

**Hybrid Eurasian water-milfoil
(*Myriophyllum spicatum* X *sibiricum*)
Bed Mapping Survey
Namekagon Lake - WBIC: 2732600
Bayfield County, Wisconsin**



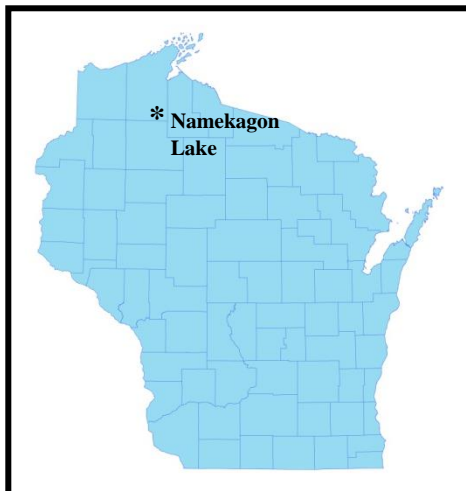
Hybrid Water-milfoil Beds (Red) - 8/26/23



Canopied bed of Hybrid water-milfoil in Bluegill Bay – 9/9/23

Project Initiated by:

The Namekagon Lake Association, Harmony Environmental,
the Wisconsin Department of Natural Resources, and
the Bayfield County Land & Water Conservation Department



Scattered Hybrid water-milfoil in the Lakewoods Marina - 8/26/23

Survey Conducted by and Report Prepared by:

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August 26, 2023

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INTRODUCTION:

Namekagon Lake (WBIC 2732600) is a 2,897-acre drainage lake in south-central Bayfield County, Wisconsin in the Towns of Namekagon and Grand View (T43/44N R5/6W). It has a maximum depth of 51ft and an average depth of approximately 16ft. The lake is eutrophic bordering on mesotrophic in nature, and water clarity is generally fair with summer Secchi readings from 1995-2018 (the last year data was available) ranging from 6-14ft and averaging 8.1ft in the deep hole northeast of Paines Island (Figure 1) (WDNR 2023). The lake's bottom substrate is variable with sand and rock occurring along the majority of shorelines and around the lake's numerous islands, while sandy and organic muck dominate the deep flats and sheltered bays (Holt et al. 1971).

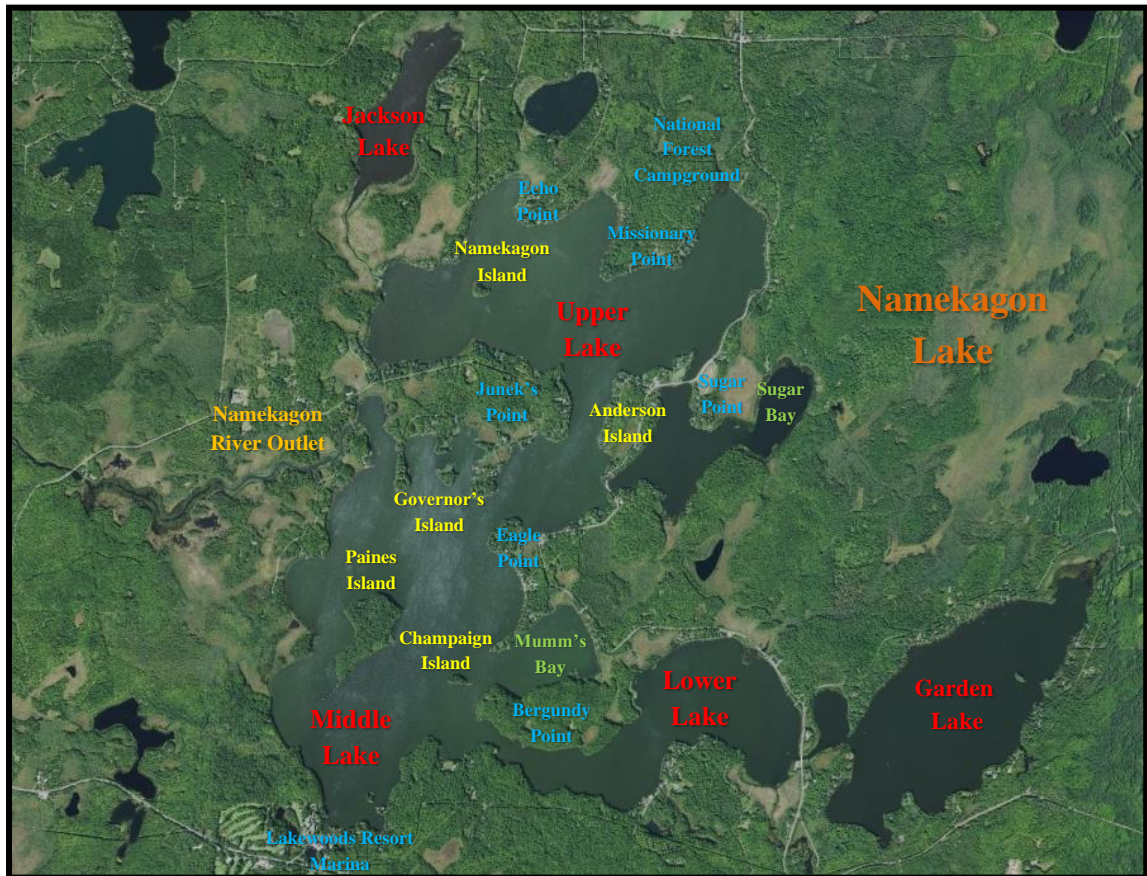


Figure 1: Namekagon Lake Aerial Photo

STUDY BACKGROUND AND RATIONALE:

On June 17, 2016, while doing bird surveys on the lake, we discovered plants at the Lakewoods Resort Marina boat landing that looked to be intermittent between the exotic invasive Eurasian water-milfoil (*Myriophyllum spicatum*) (EWM) and native Northern water-milfoil (*Myriophyllum sibiricum*) (NWM). Wisconsin Department of Natural Resources (WDNR) and Bayfield County Land and Water Conservation Department (BCLWCD) immediately followed-up with a collection of plants that were sent to the state lab where DNA analysis confirmed them as Hybrid water-milfoil (HWM).

In response to these findings, we were asked by the Namekagon Lake Association (NLA) and the WDNR to complete a full warm-water point-intercept macrophyte survey on Namekagon Lake from August 23-25, 2016. These data were used to develop the lake's initial Aquatic Plant Management Plan (APMP) which outlined manual removal and limited herbicide treatments to control the infestation.

Manually removal efforts continued from 2016-2018, but a fall shoreline survey in 2018 found that Hybrid water-milfoil had broken out of these original areas and was spreading throughout the entire lake. Because of this, in 2019, the NLA decided to treat four areas totaling 6.92 acres (0.24% of the lake's total surface area) with Diquat (Tribune – 2gal/acre) and lead seven additional hand pulling workshops. Unfortunately, these efforts proved largely unsuccessful as our fall 2019 survey delineated 18 areas covering 12.30 acres (0.42% surface area). After a further chemical treatment of 10.03 acres (0.35% surface area) with Diquat in June of 2020, our late-summer bed mapping survey found slightly reduced acreage of HWM; but it also documented a thickening of established beds and many new satellite areas (26 beds covering 9.87 acres or 0.34% of the lake). Based on these results, in 2021 the NLA decided to experiment with different herbicides (Diquat/2,4-D/ProcellaCor) and further expand its treatment program (22.86 acres – 0.79% of the lake). We were disappointed to report that these treatments again proved unsuccessful as our fall survey found a further expansion in HWM (33 beds covering 23.14 acres – 0.80% of the lake).

In an effort to reverse this trend in 2022, the NLA, under the guidance Harmony Environmental (HE – Cheryl Clemens) and with the WDNR's authorization, decided to treat 24 Hybrid water-milfoil beds as well as buffer areas (43.14 acres – 1.49% of the lake). This treatment proved highly successful at reducing HWM acreage in the lake as our August 2022 survey found six beds covering 5.19 acres (0.18% of the lake's 2,897 acres) – a nearly 18-acre decline (-77.57%) compared to 2021. Based on these results, the NLA decided to forego any chemical treatments in 2023 and see how HWM responded. They also requested that we again complete a late-summer bed mapping survey to help determine what, if any, management should occur in 2024. This report is the summary analysis of that survey conducted on August 26, 2023.

METHODS:

Late Summer Hybrid Water-milfoil Bed Mapping Survey:

During the survey, we searched the visible littoral zone throughout the entire lake. By definition, a “bed” was determined to be any area where we visually estimated that HWM 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 taking GPS coordinates at regular intervals. We also estimated the rake density range and mean rake fullness of the bed (Figure 2), the range and mean 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. We also mapped “high density areas” where HWM plants were continuous but didn’t meet all of the other “bed” criteria.




<u>Rating</u>	<u>Coverage</u>	<u>Description</u>
1		A few plants on rake head
2		Rake head is about 1/2 full Can easily see top of rake head
3		Overflowing Cannot see top of rake head

Figure 2: Rake Fullness Ratings

RESULTS AND DISCUSSION:

Late Summer Hybrid Water-milfoil Bed Mapping Survey:

On August 26, 2023, we searched 68.8km (42.8 miles) of transects throughout the lake's visible littoral zone (Figure 3). With the exceptions of Mumm's Bay and east of Governor's Island, most 2022 treatment areas continued to have no or very low levels of milfoil. However, outside these areas, we found previously mapped beds had undergone significant expansion. We also located many newly established small beds. In total, we mapped 30 areas that covered 38.24 acres (1.32% of the lake's 2,897 acres). This was a 33.05-acre increase (+638.80%) compared to our 2022 posttreatment survey when we mapped six beds covering 5.19 acres (0.18% of the lake's surface area) (Table 1). It was also the highest acreage total since our monitoring began in 2018 (Table 2) (Figure 4) (Appendix I).

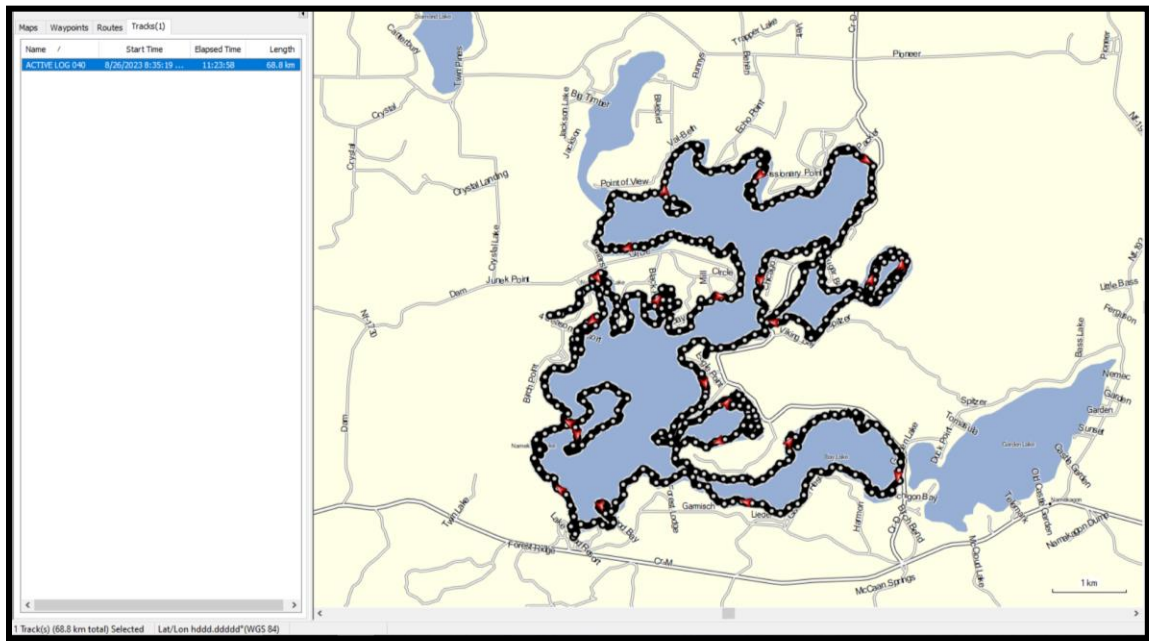


Figure 3: August 26, 2023 HWM Littoral Zone Survey GPS Tracks

**Table 1: Hybrid Water-milfoil Bed Mapping Summary
Namekagon Lake - Bayfield County, WI
August 3-5, 2022 and August 26, 2023**

Area Number	Lake Region	2023 Late Summer Acreage	2022 Late Summer Acreage	2022-2023 Change in Acreage	Rake Range and Mean Rake Fullness	Range and Mean Depth	Canopied?	Navigation Impairment	2023 Field Notes
Area 1	Lakewoods Bay to Paines Island	3.11	0.04	3.07	<<<1-3; 1	2-8; 6	Yes	Minor	Most beds mixed w/ NWM.
Area 2	Lake Outlet – River	0	0	0	<<<1	2-5; 4	Yes	None	Only a handful of plants seen.
Area 3	Four Seasons Bay	0.01	0	0.01	1-2; 1	4-6; 5	Yes	None	Few clusters of dense plants.
Area 4	Governor’s Island Bays	7.56	0.07	7.49	<<<1-3; 1	4-8; 5	Yes	Minor	Open but thickening beds.
Area 5	West Channel to Garmish	0.26	0	0.26	<<<1-2; <1	3-8; 6	Yes	None	Regular establishing plants.
Area 6	Mumm’s Bay	9.10	0	9.10	<<<1-3; 1	3-8; 6	Yes	Minor	Merging microbeds.
Area 7	Anderson Island - East Bay	0	0	0	-	-	-	-	No HWM seen.
Area 8	National Campground Bay	0.13	0	0.13	<<<1-2; 1	3-7; 6	Yes	Minor	Open deepwater beds.
Area 9	Mogasheen Bay	0.03	0	0.03	<<<1-2; 1	6-8; 7	Yes	Minor	Open deepwater bed.
Area 10	Echo Point West Bay	0	0	0	0	-	-	-	No HWM seen.
Area 11	Upper Lake SW Shoreline	0.05	0	0.05	<<<1-2; <1	5-8; 6	Yes	None	Regular, but scattered plants.
Area 12	Bluegill Bay (Tank Lake)	15.95	5.08	10.87	<<<1-3; 1	3-7; 6	Yes	Minor	Dense microbeds ring bay.
Area 13	Anderson Island - Southwest Bay Including Finger Bay	0.88	0	0.88	<<<1-3; 1	2-7; 6	Yes	Minor	Establishing open beds.
Area 14	Lower Lake (Bay Lake)	1.16	0	1.16	<<<1-2; <1	3-7; 6	Yes	None	Regular pioneering clusters.
	Total	38.24	5.19	+33.05					

**Table 2: Historical Hybrid Water-milfoil Bed Mapping Summary
Namekagon Lake - Bayfield County, WI
2018-2023**

Area Number	Lake Region	2023 Late Summer Acreage	2022 Late Summer Acreage	2021 Late Summer Acreage	2020 Late Summer Acreage	2019 Fall Acreage	2018 Fall Acreage	2022-2023 Change in Acreage
Area 1	Lakewoods Bay	3.11	0.04	0.19	0	0.73	2.48	3.07
Area 2	Lake Outlet – River	0	0	2.57	1.31	1.26	6.86	0
Area 3	Four Seasons Bay	0.01	0	6.07	1.76	3.16	7.63	0.01
Area 4	Governor’s Island Bay	7.56	0.07	0.66	3.41	0.80	0.45	7.49
Area 5	West Channel to Garmish	0.26	0	0.30	0.23	0.15	0	0.26
Area 6	Mumm’s Bay	9.10	0	1.75	0.76	4.09	2.68	9.10
Area 7	Anderson Island East Bay	0	0	3.18	0.44	0.04	0.06	0
Area 8	National Campground Bay	0.13	0	0.77	0.34	0.07	0	0.13
Area 9	Mogasheen Bay	0.03	0	4.07	1.08	1.98	0.21	0.03
Area 10	Echo Point West Bay	0	0	2.77	0	0	0	0
Area 11	Upper Lake SW Shoreline	0.05	0	0.82	0.53	0	0	0.05
Area 12	Bluegill Bay (Tank Lake)	15.95	5.08	0	0	0	0	10.87
Area 13	Anderson Island - Southwest Bay (Including Finger Bay)	0.88	0	0	0	0	0	0.88
Area 14	Lower Lake (Bay Lake)	1.16	0	0	0	0	0	1.16
	Total	38.24	5.19	23.14	9.87	12.30	20.37	+33.05

Descriptions of Past and Present Hybrid Water-milfoil Beds:

Area 1 – Lakewoods Bay – Hybrid water-milfoil was present throughout the Lakewoods Marina; especially leading away from the public boat launch (Figure 4) (Appendix I). Floating fragments were common, and, unfortunately, we noted most plants had been prop-clipped. Despite this, plants were generally low density and did not appear to be causing more than minor impairment if at all.

Along the western shoreline southwest of Paines Island and on the island’s western shoreline, we delineated seven additional beds. Five were small pioneer clusters that covered <0.10 acre each, but the other two formed a nearly continuous mat with a combined area of 2.51 acres. Each of these areas also contained significant amounts of Northern water-milfoil interspersed with dense clusters of HWM.

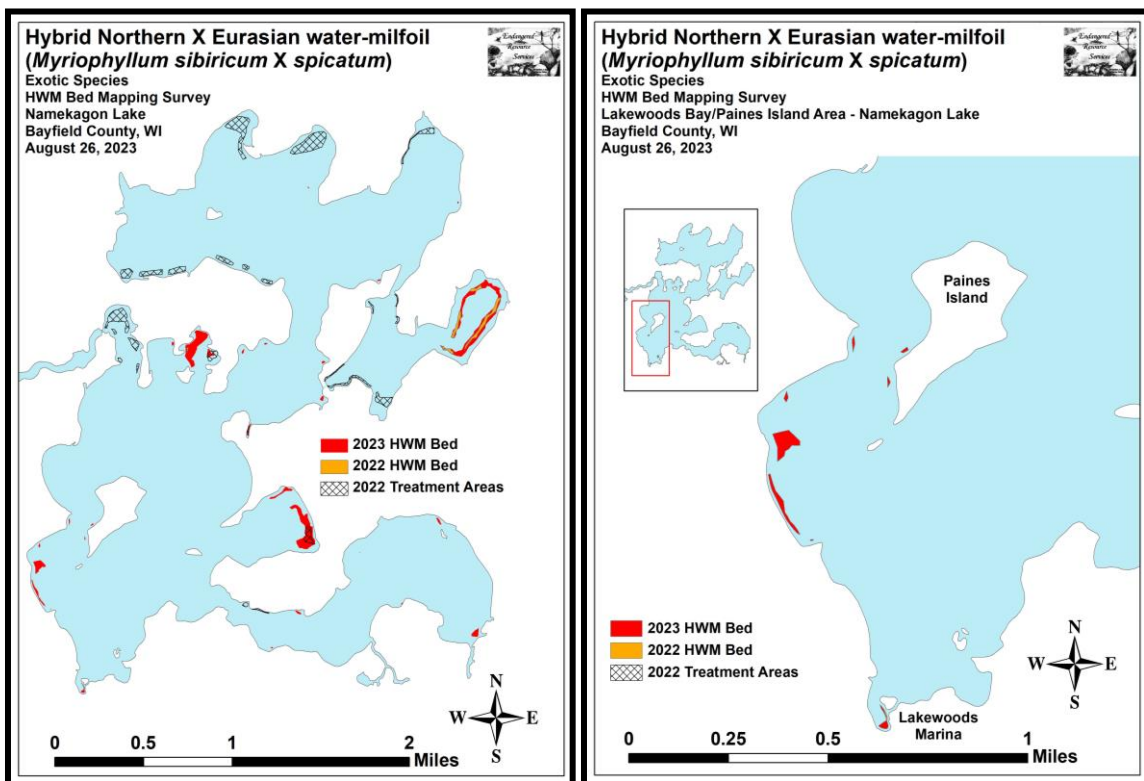


Figure 4: 2023 HWM Bed Map/Lakewoods Bay and Paines Island Area

Area 2 – Lake Outlet to River – In the lake’s outlet channel, we again found almost no sign of HWM (Figure 5) (Appendix I). Collectively, we saw only a handful of plants in this overall area.

Area 3 – Four Seasons Bay – A single microbed that covered 0.01 acre had reestablished just southeast of the Four Seasons’ docks. It consisted of a few dense clusters of plants and appeared unlikely to cause any navigation impairment. Because of its small size and proximity to high levels of boat traffic, it would be an ideal candidate for volunteer manual removal.

Area 4 – Governor’s Island Bays – The bay northwest of Governor’s Island had a single small pioneer bed that was likely a non-issue for residents (Figure 5) (Appendix I). However, in the bay northeast of the island, Hybrid water-milfoil was increasingly common, and we noted floating prop-clipped fragments throughout the area. Plants were expanding into deep water, and an open but nearly continuous bed ringed the entire western and northern shorelines. On the bay’s east side, the 2022 treatment area remained relatively clear, but pioneer plants and clusters were reestablishing on the deepwater edge and in the navigation channel away from shore. For local residents, these beds were already likely causing at least a minor impairment.

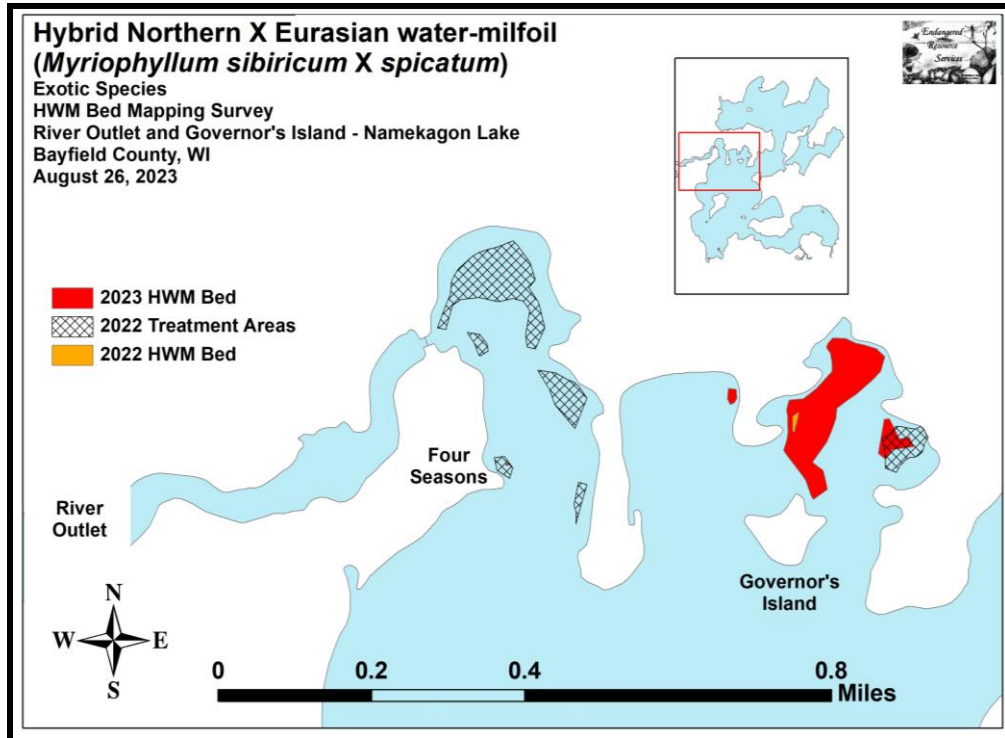


Figure 5: River Outlet, Four Seasons, and Governor’s Island Bay

Area 5 – West Channel to Garmish – Although the 2022 treatment areas were still free of HWM, we found two new microbeds had established further to the east with one occurring on the north side and the other on the south side of the channel (Figure 6) (Appendix I).

Area 6 – Mumm’s Bay – For unknown reasons, neither the 2021 nor the 2022 treatments in Mumm’s Bay proved to have lasting impact. It may simply be that deepwater HWM was present over a significantly greater area than what was treated as we noted the 2023 beds were approximately triple the area that was treated in 2022. Regardless of the cause, this was again one of the worst areas on the lake with residents likely experiencing at least minor and potentially moderate impairment.

Area 7 – Anderson Island East – We saw no evidence of HWM in or between any of the 2022 treatment areas east of the island.

Area 12 – Bluegill Bay – Hybrid water-milfoil levels in “Tank Lake” were easily the worst in the system (Figure 6) (Appendix I). We noted plants appeared to be spreading rapidly, and there was a nearly continuous ring of canopied plants around the perimeter of the entire bay in 3-7ft of water (see report cover). For residents, these beds were likely causing at least minor and, in some areas, moderate impairment.

Area 13 – Anderson Island Southwest – We found HWM beds in each of the small side bays southwest of Anderson Island. None of them seemed likely to cause more than a minor impairment as they were all <0.30 acre, and we noted that they also had generally low density with the exception of the bed immediately southwest of the island’s southern bridge. HWM had also returned to the finger bay, but regular boat traffic was keeping the area open with only a few prop-clipped plants in the central channel.

Area 14 – Lower Lake (Bay Lake) – For the first time ever, we found HWM in the eastern end of Lower Lake. Small beds were present on the northwest flat, near the north side public landing, along the docks of a private residence on the south shoreline, and in the bay immediately southwest of the channel to Garden Lake. None of these beds appeared likely to cause significant impairment at the time of the survey, but, excluding the microbed on the south shoreline, each of them occurred in an area that has significant habitat for HWM to expand into.

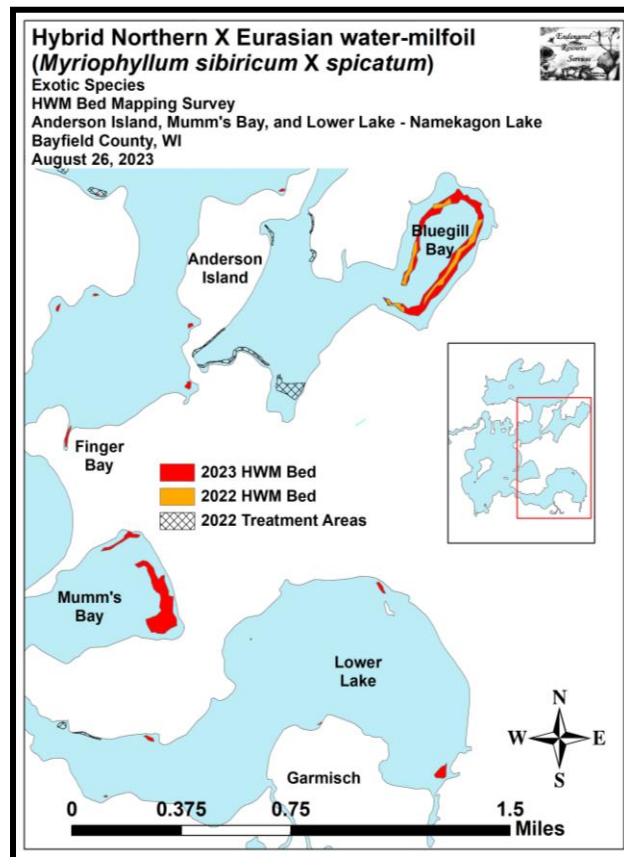


Figure 6: Anderson Island, Bluegill Bay, Mumm’s Bay, and Lower Lake

Area 8 – National Campground Bay – We again saw no evidence of Hybrid water-milfoil in the 2022 treatment area along the National Forest Campground shoreline. Elsewhere in the bay, the only evidence of HWM was two microbed – one on the east shoreline, and one in a small side bay on the north shoreline of Anderson Island (Figure 7) (Appendix I).

Area 9 – Mogasheen Bay – In the north end of Mogasheen Bay, the bed treated with 2,4-D in 2022 continued to be almost completely free of HWM. Collectively, we saw only a handful of plants anywhere in this area. However, on the southeast end of the bay, a small deepwater bed had appeared. Although not a significant navigation impairment, it showed evidence of prop-clipping as boats traveling to and from the resort tend to motor through this area.

Area 10 – Echo Point’s West Bay – Similar to the majority of the other ProcellaCor treatment areas, we again saw no signs of surviving HWM in this bay.

Area 11 – Upper Lake – Southwest Shoreline – The only sign of HWM we saw along this shoreline was a small collection of plants immediately southwest of Junek’s Point. More of a “High density area” than a true bed, these regular but scattered plants seemed unlikely to cause any navigation impairment.

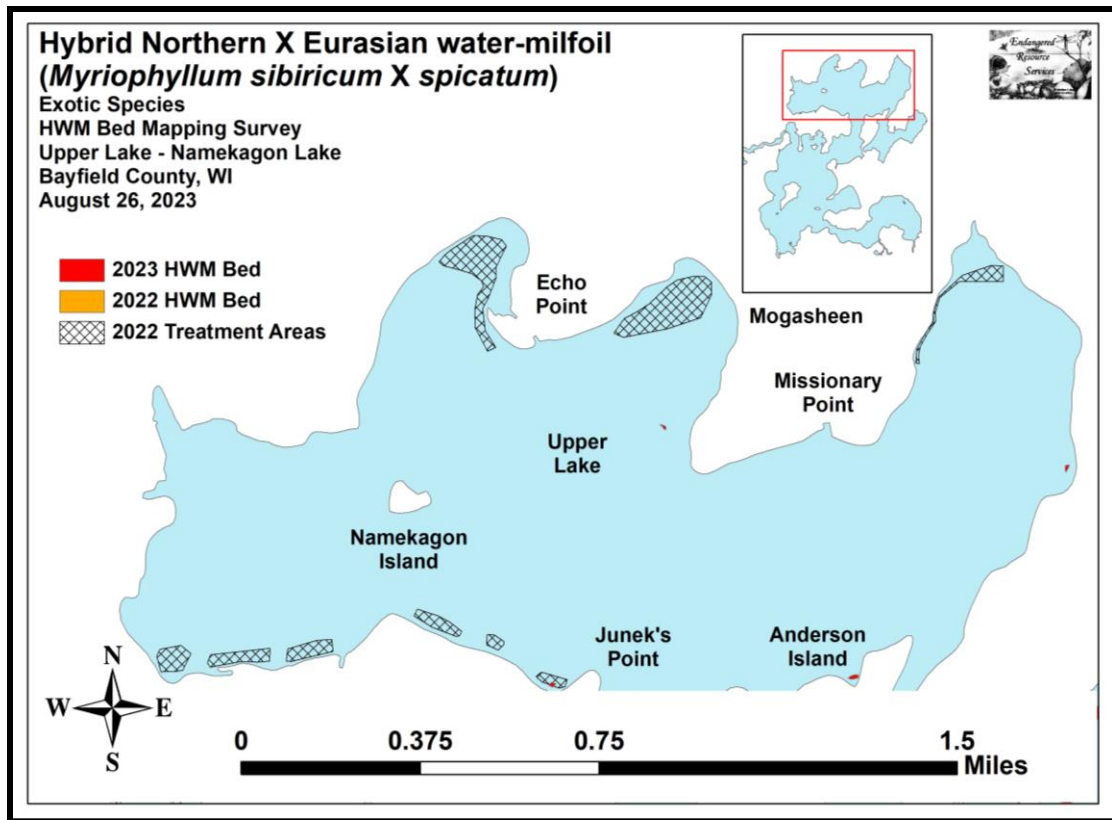


Figure 7: Upper Lake – Echo Point, Mogasheen, and National Campground Bay

CONSIDERATIONS FOR MANAGEMENT:

Hybrid water-milfoil:

Even with the significant expansion we documented in 2023, Hybrid water-milfoil continues to occupy a relatively low percentage of the lake's surface area. Unfortunately, despite recent management successes, it is widely-established making eradication an unrealistic expectation. With this in mind, continuing to work to manage it in the most cost-effective manner possible, while simultaneously minimizing its impact on the lake's aquatic ecosystem will likely continue to be important goals for the lake association moving forward.

Ultimately, the NLA, HE, and the WDNR will have to decide on what, if any, active management should occur in 2024. Similarly, how much monitoring will be needed in 2024, if any, is a conversation that needs to take place.

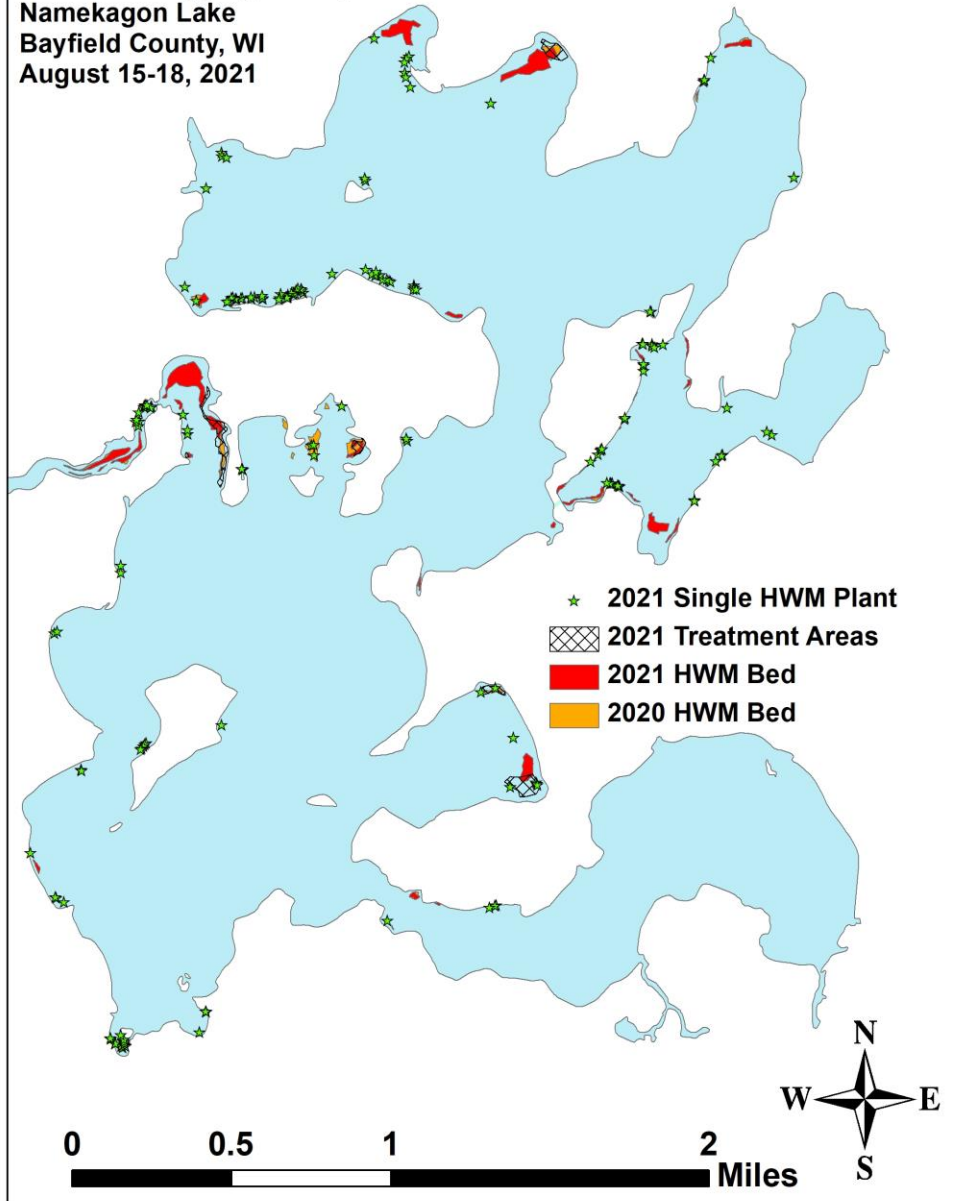
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- WDNR. [online]. 2023. Namekagon Lake - Wisconsin Lakes Information. <https://apps.dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2732600> (2023, November).

Appendix I: 2021, 2022, and 2023 HWM Late Summer Bed Maps

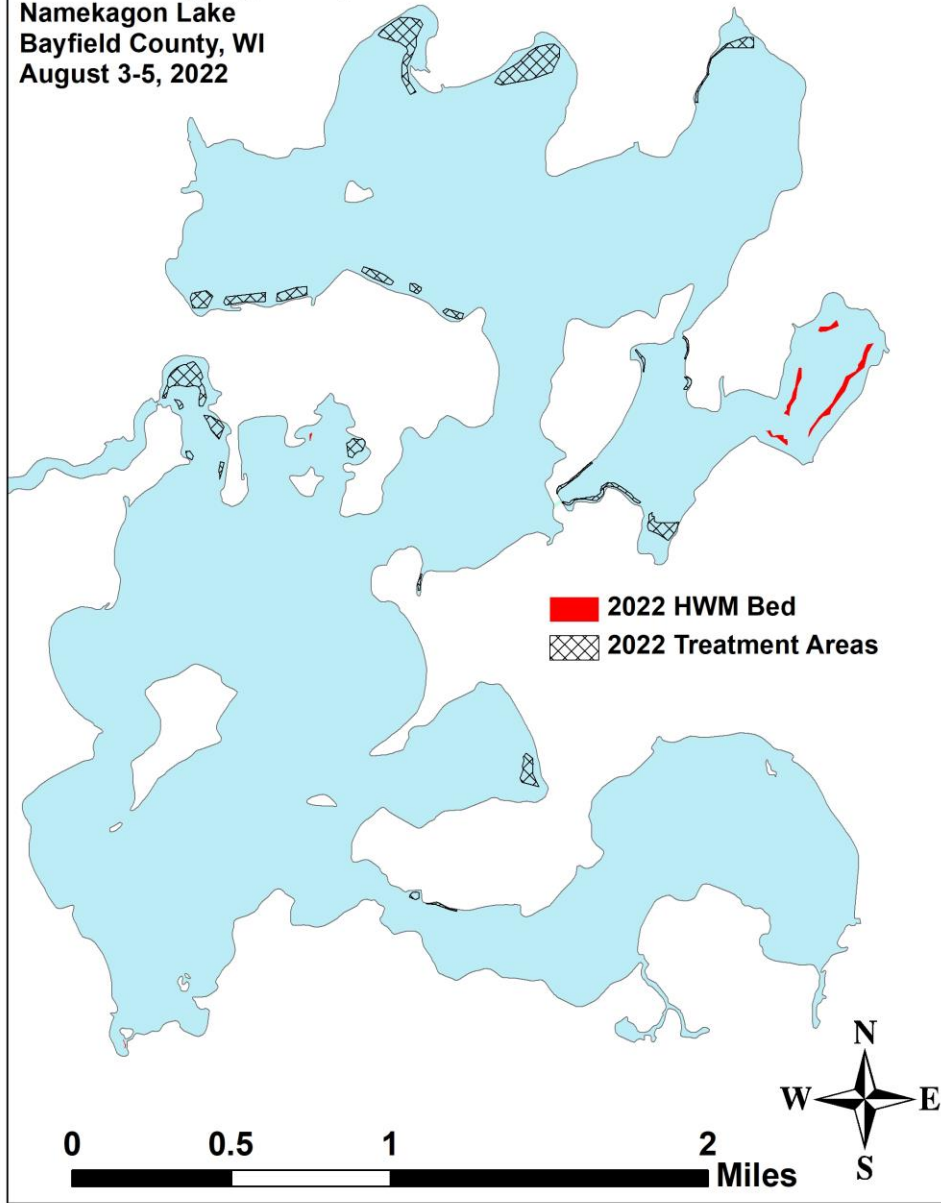
Hybrid Northern X Eurasian water-milfoil (*Myriophyllum sibiricum* X *spicatum*)

Exotic Species
HWM Bed Mapping Survey
Namekagon Lake
Bayfield County, WI
August 15-18, 2021



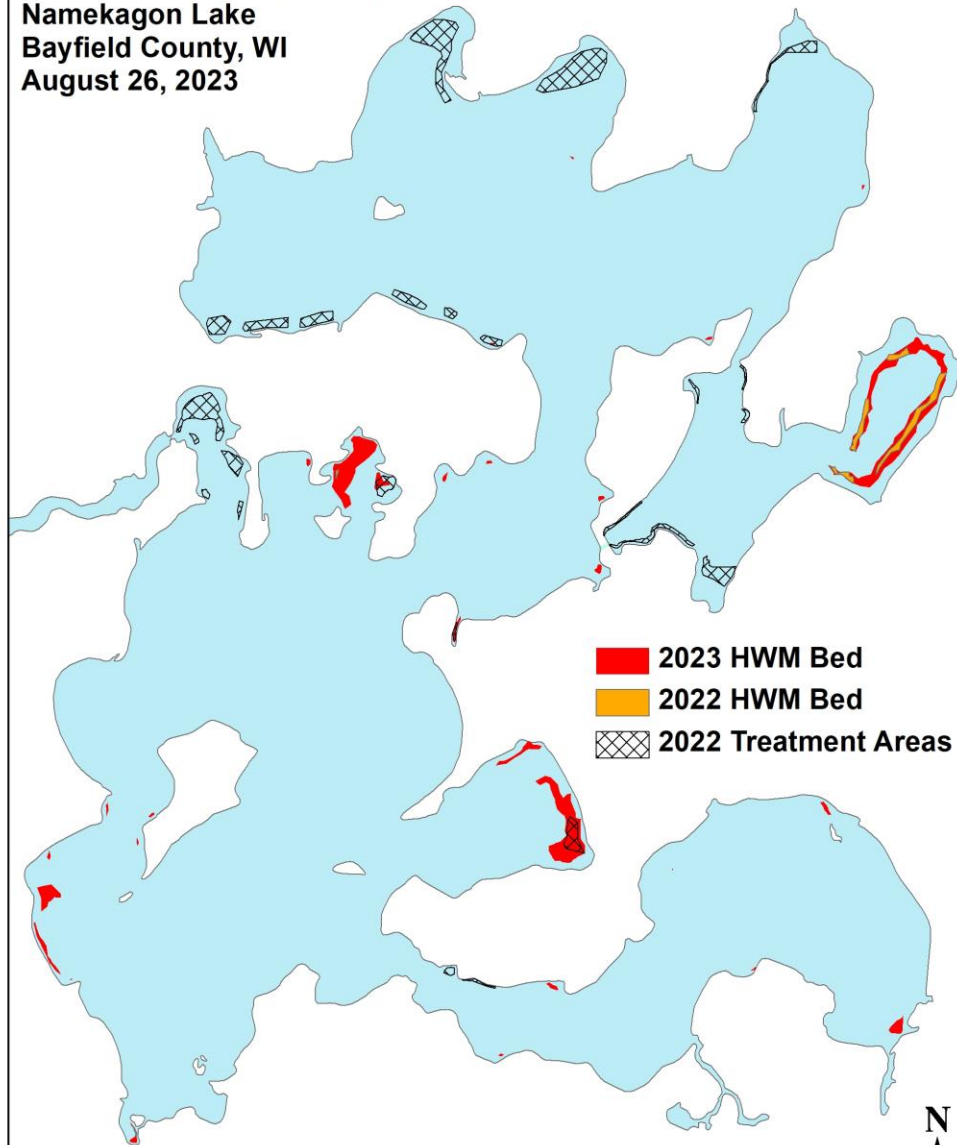
Hybrid Northern X Eurasian water-milfoil (*Myriophyllum sibiricum* X *spicatum*)

Exotic Species
HWM Bed Mapping Survey
Namekagon Lake
Bayfield County, WI
August 3-5, 2022



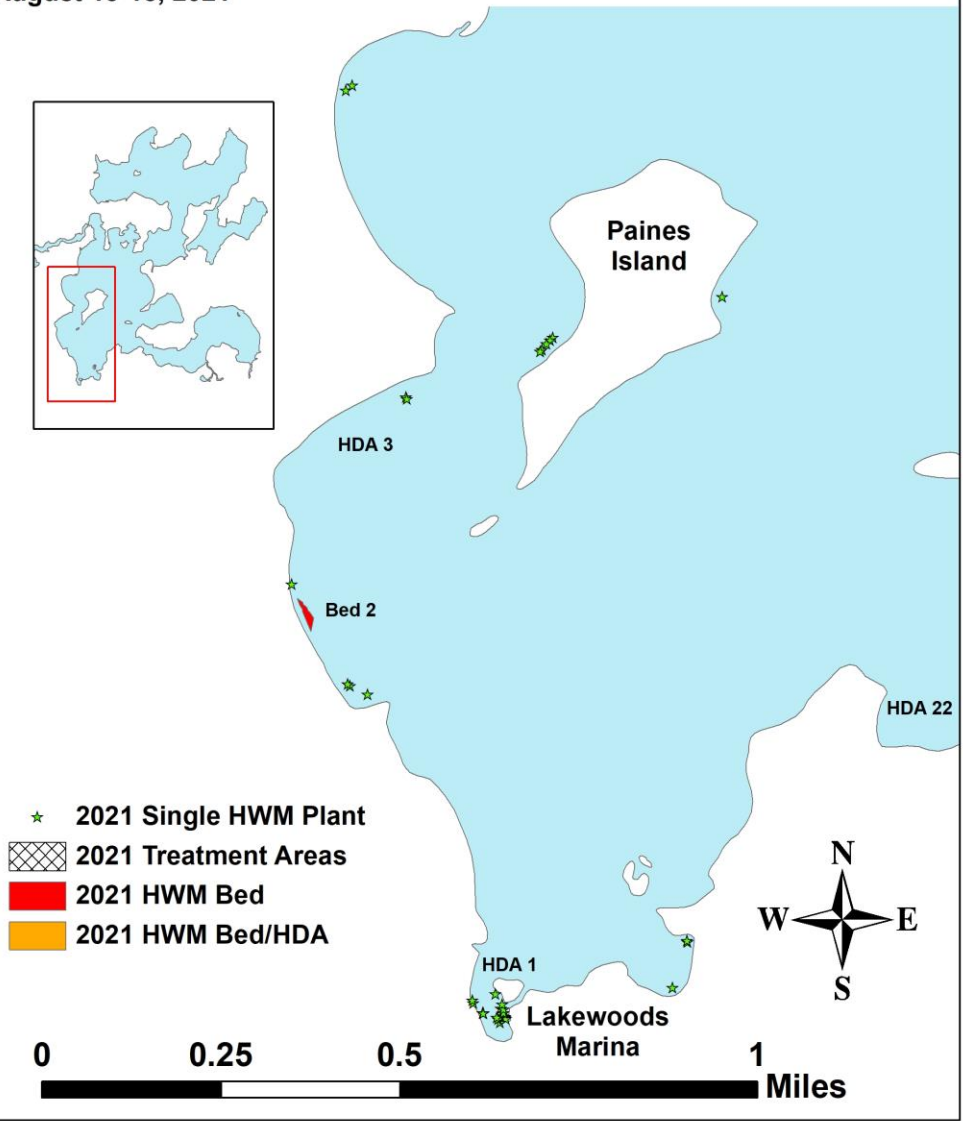
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Exotic Species
HWM Bed Mapping Survey
Namekagon Lake
Bayfield County, WI
August 26, 2023



Hybrid Northern X Eurasian water-milfoil (*Myriophyllum sibiricum* X *spicatum*)

Exotic Species
HWM Bed Mapping Survey
Paines Island Area - Namekagon Lake
Bayfield County, WI
August 15-18, 2021



Hybrid Northern X Eurasian water-milfoil (*Myriophyllum sibiricum* X *spicatum*)



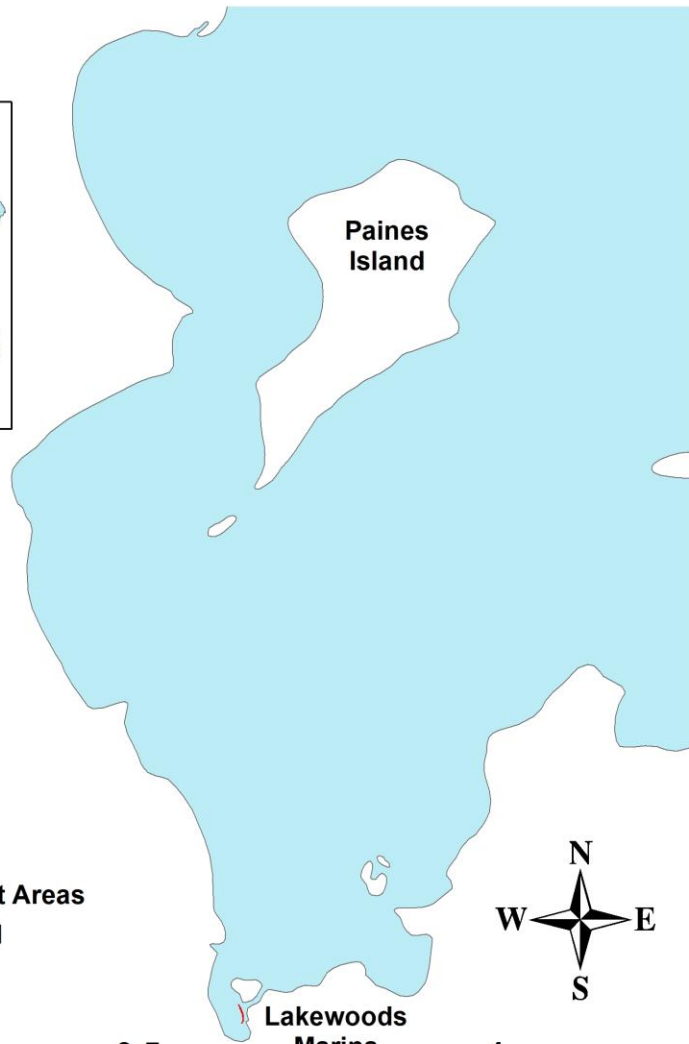
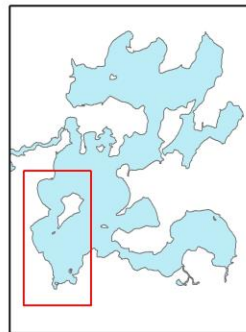
Exotic Species

HWM Bed Mapping Survey

Lakewoods Bay/Paines Island Area - Namekagon Lake

Bayfield County, WI

August 3-5, 2022



-  2022 Treatment Areas
-  2022 HWM Bed

0 0.25 0.5 1 Miles

Hybrid Northern X Eurasian water-milfoil (*Myriophyllum sibiricum* X *spicatum*)

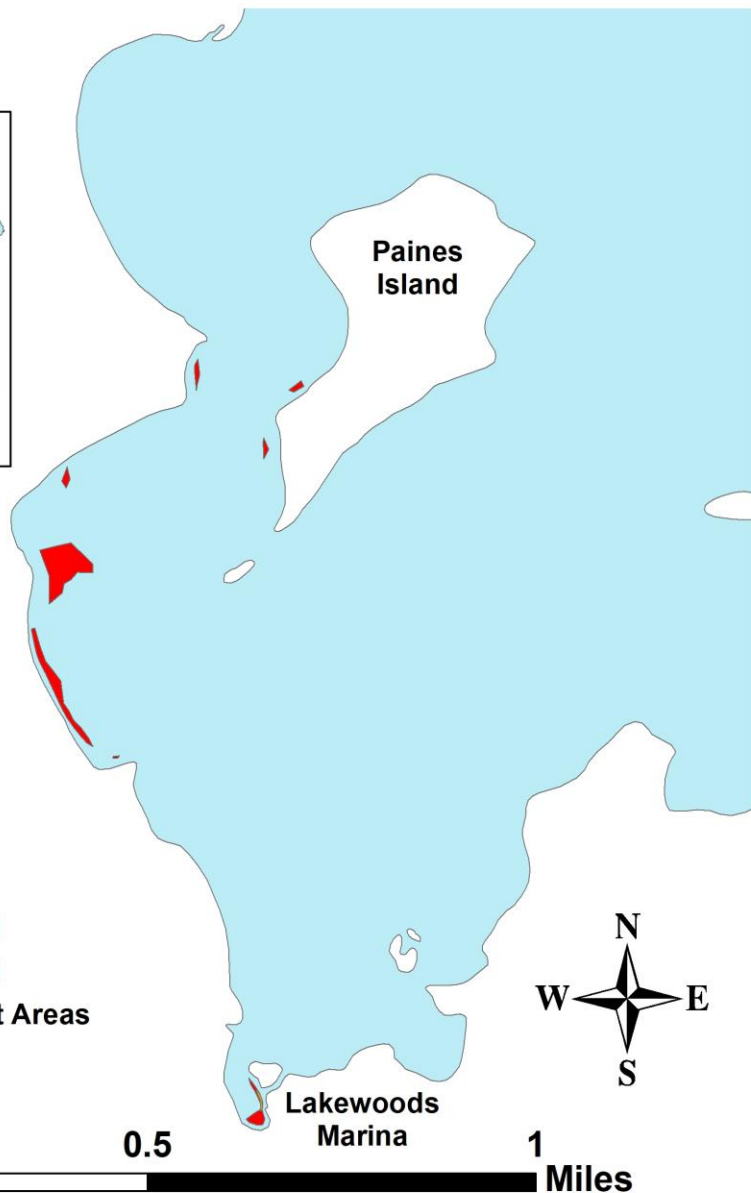
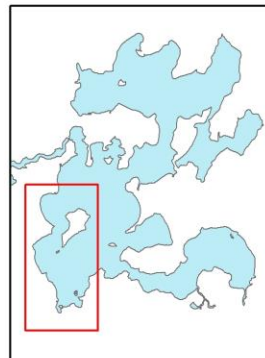
Exotic Species

HWM Bed Mapping Survey

Lakewoods Bay/Paines Island Area - Namekagon Lake

Bayfield County, WI

August 26, 2023



- 2023 HWM Bed
- 2022 HWM Bed
- 2022 Treatment Areas

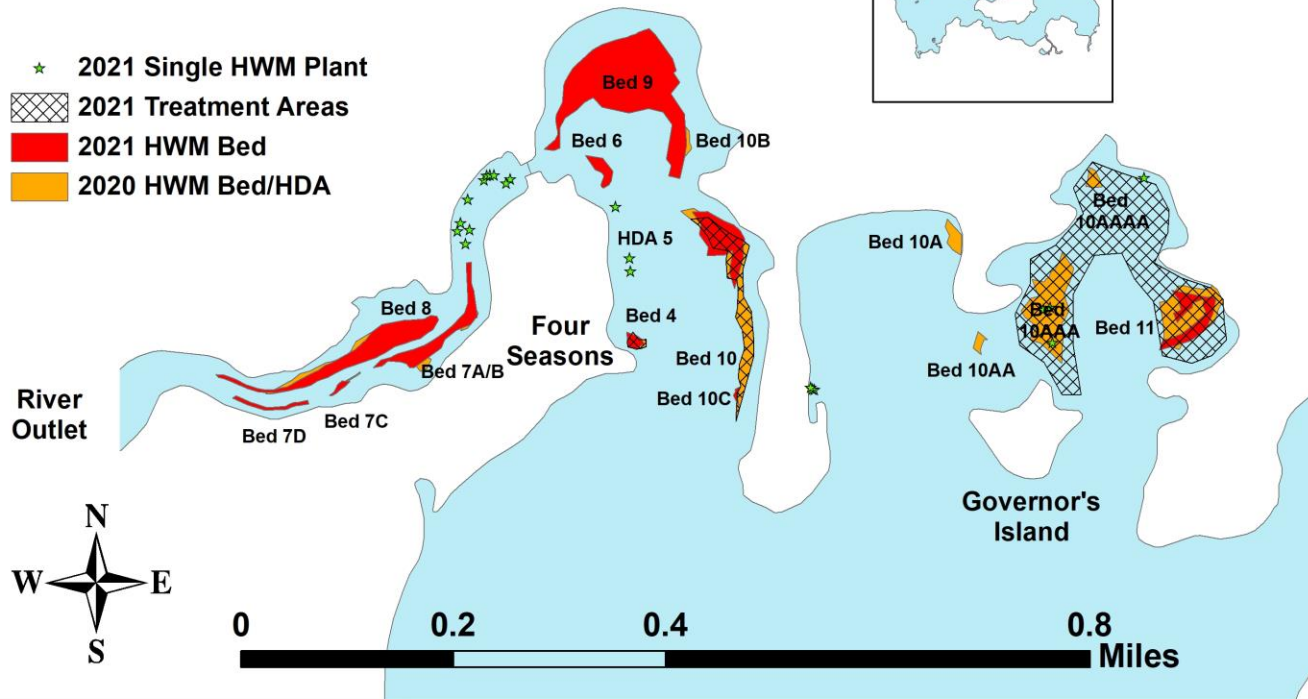
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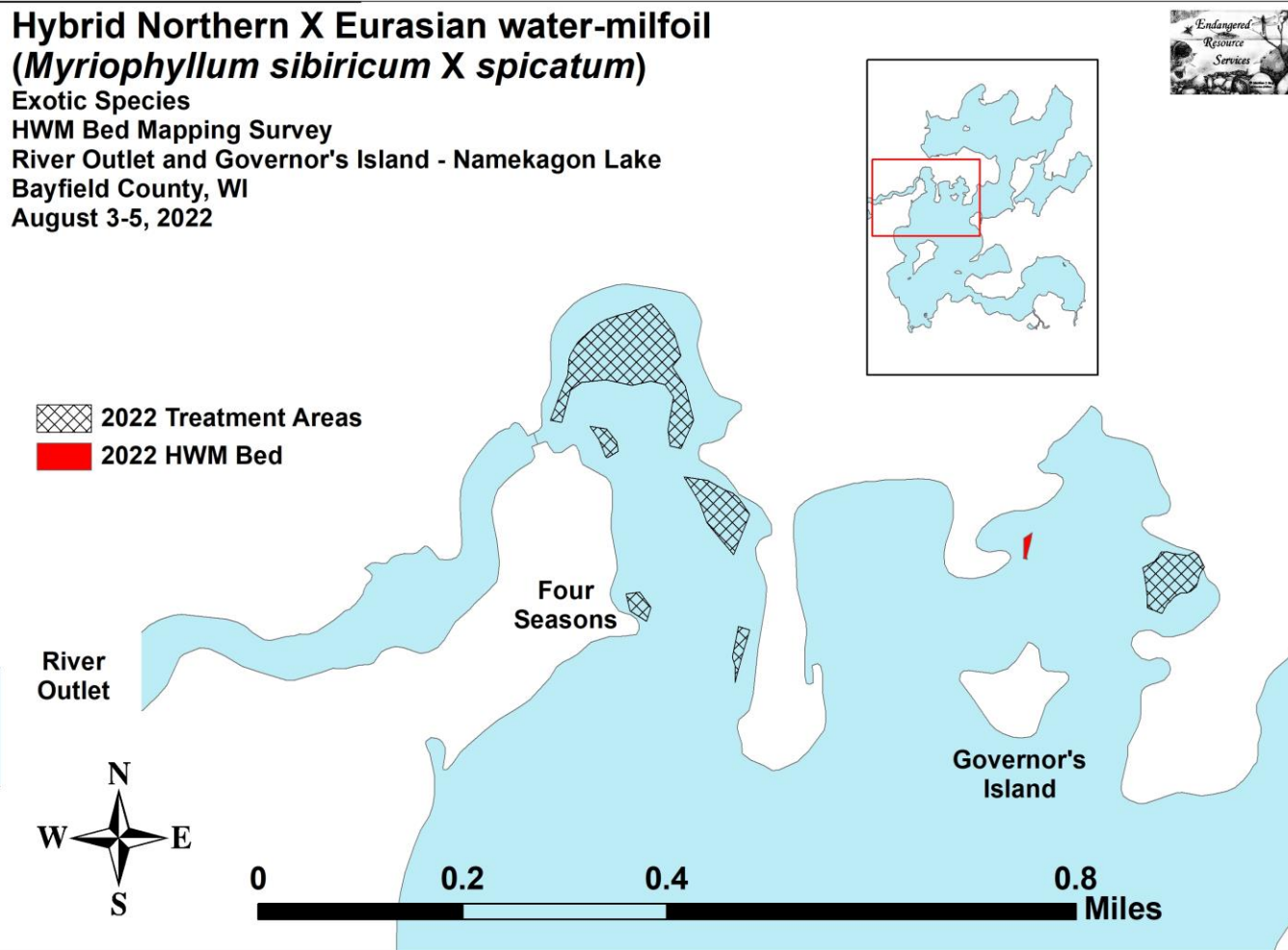
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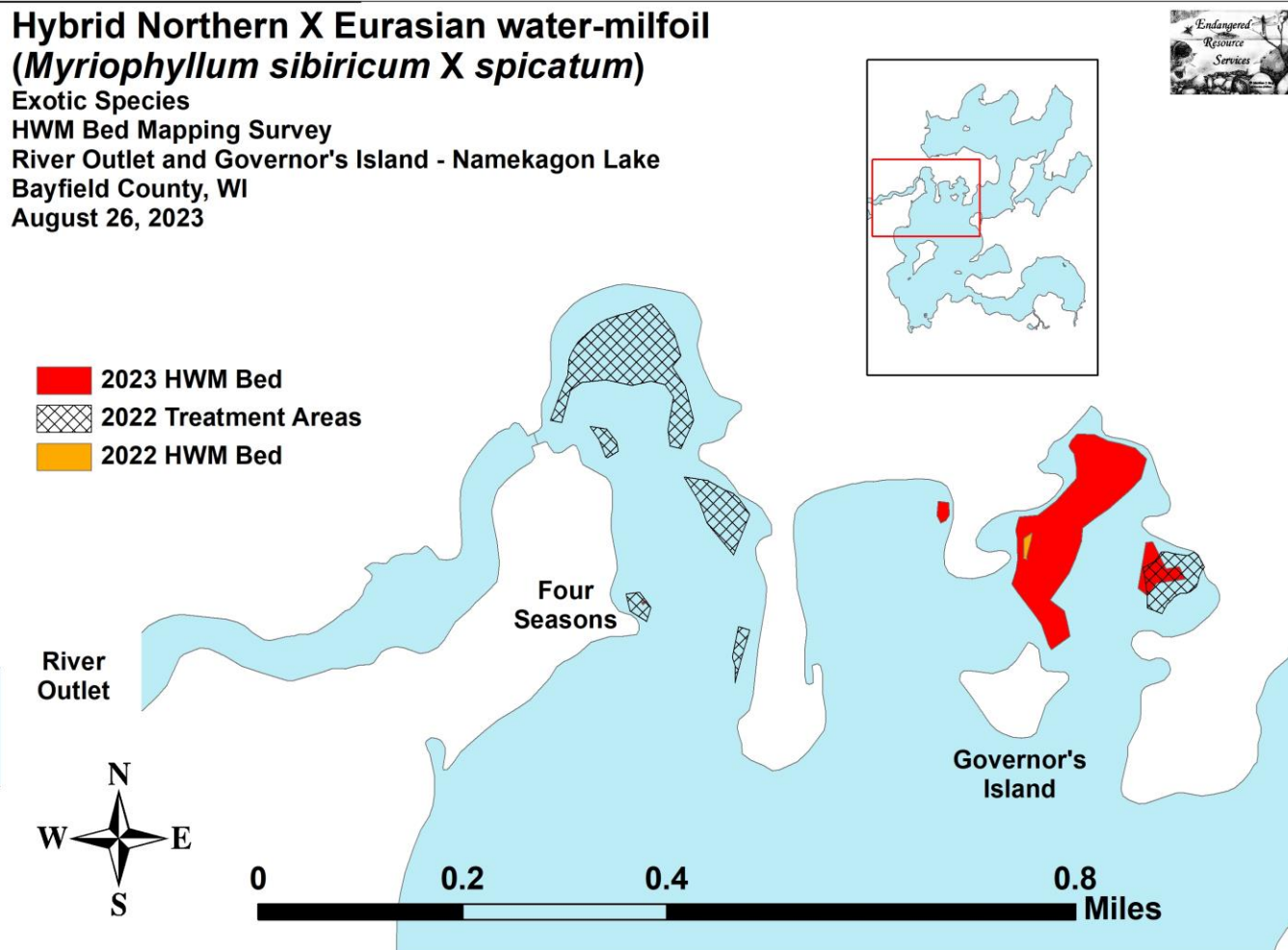
Exotic Species
HWM Bed Mapping Survey
River Outlet and Governor's Island - Namekagon Lake
Bayfield County, WI
August 15-18, 2021



- ★ 2021 Single HWM Plant
- ▨ 2021 Treatment Areas
- 2021 HWM Bed
- 2020 HWM Bed/HDA







Hybrid Northern X Eurasian water-milfoil (*Myriophyllum sibiricum* X *spicatum*)



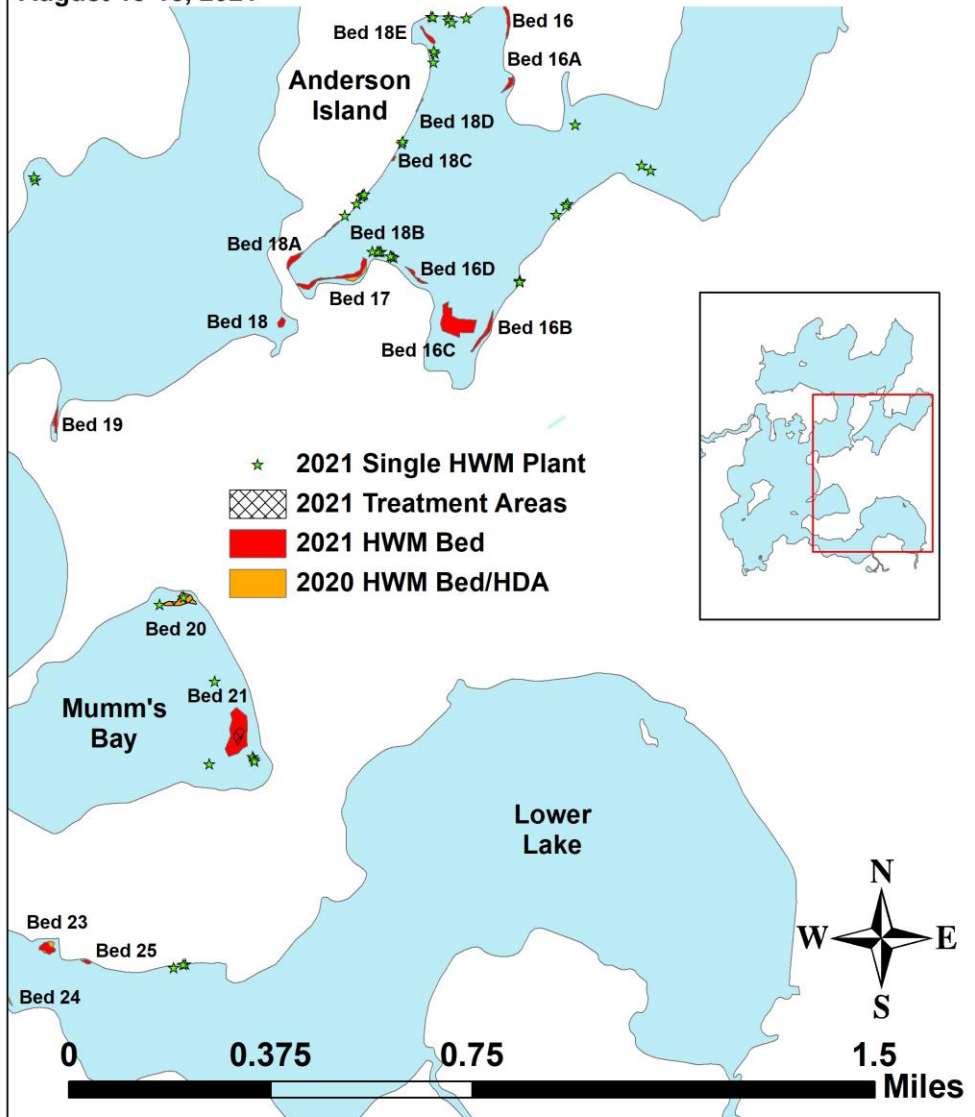
Exotic Species

HWM Bed Mapping Survey

Anderson Island, Mumm's Bay, and Lower Lake - Namekagon Lake

Bayfield County, WI

August 15-18, 2021



Hybrid Northern X Eurasian water-milfoil (*Myriophyllum sibiricum* X *spicatum*)



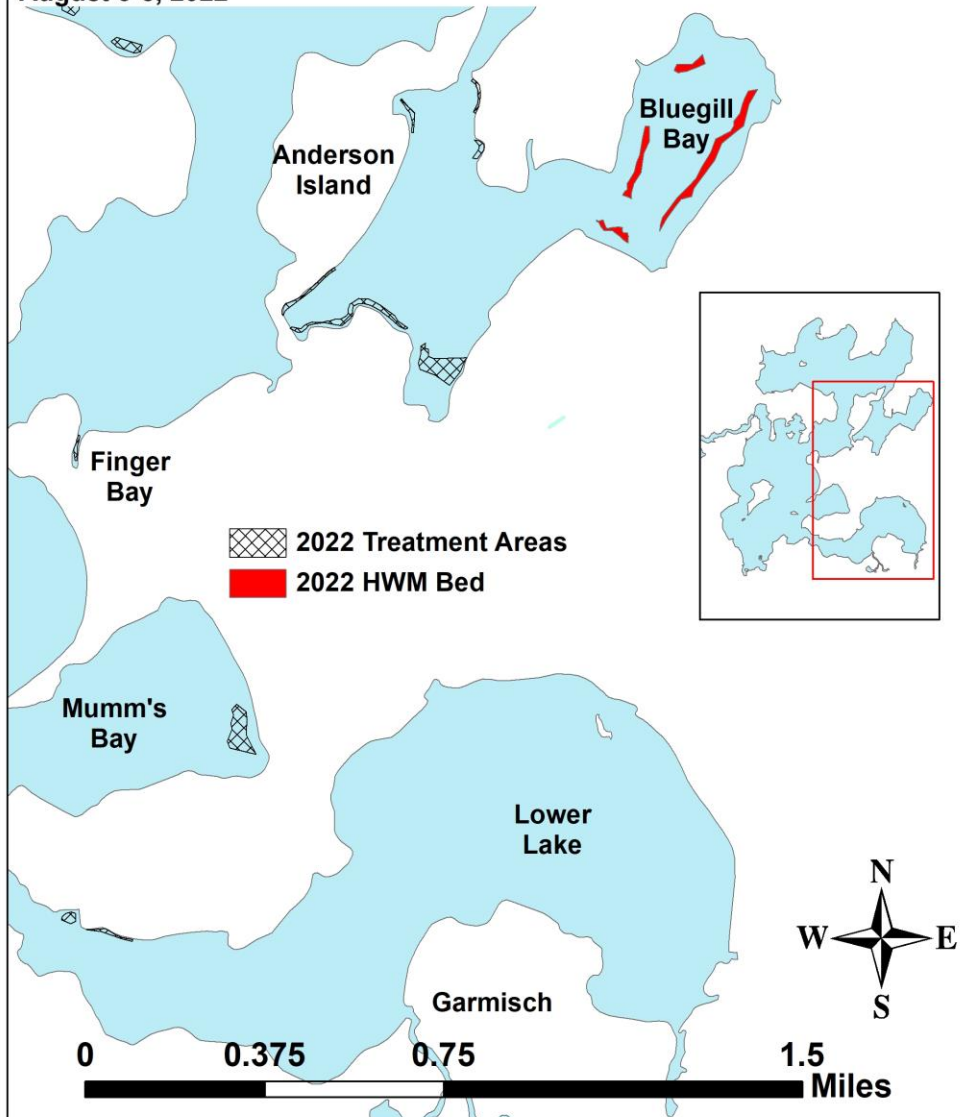
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HWM Bed Mapping Survey

Anderson Island, Mumm's Bay, and Lower Lake - Namekagon Lake

Bayfield County, WI

August 3-5, 2022



Hybrid Northern X Eurasian water-milfoil (*Myriophyllum sibiricum* X *spicatum*)



Exotic Species

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