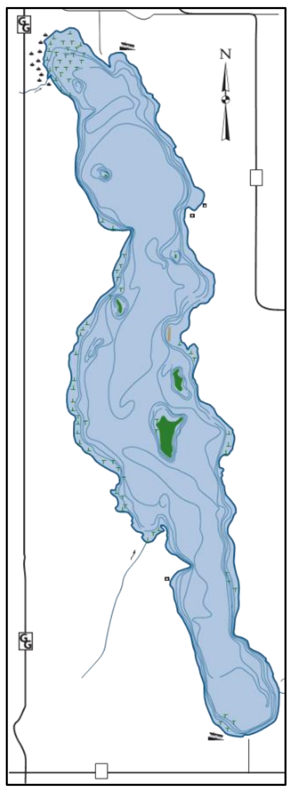
Sensitive Area (Critical Habitat) Survey: Evaluation of macrophytes, zooplankton, macroinvertebrates, herptiles, and mammals

Bone Lake, Polk County Wisconsin

2021-22



Supported by: Wisconsin Dept. of Natural Resources and Bone Lake Management District

Survey conducted and analyzed by: Ecological Integrity Service, LLC Amery Wisconsin

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Introduction

In 1988-89, the Wisconsin Department of Natural Resources conducted a sensitive area (critical habitat areas) survey on Bone Lake, Polk County, Wisconsin. The purpose of the study was to designate areas deemed essential habitats for lake organisms. The survey resulted in 11 areas (A-K) delineated around Bone Lake. Most of the references to critical habitats refer to aquatic plants and fish habitats.

The following information is from the Wisconsin Dept of Natural Resources[1]:

Wisconsin law mandates special protections for these critical habitats. Critical Habitat Designation is a program that recognizes those areas and maps them so that everyone knows which areas are most vulnerable to impacts from human activity. A critical habitat designation assists waterfront owners by identifying these areas upfront, so they can design their waterfront projects to protect habitat and ensure the long-term health of the lake where they live.

Areas are designated as Critical Habitat if they have Public Rights Features, Sensitive Areas, or both. Public rights features (defined in NR 1.06, Wis. Adm. Code) include the following:

- *fish and wildlife habitat;*
- *physical features of lakes and streams that ensure the protection of water quality;*
- *reaches of the bank, shore, or bed that are predominantly natural in appearance; and*
- *navigation thoroughfares;*

> *Every waterbody has critical habitat - those areas that are most important to the overall health of the aquatic plants and animals. Remarkably, 80 percent of the plants and animals on the state's endangered and threatened species list spend all or part of their life cycle within the nearshore zone. As many as 90 percent of the living things in lakes and rivers are found along the shallow margins and shores.* (Wisconsin DNR Critical Habitat Areas Information)

These critical habitat areas are of deep concern for the Bone Lake District. A baseline survey outlining biota present and indications of diversity was conducted to address these concerns. This survey evaluated the aquatic plant species present within each sensitive area, the diversity, and sensitivity of aquatic plants present, enumeration of three major groups of zooplankton, a survey of the macroinvertebrates identified to family level with a Shannon Diversity Index calculation, and reptile observations within the sensitive areas and mammals, with emphasis on furbearers. Frog and bird surveys were conducted in previous years for the entire lake and were repeated in 2021-22. The frog survey results will be included in this report, focusing on sensitive areas only. The bird survey results are available in a separate report.

[1] https://dnr.wisconsin.gov/topic/lakes/criticalhabitat

Although the presentation of the data may appear to compare the sensitive areas, that is not the intention of this study. The data provides a baseline to help measure the ecological significance and allow for the evaluation of changes in the future by using the same parameters.

Sensitive Areas Summary

Eleven critical habitat areas were designated in 1988 by the Wisconsin Department of Natural Resources A-K). Their summary appears to emphasize their role in fisheries in Bond Lake. The following summarizes each critical habitat area, including some information from the DNR summary[2] and the observations during various surveys within these areas. Figure 1 (below shows) the critical habitat area locations.

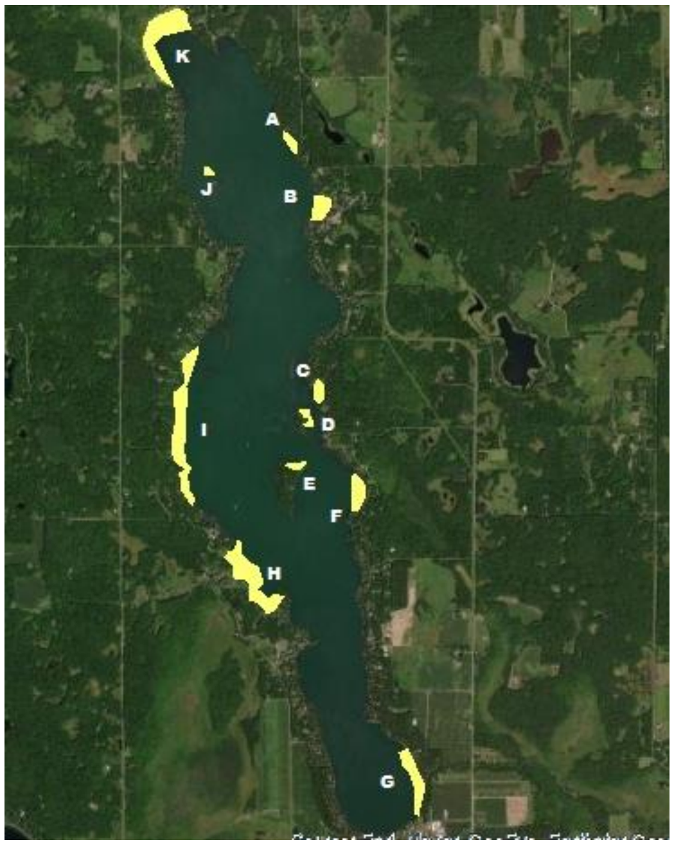


Figure 1: Map of Wisconsin DNR designated sensitive areas, 1988-89

Area A: This area is in a bay with the entire shoreline developed. There is no floating or emergent vegetation. There is a small 60-70 foot portion of the shoreline with natural vegetation, and with the remainder lacking natural vegetation.

The Wisconsin DNR designated this area as a critical habitat for bass and panfish and northern pike and muskellunge. It was also noted site A provides critical habitat vital for birds, furbearers, turtles, and amphibians.

[2] Bone Lake Sensitive Area Survey Report and Management Guidelines. July 1988 and 1989.

Figure 2: Pictures of Area A from the lake perspective.

Area B: Area B has extensive shoreline and riparian development. There is evidence of vegetation removal or reduction due to boat activity. One small area has floating and emergent vegetation. It is estimated that this area would have extensive floating and emergent vegetation without human action.

The Wisconsin DNR cited critical habitat for bass and panfish and spawning/nursery area for northern pike and muskellunge. The site is expected to provide crucial foraging habitat. The survey indicates wildlife also are reliant upon this area for habitat. Eagles, loons, herons, waterfowl, songbirds, furbearers, turtles, and amphibians benefit from this valuable habitat.

Figure 3: Pictures of Area B from the lake perspective.

Area C: Area C has mostly natural shoreline vegetation. Approximately two thirds of the shoreline area has floating and emergent vegetation. There is a small amount of coarse woody habitat. The most northern and southern portions of the sites are developed.

The Wisconsin DNR survey describes that this area provides essential habitat for bass, panfish, and northern pike and muskellunge spawning and nursery areas. This area also should provide critical habitat for forage species. Wildlife also is reliant upon this area for habitat. Eagles, loons, herons, waterfowl, songbirds, furbearers, turtles, and amphibians benefit from this valuable habitat.

Figure 4: Pictures of Area C from the lake perspective.

Area D: This area encompasses an undeveloped portion of an island. There are two bands of emergent vegetation covering most of the site. There are a few pieces of coarse woody habitat towards the north end. The northern portion has some floating vegetation.

A critical habitat survey indicates that this area provides essential habitat for bass and panfish spawning and nursery areas. This area also provides critical habitat for forage species. Wildlife also is reliant upon this area for habitat. Eagles, loons, herons, waterfowl, songbirds, furbearers, turtles, and amphibians benefit from this valuable habitat.

Figure 5: Pictures of Area D from the lake perspective.

Area E: Area E is adjacent to an undeveloped island. There is no emergent or floating vegetation. There are two pieces of coarse woody habitat present.

According to the Wisconsin DNR, this area provides essential habitat for bass, panfish, and northern pike and muskellunge spawning and nursery areas. This area also provides critical habitat for forage species. Wildlife also is reliant upon this area for habitat. Eagles, loons, herons, waterfowl, songbirds, furbearers, turtles, and amphibians benefit from this valuable habitat.

Figure 6: Picture of Area E from the lake perspective. This is off the north side of the island.

Area F: Area F has the entire shoreline developed with many manicured lawns leading to the lake. There is one bed of emergent vegetation, some floating vegetation between docks, with evidence of plant reduction due to removal or boat activity. One piece of coarse woody habitat is present. There are also two springs on the shoreline with groundwater flowing into the lake.

The critical habitat survey found that this area provides essential habitat for bass and panfish spawning and nursery areas. This area also provides critical habitat for forage species. Wildlife also is reliant upon this area for habitat. Waterfowl, songbirds, turtles, and amphibians benefit from this valuable habitat.

Figure 7: Pictures of Area F from the lake perspective.

__Area G:__ It is estimated the southern half is not developed, and the northern half is developed. There is extensive emergent vegetation in the north half, some moved in front of houses. The southern half has no emergent vegetation. Floating vegetation is present but limited. There is no coarse woody habitat.

The Wisconsin DNR survey suggests this area provides essential habitat for bass, panfish, and northern pike and muskellunge spawning and nursery areas. Heavy use by muskellunge has been observed during spawning seasons in this area.

This area also provides essential habitat for forage species. Wildlife also is reliant upon this area for habitat. Eagles, loons, herons, waterfowl, songbirds, furbearers, turtles, and amphibians benefit from this valuable habitat.

Figure 8: Pictures of Area G from the lake perspective.

Area H: Area H is a large area along a long stretch of shoreline. There is a fair development with some floating and emergent vegetation, mostly between residences. Some manicured lawns lead up to the lake and one piece of coarse woody habitat is present.

According to Wisconsin DNR, this area provides essential habitat for centrarchid bass, panfish, and northern pike and muskellunge spawning and nursery areas. This area also provides critical habitat for forage species. Wildlife also is reliant upon this area for habitat. Eagles, loons, herons, waterfowl, songbirds, furbearers, turtles, and amphibians benefit from this valuable habitat.

Figure 9: Pictures of Area H from the lake perspective.

The area I: Area I covers an extensive stretch of shoreline on the west shore of Bone Lake. There is a fair amount of development. Some large beds of emergent vegetation (bulrush) along this shore, reaching several feet out from shore. There is evidence of vegetation removal in front of residences. Some manicured lawns lead up to the lake. There is one piece of coarse woody habitat.

The Wisconsin DNR sensitive area summarizes that this area provides essential habitat for bass and panfish and northern pike and muskellunge spawning and nursery areas. This area also provides critical habitat for forage species. Wildlife also is reliant upon this area for habitat. Eagles, loons, herons, waterfowl, songbirds, furbearers, turtles, and amphibians benefit from this valuable habitat.

Figure 10: Pictures of Area I from the lake perspective.

<u>Area J:</u> Area J is portrayed on the Wisconsin DNR surface water viewer map showing sensitive areas on Bone Lake. Based on the summary of the location in the survey document, this area is likely a rock bed near the mapped location. The DNR survey cites an important bulrush bed within this area. There are no bulrush plants present in 2021. The area is far off the shore and has some submerged plants bordering the rock bed. No emergent or floating vegetation is present.

According to the Wisconsin DNR, this area provides essential habitat for bass and muskellunge spawning and nursery areas. This area also provides critical habitat for forage species. Wildlife also is reliant upon this area for habitat. Great Blue Herons use this site for feeding.

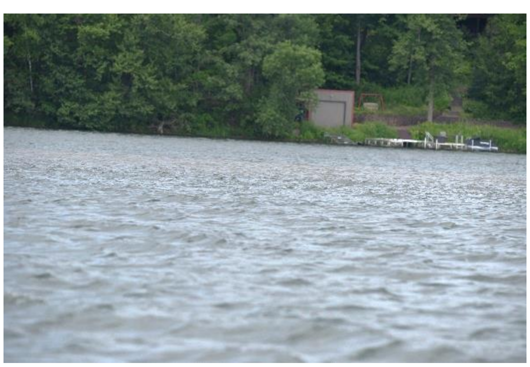


Figure 11: Picture of Area J from the lake perspective.

Area K: Area K is located on the far northern end of Bone Lake, where most wild rice has historically grown. Most of the shoreline is a wetland with extensive emergent and floating vegetation. Development is limited, with some evidence of plant removal or reduction likely due to navigation issues.

The Wisconsin DNR survey summarizes Area K as providing critical habitat for bass, panfish, and northern pike and muskellunge spawning and nursery areas. This area also provides essential habitat for forage species. Wildlife also is reliant upon this area for habitat. Eagles, loons, herons, waterfowl, songbirds, furbearers, turtles, and amphibians benefit from this valuable habitat.

Figure 12: Pictures of Area K from the lake perspective.

Survey components

Aquatic macrophytes

Aquatic macrophytes were a significant criterion in the designation of the sensitive areas in 1988. All plants serve an essential role ecologically. However, certain plants provide unique and vital habitats for zooplankton, invertebrates, fish, herptiles, and mammals. Fine-leaved submergent plants such as northern watermilfoil, coontail, and whitewater crowfoot provide cover for zooplankton to hide and forage. Broader-leaved submerged plants provide attachment sites for various periphyton and invertebrates and provide cover and feed.

Floating leaf plants, such as white-water lily and spatterdock, provide cover and protection for fish and can contain large numbers of invertebrates that can be found on the underside of the large, floating leaves. These plants also stabilize sediments and reduce wave energy hitting the shoreline. Amphibians will sometimes use these to bask, and all underwater organisms can use the leaves for cover from birds of prey.

Figure 13: Photos of white-water lily (left) and spatterdock (right).

Emergent plants stick up above the surface of the water. Some common species within Bone Lake are hard stem bulrush and bur-reed. These plants provide excellent cover for a wide range of organisms including fish, herptiles, birds, and mammals as well as good nesting material. Emergent plants also aid in sediment stabilization and reduce wave energy which can help protect shoreline banks through reduced erosion.

Figure 14: Photos of emergent plants bulrush (left), bur-reed (center) and cattail (right).

Rocky and sand substrates tend to have limited plant growth but hold more sensitive plants. A conservatism value is assigned to most native aquatic plants. The values range from 1 to 10, with the higher number representing more susceptible plants. These plants are more susceptible to habitat changes, often associated with human disturbance. A higher mean conservatism value within a sensitive area indicates more sensitive plants and shows a healthy plant community disturbed less by human activity.

Figure 15: Photos of plants that grow in low nutrient sediments. Variable pondweed (left), slender naiad (center), and needle spike rush (right).

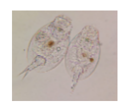
Zooplankton

Zooplanktons are vital organisms in the aquatic food web. Many feeds on phytoplankton (algae) and detritus. This is a critical link between producers, decomposers and organisms at higher trophic levels. In addition, zooplankton can consume large amounts of algae and research is continuing on their potential contributions to increased water clarity. Some zooplankton will feed on other zooplankton as well. Invertebrates and smaller fish rely heavily on zooplankton for food.

For this survey, the zooplankton were enumerated based on three categories: Cladocerans, copepods, and rotifers.

Cladocera are microcrustaceans that include the commonly known daphnia. This zooplankton is typically larger than the other groups. They can eat large amounts of phytoplankton, especially large species. Various species are known to feed on protists, rotifers, and other smaller crustaceans. This zooplankton is a crucial food source for small fish. This zooplankton is highly mobile and can migrate large distances vertically and horizontally in lakes. Several species are pelagic, being found primarily in open water away from the littoral zone.

Copepods are also microcrustaceans. Most species are associated with the littoral zone habituating vegetation and littoral sediments. Some species are planktonic, free-swimming organisms. Many copepods have mouthparts designed to scrap particles from sediments and microvegetation. Free-living copepods do not filter feed but rather seize plant or animal particles by mouth. Depending on the species, copepods feed on various forms of algae, other microcrustaceans, dipteran larvae, and oligochaetes. Copepods are also highly mobile and can migrate vertically and horizontally in the water column. There are several pelagic species of copepods, which are more common in open water.



Rotifers are tiny, usually sessile organisms associated with littoral substrates, with some species (about one-third of all species) being planktonic or free living. Rotifers eat by sweeping sediment particles into the mouth using cilia. Some rotifers can seize and ingest whole organisms after the body wall is punctured.

The group composition of zooplankton can vary for many reasons. Cladocera is highly mobile, and their population numbers are dependent on the amount of food available, namely desirable algae species. If there is abundant food, their population will grow. However, they are susceptible to predators such as fish. If numerous small fish populations are present, their population will decline. As a result, they may not frequent littoral zones where many baitfish hide. A high percentage of Cladocera may indicate high numbers of desirable food algae species and fewer fish foraging. This would be similar to copepods, also larger crustacean zooplankton.

There is evidence of zooplankton correlating to water quality and ecological potential. The density of all zooplankton is directly related to ecological potential, with higher density indicating a healthier ecosystem, likely due to their importance in the food web. The correlation between the type of zooplankton that is present and ecological potential has also been established. The greater the density of cladocerans and copepods, the more significant the ecological potential (Munoz-Colemenares et al., 2021).

Macroinvertebrates

Using macroinvertebrates as water quality indicators and ecological health have a long history as a valid metric (US Environmental Protection Agency, 2022). Aquatic macroinvertebrates vary immensely in their tolerance to poor water quality. Tolerance values have been assigned to families of invertebrates. The presence of lower tolerance families indicates better water quality and a healthier ecosystem. This is also reflected in the diversity since the loss of less tolerant organisms can lead to less variety. Weighted tolerance values of families (family biotic index) and diversity indices such as the Shannon diversity index are both metrics that are strong indicators of aquatic ecosystem quality.

Bone Lake Critical Habitat Survey Methods

Aquatic macrophytes

For each critical area, a systematic point grid was created using GIS. The space between the points was consistent for each critical area. On July 8-9, 2021, each sample point was located using GPS, and a double-tined rake was used to sample the plants with an approximately 1-meter sample. The plant density was rated by estimating how full the rake was with all plants sampled (0-3 rating). Each species on the rake was identified and given a density rating of 1-3. This was repeated at each sample point within each critical area delineated. The plants within each critical habitat area were evaluated by calculating the following (with a brief explanation of each):

- Percent of the area with plants sampled is the number of survey points with plants present divided by the total number of points in the grid (X 100%). Since the point grid is created in GIS, some sample points could have been too deep for plants. Sand and rock substrates also tend to grow fewer plants, so substrate can be a factor.
- Species richness is the total number of species sampled in the critical habitat area.
- Mean number of species per sample point shows diversity per sample point, accounting for different sizes (different number of sample points) of critical habitat areas (assuming the larger number of sample points increases the odds of more species sampled).
- Simpson's diversity index is a calculation that indicates the probability of two sampled species being different. The higher the Simpson's diversity index, the more diverse the area is regarding plants sampled.
- Floristic quality index (FQI) calculates the number of species and the mean conservatism value (how sensitive a plant is to habitat changes). The higher the FQI, the more diverse and sensitive the plant community.
- Mean conservatism value is the mean of all conservatism values of the sampled plants. More sensitive plants have higher conservatism values.

Zooplankton enumeration

One vertical plankton tow will occur, within each sensitive area on July 7, 2021, in 5-feet of water within macrophytes (2 tows in Area H and three tows in Area I due to size) using a Wisconsin-type plankton net with a 1-foot diameter opening. The net was rinsed to obtain a 250 ml composite sample of the vertical water column. The samples were then preserved with 2.5 ml of Lugol's solution to make a 1% solution. The area with more than one sample collected were mixed to make one composite sample.

For enumeration, each sample was mixed, and a random aliquot of 10 ml was removed and placed into a Wildco zooplankton counting wheel. The sample was allowed to settle for 30 minutes. The wheel was observed under a stereomicroscope at 10X (to count large cladocerans) and 30X to count smaller zooplankton. The zooplankton was placed into three main categories: Cladocerans, copepods, and rotifers. Each category was totaled within each sample. The numbers were adjusted to reflect the number of each zooplankton per liter within the 5-foot vertical water column.

Aquatic Macroinvertebrates

To survey the aquatic macroinvertebrates, sampling was conducted in the benthos (bottom) and within any aquatic macrophytes that may have been present within each critical habitat area On July 5 and 6, 2021. The following methods were used to sample each area:

Benthos-A Ponar type sediment sampler was used to sample each sediment type, sand, gravel/rock, and muck (if each is present). The sediment was transferred into a sample bucket. The sediment was then processed through wire mesh screens (#6, #20, and #40 screen mesh) to remove small particles and detritus and separate invertebrates. The wire mesh screens were then rinsed into a sizeable white pan. All observed invertebrates were removed from the pan and placed into a sample bottle containing 70% ethanol to preserve specimens.

Plants-Within a transect from shore out to the end of the plant growth, or 5 feet, four 15-second net sweeps (using a triangular macroinvertebrate net-500 Um mesh) were conducted. The net contents were transferred to a large white tray, and all observed invertebrates were transferred to a sample bottle containing 70% ethanol.

All invertebrates were combined, and each was identified to family using the *Guide to Aquatic Invertebrates of the Upper Midwest* (Bouchard, 2004) and *Key to Wisconsin Freshwater Snails* (Perez and Sandland, 1980) for gastropods (snails). The Shannon-Diversity Index was calculated using a digital program and entering the number of each taxon (family level) into the calculator. The tolerance values listed in the family level key were used to determine the mean tolerance value. The weighted mean accounted for the number of each family within the sample.

Common groups found in Bone Lake

Insect orders:

Diptera-These invertebrates are known as the aquatic flies. They undergo complete metamorphosis with the aquatic stage are larvae which are maggot-like. A common family of Diptera found in lakes is Chironomidae. Some chironomids are deep red in color, known as blood-red chironomids. Those that are not red are referred to as non-blood red chironomids.

Diptera-*Chironomidae* (blood red)

Odonata-This group includes both dragonflies and damselflies. These organisms undergo incomplete metamorphosis with the aquatic stage being nymphs. They crawl out of the water and emerge as an adult, flying insects.

 Odonata (damselfly) Odonata (dragonfly)

Trichopterans-These are caddisflies, which often build a case out of local debris (sticks, pebbles, grass) for protection. Some spin nets to live under, and a few are free of any structure. These will undergo complete metamorphosis with the most common stage sampled being larvae, often living inside a case.

Trichoptera-*Limnephilidae*

Ephemeroptera-Known as mayflies, these organisms hatch into flying adults and live a short time as flying adults, in order to expand their populations. Some lakes can have impressive mayfly hatches resulting in many flying insects ending in numerous dead adults on the surface.

Ephemeroptera-*Tricorythidae*

Coleoptera-These are the aquatic beetles. Both larvae and adults are sampled in lakes. The adults are often near the surface, such as the whirligig beetle. The larvae live underwater and are predators.

  Coleoptera-*Gyrinidae* (larvae left and adult right)

Lepidoptera-Aquatic moths have larvae that live underwater before they pupate and emerge as adults. These can appear like Diptera but have very small, jointed legs (as larvae) that Diptera lack.

 Lepidoptera-*Pyralidae*

Hemiptera-Known as aquatic bugs, these are sampled as adults only. They have thick wings and can be easily confused with some adult beetles.

 Hemiptera-*Corixidae*

Megaloptera-Often is more associated with flowing water, some species of Megaloptera are found in lakes. They are known commonly as dobsonflies and fishflies.


Megalopteran-*Corydalidae*

Non-insects:

Crustacea-These include crayfish, amphipods, and isopods. They are different from insects in that they have 10 legs and do not live out of the water during their lifetime.

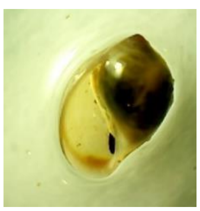

Crustacean (amphipod)-*Hyalelllidae*

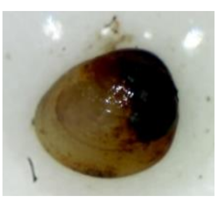

Crustacean (isopod)-*Asellidae*

Oligochaete-Aquatic worms that look like small nightcrawlers.


Oligochaete

Mollusks-The mollusks in lakes are generally mussels (bivalves) or snails (gastropods). They live entirely in water. They have shells with protection and move with the use of a fleshy "foot."


Gastropod (snail)-*Physidae*


Bivalve (freshwater mussel)- *Sphaeriidae*

Frog (Amphibian) Survey

In 2012, a frog survey was conducted using breeding calls to identify the species present. The procedure used for the 2012 survey was repeated in the 2022 survey, so the results can be compared. This procedure is from the Wisconsin Frog Survey protocol. An emphasis of all surveys in 2021-22 is to provide a baseline for the sensitive areas within Bone Lake. For this reason, a data point was added to discern if the frogs are present in a sensitive area or not.

The frog survey involved traveling to 54 predetermined locations around Bone Lake when the water temperatures were in the 50', 60', s and then 70 or higher (three separate occasions). While at each survey point, calls were recorded using a rating system while listening for 5 minutes. The ratings are as follows:

1 = individual species can be distinguished, and there is no overlap.

2= calls somewhat overlap, but individuals can still be distinguished.

3= full chorus; calls overlap, and individual frogs cannot be distinguished.

In addition, the weather conditions and water temperature were recorded at the time of the survey.

Figure 16 shows the frog survey sample points, Bone Lake sensitive areas, and wetlands.

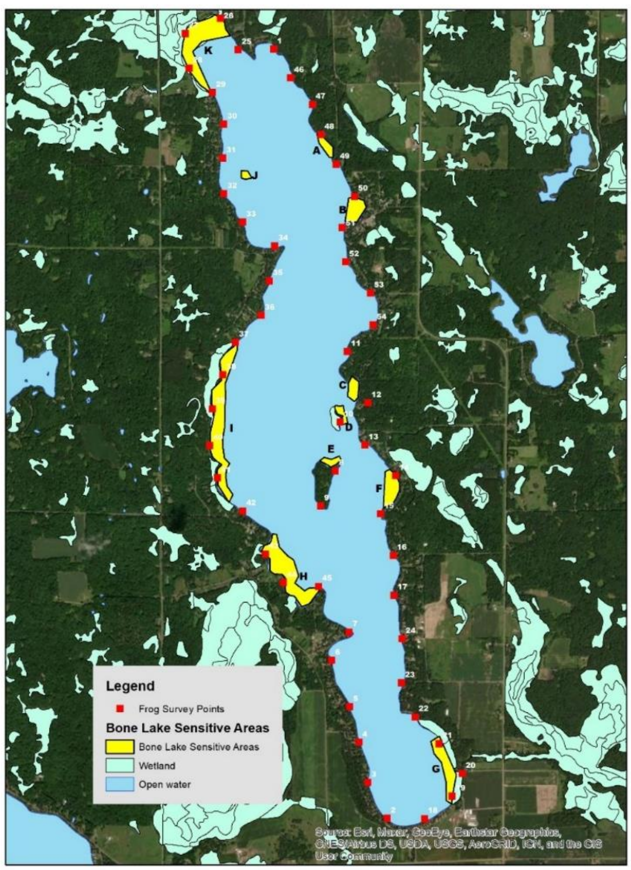


Figure 16: Map showing frog survey sample points, sensitive areas and wetlands around Bone Lake.

Reptile Survey/Mammal Survey

The survey is comprised of two versions on August 16, 2021. One was to do a visual encounter survey. The visual encounter survey will involve observing the sensitive area for 30-minute intervals in a central location. In large areas where the entire area cannot be seen, the area was split into regions where the whole site could be observed. The riparian zone will also be observed within the sensitive area for any organisms and evidence of activity. A basking survey was also conducted where each sensitive area was traveled by boat (on the outer edge), noting any reptiles basking on logs, rocks, or other substrates.

In addition to the visual/encounter and basking surveys, wildlife cameras were placed within each sensitive area (lakeside with the camera pointed toward shore at a diagonal) for 5 days. All photos were evaluated and documented any vertebrate organisms observed. This occurred during July and August.

Mammals (emphasis furbearers) were surveyed from July to August by volunteers using visual encounter methods. This survey entailed going to a sensitive area at dawn and dusk. The volunteers sat and observed mammals for 30-minute intervals and recorded any observed *(note: not all volunteers were able to fulfill having all sensitive areas surveyed with this protocol)*.

Results

Aquatic macrophytes

The aquatic macrophytes were evaluated in relationship to aerial coverage of the delineated area, species richness, species per sample point, Simpson's diversity index, mean conservatism value of plants sampled, and the floristic quality index (FQI).

Sensitive Area	% of the area with plants sampled	Species richness	Mean # of species per sample point	Simpson's Diversity Index	Mean Conservatism Value	FQI
A	100	11	2.78	0.86	6.3	19.9
B	81.2	22	3.31	0.92	6.0	27.7
C	100	20	4.56	0.92	5.6	22.5
D	85.7	9	2.67	0.84	6.0	18
E	80.0	8	2.5	0.86	6.4	18
F	80.9	9	2.0	0.79	6.3	19
G	90.3	22	2.0	0.91	5.95	26.6
H	89.3	18	2.08	0.86	5.8	23.25
I	97.7	18	2.36	0.89	6.25	25.0
J	100*	3	2.0	0.63	5.3	9.2
K	94.1	22	3.77	0.90	5.23	24.0

*Site J map location from Wisconsin DNR was in deep water. Samples occurred on the edge of the delineated area with most of the rock piles without plants. Therefore 100% is misleading.

Table 1: Summary of point intercept survey results within each sensitive area.

Areas B, G, and K have the most species with area C and area K with the most species per plant. The highest Simpson's diversity index occurred in areas B and C at 0.92. The most sensitive plants were found in area E, with a mean conservatism value of 6.4, followed by A and F at 6.3. Area B had the highest FQI largely due to high species richness.

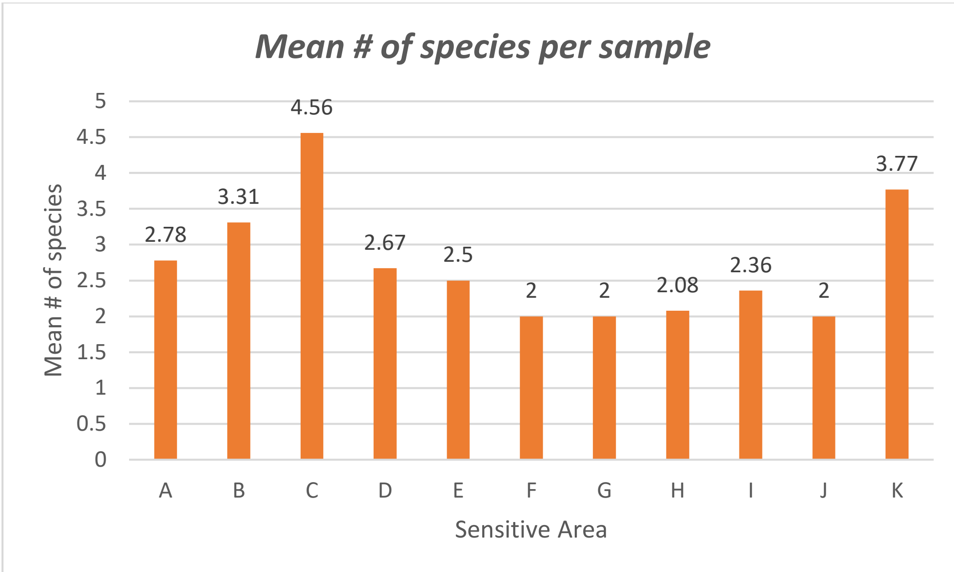


Figure 17: Graph showing the mean number of species of aquatic plants sampled in each sensitive area.

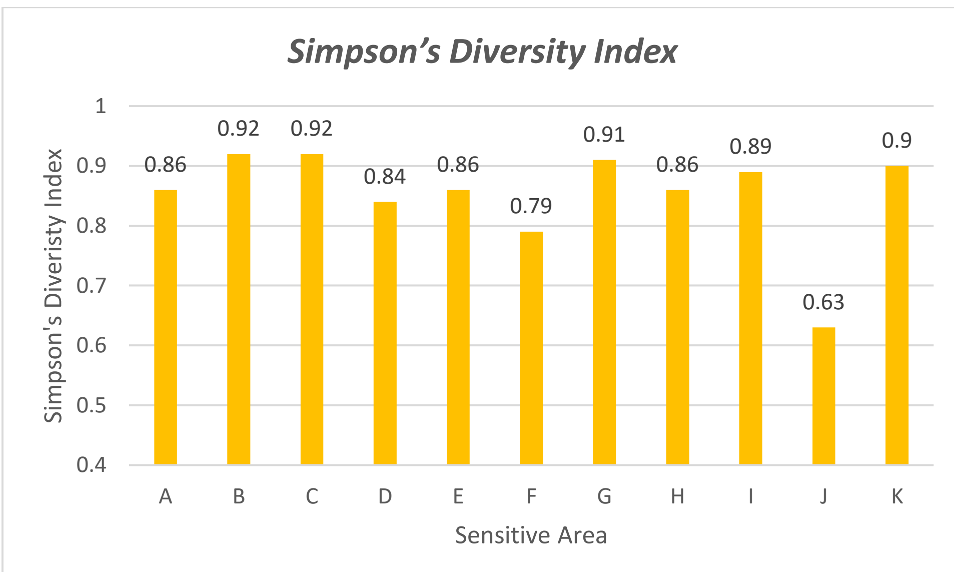


Figure 18: Graph showing the Simpson's Diversity Index calculated for each sensitive area.

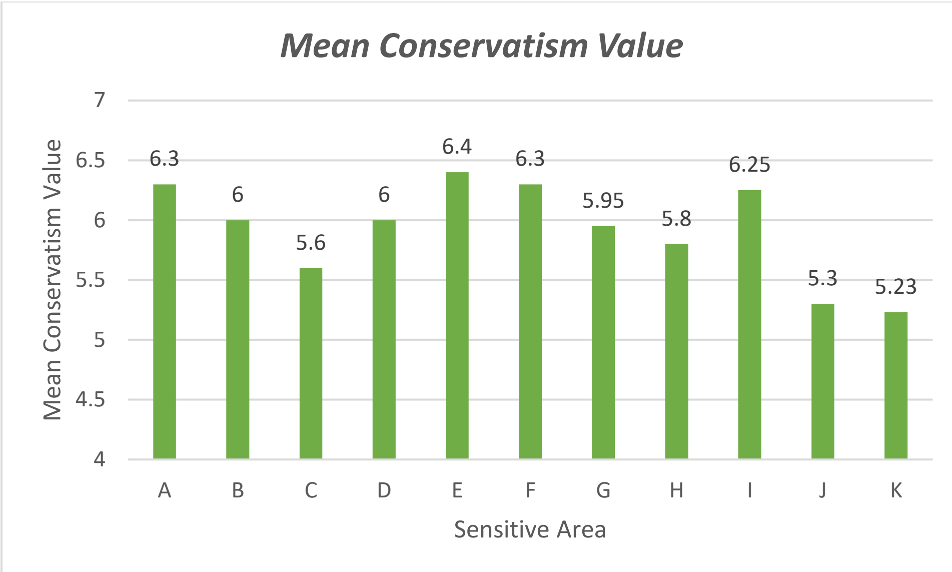


Figure 19: Graph of the mean conservatism value from aquatic plants sampled in each sensitive area.

Tables 2-12 show the list of each species sampled within each sensitive area.

Sensitive Area A			
Species	**FOO**	**Relative Freq.**	**Mean rake fullness**
Chara sp.-muskgrass	66.7%	24.0%	1.0
Eleocharis acicularis-needle spike rush	11.1%	4.0%	1.0
Myriophyllum sibiricum-northern watermilfoil	11.1%	4.0%	2.0
Najas flexilis-slender naiad	33.3%	12.0%	1.0
Potamogeton friesii-Fries' pondweed	11.1%	4.0%	1.0
Potamogeton gramineus-variable pondweed	33.3%	12.0%	1.0
Potamogeton pusillus-small pondweed	11.1%	4.0%	1.0
Potamogeton richardsonii-clasping pondweed	33.3%	12.0%	1.0
Potamogeton zosteriformis-flat-stem pondweed	11.1%	4.0%	1.0
Sagittaria sp.-arrowhead rosette	11.1%	4.0%	1.0
Vallisneria americana-wild celery	44.4%	16.0%	1.0
Potamogeton illinoensis-Illinois pondweed	viewed	only	
Stuckenia pectinate-sago pondweed	viewed	only	

Table 2: Area A

Sensitive Area B			
Species	**FOO**	**Relative Freq.**	**Mean rake fullness**
Bidens beckii-water marigold	7.7%	2.3%	1.0
Ceratophyllum demersum-coontail	7.7%	2.3%	1.0
Chara sp.-muskgrass	69.2%	20.9%	1.2
Elodea canadensis-common waterweed	7.7%	2.3%	1.0
Heteranthera dubia-water stargrass	15.4%	4.7%	1.0
Lemna trisulca-forked duckweed	7.7%	2.3%	1.0
Myriophyllum sibiricum-northern watermilfoil	15.4%	4.7%	1.0
Najas flexilis-slender naiad	7.7%	2.3%	1.0
Potamogeton crispus-curly-leaf pondweed	7.7%	2.3%	1.0
Nuphar variegata-spatterdock	7.7%	2.3%	1.0
Nymphaea odorata-white lily	15.4%	4.7%	1.0
Potamogeton amplifolius-large-leaf pondweed	7.7%	2.3%	1.0
Potamogeton friesii-Fries' pondweed	15.4%	4.7%	1.0
Potamogeton gramineus-variable pondweed	30.8%	9.3%	1.0
Potamogeton pusillus-small pondweed	7.7%	2.3%	1.0
Potamogeton richardsonii-clasping pondweed	15.4%	4.7%	1.0
Potamogeton zosteriformis-flat-stem pondweed	23.1%	7.0%	1.0
Ranunculus aquatilis-white-water crowfoot	7.7%	2.3%	1.0
Sparganium eurycarpum-common bur-reed	7.7%	2.3%	1.0
Stuckenia pectinate-Sago pondweed	15.4%	4.7%	1.0
Vallisneria americana-wild celery	23.1	7.0%	1.0
Zizania palustris-wild rice	7.7%	2.3%	1.0
Also observed but not sampled: *Schoenoplectus tabernaemontanii*-softstem bullrush (appears some removed) (nice large bed)			

Table 3: Area B

Sensitive Area C			
Species	**FOO**	**Relative Freq.**	**Mean rake fullness**
Asclepias incarnata-swamp milkweed	11.1%	2.3%	1.0
Carex comosa-bottle brush sedge	11.1%	2.3%	1.0
Ceratophyllum demersum-coontail	55.6%	11.6%	1.0
Chara sp.-stonewort	22.2%	4.7%	1.5
Eleocharis acicularis-needle spike rush	11.1%	2.3%	1.0
Lemna trisulca-forked duckweed	44.4%	9.3%	1.5
Myosotis scorpioides-aquatic forget me not	11.1%	2.3%	1.0
Najas flexilis-slender naiad	11.1%	2.3%	1.0
Nuphar variegata-spatterdock	22.2%	4.7%	1.0
Nymphaea odorata-white lily	55.6%	11.6%	1.0
Potamogeton crispus-curly-leaf pondweed	22.2%	4.7%	1.0
Potamogeton pusillus-small pondweed	11.1%	2.3%	1.0
Potamogeton richardsonii-clasping pondweed	22.2%	4.7%	1.0
Potamogeton zosteriformis-flat-stem pondweed	66.7%	14.0%	1.2
Ranunculus aquatilis-white-water crowfoot	11.1%	2.3%	1.0
Sagittaria rigida-sessile fruited arrowhead	33.3%	7.0%	1.0
Sagittaria sp.-arrowhead rosette	11.1%	2.3%	1.0
Sparganium eurycarpum-common bur-reed	11.1%	2.3%	1.0
Typha sp.-cattail	11.1%	2.3%	1.0
Vallisneria americana-wild celery	22.2%	4.7%	1.0
Bidens beckii-water marigold	Viewed	only	
Also observed but not sampled: reed canary grass, phragmites, narrow cattail, broad cattail, common burreed, hard stem bullrush			

Table 4: Area C

Sensitive Area D			
Species	**FOO**	**Relative Freq.**	**Mean rake fullness**
Ceratophyllum demersum-coontail	50.0%	18.8%	1.0
Chara sp.-muskgrass	16.7%	6.3%	1.0
Heteranthera dubia-water stargrass	16.7%	6.3%	1.0
Lemna trisulca-forked duckweed	16.7%	6.3%	1.0
Myriophyllum sibiricum-northern watermilfoil	50.0%	18.8%	1.0
Potamogeton praelongus-white-stem pondweed	16.7%	6.3%	2.0
Potamogeton pusillus-small pondweed	16.7%	6.3%	1.0
Potamogeton richardsonii-clasping pondweed	16.7%	6.3%	1.0
Vallisneria americana-wild celery	66.7%	25.0%	1.25
Also observed but not sampled: Phragmites, creeping spike rush, and softstem bulrush			

Table 5: Area D

Sensitive Area E			
Species	**FOO**	**Relative Freq.**	**Mean rake fullness**
Ceratophyllum demersum-coontail	25.0%	10.0%	1.0
Chara sp.-muskgrass	50.0%	20.0%	1.5
Heteranthera dubia-water stargrass			
Lemna trisulca-forked duckweed	25.0%	10.0%	1.0
Myriophyllum sibiricum-northern watermilfoil	25.0%	10.0%	1.0
Potamogeton friesii-Fries' pondweed	25.0%	10.0%	2.0
Potamogeton gramineus-variable pondweed	25.0%	10.0%	1.0
Ranunculus aquatilis-white water crowfoot	25.0%	10.0%	1.0
Vallisneria americana-wild celery	50.0%	10.0%	1.0

Table 6: Area E

Sensitive Area F			
Species	**FOO**	**Relative Freq.**	**Mean rake fullness**
Bidens beckii-water marigold	17.7%	8.8%	1.0
Ceratophyllum demersum-coontail	23.5%	11.8%	1.25
Chara sp.-muskgrass	64.7%	32.4%	1.82
Lemna trisulca-forked duckweed	5.9%	2.9%	1.0
Najas flexilis-slender naiad	5.9%	2.9%	1.0
Nuphar variegata-spatterdock	11.8%	5.9%	1.0
Potamogeton gramineus-variable pondweed	11.8%	5.9%	1.0
Potamogeton praelongus-whitestem pondweed	5.9%	2.9%	1.0
Vallisneria americana-wild celery	52.9%	26.5%	1.2
Potamogeton zosteriformis-flat-stem pondweed	viewed	only	
Also observed but not sampled: Common bur-reed, pickerelweed, broad cattail and some possible hybrid *Typha, hard stem bullrush, creeping spike rush, forget me not (non-native) on shore.*			

Table 7: Area F

Sensitive Area G			
Species	**FOO**	**Relative Freq.**	**Mean rake fullness**
Bidens beckii-water marigold	3.6%	1.1%	1.0
Ceratophyllum demersum-coontail	17.9%	5.6%	1.4
Chara sp.-muskgrass	53.6%	16.9%	1.2
Eleocharis acicularis-needle spike rush	3.6%	1.1%	1.0
Heteranthera dubia-water stargrass	7.1%	2.2%	1.0
Lemna trisulca-forked duckweed	3.6%	1.1%	1.0
Myriophyllum sibiricum-northern watermilfoil	17.9%	5.6%	1.0
Najas flexilis-slender naiad	25.0%	7.9%	1.0
Potamogeton crispus-curly-leaf pondweed	7.1%	2.2%	1.0
Potamogeton friesii-Fries' pondweed	14.3%	4.5%	1.25
Potamogeton gramineus-variable pondweed	14.3%	4.5%	1.0
Potamogeton illinoensis-Illinois pondweed	3.6%	1.1%	1.0
Potamogeton praelongus-white-stem pondweed	7.1%	2.2%	1.0
Potamogeton pusillus-small pondweed	7.1%	2.2%	1.0
Potamogeton richardsonii-clasping pondweed	17.9%	5.6%	1.2
Potamogeton zosteriformis-flat-stem pondweed	39.3%	12.4%	1.4
Schoenoplectus acutus-hardstem bulrush	3.6%	1.1%	1.0
Schoenoplectus punguns-three-square bulrush	7.1%	2.2%	1.0
Schoenoplectus fluviatilis-river bulrush	10.7%	3.4%	1.3
Sparganium eurycarpum-common bur-reed	7.1%	2.2%	1.0
Stuckenia pectinate-Sago pondweed	3.6%	1.1%	1.0
Vallisneria americana-wild celery	42.9%	13.5%	1.0
Also observed but not sampled: river bulrush and common burreed near shore (appears about 150 ft of emergent plants removed), broad leaved cattail			

Table 8: Area G

Sensitive Area H			
Species	**FOO**	**Relative Freq.**	**Mean rake fullness**
Ceratophyllum demersum-coontail	8.0%	3.8%	1.0
Chara sp.-muskgrass	56.0%	26.9%	1.7
Heteranthera dubia-water stargrass	4.0%	1.9%	1.0
Lemna minor-small duckweed	4.0%	1.9%	1.0
Myriophyllum sibiricum-northern watermilfoil	16.0%	7.7%	2.25
Najas flexilis-slender naiad	8.0%	3.8%	1.0
Nitella sp.-stonewort	4.0%	1.9%	1.0
Nuphar variegate-spatterdock	8.0%	3.8%	1.0
Nymphaea odorata-white lily	4.0%	1.9%	1.0
Pontederia cordata-pickerelweed	4.0%	1.9%	2.0
Potamogeton crispus-curly-leaf pondweed	20.0%	9.6%	1.2
Potamogeton gramineus-variable pondweed	4.0%	1.9%	1.0
Potamogeton praelongus-white-stem pondweed	4.0%	1.9%	1.0
Potamogeton pusillus-small pondweed	4.0%	1.9%	1.0
Sagittaria sp.-arrowhead rosette	8.0%	3.8%	1.0
Sparganium eurycarpum-common bur-reed	4.0%	1.9%	1.0
Typha latifolia-broad-leaved cattail	4.0%	1.9%	1.0
Vallisneria americana-wild celery	44.0%	21.2%	1.0
Eleocharis acicularis-needle spike rush	Viewed	only	
Also observed but not sampled: common burreed bed in bay portion bed of emergents: common burreed, broad leaved cattail, pickerelweed and narrow leaved cattail.			

Table 9: Area H

Sensitive Area I			
Species	**FOO**	**Relative Freq.**	**Mean rake fullness**
Bidens beckii-water marigold	4.7%	1.9%	1.0
Chara sp.-muskgrass	58.1%	24.0%	1.6
Eleocharis acicularis-needle spikerush	4.7%	1.9%	1.0
Myriophyllum sibiricum-northern watermilfoil	2.3%	1.0%	1.0
Najas flexilis-slender naiad	9.3%	3.8%	1.0
Potamogeton crispus-curly-leaf pondweed	11.6%	4.8%	1.0
Potamogeton friesii-Fries' pondweed	11.6%	4.8%	1.0
Potamogeton gramineus-variable pondweed	18.6%	7.7%	1.0
Potamogeton illinoensis-Illinois pondweed	4.7%	1.9%	1.0
Potamogeton praelongus-white-stem pondweed	2.3%	1.0%	1.0
Potamogeton pusillus-small pondweed	9.3%	3.8%	1.0
Potamogeton richardsonii-clasping pondweed	14.0%	5.8%	1.0
Potamogeton zosteriformis-flat-stem pondweed	37.2%	15.4%	1.25
Sagittaria sp.-arrowhead rosette	4.7%	1.9%	1.0
Schoenoplectus acutus-hardstem bulrush	20.9%	8.7%	1.1
Sparganium eurycarpum-common bur-reed	2.3%	1.0%	1.0
Stuckenia pectinate-sago pondweed	7.0	2.9%	1.0
Vallisneria americana-wild celery	18.6%	7.7%	1.0
Nuphar variegate-spatterdock	viewed	only	
Schoenoplectus pungens-three-square bulrush	viewed	only	
Also observed but not sampled: hardstem bulrush, common burreed, creeping spikerush, pickerelweed near shore			

Table 10: Area I

Sensitive Area J			
Species	**FOO**	**Relative Freq.**	**Mean rake fullness**
Potamogeton gramineus-variable pondweed	100.0%	50.0%	1.0
Stuckenia pectinate-sago pondweed	50.0%	25.0%	1.0
Vallisneria americana-wild celery	50.0%	25.0%	1.0

Table 11: Area J

Sensitive Area K			
Species	**FOO**	**Relative Freq.**	**Mean rake fullness**
Bidens beckii-water marigold	3.1%	0.8%	2.0
Carex comosa-bottle brush sedge	3.1%	0.8%	1.0
Ceratophyllum demersum-coontail	75.0%	20.0%	1.04
Chara sp.-muskgrass	3.1%	0.8%	1.0
Elodea canadensis-common waterweed	9.4%	2.5%	1.0
Heteranthera dubia-water stargrass	15.6%	4.2%	1.2
Lemna minor-small duckweed	37.5%	10.0%	1.0
Lemna trisulca-forked duckweed	6.25%	1.7%	1.0
Myriophyllum sibiricum-northern watermilfoil	15.6%	4.2%	1.0
Najas flexilis-slender naiad	6.25%	1.7%	1.0
Nuphar variegata-spatterdock	9.4%	2.5%	1.0
Nymphaea odorata-white lily	37.5%	10.0%	1.2
Potamogeton crispus-curly-leaf pondweed	9.4%	2.5%	1.0
Potamogeton richardsonii-clasping pondweed	12.5%	3.3%	1.0
Potamogeton zosteriformis-flat-stem pondweed	34.4%	9.2%	1.6
Schoenoplectus acutus-hardstem bulrush	3.1%	0.8%	1.0
Sparganium eurycarpum-common bur-reed	6.3%	1.7%	1.5
Spirodela polyrhiza-large duckweed	37.5%	10.0%	1.0
Stuckenia pectinate-Sago pondweed	3.1%	0.8%	1.0
Typha latifolia-broad-leaved cattail	6.25%	1.7%	1.0
Wolfia columbiana-common watermeal	37.5%	10.0%	1.0
Zizania palustris-wild rice	3.1%	0.8%	1.0
Sagittaria rigida-sessile fruited arrowhead	Viewed	only	
Also observed but not sampled: wild rice, forget me not; evidence of removed vegetation hardstem bulrush, broad leaved cattail, bottle brush sedge			

Table 12: Area K

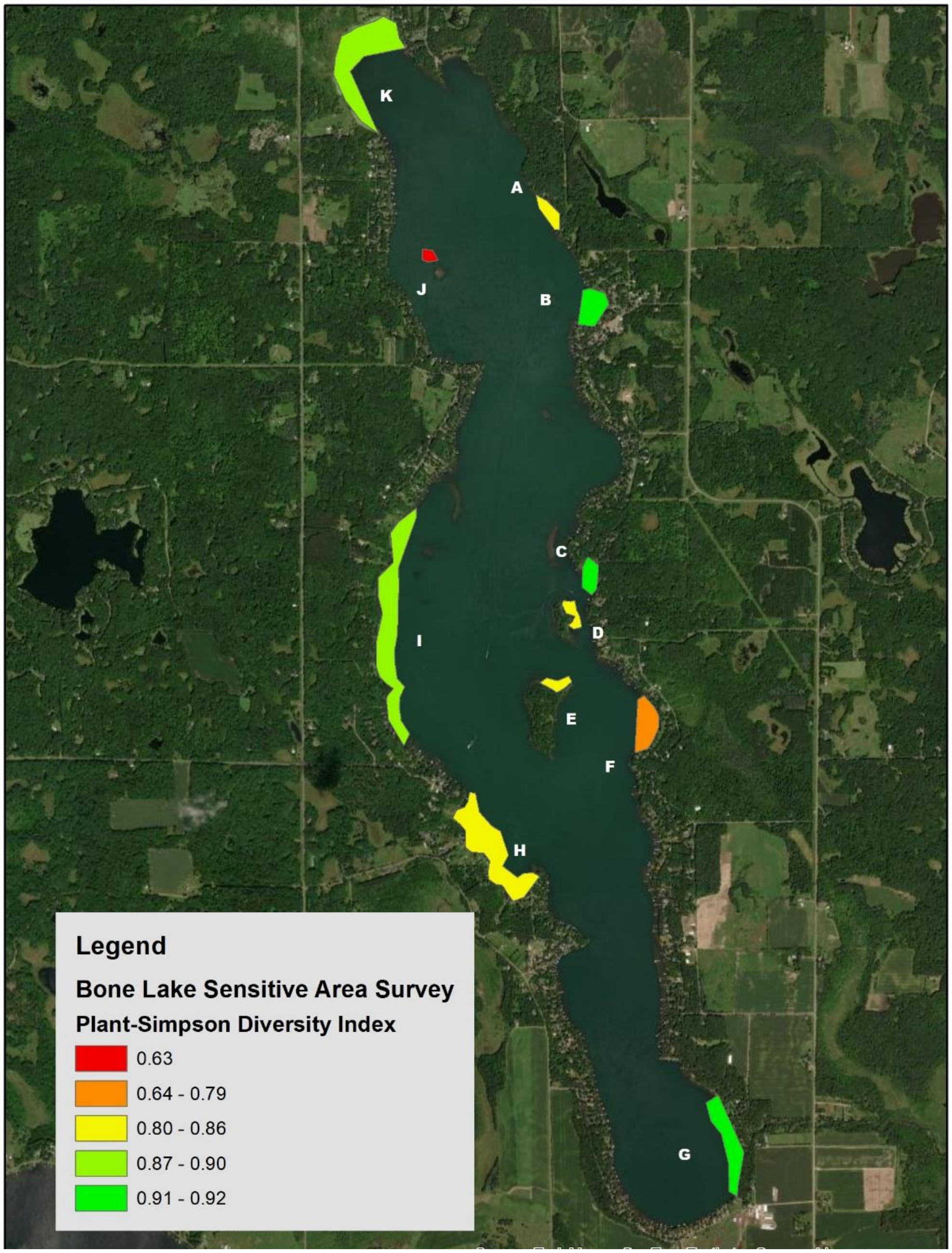


Figure 20: Map portraying the Simpson's Diversity Index (from aquatic plant survey) of each sensitive area.

Figure 20 is a map that allows for easy evaluation of the most plant diversity based on Simpson's diversity index. The higher the index, the greater the chance that two randomly sampled plants are different.

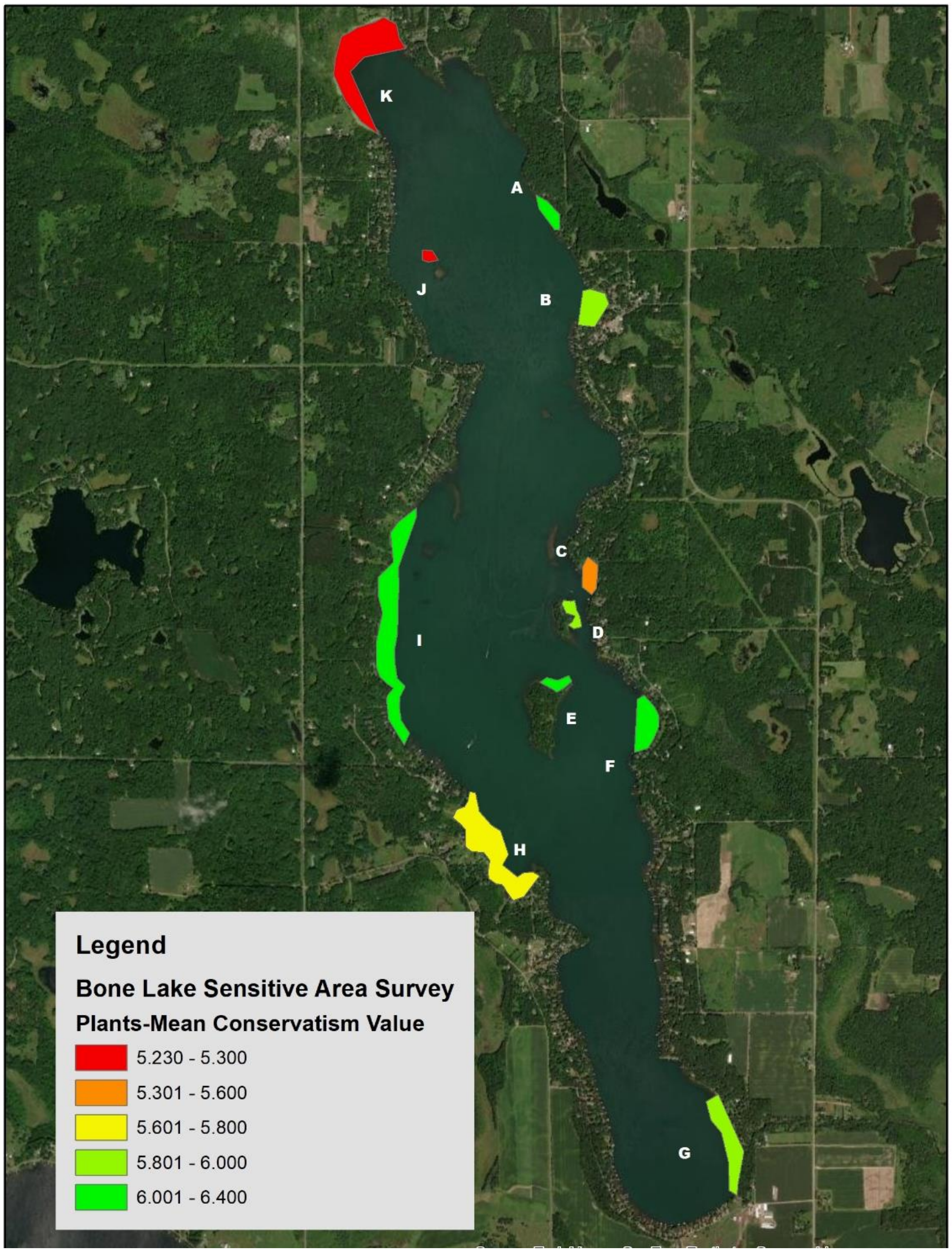


Figure 21: A map showing the sensitive areas' mean conservatism values. The higher the number, the more sensitive the plants are found in an area.

Aquatic macroinvertebrates

The macroinvertebrate survey data was evaluated for diversity using the total number of taxa (at the family level) and the Shannon Diversity Index. The tolerance of the invertebrates was also assessed by calculating a weighted mean. The lower this number, the less tolerant (more sensitive) the macroinvertebrates found in that area. Table 13 summarizes this data.

Sensitive area	Number of taxa (family level ID)	Weighted Mean tolerance	Shannon Diversity Index
A	16	6.85	2.18
B	14	7.4	1.81
C	13	7.0	2.06
D	12	6.8	2.26
E	12	6.9	1.67
F	13	7.1	2.14
G	12	6.5	2.36
H	14	7.6	1.35
I	12	7.2	1.70
J	7	7.7	0.80
K	9	7.3	1.49

Table 13: Summary of data collected for macroinvertebrates at each sensitive area.

Figures 22-24 graphically show each of the parameters for each sensitive area. The data shows that the most diverse area in terms of different taxa sampled was area A, followed by B and then C. Area G had the highest Shannon Diversity Index, followed by D and then A. Area A ranked the highest when combining both diversity parameters.

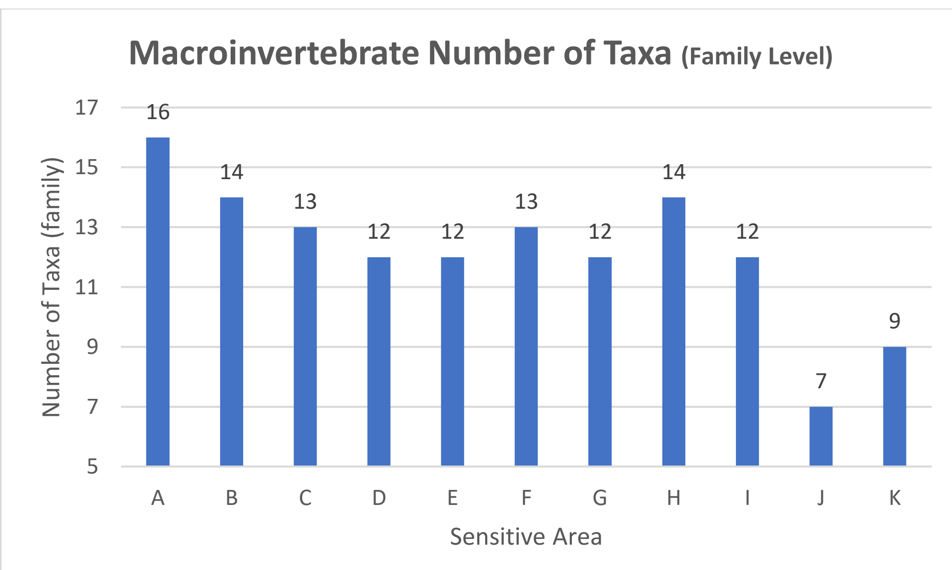


Figure 22: Graph showing the number of taxa (family level) sampled at each sensitive area.

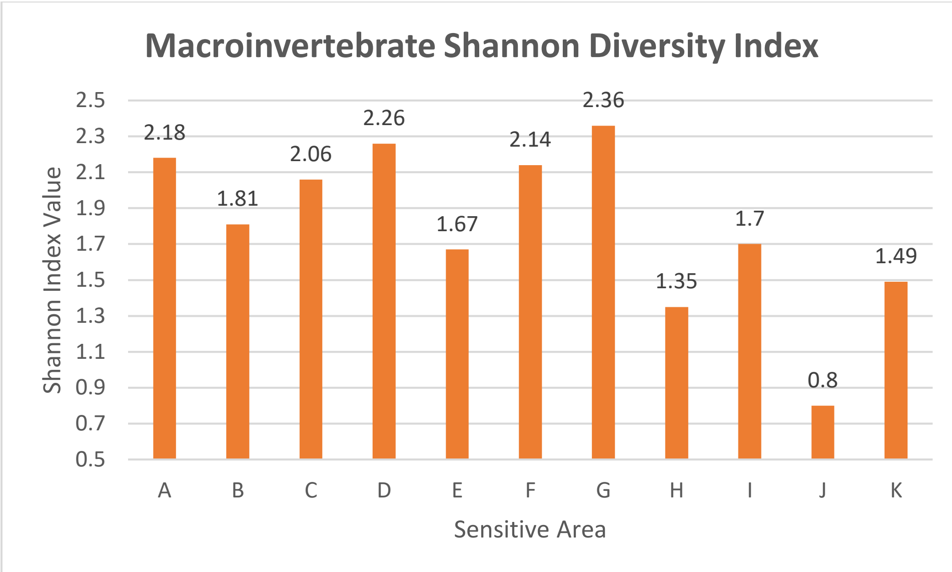


Figure 23: Graph showing the Shannon Diversity Index calculated for each sensitive are using macroinvertebrate data.

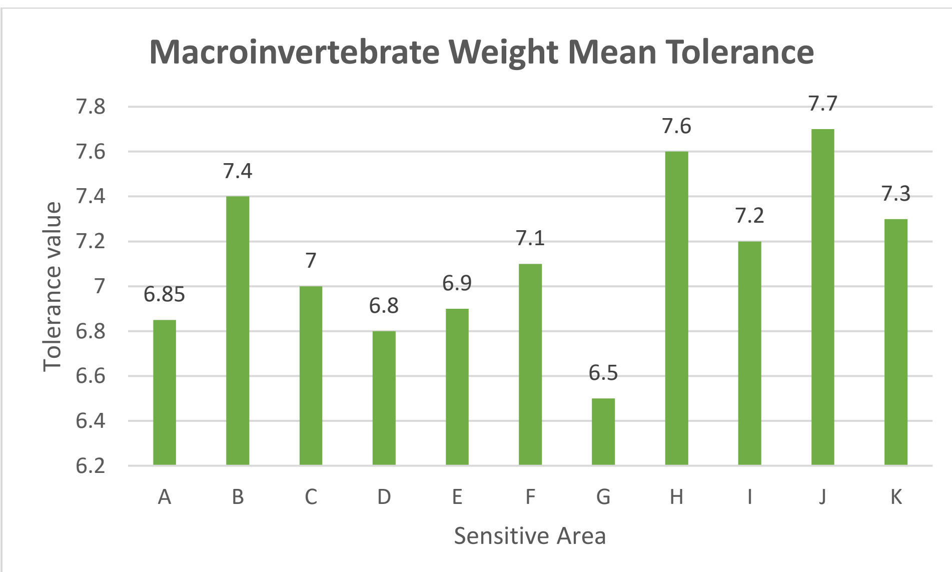


Figure 24: Graph of the mean tolerance (weighted) from macroinvertebrate data.

Area G had the most in-tolerant invertebrates on average, followed by D and then A. When combining all three parameters, it appears area A is the most profound in terms of aquatic macroinvertebrates.

Tables 14-24 list the families of invertebrates sampled and the number of each sampled as well as their tolerance values.

Lists of macroinvertebrates sampled

Area A Order (insects)/Group	Family	Number
Diptera (aquatic flies)	Chironomidae-blood red	4
	Chironomidae-non-blood red	17
	Simulidae	3
	Emphididae	1
Coleoptera (aquatic beetles)	Emilidae	1
Odonata (damselflies and dragonflies)	Lestidae	1
	Clapterygidae	2
Trichoptera (caddisflies)	Sericostomatidae	1
	Limnephilidae	1
Hemiptera (aquatic bugs)	Corixidae	1
Crustacean (amphipods and crayfish)	Hyalellidae	12
	Asellidae	1
Gastropod (aquatic snails)	Planorbidae	9
	Viviparidae	8
	Physidae	3
	Hydrobiidae	24

Table 14: Area A

Area B Order (insects)/Group	Family	Number
Diptera	Tabanidae	1
	Chironomidae-non blood red	2
Odonata	Coenagrionidae	2
	Calopterygidae	2
	Aeshnidae	1
Trichoptera	Limnephillidae	1
Hemiptera	Corixidae	1
Crustacean	Asellidae	2
	Hyalellidae	43
Gastropod	Planorbidae	6
	Viviparidae	5
	Physidae	8
	Hydrobiidae	12
freshwater mussel	Sphaeridae	4

Table 15: Area B

Area C Order (insects)/Group	Family	Number
Diptera	Chironomidae-non blood red	6
Coleoptera	Gyrinidae	1
Odonata	Coenagrionidae	1
	Libelluidae	2
Lepidoptera (aquatic moths)	Pyralidae	1
Trichoptera	Moannidae	1
Hemiptera	Belostomatidae	1
Crustaceans	Gammaridae	4
	Hyalellidae	8
Gastropoda	Planorbidae	14
	Hydrobiidae	12
Oligochaete (aquatic worms)	xx	13

Table 16: Area C

Area D Order (insects)/Group	Family	Number
Diptera	Chironomidae-non blood red	6
Trichoptera	Lepidostomatidae	6
	Sericostomatidae	1
Odanata	Coenagronidae	5
Lepidoptera	Pyralidae	1
Hemiptera	Corixidae	5
Crustacean	Hyalellidae	13
	Asellidae	2
Gastropoda	Planorbidae	9
	Hyrobiidae	10
Freshwater mussel	Sphaeridae	3
Oligochaete	xx	3

Table 17: Area D

Area E Order (insects)/Group	Family	Number
Diptera	Chironomidae-non blood	39
	Chironomidae-blood red	6
	Tabanidae	1
Hemiptera	Corixidae	1
Trichoptera	Molannidae	2
Crustacean	Hyalellidae	16
Gastropod	Planorbidae	1
	Hydrobiidae	74
	Viviparidae	25
	Physidae	5
Freshwater mussel	Sphaeridae	1
Oligochaete	xx	4

Table 18: Area E

Area F Order (insects)/Group	Family	Number
Diptera	Chironomidae-non blood	6
	Chaoboridae	2
Megaloptera (Dobson flies)	Corydalidae	2
Odonata	Lestidae	2
Coleoptera	Gyrinidae	1
Crustacean	Hyalellidae	20
	Astacidae	2
	Asellidae	2
Oligochaete		5
Gastropod	Planorbidae	3
	Viviparidae	7
	Hydobiidae	3
Freshwater mussel	Sphaeridae	1

Table 19: Area F

Area G Order (insects)/Group	Family	Number
Diptera	Chironomidae-non blood	6
Odonata	Calopterygidae	3
	Ashnidae	2
Coleoptera	Halipilidae	2
Ephemeroptera (mayflies)	Tricorythidae	1
Hemiptera	Belostomatidae	1
Crustacean	Asellidae	2
	Astacidae	3
Gastropod	Valvatidae	2
	Physidae	5
Freshwater mussel	Sphaeridae	3
Oligochaete	xx	4

Table 20: Area G

Area H Order (insects)/Group	Family	Number
Diptera	Chironomidae-non blood	7
	Chironomidae-blood	1
	Tabanidae	1
Trichoptera	Molannidae	2
	Leptoceridae	1
	Leptostoamatidae	1
Odanata	Lestidae	2
Crustacean	Hyalellidae	81
	Asellidae	2
Gastropoda	Planorbidae	3
	Hydrobiidae	23
	Physidae	3
Hemiptera	Belostomatidae	1
Freshwater mussel	Sphaeridae	1

Table 21: Area H

Area I Order (insects)/Group	Family	Number
Diptera	Chironomidae-non blood	5
	Tabanidae	1
Trichoptera	Leptidostomatidae	4
	Leptoceridae	1
Odonata	Coenagrinidae	3
Coleoptera	Elmidae	1
Crustacean	Hyalellidae	48
	Asellidae	2
Freshwater mussel	Sphaeridae	1
Gastropoda	Planorbidae	6
	Viviparadae	11
	Hydrobiidae	12

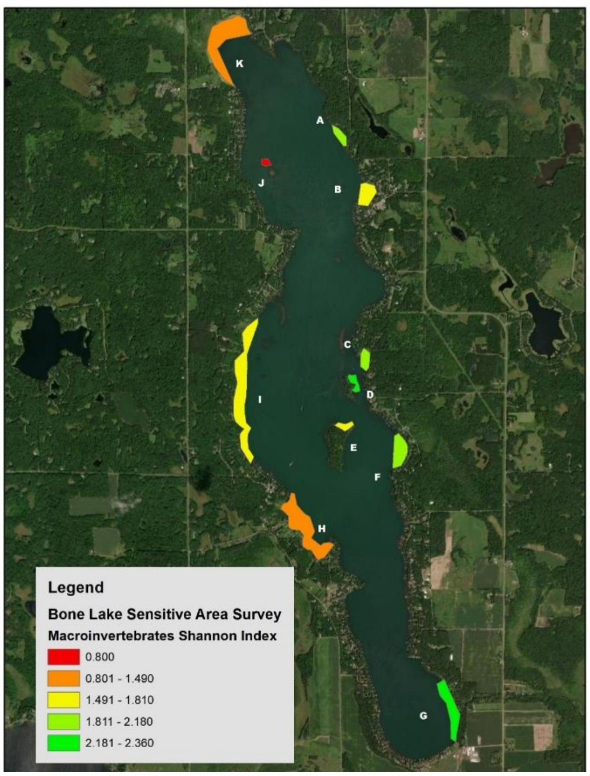
Table 22: Area I

Area J Order (insects)/Group	Family	Number
Diptera	blood chironomid	1
Lepidoptera	Pyralidae	1
Trichoptera	Molannidae	1
Freshwater mussel	Sphaeridae	1
Crustacean	Hyalellidae	76
Gastropod	Hydrobiidae	17
	Viviparidae	3

Table 23: Area J

Area K Order (insects)/Group	Family	Number
Diptera	Chironomidae-non blood	11
	Chironomidae-blood	1
	Ceratopogonidae	1
Odonata	Libellulidae	3
Crustacean	Hyalliladae	31
	Asellidae	1
Annelida	leech	1
Gastropoda	Planorbidae	2
	Physidae	18

Table 24: Area K



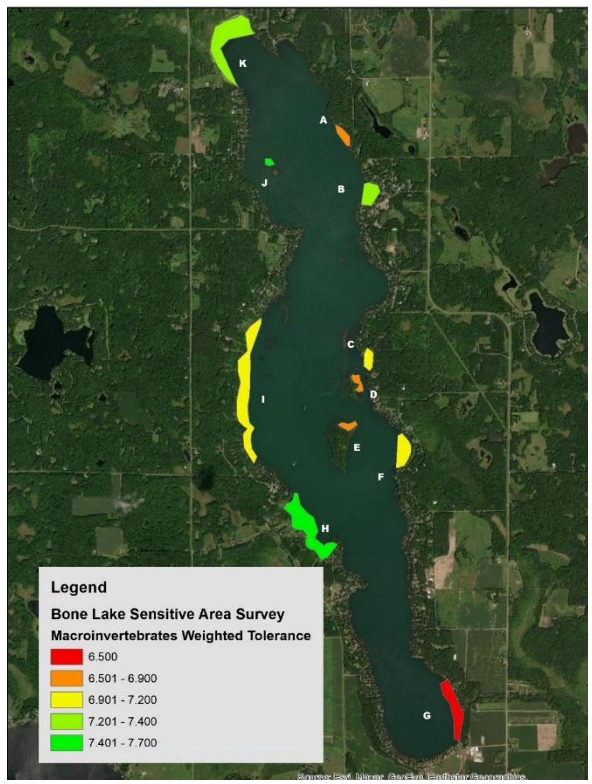
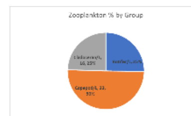
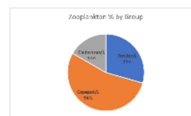
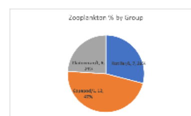
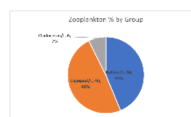
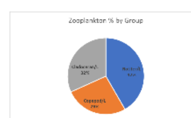
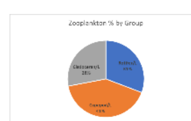


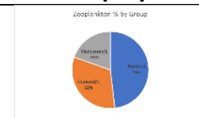
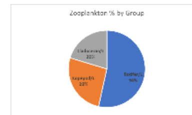
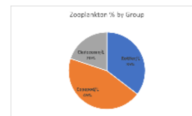
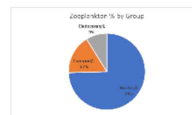
Figure 25: Maps showing sensitive area values for the Shannon Index and weighted tolerance using macroinvertebrate data.

Zooplankton

The zooplankton survey resulted in Area G having the most total zooplankton, with 172 zooplankton per liter of water followed by Area B with 132/liter. Area G had the highest number of large zooplankton at 119 per liter. Area B had the second-largest concentration of large zooplankton (cladocerans and copepods) at 93. See Table 25 and Figure 26.

Table 25: Summary of the zooplankton enumeration data from each sensitive area.

Sensitive Area	Total number/L	Rotifers/L	Copepods/L	Cladocerans/L	Group by %
A	65	17	33	16	
B	132	39	71	22	
C	25	7	12	6	
D	82	36	40	6	
E	101	42	27	32	
F	37	21	12	5	
G	172	53	71	48	

Sensitive Area	Total number/L	Rotifers/L	Copepods/L	Cladocerans/L	Group by %
H	138	66	45	27	
I	108	58	28	22	
J	45	16	20	9	
K	68	51	11	6	

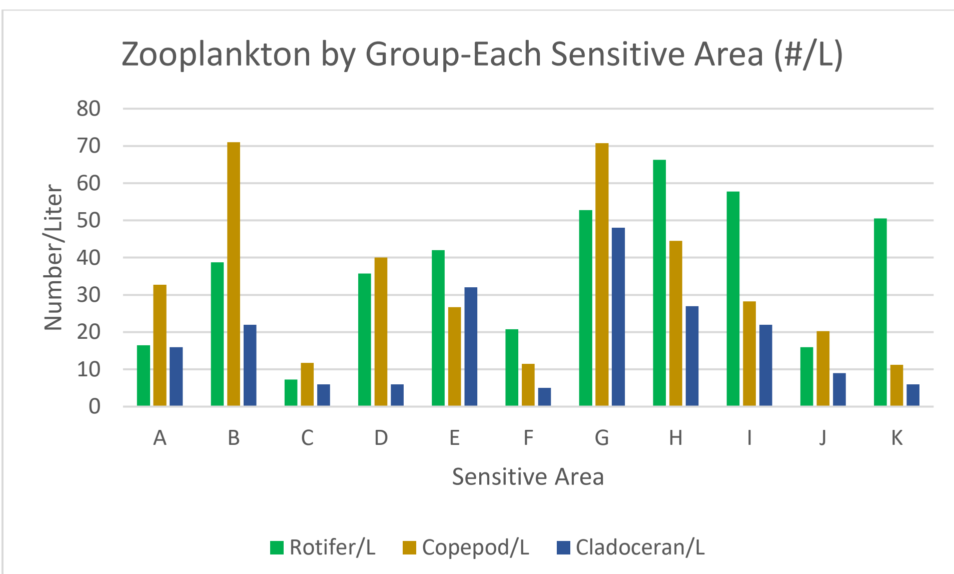


Figure 26: Graph showing the number per liter of each major zooplankton group collected.

Figure 27 shows the comparison of each sensitive area for total zooplankton and the mean for all areas. As seen in this graph, areas B, E, G, H and I are all above the mean for all areas. Figure X is a map that shows the most ecologically significant sensitive areas based upon total zooplankton sampled per liter.

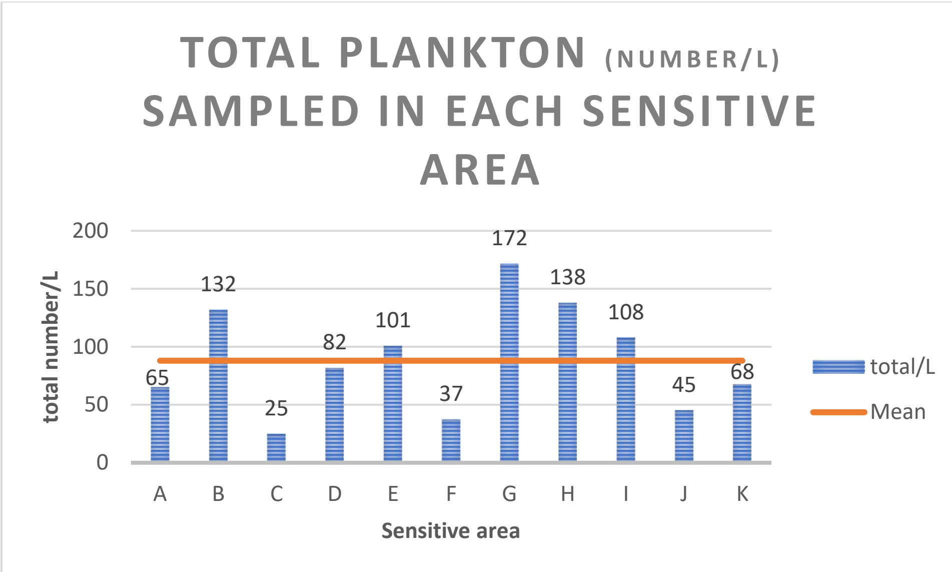


Figure 27: Graph showing the total number of zooplankton per liter collected within each sensitive area.

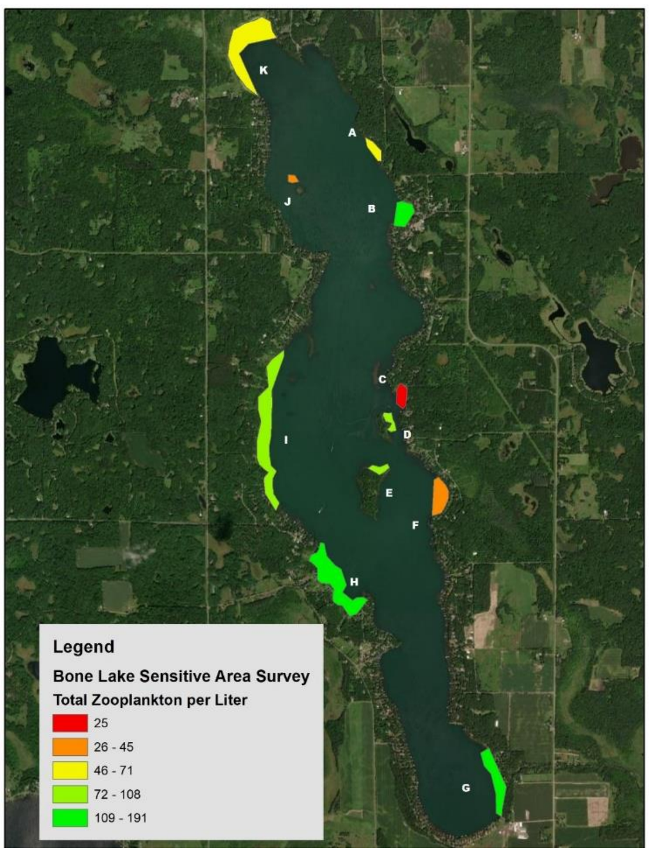


Figure 28: Map showing total zooplankton per liter sampled within each sensitive area.

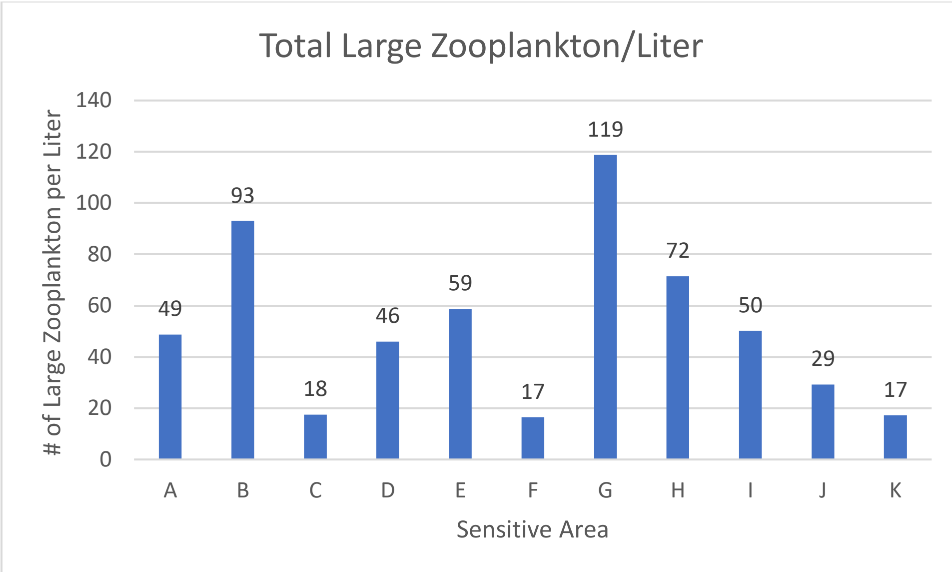
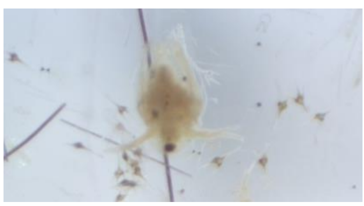
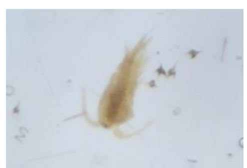


Figure 29: Graph showing the total number of large zooplankton sampled within each sensitive area. More large zooplankton indicates more ecological significance.



Typical Cladoceran sampled



Typical copepod sampled

Typical rotifer sampled

Frog Survey

There were seven total species recorded during the three periods of surveys. The species recorded were as follows:

- Early spring (water temps in 50s): Boreal chorus frog, spring peeper and northern leopard frog.
- Late spring (water temps in 60s): Cope's treefrog, gray treefrog, and American toad
- Summer (water temps in 70s): Green frog

Species recorded photos[3]

Early spring

Boreal chorus frog

Spring peeper

Northern leopard frog

Late spring

American toad

Gray tree frog

Cope's gray tree frog

Summer

Green frog

As Table 26 shows, areas I and K had the most total species of frogs recorded over all three survey periods with six. Both of these sensitive areas have a large area of excellent amphibian habitat present.

[3] All frog pictures from https://dnr.wi.gov/topic/EndangeredResources/Animals.asp. AB Sheldon photo credit.

Sensitive area	**Species recorded**	**# of species (all time periods combined)**	**Mean rating (from all time periods)**	**# of species x Mean rating**
A	xxx	0	0	0
B	Spring peeper Boreal Chorus American toad	3	1.3	3.9
C	Northern leopard Green	2	1.5	3
D	Green	1	1	1
E	xxx	0	0	0
F	Northern leopard Cope's gray tree American toad	3	1.7	5.1
G	Northern leopard Green	2	1	2
H	Spring peeper Boreal chorus Northern leopard American toad Green	5	1.71	8.55
I	Spring peeper Boreal chorus Northern leopard Gray tree American toad Green	6	1.75	10.5
J	xxx	0	0	0
K	Spring peeper Boreal chorus Northern leopard Gray tree American toad Green	6	1.3	7.8

Table 26: Summary of frog data collected in all three survey periods within each sensitive area.

Both Area I and Area K had the highest product of number of species times the mean rating. Again, these two sensitive areas had the best amphibian habitat with large amounts of emergent/floating vegetation present.

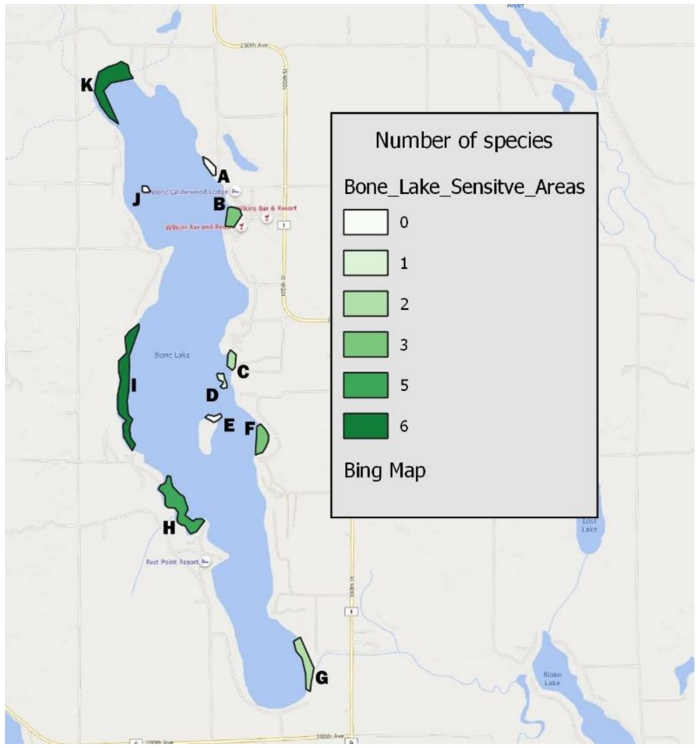


Figure 30: Map showing the total number of frog species recorded in each sensitive area.

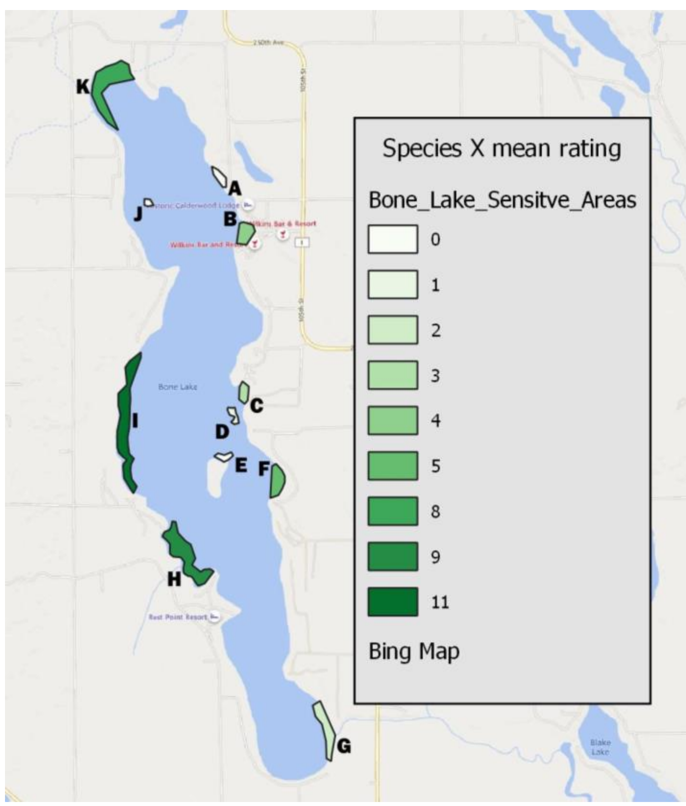


Figure 31: Map showing the product of the number of species times the mean density rating at each area.

Reptiles (**amphibians surveyed in a separate survey**) **Observed**

The basking/encounter surveys revealed few reptiles. This may be due to the limited coarse woody habitat that is available in the sensitive areas (and Bone Lake) in general. As Table 27 shows, area G had the most species of reptiles observed while area D had the most individuals. Five of the sensitive areas had no reptiles observed.

Observed	**Site**
Painted turtle (*Chrysemys picta*)	K
Painted turtle (*Chrysemys picta*)	G
Painted turtle (*Chrysemys picta*)	F
Painted turtle (*Chrysemys picta*)	near E (just outside border)
Painted turtles (15) (*Chrysemys picta*)	D (on woody habitat)
Snapping turtle (*Chelydra serpentina*)	G
Softshell turtle *(Trionychidae)*	G

Table 27: List of reptiles encountered in reptile survey.

Painted turtle (*Chrysemys picta)*

Photo © A.B. Sheldon./Wisconsin DNR

Snapping turtle (*Chelydra serpentina*)

Photo © A.B. Sheldon./Wisconsin DNR

Softshell turtle *(Trionychidae)*

Photo by Robert Hay, WDNR

Mammals Observed

Volunteers were trained and organized to use wildlife viewing cameras and dusk and dawn observations (encounter surveys) to evaluate the presence of mammals. The wildlife cameras were each placed for 5 days in each sensitive area. Not all sensitive areas had visual encounter surveys completed by the volunteers due to limited time available. Wildlife cameras became the main method to evaluate mammals.

Observed	Site
Muskrat (*Ondatra zibethicus*) feeding bed	B
Muskrat (*Ondatra zibethicus*) feeding bed	F
Whitetail deer (*Odocoileus virginianus*) (3 does)	I (feeding in bulrush)
Otter (*Lontra canadensis*)	K
Whitetail deer (*Odocoileus virginianus*) (2 does)	A
Muskrat (*Ondatra zibethicus*)	K
Muskrat (*Ondatra zibethicus*) den	C
Beaver (*Castor canadensis*) (3)	C
Racoon (*Procyon lotor)* (1 adult w/4 juveniles	A

Table 28: List of mammals recorded on wildlife camera or encountered.

The following are photos of mammals using the Bone Lake ecosystem that were captured on the wildlife camera or encountered.

Photo on Bone Lake of white-tailed deer, August 2021

Photo Bone Lake of racoons, August 2021.

Photo Bone Lake of beaver, July 2021

Photo of otter for representation and not from Bone Lake.

Discussion of results

The focus of these surveys was to establish a baseline of data on the sensitive areas in order to allow for evaluation of change in the future. It can be assumed that the ecological significance of critical habitat is habitat that can hold a higher diversity of aquatic organisms and can sustain more sensitive organisms. In order to establish the potential ecological significance of each sensitive area, the mean rank of each area was determined using all survey data. The better the rank (1 of 11), the more ecological significance that critical habitat provides within the lake. After all of the ranks were established, a relative rank from 1 to 11 was given based on the average rank. For example, area X has the highest average ranking of 3.7, so the relative rank is given as 1. Area Y has the lowest average rank of 8.3, thus giving it a relative rank of 11.

Table 29 summarizes ranks of each area from all of the survey data. The surveys with more than one data entry for an area were averaged in this table.

Area	Mean macrophytes	Mean Invert	Mean Zooplankton	Frogs	Reptiles	Mean rank	Relative Rank
A	4	2	6.5	11	11	6.9	8
B	3	4	2.5	5	11	5.1	3
C	5	4.5	10	6	11	7.3	9
D	7	4	5	8	1	5	2
E	3.5	7	5	11	11	7.5	10
F	6	4	10.5	4	3	5.5	4
G	5	3.5	1	7	2	3.7	1
H	7	6	2.5	2	11	5.7	5
I	4.5	6.5	5.5	1	11	5.7	5
J	10.5	11	8.5	11	11	10.4	11
K	7.5	9.5	8.5	3	3	6.3	7

Table 29: Summary of sensitive area ranks for each survey category and the overall rank of the sensitive area to all eleven areas.

As Table 29 shows, area G has the highest relative rank and area J has the lowest. Area J is not associated with any riparian area and has limited aquatic plant growth. Therefore, it is understandable this area did not rank higher than 11. Area D was second highest rank and has no development associated with this area. Interestingly area B, which ranked third, has rather extensive development in the riparian zone. Area E also has more development per unit area than many other sensitive areas and ranked 10^{th}.

Arguably the most significant contributor of critical habitat in a lake is aquatic vegetation. This provides habitat for nearly all aquatic organisms from plankton, fish, amphibians/reptiles, birds, and mammals. Therefore, the most important component for protection for any critical habitat in a lake is the aquatic vegetation. This would include floating and emergent, which can provide cover and help stabilize lake sediments. All sensitive areas on Bone Lake are important critical habitat and all efforts should be taken to preserve these areas. Area B already has a large amount of development, yet the relative rank of area B is third out of the 11 areas. This shows that the presence of key habitat and diversity of organisms can exist in developed areas. However, if the development degrades the habitat in area B such as reduction in aquatic plants, it's ecological significance could decrease significantly.

One characteristic noticed during the reptile survey was lack of large woody habitat. Large woody habitat not only provides basking surface for reptiles, it is also key habitat for invertebrates and fish. During the survey, only six coarse woody habitat logs were observed, which is extremely low for a lake the size of Bone Lake. Although residents may not like the disordered look of trees, or portions of trees laying the water adjacent to their riparian zone, they should be left intact. Removal of branches or trees that have fallen into the water, is discouraged.

The development density on Bone Lake is extensive, with little riparian zone remaining undeveloped. This development has extensive adverse effects on the habitat for nearly all aquatic organisms in Bone Lake. For this reason, it is imperative that lake residents, along with the Bone Lake Protection District, work to preserve these sensitive areas so as no reduction in aquatic native shoreline plants occur. Further limiting habitat would have detrimental effects on the Bone Lake ecosystem as a whole. A healthy lake ecosystem contains a highly diverse set of aquatic organisms, which is the result of good habitat. There is no question this habitat has likely been degraded by human activity, so further degradation should be avoided.

It was noted that there was some evidence of what appeared to be the removal of emergent or floating vegetation in a couple of sensitive areas. Although removal of a 30-foot-wide area of vegetation within the littoral zone is legal, it is strongly recommended that riparian owners refrain from this practice anywhere around the lake, especially in these critical habitat areas.

Recommendations for lake users/riparian owners:

- Refrain from removing or reducing aquatic vegetation, especially floating and emergent species.
- Leave coarse woody habitat that fall into the water (tree falls leave it be).
- Leave snag or cavity trees standing (if do not pose a threat to property).
- Restore manicured lawn/developed shoreline to native vegetation.
- Familiarize yourself with the sensitive areas (critical habitat) in Bone Lake and their importance.
- Do not disturb herptiles, birds or mammals utilizing various habitats around Bone Lake.

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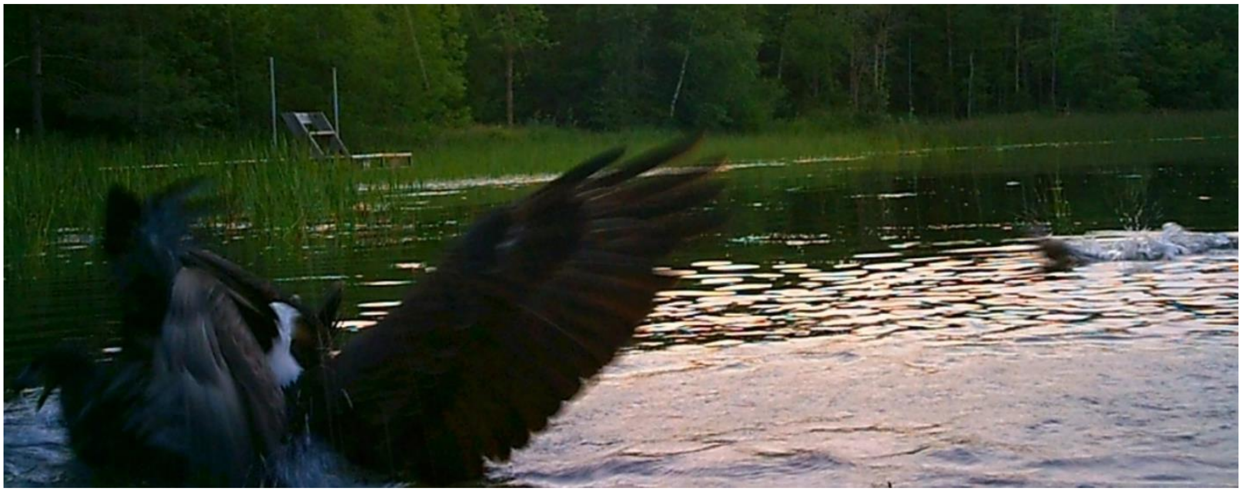
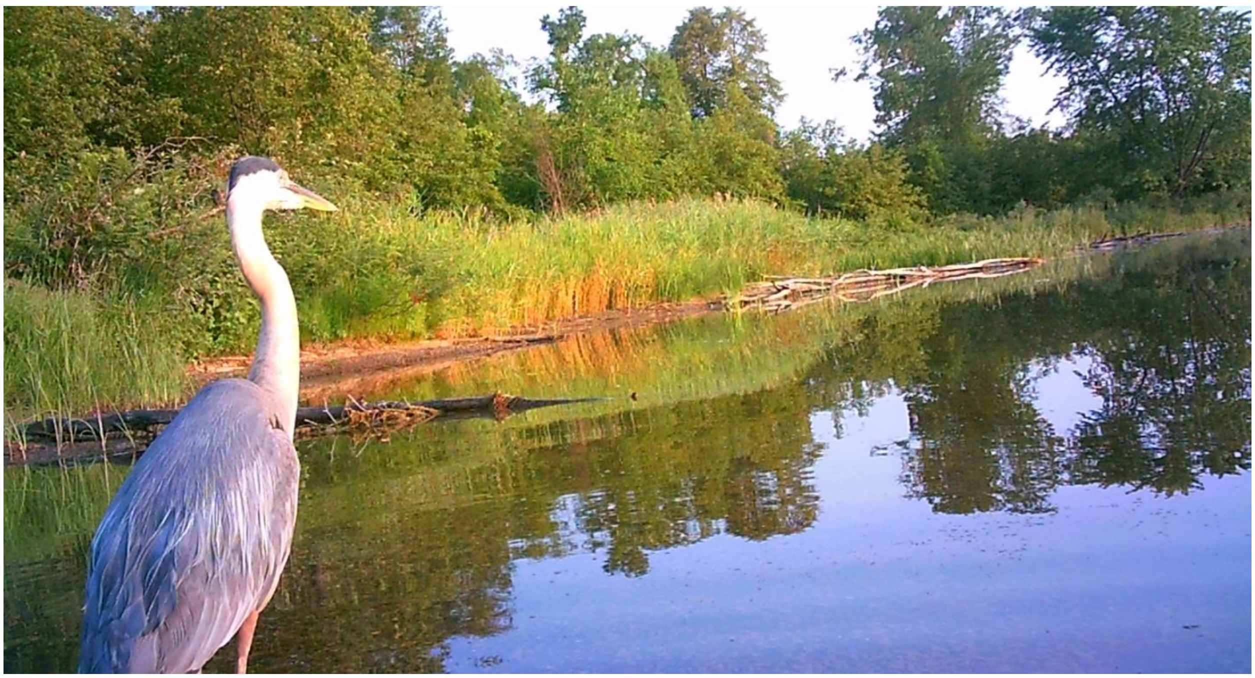
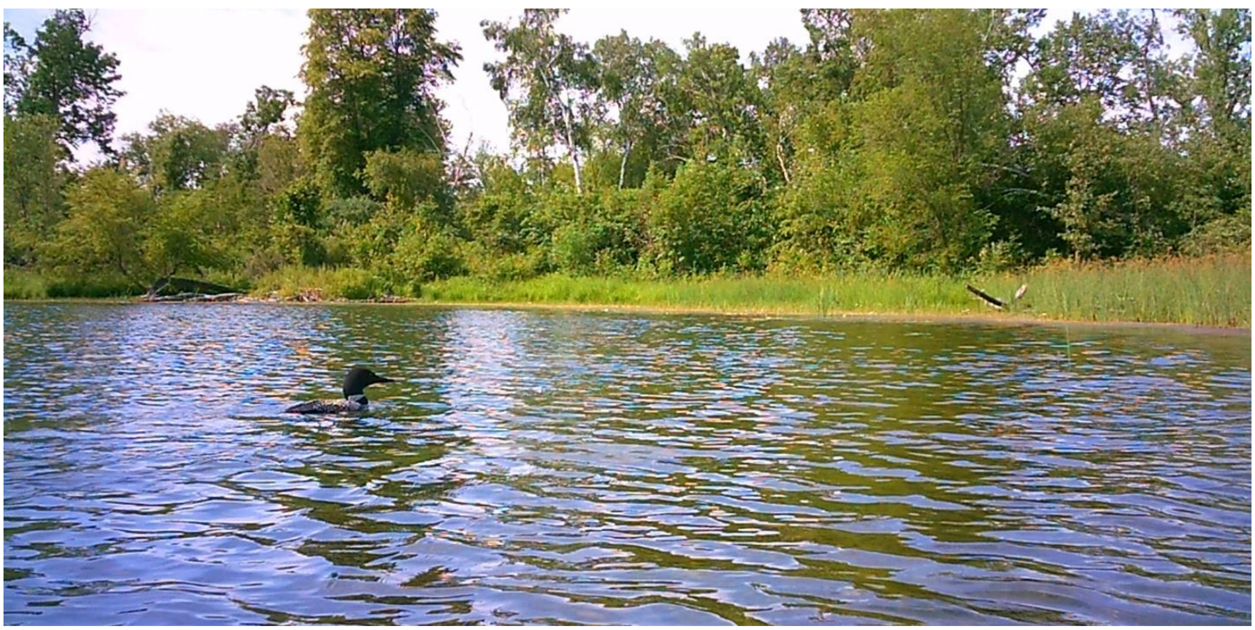
Appendix A: Other Lake Photos from wildlife cameras:







Appendix B: Data tables

SUMMARY STATS: Area A Plants	
Total number of sites visited	9
Total number of sites with vegetation	9
Total number of sites shallower than maximum depth of plants	9
Frequency of occurrence at sites shallower than maximum depth of plants	100.00
Simpson Diversity Index	0.86
Maximum depth of plants (ft)**	7.70
Average number of all species per site (shallower than max depth)	2.78
Average number of all species per site (veg. sites only)	2.78
Average number of native species per site (shallower than max depth)	2.78
Average number of native species per site (veg. sites only)	2.78
Species Richness	11
Species Richness (including visuals)	13

SUMMARY STATS: Area B plants	
Total number of sites visited	16

Total number of sites with vegetation	13
Total number of sites shallower than maximum depth of plants	14
Frequency of occurrence at sites shallower than maximum depth of plants	92.86
Simpson Diversity Index	0.92
Maximum depth of plants (ft)**	16.00
Average number of all species per site (shallower than max depth)	3.07
Average number of all species per site (veg. sites only)	3.31
Average number of native species per site (shallower than max depth)	3.00
Average number of native species per site (veg. sites only)	3.23
Species Richness	22
Species Richness (including visuals)	22

SUMMARY STATS: Area C plants	
Total number of sites visited	9
Total number of sites with vegetation	9
Total number of sites shallower than maximum depth of plants	9
Frequency of occurrence at sites shallower than maximum depth of plants	100.00
Simpson Diversity Index	0.92
Maximum depth of plants (ft)**	4.60
Average number of all species per site (shallower than max depth)	4.78
Average number of all species per site (veg. sites only)	4.78
Average number of native species per site (shallower than max depth)	4.56
Average number of native species per site (veg. sites only)	4.56
Species Richness	20
Species Richness (including visuals)	21

SUMMARY STATS: Area D plants	
Total number of sites visited	7
Total number of sites with vegetation	6
Total number of sites shallower than maximum depth of plants	6
Frequency of occurrence at sites shallower than maximum depth of plants	100.00
Simpson Diversity Index	0.84
Maximum depth of plants (ft)**	7.70
Average number of all species per site (shallower than max depth)	2.67
Average number of all species per site (veg. sites only)	2.67
Average number of native species per site (shallower than max depth)	2.67
Average number of native species per site (veg. sites only)	2.67
Species Richness	9
Species Richness (including visuals)	9

SUMMARY STATS: Area E plants	
Total number of sites visited	5
Total number of sites with vegetation	4

Total number of sites shallower than maximum depth of plants	4
Frequency of occurrence at sites shallower than maximum depth of plants	100.00
Simpson Diversity Index	0.86
Maximum depth of plants (ft)**	5.30
Average number of all species per site (shallower than max depth)	2.50
Average number of all species per site (veg. sites only)	2.50
Average number of native species per site (shallower than max depth)	2.50
Average number of native species per site (veg. sites only)	2.50
Species Richness	8
Species Richness (including visuals)	8

SUMMARY STATS: Area F plants	
Total number of sites visited	21
Total number of sites with vegetation	17
Total number of sites shallower than maximum depth of plants	19
Frequency of occurrence at sites shallower than maximum depth of plants	89.47
Simpson Diversity Index	0.79
Maximum depth of plants (ft)**	12.50
Average number of all species per site (shallower than max depth)	1.79
Average number of all species per site (veg. sites only)	2.00
Average number of native species per site (shallower than max depth)	1.79
Average number of native species per site (veg. sites only)	2.00
Species Richness	9
Species Richness (including visuals)	10

SUMMARY STATS: Area G plants	
Total number of sites visited	31
Total number of sites with vegetation	28
Total number of sites shallower than maximum depth of plants	28
Frequency of occurrence at sites shallower than maximum depth of plants	100.00
Simpson Diversity Index	0.91
Maximum depth of plants (ft)**	10.00
Average number of all species per site (shallower than max depth)	3.18
Average number of all species per site (veg. sites only)	3.18
Average number of native species per site (shallower than max depth)	3.11
Average number of native species per site (veg. sites only)	3.11
Species Richness	22
Species Richness (including visuals)	22

SUMMARY STATS: Area H plants	
Total number of sites visited	28

Total number of sites with vegetation	25
Total number of sites shallower than maximum depth of plants	26
Frequency of occurrence at sites shallower than maximum depth of plants	96.15
Simpson Diversity Index	0.86
Maximum depth of plants (ft)**	13.00
Average number of all species per site (shallower than max depth)	2.00
Average number of all species per site (veg. sites only)	2.08
Average number of native species per site (shallower than max depth)	1.81
Average number of native species per site (veg. sites only)	1.96
Species Richness	18
Species Richness (including visuals)	19

SUMMARY STATS: Area I plants	
Total number of sites visited	44
Total number of sites with vegetation	43
Total number of sites shallower than maximum depth of plants	43
Frequency of occurrence at sites shallower than maximum depth of plants	100.00
Simpson Diversity Index	0.89
Maximum depth of plants (ft)**	9.80
Average number of all species per site (shallower than max depth)	2.42
Average number of all species per site (veg. sites only)	2.42
Average number of native species per site (shallower than max depth)	2.30
Average number of native species per site (veg. sites only)	2.36
Species Richness	18
Species Richness (including visuals)	20

SUMMARY STATS: Area J plants	
Total number of sites visited	2
Total number of sites with vegetation	2
Total number of sites shallower than maximum depth of plants	2
Frequency of occurrence at sites shallower than maximum depth of plants	100.00
Simpson Diversity Index	0.63
Maximum depth of plants (ft)**	3.30
Average number of all species per site (shallower than max depth)	2.00
Average number of all species per site (veg. sites only)	2.00
Average number of native species per site (shallower than max depth)	2.00
Average number of native species per site (veg. sites only)	2.00
Species Richness	3
Species Richness (including visuals)	3

SUMMARY STATS: Area K plants	
Total number of sites visited	34
Total number of sites with vegetation	32

Total number of sites shallower than maximum depth of plants	34
Frequency of occurrence at sites shallower than maximum depth of plants	94.12
Simpson Diversity Index	0.90
Maximum depth of plants (ft)**	13.00
Average number of all species per site (shallower than max depth)	3.53
Average number of all species per site (veg. sites only)	3.75
Average number of native species per site (shallower than max depth)	3.44
Average number of native species per site (veg. sites only)	3.77
Species Richness	22
Species Richness (including visuals)	23

Zooplankton Data

Sensitive Area	Rotifer/L	Copepod/L	Cladoceran/L	total/L	Total Large/L
A	17	33	16	65	49
B	39	71	22	132	93
C	7	12	5.75	25	18
D	36	40	6	82	46
E	42	27	32	101	59
F	21	12	5	37	17
G	53	71	48	172	119
H	66	45	27	138	72
I	58	28	22	108	50
J	16	20	9	45	29
K	51	11	6	68	17

Area A Order (insects)/Group	Family	Number	Tol value	wt		
Diptera	Chironomidae-blood red	4	8	32		
	Chironomidae-non-blood red	17	6	102		
	Simulidae	3	6	18		
	Emphididae	1	6	6		
Coleoptera	Emilidae	1	5	5		
Odonata	Lestidae	1	9	9		
	Clapterygidae	2	5	10		
Trichoptera	Sericostomatidae	1	3	3		
	Limnephilidae	1	4	4		
Hempitera	Corixidae	1	9	9		
Crustacean	Hyalellidae	12	8	96		
	Asellidae	1	8	8		
Gastropod	Planorbidae	9	7	63		
Gastropod	Viviparidae	8	7	56		
	Physidae	3	7	21		
	Hydrobiidae	24	7	168		
Taxa	16	89	6.56	610	wt mean	6.85
	Shannon Diversity Index	2.18				

Area B Order (insects)/Group	Family	Number	Tol	wt		
Diptera	Tabanidae	1	6	6		
	Chironomidae	2	6	12		
Odonata	Coenagrionidae	2	9	18		
	Calopterygidae	2	5	10		
	Aeshnidae	1	3	3		
Trichoptera	Limnephillidae	1	4	4		
Hemiptera	Corixidae	1	9	9		
Crustacean	Asellidae	2	8	16		
	Hyalellidae	43	8	344		
Gastropod	Planorbidae	6	7	42		
	Viviparidae	5	7	35		
	Physidae	8	7	56		
	Hydrobiidae	12	7	84		

freshwater mussel	Sphaeridae	4	7	28		
Taxa	14	90	6.64	667	wt mean	7.41
	Shannon index	1.81				

Area C Order (insects)/Group	Family	Number	Tol	wt		
Diptera	Chironomidae	6	6	36		
Coleoptera	Gyrinidae	1	4	4		
Odonata	Coenagrionidae	1	9	9		
	Libelluidae	2	7	14		
Lepidoptera	Pyralidae	1	5	5		
Trichoptera	Moannidae	1	6	6		
Hemiptera	Belostomatidae	1	10	10		
Crustaceans	Gammaridae	4	4	16		
	Hyalellidae	8	8	64		
Gastropoda	Planorbidae	14	7	98		
	Hydrobiidae	12	7	84		
Oligochaete	xx	13	8	104		
Taxa	13	64	6.75	450	wt mean	7.03
	Shannon index	2.06				

Area D Order (insects)/Group	Family	Number	Tol	wt		
Diptera	Chironomidae	6	6	36		
Trichoptera	Lepidostomatidae	6	1	6		
	Sericostomatidae	1	3	3		
Odanata	Coenagronidae	5	9	45		
Lepidoptera	Pyralidae	1	5	5		
Hemiptera	Corixidae	5	9	45		
Crustacean	Hyalellidae	13	8	104		
	Asellidae	2	8	16		
Gastropoda	Planorbidae	9	7	63		
	Hyrobiidae	10	7	70		
Freshwater mussel	Sphaeridae	3	7	21		
Oligochaete	xx	3	8	24		

Taxa	12	64	6.5	438	wt mean	6.84
	Shannon index	2.26				

Area E Order (insects)/Group	Family	Number	Tol	wt		
Diptera	Chironomidae	39	6	234		
	Blood red Chironomidae	6	8	48		
	Tabanidae	1	6	6		
Hempitera	Corixidae	1	9	9		
Trichoptera	Molannidae	2	6	12		
Crustacean	Hyalellidae	16	8	128		
Gastropod	Planorbidae	1	7	7		
	Hydrobiidae	74	7	518		
	Viviparidae	25	7	175		
	Physidae	5	7	35		
Freshwater mussel	Sphaeridae	1	7	7		
Oligochaete		4	8	32		
Taxa	12	175	7.17	1211	wt mean	6.92
	Shannon index	1.67				

Area F Order (insects)/Group	Family	Number	Tol	wt		
Diptera	Chironomidae	6	6	36		
	Chaoboridae	2	8	16		
Megaloptera	Corydalidae	2	0	0		
Odonata	Lestidae	2	9	18		
Coleoptera	Gyrinidae	1	4	4		
Crustacean	Hyalellidae	20	8	160		
	Astacidae	2	6	12		
	Asellidae	2	8	16		
Oligochaete		5	8	40		
Gastropod	Planorbidae	3	7	21		
	Viviparidae	7	7	49		
	Hydobiidae	3	7	21		

Freshwater mussel	Sphaeridae	1	7	7		
taxa	13	56	6.54	400	wt mean	7.14
	Shannon index	2.14				

Area G Order (insects)/Group	Family	Number	Tol	wt		
Diptera	Chironomidae	6	6	36		
Odonata	Calopterygidae	3	5	15		
	Ashnidae	2	3	6		
Coleoptera	Halipilidae	2	7	14		
Ephemeroptera	Tricorythidae	1	4	4		
Hemiptera	Belostomatidae	1	10	10		
Crustacean	Asellidae	2	8	16		
	Astacidae	3	6	18		
Gastrophod	Valvatidae	2	7	14		
	Physidae	5	7	35		
Freshwater mussel	Sphaeridae	3	7	21		
Oligochaete		4	8	32		
taxa	12	34	6.5	221	wt mean	6.5
	Shannon index	2.36				

Area H Order (insects)/Group	Family	Number	Tol	wt		
Diptera	Chironomidae	7	6	42		
	Blood chironomidae	1	8	8		
	Tabanidae	1	6	6		
Trichoptera	Molannidae	2	6	12		
	Leptoceridae	1	4	4		
	Leptostoamatidae	1	1	1		
Odanata	Lestidae	2	9	18		
Crustacean	Hyalellidae	81	8	648		
	Asellidae	2	8	16		
Gastropoda	Planorbidae	3	7	21		
	Hydrobiidae	23	7	161		

	Physidae	3	7	21		
Hemiptera	Belostomatidae	1	10	10		
Freshwater mussel	Sphaeridae	1	7	7		
taxa	14	129	6.71	975	wt mean	7.56
	Shannon index	1.35				

Area I Order (insects)/Group	Family	Number	Tol	wt		
Diptera	Chironomidae	5	6	30		
	Tabanidae	1	6	6		
Trichoptera	Leptidostomatidae	4	1	4		
	Leptoceridae	1	4	4		
Odonata	Coenagrinidae	3	9	27		
Coleoptera	Elmidae	1	5	5		
Crustacean	Hyalellidae	48	8	384		
	Asellidae	2	8	16		
Freshwater mussel	Sphaeridae	1	7	7		
Gastropoda	Planorbidae	6	7	42		
	Viviparadae	11	7	77		
	Hydrobiidae	12	7	84		
taxa	12	95	6.25	686	wt mean	7.22
	Shannon index	1.7				

Area J Order (insects)/Group	Family	Number	Tol	wt		
Diptera	blood chironomid	1	8	8		
Lepidoptera	Pyralidae	1	5	5		
Trichoptera	Molannidae	1	6	6		
Freshwater mussel	Sphaeridae	1	7	7		
Crustacean	Hyalellidae	76	8	608		
Gastropod	Hydrobiidae	17	7	119		
	Viviparidae	3	7	21		
taxa	7	100	6.86	774	wt mean	7.74
	Shannon index	0.8				

Area K Order (insects)/Group	Family	Number	Tol	wt		
Diptera	Chironomidae	11	6	66		
	blood chironomid	1	8	8		
	Ceratopogonidae	1	6	6		
Odonata	Libellulidae	3	7	21		
Crustacean	Hyalliladae	31	8	248		
	Asellidae	1	8	8		
Leech		1	10	10		
Gastropoda	Planorbidae	2	7	14		
	Physidae	18	7	126		
Taxa	9	69	7.44	507	wt mean	7.35
	Shannon index	1.49				

Sens area	Sample pt	Lat	Long	spring peeper	chorus	leopard	copes tree	gray tree	American toad	Green	total species	mean rating
A	48	45.55713	-92.3879								0	0.00
B	50	45.55206	-92.384	2	1				1		3	1.33
C	12	45.53523	-92.3827			1				2	2	1.50
D	10	45.53367	-92.3859							1	1	1.00
E	8	45.5297	-92.3865								0	0.00
F	14	45.52928	-92.3795			1	1		3		3	1.67
G	19	45.50311	-92.3732			1				1	2	1.00
G	21	45.5074	-92.3747								0	0.00

H	43	45.52297	-92.3947	2	2	1			3	1	5	1.80
H	44	45.52062	-92.3926	2						1	2	1.50
I	38	45.53761	-92.3995	1		1		1	3	2	5	1.60
I	39	45.53484	-92.4007	3		1			2	1	4	1.75
I	40	45.53185	-92.4011	2	1				2	2	4	1.75
I	41	45.5292	-92.4002					1	2	3	3	2.00
No sites for J												
K	26	45.56666	-92.3995	2	1	1		1	1	1	6	1.17
K	27	45.56545	-92.4035	1	1	1		1	3	2	6	1.50
K	28	45.56262	-92.4031	1				1		1	3	1.00