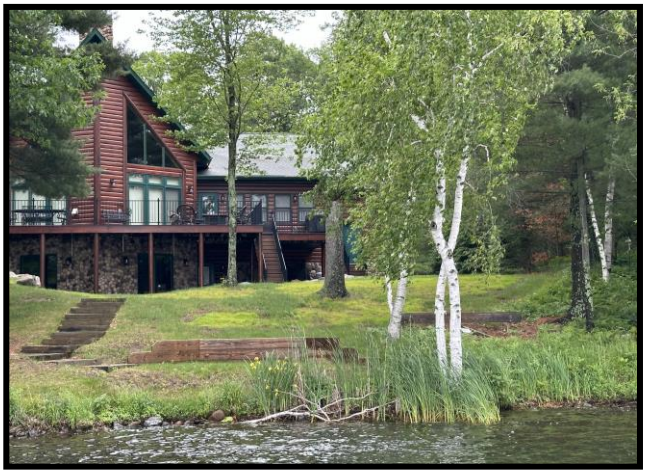
Aquatic Invasive Species Shoreline Surveys
Long Lake - WBIC: 2106800
Washburn County, Wisconsin

Long Lake Aerial Photo (2015)

Worst Curly-leaf pondweed area – canopied bed in the northeast end of the narrow 6/15/24

Project Initiated by:

Long Lake Preservation Association, the Northwest Regional Planning Commission, and the Wisconsin Department of Natural Resources



Residents mowing around Yellow iris 6/16/24

Survey Conducted by and Report Prepared by:

Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin
June 16 and September 8, 2024

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INTRODUCTION:

Long Lake (WBIC 2106800) is a 3,478 acre, stratified, drainage lake located in southeastern Washburn County, Wisconsin in the Towns of Birchwood, Long Lake, and Madge (T37N R10/11W). The lake reaches a maximum depth of 74ft in the northeast thumb and has an average depth of 26ft (Figure 1). The northeast lobe of Long Lake is eutrophic in nature with fair water clarity that produced average Secchi readings of 6.4ft over the last ten years. Elsewhere during this time period, the lake was bordering between eutrophic and mesotrophic with fair to good water clarity and Secchi readings that ranged from 9.0ft north of Kunz Island to 9.9ft in the northeast thumb (WDNR 2024). The bottom substrate is predominantly organic muck in sheltered bays and a mixture of sand, rock, and sandy muck along the majority of the rest of the shoreline. Away from the immediate shoreline, the lake's many bars, humps and sunken inlands were dominated by gravel and sand, while many shallow flats tended to have a thin layer of muck over these firmer substrates (Miller et al. 1965).

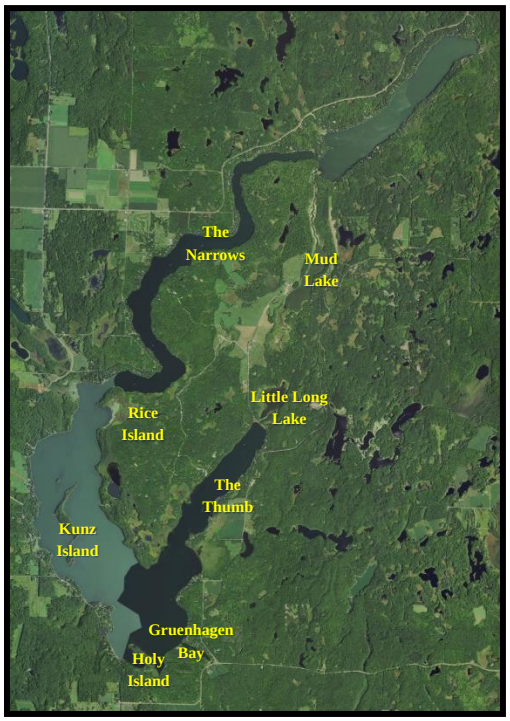

Figure 1: Long Lake Aerial Photo

BACKGROUND AND STUDY RATIONALE:

Following a lakewide full point-intercept aquatic macrophyte survey in July 2022, the Long Lake Preservation Association (LLPA) – under the direction of the Northwest Regional Planning Commission (Megan Sorensen) – updated their Wisconsin Department of Natural Resources (WDNR) approved Aquatic Plant Management Plan (APMP). The updated plan identified quantifying the distribution of Yellow iris (*Iris pseudacorus*) (YI) and monitoring for new Aquatic Invasive Species (AIS) as management priorities. Because of this, we were asked to complete late spring and late summer meandering shoreline surveys. This report is the summary analysis of those field surveys conducted on June 16 and September 8, 2024.

SURVEY METHODS:

We conducted meandering surveys along the shorelines of both Long and Mud Lakes to look for aquatic invasive plant species in the zone of growth they would most likely be found in. During the June survey, we logged GPS coordinates of all Yellow iris found and recorded the approximate number of plants/clusters at each location marked. We also searched for significant new Curly-leaf pondweed (*Potamogeton crispus*) (CLP) beds, Japanese Knotweed (*Polygonum cuspidatum*), and any other exotic/invasive plant species that may be present during the early growing season. The late summer survey focused on looking for Eurasian water-milfoil (*Myriophyllum spicatum*) (EWM) and Purple loosestrife (*Lythrum salicaria*) (PL) – a species that we documented in 2016, but saw no evidence of during our point-intercept survey in 2022. During the September survey, we especially focused around docks and on the north shorelines as these are places that floating fragments introduced at the public boat landings would most likely get blown to by prevailing summer winds before settling to the lake bottom.

RESULTS AND DISCUSSION:

In June, we surveyed transects totaling 66.9km (41.6 miles), and in September we covered 65.1km (40.5 miles) of search lines (Figure 2) (Appendix I). **We did NOT find any evidence of Eurasian water-milfoil, Japanese knotweed, or any other previously undocumented aquatic invasive species anywhere in Long or Mud Lakes during either of these surveys**.

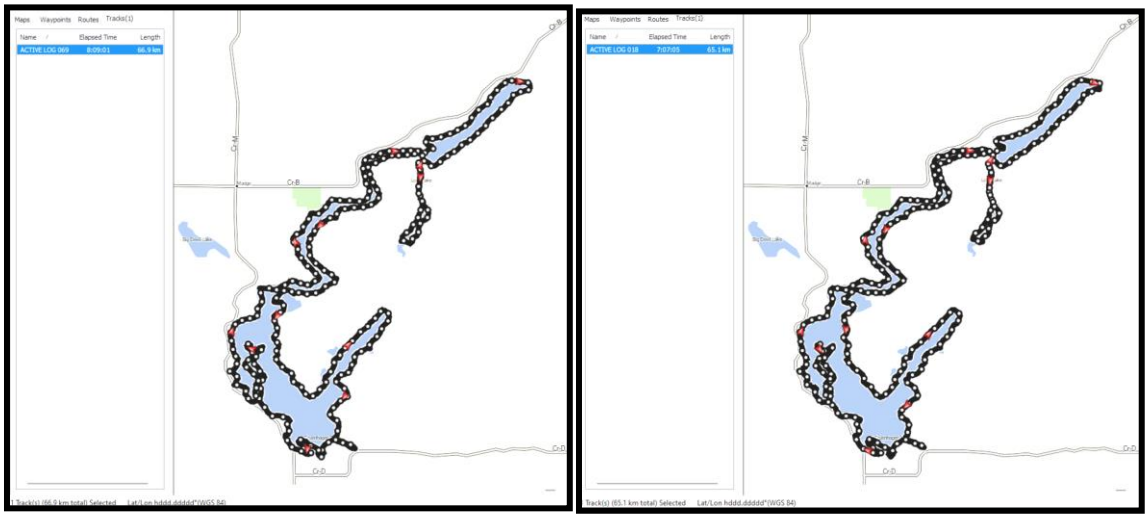

Figure 2: June and September 2024 Shoreline Survey Tracks

Yellow Iris:

During the July 2022 point-intercept survey, we found several large clusters of Yellow iris scattered throughout the northeast end of the lake. Our June 2024 survey found this species density and distribution has increased exponentially, and it is now present throughout "the Narrows" and is increasingly common in the lower lake; especially in the lake outlet where large beds lined the shoreline. Collectively, we marked 264 areas that had YI present, and we noted that most large clusters had satellite plants radiating away from them (Figure 3) (Appendix II). An attractive species, many shoreline owners – not understanding its potential to invade native wetlands – were mowing around the plant rather than removing it (see report cover).

Curly-leaf Pondweed:

The mild winter with little snowfall and thin ice followed by early ice-out appeared to benefit Curly-leaf pondweed as this species continues to grow slowly throughout the winter and bolts in spring. In Long Lake, as well as many other lakes we surveyed in 2024, CLP was abundant in previously known locations and was also found growing in areas we've never seen it at before. Although still relatively uncommon, we marked beds dominated by CLP at 35 locations including several relatively large and dense ones in the Narrows (see report cover) (Figure 3) (Appendix II)

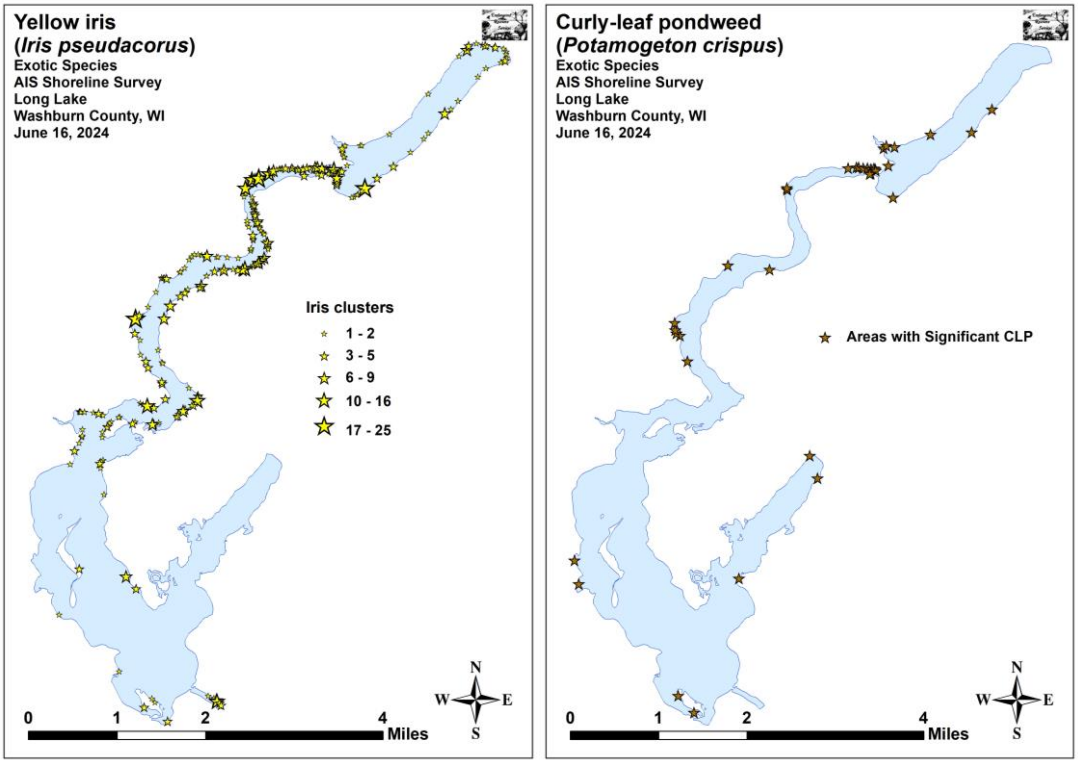

Figure 3: 2024 June Yellow Iris and Curly-leaf Pondweed Distribution

Purple Loosestrife:

In 2016, we found and removed a few Purple loosestrife plants in the Narrows. Despite rechecking these areas in 2022 and 2024, we saw no further evidence of this species (Figure 4) (For more information on a sampling of other aquatic exotic invasive plant species, see Appendix III).

Figure 4: Purple Loosestrife in Bloom

Native Milfoils:

During the September survey, we again found many beds of both Northern water-milfoil (*Myriophyllum sibiricum*) and Whorled water-milfoil (*Myriophyllum verticillatum*) on Long Lake. Northern water-milfoil (NWM) – a native species that is closely related to Eurasian water-milfoil – is especially common in easily accessible areas of the lake while Whorled water-milfoil (WWM) is largely restricted to nearly inaccessible areas in the far ends of shallow muck-bottomed bays. Despite their superficial resemblance, EWM and NWM/WWM can be told apart by their number of leaflets – NWM/WWM have <24 whereas EWM normally has >26 (Figure 5). EWM also tends to have a bright red growth tip on the top of the plant whereas NWM has a bright lime green growth tip. In the fall, NWM and WWM both form winter buds on the tips of shoots whereas EWM has none (Figure 6) (For tips on how to identify milfoil species, see Appendix IV).

Eurasian water- milfoil

Northern water-milfoil

Figure 5: Eurasian and Northern Water-milfoil Identification (Berg 2007)

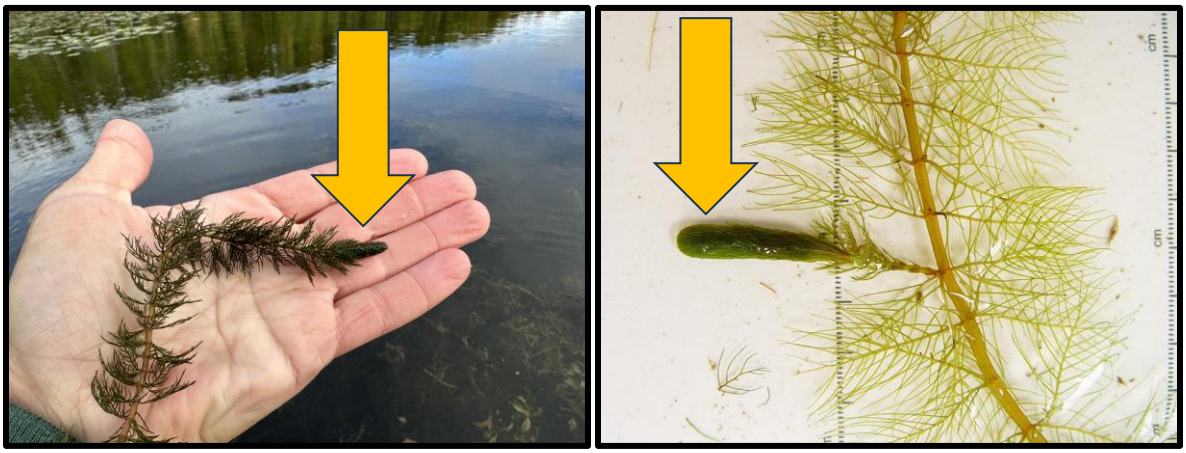

Figure 6: Winter Buds on Northern and Whorled-water Milfoil

CONSIDERATIONS FOR FUTURE MANAGEMENT:

Yellow Iris Management:

Yellow iris is spreading rapidly throughout Long Lake and now dominates many shoreline areas. Because no biological control agents currently exist for this species, we STRONGLY encourage residents to watch for and eliminate plants on their property. June is the best time to look for this iris as the bright yellow "fleur-de-lis" are most common at this time. At other times of the year when it is not in bloom, its leaves could be confused with Northern blue flag (*Iris versicolor*) – a native and non-invasive species.

Because Yellow iris is spreading so rapidly, it may be time for the LLPA to consider a more aggressive and coordinated effort to manage the species. At a minimum, sending out annual notices in May and June to remind lakeshore residents to dig this species out whenever and wherever they find it is strongly encouraged. However, especially in the dense beds that have formed in many parts of the lake, at least limited chemical management may be required to reverse this species' recent expansion on the lake.

Purple Loosestrife Management:

Although we didn't see Purple loosestrife during either of our most recent surveys, it is unlikely that the plant has been eliminated from the system. Because of this, residents should be on the lookout for loosestrife in August and September when the bright fuchsia candle-shaped flower spikes are most easily seen. Similar to Yellow iris, we also encourage the LLPA to send out annual reminders to residents to be on the lookout for PL. Residents and volunteers should continue to watch for and remove plants in August and September when the bright fuchsia candle-shaped flower spikes are easily seen. Because both YI and PL have an extensive root system, care should be taken to remove the entire plant as even small root fragments can survive and produce new plants the following year. In both cases, plants should be bagged and disposed of well away from any wetland.

Eurasian Water-milfoil Monitoring:

With Eurasian water-milfoil growing in at least 23 other nearby Washburn and Sawyer County lakes, we encourage the LLPA to continue their Clean Boats/Clean waters landing inspections and consider at least annual whole shoreline inspections to look for new AIS. Early detection of an AIS like EWM provides the best chance to economically contain them once an infestation has occurred. We also encourage any lake resident or boater that discovers a plant they even suspect may be a new AIS to immediately contact Matthew Berg, ERS, LLC Research Biologist at 715-338-7502 for identification confirmation. Ideally, a specimen, a jpg, and the accompanying GPS coordinates of the location should be included. However, even a texted picture of the plant in question held in hand is often enough to confirm identification. Likewise, we are happy to identify ANY plant a lake resident may be curious about.

LITERATURE CITED

Miller, G., C. Olson, L. Sather, and E. Eaton. [online]. 1965. Long Lake Bathymetric Map. Available from https://apps.dnr.wi.gov/swims/Documents/DownloadDocument?id=29816603 (2024, September).

WDNR. [online]. 2024. Citizen Lake Water Quality Monitoring Database – Long Lake. Available from https://apps.dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2106800&page=waterquality (2024, September).

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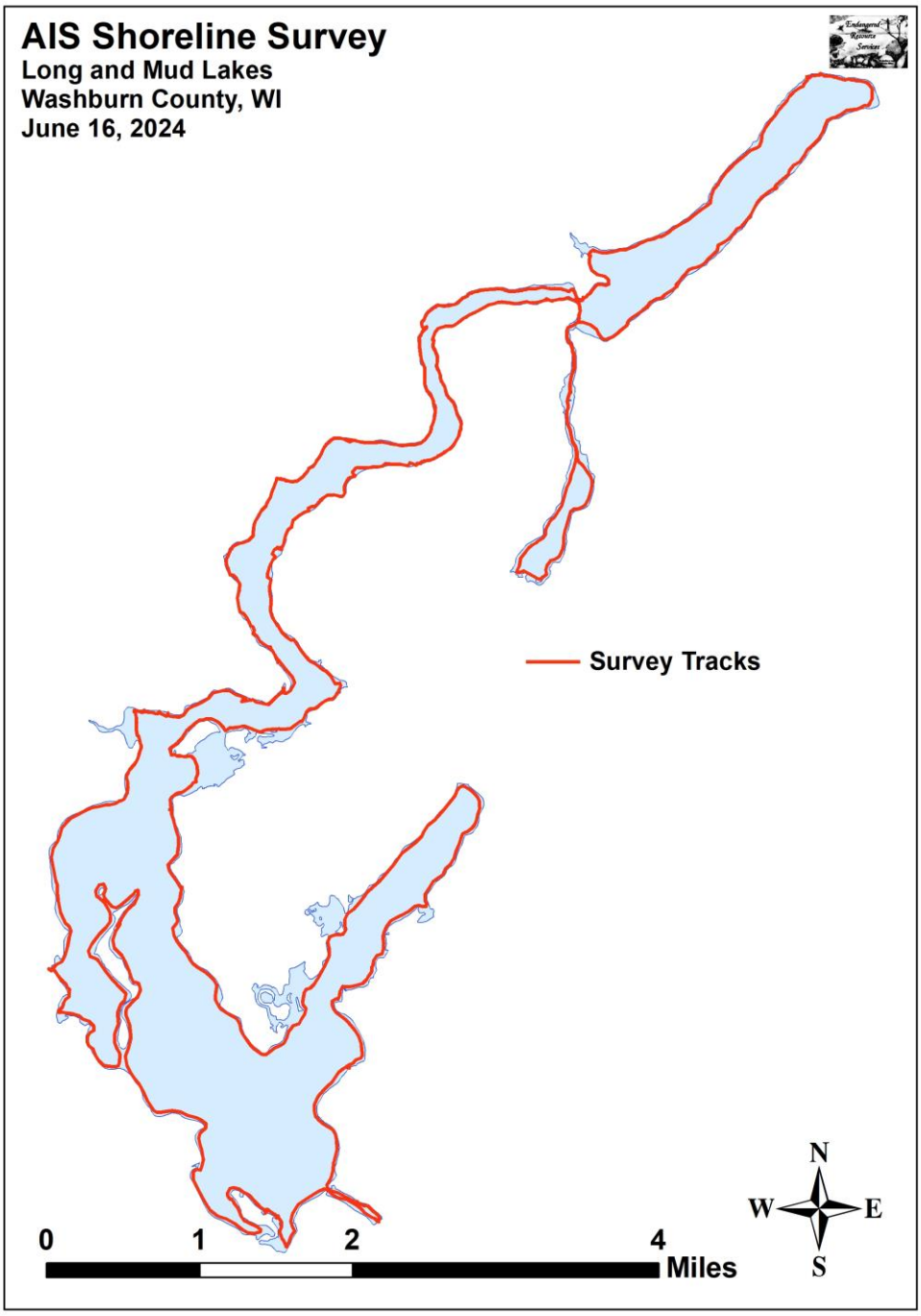
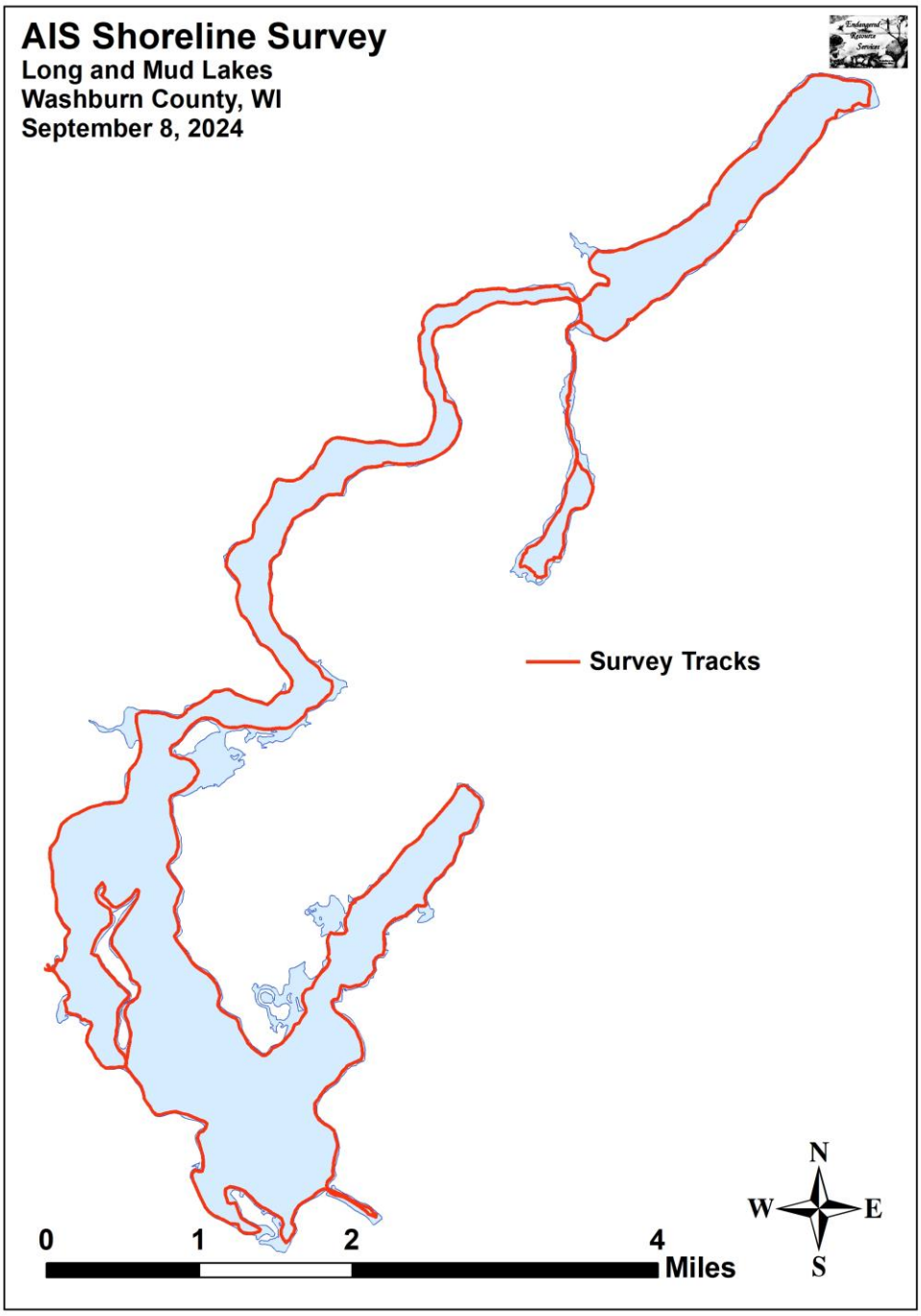
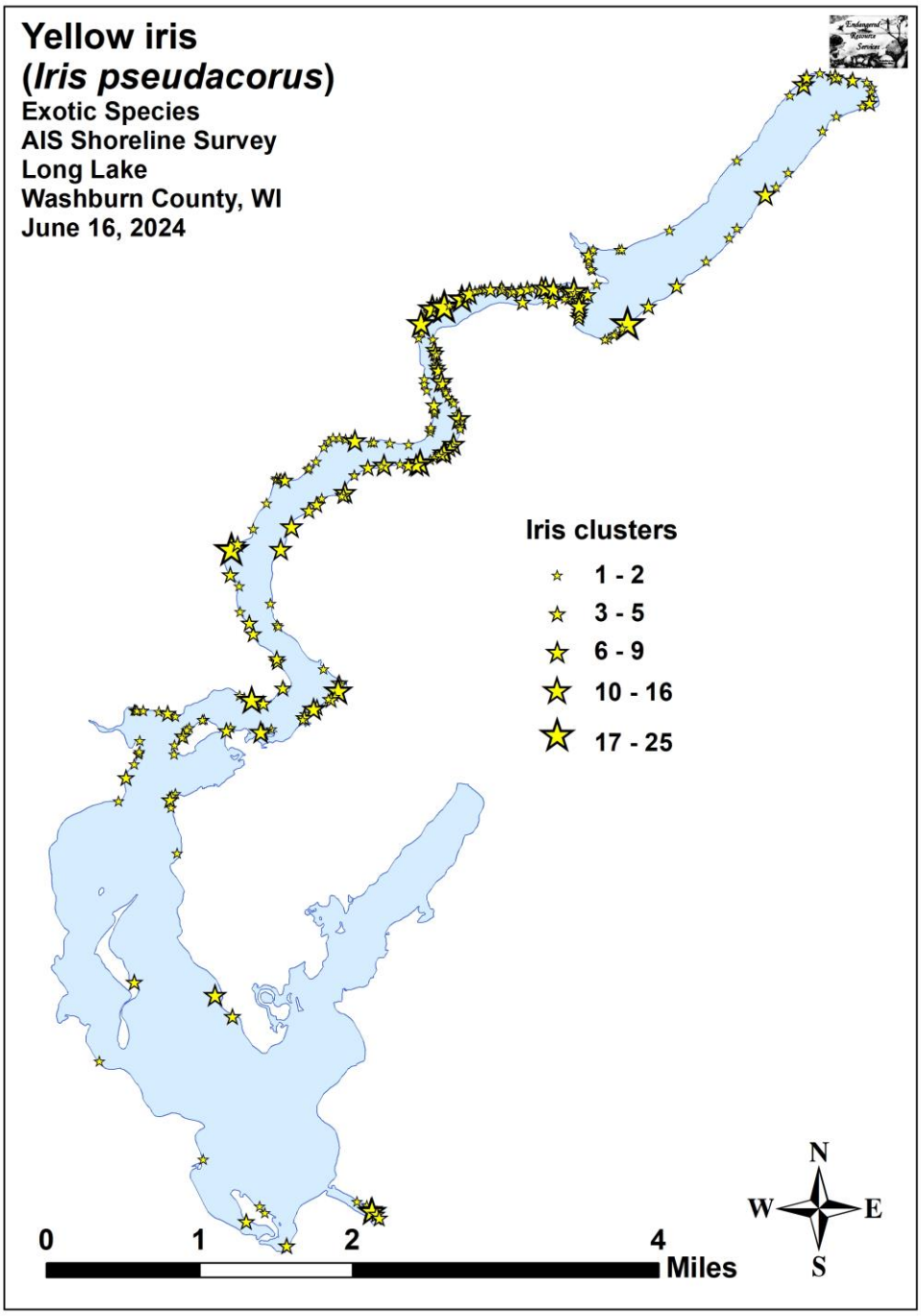
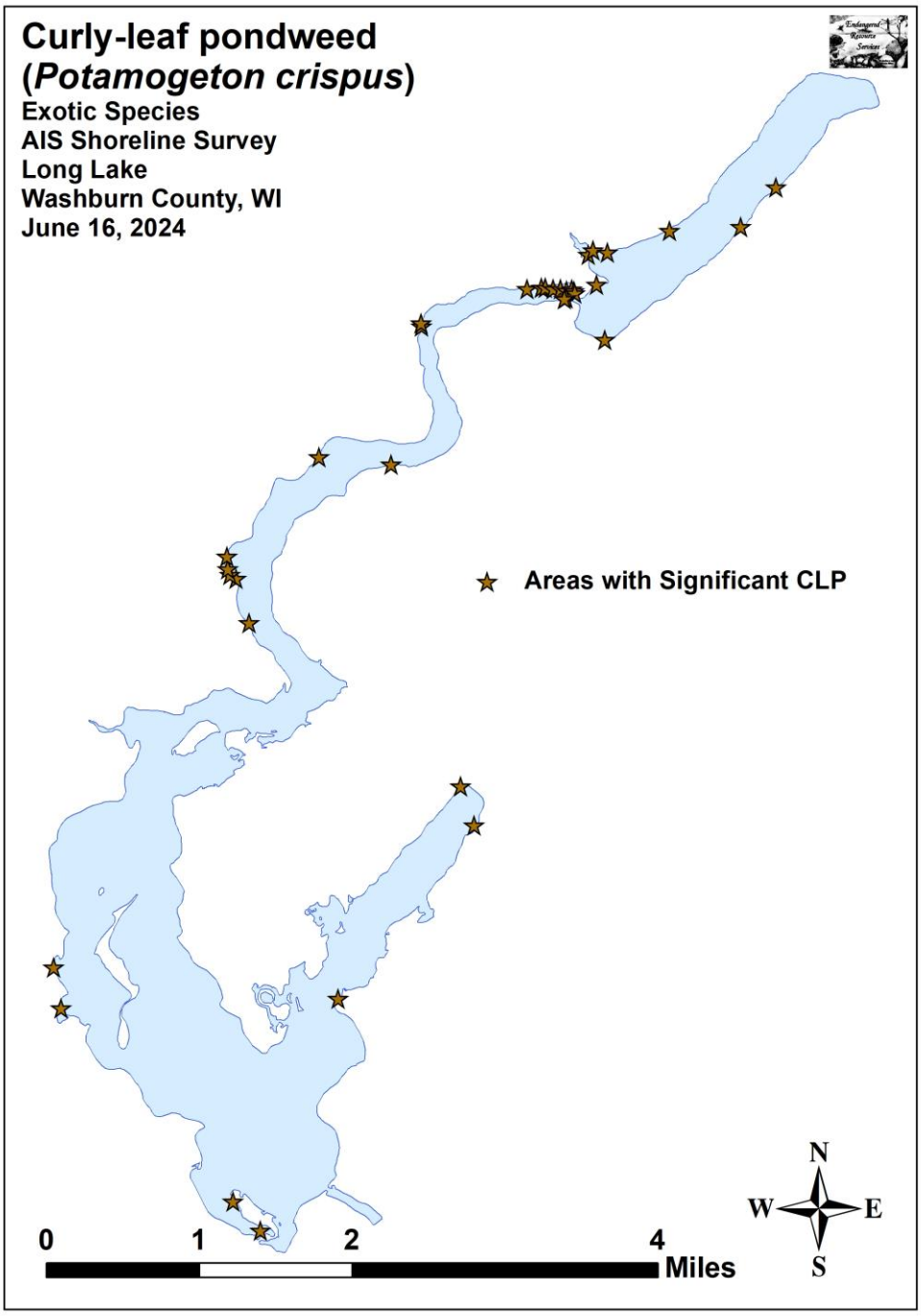
Appendix I: 2024 June and September Survey Tracks


AIS Shoreline Survey
Long and Mud Lakes
Washburn County, WI
June 16, 2024
Survey Tracks
N
W
E
S
0
1
2
4
Miles


AIS Shoreline Survey
Long and Mud Lakes
Washburn County, WI
September 8, 2024
Survey Tracks
0
1
2
4
Miles
N
W
E
S

Appendix II: 2024 June Yellow Iris and Curly-leaf Pondweed Distribution Maps and Field Notes


Yellow iris
(Iris pseudacorus)
Exotic Species
AIS Shoreline Survey
Long Lake
Washburn County, WI
June 16, 2024
Iris clusters
1 - 2
3 - 5
6 - 9
10 - 16
17 - 25
0
1
2
4
Miles
N
W
E
S


Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
AIS Shoreline Survey
Long Lake
Washburn County, WI
June 16, 2024
Areas with Significant CLP
N
W
E
S
0
1
2
4
Miles

ID	Latitude	Longitude	Yellow Iris Clusters	High CLP Areas
1	45.7073	-91.7173	1	
2	45.70958	-91.7163	3	
3	45.71081	-91.7153	1	
4	45.71176	-91.7147	1	
5	45.71186	-91.7147	1	
6	45.71202	-91.7146	1	
7	45.71303	-91.7146	1	
8	45.71593	-91.7154	1	
9	45.71594	-91.7154	1	
10	45.71592	-91.7152	1	
11	45.71593	-91.7152	1	
12	45.71588	-91.715	1	
13	45.71592	-91.7142	1	
14	45.71589	-91.7142	1	
15	45.71586	-91.7121	1	
16	45.71574	-91.7109	5	
17	45.71544	-91.7098	1	
18	45.71754	-91.7012	1	
19	45.71733	-91.7005	1	
20	45.71719	-91.6996	12	
21	45.71687	-91.698	4	
22	45.71836	-91.6954	4	
23	45.72083	-91.6962	4	
24	45.72115	-91.6963	4	
25	45.72343	-91.6996	5	
26	45.72445	-91.7001	4	1
27	45.72547	-91.7014	1	
28	45.7279	-91.7016	1	
29	45.72863	-91.702		1
30	45.72897	-91.7028	5	1
31	45.7295	-91.7031		1
32	45.73069	-91.7033		1
33	45.73143	-91.7027	25	
34	45.73191	-91.702	4	
35	45.73334	-91.6998	1	
36	45.73581	-91.6981	1	
37	45.73804	-91.6969	1	
38	45.73819	-91.6968	1	
39	45.73814	-91.6964	1	
40	45.73816	-91.6962	1	
41	45.7381	-91.6959	1	
42	45.73805	-91.6957	3	
43	45.73909	-91.6926	1	
44	45.73922	-91.6925	1	

45	45.73986	-91.6916	1	
46	45.74029	-91.6912		1
47	45.74122	-91.6905	1	
48	45.74175	-91.6899	2	
49	45.74209	-91.6893	1	
50	45.74211	-91.6884	1	
51	45.74199	-91.6876	2	
52	45.74198	-91.6868	2	
53	45.74194	-91.6864	9	
54	45.74175	-91.6842	1	
55	45.74178	-91.6838	1	
56	45.74173	-91.6816	1	
57	45.74165	-91.679	1	
58	45.74288	-91.6763	1	
59	45.74312	-91.6761	1	
60	45.74327	-91.6761	2	
61	45.74463	-91.6756	1	
62	45.74473	-91.6756	1	
63	45.74489	-91.6756	1	
64	45.74548	-91.6758	5	
65	45.74682	-91.6768	2	
66	45.7474	-91.6771	2	
67	45.74788	-91.6772	2	
68	45.75173	-91.678	1	
69	45.75229	-91.6777	1	
70	45.75288	-91.6776	5	1
71	45.75318	-91.6777	13	1
72	45.75405	-91.6771	1	
73	45.75428	-91.6768	1	
74	45.75461	-91.6762	13	
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76	45.75491	-91.6753	4	
77	45.75485	-91.6747	21	
78	45.75493	-91.6739	1	
79	45.75534	-91.6727	1	
80	45.75561	-91.6723	16	
81	45.7557	-91.672	1	
82	45.75582	-91.6717	5	
83	45.756	-91.6714	1	
84	45.75612	-91.6713	8	
85	45.7563	-91.6705	2	
86	45.75639	-91.6699	1	
87	45.75643	-91.6697	2	
88	45.75646	-91.6693	2	
89	45.75649	-91.6692	1	

90	45.75654	-91.6685	4	
91	45.7566	-91.6672	1	
92	45.75658	-91.6669	3	
93	45.75651	-91.6666	2	
94	45.75638	-91.6656	4	
95	45.75638	-91.6653	1	
96	45.75645	-91.6646	1	
97	45.75647	-91.6644	3	
98	45.75663	-91.6635	5	1
99	45.75664	-91.6628	1	
100	45.75681	-91.6615	9	1
101	45.75678	-91.661	9	1
102	45.75671	-91.6599	7	1
103	45.75669	-91.6589	1	1
104	45.75654	-91.6581	5	1
105	45.7567	-91.6574	1	1
106	45.75653	-91.6571	13	1
107	45.75632	-91.657	2	1
108	45.75589	-91.6568	1	
109	45.7557	-91.6567	2	
110	45.75566	-91.6564	2	
111	45.75566	-91.6563	5	
112	45.75577	-91.656	2	
113	45.75601	-91.6556	1	
114	45.75621	-91.6553	3	
115	45.75717	-91.6541	1	1
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117	45.75861	-91.6549	2	
118	45.75921	-91.6552	1	
119	45.75943	-91.6552	2	
120	45.75999	-91.6553	5	1
121	45.76045	-91.6546	1	1
122	45.76024	-91.6527		1
123	45.76051	-91.6511	1	
124	45.76054	-91.6508	1	
125	45.76244	-91.6443	1	1
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131	45.77705	-91.6262	1	
132	45.77723	-91.6263	5	
133	45.7776	-91.6244	1	
134	45.77737	-91.623	1	

135	45.7773	-91.6224	3	
136	45.7772	-91.6219	1	
137	45.77703	-91.6203	1	
138	45.77706	-91.62	5	
139	45.77682	-91.6181	1	
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146	45.77213	-91.6239	1	
147	45.76813	-91.6285	1	
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152	45.76186	-91.6363	1	
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159	45.75242	-91.6516	1	
160	45.75209	-91.6523	1	
161	45.752	-91.6528	1	1
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165	45.75513	-91.6564	6	
166	45.75586	-91.6578	2	
167	45.75586	-91.6582	1	1
168	45.75577	-91.6584	2	1
169	45.75558	-91.66	3	
170	45.75564	-91.6609	1	
171	45.75539	-91.6641	3	
172	45.75164	-91.6761	1	
173	45.75072	-91.6759	4	
174	45.75053	-91.6758	1	
175	45.7504	-91.6757	5	
176	45.75017	-91.6755	1	
177	45.74957	-91.6755	2	
178	45.74927	-91.6756	1	
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181	45.74872	-91.6753	5	
182	45.74773	-91.6749	7	
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185	45.7468	-91.6742	1	
186	45.74663	-91.6742	1	
187	45.7462	-91.6738	1	
188	45.74591	-91.6734	2	
189	45.74584	-91.6733	2	
190	45.74562	-91.6731	1	
191	45.74461	-91.6726	2	
192	45.74423	-91.6723	8	
193	45.74392	-91.6721	1	
194	45.74378	-91.6721	1	
195	45.74345	-91.6721	1	
196	45.74323	-91.6721	1	
197	45.7418	-91.673	6	
198	45.74164	-91.6731	2	
199	45.74135	-91.6735	3	
200	45.74111	-91.6741	5	
201	45.74096	-91.6743	8	
202	45.74081	-91.6747	3	
203	45.74067	-91.675	1	
204	45.74041	-91.6756	1	
205	45.74026	-91.6761	2	
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215	45.73859	-91.6863	2	
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217	45.73675	-91.6877	3	
218	45.73661	-91.688	1	
219	45.73635	-91.6907	1	
220	45.7358	-91.6914	3	
221	45.73524	-91.6924	3	
222	45.73368	-91.6947	9	
223	45.73151	-91.6961	6	
224	45.72632	-91.6973	2	

225	45.72432	-91.6964	1	
226	45.72415	-91.6962	1	
227	45.72019	-91.6899	2	
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229	45.71877	-91.6876	2	
230	45.71821	-91.6879	12	
231	45.71764	-91.6883	2	
232	45.71739	-91.6888	5	
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242	45.71447	-91.7023	1	
243	45.7142	-91.7029	3	
244	45.7152	-91.706	1	
245	45.71513	-91.7062	2	
246	45.71439	-91.7079	1	
247	45.71418	-91.7082	2	
248	45.71361	-91.7088	4	
249	45.71343	-91.7089	2	
250	45.71272	-91.7099	1	
251	45.71185	-91.7099	1	
252	45.70811	-91.7096	1	
253	45.70787	-91.71	2	
254	45.70757	-91.7103	3	
255	45.70678	-91.7101	1	
256	45.70245	-91.7092	2	
257	45.68914	-91.7037	6	
258	45.68716	-91.7013	4	
259	45.70941	-91.6711		1
260	45.70575	-91.6691		1
261	45.68905	-91.687		1
262	45.66983	-91.6839	1	
263	45.66948	-91.6825	2	
264	45.66918	-91.682	8	
265	45.66902	-91.6818	14	
266	45.66872	-91.6812	3	
267	45.66835	-91.6808	5	
268	45.66554	-91.6933	5	
269	45.66858	-91.6963	2	

270	45.66919	-91.6971	2	
271	45.66962	-91.7006		1
272	45.66775	-91.6988	3	
273	45.66694	-91.6969		1
274	45.67352	-91.7048	2	
275	45.69019	-91.7146	5	
276	45.6826	-91.7191	1	
277	45.6876	-91.7244		1
278	45.69146	-91.7255		1
		Count	**264**	**35**

Appendix III: Aquatic Exotic Invasive Plant Species Information

Eurasian Water-milfoil

DESCRIPTION: Eurasian Water-milfoil is a submersed aquatic plant native to Europe, Asia, and northern Africa. It is the only non-native milfoil in Wisconsin. Like the native milfoils, the Eurasian variety has slender stems whorled by submersed feathery leaves and tiny flowers produced above the water surface. The flowers are located in the axils of the floral bracts, and are either four-petaled or without petals. The leaves are threadlike, typically uniform in diameter, and aggregated into a submersed terminal spike. The stem thickens below the inflorescence and doubles its width further down, often curving to lie parallel with the water surface. The fruits are four-jointed nut-like bodies. Without flowers or fruits, Eurasian Water-milfoil is nearly impossible to distinguish from Northern Water-milfoil. Eurasian Water-milfoil has 9-21 pairs of leaflets per leaf, while Northern milfoil typically has 7-11 pairs of leaflets. Coontail is often mistaken for the milfoils, but does not have individual leaflets.

DISTRIBUTION AND HABITAT: Eurasian milfoil first arrived in Wisconsin in the 1960's. During the 1980's, it began to move from several counties in southern Wisconsin to lakes and waterways in the northern half of the state. As of 1993, Eurasian milfoil was common in 39 Wisconsin counties (54%) and at least 75 of its lakes, including shallow bays in Lakes Michigan and Superior and Mississippi River pools.

Eurasian Water-milfoil grows best in fertile, fine-textured, inorganic sediments. In less productive lakes, it is restricted to areas of nutrient-rich sediments. It has a history of becoming dominant in eutrophic, nutrient-rich lakes, although this pattern is not universal. It is an opportunistic species that prefers highly disturbed lake beds, lakes receiving nitrogen and phosphorous-laden runoff, and heavily used lakes. Optimal growth occurs in alkaline systems with a high concentration of dissolved inorganic carbon. High water temperatures promote multiple periods of flowering and fragmentation.

LIFE HISTORY AND EFFECTS OF INVASION: Unlike many other plants, Eurasian Water-milfoil does not rely on seed for reproduction. Its seeds germinate poorly under natural conditions. It reproduces vegetatively by fragmentation, allowing it to disperse over long distances. The plant produces fragments after fruiting once or twice during the summer. These shoots may then be carried downstream by water currents or inadvertently picked up by boaters. Milfoil is readily dispersed by boats, motors, trailers, bilges, live wells, or bait buckets, and can stay alive for weeks if kept moist.

Once established in an aquatic community, milfoil reproduces from shoot fragments and stolons (runners that creep along the lake bed). As an opportunistic species, Eurasian Water-milfoil is adapted for rapid growth early in spring. Stolons, lower stems, and roots persist over winter and store the carbohydrates that help milfoil claim the water column early in spring, photosynthesize, divide, and form a dense leaf canopy that shades out native aquatic plants. Its ability to spread rapidly by fragmentation and effectively block out sunlight needed for native plant growth often results in monotypic stands. Monotypic stands of Eurasian milfoil provide only a single habitat, and threaten the integrity of aquatic communities in a number of ways; for example, dense stands disrupt predator-prey relationships by fencing out larger fish, and reducing the number of nutrient-rich native plants available for waterfowl.

Dense stands of Eurasian Water-milfoil also inhibit recreational uses like swimming, boating, and fishing. Some stands have been dense enough to obstruct industrial and power generation water intakes. The visual impact that greets the lake user on milfoil-dominated lakes is the flat yellow-green of matted vegetation, often prompting the perception that the lake is "infested" or "dead". Cycling of nutrients from sediments to the water column by Eurasian Water-milfoil may lead to deteriorating water quality and algae blooms of infested lakes. (Taken in its entirety from WDNR, 2012 http://www.dnr.state.wi.us/invasives/fact/milfoil.htm)

Curly-leaf pondweed

DESCRIPTION: Curly-leaf pondweed is an invasive aquatic perennial that is native to Eurasia, Africa, and Australia. It was accidentally introduced to United States waters in the mid-1880s by hobbyists who used it as an aquarium plant. The leaves are reddish-green, oblong, and about 3 inches long, with distinct wavy edges that are finely toothed. The stem of the plant is flat, reddish-brown and grows from 1 to 3 feet long. The plant usually drops to the lake bottom by early July.

DISTRIBUTION AND HABITAT: Curly-leaf pondweed is commonly found in alkaline and high nutrient waters, preferring soft substrate and shallow water depths. It tolerates low light and low water temperatures. It has been reported in all states but Maine.

LIFE HISTORY AND EFFECTS OF INVASION: Curly-leaf pondweed spreads through burr-like winter buds (turions), which are moved among waterways. These plants can also reproduce by seed, but this plays a relatively small role compared to the vegetative reproduction through turions. New plants form under the ice in winter, making curly-leaf pondweed one of the first nuisance aquatic plants to emerge in the spring.

It becomes invasive in some areas because of its tolerance for low light and low water temperatures. These tolerances allow it to get a head start on and out compete native plants in the spring. In mid-summer, when most aquatic plants are growing, curly-leaf pondweed plants are dying off. Plant die-offs may result in a critical loss of dissolved oxygen. Furthermore, the decaying plants can increase nutrients which contribute to algal blooms, as well as create unpleasant stinking messes on beaches. Curly-leaf pondweed forms surface mats that interfere with aquatic recreation. (Taken in its entirety from WDNR, 2012 http://www.dnr.state.wi.us/invasives/fact/curlyleaf_pondweed.htm)

Reed canary grass

DESCRIPTION: Reed canary grass is a large, coarse grass that reaches 2 to 9 feet in height. It has an erect, hairless stem with gradually tapering leaf blades 3 1/2 to 10 inches long and 1/4 to 3/4 inch in width. Blades are flat and have a rough texture on both surfaces. The lead ligule is membranous and long. The compact panicles are erect or slightly spreading (depending on the plant's reproductive stage), and range from 3 to 16 inches long with branches 2 to 12 inches in length. Single flowers occur in dense clusters in May to mid-June. They are green to purple at first and change to beige over time. This grass is one of the first to sprout in spring, and forms a thick rhizome system that dominates the subsurface soil. Seeds are shiny brown in color.

Both Eurasian and native ecotypes of reed canary grass are thought to exist in the U.S. The Eurasian variety is considered more aggressive, but no reliable method exists to tell the ecotypes apart. It is believed that the vast majority of our reed canary grass is derived from the Eurasian ecotype. Agricultural cultivars of the grass are widely planted.

Reed canary grass also resembles non-native orchard grass (*Dactylis glomerata*), but can be distinguished by its wider blades, narrower, more pointed inflorescence, and the lack of hairs on glumes and lemmas (the spikelet scales). Additionally, bluejoint grass (*Calamagrostis canadensis*) may be mistaken for reed canary in areas where orchard grass is rare, especially in the spring. The highly transparent ligule on reed canary grass is helpful in distinguishing it from the others. Ensure positive identification before attempting control.

DISTRIBUTION AND HABITAT: Reed canary grass is a cool-season, sod-forming, perennial wetland grass native to temperate regions of Europe, Asia, and North America. The Eurasian ecotype has been selected for its vigor and has been planted throughout the U.S. since the 1800's for forage and erosion control. It has become naturalized in much of the northern half of the U.S., and is still being planted on steep slopes and banks of ponds and created wetlands.

Reed canary grass can grow on dry soils in upland habitats and in the partial shade of oak woodlands, but does best on fertile, moist organic soils in full sun. This species can invade most types of wetlands, including marshes, wet prairies, sedge meadows, fens, stream banks, and seasonally wet areas; it also grows in disturbed areas such as bergs and spoil piles.

LIFE HISTORY AND EFFECTS OF INVASION: Reed canary grass reproduces by seed or creeping rhizomes. It spreads aggressively. The plant produces leaves and flower stalks for 5 to 7 weeks after germination in early spring, then spreads laterally. Growth peaks in mid-June and declines in mid-August. A second growth spurt occurs in the fall. The shoots collapse in mid to late summer, forming a dense, impenetrable mat of stems and leaves. The seeds ripen in late June and shatter when ripe. Seeds may be dispersed from one wetland to another by waterways, animals, humans, or machines.

This species prefers disturbed areas, but can easily move into native wetlands. Reed canary grass can invade a disturbed wetland in less than twelve years. Invasion is associated with disturbances including ditching of wetlands, stream channelization, deforestation of swamp forests, sedimentation, and intentional planting. The difficulty of selective control makes reed canary grass invasion of particular concern. Over time, it forms large, monotypic stands that harbor few other plant species and are subsequently of little use to wildlife. Once established, reed canary grass dominates an area by building up a tremendous seed bank that can eventually erupt, germinate, and recolonize treated sites. (Taken in its entirety from WDNR, 2012 http://www.dnr.state.wi.us/invasives/fact/reed_canary.htm)

Purple loosestrife
(Photo Courtesy Brian M. Collins)

DESCRIPTION: Purple loosestrife is a perennial herb 3-7 feet tall with a dense bushy growth of 1-50 stems. The stems, which range from green to purple, die back each year. Showy flowers vary from purple to magenta, possess 5-6 petals aggregated into numerous long spikes, and bloom from August to September. Leaves are opposite, nearly linear, and attached to four-sided stems without stalks. It has a large, woody taproot with fibrous rhizomes that form a dense mat.

This species may be confused with the native wing-angled loosestrife (*Lythrum alatum*) found in moist prairies or wet meadows. The latter has a winged, square stem and solitary paired flowers in the leaf axils. It is generally a smaller plant than the Eurasian loosestrife.

By law, purple loosestrife is a nuisance species in Wisconsin. It is illegal to sell, distribute, or cultivate the plants or seeds, including any of its cultivars.

DISTRIBUTION AND HABITAT: Purple loosestrife is a wetland herb that was introduced as a garden perennial from Europe during the 1800's. It is still promoted by some horticulturists for its beauty as a landscape plant, and by beekeepers for its nectar-producing capability. Currently, about 24 states have laws prohibiting its importation or distribution because of its aggressively invasive characteristics. It has since extended its range to include most temperate parts of the United States and Canada. The plant's reproductive success across North America can be attributed to its wide tolerance of physical and chemical conditions characteristic of disturbed habitats, and its ability to reproduce prolifically by both seed dispersal and vegetative propagation. The absence of natural predators, like European species of herbivorous beetles that feed on the plant's roots and leaves, also contributes to its proliferation in North America

LIFE HISTORY AND EFFECTS OF INVASION: Purple loosestrife can germinate successfully on substrates with a wide range of pH. Optimum substrates for growth are moist soils of neutral to slightly acidic pH, but it can exist in a wide range of soil types. Most seedling establishment occurs in late spring and early summer when temperatures are high.

Purple loosestrife spreads mainly by seed, but it can also spread vegetatively from root or stem segments. A single stalk can produce from 100,000 to 300,000 seeds per year. Seed survival is up to 60-70%, resulting in an extensive seed bank. Mature plants with up to 50 shoots grow over 2 meters high and produce more than two million seeds a year. Germination is restricted to open, wet soils and requires high temperatures, but seeds remain viable in the soil for many years. Even seeds submerged in water can live for approximately 20 months. Most of the seeds fall near the parent plant, but water, animals, boats, and humans can transport the seeds long distances. Vegetative spread through local perturbation is also characteristic of loosestrife; clipped, trampled, or buried stems of established plants may produce shoots and roots. Plants may be quite large and several years old before they begin flowering. It is often very difficult to locate non-flowering plants, so monitoring for new invasions should be done at the beginning of the flowering period in mid-summer.

Any sunny or partly shaded wetland is susceptible to purple loosestrife invasion. Vegetative disturbances such as water drawdown or exposed soil accelerate the process by providing ideal conditions for seed germination. Invasion usually begins with a few pioneering plants that build up a large seed bank in the soil for several years. When the right disturbance occurs, loosestrife can spread rapidly, eventually taking over the entire wetland. The plant can also make morphological adjustments to accommodate changes in the immediate environment; for example, a decrease in light level will trigger a change in leaf morphology. The plant's ability to adjust to a wide range of environmental conditions gives it a competitive advantage; coupled with its reproductive strategy, purple loosestrife tends to create monotypic stands that reduce biotic diversity.

Purple loosestrife displaces native wetland vegetation and degrades wildlife habitat. As native vegetation is displaced, rare plants are often the first species to disappear. Eventually, purple loosestrife can overrun wetlands thousands of acres in size, and almost entirely eliminate the open water habitat. The plant can also be detrimental to recreation by choking waterways. (Taken in its entirety from WDNR, 2010 http://www.dnr.state.wi.us/invasives/fact/loosestrife.htm)

Appendix IV: Milfoil Identification Guide

Eurasian water-milfoil vs. Northern water-milfoil

EWM Leaflets >26 NWM Leaflets < 24

EWM Leaflets Limp out of Water - NWM Leaflets Stiff Out of Water

Eurasian water-milfoil vs. Whorled water-milfoil

Dwarf water-milfoil

Plants spread by rhizomes, have no leaflets and are usually <6in.