

Overview of Michigan's Surface Water Monitoring Program

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Monitoring Strategy



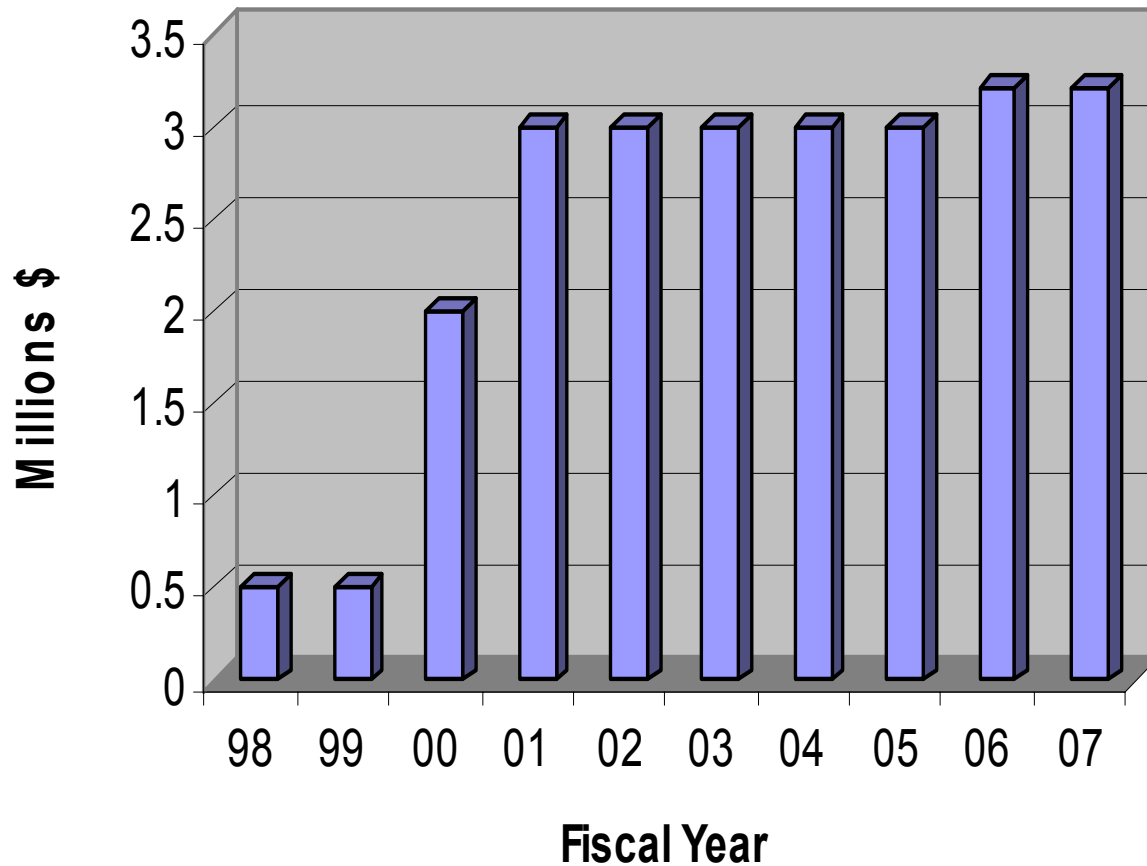
- Completed in January 1997
- Identified a comprehensive list of monitoring activities with cost estimates
- Implementation primarily through grants and contracts
- Updated in 2004/2005 per EPA requirements
- Includes sections on objectives, study design, indicators, quality assurance, data analysis, data management, reporting, program review, and existing/needed infrastructure

Four Monitoring Goals



- Assess the current status and condition of individual waterbodies and determine whether MI Water Quality Standards are being met
- Measure temporal and spatial water quality trends
- Provide data to support DEQ water quality protection programs and evaluate their effectiveness
- Detect new and emerging water quality problems

Funding Increase For Water Quality Monitoring From the Clean Michigan Initiative



Water Quality Monitoring Program Elements

- Water Chemistry
- Sediment Chemistry
- Fish Contaminants
- Biological Integrity & Physical Habitat
- Wildlife Contaminants
- Beach Monitoring
- Volunteer Monitoring
- Inland Lake Quality
- Stream Flow

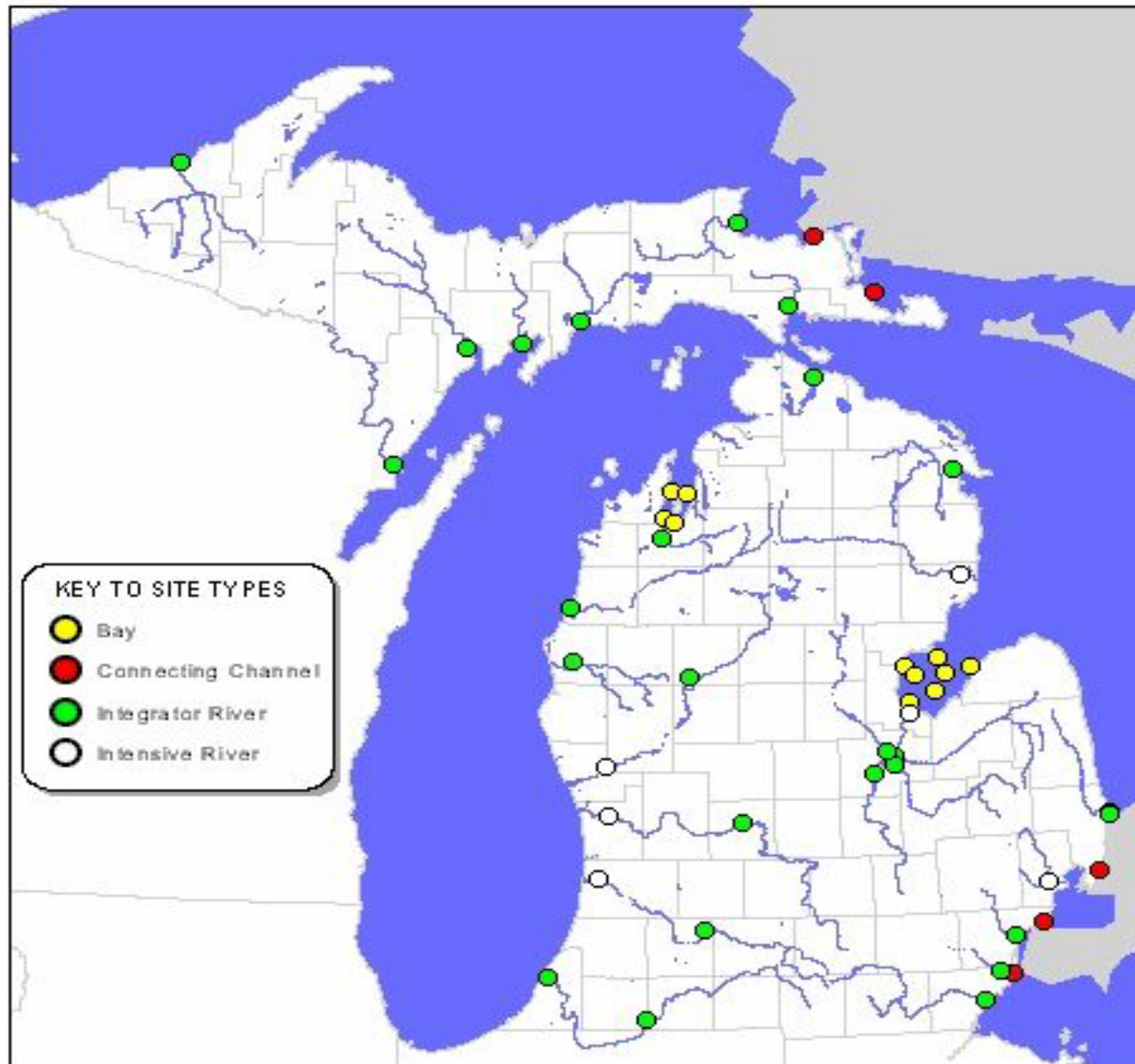


Water Chemistry

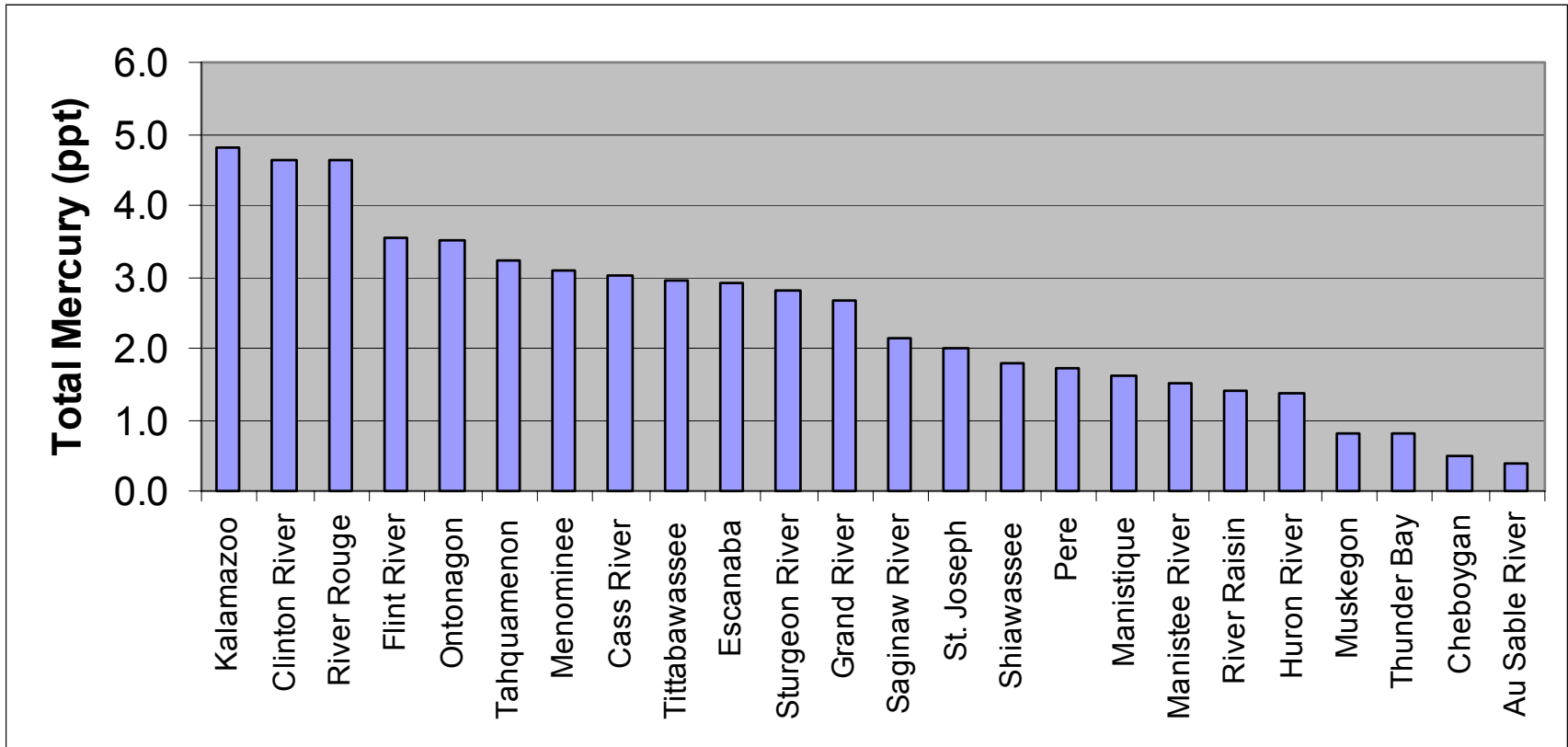


- 5-year basin surveys
- Fixed station trends
- Statewide random sampling
- CREP monitoring, TMDLs, other special studies (esp. non-point source effectiveness)
- Local water quality monitoring and emerging issue monitoring grants (\$200,000 each)

**Water chemistry trend monitoring locations in Michigan
(Bay, Connecting Channel, Intensive, and Integrator types).**



Mean total mercury concentrations (ng/L) in Michigan Rivers in 2004



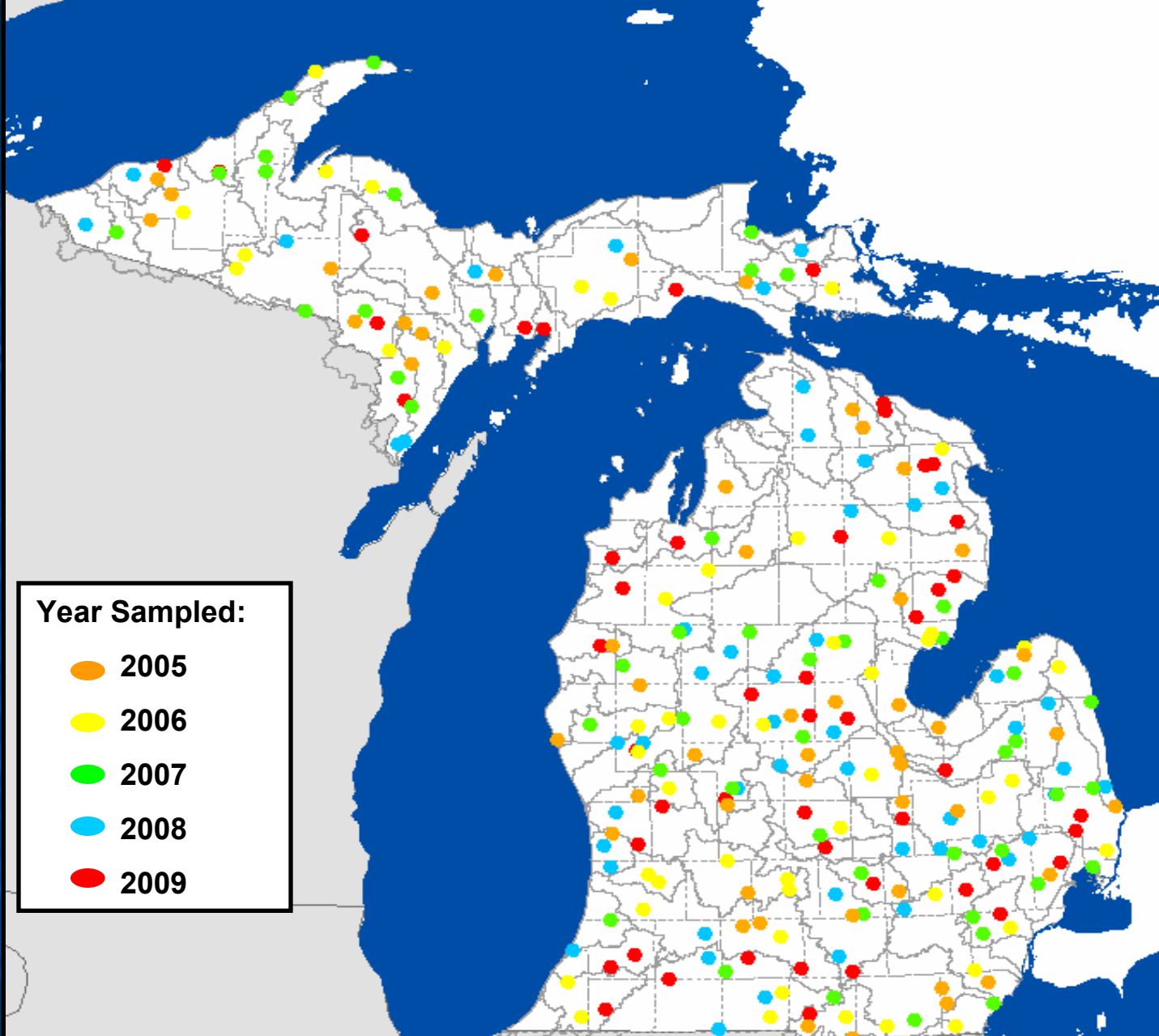


Figure 5. Randomly selected stations, grouped by year sampled. All 250 stations are located on streams (WCMP 2006).

Sediment Chemistry – Inland Lake Trends

- 35-40 lakes to be sampled
- 31 lakes sampled through 2006
- Provides long-term record of contaminants
- Contracted through MSU





Chemical Sediment Chronologies



2001

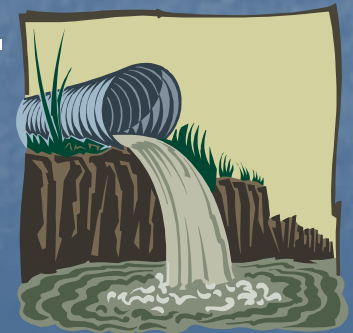
recent

time

old

1500

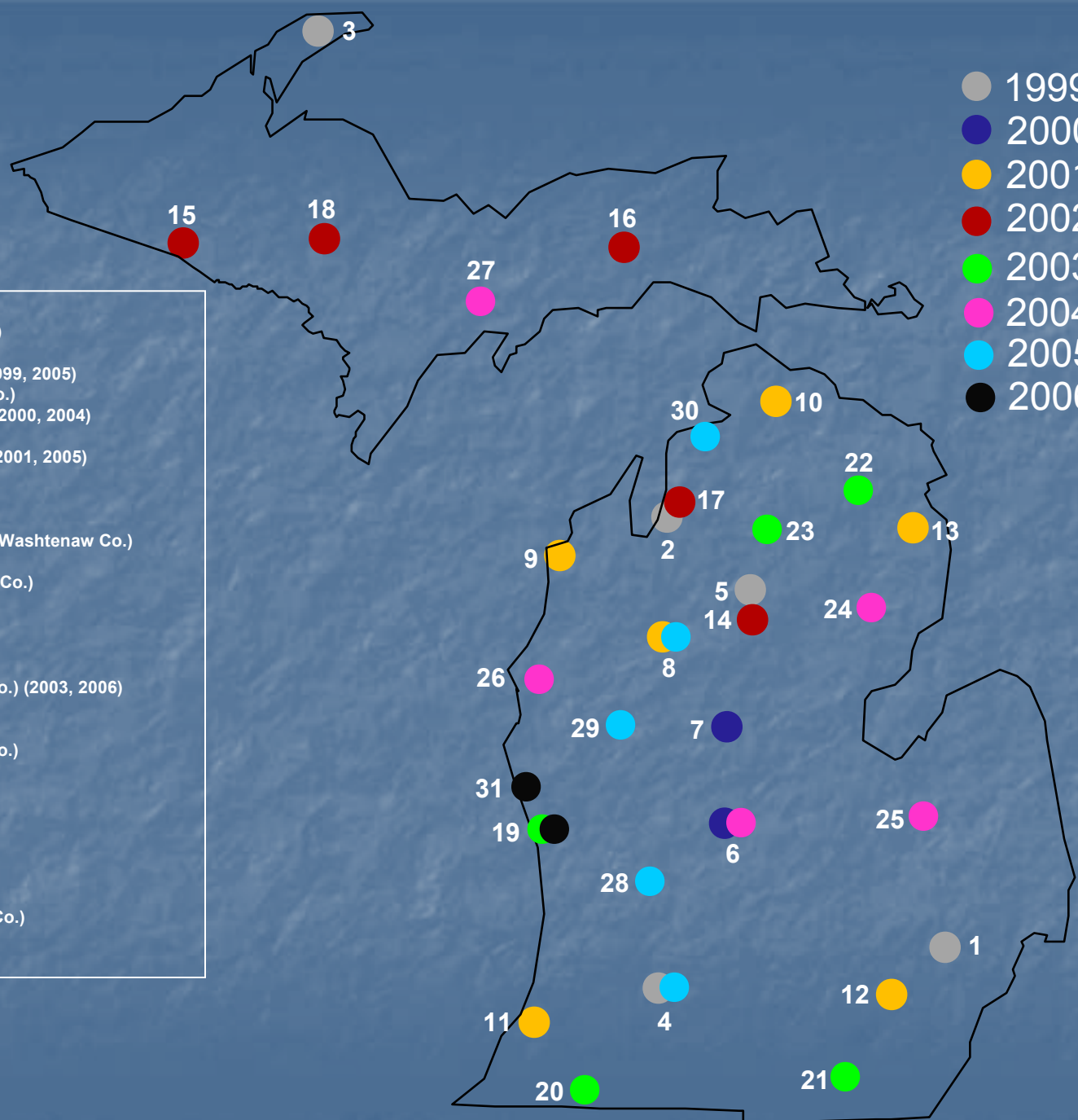
The use of sediments in lakes as a “tape recorder” of changes in chemical loadings to the environment.

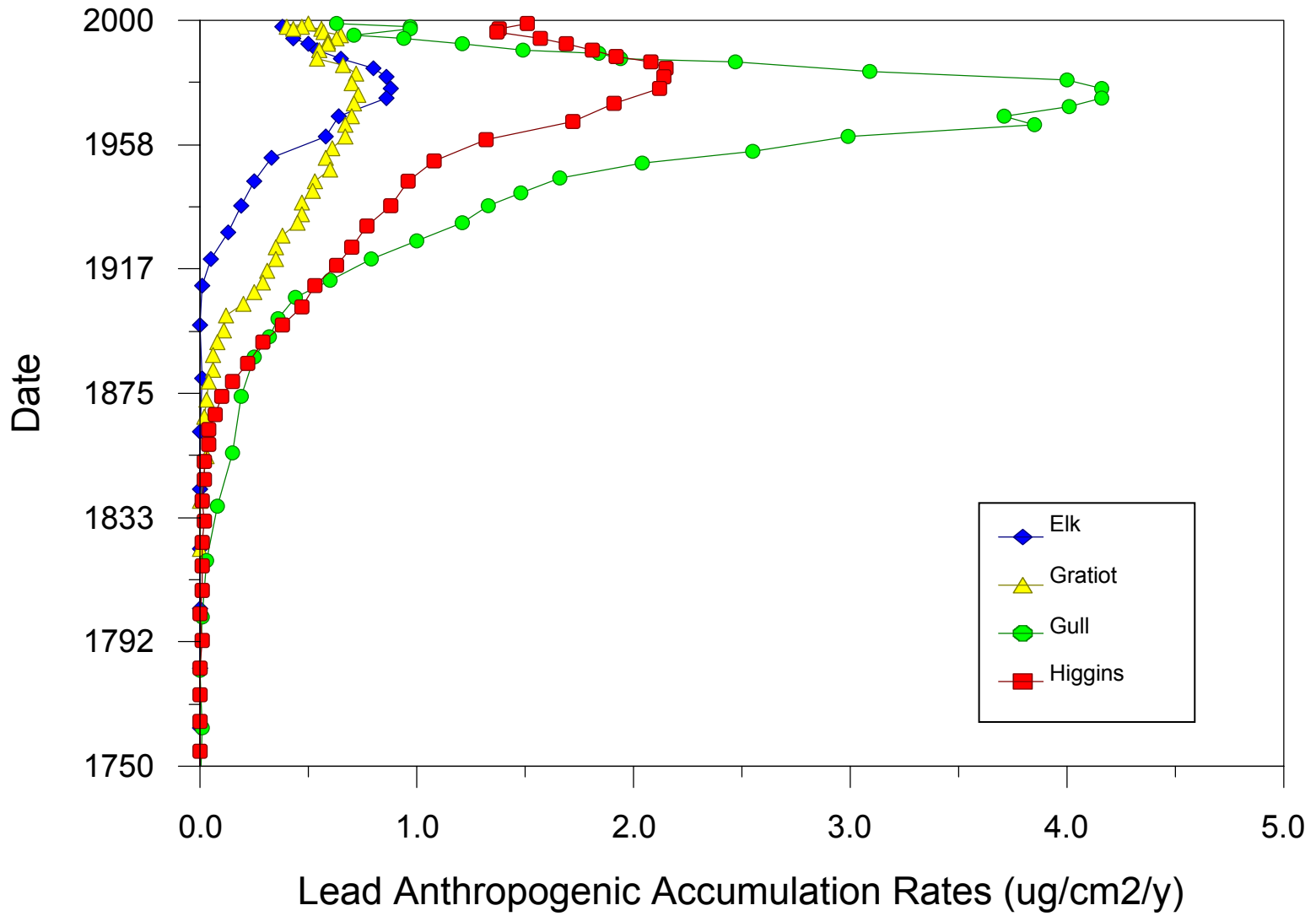


Elk Lake

Sediment Trend Lakes

1. Cass Lake (Oakland Co.)
2. Elk Lake (Grand Traverse Co.)
3. Gratiot Lake (Keweenaw Co.)
4. Gull Lake (Kalamazoo Co.) (1999, 2005)
5. Higgins Lake (Roscommon Co.)
6. Crystal Lake (Montcalm Co.) (2000, 2004)
7. Littlefield Lake (Isabella Co.)
8. Lake Cadillac (Wexford Co.) (2001, 2005)
9. Crystal Lake (Benzie Co.)
10. Mullett Lake (Cheboygan Co.)
11. Paw Paw Lake (Berrien Co.)
12. Whitmore Lake (Livingston & Washtenaw Co.)
13. Hubbard Lake (Alcona Co.)
14. Houghton Lake (Roscommon Co.)
15. Imp Lake (Gogebic Co.)
16. Round Lake (Luce Co.)
17. Torch Lake (Antrim Co.)
18. Witch Lake (Marquette Co.)
19. Muskegon Lake (Muskegon Co.) (2003, 2006)
20. Birch Lake (Cass Co.)
21. Sand Lake (Lenawee Co.)
22. Avalon Lake (Montmorency Co.)
23. Shupac Lake (Crawford Co.)
24. Lake George (Ogemaw Co.)
25. Otter Lake (Genesee Co.)
26. Hackert Lake (Mason Co.)
27. Round Lake (Delta Co.)
28. Campau Lake (Kent Co.)
29. Nichols Lake (Newagyo Co.)
30. Lake Charlevoix (Charlevoix Co.)
31. White Lake (Muskegon Co.)





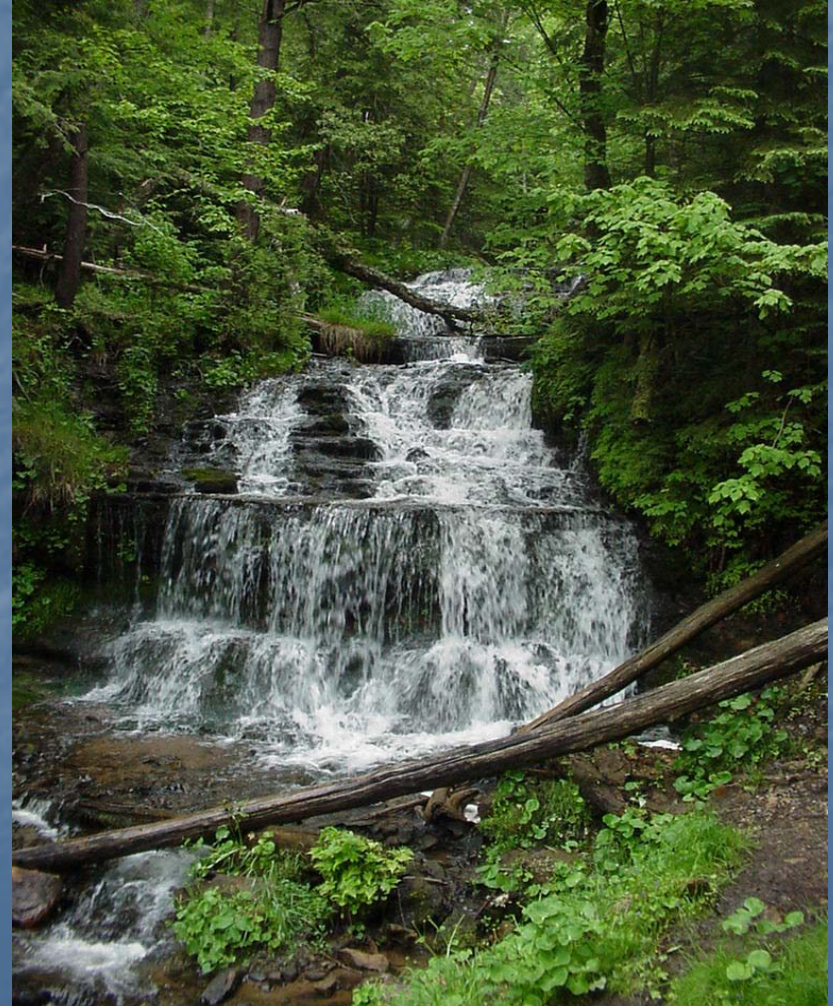
Biological Integrity



- 5 Year basin surveys in wadable streams and rivers
- Qualitative Biological and Habitat Survey for Nonwadable Rivers


5 Year Basin Surveys

- Targeted Sites
- Random Sites





Qualitative Biological and Habitat Survey for Nonwadable Rivers



- Developed under contract by MSU
- Established a suite of metrics for macroinvertebrates and habitat evaluation

Biological Metrics

- Functional Feeding Group (FFG) Diversity
- Habitat Stability FFG Surrogate
- Percent Caddisflies
- EPT Taxa Richness
- Total Taxa Richness
- True Flies Taxa Richness
- Stonefly Taxa Richness
- Percent Dominance



Habitat Metrics



- Riparian Buffer Width
- Large Woody Debris
- Aquatic Vegetation
- Thalweg Substrate
- Bottom Deposition
- Bank Stability
- Off-Channel Habitat

Volunteer Monitoring



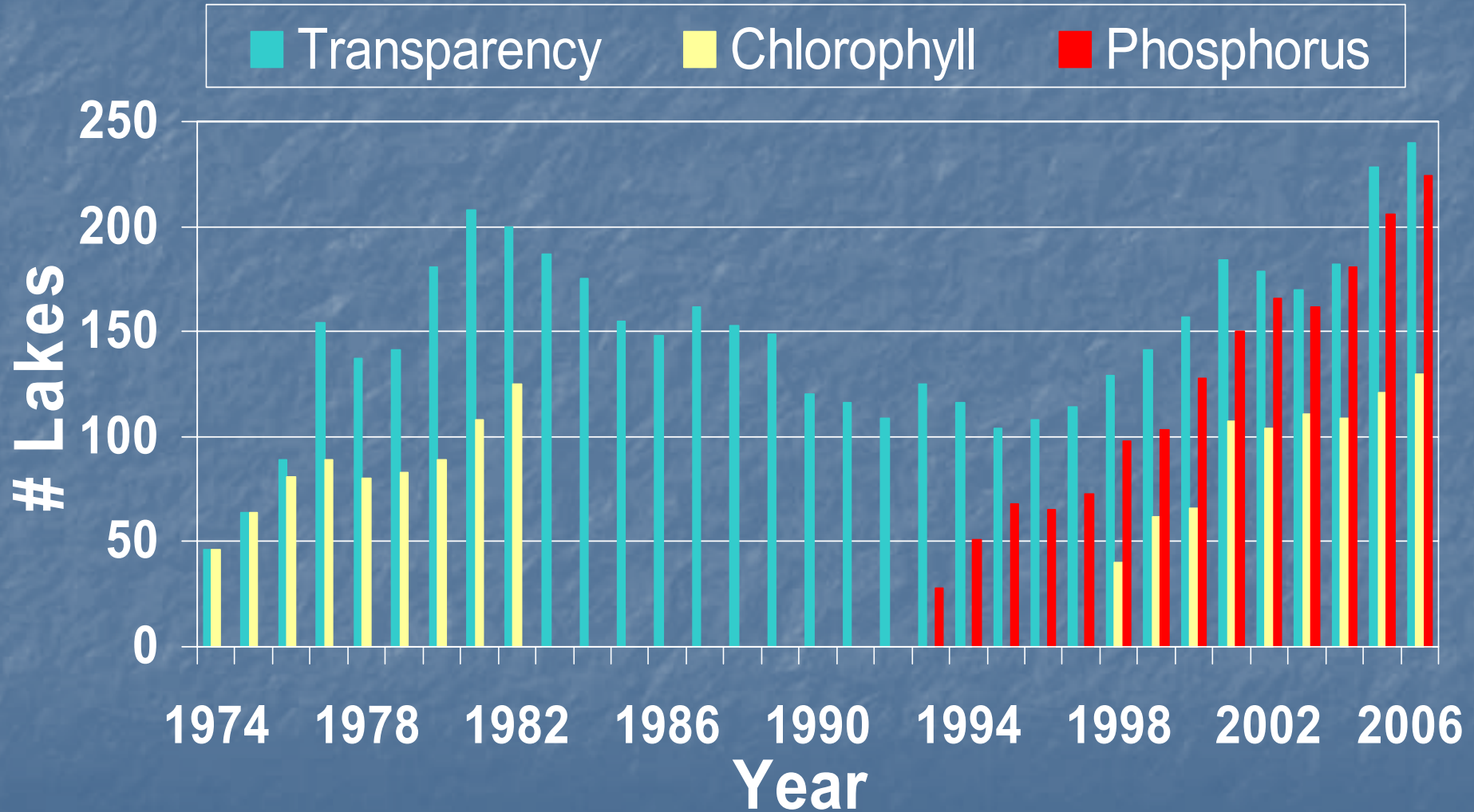
- FY98 through FY06: 38 grants awarded totaling \$313,000
- Michigan Clean Water Corps was established in 2003
- Includes stream/river and inland lake volunteers
- MiCorps web-site - www.micorps.net
- DEQ uses data as a “screening tool” to identify sites for follow-up assessment

Cooperative Lakes Monitoring Program

(The Self-Help Legacy)

- Program began in 1974 with water clarity (Secchi disk) monitoring – second oldest program in country
- Current focus on trophic state indicators
 - water clarity (240 lakes)
 - total phosphorus
 - spring overturn (192 lakes)
 - late-summer stratification (224 lakes)
 - chlorophyll *a* (130 lakes)
 - dissolved oxygen and temperature (57 lakes)
 - aquatic plant ID and mapping (5 lakes)

Program Participation

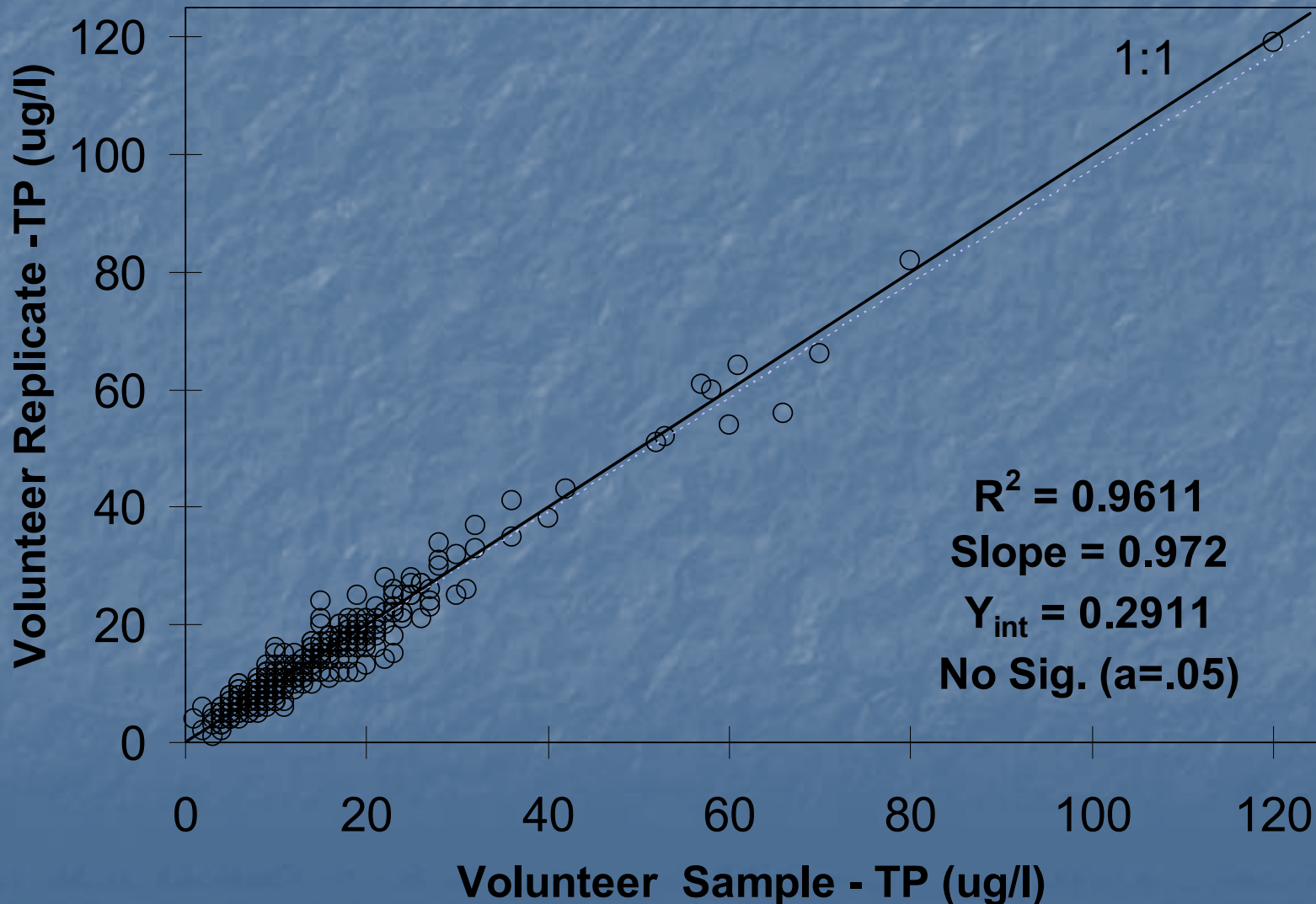


CLMP Quality Data

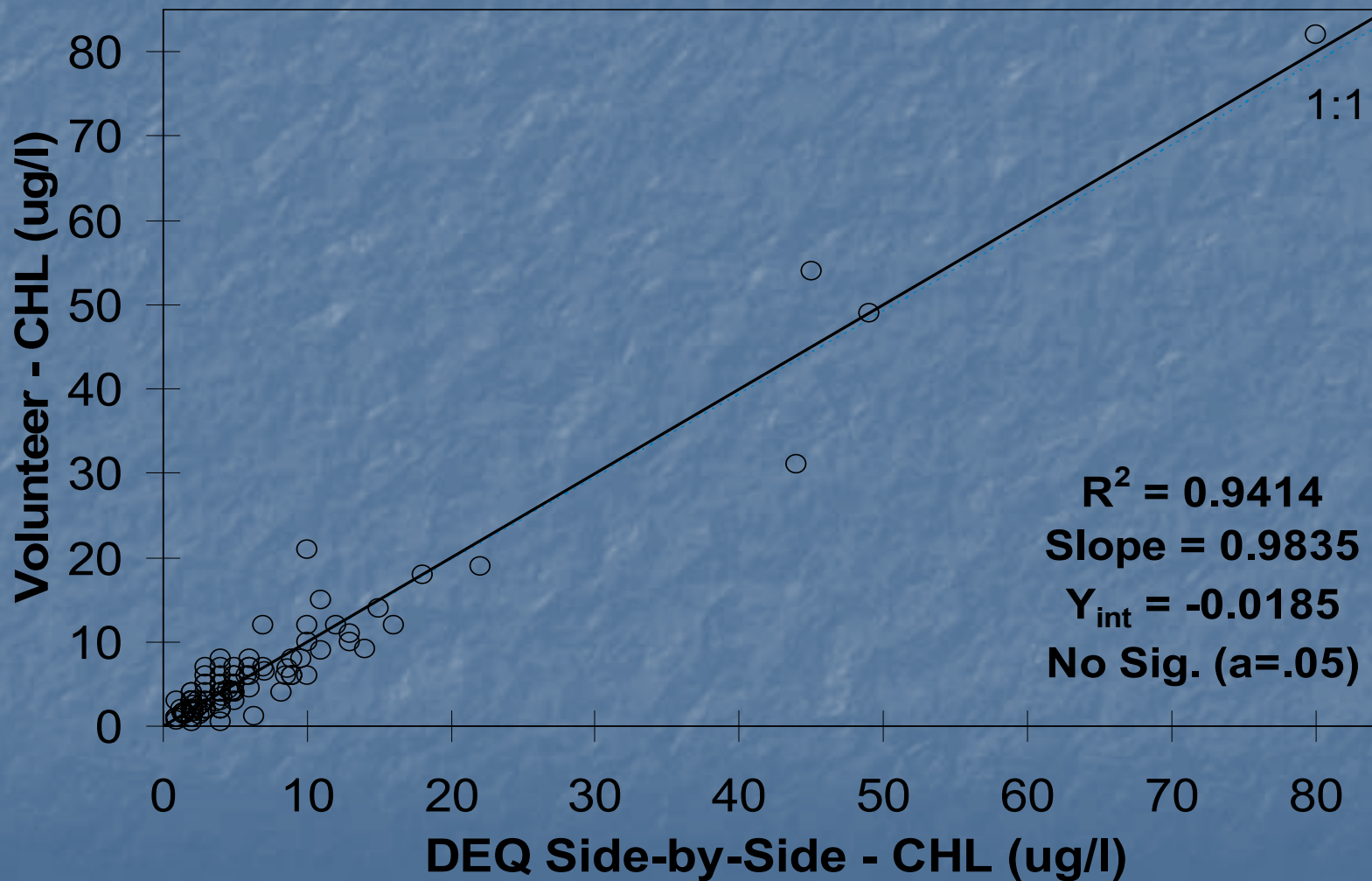
- Detailed procedures
- Comprehensive training
- Replicate sampling
- DEQ side-by-side sampling



CLMP Spring Total Phosphorus (1993-2004) Volunteer Replicate Samples, n=413



CLMP Chlorophyll a (1998-2004)
Volunteer vs. DEQ Side-by-Side Samples; n=110

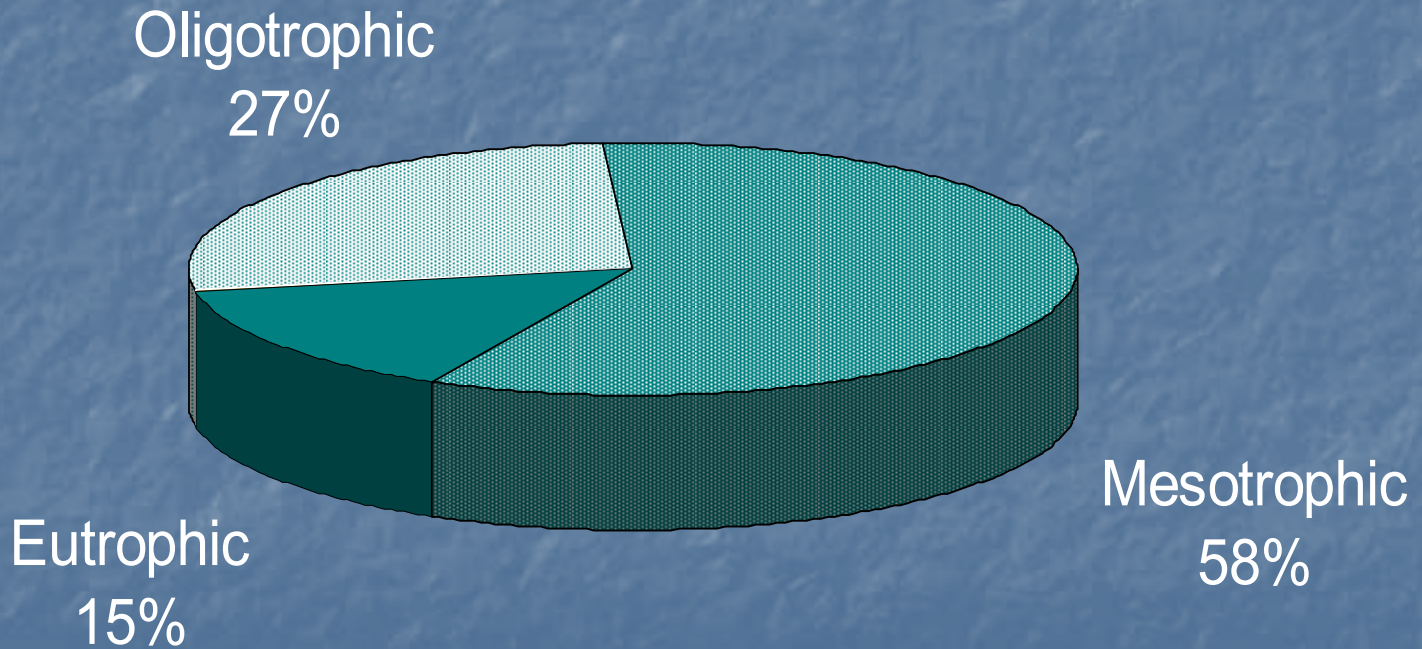


CLMP Data Applications

- Annual Baseline Data
- Trophic Status Updates
- Long-term Trends



Classification of 101 Lakes Monitored through Michigan's CLMP during 2003-2004



Lake Trophic Status

Carlson's TSI Equations

$$TSI_{SD} = 60 - 33.2 \log_{10} SD$$

$$TSI_{TP} = 4.2 + 33.2 \log_{10} TP$$

$$TSI_{CHL} = 30.6 + 22.6 \log_{10} CHL$$

where,

SD = Secchi depth transparency (m)

TP = total phosphorus concentration (ug/l)

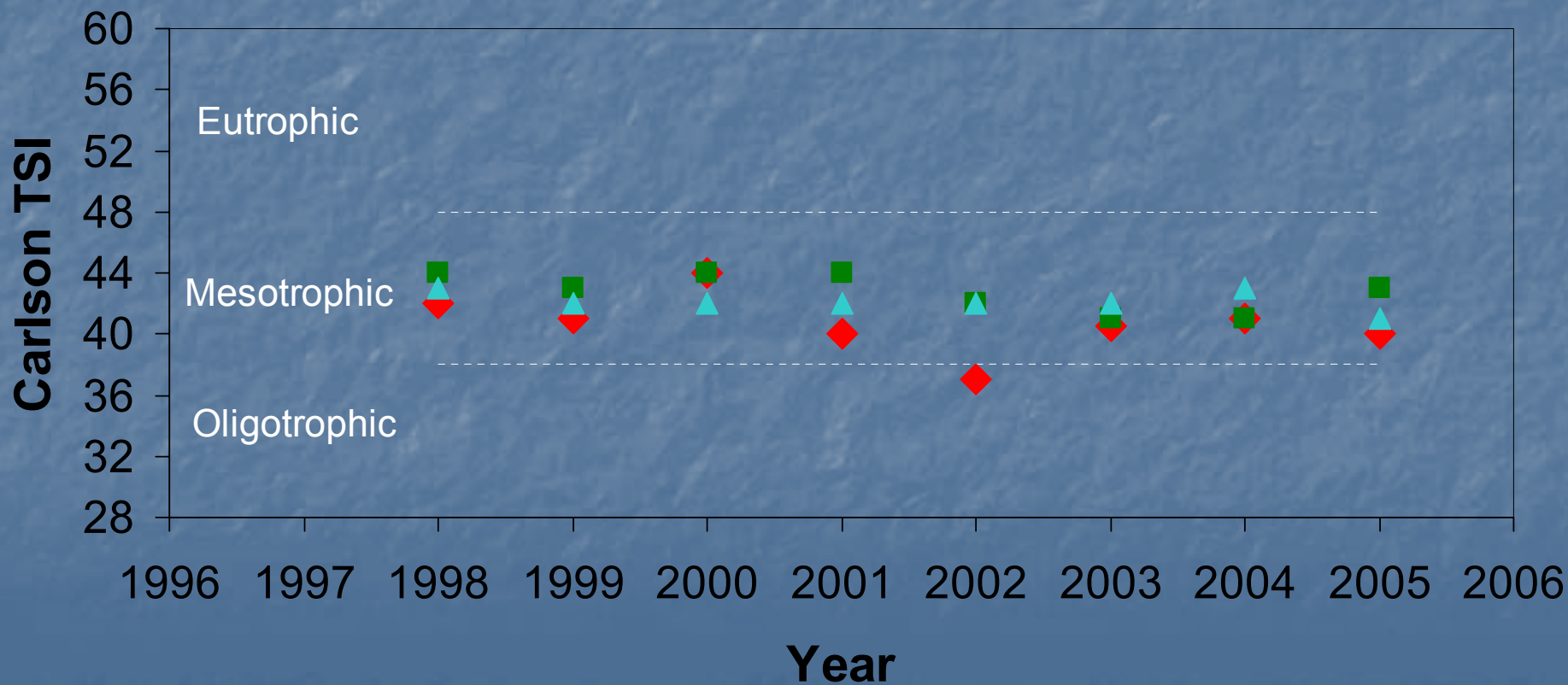
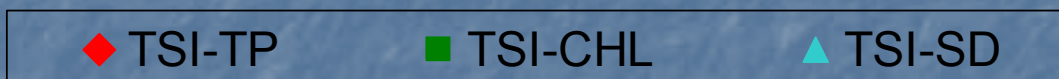
CHL = chlorophyll *a* concentration (ug/l)

Michigan's Inland Lakes Trophic Status Classification Criteria

Lake Trophic State	Carlson TSI	TP (ug/l)	SD-Trans. (ft)	SD-Trans. (m)	Chl-a (ug/l)
Oligotrophic	<38	≤10	>15	>4.6	<2.2
Mesotrophic	38-48	10-20	7.5-15	2.3-4.6	2.2-6
Eutrophic	48-61	20-50	3-7.5	0.9-2.3	6-22
Hypereutrophic	>61	>50	<3	<0.9	>22

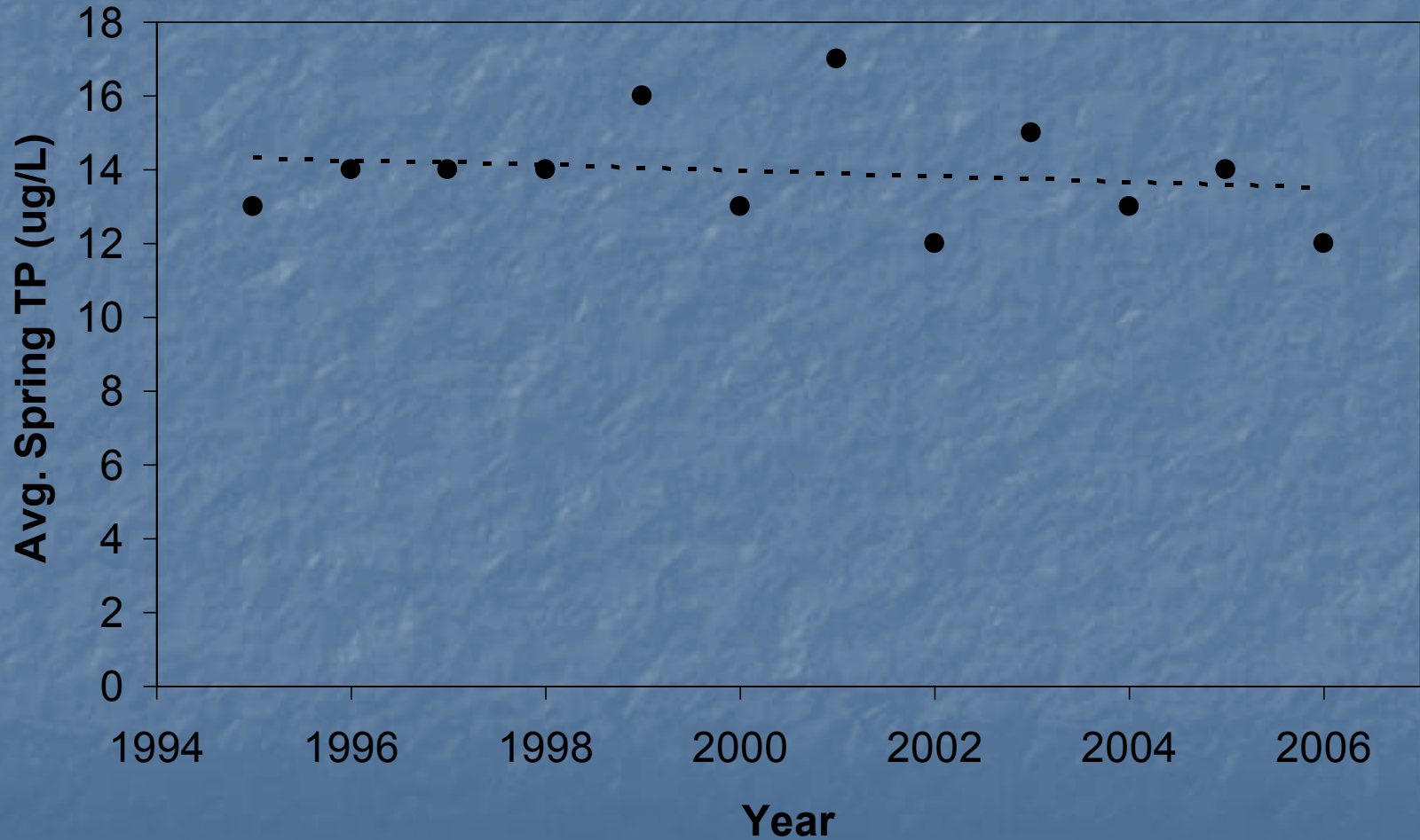
CLMP Annual Results

Mean Trophic State Indices

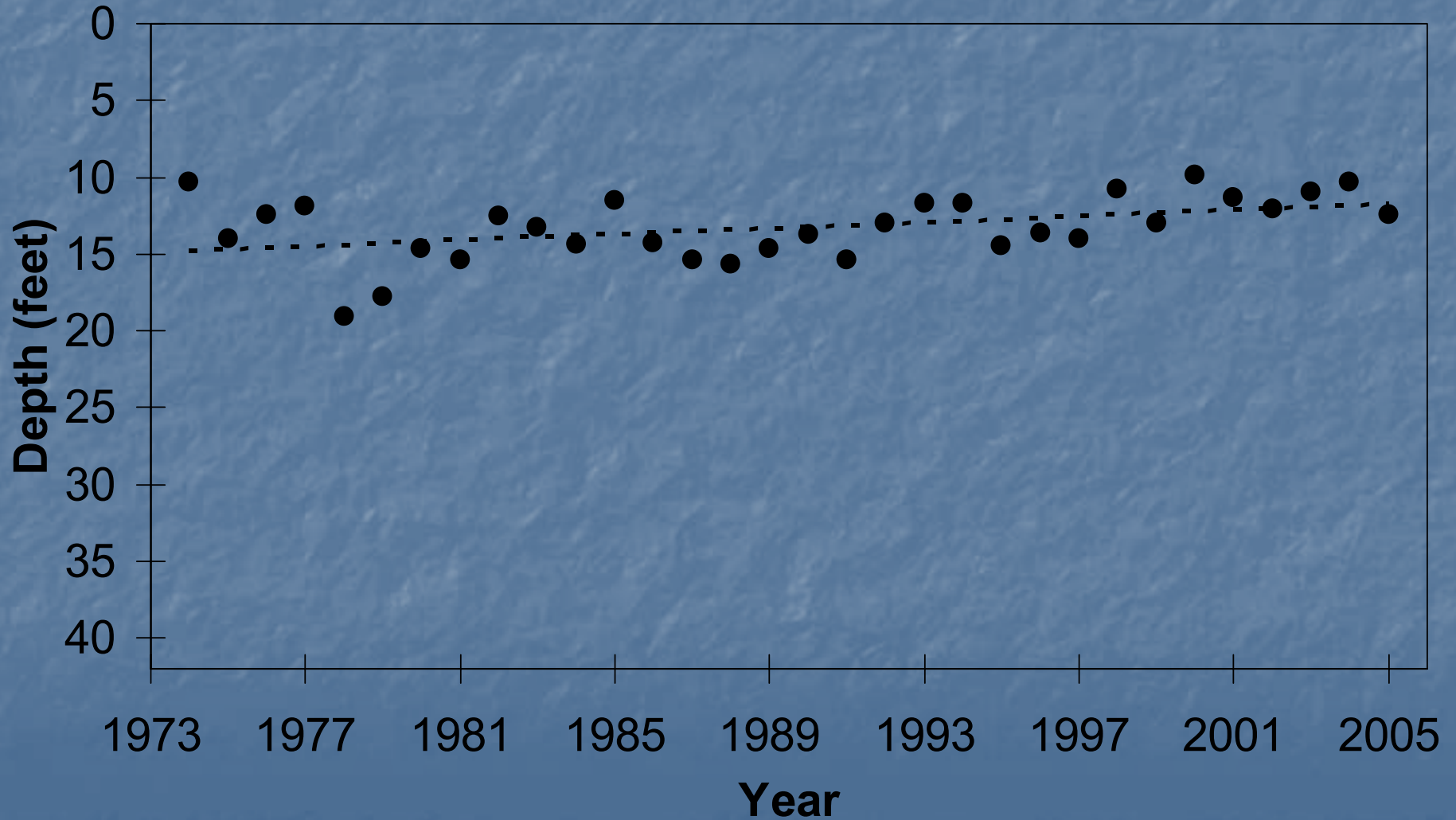


CLMP Annual Results

Mean Spring Total Phosphorus (ug/L)



CLMP Summer Mean Transparency Corey Lake (St. Joseph Co.)



Additional Information



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- www.michigan.gov/deg, click on “Water”, click on “Water Quality Monitoring”, click on “Assessment of Michigan Waters”
- www.micorps.net