1.0 INTRODUCTION

Berry Lake, Menominee and Oconto Counties, is an approximately 209-acre seepage lake with a maximum depth of 27 feet and a mean depth of 8 feet (Figure 1.0-1). This mesotrophic lake has a relatively small watershed when compared to the size of the lake. Eurasian water milfoil (EWM), later confirmed also having hybrid watermilfoil (HWM) has been present in Berry Lake since at least 2007. This report will refer to the overall invasive watermilfoil population of Berry Lake as "HWM."

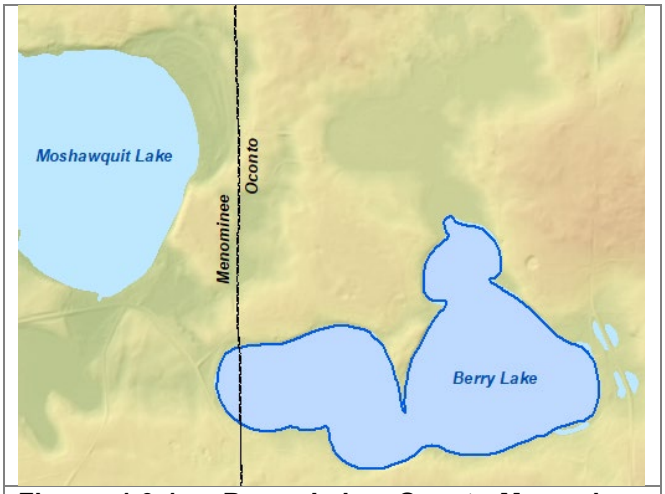


Figure 1.0-1. Berry Lake, Oconto-Menominee Counties.

Numerous control efforts have targeted the HWM population within Berry Lake since discovery, including volunteer and professional hand-harvesting efforts, spot herbicide treatments, basin-wide treatments, and a whole-lake 2,4-D treatment in 2018.

Berry Lake is subjected to dramatic fluctuations in water levels driven by regional climactic factors including rainfall. A USGS gauge station on Berry Lake provides a continuous record of water levels since 2013. These data have shown that water levels increased in the lake by about five feet from 2013-2020. In recent years water levels have trended lower, down nearly three feet since 2020. The impact that the water level fluctuations may have on the aquatic plant populations in Berry Lake are difficult to determine. Overall, some species likely struggle to adapt, while other species may thrive.

1.1 Recent HWM Management

Historical 2,4-D spot treatments have produced seasonal HWM reductions, with HWM populations largely returning to pretreatment levels within a year of treatment. The last whole-lake 2,4-D treatment occurred in 2018. As the BLPOA considered future herbicide management options, Onterra recommend the BLPOA consider rotating away from 2,4-D towards a new herbicide chemistry, florpyrauxifen-benzyl. Repetitive treatments with the same herbicide mode-of-action may cause a shift towards increased herbicide tolerance in the population. While florpyrauxifen-benzyl is a similar mode of action to 2,4-D (auxin hormone mimic), differences in molecular configuration and binding affinity are thought to generate a different enough response in the plant to minimize this potential.

No active HWM management was deployed in Berry Lake in 2021 and monitoring showed the largest concentration of HWM in the lake was a colonized areas on the western end of the lake. The BLPOA applied for and was awarded a WDNR AIS-Control grant from the fall 2021 grant cycle. The two-year project (2022-2023), provided funding assistance to conduct and integrated pest management strategy for HWM control that included an herbicide spot treatment in 2022 followed by approximately two days of professional hand harvesting efforts in 2023. Results from the first year of the project indicated that the 3.7-acre herbicide treatment site in the western basin of the lake did not meet control expectations with a modest decrease in density of the target plants. It was suspected that the relatively small treatment area did not hold sufficient herbicide concentration exposure times to result in effective HWM control,

and wind conditions during and shortly after the application may have been a contributing factor. Details of the monitoring that took place during the first year of the project are included within the *Berry Lake 2022 HWM Management & Monitoring Report* (Jan. 2023).

1.2 2023 HWM Management Strategy

Within the approved *Comprehensive Management Plan* for Berry Lake (March 2015), the BLPOA outlined a management goal to "Control Existing and Prevent Further Aquatic Invasive Species Infestations within Berry Lake." The BLPOA's evolved management strategy includes targeting HWM populations that are *dominant or greater in density* with herbicide treatment strategies. These strategies would consider basin-wide or whole-lake approaches when applicable. The remnant HWM colony in the 2022 treatment area would still meet this trigger of considering treatment in 2023. After careful discussion, the BLPOA chose not to pursue retreatment of this area in 2023 due to the uncertainty of success even with more ideal treatment conditions, their desire to space out treatments for the health of their aquatic ecosystem, and financial limitations.

The BLPOA followed their original intended course of action outlined within the open AIS Control Grant, utilizing professional manual removal efforts to preserve the gains made from past herbicide treatments. The budgeted amount for hand harvesting in the grant was sufficient for two days of effort with Diver Assisted Suction Harvesting (DASH). The BLPOA has learned from past efforts that targeting large and dense HWM colonies with manual removal is not likely to be effective. Manual removal is most effective when targeting scale-appropriate manageable HWM occurrences. Two sites in the eastern basin were give consideration for DASH harvesting efforts in 2023, including a grouping of single plants and clumps of plants towards the northern end of the basin and a concentrated area of HWM located near the public boat landing (Map 1).

Aquatic plant monitoring planned for 2023 included the completion of a whole-lake point-intercept survey and a late-summer HWM mapping survey. The whole-lake point-intercept survey is valuable in assessing the lake-wide aquatic plant population and results are compared to previous or future surveys to monitor aquatic plant populations in the lake. The last point-intercept survey on Berry Lake took place in 2020. The late-summer HWM mapping survey served to assess the management occurring on the system and would also be used to develop an initial management strategy for the following year. This report details the results of the monitoring that took place during 2023 on Berry Lake and is the final report deliverable from WDNR Grant ACEI-277-22.

2.0 2023 PROFESSIONAL HAND HARVESTING ACTIVITIES – DIVER ASSISTED SUCTION HARVEST (DASH)

Table 2.0-1 highlights the professional hand-harvesting activities that took place during 2023 on Berry Lake. Harvesting efforts occurred during July 19-20, 2023 and resulted in the harvest of 101 cubic feet of HWM from site B-23 in the eastern basin of the lake. Divers noted that native aquatic plant density was a hindrance to the harvesting progress (Appendix A). Additional details of the professional DASH efforts are included in a HWM Removal Report issued by APM, LLC within Appendix A.

Table 2.0-1. 2023 hand-harvesting activities in Berry Lake. Table extracted from Aquatic Plant Management LLC Report. (Appendix A).

Dive Location	Avg. Water Depth	# of Dives	Underwater Dive Time	AIS Removed (cubic feet)
B-23	8.0	11	11.6	101.0
Grand Total	**8.0**	**11**	**11.6**	**101.0**

Date	Weather Conditions	Water Temp (F)	Underwater Dive Time (hrs)	AIS Removed (cubic ft)
7/19/2023	Cloudy	67	5.9	45.0
7/20/2023	Periods of rain	70	5.7	56.0
Grand Total			**11.6**	**101.0**

3.0 2023 AQUATIC PLANT MONITORING RESULTS

It is important to note that two types of surveys are discussed in the subsequent materials: 1) point-intercept surveys and 2) HWM mapping surveys. The point-intercept survey provides a standardized way to gain quantitative information about a lake's aquatic plant population through visiting predetermined locations and using a rake sampler to identify all the plants at each location. The survey methodology allows comparisons to be made over time, as well as between lakes.

While the point-intercept survey is a valuable tool to understand the overall plant population of a lake, it does not offer a full account (census) of where a particular species exists in the lake. During the HWM mapping survey, the entire littoral area of the lake is surveyed through visual observations from the boat (Photograph 3.0-1). Field crews supplemented the visual survey by deploying a submersible camera along with periodically doing rake tows. The HWM population is mapped using sub-meter GPS technology by using either 1) point-based or 2) area-based methodologies. Large colonies >40 feet in diameter are mapped using polygons (areas) and are qualitatively attributed a density rating based upon a five-tiered scale from *highly scattered* to *surface matting*. Point-based techniques were applied to AIS locations that were considered as *small plant colonies* (<40 feet in diameter), *clumps of plants*, or *single or few plants*.

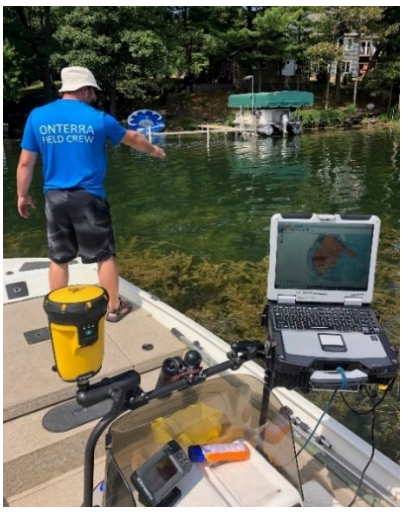


Photo 3.0-1. HWM mapping survey. Photo credit Onterra.

Overall, each survey has its strengths and weaknesses, which is why both are utilized in different ways as part of this project.

3.1 Whole-Lake Point-Intercept Survey

A point-intercept aquatic plant survey was first conducted on Berry Lake in 2007. Additional surveys were conducted by the WDNR in 2008-2015 as part of the HWM Long-Term Trends Monitoring Dataset and continued in 2016-2020 by Onterra as part of a WDNR grant-funded AIS control and monitoring project. The most recent whole-lake point-intercept survey was conducted on Berry Lake on August 7, 2023. A full matrix of the littoral frequency of occurrence data from whole-lake point-intercept surveys in Berry Lake is included in Appendix B.

Throughout the monitoring timeframe (2007-2023) five non-native, invasive species have been found in the Berry Lake ecosystem: Eurasian watermilfoil, pale-yellow iris, purple loosestrife, reed canary grass, and giant reed. From all 15 point-intercept surveys and one community mapping survey, the total number of aquatic plant species located within Berry Lake and its immediate shoreline is 67. Emergent and floating-leaf species are less commonly encountered during point-intercepts surveys as they are often found growing on the margins of the lake. Many of these species are documented incidentally during point-intercept surveys, meaning they were observed but physically encountered on the survey rake. Table 3.1-1 displays the variety of emergent and floating-leaf species present within Berry Lake and its immediate shoreline.

Table 3.1-1. Emergent & Floating Leaf Aquatic plant species located in Berry Lake.

Growth Form	Scientific Name	Common Name	Status in Wisconsin	Coefficient of Conservatism	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2023
Emergent	*Asclepias incarnata*	Sw amp milkw eed	Native	5									I						
	Bolboschoenus fluviatilis	River bulrush	Native	5							I								
	Carex pseudocyperus	Cypress-like sedge	Native	8								I							
	Carex sp. 1	Sedge sp. 1	Native	N/A				I											
	Cladium mariscoides	Smooth saw grass	Native	N/A								I							
	Dulichium arundinaceum	Three-w ay sedge	Native	9						I									
	Eleocharis palustris	Creeping spikerush	Native	6					I						X	X	X		
	Eupatorium maculatum	Spotted joe-pye-w eed	Native	4					I										
	Iris pseudacorus	Pale-yellow iris	Non-Native - Invasive	N/A								I							
	Iris versicolor	Northern blue flag	Native	5					I		I	I							
	Lysimachia terrestris	Bulbil loosestrife	Native	7	X				I				X						
	Lythrum salicaria	Purple loosestrife	Non-Native - Invasive	N/A										I					
	Phalaris arundinacea	Reed canary grass	Non-Native - Invasive	N/A								I							
	Phragmites australis subsp. americanus	Common reed	Native	5					I	I		I				I			
	Phragmites australis subsp. australis	Giant reed	Non-Native - Invasive	N/A								I		I	I			I	
	Pontederia cordata	Pickerelw eed	Native	9			I			X		I	I			X			
	Schoenoplectus acutus	Hardstem bulrush	Native	5								I		X	X	X	X	X	X
	Schoenoplectus pungens	Three-square rush	Native	5		I			X	X	X	X			X		X		
	Schoenoplectus tabernaemontani	Softstem bulrush	Native	4					X	X		X							
	Sparganium eurycarpum	Common bur-reed	Native	5														X	
FL	*Brasenia schreberi*	Watershield	Native	7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Nuphar variegata	Spatterdock	Native	6			I	I	I	X		X	X						
	Nymphaea odorata	White w ater lily	Native	6	X	X		I	X	X	X	X	X		X	X	X	X	X
	Persicaria amphibia	Water smartw eed	Native	5					I	I	I				I	I	X	I	
FL/E	*Sparganium sp.*	Bur-reed sp.	Native	N/A			X												

X = Located on rake during point-intercept survey; I = Incidentally located; not located on rake during point-intercept survey
FL = Floating-leaf; F/L = Floating-leaf & Emergent; S/E = Submergent and/or Emergent; FF = Free-floating

Berry Lake also houses a wide array of submersed or free-floating aquatic plant species as displayed on Table 3.1-2 below.

Table 3.1-2. Submergent & Free-floating Aquatic plant species located in Berry Lake during point-intercept surveys.

Growth Form	Scientific Name	Common Name	Status in Wisconsin	Coefficient of Conservatism	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2023
Submergent	*Bidens beckii*	Water marigold	Native	8			X	X	I					X					
	Ceratophyllum demersum	Coontail	Native	3				X			X		X					X	
	Chara spp.	Muskgrasses	Native	7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Elatine minima	Waterwort	Native	9					I									X	
	Elodea canadensis	Common waterweed	Native	3	X	X	X	X	X		I		X			X			X
	Elodea nuttallii	Slender waterweed	Native	7						X		X							
	Eriocaulon aquaticum	Pipewort	Native	9					I		X			X	X				I
	Isoetes spp.	Quillwort spp.	Native	8												X		X	
	Myriophyllum sibiricum	Northern watermilfoil	Native	7	X	X	X	X	X	X	X								
	Myriophyllum spicatum	Eurasian watermilfoil	Non-Native - Invasive	N/A	I	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Myriophyllum tenellum	Dwarf watermilfoil	Native	10	X	X	X	X	X	X	X	X	X	X	X	X	X		X
	Najas flexilis	Slender naiad	Native	6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Najas guadalupensis	Southern naiad	Native	7		I		X	X	X	X	X	X	X	X	X	X	X	X
	Nitella spp.	Stoneworts	Native	7	X	X	X	X	X	X	X	X	X	X	X	X		X	
	Potamogeton amplifolius	Large-leaf pondweed	Native	7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Potamogeton gramineus	Variable-leaf pondweed	Native	7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Potamogeton illinoensis	Illinois pondweed	Native	6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Potamogeton praelongus	White-stem pondweed	Native	8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Potamogeton pusillus	Small pondweed	Native	7			X	X	X	X	X	X		X	X		X	X	X
	Potamogeton richardsonii	Clasping-leaf pondweed	Native	5		X										X		X	
	Potamogeton robbinsii	Fern-leaf pondweed	Native	8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Potamogeton strictifolius	Stiff pondweed	Native	8	X			X	X	X				X				X	
	Potamogeton X scoliophyllus	Large-leaf X Illinois pondweed	Native	N/A				X											
	Potamogeton zosteriformis	Flat-stem pondweed	Native	6	X		I	X					X	X				X	X
	Ranunculus aquatilis	White water crowfoot	Native	8														X	
	Sagittaria sp. (rosette)	Arrowhead sp. (rosette)	Native	N/A	X			X						X	X				
	Stuckenia pectinata	Sago pondweed	Native	3	X	X	X	X	X	X	X	X	X	X					
	Utricularia cornuta	Horned bladderwort	Native	10			I												
	Utricularia geminiscapa	Twin-stemmed bladderwort	Native	9										X	X	X	X		
	Utricularia gibba	Creeping bladderwort	Native	9		X	X	X	X	X	X	X	X	X	X	X	X		X
	Utricularia intermedia	Flat-leaf bladderwort	Native	9	X						I	X	X	X	X	X	X	X	X
	Utricularia minor	Small bladderwort	Native	10									I				X	X	
	Utricularia resupinata	Northeastern bladderwort	Native - Special Concern	9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Utricularia vulgaris	Common bladderwort	Native	7	I				X	X	X	X	X	X	X	X	X	X	X
	Vallisneria americana	Wild celery	Native	6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
S/E	*Alisma spp.*	Water plantain sp.	Native	N/A														X	
	Eleocharis acicularis	Needle spikerush	Native	5		X		X	X	X	X		X	X		X	X	X	X
	Juncus pelocarpus	Brown-fruited rush	Native	8	X	I	X	X	X		X	X		X					
FF	*Lemna minor*	Lesser duckweed	Native	5				X											

X = Located on rake during point-intercept survey; I = Incidentally located; not located on rake during point-intercept survey
FL = Floating-leaf; F/L = Floating-leaf & Emergent; S/E = Submergent and/or Emergent; FF = Free-floating

Whole-lake point-intercept surveys are used to quantify the abundance of individual plant species within the lake. Of the 328 point-intercept sampling locations that fell at or shallower than the maximum depth of plant growth (the littoral zone) in Berry Lake in 2023, approximately 78% contained aquatic vegetation. A total of 23 aquatic plant species were physically encountered on the survey rake during the 2023 whole-lake point-intercept survey. Muskgrasses, fern-leaf pondweed, and variable-leaf and were the most frequently encountered native aquatic plant species in the survey (Figure 3.1-1).

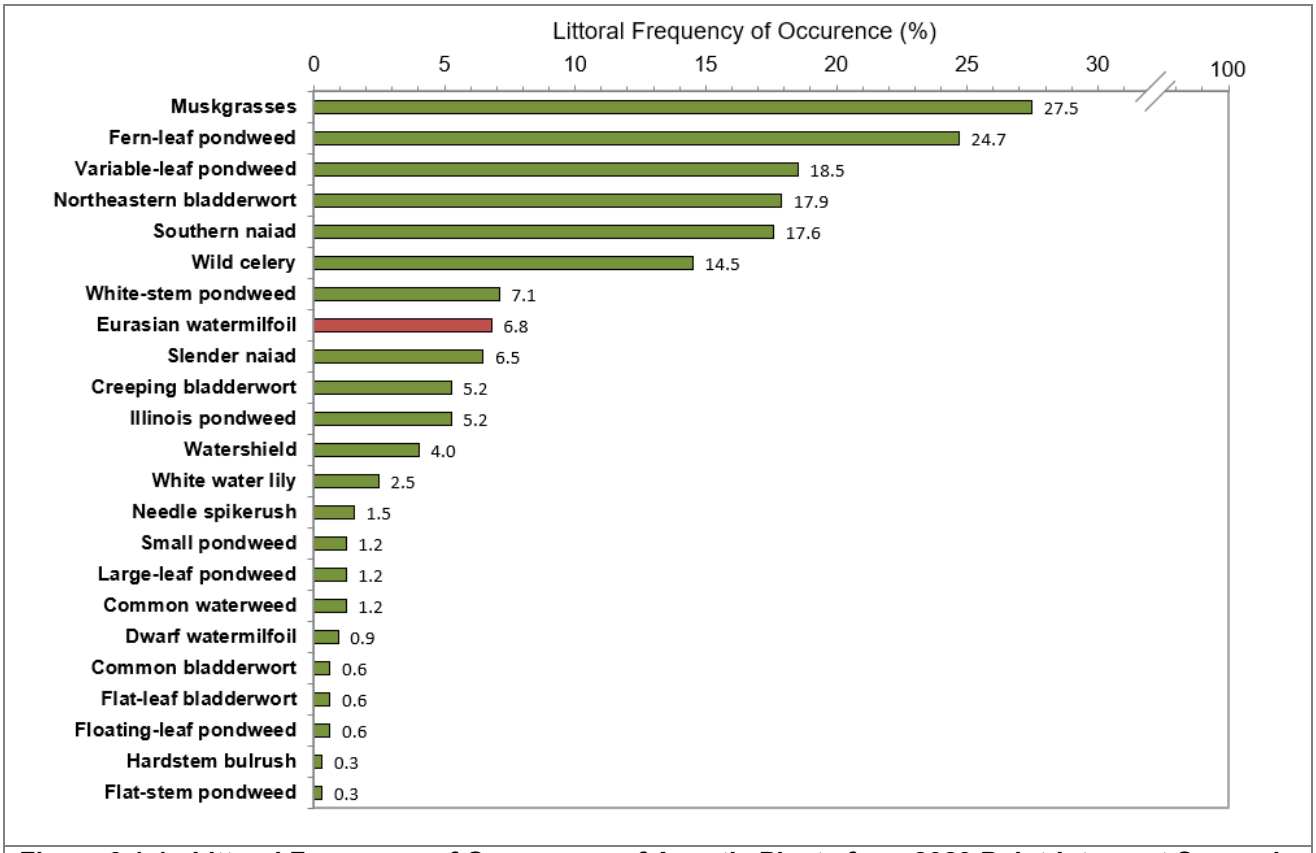
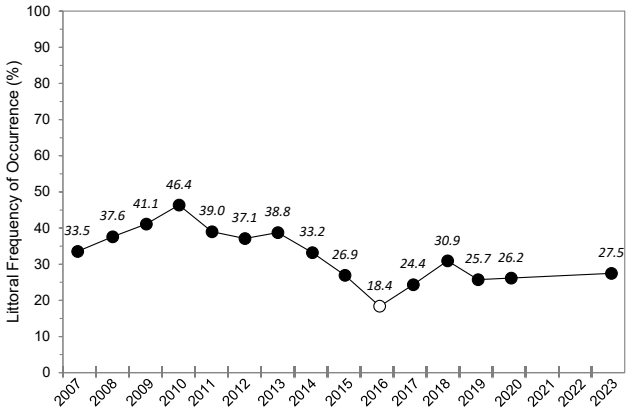


Figure 3.1-1. Littoral Frequency of Occurrence of Aquatic Plants from 2023 Point-Intercept Survey in Berry Lake.

In the field, it is often difficult to distinguish between certain species of aquatic plants that are very similar morphologically, especially when flowering/fruiting material is not present. Because of this, the littoral occurrences of the following morphologically-similar species were combined for the following analysis: muskgrasses (*Chara* spp.) and stoneworts (*Nitella* spp.), slender naiad (*Najas flexilis*) and southern naiads (*N. guadalupensis*), variable-leaf (*Potamogeton gramineus*) and Illinois pondweeds (*P. illinoensis*), as well as common waterweed (*Elodea canadensis*) and slender waterweed (*E. nuttallii*). The following series of figures compares the 2023 aquatic plant population to past surveys that have occurred on the lake.

Charophytes have historically been one of the most frequently encountered species during the point-intercept surveys in Berry Lake (Figure 3.1-2). Muskgrasses, a genus of macroalgae, are not true vascular plants, and are often abundant in waterbodies that are clear with higher alkalinity. Often growing in dense beds, muskgrasses stabilize bottom sediments, provide excellent structural habitat for aquatic organisms, and are sources of food for fish, waterfowl, and other wildlife (Borman S. , 2007). *Nitella* species, or stoneworts as they may be called, are actually a type of macro-algae rather than a vascular plant. Whorls of forked branches are attached to the "stems" of the plant, which are long, slender, smooth-textured algae. Because they lack roots, stoneworts remove nutrients directly from the water. The combined occurrence of muskgrasses and stonewort species was 27.5% in 2023 which is similar to recent surveys.



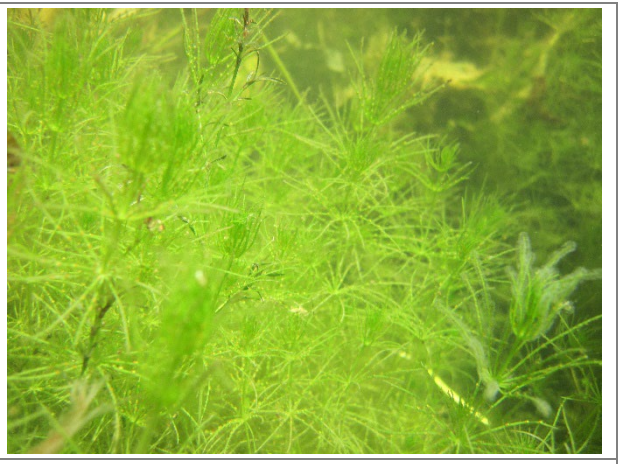


Figure 3.1-2. Charophytes Littoral Frequency of Occurrence in Berry Lake. Open circle represents statistically valid change from previous survey (Chi-Square α = 0.05).

Fern-leaf pondweed was the second-most frequently encountered species in the 2023 survey. Fern-leaf has also historically been a very common plant found in past surveys. The occurrence of fern-leaf pondweed in Berry Lake exhibited a steady decline in occurrence from 2012-2020 (Figure 3.1-3). The occurrence of fern-leaf pondweed in 2023 was 24.6% and represents a statistically valid increase from the last survey completed in 2020.

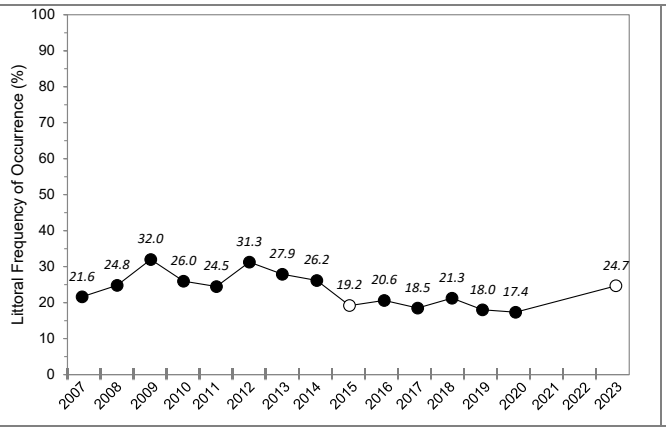


Figure 3.1-3. Fern-leaf pondweed Littoral Frequency of Occurrence in Berry Lake. Open circle represents statistically valid change from previous survey (Chi-Square α = 0.05).

Variable-leaf and Illinois pondweed are two of several pondweed species found in Wisconsin. These pondweeds produce long, slender stems with alternating lance-shaped leaves. These plants can look very different from lake to lake, with some populations having larger leaves and others possessing smaller leaves. In Berry Lake, variable-leaf and Illinois pondweed were most prevalent between 3 and 16 feet of water. The occurrence of these pondweeds has been variable over time with some statistically valid changes in occurrence (Figure 3.1-4).

Northeastern bladderwort is considered a special concern species in Wisconsin because it is considered vulnerable due to a fairly restricted range. This species has been relatively stable throughout the monitoring timeframe with a 17.9% occurrence in 2023 (Figure 3.1-4). The occurrence of wild celery

has fluctuated slightly over time but overall has been relatively stable over the monitoring timeframe (Figure 3.1-4). The 2023 occurrence was statistically lower than the previous survey from 2020.

The combined occurrences of slender and southern naiads are common within Berry Lake. Populations were fairly stable from 2007-2014 and then showed a decreasing trend through 2018 (Figure 3.1-4). The occurrence in 2023 was 23.8% and was similar to the last survey completed in 2020.

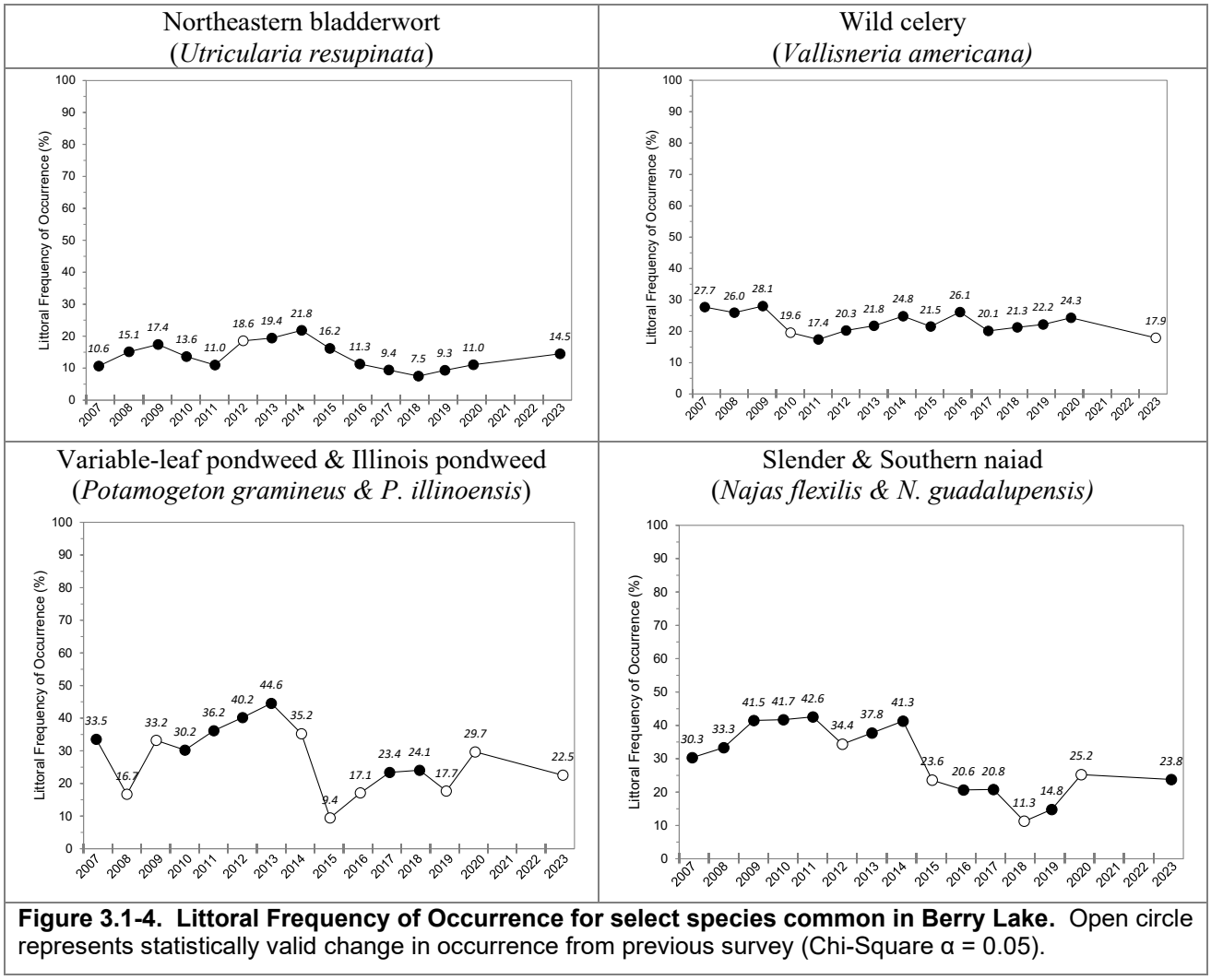


Figure 3.1-4. Littoral Frequency of Occurrence for select species common in Berry Lake. Open circle represents statistically valid change in occurrence from previous survey (Chi-Square α = 0.05).

The occurrence of HWM in the point-intercept surveys has been highly variable over time as a result of active management occurring on the system (Figure 3.1-5). Statistically valid increases and decreases in occurrence were documented between most surveys while HWM either increased when no management was occurring or decreased following herbicide treatments. The occurrence was below 1% in the earliest surveys dating back to 2007-2009. The highest occurrence was documented in 2017 at 25.3%. Hybrid Eurasian watermilfoil exhibited an occurrence of 6.8% in the 2023 survey.

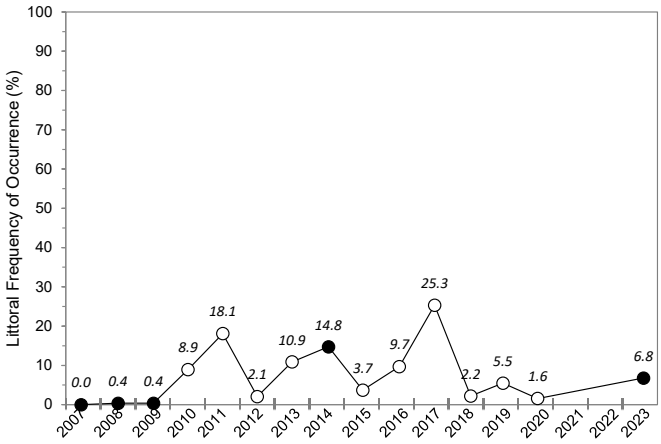


Figure 3.1-5. Hybrid watermilfoil Littoral Frequency of Occurrence in Berry Lake. Open circle represents statistically valid change from previous survey (Chi-Square α = 0.05).

Because each sampling location may contain numerous plant species, relative frequency of occurrence is one tool to evaluate how often each plant species is found in relation to all other species found (composition of population). For example, while charophytes were found at 27.5% of the littoral sampling locations in Berry Lake in 2023, its relative frequency of occurrence is 11.4% (Figure 3.1-6). Explained another way, if 100 plants were randomly sampled from Berry Lake, 11 of them would be charophytes. Figure 3.2-12 displays the relative frequency of occurrence of aquatic plant species from each of the point-intercept surveys in Berry Lake.

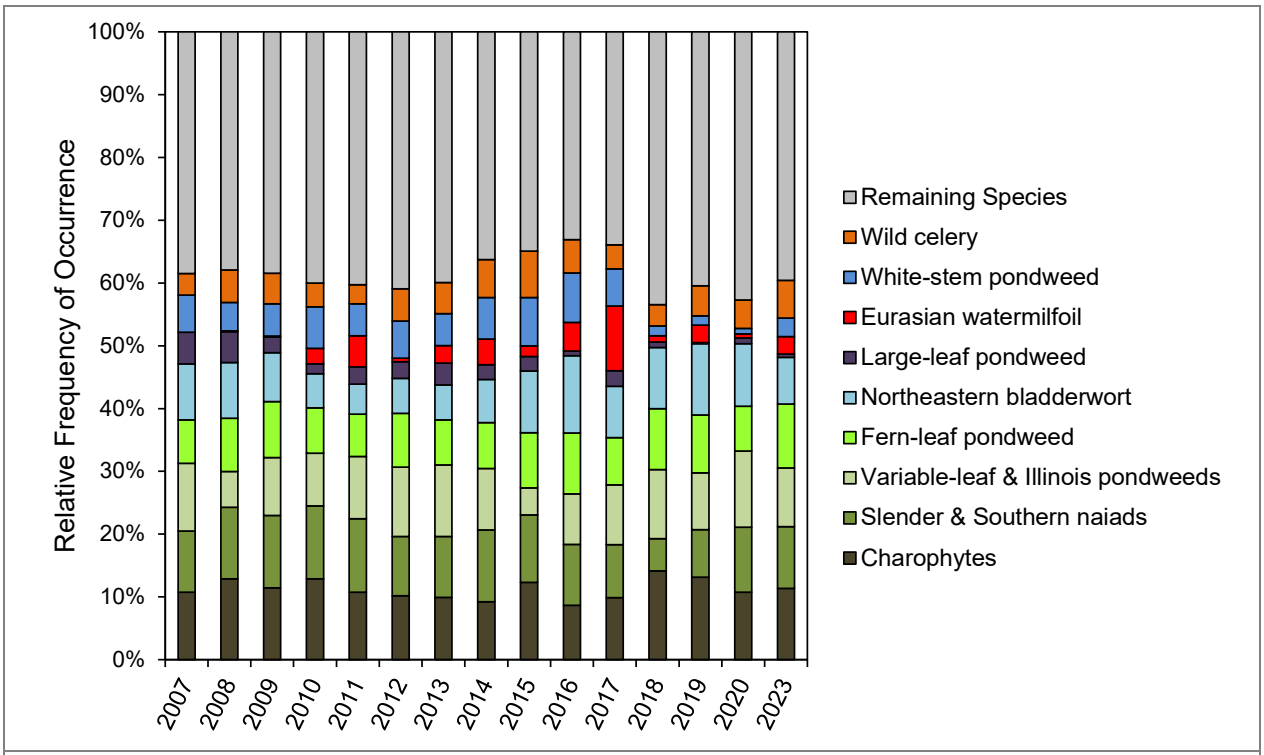


Figure 3.1-6. Relative frequency of occurrence of aquatic plants in Berry Lake.

Floristic Quality Assessment

The floristic quality of a lake's aquatic plant community is calculated using its native *species richness* and their *average conservatism*. Species richness is the number of native aquatic plant species that were physically encountered on the rake during the point-intercept survey. Average conservatism is calculated by taking the sum of the coefficients of conservatism (C-values) of the native species located and dividing it by species richness. Every plant in Wisconsin has been assigned a coefficient of conservatism, ranging from 1-10, which describes the likelihood of that species being found in an undisturbed environment. Species which are more specialized and require undisturbed habitat are given higher coefficients, while species which are more tolerant of environmental disturbance have lower coefficients. Higher average conservatism values generally indicate a healthier lake as it is able to support a greater number of environmentally-sensitive aquatic plant species. Low average conservatism values indicate a degraded environment, one that is only able to support disturbance-tolerant species.

On their own, the species richness and average conservatism values for a lake are useful in assessing a lake's plant community; however, the best assessment of the lake's plant community health is determined when the two values are used to calculate the lake's floristic quality. The floristic quality is calculated using the species richness and average conservatism value of the aquatic plant species that were solely encountered on the rake during the point-intercept surveys (equation shown below). This assessment allows the aquatic plant community of Berry Lake to be compared to other lakes within the region and state.

$$\text{FQI} = \text{Average Coefficient of Conservatism} * \sqrt{\text{Number of Native Species}}$$

Data collected during the aquatic plant surveys was also used to complete a Floristic Quality Assessment which incorporates the number of native aquatic plant species recorded on the rake during the point-intercept survey and their average conservatism. The data used for these calculations does not include any incidental species (visual observations) but only considers plants that were sampled on the rake during the point-intercept survey. Figure 3.2-10 displays the species richness, average conservatism, and floristic quality of Berry Lake along with ecoregion and state median values.

Native species richness has varied from year to year with an average of 27 native species per year. In the 2023 survey, 23 native species were encountered which is slightly lower than average from past surveys in the lake (Figure 3.2-7). Species such as giant reed, coontail, stoneworts, and stiff pondweed were among those species encountered in 2020 but not 2023. In all years, the species richness has been above the ecoregion and state median values.

Average conservatism values were consistently between 6.6-7.3 in surveys conducted between 2007-2023. All recorded values are above the state median and ecoregion median values. The floristic quality values have been above state and ecoregion medians in all surveys. The 2023 survey resulted in an FQI value of 33.1 which falls slightly lower that average from past survey in Berry Lake, but remains higher than ecoregion and state median values.

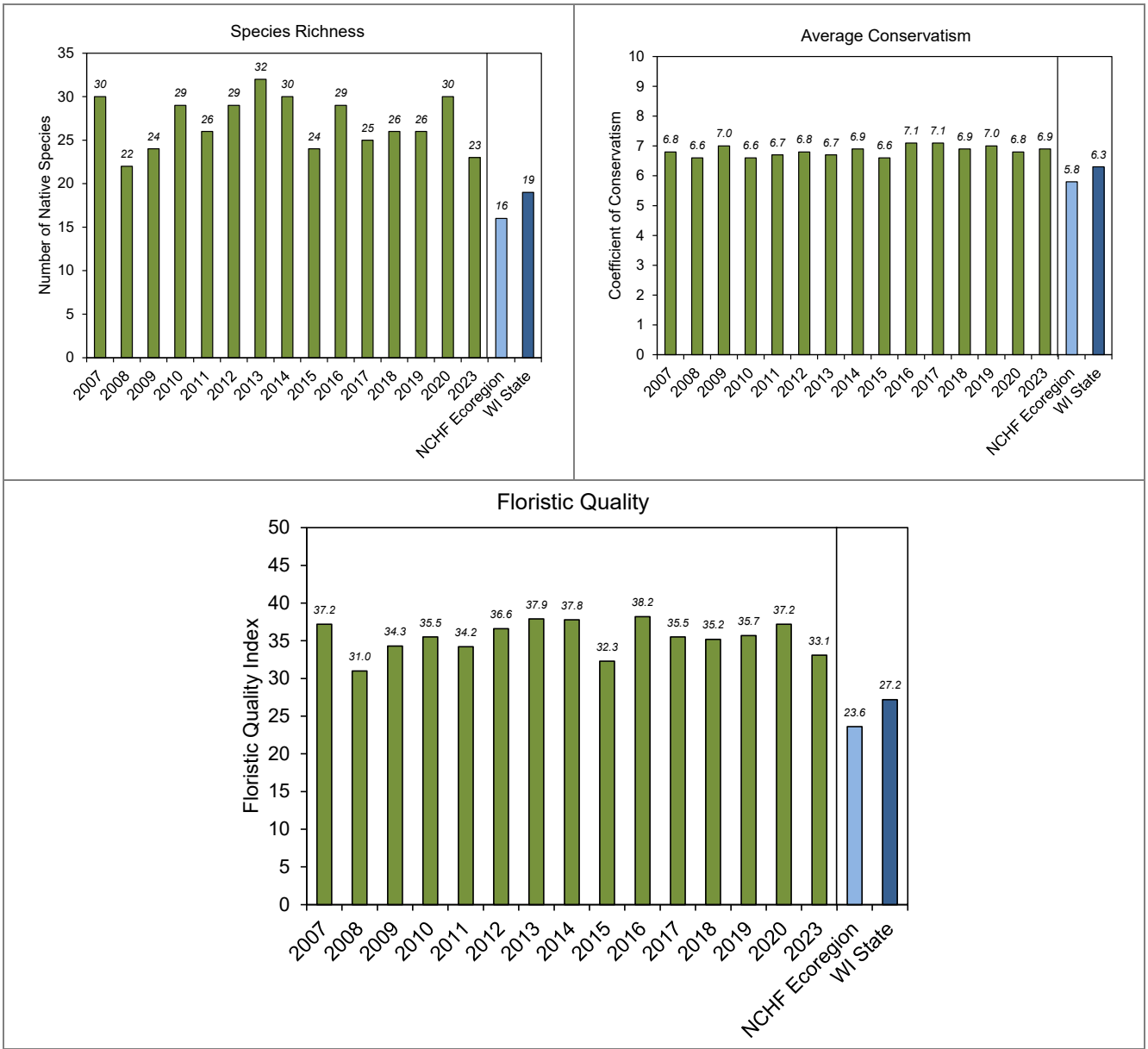


Figure 3.1-7. Native aquatic plant species richness, average conservationism, and floristic quality in Berry Lake. Data from point-intercept surveys.

While a method for characterizing diversity values of fair, poor, etc. does not exist, lakes within the same ecoregion may be compared to provide an idea of how Berry Lake's diversity values rank. Using data collected by Onterra and the WDNR Science Services, quartiles were calculated for lakes within the North Central Hardwood Forest (NCHF) Ecoregion and on lakes throughout Wisconsin. Using the data collected from the whole-lake point-intercept surveys, Berry Lake's aquatic plant species diversity has been relatively consistent over time near the upper quartile (Figure 3.1-8). In 2023, Simpson's diversity was at 0.90 which falls at the upper quartile.

Another metric that assesses the native plant community in the lake over time is through comparing the average number of native plant species per sampling location from the point-intercept surveys. These

data show slightly higher values in 2007-2014, when compared to 2015-2023 (Figure 3.1-9). The 2023 survey indicated 2.06 native species per littoral sampling site.

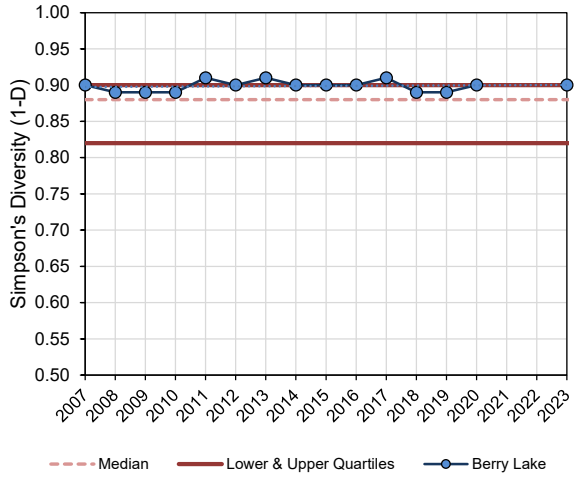


Figure 3.1-8. Berry Lake Simpson's Diversity Index.

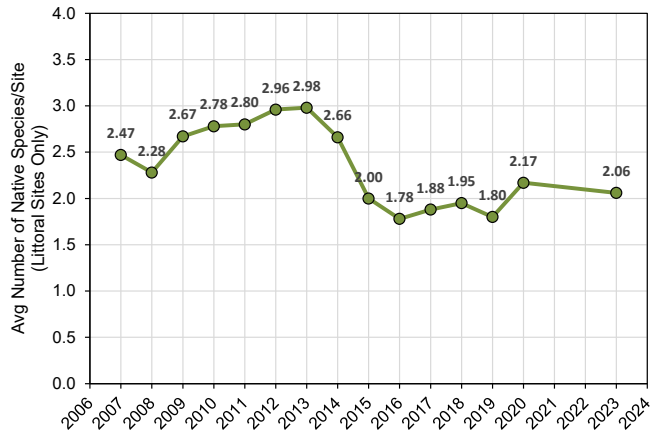


Figure 3.1-9. Average number of native plant species per littoral sampling site in Berry Lake.

3.2 Late-Summer HWM Mapping Survey

The Late-Summer HWM Mapping Survey was conducted on September 1st, 2023 to qualitatively assess the hand harvesting efforts as well as to understand the peak growth of the HWM population throughout the lake. The entire littoral zone was meandered and HWM occurrences were mapped by using the same methodology described above in Section 3.0. The crews noted mostly sunny skies and 5-10 mph winds during the survey. The HWM population was easily observed from surface viewing, with the crews noting many areas were in flower making the density seem greater than when just looking at the overall plant biomass.

An interesting finding from the 2023 survey was the presence of a globular species of algae, potentially identified as *Nostoc zetterstedtii* by a WDNR algae specialist. These natural and native blobs of algae thrive in warm water, and have been periodically noticed by Onterra and WDNR aquatic plant surveyors over the years during late-summer surveys on Berry Lake. This type of algae is thought to be found less frequently than it would have existed historically, as free-floating algae growing higher in the water column from increased nutrient runoff have shaded out these bottom growing species on many waterbodies. The hot and sunny conditions during the summer of 2023 in combination with the high water clarity of Berry Lake made ideal conditions for this algae, which were frequently encountered during Onterra's surveys.

Photo 3.2-1. Nostoc species found in Berry Lake. Photo credit Onterra.

Overall, the survey showed there was an increase in density of the HWM population compared to recent years with more areas requiring area-based mapping techniques and a notable increase in plants in the vicinity of the boat landing (Map 2). Some HWM population rebound was observed in the eastern basin, including around the deep hole where HWM has been prevalent in the past. Being three full summers following that treatment, these results are consistent with expectations from a whole-basin herbicide treatment. An area of colonized HWM was mapped in the vicinity of the public boat landing on the east end of the lake with a *surface matting* density in some portions of the colony. A few other isolated colonized areas were mapped along the southern portions of the lake and areas within the western basin as well. Several *single or few plants*, *clumps of plants*, and *small plant colony* occurrences were also mapped in various locations around the lake.

A total of 10.9 acres of colonized HWM was mapped in the 2023 survey compared to 2.9 acres in 2022. The total acreage of HWM in Berry Lake has remained relatively low since the 2018 whole-lake 2,4-D treatment as the BLPOA has conducted follow up integrated pest management activities including professional hand harvesting and herbicide spot-treatments (Figure 3.2-1). It is important to note that Figure 3.2-1 displays only those HWM occurrences that were mapped with area-based (polygons) mapping methodologies. Many additional HWM occurrences were mapped with point-based methodologies throughout the system and are described as either *single or few plants*, *clumps of plants*, or *small plant colonies*. Any HWM mapped with point-based methods do not contribute to the acreages displayed on Figure 3.2-1.

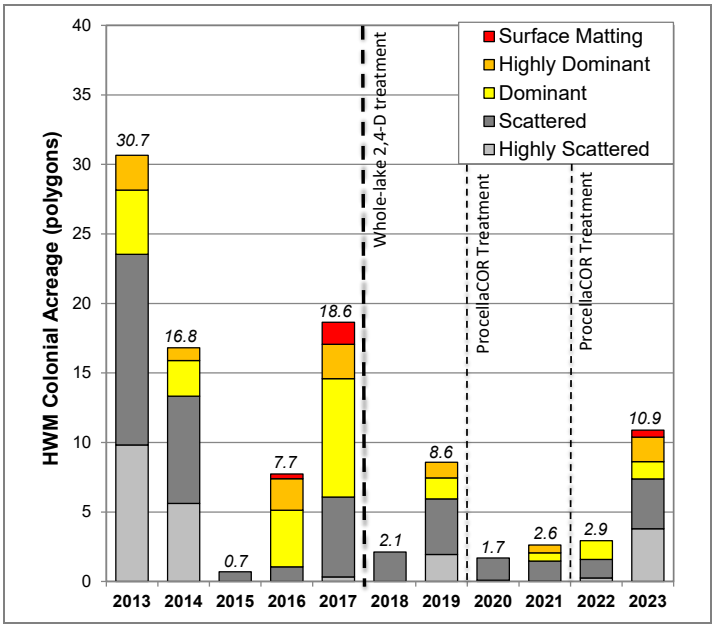


Figure 3.2-1. Berry Lake acreage of colonized HWM (polygons) from 2013-2023. Created using data from Onterra late-summer HWM mapping surveys.

2023 Hand Harvesting/Diver Assisted Suction Harvest Efficacy

The site that was managed with professional hand harvesting/DASH efforts in 2023 showed an HWM population increase between 2022-2023 (Figure 3.2-2). A total of 11.6 hours of dive time resulted in the harvest of 101.0 cubic feet of HWM from site B-23 during 2023. Divers noted that they encountered high amounts of native plants, which hindered their ability to effectively remove HWM at times. The HWM population in this site expanded at a rate that much exceeded the rate for which the harvesting strategy could achieve.

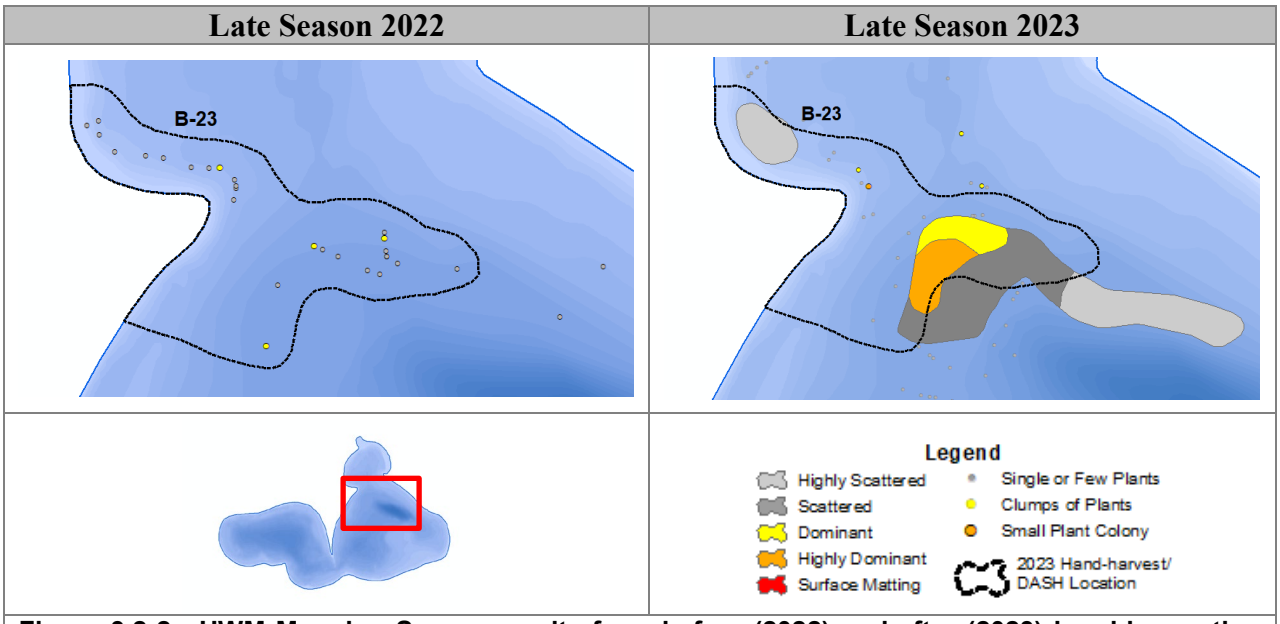


Figure 3.2-2. HWM Mapping Survey results from before (2022) and after (2023) hand-harvesting efforts in Berry Lake. Data from Onterra Late-Summer HWM Mapping Surveys.

3.3 Year after treatment Monitoring of 2022 Herbicide Treatment

Quantitative Monitoring: Subsample Point-Intercept Survey

A quantitative monitoring plan was devised for this trial treatment site in which a total of 35 subsample point-intercept sampling locations are contained within the treatment site (Figure 3.3-1). The quantitative assessment was completed through the comparison of the sub point-intercept survey from mid-June 2022 (*year of pre-treatment*), to 2022 (*year of post-treatment*), and 2023 (*year after treatment*). The frequency of occurrence for all species from each of the subsample point-intercept surveys is contained within Appendix B.

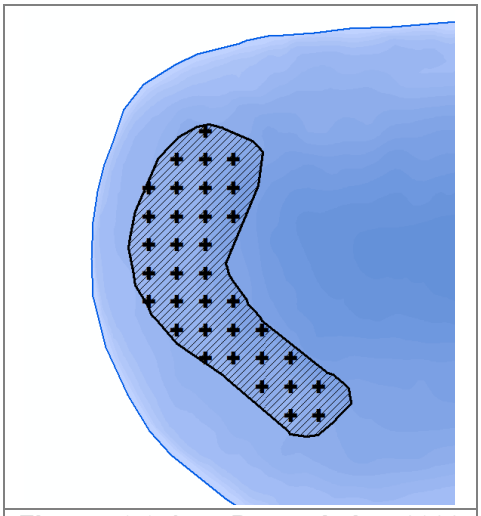


Figure 3.3-1. Berry Lake 2022 Treatment Quantitative Monitoring Plan. 20m spacing, n=35.

Figure 3.3-2 displays the littoral frequency of occurrence of aquatic plant species located in the treated site before (June 2022), after (September 2022) treatment, and a *year after treatment* (2023). HWM exhibited a 40% decrease in frequency of occurrence during the *year of treatment*, however, increased to near pretreatment levels by the *year after treatment*. This treatment did not meet the quantitative success criteria based on the minimally reduced HWM population in the subsample point-intercept survey.

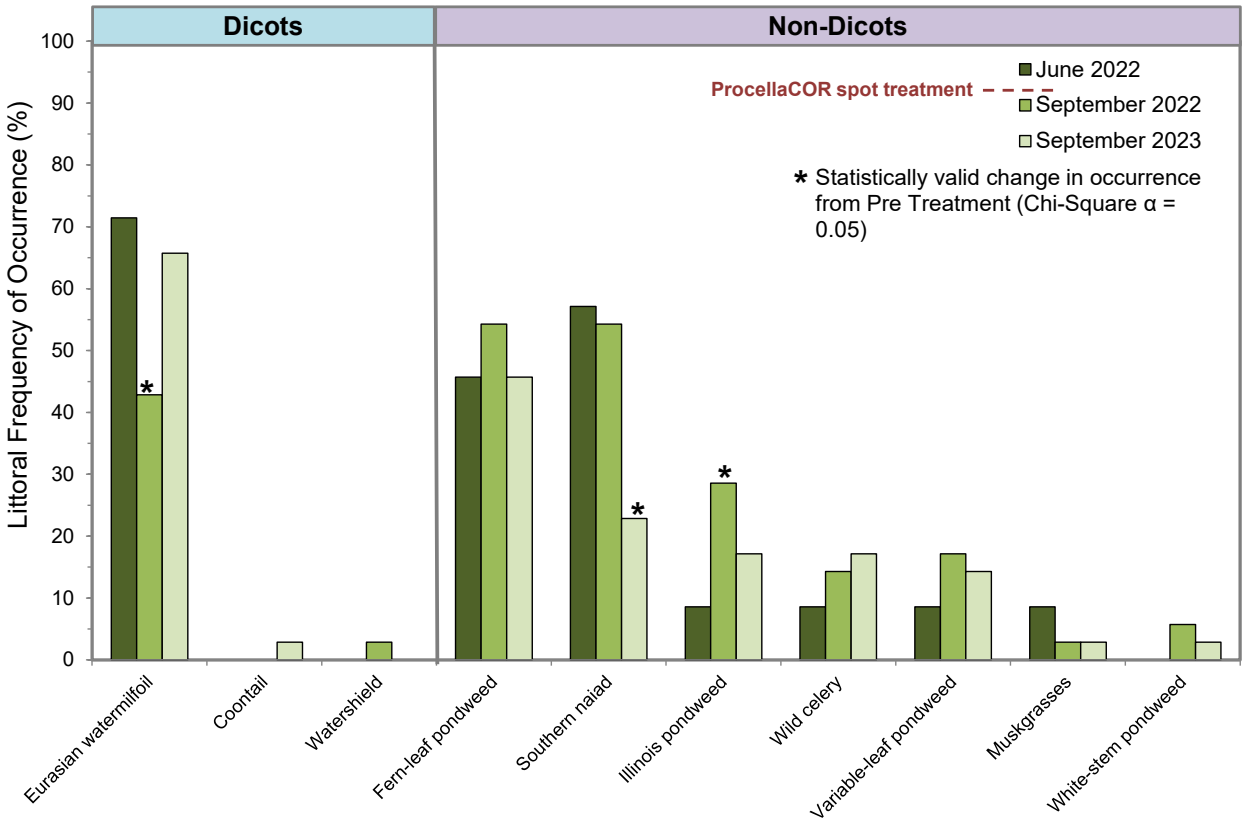


Figure 3.3-2. Frequency of Occurrence of Aquatic Plants from Subsample Point-Intercept Survey within a 2022 Herbicide Treatment site in Berry Lake. n=35.

No native species showed valid decreases in occurrence during the *year of treatment*. Illinois pondweed (*Potamogeton illinoensis)* exhibited a statistically valid increase from *pretreatment* to *year-of-treatment* but this may be a reflection of the timing of the surveys in which this species was likely at an early growth stage during the mid-June pretreatment survey timing compared with the September post treatment survey.

The occurrence of southern naiad was not statistically different from *pretreatment* to the *year-of-treatment*, but did show a valid decrease in occurrence comparing the *year-of-treatment* to the *year after treatment*. This is likely not attributable to the herbicide treatment as impacts were not apparent in the *year of treatment* for this species.

Qualitative Monitoring: HWM Mapping Surveys

Qualitative monitoring compares the late-summer HWM mapping survey population mapped during 2021 (pre-treatment), late-summer 2022 (post-treatment), and late-summer 2023 (*year after treatment*). The late-summer 2022 survey indicated that the HWM footprint remained approximately the same as the 2021 survey, with a slight decrease in density such that no areas consisted of a *highly dominant* rating. The 2023 mapping survey showed the HWM population in the site had completely recovered from any short-term suppression from the previous years' treatment and had returned to pretreatment

population levels. These data further indicate that the treatment fell well short of control expectations and resulted in little to no impact to the targeted area.

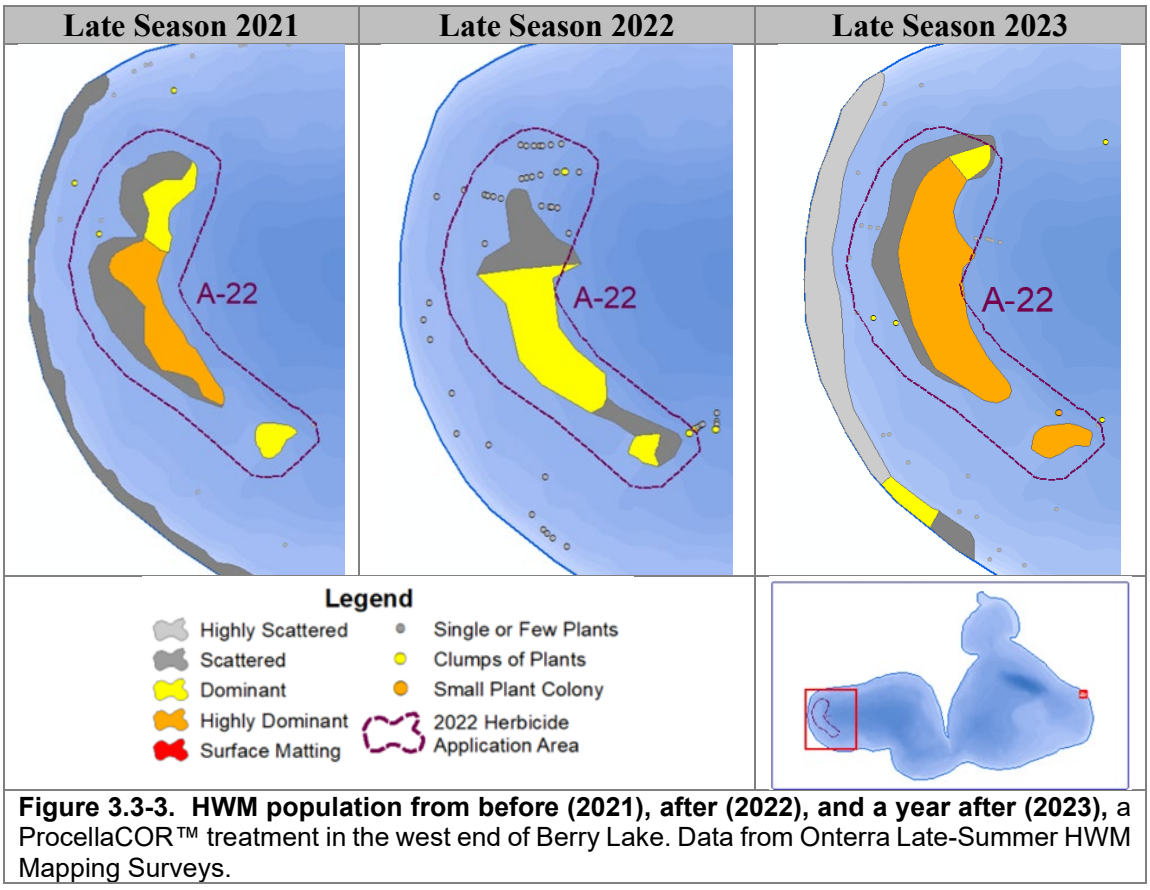


Figure 3.3-3. HWM population from before (2021), after (2022), and a year after (2023), a ProcellaCOR™ treatment in the west end of Berry Lake. Data from Onterra Late-Summer HWM Mapping Surveys.

4. 0 CONCLUSIONS AND DISCUSSION

From the 2023 point-intercept survey, the native aquatic plant community in Berry Lake is of high quality. The average species richness, average conservationism, and floristic quality have all been above both the Ecoregion and state median values.

Year after treatment monitoring of the 2022 herbicide management site confirmed that the treatment was unsuccessful and no negative impacts to native plants were apparent from the analysis of the monitoring that took place. Hand removal efforts resulted in HWM suppression in the targeted site during 2023 but a much greater amount of effort would have been required to maintain or reduce the HWM population.

The HWM population expanded in Berry Lake between 2022 and 2023 with several colonized areas mapped around both basins of the lake. The HWM population in the eastern basin remains somewhat lower than levels that were documented prior to the 2020 ProcellaCOR treatment.

The BLPOA completed a project to update their Aquatic Plant Management Plan during 2023. The updated plan creates a framework for the BLPOA to utilize an integrated pest management strategy to work towards meeting their HWM management goals.

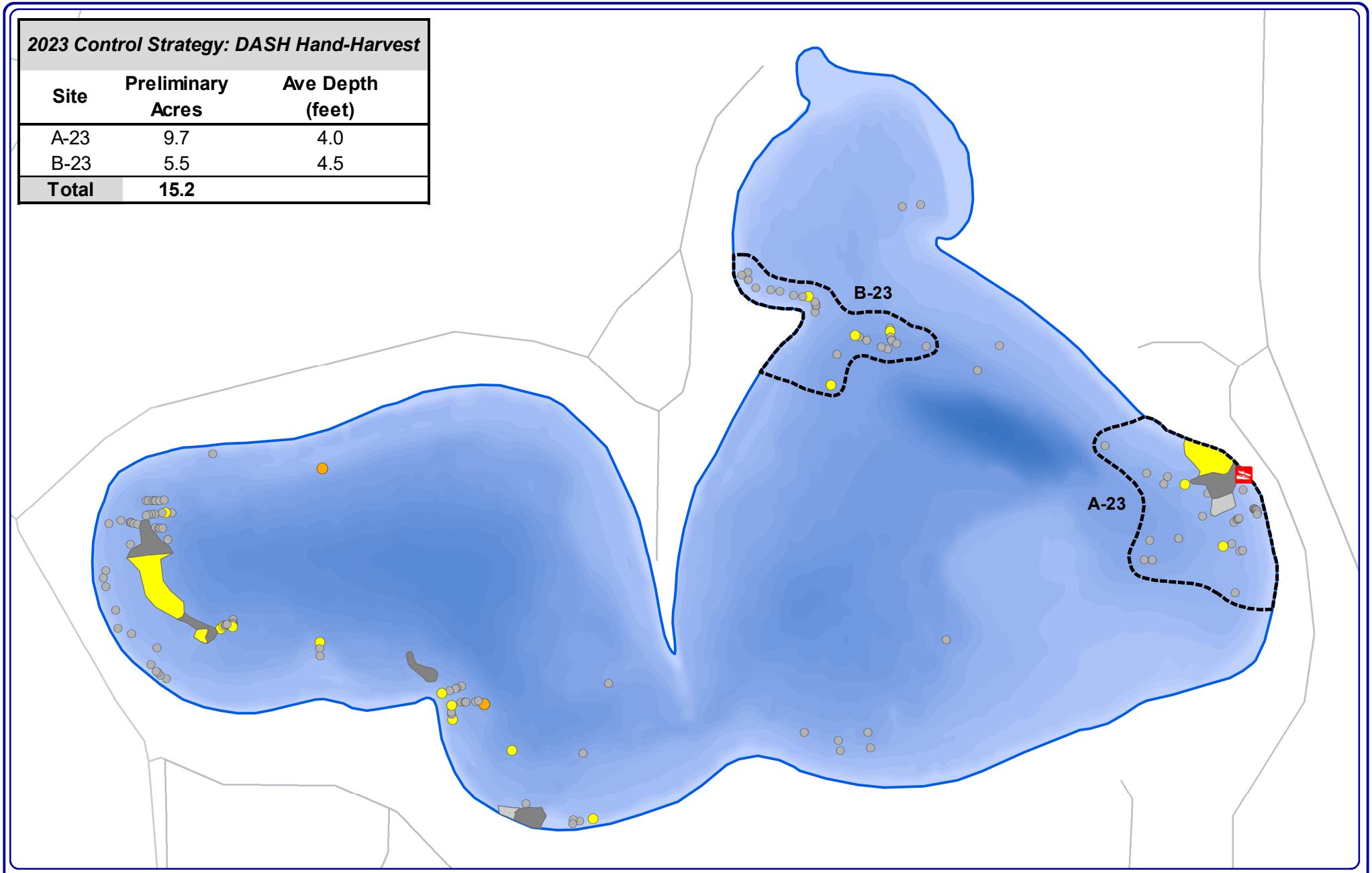
5.0 2024 HWM MANAGEMENT AND MONITORING STRATEGY

The HWM population in the western basin have exceeded levels that can be managed with hand-harvesting, so the BLPOA opted to move forward with a fall 2023 WDNR grant application to a whole-basin ProcellaCOR treatment in this basin during 2024. All HWM colonies within the western basin would be targeted with direct application of ProcellaCOR, reaching a basin-wide concentration of approximately 1.0 ppb. This is slightly on the higher side, to account for inevitable loss into the eastern basin. Some impacts from the western basin treatment would be anticipated in the eastern basin within proximity to the entrance to the western basin.

Unfortunately, the AIS Control Grant was not successful. The grant cycle was very competitive, with only 4 projects receiving funding in this category statewide. After much discussion, the BLPOA opted to postpone the large-scale HWM management plan potentially until spring 2025 following another grant application opportunity in fall of 2024. The BLPOA will instead focus their 2024 efforts on financial fund raising activities in the event that future grants continue to be difficult to obtain. They will also ensure the necessary pretreatment monitoring has been completed to be prepared for herbicide application in spring 2025.

The BLPOA's Aquatic Plant Management Plan discusses their desire for staggered eastern vs western whole-basin treatments (not in the same year) in an effort to protect the native plant community, particularly native dicots like bladderworts which are abundant in this system. Depending on the progression of the EWM population in 2024, the BLPOA may have to consider a whole-lake treatment in 2024 as opposed to their preferred staggered approach.

2023 Control Strategy: DASH Hand-Harvest		
Site	**Preliminary Acres**	**Ave Depth (feet)**
A-23	9.7	4.0
B-23	5.5	4.5
Total	**15.2**	



N
W E
S

550
Feet

Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources
Roads & Hydro: WDNR
Bathymetry: 2017 ; Onterra
Aquatic Plants: Onterra, 2022
Map Date: May 11th, 2023 AMS


Project Location in Wisconsin

Legend

EWM Survey: (9/1/2022)
- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony

2023 Proposed DASH Area

Map 1
Berry Lake
Oconto County, Wisconsin

Late-Summer 2022 HWM Survey Results & 2023 Preliminary DASH Strategy

N
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550
Feet

Onterra, LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Roads and Hydro: WDNR
Bathymetry: Onterra, 2017
Aquatic Plants: Onterra, 2022
Orthophtography: NAIP, 2022
Map Date: October 10th, 2023 KLW

Project Location in Wisconsin

Legend

Eurasian watermilfoil (September 1, 2023)

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony

Map 2
Berry Lake
Oconto County, Wisconsin

Late-Summer 2023 HWM Survey Results

A

APPENDIX A

Berry Lake EWM Removal Report 2023 – Aquatic Plant Management LLC

EST. 2013

AQUATIC PLANT MANAGEMENT

Berry Lake EWM Removal Report 2023

PO Box 1134 Minocqua, WI 54548

Berry EWM Removal Summary 2023

Dive Background: In July, Aquatic Plant Management LLC (APM) conducted two (2) days of Diver Assisted Suction Harvesting (DASH) for Eurasian Watermilfoil (EWM) on Berry Lake in Oconto County, WI. The team focused their efforts at 1 sites as prioritized by the Berry Lake Property Owners Association. In total APM was able to remove **101 cubic feet of EWM** from Berry Lake.

Date	Weather Conditions	Water Temp (F)	Underwater Dive Time (hrs)	AIS Removed (cubic ft)
7/19/2023	Cloudy	67	5.9	45.0
7/20/2023	Periods of rain	70	5.7	56.0
Grand Total			**11.6**	**101.0**

Dive Location	Avg. Water Depth	# of Dives	Underwater Dive Time	AIS Removed (cubic feet)
B-23	8.0	11	11.6	101.0
Grand Total	**8.0**	**11**	**11.6**	**101.0**

Dive Highlights and Recommendations: The dive team spent all of their time at site B-23, where they encountered a hig amount of native plant density that hindered progress. Overall, Berry Lake should continue to take an Integrated Pest Management (IPM) approach and evaluate different strategies to manage the EWM population on the lake. Continued monitoring and management efforts are important to prevent the spread of EWM throughout Berry Lake.

Map of Berry Lake Dive Sites

Detailed Diving Activities

Date	Dive Location	Latitude	Longitude	Underwater Dive Time (hrs)	AIS Removed (cubic ft)	AIS Density	Avg Water Depth (ft)	Native Species	Native By-Catch	Substrate Type
7/19/2023	B-23	44.89149	-88.47550	0.58	3.0	Clumps	7.0	Pondweeds	1.0	Organic
7/19/2023	B-23	44.89141	-88.47595	1.00	8.5	Scattered	7.0	Pondweeds	0.5	Organic
7/19/2023	B-23	44.89159	-88.47612	1.42	12.0	Clumps	10.0	Pondweeds	1.0	Organic
7/19/2023	B-23	44.89159	-88.47612	1.25	15.0	Clumps	10.0	Grasses	3.0	Organic
7/19/2023	B-23	44.89205	-88.47728	0.75	0.5	Single or Few	6.0	Grasses	0.5	Organic
7/19/2023	B-23	44.89195	-88.47751	0.92	6.0	Clumps	6.5	Grasses	1.5	Organic
7/20/2023	B-23	44.89136	-88.47562	0.92	4.5	Scattered	8.0	Grasses	1.0	Organic
7/20/2023	B-23	44.89143	-88.47588	1.25	10.0	Clumps	8.0	Grasses	2.0	Organic
7/20/2023	B-23	44.89166	-88.47629	0.92	4.0	Scattered	8.0	Grasses	0.5	Organic
7/20/2023	B-23	44.89179	-88.47662	1.42	25.5	Highly Dominant	8.0	Grasses	1.5	Organic
Total	**10**			**10.43**	**89.0**					

B

APPENDIX B

2021-2023 Subsample Point-Intercept Survey - Littoral Frequency of Occurrence (LFOO) of Aquatic Plants

2007-2023 Whole-lake Point-Intercept Surveys - LFOO

2022 Treatment Monitoring: subsample point-intercept survey n=35

Scientific Name	Common Name	LFOO (%)		
		June 2022	September 2022	September 2023
Myriophyllum spicatum	Eurasian watermilfoil	71.4	42.9	65.7
Potamogeton robbinsii	Fern-leaf pondweed	45.7	54.3	45.7
Najas guadalupensis	Southern naiad	57.1	54.3	22.9
Potamogeton illinoensis	Illinois pondweed	8.6	28.6	17.1
Vallisneria americana	Wild celery	8.6	14.3	17.1
Potamogeton gramineus	Variable-leaf pondweed	8.6	17.1	14.3
Chara spp.	Muskgrasses	8.6	2.9	2.9
Potamogeton praelongus	White-stem pondweed	0.0	5.7	2.9
Ceratophyllum demersum	Coontail	0.0	0.0	2.9
Potamogeton praelongus X P. richards	White-stem pondweed X claspin	2.9	0.0	0.0
Potamogeton amplifolius	Large-leaf pondweed	0.0	2.9	0.0
Brasenia schreberi	Watershield	0.0	2.9	0.0

Whole-Lake Point-Intercept Surveys: LFOO

Scientific Name	Common Name	LFOO (%)														
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2023
Chara & Nitella	Charophytes	33.5	37.6	41.1	46.4	39.0	37.1	38.8	33.2	26.9	18.4	24.4	30.9	25.7	26.2	27.5
Chara spp.	Muskgrasses	32.3	36.0	39.9	45.1	38.3	36.1	37.4	32.2	26.6	16.5	21.8	30.6	25.7	24.9	27.5
Najas flexilis & N. guadalupensis	Slender & Southern naiads	30.3	33.3	41.5	41.7	42.6	34.4	37.8	41.3	23.6	20.6	20.8	11.3	14.8	25.2	23.8
Potamogeton gramineus & P. illinoens	Variable-leaf & Illinois pondweed	33.5	16.7	33.2	30.2	36.2	40.2	44.6	35.2	9.4	17.1	23.4	24.1	17.7	29.7	22.5
Potamogeton robbinsii	Fern-leaf pondweed	21.6	24.8	32.0	26.0	24.5	31.3	27.9	26.2	19.2	20.6	18.5	21.3	18.0	17.4	24.7
Utricularia resupinata	Northeastern bladderwort	27.7	26.0	28.1	19.6	17.4	20.3	21.8	24.8	21.5	26.1	20.1	21.3	22.2	24.3	17.9
Potamogeton gramineus	Variable-leaf pondweed	14.8	7.0	22.9	27.2	24.8	29.6	34.7	30.9	9.4	14.2	16.9	18.8	14.1	24.0	18.5
Najas guadalupensis	Southern naiad	0.0	0.0	0.0	39.6	36.9	30.9	33.7	36.9	17.8	18.1	15.6	9.7	10.3	18.9	17.6
Potamogeton praelongus	White-stem pondweed	18.4	13.2	18.6	23.8	18.4	21.6	19.7	23.8	16.8	16.8	14.6	3.4	2.9	2.2	7.1
Vallisneria americana	Wild celery	10.6	15.1	17.4	13.6	11.0	18.6	19.4	21.8	16.2	11.3	9.4	7.5	9.3	11.0	14.5
Potamogeton illinoensis	Illinois pondweed	23.9	11.6	15.4	4.7	17.0	24.7	22.4	7.7	0.0	3.2	7.8	6.6	3.5	9.5	5.2
Najas flexilis	Slender naiad	30.3	33.3	41.5	2.6	5.7	3.4	4.1	5.7	7.4	2.6	5.2	1.6	4.8	7.9	6.5
Myriophyllum spicatum	Eurasian watermilfoil	0.0	0.4	0.4	8.9	18.1	2.1	10.9	14.8	3.7	9.7	25.3	2.2	5.5	1.6	6.8
Potamogeton amplifolius	Large-leaf pondweed	15.8	14.3	9.1	5.5	9.9	9.6	13.6	8.4	5.1	1.6	6.2	1.9	0.3	2.2	1.2
Brasenia schreberi	Watershield	3.9	1.9	2.8	3.0	3.9	7.2	6.8	5.7	6.7	6.5	6.8	5.6	4.8	3.2	4.0
Utricularia gibba	Creeping bladderwort	0.0	5.8	1.2	2.1	2.8	5.8	2.7	1.0	1.3	0.6	1.0	2.8	1.6	0.0	5.2
Nitella spp.	Stoneworts	6.1	1.6	1.2	3.0	1.8	1.7	1.4	1.3	0.3	2.3	2.6	0.9	0.0	1.9	0.0
Nymphaea odorata	White water lily	0.6	0.4	0.0	0.0	1.1	1.0	1.7	1.7	1.3	0.0	0.3	0.9	1.9	1.3	2.5
Myriophyllum sibiricum	Northern watermilfoil	1.6	2.3	2.0	5.1	6.4	1.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Utricularia vulgaris	Common bladderwort	0.0	0.0	0.0	0.0	0.4	0.7	0.7	0.3	0.3	1.0	0.6	4.1	3.9	3.2	0.6
Eleocharis acicularis	Needle spikerush	0.0	0.4	0.0	1.3	2.1	0.7	1.4	0.0	0.3	0.3	0.0	4.1	1.3	0.6	1.5
Potamogeton pusillus	Small pondweed	0.0	0.0	2.0	3.4	1.1	0.3	1.7	1.3	0.0	0.6	0.3	0.0	0.6	0.9	1.2
Myriophyllum tenellum	Dwarf watermilfoil	0.6	0.4	1.2	0.4	0.4	1.0	1.0	0.3	1.3	0.3	1.0	2.2	1.3	0.0	0.9
Stuckenia pectinata	Sago pondweed	1.0	1.9	2.0	1.3	0.4	2.1	2.7	0.3	0.7	0.3	0.0	0.0	0.0	0.0	0.0
Elodea canadensis & E. nuttallii	Common & Slender waterweeds	0.6	1.2	2.0	0.4	0.4	0.3	0.0	0.3	0.3	0.0	0.0	0.3	0.0	0.0	1.2
Utricularia intermedia	Flat-leaf bladderwort	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7	0.3	0.3	1.6	1.6	0.6	0.6
Elodea canadensis	Common waterweed	0.6	1.2	2.0	0.4	0.4	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	1.2
Schoenoplectus pungens	Three-square rush	0.0	0.0	0.0	0.0	1.4	0.3	1.4	2.3	0.0	0.0	1.0	0.0	0.3	0.0	0.0
Potamogeton richardsonii	Clasping-leaf pondweed	0.0	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.0
Schoenoplectus acutus	Hardstem bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.6	1.0	1.3	0.3
Potamogeton natans	Floating-leaf pondweed	0.0	0.0	0.4	0.0	0.0	0.0	0.3	0.0	0.0	0.6	0.0	0.0	0.3	0.6	0.6
Utricularia geminiscapa	Twin-stemmed bladderwort	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	1.9	0.6	0.0	0.0
Sagittaria sp. (rosette)	Arrowhead sp. (rosette)	1.6	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0
Juncus pelocarpus	Brown-fruited rush	0.3	0.0	0.8	0.9	0.4	0.0	0.3	0.7	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Potamogeton zosteriformis	Flat-stem pondweed	0.3	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.6	0.3
Potamogeton strictifolius	Stiff pondweed	0.6	0.0	0.0	0.4	0.7	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.3	0.0
Utricularia minor	Small bladderwort	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.6	0.0
Ceratophyllum demersum	Coontail	0.0	0.0	0.0	0.4	0.0	0.0	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.6	0.0
Fissidens spp. & Fontinalis spp.	Aquatic Moss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.9	0.0	0.0	0.0
Eleocharis palustris	Creeping spikerush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.6	0.3	0.0	0.0
Schoenoplectus tabernaemontani	Softstem bulrush	0.0	0.0	0.0	0.0	0.4	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nuphar variegata	Spatterdock	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Isoetes spp.	Quillwort spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.6	0.0
Eriocaulon aquaticum	Pipewort	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0
Bidens beckii	Water marigold	0.0	0.0	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Lysimachia terrestris	Bulbil loosestrife	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Sparganium sp.	Bur-reed sp.	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pontederia cordata	Pickerelweed	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Elodea nuttallii	Slender waterweed	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potamogeton X scoliophyllus	Large-leaf X Illinois pondweed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alisma spp.	Water plantain sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Typha spp.	Cattail spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sparganium eurycarpum	Common bur-reed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Ranunculus aquatilis	White water crowfoot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Persicaria amphibia	Water smartweed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
Lemna minor	Lesser duckweed	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Elatine minima	Waterwort	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0