

INTRODUCTION

Eurasian water milfoil (EWM, *Myriophyllum spicatum*) was first discovered in Squash Lake in 2009. In September of that year, Onterra ecologists completed a full-lake meander-based survey to locate and map its locations. That survey revealed that Eurasian water milfoil was spread within near-shore areas around the lake, but at very low abundance, mainly in the northern, northwestern, and western portions of the lake. The results of this survey along with potential management options were presented to members of the Squash Lake Association, Inc. (SLA). After reviewing these options, the association decided to move forward with an aggressive hand-harvesting effort to reduce the Eurasian water milfoil population in Squash Lake.

Hand-harvesting using paid scuba divers began during the 2010 growing season, and have since been carried out through the growing seasons of 2011, 2012, and 2013. Seventy-five percent of the cost of these hand-harvesting efforts, training, and associated monitoring has been funded through WDNR AIS Early Detection and Response Grants awarded to the SLA in 2009 and 2011. The SLA recently received a third WDNR AIS Early Detection and Response Grant in February of 2013 to continue their hand-harvesting and monitoring efforts through 2013.

EARLY-SEASON AIS SURVEY RESULTS

On July 9, 2013, Onterra ecologists visited Squash Lake to complete an early-summer EWM mapping survey. While EWM surveys are normally conducted later in the summer to coincide with its peak growth, this early-July survey was intended to locate areas of EWM so these data could be relayed to SLA hand-harvesters. With these locations, the SLA hand-harvesters could better allocate their time to removing EWM rather than searching the lake for suitable areas to conduct hand-removal. The results of the Early-season AIS (ESAIS) Survey were digitally formatted into a basemap that was loaded onto the association's GPS unit.

Monitoring EWM control strategies and defining their success can be completed through qualitative and quantitative methods. Due to the small size of this Squash Lake's EWM infestation, quantitative monitoring methodologies were not implemented. Qualitative monitoring was completed by comparing observational data such as EWM colony density ratings before and after the control strategy was implemented. Large EWM colonies over 40 feet in diameter were mapped using polygons (areas), while *small plant colonies*, *clumps of plants*, and *single or few plants* were mapped using points. Colonies marked with polygons were designated using a 5-tiered density scale as follows: *Surface Matting* > *Highly Dominant* > *Dominant* > *Scattered* > *Highly Scattered*.

The early-July 2013 ESAIS survey revealed that the occurrence of EWM had increased in the northern portion of the lake (Dog Ear Bay and Saw Mill Bay) from the previous September 2012 survey (Map 1 and Map 2). The occurrence of EWM was found to have declined along the shoreline between Saw Mill Bay and Pickerel Bay, and along the shoreline from Pickerel Bay up to Finger Bay. The level of EWM observed in July 2013 was similar to the level observed in September 2012 within Finger Bay, Serenity Bay, and Resort Bay. The decline observed along the northwestern and western portion of the lake can be attributed to the hand-harvesting efforts conducted in this area prior to the July 2013 survey.

LATE-SUMMER EWM PEAK-BIOMASS SURVEY RESULTS

On September 17, 2013, Onterra ecologists visited Squash Lake to conduct the late-summer EWM Peak-biomass Survey. Like the July 2013 survey, this was a meander-based survey of the lake's littoral zone to locate and map locations of EWM. Like most native aquatic plants, EWM continues to grow and spread throughout the summer. For this reason, a late-summer EWM survey was conducted to understand the peak growth (peak-biomass) of the EWM population during 2013. Comparing the 2013 peak-biomass survey results to those at the same growth stage the summer prior to the control activities took place is the best way to evaluate the strategy. The results of the 2013 EWM Peak-biomass Survey are also important in developing and preparing for the following year's control strategy.

Squash Lake – North

As mentioned previously, EWM within the northern-most portion of Squash Lake (Dog Ear Bay and Saw Mill Bay) increased in occurrence from September 2012 to July 2013, with numerous *single or few plants* and *clumps of plants* located (Figure 1). In addition, two small colonized areas of EWM were located in Dog Ear Bay during July 2013 and three small colonized areas were located in Saw Mill Bay.

The hand harvesting log provided by the SLA indicates that approximately 572 diver hours of hand removal were conducted in the northern portion of Squash Lake in 2013, accounting for approximately 66% of the total diver hours for 2013. The September 2013 EWM survey revealed that the hand harvesting efforts within Dog Ear Bay were effective, as the *scattered* and *dominant* EWM colonies located in July contained almost no EWM following the control activities. In addition, the number of *single or few plants* and *clumps of plants* were also reduced in this area.

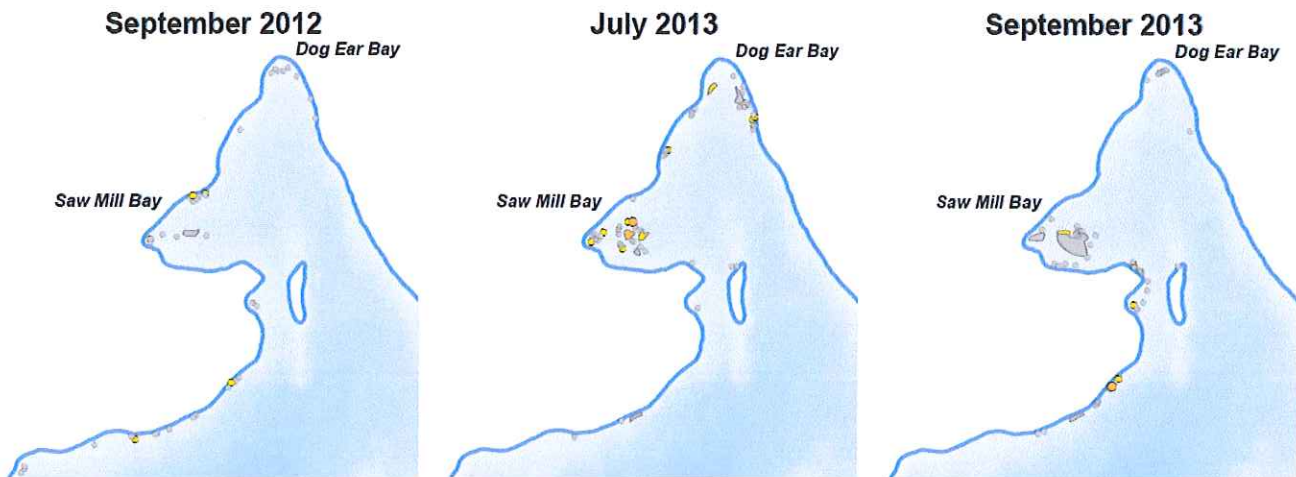


Figure 1. Squash Lake – North EWM locations from September 2012, July 2013, and September 2013 surveys. Gray Point = Single Plant; Yellow Point = Clumps of Plants; Orange Point = Small Plant Colony; Gray Polygon = Scattered; Yellow Polygon = Dominant; Orange Polygon = Highly Dominant.

The hand harvesting also proved effective along the shoreline between Dog Ear Bay and Saw Mill Bay, as no EWM could be located in this area in September 2013. Within Saw Mill Bay, the small *highly dominant* and *dominant* colonies of EWM located in July of 2013 could not be relocated in September 2013, indicating hand-harvesting was effective at reducing EWM density in this area.

However, a larger *scattered* colony of EWM still remained in this area in September 2013, along with a small *dominant* and another *scattered* colony. Overall, it appears the hand-harvesting was effective at reducing the densest colonies of EWM and maintaining low-density colonies of EWM within Saw Mill Bay.

The number of *single or few plants* and *clumps of plants* encountered along the shoreline and within the bay west of the island increased from the July 2013 to September 2013 surveys, and a slight increase in EWM occurrence was also observed along the northwest shoreline from July 2013 to September 2013. Overall, when comparing EWM within the northern portion of Squash Lake from September 2012 to September 2013, the results are mixed. EWM was reduced in Dog Ear Bay and along the northwest shore, while EWM increased in Saw Mill Bay and along the shoreline west of the island. However, given the increase in EWM observed in this area from September 2012 to July 2013, the hand-harvesting efforts appear to have been successful at reducing/removing the densest colonies of EWM and maintain a low-density population of EWM within this area.

Squash Lake – West-Southwest

The west-southwest region of Squash Lake includes Pickerel Bay, Water Lily Bay, Finger Bay, Serenity Bay, Resort Bay, and shoreline areas between these bays (Figure 2). The hand-harvesting log provided by the SLA indicates that approximately 272 diver hours were spent hand-removing within this area, or approximately 31% of the 2013 total diver hours. The occurrence of EWM from Pickerel Bay south along the shoreline to just outside of Finger Bay had declined from the September 2012 to July 2013 survey, likely due to hand-harvesting efforts in 2012 following the EWM survey and in 2013 prior to the July 2013 survey. However, EWM either rebounded or recolonized within this area following the July 2013 survey, as a number of *single or few plants* and *clumps of plants* were observed in this area in September 2013.

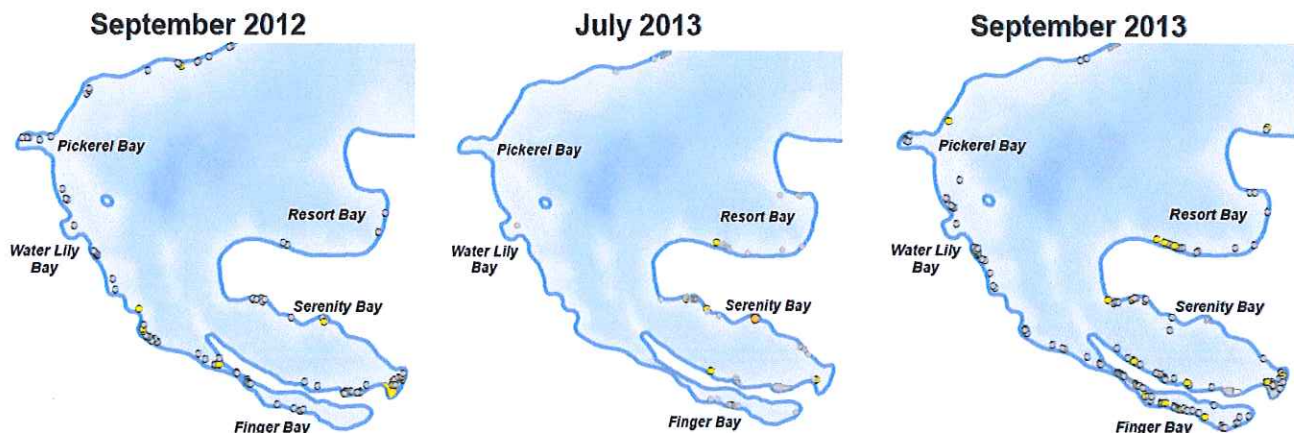


Figure 2. Squash Lake – West-Southwest EWM locations from September 2012, July 2013, and September 2013 surveys. Gray Point = Single Plant; Yellow Point = Clumps of Plants; Orange Point = Small Plant Colony; Gray Polygon = Scattered; Yellow Polygon = Dominant; Orange Polygon = Highly Dominant.

The EWM within Finger Bay in July 2013 was relatively similar to what was observed in September 2012, a small number of *single or few plants* and *clumps of plants*. Unfortunately, the September 2013 survey revealed that EWM had increased within this area since July 2013, with many more *single or few plants* and *clumps of plants* observed, along with a small *scattered* colony of EWM. Finger Bay is

relatively shallow, highly vegetated, and comprised of soft, flocculent substrates which make hand-removal within this area more difficult.

The EWM within Serenity Bay was relatively similar from September 2012 to July 2013, though the colony of *dominant* EWM on the eastern end of the bay had been removed. An area on the south eastern end of the bay that had been marked with point-based mapping had increased to an area of *scattered* EWM. The September 2013 survey indicated that the occurrence of EWM had increased around the shoreline of Serenity Bay from July 2013, with the number of *single or few plants* and *clumps of plants* increasing. Half of the colony marked as *scattered* in July 2013 was reduced in density to *highly scattered*. In Resort Bay, more *single or few* and *clumps of plants* were located in near-shore areas in July 2013 than in September 2012. There was also a slight increase observed in this bay from July 2013 to September 2013.

Looking at the west-southwest portion of Squash Lake as a whole, EWM increased slightly from September 2012 to September 2013, but not evenly across this area. The level of EWM along the western shore was relatively similar in September 2012 and September 2013, and the most notable increases were in Finger Bay, Serenity Bay, and Resort Bay. However, the largest and densest colony of EWM located in September 2012, the *dominant* colony in the eastern portion of Serenity Bay, was reduced by one density rating to *scattered* in September 2013.

Squash Lake – East

The eastern portion of Squash Lake contains Heron Bay, Singing Frog Bay, Sleeping Turtle Bay, and Loon Bay. Hand-harvesting data provided by the SLA indicates that approximately 2.8 diver hours were spent hand-removing EWM within this area, or approximately 3% of the total 2013 diver hours. Since 2009, very little EWM has been located in this area, and only one plant was located within Singing Frog Bay in September 2012. No EWM was located within this area in July 2013, while a handful of *single or few plants* were located along the eastern shore of this area in September 2013, representing a slight increase in EWM since September 2012.



Figure 3. Squash Lake – East EWM locations from September 2012, July 2013, and September 2013 surveys. Gray Point = Single Plant; Yellow Point = Clumps of Plants; Orange Point = Small Plant Colony; Gray Polygon = Scattered; Yellow Polygon = Dominant; Orange Polygon = Highly Dominant.

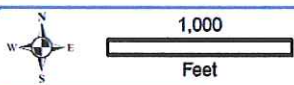
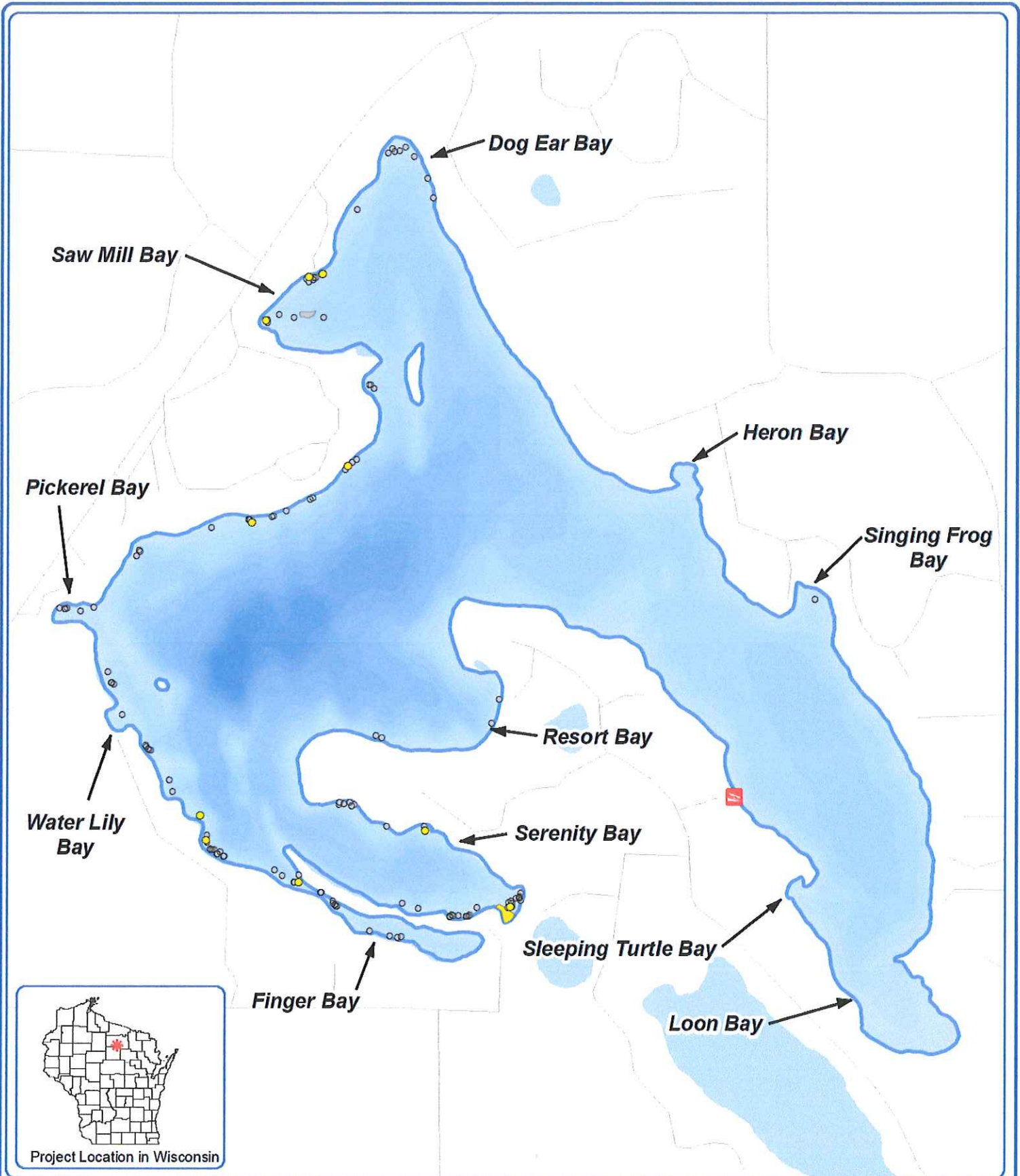
2013 CONCLUSIONS

The 2013 hand-harvesting on Squash Lake was effective at removing/reducing the densest, colonized areas of EWM, and declines in the occurrence of EWM were observed areas such as Dog Ear Bay and the northwest shore. However, there was an increase in EWM observed in some areas as well, most notably in the south-southwest portion of Squash Lake within Finger and Serenity Bays.

The northern portion of Squash Lake saw the highest level of hand-removal effort in 2013, with approximately 572 hours spent in this area. While there is more EWM within this area, particularly in Saw Mill Bay, than was observed in 2012, the level of effort spent within this area was effective at removing and/or reducing the *highly dominant* and *dominant* colonies of EWM mapped in July 2013. The approximately 272 diver hours spent in the south-southwest portion of Squash Lake was sufficient to reduce the *dominant* colony of EWM on the eastern end of Serenity Bay and to maintain the level of EWM along the western shore. However, the number of *single or few plants* and *clumps of plants* increased within Finger Bay and along the shorelines of Serenity Bay.

On a lake-wide level, EWM appears to have increased slightly in Squash Lake from 2012 to 2013; mostly in the form of *single or few plants* and *clumps of plants* within the south-southwest portion of the lake. However, the EWM population in Squash Lake remains small, with the densest areas reduced or removed by hand-removal.

Paid hand-harvesting activities targeting EWM will continue on Squash Lake in 2014. The SLA is currently in the process of forming an Implementation Plan as part of their lake management planning project. The Implementation Plan will outline a control strategy that builds on the successes of the current hand-harvesting program and outline, including a framework that will determine where efforts will be focused and criteria that will be used to evaluate the success of future control efforts. The Implementation Plan will also outline a funding strategy for conducting future hand-harvesting efforts.



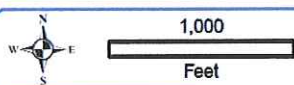
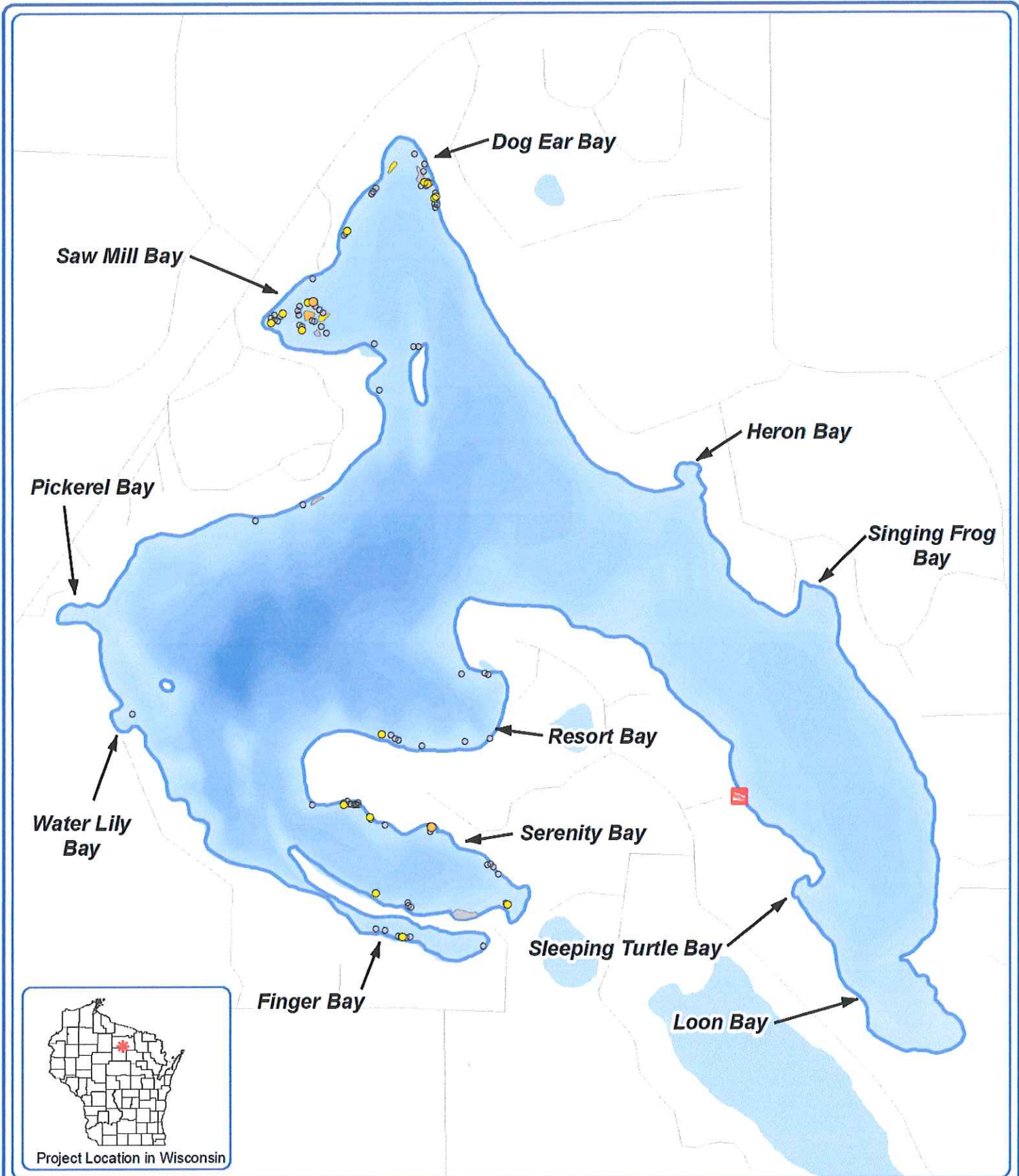
Legend

- | Large EWM Community | Small EWM Community |
|---------------------|---------------------|
| Highly Scattered | Single or Few |
| Scattered | Clumps of Plants |
| Dominant | Small Plant Colony |
| Highly Dominant | |
| Surface Matting | |

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 www.onterra-eco.com

Sources:
 Roads and Hydro: WDNR
 Bathymetry: WDNR 1975; digitized by Onterra
 Aquatic Plants: Onterra, 2012
 Map Date: August 21, 2013
 Filename: Map1_Squash_EWM_Sep112.mxd

Map 1
 Squash Lake
 Oneida County, Wisconsin
**September 2012 EWM
 Survey Locations**



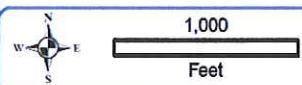
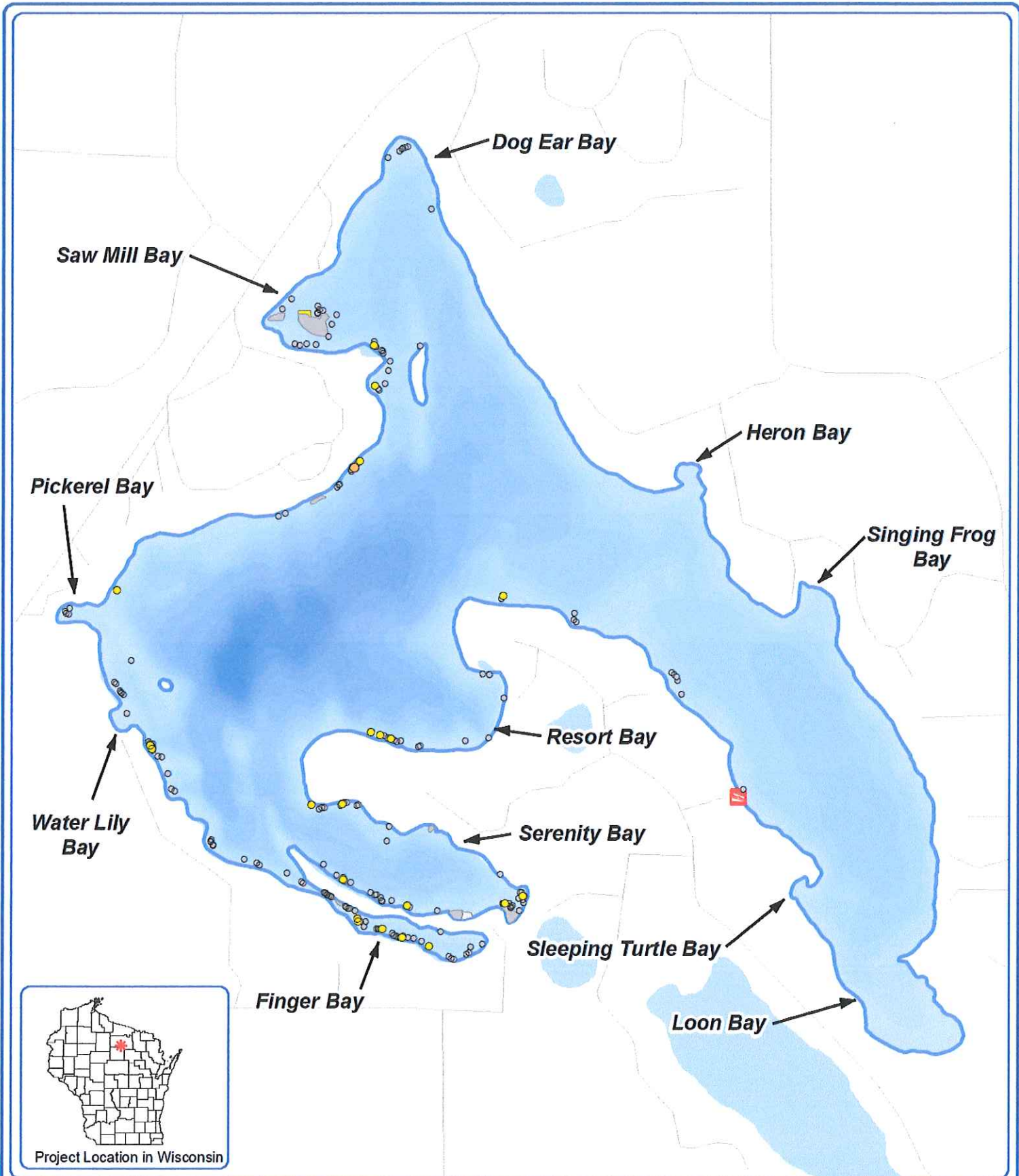
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Sources:
 Roads and Hydro: WDNR
 Bathymetry: WDNR 1975; digitized by Onterra
 Aquatic Plants: Onterra, 2013
 Map Date: August 21, 2013
 Filename: Map2_Squash_EWM_July13.mxd

Legend

- | | |
|----------------------------|----------------------------|
| Large EWM Community | Small EWM Community |
| Highly Scattered | Single or Few |
| Scattered | Clumps of Plants |
| Dominant | Small Plant Colony |
| Highly Dominant | |
| Surface Matting | |

Map 2
 Squash Lake
 Oneida County, Wisconsin
**July 2013 EWM
 Survey Locations**



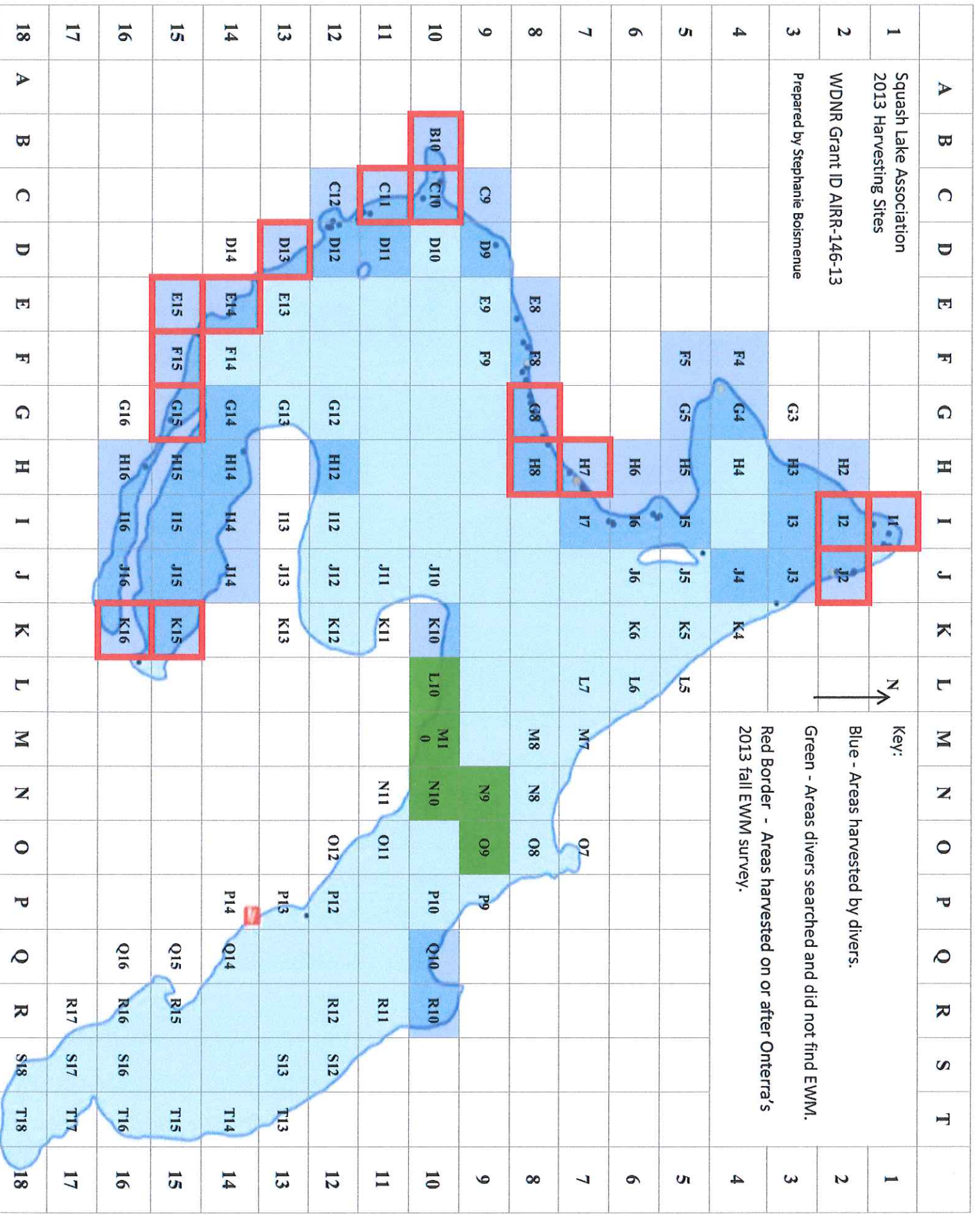
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Sources:
 Roads and Hydro: WDNR
 Bathymetry: WDNR 1975; digitized by Onterra
 Aquatic Plants: Onterra, 2013
 Map Date: October 11, 2013
 Filename: Map3_Squash_EWM_Sep13.mxd

Legend

- | | |
|----------------------------|----------------------------|
| Large EWM Community | Small EWM Community |
| Highly Scattered | Single or Few |
| Scattered | Clumps of Plants |
| Dominant | Small Plant Colony |
| Highly Dominant | |
| Surface Matting | |

Map 3
 Squash Lake
 Oneida County, Wisconsin
**September 2013 EWM
 Survey Locations**



Project 2013 EWM Harvesting Sites Within Each Area of the Lake. WDNr Grant ID 146-13

Prepared by Stephanie Bolsmentre 11-01-2013

Notes: *Dates highlighted in green represent areas the divers checked and did not find any September 17th, 2013 EWM Survey.

Harvesting Sites	2013 Harvesting Dates														
B10	5/22	5/24	8/22	10/10											
C9	6/24	8/22													
C10	6/24	6/25	6/26	6/27	8/22										
C11	6/24	6/25	6/26	6/27	8/22										
C12	6/25														
D9	6/24	8/21													
D11	6/26	9/2													
D12	9/2	9/3													
D13	6/26	8/23	10/10												
E8	6/19	6/20													
E14	5/13	5/14	5/15	8/23	10/8										
E15	5/15	8/23	10/8												
F4	7/23	7/29													
F5	7/23	7/29													
F8	8/19														
F15	5/17	6/27	7/1	10/8											
G4	7/15	7/16	7/19	7/22	7/23	7/24	7/25	7/26	7/29	7/31	8/1	8/2	8/5	8/6	8/13
G5	7/19	7/23	7/24	7/25	7/29	7/31	8/1	8/2	8/5	8/6					
G8	7/8	7/9	8/19	10/10											
G14	7/18														
G15	6/27	7/1	7/8	9/16	10/8										
H2	7/11	8/7	8/13	8/15											
H3	7/11	8/7	8/13	8/15											
H5	7/29														
H6	5/24	5/25	5/28	7/22											
H7	7/10	7/11	10/4	10/10											
H8	10/4	10/10													
H12	7/16														
H14	7/18														
H15	7/8	7/18													
H16	5/17	7/1													
I1	8/14	8/27													
I2	7/10	7/11	8/14	8/15	8/27	9/13	9/24								
I3	8/19														
I5	5/25	8/23													
I6	5/25	5/28	7/22	8/23											
I14	7/18														

Project 2013 EWM Harvesting Sites Within Each Area of the Lake. WDNr Grant ID 146-13

Prepared by Stephanie Bolsmentre 11-01-2013

Notes: *Dates highlighted in green represent areas the divers checked and did not find any September 17th, 2013 EWM Survey.

Harvesting Sites	2013 Harvesting Dates											
I15	7/18											
I16	5/17											
J2	7/10	8/7	8/13	8/15	8/16	8/27	9/11	9/13	9/17	9/18	9/19	
J3	7/16	8/16	8/19	9/10	9/11	9/13						
J4	6/24	9/3	9/10	9/11								
J14	7/18											
J15	7/18											
J16	5/17	9/30										
K10	7/16											
K15	6/3	6/5	6/17	6/18	7/18							
K16	5/17	9/30										
L10	7/14											
M10	7/14											
N9	7/14											
N10	7/14											
N11	7/14											
O9	7/14											
Q10	6/18											
R10	6/18											