# The Aquatic Plant Community in Wolf Lake, Portage County 2001

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## EXECUTIVE SUMMARY


Wolf Lake is an oligotrophic/mesotrophic lake with good water quality and water clarity. The lake is well protected by a buffer of natural shoreline.

The aquatic plant community in Wolf Lake is of below average quality for Wisconsin lakes and is characterized by an average diversity and a greater than average tolerance to disturbance. There was evidence that the lake may experience fluctuating water levels, which may be the cause of the disturbance.

Aquatic plants occurred throughout Wolf Lake to a maximum depth of 12 feet, the most abundant plant growth occurred in the 1.5-5 ft. depth zone. *Najas flexilis* is the dominant species within the plant community; *Potamogeton zosteriformis* was sub-dominant..

**Recommendations**
To protect the aquatic plant community that plays a key role in protecting water quality and providing habitat:
1) Protect the submerged plant communities.
2) Designate sensitive areas that support the plant communities most important to providing habitat and other water quality benefits (Figure 10).
3) Preserve the natural buffer zones of shoreline. Native vegetation reduces run-off into the lake and filters the run-off that does enter the lake.
4) Designate the lake as a no-gas motor lake due to its small size and shallow depths.


## I. INTRODUCTION

A study of the aquatic macrophytes (plants) in Wolf Lake was conducted during August 2001 by Water Resources staff of the West Central Region and Central Wisconsin Basin - Department of Natural Resources (DNR). This was the first quantitative vegetation study of Wolf Lake by the DNR.

A study of the diversity, density, and distribution of aquatic plants is an essential component of understanding a lake due to the important ecological role of aquatic vegetation and the ability of the vegetation to characterize the water quality (Dennison et al. 1993).

**Ecological Role:** All other life in the lake depends on the plant life (including algae) - the beginning of the food chain. Aquatic plants provide food and shelter for fish, wildlife, and the invertebrates that in turn provide food for other organisms. Plants improve water quality, protect shorelines and lake bottoms, add to the aesthetic quality of the lake and impact recreation.

**Characterize Water Quality:** Aquatic plants serve as indicators of water quality because of their sensitivity to water quality parameters, such as water clarity and nutrient levels (Dennison et. al. 1993).

The present study will provide information that is important for effective management of the lake including: fish habitat improvement, protection of sensitive wildlife areas, aquatic plant management, and water resource regulations. The baseline data that it provides will be compared to future macrophyte inventories and offer insight into any changes occurring in the lake.

**Background and History:** Wolf Lake is a 22-acre, hard water, seepage lake in southeast Portage County, Wisconsin. Wolf Lake has a maximum depth of 17 feet and an average depth is 8 feet. There is a County Park on the east shore.

## II.METHODS

**Field Methods**

The study design was based primarily on the rake-sampling method developed by Jessen and Lound (1962), using stratified random placement of the transect lines.

The shoreline was divided into 8 equal segments and a transect, perpendicular to the shoreline, was randomly placed within each segment (Appendix IV), using a random numbers table.

One sampling site was randomly located in each depth zone (0-1.5 ft., 1.5-5 ft., 5-10ft. and 10-20 ft.) along each transect. Using a long-handled, steel, thatching rake, four rake samples were taken at each sampling site. The four samples were taken from each quarter of a 6-foot diameter quadrat. The aquatic plant species that were present on each rake sample were recorded. Each species was given a density rating (0-5) based on the number of rake samples on which it was present at each sampling site.
A rating of 1 indicates that a species was present on one rake sample
a rating of 2 indicates that a species was present on two rake samples
a rating of 3 indicates that it was present on three rake samples
a rating of 4 indicates that it was present on all four rake samples
a rating of 5 indicates that a species was abundantly present on all rake samples at that sampling site.)

The sediment type at each sampling site was recorded. Visual inspection and periodic samples were taken between transect lines in order to record the presence of any species that did not occur at the sampling sites. Specimens of all plant species present were collected and saved in a cooler for later preparation of voucher specimens. Nomenclature was according to Gleason and Cronquist (1991).

The type of shoreline cover was recorded at each transect. A section of shoreline, 50 feet on either side of the transect intercept with the shore and 30 feet back from the shore, was evaluated. The percentage of each cover type within this 100' x 30' rectangle was visually estimated and verified by a second researcher.

**Data Analysis**

The percent frequency of each species was calculated (number of sampling sites at which it occurred / total number of sampling sites) (Appendix I). Relative frequency was calculated based on the number of occurrences of a species relative to total occurrence of all species (Appendix I). The mean density was calculated for each species (sum of a species' density ratings / number of sampling sites) (Appendix II). Relative density was calculated based on a species density relative to total plant densities. A "mean density where present" was calculated for each species (sum of a species' density ratings / number of sampling sites at which the species occurred) (Appendix II). The relative frequency and relative density was summed to obtain a dominance value (Appendix III). Species diversity was measured by calculating Simpson's Diversity Index (Appendix I).

## III. RESULTS

### PHYSICAL DATA

**WATER QUALITY** - The trophic state of a lake is an indication of its water quality. Phosphorus concentration, chlorophyll concentration, and water clarity data are collected and combined to determine the trophic state.

Eutrophic lakes are high in nutrients and therefore support a large biomass. Oligotrophic lakes are low in nutrients and support limited plant growth and smaller fish populations. Mesotrophic lakes have intermediate levels of nutrients and biomass.

**Nutrients**

Phosphorus is a limiting nutrient in many Wisconsin lakes and is measured as an indication of the nutrient level in a lake. Increases in phosphorus in a lake can feed algae blooms and, occasionally, excess plant growth.

**2001 mean summer phosphorus in Wolf Lake was 17ug/l**

This level of phosphorus in Wolf Lake was indicative of a mesotrophic lake (Table 1).

**Table 1. Trophic Status**

| | Quality Index | Phosphorus ug/l | Chlorophyll ug/l | Secchi Disc ft. |
|---|---|---|---|---|
| Oligotrophic | Excellent | <1 | <1 | > 19 |
| | Very Good | 1-10 | 1-5 | 8-19 |
| Mesotrophic | Good | 10-30 | 5-10 | 6-8 |

| | | | | |
|---|---|---|---|---|
| | Fair | 30-50 | 10-15 | 5-6 |
| Eutrophic | Poor | 50-150 | 15-30 | 3-4 |
| Hypereutrophic | Very Poor | >150 | >30 | >3 |
| Wolf Lake | Very Good | 17 | 2.1 | 11.3 |

After Lillie & Mason (1983) & Shaw et. al. (1993)

**Algae**

Measuring the level of chlorophyll in the water gives an indication of algae concentrations. Algae are natural and essential in lakes, but high algae levels can cause problems, increasing the turbidity and reducing the light available for plant growth.
**2001 mean summer chlorophyll in Wolf Lake was 2.1 ug/l.**
The chlorophyll concentration in Wolf Lake indicates that it was an oligotrophic lake (Table 1).

**Water Clarity**

Water clarity is a critical factor for plants. When plants receive less than 1 - 2% of the surface illumination, they can not survive. Water clarity is reduced by turbidity (suspended materials such as algae and silt) and dissolved organic chemicals that color the water. Water clarity is measured with a Secchi disc that shows the combined effect of turbidity and color.
**2001 Mean summer Secchi disc clarity was 11.3 ft.**
Water clarity indicates (Table 1) that Wolf Lake was an oligotrophic lake with very good clarity.

Secchi disc readings can be used to calculate a predicted maximum rooting depth for plants in the lake (Dunst 1982).
**Based on the 2001 mean Secchi disc clarity, the predicted maximum rooting depth in Wolf Lake would be 16.5 ft.**

**LAKE MORPHOMETRY** - The morphometry of a lake is an important factor in determining the distribution of aquatic plants. Duarte and Kalff (1986) found that the slope of the littoral zone could explain 72% of the observed variability in the growth of submerged plants. Gentle slopes support more plant growth than steep slopes (Engel 1985).

Wolf Lake has a gradually sloped littoral zone (Appendix IV). The shallow depths in a large portion of the lake and the gradually sloped littoral zone would favor plant growth.

**SEDIMENT COMPOSITION** – Marl was the predominant sediment in Wolf Lake, especially in the 0-10 ft. depth zone (Table 2).

Marl mixed with silt was commonly encountered, especially in the deeper zones (Table 2).

**Table 2. Sediment Composition**

| Sediment Type | | 0-1.5' Depth | 1.5-5' Depth | 5-10' Depth | 10-20' Depth | Percent of all Sample Sites |
|---|---|---|---|---|---|---|
| Soft Sediments | Marl | 62% | 62% | 67% | 25% | 58% |
| | Marl/Silt | 12% | 25% | 17% | 75% | 27% |
| Mixed Sediments | Marl/Sand | 12% | 12% | 17% | | 12% |
| Sediments | Sand | 12% | | | | 4% |

**SHORELINE LAND USE** – Land use practices strongly impact the aquatic plant community and, therefore, the entire aquatic community. These practices can directly impact the plant community through increased sedimentation from erosion, increased nutrient input from fertilizer run-off and soil erosion and increased toxics from farmland and urban run-off.

Natural shoreline occurred at all of the sample sites. Native herbaceous growth and bare sand were the most frequently encountered shoreline cover at the transects; found at all transects. Native herbaceous growth also had the highest mean coverage (Table 3).

**Table 3. Shoreline Land Use**

| Cover Type | | Frequency of Occurrences at Transects | Mean % Coverage |
|---|---|---|---|
| Natural Shoreline | Wooded | 38% | 4% |
| | Native Herbaceous | 100% | 64% |
| | Bare Sand | 100% | 32% |
| Disturbed Shoreline | Cultivated Lawn | | |
| | Hard Structures | | |

## MACROPHYTE DATA
### SPECIES PRESENT

Of the 11 species of aquatic plants found in Wolf Lake, 1 was an emergent species and 10 were submergent species (Table 4). No non-native species, threatened or endangered species were found.

**Table 4. Wolf Lake Aquatic Plant Species**

| Scientific Name | Common Name | I. D. Code |
|---|---|---|
| **Emergent Species** | | |
| 1) *Scirpus validus* Vahl. | softstem bulrush | sciva |
| **Submergent Species** | | |
| 2) *Chara* sp. | muskgrass | chasp |
| 3) *Elodea canadensis* Michx. | common waterweed | eloca |
| 4) *Myriophyllum sibiricum* Komarov. | common watermilfoil | myrsi |
| 5) *Najas flexilis* (Willd.) Rostkov and Schmidt. | slender naiad | najfl |
| 6) *Nitella* sp. | nitella | nitsp |
| 7) *Potamogeton illinoensis* Morong. | Illinois pondweed | potil |
| 8) *Potamogeton natans* L. | floating-leaf pondweed | potna |
| 9) *Potamogeton oakesianus* Robbins. | Oakes pondweed | potoa |
| 10) *Potamogeton pectinatus* L. | sago pondweed | potpe |
| 11) *Potamogeton zosteriformis* Fern. | flatstem pondweed | potzo |

### FREQUENCY OF OCCURRENCE

*Najas flexilis* was the most frequently occurring species in Wolf Lake (92% of sample sites) (Figure 1). *Chara* sp., *Potamogeton illinoensis, P natans* and *P. zosteriformis* were also commonly occurring species, (42%, 27%, 31% and 50%).

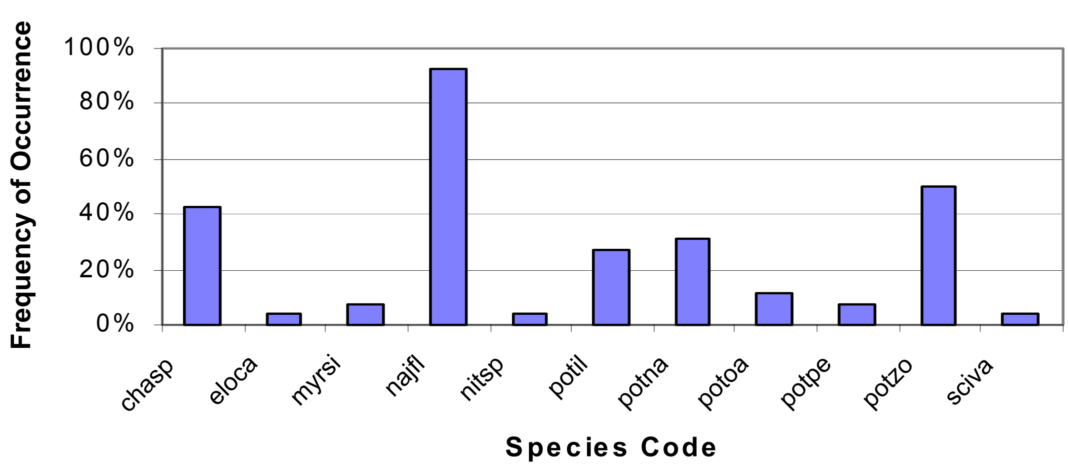


**Figure 1. Aquatic plant frequencies in Wolf Lake, 2001**

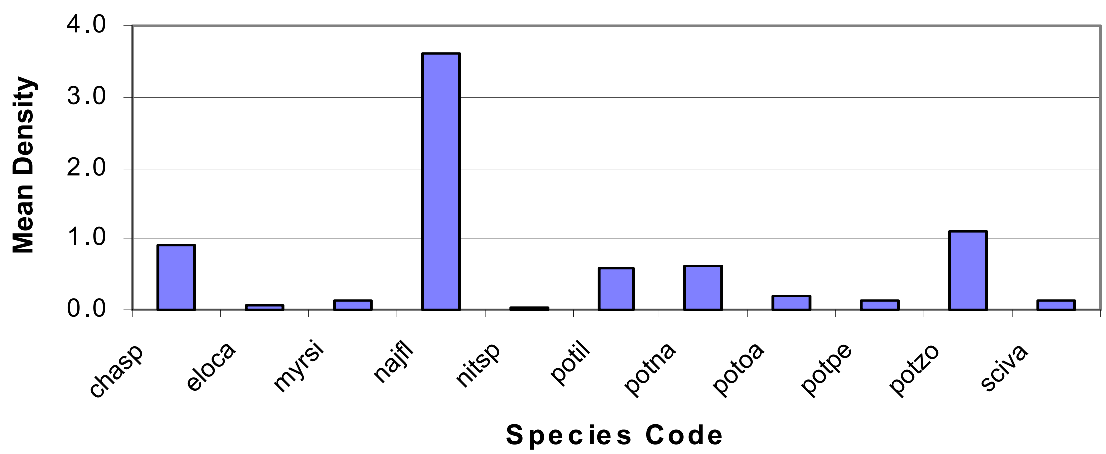
Filamentous algae occurred at none of the sample sites.

**DENSITY**

*Najas flexilis* was also the species with the highest mean density (3.62 on a density scale of 0-4) in Wolf Lake (Figure 2).

*Najas flexilis* had a "mean density where present" of 3.92. Its "mean density where present" indicates that *N. flexilis* exhibitied a dense growth form in Wolf Lake (Appendix II). The other species in Wolf Lake that had a "density where present" of 2.5 or more, indicating that it grew at above average density, was *Scirpus validus* (3.0) but occurred at only one site.

**Figure 2. Densities of aquatic plants in Wolf Lake, 2001**




**DOMINANCE**

Combining relative frequency and relative density into a Dominance Value indicates how dominant a species is within the macrophyte community (Appendix III). Based on the Dominance Value, *Najas flexilis* was the dominant plant species in Wolf Lake (Figure 3). *Potamogeton zosteriformis* was sub-dominant.

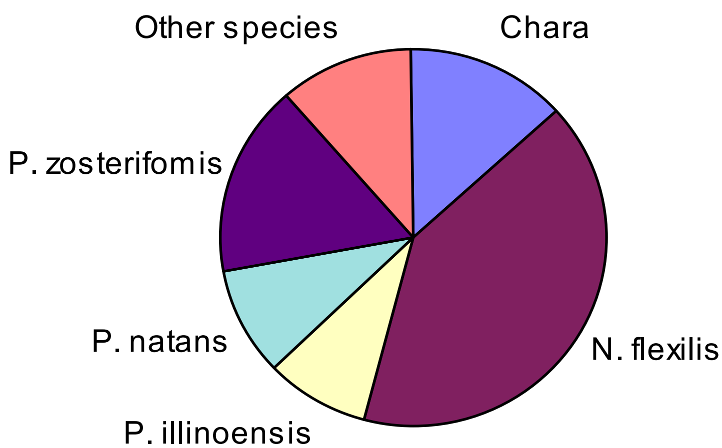



**Figure 3. Dominance within the macrophyte community, of the most prevalent macrophytes in Wolf Lake, 2001.**

*Najas flexilis* was the most frequent and the most dense species in the 0-10ft depth zone (Appendix I, II). *N. flexilis* occurred at its highest frequency and density in the 1.5-10 ft. depth zone (Figure 4, 5).

*Potamogeton zosteriformis,* the sub-dominant species, was the most frequent and dense species in the 10-15ft depth zone (Appendix I, II) and occurred at its highest frequency and density in the 10-15ft depth zone (Figure 4, 5). The frequency and density of *P. zosteriformis* declined noticeably in the shallower depth zones.

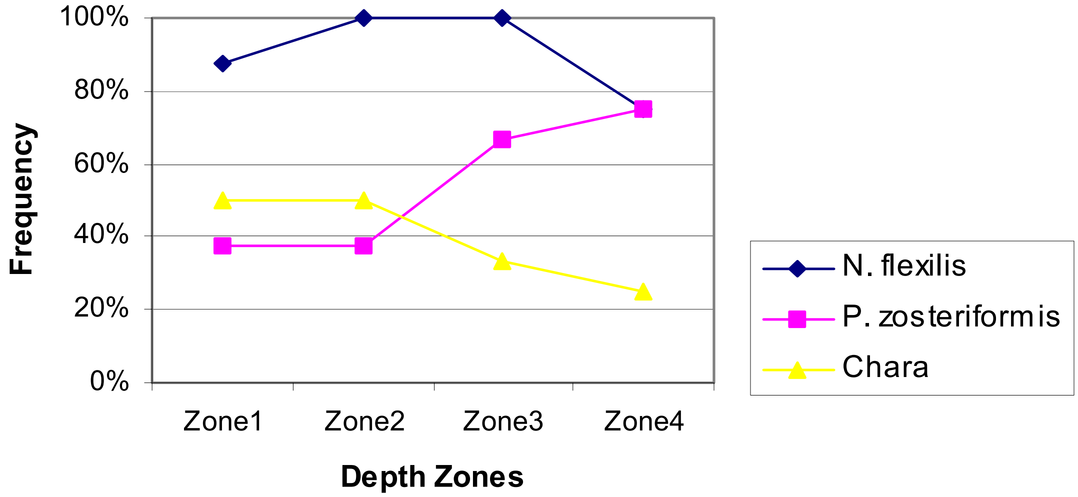
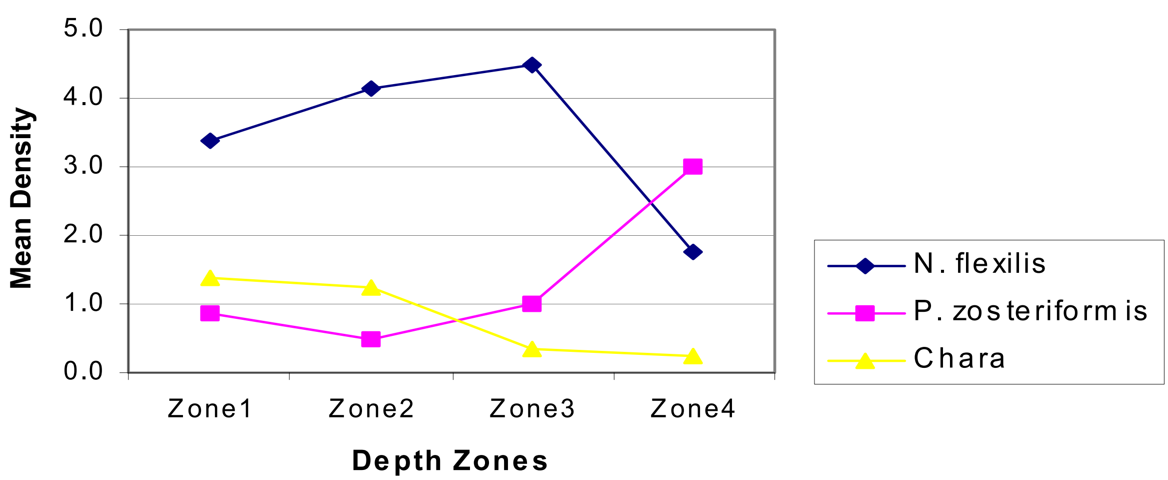



**Figure 4. Frequency of occurrence of the most prevalent macrophytes in Wolf Lake, by depth zone.**
**Figure 5. Density of the most prevalent macrophytes in Wolf Lake, by depth zone.**

**DISTRIBUTION**
Aquatic macrophytes occurred throughout Wolf Lake to a maximum rooting depth of 12 feet and the most prevalent species were distributed throughout the lake. 92% of the sampling sites were vegetated with rooted aquatic macrophytes.

The dominant plant species, *Najas flexilis* and *Potamogeton zosteriformis,* occurred at the maximum rooting depth. The maximum rooting depth of 12 feet is less than the predicted rooting depth of 16.5 feet, based on water clarity.

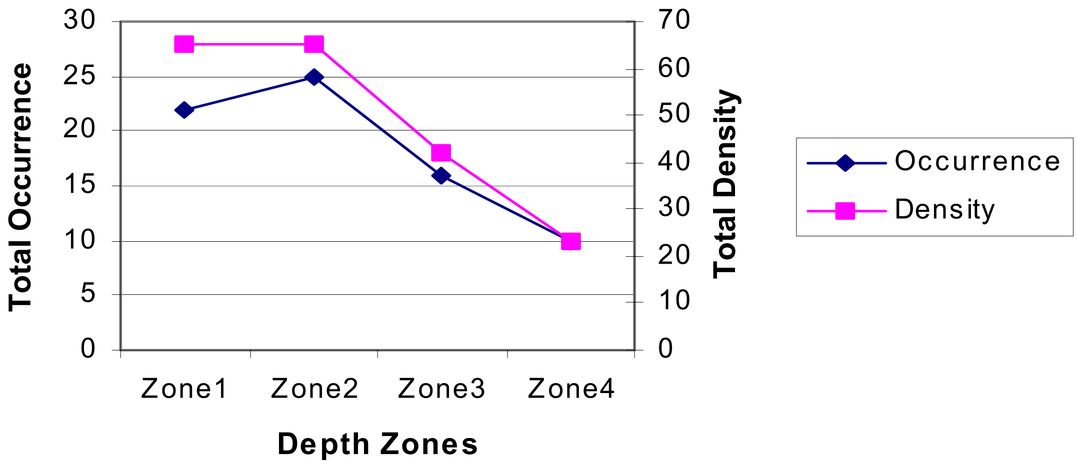
It appeared that the water level in Wolf Lake was low during the time of the survey. *Scirpus validus* was found rooted in the water only in the northwest corner of the lake. However, *S.*



*validus*, formed a nearly continuous ring around the lake on higher ground.

The 1.5-5ft depth zone supported the greatest amount of plant growth. The highest total occurrence and total density of plant growth was recorded in the 1.5-5 ft. depth zone (Figure 6). The highest percent of vegetated sites was in the 1.5-10 ft depth zone and the greatest mean number of species per site was found in the 1.5-5 ft zone (Figure 7).

**Figure 6. Total occurrence and density of plants by depth zone.**



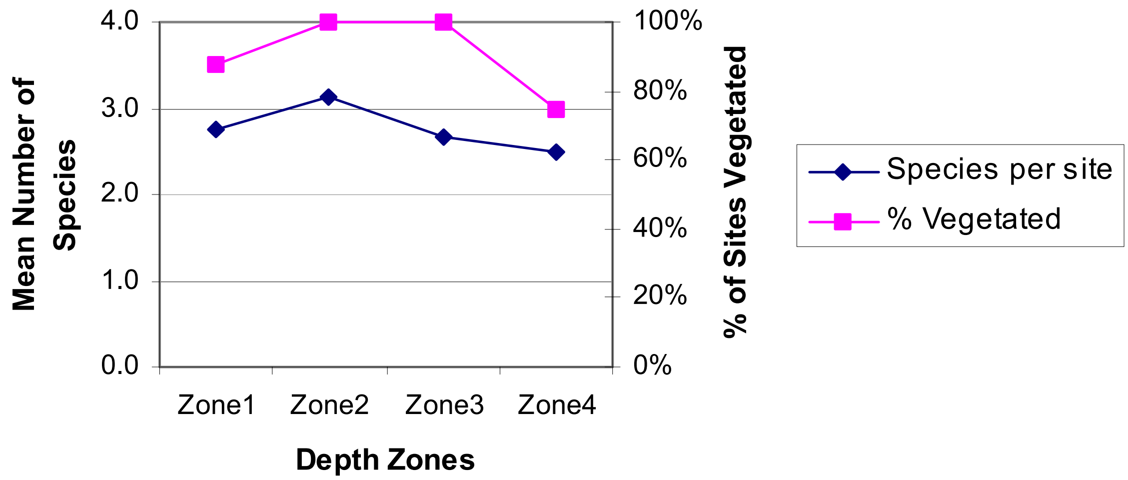



**Figure 7. Percentage of vegetated site and mean number of plant species per site in Wolf Lake, by depth zone.**

The mean number of species found at each sampling sites was 2.8
2 sites had 0 species
1 sites had 1 species
4 sites had 2 species
14 sites had 3 species
3 sites had 4 species
2 sites had 5 species

**INFLUENCE OF SEDIMENT** – Many species of plants depend on the sediment in which they are rooted for their nutrients. The richness or sterility and texture of the sediment will determine the type and abundance of macrophyte species that can survive in a location.

Marl was the predominant sediment found in Wolf Lake. All of the sites with marl sediment and sand/marl mixtures were vegetated (Table 5). Silt/marl sediments also supported a high percentage of vegetated sites. The availability of mineral nutrients for growth is highest in sediments of intermediate density, such as silt (Barko and Smart 1986).

Sand, a high density sediment, did not support vegetation at the study sites in Wolf Lake.

**Table 5. Sediment Influence**

| Sediment Type | | Percent of all Sample Sites | Percent Vegetated |
|---|---|---|---|
| **Soft Sediments** | Marl | 58% | 100% |
| | Marl/Silt | 27% | 86% |
| **Mixed Sediments** | Marl/Sand | 12% | 100% |
| **Hard Sediments** | Sand | 4% | 0% |

**THE COMMUNITY**

Simpson's Diversity Index was 0.81, indicating an average diversity in the plant community. A rating of 1.0 would mean that each plant in the lake was a different species (the most diversity achievable).

The Aquatic Macrophyte Community Index (AMCI) developed by Weber et. al. (1995) was applied to Wolf Lake (Table 6). Values between 0 and 10 are given for each of six parameters that characterize the plant community. The highest value for this index is 60. The AMCI for Wolf Lake is 32. This is below the average (40) for lakes in Wisconsin.

**Table 6. Aquatic Macrophyte Community Index**

| Parameters | | Value |
|---|---|---|
| Maximum Rooting Depth | 3.6 meters | 6 |
| % Littoral Zone Vegetated | 92% | 10 |
| Simpson's Diversity | 0.81 | 8 |
| # of Species | 11 (no exotics) | 4 |
| % Submergent Species | 99% Rel. Freq. | 4 |
| % Sensitive Species | 4% Relative Freq. | 0 |
| Totals | | 32 |

Nichols (1998) recently outlined a method for evaluating the plant community in a lake with regard to its disturbance tolerance.

A coefficient of conservatism (C) is an assigned value, 0-10, the probability that a plant species will occur in an undisturbed habitat. The Average Coefficient of Conservatism for the plant community is the mean of the Coefficients of Conservatism for each species found in a lake.

The Floristic Quality (FQI) is calculated from the Coefficient of Conservatism and is a measure of a plant community's closeness to an undisturbed condition.

When Nichols applied this metric to a sample of 554 lakes throughout Wisconsin, the Average Coefficient of Conservatism for all Wisconsin lakes ranged from a low of 2.0 (the most disturbance tolerant) to a high of 9.5 (least disturbance tolerant). The mean value was 6.0 and values above 6.9 were in the upper quartile (Table 7).

The lowest Floristic Quality was 3.0 (the most disturbance tolerant), the mean value was 22.2, and the high was 44.6 (the least disturbed). Values greater than 27.5 were within the upper quartile (Table 7).

In the North Central Hardwoods Region (NCHR), the region in which Wolf Lake is located, the Average Coefficient of Conservatism lower quartile included values less than 5.2, the mean was 5.6 and the upper quartile included values greater than 5.8 (Table 7).

Floristic Quality values less than 17.0 were in the lower quartile, values greater than 24.4 were in the upper quartile, and the mean was 20.9 (Table 7).

**Table 7. Floristic Quality and Coefficient of Conservatism of Wolf Lake, Compared to Wisconsin Lakes and Northern Wisconsin Lakes.**

| | (C)Average Coefficient of Conservatism | Floristic Quality (FQI) |
|---|---|---|
| Wisconsin Lakes * | 5.5, 6.0, 6.9 | 16.9, 22.2, 27.5 |
| NCHR * | 5.2, 5.6, 5.8 | 17.0, 20.9, 24.4 |
| Wolf Lake 2001 | 5.82 | 19.30 |

* - Values indicate the highest value of the lowest quartile, the mean and the lowest value of the upper quartile.

The Average Coefficient of Conservatism for Wolf Lake was below average for all Wisconsin lakes analyzed and in the upper quartile for lakes in the North Central Hardwood Region (Table 7). This suggests that the aquatic plants in Wolf Lake are less tolerant of disturbance than the average lake.

The Floristic Quality of the plant community in Wolf Lake was below average for Wisconsin lakes and North Central Hardwood Lakes (Table 7). This suggests that the plant community in Wolf Lake has been subject to more disturbance than the average lake in Wisconsin or North Central Hardwood Region.

Disturbances can be of many types:

1) Direct disturbances to the plant beds result from boat traffic, plant harvesting, chemical treatments, the placement of docks and other structures, fluctuating water levels, etc.
2) Indirect disturbances can be the result of factors that impact water clarity and thus stress species that are more sensitive: resuspension of sediments, sedimentation from erosion, increased algae growth due to nutrient inputs.
3) Biological disturbances include the introduction of a non-native or invasive plant species, grazing from an increased population of aquatic herbivores, destruction of plant beds by the fish population, etc.

## V. DISCUSSION

Based on water clarity, chlorophyll and phosphorus data, Wolf Lake is a oligotrophic/mesotrophic lake with very good water clarity. Marl was the dominant sediment in the lake.

The good water clarity, hard water, adequate nutrient levels, shallow depth and gradually sloped littoral zone in Wolf Lake would favor macrophyte growth.

Aquatic plant growth occurred throughout Wolf Lake, at 92% of the sites, to a maximum depth of 12 ft. This maximum rooting depth is less than the predicted maximum rooting depth of 16.5ft. This was due to the inability to find the maximum depth in Wolf Lake during the survey, because of the very small area with the maximum depth. The 1.5-5ft depth zone supported the greatest amount of plant growth: the highest total occurrence of plants, highest total density of plants, the greatest percentage of vegetated sites and the largest mean number of species per sample site.

*Najas flexilis* was the dominant macrophyte species, occurring throughout the lake and at above average densities, especially in the 0-10ft depth zone. *Potamogeton zosteriformis* was sub-dominant in Wolf Lake, especially in the 10-15ft depth zone. Filamentous algae did not occur at the time of the survey.

The Aquatic Macrophyte Community Index (AMCI) for Wolf Lake was 32, indicating that the quality of the macrophyte community in Wolf Lake is below average (40) for Wisconsin lakes. The limited number of species, lack of emergent species and lack of sensitive species are limiting the quality of the aquatic plant community. Simpson's Diversity Index (0.81) indicates that the macrophyte community had an average diversity. The mean number of species per sample site was 2.8. Of the 11 species, only one species was an emergent species and occurred at only 1 of the shallow sites. The emergent species may be more dominant if the water level is ever higher.

The Floristic Quality Index suggests that Wolf Lake has been subjected to more disturbance than the average for lakes in Wisconsin and in the North Central Hardwoods Region of Wisconsin. The dominant species, *Najas flexilis,* is an annual species. Annual species do well in communities subjected to continual disturbance.

Wolf Lake is protected by a buffer of natural shoreline (wooded, sand and native herbaceous growth). Natural shoreline occurred at all of the sample sites. The bare sand at all sample sites appears to be the result of a lowered lake level.

## VI. CONCLUSIONS

Wolf Lake is an oligotrophic/mesotrophic lake with good water quality and water clarity. Marl was the dominant sediment. Filamentous algae was not found during the survey.

Wolf Lake is well protected by a buffer of natural shoreline.

The aquatic plant community is of below average quality for Wisconsin lakes and is characterized by an average diversity and a greater than average tolerance to disturbance. Above average disturbance tolerance indicates that the plant community has been subjected to more disturbance than the average lake in Wisconsin or North Central Hardwood Region. There was evidence that the lake may experience fluctuating water levels, which may be the cause of the disturbance.

Aquatic plants occurred throughout Wolf Lake to a maximum depth of 12 feet, the most abundant plant growth occurred in the 1.5-5 ft. depth zone.

*Najas flexilis* is the dominant species within the plant community, especially in the 0-10 ft dpeth zone, grwoing at above average densities. *N. flexilis* can be an indicator of disturbance. *Potamogeton zosteriformis* was sub-dominant, especially in the 10-15ft depth zone.

As a shallow lake, Wolf Lake is a unique resource that can not be forced to act like a deep-water lake. Shallow lakes exist as two, alternate types:

1) clear water with abundant aquatic plant growth

or

2) murky, algae-dominated with sparse aquatic plant growth

Once the balance is tipped from a clear water state to a turbid water state, it is very hard to bring a shallow lake back to a clear water state. Shallow lakes are much more susceptible to certain disturbances than deep water lakes. Wind has a much greater impact on shallow lakes. Boat motors have a greater impact on shallow lakes: a 25hp motor can disturb sediments 10 ft. below the surface (Asplund and Cook 1997).

A healthy aquatic plant community plays a vital role within the lake community. This is due to the role plants provide play in
1) improving water quality 2) providing valuable resources for fish and wildlife 3) resisting invasions of non-native species and 4) checking excessive growth of tolerant species that could crowd out the more sensitive species and reduce diversity.

1) Macrophyte communities improve water quality in many ways:
 they trap nutrients, debris, and pollutants entering a water body;
 they absorb and break down some pollutants;
 they reduce erosion by damping wave action and stabilizing shorelines and lake bottoms;
 they remove nutrients that would otherwise be available for algae blooms (Engel 1985).

2) Aquatic plant communities provide important fishery and wildlife resources. Plants (including algae) start the food chain that supports many levels of wildlife, and at the same time produce

oxygen needed by animals. Plants are used as food, cover and nesting/spawning sites by a variety of wildlife and fish (Table 8). The macrophyte community in Wolf Lake provides habitat in 92% of the littoral zone. This amount of vegetation provides more than adequate cover (25-85%) to support a healthy fishery.

Compared to non-vegetated lake bottoms, macrophyte beds support larger, more diverse invertebrate populations that in turn will support larger and more diverse fish and wildlife populations (Engel 1985). Additionally, mixed stands of macrophytes support 3-8 times as many invertebrates and fish as monocultural stands (Engel 1990). Diversity in the plant community creates more microhabitats for the preferences of more species. Macrophyte beds of moderate density support adequate numbers of small fish without restricting the movement of predatory fish (Engel 1990).

**Recommendations**

It is important to take measures to protect the aquatic plant community that plays a key role in protecting water quality and providing habitat:

5) Protect the submerged plant communities.
6) Designate sensitive areas that support the plant communities most important to providing habitat and other water quality benefits (Figure 10).
7) Preserve the natural buffer zones of shoreline. Native vegetation reduces run-off into the lake and filters the run-off that does enter the lake.
8) Designate the lake as a no-gas motor lake due to its small size and shallow depths.

Taking steps to protect the aquatic plant community in Wolf Lake will preserve water quality and protect fish and wildlife resources.