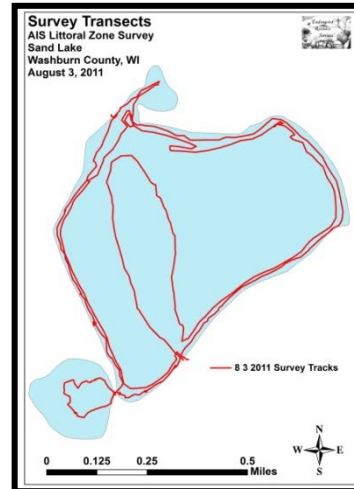
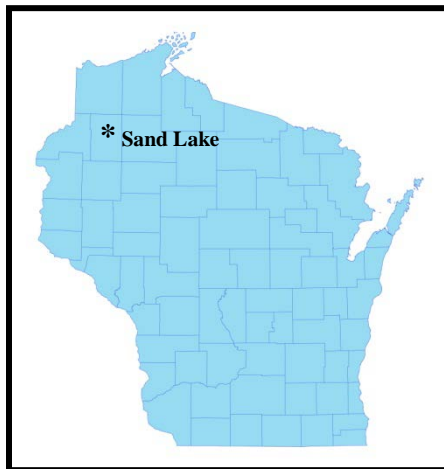


**Eurasian water milfoil (*Myriophyllum spicatum*)
Meandering Littoral Zone Survey
Sand Lake - WBIC: 2495200
Minong Township - Washburn County, Wisconsin**



Project Sponsored by:

Wisconsin Department of Natural Resources, and the
Town of Minong



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August 3, 2011

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INTRODUCTION:

Sand Lake (WBIC 2495200) is a 210 acre seepage lake in north-central Washburn County, Wisconsin in the Town of Minong (T42N R13W S5 SW NE) (Figure 1). It reaches a maximum depth of 9ft in the northeast corner of the central basin, and has an average depth of approximately 6ft. Sand Lake is eutrophic in nature with poor to very poor water clarity. Although no historical water quality data exists (WDNR 2011), we could see the bottom clearly in only about 4ft of water. Secchi readings on the day of the survey were in the 5ft range with the littoral zone extending to 8ft. The bottom substrate is predominately sand and sandy muck with some organic muck occurring in the 10 acre “pond” on the southwest end of the lake (Bush et al. 1967).



Figure 1: Sand Lake Aerial Photo

Eurasian water milfoil (*Myriophyllum spicatum*) (EWM) is a highly invasive exotic species that is a growing problem in the lakes of northern Wisconsin. In the Town of Minong (TM), it has been found in Gilmore, Horseshoe and Nancy Lakes as well as the Minong Flowage. Because EWM can have negative ecological, recreational, and economic impacts if left unchecked and because a new isolated infestation is generally much cheaper and easier to control than an older established one, the TM and Wisconsin Department of Natural Resources (WDNR) commissioned a meandering shoreline survey to look for EWM in Sand Lake. This report is the summary analysis of that survey conducted on August 3, 2011.

METHODS:

Using a standard formula that takes into account the shoreline shape, distance, and total lake acres, Michelle Nault (WDNR – lake biologist) generated a sampling grid of 289 points that covered the entire lake (Appendix I). This grid will be used for any future full lake plant surveys and serves as a location reference in case any new exotic species are located.

Early August was chosen as the target date for the survey as EWM has often canopied by this time of year making its bright red growth tips easy to see. It is also prone to fragment in late summer, and small pieces of EWM with white root sprouts are often found floating around established beds of milfoil (Figure 2).



Figure 2: Summer EWM Plant with New Growth Ready to Fragment

Because the most likely place for a new infestation to occur is the public boat landing, we initially conducted a transect survey of this area. Using multiple 150-200m parallel transects, we motored at idle speed looking for any evidence of EWM. Once we had finished the transects, we returned to our starting point using a stitch pattern that crossed back and forth over the other lines to look for any plants we may have missed between the transects. In addition to surveying the landing, we conducted a meandering survey of the lake's entire visible littoral zone spacing transects close enough that our field of view overlapped from one transect to another. We paid special attention to the areas around docks as this is where EWM brought in on props is most likely to establish. Because the visible littoral zone was so narrow, we also ran two transects down the center of the lake and rake sampled at random points along the way to develop a greater understanding of the lake's overall plant community

While we surveyed, we created a list of all aquatic macrophyte species found growing in and adjacent to the lake. From the total species found, we calculated a hypothetical Floristic Quality Index Value (FQI) for the lake. This index measures the impact of human development on a lake's aquatic plants. The 124 species in the index** are assigned a Coefficient of Conservatism (C) which ranges from 1-10. The higher the value assigned, the more likely the plant is to be negatively impacted by human activities

relating to water quality or habitat modifications. Plants with low values are tolerant of human habitat modifications, and they often exploit these changes to the point where they may crowd out other species. The FQI is calculated by averaging the conservatism value for each native index species found in the lake during the survey and multiplying it by the square root of the total number of plant species (N) in the lake ($FQI = (\sum(c_1 + c_2 + c_3 + \dots + c_n) / N) * \sqrt{N}$). Statistically speaking, the higher the index value, the healthier the lake's macrophyte community is assumed to be. Nichols (1999) identified four eco-regions in Wisconsin: Northern Lakes and Forests, Northern Central Hardwood Forests, Driftless Area and Southeastern Wisconsin Till Plain. He recommended making comparisons of lakes within ecoregions to determine the target lake's relative diversity and health. Sand Lake is in the Northern Lakes and Forests Ecoregion (Table 1).

**** Species not included in the index are excluded from FQI analysis, but they are listed separately to document their presence in the lake (Table 2).**

RESULTS:

On August 3rd, we surveyed 6.8 transect miles through the littoral zone of Sand Lake (Figure 3) (Appendix II). No Eurasian water milfoil, Curly-leaf pondweed, or any other exotic plants were found. Interestingly, we also did not locate any Coontail (*Ceratophyllum demersum*), Northern water milfoil (*Myriophyllum sibiricum*) or Whorled water milfoil (*Myriophyllum verticillatum*). These species are common to abundant in most northern Wisconsin lakes, and are frequently confused with EWM. Dwarf water milfoil (*Myriophyllum tenellum*) is the only species of milfoil we found in the lake. This highly desirable, sensitive native species provides habitat for young fish and insect larvae. It is common in sandy shoreline areas of the lake, but it has no leaflets, and is not easily recognizable as a water milfoil. (For more information on Milfoil identification, see Appendix III).



Figure 3: Survey Transects

In general, Sand Lake has a very limited plant community because the low nutrient sand and sandy muck doesn't support excessive plant growth (Figure 4), and because poor water clarity prevent plants from growing in deep water. Based on our shoreline survey and the rake transects through the center of the lake, plants disappear almost altogether in areas deeper than 4ft although we did find a few widely scattered Wild celery (*Vallisneria americana*) and White-stem pondweed (*Potamogeton praelongus*) plants in water up to 7ft. Interestingly, we found evidence that large amounts of Fern pondweed (*Potamogeton robbinsii*), another high habitat value native plant, used to be found throughout the lake in these deeper areas. Partially decomposed stems and leaves of the plant were found to depths of 8ft along with only a handful of live individuals. Perhaps the plants were able to colonize these depths during the drought of the past few years when lake levels were low, but have now died off due to lack of light. Nutrients being released from their decomposition may also explain the lack of clarity.

Despite the low numbers of plants, the macrophyte community was very rich and diverse for such a small lake. We identified 37 native plants to species growing in and immediately adjacent to the lake. The 32 species in the index produced a mean Coefficient of Conservation of 7.1 and a Floristic Quality Value of 40.0 (Tables 1 and 2). Nichols (1999) reported an average mean C for the Northern Lakes and Forest Region of 6.7 putting Sand Lake above average for this part of the state. The FQI was also well above the median FQI of 24.3 for the Northern Lakes and Forest Region (Nichols 1999). This very high FQI is likely a result of the lake's variable substrate/habitats and patches of undeveloped shoreline. All of these factors create a variety of microhabitats which offer a wide variety of plants suitable growing conditions.



Figure 4: Typical Limited Shoreline Plant Community

**Table 1: Hypothetical Floristic Quality Index of Aquatic Macrophytes
Sand Lake, Washburn County
August 3, 2011**

Species	Common Name	C
<i>Brasenia schreberi</i>	Watershield	6
<i>Chara</i> sp.	Muskgrass	7
<i>Dulichium arundinaceum</i>	Three-way sedge	9
<i>Elatine minima</i>	Waterwort	9
<i>Eleocharis acicularis</i>	Needle spikerush	5
<i>Eleocharis erythropoda</i>	Bald spikerush	3
<i>Eleocharis palustris</i>	Creeping spikerush	6
<i>Elodea canadensis</i>	Common waterweed	3
<i>Eriocaulon aquaticum</i>	Pipewort	9
<i>Glyceria borealis</i>	Northern manna grass	8
<i>Juncus pelocarpus</i> f. <i>submersus</i>	Brown-fruited rush	8
<i>Myriophyllum tenellum</i>	Dwarf water-milfoil	10
<i>Nuphar variegata</i>	Spatterdock	6
<i>Nymphaea odorata</i>	White water lily	6
<i>Polygonum amphibium</i>	Water smartweed	5
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	7
<i>Potamogeton epihydrus</i>	Ribbon-leaf pondweed	8
<i>Potamogeton gramineus</i>	Variable pondweed	7
<i>Potamogeton praelongus</i>	White-stem pondweed	8
<i>Potamogeton pusillus</i>	Small pondweed	7
<i>Potamogeton robbinsii</i>	Fern pondweed	8
<i>Potamogeton spirillus</i>	Spiral-fruited pondweed	8
<i>Ranunculus flammula</i>	Creeping spearwort	9
<i>Schoenoplectus acutus</i>	Hardstem bulrush	6
<i>Schoenoplectus pungens</i>	Three-square bulrush	5
<i>Schoenoplectus tabernaemontani</i>	Softstem bulrush	4
<i>Sparganium angustifolium</i>	Narrow-leaved bur-reed	9
<i>Utricularia gibba</i>	Creeping bladderwort	9
<i>Utricularia intermedia</i>	Flat-leaf bladderwort	9
<i>Utricularia resupinata</i>	Small purple bladderwort	9
<i>Utricularia vulgaris</i>	Common bladderwort	7
<i>Vallisneria americana</i>	Wild celery	6
N		32
mean C		7.1
FQI		40.0

*** Small purple bladderwort is listed as a **state species of special concern**. It is not currently threatened or endangered, but it is uncommon to rare in the state. Because it is so sensitive to pollution/human disturbance, there is concern it will become threatened or endangered in the future.

**Table 2: Additional Non-Index Aquatic Macrophyte Species Found
Sand Lake, Washburn County
August 3, 2011**

Species	Common Name	C
<i>Comarum palustre</i>	Marsh cinquefoil	8
<i>Cladium mariscoides</i>	Smooth sawgrass	10
<i>Iris versicolor</i>	Northern blue flag	5
<i>Scirpus cyperinus</i>	Woolgrass	4
<i>Spartina pectinata</i>	Prairie chordgrass	5

DISCUSSION AND CONSIDERATIONS FOR MANAGEMENT:

Aquatic Invasive Species Prevention:

Aquatic Invasive Species (AIS) such as Eurasian water milfoil are an increasing problem in the lakes of northern Wisconsin in general, and several nearby lakes in the Minong area in particular. Preventing their introduction into Sand Lake with proactive measures is strongly encouraged. Especially around the boat landing, lakeshore owners should minimize the removal of native plants from the lake unless absolutely necessary as these patches of barren substrate can provide an easy place for invasive plants to take root and become established. The newly added sign at the boat landing offers a layer of protection against AIS by providing education, reeducation, and continual reminders of the dangers/impacts of aquatic invasive species to lake owners and visitors alike (Figure 5).



Figure 5: Sign at Sand Lake Landing

Training volunteers to recognize EWM and CLP is another low cost management strategy that we strongly encourage. Monthly volunteer transect surveys at the lake's boat landing and at least biannual meandering shoreline surveys of the whole lake could result in early detection if an AIS is introduced into Sand Lake. The sooner an infestation is detected, the greater the chances it can be successfully and economically controlled.

As there are no similar looking native milfoils in the lake, any suspicious looking plants that are found in the future should be immediately investigated to determine species. If any lake resident or boater discovers a plant they even suspect may be EWM, they are invited to contact Matthew Berg, ERS, LLC Research Biologist at 715-338-7502 and/or Pamela Toshner, Regional Lakes Management Coordinator in the Spooner DNR office at 715-635-4073 for identification confirmation. If possible, a specimen, a jpg, and the accompanying GPS coordinates of the location it was found at should be included.

Native Aquatic Macrophytes, Algae and Water Clarity:

A lake's plants are the basis of the aquatic ecosystem, and they are as important to the aquatic environment as trees are to a forest. Because of this, preserving them is critical to maintaining a healthy lake environment. As the basis of the food pyramid, they provide habitat for other aquatic organisms, are important food sources for waterfowl and other wildlife, stabilize the shoreline, and work to improve water clarity by absorbing excess nutrients from the water.

Sand Lake has a rich and diverse, but very limited aquatic plant community. The lake currently supports ten extremely high quality species (C value of 9 or 10), but most of these are rare on the lake with localized distribution making them vulnerable to lake-wide extinction. For example, Small purple bladderwort (*Utricularia resupinata*), a state species of special concern, was limited to a few tiny patches in front of undeveloped areas along the north and western shorelines.

Currently, the lake's lack of clarity seems to be the biggest limiting factor to improving the overall plant community. Normally, seepage lakes have good clarity and limited nutrients. In Sand, the poor clarity is causing a lack of light penetration which means that few "big plants" or macrophytes are growing much past 4ft. Without these plants to absorb nutrients, algae proliferate which further reduces clarity. Such things as internal loading from sediments/decomposing plants, failed septic systems, and lawn and field fertilizer runoff are common causes of excess nutrients in surface water. Because the lake's plant community is so limited, even a small increase in macrophyte plants or a small decrease in nutrient input could tip the lake's current balance away from algae and back towards macrophytes with resulting improvements in both water clarity and quality.

Regardless of where nutrients are coming from, educating lake residents about reducing nutrient input directly along the lake is one of the easiest ways to limit algal growth and maintain or even improve water clarity. Not mowing down to the lakeshore, bagging grass clippings, switching to a phosphorus-free fertilizer or eliminating fertilizer altogether, and avoiding motor start-ups in shallow water would all be positive steps to this end. Wherever possible, restoring shorelines, building rain gardens, and establishing buffer strips of native vegetation would also enhance water quality by preventing erosion and runoff. Hopefully, with a greater understanding of how better conservation practices by even a few people can have lake-wide impacts, more people will be encouraged to make positive changes (Figure 6).



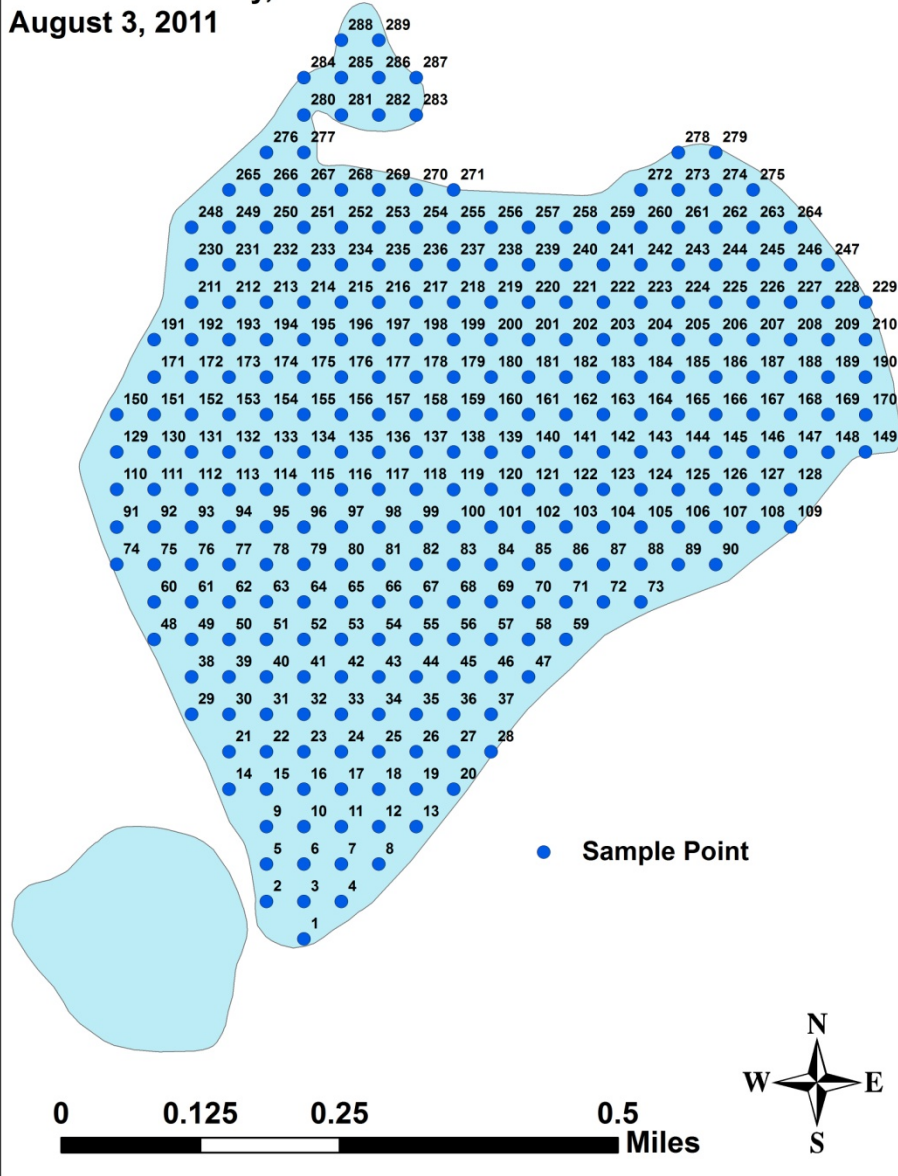
Figure 6: Model Natural Shoreline on a Nearby Washburn Co. Lake

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Appendix I: Sand Lake Map with Survey Sample Points

Survey Sample Points
AIS Littoral Zone Survey
Sand Lake
Washburn County, WI
August 3, 2011



Appendix II: Sand Lake Map with Survey Transects

Survey Transects
AIS Littoral Zone Survey
Sand Lake
Washburn County, WI
August 3, 2011



Appendix III: Milfoil Identification Guide

Eurasian water milfoil vs. Northern water milfoil



EWM Leaflets >26 NWM Leaflets < 22



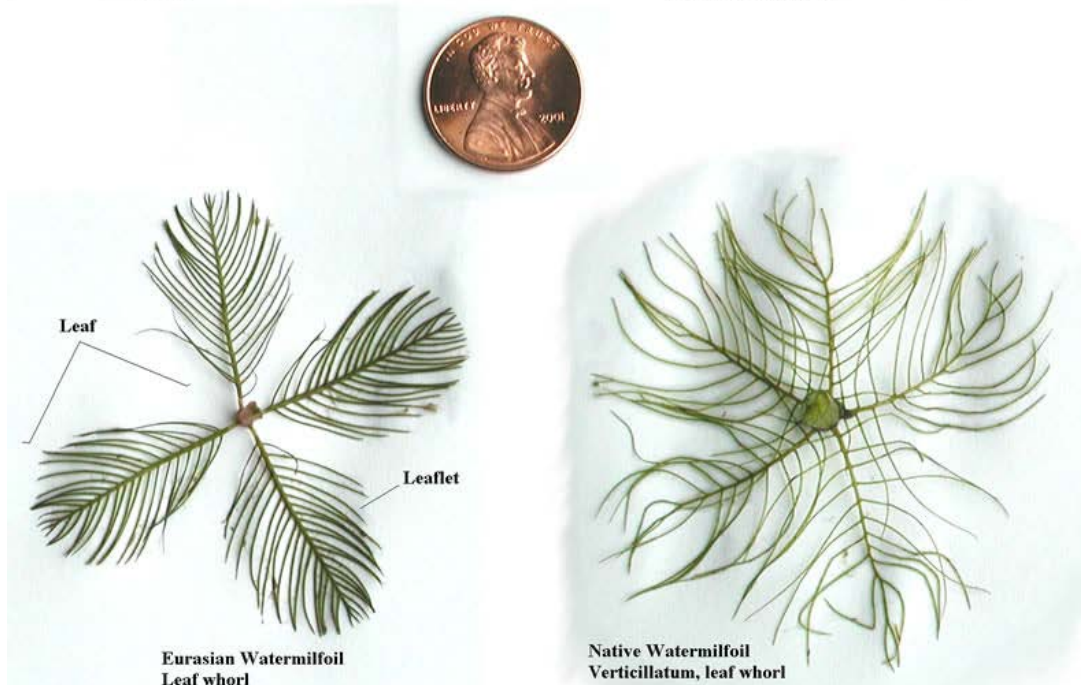
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EWM Leaflets Limp out of Water NWM Leaflets Stiff Out of Water

Eurasian water milfoil vs. Whorled water milfoil



Dwarf water milfoil



Plants spread by rhizomes, have no leaflets and are usually <6in.

Appendix IV: Glossary of Biological Terms

Aquatic:

organisms that live in or frequent water.

Cultural Eutrophication:

accelerated eutrophication that occurs as a result of human activities in the watershed that increase nutrient loads in runoff water that drains into lakes.

Dissolved Oxygen (DO):

the amount of free oxygen absorbed by the water and available to aquatic organisms for respiration; amount of oxygen dissolved in a certain amount of water at a particular temperature and pressure, often expressed as a concentration in parts of oxygen per million parts of water.

Diversity:

number and evenness of species in a particular community or habitat.

Drainage lakes:

Lakes fed primarily by streams and with outlets into streams or rivers. They are more subject to surface runoff problems but generally have shorter residence times than seepage lakes. Watershed protection is usually needed to manage lake water quality.

Ecosystem:

a system formed by the interaction of a community of organisms with each other and with the chemical and physical factors making up their environment.

Eutrophication:

the process by which lakes and streams are enriched by nutrients, and the resulting increase in plant and algae growth. This process includes physical, chemical, and biological changes that take place after a lake receives inputs for plant nutrients--mostly nitrates and phosphates--from natural erosion and runoff from the surrounding land basin. The extent to which this process has occurred is reflected in a lake's trophic classification: oligotrophic (nutrient poor), mesotrophic (moderately productive), and eutrophic (very productive and fertile).

Exotic:

a non-native species of plant or animal that has been introduced.

Habitat:

the place where an organism lives that provides an organism's needs for water, food, and shelter. It includes all living and non-living components with which the organism interacts.

Limnology:

the study of inland lakes and waters.

Littoral:

the near shore shallow water zone of a lake, where aquatic plants grow.

Macrophytes:

Refers to higher (multi-celled) plants growing in or near water. Macrophytes are beneficial to lakes because they produce oxygen and provide substrate for fish habitat and aquatic insects. Overabundance of such plants, especially problem species, is related to shallow water depth and high nutrient levels.

Nutrients:

elements or substances such as nitrogen and phosphorus that are necessary for plant growth. Large amounts of these substances can become a nuisance by promoting excessive aquatic plant growth.

Organic Matter:

elements or material containing carbon, a basic component of all living matter.

Photosynthesis:

the process by which green plants convert carbon dioxide (CO₂) dissolved in water to sugar and oxygen using sunlight for energy. Photosynthesis is essential in producing a lake's food base, and is an important source of oxygen for many lakes.

Phytoplankton:

microscopic plants found in the water. Algae or one-celled (phytoplankton) or multicellular plants either suspended in water (Plankton) or attached to rocks and other substrates (periphyton). Their abundance, as measured by the amount of chlorophyll a (green pigment) in an open water sample, is commonly used to classify the trophic status of a lake. Numerous species occur. Algae are an essential part of the lake ecosystem and provides the food base for most lake organisms, including fish. Phytoplankton populations vary widely from day to day, as life cycles are short.

Plankton:

small plant organisms (phytoplankton and nanoplankton) and animal organisms (zooplankton) that float or swim weakly through the water.

ppm:

parts per million; units per equivalent million units; equal to milligrams per liter (mg/l)

Richness:

Number of species in a particular community or habitat.

Rooted Aquatic Plants:

(macrophytes) Refers to higher (multi-celled) plants growing in or near water. Macrophytes are beneficial to lakes because they produce oxygen and provide substrate for fish habitat and aquatic insects. Overabundance of such plants, especially problem species, is related to shallow water depth and high nutrient levels.

Runoff:

water that flows over the surface of the land because the ground surface is impermeable or unable to absorb the water.

Secchi Disc:

An 8-inch diameter plate with alternating quadrants painted black and white that is used to measure water clarity (light penetration). The disc is lowered into water until it disappears from view. It is then raised until just visible. An average of the two depths, taken from the shaded side of the boat, is recorded as the Secchi disc reading. For best results, the readings should be taken on sunny, calm days.

Seepage lakes:

Lakes without a significant inlet or outlet, fed by rainfall and groundwater. Seepage lakes lose water through evaporation and groundwater moving on a down gradient. Lakes with little groundwater inflow tend to be naturally acidic and most susceptible to the effects of acid rain. Seepage lakes often have long residence times, and lake levels fluctuate with local groundwater levels. Water quality is affected by groundwater quality and the use of land on the shoreline.

Turbidity:

degree to which light is blocked because water is muddy or cloudy.

Watershed:

the land area draining into a specific stream, river, lake or other body of water. These areas are divided by ridges of high land.

Zooplankton:

Microscopic or barely visible animals that eat algae. These suspended plankton are an important component of the lake food chain and ecosystem. For many fish, they are the primary source of food.

Appendix V: Aquatic Invasive Plant Species Information



Curly-leaf pondweed

(Photo Courtesy Paul Skawinski – Golden Sands RC&D)

DESCRIPTION: Curly-leaf pondweed is an invasive aquatic perennial that is native to Eurasia, Africa, and Australia. It was accidentally introduced to United States waters in the mid-1880s by hobbyists who used it as an aquarium plant. The leaves are reddish-green, oblong, and about 3 inches long, with distinct wavy edges that are finely toothed. The stem of the plant is flat, reddish-brown and grows from 1 to 3 feet long. The plant usually drops to the lake bottom by early July

DISTRIBUTION AND HABITAT: Curly-leaf pondweed is commonly found in alkaline and high nutrient waters, preferring soft substrate and shallow water depths. It tolerates low light and low water temperatures. It has been reported in all states but Maine

LIFE HISTORY AND EFFECTS OF INVASION: Curly-leaf pondweed spreads through burr-like winter buds (turions), which are moved among waterways. These plants can also reproduce by seed, but this plays a relatively small role compared to the vegetative reproduction through turions. New plants form under the ice in winter, making curly-leaf pondweed one of the first nuisance aquatic plants to emerge in the spring.

It becomes invasive in some areas because of its tolerance for low light and low water temperatures. These tolerances allow it to get a head start on and out compete native plants in the spring. In mid-summer, when most aquatic plants are growing, curly-leaf pondweed plants are dying off. Plant die-offs may result in a critical loss of dissolved oxygen. Furthermore, the decaying plants can increase nutrients which contribute to algal blooms, as well as create unpleasant stinking messes on beaches. Curly-leaf pondweed forms surface mats that interfere with aquatic recreation. (Taken in its entirety from WDNR, 2011 http://www.dnr.state.wi.us/invasives/fact/curlyleaf_pondweed.htm)



Eurasian water milfoil

(Photo M. Berg)

DESCRIPTION: Eurasian water milfoil is a submersed aquatic plant native to Europe, Asia, and northern Africa. It is the only non-native milfoil in Wisconsin. Like the native milfoils, the Eurasian variety has slender stems whorled by submersed feathery leaves and tiny flowers produced above the water surface. The flowers are located in the axils of the floral bracts, and are either four-petaled or without petals. The leaves are threadlike, typically uniform in diameter, and aggregated into a submersed terminal spike. The stem thickens below the inflorescence and doubles its width further down, often curving to lie parallel with the water surface. The fruits are four-jointed nut-like bodies. Without flowers or fruits, Eurasian water milfoil is nearly impossible to distinguish from Northern water milfoil. Eurasian water milfoil has 9-21 pairs of leaflets per leaf, while Northern milfoil typically has 7-11 pairs of leaflets. Coontail is often mistaken for the milfoils, but does not have individual leaflets.

DISTRIBUTION AND HABITAT: Eurasian milfoil first arrived in Wisconsin in the 1960's. During the 1980's, it began to move from several counties in southern Wisconsin to lakes and waterways in the northern half of the state. As of 1993, Eurasian milfoil was common in 39 Wisconsin counties (54%) and at least 75 of its lakes, including shallow bays in Lakes Michigan and Superior and Mississippi River pools.

Eurasian water milfoil grows best in fertile, fine-textured, inorganic sediments. In less productive lakes, it is restricted to areas of nutrient-rich sediments. It has a history of becoming dominant in eutrophic, nutrient-rich lakes, although this pattern is not universal. It is an opportunistic species that prefers highly disturbed lake beds, lakes receiving nitrogen and phosphorous-laden runoff, and heavily used lakes. Optimal growth occurs in alkaline systems with a high concentration of dissolved inorganic carbon. High water temperatures promote multiple periods of flowering and fragmentation.

LIFE HISTORY AND EFFECTS OF INVASION: Unlike many other plants, Eurasian water milfoil does not rely on seed for reproduction. Its seeds germinate poorly under natural conditions. It reproduces vegetatively by fragmentation, allowing it to disperse over long distances. The plant produces fragments after fruiting once or twice during the summer. These shoots may then be carried downstream by water currents or inadvertently picked up by boaters. Milfoil is readily dispersed by boats, motors, trailers, bilges, live wells, or bait buckets, and can stay alive for weeks if kept moist.

Once established in an aquatic community, milfoil reproduces from shoot fragments and stolons (runners that creep along the lake bed). As an opportunistic species, Eurasian water milfoil is adapted for rapid growth early in spring. Stolons, lower stems, and roots persist over winter and store the carbohydrates that help milfoil claim the water column early in spring, photosynthesize, divide, and form a dense leaf canopy that shades out native aquatic plants. Its ability to spread rapidly by fragmentation and effectively block out sunlight needed for native plant growth often results in monotypic stands. Monotypic stands of Eurasian milfoil provide only a single habitat, and threaten the integrity of aquatic communities in a number of ways; for example, dense stands disrupt predator-prey relationships by fencing out larger fish, and reducing the number of nutrient-rich native plants available for waterfowl.

Dense stands of Eurasian water milfoil also inhibit recreational uses like swimming, boating, and fishing. Some stands have been dense enough to obstruct industrial and power generation water intakes. The visual impact that greets the lake user on milfoil-dominated lakes is the flat yellow-green of matted vegetation, often prompting the perception that the lake is "infested" or "dead". Cycling of nutrients from sediments to the water column by Eurasian water milfoil may lead to deteriorating water quality and algae blooms of infested lakes. (Taken in its entirety from WDNR, 2011 <http://www.dnr.state.wi.us/invasives/fact/milfoil.htm>)



Reed canary grass

DESCRIPTION: Reed canary grass is a large, coarse grass that reaches 2 to 9 feet in height. It has an erect, hairless stem with gradually tapering leaf blades 3 1/2 to 10 inches long and 1/4 to 3/4 inch in width. Blades are flat and have a rough texture on both surfaces. The leaf ligule is membranous and long. The compact panicles are erect or slightly spreading (depending on the plant's reproductive stage), and range from 3 to 16 inches long with branches 2 to 12 inches in length. Single flowers occur in dense clusters in May to mid-June. They are green to purple at first and change to beige over time. This grass is one of the first to sprout in spring, and forms a thick rhizome system that dominates the subsurface soil. Seeds are shiny brown in color.

Both Eurasian and native ecotypes of reed canary grass are thought to exist in the U.S. The Eurasian variety is considered more aggressive, but no reliable method exists to tell the ecotypes apart. It is believed that the vast majority of our reed canary grass is derived from the Eurasian ecotype. Agricultural cultivars of the grass are widely planted.

Reed canary grass also resembles non-native orchard grass (*Dactylis glomerata*), but can be distinguished by its wider blades, narrower, more pointed inflorescence, and the lack of hairs on glumes and lemmas (the spikelet scales). Additionally, bluejoint grass (*Calamagrostis canadensis*) may be mistaken for reed canary in areas where orchard grass is rare, especially in the spring. The highly transparent ligule on reed canary grass is helpful in distinguishing it from the others. Ensure positive identification before attempting control.

DISTRIBUTION AND HABITAT: Reed canary grass is a cool-season, sod-forming, perennial wetland grass native to temperate regions of Europe, Asia, and North America. The Eurasian ecotype has been selected for its vigor and has been planted throughout the U.S. since the 1800's for forage and erosion control. It has become naturalized in much of the northern half of the U.S., and is still being planted on steep slopes and banks of ponds and created wetlands.

Reed canary grass can grow on dry soils in upland habitats and in the partial shade of oak woodlands, but does best on fertile, moist organic soils in full sun. This species can invade most types of wetlands, including marshes, wet prairies, sedge meadows, fens, stream banks, and seasonally wet areas; it also grows in disturbed areas such as berms and spoil piles.

LIFE HISTORY AND EFFECTS OF INVASION: Reed canary grass reproduces by seed or creeping rhizomes. It spreads aggressively. The plant produces leaves and flower stalks for 5 to 7 weeks after germination in early spring, then spreads laterally. Growth peaks in mid-June and declines in mid-August. A second growth spurt occurs in the fall. The shoots collapse in mid to late summer, forming a dense, impenetrable mat of stems and leaves. The seeds ripen in late June and shatter when ripe. Seeds may be dispersed from one wetland to another by waterways, animals, humans, or machines.

This species prefers disturbed areas, but can easily move into native wetlands. Reed canary grass can invade a disturbed wetland in less than twelve years. Invasion is associated with disturbances including ditching of wetlands, stream channelization, deforestation of swamp forests, sedimentation, and intentional planting. The difficulty of selective control makes reed canary grass invasion of particular concern. Over time, it forms large, monotypic stands that harbor few other plant species and are subsequently of little use to wildlife. Once established, reed canary grass dominates an area by building up a tremendous seed bank that can eventually erupt, germinate, and recolonize treated sites. (Taken in its entirety from WDNR, 2011
http://www.dnr.state.wi.us/invasives/fact/reed_canary.htm)



Purple loosestrife

(Photo Courtesy Brian M. Collins)

DESCRIPTION: Purple loosestrife is a perennial herb 3-7 feet tall with a dense bushy growth of 1-50 stems. The stems, which range from green to purple, die back each year. Showy flowers vary from purple to magenta, possess 5-6 petals aggregated into numerous long spikes, and bloom from July to September. Leaves are opposite, nearly linear, and attached to four-sided stems without stalks. It has a large, woody taproot with fibrous rhizomes that form a dense mat.

This species may be confused with the native wing-angled loosestrife (*Lythrum alatum*) found in moist prairies or wet meadows. The latter has a winged, square stem and solitary paired flowers in the leaf axils. It is generally a smaller plant than the Eurasian loosestrife.

By law, purple loosestrife is a nuisance species in Wisconsin. It is illegal to sell, distribute, or cultivate the plants or seeds, including any of its cultivars.

Distribution and Habitat: Purple loosestrife is a wetland herb that was introduced as a garden perennial from Europe during the 1800's. It is still promoted by some horticulturists for its beauty as a landscape plant, and by beekeepers for its nectar-producing capability. Currently, about 24 states have laws prohibiting its importation or distribution because of its aggressively invasive characteristics. It has since extended its range to include most temperate parts of the United States and Canada. The plant's reproductive success across North America can be attributed to its wide tolerance of physical and chemical conditions characteristic of disturbed habitats, and its ability to reproduce prolifically by both seed dispersal and vegetative propagation. The absence of natural predators, like European species of herbivorous beetles that feed on the plant's roots and leaves, also contributes to its proliferation in North America.

Purple loosestrife was first detected in Wisconsin in the early 1930's, but remained uncommon until the 1970's. It is now widely dispersed in the state, and has been recorded in 70 of Wisconsin's 72 counties. Low densities in most areas of the state suggest that the plant is still in the pioneering stage of establishment. Areas of heaviest infestation are sections of the Wisconsin River, the extreme southeastern part of the state, and the Wolf and Fox River drainage systems.

This plant's optimal habitat includes marshes, stream margins, alluvial flood plains, sedge meadows, and wet prairies. It is tolerant of moist soil and shallow water sites such as pastures and meadows, although established plants can tolerate drier conditions. Purple loosestrife has also been planted in lawns and gardens, which is often how it has been introduced to many of our wetlands, lakes, and rivers.

Life History and Effects of Invasion: Purple loosestrife can germinate successfully on substrates with a wide range of pH. Optimum substrates for growth are moist soils of neutral to slightly acidic pH, but it can exist in a wide range of soil types. Most seedling establishment occurs in late spring and early summer when temperatures are high.

Purple loosestrife spreads mainly by seed, but it can also spread vegetatively from root or stem segments. A single stalk can produce from 100,000 to 300,000 seeds per year. Seed survival is up to 60-70%, resulting in an extensive seed bank. Mature plants with up to 50 shoots grow over 2 meters high and produce more than two million seeds a year. Germination is restricted to open, wet soils and requires high temperatures, but seeds remain viable in the soil for many years. Even seeds submerged in water can live for approximately 20 months. Most of the seeds fall near the parent plant, but water, animals, boats, and humans can transport the seeds long distances. Vegetative spread through local perturbation is also characteristic of loosestrife; clipped, trampled, or buried stems of established plants may produce shoots and roots. Plants may be quite large and several years old before they begin flowering. It is often very difficult to locate non-flowering plants, so monitoring for new invasions should be done at the beginning of the flowering period in mid-summer.

Any sunny or partly shaded wetland is susceptible to purple loosestrife invasion. Vegetative disturbances such as water drawdown or exposed soil accelerate the process by providing ideal conditions for seed germination. Invasion usually begins with a few pioneering plants that build up a large seed bank in the soil for several years. When the right disturbance occurs, loosestrife can spread rapidly, eventually taking over the entire wetland. The plant can also make morphological adjustments to accommodate changes in the immediate environment; for example, a decrease in light level will trigger a change in leaf morphology. The plant's ability to adjust to a wide range of environmental conditions gives it a competitive advantage; coupled with its reproductive strategy, purple loosestrife tends to create monotypic stands that reduce biotic diversity.

Purple loosestrife displaces native wetland vegetation and degrades wildlife habitat. As native vegetation is displaced, rare plants are often the first species to disappear. Eventually, purple loosestrife can overrun wetlands thousands of acres in size, and almost entirely eliminate the open water habitat. The plant can also be detrimental to recreation by choking waterways. (Taken in its entirety from WDNR, 2011 <http://www.dnr.state.wi.us/invasives/fact/loosestrife.htm>)