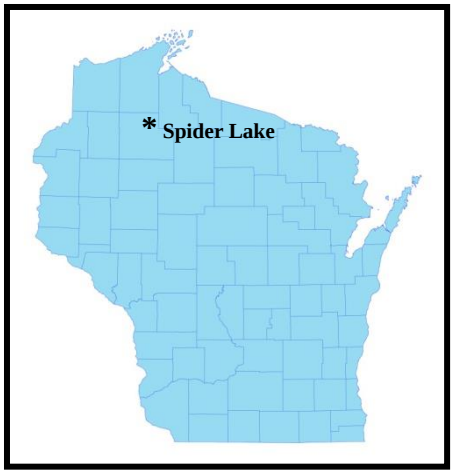
Aquatic Invasive Species
Meandering Littoral Zone Surveys
Spider Chain of Lakes (Clear, Fawn, North, Big and Little Spider) - Sawyer County, WI

Typical short Curly-leaf pondweed 6/30/22

Yellow Iris Clusters – North Bay of Big Spider 6/30/22

Project Initiated by:

Spider Chain of Lakes Association, Harmony Environmental, and the Wisconsin Department of Natural Resources



Dense Purple Loosestrife on Big Spider – 8/21/22

Surveys Conducted by and Report Prepared by:

Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin
June 30 and August 21, 2022

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INTRODUCTION:

The Spider Chain of Lakes (Clear Lake – WBIC 2435800 – 250 acres/Fawn Lake - WBIC 2435900 – 28 acres/North Lake – WBIC 2436000 – 132 acres/Spider Lake – WBIC 2435700 - 1,194 acre) cover 1,604 acres in the Town of Spider Lake in north-central Sawyer County (T42N R7W). Spider Lake reaches a maximum depth of 64ft in the deep hole in Big Spider just north of the channel to Little Spider, and it has an average depth of approximately 14ft (Figure 1). The lakes are mesotrophic in nature with Secchi readings from 1989-2017 averaging 11.2ft in Big Spider and 10.4ft in Little Spider (WDNR 2022). This good water clarity produced a littoral zone that reached approximately 15ft in 2022.

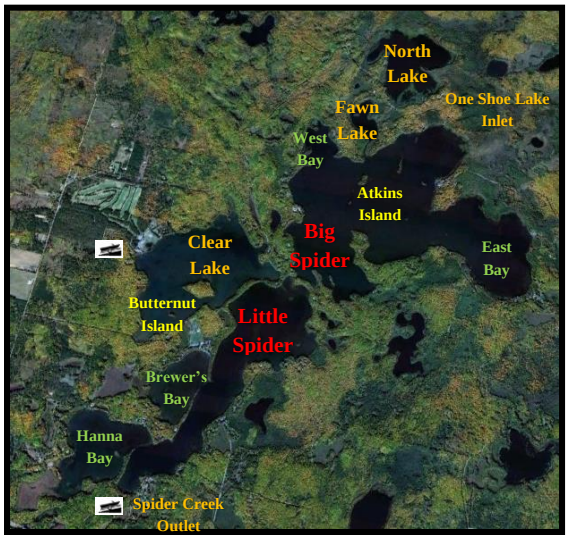

Figure 1: Spider Chain Aerial Photo

BACKGROUND AND STUDY RATIONALE:

The Spider Chain of Lakes Association (SCLA) has historically conducted aquatic plants surveys as a way of documenting the lakes' long-term health. The surveys also provide an opportunity to look for new exotic invasive species such as Eurasian water-milfoil (*Myriophyllum spicatum*) (EWM) – a species which has invaded many other lakes in the Hayward area, but has never been found in the Spider Chain. Curly-leaf pondweed (*Potamogeton crispus*) (CLP), another exotic species, was first documented in the Spider Lakes in 2005 (WDNR 2022). Herbicides were initially applied to CLP beds in 2010 and 2011, and the SCLA), under the direction of Dave Blumer (then Short, Elliot, Hendrickson, Inc. – now Lake Education and Planning Services, LLC), and the Wisconsin Department of Natural Resources (WDNR) authorized the first CLP and full point-intercept surveys on the chain in 2012 to develop both a better understanding of the level of infestation as well as to gather baseline information on the lakes' native plants. These surveys found CLP was largely confined to Big Spider with a single small bed found in Little Spider. Fortunately, at that time, no CLP was found in Clear, Fawn, or North Lakes. The data from these surveys was used to develop an initial WDNR approved Aquatic Plant Management Plan (APMP) which outlined the further use of herbicides to control CLP. However, because the initial applications produced little change in CLP coverage and because the cost to expand the program was deemed too expensive, the SCLA decided to abandon herbicide treatments altogether and take a wait-and-see approach.

Follow-up 2017 CLP point-intercept, CLP bed mapping, and full point-intercept surveys in each lake in the Spider Chain again found no evidence of EWM. However, they did document a sharp increase in CLP bed coverage in Big Spider and the spread of CLP to the channel between Big Spider and Fawn Lake. They also documented the spread of Yellow iris (*Iris pseudacorus*) throughout the system, and Purple loosestrife (*Lythrum salicaria*) throughout primarily Big Spider's East Bay.

In 2022, the SCLA, under the direction of Harmony Environmental (Chery Clemens), requested we complete two AIS shoreline surveys. The goals of the June survey were to document any expansion of CLP and quantify the total acreage of CLP areas that were likely to cause moderate to severe navigation impairment. The focus of the August survey was to look for evidence of EWM. This report is the summary of our June 30 and August 21, 2022 AIS shoreline surveys on the chain.

SURVEY METHODS:

We conducted a meandering survey along the shoreline of the entire chain of lakes to look for aquatic invasive plant species in the zone of growth they would most likely be found in. During the surveys, in addition to recording our tracks, we logged GPS waypoints for any AIS found. In June, we also revisited all previously known Curly-leaf pondweed beds, conducted random rake samples to quantify density, and mapped beds that had moderate (rake fullness 2) or high (rake fullness 3) densities (Figure 2). By definition, a "bed" was determined to be any area where we visually estimated that CLP made up >50% of the area's plants, was generally continuous with clearly defined borders, and was canopied, or close enough to being canopied that it would likely interfere with boat traffic. After we located a bed, we motored around the perimeter of the area taking GPS coordinates at regular intervals. We also estimated the rake density range and mean rake fullness of the bed, the maximum depth of the bed, whether it was canopied, and the impact it was likely to have on navigation (**none** – easily avoidable with a natural channel around or narrow enough to motor through/**minor** – one prop clear to get through or access open water/**moderate** – several prop clears needed to navigate through/**severe** – multiple prop clears and difficult to impossible to row through). These data were then mapped using ArcMap 9.3.1, and we used the WDNR's Forestry Tools Extension to determine the acreage of each bed to the nearest hundredth of an acre (Table 1).

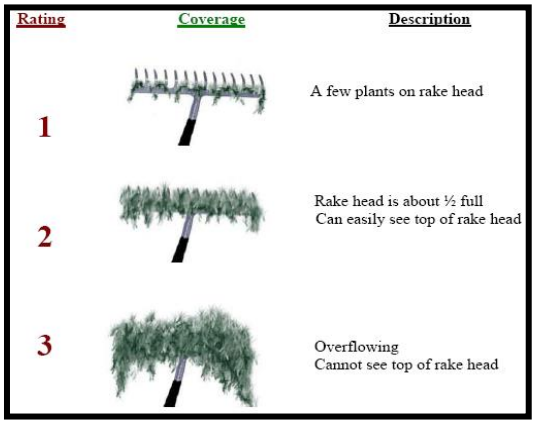

Figure 2: Rake Fullness Ratings (UWEX 2010)

RESULTS AND DISCUSSION:

In June, we surveyed transects totaling 41.8km (26.0 miles) throughout the visible littoral zone, and in August we covered 39.6km (24.6 miles) of search lines (Figure 3) (Appendix I). We **did NOT find any evidence of Eurasian water-milfoil, Japanese knotweed, or any other previously undocumented aquatic invasive species anywhere in the Spider Chain during either of these surveys**.

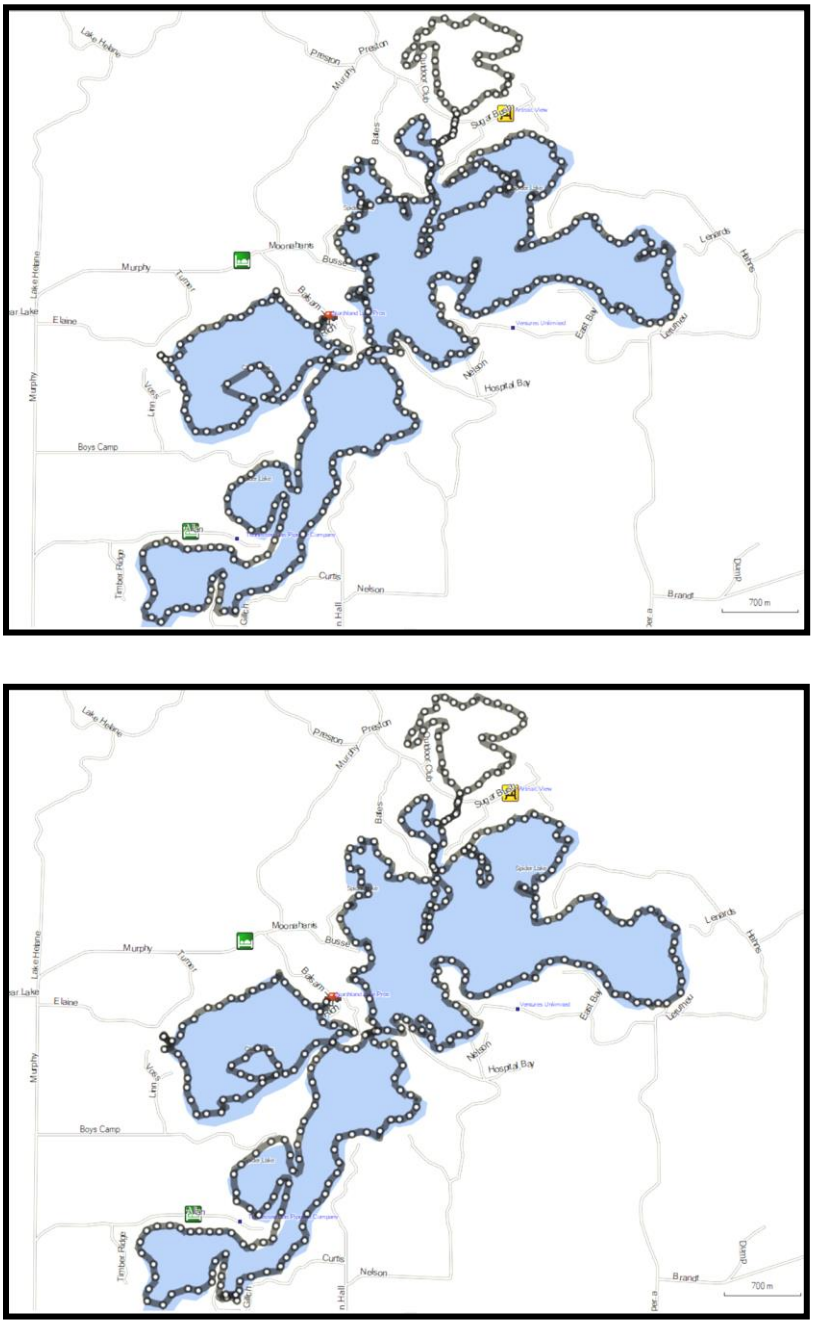

Figure 3: June and August 2022 Shoreline Survey Tracks

Curly-leaf Pondweed Bed Mapping:

In 2012, we found that searching Big Spider's 10ft bathymetric ring in areas over organic muck consistently produced CLP plants that were either canopied or nearing canopy. However, we were left with the opinion that, despite being an exotic species, CLP was seldom invasive to the point that it impeded navigation or excluded native vegetation. For the most part, CLP was acting like "just another plant" interspersed among other native species. Ultimately, we located and mapped 26 small areas that met the bed criteria or were at least close to it (Figure 4). The biggest (Bed 23) was 4.23 acres, and only two others (Bed 2 and 21) were over an acre (Table 1). Collectively, they covered 12.06 acres and accounted for 1.0% of the lake's approximately 1,194 total acres (Appendix II).

The 2013 survey found similar results with 28 beds totaling 9.22 acres (0.8% coverage) (Table 1) (Figure 4). Bed 23 was again the biggest (2.57 acres), and only one other (Bed 21 – 1.59 acres) was over an acre. As there was no active management on the lake in 2013, the decline in total acreage (**-23.55%**) from 2012 can be attributed to simple variations based on changes in annual growing conditions.

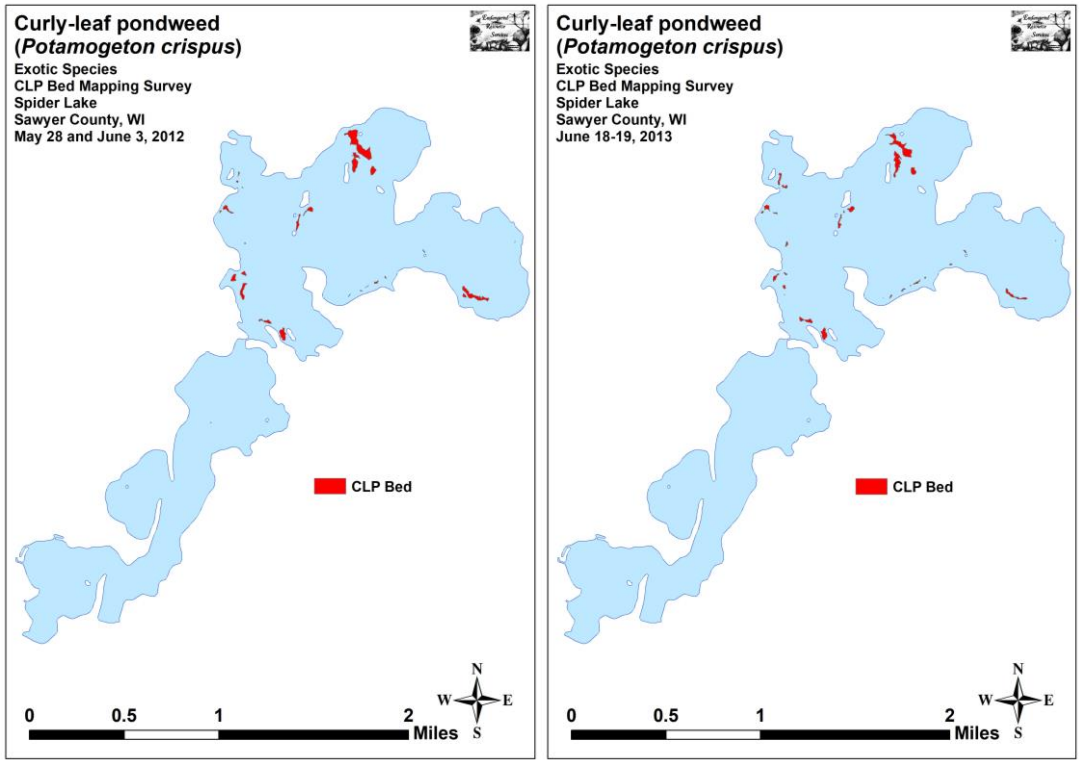

Figure 4: 2012 and 2013 Spring Curly-leaf Pondweed Beds

The spring of 2017 brought near record early ice-out in late March and early April followed by prolonged cool weather that kept lake temperatures in the 40's and 50's through May. These conditions appeared to benefit Curly-leaf pondweed, and we found exceptionally high levels on many of the lakes we surveyed. This was definitely the case on Spider Lake where we mapped 31 beds totaling 35.77 acres (3.0% of the lake's surface area) (Figure 5) (Table 1). This represented a 23.71-acre increase (+197%) over our 2012 bed mapping survey, and a 26.55-acre increase (+288%) over our 2013 survey (Appendix II). We also noted that many of these beds showed evidence of prop-trails, and floating CLP plants that had been ripped out of the bottom were common.

Conversely, the spring of 2022 brought late ice-out in late April followed by a rapid warm-up from freezing to water temperatures in the 60's in little over a week. This appears to have produced unfavorable growing conditions for CLP as many of the lakes we surveyed had very low levels. Despite this, we were surprised to find that CLP was almost undetectable on the Spider Chain. In 2022, we saw no evidence of CLP being uprooted or causing any navigation impairment as we saw no evidence of canopied or near-canopy beds (Figure 5) (Appendix II). Despite raking in the former beds, we had difficulty finding **ANY** CLP, and, when we did, plants tended to be only a few feet tall and were setting turions (see front cover of the report) (Table 1).

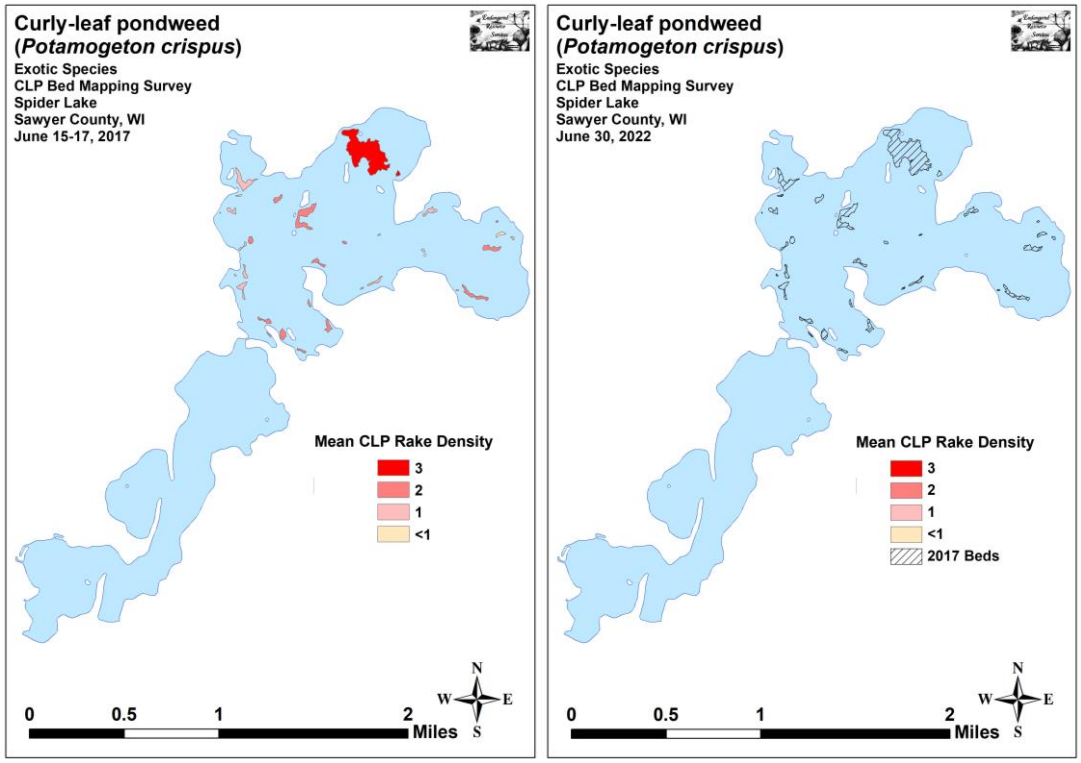

Figure 5: 2017 and 2022 Spring Curly-leaf Pondweed Beds

Table 1: Curly-leaf Pondweed Bed Summary
Spider Lake – Spider Chain, Sawyer County – June 30, 2022

Bed Number	2022 Acreage	2017 Acreage	2013 Acreage	2012 Acreage	2017-2022 Change in Acres	Rake Range; Est. Mean Rake Full.	Estimated Navigation Impairment	Other Field Notes
1	0.00	0.14	0.00	0.01	-0.14	-	None	No CLP found.
2	0.00	1.43	0.65	1.58	-1.43	1-2; 1	None	Regular plants 3-4ft tall – not visible.
3 and 3A	0.00	0.05	0.00	0.15	-0.05	-	None	No CLP found.
4 and 4B	0.00	0.00	0.09	0.03	0.00	-	None	No CLP found.
5	0.00	0.00	0.02	0.02	0.00	-	None	No CLP found.
6 and 7	0.00	0.48	0.14	0.10	-0.48	-	None	No CLP found.
8	0.00	0.07	0.08	0.02	-0.07	-	None	No CLP found.
9 and 9B	0.00	0.00	0.05	0.01	0.00	-	None	No CLP found.
9C	0.00	0.56	0.00	0.00	-0.56	-	None	No CLP found.
9D	0.00	0.20	0.00	0.00	-0.20	-	None	No CLP found.
9E	0.00	0.77	0.00	0.00	-0.77	-	None	No CLP found.
9F	0.00	0.28	0.00	0.00	-0.28	-	None	No CLP found.
10	0.00	0.84	0.77	0.89	-0.84	-	None	No CLP found.
11	0.00	0.55	0.51	0.36	-0.55	-	None	No CLP found.
11A	0.00	0.08	0.00	0.00	-0.08	-	None	No CLP found.
12A and B	0.00	0.90	0.13	0.75	-0.90	<<<1-1; <<<1	None	Just a couple of plants raked up.
13	0.00	0.05	0.27	0.43	-0.05	-	None	No CLP found.
14	0.00	0.52	0.06	0.21	-0.52	-	None	No CLP found.
15	0.00	0.23	0.10	0.01	-0.23	-	None	No CLP found.
15A	0.00	0.48	0.00	0.00	-0.48	<<<1-1; <<<1	None	Just a couple of plants raked up.
16	0.00	0.01	0.06	0.04	-0.01	-	None	No CLP found.
17A and B	0.00	0.56	0.38	0.38	-0.56	<<<1-1; <<<1	None	Just a couple of plants raked up.
18A	0.00	0.13	0.00	0.00	0.13	-	None	No CLP found.
18, 19, and 20	0.00	2.41	0.49	0.10	2.41	-	None	No CLP found.
20A	0.00	0.61	0.00	0.00	0.61	-	None	No CLP found.

Table 1 (continued): Curly-leaf Pondweed Bed Summary
Spider Lake – Spider Chain, Sawyer County – June 30, 2022

Bed Number	2022 Acreage	2017 Acreage	2013 Acreage	2012 Acreage	2017-2022 Change in Acres	Rake Range; Est. Mean Rake Full.	Estimated Navigation Impairment	Other Field Notes
21, 22, and 23	0.00	18.17	4.64	6.17	18.17	<<<1-1; <<<1	None	Just a handful of CLP plants found.
22A	0.00	0.26	0.00	0.00	0.26	-	None	No CLP found.
24, 25A and 25B	0.00	3.45	0.74	0.80	3.45	-	None	No CLP found.
26	0.00	0.16	0.00	0.00	0.16	-	None	No CLP found.
27	0.00	0.04	0.00	0.00	0.04	-	None	No CLP found.
28	0.00	0.77	0.00	0.00	0.77	-	None	No CLP found.
29	0.00	1.10	0.00	0.00	1.10	-	None	No CLP found.
30	0.00	0.40	0.00	0.00	0.40	-	None	No CLP found.
31	0.00	0.06	0.00	0.00	0.06	-	None	No CLP found.
32 (Little Spider)	0.00	0.00	0.00	0.01	0.00	-	None	No CLP found.
Total Acres	**0.00**	**35.77**	**9.22**	**12.06**	**-35.77**			

Yellow Iris:

In 2017, we found eight areas with clusters of Yellow iris (*Iris pseudacorus*) on Spider Lake and a few additional clusters on North Lake (Figure 6). This exotic invasive species was not seen anywhere on the lake during the original 2012 surveys suggesting it is a relatively recent introduction. At the time of the 2017 survey, we noted that it appeared to be spreading rapidly as most large clusters had satellite plants radiating out in all directions. An attractive species, we also noticed that many shoreline owners – not understanding its potential to invade native wetlands – were mowing around the plant rather than removing it (Appendix III).

The 2022 survey found Yellow iris was present around almost the entire north bay of Big Spider in increasingly inaccessible or nearly inaccessible wetlands. Elsewhere, we noticed residents were now actively removing plants whenever they found them. Several residents informed us they were actively looking for and removing this species along both their immediate shoreline and adjacent areas. Whenever possible, we informed shoreline owners of this species and encouraged them to remove it.

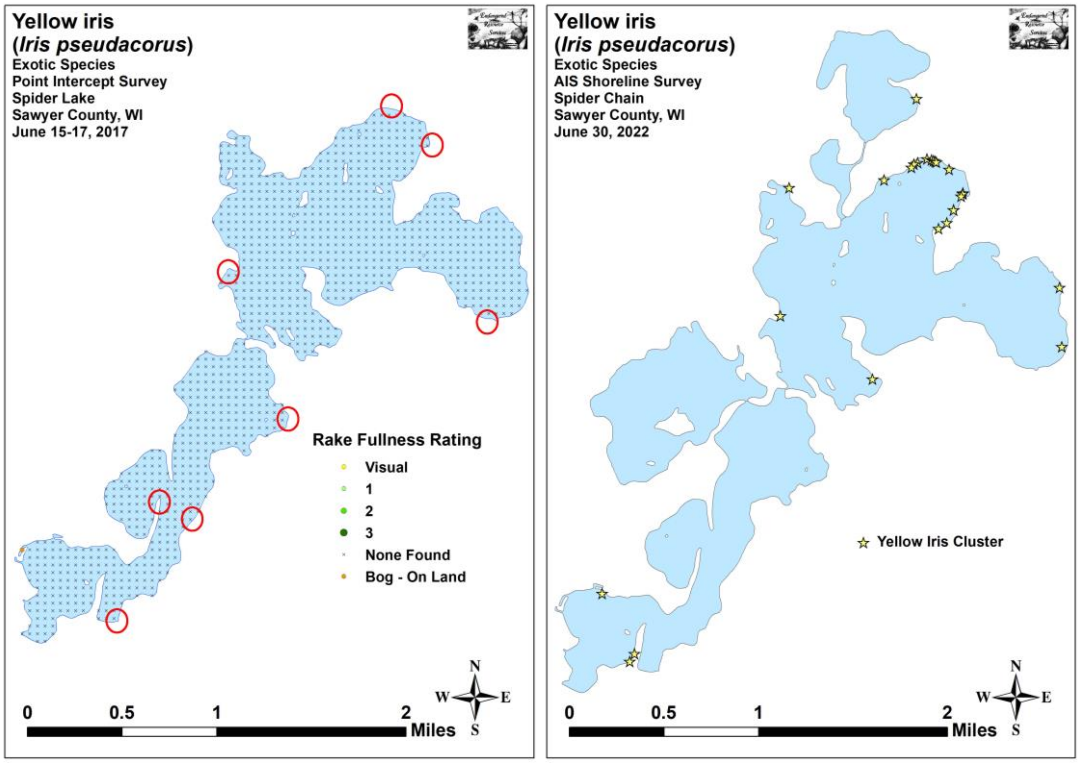

Figure 6: 2017 and 2022 Spring Yellow Iris Distribution

Purple Loosestrife:

We have documented Purple loosestrife on the lake during each late-summer survey since 2012. Plant have historically occurred at the main public landing on Clear Lake and scattered around the north and east bays of Big Spider. Loosestrife beetles (*Galerucella* spp.) have been introduced to the population at the Clear Lake landing, and this, coupled with volunteer flower head clipping, are keeping those plants at almost undetectable levels. However, away from this area, plants show no signs of beetle herbivory, and, especially along the eastern shoreline of the north bay on Big Spider, Purple loosestrife is aggressively invading lowland areas (Figure 7) (Appendix III). For more information on a selection of aquatic exotic invasive plant species, see Appendix IV.

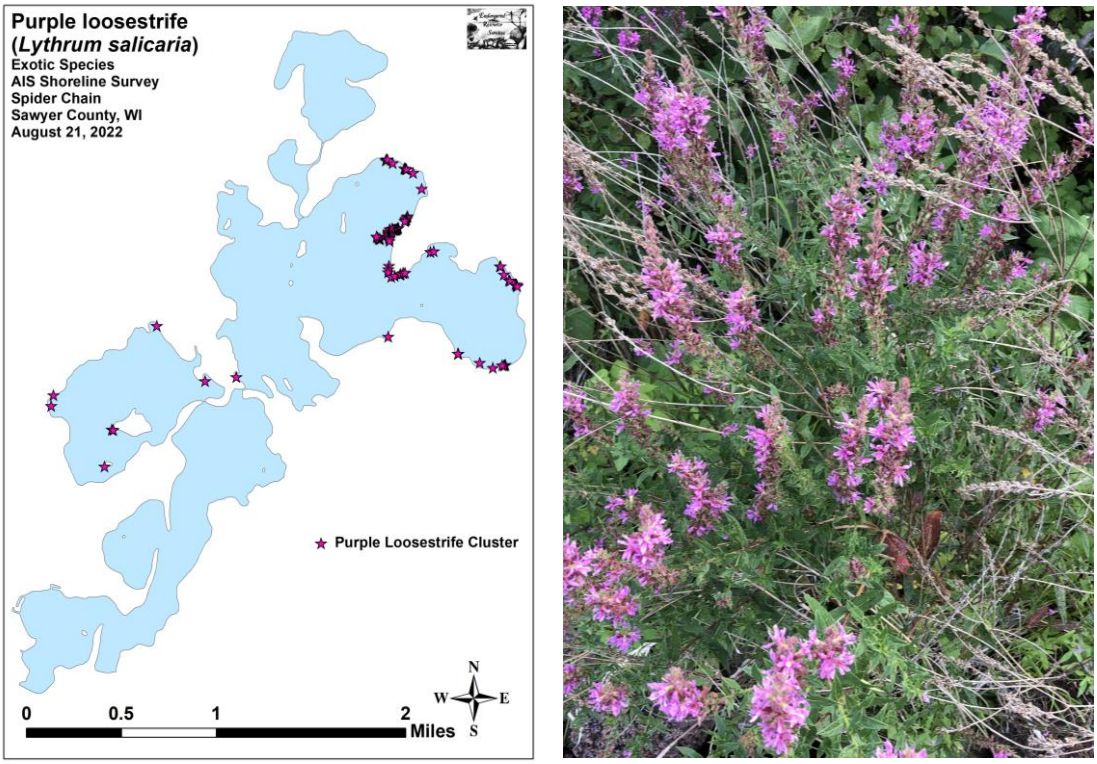

Figure 7: August 2022 Purple Loosestrife Distribution/ Beetle Free Plants in Big Spider

CONSIDERATIONS FOR FUTURE MANAGEMENT:

Eurasian Water-milfoil:

With Eurasian water-milfoil growing in at least 18 other nearby Sawyer County Lakes, we encourage the SCLA 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.

Yellow Iris:

Educating lakeshore residents to dig Yellow iris out has resulted in declines in this species around Little Spider, and is holding the plants in check on North Lake. Elsewhere, especially in the north bay of Big Spider, the plant continues to spread rapidly making containing it increasing difficult. Plants may now be so dense that simple manual removal may no longer be possible, and spot herbicide applications may be the most likely solution.

Purple Loosestrife:

Volunteer efforts coupled with the beetle population at Clear Lake's landing are containing this species as they are supposed to. Unfortunately, the population on Big Spider appears to be too far away for the beetles to disperse on their own. Raising beetles to release on the Big Spider population of loosestrife is strongly encouraged as the density on the east shoreline of the north bay is now big enough to support a large beetle population that should be both self-sustaining and able to disperse into the east bay.

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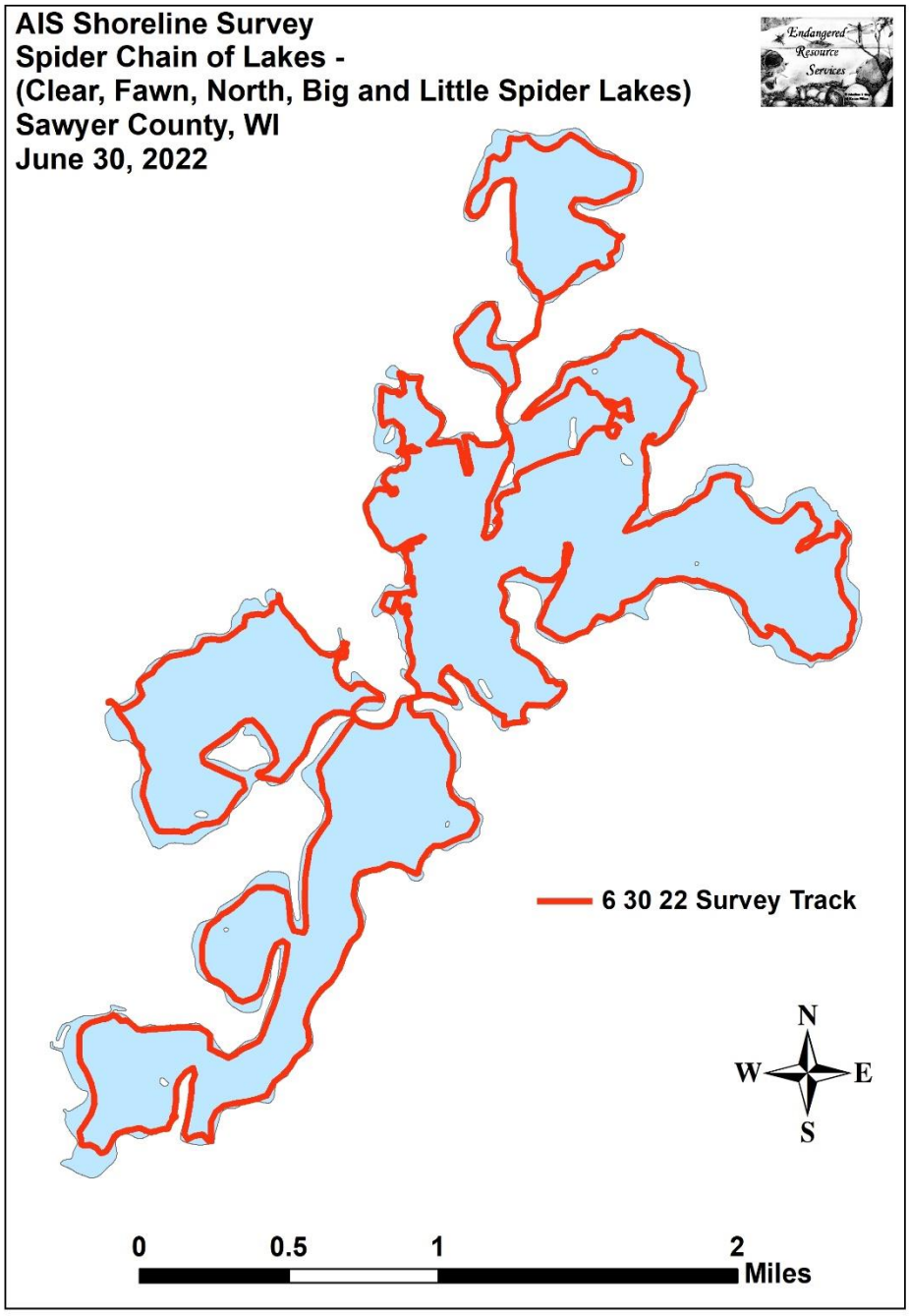
WDNR. [online]. 2012. Reed canary grass fact sheet. http://dnr.wi.gov/topic/Invasives/fact/ReedCanaryGrass.html (2012, October).

Appendix I: 2022 Spider Chain June and August Survey Tracks


AIS Shoreline Survey
Spider Chain of Lakes -
(Clear, Fawn, North, Big and Little Spider Lakes)
Sawyer County, WI
June 30, 2022
Endangered Resource Services
6 30 22 Survey Track
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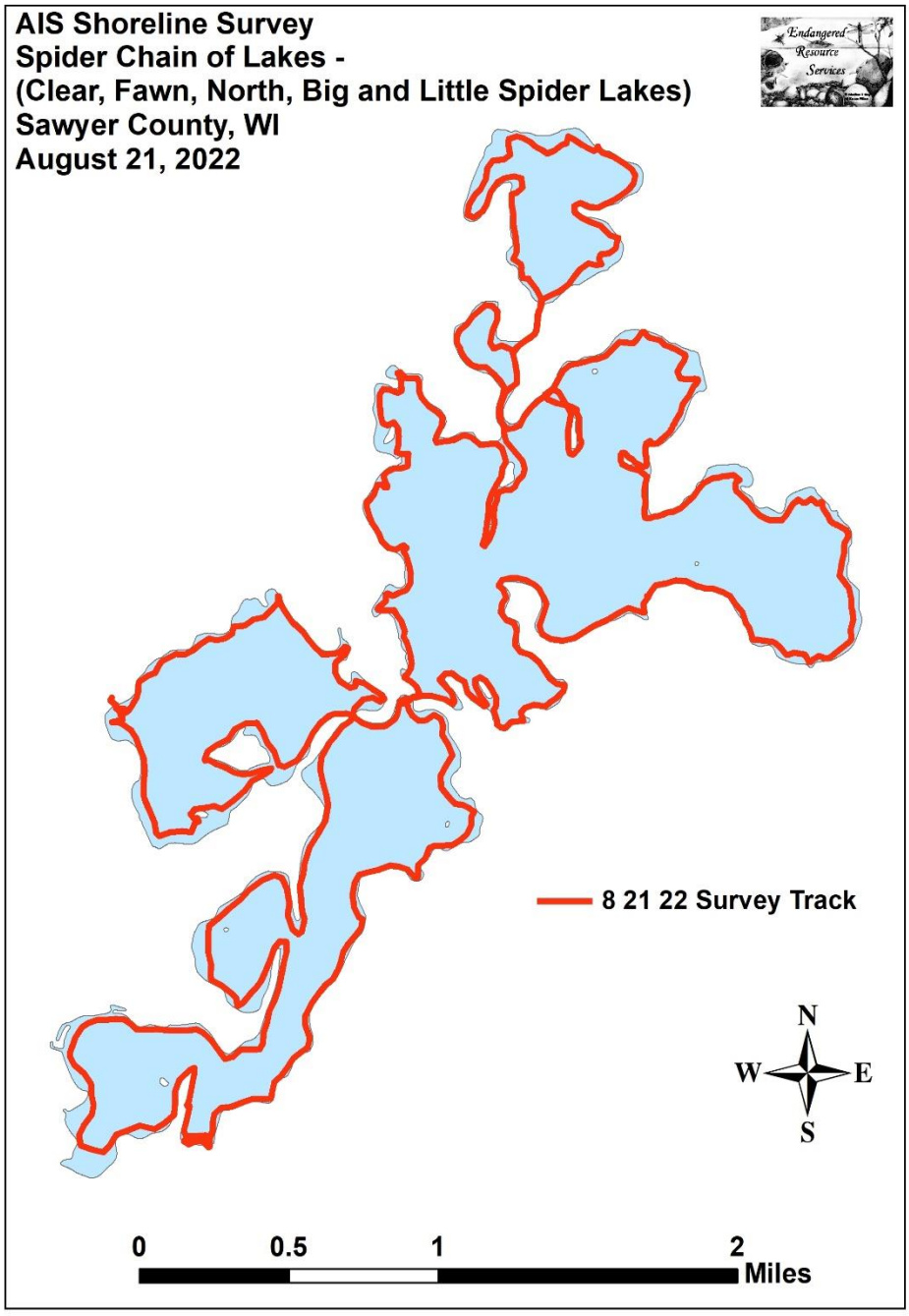
AIS Shoreline Survey
Spider Chain of Lakes -
(Clear, Fawn, North, Big and Little Spider Lakes)
Sawyer County, WI
August 21, 2022
Endangered Resource Services
8 21 22 Survey Track
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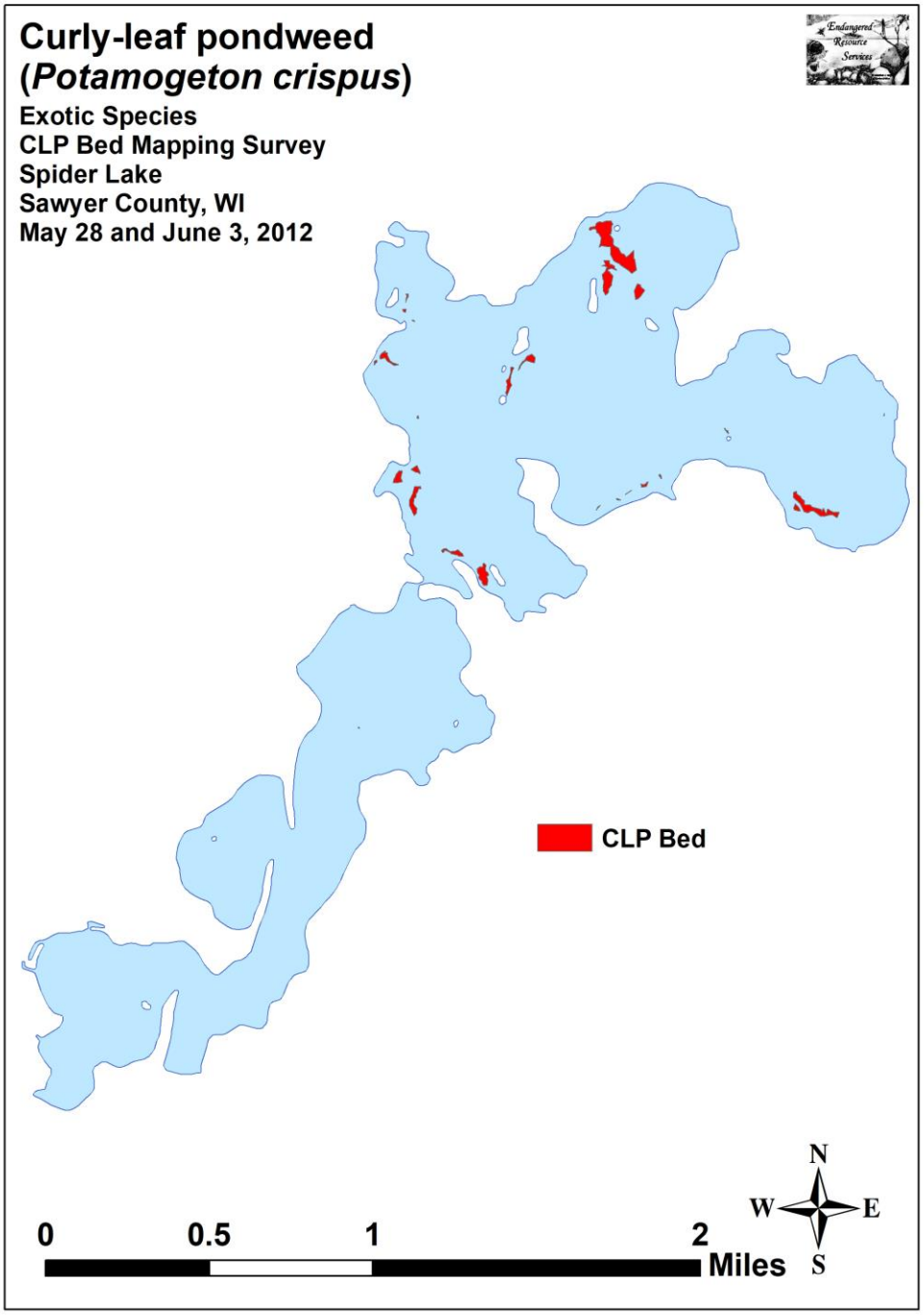
Appendix II: 2012, 2013, 2017, and 2022 Spider Lake Curly-leaf Pondweed Bed Maps


Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Bed Mapping Survey
Spider Lake
Sawyer County, WI
May 28 and June 3, 2012
Endangered Resource Services
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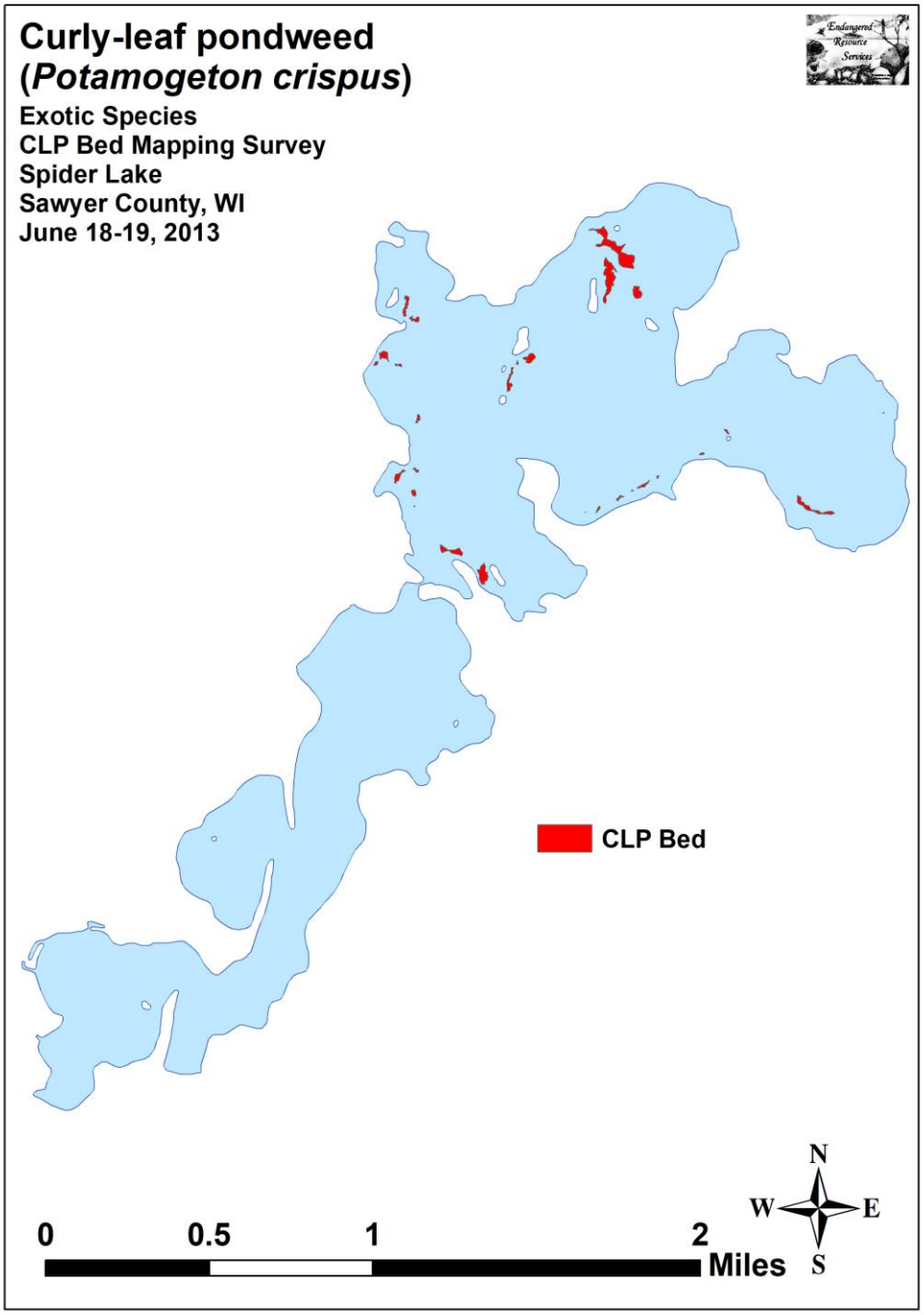
Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Bed Mapping Survey
Spider Lake
Sawyer County, WI
June 18-19, 2013
Endangered Resource Services
CLP Bed
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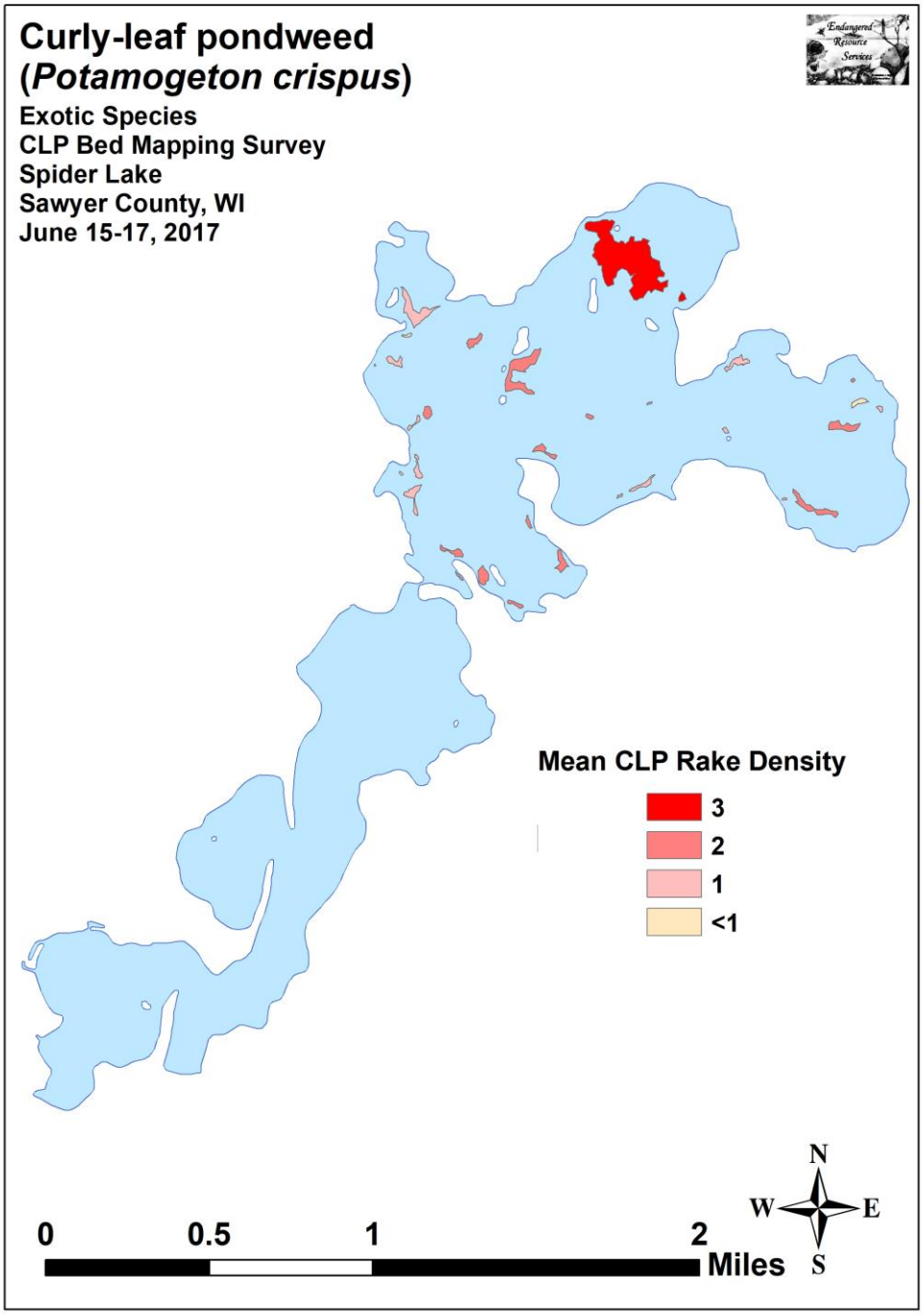
Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Bed Mapping Survey
Spider Lake
Sawyer County, WI
June 15-17, 2017
Endangered Resource Services
Mean CLP Rake Density
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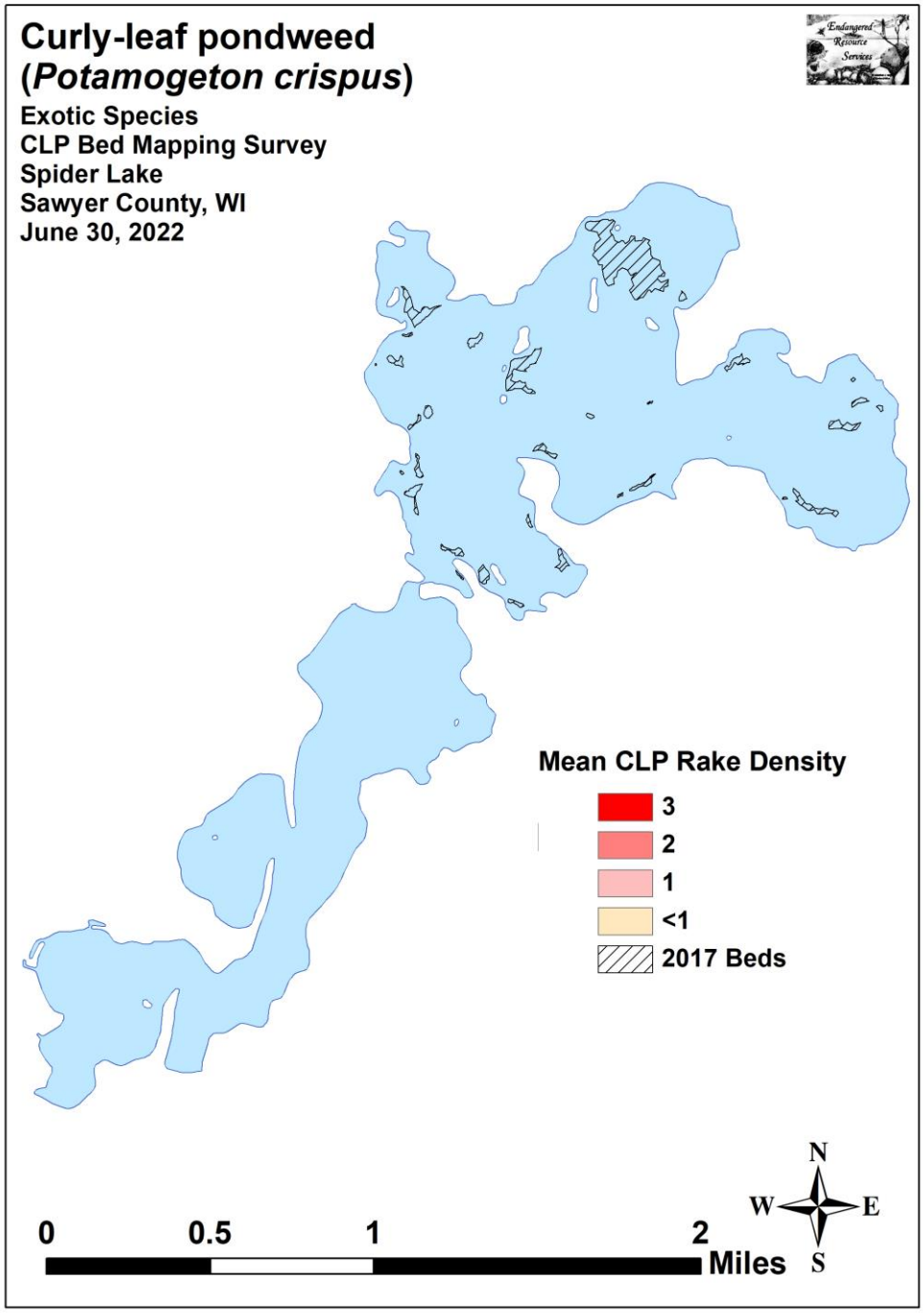
Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Bed Mapping Survey
Spider Lake
Sawyer County, WI
June 30, 2022
Endangered Resource Services
Mean CLP Rake Density
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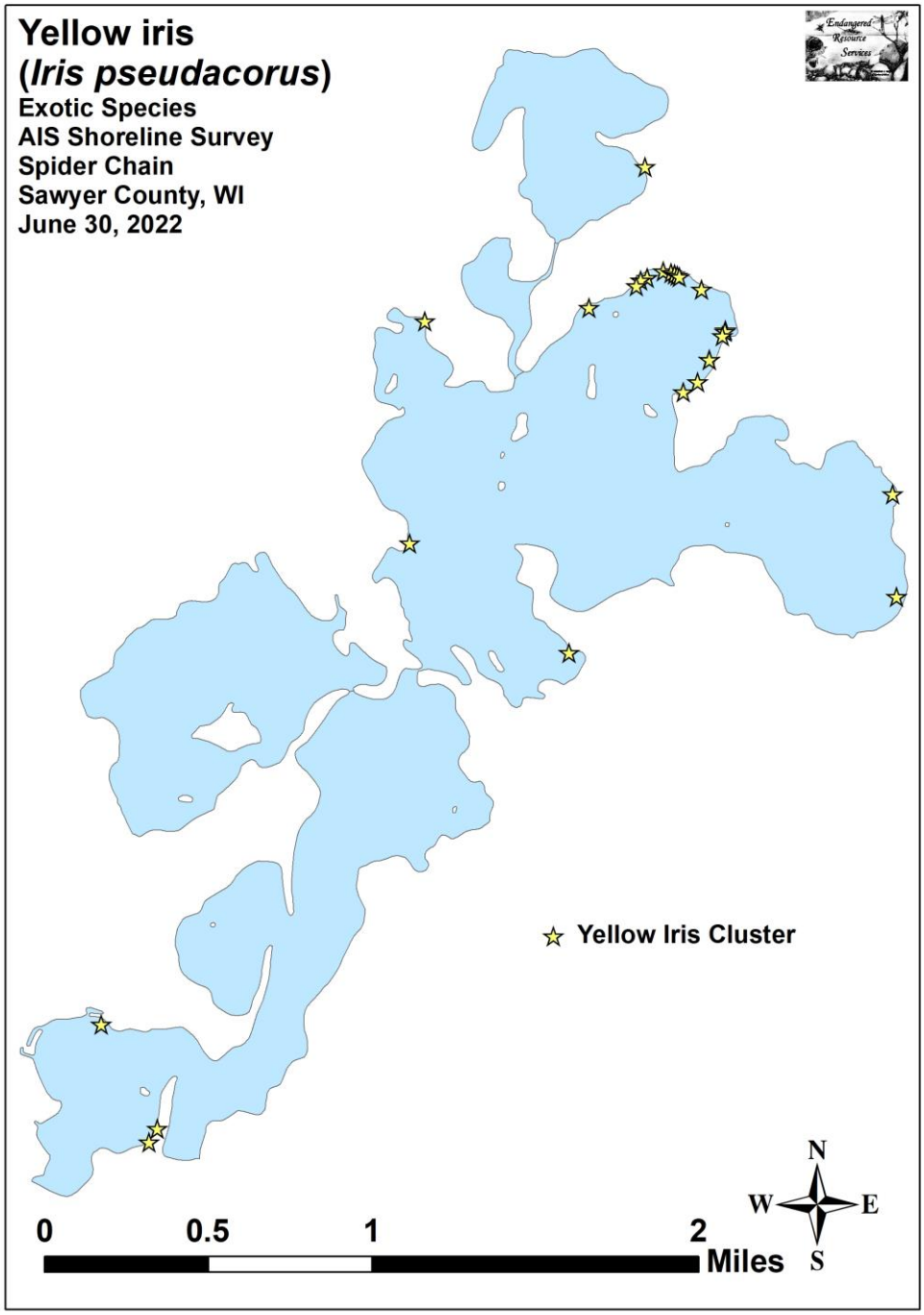
Appendix III: 2022 Yellow Iris and Purple Loosestrife Maps


Yellow iris
(Iris pseudacorus)
Exotic Species
AIS Shoreline Survey
Spider Chain
Sawyer County, WI
June 30, 2022
Endangered Resource Services
Yellow Iris Cluster
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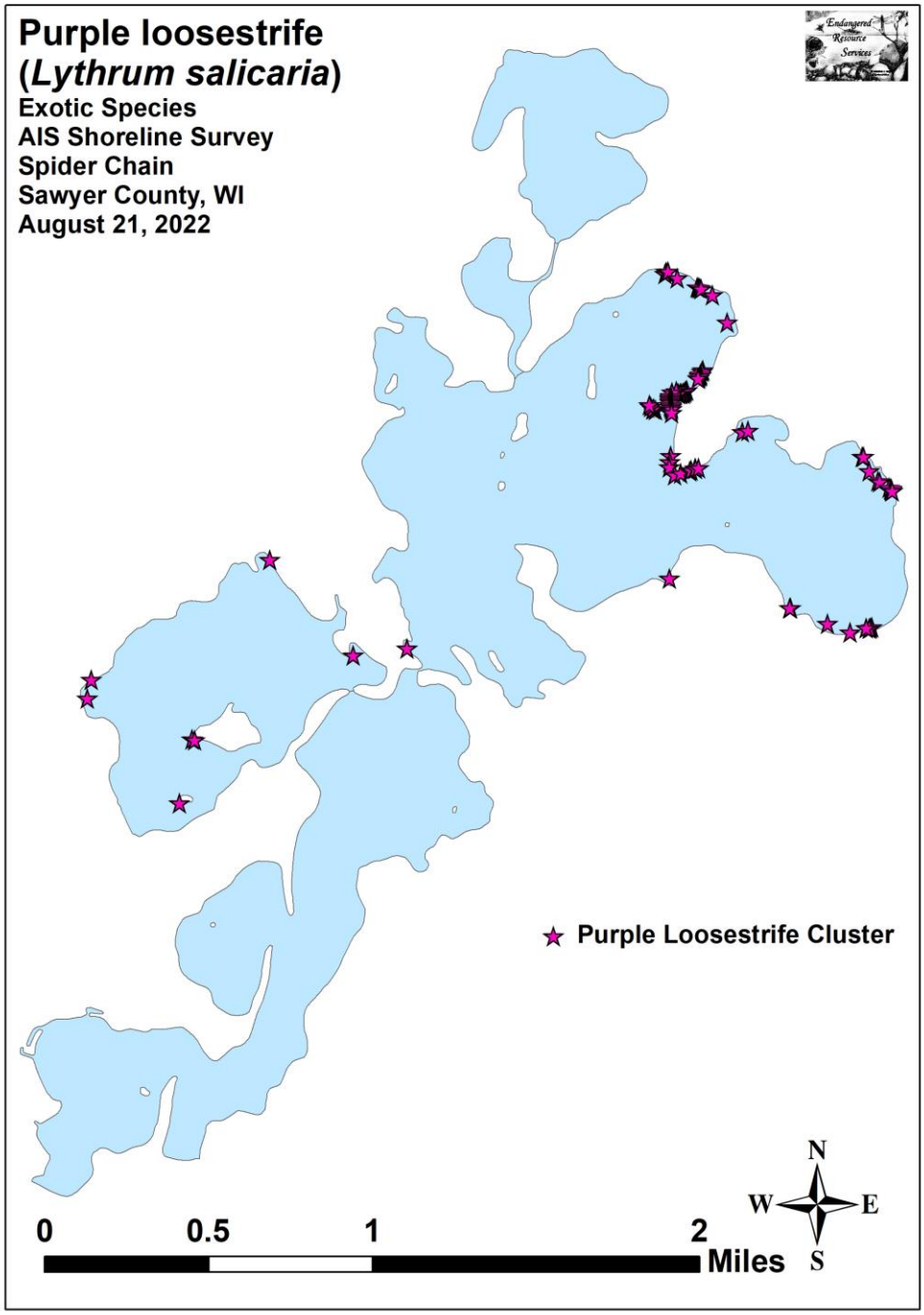
Purple loosestrife
(Lythrum salicaria)
Exotic Species
AIS Shoreline Survey
Spider Chain
Sawyer County, WI
August 21, 2022
Endangered Resource Services
Purple Loosestrife Cluster
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Appendix IV: Aquatic Exotic Invasive Plant Species Information

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.

Purple loosestrife was first detected in Wisconsin in the early 1930's, but remained uncommon until the 1970's. It is now widely dispersed in the state, and has been recorded in 70 of Wisconsin's 72 counties. Low densities in most areas of the state suggest that the plant is still in the pioneering stage of establishment. Areas of heaviest infestation are sections of the Wisconsin River, the extreme southeastern part of the state, and the Wolf and Fox River drainage systems.

This plant's optimal habitat includes marshes, stream margins, alluvial flood plains, sedge meadows, and wet prairies. It is tolerant of moist soil and shallow water sites such as pastures and meadows, although established plants can tolerate drier conditions. Purple loosestrife has also been planted in lawns and gardens, which is often how it has been introduced to many of our wetlands, lakes, and rivers.

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, 2012 http://www.dnr.state.wi.us/invasives/fact/loosestrife.htm)