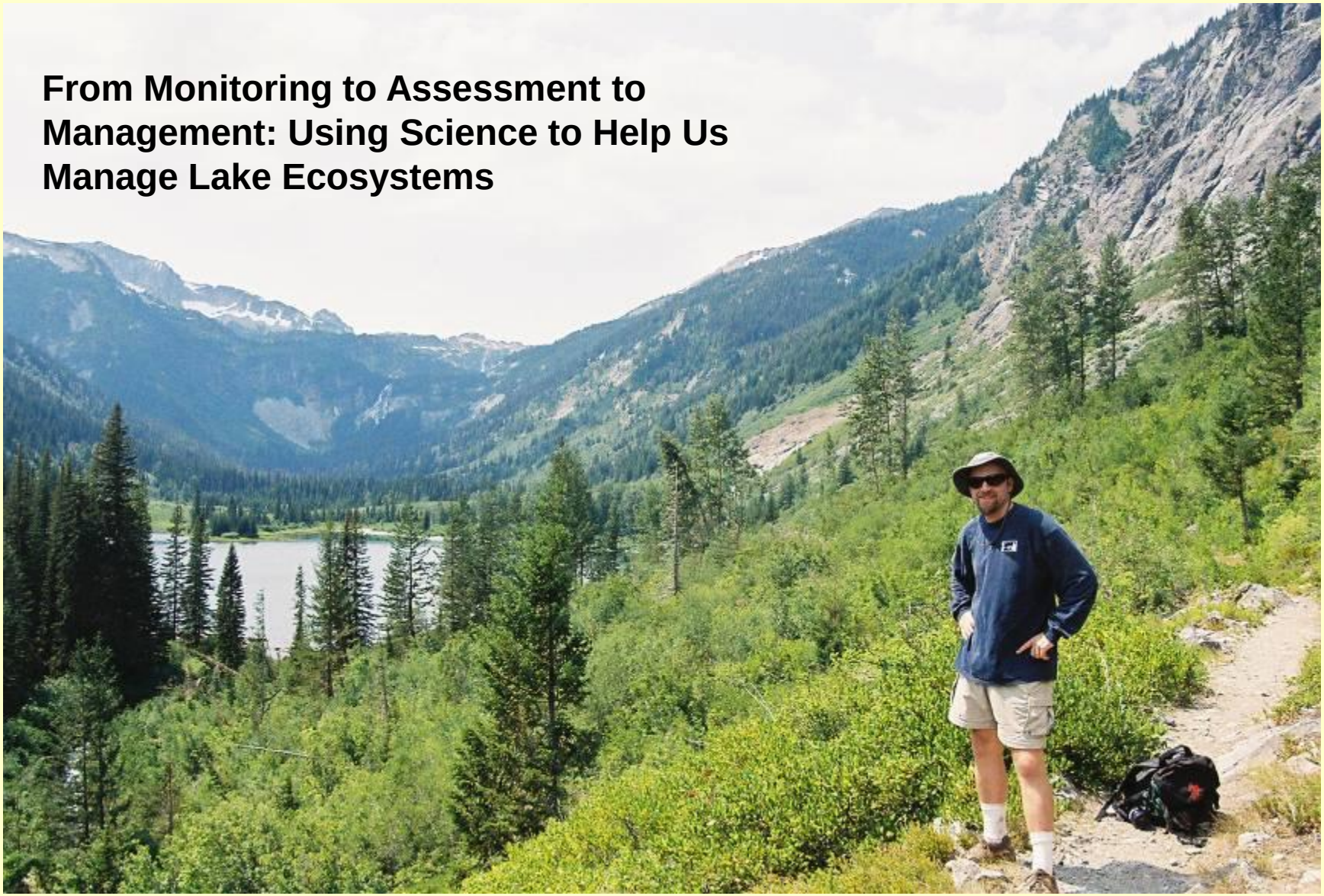
From Monitoring to Assessment to Management: Using Science to Help Us Manage Lake Ecosystems



Tim Asplund, WDNR
Lake Leaders, September 2010

Lake Monitoring, Assessment, and Management - Overview

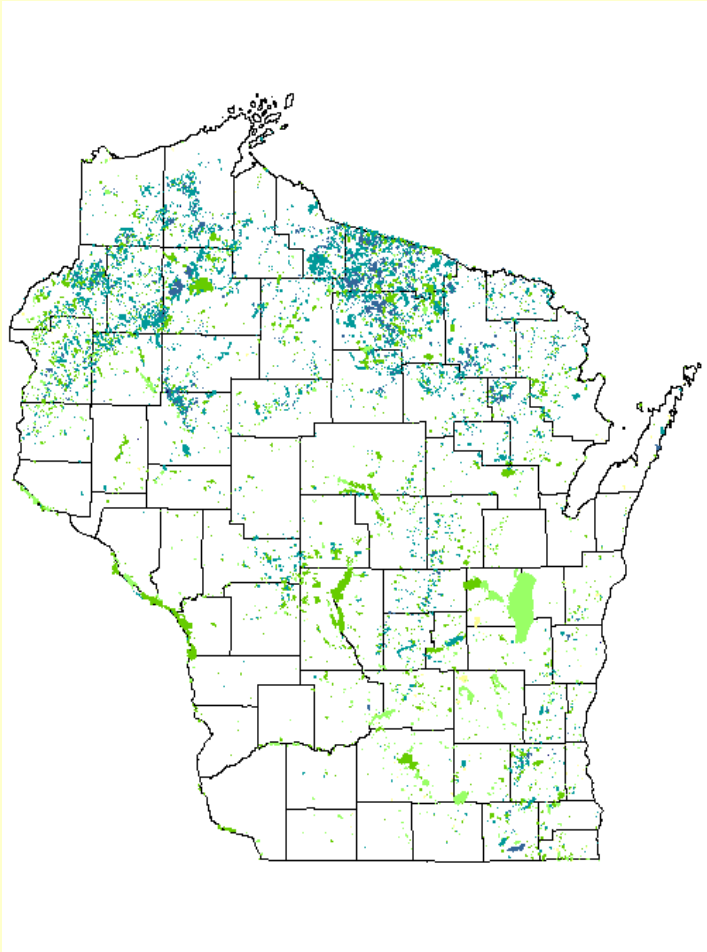
- Lake Monitoring – water, plants, fish, AIS
  - Role of CLMN, grants,
- Statewide Lake Assessment
  - WisCALM
  - Nutrient Criteria
- Goal setting and planning at lake scale
  - how we use data to drive decision-making
- Management Tools – Protect, Manage, Restore
- Case histories or examples (Lake Tomah)

How’s my lake doing?

- Water Quality
  - Water clarity
  - Trophic status
- Ecological Integrity
  - Fish and Aquatic Life
  - Plants
  - Invasives
- Recreation
  - Boating
  - Swimming
  - Fishing
- Public Health
  - Blue-green algae
  - Bacteria

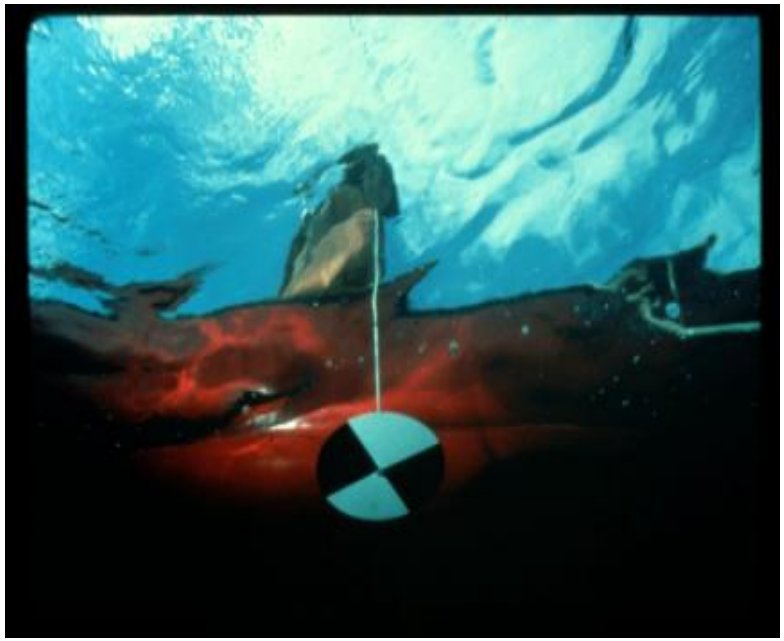
Wisconsin's Lake Monitoring

- Citizen Lake Monitoring Network (Self-Help)
- WDNR Baseline/Long Term Trend Monitoring
- Satellite (Lakesat.org)
- Other (grants, research, special studies)



Water Quality Monitoring

- Secchi disk transparency
- In situ profiles (DO, temp, pH, conductivity)
- Chl *a* and Total P
- Water Chemistry (other nutrients, anions, cations, ANC, DOC)
- Color and turbidity



Wisconsin DNR Surface Water Data Viewer - Windows Internet Explorer provided by Wisconsin DNR

http://dnrmaps.wisconsin.gov/imf/imf.jsp?qzoom=true&site=SurfaceWaterViewer&qlyr=00shaids&qbuf=500&qry=WATERBODY_ID_CODE=1542700

File Edit View Favorites Tools Help

Wisconsin DNR Surface Water Data Viewer

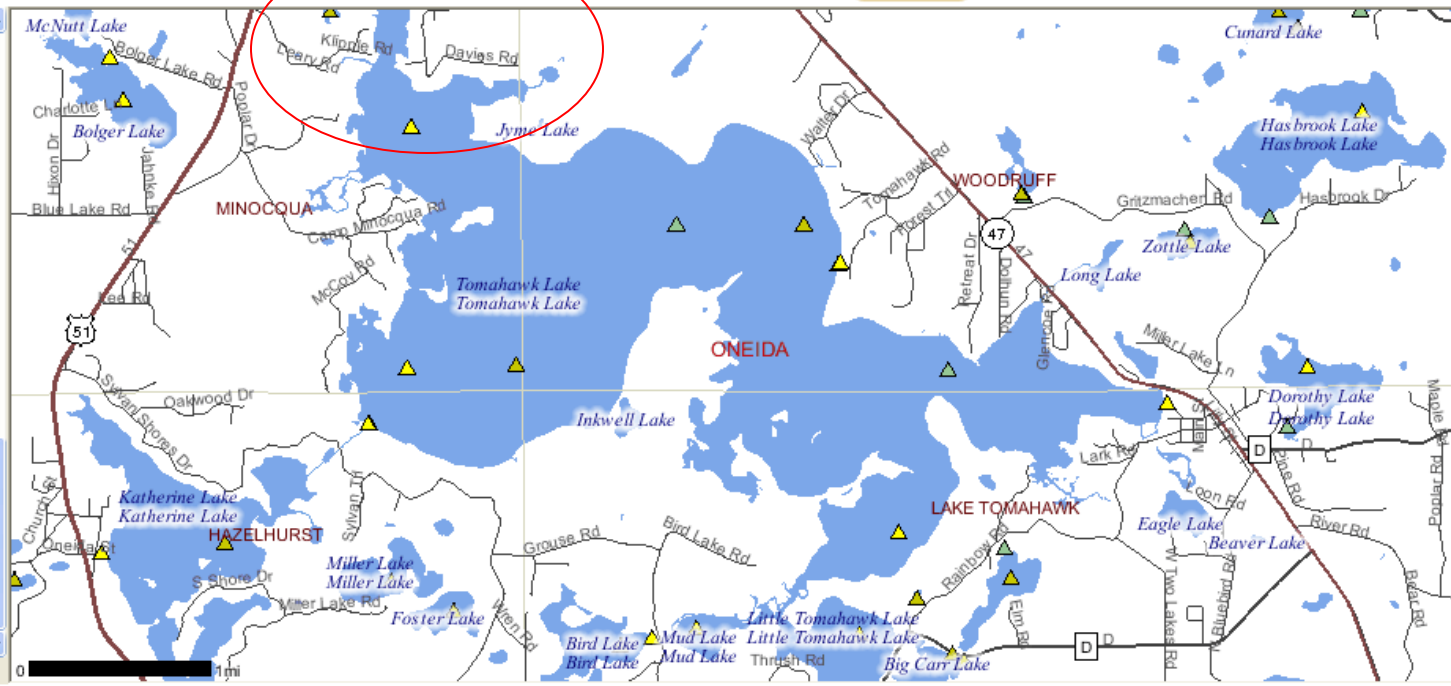
Wisconsin Department of Natural Resources

Surface Water Data Viewer

Layers · Legend · Find Location · Themes · Designated Waters · Select · Help · Print

Full State | Zoom In | Zoom Out | Move | Zoom Last | Zoom to... | Identify | Download | Advanced Tools

County:	Oneida
Civil Towns	
MCD Fips Code:	53225
Name:	Minocqua
City Class Code:	0
Area (Sq. Miles):	168.04757166
MCD Type Code:	T
County Boundaries	
Name:	Oneida
County FIPS Code:	85
DNR County Code:	44
DNR Region:	Northern Region
Monitoring Station Points With Data	
More Data: Log into SWIMS	
SWIMS Station ID:	443146
Primary Station Name:	Tomahawk Lake - Deep Hole
WBIC:	1542700
Waterbody Name:	Tomahawk Lake
Station Type:	LAKE
Station Status Code:	ACTIVE
Status Description:	Active, Usable.
Earliest Fieldwork Date:	Aug 15, 1973
Latest Fieldwork Date:	Aug 4, 2010
Monit Station Seq No:	8011



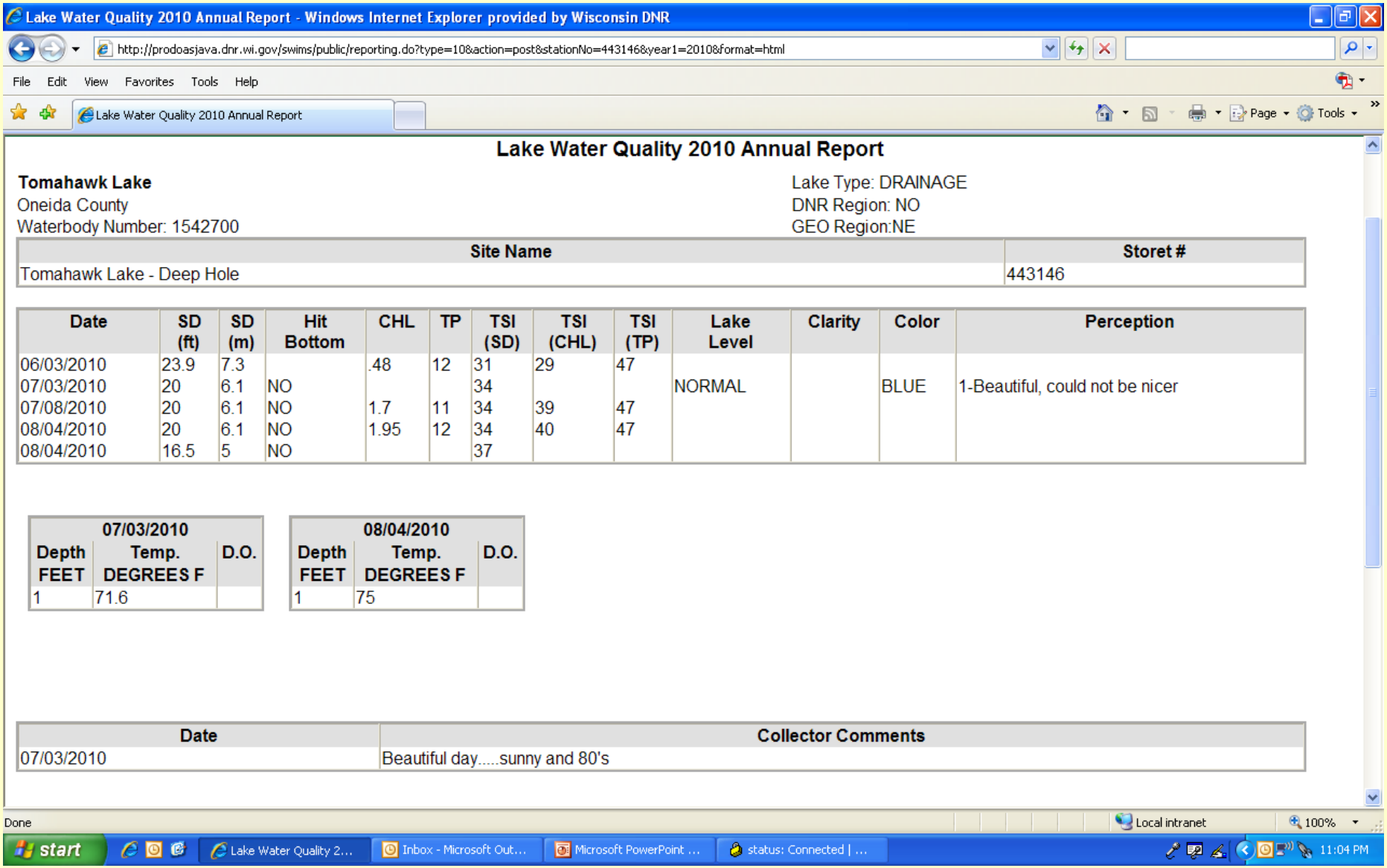
Scale: 1: 52,651 go | Quick View: Select a location | Selected Map Tool: Identify | Drill Down Identify

| DNR Maps & Aerial Photography | DNR GIS Overview | Division of Water | Remediation and Redevelopment Sites | Comments on this website |

Internet

start | Wisconsin Lake Direct... | Wisconsin DNR Surfa... | Inbox - Microsoft Out... | Microsoft PowerPoint ... | status: Connected | ...

http://dnr.wi.gov/lakes/CLMN/reportsanddata



Lake Water Quality 2010 Annual Report

Tomahawk Lake
Oneida County
Waterbody Number: 1542700

Lake Type: DRAINAGE
DNR Region: NO
GEO Region:NE

Site Name	Storet #
Tomahawk Lake - Deep Hole	443146

Date	SD (ft)	SD (m)	Hit Bottom	CHL	TP	TSI (SD)	TSI (CHL)	TSI (TP)	Lake Level	Clarity	Color	Perception
06/03/2010	23.9	7.3		.48	12	31	29	47				
07/03/2010	20	6.1	NO			34			NORMAL		BLUE	1-Beautiful, could not be nicer
07/08/2010	20	6.1	NO	1.7	11	34	39	47				
08/04/2010	20	6.1	NO	1.95	12	34	40	47				
08/04/2010	16.5	5	NO			37						

07/03/2010		
Depth FEET	Temp. DEGREES F	D.O.
1	71.6	

08/04/2010		
Depth FEET	Temp. DEGREES F	D.O.
1	75	

Date	Collector Comments
07/03/2010	Beautiful day.....sunny and 80's

Secchi Graph - Windows Internet Explorer provided by Wisconsin DNR

http://prodoasjava.dnr.wi.gov/swims/public/reporting.do?type=11&action=post&format=html&stationNo=443146

File Edit View Favorites Tools Help

Secchi Graph

Wisconsin Department of Natural Resources

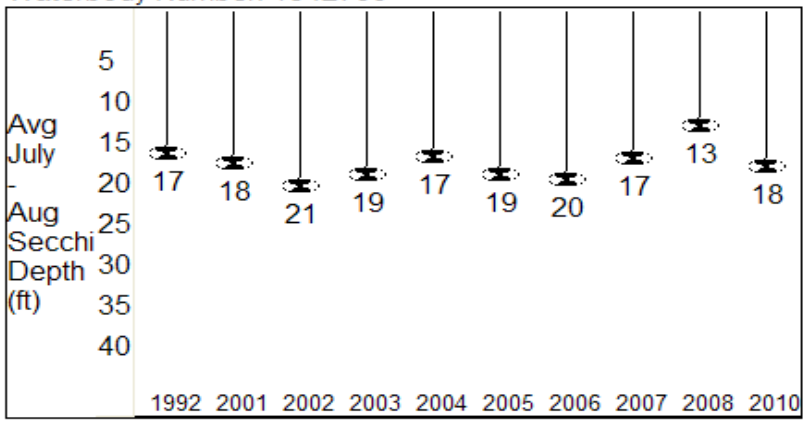
Search

Program

Home | About | A-Z Topics | Contact

Tomahawk Lake
Oneida County
Waterbody Number: 1542700

Lake Type: DRAINAGE
DNR Region: NO
GEO Region:NE



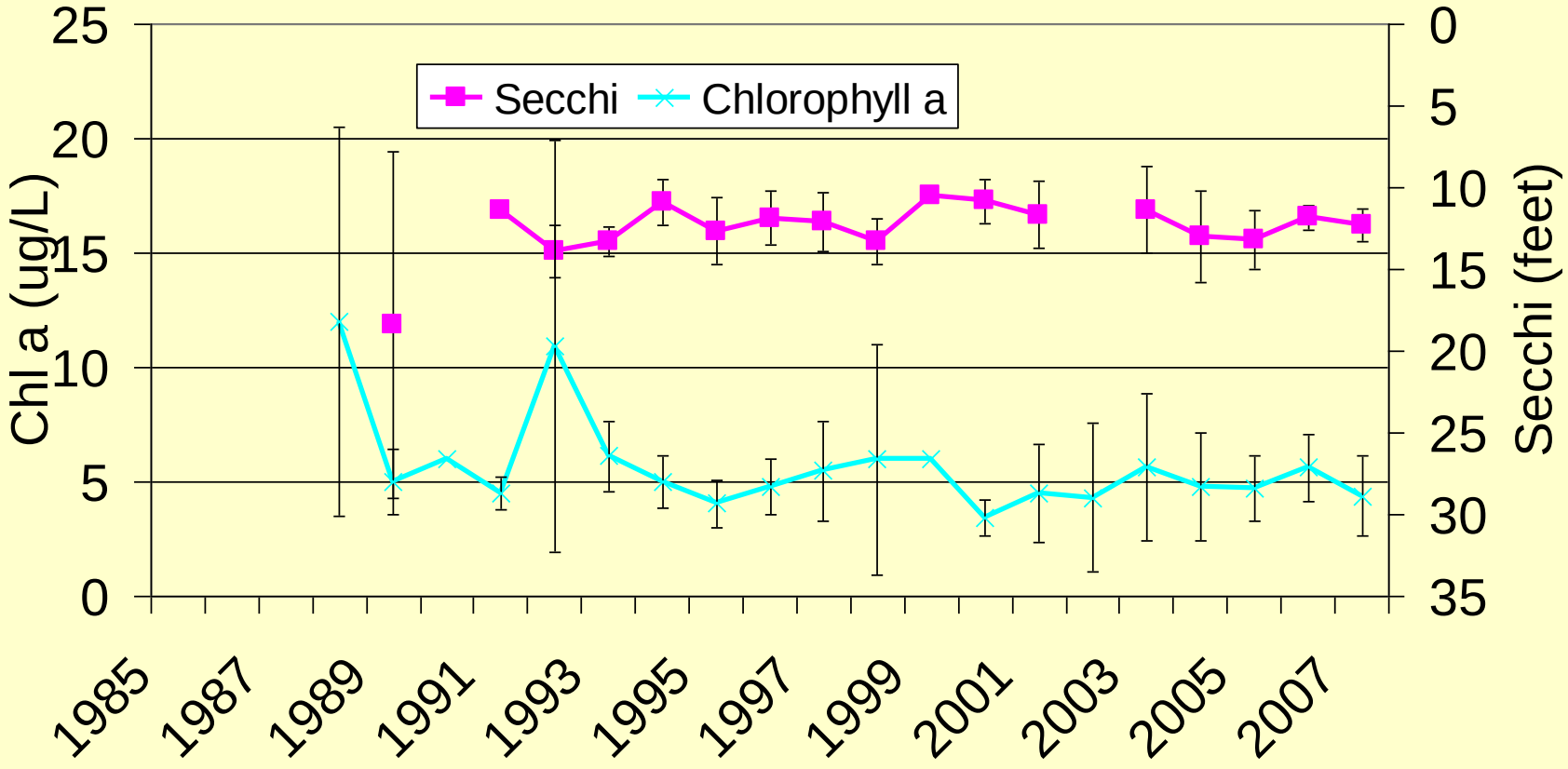
Past secchi averages in feet (July and August only).

Year	Secchi Mean	Secchi Min	Secchi Max	Secchi Count
1992	16.7	15	18	3
2001	17.9	13	20.5	6
2002	20.8	20.5	21	2

Done

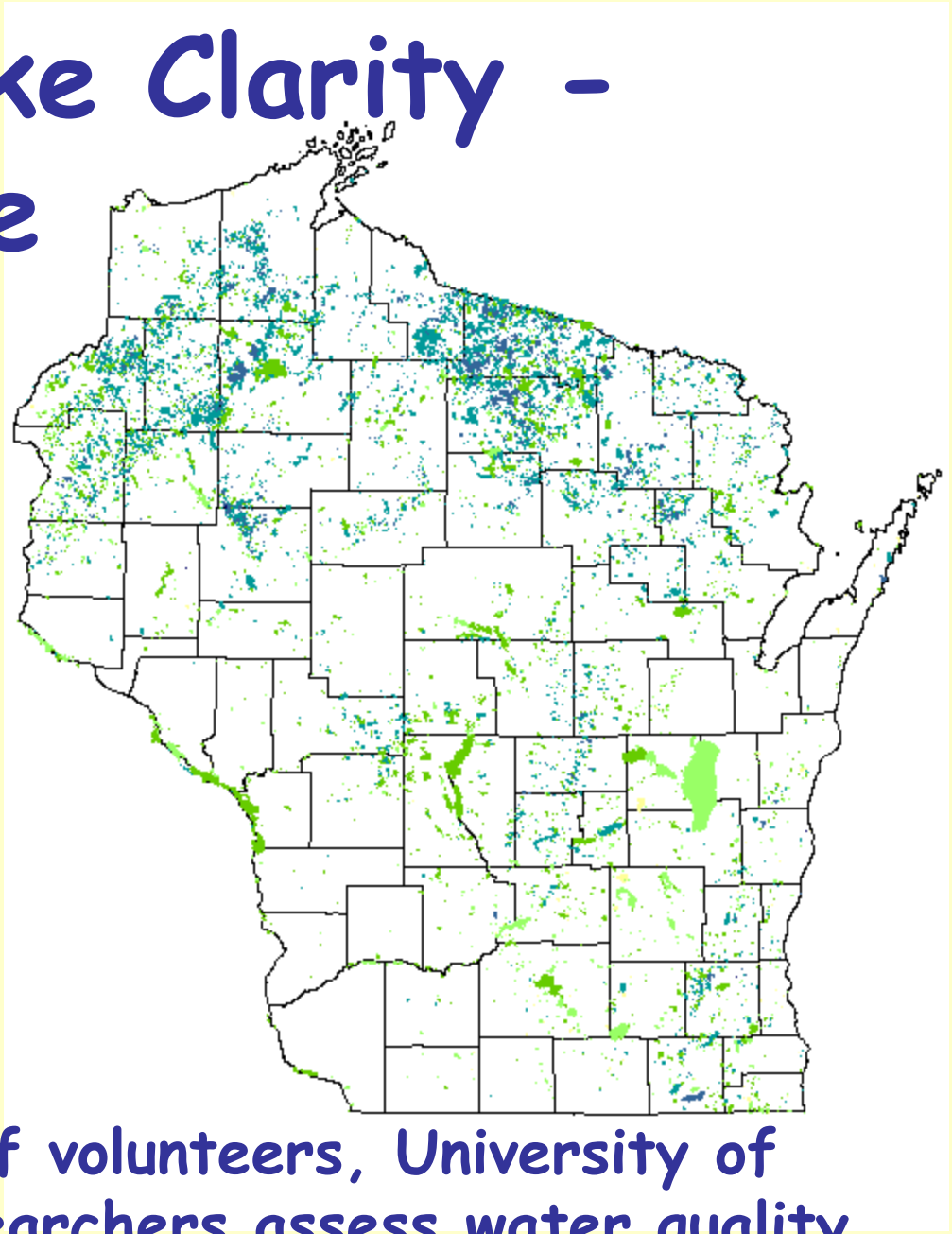
start | Secchi Graph - Windo... | Inbox - Microsoft Out... | Microsoft PowerPoint ... | status: Connected | ...

Long Term Water Quality Trends – Lake Minocqua, Oneida Co.

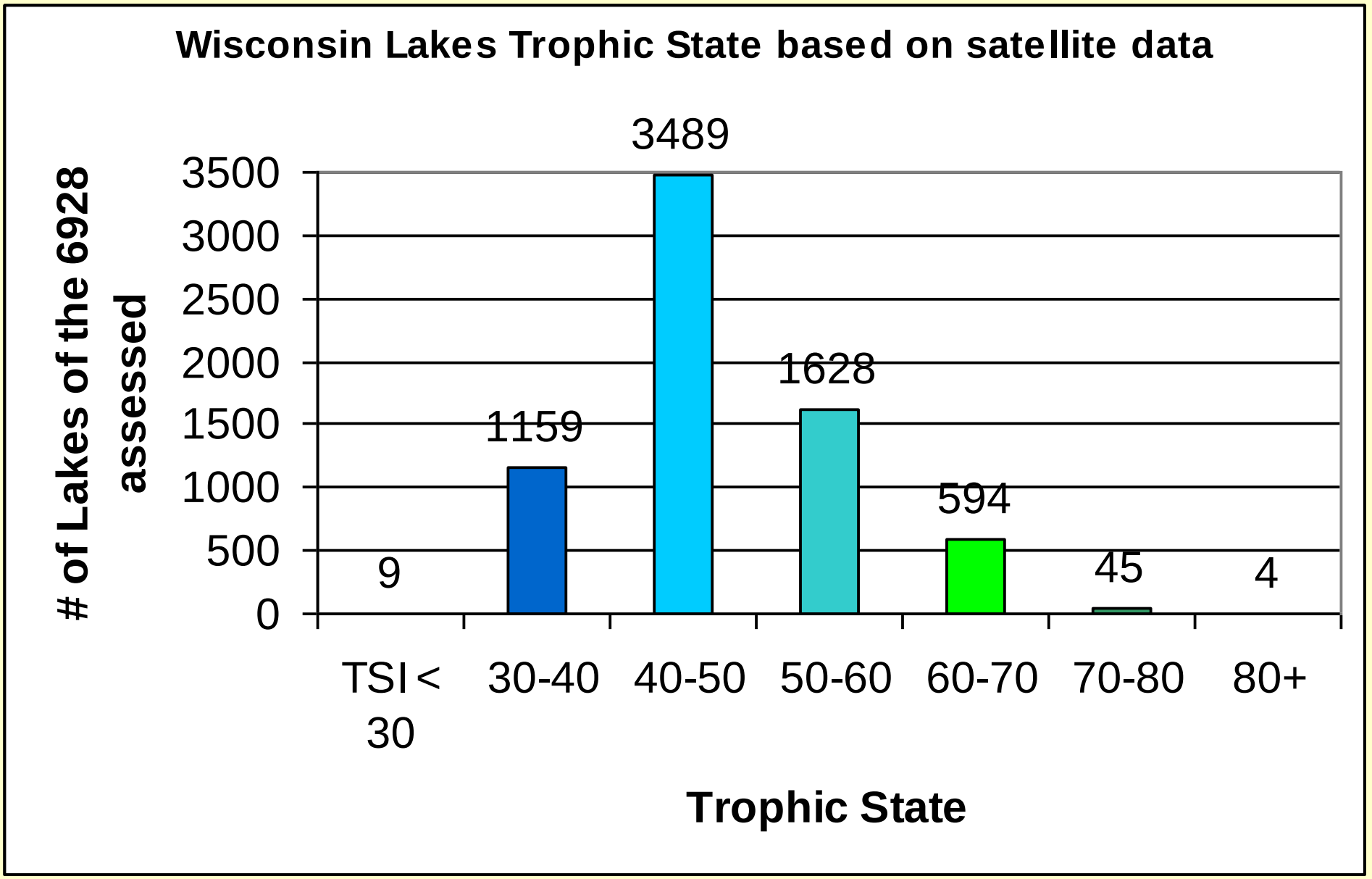


Wisconsin Lake Clarity - Trophic State From Space

Trophic State Index	Estimated Secchi Depth
> 80	< 0.25 m (< 0.8 ft)
70 to 80	0.25 - 0.5 m (0.8 - 1.6 ft)
60 to 70	0.5 - 1 m (1.6 - 3.3 ft)
50 to 60	1 - 2 m (3.3 - 6.6 ft)
40 to 50	2 - 4 m (6.6 - 13.1 ft)
30 to 40	4 - 8 m (13.1 - 26.2 ft)
< 30	> 8 m (> 26.2 ft)



Assisted by hundreds of volunteers, University of Wisconsin-Madison researchers assess water quality of Wisconsin's lakes from space (map: 1999-2001).


Wisconsin Lakes Trophic State based on satellite data
# of Lakes of the 6928 assessed
3500
3000
2500
2000
1500
1000
500
0
9
1159
3489
1628
594
45
4
TSI < 30
30-40
40-50
50-60
60-70
70-80
80+
Trophic State

Recommended Baseline Monitoring of Aquatic Plants in Wisconsin:

Sampling Design, Field and Laboratory Procedures, Data Entry and Analysis, and Applications

Jennifer Hauxwell, Susan Knight, Kelly Wagner, Alison Mikulyuk, Michelle Nault, Meghan Porzky and Shaunna Chase

March 2010

Document citation:
Hauxwell, J., S. Knight, K. Wagner, A. Mikulyuk, M. Nault, M. Porzky and S. Chase. 2010. Recommended baseline monitoring of aquatic plants in Wisconsin: sampling design, field and laboratory procedures, data entry and analysis, and applications. Wisconsin Department of Natural Resources Bureau of Science Services, PUB-SS-1068 2010. Madison, Wisconsin, USA.

WISCONSIN DEPT. OF NATURAL RESOURCES

Protocol available at:

http://wiatri.net/ecoatlas/ReportFiles/Reports2/1757AquaticPlantReport.pdf

http://www.uwsp.edu/cnr/uwexlakes/ecology/APM/Appendix-B.pdf

Data Collection

- Point-intercept method (Hauxwell *et al*., 2010)
- Species list and distributions for each lake
- Density rating for each species (1,2,3)

Fullness Rating	Coverage	Description
1		Only few plants. There are not enough plants to entirely cover the length of the rake head in a single layer.
2		There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover the tines.
3		The rake is completely covered and tines are not visible.

In-lake examples:

Summary statistics

Enterprise Lake, Langlade County

Size - 200 ha; Max depth - 8.2 m

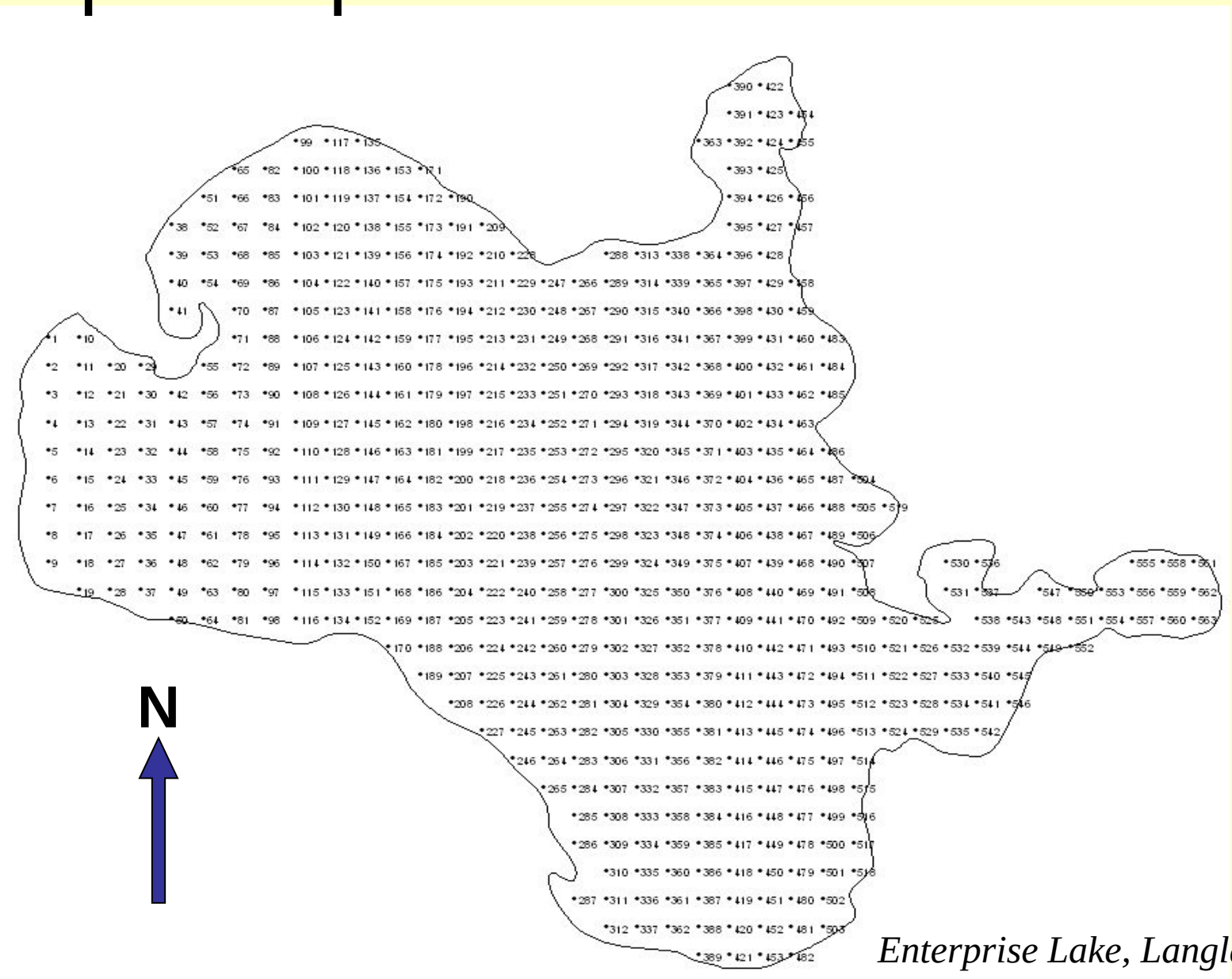
Summary Statistics	
Total lake points	**563**
Number of points with plants	**178**
Maximum depth of plants (m)	**4.1**
Littoral area (% of lake)	**32**
Mean # species/point	**1.7**
Species Richness	**27**
Simpson's Diversity Index	**0.87**

Species	Frequency of occurrence (%)	Species	Frequency of occurrence (%)
E. canadensis	48.1	*M. tenellum*	1.9
Nitella spp.	26.4	*Chara* spp.	1.9
V. americana	14.3	*Isoetes* spp.	1.9
C. demersum	12.0	*P. amplifolius*	1.6
N. flexilus	11.6	*M. beckii*	1.6
P. pusillus	11.2	*E. acicularis*	1.2
N. gracillima	8.1	*N. odorata*	1.2
P. richardsonii	4.7	*P. strictifolius*	1.2
S. fluctuans	4.7	*E. palustris*	0.8
P. robbinsii	3.9	*M. heterophyllum*	0.8
U. purpurea	3.9	*N. variegata*	0.4
M. spicatum	3.5	*P. crispus*	0.4
P. spirillus	3.1		
B. schreberi	2.3		

Enterprise Lake, Langlade Co.

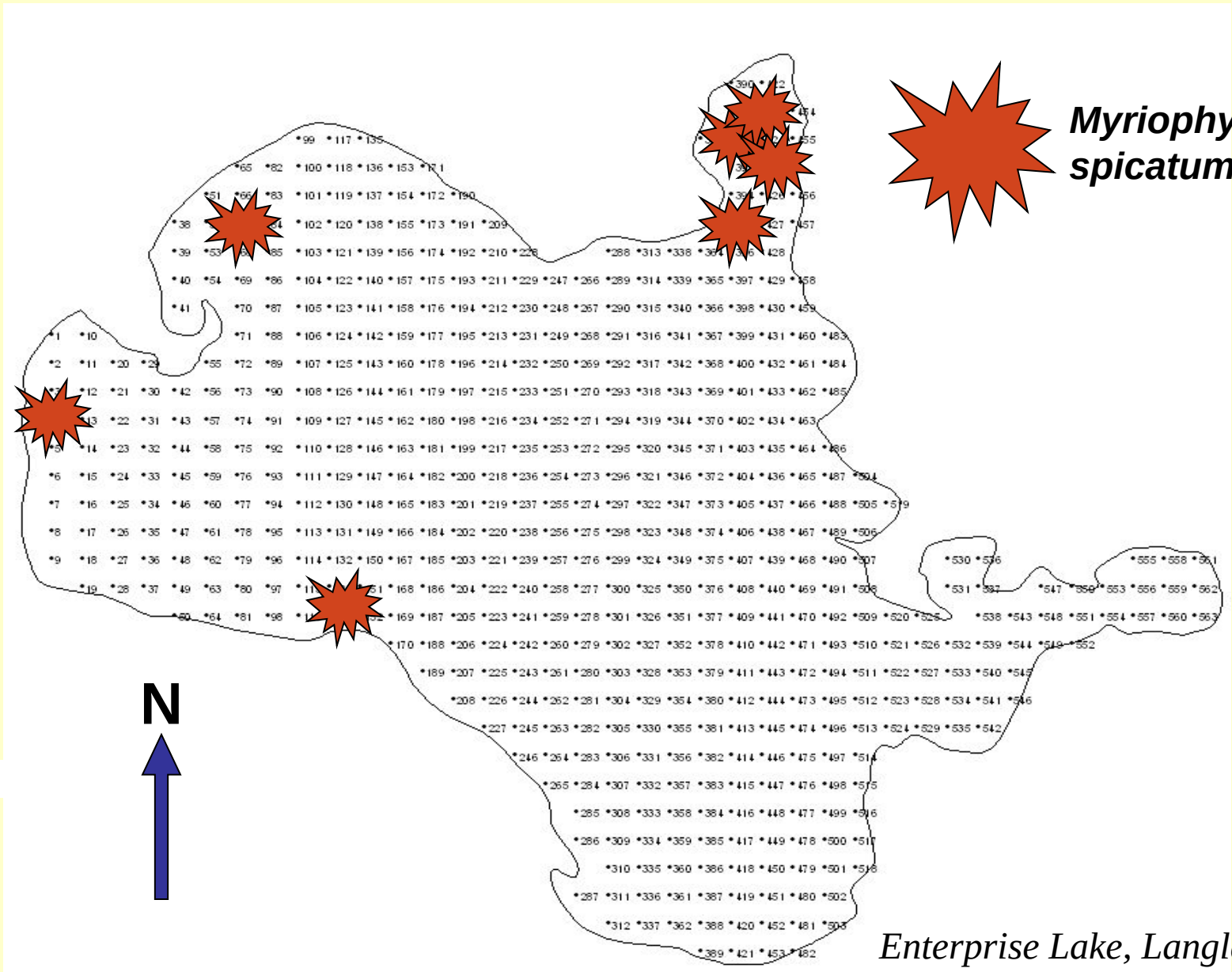
In-lake examples:

2) Maps of species distributions



Enterprise Lake, Langlade Cty.

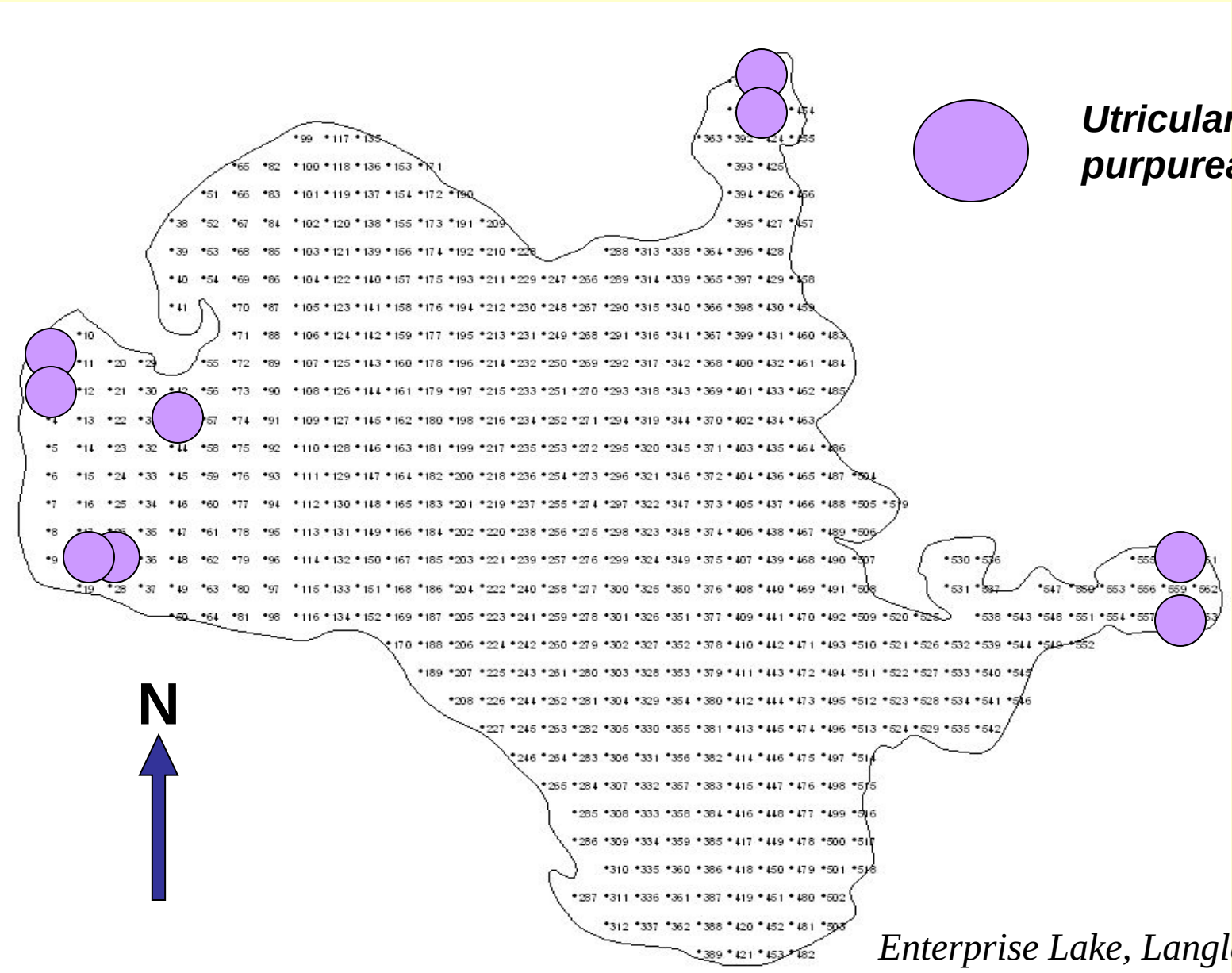
Distribution of Eurasian Watermilfoil



Myriophyllum spicatum

Enterprise Lake, Langlade Cty.

Species of Special Concern

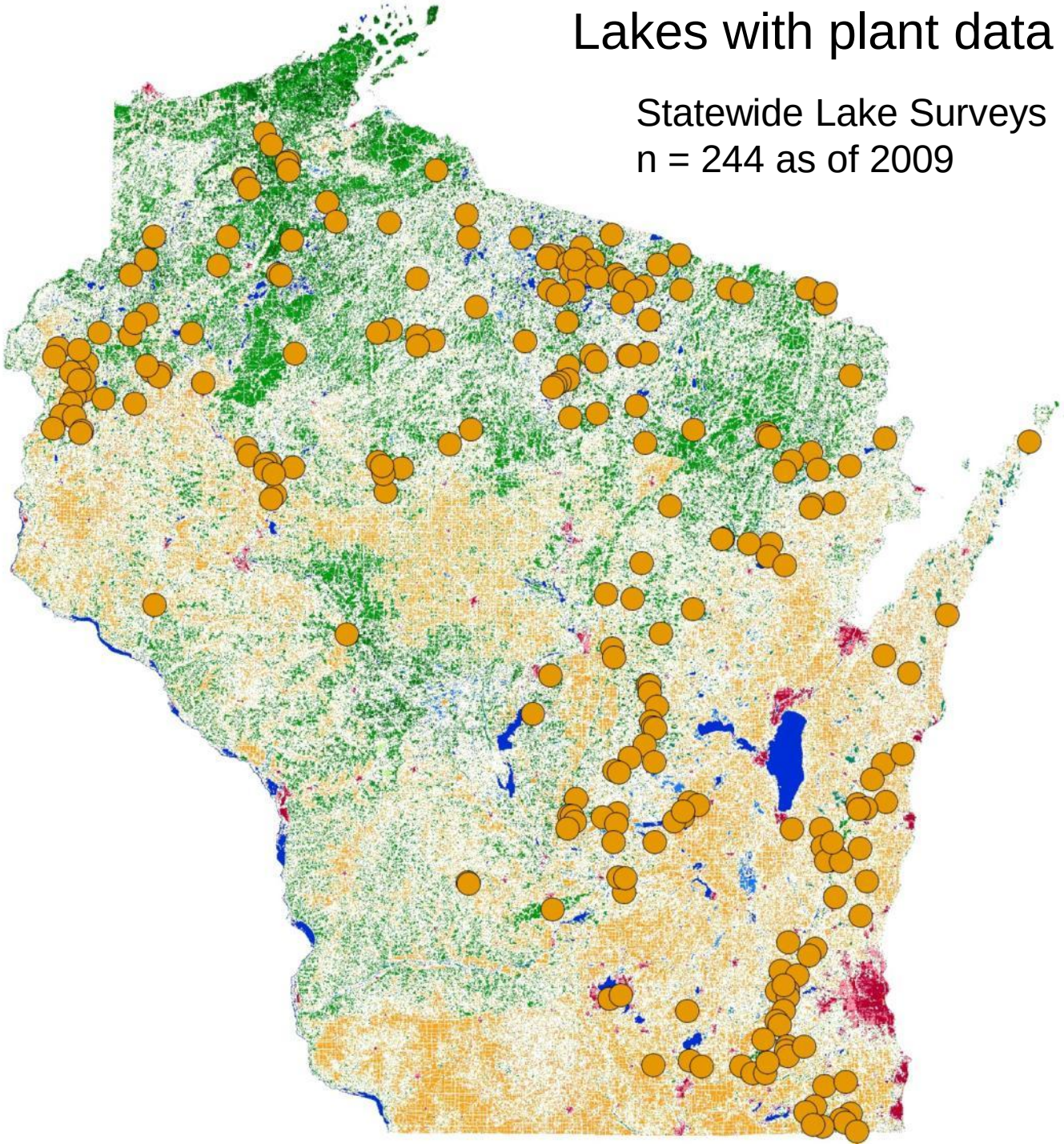


Utricularia purpurea

Enterprise Lake, Langlade Cty.

Lakes with plant data

Statewide Lake Surveys
n = 244 as of 2009



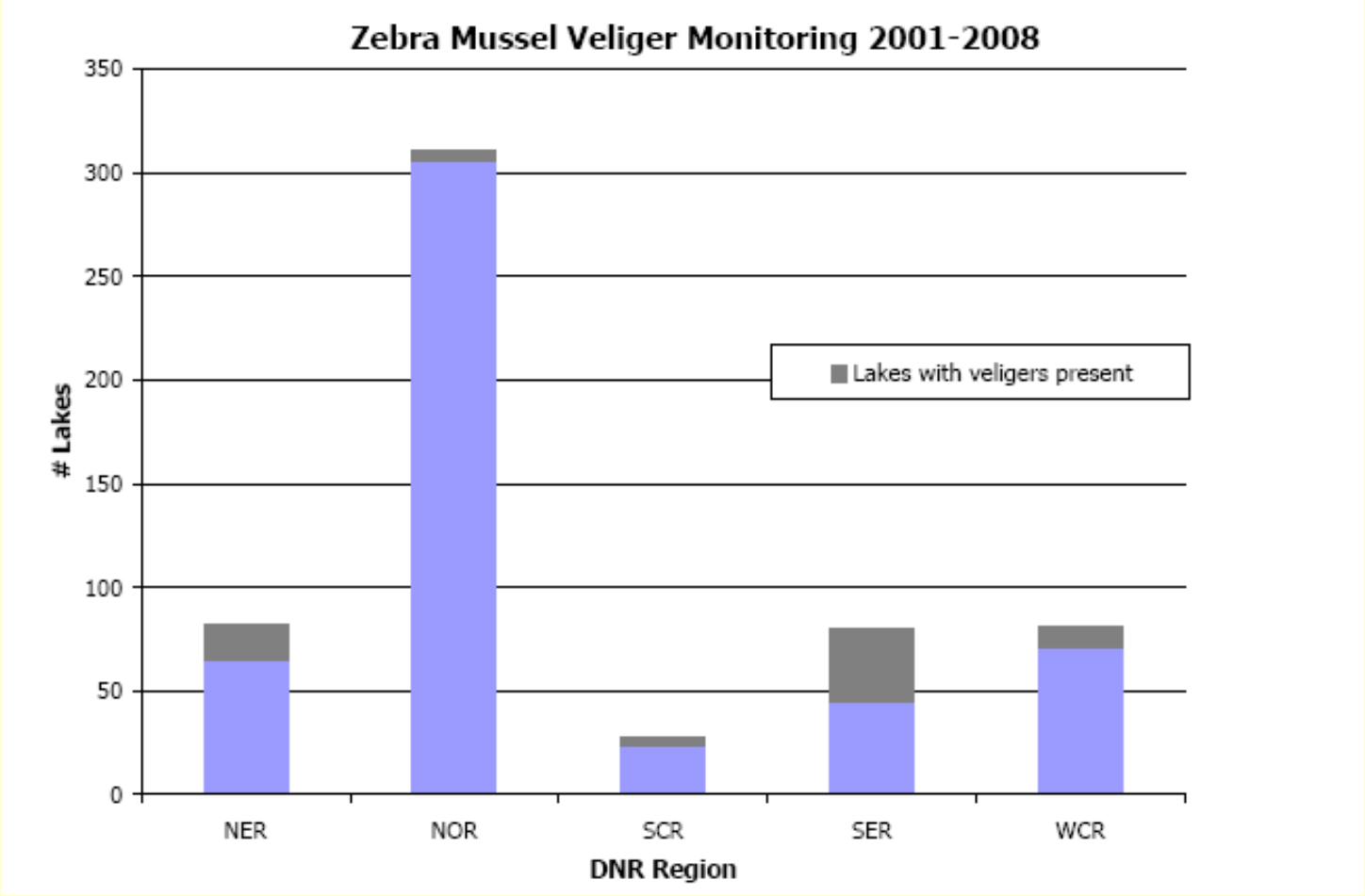
Aquatic Invasive Species Monitoring

“Smart Prevention” approach to AIS monitoring

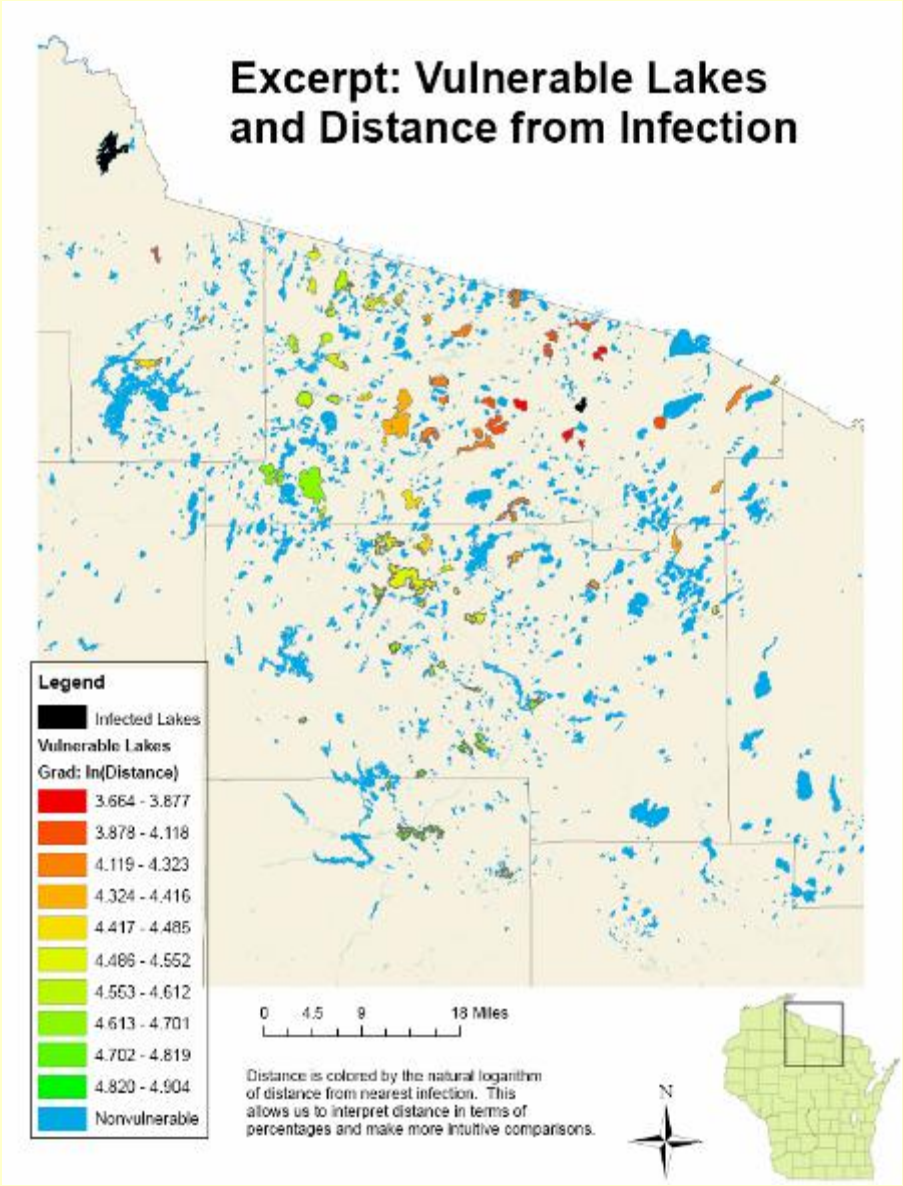
- Is there a vector for introduction to a waterbody?
- Can the species become established in the waterbody?
- Is there a likelihood of secondary spread from the waterbody?
- Is there potential for impacts to native species or habitat?

Does the lake have public access?

Do species have physiological requirements?



Spiny Waterflea Monitoring



M. Sallstrom, E. Stone, K. Lund, N. Braun, 2009

Vulnerability Thresholds

- Boat landing access
- Min area = 123 acres
- Min Z_{max} = 25 feet
- Min Secchi = 8 feet

Future Directions

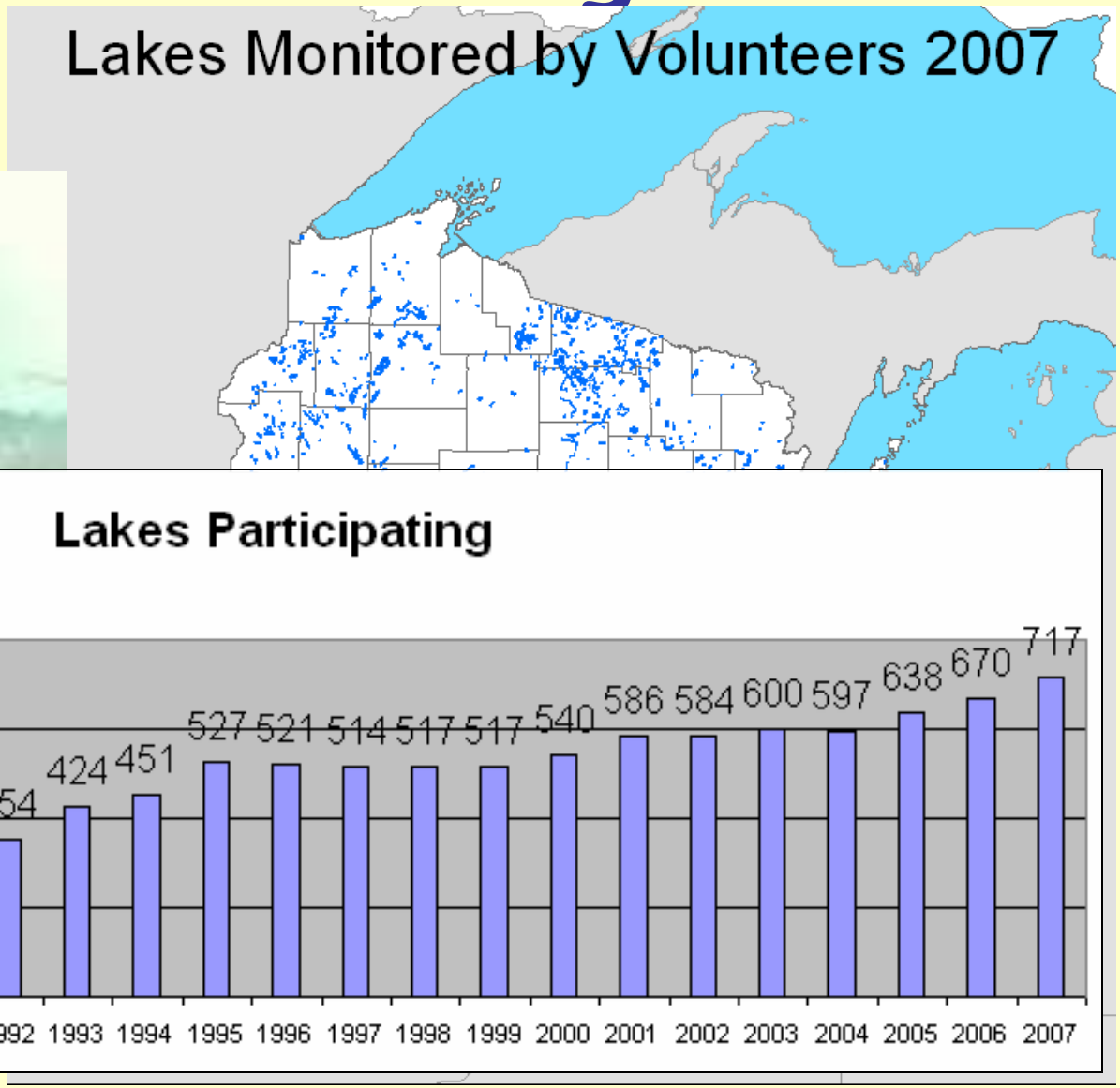
- **Surveillance/Early Detection Monitoring**
- "Casual" and trained observers – broad coverage

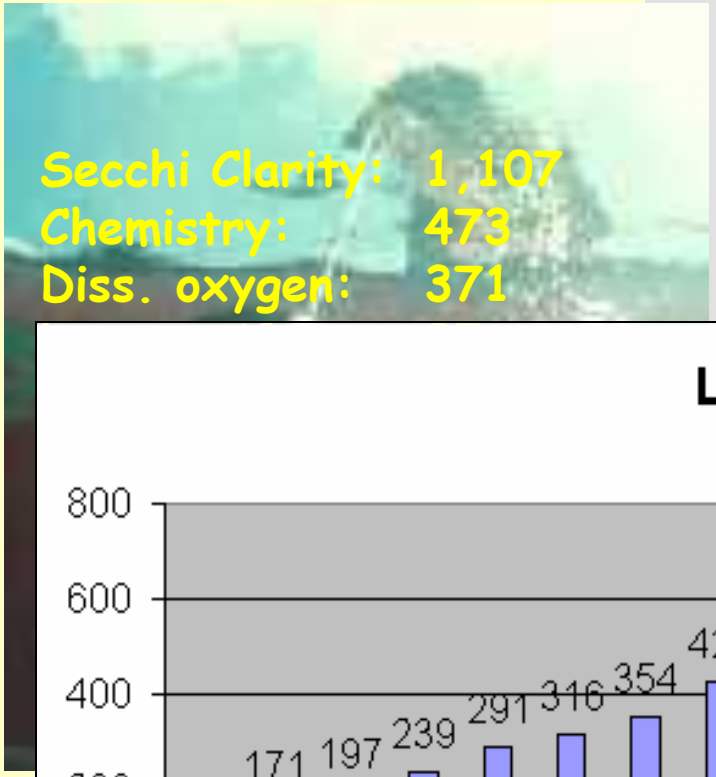
- **Targeted AIS Monitoring**
- Tracking the regional extent of a species

- **Strategic AIS Monitoring (Tier 1)**
- Randomized monitoring – are we slowing the spread?

- **Strategic AIS Monitoring (Tier 2, 3)**
- Case specific response monitoring, containment and control for restricted/prohibited species.

Citizen Lake Monitoring Network





USGS Lake Level Network

- Establish a lake-level monitoring network to evaluate trends in various regions of the state.
  - Emphasis will be on relatively natural seepage lakes, which are most responsive and can give indications of climatic/hydrologic change following a regional pattern.
- Establish baseline conditions for environmental studies and comparison with short-term results.
- Increase the understanding of different lake hydrologic systems and how they affect lake water levels.
- Build a framework for broader lake level monitoring through CLMN

Lake Assessment

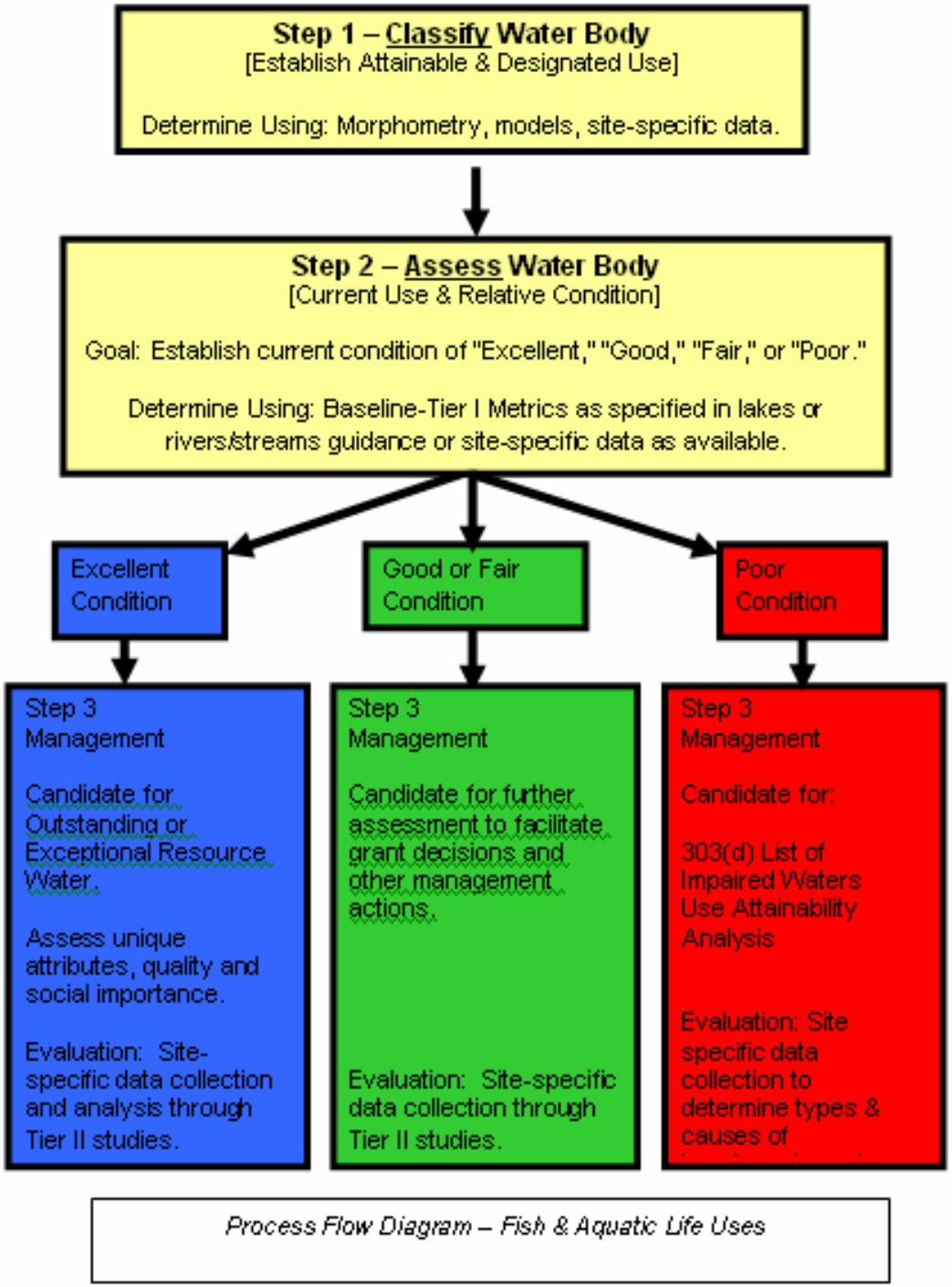
- How are Wisconsin lakes doing?
  - WisCALM
- Approaches
  - Comparative – lake class, ecoregion, reference lakes/conditions
  - Standards/thresholds – P criteria
  - Historical Trends and Paleolimnology
- National Lake Assessment

Designate use

Categorize lakes

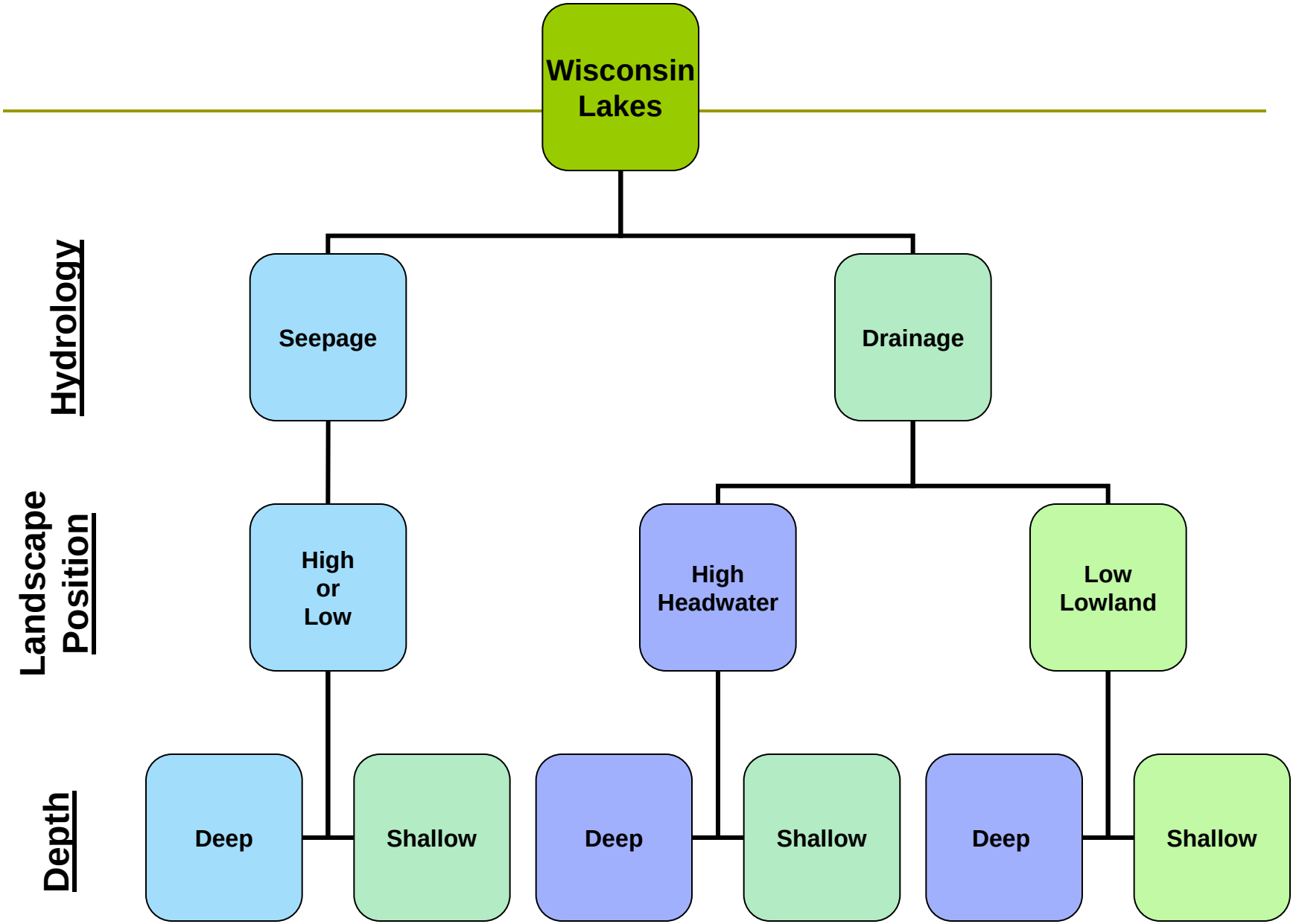
Establish reference conditions

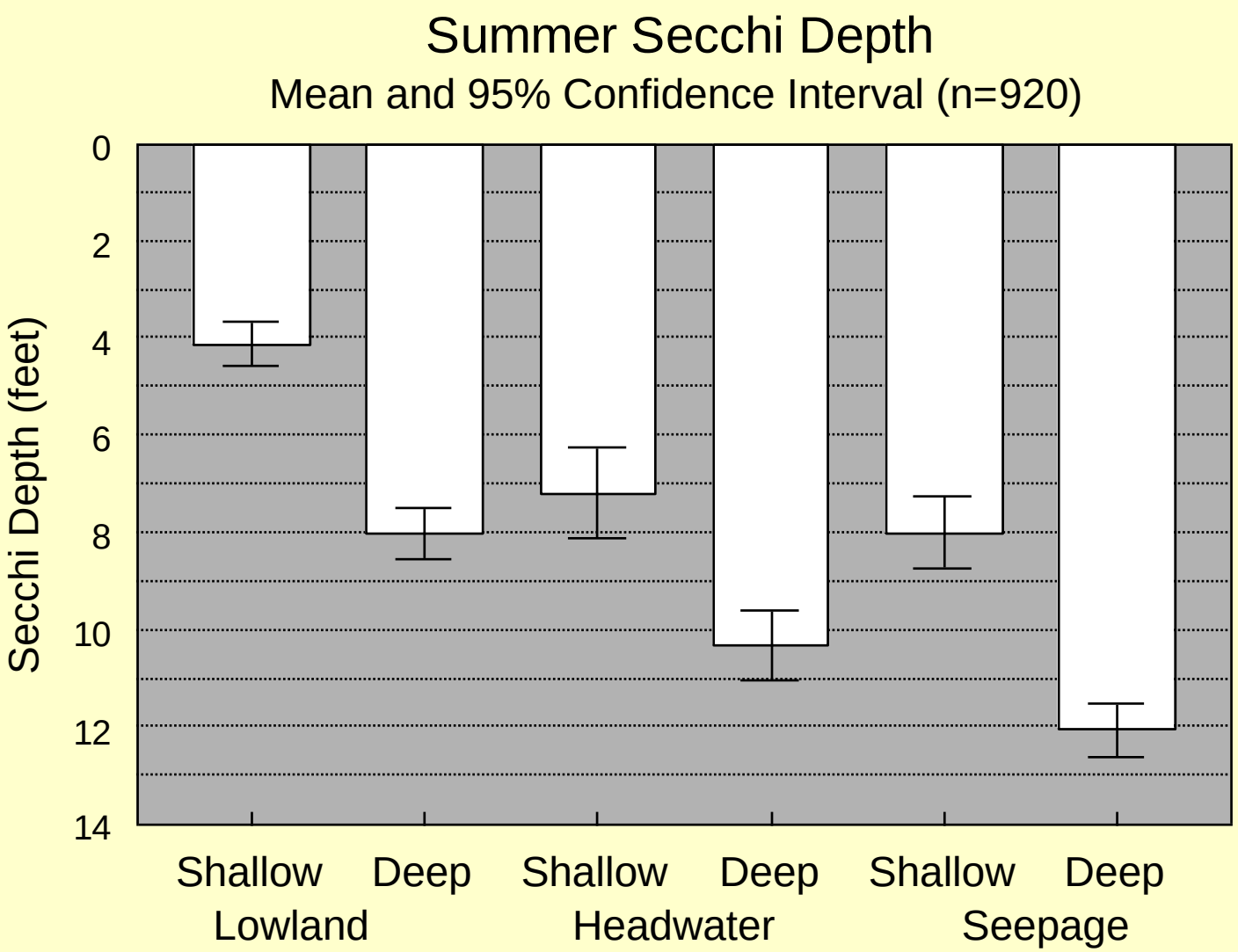
Use TSI data to assess condition of lake (Excellent, Good, Fair, Poor)



Process Flow Diagram – Fish & Aquatic Life Uses

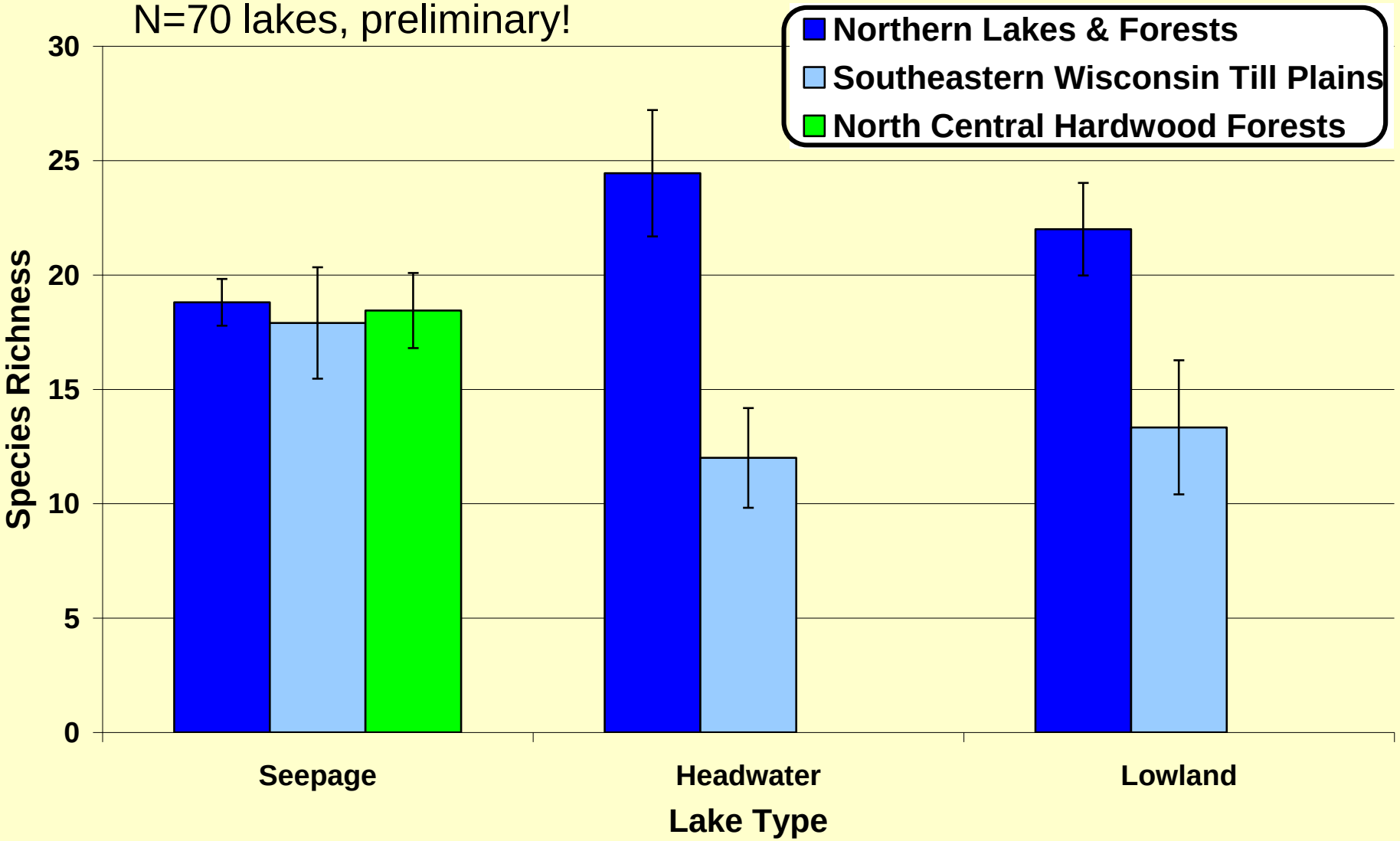
Wisconsin Lake Classification




Summer Secchi Depth
Mean and 95% Confidence Interval (n=920)
Secchi Depth (feet)
0
2
4
6
8
10
12
14
Shallow
Deep
Shallow
Deep
Shallow
Deep
Lowland
Headwater
Seepage

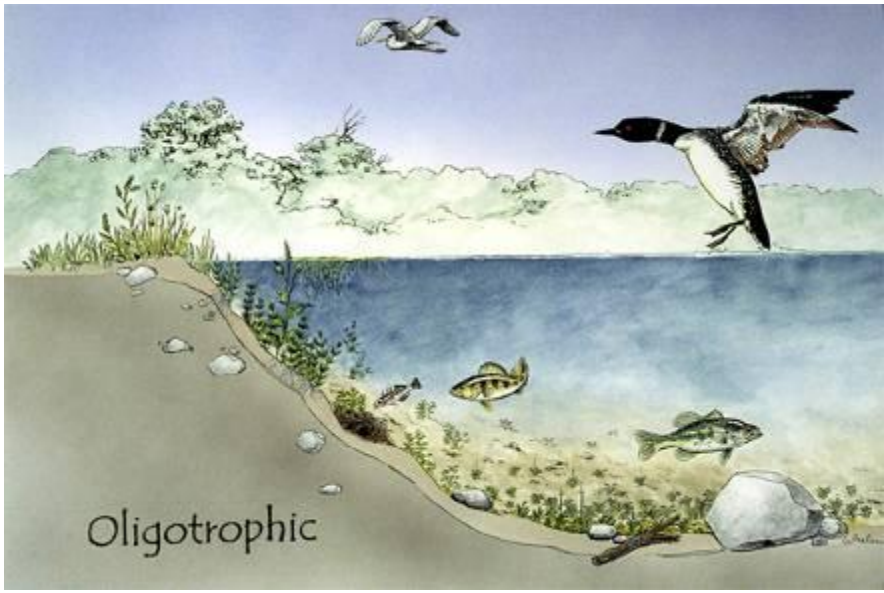
Statewide examples (plants):

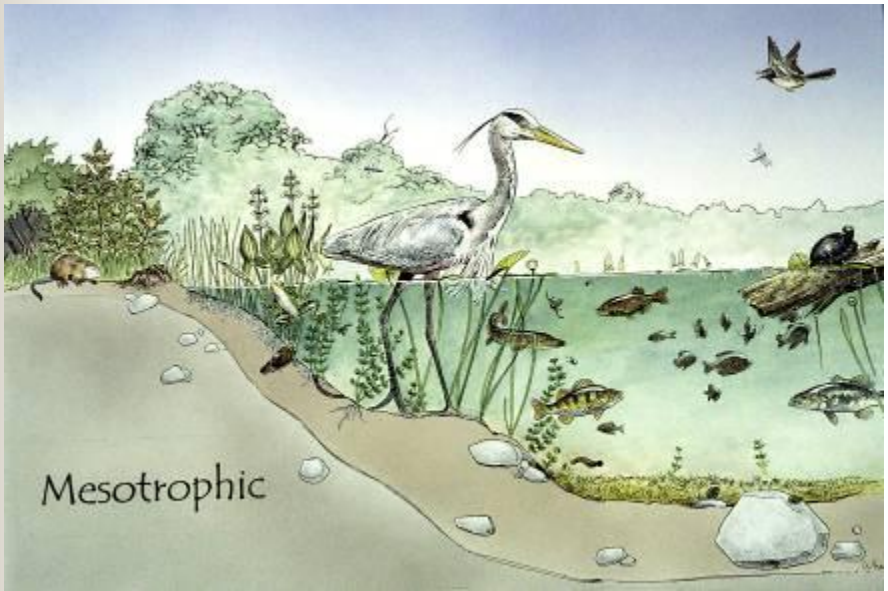
1) How does species richness vary across lake types and regions?



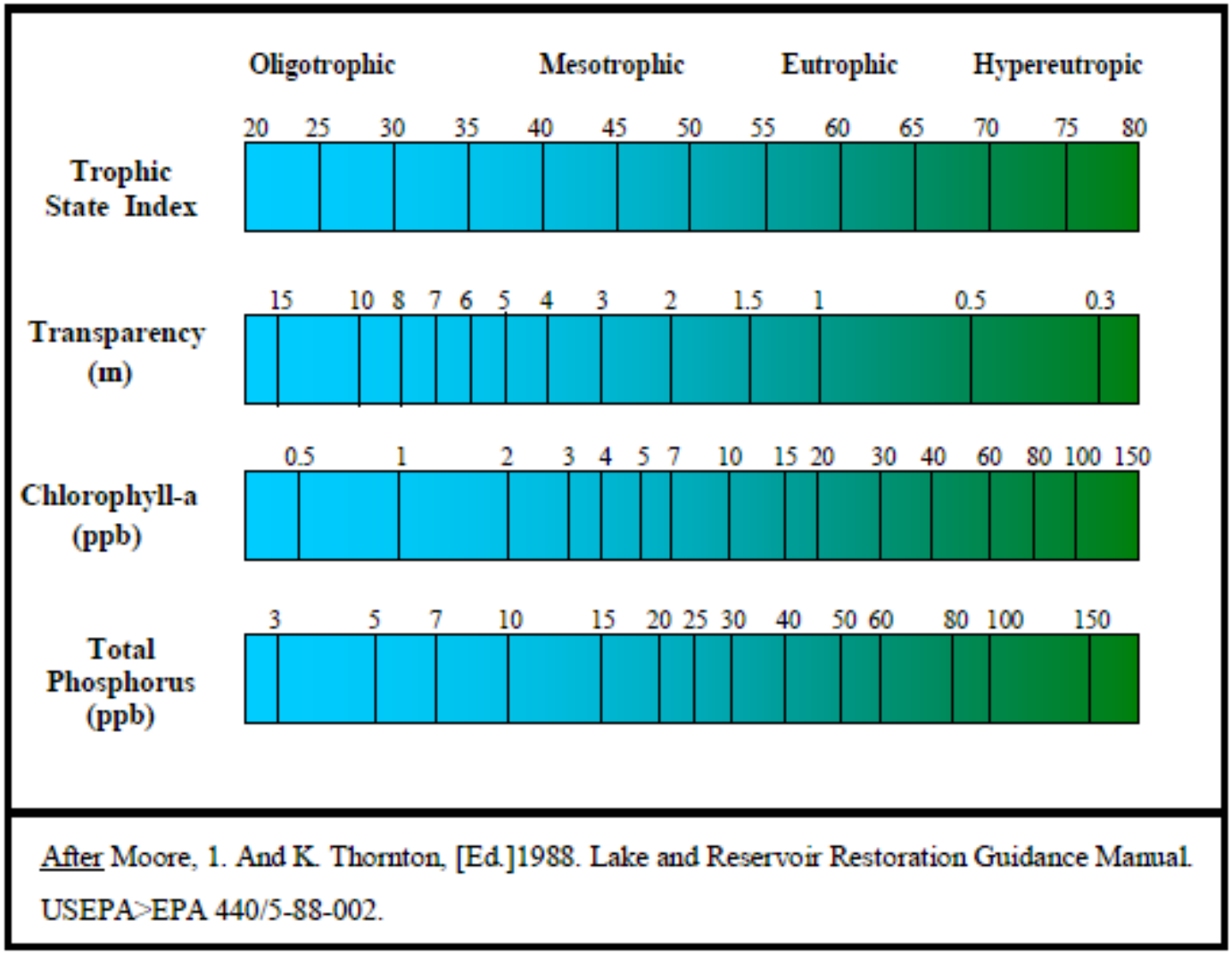
TROPHIC STATE

- Nutrients & Productivity
- Sediment & Accumulation
- Species Shifts
- Species Richness



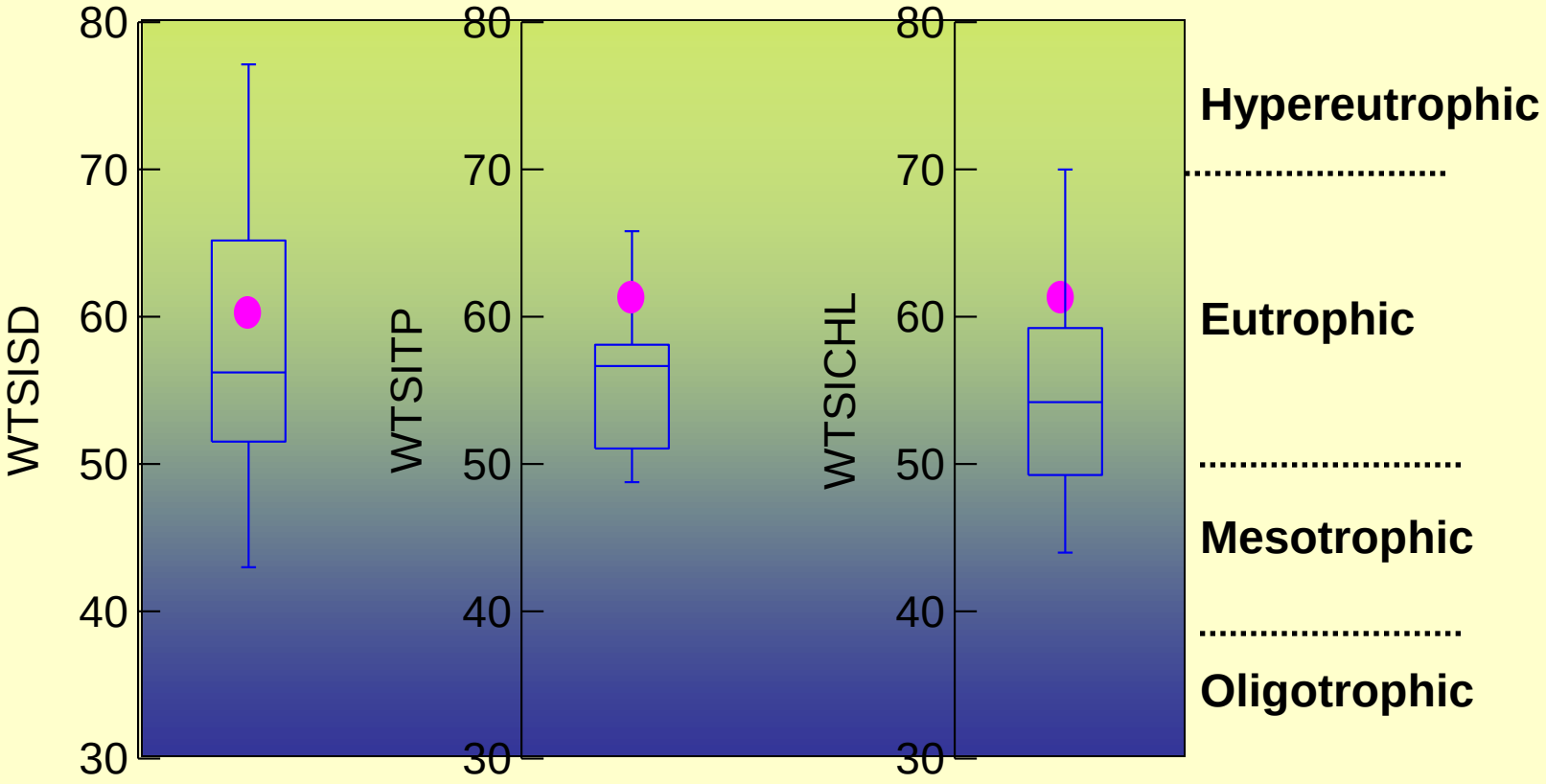


Trophic State Index (TSI) Scale



After Moore, 1. And K. Thornton, [Ed.]1988. Lake and Reservoir Restoration Guidance Manual. USEPA>EPA 440/5-88-002.

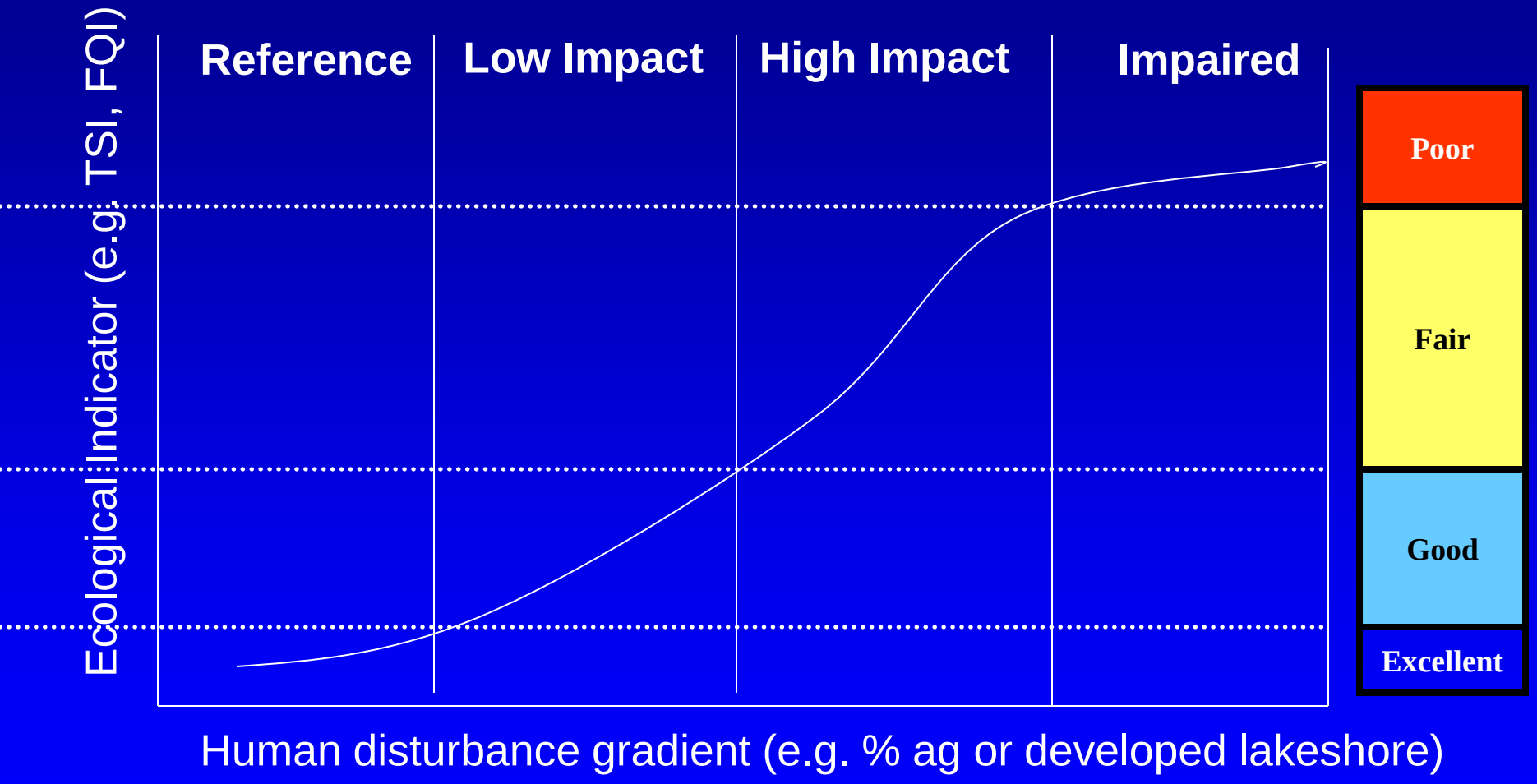
Comparative Lake Assessment: Trophic State Indices



Box plots: Shallow lowland drainage lakes in Southern Wisconsin

● 2003-2005 (mean) Eagle Lake TSI values (summer)

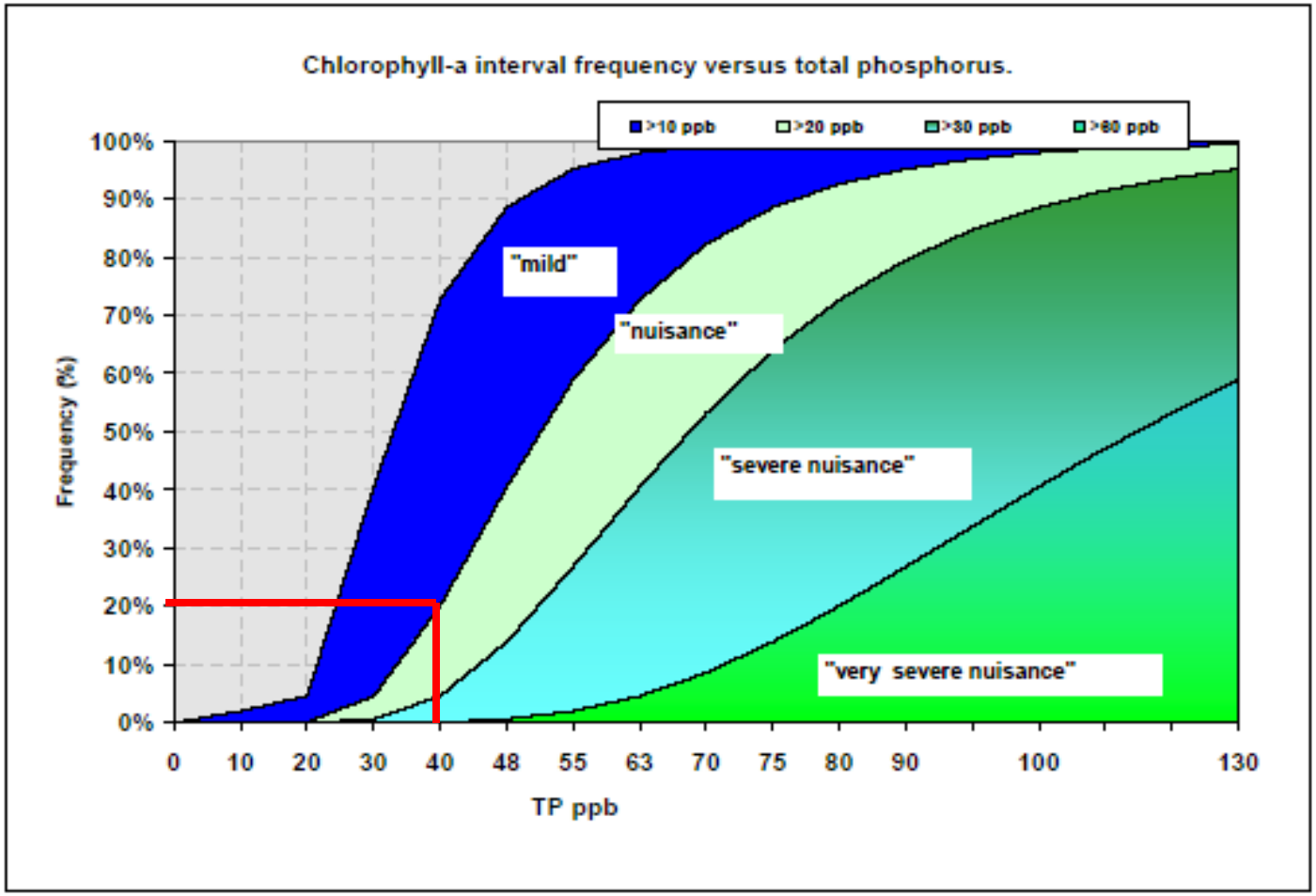
Setting assessment thresholds



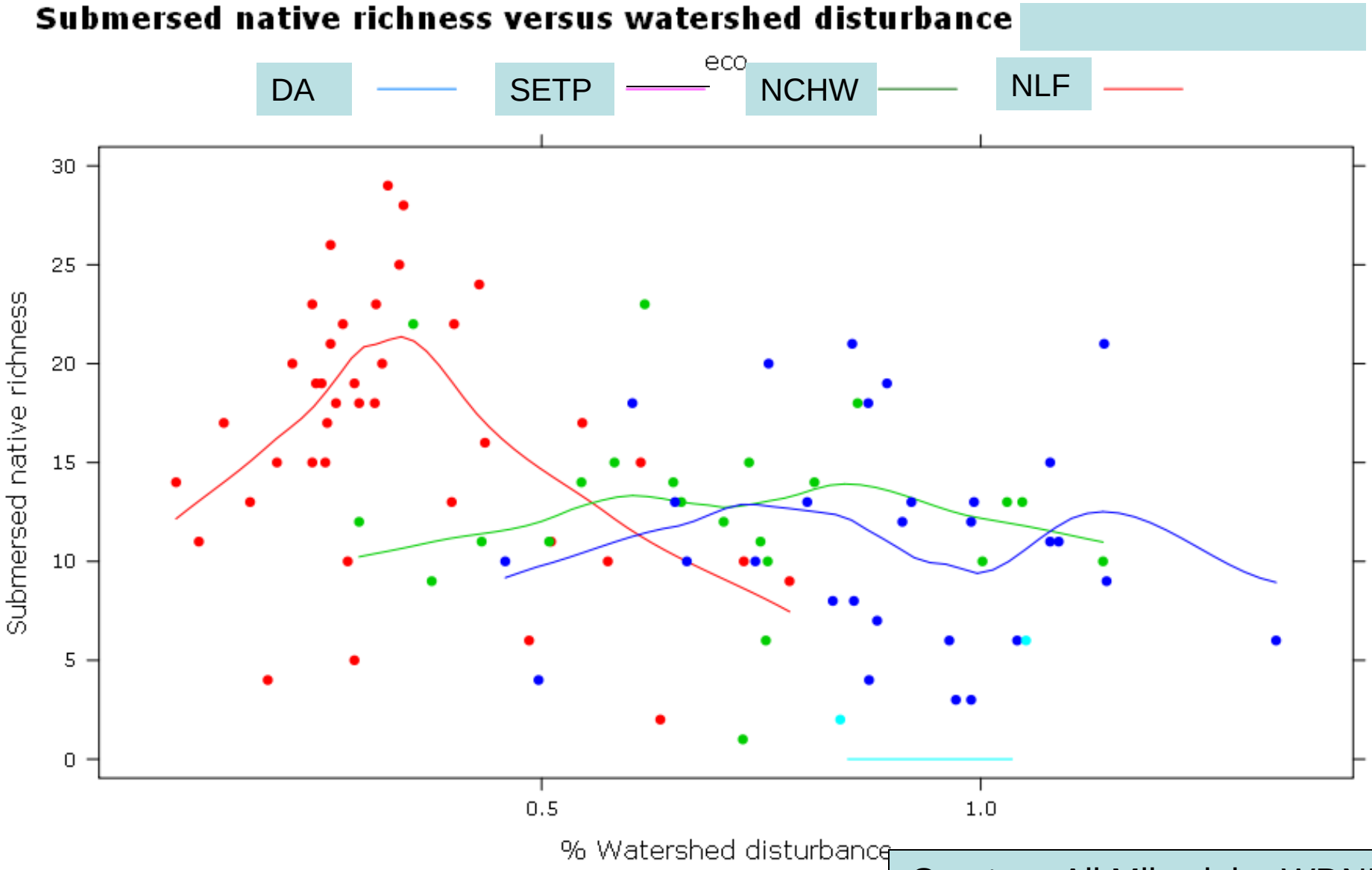
Setting Reference Thresholds

- Indicator of some previous ecological state
- Pre-settlement
- Undeveloped lakes
- Minimally impacted lakes

Setting Impairment Thresholds



Plants are a bit more complicated



Courtesy Ali Mikyuluk - WDNR

TSI Thresholds By Natural Lake Community

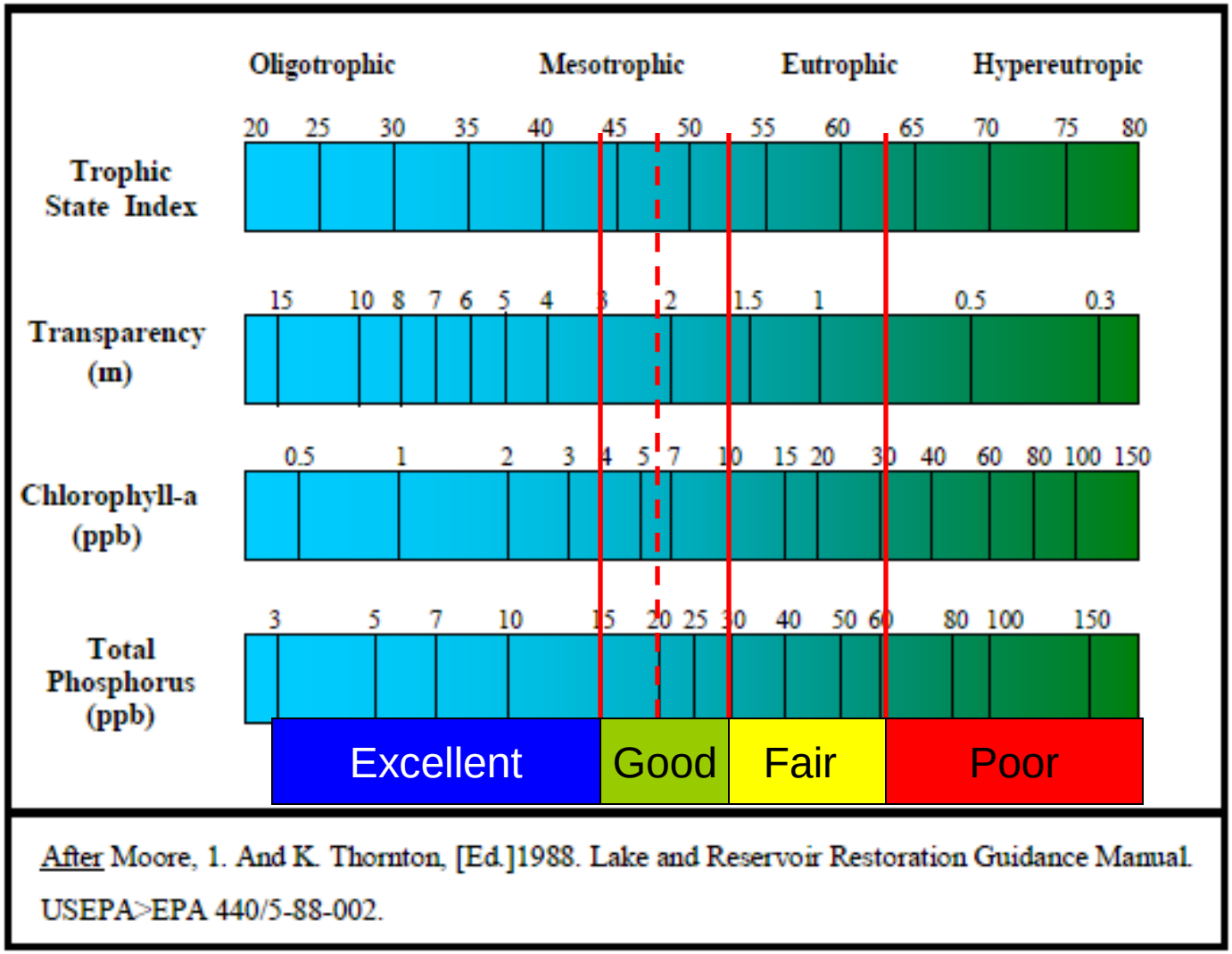
Condition Level	Shallow			Deep			
	Headwater	**Lowland**	**Seepage**	**Headwater**	**Lowland**	**Seepage**	**Two-Story**
Excellent	< 45	< 49	< 39	< 47	< 46	< 44	< 44
Good	45 – 57	49 – 59	39 – 54	47 – 54	46 – 53	44 – 52	44 – 47
Fair	58 – 70	60 – 70	55 – 70	55 – 62	54 – 62	53 – 62	48 – 52
Poor	≥ 71	≥ 71	≥ 71	≥ 63	≥ 63	≥ 63	≥ 53

P criteria for WI Waters – As of Sept. 9th, 2010!

Proposed Phosphorus Criteria by Type of Water Body	Total Phosphorus in ug/l
Listed rivers	100
All other streams	75
Stratified reservoirs	30
Non-stratified reservoirs	40
Stratified "two-story" fishery lakes	15
Stratified drainage lakes	30
Non-stratified (shallow) drainage lakes	40
Stratified seepage lakes	20
Non-stratified (shallow) lakes	40
Impoundments	Same as inflowing river or stream
Lake Michigan open and nearshore waters	7
Lake Superior open and nearshore waters	5

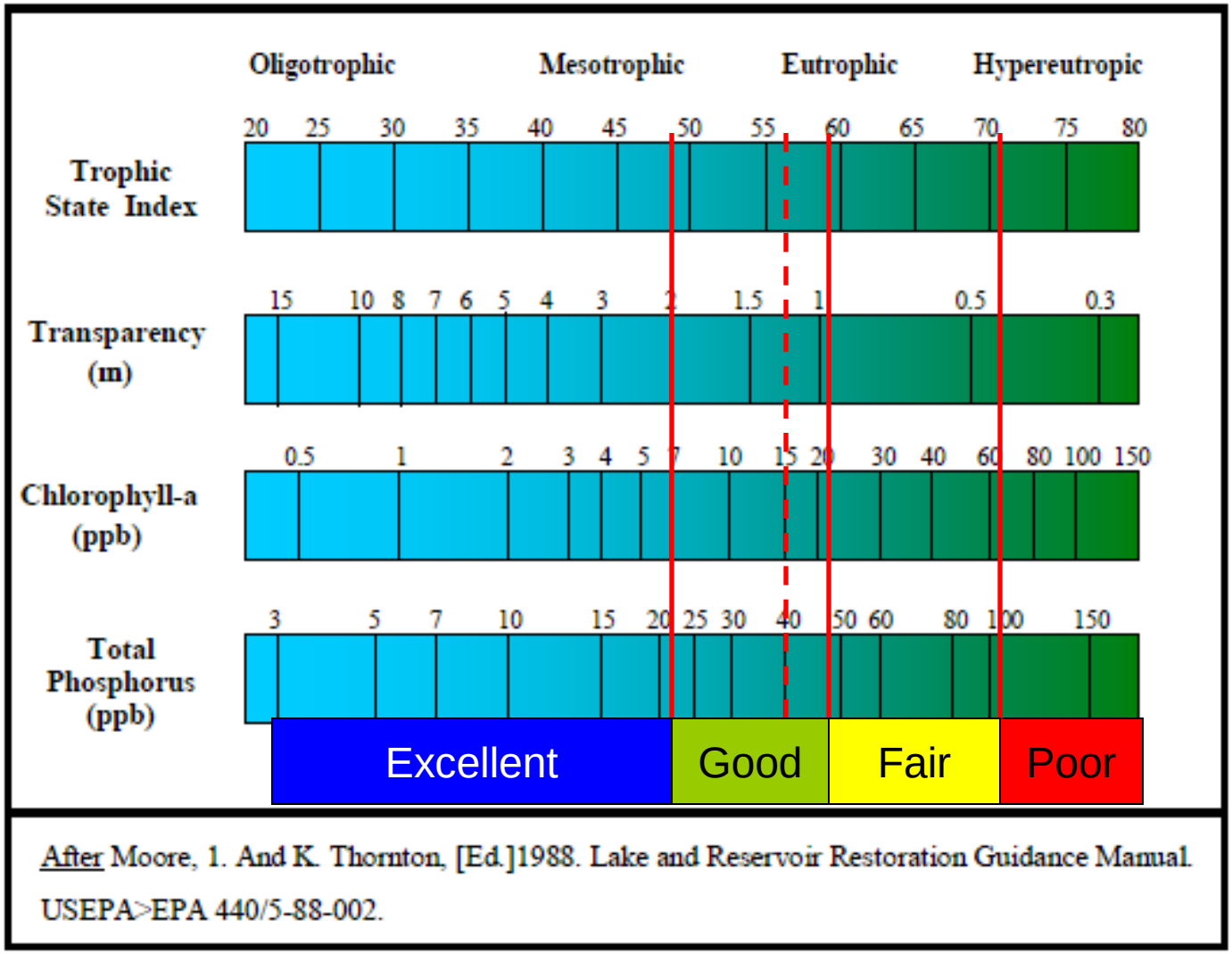
Two-story fishery lakes	15 ug/L
Stratified (Deep) Seepage Lakes	20 ug/L
Stratified (Deep) Drainage Lakes and Reservoirs	30 ug/L
Non-stratified (Shallow) Lakes and Reservoirs	40 ug/L
Impounded waters (<14 day residence time)	75/100 ug/L

Ex: Deep Seepage lakes



After Moore, 1. And K. Thornton, [Ed.]1988. Lake and Reservoir Restoration Guidance Manual. USEPA>EPA 440/5-88-002.

Ex: Shallow, lowland drainage lakes



After Moore, 1. And K. Thornton, [Ed.]1988. Lake and Reservoir Restoration Guidance Manual. USEPA>EPA 440/5-88-002.

How are Wisconsin lakes doing?

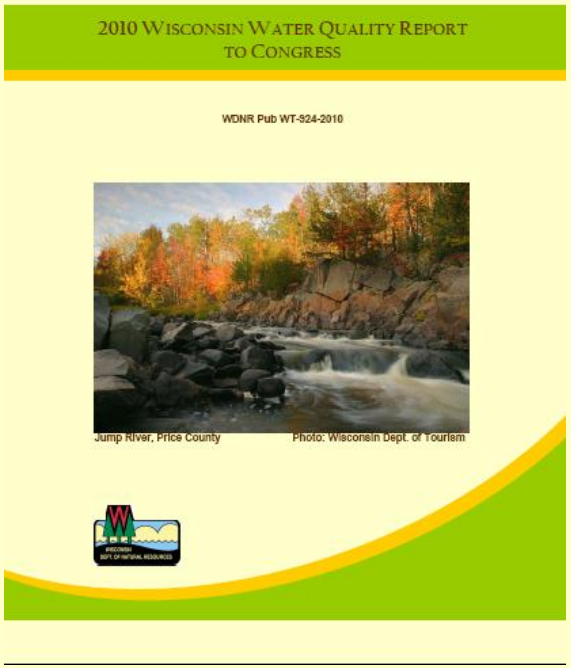


Figure 16. Trophic State of Assessed Wisconsin Lakes, 2010

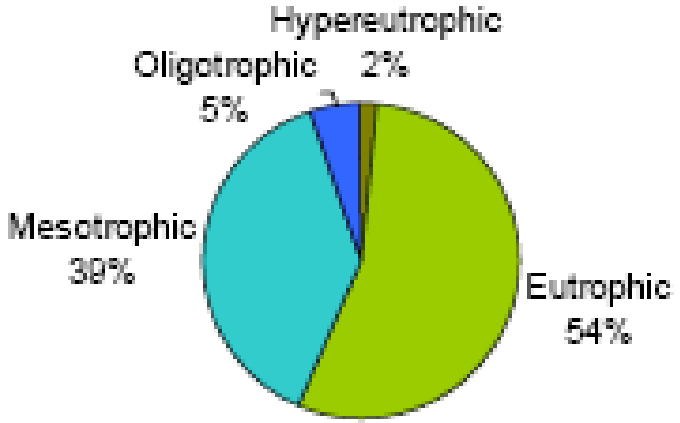


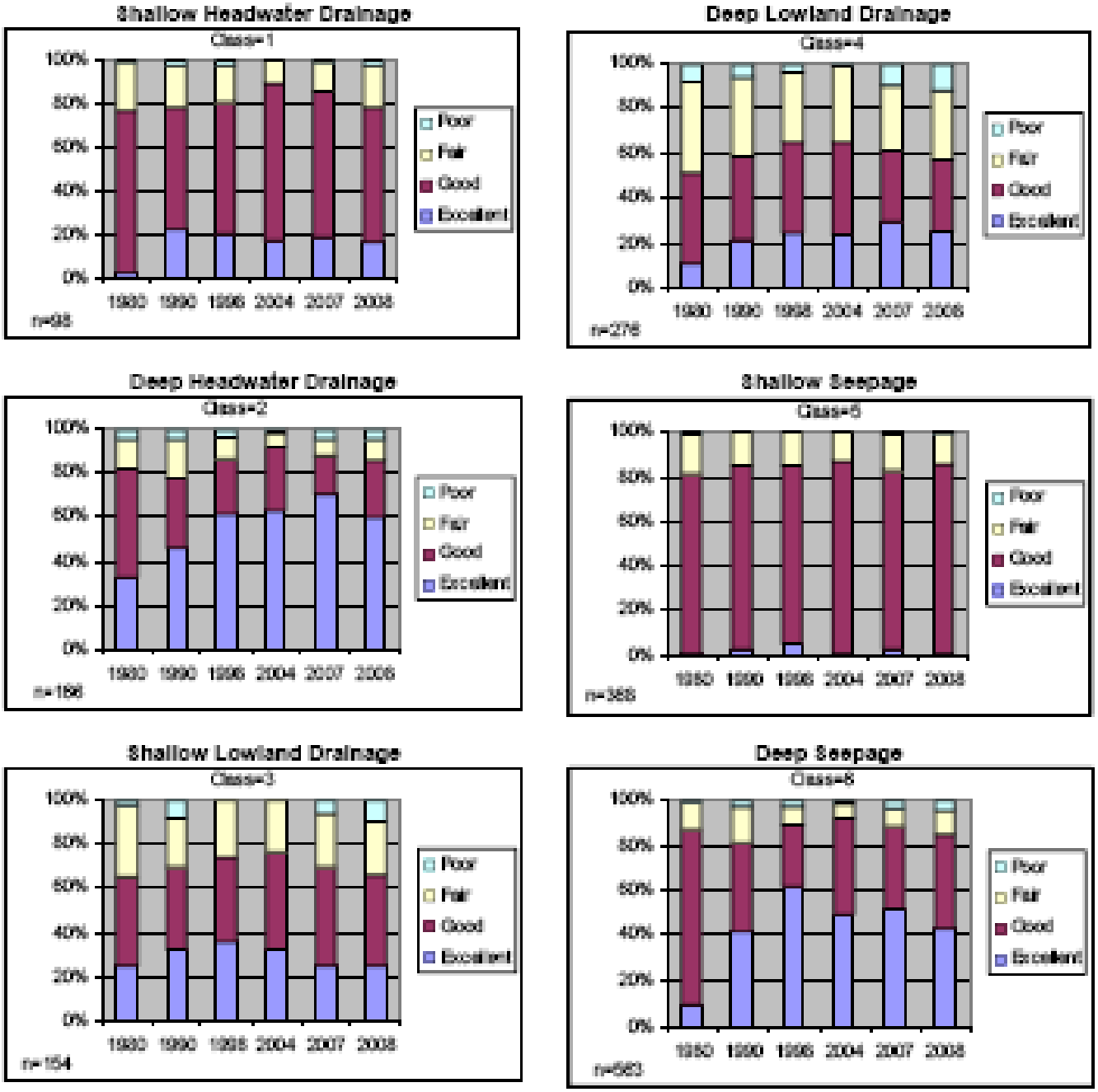
Table 37. Summary of General Condition of TSI Assessed Lakes, 2010

All Lakes Assessed by 2010 TSI Methodology	Number Lakes	Percent (# Lakes)	Lake Acres	Percent (# Acres)
Excellent	604	14%	129,769	19%
Good	1762	41%	231,677	33%
Fair	680	16%	264,128	38%
Poor	127	3%	35,825	5%
No Condition Rating*	1074	25%	32,360	5%
Total TSI Assessed Lakes	**4247**	**100%**	**693,778.57**	**100%**

**Either no natural community assigned or small lake*

http://dnr.wi.gov/org/water/condition/2010_IR/

Figure 21. Changes in lake clarity by lake classification, based on satellite data from 1980-2008



The 2007 National Lakes Assessment

Water Quality, Recreational Suitability, and Ecological Integrity of Lakes and Reservoirs

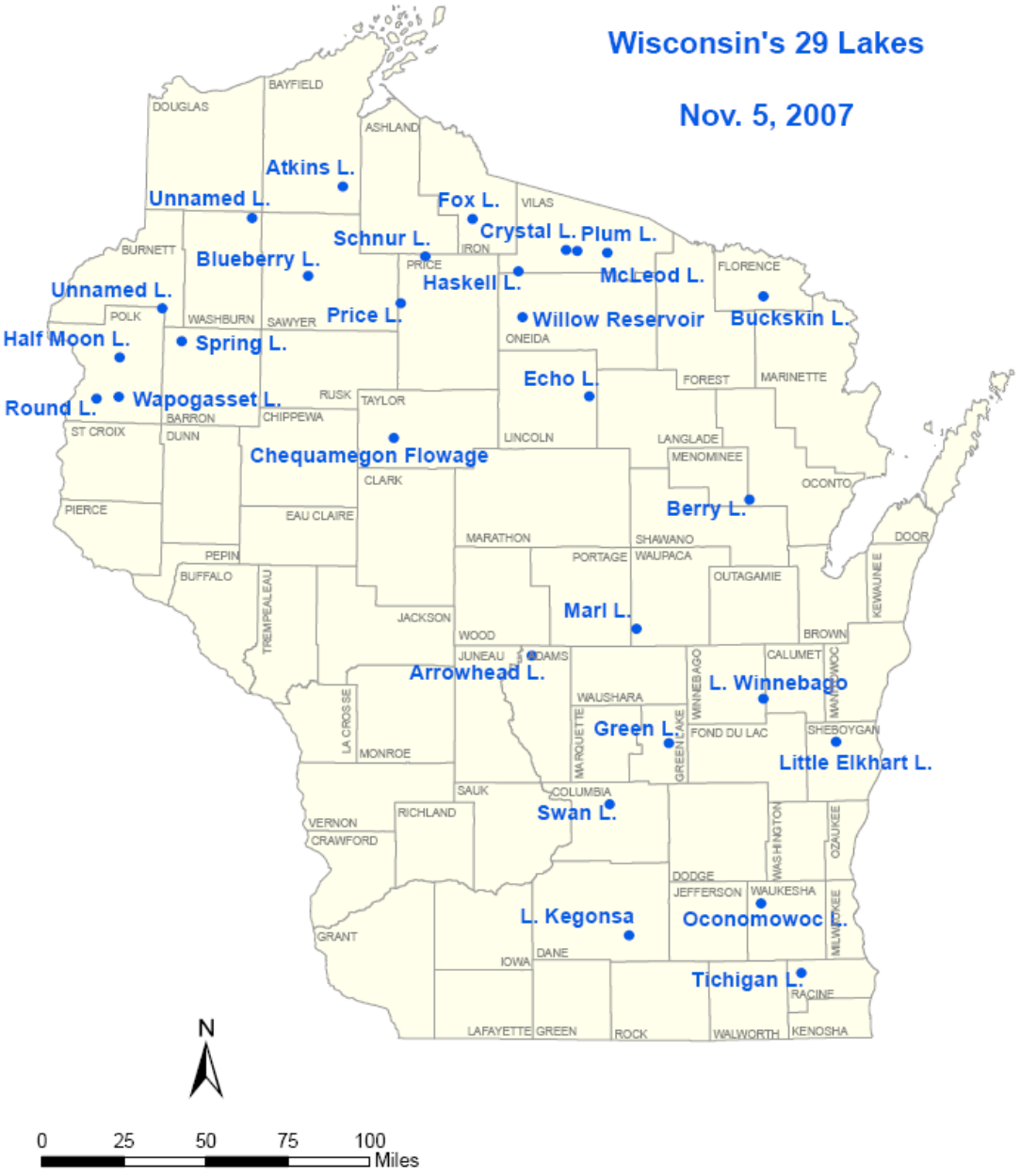
Richard Mitchell, United States Environmental Protection Agency
Neil Kamman, Vermont Agency of Natural Resources

Wisconsin Lakes Convention
Green Bay, WI
4-1-2010

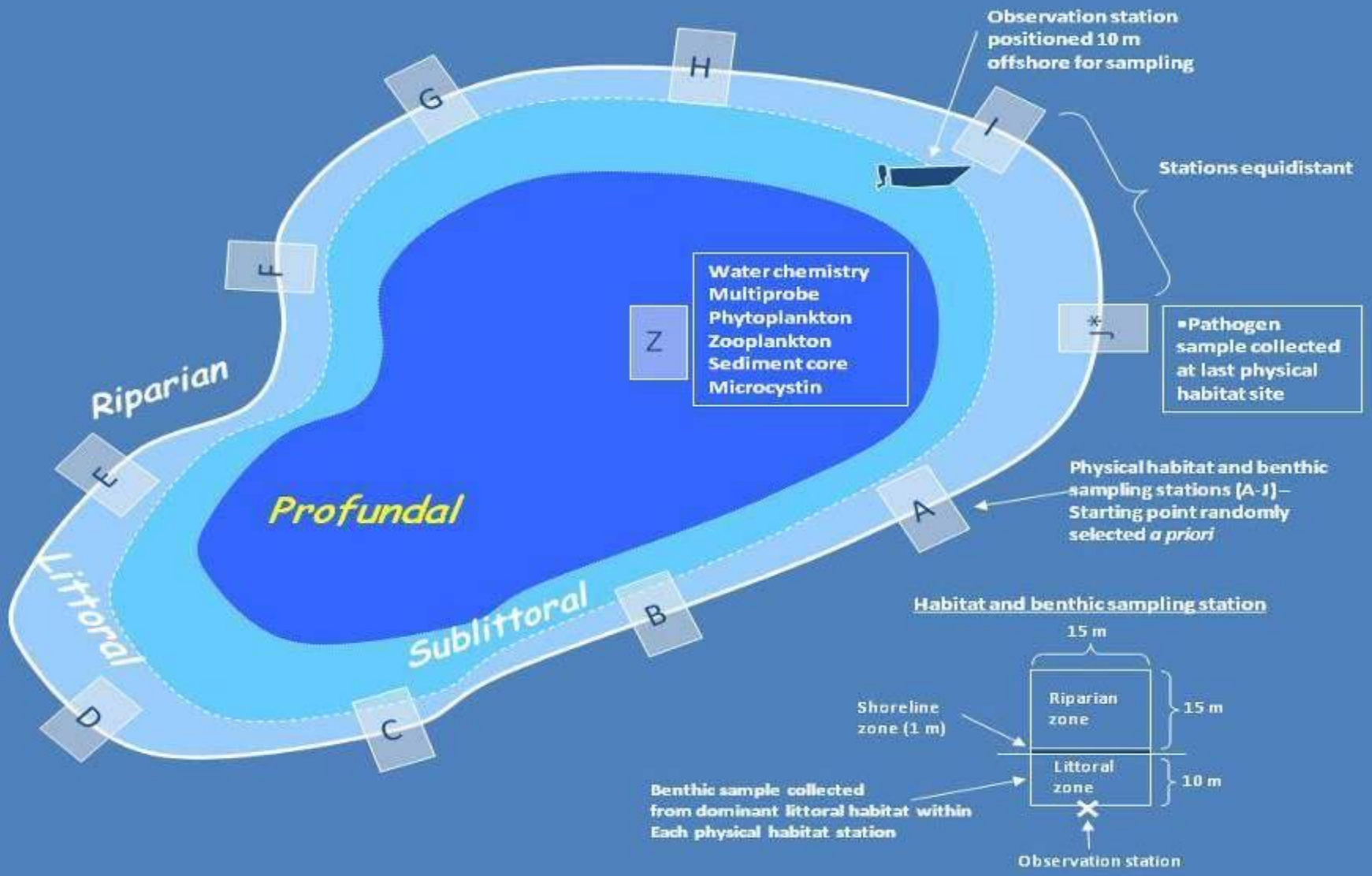
USEPA National Lake Assessment:

Wisconsin's 29 Lakes

Nov. 5, 2007



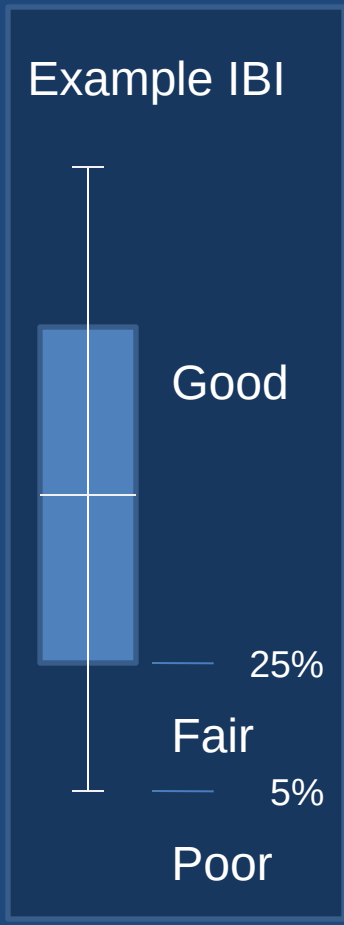
National Lakes Assessment: Sampling Approach



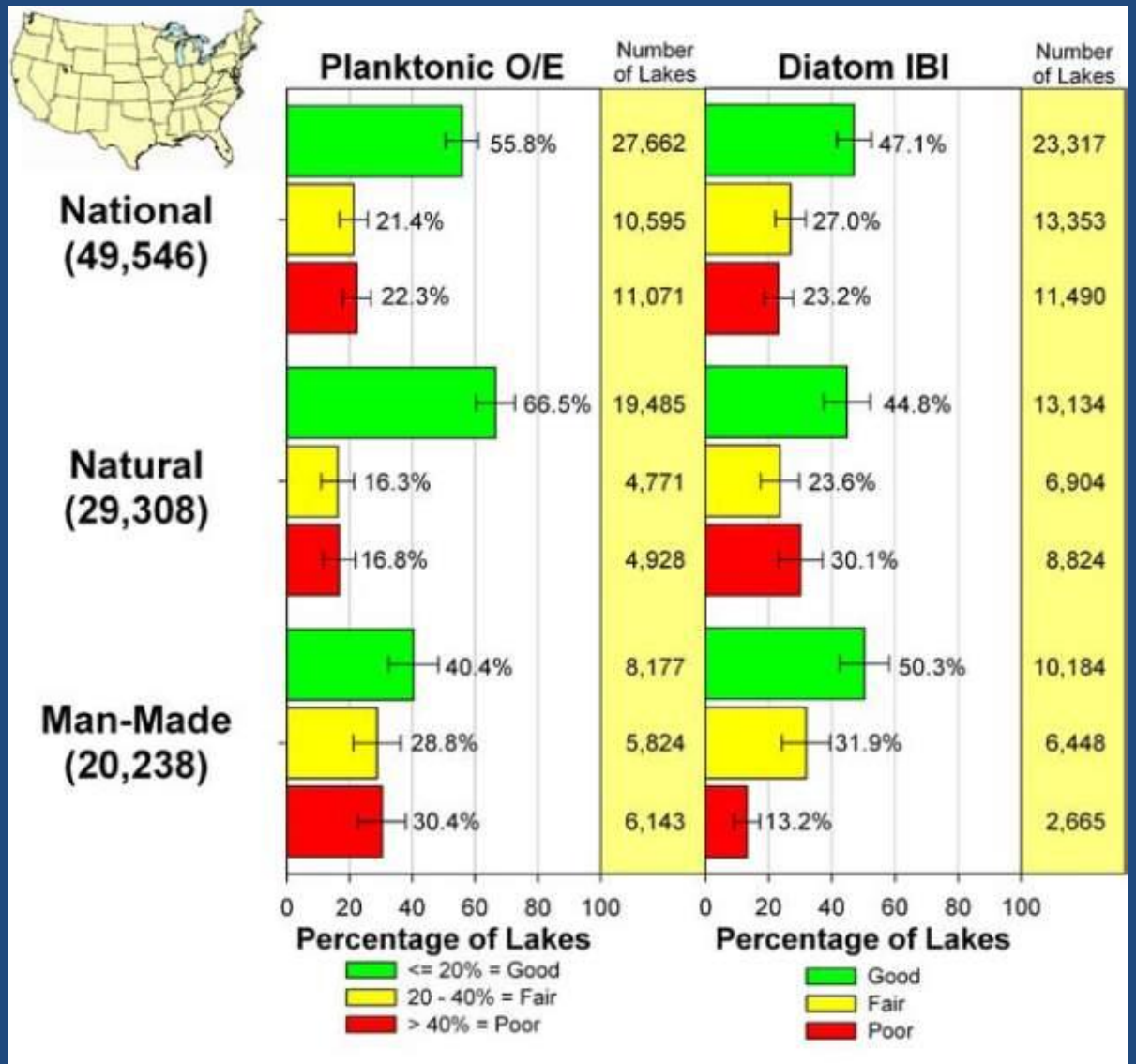
Determining Thresholds: Setting the Bar

For the NLA, two types of thresholds were used to determine condition:

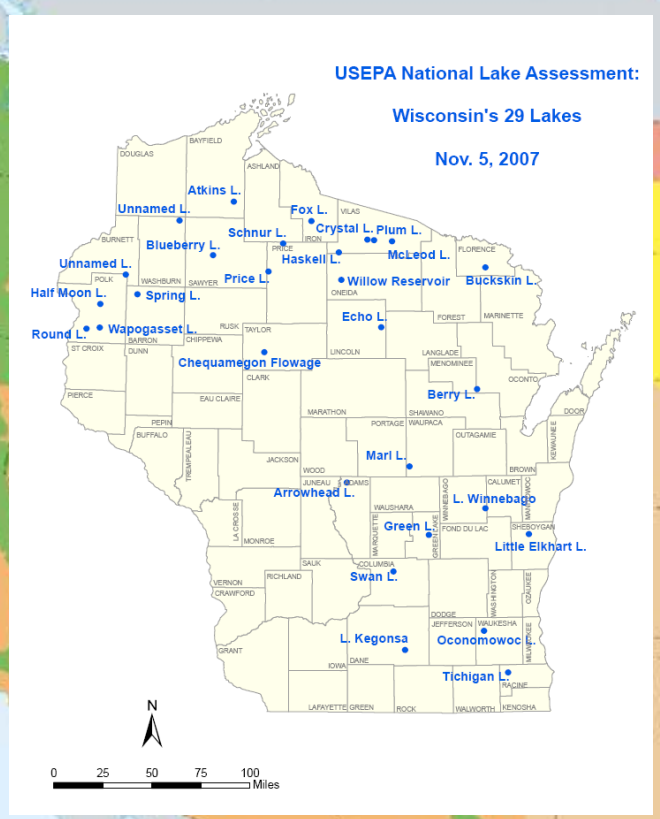
- Nationally-consistent thresholds
  - Fixed values correspond to assessment findings
  - Applied to trophic state and recreational condition
- Regionally reference-based thresholds
  - Fixed percentile defines good/fair and fair/ poor
  - Applied to bioindicators, some habitat indicators and some stressors



Condition of the Nation's Lakes: Biological Condition



Two Ecoregions



Upper Midwest

Temperate Plains

NLA Analysis Regions*

NAP
SAP
CPL
TPL
UMW
SPL
NPL
XER
WMT

*based on Omernik Level III ecoregions

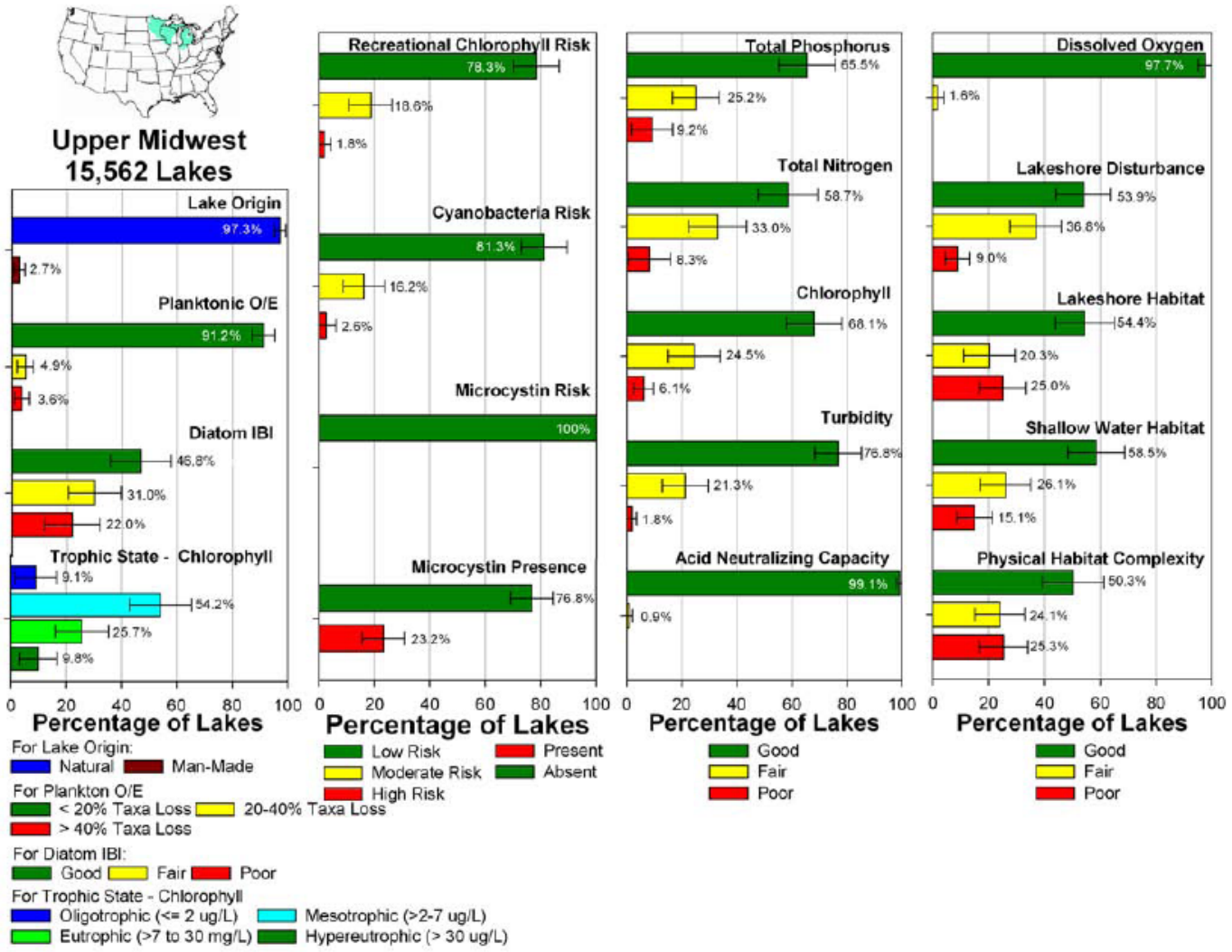


Figure 28. NLA findings for the Upper Midwest ecoregion. Bars show the percentage of lakes within a condition class for a given indicator.

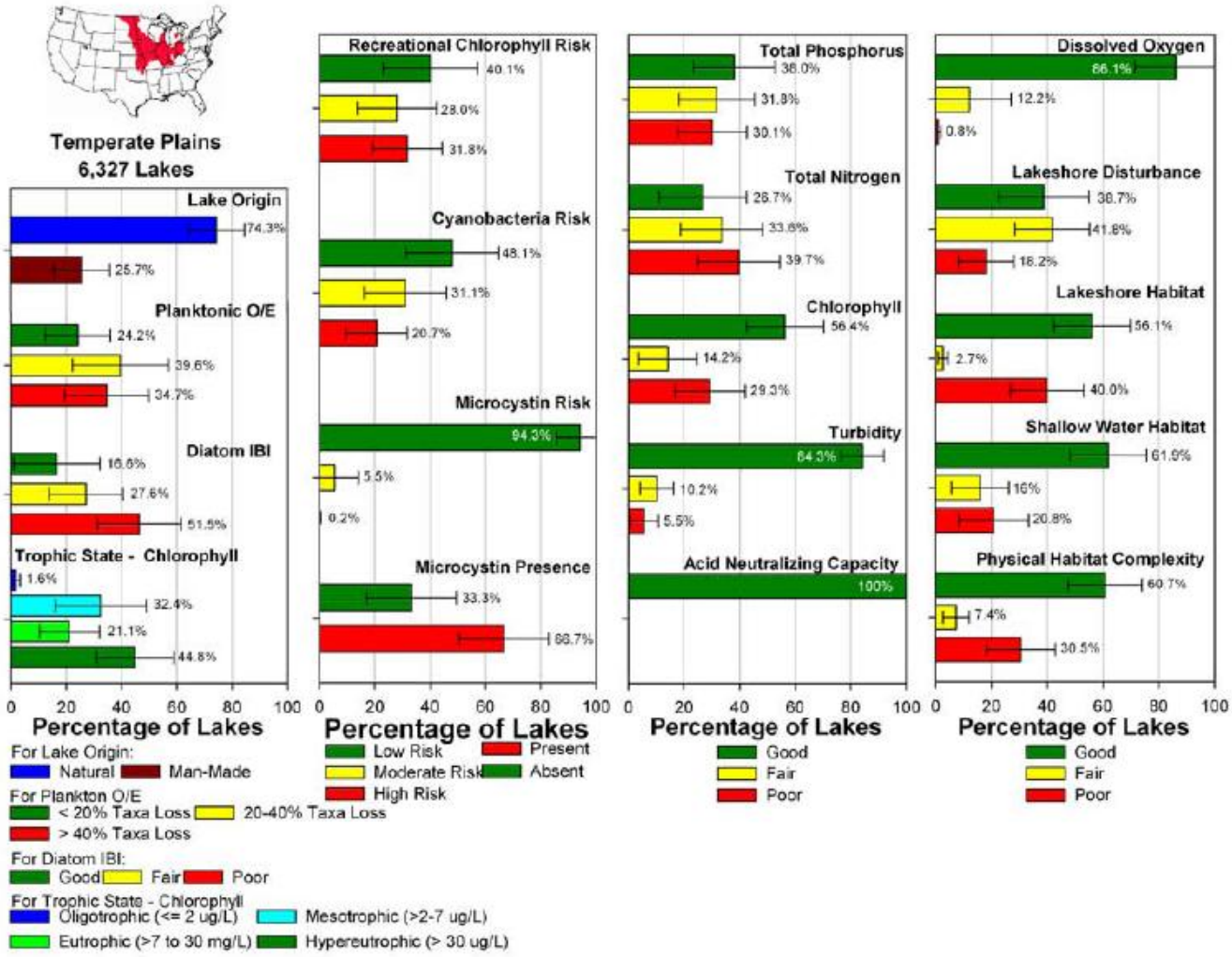
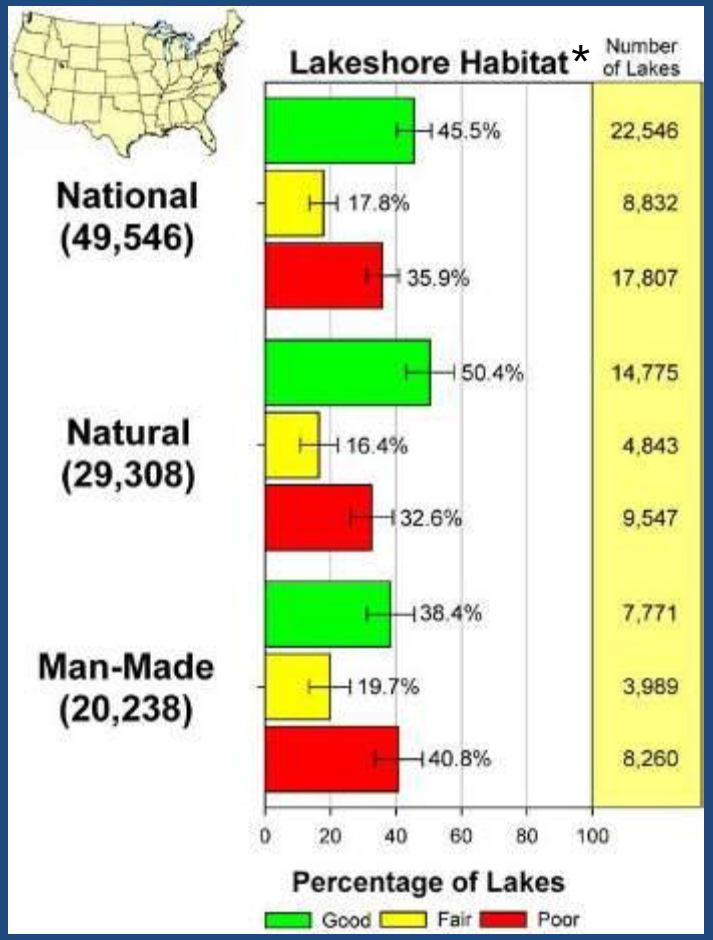


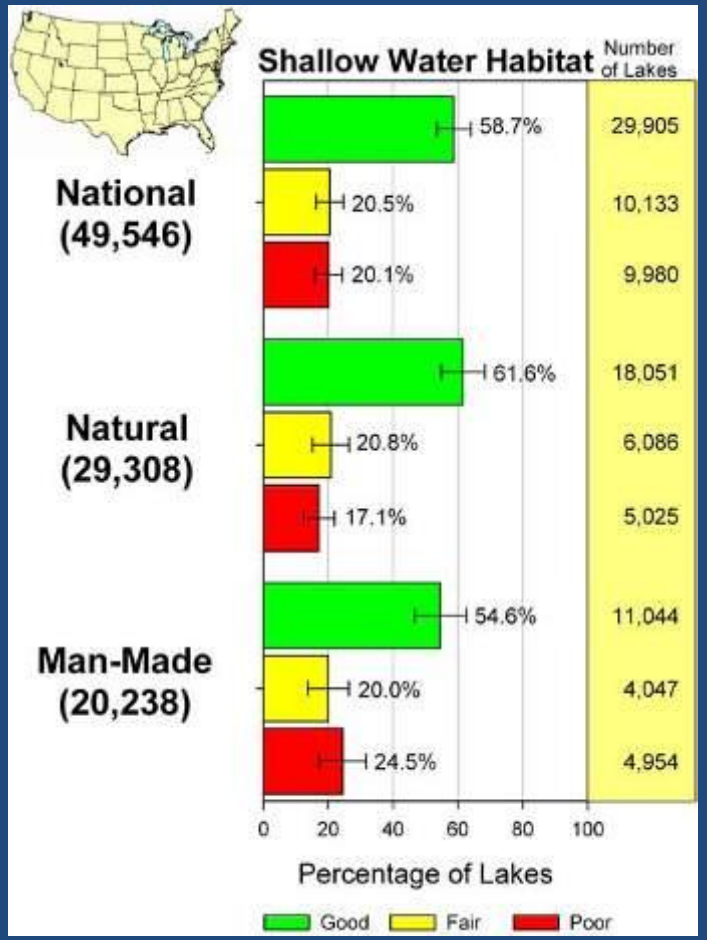
Figure 29. NLA findings for the Temperate Plains ecoregion. Bars show the percentage of lakes within a condition class for a given indicator.

Condition of the Nation's Lakes: Habitat

- 55 individual habitat metrics captured at each site (550/lake).
- Metrics reduced to four indices of habitat quality:
  - Human Disturbance on Lakeshores
  - Riparian Zone Integrity
  - Littoral Zone Integrity
  - Complexity of Riparian/Littoral Interface
- Disturbance index scores assessed against nationally consistent thresholds
- Riparian/littoral indices assessed against regionally-explicit reference conditions (*corrects for expected regional differences*)

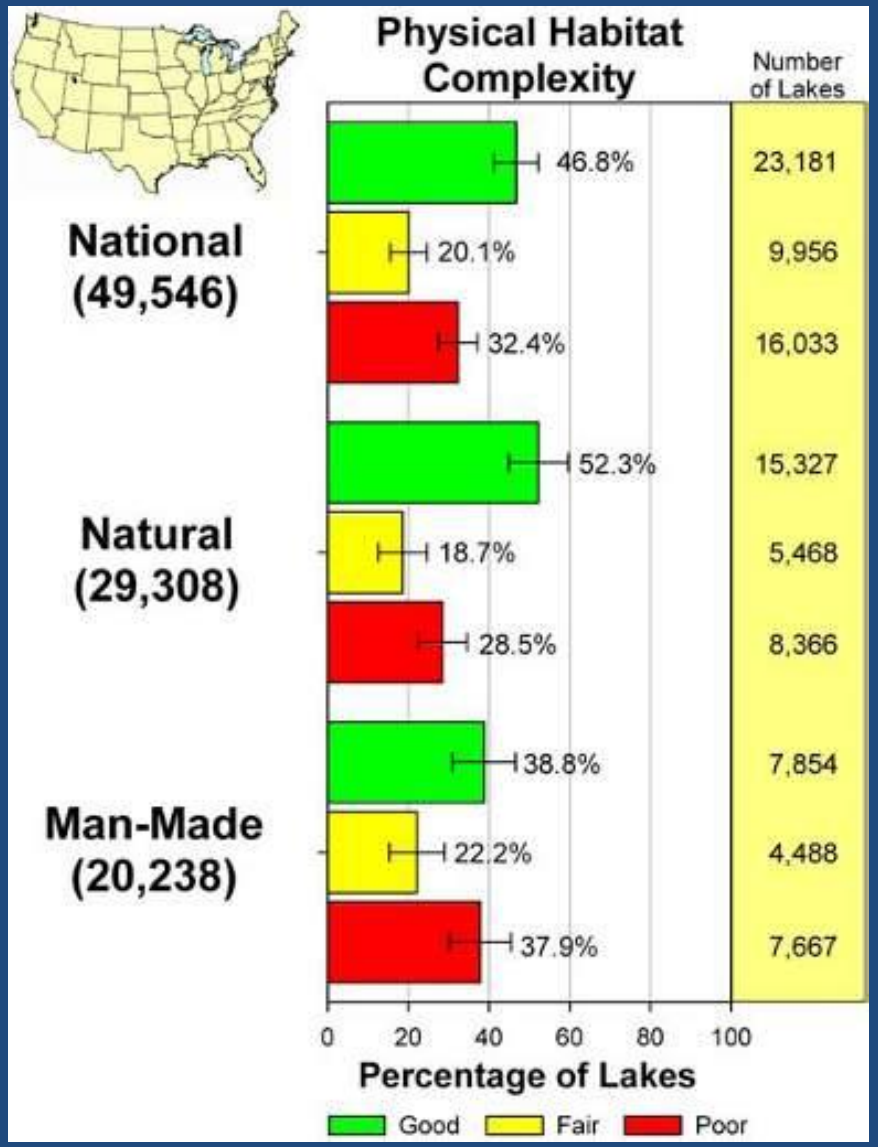
Condition of the Nation's Lakes: Habitat

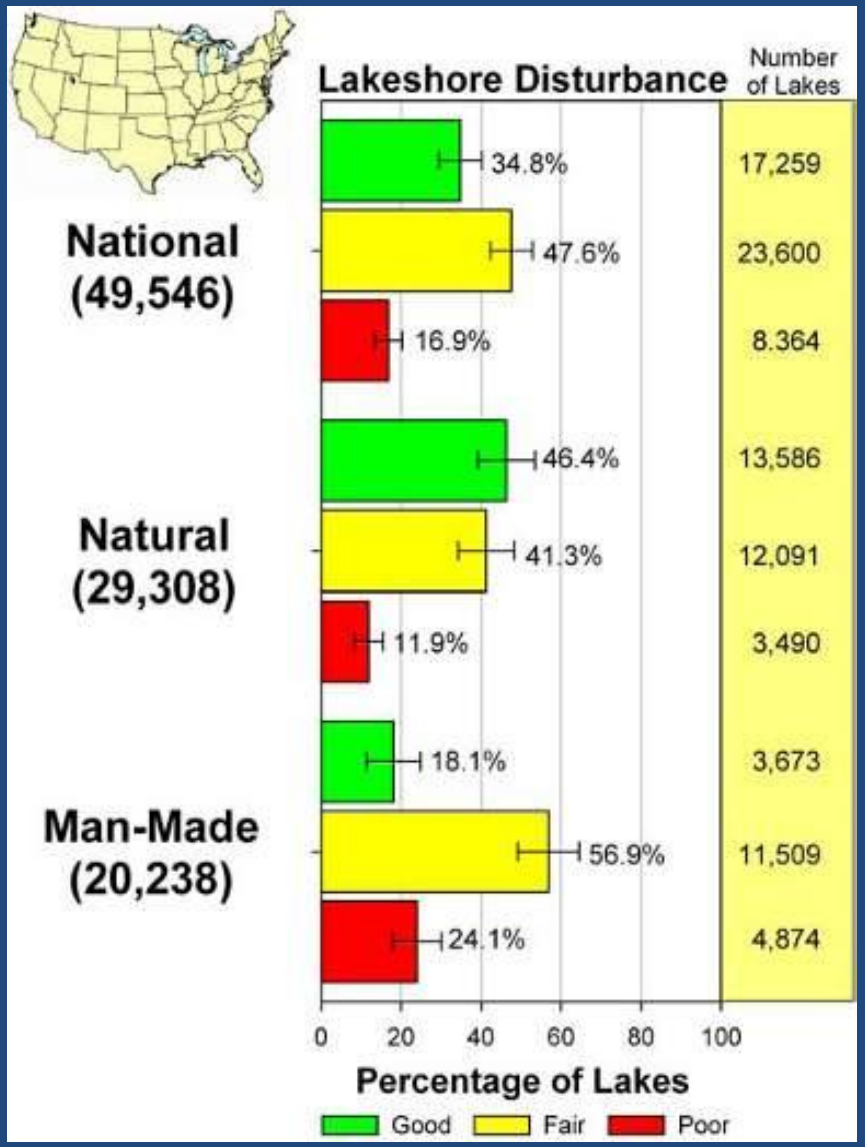




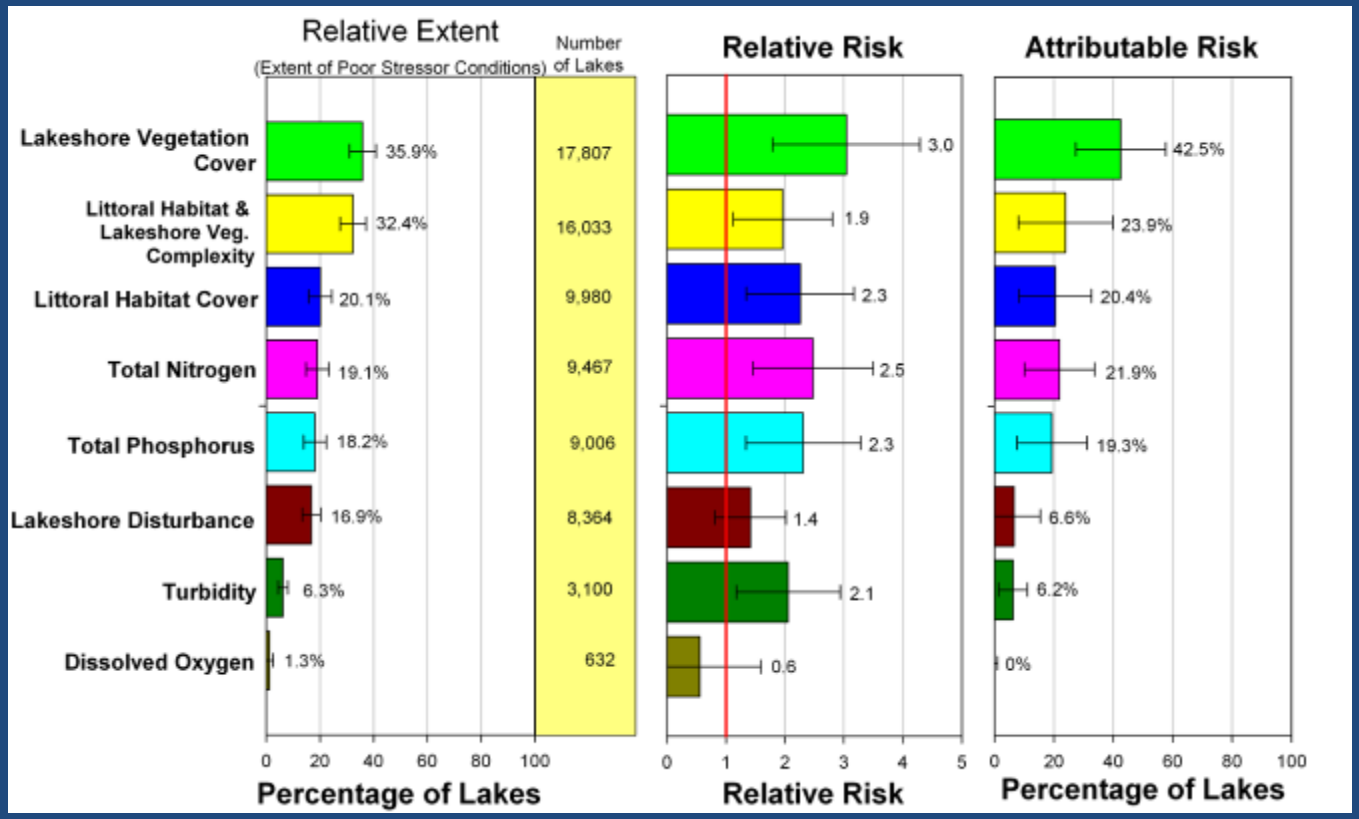
**) NLA Primary indicator is Lakeshore Habitat*

Condition of the Nation's Lakes: Habitat



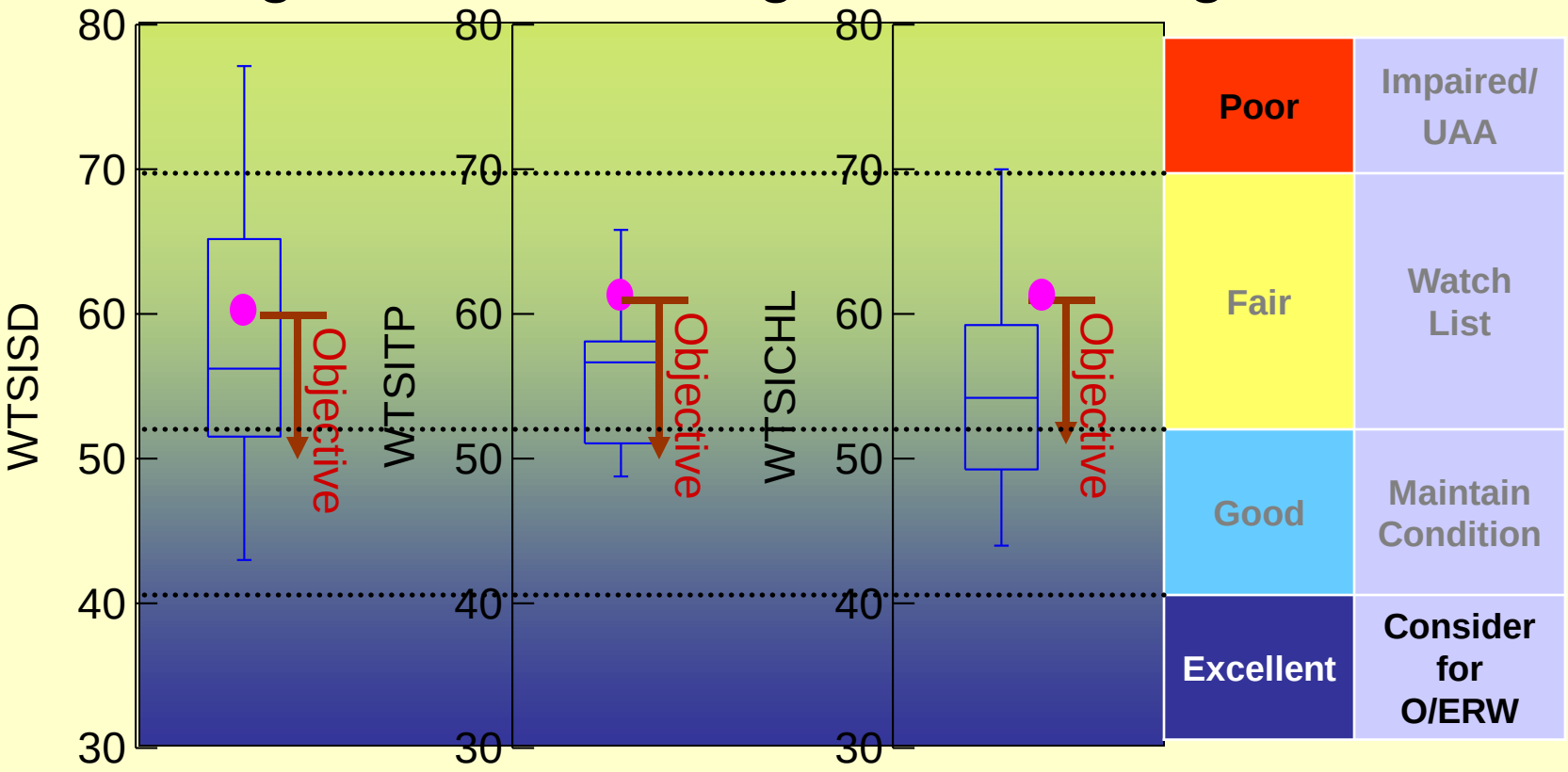


Stressors to the Nation's Lakes: Extent, Relative Risk, and Attributable Risk



- #1 – Lakeshore vegetation: Poor biology is three times more common when lakeshore vegetation cover is in poor condition. This affects 36% of lakes.
- #2 – Nutrients: Poor biology is 2.5 times more common when nutrients are high. This affects about 20% of lakes.

Putting it together – Setting lake specific goals and management strategies



Box plots: Shallow lowland drainage lakes in Southern Wisconsin

● 2003-2005 (mean) Eagle Lake TSI values (summer)


Lake Conditions
Excellent
Good
Fair
Poor
Protect
Manage
Restore
Management Strategy

Management for What?

- Water quality
- Fisheries/Wildlife
- Aquatic Plants
- Shorelands
- Watersheds
- User Conflicts
- AIS
- Other

- Same approach can be used regardless of the management objective

Science- and community-based goal setting process

- Lake monitoring and assessment
- Lake management planning
- Set management objectives that can be realistically evaluated
- Public input and consensus
- Decision-making tied to objectives
- Go for it!

Protection Lake
Characteristics

- Good to excellent lake conditions
- Beneficial uses are being met
- Public satisfied with resource condition
- Low impacted lakes, *generally* smaller, less developed seepage lakes in forested watersheds

Protection Goal

Protection Strategies

Shoreland Management

- Most protective county lake classification
- Control density/impact of new development
- Large lot and buffer dimensional standards
- Deeper setbacks
- Limit key hole development
- Retention of natural vegetation
- Strict pier development - No boat houses
- Septic monitoring and maintenance

Protection Strategies
Watershed Management

- Land use planning and zoning
- Ordinance development and enforcement
  - Stormwater, construction site erosion, wetlands
- Critical Site Identification
  - Environmental corridors
  - Obvious problem sites: feedlots, drain tiles
  - Voluntary deed restrictions, best management practices, acquisition

Protection Strategies
Lake Use

- Boats
  - No wake restrictions
  - Courtesy codes
- Fisheries
  - Voluntary catch and release
  - Special regulations for unique fisheries
- Invasives
  - Shield lakes
  - Boat inspections

Protection Strategies

Education and Information

- Compliance & Stewardship
- Lake Organization
  - Limited
- Monitoring - Secchi, AIS, shoreland watch

Ex. Black Oak Lake

Management Lake
Characteristics

- Good to fair water quality but signs of decline
- Some problems and threats exist that require active management.
  - nusiance plants, user conflicts, public complaints
  - fishing pressure/poor recruitment
  - Growth and development pressure
- Mid sized to larger lakes - Higher watershed to lake area ratios
- Transitional lakes and landscapes

Management Goal

Halt degradation

Manage specific problems

Management Strategies

- Begin with protection plan
- Conduct site and problem specific planning

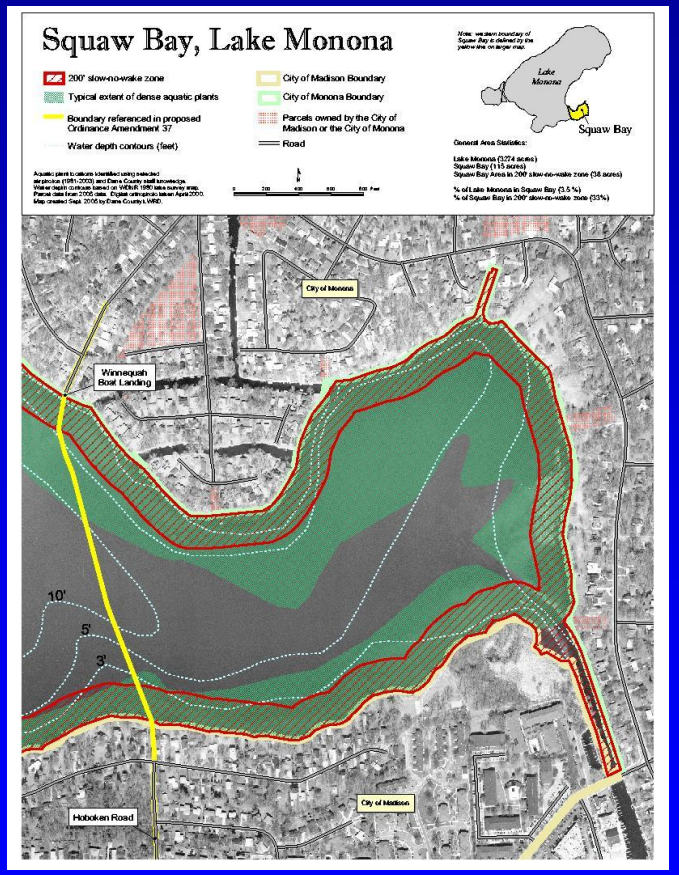
  ex. aquatic plants, watershed management, diagnostic monitoring
- Develop a long range management plan with recommendations

Best Management Practices

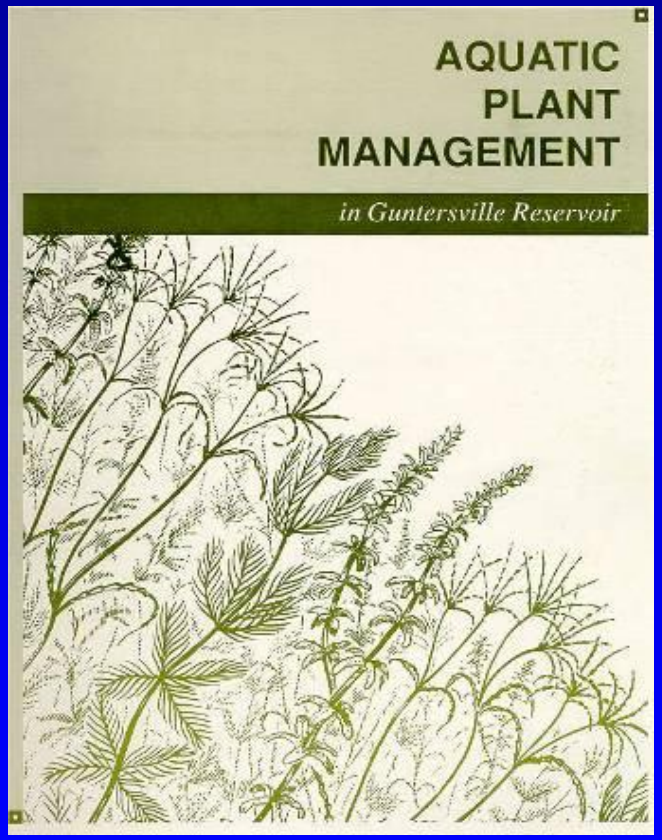
- Urban runoff controls
- Grass waterways
- Buffer strips
- Manure storage/feedlots
- Sediment basins
- Land & Easements Acquisition

Management Strategies
Lake Use

- Aquatic Plant Management Plans
  - Harvesting
  - Sensitive Area Designation
- Boats
  - Time of Day Use Restrictions or No Wake Zones
- Fisheries
  - reduced bag limits
  - protective slots



Aquatic Plant Management Plan



- Goals & Objectives
- Lake Information
- Analysis
- Alternatives
- Recommendations
- Implementation
- Monitoring & Evaluation

http://www.uwsp.edu/cnr/uwexlakes/ecology/APMguide.asp

Restoration Lake

Characteristics

- Poor water quality (“impaired” waters)
- Frequent and potentially toxic algae blooms
- Excessive aquatic plants (often dominated by invasives)
- Not meeting beneficial uses (swimming, boating, aesthetics)
- Imbalanced fisheries - rough fish

Restoration Goal

Return to some pre-existing condition

Restore beneficial uses

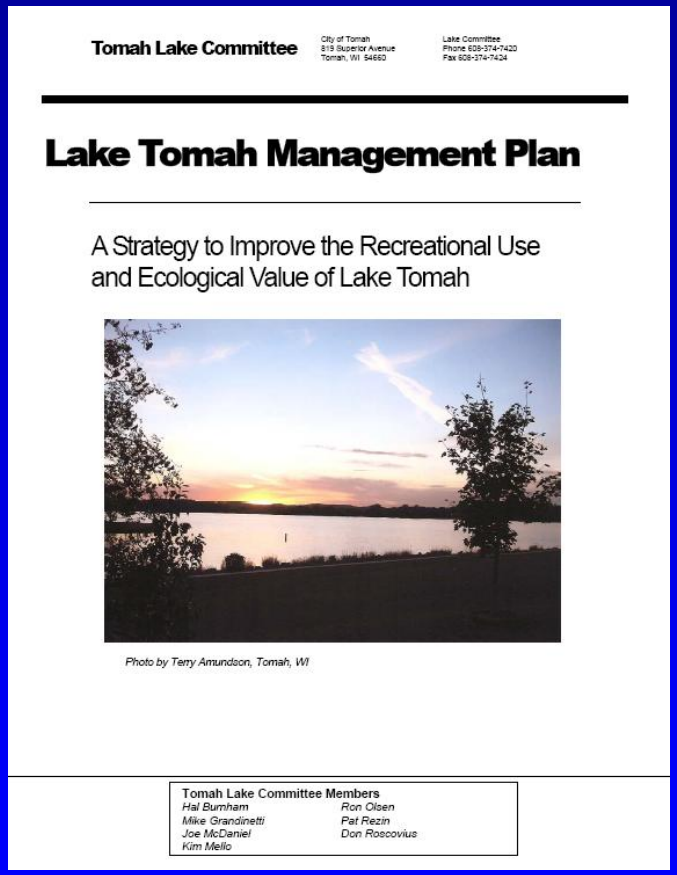
Turbid state

Restoration Strategies
In-lake management

- Alum, nutrient inactivation
- Large-scale herbicide treatments
- Drawdowns
- Biomanipulation
- Fish rehabilitation (rotenone)
- Aeration
- Hypolimnetic (bottom) withdrawals

Lake Tomah Extreme Makeover

- Drawdown (1 yr)
- Carp eradication
- Shoreland restoration
- Watershed assessment
- Ag and urban BMP's
- Boating ordinance
- Fish restocking
- AIS prevention



Tomah Lake Committee

City of Tomah
819 Superior Avenue
Tomah, WI 54660

Lake Committee
Phone 608-374-7420
Fax 608-374-7424

Lake Tomah Management Plan

A Strategy to Improve the Recreational Use and Ecological Value of Lake Tomah

Photo by Terry Amundson, Tomah, WI

Tomah Lake Committee Members

Hal Burnham
Mike Grandinetti
Joe McDaniel
Kim Mello
Ron Olsen
Pat Rezin
Don Roscovius

Lake Tomah Restoration and Rehabilitation - WDNR - Windows Internet Explorer provided by Wisconsin DNR

http://dnr.wi.gov/fish/pages/laketomah.html

File Edit View Favorites Tools Help

Lake Tomah Restoration and Rehabilitation - WDNR

Wisconsin Department of Natural Resources

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Extreme Makeover - Lake Tomah Edition

A project now unfolding on Tomah's namesake lake aims to transform it from a carp-infested, algae-choked waterbody into a community asset with clean water, healthy plants that can help keep it that way, and good fishing.

News Release: Lake Tomah carp removal project aims at improved fishery, lake habitat (10/20/09)

Reclaiming Lake Tomah [VIDEO Length 7:12]

The project partners include the City of Tomah, its Tomah Lake Committee, DNR, the Monroe County Land Conservation Department, and individual citizens and fishing club members. A U.S. Environmental Protection Agency grant funded the chemical treatment and a DNR Lake Protection grant will pay for shoreline habitat restoration work.

Lake Tomah is on its way to becoming a healthy fishery.

Background

- Lake Tomah Management Plan [exit DNR]
- Lake Tomah Environmental Assessment [PDF 1.18MB]

Efforts to Reduce Runoff

Monroe County conservation staff have worked hard with farmers to reduce erosion and runoff from their fields to keep soil, fertilizer and manure from entering Lake Tomah. Most recently, workshops helped farmers develop plans guiding when, where and how much manure and commercial fertilizer to apply to meet crop needs while reducing the excess that can wash into the lake. As a result of these Nutrient Management Plans, farmers will save an estimated $60 an acre in fertilizer costs and Lake Tomah will have less algae-fueling phosphorus.

- Map of nutrient management plans produced by farmers. [PDF 5.81MB]
- Little Lemonweir River Watershed

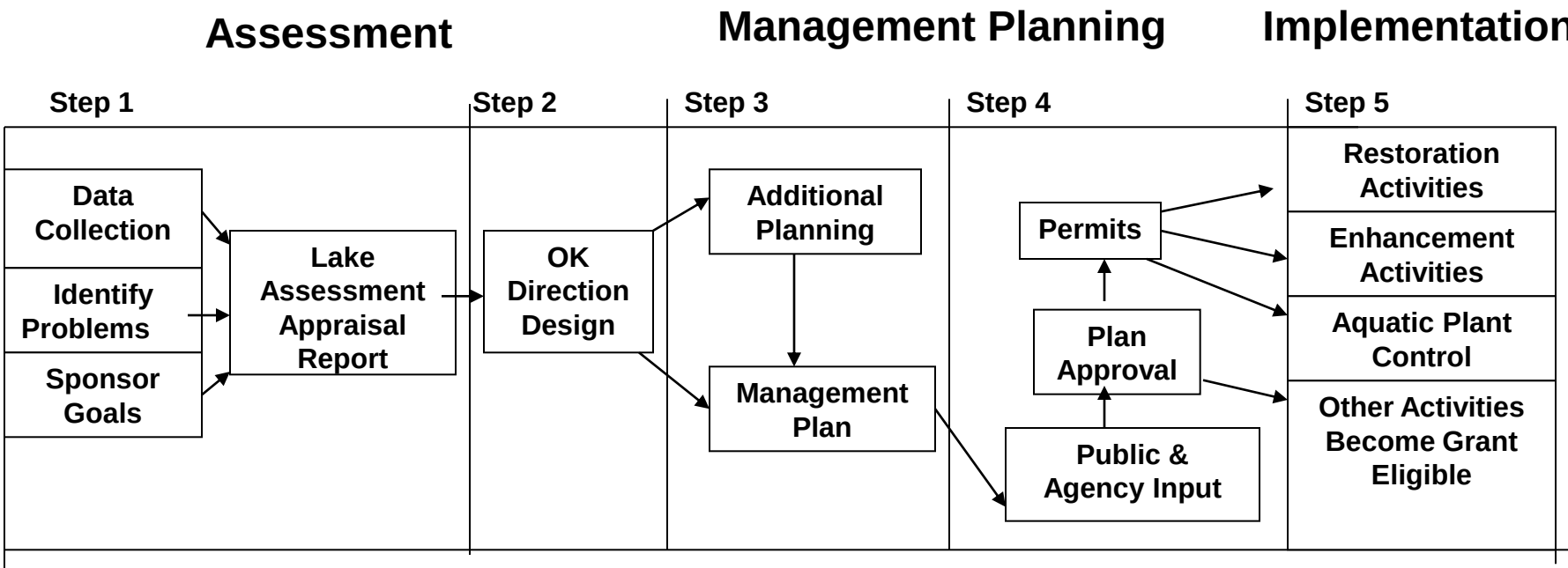
History

- Lake Tomah drawdown and restoration to begin September 8 - (08/05/09)
- Bag, size and possession limits lifted from Lake Tomah - (02/12/09)
- City officials envision new life for carp infested Lake Tomah - (01/26/09)

Last Revised: Wednesday November 04 2009

Internet 100%

What are we trying to accomplish?



Protection Grant Activities NOT requiring an approved *lake* plan*.

- Land Acquisition
- Wetland/Shoreland Restoration
- Ordinance Development