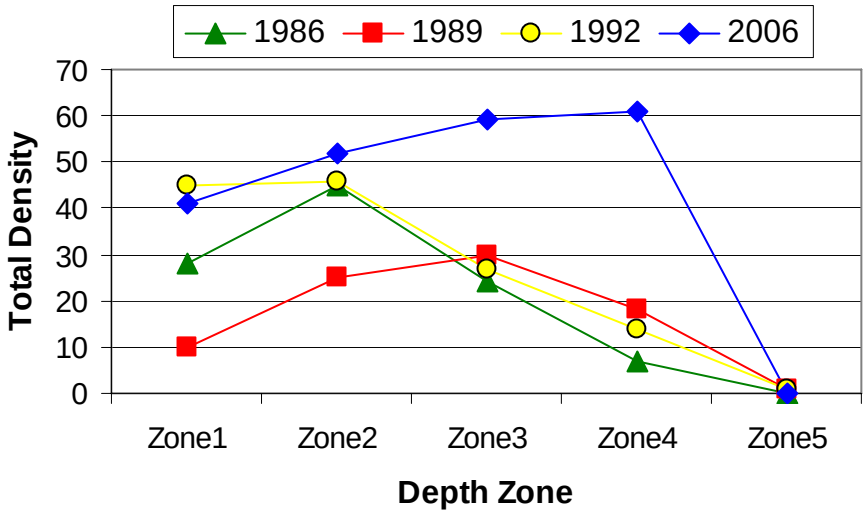


Figure 9. Total density by depth zone in Clark Lake 1986, 1986, 1992 and 2006

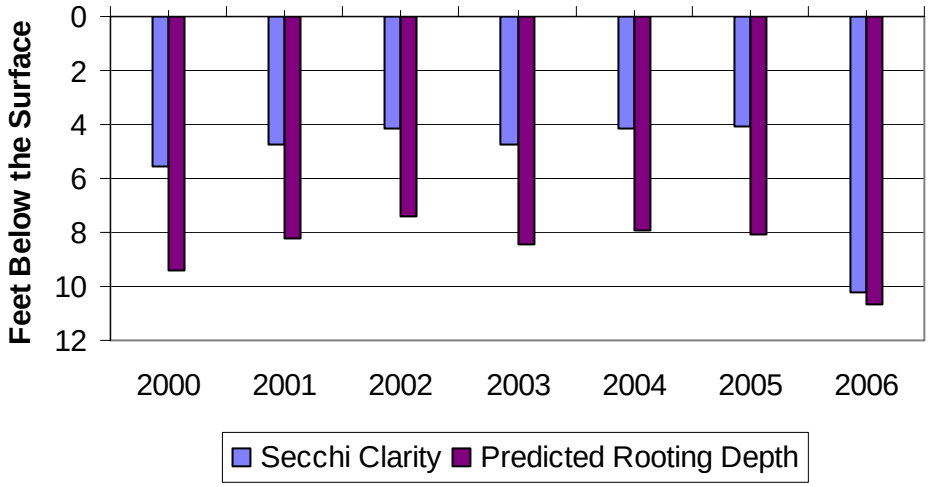


Figure 10. Water clarity and predicted rooting depth for Clark Lake, 2000 – 2006. Data compiled on secchi disc measurements were from WDNR Self-Help volunteer monitoring and UWSP.

Aquatic Macrophyte Community

Several indices and parameters can be used to assess changes that have occurred over time in the aquatic macrophyte community in Clark Lake. There was a 120% increase in the number of species from 1986-2006 but a decrease in percent of sites with emergent, submergent, and floating-leaf plants (Table 6).

The Simpson's Diversity Index is an indication of diversity in a lake's aquatic plant community and a value closest to 1 indicates a community with the most diversity. The index has slowly increased since 1986 and was 0.89 in 2006. The lake's Floristic Quality Index (FQI) has fluctuated slightly between

1986 and 1992 but increased to its highest value in 2006. The FQI will be discussed in more detail later in this document.

	1986	1989	1992	2006	Change 1986-2006	% Change 1986-2006
Number of sites sampled	26	30	30	40		
Number of species	10	13	13	22	12	120.0
% sites/emergent	20%	7%	26%	8%	-12	-62.5
% sites/submergent	92%	57%	76%	73%	-19	-21.2
% sites/floating/leaf	8%	3%	6%	8%	0	-6.3
% sites/free-floating	0%	0%	0%	0%	0	0
Simpson's Diversity Index	.85	.87	.88	.89	.04	4.3
Floristic Quality	18.3	19.6	17.0	27.9	9.59	52.3

Table 6. Comparison of summary statistics and hanges in Clark Lake macrophyte community, 1986-2006.

The Aquatic Macrophyte Community Index (AMCI) was developed by Nichols in 2000. It is a multipurpose tool to access the biological quality of aquatic macrophyte communities in Wisconsin Lakes and compare them to lakes within the same ecoregion. It summarizes a number of attributes including maximum rooting depth, % littoral zone vegetated, Simpson's Diversity Index, relative frequency of submersed species, relative frequency of exotic species, and the number of taxa present. The Max AMCI value is 70 with the average for all Wisconsin Lakes is 50. For Clark Lake the AMCI was above average for all years sampled for similar lakes of the Southeastern Wisconsin Till Plains (SETP) region and all Wisconsin Lakes (Table 7). Clark Lake classified in the upper quartile of SETP scale for all four survey years. AMCI Indices ranges for the SETP region are: 40 (upper value of lower quartile), 46 (mean), 51 (lower value of upper quartile).

The AMCI Index values for the relative frequency of submersed species decreased from 9 to 7 while the value for relative frequency for exotic species increased from 4 in 1992 to 5 in 2006. Sensitive species are those that have the tendency to decrease in biomass or disappear with disturbance to the lake ecosystem. An increase in relative frequency and its higher AMCI Index for sensitive species occurred from 1992 to 2006.

Table 7. Aquatic Macrophyte Community Index for Clark Lake, 1986-2006.

AMCI Variables	1986	1989	1992	2006
Maximum Rooting Depth	8	10	10	10
% Littoral Zone Vegetated	10	10	10	10
Simpsons Diversity Index	6	7	8	8
Relative Frequency of submersed species	9	8	9	7
Relative Frequency of exotic species	10	4	4	5
Relative Frequency of sensitive species	8	7	7	8
# of Taxa (reduced by exotic)	5	6	6	9
AMCI Index	**56**	**52**	**54**	**57**

The Max AMCI value is 70 with the average for Wisconsin Lakes is 50

Multiple species decreased or were absent in Clark Lake from 1986 to 2006. Those that disappeared from the 1986, 1989, and 1992 surveys include: *Ceratophyllum demersum, Heteranthera dubi, Isoetes sp., Potamogeton richardsoni, Potamogeton zosteriformis and Vallisneria Americana*. During this time two non-native species were also identified; *Potamogeton crispus* and *Myriophyllum spicatum*. *Potamogeton crispus* has not yet increased to a problematic level and *Myriophyllum spicatum* increased in frequency, density, and dominance in 1992 but decreased in 2006. Year-to-year fluctuations in frequency, density, and dominance from 1986 to 2006 were observed for many other species in Clark Lake. Significant increases occurred with multiple species since 1986, most notably *Najas flexis, Chara*, *Potamogeton illinoinesis* and *Myriophyllum heterrophyllum*.

When compared to all Wisconsin Lakes the Average Coefficient of Conservatism for Clark Lake was below the mean in 1986, in the upper limit of the lower quartile for 1989 and 1992, and just below the mean in 2006 (Table 8). This suggests that Clark Lake is about average when compared to all Wisconsin lakes. The Average Coefficient of Conservatism and Floristic Quality were calculated to measure disturbance in the plant community (Nichols 1998). A coefficient of conservatism is an assigned value, 0-10, the probability that a species will occur in a relatively undisturbed habitat. The Average Coefficient of Conservatism is the mean of the coefficients of the species found in a lake and the Floristic Quality Index is calculated from the Average Coefficient of Conservatism. The Floristic Quality Index (FQI) for Clark Lake was highest in 2006 and when compared to all Wisconsin lakes was in the upper quartile for 2006 and less than or around average for 1986, 1989, and 1992. The FQI was recalculated by weighing its relative frequency and dominance values and a similar pattern resulted (Table 8). These values

and conclusions were based on the occurrence of disturbance tolerant and disturbance sensitive species and indicated that Clark Lake is further from a disturbed state than in previous surveys. An FQI value was also calculated for all sample locations and is shown spatially in Figure 11. These FQI values were calculated using the sum of coefficients of conservatism for species identified at each site and using the whole lake number of species (60 species) to develop a whole lake comparison. Locations of the highest FQI's are similar to the locations with the greatest species richness.

Table 8 Floristic Quality Index and Coefficient of Conservatism in the Clark Lake aquatic plant community compared with Wisconsin Lakes.

	(c) Average Coefficient of Conservatism ^	(I) Floristic Quality Index ^ ^	(I) Based on Relative Frequency	(I) Based on Dominance
1986	5.8	18.3	16.5	16.1
1989	5.5	19.7	19.3	19.2
1992	4.7	16.9	17.2	16.9
2006	6.0	27.9	27.7	28.1
Wisconsin Lakes	5.5, 6.0, 6.9*	16.9, 22.2, 27.5 *		

* - upper limit of lowest quartile, mean, lower limit of upper quartile

^ - Average Coefficient of Conservatism for all WI lakes ranged from a low of 2.0 (most disturbance tolerant) to a high of 9.5 (least disturbance tolerant)

^ ^ - The lowest Floristic Quality value for all WI lakes was 3.0 (farthest from undisturbed condition) to a high of 44.6 (closest to undisturbed condition)

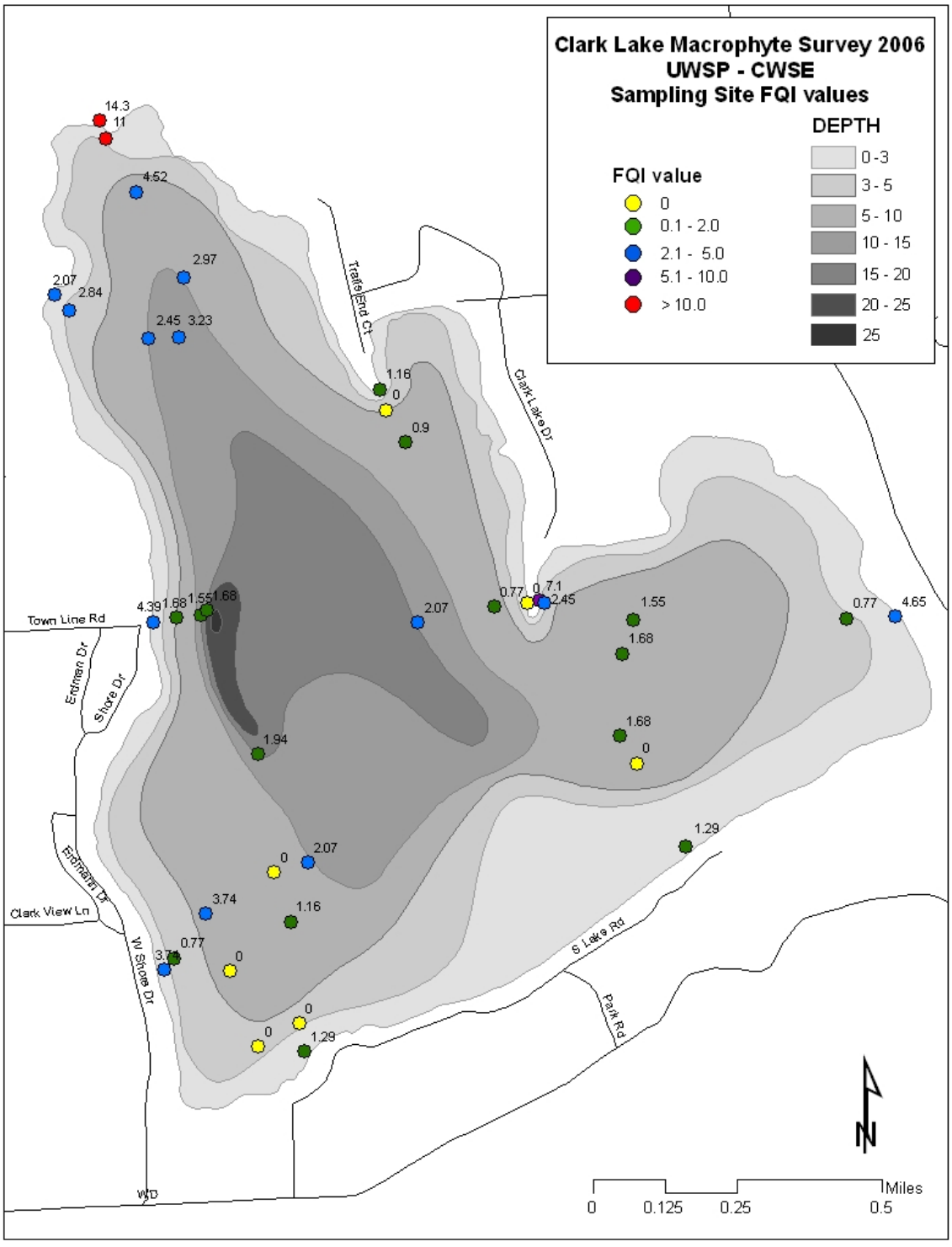


Figure 11. FQI value for each sampling location.

Logan Creek

Logan Creek is the tributary flowing into the north end of Clark Lake. Many fish in Clark Lake spawn in this tributary and it has abundant groundwater springs near the stream edge as well as a white cedar swamp that surrounds it. An informal survey of aquatic macrophytes of Logan Creek was conducted on August 21, 2006. This informal survey took place between Hwy 57 and Clark Lake. Several aquatic macrophyte species were identified in Logan Creek that were not observed in Clark Lake. These species are *Potamogeton filimormis, Ranunculus flabellaris*, and *Callitriche palustris*. *Callitriche palustris* was found around areas with groundwater upwelling.

Aquatic Plant Survey Summary and Recommendations

Aquatic macrophyte Community

In 2006 a total of 60 species of aquatic plants were identified in Clark Lake and upstream to Highway 57 in Logan Creek. Not all species were present in the line/transect sampling. When 2006 transect date is compared with the 1986, 1989, and 1992 transect surveys six species of aquatic macrophytes were absent while ten additional species were identified for a total of 28 species. The dominant species has shifted from *Ceratophyllum demersum* in 1986 to *Ceratophyllum demersum*, *Chara* and *Potamogeton richardsonii* in the 1989 to *Myriophyllum spicatum*, *Chara* and *Potamogeton pectinatus* in 1992 and *Najas flexis, Chara*, *Potamogeton illinoinesis* and *Myriophyllum heterrophyllum* in 2006.

In 2006 the greatest amount of growth has shifted from depth zones 1 and 2 to depth zones 3 and 4.

Two non-native species have been identified in Clark Lake: *Potamogetan crispus* and *Myirophyllum spicatum*. These species have been observed since 1989 and have yet to drastically influence the overall aquatic macrophyte community in Clark Lake. *Myriophyllum spicatum* has become less dominant since 1992 but is still a potentially problematic species. *Potamogetan crispus* has yet to establish itself as a dominant species. Continued annual monitoring should be conducted to track these non-native species.

An endangered species of pondweed was identified in the 2006 survey, *Potamogeton pulcher*. This is significant because it is an endangered species of pondweed and has never been identified on Clark Lake before. Further monitoring will be needed to track the progress of this endangered species of pondweed.

Changes in the aquatic macrophyte community

Significant changes to the aquatic macrophyte community have occurred since the 1986, 1989, and 1992 surveys. Some species of aquatic macrophytes have suffered a decline and/or even absence in the 2006 survey. *Ceratophyllum demersum, Heteranthera dubi, Isoetes sp., Potamogeton richardsoni, Potamogeton zosteriformis and Vallisneria americana* are those absent from the 2006 survey. Shallow vegetation, which seems to be on the decrease, in particular *Schoenplectus acutus* is becoming less common in areas that this species once dominated.

Since 1986

- Species diversity has increased
- *Ceratophyllum demersum* is no longer dominant or collected from transects.

Since 1989

- Species diversity has increased
- *Ceratophyllum demersum* and *Potamogeton richardsonii* are no longer dominant and are no longer collected from transects.

Since 1992

- Increased number of species have been identified
- Addition of 10 previously unidentified species along transects
- Absence of 6 previously identified species along transects
- Increased abundance and density of vegetation at deeper depths
- Decreased vegetation in the shallower water
- Non-native *Myriophyllyum spicatum* which was previously dominant in 1992 is no longer dominant but still frequent.
- An endangered species of pondweed has been identified: *Potamogeton pulcher*

Recommendations

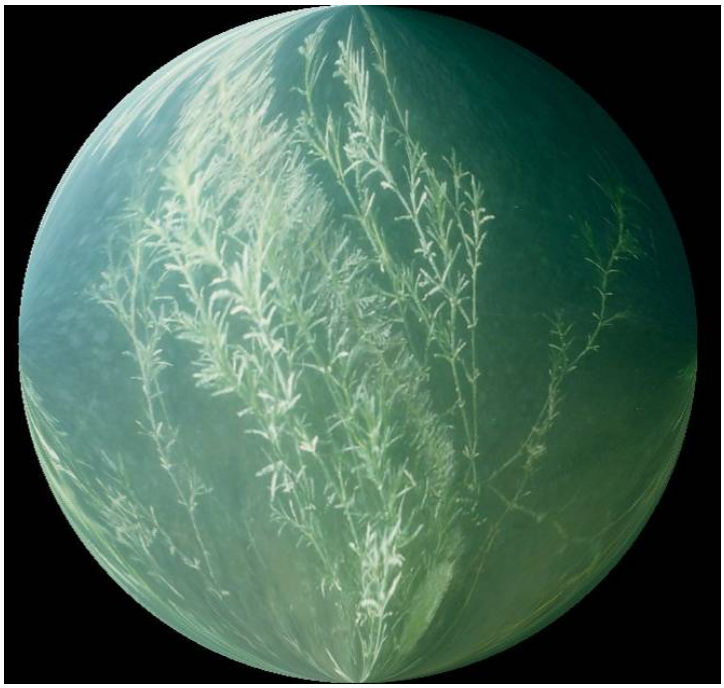
1) Minimize the removal of aquatic macrophytes to reduce the opportunities for establishment of invasive species.

2) Routinely identify and monitor for exotic invasive species and participate with WDNR's Clean Boats/Clean Waters Program.

3) Replace riprap and concrete shoreline reinforcements with native emergent vegetation that are more beneficial to water quality, wildlife, and shoreline stabilization. Emergent vegetation acts as a buffer from near shore wave and will dampen the effects of wave and wind induced erosion and sediment disturbance which will in turn promote shallow growth of other aquatic vegetation.

4) Establish a plan to re-establish *Schoenplectus acutus* and other native shallow species in regions of the lake that are experiencing a decline in population. This may be done by means of water level manipulation, manual planting, establishing no-wake or no-motor zones in regions of concern, or creating buffer barriers where wind and waves are problematic.

5) Establish a no-wake or no-motor zone in the north bay of Clark Lake and into Logan Creek to help preserve the diversity and abundance of aquatic vegetation in this ecologically significant part of the lake.



Appendix 1 : Species List (all surveys)

Scientific Name	Common Name	I.D.Code	Identified
Submergent Species			
Bidens beckii	marsh marigold	bidbe	O
Callitriche palustris	common water starwort	calpa	O
Ceratophyllum demersum	coontail	cerde	X
Chara vulgaris	muskgrass / chara	chara	X
Elodea Canadensis	elodea	eloca	X
Hepatophyta sp.	leafy liverwort	hepsp	O
Heteranthera dubia	water stargrass	hetdu	X
Hippuris vulgaris	common mares-tail	hipvu	O
Isoetes sp.	quillwort	isosp	X
Myriophyllum heterrophyllum	various-leaved water milfoil	myrhe	O
Myriophyllum spicatum *****	eurasian water milfoil	myrspi	X
Myriophyllum vertillatum	whorled water milfoil	myrve	O
Najas flexis	slender naiad	nahfl	X
Nasturtium offcinale	water cress	nasof	O
Potamogeton amplifolius	large-leaf pondweed	potam	X
Potamogeton crispus *****	curly-leaf pondweed	potcr	X
Potamogeton filiformis	thread-leaf pondweed	potgr	O
Potamogeton gramineus	variable-leaf pondweed	potgr	O
Potamogeton illinoensis	illinois pondweed	potil	X
Potamogeton natans	floating-leaf pondweed	potna	X
Potamogeton pecinatus	sago pondweed	potpe	X
Potamogeton poerlongus	white stem pondweed	potpo	X
Potamogeton pulcher ******	spotted pondweed	potpu	O
Potamogeton richardsonii	clasping-leaf pondweed	potri	X
Potamogeton robbinsii	fern Pondweed	potro	X
Potamogeton zosteriformis	flatstem pondweed	potzo	X
Ranunculus flabellaris	yellow water crowfoot	ranfl	O
Scirpus subterminalis	water bulrush	scisu	O
Utricularia vulgaris	common bladderwort	utrvu	O
Vallisneria Americana	wild celery	valam	X
Floating leaf species			
Nuphur variegate	spatterdock	nupva	X
Nymphaea odorata	white water lily	nymod	O

Scientific Name	Common Name	I.D.Code	Identified
Emergent Species			
Phalaris arundinacea	reed canary grass	phaar	O
Phragmites australis	common reed	phrau	O
Sagittaria latifolia	common arrowhead	sagla	O
Schoenplectus acutus (Scirpus acutus)	hardstem bulush	sciac	X
Scirpus americanus	three-square rush	sciam	O
Sparganium chlorocarpum	short-stemmed bur-reed	spach	X
Sparganium eurycarpum	narrow-leaf bur-reed	spaeu	O
Typha angustifolia	narrow-leaf cattail	typan	O
Typha lattiflora	broad-leaf cattail	typla	O
Zinzania Palustris	wild rice	zinpa	O
Wetland/Shoreline Plants			
Acorus calamus	sweetflag	acoca	O
Aster lanceolatus	aster	astla	O
Carex stricta	hummock sedge	carst	O
Cicutra bulbifera	water plantain	cicbu	O
Cornus stolonifera	red oaser dogwood	corst	O
Eupaorium perfoliatum	boneset	euppe	O
Eupatorium maculatum	joe-pye weed	eupma	O
Festuca arundinacea	tall festuca	fesar	O
Impatiens copensis	spotted jewelweed	impco	O
Lobelia siphilitica	great blue lobelia	lobsi	O
Lycopus americanus	common bugleweed	lycam	O
Myrica gale		myrga	O
Populus tremuloidus	popler	poptr	O
Potentilla palustris	marsh cinquefoil	potpa	O
Scutellaria galericulata	marsh shullcap	scuga	O
Scutellaria latifolia	mad-dog skullcap	scula	O
Solanum dulcamara	bittersweet	soldu	O
Solidago sp.	goldenrod sp.	solsp	O
Thuja occidentalis	white cedar	thuoc	O
Veronica anagallis	water speedweed	veran	O

X = Identified in 1986, 1989, or 1992 surveys

O = Newly Identified for 2006

****** = endanged species ***** = non-native species

Appendix 2: Survey Results

Scientific name **(Common name)**	**1986**	**1989**	**1992**	**2006**
Ceratophyllym demersum **(Coontail)**	A: 2-2, 3-2, 4-1 C: 1-2, 2-2, 3-3, 4-3 D:1-2, 2-2 E:1-5, 2-5, 3-5 F: 1-1 H: 1-1, 2-1 I: 1-3, 2-1	A: 2-2, 3-3, 4-3, 5-1 E: 2-3, 3-2	Observed	None Sampled
Schoenplectus sp. *(formally Scirpus acutus)* **(Bulrsuh)** *** 2006 (*Schoenplectus acutus*)**	B: 1-2 C: 1-2 E: 2-5 F: 1-1 G: 1-1 H: 1-1	E: 2-3 H: 1-2	B: 1-1, 2-1 C: 1-1, 2-1, D: 1-1 E: 1-2 G: 1-1 H: 1-2 J: 1-1	E: 2-5* F: 2-2* J: 1-2*
Scirpus subterminalis **(Water bulrush)**	None Sampled	None Sampled	None Sampled	K: 2-1, 4-4
Elodea Canadensis **(Common waterweed)**	A: 2-2, 3-2, 4-1 C: 3-1,4-1 E: 2-2, 3-1	A: 2-2, 3-2 C: 3-1, 4-3 I: 3-2	A: 3-1, 4-2 I: 3-2, 4-3	E: 4-1 K: 4-1
Najas flexilis **(Bushy pondweed)**	A: 2-2, 3-2 C: 2-2 E: 2-2, 3-2	C: 4-4 G: 3-1 I: 1-1	A: 2-1, 3-2, 4-2, 5-1 D: 2-1, 3-1 F: 2-2 G: 2-1 I: 2-1	A: 3-4, 4-3 B: 3-1, 4-3 C: 4-4 D: 1-4, 2-1 E: 3-4, 4-4 F: 3-1 G: 3-2 H: 1-1 I: 3-1, 4-1 J: 4-2 K: 3-3, 4-4
Isoetes sp. **Quillwort**	A: 2-2, 2-1, 3-1 B: 2-2 C:2-1 I: 1-4	B: 2-1 I: 1-3	None sampled	None sampled
Chara **(Muskgrass)**	B: 2-1 F: 2-1 G: 1-1	A: 1-1, 2-1, 4-3 B: 2-2, 3-1 I: 1-2, 2-2, 3-3	A: 1-1, 2-3, 3-2 B: 2-2 C: 1-1, 3-1 D: 1-1, 2-2 F: 1-2, 2-3 G: 1-2, 2-1 H: 1-3, 2-1 I: 1-3 J: 1-1, 2-3	A: 1-1, 2-4 D: 1-1, 3-4 E: 1-1, 2-2, 3-4, 4-3 G: 3-1 H: 3-1 I: 1-3 K: 1-4, 2-5, 3-3, 4-1
Potamogeton zosteriformis **(Flatstem pondweed)**	A: 2-2 E: 2-2, 3-3 I: 1-1	C: 4-2 E: 3-1	E: 1-3, 2-3 I: 1-1, 3-1, 4-1	None sampled
P. praelongus **(Whitestem pondweed)**	C: 3-1, 4-1 E: 2-1, 3-1 F: 1-1 I:1-1	None sampled	None sampled	I: 1-1
P. natans **(Floating leaf pondweed)**	E: 2-2	None sampled	E: 1-4	E: 2-1
P. richardsonii **(Clasping leaf pondweed)**	None sampled	A: 2-2, 3-1, 4-1 B: 3-1 C: 3-1 E: 2-1 F: 3-1 G: 3-1 H: 3-1 I: 1-1, 2-1, 3-2	None sampled	None sampled
P. amplifolius **(Big leaf pomdweed)**	None sampled	A: 3-2, 4-2 B: 2-2, 3-1	C: 3-1 E: 2-1	I: 3-3
P. robinsii **(Fern pondweed)**	None sampled	C: 3-1	None sampled	E: 4-1

Scientific name (Common name)	1986	1989	1992	2006
P. crispus **(Curly leaf pondweed)**	None sampled	None sampled	E: 1-1	E: 1-1
P. illinoensis **(Illinois pondweed)**	None sampled	None sampled	A: 1-1, 3-2 C: 2-1, 3-1 E: 2-1 F: 1-2	A: 2-4, 3-4 C: 3-2 D: 1-2, 2-2, 3-1 E: 2-1, 3-4 F: 3-3 I: 2-4, 3-4, 4-4 K: 2-3, 3-2
P. pectinatus **(Sago pondweed)**	None sampled	None sampled	B: 2-1 C: 3-1 D: 2-1 E: 1-1, 2-2 F: 2-1 I: 1-1, 2-2, 3-2, 4-2 J: 2-2	B: 3-1, 4-2 C: 4-4 E: 3-1 I: 3-1, 4-4
P. gramineus **(variable pondweed)**	None sampled	None sampled	None sampled	E: 1-1
P. pulcher **(Spotted pondweed)**	None sampled	None sampled	None sampled	I: 3-1
Nuphar sp. **(Yellow pondlilly)**	E: 1-2, 2-4	E: 2-3	E: 1-4	E: 1-5, 2-4 (variegata)
Vallisneria americana **(Wild celery)**	None sampled	E: 3-1	None sampled	None sampled
Myriophyllum spicatum **(Eurasian water milfoil)**	None sampled	I: 3-1	A: 2-1, 3-3 C: 2-1, 3-1 E: 1-5, 2-5 H: 1-1 I: 1-1, 2-1, 3-2, 4-2	E: 2-2, 4-3 D: 1-1 I: 4-1
Myriophyllum heterophyllum **(Various-leaved water milfoil**	None Sampled	None Sampled	None Sampled	A: 4-2 B:4-1 C: 4-4 D: 2-1 E: 1-5, 2-5, 3-2, 4-4 I: 3-1
Heteranthera dubia **(Water stargrass)**	None sampled	None sampled	C: 3-1 I: 3-3, 4-2	None Sampled
Nasturium officianale **(watercress)**	None Sampled	None Sampled	None Sampled	E: 1-1
Bidens beckii **(Marsh marigold)**	None Sampled	None Sampled	None Sampled	E: 2-2
Hippuris vulgaris **(Common mares-tail)**	None Sampled	None Sampled	None Sampled	E: 1-2
Sparganium chlorocarpum **(Short-stemmed bur-reed)**	None Sampled	None Sampled	None Sampled	E: 1-4, 2-2
Utricularia vulgaris **(Common bladderwort)**	None Sampled	None Sampled	None Sampled	E: 1-1, 2-1
Leafy moss	None Sampled	E: 3-1	None Sampled	Observed

Table description: A through K represent transects

The number adjacent in the transect letter represents depth of observation
1. 0.0 - 0.5 meters
2. 0.5 - 1.5 meters
3. 1.5 - 3.0 meters
4. 3.0 - 6.0 meters
5. > 6.0 meters

The number nest to the dash (-) represents relative abundance
1. rare
2. occasional
3. common
4. very common
5. abundant

Example: A: 1-3, indicates transect A, from 0.0 - 0.5 meters, and the species is common

Clark Lake Aquatic Macrophyte Survey

Appendix 3 Abundance Comparison by Depth Code for 1986, 1989, 1992 and 2006 Surveys

Scientific name **(Common name)**	1 - Depth Code				2 - Depth Code				3 - Depth Code				4 - Depth Code				5 - Depth Code			
	(86)	(89)	(92)	(06)	(86)	(89)	(92)	(06)	(86)	(89)	(92)	(06)	(86)	(89)	(92)	(06)	(86)	(89)	(92)	(06)
Ceratophyllym demersum **(Coontail)**	67%	0%	0%	0%	67%	22%	0%	0%	33%	22%	0%	0%	22%	11%	0%	0%	0%	11%	0%	0%
Schoenplectus sp. **(Bulrsuh)** *(Scirpus acutus)*	56%	11%	70%	45%	22%	11%	20%	18%	0%	0%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%
Scirpus subterminalis* **(Water bulrush)**	0%	0%	0%	0%	0%	0%	0%	9%	0%	0%	0%	0%	0%	0%	0%	9%	0%	0%	0%	0%
Elodea Canadensis **(Common waterweed)**	0%	0%	0%	0%	22%	11%	0%	0%	33%	33%	20%	0%	22%	22%	20%	18%	0%	0%	0%	0%
Najas flexilis **(Bushy pondweed)**	0%	11%	0%	18%	33%	0%	50%	9%	22%	11%	20%	64%	0%	11%	0%	64%	0%	0%	0%	0%
Isoetes sp. **Quillwort**	22%	11%	0%	0%	33%	11%	0%	0%	11%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chara **(Muskgrass)**	11%	22%	80%	45%	22%	33%	70%	27%	0%	22%	20%	45%	0%	11%	0%	18%	0%	0%	0%	0%
Potamogeton zosteriformis **(Flatstem pondweed)**	11%	0%	22%	0%	22%	0%	10%	0%	11%	11%	10%	0%	0%	11%	10%	0%	0%	0%	0%	0%
P. praelongus **(Whitestem pondweed)**	22%	0%	0%	9%	11%	0%	0%	0%	22%	0%	0%	0%	11%	0%	0%	0%	0%	0%	0%	0%
P. natans **(Floating leaf pondweed)**	0%	0%	0%	0%	11%	0%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
P. richardsonii **(Clasping leaf pondweed)**	0%	11%	0%	0%	0%	33%	0%	0%	0%	66%	0%	0%	0%	78%	0%	0%	0%	0%	0%	0%
P. amplifolius **(Big leaf pomdweed)**	0%	0%	0%	0%	0%	11%	10%	0%	0%	22%	10%	9%	0%	11%	0%	0%	0%	0%	0%	0%
P. robinsii **(Fern pondweed)**	0%	0%	0%	0%	0%	0%	0%	0%	0%	11%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
P. crispus **(Curly leaf pondweed)**	0%	0%	10%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
P. illinoensis **(Illinois pondweed)**	0%	0%	20%	9%	0%	0%	20%	45%	0%	0%	20%	64%	0%	0%	0%	9%	0%	0%	0%	0%
P. pectinatus* **(Sago pondweed)**	0%	0%	0%	9%	0%	0%	0%	0%	0%	0%	0%	27%	0%	0%	0%	27%	0%	0%	0%	0%
P. gramineus* **(variable pondweed)**	0%	0%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
P. pulcher* **(Spotted pondweed)**	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%

Scientific name **(Common name)**	1 - Depth Code				2 - Depth Code				3 - Depth Code				4 - Depth Code				5 - Depth Code			
	(86)	(89)	(92)	(06)	(86)	(89)	(92)	(06)	(86)	(89)	(92)	(06)	(86)	(89)	(92)	(06)	(86)	(89)	(92)	(06)
Nuphar sp. **(Yellow pondlilly)**	11%	0%	10%	9%	11%	11%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Vallisneria americana **(Wild celery)**	0%	0%	0%	0%	0%	0%	0%	0%	0%	11%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Myriophyllum spicatum **(Eurasian water milfoil)**	0%	0%	33%	9%	0%	0%	33%	9%	0%	11%	50%	0%	0%	0%	20%	18%	0%	0%	0%	0%
Myriophyllum heterophyllum *** (Various-leaved water milfoil**	0%	0%	0%	9%	0%	0%	0%	18%	0%	0%	0%	18%	0%	0%	0%	36%	0%	0%	0%	0%
Heteranthera dubia **(Water stargrass)**	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	10%	0%	0%	0%	0%	0%
Nasturium officianale *** (watercress)**	0%	0%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bidens beckii *** (Marsh marigold)**	0%	0%	0%	0%	0%	0%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Hippuris vulgaris *** (Common mares-tail)**	0%	0%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sparganium chlorocarpum *** (Short-stemmed bur-reed)**	0%	0%	0%	9%	0%	0%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Utricularia vulgaris *** (Common bladderwort)**	0%	0%	0%	9%	0%	0%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

*** Previously unidentified in 86, 89 or 92**

Appendix 4a 2006 Aquatic Plant Frequency

Species	Total Occur.	Occurrence DepthZone1	Occurrence DepthZone2	Occurrence DepthZone3	Occurrence DepthZone4	Occurrence DepthZone5	%Freq.	%Freq. w.veg.	Relative Freq.	Freq. Zone1	Freq. Zone2	Freq. Zone3	Freq. Zone4	Freq. Zone5
Ceratophyllum demersum														
Biddens beckii	1.00		1.00				2.50%	3.13%	0.01		9.1%			
Chara sp.	14.00	4.00	3.00	5.00	2.00		35.00%	43.75%	0.16	36.4%	27.3%	45.5%	28.6%	
Elodea canadensis	1.00				1.00		2.50%	3.13%	0.01				14.3%	
Heteranthera dubia														
Hippuris vulgaris	1.00	1.00					2.50%	3.13%	0.01	9.1%				
Isoetes sp.														
Myriophyllum heterophyllum	9.00	1.00	2.00	2.00	4.00		22.50%	28.13%	0.10	9.1%	18.2%	18.2%	57.1%	
Myriophyllum spicatum	4.00	1.00	1.00		2.00		10.00%	12.50%	0.05	9.1%	9.1%		28.6%	
Najas flexilis	17.00	2.00	1.00	7.00	7.00		42.50%	53.13%	0.20	18.2%	9.1%	63.6%	100.0%	
Nasturiuim officianale	1.00	1.00					2.50%	3.13%	0.01	9.1%				
Nuphar variegata	2.00	1.00	1.00				5.00%	6.25%	0.02	9.1%	9.1%			
Potamogeton amplifolius	1.00			1.00			2.50%	3.13%	0.01			9.1%		
Potamogeton crispus	1.00	1.00					2.50%	3.13%	0.01	9.1%				
Potamogeton illinoensis	14.00	1.00	5.00	7.00	1.00		35.00%	43.75%	0.16	9.1%	45.5%	63.6%	14.3%	
Potamogeton gramineus	1.00	1.00					2.50%	3.13%	0.01	9.1%				
Potamogeton natans	1.00		1.00				2.50%	3.13%	0.01		9.1%			
Potamogeton pectinatus	6.00			3.00	3.00		15.00%	18.75%	0.07			27.3%	42.9%	
Potamogeton praelongus	1.00	1.00					2.50%	3.13%	0.01	9.1%				
Potamogeton pulcher	1.00			1.00			2.50%	3.13%	0.01			9.1%		
Potamogeton richardsonii														
Potamogeton robinsii	1.00				1.00		2.50%	3.13%	0.01				14.3%	
Potamogeton zosteriformis														
Schoenplectus acutus (Scirpus acutus)	3.00	1.00	2.00				7.50%	9.38%	0.03	9.1%	18.2%			
Scirpus subterminalis	2.00		1.00		1.00		5.00%	6.25%	0.02		9.1%		14.3%	
Sparganium chlorocarpum	2.00	1.00	1.00				5.00%	6.25%	0.02	9.1%	9.1%			
Utricularia vulgaris	2.00	1.00	1.00				5.00%	6.25%	0.02	9.1%	9.1%			
Vallisneria americana														
Totals	86.00	18.00	20.00	26.00	22.00		215.0%		1.00					

Appendix 4b 1992 Aquatic Plant Frequency

Species	Total Occur.	Occurrence DepthZone1	Occurrence DepthZone2	Occurrence DepthZone3	Occurrence DepthZone4	Occurrence DepthZone5	%Freq.	%Freq. w.veg.	Relative Freq.	Freq. Zone1	Freq. Zone2	Freq. Zone3	Freq. Zone4	Freq. Zone5
Ceratophyllum demersum														
Biddens beckii														
Chara sp.	17.00	8.00	7.00	2.00			50.00%	62.96%	0.20	80.0%	70.0%	20.0%		
Elodea canadensis	4.00			2.00	2.00		11.76%	14.81%	0.05			20.0%	50.0%	
Heteranthera dubia	3.00			2.00	1.00		8.82%	11.11%	0.04			20.0%	25.0%	
Hippuris vulgaris														
Isoetes sp.														
Myriophyllum heterophyllum														
Myriophyllum spicatum	11.00	3.00	4.00	3.00	1.00		32.35%	40.74%	0.13	30.0%	40.0%	30.0%	25.0%	
Najas flexilis	11.00		5.00	3.00	2.00	1.00	32.35%	40.74%	0.13		50.0%	30.0%	50.0%	25.0%
Nasturiuim officianale														
Nuphar variegata	1.00	1.00					2.94%	3.70%	0.01	10.0%				
Potamogeton amplifolius	2.00		1.00	1.00			5.88%	7.41%	0.02		10.0%	10.0%		
Potamogeton crispus	1.00	1.00					2.94%	3.70%	0.01	10.0%				
Potamogeton illinoensis	6.00	2.00	2.00	2.00			17.65%	22.22%	0.07	20.0%	20.0%	20.0%		
Potamogeton gramineus														
Potamogeton natans	1.00	1.00					2.94%	3.70%	0.01	10.0%				
Potamogeton pectinatus	12.00	2.00	6.00	2.00	2.00		35.29%	44.44%	0.14	20.0%	60.0%	20.0%	50.0%	
Potamogeton praelongus														
Potamogeton pulcher														
Potamogeton richardsonii														
Potamogeton robinsii														
Potamogeton zosteriformis	5.00	2.00	1.00	1.00	1.00		14.71%	18.52%	0.06	20.0%	10.0%	10.0%	25.0%	
Schoenplectus acutus (Scirpus acutus)	9.00	7.00	2.00				26.47%	33.33%	0.11	70.0%	20.0%			
Scirpus subterminalis														
Sparganium chlorocarpum														
Utricularia vulgaris														
Vallisneria americana														
Totals	83.00	27.00	28.00	18.00	9.00	1.00	244.1%		1.00					

Appendix 4c 1989 Aquatic Plant Frequency

Species	Total Occur.	Occurrence DepthZone1	Occurrence DepthZone2	Occurrence DepthZone3	Occurrence DepthZone4	Occurrence DepthZone5	%Freq.	%Freq. w.veg.	Relative Freq.	Freq. Zone1	Freq. Zone2	Freq. Zone3	Freq. Zone4	Freq. Zone5
Ceratophyllum demersum	6.00		2.00	2.00	1.00	1.00	20.00%	33.33%	0.12		22.2%	22.2%	50.0%	50.0%
Biddens beckii														
Chara sp.	8.00	2.00	3.00	2.00	1.00		26.67%	44.44%	0.16	22.2%	33.3%	22.2%	50.0%	
Elodea canadensis	5.00		1.00	3.00	1.00		16.67%	27.78%	0.10		11.1%	33.3%	50.0%	
Heteranthera dubia														
Hippuris vulgaris														
Isoetes sp.	2.00	1.00	1.00				6.67%	11.11%	0.04	11.1%	11.1%			
Myriophyllum heterophyllum														
Myriophyllum spicatum	1.00			1.00			3.33%	5.56%	0.02			11.1%		
Najas flexilis	3.00	1.00		1.00	1.00		10.00%	16.67%	0.06	11.1%		11.1%	50.0%	
Nasturiuim officianale														
Nuphar variegata	1.00		1.00				3.33%	5.56%	0.02		11.1%			
Potamogeton amplifolius	4.00		1.00	2.00	1.00		13.33%	22.22%	0.08		11.1%	22.2%	50.0%	
Potamogeton crispus														
Potamogeton illinoensis														
Potamogeton gramineus														
Potamogeton natans														
Potamogeton pectinatus														
Potamogeton praelongus														
Potamogeton pulcher														
Potamogeton richardsonii	12.00	1.00	3.00	7.00	1.00		40.00%	66.67%	0.24	11.1%	33.3%	77.8%	50.0%	
Potamogeton robinsii	1.00			1.00			3.33%	5.56%	0.02			11.1%		
Potamogeton zosteriformis	5.00			1.00	4.00		16.67%	27.78%	0.10			11.1%	200.0%	
Schoenplectus acutus (Scirpus acutus)	2.00	1.00	1.00				6.67%	11.11%	0.04	11.1%	11.1%			
Scirpus subterminalis														
Sparganium chlorocarpum														
Utricularia vulgaris														
Vallisneria americana	1.00			1.00			3.33%	5.56%	0.02			11.1%		
Totals	51.00	6.00	13.00	21.00	10.00	1.00	170.0%		1.00					

Appendix 4d 1986 Aquatic Plant Frequency

Species	Total Occur.	Occurrence DepthZone1	Occurrence DepthZone2	Occurrence DepthZone3	Occurrence DepthZone4	Occurrence DepthZone5	%Freq.	%Freq. w.veg.	Relative Freq.	Freq. Zone1	Freq. Zone2	Freq. Zone3	Freq. Zone4	Freq. Zone5
Ceratophyllum demersum	16.00	5.00	6.00	3.00	2.00		64.00%	69.57%	0.29	55.6%	66.7%	75.0%	100.0%	
Biddens beckii														
Chara sp.	3.00	1.00	2.00				12.00%	13.04%	0.05	11.1%	22.2%			
Elodea canadensis	7.00		2.00	3.00	2.00		28.00%	30.43%	0.13		22.2%	75.0%	100.0%	
Heteranthera dubia														
Hippuris vulgaris														
Isoetes sp.	6.00	2.00	3.00	1.00			24.00%	26.09%	0.11	22.2%	33.3%	25.0%		
Myriophyllum heterophyllum														
Myriophyllum spicatum														
Najas flexilis	5.00		3.00	2.00			20.00%	21.74%	0.09		33.3%	50.0%		
Nasturiuim officianale														
Nuphar variegata	2.00	1.00	1.00				8.00%	8.70%	0.04	11.1%	11.1%			
Potamogeton amplifolius														
Potamogeton crispus														
Potamogeton illinoensis														
Potamogeton gramineus														
Potamogeton natans	1.00		1.00				4.00%	4.35%	0.02		11.1%			
Potamogeton pectinatus														
Potamogeton praelongus	6.00	2.00	1.00	2.00	1.00		24.00%	26.09%	0.11	22.2%	11.1%	50.0%	50.0%	
Potamogeton pulcher														
Potamogeton richardsonii														
Potamogeton robinsii														
Potamogeton zosteriformis	4.00	1.00	2.00	1.00			16.00%	17.39%	0.07	11.1%	22.2%	25.0%		
Schoenplectus acutus (Scirpus acutus)	6.00	5.00	1.00				24.00%	26.09%	0.11	55.6%	11.1%			
Scirpus subterminalis														
Sparganium chlorocarpum														
Utricularia vulgaris														
Vallisneria americana														
Totals	56.00	17.00	22.00	12.00	5.00		224.0%		1.00					

Appendix 5a 2006 Aquatic Plant Density

Species	Total Density	Density DepthZone1	Density DepthZone2	Density DepthZone3	Density DepthZone4	Density DepthZone5	Mean Density	MeanDens. w.pres.	Relative Density	Density Zone1	Density Zone2	Density Zone3	Density Zone4	Density Zone5
Ceratophyllum demersum														
Biddens beckii	2.00		2.00				0.05	2.00	0.01		0.18			
Chara sp.	38.00	10.00	11.00	13.00	4.00		0.95	2.71	0.18	0.91	1.00	1.18	0.57	
Elodea canadensis	2.00				2.00		0.05	2.00	0.01				0.29	
Heteranthera dubia														
Hippuris vulgaris	2.00	2.00					0.05	2.00	0.01	0.18				
Isoetes sp.														
Myriophyllum heterophyllum	25.00	5.00	6.00	3.00	11.00		0.63	2.78	0.12	0.45	0.55	0.27	1.57	
Myriophyllum spicatum	7.00	1.00	2.00		4.00		0.18	1.75	0.03	0.09	0.18		0.57	
Najas flexilis	43.00	5.00	1.00	16.00	21.00		1.08	2.53	0.20	0.45	0.09	1.45	3.00	
Nasturiuim officianale	1.00	1.00					0.03	1.00	0.00	0.09				
Nuphar variegata	9.00	5.00	4.00				0.23	4.50	0.04	0.45	0.36			
Potamogeton amplifolius	3.00			3.00			0.08	3.00	0.01			0.27		
Potamogeton crispus	1.00	1.00					0.03	1.00	0.00	0.09				
Potamogeton illinoensis	40.00	2.00	14.00	20.00	4.00		1.00	2.86	0.19	0.18	1.27	1.82	0.57	
Potamogeton gramineus	1.00	1.00					0.03	1.00	0.00	0.09				
Potamogeton natans	1.00		1.00				0.03	1.00	0.00		0.09			
Potamogeton pectinatus	13.00			3.00	10.00		0.33	2.17	0.06			0.27	1.43	
Potamogeton praelongus	1.00	1.00					0.03	1.00	0.00	0.09				
Potamogeton pulcher	1.00			1.00			0.03	1.00	0.00			0.09		
Potamogeton richardsonii														
Potamogeton robinsii	1.00				1.00		0.03	1.00	0.00				0.14	
Potamogeton zosteriformis														
Schoenplectus acutus (Scirpus acutus)	9.00	2.00	7.00				0.23	3.00	0.04	0.18	0.64			
Scirpus subterminalis	5.00		1.00		4.00		0.13	2.50	0.02		0.09		0.57	
Sparganium chlorocarpum	6.00	4.00	2.00				0.15	3.00	0.03	0.36	0.18			
Utricularia vulgaris	2.00	1.00	1.00				0.05	1.00	0.01	0.09	0.09			
Vallisneria americana														
Totals	213.00	41.00	52.00	59.00	61.00		5.33	44.80	1.00	3.73	4.73	5.36	8.71	

Appendix 5b 1992 Aquatic Plant Density

Species	Total Density	Density DepthZone1	Density DepthZone2	Density DepthZone3	Density DepthZone4	Density DepthZone5	Mean Density	MeanDens. w.pres.	Relative Density	Density Zone1	Density Zone2	Density Zone3	Density Zone4	Density Zone5
Ceratophyllum demersum														
Biddens beckii														
Chara sp.	32.00	14.00	15.00	3.00			0.94	1.88	0.24	1.40	1.50	0.30		
Elodea canadensis	8.00			3.00	5.00		0.24	2.00	0.06			0.30	1.25	
Heteranthera dubia	6.00			4.00	2.00		0.18	2.00	0.05			0.40	0.50	
Hippuris vulgaris														
Isoetes sp.														
Myriophyllum heterophyllum														
Myriophyllum spicatum	23.00	7.00	8.00	6.00	2.00		0.68	2.09	0.17	0.70	0.80	0.60	0.50	
Najas flexilis	12.00		6.00	3.00	2.00	1.00	0.35	1.09	0.09		0.60	0.30	0.50	1.00
Nasturiuim officianale														
Nuphar variegata	4.00	4.00					0.12	4.00	0.03	0.40				
Potamogeton amplifolius	2.00		1.00	1.00			0.06	1.00	0.02		0.10	0.10		
Potamogeton crispus	1.00	1.00					0.03	1.00	0.01	0.10				
Potamogeton illinoensis	8.00	3.00	2.00	3.00			0.24	1.33	0.06	0.30	0.20	0.30		
Potamogeton gramineus														
Potamogeton natans	1.00	1.00					0.03	1.00	0.01	0.10				
Potamogeton pectinatus	16.00	2.00	9.00	3.00	2.00		0.47	1.33	0.12	0.20	0.90	0.30	0.50	
Potamogeton praelongus														
Potamogeton pulcher														
Potamogeton richardsonii														
Potamogeton robinsii														
Potamogeton zosteriformis	9.00	4.00	3.00	1.00	1.00		0.26	1.80	0.07	0.40	0.30	0.10	0.25	
Schoenplectus acutus (Scirpus acutus)	11.00	9.00	2.00				0.32	1.22	0.08	0.90	0.20			
Scirpus subterminalis														
Sparganium chlorocarpum														
Utricularia vulgaris														
Vallisneria americana														
Totals	133.00	45.00	46.00	27.00	14.00	1.00	3.91	21.75	1.00	4.50	4.60	2.70	3.50	1.00

Appendix 5c 1989 Aquatic Plant Density

Species	Total Density	Density DepthZone1	Density DepthZone2	Density DepthZone3	Density DepthZone4	Density DepthZone5	Mean Density	MeanDens. w.pres.	Relative Density	Density Zone1	Density Zone2	Density Zone3	Density Zone4	Density Zone5
Ceratophyllum demersum	14.00		5.00	5.00	3.00	1.00	0.47	2.33	0.17		2.50	0.56	1.50	1.00
Biddens beckii														
Chara sp.	15.00	3.00	5.00	4.00	3.00		0.50	1.88	0.18	0.33	2.50	0.44	1.50	
Elodea canadensis	10.00		2.00	5.00	3.00		0.33	2.00	0.12		1.00	0.56	1.50	
Heteranthera dubia														
Hippuris vulgaris														
Isoetes sp.	4.00	3.00	1.00				0.13	2.00	0.05	0.33	0.50			
Myriophyllum heterophyllum														
Myriophyllum spicatum	1.00			1.00			0.03	1.00	0.01			0.11		
Najas flexilis	6.00	1.00		1.00	4.00		0.20	2.00	0.07	0.11		0.11	2.00	
Nasturiuim officianale														
Nuphar variegata	3.00		3.00				0.10	3.00	0.04		1.50			
Potamogeton amplifolius	7.00		2.00	3.00	2.00		0.23	1.75	0.08		1.00	0.33	1.00	
Potamogeton crispus														
Potamogeton illinoensis														
Potamogeton gramineus														
Potamogeton natans														
Potamogeton pectinatus														
Potamogeton praelongus														
Potamogeton pulcher														
Potamogeton richardsonii	14.00	1.00	4.00	8.00	1.00		0.47	1.17	0.17	0.11	2.00	0.89	0.50	
Potamogeton robinsii	1.00			1.00			0.03	1.00	0.01			0.11		
Potamogeton zosteriformis	3.00			1.00	2.00		0.10	0.60	0.04			0.11	1.00	
Schoenplectus acutus (Scirpus acutus)	5.00	2.00	3.00				0.17	2.50	0.06	0.22	1.50			
Scirpus subterminalis														
Sparganium chlorocarpum														
Utricularia vulgaris														
Vallisneria americana	1.00			1.00			0.03	1.00	0.01			0.11		
Totals	84.00	10.00	25.00	30.00	18.00	1.00	2.80	22.23	1.00	1.11	12.50	3.33	9.00	1.00

Appendix 5d 1986 Aquatic Plant Density

Species	Total Density	Density DepthZone1	Density DepthZone2	Density DepthZone3	Density DepthZone4	Density DepthZone5	Mean Density	MeanDens. w.pres.	Relative Density	Density Zone1	Density Zone2	Density Zone3	Density Zone4	Density Zone5
Ceratophyllum demersum	36.00	9.00	13.00	10.00	4.00		1.44	2.25	0.35	1.00	6.50	2.50	2.00	
Biddens beckii														
Chara sp.	3.00	1.00	2.00				0.12	1.00	0.03	0.11	1.00			
Elodea canadensis	10.00		4.00	4.00	2.00		0.40	1.43	0.10		2.00	0.44	1.00	
Heteranthera dubia														
Hippuris vulgaris														
Isoetes sp.	11.00	6.00	4.00	1.00			0.44	1.83	0.11	0.67	2.00	0.11		
Myriophyllum heterophyllum														
Myriophyllum spicatum														
Najas flexilis	10.00		6.00	4.00			0.40	2.00	0.10		3.00	0.44		
Nasturiuim officianale														
Nuphar variegata	6.00	2.00	4.00				0.24	3.00	0.06	0.22	2.00			
Potamogeton amplifolius														
Potamogeton crispus														
Potamogeton illinoensis														
Potamogeton gramineus														
Potamogeton natans	2.00		2.00				0.08	2.00	0.02		1.00			
Potamogeton pectinatus														
Potamogeton praelongus	6.00	2.00	1.00	2.00	1.00		0.24	1.00	0.06	0.22	0.50	0.22	0.50	
Potamogeton pulcher														
Potamogeton richardsonii														
Potamogeton robinsii														
Potamogeton zosteriformis	8.00	1.00	4.00	3.00			0.32	2.00	0.08	0.11	2.00	0.33		
Schoenplectus acutus (Scirpus acutus)	12.00	7.00	5.00				0.48	2.00	0.12	0.78	2.50			
Scirpus subterminalis														
Sparganium chlorocarpum														
Utricularia vulgaris														
Vallisneria americana														
Totals	104.00	28.00	45.00	24.00	7.00		4.16	18.51	1.00	3.11	22.50	4.06	3.50	

Appendix 6 Dominance Values				
Species	**2006**	**1992**	**1989**	**1986**
Ceratophyllum demersum			0.28	0.63
Biddens beckii	0.02			
Chara sp.	0.34	0.45	0.34	0.08
Elodea canadensis	0.02	0.11	0.22	0.22
Heteranthera dubia		0.08		
Hippuris vulgaris	0.02			
Isoetes sp.			0.09	0.21
Myriophyllum heterophyllum	0.22			
Myriophyllum spicatum	0.08	0.31	0.03	
Najas flexilis	0.40	0.22	0.13	0.19
Nasturiuim officianale	0.02			
Nuphar variegata	0.07	0.04	0.06	0.09
Potamogeton amplifolius	0.03	0.04	0.16	
Potamogeton crispus	0.02	0.02		
Potamogeton illinoensis	0.35	0.13		
Potamogeton gramineus	0.02			
Potamogeton natans	0.02	0.02		0.04
Potamogeton pectinatus	0.13	0.26		
Potamogeton praelongus	0.02			0.16
Potamogeton pulcher	0.02			
Potamogeton richardsonii			0.40	
Potamogeton robinsii	0.02		0.03	
Potamogeton zosteriformis		0.13	0.13	0.15
Schoenplectus acutus (Scirpus acutus)	0.08	0.19	0.10	0.22
Scirpus subterminalis	0.05			
Sparganium chlorocarpum	0.05			
Utricularia vulgaris	0.03			
Vallisneria americana			0.03	
Total	2.00	2.00	2.00	2.00

Appendix 7 Transect Sampling SItes						
Projection: NAD 83 HARN Wisconsin Transverse Mercator and Lat/Long						
Site ID	Transect ID	Lat	Long	X	Y	DEPTH (ft)
4	E	44.950	-87.214	739801.12	501150.93	1.5
6	E	44.949	-87.213	739819.30	501099.08	2.5
10	E	44.948	-87.212	739905.68	500952.03	4
17	E	44.946	-87.211	740036.41	500715.17	11
28	H	44.943	-87.204	740584.97	500402.56	1
30	H	44.942	-87.204	740601.93	500344.86	3
33	H	44.941	-87.203	740655.29	500255.12	6
37	C	44.937	-87.199	740993.71	499806.32	3
41	C	44.937	-87.200	740901.76	499796.23	7
44	C	44.937	-87.203	740688.35	499750.77	12
46	D	44.937	-87.199	741029.40	499814.02	1.5
47	D	44.937	-87.198	741042.69	499807.66	4
48	D	44.936	-87.196	741259.03	499664.76	6
49	F	44.937	-87.186	742021.07	499768.27	1.5
50	F	44.937	-87.188	741884.73	499763.25	2.8
51	F	44.937	-87.195	741288.68	499759.78	5.5
52	G	44.931	-87.194	741436.93	499128.82	1.5
53	G	44.933	-87.195	741298.77	499358.99	3
54	G	44.934	-87.196	741253.86	499435.91	7
55	A	44.937	-87.212	739952.76	499753.82	1.5
56	A	44.937	-87.212	740014.99	499764.91	4.7
57	A	44.937	-87.211	740084.70	499771.92	9.1
58	A	44.937	-87.210	740099.82	499784.91	12
59	I	44.928	-87.212	739982.67	498784.11	1.5
60	I	44.929	-87.212	740010.17	498816.64	4
61	I	44.930	-87.211	740098.16	498939.39	7.5
62	I	44.934	-87.209	740242.68	499386.04	10
64	B	44.928	-87.210	740164.73	498779.86	12.7
63	B	44.926	-87.209	740245.23	498568.85	7
65	B	44.930	-87.208	740334.06	498917.67	1.5
66	B	44.931	-87.207	740381.56	499083.74	4
67	J	44.926	-87.207	740374.10	498555.37	1.5
68	J	44.927	-87.208	740358.95	498635.28	4.2
69	J	44.931	-87.208	740289.37	499055.33	12.7
70	K	44.945	-87.215	739675.86	500665.85	1.5
71	K	44.945	-87.215	739718.09	500622.28	3.6
72	K	44.944	-87.212	739936.98	500544.25	7.7
73	K	44.944	-87.211	740022.37	500546.03	13

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