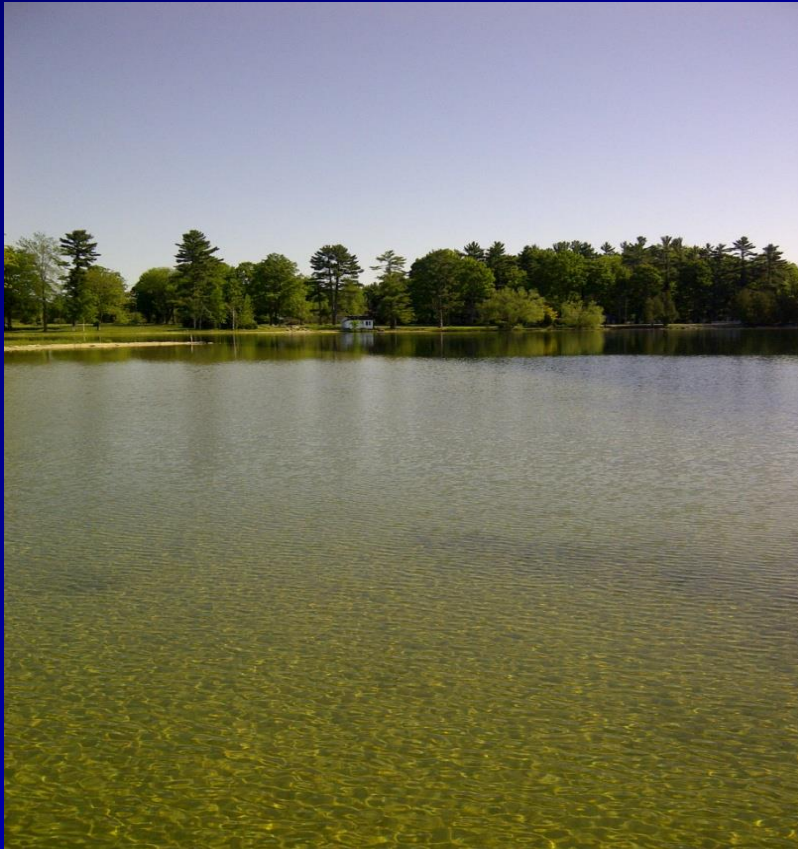


Bear Lake Improvement Program: A Success Story of EWM Management

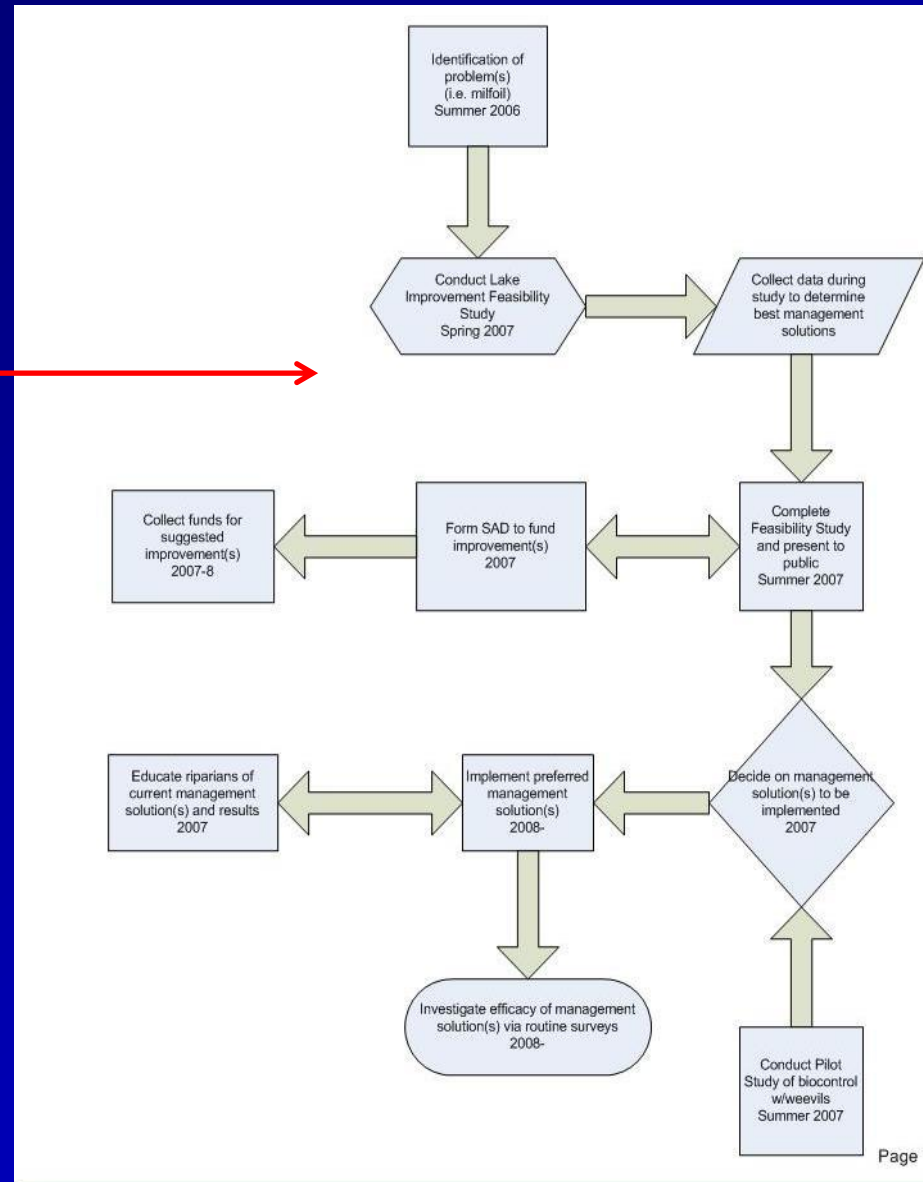
July 12, 2022

Jennifer Jermalowicz-Jones, PhD, CLP
Restorative Lake Sciences



Bear Lake Improvement Program Formation

With assistance from Community Council to Control Milfoil (CCCM) formed by Raiff et al. CCCM was comprised of stakeholders such as BLPOA members, Promoters, Trigenta, Lions, the golf course, and other concerned citizens



1st
Meeting
of BLIB
Held on
8/30/07

What the BLIB Does:

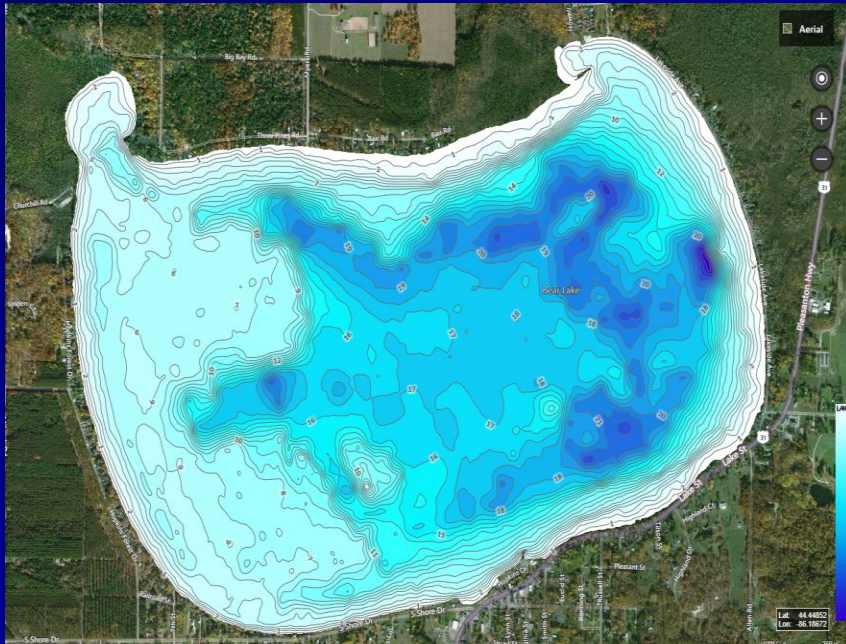
- Holds regular meeting to interface with public on lake concerns
- Commissions the limnologist to educate riparians by attendance at all meetings, a spring newsletter, and with a booth at Bear Lake Days
- Commissions the limnologist to conduct two GPS surveys of the entire lake bottom to scan for EWM and other invasives
- Commissions the limnologist to oversee each aquatic herbicide treatment to assure performance is to spec
- Commissions the limnologist to collect water quality data on the lake in spring and fall of each year and to provide an annual progress report
- Tests EWM for genetic hybridity (which complicates treatment)
- Essentially, insurance for Bear Lake!

The Bear Lake Improvement Board: Members

P.A. 451 of 1994 (Part 309)

- Dave Adams, Pleasanton Township
Representative and Treasurer
- Bob Yates, Bear Lake Township
Representative and Chair
- Andrea Ware, Village of Bear Lake
Representative
- Rita Brisbin, Riparian Representative and
Secretary
- Gary Schwaiger, Manistee County Drain
Commissioner
- Pauline Jaquish, Manistee County Board of
Commissioners

Bear Lake Physical Characteristics



- Primarily groundwater-fed
- Approx. 1,843 acres (during high water periods)
- Max. Depth = 24 ft.
- Mean Depth = 14.4 ft.
- Lake Volume = 26,503 acre-feet
- Shoreline Length = 7.62 miles
- Hydraulic Retention Time = 2.19 yrs.
- Watershed drainage area = 9,386 acres
- Shoreline Development Factor = 1.3
- Predominantly well-drained soils; some ponded soils in the West, East Bays and at SE shore of lake

Bear Lake Aquatic Algae Analyses*

- 10-15 species of Green Algae (Chlorophyta); Preferred source
- 8-10 species of diatoms (Basillariophyta)
- 2 species of Blue-green algae (Cyanobacteria); including *Microcystis* sp. (less-preferred)
- A good balance; focus future analyses on relative proportion of blue-greens: greens



Bear Lake Native Aquatic Plants

- 19 Submersed, rooted species (was 13 prior to EWM management)
- 3 Floating-leaved, rooted species
- 4 Emergent, rooted species
- Fern-leaf Pondweed common throughout lake ; Also common is leafless watermilfoil and pondweeds
- Growth of riparian vegetation around shoreline is encouraged



Fern-leaf Pondweed

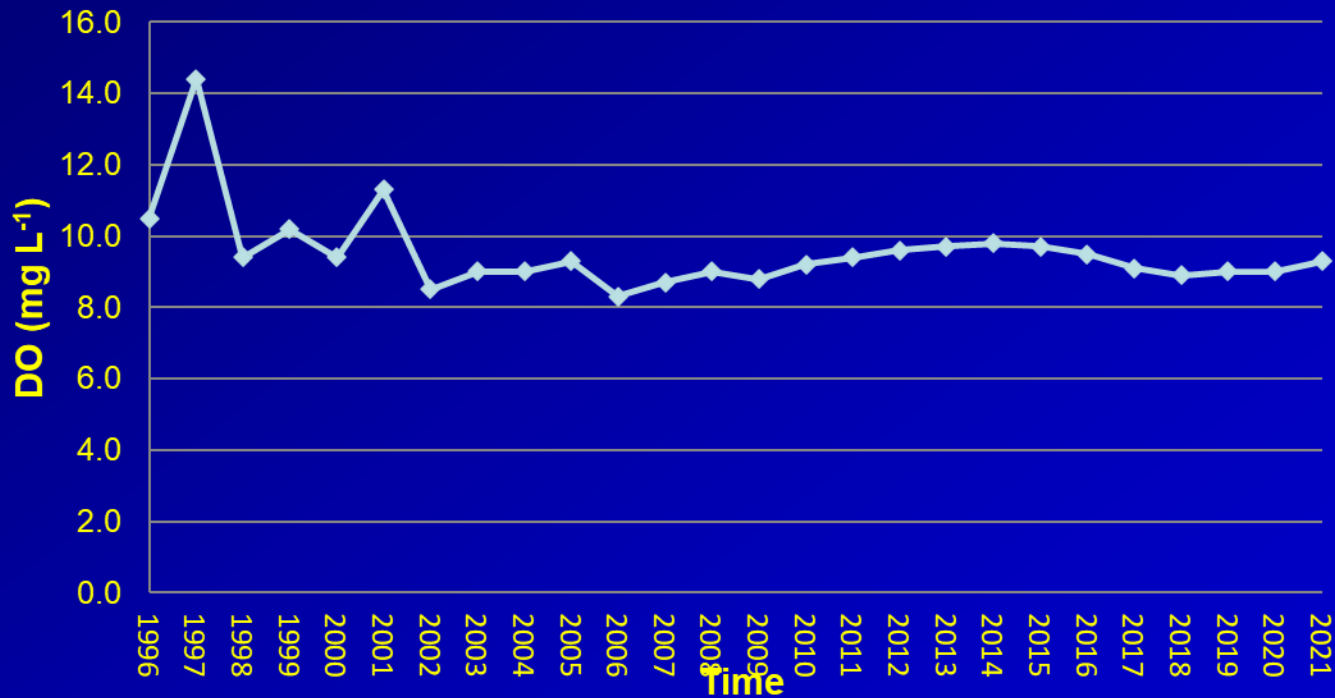


Leafless Watermilfoil

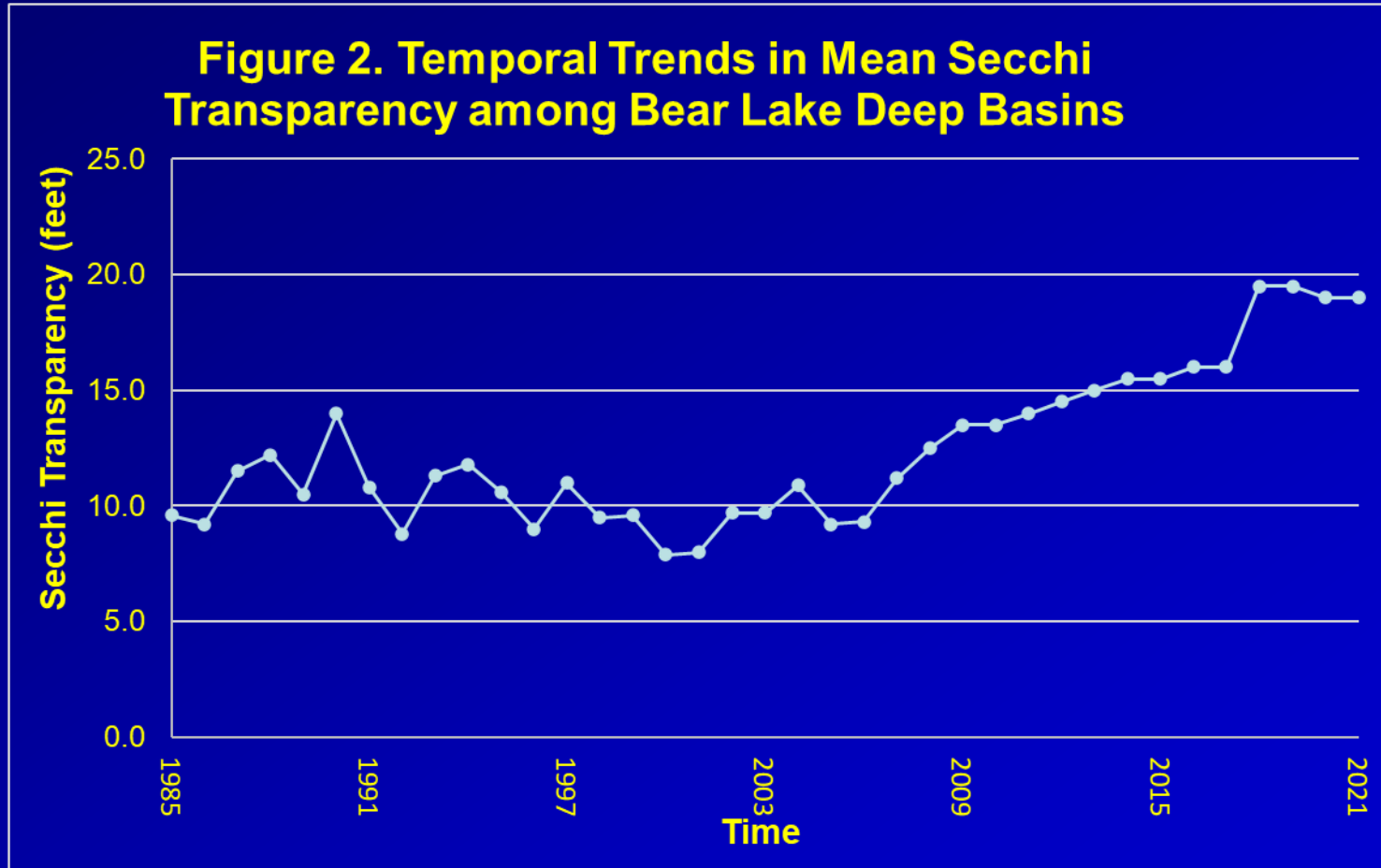
| Native Aquatic Plant Species | Aquatic Plant Common Name | % cover in/around Bear Lake (June 2021) | % cover in/around Bear Lake (August 2021) |
|-------------------------------------|----------------------------------|------------------------------------------------|--------------------------------------------------|
| Chara vulgaris | Muskgrass | 7.0 | 14.0 |
| Potamogeton illinoensis | Illinois Pondweed | 10.1 | 15.5 |
| Potamogeton pusillus | Small-leaf Pondweed | 4.2 | 4.2 |
| Potamogeton robbinsii | Fern-leaf Pondweed | 22.0 | 49.6 |
| Stuckenia pectinatus | Sago Pondweed | 4.0 | 10.1 |
| Potamogeton amplifolius | Large-leaf Pondweed | 9.0 | 12.7 |
| Potamogeton praelongus | White-stem Pondweed | 20.2 | 38.9 |
| Potamogeton gramineus | Variable-leaf Pondweed | 7.0 | 25.5 |
| Potamogeton natans | Floating-leaf Pondweed | 4.0 | 15.6 |
| Potamogeton zosteriformis | Flat-stem Pondweed | 2.1 | 2.8 |
| Vallisneria americana | Wild Celery | 2.0 | 9.4 |
| Najas guadalupensis | Southern Naiad | 2.5 | 8.8 |
| Najas flexilis | Slender Naiad | 0.1 | 2.3 |
| Myriophyllum tenellum | Leafless Watermilfoil | 32.5 | 48.4 |
| Megalodonta beckii | Water Marigold | 0.7 | 0.7 |
| Ceratophyllum demersum | Coontail | 0.1 | 0.3 |
| Elodea canadensis | Common Elodea | 4.3 | 9.4 |
| Utricularia vulgaris | Common Bladderwort | 9.6 | 17.1 |
| Utricularia minor | Small Bladderwort | 0.5 | 0.2 |
| Nymphaea odorata | White Waterlily | 1.2 | 1.2 |
| Nuphar variegata | Yellow Waterlily | 1.5 | 1.5 |
| Brasenia schreberi | Watershield | 1.0 | 2.1 |
| Typha latifolia | Cattails | 2.6 | 2.8 |
| Schoenoplectus acutus | Bulrushes | 1.0 | 1.3 |
| Iris versicolor | Blueflag Iris | 0.2 | 0.6 |
| Decodon verticillatus | Swamp Loosestrife | 3.0 | 3.5 |

Bear Lake Annual Mean Dissolved Oxygen Concentrations

Figure 1. Temporal Trends in Mean DO among Bear Lake Deep Basins

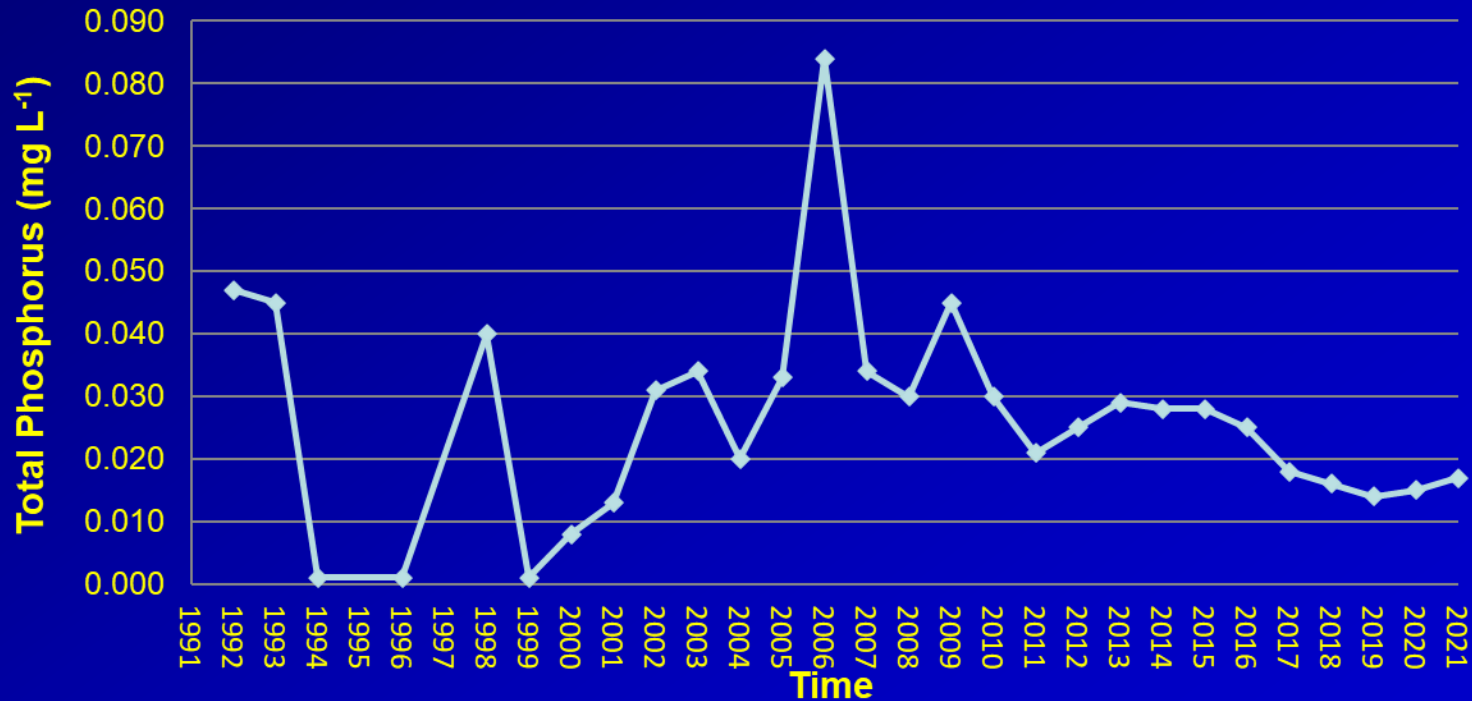


Bear Lake Annual Mean Secchi Transparency



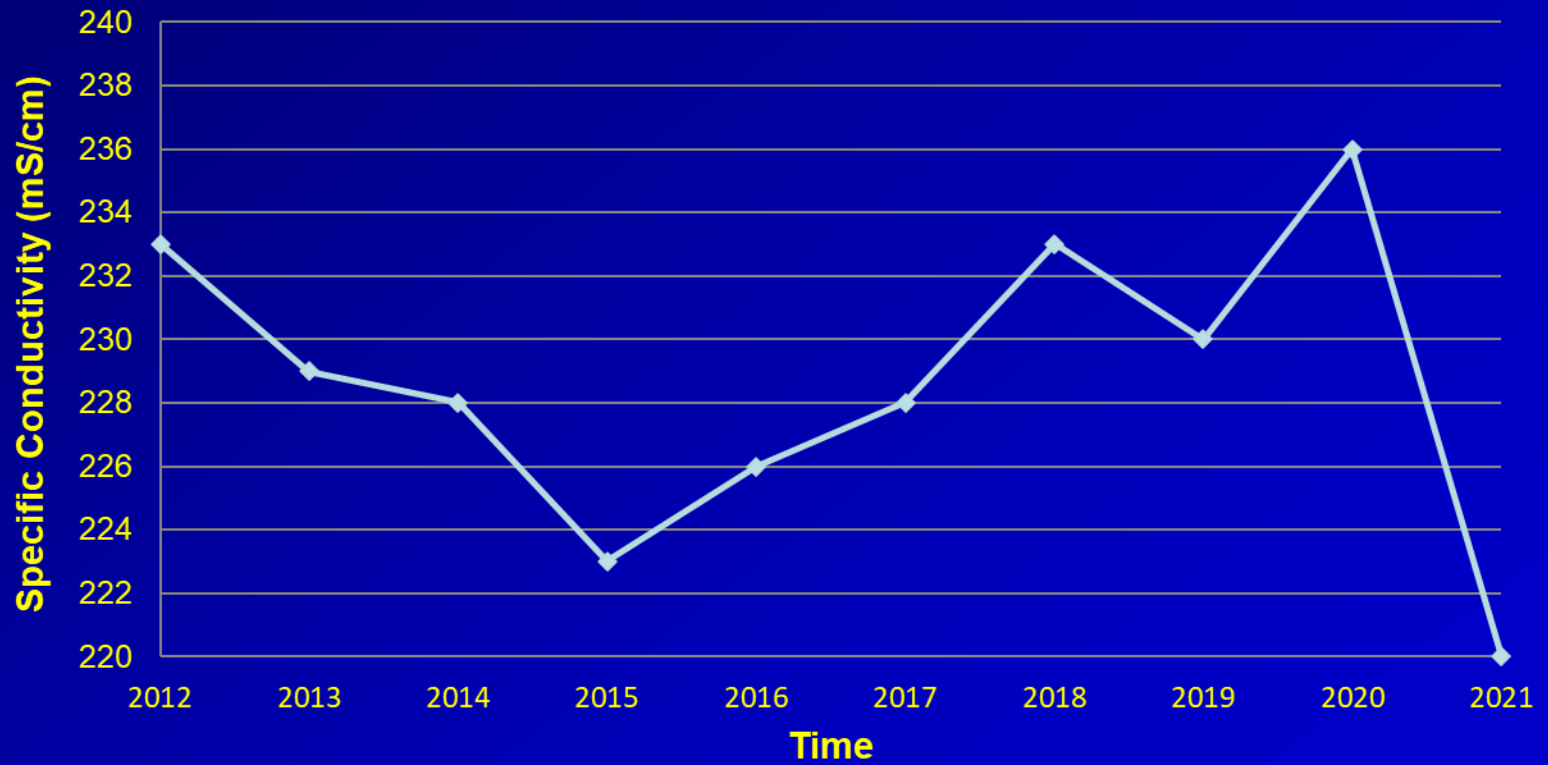
Bear Lake Annual Mean Total Phosphorus Concentrations

Figure 3. Temporal Trend in Mean TP among Bear Lake Deep Basins



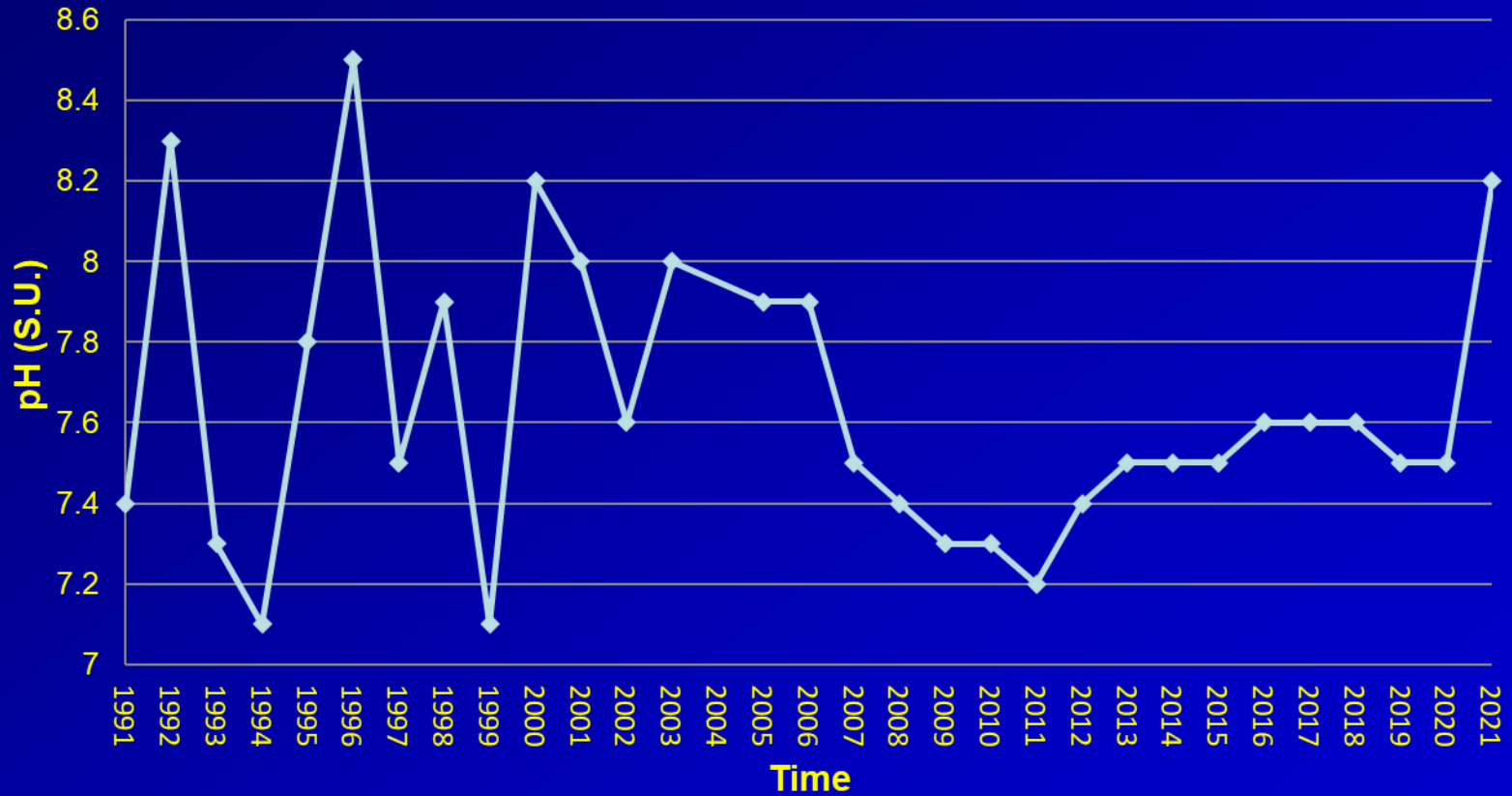
Bear Lake Annual Mean Conductivity

Figure 6. Temporal Trends in Mean Conductivity among Bear Lake Deep Basins



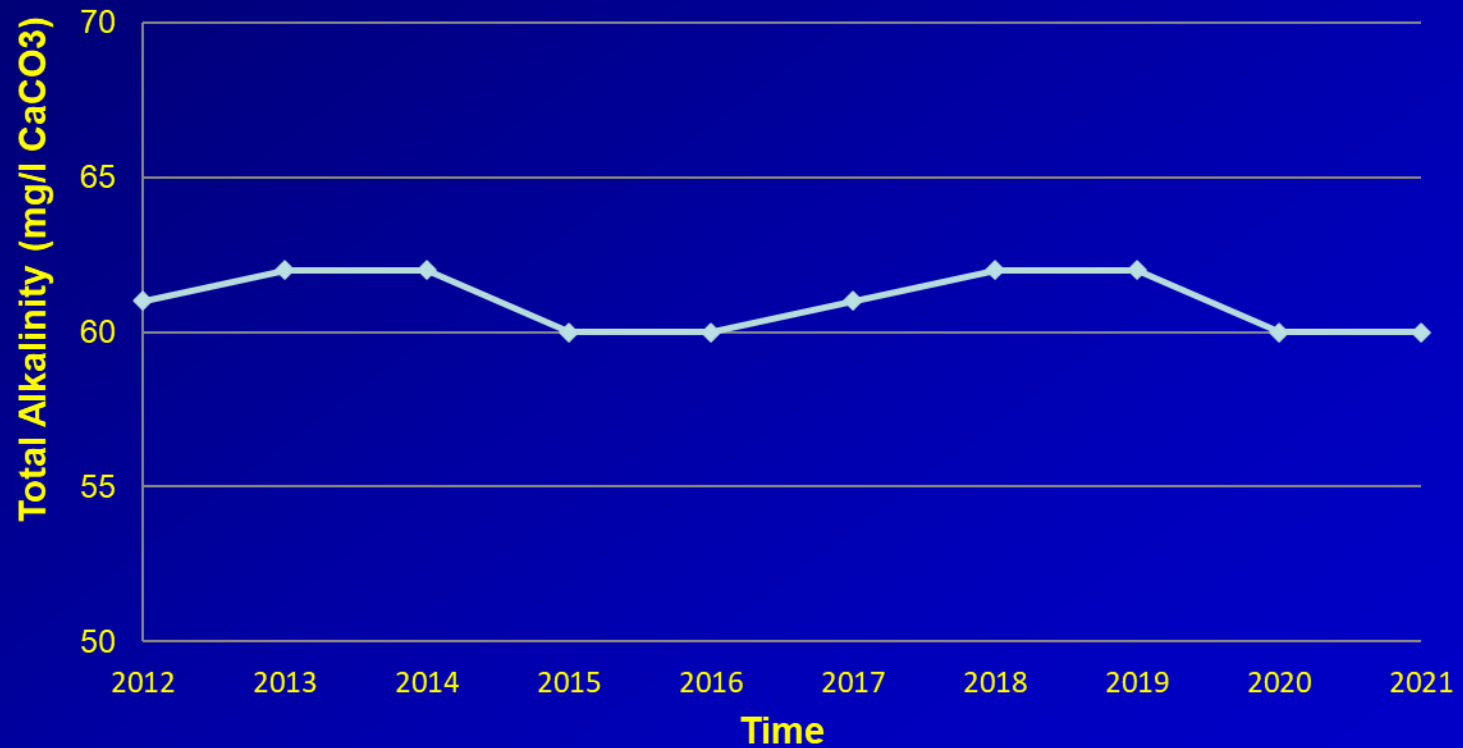
Bear Lake Annual Mean pH Values

Figure 5. Temporal Trends in Mean pH among Bear Lake Deep Basins



Bear Lake Annual Mean Alkalinity Values

Figure 4. Temporal Trends in Mean Total Alkalinity among Bear Lake Deep Basins



The Problem: Eurasian Watermilfoil (*Myriophyllum spicatum* L.)

- Highly invasive; not native to U.S. waters
- Growth rates up to 1 inch per day
- Spreads via numerous reproductive means – fragmentation, seed, turion, and sedimentary stolons
- Displaces favorable native aquatic plants
- Disrupts ecological balance of Bear Lake



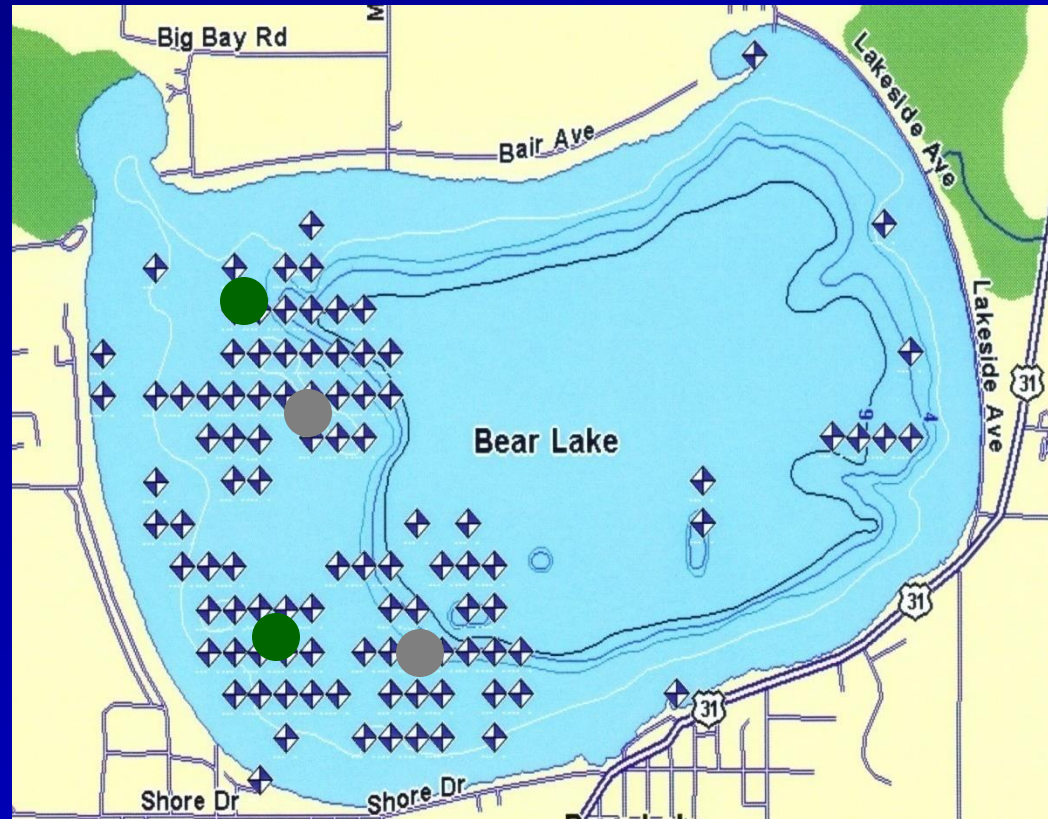
Bear Lake Eurasian Watermilfoil, 2007





Bear Lake Weevil Experimental Sites

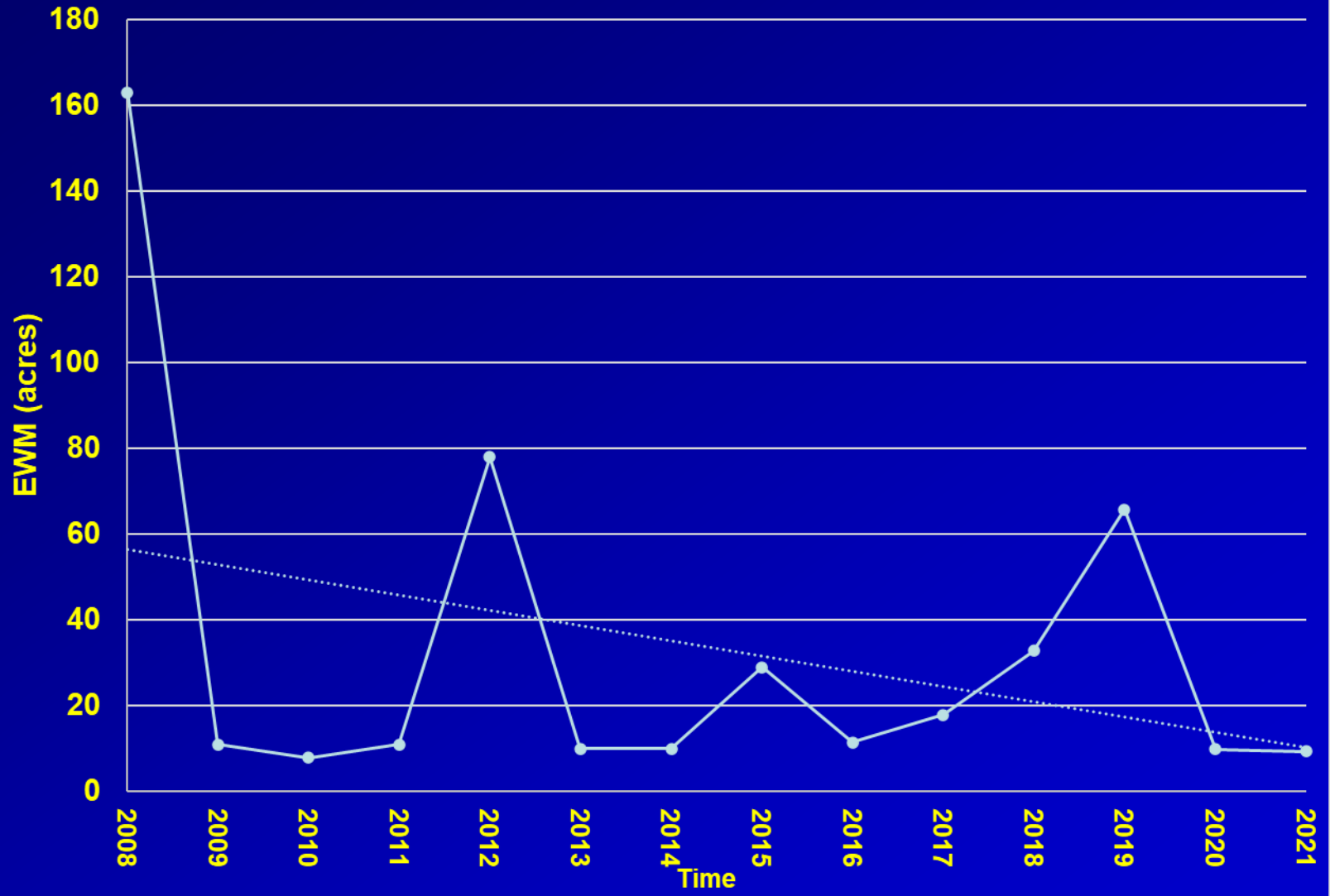
- 2 control and 2 treatment sites
- Test plot areas 144 ft² in size; marked with GPS
- Weevil stocking density of ~182 weevils m⁻²
- Depth of experimental sites approximately 6-8 feet
- Areas marked with yellow sediment stakes
- Not significant results
- Predation by fish evident



Treatment Sites ●

Control Sites ●

Acres EWM Treated in Bear Lake with Time



Aquatic Herbicide Cost with Time for Bear Lake EWM



EWM Overgrowth in Other Lakes:



EWM Management Options Considered

- **Mechanical Harvesting** – Causes fragmentation of EWM stems, temporary, not feasible
- **Biological Control** – Was considered for long-term control, yet not reliable for resisting “spread”, failed to prove satisfactory results on EWM; no longer available
- **Chemical Herbicides** – Contacts such as Reward offer only temporary control; do not kill entire plant. Systemics such as 2,4-D very effective and allow for localized treatments. Triclopyr may be used for spot-treatments near shore
- **No Action** – Would have likely lead to a whole-lake treatment (SONAR) or declines in property values

What Has Been Used to Treat Bear Lake EWM?

- **ProcellaCOR-** Newer herbicide developed to be more target-specific with sustained control of EWM
- **Systemic Herbicide 2,4-D-** Different than land-applied formula
biodegrades into Cl, CO₂, and NH₃⁺
Kills roots of plant to allow other natives to replace EWM
Can only be used 250+ feet offshore
- **Systemic Herbicide Triclopyr-**
Two week watering restriction in smaller lakes for ornamentals
Kills roots slowly to allow for less algal blooms and more natives
Can be used in shallow areas near shore

What Happens if We Kill Too Much Vegetation ?



Toxic Blue-green algae bloom, Spring Lake, Ottawa County, MI



Lake may not be able to break down plant matter fast enough

What Will Happen If We Do Nothing?

- EWM will displace native aquatic plant species
- Fishery will decline in quantity and quality
- Excessive die-off of massive EWM beds will cause major declines in water quality parameters
- Hydrilla or other species may invade and further destroy the lake



Bear Lake EWM Program Proposed Cost Estimates (2023-2027)

| Management Item | 2023 | 2024 | 2025 | 2026 | 2027 |
|----------------------------------------------------------------|-------------|-------------|-------------|-------------|-------------|
| EWM Management Methods/Herbicides + EGLE permit | \$25,000 | \$25,000 | \$25,000 | \$25,000 | \$25,000 |
| Gabridge Audit | \$1,500 | \$1,500 | \$1,500 | \$1,500 | \$1,500 |
| Legal Expenses/Publ. | \$1,000 | \$1,000 | \$1,000 | \$1,000 | \$10,000 |
| Professional Services | \$14,500 | \$14,500 | \$15,000 | \$15,000 | \$15,000 |
| Contingency | \$4,200 | \$4,200 | \$4,250 | \$4,250 | \$4,250 |
| TOTAL ANNUAL COST | \$46,200 | \$46,200 | \$46,750 | \$46,750 | \$46,750 |

Future Management Recommendations

- Continue monitoring vegetation for necessary spot-treatments of invasive aquatic plants and to assess native biodiversity
- Continue monitoring water quality and make necessary recommendations for improvements
- Continue riparian education
- Continue to keep assessment equivalent to a mid-range year of treatment (~\$?)
- Continue to retain reserve of ~\$120,000 for unexpected seed bank germination events
- Assist the BLIB with by-laws and future objectives

Questions or Comments ?

