Eurasian Water-milfoil (*Myriophyllum spicatum*) Manual Rake and SCUBA Removal and Fall Bed Mapping Surveys Echo Lake – WBIC: 2630200 Barron County, Wisconsin

Eurasian water-milfoil (Berg 2007)

EWM SCUBA Removal 9/24/17

Project Initiated by:

Echo Lake Association, Lake Education and Planning Services, and the Wisconsin Department of Natural Resources

Eurasian Water-milfoil Removed 7/27/17

Surveys Conducted by and Report Prepared by:
Endangered Resource Services, LLC
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June 23, July 27, and September 24, 2017

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INTRODUCTION:

Echo Lake (WBIC 2630200) is a 172 acre stratified seepage lake in west-central Barron County, Wisconsin in the Town of Almena (T34N R14W S07 NE NE). The lake reaches a maximum depth of 41ft in the southeast corner of the central basin and has an average depth of 20ft (Busch et al. 1967)(Figure 1). Echo Lake is mesotrophic bordering on oligotrophic in nature, and water clarity is good to very good with summer Secchi readings from 2004-17 averaging 11.7ft (WDR 2017). The lake's bottom substrate is variable with sandy muck bottoms in most bays, and rock/sand bars along most points and around the islands.

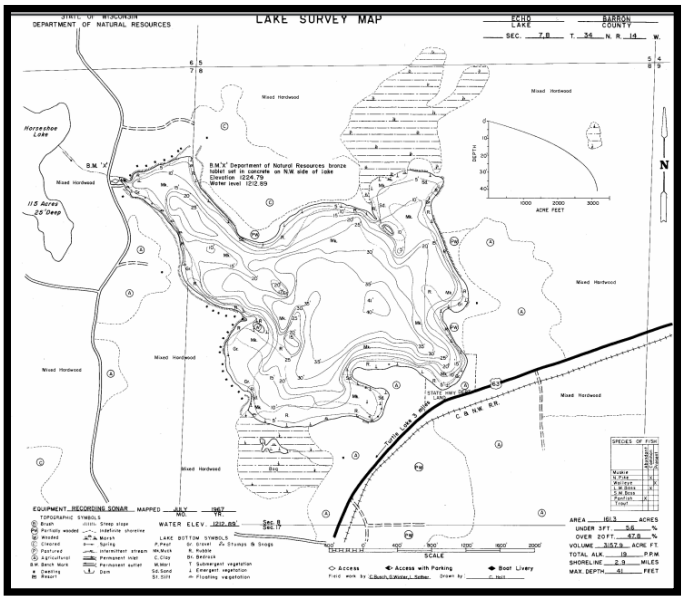


Figure 1: Echo Lake Bathymetric Map

BACKGROUND AND STUDY RATIONALE:

Eurasian water-milfoil (*Myriophyllum spicatum*) (EWM) was discovered in Echo Lake in 2006, and the Echo Lake Association (ELA) has been actively managing this invasive exotic species since 2008. The 2016 EWM bed mapping/rake removal surveys found extremely low numbers of EWM plants scattered throughout the lake; however, there was a super cluster of plants in the northeast corner of the northwest boat landing bay during the fall survey. To prevent further spread, the ELA, under the direction of Lake Education and Planning Services, Inc. (LEAPS), decided to treat 0.37 acre with granular 2,4-D with a target concentration of 4ppm in the spring of 2017. Following the treatment, we were asked to complete two lakewide EWM monitoring and manual rake removal surveys in addition to the previously scheduled point-incept surveys in the summer of 2017.

On September 21, 2017, Dave Blumer and Mike Clohisy (ELA President) toured the lake's shoreline and found enough EWM to justify an additional fall survey. Because many plants were located in water from 6-10ft deep making rake removal difficult, they requested we use SCUBA to complete dive removal in these areas. This report is the summary analysis of our three field surveys to locate and remove EWM on the lake in 2017. These data will also be used to determine where EWM control might be considered in 2018.

METHODS:

Summer Littoral Zone and Rake Removal Surveys:

During the June and July point-intercept surveys, we searched the lake's entire visible littoral zone for Eurasian water-milfoil. When found, we logged a GPS waypoint and used a rake to remove all EWM plants by the roots. Extra care was also taken to gather any fragments that broke off of the plants.

Fall Eurasian Water-milfoil SCUBA Removal and Bed Mapping Survey:

During the fall survey, in addition to rake removal, we used SCUBA when plants were densely clustered making it difficult to ensure complete root removal, or when they were too deep for us to guarantee we could rake out the entire root. When diving, the plant roots were gently removed from the substrate, and the stems were wound into a ball to avoid losing fragments. Plants were then placed in a mesh bag which was returned to the boat for disposal.

During the survey, we again searched the entire visible littoral zone of the lake and mapped all known beds of EWM. A "bed" was determined to be any area where we visually estimated that EWM made up >50% of the area's plants and was generally continuous with clearly defined borders. After we located a bed, we motored around the perimeter of the area, took GPS coordinates at regular intervals, and estimated the average rake fullness rating of EWM within the bed. Using the WDNR's Forestry Tool's Extension to ArcGIS 9.3.1, we used these coordinates to generate bed shapefiles and determine the acreage to the nearest hundredth of an acre. We also GPS marked individual EWM plants outside of the beds.

RESULTS AND DISCUSSION:

June Littoral Zone and Rake Removal Survey:

As in 2016, heavy spring rain events brought water levels in the lake up from1-2ft and led to unusually poor water clarity relative to historic conditions. During our initial visit in June, we found that the functional littoral zone had shrunk to 15ft with plants as shallow as 9ft dying from low light conditions. Despite searching transects totaling over 17.9km (11.1miles) and spending extra time searching locations we found plants in during the fall 2016 survey, **we only found and removed three individual EWM plants** (Figure 2). Plants 1 and 2 were in the boat landing bay and conceivably would have died following the herbicide treatment anyway. Plant 3 was in the southeast finger bay in an area that has produced a handful of plants during both the 2015 and 2016 surveys. All plants were located in water <5ft deep and were easily removed with a rake as they were single-stemmed and appeared to be recently established.

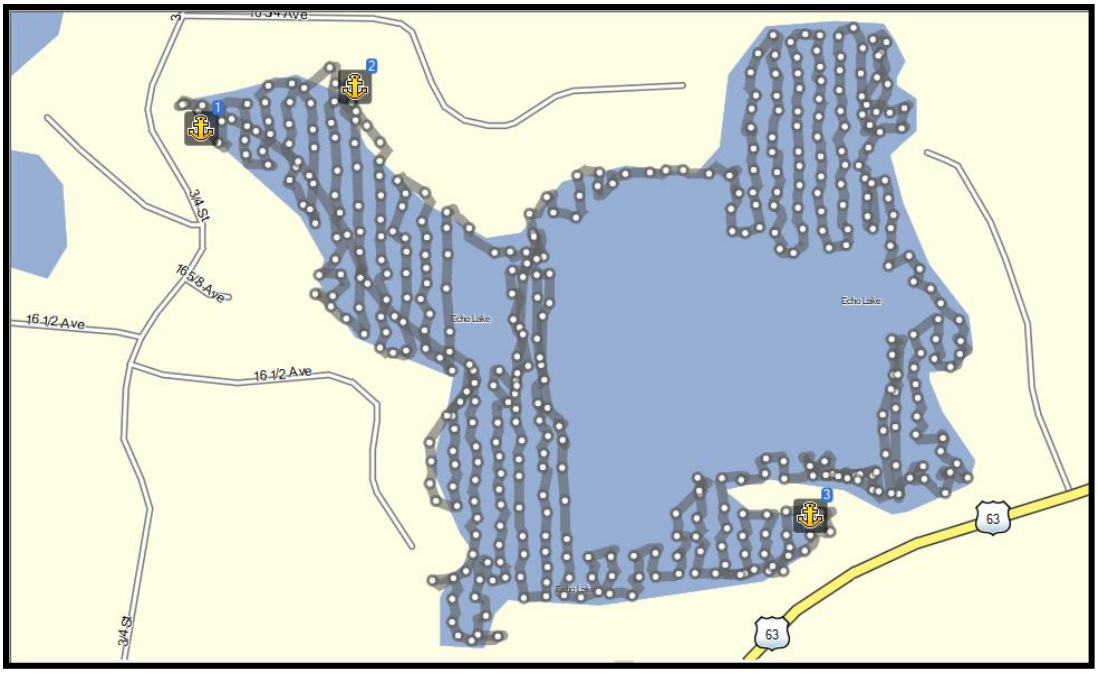


Figure 2: June 23, 2017 Survey Tracks and EWM Locations

July Littoral Zone and Rake Removal Survey:

During the July survey, we covered 26km (16.2 miles) of transects on the lake (Figure 3). Unfortunately, we documented a sharp uptick in EWM growth as we found and removed 45 plants – 24 in the northeast bay and 21in the southeast finger bay. No plants or floating fragments were seen anywhere else on the lake despite paying special attention to areas that have supported EWM growth in the past. All EWM plants were again located in water <5ft deep and were easily removed with a rake as they were again single-stemmed and appeared to be recently established.

At first glance, the continued isolation of EWM to just two areas on the lake seemed positive. However, the presence of so many newly established plants in the northeast bay suggested to us that there was likely a yet to be discovered source population somewhere to the south/southwest that was providing fragments that were drifted in on the prevailing winds. The rapid expansion of plants in the southeast bay was also troubling as it suggested seasonal growing conditions were favorable for EWM – potentially due to the continued poor clarity and the nutrient release it was causing due to plants dying back at the edge of the littoral zone.

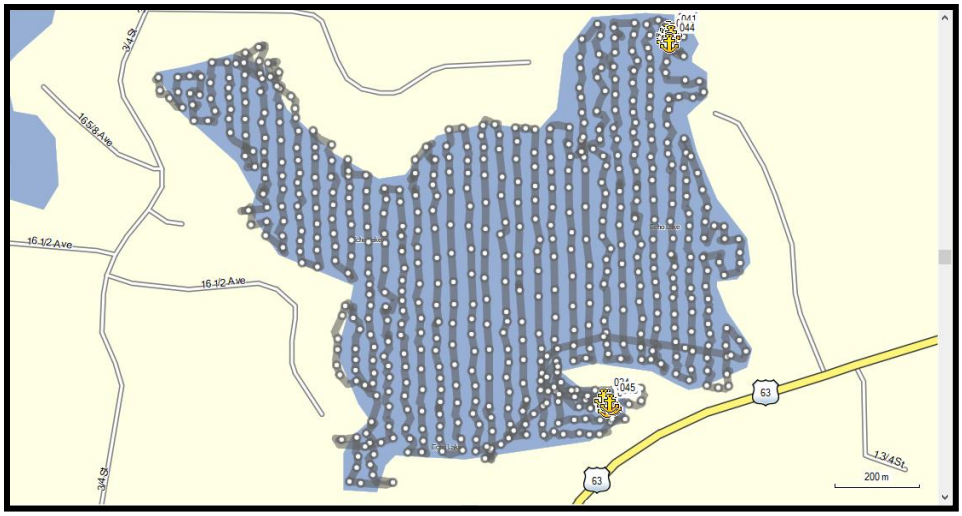


Figure 3: July 24, 27, 2017 Survey Tracks and EWM Locations

Fall Eurasian Water-milfoil Bed Mapping Survey:

A September 21, 2017 survey by Dave Blumer and Mike Clohisy identified several new areas with Eurasian water-milfoil (Figure 4). Although they removed approximately 20 EWM plants, the majority of plants where left for later dive removal; especially when they were in water >5ft deep or were growing in clusters.

Figure 4: Shoreline Transect Survey Tracks/EWM Plants – 9/21/17

As a follow-up to their findings, on September 24, 2017, we conducted an exhaustive survey of the lake's visible littoral zone with over 29km (12.4miles) of transects searched (Figure 5). **No true Eurasian water-milfoil beds were present**, but we did find **five "high density" areas (HDAs) totaling 0.59 acre** (Table 1). This was a sharp increase from 2016 when we identified a single HDA that covered 0.32 acre (Figure 6)(Appendix I).

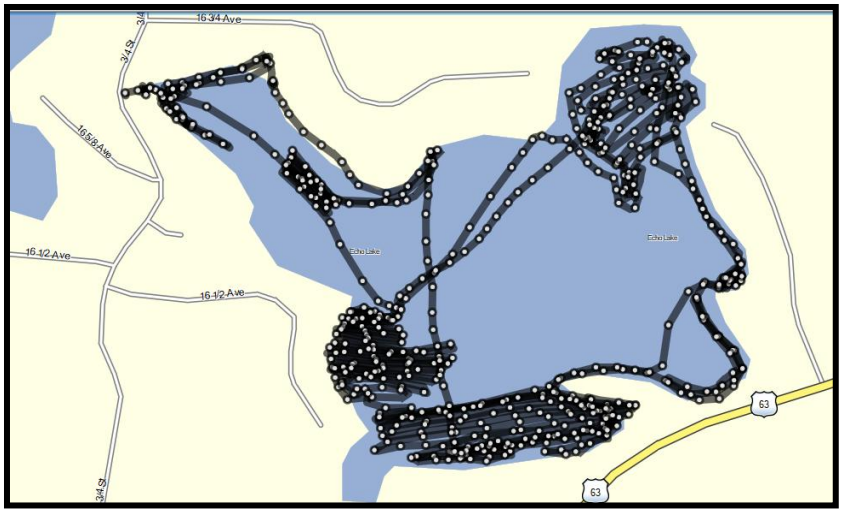


Figure 5: September 24, 2017 Survey Tracks

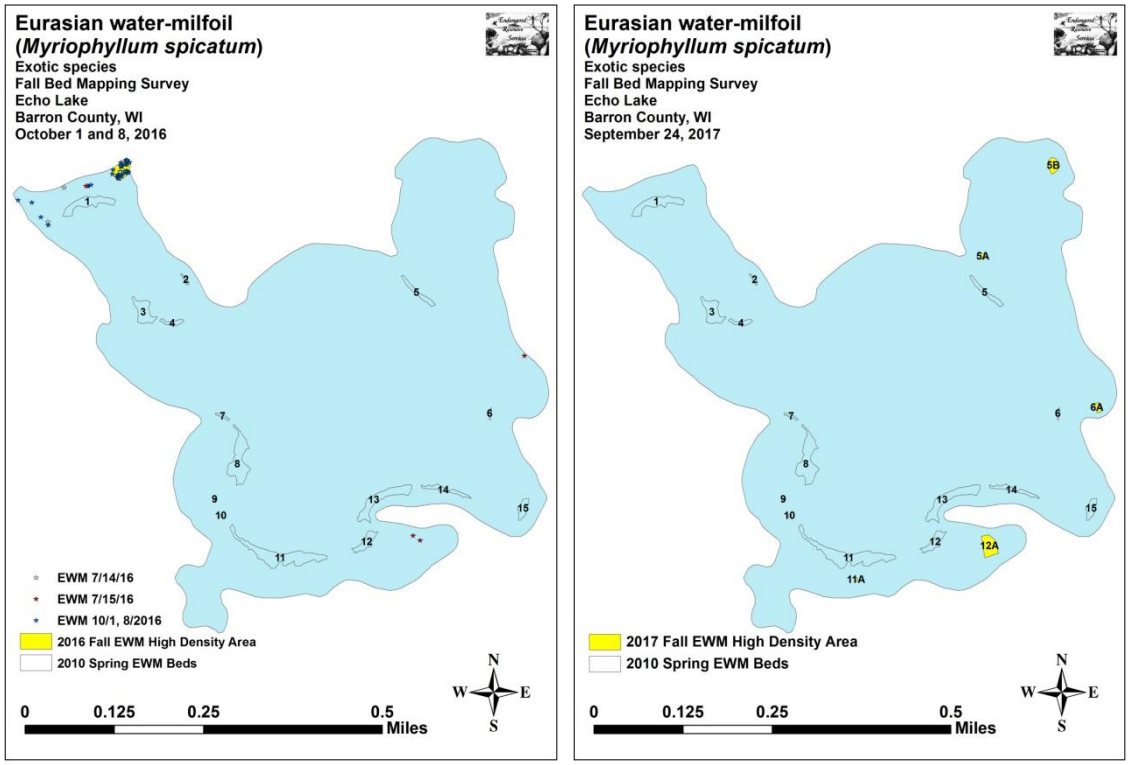


Figure 6: 2016 and 2017 Fall EWM High Density Areas Maps

In the **northwest boat landing bay**, EWM continued to be rare following the treatment as we found and removed **a total of seven plants**. In the **northeast and east-central bays**, we found several super clusters of plants in deep water (HDAs 5A and 5B) that were actively fragmenting. We also found fragments drifting to the northeast into the far northeast corner of the bay where we removed **at least 101 plants** (Figure 7). In the **southeast finger bay and along the south shoreline**, we found and removed **approximately 45 more plants** that were concentrated in two areas. **Despite this uptick, we were able to remove every EWM plant we found – a total of 209 plants** (Figure 8).

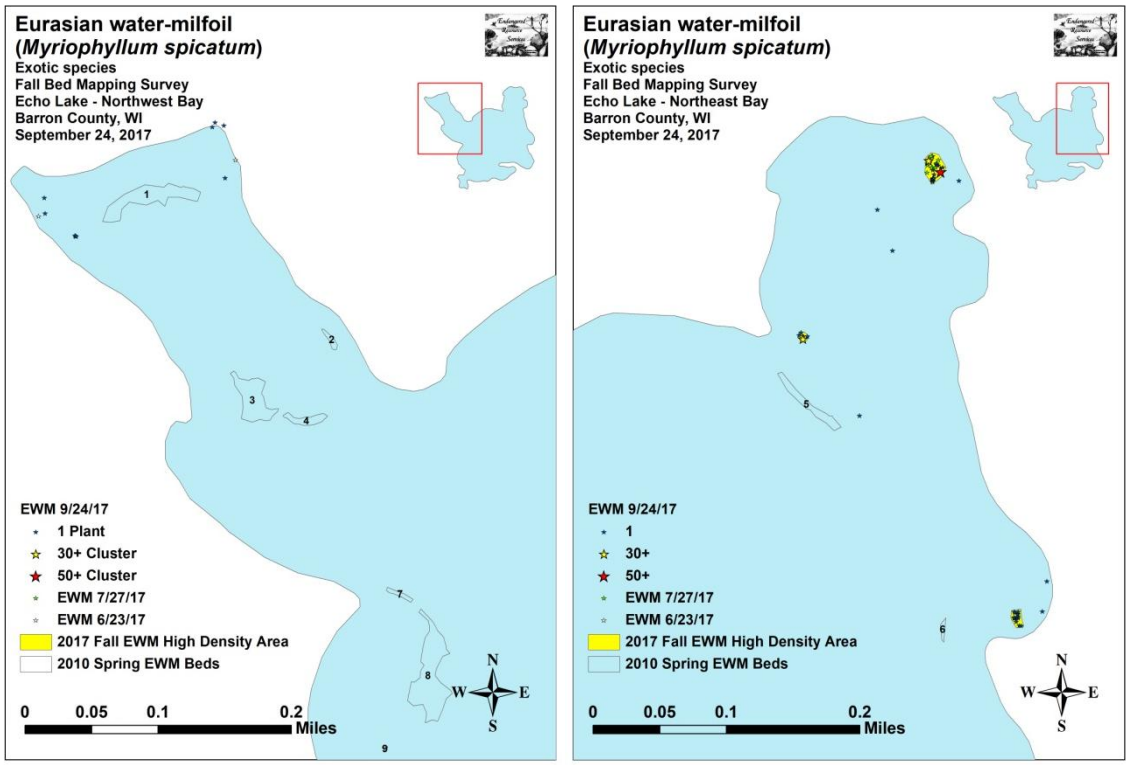


Figure 7: 2017 EWM Distribution – Northwest and Northeast Bays

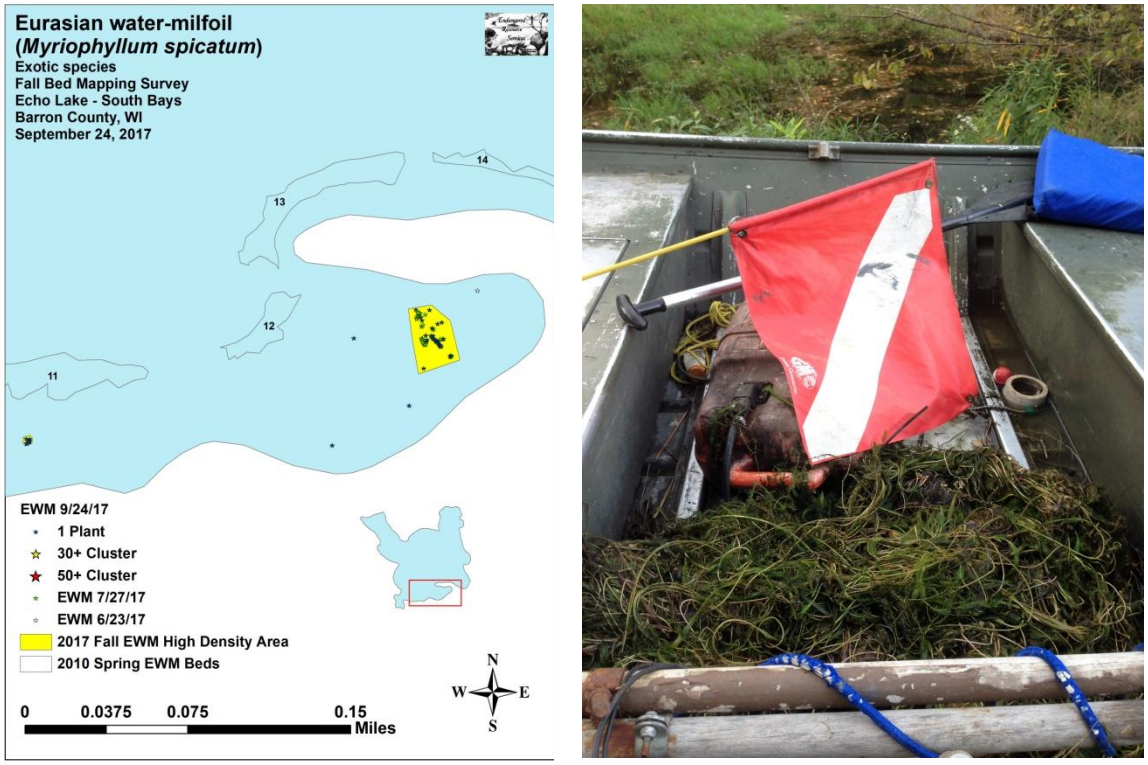


Figure 8: 2017 EWM Distribution – South Bays/EWM Removed 9/24/17

Table 1: Fall Eurasian Water-milfoil Bed Mapping Summary
Echo Lake, Barron County
September 24, 2017

Bed Number	2017 Fall HDA Acreage	2016 Fall HDA Acreage	2015 Fall Bed Acreage	2014 Fall Bed Acreage	2013 Fall Bed Acreage	2012 Fall Bed Acreage	Years Treated	2017 Bed /HDA Characteristics And Field Notes
1	0	0.32	0	0	0	0	2010, 2014, 2017	Scattered EWM throughout
2	0	0	0	0	0	0	2010	No EWM found
3	0	0	0	0	0	0	2010	No EWM found
4	0	0	0	0	0	0	2010	No EWM found
4B	0	0	0	0	0	0	2014	No EWM found
5	0	0	0	0	0	0	2010	Single plant of point.
5A	0.03	0	0	0	0	0	None	Super cluster of large plants
5B	0.16	0	0	0	0	0	None	Regular small towers
6	0	0	0	0	0	0	2010, 2013	No EWM found
6A	0.06	0	0	0	0	0	None	Super cluster of large plants
7	0	0	0	0	0	0	2010	No EWM found
8	0	0	0	0	0.02	0.09	’10, ’11, ’13, ’14	No EWM found
8A, B, C, D	0	0	0	0	0.02	0.05	2012, 2013	No EWM found
9	0	0	0	0	0	0	2010, 2011	No EWM found
10	0	0	0	0	0	0	2010	No EWM found
11	0	0	0	0	0	0	’10, ’11, ’12, ’14	No EWM found
11A	0.01	0	0	0	0	0	None	Super cluster of large plants
12	0	0	0	0	0	0	2010, 2014	No EWM found
12A	0.33	0	0	0	0	0.03	None	Regular low density plants
12B	0	0	0	0	0	0.04	None	No EWM found
13	0	0	0	0	0	0	2010, 2014	No EWM found
14	0	0	0	0	0	0	2010	No EWM found
15	0	0	0	0	0	0	2010, 2014	No EWM found
Total	**0.59**	**0.32**	**0.00**	**0.00**	**0.04**	**0.21**		

CONSIDERATIONS FOR MANAGEMENT:

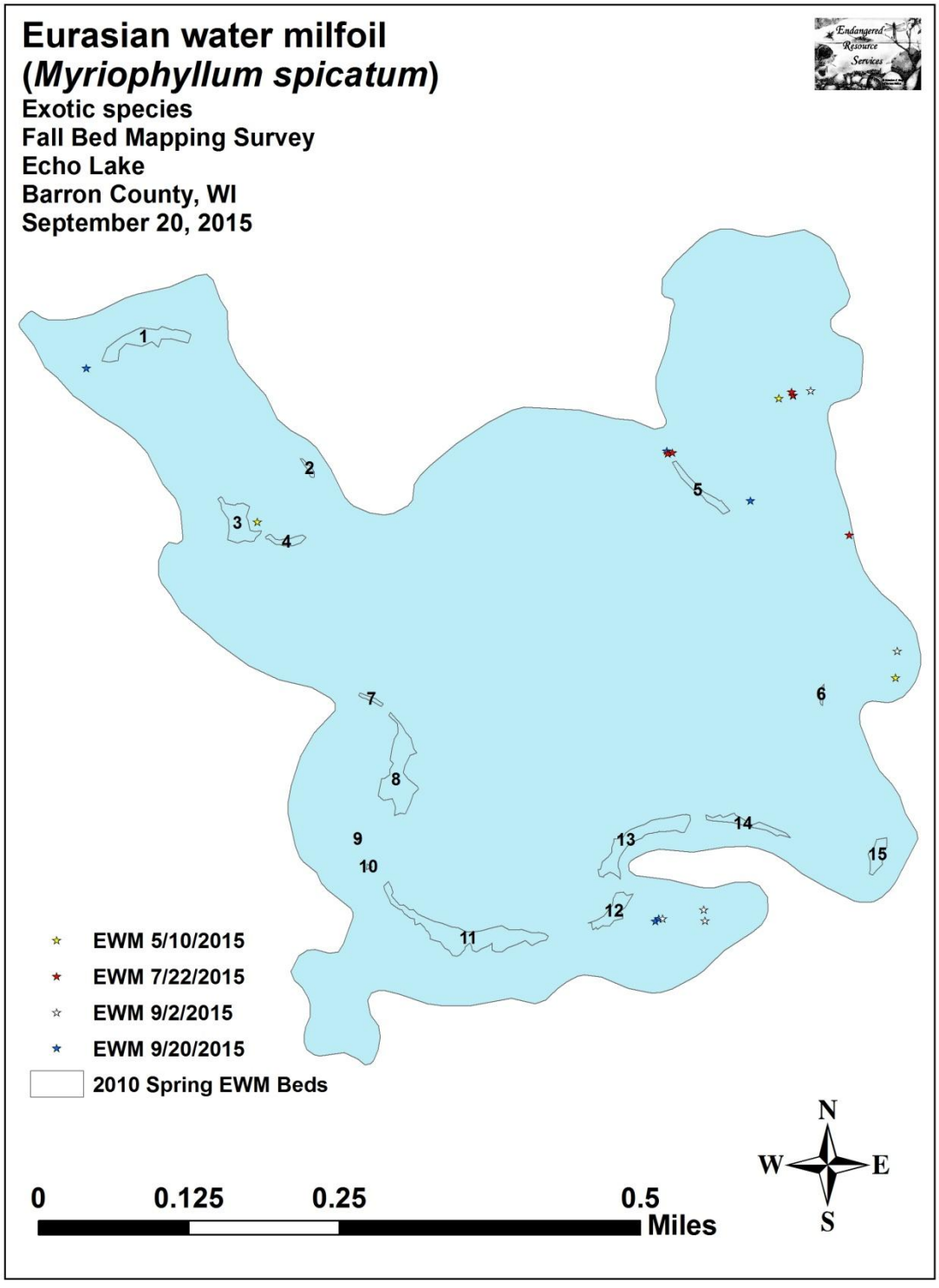
The significant increase in EWM in the northeast, east-central, and south bays is unfortunate, but the continued low levels throughout the rest of the lake is encouraging. Although every plant found in the lake was rake removed, because there were so many plants in such a small area, a limited chemical treatment might be justified as there are certainly additional plants in these areas. However, a "wait and see" approach with continued rake removal throughout the lake might also be considered as even where plants were present, the density still wasn't high. Regardless of what management is decided on, we continue to recommend regular monitoring and rake removal for the rest of the lake as this method has proved effective at keeping the infestation in check.

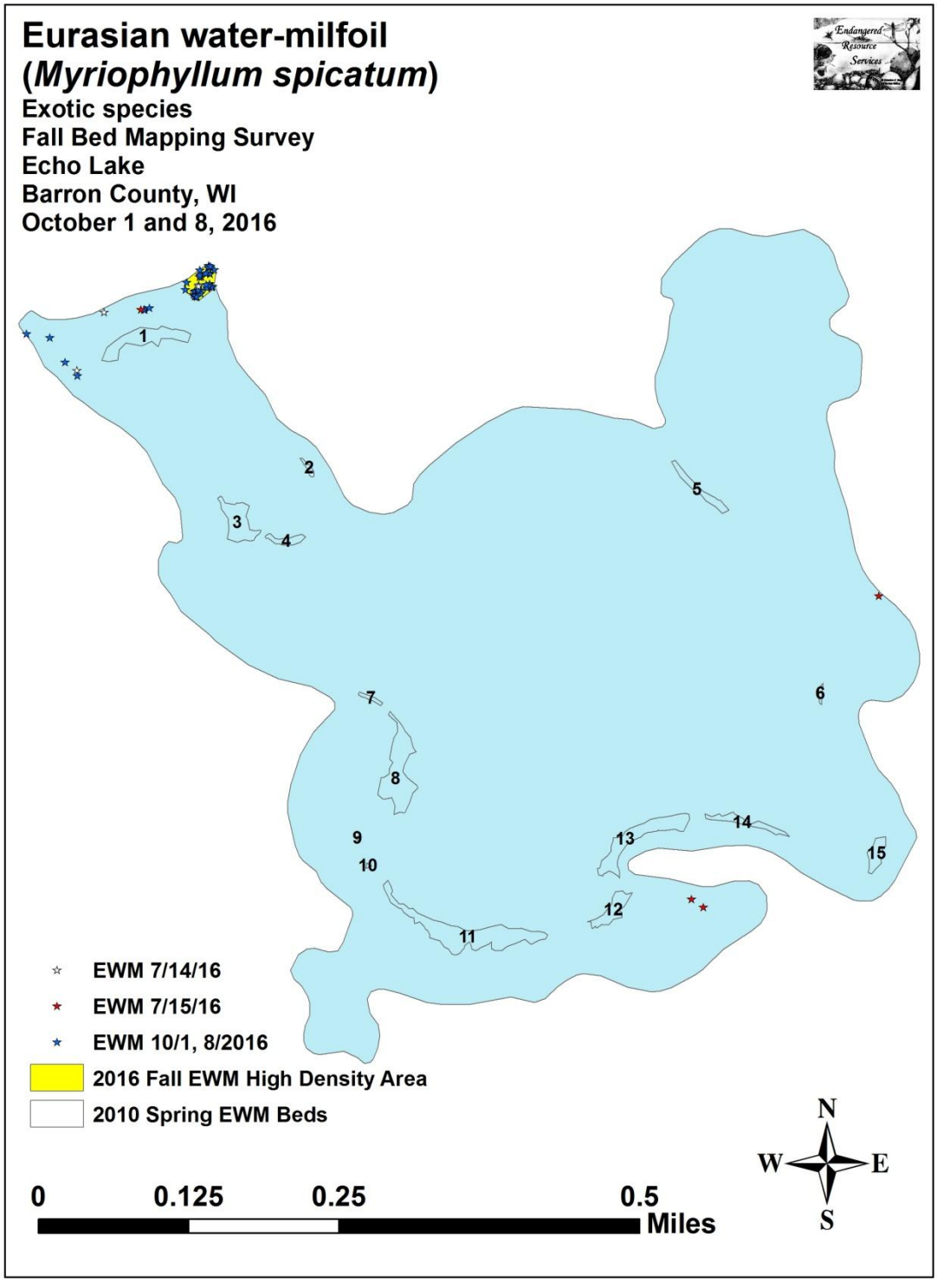
LITERATURE CITED

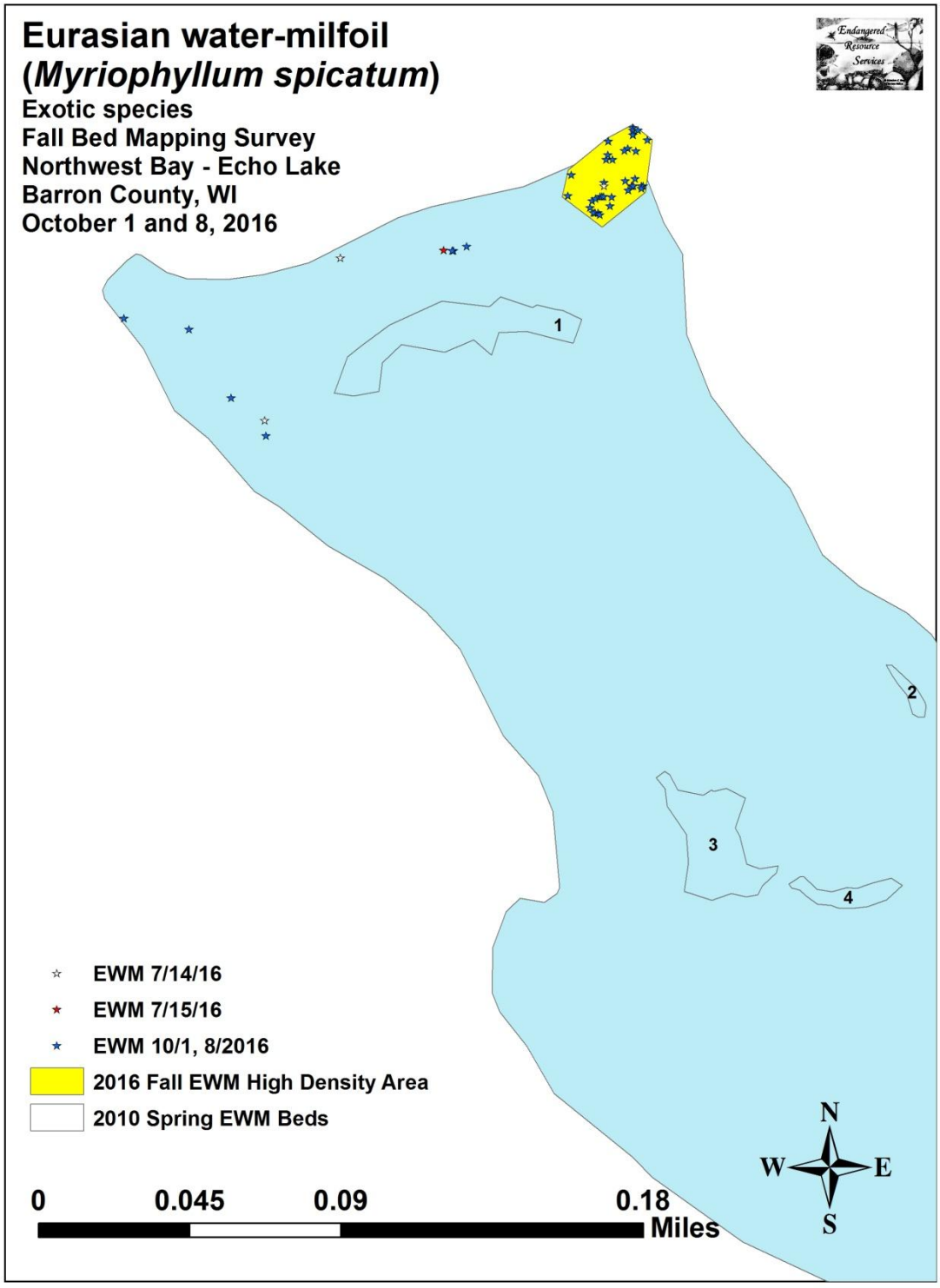
Busch, C., G. Winter, L. Sather, and C. Holt. [online]. 1967. Echo Lake Map. Available from http://dnr.wi.gov/lakes/maps/DNR/2630200a.pdf (2017, September).

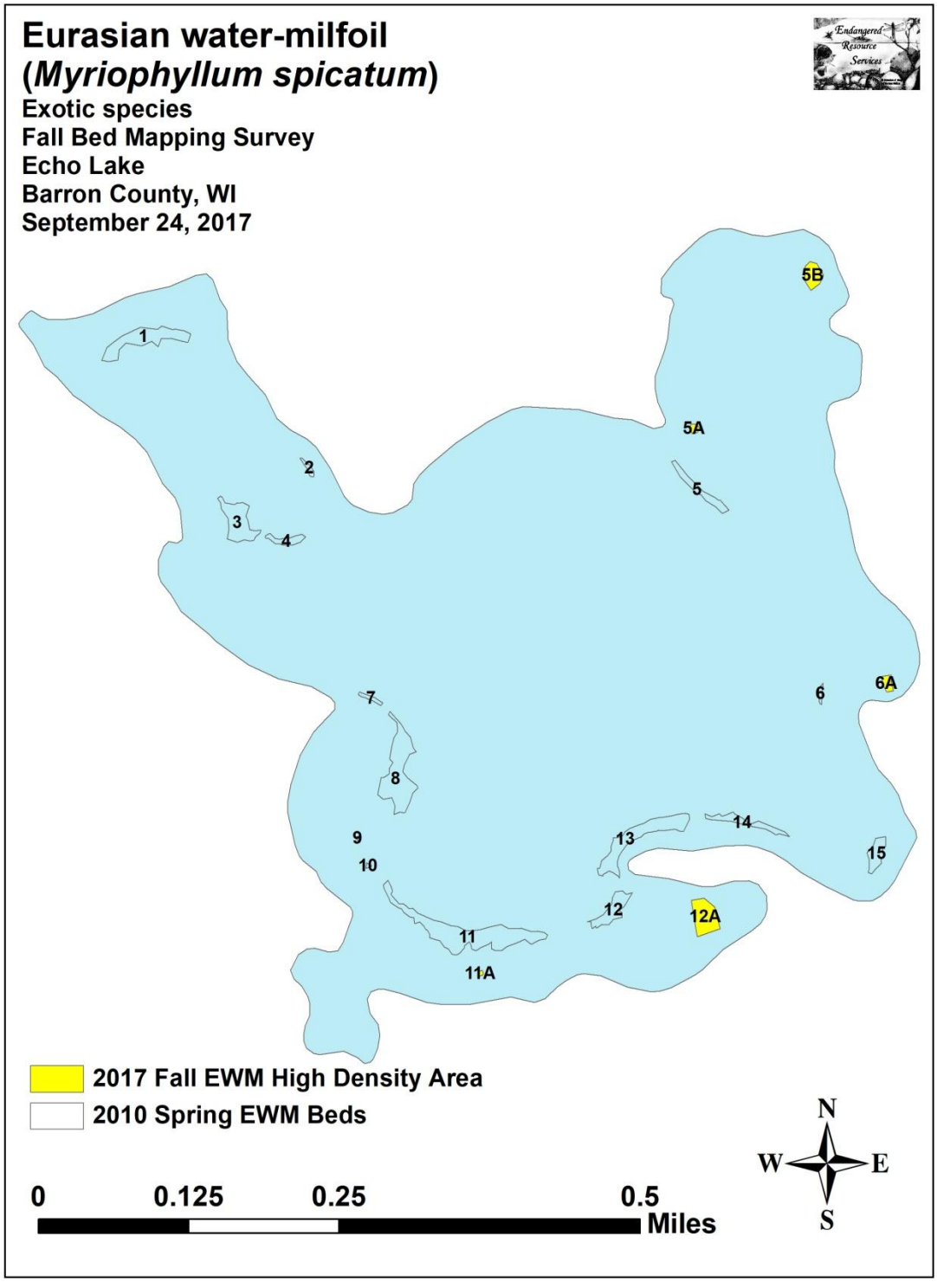
WDNR. [online]. 2017. Echo Lake - Citizen Lake Water Quality Monitoring Database. Available from http://dnr.wi.gov/lakes/waterquality/Station.aspx?id=033210 (2017, September).

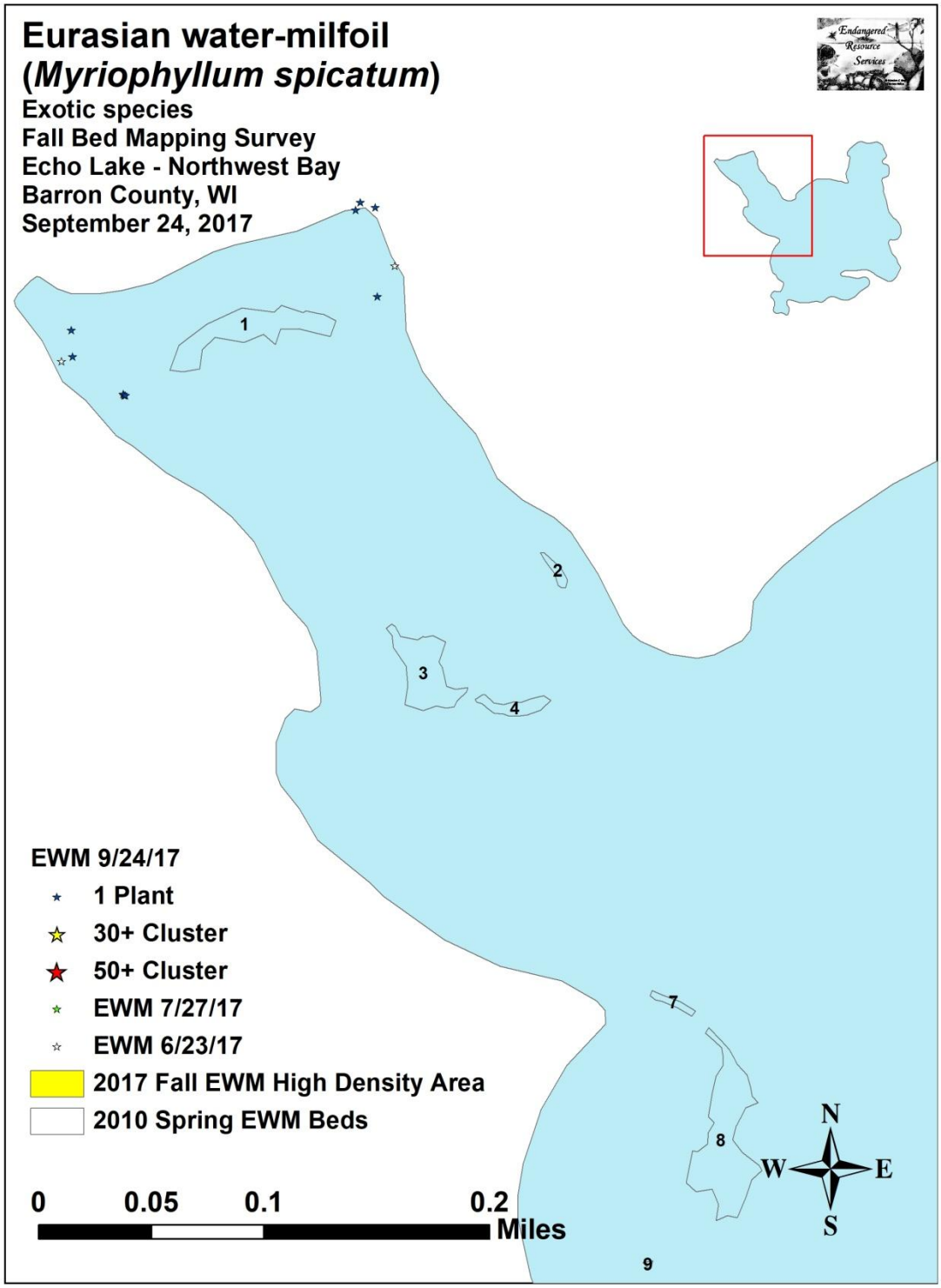
Appendix I: 2015, 2016, and 2017 Fall Bed Mapping Surveys

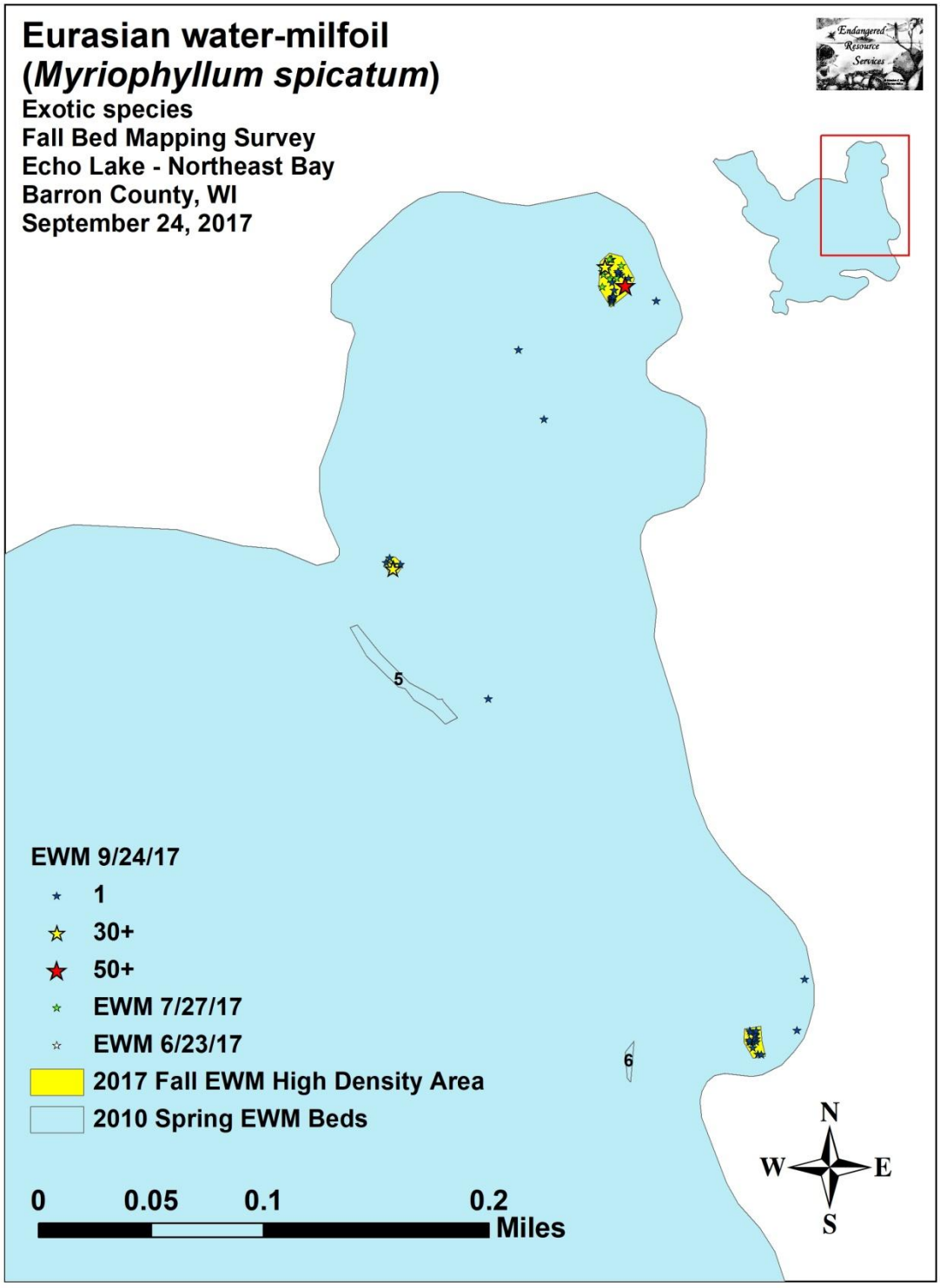

Eurasian water milfoil
(Myriophyllum spicatum)
Exotic species
Fall Bed Mapping Survey
Echo Lake
Barron County, WI
September 20, 2015
Endangered Resource Services
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
EWM 5/10/2015
EWM 7/22/2015
EWM 9/2/2015
EWM 9/20/2015
2010 Spring EWM Beds
N
W
E
S
0
0.125
0.25
0.5
Miles

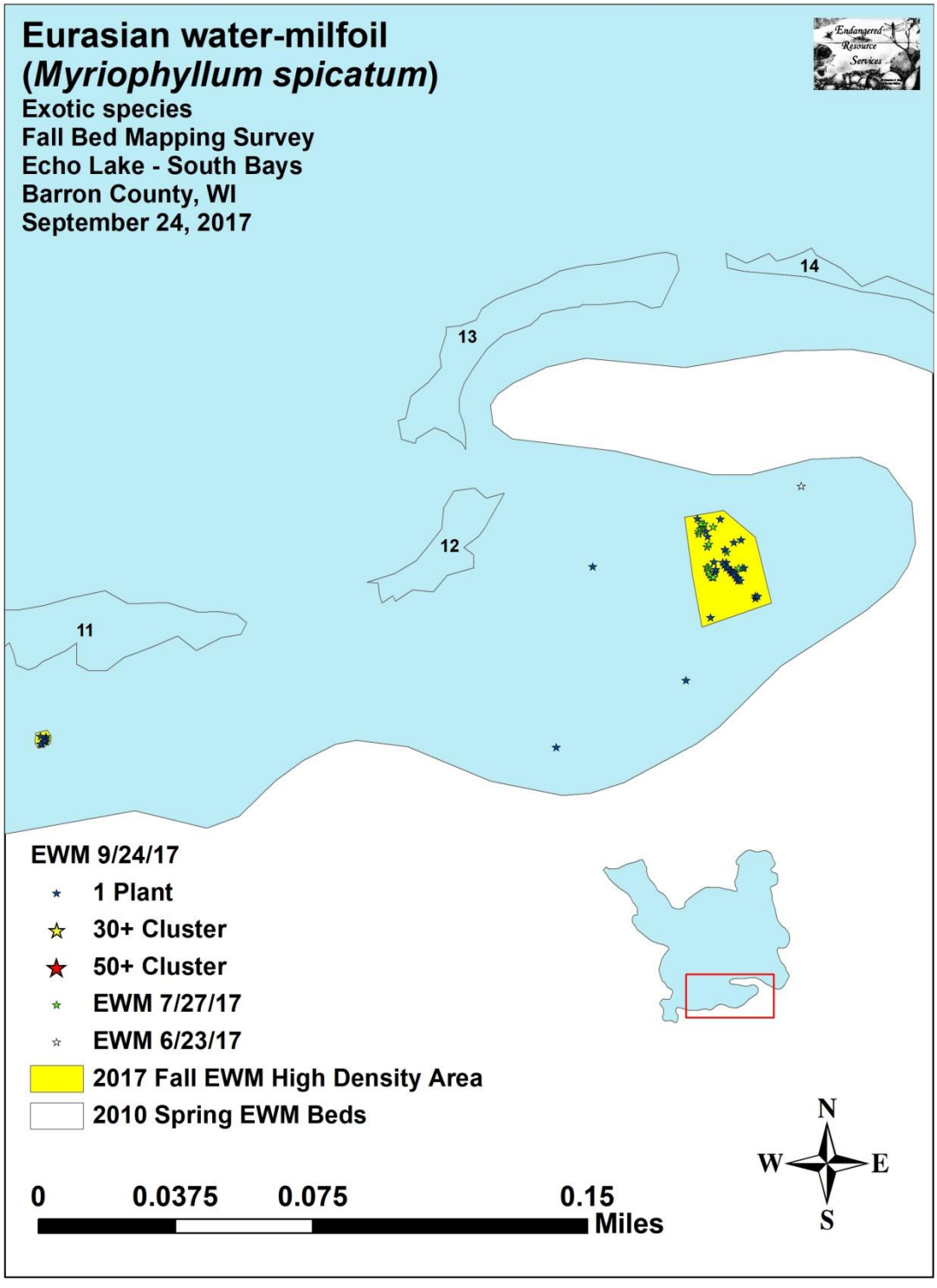

Eurasian water-milfoil
(Myriophyllum spicatum)
Exotic species
Fall Bed Mapping Survey
Echo Lake
Barron County, WI
October 1 and 8, 2016
Endangered Resource Services
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
EWM 7/14/16
EWM 7/15/16
EWM 10/1, 8/2016
2016 Fall EWM High Density Area
2010 Spring EWM Beds
0
0.125
0.25
0.5
Miles
N
W
E
S


Eurasian water-milfoil
(Myriophyllum spicatum)
Exotic species
Fall Bed Mapping Survey
Northwest Bay - Echo Lake
Barron County, WI
October 1 and 8, 2016
Endangered Resource Services
1
2
3
4
EWM 7/14/16
EWM 7/15/16
EWM 10/1, 8/2016
2016 Fall EWM High Density Area
2010 Spring EWM Beds
0
0.045
0.09
0.18
Miles
N
W
E
S


Eurasian water-milfoil
(Myriophyllum spicatum)
Exotic species
Fall Bed Mapping Survey
Echo Lake
Barron County, WI
September 24, 2017
Endangered Resource Services
5B
1
5A
2
5
3
4
6
6A
7
8
14
9
13
15
10
12
12A
11
11A
2017 Fall EWM High Density Area
2010 Spring EWM Beds
N
W
E
S
0
0.125
0.25
0.5
Miles


Eurasian water-milfoil
(Myriophyllum spicatum)
Exotic species
Fall Bed Mapping Survey
Echo Lake - Northwest Bay
Barron County, WI
September 24, 2017
Endangered Resource Services
1
2
3
4
7
8
9
EWM 9/24/17
1 Plant
30+ Cluster
50+ Cluster
EWM 7/27/17
EWM 6/23/17
2017 Fall EWM High Density Area
2010 Spring EWM Beds
0
0.05
0.1
0.2
Miles
N
W
E
S


Eurasian water-milfoil
(Myriophyllum spicatum)
Exotic species
Fall Bed Mapping Survey
Echo Lake - Northeast Bay
Barron County, WI
September 24, 2017
Endangered Resource Services
5
6
EWM 9/24/17
1
30+
50+
EWM 7/27/17
EWM 6/23/17
2017 Fall EWM High Density Area
2010 Spring EWM Beds
0
0.05
0.1
0.2
Miles
N
W
E
S


Eurasian water-milfoil
(Myriophyllum spicatum)
Exotic species
Fall Bed Mapping Survey
Echo Lake - South Bays
Barron County, WI
September 24, 2017
Endangered Resource Services
14
13
12
11
EWM 9/24/17
1 Plant
30+ Cluster
50+ Cluster
EWM 7/27/17
EWM 6/23/17
2017 Fall EWM High Density Area
2010 Spring EWM Beds
0
0.0375
0.075
0.15
Miles
N
W
E
S