Aquatic Vegetation Management

Do We Know What We're Doing?

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LakeScan

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Lake Management

Context and Perspective

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Lake Management

The Pollution Paradigm

The Disturbance Paradigm

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Aquatic Vegetation Management

The Disturbance Paradigm

Nutrient/Sediment Pollution

Shoreline Alteration

Biological Pollution (invasive species)

Irrigation Demands

"Bottom Blasting"

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Consequences of Cultural Disturbance

Loss of Species and Habitat Diversity

Diminished Complexity and Ecosystem Feedback Mechanisms

Consequences of Cultural Disturbance

Loss of Ecosystem Stability

Algae Blooms

Noxious Filamentous and Planktonic Species

Weedy Plant Communities

Opportunistic and Facultative Invasive Species

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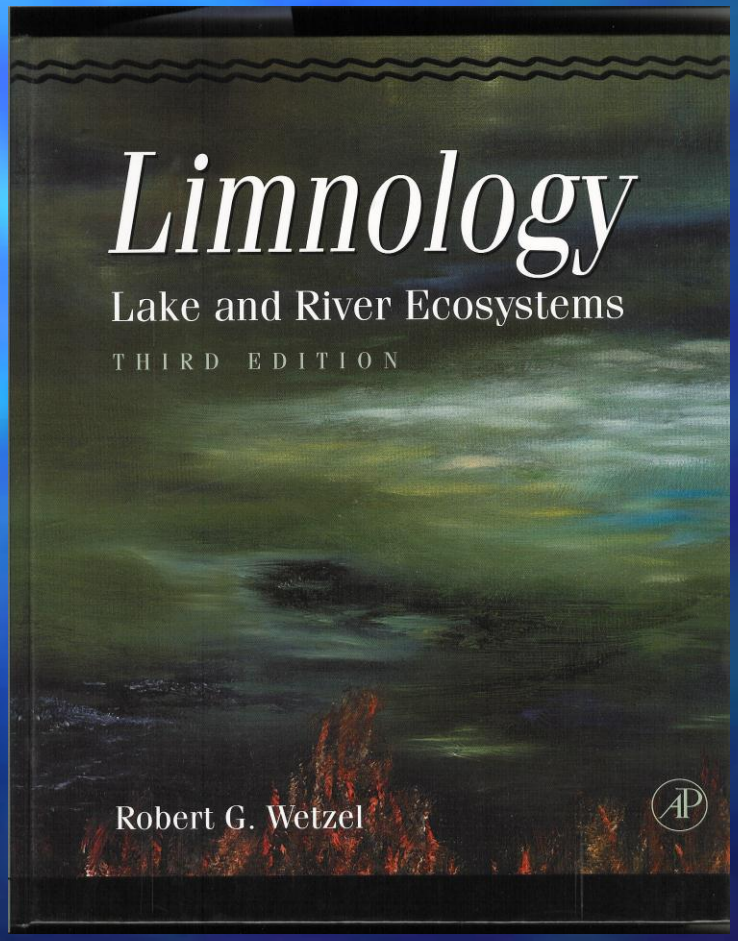
It's Basic Limnology!



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Hypothesis

Most lake users are satisfied with conditions where biodiversity is high and ecosystem stability is optimized AND where the lake plant community is dominated by “non-invasive species”.

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What's the Goal?

A Stable, Biologically Diverse Ecosystem

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Lake Management

What's Possible (and Sustainable)

A Stable, Biologically Diverse Ecosystem

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Lake Monitoring

~ What's the Problem?

~ What Can I Do To Fix It?

~ Did I Do What I Wanted to Do?

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Do We Really Know?

- Is the lake getting better?
- Is the lake getting worse?
- What is better and what is worse?
- Does management have any impact on key metric?

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So, What is so Important?

- Species Present
- Species Locations (% cover, tmt areas, etc.)
- Plant Density (AVAS)
- Coefficient of Conservatism ("C" value)
- BioDiversity, MorphoDiversity, Vertical Diversity
- Density and Distribution (see Aquest Method)
- Plant Species Dominance, Littoral Zone Dom Factor
- Weediness Index and Factors
- Plant Biovolume

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Lake Management

What Good is Monitoring Data?

- Comparisons of Critical Indices
  - Biodiversity
  - Species Richness (Number)
  - Mean “C” Value
  - Relative Density and Distribution Patterns
  - Mean or Dominant Morphotype and Variation
  - Water Column Structural Diversity
  - Area Cover
- Management Information
  - Plant Species Locations
  - Analysis by Tier
  - Treatment Area Referencing
  - Program Evaluation

LakeScan™

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What Needs to Be Done?

STEP 1

~ Identify the Species Present

~ Record Where the Species Are Found

STEP 2

~ Notes on Density and Distribution

~ Notes on Water Column Position

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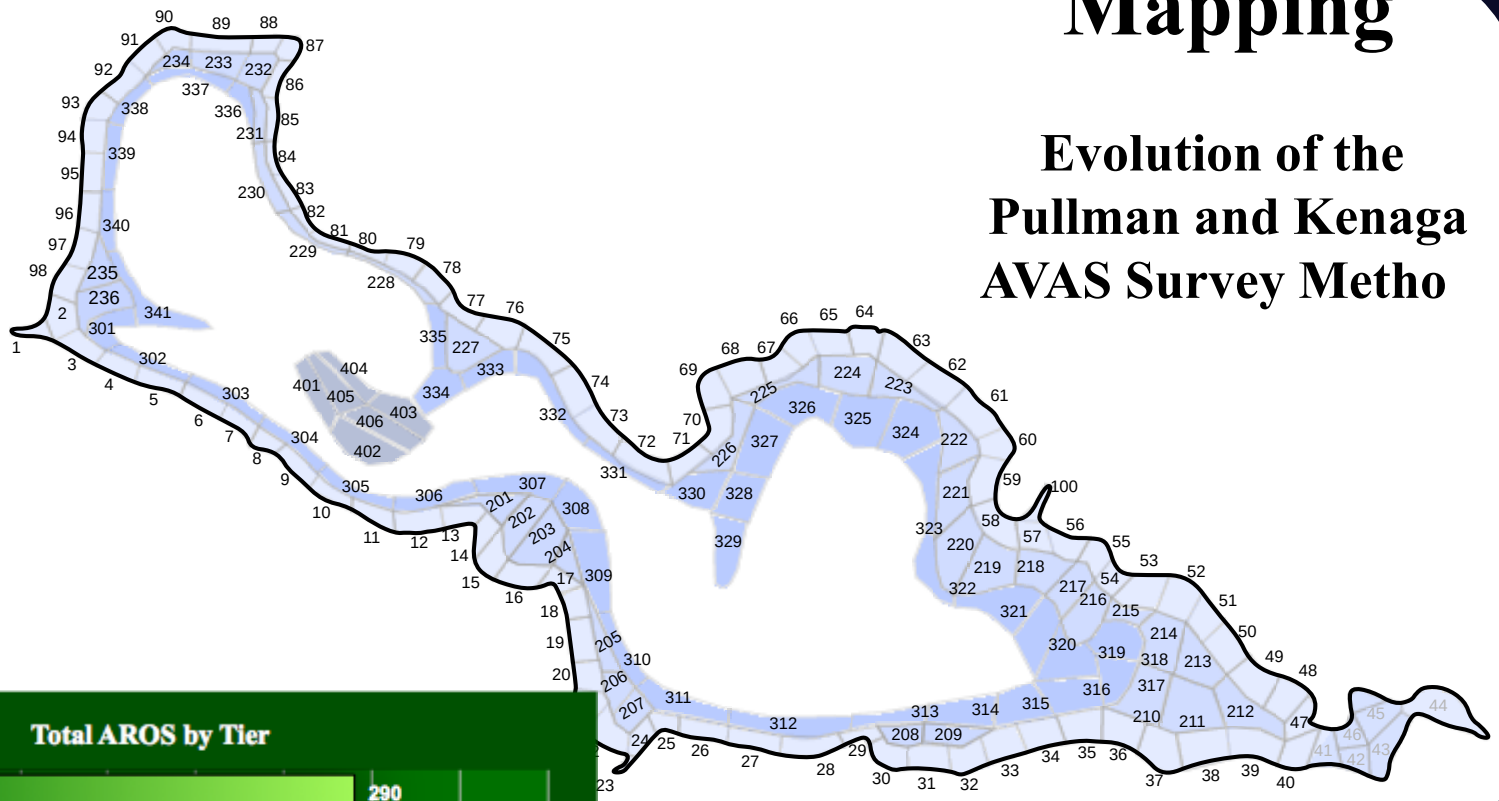
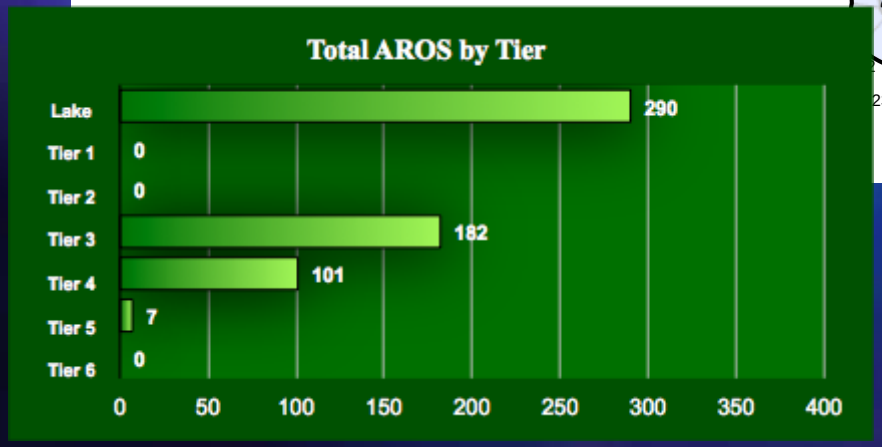
AROS

Mapping

Evolution of the Pullman and Kenaga AVAS Survey Metho





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Aquatic Resource Observation Site

~ Find everything in observation site,
~ Can be georeferenced,
~ Can be weighted according to size of site,
~ Can be weighted according to location,
~ Provides treatment zone location info.

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Observation Methods

- ~ Frodis Sample Analysis
- ~ Simple Visual Analysis
- ~ Hydro-Acoustic Techniques
- ~ Video

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Observation Methods

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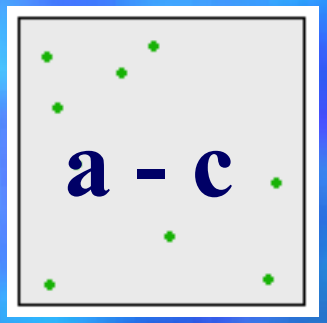
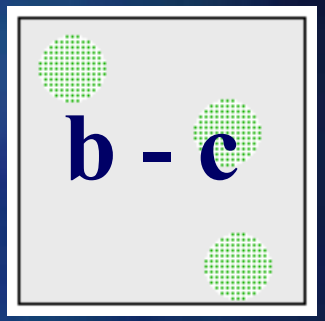
Density and Distribution

"s" = scattered



"sp" = scattered patches



"p" = patchy

"cp" = contiguous patches

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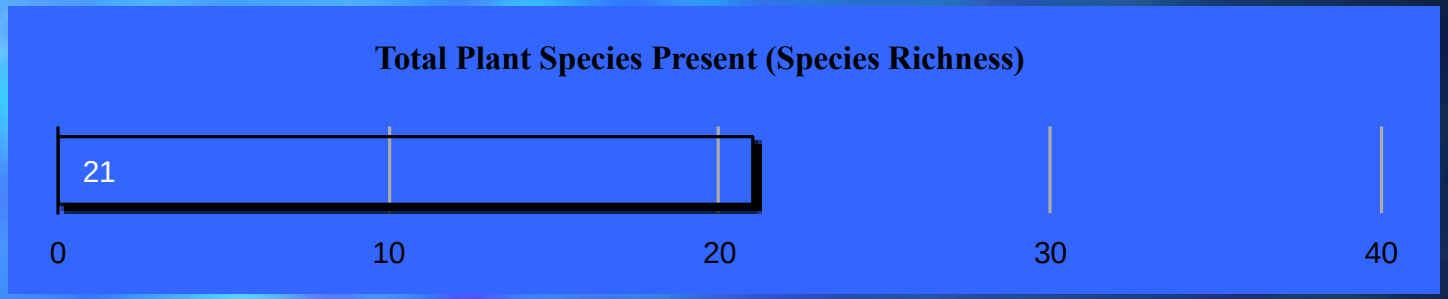
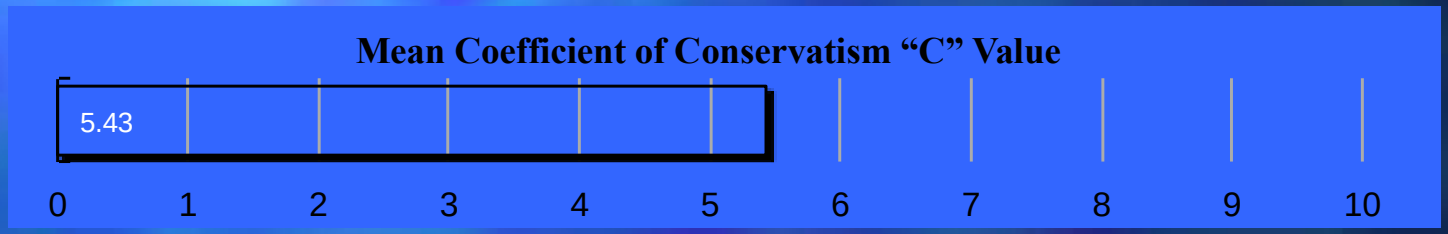
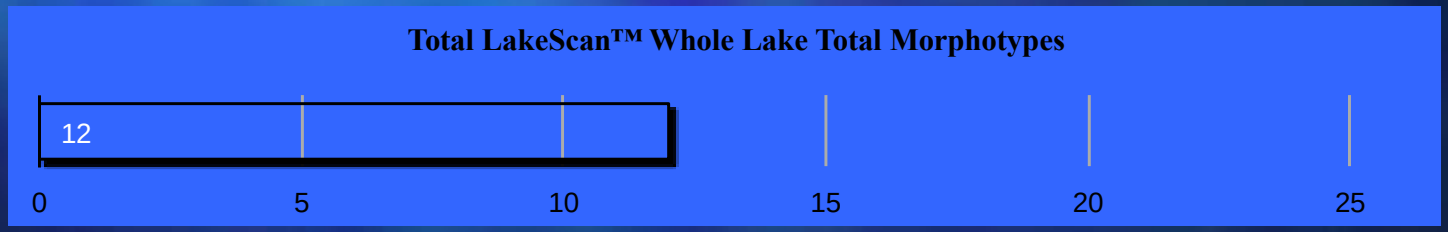
Species Richness and Quality







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Analysis

PLANT NAME, CODES, AND SELECTED ATTRIBUTES								
	CODE #	SHORT NAME	COMMON NAME	SCIENTIFIC NAME	"C" VALUE	"I" VALUE	"T" VALUE	MORPHOTYPE
1	2	EWMx	Eurasian Watermilfoil Hybrid	*Myriophyllum spicatum x sibiricum*	3	8	1	feathery
2	22	WWCF	White Water Crowsfoot	*Ranunculus sp.*	8	4	3	feathery
3	25	BLAD	Common Bladderwort	*Utricularia vulgaris L.*	7	4	3	feathery
4	27	MiniB	Mini-Bladderwort	*Utricularia sp.*	9	4	4	feathery
5	33	CNTL	Coontail	*Ceratophyllum sp.*	3	7	2	bushy
6	50	NAID	Naiad	*Najas sp.*	4	7	2	bushy
7	60	CHARA	Chara	*Chara sp.*	6	3	4	bushy
8	75	CLP	Curly Leaf Pondweed	*Potamogeton crispus L.*	2	9	1	narrow leafy
9	76	FSP	Flat Stem Pondweed	*Potamogeton zosteriformis Fern.*	6	5	2	narrow leafy
10	102	WSP	White Stem Pondweed	*Potamogeton praelongus Wulfen*	8	5	3	broad leafy
11	109	HPW	Hybrid Pondweed	*Potamogeton Hybrid*	5	5	2	broad leafy
12	110	WBLP	Weedy Broad Leaf Pondweed	*Potamogeton amplifolius Hybrid*	4	6	2	broad leafy
13	115	Stuk	Sago Pondweed	*Stuckenia sp.*	3	6	2	stringy
14	117	TLP	Thin Leaf Pondweed	*Potamogeton sp.*	5	5	4	stringy
15	120	ZAN	Horned Pondweed	*Zannichellia palustris L.*	7	5	3	stringy
16	125	VAL	Wild Celery	*Vallisneria americana Michaux*	3	7	2	grassy
17	126	SAG	Sagittaria	*Sagittaria sp.*	7	0	4	grassy
18	150	WL	Waterlily	*Nymphaea sp.*	6	5	2	floating leaf
19	153	SPAD	Spadderdock	*Nuphar sp.*	6	5	2	floating leaf
20	155	WSh	Water Shield	*Brasenia schreberi J.F. Gmel.*	7	5	3	floating leaf
21	166	TLFP	Thin and Floating Leaf Pondweed	*Potamogeton sp.*	5	0	3	floating leaf pondweed

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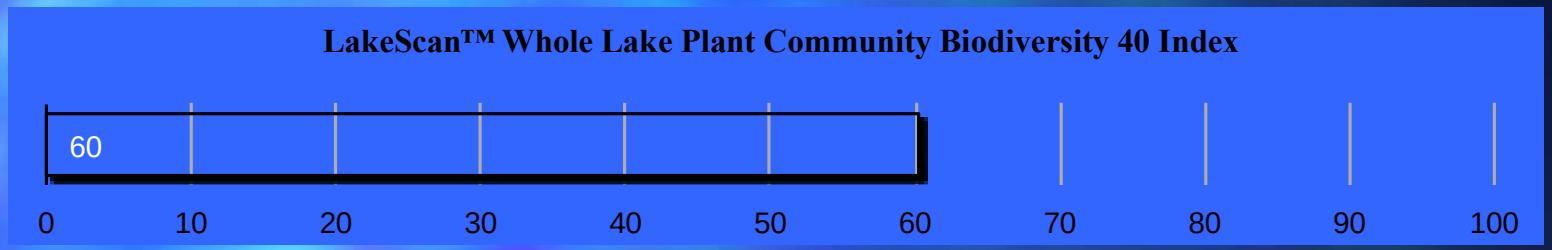
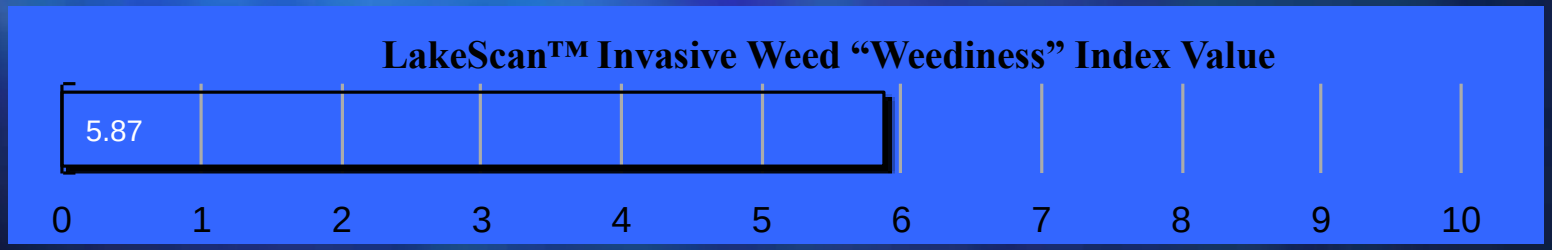
Diversity Factors





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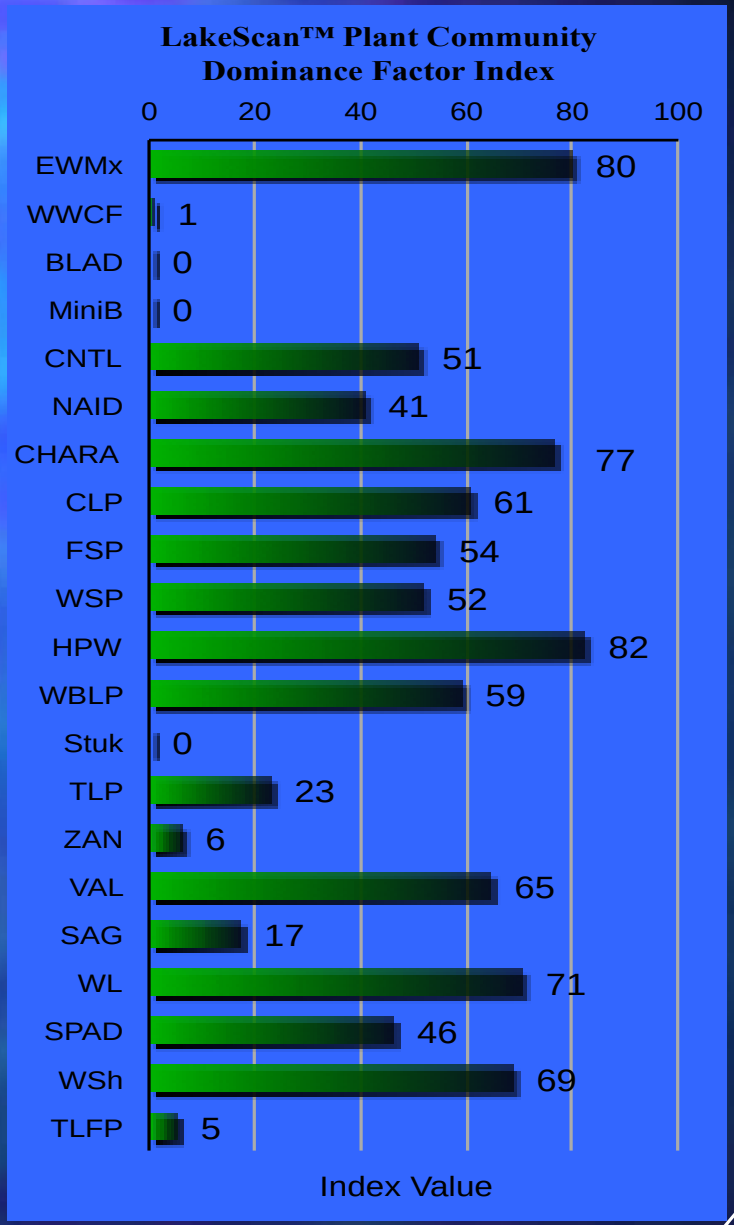
Dominance Factors



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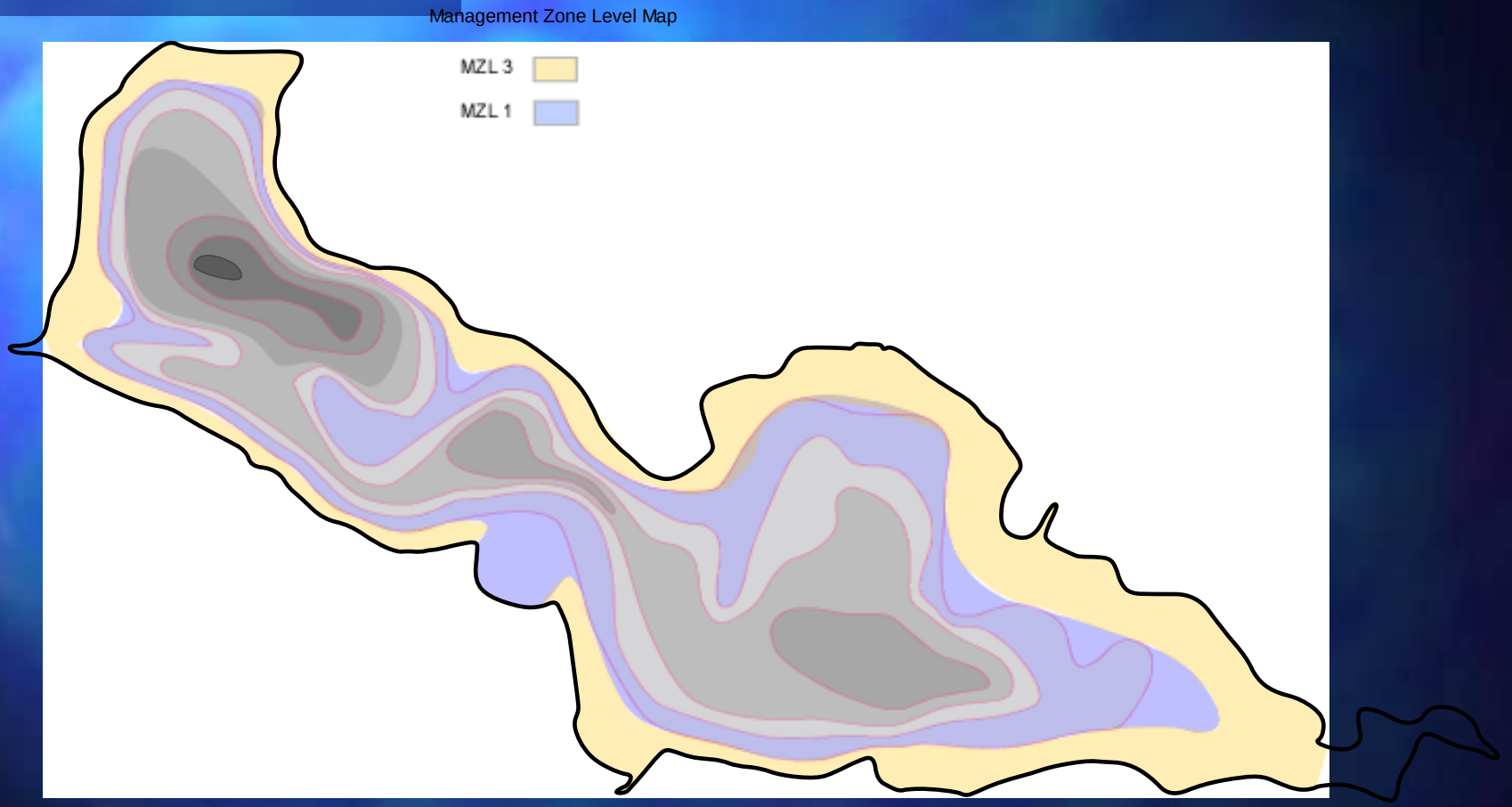
Management Zone Level - MZL 1 - 4



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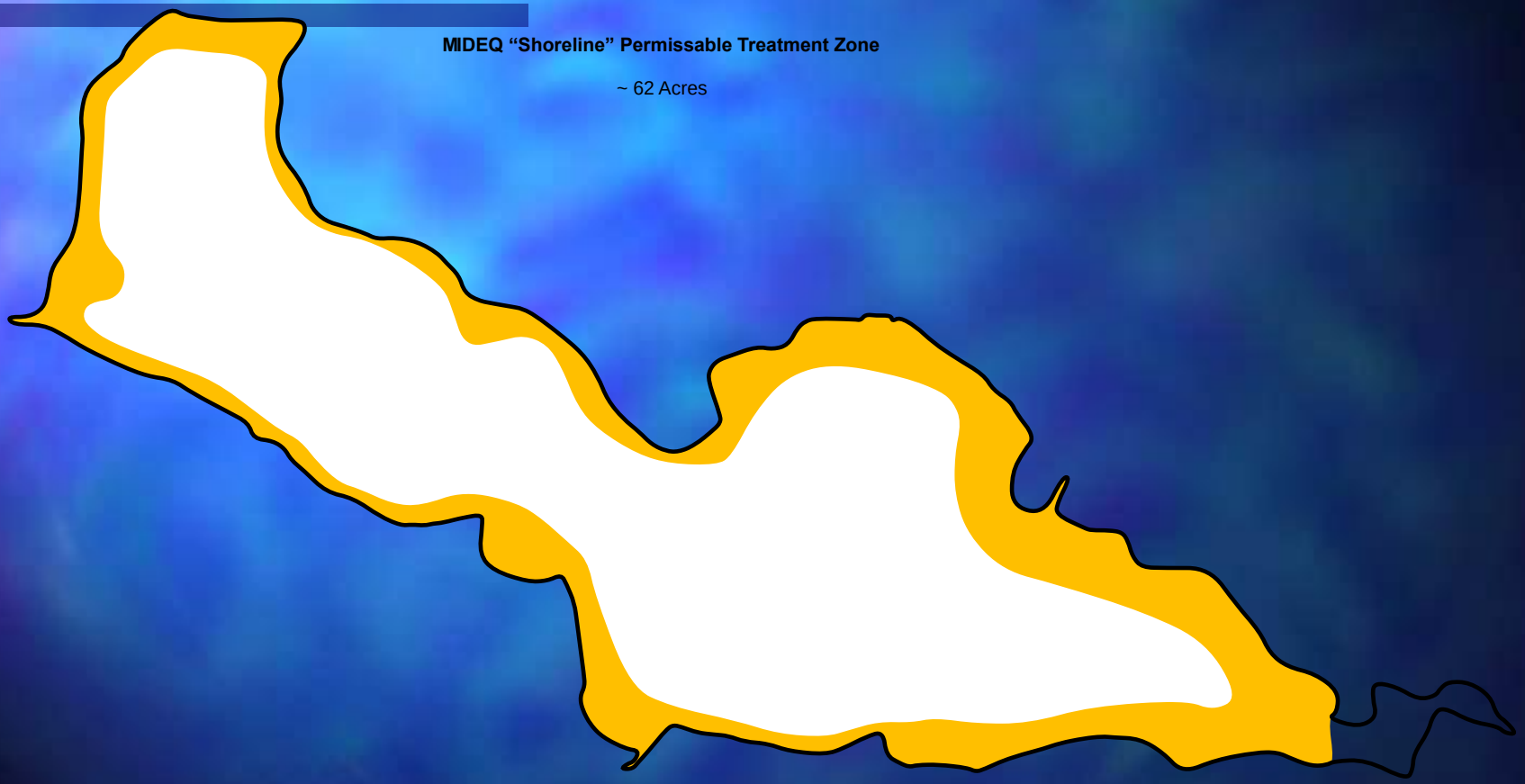
MI DEQ “Permitable” Management Zone



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Species Management Target Levels

T 1

T 2

T 3

T 4

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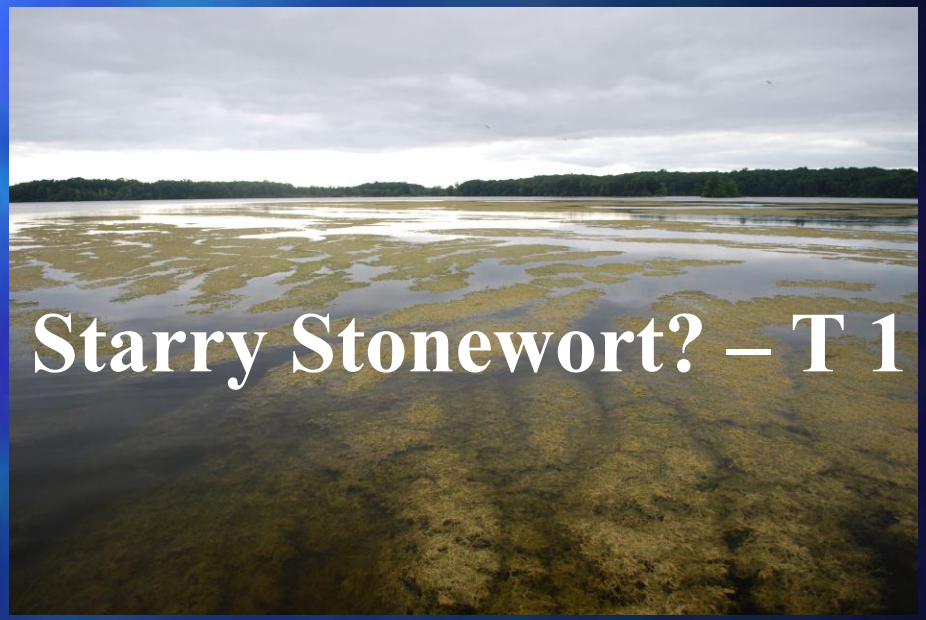
Pleasant Lake T1 Species



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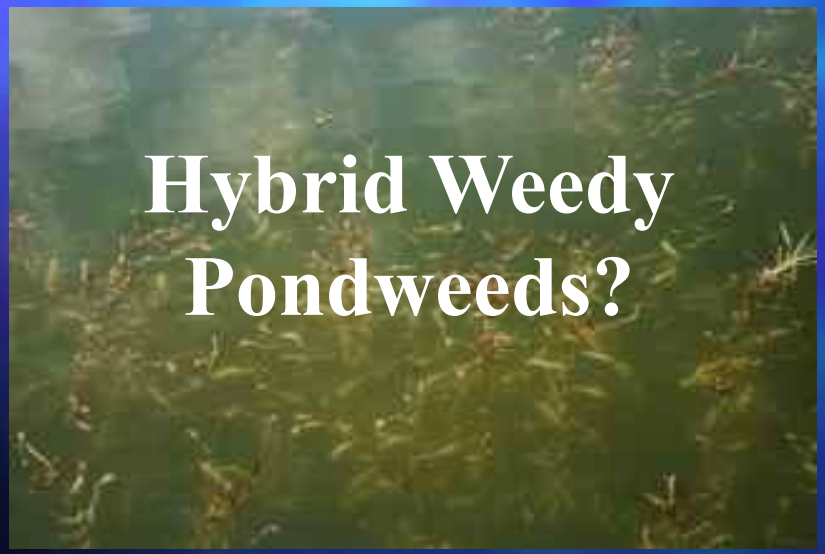
Pleasant Lake T1 Species

Ebrid Milfoil – T 1

Starry Stonewort? – T 1



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Management Prescriptives

Option 1: Do Nothing

~ Milfoil Population Likely to remain the same,

~ Pondweeds nuisance conditions may worsen,

~ Other species will wax and wane,

~ Starry stonewort will invade and seriously damage the lake!

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Management Prescriptives

Option 2: Integrated Management

~ **Apply species specific herbicides for selective management of ebrid milfoil throughout most of the lake. May require 2 treatments per year.**

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Management Prescriptives

Option 3: Integrated Management

- ~ Apply species specific herbicides for selective management of ebrid milfoil throughout most of the lake. May require 2 treatments per year.
- ~ Semi-selective treatment or non-selective harvest nuisance of pondweeds. One herbicide treatment of 60 acres. Multiple harvests.

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Management Prescriptives

No Option: Starry Stonewort Management

~ **Starry stonewort will find it's way into Pleasant Lake. It will require management!**

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Thank You!
Please Protect Aquatic Biodiversity
Manage Invasive Species

Aquest SAV Field Survey Code Form

Short Form Version 5

#	MI DEQ	ABREV.	"C"	PLANT COMMON NAME
		Bushy Plants		
1	1	EWM	3	Eurasian Watermilfoil
2		EWMx	3	Eurasian Milfoil Hybrid
3	17	NWM	7	Northern Milfoil
4	18	GWM	7	Green/Var Milfoil (2)
5		VARx	3	Variable Milfoil Hybrid
6		Omil		Other Milfoils (5)
7		HALG		Prospernaca (2)
8	20	BTCP	6	Buttercup (2)
9		WWCF	8	White Water Crowsfoot (3)
10		CAB	4	Fanwort
11		WMG	8	Water Marigold
12	22	BLAD	7	Common Bladderwort
13	23	MiniB	9	Mini-Bladderwort
14				
15	20	CNTL	3	Coontail (2)
16				
17		CAL	8	Water-Starwort
18		HIP	8	Mare's-Tail
19		Moss		Water Moss (3)
20	3	CHARA	6	Chara
21	25	NAID	4	Naiad (3)
22		SpNAD	4	Spiny Naiad
23				
24	21	ELD	3	Elodea (2)
25		HYD	2	Hydrilla
26		HYDo	2	Hydrilla
27		EGR	3	Egeria
28		LARG		Largarosiphon
29				
30				

(X) = number of species represented by code number (see long form)

#	MI DEQ	ABREV.	"C"	PLANT COMMON NAME
		Leafy Plants		
30	2	CLP	2	Curly Leaf Pondweed
31	5	FSP	6	Flat Stem Pondweed
32	14	WSG	6	Water Star Grass
33	10	ILP	6	Illinois Pondweed
34	7	VP	7	Variable Pondweed
35		MLF	8	Medium Leaf Pondweed
36	11	BLP	7	Broad Leaf Pondweed
37	9	Rich	5	Richardsons Pondweed
38	6	ROB	8	Robbins Pondweed
39	8	WSP	8	White Stem Pondweed
40		RedP	8	Spotted Pondweed
41		ClsP	8	Clasping Leaved Pondweed
42	12	AMER	7	American Pondweed
43				
44				
45	13	FLP	7	Floating Leaf Pondweed (2)
46		TLFP	5	Thin and Floating Leaf (6)
47				
48				
49				
		Stringy Plants		
50	27	Stuk	3	Sago (3)
51	4	TLP	5	Thin Leaf Pondweed (7)
52		ZAN	7	Horned Pondweed
53				
54				
55				
56				
57				
58				
59				

#	MI DEQ	ABREV.	"C"	PLANT COMMON NAME
		"Grass-Like" Plants with Basal Meristems		
60	15	VAL	3	Wild Celery
61			7	Sagittaria (4)
62		SPRG	8	Sparganium (3)
63		ISO	8	Quillwort (2)
64		LOBL	8	Lobellia
65		FR	4	Flowering Rush (submersed)
66		TEN	7	Tenellum
67		SPIK	5	Spikerush (2)
68			7	Rush
69			7	Bull Rush
		Floating Leaf Plants		
80	30	WL	6	Waterlily (2)
81	31	SPAD	6	Spadderdock (3)
82	32	WSh	7	Water Shield
83		NEL	8	Lotus
84		POLYG	5	Smartweed (2)
85		CHEST	2	Water Chestnut
86		FGBT	3	Frogbit
87				
88				
89				
		Floating Plants		
90	33	DUCK	5	Common Duckweed (4)
91	35	WOLF	5	Watermeal (3)
92	34	SPIR	5	Giant Duckweed (2)
93	16	TRIS	6	Star Duckweed
94		RIC	8	Riccia
95		AZL	2	Azolla (4)
96		SALV	2	Salvinia (2)
97				
98				
99				

Plant Quality

Bushy Plants		*Leafy Plants*		*Floating Leaf and Floating Plants*	
C	PLANT NAME	C	PLANT NAME	C	PLANT NAME
3	Eurasian Watermilfoil	2	Curly Leaf Pondweed	6	Waterlily
7	Northern Milfoil	6	Flat Stem Pondweed	6	Spadderdock
7	Green/Var Milfoil	6	Illinois Pondweed	7	Water Shield
	Other Halogaraceae	7	Variable Pondweed	5	Smartweed
6	Buttercup	7	Broad Leaf Pondweed	9	Water Chestnut
8	White Water Crowsfoot	6	Richardsons Pondweed		Frogbit
8	Water Marigold	8	Robbins Pondweed		
	Mares Family	7	American Pondweed		
4	Fanwort	5	Floating Leaf Pondweed		
6	Chara	8	White Stem Pondweed		
3	Coontail	3	Thin Leaf Pondweed	5	Common Duckweed
4	Naiad	7	Horned Pondweed	5	Watermeal
3	Elodea	7	Tenellum	5	Giant Duckweed
3	Egeria	5	Spikerush	6	Star Duckweed
2	Hydrilla	6	Water Star Grass	2	Azolla
	Largarosiphon	3	Wild Celery		
7	Common Bladderwort	8	Sparganium		
9	Mini-Bladderwort		Lobellia		
		7	Sagittaria		
		4	Flowering Rush (submersed)		

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