



Lake Management Consulting Services for Lower Straits Lake Commerce Township, MI

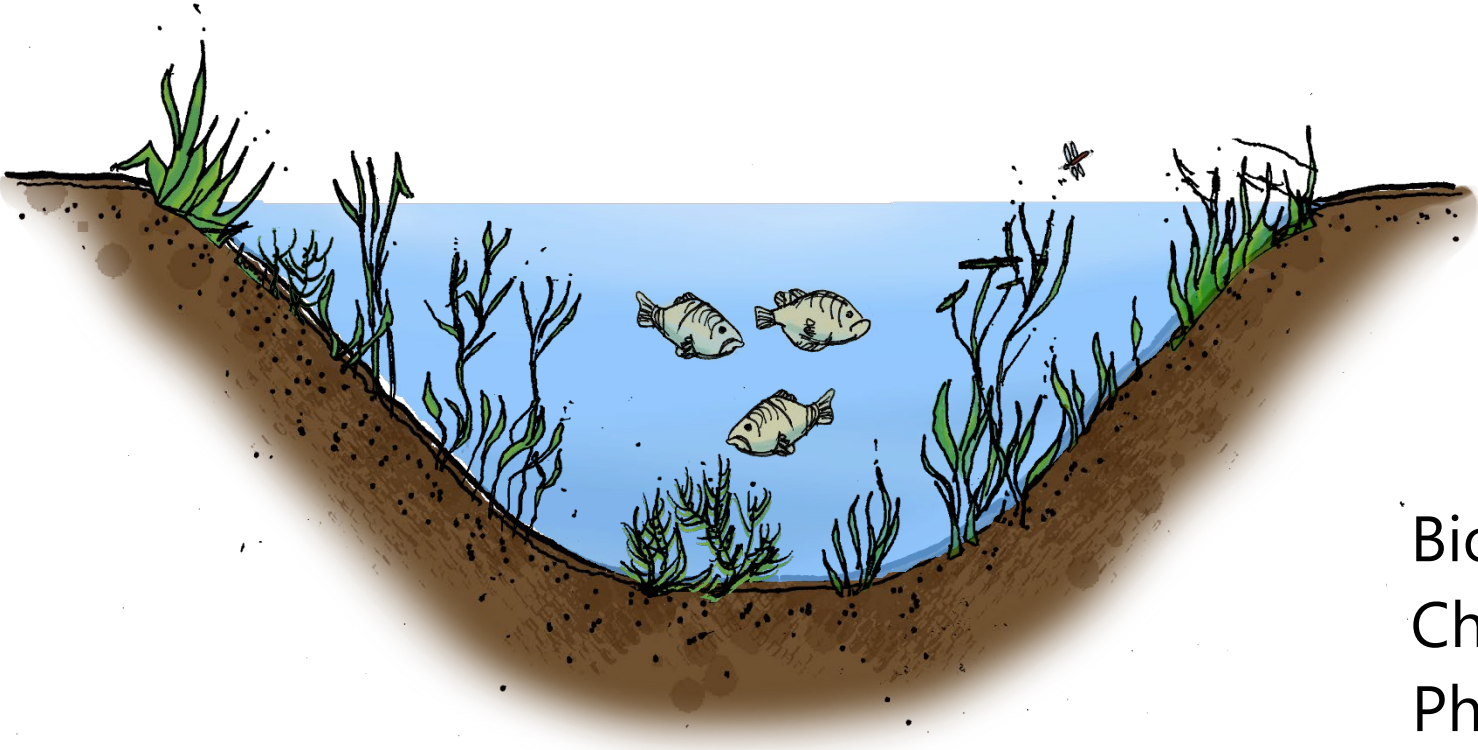
Paul Hausler, Water Resources Practice Leader, Progressive AE

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Limnology



Biological
Chemical
Physical

Aquatic plants are part of a healthy lake. They produce oxygen, provide food and habitat for fish, and help to stabilize shoreline and bottom sediments.

Insects and other invertebrates live on or near aquatic plants, and become food for fish, birds, amphibians and other wildlife.

Plants and algae are the base of the food chain. Lakes with a healthy fishery have a moderate density of aquatic plants.

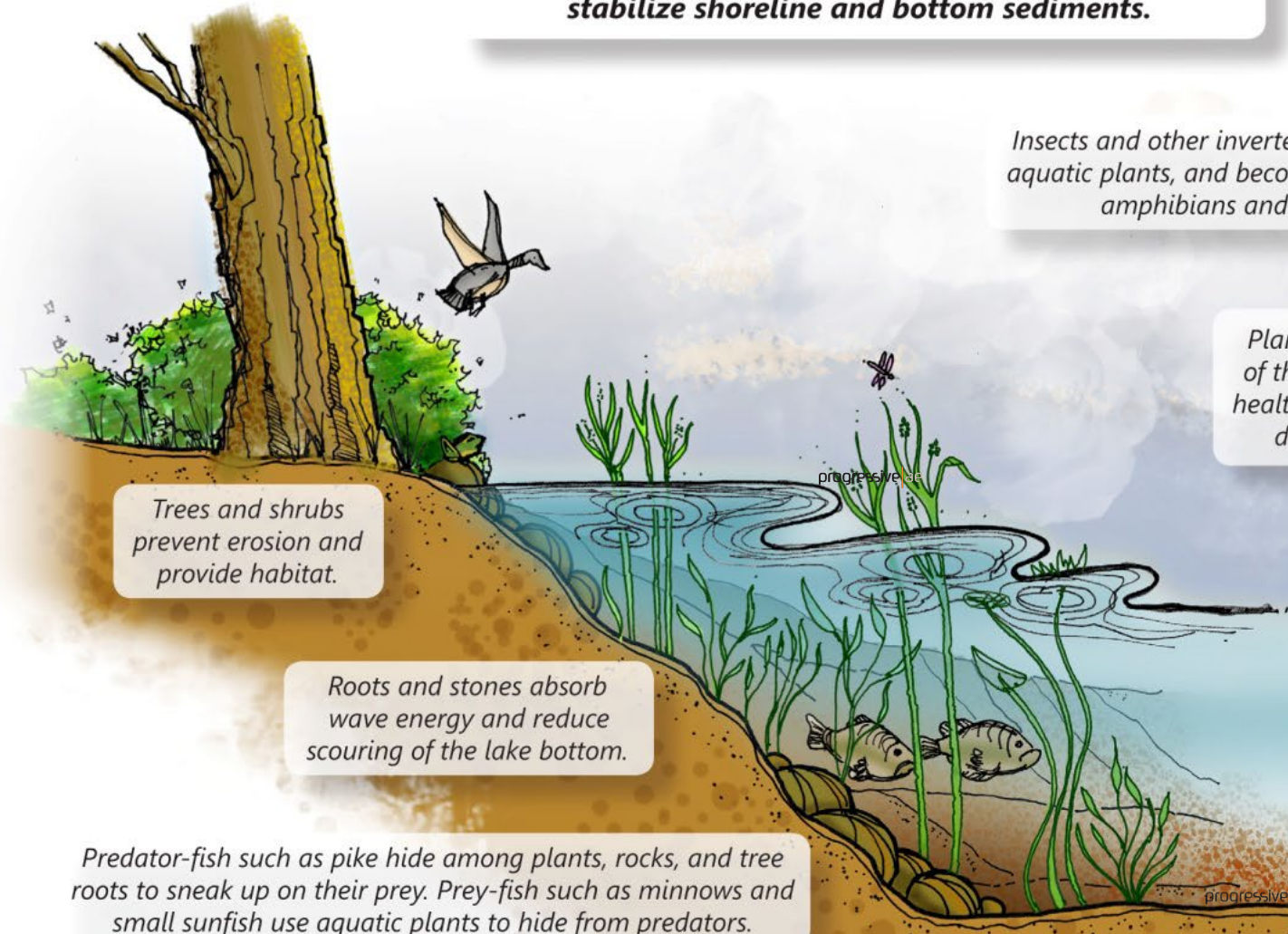
Trees and shrubs prevent erosion and provide habitat.

Roots and stones absorb wave energy and reduce scouring of the lake bottom.

Aquatic plants provide habitat for fish and other aquatic life.

Predator-fish such as pike hide among plants, rocks, and tree roots to sneak up on their prey. Prey-fish such as minnows and small sunfish use aquatic plants to hide from predators.

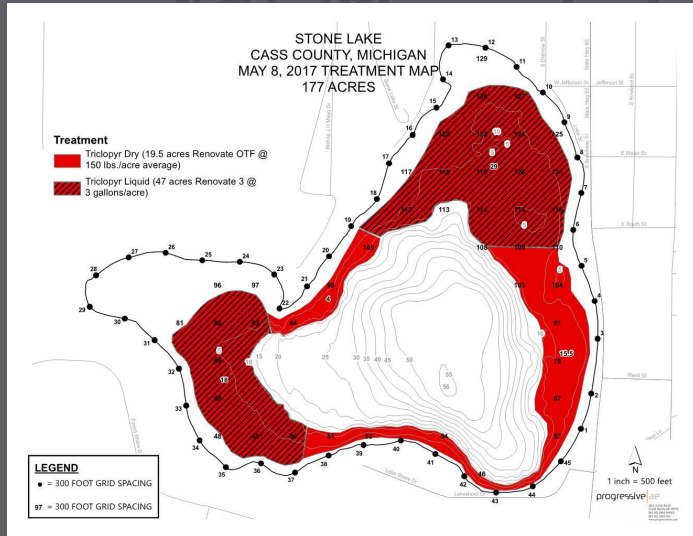
Aquatic plants help to hold sediments in place and improve water clarity.





FISH NEED A MODERATE ABUNDANCE AND DIVERSE ASSEMBLAGE OF AQUATIC PLANTS TO THRIVE (DIBBLE, ET AL. 1996)

Aquatic Plant Management



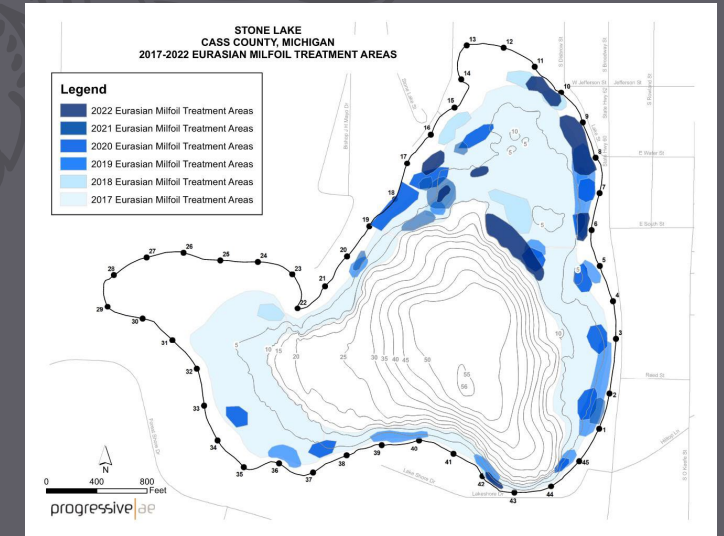
Pre-Management

Identifying and geo-spatially mapping invasive exotic species



Management Oversight

Using geo-spatial data to observe and evaluate management results



Trend Analysis

Collecting detailed geo-spatial presence/absence data to obtain trend analysis over time

Aquatic Plant Control

Plants of Primary Concern

Invasive exotic species:

Eurasian (hybrid)



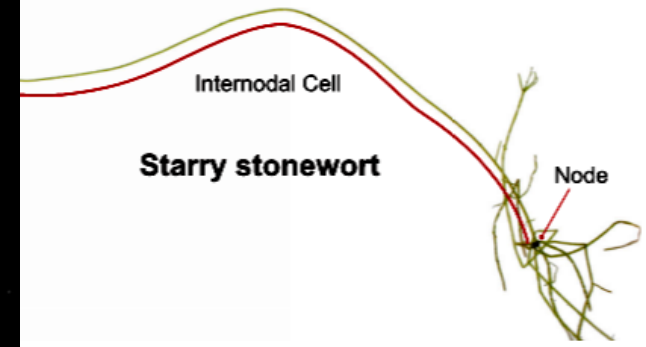
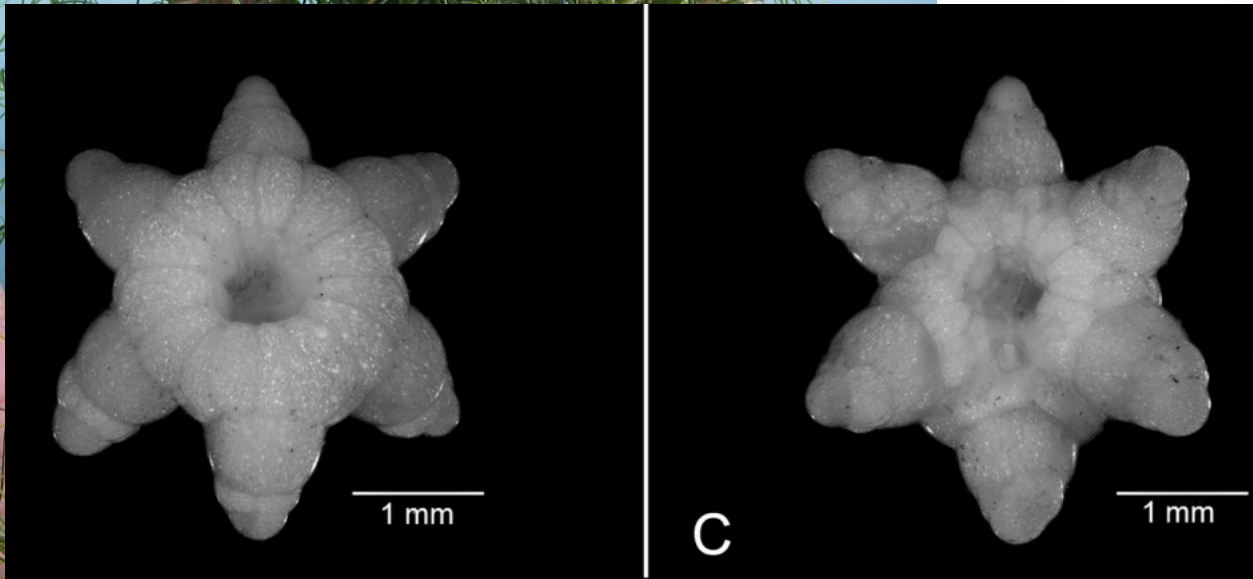
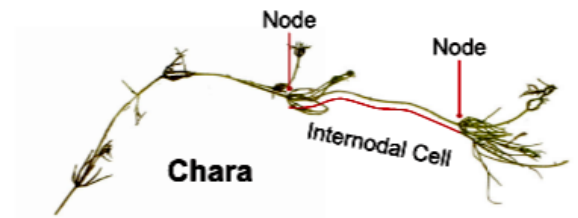
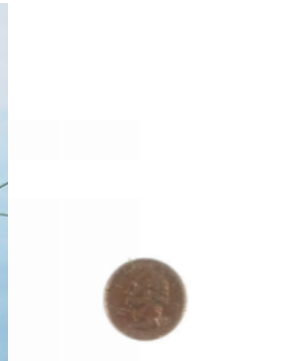
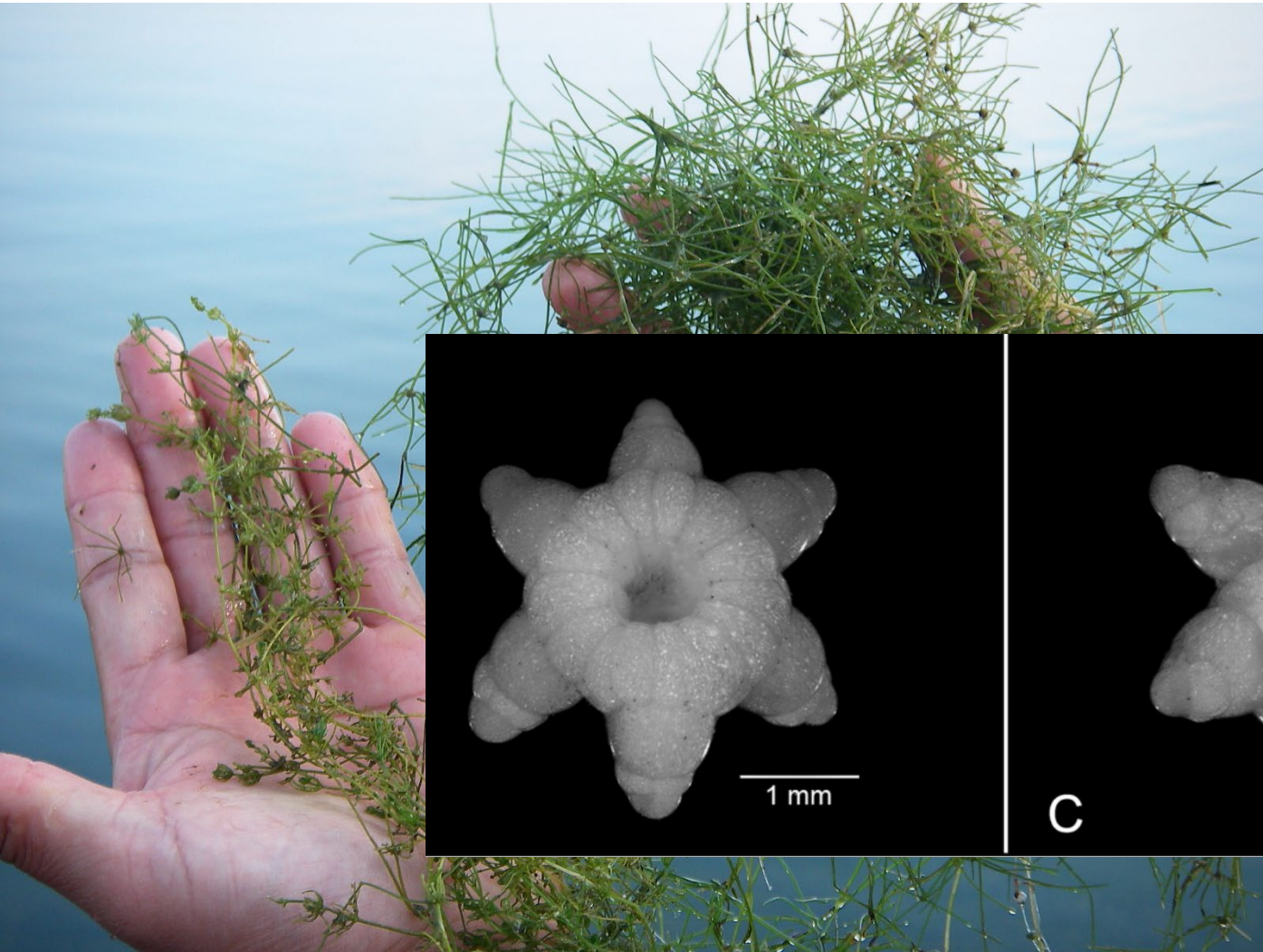
Curly-leaf pondweed



Starry stonewort



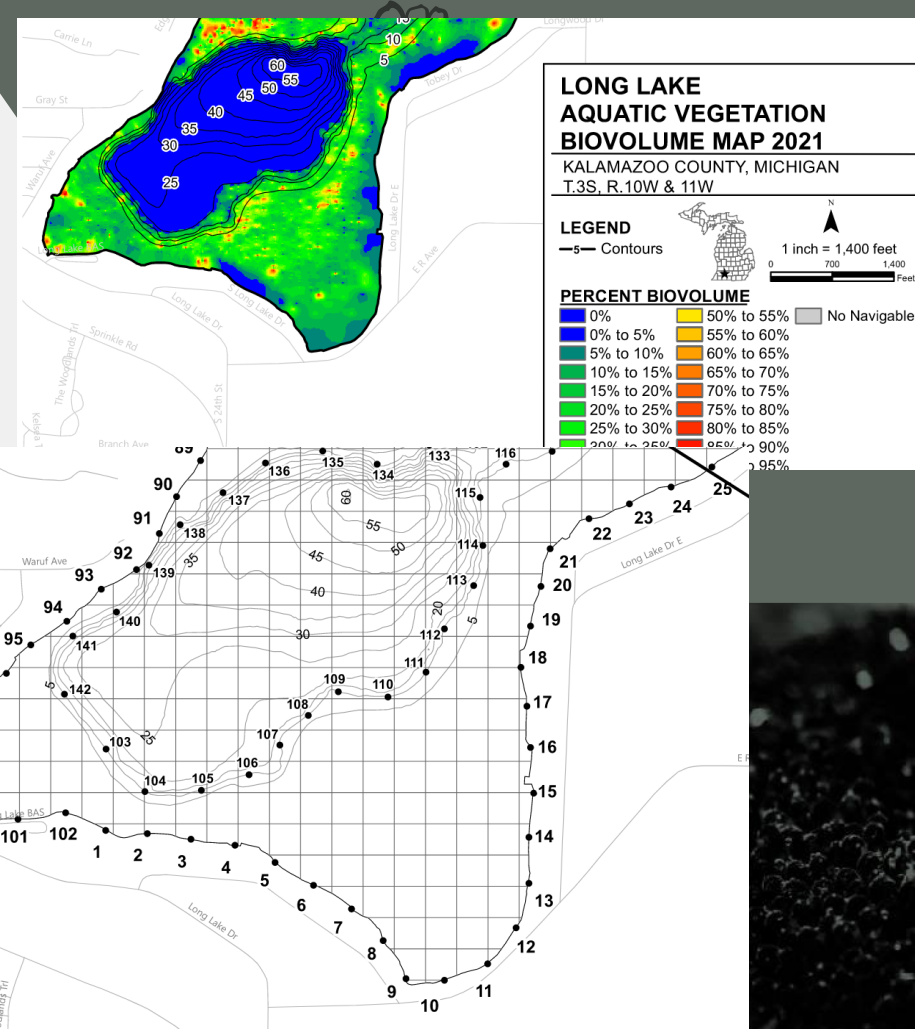
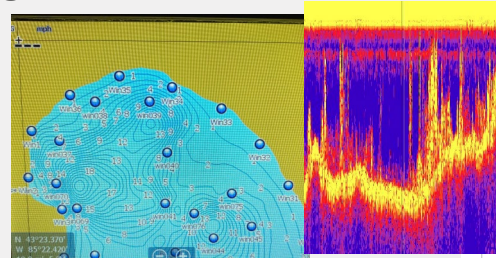
Starry Stonewort vs. *Chara* sp. Morphology

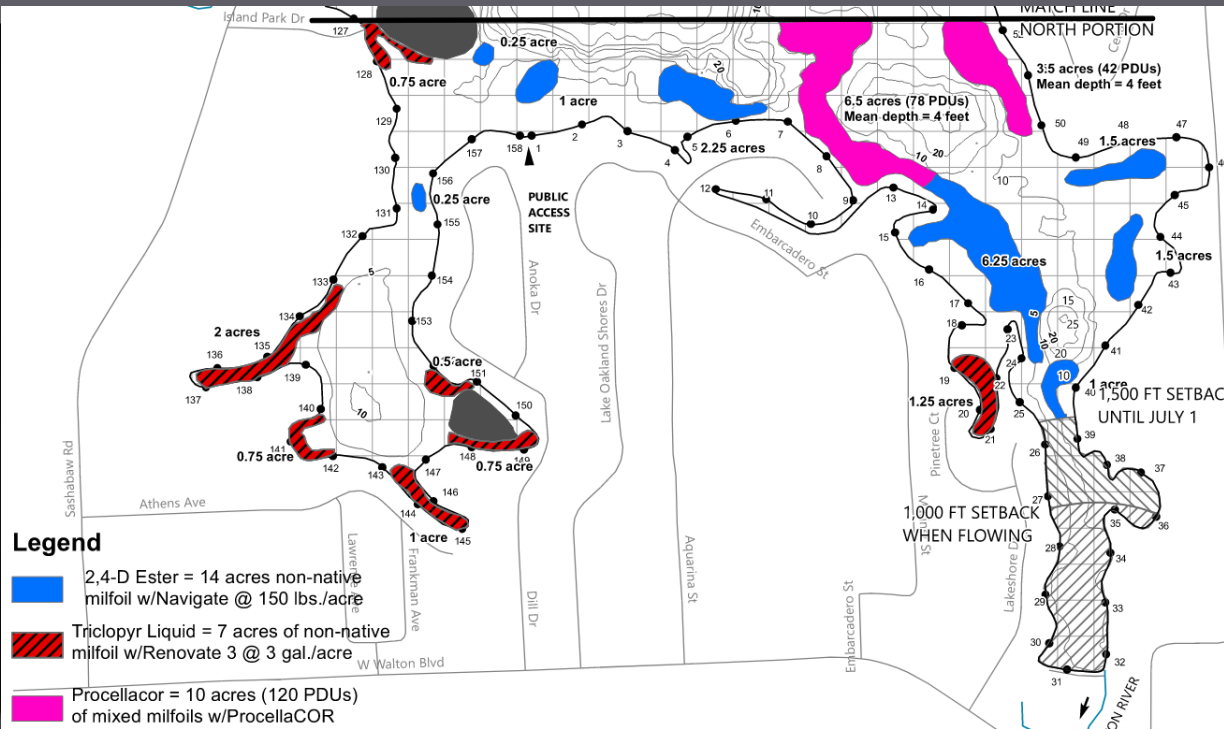


Bulbil photos from Sleith et al. 2015

Pre-Management Survey Techniques

- Create accurate base mapping and GPS reference waypoints
- Onboard SONAR/GPS units
- Field visual observation supplemented by rake tosses





Producing Accurate Management Maps

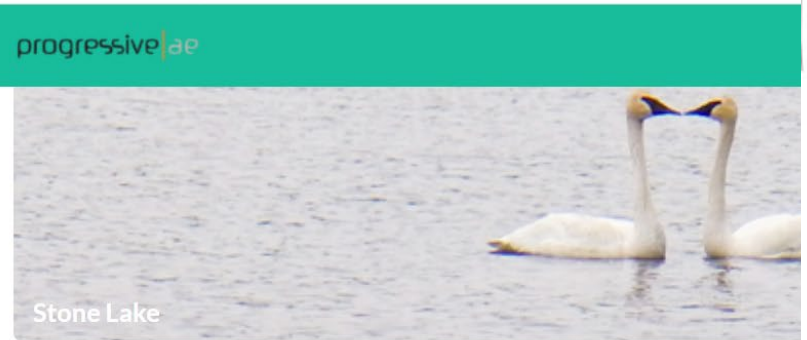
- Geo-spatial referenced polygons
- Prescriptive management
- Accurate base mapping is critical to obtaining good results

Management Oversight Survey Techniques



Prepare Preso

Intranet - Home | Project Dashboard | water.progressiveae.com/Project/Dashboard/363

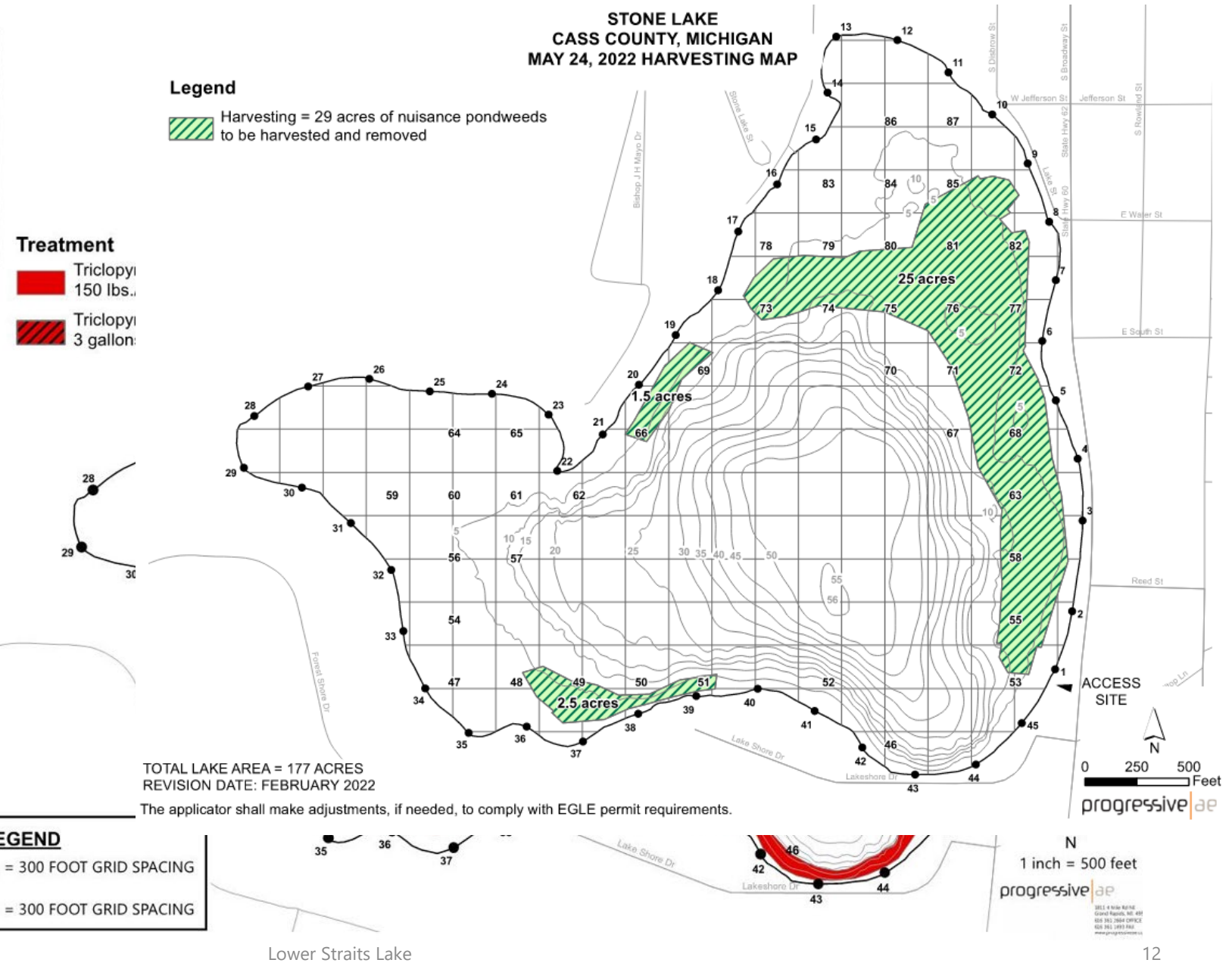


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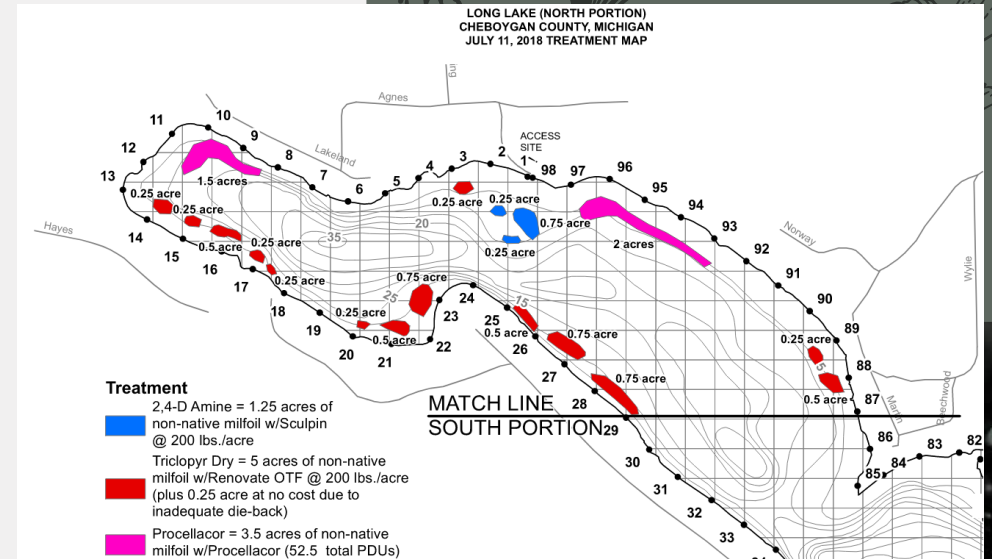
Type	Date	Summary	Work Order Status
Permit	1/3/2022	Reimbursement for 2022 EGLE permit fee	
	1/19/2022	Stone 2022 EGLE permit fee	Complete
Survey	5/25/2022	Found some milfoil and curly-leaf - abundant white stem com	
	6/6/2022	Stone 05 24 22 Treatment	Complete
	6/20/2022	Stone 05 24 22 Harvesting Map	Complete
Survey	6/23/2022	LJA Survey. One patch of milfoil offshore.	

7/21/2023



Post-Management Survey Techniques

- Using management map(s) to track results
- Onboard SONAR/GPS units
- Field visual observation supplemented by rake tosses to inspect plant damage/removal



Trend Analysis

Accurate Base Mapping

Data point accuracy and repeatability over time

Point-Intercept Methods – Random Spacing Throughout Littoral Zone

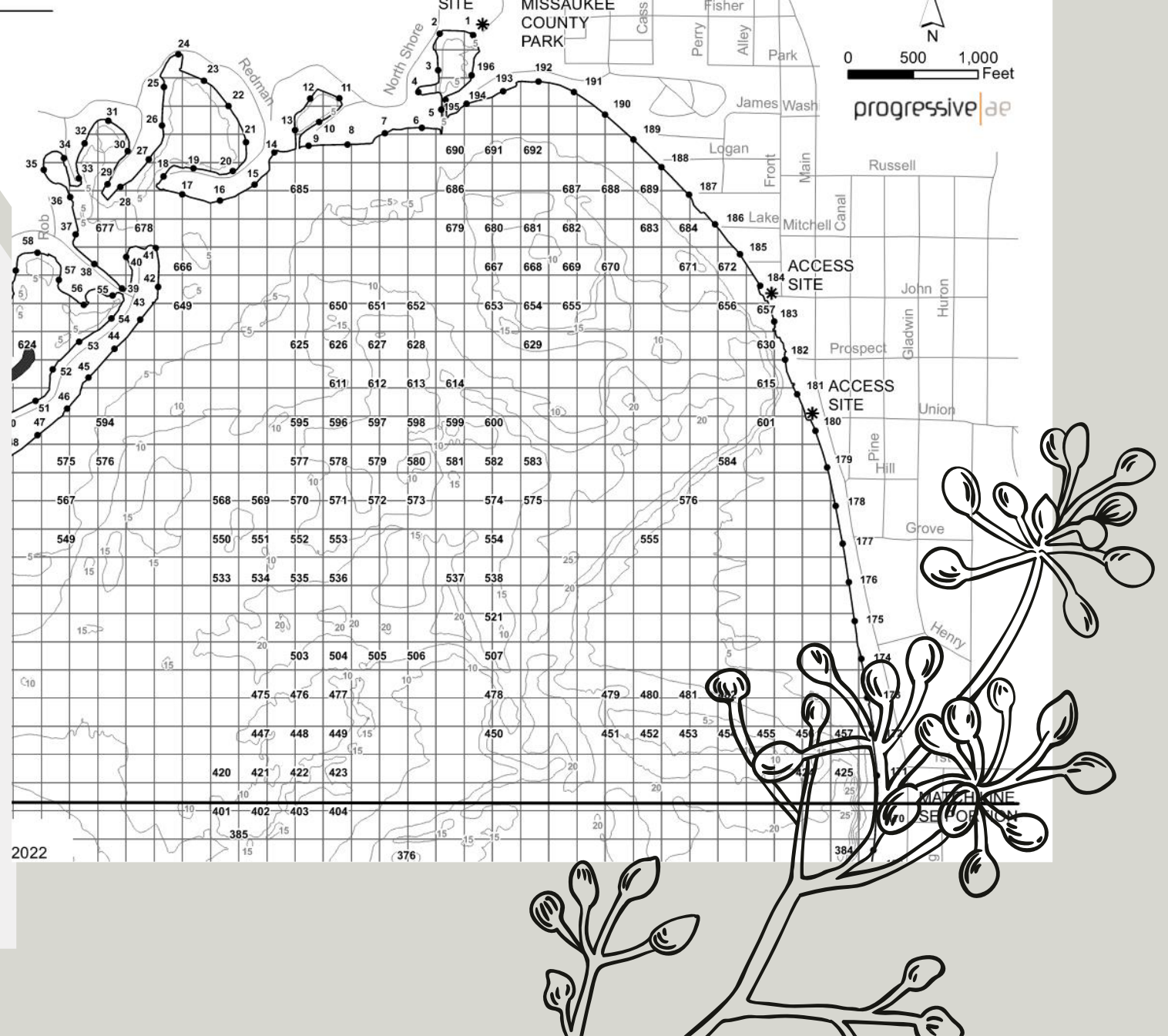
Presence/absence vs. abundance estimates – eliminating survey bias

Spatial Tracking

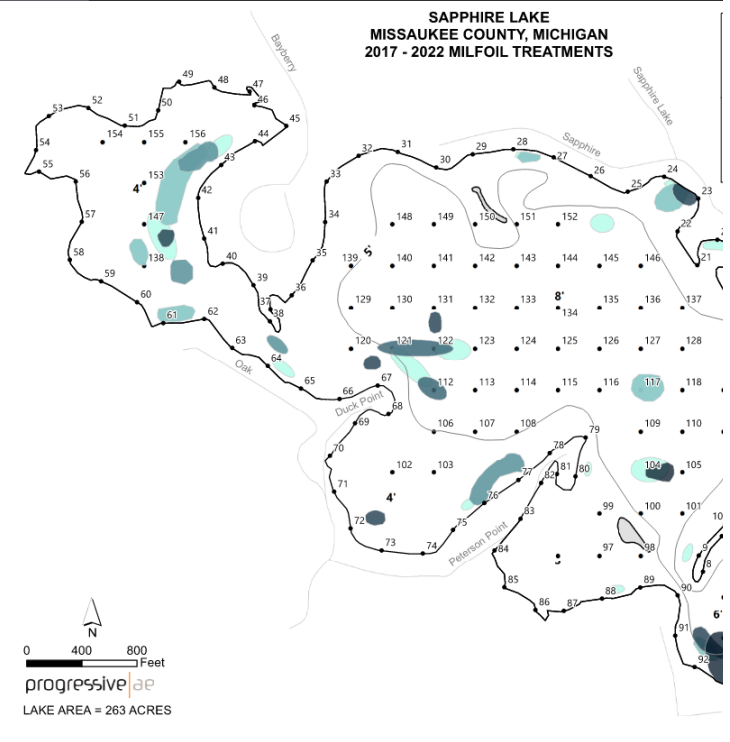
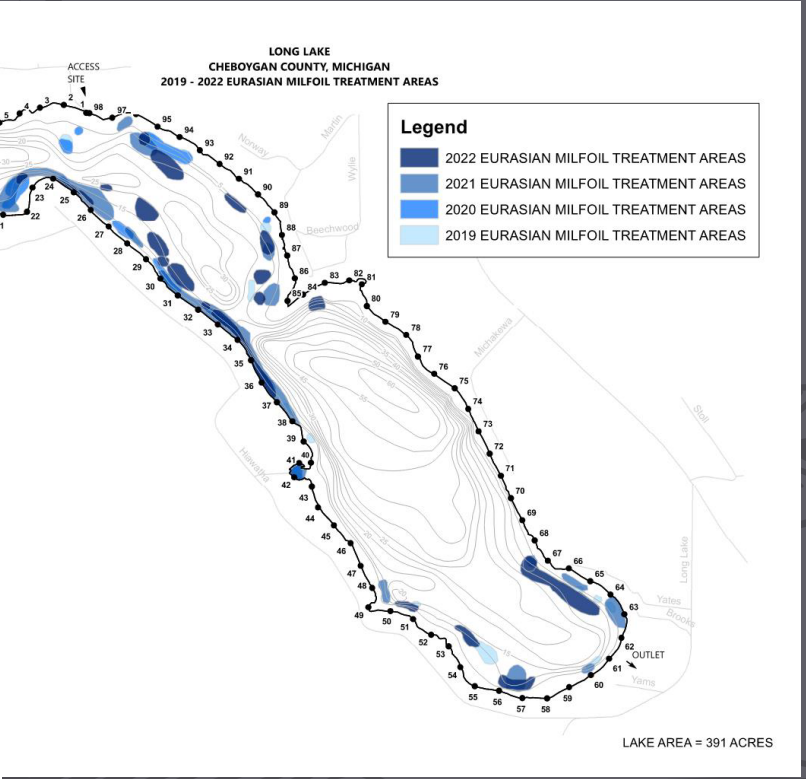
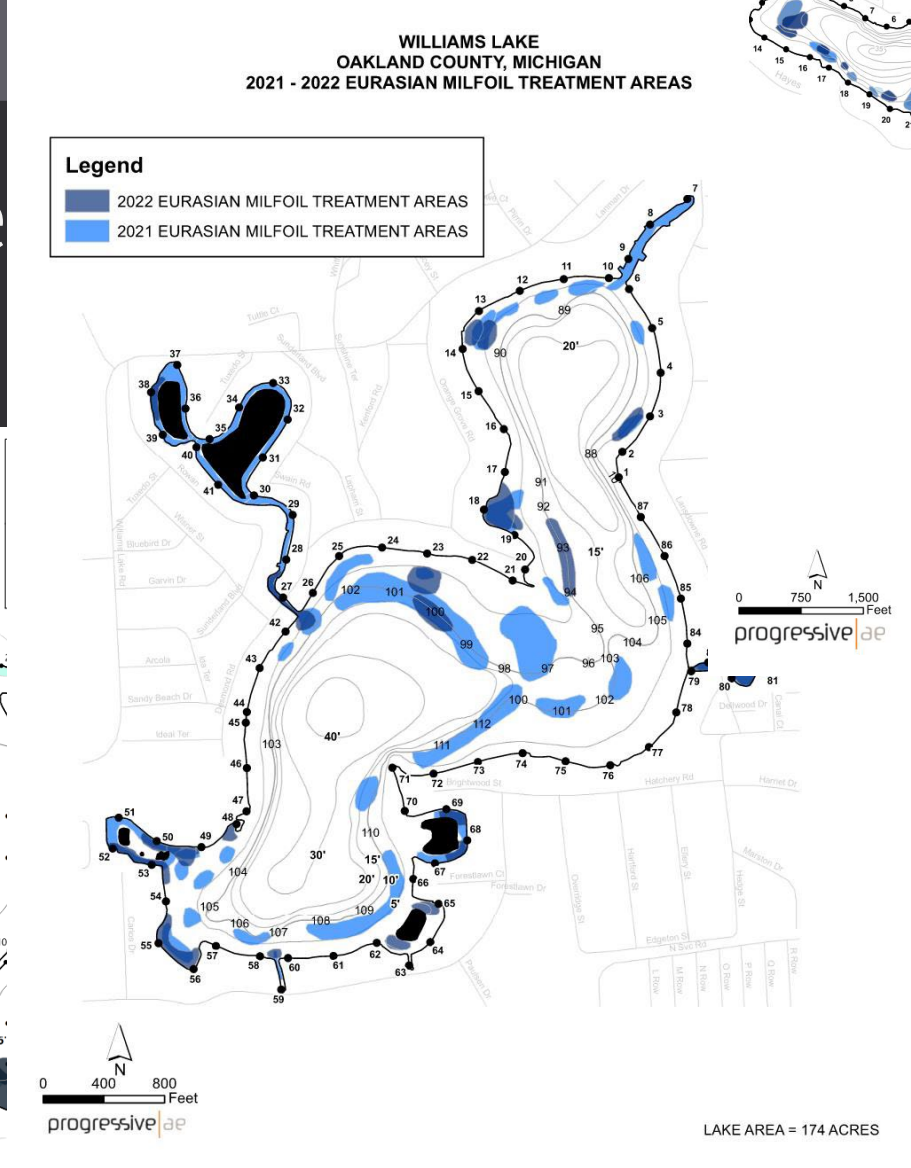
Visual educational tool

Weather:

Notes:



Spatial Tre



Data

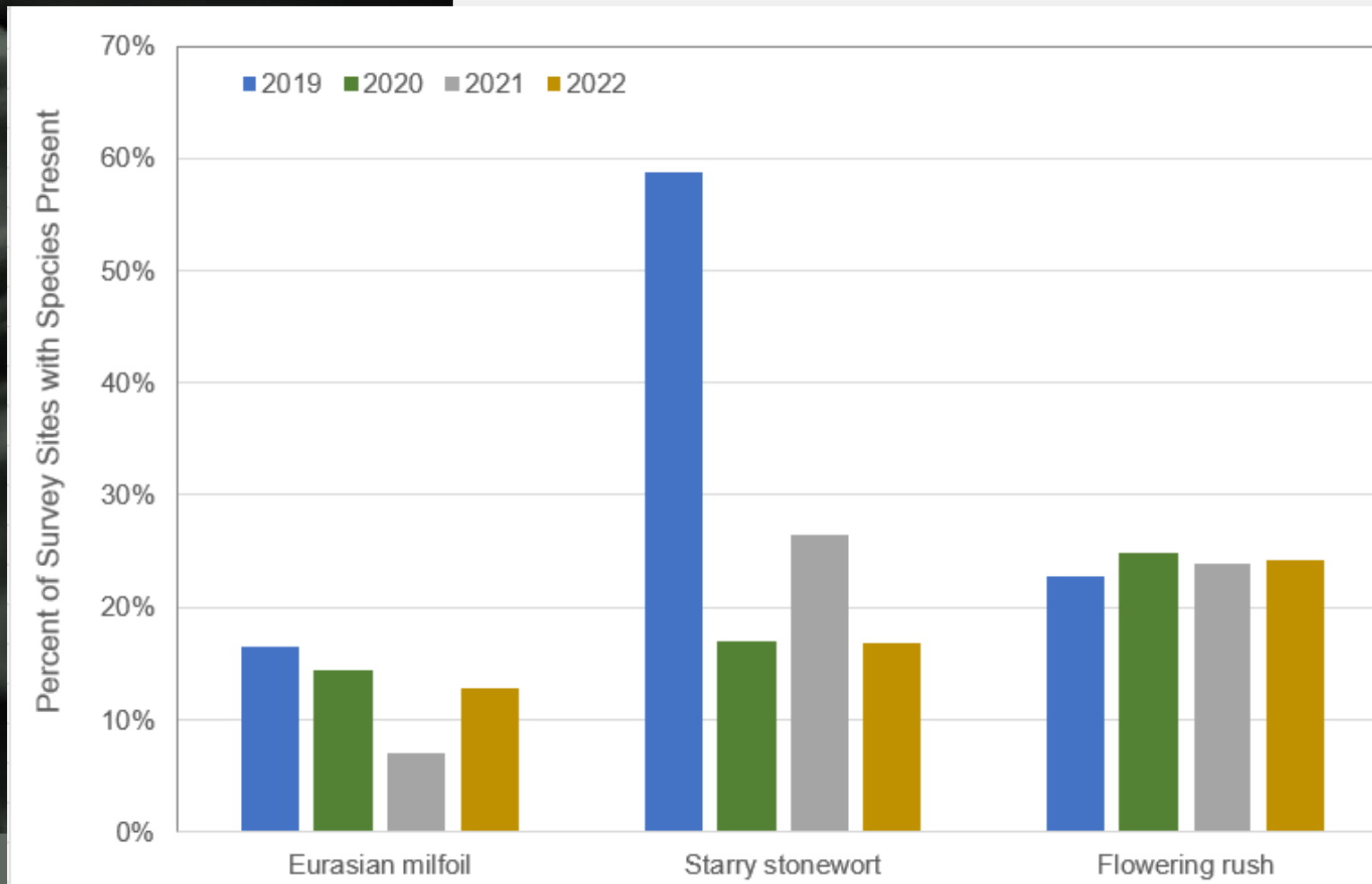
Presence/absence data is statistically valid and not prone to surveyor bias

Code No	Plant Name	Occurrence per Density Category				Relative Density Calculations				Relative Density for Entire Littoral Zone		Code No	Plant Name	
		A	B	C	D	A x 1	B x 10	C x 40	D x 80	Sum	%			
1	Eurasian milfoil	1				1	0	0	0	1	0.0	1	Myriophyllum spicatum	
2	Curly leaf pondweed					0	0	0	0	0	0.0	2	Potamogeton crispus	
3	Chara	1		1		1	0	40	0	41	0.9	3	Chara sp.	
4	Thinleaf pondweed		2	3		0	20	120	0	140	3.1	4	Potamogeton sp.	
5	Flatstem pondweed		5	30	3		0	50	1,200	240	1,480	33.1	5	Potamogeton zosteriformis
6	Robbins pondweed		8	7			0	80	280	0	360	8.0	6	Potamogeton robbinsii
7	Variable pondweed		1				0	10	0	0	10	0.2	7	Potamogeton gramineus
8	Whitestem pondweed		5	19	5		0	50	760	400	1,210	26.9	8	Potamogeton praelongus
9	Richardsons pondweed						0	0	0	0	0	0.0	9	Potamogeton richardsonii
10	Illinois pondweed						0	0	0	0	0	0.0	10	Potamogeton illinoensis
11	Large leaf pondweed						0	0	0	0	0	0.0	11	Potamogeton amplifolius
12	American pondweed						0	0	0	0	0	0.0	12	Potamogeton americanus
13	Floating leaf pondweed						0	0	0	0	0	0.0	13	Potamogeton natans
14	Water stargrass		8	5	1		0	80	200	80	360	8.0	14	Heteranthera dubia
15	Wild celery		10	3			0	100	120	0	220	4.9	15	Vallisneria americana
16	Sagittaria						0	0	0	0	0	0.0	16	Sagittaria sp.
17	Northern milfoil						0	0	0	0	0	0.0	17	Myriophyllum sibiricum
18	M. verticillatum						0	0	0	0	0	0.0	18	Myriophyllum verticillatum
19	M. heterophyllum		1				0	10	0	0	10	0.2	19	Myriophyllum heterophyllum
20	Coontail		7	25	4		0	70	1,000	320	1,390	30.9	20	Ceratophyllum demersum
21	Elodea		4				0	40	0	0	40	0.9	21	Elodea canadensis
22	Utricularia spp.						0	0	0	0	0	0.0	22	Utricularia vulgaris
23	Bladderwort-mini						0	0	0	0	0	0.0	23	Utricularia minor
24	Buttercup						0	0	0	0	0	0.0	24	Ranunculus sp.
25	Najas flexilis						0	0	0	0	0	0.0	25	Najas flexilis
26	Brittle naiad						0	0	0	0	0	0.0	26	Najas minor
27	Sago pondweed						0	0	0	0	0	0.0	27	Stuckenia pectinata
28							0	0	0	0	0	0.0	28	
29							0	0	0	0	0	0.0	29	
30	Nymphaea		11	12	11		0	110	480	880	1,470	32.7	30	Nymphaea odorata
31	Nuphar		4	9	13		0	40	360	1,040	1,440	32.0	31	Nuphar sp.
32	Brasenia		2	1			0	20	40	0	60	1.3	32	Brasenia schreberi
33	Lemna minor						0	0	0	0	0	0.0	33	Lemna minor
34	Spirodela						0	0	0	0	0	0.0	34	Spirodela polyrhiza
35	Watermeal						0	0	0	0	0	0.0	35	Wolffia punctata
36	Arrowhead						0	0	0	0	0	0.0	36	Sagittaria latifolia
37	Pickerselweed			1			0	0	40	0	40	0.9	37	Pontederia cordata
38	Arrow arum						0	0	0	0	0	0.0	38	Peltandra virginica
39	Cattails		8	11	3		0	80	440	240	740	16.4	39	Typha sp.
40	Bulrushes		5				0	50	0	0	50	1.1	40	Schoenoplectus sp.
41	Iris						0	0	0	0	0	0.0	41	Iris sp.
42	Swamp loosestrife		3	4			0	30	160	0	190	4.2	42	Decodon verticillatus
43	Purple loosestrife		3	10	3		3	100	120	0	223	5.0	43	Lythrum salicaria
44	Starry stonewort						0	0	0	0	0	0.0	44	Najas obtusa

Analysis

GROUP	PERCENT OF SITES WHERE PRESENT
Submersed	89
Submersed	69
Submersed	58
Submersed	29
Submersed	29
Submersed	24
Submersed	9
Submersed	9
Submersed	9
Submersed	7
Submersed	7
Submersed	7
Submersed	7
Submersed	4
Submersed	2
Submersed	2
Submersed	2
Floating-leaved	89
Floating-leaved	67

Trend Analysis by Species



Information and Education

- Reports
- Meetings



Stone Lake Aquatic Plant Control Program 2022 Activity Summary



Thank you

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Resources Practice Leader

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[https://www.progressiveae.com/
expertise/water-resources/](https://www.progressiveae.com/expertise/water-resources/)

