Final Report
Sensitive Lakeshore Survey
Ada Lake (11-0250-00)
Cass County, Minnesota

May 2009

STATE OF MINNESOTA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ECOLOGICAL RESOURCES

A Product of the
Intra-Lake Zoning to Protect Sensitive Lakeshores Project

Application of
Minnesota's Sensitive Lakeshore Identification Manual: *A Conservation Strategy for Minnesota's Lakeshores*

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Executive Summary

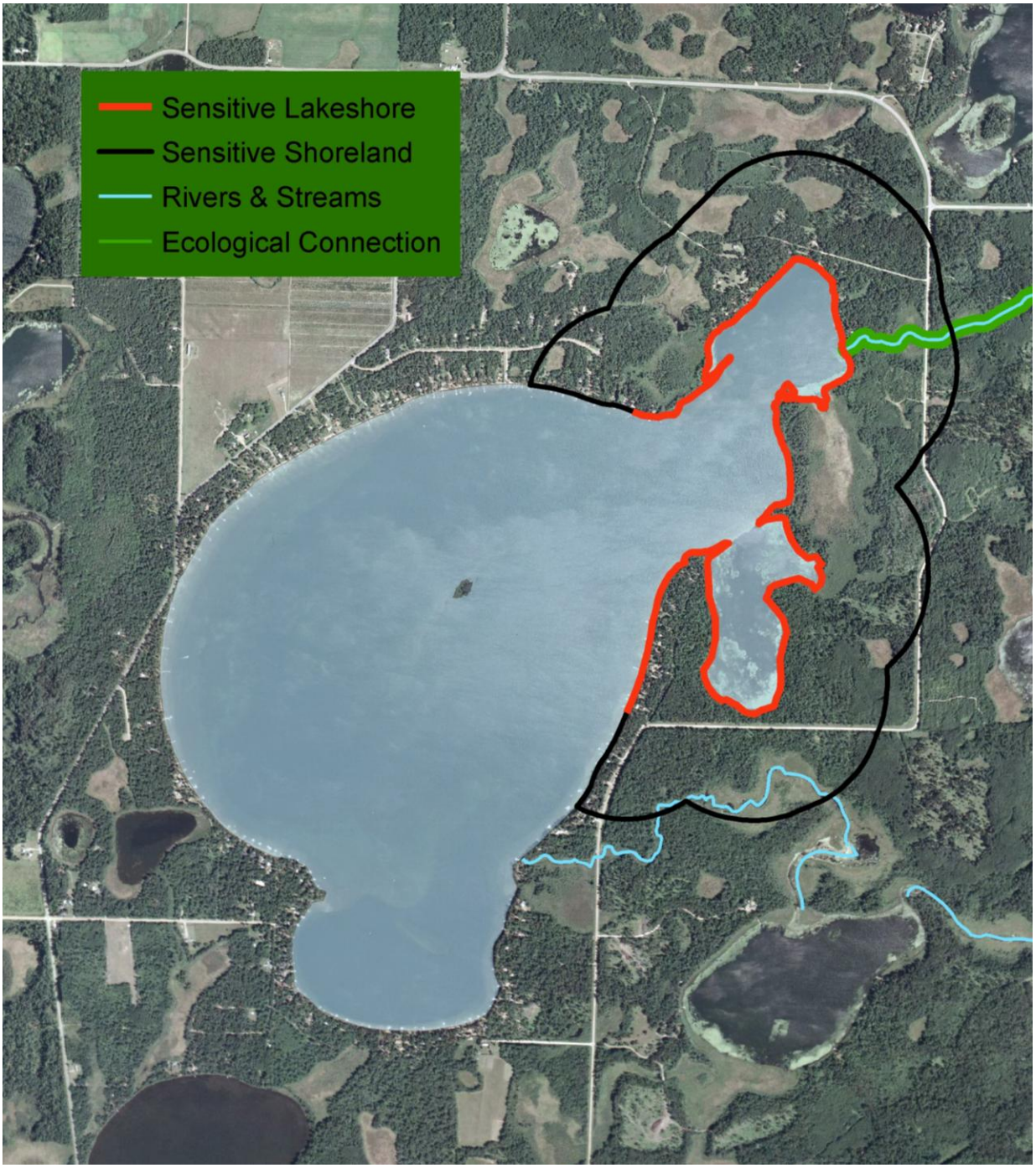
Plant surveys documented 48 native aquatic plant taxa within Ada Lake, including eight unique species of high conservation importance. Aquatic plants occurred around the entire shoreline of Ada Lake, and included 29 submerged, two free-floating, four floating-leaved, and 13 emergent taxa. Within the shore to 20 feet depth zone, 93 percent of the sample sites contained vegetation. Surveyors mapped over 40 acres of waterlily beds and 10 acres of emergent bulrush.

Twenty-seven fish species were identified during the nongame fish surveys, including four species not previously documented within Ada Lake. No fish species of greatest conservation need were detected. Both green and mink frogs were documented, with the majority found in North Bay and Little Ada Bay.

Bird surveyors documented 61 species of birds, 12 of which were species of greatest conservation need. Red-eyed vireos were the most commonly documented species, whereas the veery was the most commonly found species of greatest conservation need. The bays, in particular, provided good habitat for the bird species of greatest conservation need.

An ecological model based on major conservation principles was used to assess lakeshore sensitivity. The benefit of this approach is that criteria come from the science-based surveys and the value of the lakeshore is objectively assessed. Environmental decision-making is complex and often based on multiple lines of evidence. Integrating the information from these multiple lines of evidence is rarely a simple process. Here, the ecological model used 15 attributes (hydrological conditions and documented plant and animal presence) to identify sensitive areas of shoreland. A sensitivity index was calculated for each shoreland segment by summing the scores of the 15 attributes. Lakeshore segments were then clustered by sensitivity index values using established geospatial algorithms. Sensitive lakeshore areas were buffered and important ecological connections or linkages mapped. The identification of sensitive lakeshore areas by this method is an objective, repeatable and quantitative approach to the combination of multiple lines of evidence through calculation of weight of evidence. The ecological model results are lake-specific, in that the model results are intended to recognize the most probable highly sensitive lakeshores for a specific lake. Plant and animal assemblages differ naturally between lakes, and sensitivity scores should not be compared across lakes.

The ecological model identified one primary sensitive lakeshore area to be considered for potential resource protection districting by Cass County. The inlet of Ada Lake was also identified as an important ecological connection. The County may use this objective, science-based information in making decisions about districting and reclassification of lakeshore areas. The most probable highly sensitive lakeshore area and the recommended resource protection district is:


Sensitive Lakeshore
Sensitive Shoreland
Rivers & Streams
Ecological Connection

Introduction

Minnesota's lakes are one of its most valuable resources. The 12,000 lakes in the state provide various industrial, commercial, and recreational opportunities. They are also home to numerous fish, wildlife, and plant species. In particular, naturally vegetated shorelines provide critical feeding, nesting, resting and breeding habitat for many species. Common loons avoid clear beaches and instead nest in sheltered areas of shallow water where nests are protected from wind and wave action. Mink frogs and green frogs are shoreline-dependent species that prefer quiet bays and protected areas with a high abundance of aquatic plants. Fish such as the least darter, longear sunfish, and pugnose shiner are strongly associated with large, near-shore stands of aquatic plants. Increasing development pressure along lakeshores may have negative impacts on these species – and Minnesota's lakeshores are being developed at a rapid rate. With this in mind, the Minnesota Department of Natural Resources developed a protocol for identifying "sensitive" areas of lakeshore. Sensitive lakeshores represent geographical areas comprised of shorelands, shorelines and the near-shore areas, defined by natural and biological features, that provide unique or critical ecological habitat. Sensitive lakeshores also include:

1. Vulnerable shoreland due to soil conditions (i.e., high proportion of hydric soils);
2. Areas vulnerable to development (e.g., wetlands, shallow bays, extensive littoral zones, etc.);
3. Nutrient susceptible areas;
4. Areas with high species richness;
5. Significant fish and wildlife habitat;
6. Critical habitat for species of greatest conservation need; and
7. Areas that provide habitat connectivity

Species of greatest conservation need are animals whose populations are rare, declining or vulnerable to decline (MN DNR 2006). They are also species whose populations are below levels desirable to ensure their long-term health and stability. Multiple species of greatest conservation need depend on lakeshore areas.

The sensitive shorelands protocol consists of three components. The first component involves field surveys to evaluate the distribution of high priority plant and animal species. Aquatic plant surveys are conducted in both submerged habitats and near-shore areas, and assess the lake-wide vegetation communities as well as describe unique plant areas. Target animal species include species of greatest conservation need as well as proxy species that represent animals with similar life history characteristics. This first component also involves the compilation of existing data such as soil type, wetland abundance, and size and shape of natural areas.

The second component involves the development of an ecological model that objectively and consistently ranks lakeshore areas for sensitive area designation. The model is based on the results of the field surveys and analysis of the additional variables. Lakeshore areas used by focal species, areas of high biodiversity, and critical and vulnerable habitats are important elements in the ecological model used to identify sensitive lakeshore areas. Because the model is based on scientific data, it provides objective, repeatable results and can be used as the basis for regulatory action.

The final component of identifying sensitive lakeshore areas is to deliver advice to local governments and other groups who could use the information to maintain high quality environmental conditions and to protect habitat for species in greatest conservation need.

This report summarizes the results of the field surveys and data analysis and describes the development of the ecological model. It also presents the ecological model delineation of Ada Lake sensitive lakeshore areas.

Lake Description

Figure 1. Location of Ada Lake in Cass County, Minnesota.

Ada Lake (DOW 11-0250-00) is located about seven miles east of the city of Backus, in Cass County, north-central Minnesota (Figure 1). Ada Lake is an ice-block lake (Heiskary 1987) formed by the retreat of glaciers about 12,000 years ago. It receives drainage from a number of lakes including Rush, Hay and Hand Lakes (Heiskary 1987). A state-owned concrete dam at the southeast of Ada Lake controls outflow (Figure 2). The dam was constructed in 1936 in an attempt to control erosion and fluctuating water levels (Hansen 2002).

Ada Lake has a surface area of about 950 acres and seven miles of shoreline, making it the 25th largest lake in Cass County. The main basin of Ada Lake has a regular, circular outline and a maximum depth of 60 feet with broad stretches of shallow water (Figure 3). A one acre island occurs in the center of the lake and is surrounded by a shallow sandbar. The south bay and the northeast bay have steeper sloping shores with maximum depths of 30 feet. Little Ada Bay, located on the east shore, is entirely shallow with water depths less than ten feet. Lakewide, 43 percent of Ada Lake is less than 15 feet in depth. Much of the Ada Lake shoreline remains forested but is heavily developed with residential homes and several resorts. There is a public boat launch at the north end of the lake.

The Minnesota DNR has classified Ada Lake as a Class 27 lake; lakes in this class are generally very large, deep, regularly shaped lakes (MN DNR 2007). Ada Lake is a hardwater lake with moderate nutrient enrichment. The average Secchi depth (which measures water transparency) between 1984 and 2007 was 14 feet, indicating relatively high water clarity (MPCA 2007). The Minnesota DNR Section of Fisheries manages Ada Lake primarily for northern pike, largemouth bass, and walleye (MN DNR 2007).

Figure 2. Features of Ada Lake.

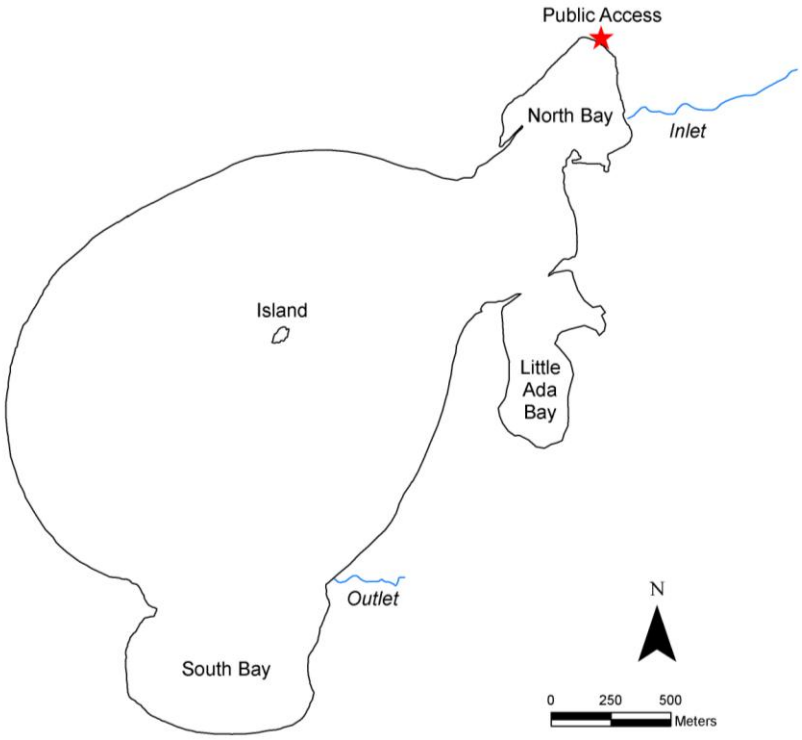
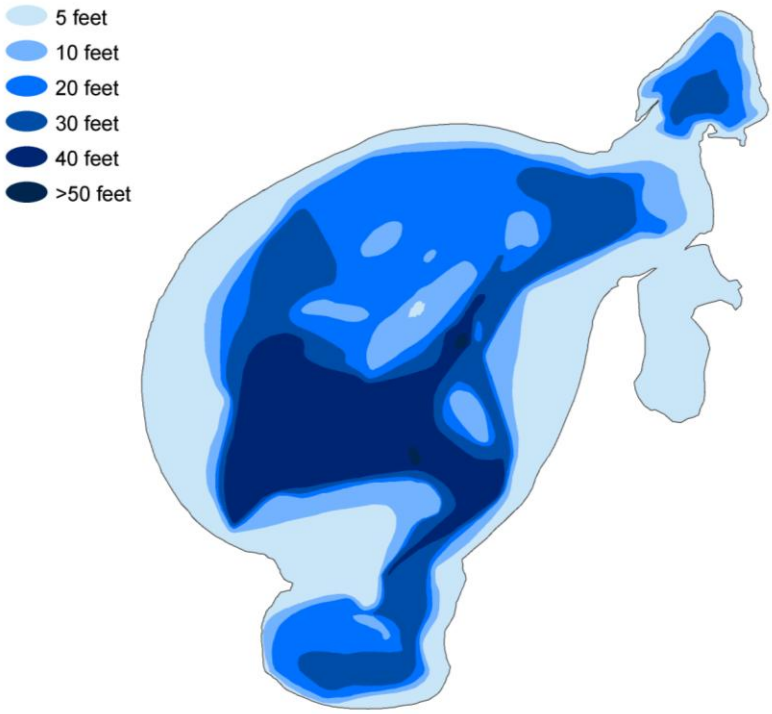
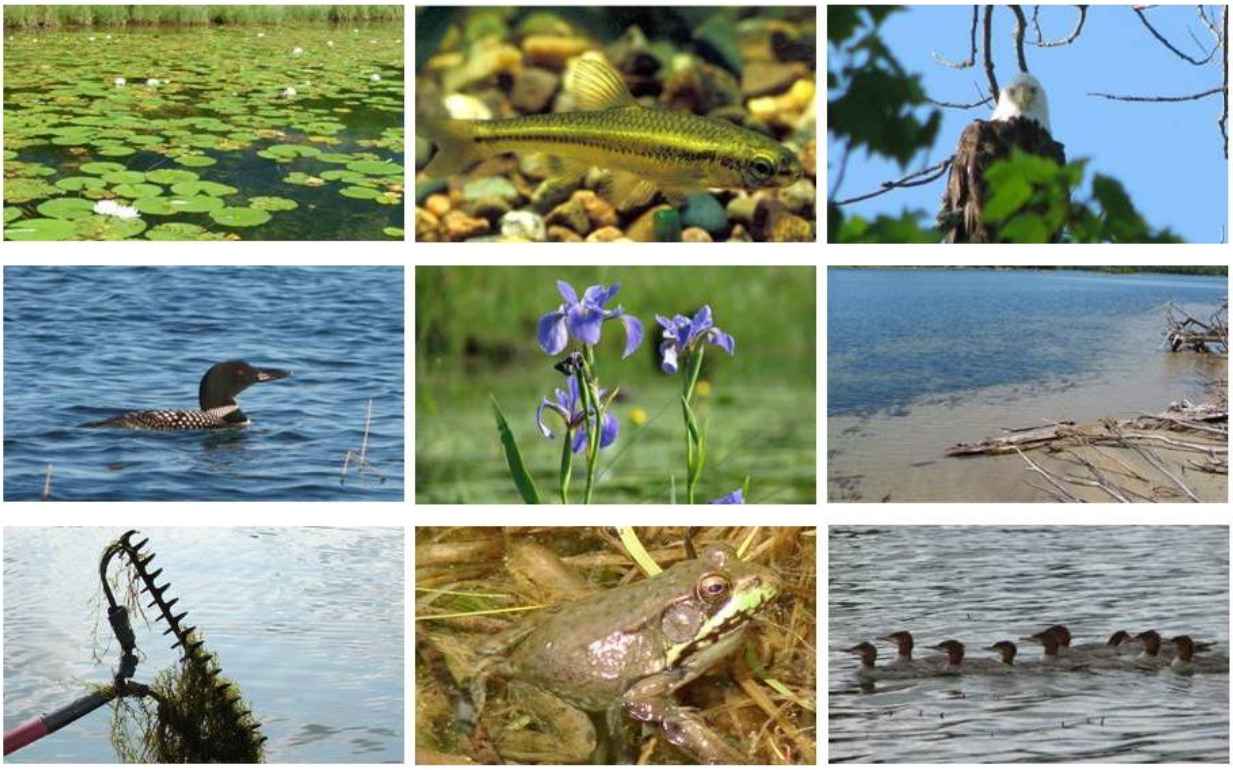


Figure 3. Depth contours of Ada Lake.



I. Field Surveys and Data Collection

Survey and data collection followed Minnesota's Sensitive Lakeshore Identification Manual protocol (MN DNR 2008). Resource managers gathered information on 15 different variables in order to develop the sensitive shorelands model. Sources of data included current and historical field surveys, informational databases, aerial photographs, and published literature. The variables used in this project were: wetlands, hydric soils, near-shore plant occurrence, aquatic plant richness, presence of emergent and floating-leaf plant beds, unique plant species, near-shore substrate, birds, bird species richness, loon nesting areas, frogs, fish, aquatic vertebrate species richness, rare features, and size and shape of natural areas.



Pugnose shiner photo courtesy of Konrad Schmidt

Wetlands

Objectives

1. Map wetlands within the extended state-defined shoreland area of Ada Lake

Introduction

Wetlands are important habitat types that provide a variety of services to the environment, to plants and animals, and to humans. Wetland vegetation filters pollutants and fertilizers, making the water cleaner. The roots and stems of wetland plants trap sediments and silt, preventing them from entering other water bodies such as lakes. They protect shorelines against erosion by buffering the wave action and by holding soil in place. Wetlands can store water during heavy rainfalls, effectively implementing flood control. This water may be released at other times during the year to recharge the groundwater. Wetlands also provide valuable habitat for many wildlife species. Birds use wetlands for feeding, breeding, and nesting areas as well as migratory stopover areas. Fish may utilize wetlands for spawning or for shelter. Numerous plants will grow only in the specific conditions provided by wetlands. Finally, wetlands provide a variety of recreational opportunities, including fishing, hunting, boating, photography, and bird watching.

Although the definitions of wetlands vary considerably, in general, wetlands are lands in which the soil is covered with water all year, or at least during the growing season. This prolonged presence of water is the major factor in determining the nature of soil development and the plants and animals that inhabit the area. The more technical definition includes three criteria:

1. Hydrology – the substrate is saturated with water or covered by shallow water at some time during the growing season of each year
2. Hydrophytes – at least periodically, the land supports predominantly hydrophytes (plants adapted to life in flooded or saturated soils)
3. Hydric soils – the substrate is predominantly undrained hydric soil (flooded or saturated soils) (adapted from Cowardin et al. 1979)

Methods

Wetland data were obtained from the National Wetlands Inventory (NWI) of the U.S. Fish and Wildlife Service (USFWS). The NWI project was conducted between 1991 and 1994 using aerial photography from 1979 – 1988. Wetland polygons obtained from the NWI were mapped in a Geographic Information System (GIS) computer program. Only wetlands occurring within the extended state-defined shoreland area (i.e., within 1320 feet of the shoreline) were considered in this project. Wetlands classified as lacustrine or occurring lakeward of the Ada Lake ordinary high water mark were excluded from this analysis.

Results

Approximately 18 percent, or just over 200 acres, of the Ada Lake shoreland (the area within 1320 feet of the shoreline), are described as wetlands by NWI. Wetlands that connect directly to

the shoreline of Ada Lake are located near North Bay and Little Ada Bay and along the outlet to Bass Lake (Figure 4). These wetlands are described as palustrine scrub shrub (Cowardin et al. 1979) or wetland shrubland systems (MN DNR 2003), dominated by deciduous or evergreen shrubs (Figure 5).

Other wetlands located around Ada Lake include emergent wetland (Cowardin et al. 1979) or marsh (MN DNR 2003) systems, characterized by herbaceous, emergent wetland vegetation (Figure 6), and forested wetlands (Cowardin et al. 1979, MN DNR 2003) with deciduous and evergreen trees. The water regime varied among wetlands and included saturated, seasonally flooded and semipermanently flooded soils.

Figure 4. Wetlands within 1320 feet of Ada Lake shoreline.

Figure 5. Shrub wetland along shoreline of Ada Lake

Figure 6. Green heron in emergent wetland along Ada Lake shoreline

Hydric Soils

Objectives

1. Map hydric soils within the extended state-defined shoreland area of Ada Lake

Introduction

Hydric soils are defined as those soils formed under conditions of saturation, flooding, or ponding. The saturation of these soils combined with microbial activity causes oxygen depletion; hydric soils are characterized by anaerobic conditions during the growing season. These conditions often result in the accumulation of a thick layer of organic matter, and the reduction of iron or other elements.

Hydric soils are one of the "diagnostic environmental characteristics" that define a wetland (along with hydrology and vegetation). Identification of hydric soils may indicate the presence of wetlands, and provide managers with valuable information on where to focus conservation efforts.

Methods

The National Cooperative Soil Survey, a joint effort of the USDA Natural Resources Conservation Service (NRCS) with other Federal agencies, State agencies, County agencies, and local participants, provided soil survey data. Polygons delineating hydric soils were mapped in a GIS computer program. Only hydric soils within 1320 feet of the shoreline were considered in this project.

Results

Approximately 270 acres of hydric soils were mapped within the Ada Lake shoreland area. Hydric soils were located along much of the Ada Lake shoreline, with the greatest concentrations occurring between North Bay and Little Ada Bay (Figure 7). Soils were poorly to very poorly drained, and most contained high to very high amounts of organic matter. Soil types included muck, peat, and loamy sand.

Figure 7. Hydric soils within 1320 feet of Ada Lake shoreline.

Plant Surveys

Objectives

1. Record presence and abundance of all aquatic plant species
2. Describe distribution of vegetation in Ada Lake
    a. Estimate maximum depth of plant colonization
    b. Estimate plant occurrence in bays versus main lake
    c. Estimate and map the near-shore occurrence of vegetation
3. Delineate and describe floating-leaf and emergent plant beds
4. Map distribution and describe habitat of unique plant species
5. Calculate and map aquatic plant taxa richness

Summary

Aquatic plants occurred around the entire perimeter of Ada Lake and low-growth beds of submerged vegetation were common near shore as well as in shallow off-shore sites. Submerged plants occurred to a depth of 24 feet but were most common in the shore to 20 feet depth zone, where 93 percent of the sample sites contained vegetation.

A total of 48 native aquatic plant taxa were recorded including 29 submerged, two free-floating, four floating-leaved, and 13 emergent taxa.

Bushy pondweed (*Najas flexilis* and *Najas guadalupensis*) and muskgrass (*Chara* sp.) were the most common submerged taxa, occurring in 53 and 39 percent of the survey sites, respectively. Other common submerged species included coontail (*Ceratophyllum demersum*), broad-leaf pondweeds (*Potamogeton gramineus*, *P. illinoensis*, *P. praelongus*, *P. amplifolius)*, and northern watermilfoil (*Myriophyllum sibiricum*).

Floating-leaf plant beds were mostly restricted to northeastern bays and occupied about 41 acres. Common species were watershield (*Brasenia schreberi*), white waterlily (*Nymphaea odorata*), yellow waterlily (*Nuphar variegata*) and floating-leaf pondweed (*Potamogeton natans*). About ten acres of emergent bulrush (*Schoenoplectus* spp.) beds were mapped and these stands occurred on sandy sites near shore and around the island.

Unique submerged aquatic plants documented during the surveys included humped bladderwort (*Utricularia gibba*), lesser bladderwort (*U. minor*), flat-leaved bladderwort (*U. intermedia*), water bulrush (*Schoenoplectus subterminalis*), creeping spearwort (*Ranunculus flammula*), and mare's tail (*Hippuris vulgaris*). Unique emergent aquatic plants were water arum (*Calla palustris*) and three-way sedge (*Dulichium arundinaceum*).

Introduction

The types and amounts of aquatic vegetation that occur within a lake are influenced by a variety of factors including water clarity, water chemistry, water depth, substrate and wave activity. Deep or wind-swept areas may lack in aquatic plant growth, whereas sheltered shallow areas

may support an abundant and diverse native aquatic plant community that in turn, provides critical fish and wildlife habitat and other lake benefits. The annual abundance, distribution and composition of aquatic plant communities may change due to environmental factors, predation, the specific phenology of each plant species, introductions of non-native plant or animal species, and human activities in and around the lake.

Non-native submerged aquatic plant species have not been documented in Ada Lake. However, if they invade the lake, they may directly or indirectly impact the native plant community. Non-native plant species, such as Eurasian watermilfoil (*Myriophyllum spicatum*) or curly-leaf pondweed (*Potamogeton crispus*) may form dense surface mats that shade out native plants. The impact of these invasive species varies among lakes but the presence of a healthy native plant community may help mitigate the harmful effects of these exotics.

Humans can impact aquatic plant communities directly by destroying vegetation with herbicide or by mechanical means. Motorboat activity in vegetated areas can be particularly harmful for species such as bulrush and wild rice. Shoreline and watershed development can also indirectly influence aquatic plant growth if it results in changes to the overall water quality and clarity. Limiting these types of activities can help protect native aquatic plant species.

Submerged plants

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

Bushy pondweed (*Najas flexilis*; Figure 8) is unusual because it is one of the few annual submerged species in Minnesota and must re-establish every year from seed. Bushy pondweed grows entirely below the water surface. It prefers hard substrates and is not tolerant of turbidity (Nichols 1999b). Southern bushy pondweed (*Najas guadalupensis*) is a closely related species but is less widespread throughout Minnesota. It can be difficult to distinguish the two species. The seeds and foliage of these plants are important duck foods and beds of these plants provide good fish cover.

Figure 8. Bushy pondweed

Muskgrass (*Chara* sp.; Figure 9) is a large algae that is common in many hardwater Minnesota lakes. Large algae resemble higher plants but do not form flowers or true leaves, stems and roots. These plants grow entirely submerged, are often found at the deep edge of the plant zone (Arber 1920), and may form thick "carpets" on the lake bottom. Muskgrass has a brittle texture and is named for its characteristic "musky" odor. Beds of muskgrass

Figure 9. Bed of muskgrass

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

Coontail (*Ceratophyllum demersum*; Figure 10) is the most common submerged flowering plant in Minnesota lakes. It grows entirely submerged and is adapted to a broad range of lake conditions, including turbid water. Coontail is a perennial and can overwinter as a green plant under the ice before beginning new growth early in spring. Because it is only loosely rooted to the lake bottom it may drift between depth zones (Borman et al. 2001). Coontail provides important cover for young fish, including bluegills, perch, largemouth bass and northern pike. It also supports aquatic insects beneficial to both fish and waterfowl.

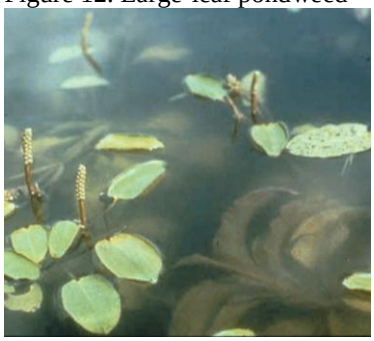
Figure 10. Coontail

Pondweeds (*Potamogeton* spp. and *Stuckenia* spp.) are one of the largest groups of submerged plants in Minnesota lakes. These plants are rooted perennials and their rhizomes may form mats on the lake bottom that help consolidate soil (Arber 1920). Pondweeds have opposite, entire leaves and form "cigar-shaped" flowers that emerge above the water surface. Many pondweed species over-winter as hardy rhizomes while other species produce tubers, specialized winter buds, or remain "evergreen" under the ice. Seeds and tubers of pondweeds are an important source of waterfowl food (Fassett 1957). The foliage of pondweeds is food for a variety of marsh birds, shore birds and wildlife and provides shelter, shade and spawning sites for a range of fish species (Borman et al. 2001). Pondweeds inhabit a wide range of aquatic sites and species differ in their water chemistry and substrate preferences and tolerance to turbidity. There are over 35 species of pondweeds in Minnesota and they vary in leaf shapes and sizes.

Figure 11. White-stem pondweed

Broad-leaf pondweeds include white-stem pondweed (*Potamogeton praelongus*; Figure 11), large-leaf pondweed (*P. amplifolius*; Figure 12), Illinois pondweed (*P. illinoensis*), and variable pondweed (*P. gramineus*). These plants are often called "cabbage" plants by anglers. Some broad-leaf pondweeds may form floating leaves in sheltered sites while other species have only submerged leaves. Species like white-stem and large-leaf pondweed are common in many clear water Minnesota lakes but are often among the first species to decline in degraded water. White-stem and large-leaf pondweeds are not tolerant of turbidity (Nichols 1999b) and may be negatively impacted by increased lake development.

Figure 12. Large-leaf pondweed



Northern watermilfoil (*Myriophyllum sibiricum*; Figure 13) is a rooted, perennial submerged plant with finely dissected leaves. It may reach the water surface, particularly in depths less than ten feet, and its flower stalk extends above the water surface. It spreads primarily by stem fragments and overwinters by hardy rootstalks and winter buds. Northern watermilfoil is not tolerant of turbidity (Nichols 1999b) and grows best in clear water lakes. This native plant provides fish shelter and insect habitat and the extensive root systems help stabilize near-shore substrates.

Figure 13. Northern watermilfoil

Floating-leaf and emergent plants

Floating-leaf and emergent aquatic plants are anchored in the lake bottom and their root systems often form extensive networks that help consolidate and stabilize bottom substrate. Beds of floating-leaf and emergent plants help buffer the shoreline from wave action, offer shelter for insects and young fish, and provide shade for fish and frogs. These beds are also sources of food, cover and nesting material for waterfowl, marsh birds and muskrat. Floating-leaf and emergent plants are most often found in shallow water to depths of about six feet and may extend lake-ward onto mudflats and into adjacent wetlands.

Figure 14. White waterlily

Figure 15. Yellow waterlily

Floating-leaf plants include white waterlily (*Nymphaea odorata),* yellow waterlily (*Nuphar variegata*), watershield (*Brasenia schreberi*), and floating-leaf pondweed (*Potamogeton natans*). These are perennial plants that can reproduce by seed and by vegetative growth. Watershield may produce winterbuds, whereas waterlilies typically over-winter by hardy rhizomes.

White and yellow waterlilies can be found in lakes in both northern and southern Minnesota. White waterlily (Figure 14) has showy white flowers and round leaves with radiating veins. Yellow waterlily (Figure 15) has smaller yellow flowers and oblong leaves with parallel veins. These species often co-occur in mixed beds but yellow waterlily is generally restricted to depths less than seven feet and white waterlily may occur to depths of ten feet (Nichols 1999b).

Figure 16. Watershield

Watershield (Figure 16) is most often found in soft-water lakes (Borman et al. 2001) in northern Minnesota. It has relatively small, floating oval leaves and small reddish flowers. The leaves are green on top,

while the underside of the leaves and stems are reddish-purple. The leaves and stems of watershield have a slippery, gelatinous coating.

Floating-leaf pondweed occurs throughout Minnesota and is most often found in depths less than five feet (Nichols 1999b). The floating leaves of this plant are smaller than waterlily leaves and have a heart-shaped base (Figure 17). Fruits of this plant provide an important food source for waterfowl.

Figure 17. Floating-leaf pondweed

Emergent aquatic plants have stems and/or leaves that extend well above the water surface. Most emergent plants are flowering plants, although their flowers may be reduced in size. Emergent plants include perennial plants as well as annual plants.

Figure 18. Bulrush bed in Ada Lake, 2007

Narrow-leaved emergent plants include bulrushes and spikerushes. Bulrush (*Schoenoplectus* spp.) is an emergent, perennial plant that occurs in lakes and wetlands throughout Minnesota (Ownbey and Morley 1991). Bulrush stems are round in cross section and lack showy leaves. Clusters of small flowers form near at the tips of long, narrow stalks. This emergent may occur from shore to water depths of about six feet and its stems may extend several feet above the water surface (Figure 18). Bulrush stands are particularly susceptible to destruction by excess herbivory and direct removal by humans.

Figure 19. Spikerush

Spikerush (*Eleocharis* spp.; Figure 19) is related to bulrush and similar in appearance, but it often is shorter in height. The stems are usually hollow, and circular in cross section. In summer, the leafless stems are topped with clusters of seeds and brown flower heads. Spikerush is often found in shallow areas, particularly near shore.

Figure 20. Arrowhead

There are several types of broad-leaved emergent plants and these often occur close to the shoreline. While these plants most often occur as emergents, several species may grow as floating-leaf plants for all or part of their life cycle.

Arrowhead (*Sagittaria* spp.; Figure 20) are broad-leaf, perennial plants that may form emergent, floating and/or submerged leaves. These plants may be found submerged in several feet of water or growing emergent along shore and in wetlands. These plants form small, but attractive white flowers that later develop into green seed

heads. Arrowhead seeds and tubers are valuable food for waterfowl and marsh birds and leaves and tubers may be eaten by muskrats (Newmaster et al. 1997).

Figure 21. Giant burreed

Burreed (*Sparganium* spp.; Figure 21) are perennial, emergent plants with leaves that resemble cattails but they are shorter in height and their leaves are triangular in cross-section. Burreed grows in shallow water (less than 4 feet) along shorelines and in wetlands throughout Minnesota. Some burreed species form only floating-leaves, some are only emergent, and some can form both types of leaves. The plants produce fruits with nut-like achenes that are eaten by ducks, common snipe and rails; the stems and leaves are a preferred food of muskrats and deer (Newmaster et al. 1997).

Unique aquatic plants

Unique aquatic plant species are of high conservation importance. These species may include:

- Plant species that are not listed as rare but are uncommon in the state or locally. These may include species that are proposed for rare listing.
- Plant species with high coefficient of conservatism values (C values). These values range from 0 to 10 and represent the "estimated probability that a plant is likely to occur in a landscape relatively unaltered from what is believed to be a pre-settlement condition" (Nichols 1999a, Bourdaghs et al. 2006). Plant species with assigned C values of 9 and 10 were included as unique species.

Bladderworts (*Utricularia* spp.) are a group of submerged plants that produce roots but do not firmly anchor to the lake bottom. Unique bladderwort species include humped bladderwort (*Utricularia gibba*), lesser bladderwort (*U. minor*) and flat-leaved bladderwort (*U. intermedia*). They have been documented at scattered locations throughout northern Minnesota (Ownbey and Morley 1991). These small, submerged plants are often confused with algae because they have fine, hair-like stems and leaves. Bladderworts have specialized air bladders that regulate their position in the water column. They also act as "underwater Venus fly-traps" by catching and digesting small insects in the bladders. Bladderworts produce small but showy flowers (Figure 22) that emerge above the water surface. They prefer soft substrates (Nichols 1999b) but also float freely in the water column and may be found in protected areas such as waterlily beds.

Figure 22. Bladderwort in flower among watershield

Figure 23. Water bulrush

Photo by: D.W. Taylor. Copyright 1996.

Water bulrush (*Schoenoplectus subterminalis*; Figure 23) is closely related to the emergent bulrush plants but grows primarily as a submerged plant. It is a rooted perennial with fine, grass-like leaves and may form mats near the

water surface. In mid to late summer its leaf tips and flower stalk may emerge above the water surface. This species once had a patchy distribution throughout North America but may now be extirpated from Illinois (Flora of North America 1993+) and its conservation status is listed as critically impaired in several other states (NatureServe 2008). It is infrequently found in Wisconsin (Nichols 1999b) and Minnesota (Ownbey and Morley 1991) lakes.

Figure 24. Creeping spearwort

Photo by: Emmit Judziewicz, U. of WI-Stevens Point Herbarium

Creeping spearwort (*Ranunculus flammula*) is mostly found in the northern half of Minnesota (Flora of North America 1993+). It grows on hard substrates like sand and gravel (Borman et al. 2001). In Cass County lakes it often grows as a submerged plant but may grow as a short emergent on mudflats. It has linear leaves that emerge in small clusters from the arched runners or stolons. This plant is in the buttercup family and if stranded on mudflats, it may form characteristic yellow buttercup flowers (Figure 24).

Figure 25. Mare's tail

Mare's tail (*Hippuris vulgaris*) is a generally submerged plant whose leaves and stems can emerge above the water in shallow depths (Figure 25). This plant occurs primarily in northern Minnesota lakes but is relatively uncommon. It is often associated with cold-water streams or springs (Voss 1985) and its presence in a waterbody may be indicative of relatively good water quality. The plant is named because the whorls of leaves resemble a horse's tail.

Figure 26. Water arum

Water arum (*Calla palustris*; Figure 26) is an emergent, perennial wetland plant that may grow along marshy lakeshores as well as in wooded swamps, marshes and bogs (Nichols 1999b). The plant is recognizable by its heart-shaped leaves and the showy, white petal-like spathe. This is a species of northern latitudes and Minnesota is the southwestern limit of its range (Flora of North America 1993+). Within Minnesota, water arum primarily occurs in the northeastern half of the state (Ownbey and Morley 1991).

Figure 27. Three-way sedge

Photo by: A. Murray, U. of FL, Center for Aquatic Plants. Copyright 2003.

Three-way sedge (*Dulichium arundinaceum*; Figure 27) is an emergent, perennial plant that grows along soft bottom lakeshores and in marshes. This plant does not produce a showy flower but can be identified by its unique three-ranked leaf arrangement that resembles an airplane propeller from above (Newmaster et al. 1997). Three-way sedge is found along shores

of lower alkalinity lakes (Nichols 1999b) throughout central and northern Minnesota (Ownbey and Morley 1991).

Species richness
Species richness is defined as the number of species present in a community and is often used as a simple measure of biodiversity (Magurran 2004). In aquatic plant communities, species richness is influenced by many complex factors (Pip 1987) including water chemistry, transparency, habitat area and habitat diversity (Vestergaard and Sand-Jensen 2000, Rolon et al. 2008). In Minnesota, water chemistry strongly influences which plant species can potentially occur in a lake (Moyle 1945), and thus, indirectly influences lakewide species richness. The trophic status of a lake further influences plant species richness, and eutrophic and hypertrophic habitats have been associated with reduced species richness (Pip 1987). Within a region of Minnesota, lakewide aquatic plant species richness can be used as a general indicator of the lake clarity and overall health of the lake plant community. Loss of aquatic plant species has been associated with anthropogenic eutrophication (Stuckey 1971, Nicholson 1981, Niemeier and Hubert 1986) and shoreland development (Meredith 1983).

Within a lake, plant species richness generally declines with increasing water depth, as fewer species are tolerant of lower light levels available at deeper depths. Substrate, wind fetch, and other physical site characteristics also influence plant species richness within lakes.

Methods

The aquatic plant communities of Ada Lake were described and measured using several techniques as found in Minnesota's Sensitive Lakeshore Identification Manual. Plant nomenclature follows MNTaxa 2009.

Grid point-intercept survey
A grid point-intercept survey was conducted on Ada Lake in late July 2007 (Perleberg 2008). A GIS computer program was used to establish aquatic plant survey points throughout the littoral (i.e., vegetated) zone of the lake to a depth of 20 feet. Points were spaced 65 meters apart and 479 sites were sampled. Surveyors navigated to each site using a handheld Global Positioning System (GPS) unit. At each sample site, water depth was recorded and all vegetation within a one-meter squared sample area was sampled using a double-headed garden rake. All aquatic plant species present within the sample plot were recorded and frequency of occurrence was calculated for each species. Any additional species found outside the sample plots were recorded as present in the lake. Voucher specimens were collected for most species and were submitted to The Herbarium of the University of Minnesota Bell Museum of Natural History, St. Paul, MN.

Emergent and floating-leaf bed delineation
Protocols for mapping plant beds were based on the procedures documented in the DNR draft Aquatic Vegetation Mapping Guidelines (MN DNR 2005). They included a combination of aerial photo delineation and interpretation, field delineation, ground-truthing and site specific surveys. Waterlily beds were delineated using 2003-2004 Farm Service Administration (FSA) true color aerial photos. Black and white aerial photos from 1999 were used to help distinguish the true shoreline from mats of perennial vegetation. Field mapping focused on bulrush beds,

which were difficult to see on aerial photos. Bulrush beds were mapped in 2007 using handheld Global Positioning System (GPS) technology. Reconnaissance surveys were conducted of other plant beds to verify species composition and, if needed, modify boundary lines.

Near-shore vegetation survey
Near-shore vegetation surveys were conducted at seven plots. Plots were selected based on the presence of nongame fish. Each plot measured 15 meters along the shoreline and 16 meters lakeward, and 30 (one-meter squared) sites were sampled within each plot. Surveyors recorded plant species present, water depth, substrate and presence of woody debris. Surveyors also recorded all plant taxa found along the shoreland within a one-meter landward by 15 meters along-shore plot.

Searches for unique and rare species
Prior to fieldwork, surveyors obtained known locations of state and federally listed rare plants within one mile of Ada Lake from the Rare Features Database of the MN DNR Natural Heritage Information System. Surveyors also queried the University of Minnesota Herbarium Vascular Plant Collection database and DNR Fisheries Lake Files to determine if certain plant species had previously been documented in or near Ada Lake.

Surveyors searched for unique and rare plant species in 2007 during the lakewide point-intercept surveys and during the near-shore plot surveys. If unique or rare plant species were located, surveyors recorded the site location, the plant species found, associated plant species, approximate water depth and substrate type. Any new sites of rare plant species were documented and entered into the Minnesota DNR Natural Heritage Information System.

A targeted search for rare aquatic vascular plants in Ada Lake was conducted by the Minnesota County Biological Survey Program on August 11, 2008 (Myhre 2008). This search focused on sites that were most likely to contain rare plant species. Botanists used professional experience to select rare species search sites and included factors such as shoreline development, substrate type, water depth, and native plant community type in their site selection. To gain access to shallow vegetated areas, searches were conducted by slowly kayaking, canoeing and/or wading through the site.

A brief habitat description and a list of all plant taxa found in the search area were recorded. When necessary, plant specimens were sent to the authority in the field for identification verification and annotation. Voucher specimens were collected to document county records and some other species, and were submitted to The Herbarium of the University of Minnesota Bell Museum of Natural History, St. Paul, MN.

Results

Distribution of plants by water depth
Submerged plants were found to a maximum depth of 24 feet but were most common in the shore to 20 feet depth zone where 93 percent of the sites were vegetated. Emergent, floating-leaf and free-floating plants were restricted to water depths of five feet and less.

Distribution of plants in main basin versus bays

Aquatic plants were found around the entire perimeter of Ada Lake as well as the shallow off-shore areas (Figure 28). Areas of sparse vegetation were shorelines with steep depth contours, such as the south and north shores. Approximately 53 acres of emergent and floating-leaf beds were mapped with the largest beds occurring in Little Ada Bay.

Aquatic plant species observed

A total of 48 native aquatic plant taxa were recorded including 29 submerged, two free-floating (Table 1), four floating-leaved and 13 emergent taxa (Table 2). In addition, 20 native emergent wetland plants and shrubs and two non-native shoreline emergent plant taxa were observed (Appendix 1).

Figure 28. Distribution of aquatic plants in Ada Lake, 2007.

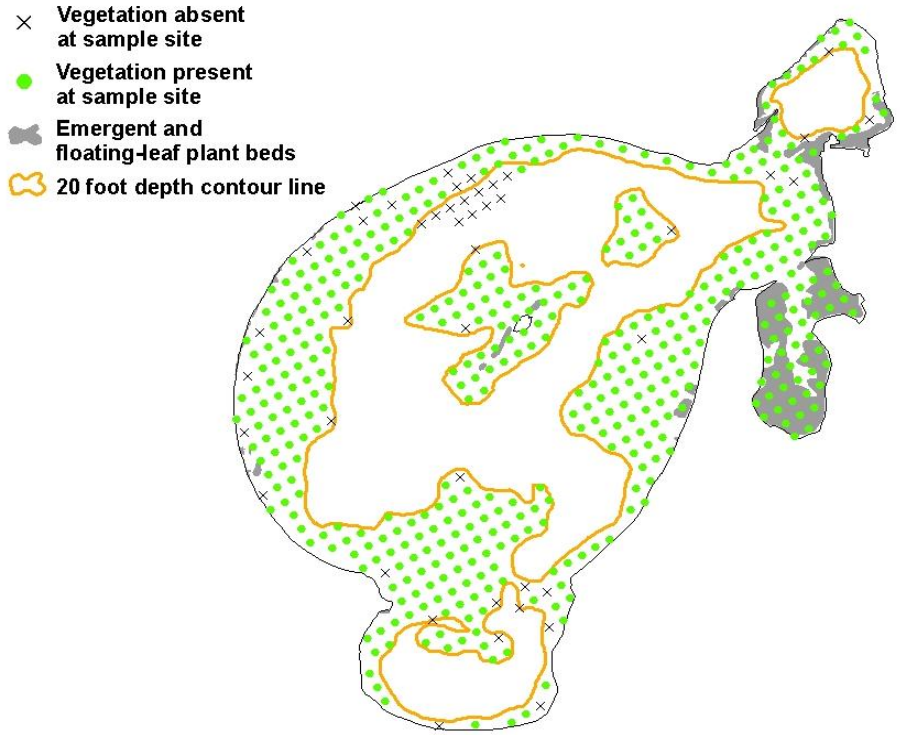


Table 1. Submerged and free-floating aquatic plants recorded in Ada Lake, 2007 and 2008.

Description		Common Name	Scientific Name	Frequency[a] N = 479
SUBMERGED These plants grow primarily under the water surface. Upper leaves may float near the surface and flowers may extend above the surface. Plants may or may not be anchored to the lake bottom.	Algae and Moss	Muskgrass	*Chara* sp.	39
		Watermoss	Not identified to genus	<1
	Bushy-leaved	Bushy pondweed	*Najas flexilis*	53
		Southern naiad	*Najas guadalupensis*	
		Canada waterweed	*Elodea canadensis*	3
		Mare's tail	*Hippuris vulgaris*	Present[c]
	Dissected-leaved	Coontail	*Ceratophyllum demersum*	17
		Northern watermilfoil	*Myriophyllum sibiricum*	7
		White water buttercup	*Ranunculus aquatilis*	<1
		Water marigold	*Bidens beckii*	Present[b]
	Broad-leaved	Variable pondweed	*Potamogeton gramineus*	9
		Illinois pondweed	*Potamogeton illinoensis*	8
		White-stem pondweed	*Potamogeton praelongus*	6
		Large-leaf pondweed	*Potamogeton amplifolius*	4
	Grass-leaved	Wild celery	*Vallisneria americana*	4
		Flat-stem pondweed	*Potamogeton zosteriformis*	4
		Robbins' pondweed	*Potamogeton robbinsii*	1
		Water stargrass	*Zosterella dubia*	<1
	Narrow-leaved	Fries' pondweed	*Potamogeton friesii*	1
		Leafy pondweed	*Potamogeton foliosus*	1
		Very small pondweed	*Potamogeton pusillus*	Present[c]
		Sago pondweed	*Stuckenia pectinata*	<1
	Needle-leaved	Creeping spearwort	*Ranunculus flammula*	1
		Water bulrush	*Schoenoplectus subterminalis*	1
		Braun's quillwort	*Isoetes echinospora*	Present[c]
	Bladderworts	Greater bladderwort	*Utricularia vulgaris*	1
		Lesser bladderwort	*Utricularia minor*	1
		Humped bladderwort	*Utricularia gibba*	Present[b]
		Flat-leaved bladderwort	*Utricularia intermedia*	Present[b]
FREE-FLOATING	Duckweeds	Star duckweed	*Lemna trisulca*	Present[b]
		Greater duckweed	*Spirodela polyhriza*	Present[b]

[a]Frequency values are provided for taxa that were observed within point-intercept survey sample stations. They represent the percent of the sample stations that contained a plant taxon.

[b]Present = Found in the lake in 2007 but not located within point-intercept sample stations.

[c]Present = Located only during Minnesota County Biological Survey, 11 August 2008.

Nomenclature follows MNTaxa 2009.

Table 2. Shoreline plants identified in Ada Lake, 2007 and 2008.

Description		Common Name	Scientific Name	Frequency[a] N = 479
FLOATING These plants are rooted in the lake bottom and have leaves that float on the water surface.		Watershield	*Brasenia schreberi*	4
		Yellow waterlily	*Nuphar variegata*	4
		White waterlily	*Nymphaea odorata*	2
		Floating-leaf pondweed	*Potamogeton natans*	3
EMERGENT These plants extend well above the water surface and are usually found in shallow water, near shore.	Narrow-leaf	Hard-stem bulrush	*Schoenoplectus acutus*	2
		Soft-stem bulrush	*Schoenoplectus tabernaemontani*	Present[c]
		Small spikerush	*Eleocharis palustris*	1
		Needlegrass	*Eleocharis acicularis*	<1
		Bald spikerush	*Eleocharis erythropoda*	Present[c]
	Broad-leaf	Water arum	*Calla palustris*	Present[b]
		Three-way sedge	*Dulichium arundinaceum*	<1
		Broadleaf arrowhead	*Sagittaria latifolia*	1
		Stiff wapato	*Sagittaria rigida*	Present[c]
		American burreed	*Sparganium americanum*	<1
		Giant burreed	*Sparganium eurycarpum*	<1
		Narrow-leaf cattail	*Typha* sp.	<1
		Wild rice	*Zizania palustris*	<1

[a]Frequency values are provided for taxa that were observed within point-intercept survey sample stations. They represent the percent of the sample stations that contained a plant taxon.

[b]Present = Found in the lake in 2007 but not located within point-intercept sample stations.

[c]Present = Located only during Minnesota County Biological Survey, 11 August 2008 .

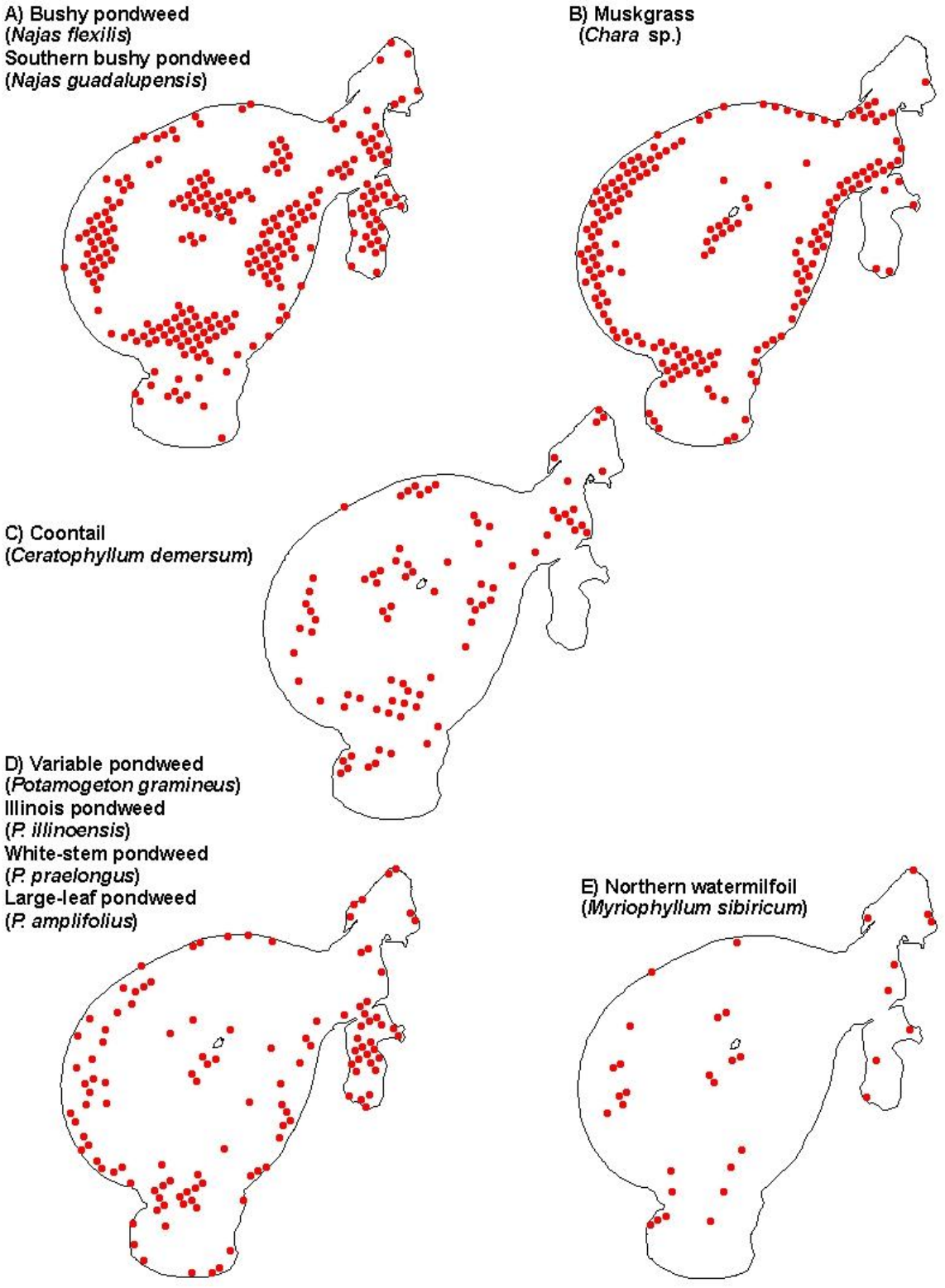
Nomenclature follows MNTaxa 2009.

Submerged plants

Bushy pondweed and southern bushy pondweed were grouped for analyses and were the most frequently sampled taxa. They occurred in 53 percent of the sample sites and were most common in depths of six to 15 feet (Figure 29A). Muskgrass was found in 39 percent of the sites but occurred in shallower waters (shore to five feet) than bushy and southern bushy pondweed (Figure 29B). Coontail occurred in 17 percent of the Ada Lake sample sites (Figure 29C). It was most common in depths of 15 to 20 feet, and was the only taxa found beyond the depth of 20 feet.

Ten different submerged pondweed species (*Potamogeton* spp. and *Stuckenia* spp.) were found in Ada Lake. Variable pondweed was the most abundant pondweed in Ada Lake and was found in nine percent of all sample sites (Figure 29D). Illinois pondweed and white-stem pondweed occurred in eight and six percent of the sites, respectively. These pondweeds were found around the entire perimeter of Ada Lake, often co-occurred at sites, and were most frequent in depths of 15 feet and less. Northern watermilfoil was found in 7 percent of the Ada Lake sample sites (Figure 29E). It was scattered throughout Ada Lake but was most frequently found in water depths less than 11 feet.

Figure 29. Distribution of common submerged plants in Ada Lake, 2007.



Emergent and floating-leaf plants

About 41 acres of floating-leaf plant beds were mapped. These beds were located mainly in the soft sediment areas of the northeastern bays (Figure 30). The beds included a mix of white waterlily, yellow waterlily, floating-leaf pondweed and watershield (Figure 31). Some beds also contained scattered bulrush and broad-leaf emergent plants as well as submerged plants. Because surveyors avoided motoring into floating-leaf plant beds, the frequency values obtained for these taxa (Table 2) were lower than the actual occurrence. Frequency values for floating-leaf taxa represent the occurrence of these taxa only within the sites that were surveyed.

Figure 31. Floating-leaf plant beds in Ada Lake

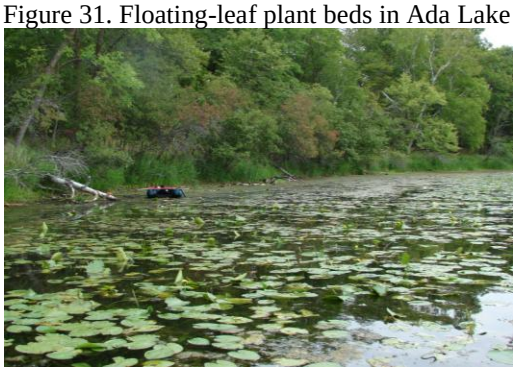
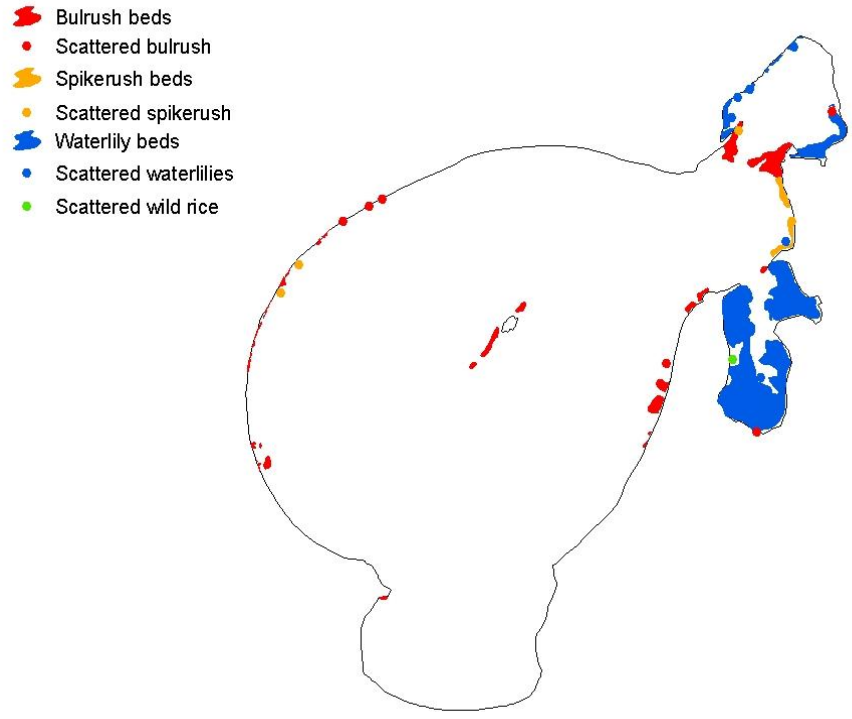


Figure 32. Emergent bulrush in Ada Lake

Surveyors delineated approximately ten acres of bulrush beds. Narrow bands of bulrush occurred along the east and west shores as well as at the entrance to the north bay (Figure 30). Bulrush beds were often associated with sandy substrates (Figure 32). Spikerush was found within bulrush beds, as well as in solitary stands along the shore between Little Ada Bay and North Bay.

Figure 30. Distribution of emergent and floating-leaf plant beds in Ada Lake, 2007.



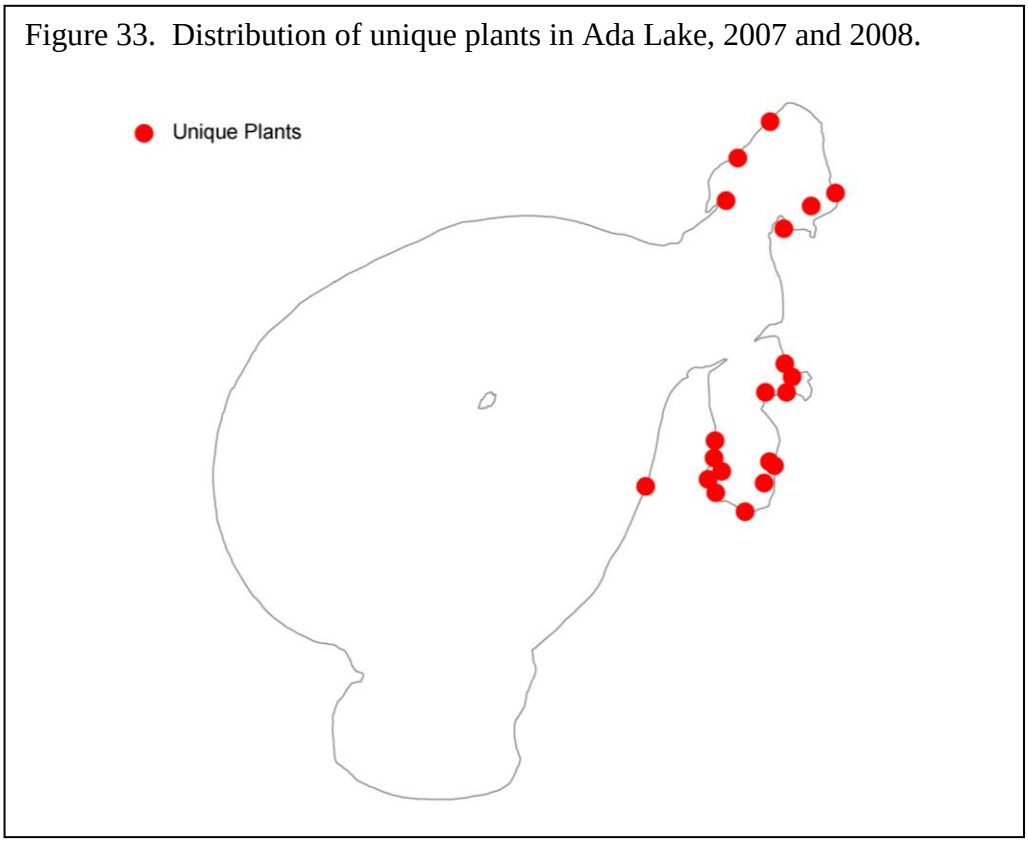
Other emergent plants included wild rice, arrowhead, and burreed. Many of these emergent plants occupied the transitional zone between upland and lake and some taxa extended into the water up to a depth of six feet.

Unique plants

In addition to the commonly occurring plants in Ada Lake, eight unique plant species were documented at 20 locations during the survey (Figure 33). These plants were primarily in shallow, protected waters along undeveloped shores of the northeastern bays (North Bay and Little Ada Bay). These species are not widespread in Minnesota and their presence is indicative of relatively undisturbed native plant communities in Ada Lake.

Unique submerged aquatic plants found in Ada Lake included humped bladderwort, lesser bladderwort, flat-leaved bladderwort, water bulrush, creeping spearwort and mare's tail. Unique emergent species found were water arum and three-way sedge. Creeping spearwort was the most frequently found unique species, and occurred at seven sampling stations. Three-way sedge and water bulrush were documented at six stations each. The maximum number of unique plant taxa at a sampling location was three.

Figure 33. Distribution of unique plants in Ada Lake, 2007 and 2008.

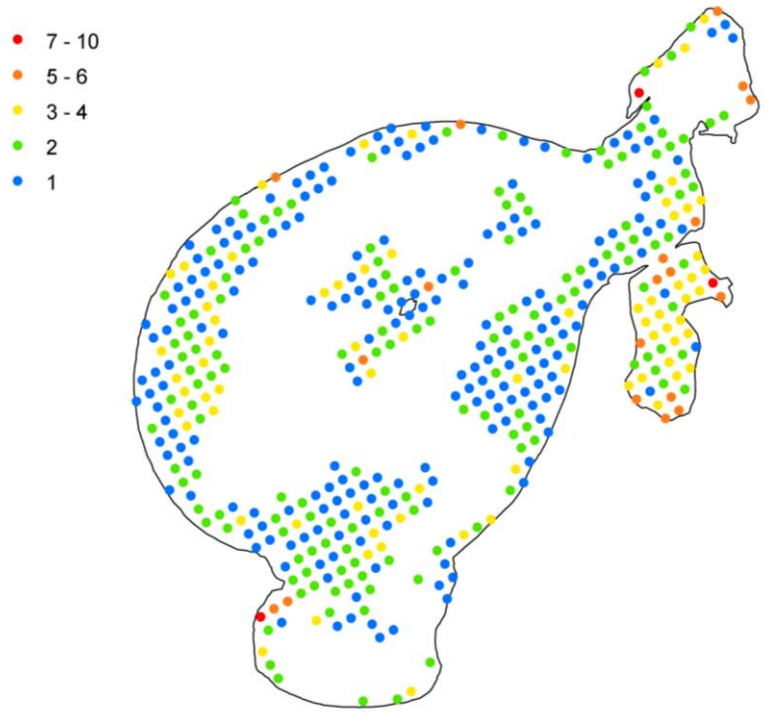


Species richness

The number of plant taxa found at each one-meter square site ranged from zero to ten (Figure 34). Sites with the highest number of taxa occurred in the Little Ada Bay where a mixture of

emergent, floating-leaf and submerged plants was found. In water depths greater than 15 feet, most sites contained one or no taxa.

Figure 34. Aquatic plant richness (number of taxa per sampling station) in Ada Lake, 2007.



Near-shore Substrates

Objectives

1. Describe and map the near-shore substrates of Ada Lake

Introduction

Substrate type can have an effect on species make-up and richness. Some fish, such as the pugnose shiner, least darter, and longear sunfish, prefer small diameter substrates that range from soft to hard, such as silt, muck, and sand. Other species, such as walleye, prefer hard bottom substrates with a larger diameter, such as gravel and rubble. A diverse substrate will also allow plants with different habitat requirements to exist within a system. For example, bulrush may occur on sand or gravel whereas yellow waterlily prefers soft substrates (Nichols 1999b).

Methods

Near-shore substrate in Ada Lake was evaluated at a total of 381 sampling stations set up in the grid point-intercept aquatic plant surveys and near-shore fish surveys. Plant sample stations were 65 meters apart and occurred in a grid from shore to a depth of 20 feet. To increase sample coverage at near-shore sites not covered by the grid sampling, substrate was also evaluated at near-shore fish sample stations. Fish sample stations were located every 400 meters around the perimeter of the lakeshore and substrate was evaluated at 29 of these stations.

Surveyors evaluated substrate by tapping a pole into the lake bottom; soft substrate could usually be brought to the surface on the pole or sampling rake for evaluation. If this was not feasible, substrate was evaluated by visual observation. Standard lake substrate classes were based on the DNR Fisheries Survey Manual (MN DNR 1993):

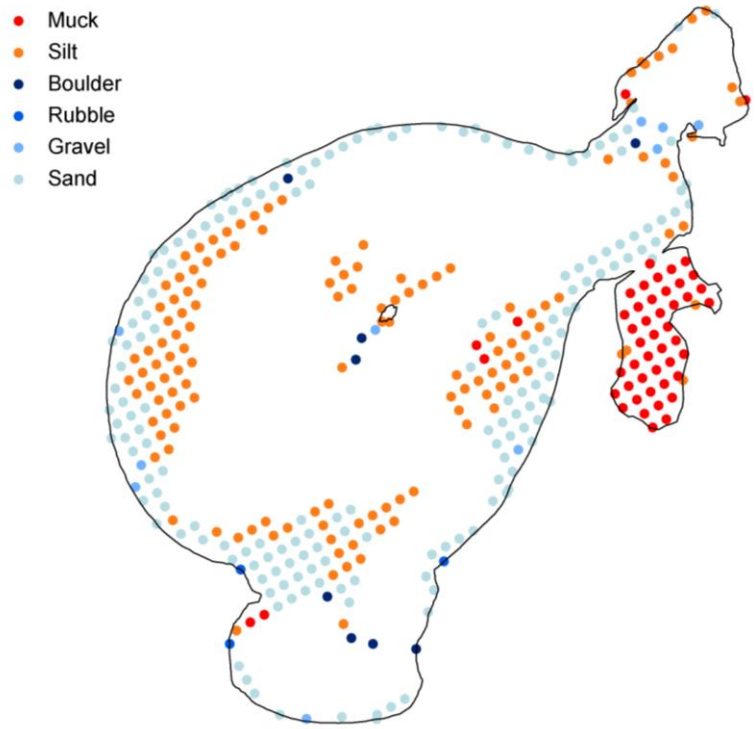
Substrate Group	Type	Description
Hard Bottom	Boulder	Diameter over 10 inches
	Rubble	Diameter 3 to 10 inches
	Gravel	Diameter 1/8 to 3 inches
	Sand	Diameter less than 1/8 inch
Soft Bottom	Silt	Fine material with little grittiness
	Marl	Calcareous material
	Muck	Decomposed organic material

Results

Both hard bottom and soft bottom substrates were documented in Ada Lake. Sand and silt were the two most common substrate types (Figure 35). Sand was more common in shallow water (shore to a depth of four feet) and silt was more common in depths of five to seven feet. Little Ada Bay was dominated by muck substrates. Broad sand shoals occurred along the east and

west shores, as well as the south shore of South Bay. Boulders were scattered along the south end of the island, and at the openings to the northeast and the south bays.

Figure 35. Distribution of substrates around Ada Lake, 2007.



Bird Surveys

Objectives

1. Record presence of all bird species detected during point count surveys
2. Record presence of marsh birds detected with call-playback surveys
3. Document all non-survey observations of birds
4. Develop distribution maps for species of greatest conservation need

Introduction

Bird Species of Greatest Conservation Need
There are 97 bird species of greatest conservation need (SGCN) in Minnesota. Species of greatest conservation need are documented in Minnesota's State Wildlife Action Plan, Tomorrow's Habitat for the Wild and Rare (2006). Twelve of these species were identified at Ada Lake.

Bald eagles (*Haliaeetus leucocephalus*; Figure 36) are an increasingly common sight in Minnesota. Once listed as an endangered species, bald eagle numbers have rebounded due to effective environmental protection laws and conservation efforts. Adult bald eagles are easily identified by the white head and tail, although these colors don't appear until birds are 4 or 5 years old. Prior to that, eagles are generally dark brown with white feathers scattered along the wings, head, tail and back. With a wingspan of up to 7 feet, bald eagles are one of the largest birds in North America. They are found in forested areas near large, open bodies of water. Although bald eagle numbers are increasing, these birds still face threats from environmental contaminants and destruction of habitat. Bald eagles are listed as a species of Special Concern in the state of Minnesota.

Figure 36. Bald eagle

Photo by: Carrol Henderson

Black terns (*Chlidonias niger*; Figure 37) are distinguished by a black head and chest with gray wings, back, and tail. The nonbreeding plumage is lighter in color, and much of the black is replaced with white or gray. The bill is long and slightly curved. Black terns are loosely colonial, and often are found in freshwater marshes or wetlands. They may also occur along lake edges with abundant emergent vegetation. Black tern populations have declined dramatically since the 1960s. Habitat loss, environmental contamination, and human disturbance are often cited as causes of the decline.

Figure 37. Black tern

Photo by: Carrol Henderson

Common loons (*Gavia immer*; Figure 38) are one of Minnesota's most recognizable birds. They are found from northeastern to central Minnesota, and numbers are higher here than in any other state except Alaska. These large diving birds possess red eyes and a large, dark pointed bill that is well-adapted for catching fish. Loons spend most of their time in water, and go ashore only to mate and incubate eggs. Summer plumage is spotted black and white, while in winter the colors are gray above and white below. Loon populations are closely monitored in Minnesota; however, these birds still face threats, particularly in the form of human disturbance and lead poisoning.

Figure 38. Common loon

Photo by: Carrol Henderson

Common terns (*Sterna hirundo*; Figure 39) are the most widespread terns in North America. In the breeding season common terns have a solid black cap with gray back and underparts. The gray wings have dark edges. The rump is white, and the legs and bill are orange-red in color. Common terns nest in colonies, often on islands or peninsulas of larger lakes with sandy substrates. Populations of common terns declined in the 1970s, likely due to poisoning by pesticides. Habitat loss, nest predation, and disturbance by humans may also negatively affect common terns.

Figure 39. Common tern

Photo by: Carrol Henderson

Eastern wood-pewees (*Contopus virens*; Figure 40) are medium-sized, nondescript birds common in Eastern forests. They are grayish-olive above, with a paler throat and belly and whitish wingbars. Eastern wood-pewees are named after their song, a whistled "pee-a-wee." They forage throughout the canopy, often flying out from their perch to catch insects before returning to the same perch. Populations of eastern wood-pewees are declining throughout much of their range. Possible causes of the decline include the increase in white-tailed deer, which browse and decrease the lower-canopy foraging area available to the pewee, and loss of forested habitat in the winter range.

Figure 40. Eastern wood-pewee

Photo by: J.A. Spendelow

Golden-winged warblers (*Vermivora chrysoptera*; Figure 41) are small, active, insectivorous warblers. They possess a distinctive yellow crown and yellow patch on the wings. A black mask and throat contrast with the gray and white plumage on the back and breast. They often inhabit forest edges, such as those along marshes, bogs, and fields, and are also common in alder shrub swamps. Regional declines of the golden-winged warbler are considerable. Human-caused disturbance and hybridization with increasing numbers of blue-winged warblers are correlated with the declines.

Figure 41. Golden-winged warbler

Photo by: Carrol Henderson

Least flycatchers (*Empidonax minimus*; Figure 42) are the smallest flycatchers found in Minnesota. Like many other flycatchers, they are olive to gray in color with two white wingbars and whitish underparts. They have a small bill and a prominent white eye ring. The best way to distinguish least flycatchers from other flycatchers is the call, a harsh "che-bek." These birds are often found along water edges in mature, open woods. Least flycatchers are common throughout most of their range where habitat is suitable. However, they are sensitive to human disturbance and require large areas of forest to survive.

Figure 42. Least flycatcher

Photo by: J.A. Spendelow

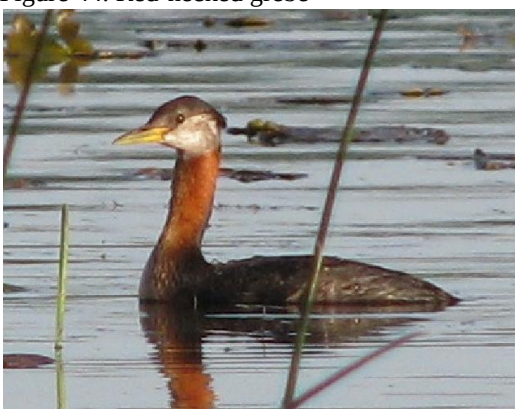
Ovenbirds (*Seiurus aurocapillus*; Figure 43) are rarely seen birds of the forest. However, their loud "teacher, teacher, teacher" song is commonly heard during the summer months. They dwell on the ground, and build a covered nest that resembles a Dutch oven. Ovenbirds are olive-brown with a boldly streaked breast. Two black stripes border an orange crown. They have a thin bill and a white eye ring. They breed in mature deciduous and mixed forests, especially those with minimal undergrowth, and often forage on the ground, searching for insects in the leaf litter. Ovenbird numbers appear to be stable, but the birds are vulnerable to forest fragmentation and parasitism by brown-headed cowbirds (*Molothrus ater*).

Figure 43. Ovenbird

Photo source: U.S. Fish and Wildlife Service

Red-necked grebes (*Podiceps grisegena*; Figure 44) are one of the larger grebe species. The red neck, which distinguishes the bird, is visible only during the breeding season; in the winter it turns to whitish or gray. The back is dark, and the head is characterized by white cheeks and a black cap. Red-necked grebes breed in a variety of water bodies, from marshes to small, shallow lakes to the bays of large lakes. These birds are uncommon in Minnesota, and populations are imperiled by the loss and modification of wetland habitat.

Figure 44. Red-necked grebe



Rose-breasted grosbeaks (*Pheucticus ludovicianus*; Figure 45) are summer visitors to Minnesota bird feeders. The males are easily identified by a red triangle on a white breast, with a black head and back and a large bill. Females are more difficult to identify, and resemble a large sparrow with brown and white streaks. Rose-breasted grosbeaks are found in open woodlands near water, edges of marshes, meadows and woodlands, and suburban parks and gardens. The winter range spans from southern Mexico to South America and the Caribbean. Significant regional declines in rose-breasted grosbeak populations have been noted.

Figure 45. Rose-breasted grosbeak

Photo by: J.A. Spendelow

The veery (*Catharus fuscescens*; Figure 46) is one of the most easily identifiable thrushes. It has faint dark spots on a buffy breast and a reddish brown back and head. The legs are pink and the eyes are dark with an indistinct light eye ring. The veery was named after its most common call, a "vee-er" sound. Riparian areas with dense vegetation and wetlands within large forests are good places to find the veery. The veery is suffering declines throughout many parts of its range. Destruction of winter habitat and parasitism by brown-headed cowbirds are major reasons cited for the decline.

Figure 46. Veery

Photo by: Deanna Dawson

The yellow-bellied sapsucker's (*Sphyrapicus varius*; Figure 47) name describes it well. This medium-sized woodpecker exhibits a yellow underside, and feeds primarily on sap it harvests from trees. The forehead and crown are red, and the throat is also red in the male. The back and sides are striped with black and white. Deciduous forests and riparian areas along streams characterize the breeding habitat of this species. Yellow-bellied sapsuckers create a food source for many other species when they drill holes for sap, and are therefore considered an important part of the ecosystem. Populations currently appear stable, and care should be taken to ensure they remain that way.

Figure 47. Yellow-bellied sapsucker

Photo by: J.A. Spendelow

Methods

Surveyors used several techniques to collect information on bird species. Point counts were conducted at 29 stations, located 400 meters apart along the lakeshore. Surveyors listened for five minutes per station and recorded all species detected (heard or seen) within that time. Point count surveys were conducted in the early morning hours, when species were most likely to be singing. Call-playback surveys were conducted at survey stations that had appropriate habitat. At each station, surveyors played a tape that included the calls of six marsh birds (least bittern (*Ixobrychus exilis*), yellow rail (*Coturnicops noveboracensis*), sora (*Porzana carolina*), Virginia rail (*Rallus limicola*), American bittern (*Botaurus lentiginosus*), and pied-billed grebe (*Podilymbus podiceps*)) and listened for a response. Call-playback surveys generally took place in the early evening. Both survey techniques were dependent on good listening conditions, and surveys were stopped if inclement conditions prevented the ability to hear bird vocalizations. Casual observations of birds seen or heard on the lake or on the lakeshore were also recorded.

Results

Bird surveys were conducted between May 21 and June 7, 2008. During this time, surveyors documented 61 species of birds, 12 of which were species of greatest conservation need. The majority of the bird species (including ten of the species of greatest conservation need) were documented during the point count and call-playback surveys (Table 3); several additional species were recorded through casual observation of the lake (Appendix 2). The veery was the most commonly found species of greatest conservation need, detected at nine of the 29 survey stations (Table 3). The common loon, eastern wood-pewee, and ovenbird were found at five stations each. The other six species of greatest conservation need documented during the bird surveys were bald eagle, common tern, golden-winged warbler, least flycatcher, rose-breasted grosbeak, and yellow-bellied sapsucker. These species were each found at two or fewer stations. The black tern and red-necked grebe were documented during casual observation of Ada Lake.

Aquatic species of greatest conservation need were distributed mainly along the eastern half of Ada Lake (Figure 48). Common loons, found at five survey stations, tended to be located within the bays. Only one of the five sightings was not within a bay, and North Bay, Little Ada Bay,

and South Bay all contained loons. Forest-dependent species of greatest conservation need were found both within the bays and along stretches of the main shoreline (Figure 49). The veery, in particular, was widely distributed, and was found at survey stations along the eastern and western shorelines. The only species of greatest conservation need that inhabits wetlands, the golden-winged warbler, was found south of North Bay (Figure 50). The bald eagle, which can occupy a variety of habitats, was found within Little Ada Bay and South Bay (Figure 51).

Overall, red-eyed vireos were the most commonly detected species; surveyors found this bird at over 70 percent of the survey stations (21/29 stations). American crows were second in abundance, and were identified at 17 of 29 stations. Red-winged blackbirds, song sparrows, blue jays, and yellow warblers were all found at 10 or more stations.

Figure 48. Distribution of aquatic habitat-dependent bird species of greatest conservation need in Ada Lake, May – June 2008.

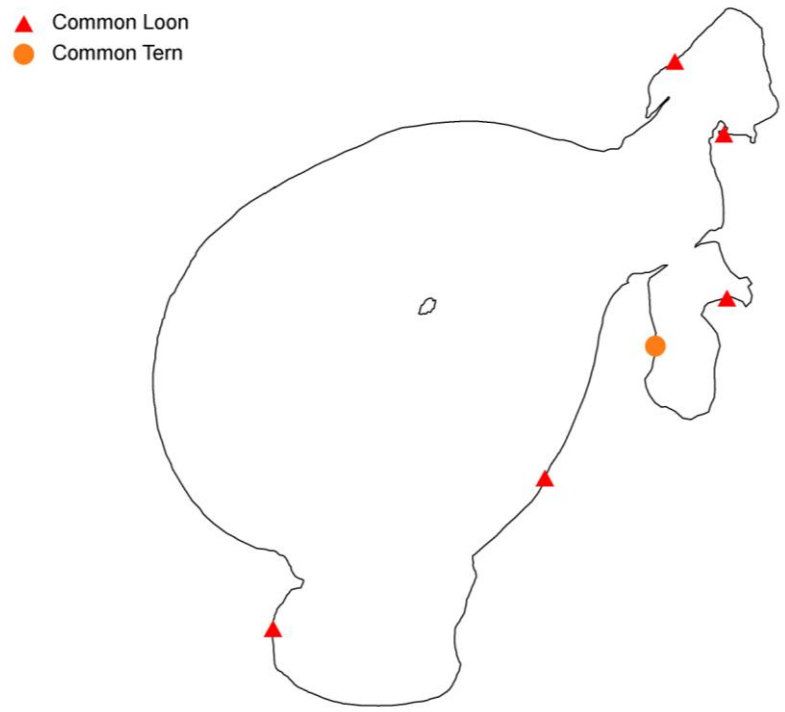


Figure 49. Distribution of forest habitat-dependent bird species of greatest conservation need in Ada Lake, May – June 2008.

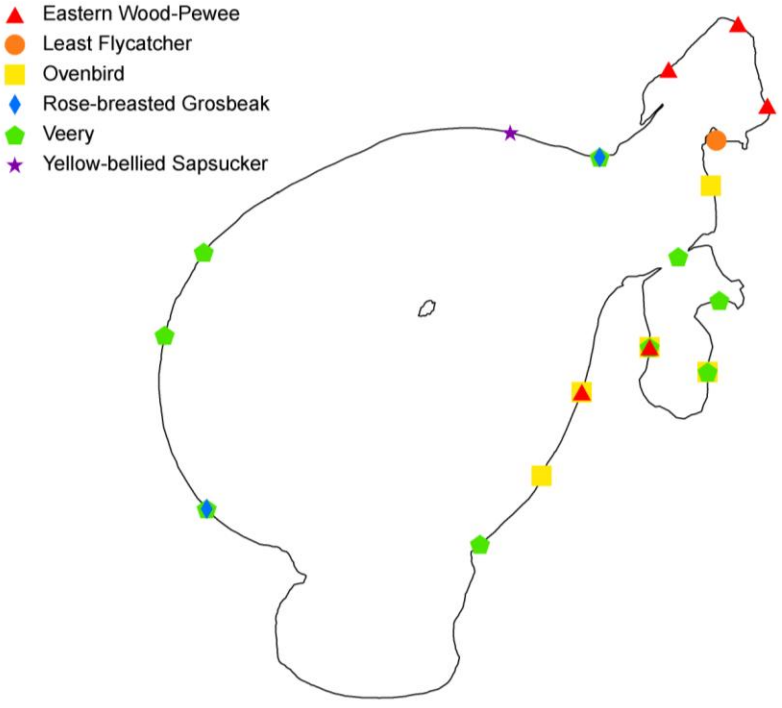


Figure 50. Distribution of wetland habitat-dependent bird species of greatest conservation need in Ada Lake, May – June 2008.

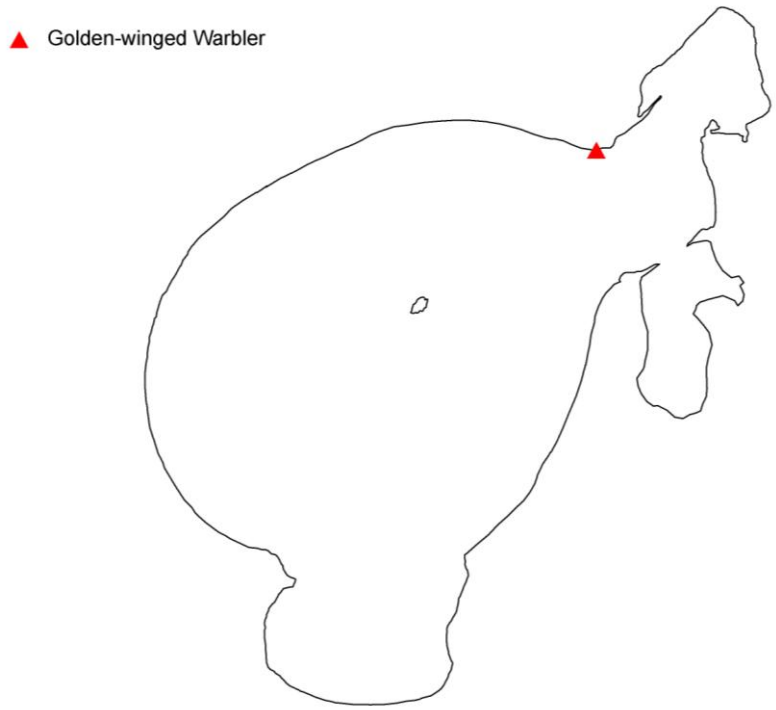


Figure 51. Distribution of bird species of greatest conservation need that occupy a variety of habitats in Ada Lake, May – June 2008.

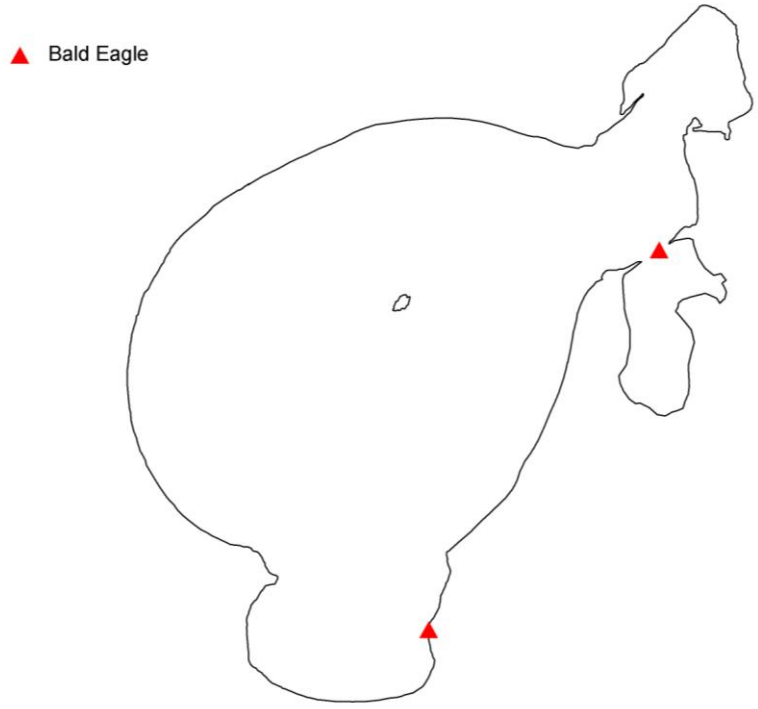


Table 3. Species list and frequency of occurrence of bird species identified during Ada Lake surveys, May – June 2008. * denotes a species of greatest conservation need.

Description	Common Name	Scientific Name	%[a]
Waterfowl	Canada Goose	*Branta canadensis*	10
	Mallard	*Anas platyrhynchos*	21
	Common Goldeneye	*Bucephala clangula*	7
Loons	Common Loon*	*Gavia immer*	17
Herons/bitterns	Green Heron	*Butorides virescens*	3
Hawks/eagles	Bald Eagle*	*Haliaeetus leucocephalus*	7
Falcons	Merlin	*Falco columbarius*	3
Gulls/terns	Common Tern*	*Sterna hirundo*	3
Pigeons/doves	Mourning Dove	*Zenaida macroura*	7
Hummingbirds	Ruby-throated Hummingbird	*Archilochus colubris*	3
Kingfishers	Belted Kingfisher	*Megaceryle alcyon*	24
Woodpeckers	Red-bellied Woodpecker	*Melanerpes carolinus*	17
	Yellow-bellied Sapsucker*	*Sphyrapicus varius*	3
	Downy Woodpecker	*Picoides pubescens*	3
	Hairy Woodpecker	*Picoides villosus*	3
	Northern Flicker	*Colaptes auratus*	3
	Pileated Woodpecker	*Dryocopus pileatus*	7
Flycatchers	Eastern Wood-Pewee*	*Contopus virens*	17
	Least Flycatcher*	*Empidonax minimus*	3
	Eastern Phoebe	*Sayornis phoebe*	10
	Great Crested Flycatcher	*Myiarchus crinitus*	10
	Eastern Kingbird	*Tyrannus tyrannus*	14
Vireos	Warbling Vireo	*Vireo gilvus*	3
	Red-eyed Vireo	*Vireo olivaceus*	72
Jays/crows	Blue Jay	*Cyanocitta cristata*	41
	American Crow	*Corvus brachyrhynchos*	59
Swallows	Purple Martin	*Progne subis*	3
	Tree Swallow	*Tachycineta bicolor*	28
	Barn Swallow	*Hirundo rustica*	7
Chickadees	Black-capped Chickadee	*Poecile atricapillus*	17
Nuthatches	White-breasted Nuthatch	*Sitta carolinensis*	7
Wrens	House Wren	*Troglodytes aedon*	14
Thrushes	Veery*	*Catharus fuscescens*	31
	American Robin	*Turdus migratorius*	21
Mockingbirds	Gray Catbird	*Dumetella carolinensis*	14

Table 3, continued.

Description	Common Name	Scientific Name	% [a]
Starlings	European Starling	*Sturnus vulgaris*	3
Waxwings	Cedar Waxwing	*Bombycilla cedrorum*	3
Warblers	Golden-winged Warbler*	*Vermivora chrysoptera*	3
	Yellow Warbler	*Dendroica petechia*	34
	Chestnut-sided Warbler	*Dendroica pensylvanica*	14
	Pine Warbler	*Dendroica pinus*	7
	Black-and-white Warbler	*Mniotilta varia*	10
	American Redstart	*Setophaga ruticilla*	17
	Ovenbird*	*Seiurus aurocapilla*	17
	Common Yellowthroat	*Geothlypis trichas*	21
	Wilson's Warbler	*Wilsonia pusilla*	3
Sparrows	Chipping Sparrow	*Spizella passerina*	31
	Song Sparrow	*Melospiza melodia*	48
Cardinals/grosbeaks	Northern Cardinal	*Cardinalis cardinalis*	3
	Rose-breasted Grosbeak*	*Pheucticus ludovicianus*	7
Blackbirds/orioles	Red-winged Blackbird	*Agelaius phoeniceus*	52
	Common Grackle	*Quiscalus quiscula*	21
	Brown-headed Cowbird	*Molothrus ater*	10
	Baltimore Oriole	*Icterus galbula*	17
Finches	American Goldfinch	*Carduelis tristis*	7

[a] % – Percent of surveyed sample sites in which a bird species occurred (N=29).

Bird Species Richness

Objectives

1. Calculate and map bird richness around the shoreline of Ada Lake

Introduction

Bird species richness is affected by a number of factors, including habitat diversity and area, habitat composition, fragmentation, competition, and presence of exotic species. Species richness is generally highest in non-fragmented habitats with a variety of vegetation types. Anthropogenic disturbance, in particular, may negatively affect bird species richness in a variety of ways. Human presence in an area may result in the loss or destruction of critical habitat. Elimination of vegetation and use of pesticides may reduce the food base for a number of bird species. Human activity in an area may also disturb breeding or nesting birds. Maintaining large areas of natural habitat will be beneficial to maintaining diversity of bird species.

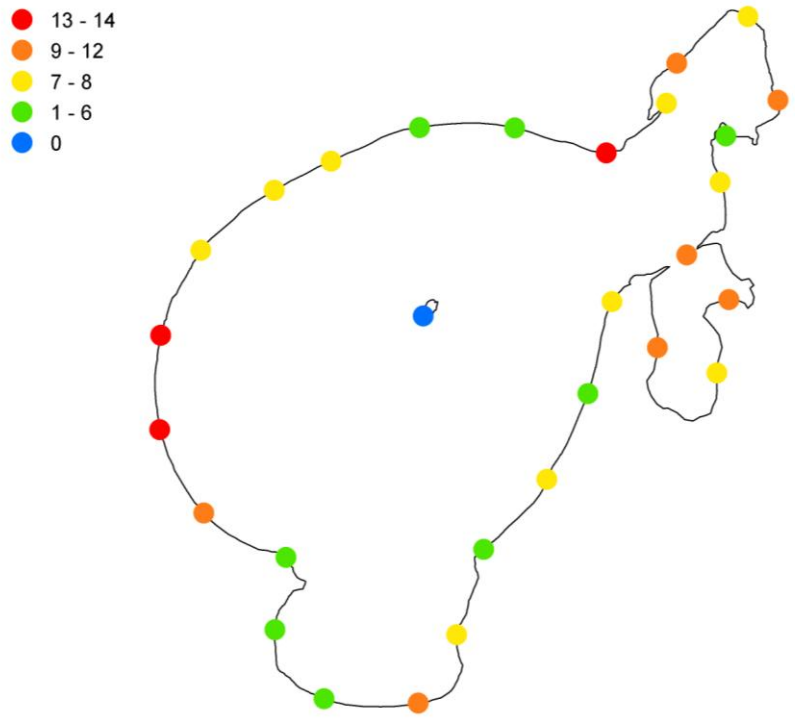
Methods

Bird species were documented during the point count and call-playback sampling surveys. At each sample station, surveyors identified and recorded the number of species found.

Results

The number of bird species at a single sampling station ranged from 0 to 14 (Figure 52). Three stations contained 14 species, and an additional seven stations contained 10 or more species. The sampling station on the island was the only station where no bird species were documented. All other stations contained at least five species. The number of species of greatest conservation need per sampling station ranged from zero (at nine stations) to four (at one station). High species diversity was not limited to the bays, and none of the sampling stations containing 14 species was located within a bay.

Figure 52. Bird species richness (number of species per sample site) in Ada Lake, May – June 2008.



Loon Nesting Areas

Objectives

1. Map current and historical loon nesting areas
2. Identify loon nests as natural or manmade

Introduction

The Volunteer LoonWatcher survey began in 1979 as a way for the DNR to obtain information on loon numbers and nesting success on a variety of lakes in Minnesota. Each year volunteer loon watchers observe the loons on a selected lake and fill out a report, noting information such as number of loons, number of nests, and number of chicks. Locations of loon nests, if known, are also documented in the report.

Loon pair with chick

Photo by: Paul Bolstad

Common loons may be easily disturbed by human presence, and tend to avoid nesting where development has occurred. They prefer protected areas such as bays and islands, especially those areas with quiet shallow water and patchy emergent vegetation that provides cover. Identification of these loon nesting sites will help managers prevent degradation and destruction of these sensitive areas.

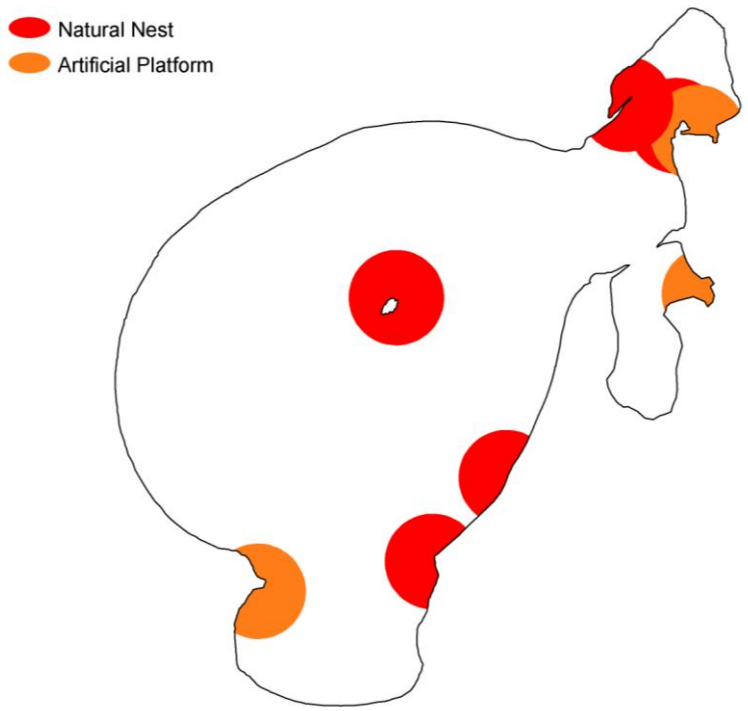
Methods

Using information from LoonWatcher reports and bird, fish, and vegetation survey crews, researchers mapped loon nesting locations in GIS. Mapped nests were buffered by 200 meters to account for locational uncertainty. Nests were identified as either natural or manmade (artificial platforms). All former and current natural nesting locations and artificial platforms used by loons were included in the maps and analysis; artificial platforms not utilized by loons were not included. Volunteers have been reporting on Ada Lake loon nesting areas since 1980.

Results

Since 1980, eight probable different loon nesting areas have been identified on Ada Lake (Figure 53). Most of the nesting areas are located within or near bays; three nesting areas are in North Bay, two are near South Bay, and one is in Little Ada Bay. One of the natural nests was built on the Ada Lake island. In 2008, seven nests (four natural nests and three artificial platforms) were used by loons on Ada Lake.

Figure 53. Location of natural loon nests and manmade loon platforms recorded on Ada Lake between 1980 and 2008.



Aquatic Frog Surveys

Objectives

1. Record index of abundance for all frogs and toads
2. Estimate actual abundance of green and mink frogs
3. Develop distribution maps for green and mink frogs

Introduction

Amphibians are ideal indicator species of lakeshore habitats. Although population declines may be caused by a number of factors, including predation, competition, and introduction of exotic species, amphibians are particularly prone to local extinctions resulting from human-caused alteration and fragmentation of their habitat. Removal of vegetation and woody debris, retaining wall construction, and other common landscaping practices all have been found to negatively affect amphibian populations.

Target species for the frog surveys were mink frog (*Rana septentrionalis*) and green frog (*Rana clamitans*). These frogs, which are strongly associated with larger lakes, are easily surveyed during their breeding season, which extends from May until August. During this time they establish and defend distinct territories, and inhabit vegetated areas along the lakeshore.

Figure 54. Mink frog

Photo by: Jeff LeClere, www.herpnet.net

Mink frogs (Figure 54) are typically green in color with darker green or brown mottling. They emit an odor similar to that of a mink when handled. They inhabit quiet waters near the edges of wooded lakes, ponds, and streams, and are considered the most aquatic of the frogs found in Minnesota. Populations of mink frogs have potentially been declining recently, and the numbers of observed deformities have been increasing.

Figure 55. Green frog

Photo by: Jeff LeClere, www.herpnet.net

Green frogs (Figure 55) are medium-sized, greenish or brownish frogs with small dark spots. The belly is often brighter in color than the back. A large tympanum (eardrum) helps identify the green frog. They can be found in a variety of habitats surrounding lakes, streams, marshes, and swamps, but are strongly associated with the shallow water of lakeshores. Although green frog populations are generally stable, regional declines and local extinctions have been noted.

Methods

The aquatic frog survey methodology followed the Minnesota Frog and Toad Calling Survey (MFTCS) protocol (see Minnesota's Sensitive Lakeshore Identification Manual for additional information on how this protocol was adjusted for water routes). Frog survey points were located around the entire lake, spaced 400 meters apart. Surveys were conducted between sunset and 1:00 AM. At each station surveyors listened for up to five minutes for all frog and toad calls. An estimate of abundance and a calling index were recorded for both green and mink frogs. For other species, only calling index was recorded. If survey conditions such as rain or wind noticeably affected listening ability, the survey was terminated.

Results

Target species

Both green frogs and mink frogs were identified during the Ada Lake frog surveys. Green frogs were found at six of the 29 survey stations. Estimates of abundance at these stations ranged from one to 20 individuals (Figure 56). Green frog index values ranged from 1 (individual frog calls were distinct; no overlap of calls) to 2 (individual frog calls were distinct, but calls overlapped). A mink frog was heard at one station (Figure 57). Both frog species were documented within North Bay and Little Ada Bay (Figure 58).

Other species

No additional frog species were heard during the surveys. Gray treefrogs (*Hyla versicolor*) could be calling in June, when the surveys were conducted, but were not identified at Ada Lake. Other frog or toad species that may be found near Ada Lake, such as wood frog (*Rana sylvatica*), spring peeper (*Pseudacris crucifer*), chorus frog (*Pseudacris triseriata*), leopard frog (*Rana pipiens*), and American toad (*Bufo americanus*), breed earlier in the year and are not strongly associated with larger lakes.

Figure 56. Abundance of green frogs heard during Ada Lake frog surveys, June 2007.

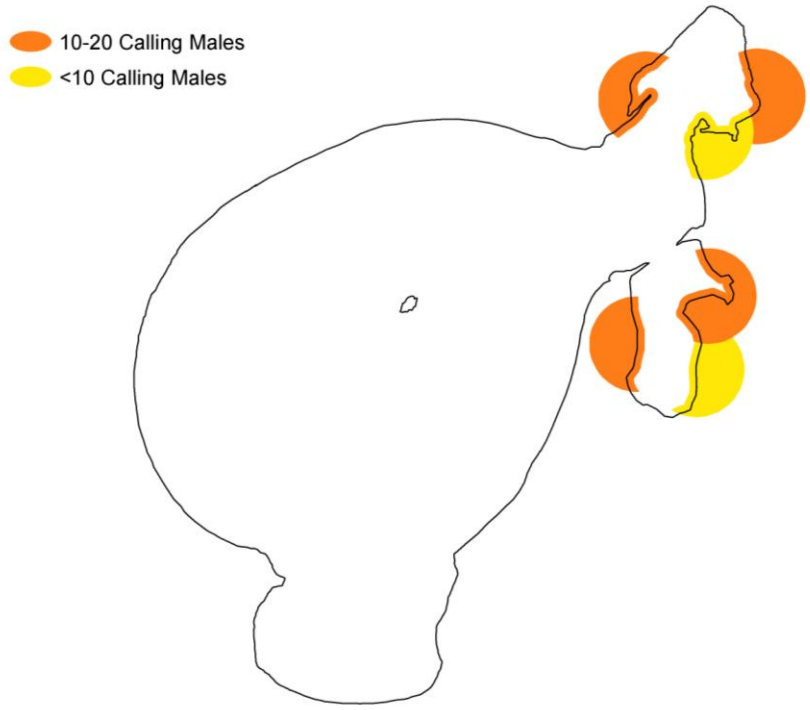


Figure 57. Abundance of mink frogs heard during Ada Lake frog surveys, June 2007.

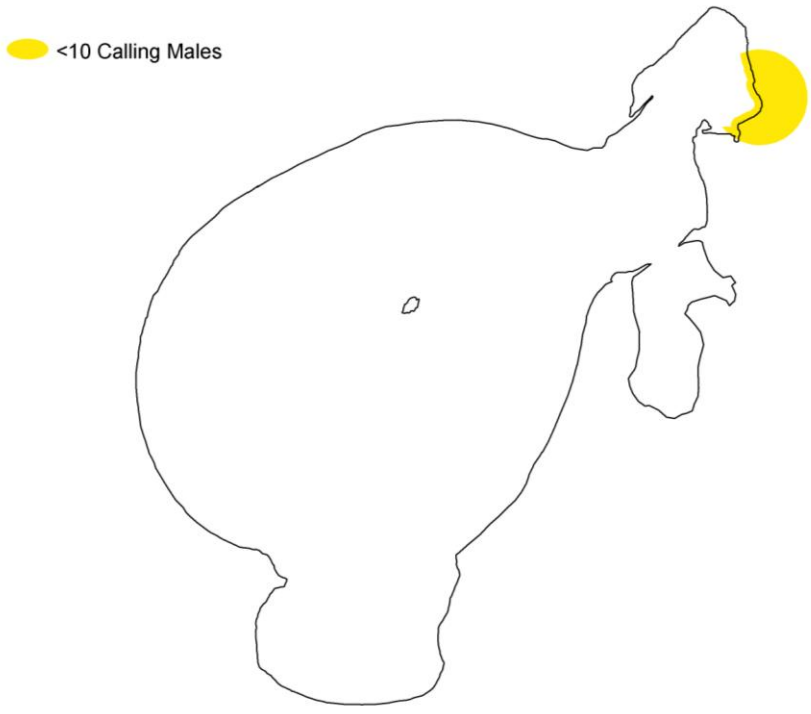


Figure 58. Distribution of green and mink frogs heard during Ada Lake frog surveys, June 2007.

Nongame Fish Surveys

Objectives

1. Record presence and abundance of near-shore fish species of greatest conservation need
2. Record presence and abundance of proxy species
3. Develop distribution maps for species of greatest conservation need and proxy species
4. Identify habitat (substrate and aquatic vegetation biovolume) associated with presence of species of greatest conservation need and proxy species
5. Identify near-shore fish assemblages

Introduction

Fish Species of Greatest Conservation Need

There are 47 fish species of greatest conservation need (SGCN) within the state of Minnesota. Of these 47 species, three are near-shore species found within Cass County. The pugnose shiner and least darter are listed as species of Special Concern in the state of Minnesota. The longear sunfish exhibits a spotty distribution, and is listed as threatened in Wisconsin.

Pugnose shiners (*Notropis anogenus*; Figure 59) are small (38 – 56 mm), slender, silverish-yellow minnows. They possess large eyes and a distinctively upturned mouth that gives them a "pugnose" appearance. They are secretive minnows, and are found often in schools of 15 to 35 individuals. Pugnose minnows inhabit clear lakes and low-gradient streams and are extremely intolerant of turbidity. Vegetation, particularly pondweed, coontail, and bulrush, is an important habitat component.

Figure 59. Pugnose shiner

Photo by: Konrad Schmidt

Least darters (*Etheostoma microperca*; Figure 60) are Minnesota's smallest fish, averaging only 25 – 38 mm in length. They are olive-brown in color with scattered dark brown spots and markings and four dark bars radiating from the eye. Males possess an extremely long pectoral fin. Least darters are found in clear, shallow areas of low-gradient streams or lakes. Extensive beds of muskgrass (*Chara* spp.) are a preferred habitat feature. Removal of vegetation, riparian area modification, and poor water quality all pose threats to the least darter.

Figure 60. Least darter

Photo by: Konrad Schmidt

Longear sunfish (*Lepomis megalotis*; Figure 61) are a deep-bodied fish reaching a length of 71 – 94 mm. These colorful fish have a belly that is orange-red, and the sides are speckled with turquoise. Adults have an elongated opercular "ear flap" that is trimmed in white. Like the other species of greatest conservation need, the longear sunfish prefers clear, shallow, vegetated areas and is intolerant of turbidity.

Figure 61. Longear sunfish

Photo by: Konrad Schmidt

Proxy species

Proxy species have similar life history characteristics and occupy habitat similar to species of greatest conservation need; they represent indicator species for those SGCNs.

Blackchin shiners (*Notropis heterodon*; Figure 62) are small (50 – 75 mm) fish with a bronze-colored back and silver sides and belly. A dark lateral band extends through the chin. Like the species of greatest conservation need, the blackchin shiner inhabits clear water with abundant submerged aquatic vegetation; it also prefers a clean sand or gravel substrate. This species cannot tolerate turbidity or loss of aquatic vegetation.

Figure 62. Blackchin shiner

Photo by: Konrad Schmidt

Blacknose shiners (*Notropis heterolepis*; Figure 63) are similar in size and coloration to blackchin shiners. However, the dark lateral line does not extend through the lips or chin. Scales on the back are outlined in a dark color, giving them a crosshatch appearance. Blacknose shiners are sensitive to turbidity and pollution, and their range has contracted since the beginning of the century. Habitat includes clean, well-oxygenated lakes and streams with plentiful vegetation and low turbidity and pollution.

Figure 63. Blacknose shiner

Photo by: Konrad Schmidt

Banded killifish (*Fundulus diaphanus*; Figure 64) are slender fish with slightly flattened heads. The mouth, which opens dorsally, is an adaptation for surface feeding. Dark vertical bars are present along

the sides. Size ranges from about 50 – 100 mm. Calm, clear, shallow water with abundant aquatic vegetation and a sandy or gravely substrate is preferred by the killifish.

Figure 64. Banded killifish

Photo by: Konrad Schmidt

Methods

Fish surveys were conducted using Minnesota's Sensitive Lakeshore Survey Protocol. Fish survey stations were located 400 meters apart, and were the same stations used for surveying birds and aquatic frogs. At each station, fish were sampled using three different methods: trapnetting, shoreline seining, and electrofishing. At several locations, excessive vegetation, depth, or soft substrate prevented surveyors from using seines or trapnets. However, electrofishing samples were still collected, from a boat if necessary. All species captured using the different sampling methods were identified and counted. Target fish species included near-shore species of greatest conservation concern (pugnose shiner, least darter, and longear sunfish) and proxy species (blackchin shiner, blacknose shiner, and banded killifish). These species are associated with large, near-shore stands of aquatic grasses and macrophytes. They are intolerant to disturbance, and have been extirpated from lakes where extensive watershed and lakeshore development has occurred.

In addition to the fish data, habitat data were collected at each sampling station. Substrate data were recorded using standard near-shore classes. Aquatic vegetation biovolume was also estimated at each station; this represented the volume (percent) of a sampling area that contained submerged aquatic vegetation.

Results

Only one species of greatest conservation need was identified during the nongame fish surveys. One pugnose shiner was found at a sampling station in North Bay (Figure 65). Least darters and longear sunfish were not documented in Ada Lake. Surveyors did find all three proxy species (Figure 66). Blacknose shiners were most abundant; surveyors found over 150 individuals at 10 different survey stations. Nine blackchin shiners were found at four stations, and four banded killifish were found at three different stations. Blacknose shiners, in particular, were widely distributed and found at survey stations along almost the entire shoreline.

The one fish species of greatest conservation need, the pugnose shiner, was found in a location with a muck substrate and abundant aquatic vegetation (average biovolume 80 percent). The proxy species were found at stations with a variety of substrates, the majority of which were sand and silt. Biovolume was essentially the same (~ 15 percent) between sites that contained proxy species and those without.

The presence of several of the target fish species at Ada Lake indicates minimal disturbance along several sections of shoreline. However, because these species are declining or vulnerable across much of their range, continued monitoring and maintenance of these shoreline habitats is necessary to ensure continued existence of these populations. Limiting macrophyte removal, pesticide and herbicide use, and modification of the riparian zone will help maintain good water quality and a healthy aquatic plant community. These conditions will also benefit multiple game fishes, including bass, muskellunge, and northern pike.

Surveyors identified 27 fish species during the surveys (Table 4). Bluegills were found most commonly, and every sample station contained at least one bluegill. One sampling station contained over 180 bluegills, and over 1000 were counted in total. Mimic shiners were found in the greatest abundance; surveyors counted over 5000 individuals at 24 stations. Bluntnose minnows, rock bass, and yellow bullheads were all found at over 75 percent of the sampling stations. The number of fish species at a single sampling location ranged from five to 13. Almost half of the sites (45 percent) contained 10 or more fish species.

Surveyors identified four fish species not previously documented in Ada Lake, bringing the total observed historical fish community to 31 species. The newly documented species in Ada Lake were central mudminnow, golden shiner, pugnose shiner, and tadpole madtom.

Figure 65. Distribution of fish species of greatest conservation need documented in Ada Lake, June – August 2007.

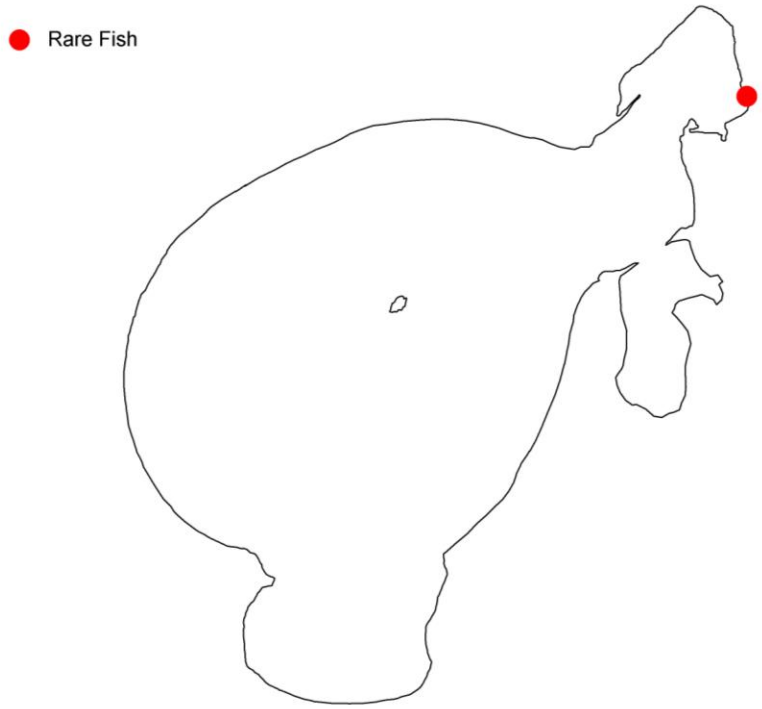


Figure 66. Distribution of fish proxy species documented in Ada Lake, June – August 2007.

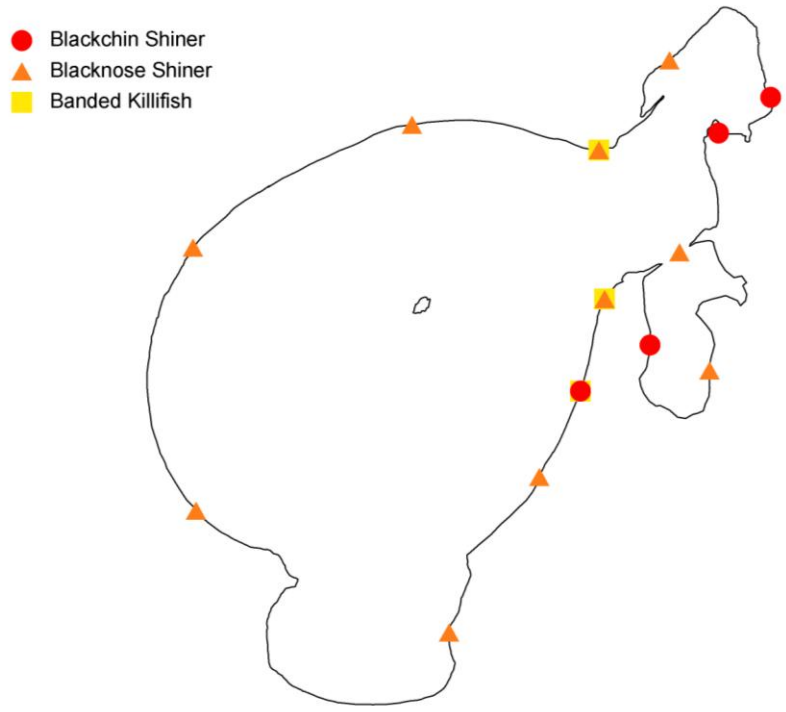


Table 4. Abundance and frequency of fish species identified during Ada Lake fish surveys, June – August 2007. * denotes species of greatest conservation need

Description	Common Name	Scientific Name	# [a]	% [b]
Bowfins	Bowfin	*Amia calva*	1	3
Minnows/carps	Spotfin shiner	*Cyprinella spiloptera*	145	62
	Golden shiner	*Notemigonus crysoleucas*	4	3
	Pugnose shiner*	*Notropis anogenus*	1	3
	Emerald shiner	*Notropis atherinoides*	2	7
	Blackchin shiner	*Notropis heterodon*	9	14
	Blacknose shiner	*Notropis heterolepis*	157	34
	Spottail shiner	*Notropis hudsonius*	4	10
	Mimic shiner	*Notropis volucellus*	~5800	83
	Bluntnose minnow	*Pimephales notatus*	~1400	90
Suckers	White sucker	*Catostomus commersonii*	61	17
North American freshwater catfishes	Black bullhead	*Ameiurus melas*	3	10
	Yellow bullhead	*Ameiurus natalis*	119	76
	Brown bullhead	*Ameiurus nebulosus*	4	10
	Tadpole madtom	*Noturus gyrinus*	2	7
Pikes	Northern pike	*Esox lucius*	9	28
Mudminnows	Central mudminnow	*Umbra limi*	2	7
Killifishes	Banded killifish	*Fundulus diaphanus*	4	10
Sunfishes	Rock bass	*Ambloplites rupestris*	116	83
	Pumpkinseed	*Lepomis gibbosus*	29	62
	Bluegill	*Lepomis macrochirus*	~1000	100
	Largemouth bass	*Micropterus salmoides*	158	69
	Black crappie	*Pomoxis nigromaculatus*	39	50
Perches	Iowa darter	*Etheostoma exile*	8	20
	Johnny darter	*Etheostoma nigrum*	10	20
	Yellow perch	*Perca flavescens*	24	24
	Walleye	*Sander vitreus*	1	3

[a] # – Total number of individuals found. Numbers above 1000 were rounded to the nearest 100.

[b] % – Percent of surveyed sample sites in which a species occurred (N=29).

Aquatic Vertebrate Richness

Objectives

1. Calculate and map aquatic vertebrate richness around the shoreline of Ada Lake

Introduction

A variety of factors may influence aquatic vertebrate richness, including habitat diversity, water chemistry, flow regime, competition, and predation. High aquatic vertebrate richness indicates a healthy lakeshore community with diverse habitat, good water quality, varied flow regimes, and a sustainable level of competition and predation. A diverse aquatic vertebrate community will also help support diversity at higher trophic levels.

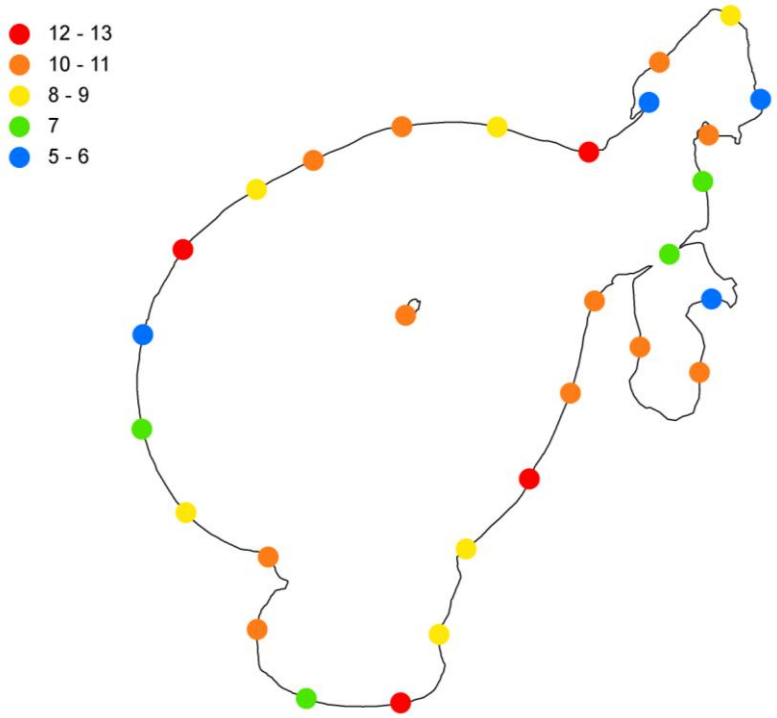
Methods

Aquatic vertebrate species were documented during the nongame fish sampling surveys. All aquatic vertebrates, including fish, frogs, and turtles, captured during trapnetting, seining, and electrofishing surveys were identified to the species level. Young-of-year animals that could not be identified to the species level and hybrids were not used in the analysis.

Results

The number of aquatic vertebrate species at a single sampling station ranged from five to 13 (Figure 67). Fifteen of the 29 sites contained 10 or more species. The only non-fish species documented during the fish surveys was the painted turtle; this species was found at three sampling stations. Hybrid sunfish were observed during the surveys, but were not included in the analysis. All of the aquatic vertebrate species identified during the surveys were native.

Figure 67. Aquatic vertebrate species richness (number of species per sample site) in Ada Lake, June – August 2007.



Other Rare Features

Objectives

1. Map rare features occurring within the extended state-defined shoreland area of Ada Lake

Introduction

The Minnesota Natural Heritage Information System provides information on Minnesota's rare animals, plants, native plant communities, and other features. The Rare Features Database includes information from both historical records and current field surveys. All Federally and State-listed endangered and threatened species and state species of special concern are tracked by the Natural Heritage program. The program also gathers information on animal aggregations, geologic features, and rare plants with no legal status.

Methods

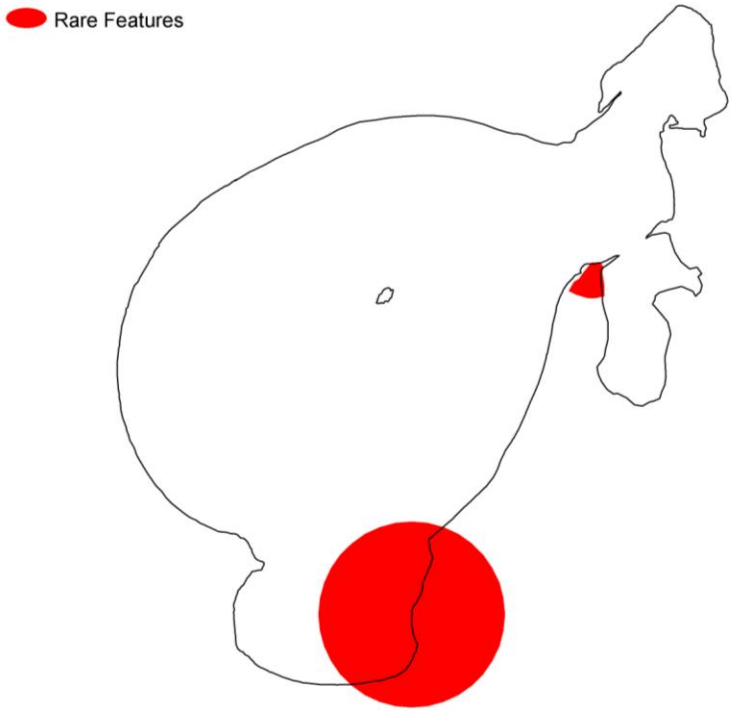
Researchers obtained locations of rare features from the Rare Features Database. Only "listed" plant and animal species (Federal or State endangered, threatened, or special concern) were considered in this project; non-listed unique plant species were included in the "Unique Plant Species" section of this report. Rare features within 1320 feet of the shoreline were mapped using GIS. Varying buffer sizes around rare feature locations represent locational uncertainty and do not indicate the size of the area occupied by a rare feature.

Results

Two rare features were documented at Ada Lake (Figure 68). These features represent two locations of a bird species of Special Concern. The publication of exact descriptive and locational information is prohibited in order to help protect this rare species.

Although specific management recommendations will vary depending on the rare features that are present at Ada Lake, practices that maintain good water quality and the integrity of the shoreline will be beneficial to all species involved.

Figure 68. Natural Heritage Database rare features (Federal or State-listed endangered, threatened, or special concern species) located within 1320 feet of Ada Lake shoreline.



 Rare features data have been provided by the Division of Ecological Resources, Minnesota Department of Natural Resources (MNDNR) and were current as of February 15, 2009. These data are not based on an exhaustive inventory of the state. The lack of data for any geographic area shall not be construed to mean that no significant features are present.

Bay Delineation

Objectives

1. Determine whether areas of the lake are in isolated bays, non-isolated bays, or not within bays

Introduction

Bays are defined as bodies of water partially enclosed by land. They often offer some degree of protection from the wind and waves to those species living within them. These protected areas provide habitat for a number of aquatic plant species, and bays are frequently characterized by abundant vegetation. These areas of calm water and plentiful vegetation, in turn, provide habitat for a number of fish and wildlife species. Protecting these areas will be beneficial to a variety of plant and animal species.

Methods

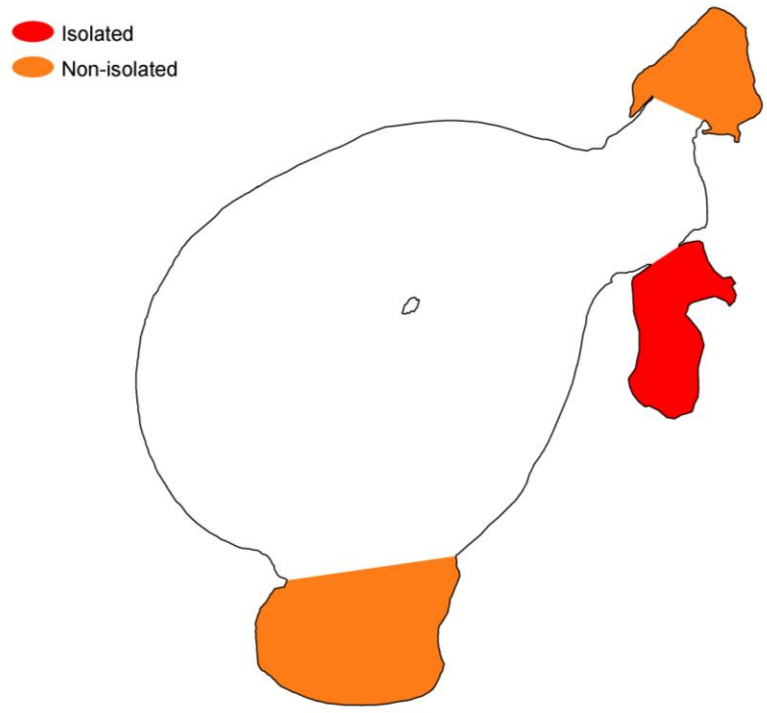
Bays were delineated using lake maps and aerial photos. Obvious bays (e.g., significant indentations of shoreline, bodies of water set off from main body or enclosed by land) were mapped based on inspection of lake maps. Additional bays were identified using aerial photos. Underwater shoals or reefs that offset a body of water from the main body were visible only in these photographs. Non-isolated bays were open to the main water body by a wide mouth. Isolated bays had a narrower connection to the main water body, or were offshoots of non-isolated bays.

Results

One isolated bay and two non-isolated bays were identified on Ada Lake (Figure 69). Little Ada Bay was defined as an isolated bay, and North Bay and South Bay were defined as non-isolated bays.

Field surveys of aquatic plants and wildlife found that the majority of these species were located within delineated bays. The largest beds of emergent and floating-leaf vegetation occurred within North Bay and Little Ada Bay, as did most of the locations containing unique plant taxa. All of the documented frogs were within these two bays, and the one fish species of greatest conservation need occurred within North Bay.

Figure 69. Location of isolated and non-isolated bays in Ada Lake.



II. Ecological Model Development

The second component of the sensitive lakeshore area protocol involved the development of an ecological model. The model scored lakeshore areas based on calculations of sensitivity. The model incorporated results of the field surveys and analysis of additional data, so included information on plant and animal communities as well as hydrological conditions.

In order to develop a continuous sensitivity score along the shoreline, the ecological model used a moving analysis window that included both shoreland and near-shore areas.
Resource managers developed a system to score each of the 15 variables. These scores were based on each variable's presence or abundance in relation to the analysis window (Table 5). Each analysis window was assigned a score, which was equal to the highest score present within a window. On occasion, point data were buffered by a set distance and converted to polygons to account for locational uncertainty before inclusion in the model.

Scores for each of the layers were summed (Figure 70). This map represents an index of sensitivity; those points with higher total scores are highly sensitive, whereas points with lower total scores have lower sensitivity.

Once the total score index was developed for the shoreline, clusters of points along the shoreline with similar values were identified using GIS (Figure 71). The clusters with high values (i.e., areas of highly sensitive shoreline) were buffered by ¼ mile. These buffered areas were defined as most likely highly sensitive lakeshore areas. These areas will be forwarded to the local government for potential designation as resource protection areas (Figure 72).

Table 5. Criteria for assigning scores to analysis windows for each variable.

Variable	Score	Criteria
Wetlands	3	> 25% of analysis window is in wetlands
	2	12.5 – 25% is in wetlands
	1	< 12.5% is in wetlands
	0	No wetlands present
Hydric Soils	3	> 25% of analysis window is hydric soils
	2	12.5 – 25% hydric soils
	1	< 12.5% hydric soils
	0	No hydric soils present
Near-shore Plant Occurrence	3	Frequency of occurrence is > 75% (> 75% of points within analysis window contained vegetation)
	2	Frequency of occurrence is 25 – 75%
	1	Frequency of occurrence < 25%
	0	No vegetation present

Table 5, continued.

Variable	Score	Criteria
Aquatic Plant Richness	3	Total number of plant taxa per analysis window > 10
	2	Total number of plant taxa 5 – 10
	1	Total number of plant taxa 1 – 4
	0	No vegetation present
Presence of Emergent and Floating-leaf Plant Beds	3	Emergent and/or floating-leaf plant stands occupy > 25% of the aquatic portion of the analysis window
	2	Stands occupy 5 – 25%
	1	Stands present but occupy less than 5%
	0	No emergent or floating-leaf plant beds present
Unique and Rare Plant Species	3	Presence of 2 or more unique or rare plant species within analysis window
	2	Presence of 1 unique plant species
	0	No unique plant species present
Near-shore substrate	3	Frequency of occurrence is > 50% soft substrate (> 50% of points within analysis window consist of soft substrate)
	2	Frequency of occurrence is 25 – 50% soft substrate
	1	Frequency of occurrence < 25% soft substrate
	0	No soft substrate present
Birds	3	Presence of 3 or more SGCN within analysis window
	2	Presence of 2 SGCN
	1	Presence of 1 SGCN
	0	No SGCN present
Bird Richness	3	Total number of bird species within analysis window > 25
	2	Total number of bird species 11 – 25
	1	Total number of bird species 1 – 10
	0	No bird species observed
Loon Nesting Areas	3	Presence of natural loon nest within analysis window
	2	Presence of artificial loon nest (nesting platform)
	0	No loon nesting observed
Frogs	3	Presence of both mink frogs and green frogs within analysis window
	2	Presence of mink frogs or green frogs
	0	Neither mink frogs nor green frogs present

Table 5, continued.

Variable	Score	Criteria
Fish	3	Presence of one or more species of greatest conservation need within analysis window
	2	Presence of one or more proxy species
	0	Neither SGCN nor proxies observed
Aquatic Vertebrate Richness	3	Total number of aquatic vertebrate species within analysis window > 10
	2	Total number of aquatic vertebrate species 5 – 10
	1	Total number of aquatic vertebrate species 1 – 4
	0	No aquatic vertebrate species observed
Rare Features	3	Presence of multiple Natural Heritage features within analysis window
	2	Presence of one Natural Heritage feature
	0	No Natural Heritage feature present
Bays	3	Isolated bay within analysis window
	2	Non-isolated bay
	0	Not a distinctive bay

Figure 70. Total score layer created by summing scores of all 15 variables. Highest total scores represent most sensitive areas of shoreline.

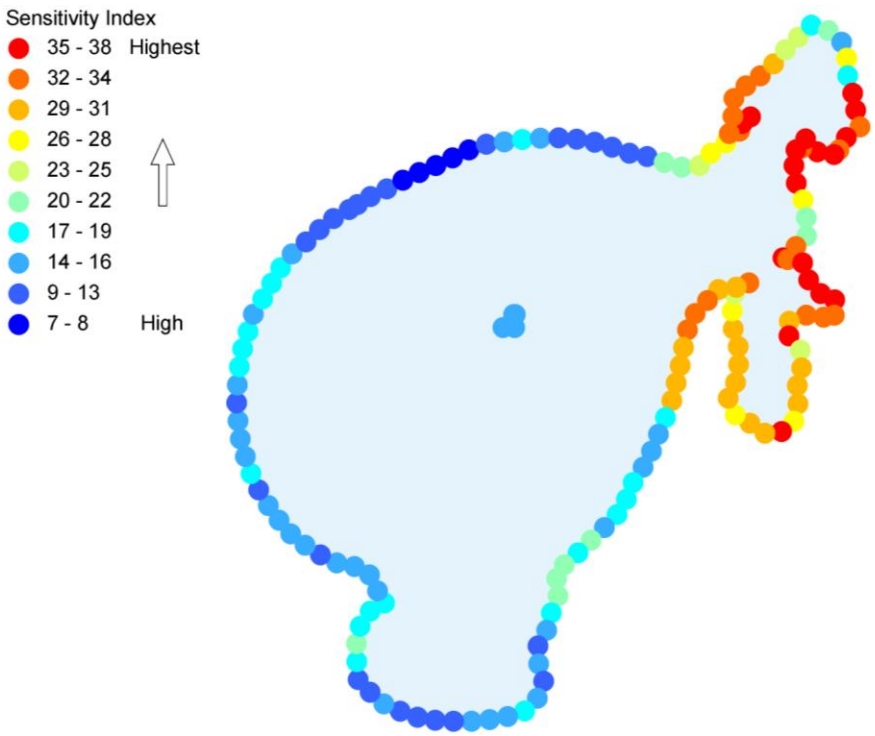


Figure 71. GIS-identified clusters of points with similar total scores. Red areas are those with high scores (i.e., areas of highly sensitive shoreland).

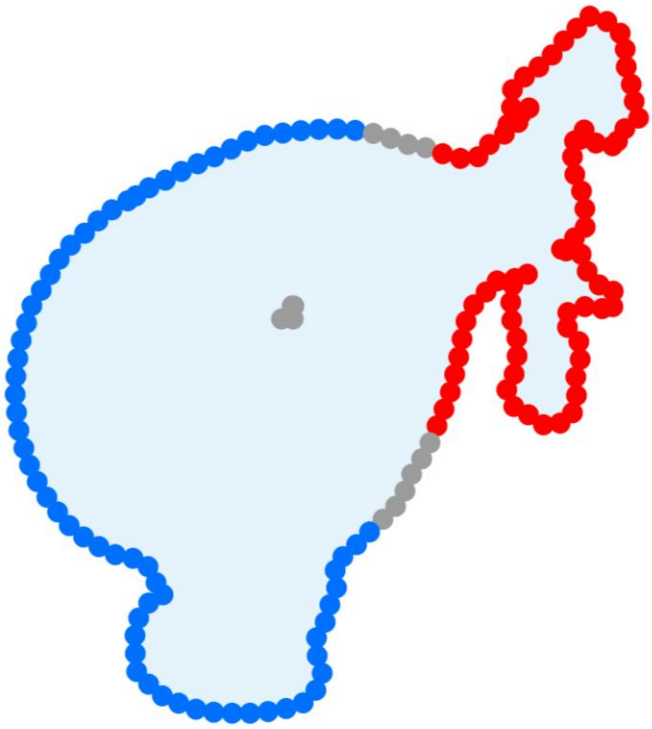
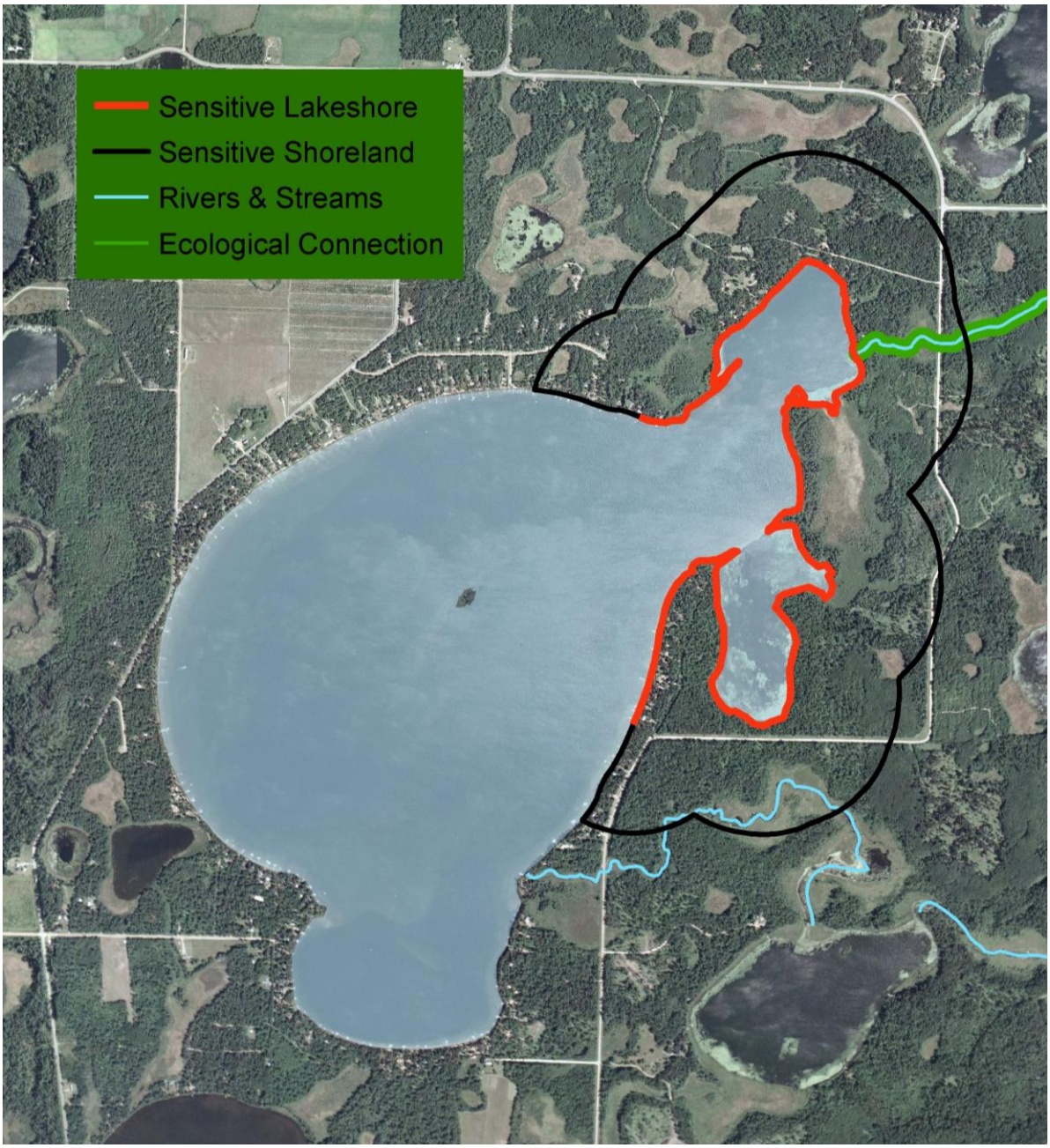


Figure 72. The sensitive lakeshore areas identified by the ecological model and an ecological connection.



Habitat Connectivity

In addition to the sensitive shorelands identified through the GIS model, surveyors considered adjacent river shorelines that provide habitat connectivity to and from the lake shorelands. Aquatic habitat connectivity allows for the movement of organisms within a watershed. Organisms can move between existing habitats, colonize new areas, or recolonize former habitat in the wake of local extinctions. The inlet of Ada Lake was identified as an important ecological connection. This river supports a known walleye spawning run, and northern pike and other fish

species likely spawn there as well. This river connects Ada Lake to several lakes, including Hand Lake and Hay Lake, upstream. Depending on the existing shoreland classification of this river, the County may use the ecological connection recommendation to consider reclassifying to a more protective river class.

Sensitive Lakeshore

As the field surveys documented, the northeastern bays (North Bay and Little Ada Bay) of Ada Lake supported a great diversity of plant and wildlife species, including species of greatest conservation need. Critical habitat, such as floating-leaf vegetation, was also present in the highest quantities near the bays. The ecological model displays these areas both as sensitive shoreline and as high priority shorelands. Although the shoreline itself is important, development and land alteration nearby may have significant negative effects on many species. Fragmented habitats often contain high numbers of invasive, non-native plants and animals that may outcompete native species. The larger a natural area is, the more likely it is to support populations of native plants and animals. Large natural areas that support a diversity of species and habitats help comprise a healthy ecosystem. The inlet of Ada Lake is also an important part of the lake ecosystem. It provides habitat connectivity between Ada Lake and nearby habitat. It allows movement of animals from various populations, increasing diversity. Habitat connectivity also allows animals with different vegetation requirements during different life stages to access those habitats. Protection of both the shoreline itself and the habitat surrounding the shoreline will be the most effective way to preserve the plant and animal communities in and around Ada Lake, and the value of the lake itself.

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Appendix 1. Shoreline plants identified in Ada Lake, 2007 and 2008.

Description		Common Name	Scientific Name	Survey Year
NATIVE SHORELINE EMERGENTS These plants are usually found at the lake/shore interface and in adjacent wetlands.	Forbs	Spreading rock-cress	*Arabis divaricarpa*	2008[a]
		Swamp milkweed	*Asclepias incarnata*	2007
		Marsh bellflower	*Campanula aparinoides*	2007
		Bulb-bearing water hemlock	*Cicuta bulbifera*	2007
		Spotted Joe-Pye weed	*Eutrochium maculatum*	2008
		Blue flag iris	*Iris versicolor*	2007
		Northern bugleweed	*Lycopus uniflora*	2007
		Tufted loosestrife	*Lysimachia thyrsiflora*	2007
		Swamp candles	*Lysimachia terrestris*	2007
		Common skullcap	*Scutellaria galericulata*	2007
	Grasses and Sedges	Canada bluejoint grass	*Calamagrostis*	2007
		Bottlebrush sedge	*Carex pseudocyperus*	2007
		Lake sedge	*Carex lacustris*	2007
		Wiregrass sedge	*Carex lasiocarpa*	2007
		Beaked sedge	*Carex utriculata*	2008
		Praire cordgrass	*Spartina pectinata*	2008
	Shrubs	Alder	*Alnus incana*	2007
		Red osier dogwood	*Cornus sericea*	2007
NON-NATIVE SHORELINE PLANTS		Purple loosestrife	*Lythrum salicaria*[b]	2007
		Giant chickweed	*Myoston aquaticum*	2008
		Reed canary grass	*Phalaris arundinacea*[b]	2007
		Sow-thistle	*Sonchus* sp.	2008

[a]2008 = located only during Minnesota County Biological Survey, 11 August 2008.

[b]Indicates species is not native to Minnesota.

Nomenclature follows MNTaxa 2009.

Appendix 2. Bird species list. Includes all species within Ada Lake and shoreland recorded during surveys and casual observation, May – June 2008.

Common Name	Scientific Name
Canada Goose	*Branta canadensis*
Wood Duck	*Aix sponsa*
Mallard	*Anas platyrhynchos*
Common Goldeneye	*Bucephala clangula*
Common Loon	*Gavia immer*
Red-necked Grebe	*Podiceps grisegena*
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides virescens*
Bald Eagle	*Haliaeetus leucocephalus*
Merlin	*Falco columbarius*
Ring-billed Gull	*Larus delawarensis*
Black Tern	*Chlidonias niger*
Common Tern	*Sterna hirundo*
Mourning Dove	*Zenaida macroura*
Barred Owl	*Strix varia*
Ruby-throated Hummingbird	*Archilochus colubris*
Belted Kingfisher	*Megaceryle alcyon*
Red-bellied Woodpecker	*Melanerpes carolinus*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Downy Woodpecker	*Picoides pubescens*
Hairy Woodpecker	*Picoides villosus*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
Eastern Wood-Pewee	*Contopus virens*
Least Flycatcher	*Empidonax minimus*
Eastern Phoebe	*Sayornis phoebe*
Great Crested Flycatcher	*Myiarchus crinitus*
Eastern Kingbird	*Tyrannus tyrannus*
Warbling Vireo	*Vireo gilvus*
Red-eyed Vireo	*Vireo olivaceus*
Blue Jay	*Cyanocitta cristata*
American Crow	*Corvus brachyrhynchos*
Purple Martin	*Progne subis*
Tree Swallow	*Tachycineta bicolor*
Barn Swallow	*Hirundo rustica*
Black-capped Chickadee	*Poecile atricapillus*
White-breasted Nuthatch	*Sitta carolinensis*
House Wren	*Troglodytes aedon*
Veery	*Catharus fuscescens*
American Robin	*Turdus migratorius*
Gray Catbird	*Dumetella carolinensis*
European Starling	*Sturnus vulgaris*
Cedar Waxwing	*Bombycilla cedrorum*

Appendix 2, continued.

Common Name	Scientific Name
Golden-winged Warbler	*Vermivora chrysoptera*
Yellow Warbler	*Dendroica petechia*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Pine Warbler	*Dendroica pinus*
Black-and-white Warbler	*Mniotilta varia*
American Redstart	*Setophaga ruticilla*
Ovenbird	*Seiurus aurocapilla*
Common Yellowthroat	*Geothlypis trichas*
Wilson's Warbler	*Wilsonia pusilla*
Chipping Sparrow	*Spizella passerina*
Song Sparrow	*Melospiza melodia*
Northern Cardinal	*Cardinalis cardinalis*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Red-winged Blackbird	*Agelaius phoeniceus*
Common Grackle	*Quiscalus quiscula*
Brown-headed Cowbird	*Molothrus ater*
Baltimore Oriole	*Icterus galbula*
American Goldfinch	*Carduelis tristis*