Consultants Roundtable: Improving Lake Management and Planning Services Provided to Local Lake Organizations



WISCONSIN LAKES CONVENTION WORKSHOP

March 18, 2009

Presenters

Tim Asplund, Statewide Limnologist, WDNR

Carroll Schaal, Lakes Team Leader, WDNR

Frank Koshere, Water Resources Biologist from Northern Region, WDNR

Kevin Gauthier, Lakes Coordinator from Northern Region, WDNR

Matt Sunseri, Pesticide Specialist with WDATCP

Dwight Osmon, water resources planner for Hey and Associates, Incorporated and NALMS CLM/CLP Program contact

Objectives of workshop

- Improve lake management services provided to local lake organizations
- Communicate Department's expectations and requirements for lake management plans and implementation projects
- Gather feedback from lake management professionals on existing guidance and future needs
- Promote Healthy Lake Ecosystems and Full Range of Recreational Opportunities!

Lake Grants

Application Fee to
DNR - 4 FTEs/$300K

APM Plan → **APM Permit**

AIS →

Adaptive Management

Incentives Approach

Add Incentives & Remove Dissatisfiers

Environmental Outcome

Lake Plan & Program Review ← **Compliance Monitoring Enforcement**

<u>AIS Grants (Quick-claim)</u>

Application fees

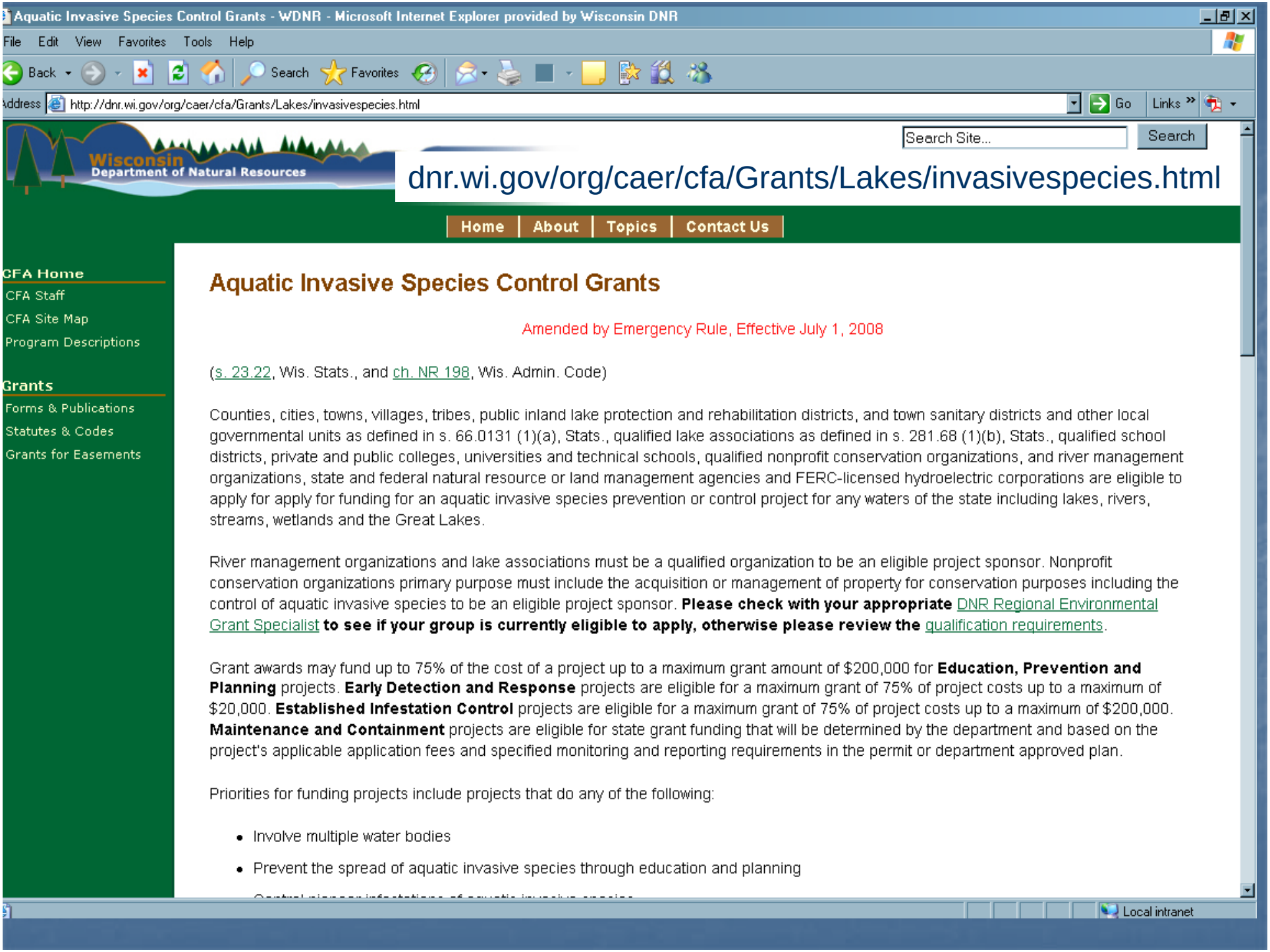
Cost of Monitoring & Reporting

Citizen Monitoring

County oversight?

Record-Keeping

Reporting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Aquatic Invasive Species Control Grants
Amended by Emergency Rule, Effective July 1, 2008
(s. 23.22, Wis. Stats., and ch. NR 198, Wis. Admin. Code)
Counties, cities, towns, villages, tribes, public inland lake protection and rehabilitation districts, and town sanitary districts and other local governmental units as defined in s. 66.0131 (1)(a), Stats., qualified lake associations as defined in s. 281.68 (1)(b), Stats., qualified school districts, private and public colleges, universities and technical schools, qualified nonprofit conservation organizations, and river management organizations, state and federal natural resource or land management agencies and FERC-licensed hydroelectric corporations are eligible to apply for apply for funding for an aquatic invasive species prevention or control project for any waters of the state including lakes, rivers, streams, wetlands and the Great Lakes.
River management organizations and lake associations must be a qualified organization to be an eligible project sponsor. Nonprofit conservation organizations primary purpose must include the acquisition or management of property for conservation purposes including the control of aquatic invasive species to be an eligible project sponsor. Please check with your appropriate DNR Regional Environmental Grant Specialist to see if your group is currently eligible to apply, otherwise please review the qualification requirements.
Grant awards may fund up to 75% of the cost of a project up to a maximum grant amount of $200,000 for Education, Prevention and Planning projects. Early Detection and Response projects are eligible for a maximum grant of 75% of project costs up to a maximum of $20,000. Established Infestation Control projects are eligible for a maximum grant of 75% of project costs up to a maximum of $200,000. Maintenance and Containment projects are eligible for state grant funding that will be determined by the department and based on the project's applicable application fees and specified monitoring and reporting requirements in the permit or department approved plan.
Priorities for funding projects include projects that do any of the following:
Involve multiple water bodies
Prevent the spread of aquatic invasive species through education and planning
Local intranet

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Wisconsin Department of Natural Resources

dnr.wi.gov/lakes/aquaplan.htm Search

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Aquatic Plant Laws - Contacts

- Contacts
- Aquatic Plant Managemen Fact Sheet (PDF, 115KB)
- NR 107(Chemical) (PDF, 24KB)
- NR 109(Manual / Mechanical) (PDF, 19KB)

Aquatic Plant Management(APM) News

- Aquatic Plant Control Rules News
- Invasive Press Releases
- West Nile Virus Bird Surveillance
- Controlling Mosquitoes Around Your Home
- West Nile Virus and Wetlands (PDF, 232KB)

APM Tools

- Aquatic Plant Managemen in Wisconsin
- Aquatic Plants Mgmt. Worksheet (XLS, 760KB)

Wisconsin's Aquatic Plant Management and Protection Program

The role that trees play in a forest is much like the role of aquatic plants in a lake. We have become aware of the consequences of poor logging practices on the inhabitants of the forest ecosystem. We need to recognize that poor or irresponsible activities designed to control aquatic plants may have unanticipated and adverse effects on all the creatures that need and use the lake ecosystem... including us. Aquatic plants are the very foundation of a healthy lake ecosystem.

In order to protect diverse and stable communities of native aquatic plants and prevent the spread of invasive aquatic plants, many aquatic plant management and nuisance control activities require a permit issued by the Department. ***Please read the specific exceptions below and/or contact your local aquatic plant management coordinator before engaging in any aquatic plant management or nuisance control activities.***

WHY:

Aquatic plants form the foundation of healthy and flourishing lake ecosystems - both within lakes and rivers and on the shores around them. They not only protect water quality, but they also produce life-giving oxygen. Aquatic plants are a lake's own filtering system, helping to clarify the water by absorbing nutrients like phosphorus and nitrogen that could stimulate algal blooms. Plant beds stabilize soft lake and river

Local intranet

Lake Ecology - Microsoft Internet Explorer provided by Wisconsin DNR

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

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UW Extension

Lakes Program

A part of the Wisconsin Lakes Partnership

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Aquatic Plant Management in Wisconsin

Full APM Guide (excluding appendices F - I)

APM Guide Excerpts

- Preface and Table of Contents
- Chapter I - Aquatic Plant Management (APM) in Wisconsin (pdf)
- Chapter II - Components of a Seven-Step APM Plan (pdf)
- Chapter III - Specific Elements of Your Aquatic Plant Management Plan (pdf)
- Chapter IV - Management Options for Aquatic Plants (pdf)

Appendices

A. Glossary of Common Lake Terms (pdf)
B. Protocol for Aquatic Plant Survey - Collecting, Mapping, Preserving and Data Entry(pdf)
C. Wisconsin Trophic Status Index (pdf)
D. Collecting and Pressing Plants(pdf)
E. How to Calculate Floristic Quality Index (excel)
F. Aquatic Plant Survey Field Data Worksheet (excel)
G. Pre and Post Treatment Evaluation of Aquatic Plant (pdf)
H. Compute Pre and Post Treatment Data Worksheet (excel)
I. Response for Early Detection of EWM Field Protocol(pdf)

Shortcut to Cover-APMguide-color.pdf

Internet

Workshop Overview

1) Overview of Lake Planning, Protection, and AIS Grant Program – Carroll
2) Aquatic Plant Management Planning, the APM Guide, and northern lake issues – Frank
3) Aquatic Plant Management and AIS Pre/Post Treatment Protocols and Reports - Kevin
4) Guidelines for large scale to whole lake scale herbicide treatments for AIS and recent findings – Tim
5) DATCP's role in aquatic pesticide regulation and upcoming issues – Matt
6) Discussion – Suggestions for improving the State's administration and oversight of grant-funded projects
7) NALMS CLM/CLP program – Dwight

Guidelines for large scale to whole lake scale herbicide treatments for AIS and recent findings

DRAFT FOR DISCUSSION

Wisconsin Lakes Convention
March 18, 2009

Evolving approach to APM in WI

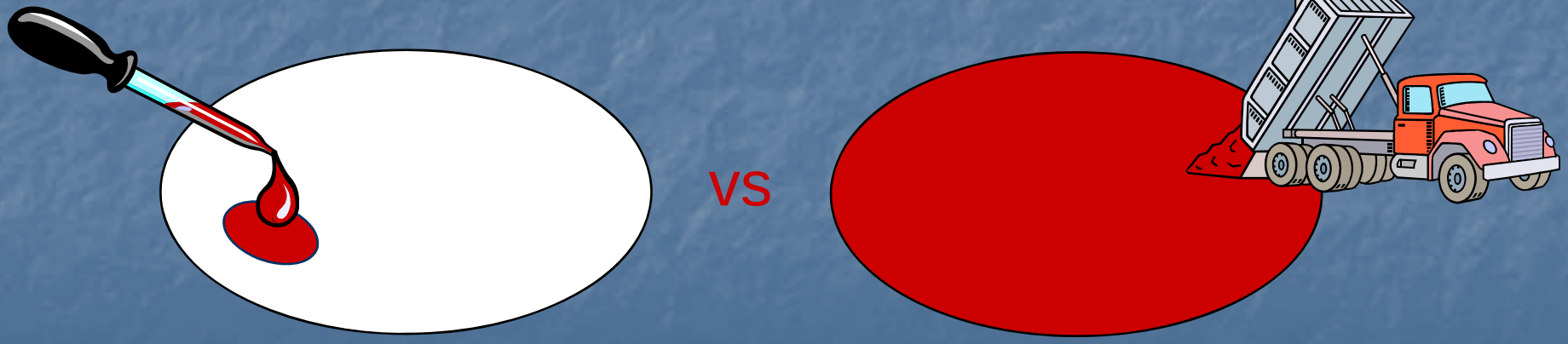
- Focus on invasive species (EWM, CLP)
- Increased emphasis on restoration vs nuisance relief goals
- Plan approval → grants → permits
- Whole lake scale management (not necessarily whole lake treatments)
- Evaluation and monitoring in an adaptive management framework
- Prevention and Education!

Recent interest in WI for large-scale treatments

-The WDNR has authority over the use of chemical treatment in public waters (but does not initiate chemical treatments or apply chemicals – permit approval)

-Detailed regulatory procedures are outlined in Ch. NR 107, Wis. Adm. Code
Includes DNR's legal responsibility to understand effectiveness of chemical treatments not only as tool for nuisance relief, but also potential ecosystem effects* before approving permit applications

Q: So what's the big deal?
A: Spatial scale!



Large-scale treatment = Whole ecosystem manipulation?

NR 107 Aquatic Plant Management – Chemical Use.

"NR 107.01. Purpose. The purpose of this chapter is to establish procedures for the management of aquatic plants and control of other aquatic organisms pursuant to s. 227.11 (2) (a), Stats., and interpreting s. 281.17 (2), Stats. A balanced aquatic plant community is recognized to be a vital and necessary component of a healthy aquatic ecosystem. The department may allow the management of nuisance-causing aquatic plants with chemicals registered and labeled by the U.S. environmental protection agency and labeled and registered by firms licensed as pesticide manufacturers and labelers with the Wisconsin department of agriculture, trade, and consumer protection. ***Chemical management shall be allowed in a manner consistent with sound ecosystem management and shall minimize the loss of ecological values in the water body****."*

Do I Need a Permit?

- **NR 107.02 Applicability.** Any person sponsoring or conducting chemical treatment for the management of aquatic plants or control of other aquatic organisms in waters of the state shall obtain a permit from the department.
- Waters of the state include those portions of Lake Michigan and Lake Superior, and all lakes, bays, rivers, streams, springs, ponds, wells, impounding reservoirs, marshes, watercourses, drainage systems and other ground or surface water, natural or artificial, public or private, within the state or its jurisdiction as specified in s. 281.01 (18), Stats.

NR 107 Aquatic Plant Management – authorities to review large-scale projects.

The Department shall issue or deny a permit within 10-15 days unless…

(1)*(a)* an environmental impact report or statement is required…no action may be taken until the report or statement has been completed.

The Department may deny issuance of the permit if…

(3)*(f) the proposed chemical application is for waters beyond 150 feet from shore except where approval is given by the department to maintain navigation channels, piers or other facilities used by organizations or the public including commercial facilities;*

When should an EA be completed?

- For projects involving more than 160 acres or more than 50% of the lake area, an Environmental Assessment following NR150 guidelines for *Type II* projects SHOULD be conducted
- For projects involving less than 160 acres or less than 50% of the lake area, an Environmental Assessment following NR150 guidelines for *Type III* projects MAY be required.

Permit Decisions: Need to be reasonably certain that “the proposed treatment” will NOT:

(3)(d) …result in a hazard to humans, animals or other non-target organisms;

(3)(e) …result in a significant adverse effect on the body of water;

(3)(g) …significantly injure fish, fish eggs, fish larvae, essential fish food organisms or wildlife, either directly or indirectly through habitat destruction;

(4) New applications will be reviewed with consideration given to the cumulative effect of applications already approved for the body of water…

(Wisconsin Administrative Code, NR 107.05)

Why do we care?

Plants = nutrient uptake, erosion control, fish habitat
Too much algae = poor water clarity, aesthetics (odors), health, affect fish
Fish = important component of ecosystem, important to WI economy and legacy

2,4-D Toxicity Thresholds
Human Health

- Human drinking water 2,4-D acid = **70 µg/L (ppb)**
- Irrigation water = **100 µg/L (ppb)**
- Human swimming standards
  - Adult 2,4-D acid = **9800 µg/L**
  - Adult butoxyethyl ester of 2,4-D acid= **1200 µg/L**
  - Child 2,4-D acid = **3600 µg/L**
  - Child butoxyethyl ester of 2,4-D acid= **900 µg/L**

Aquakleen Laboratory Toxicity Study

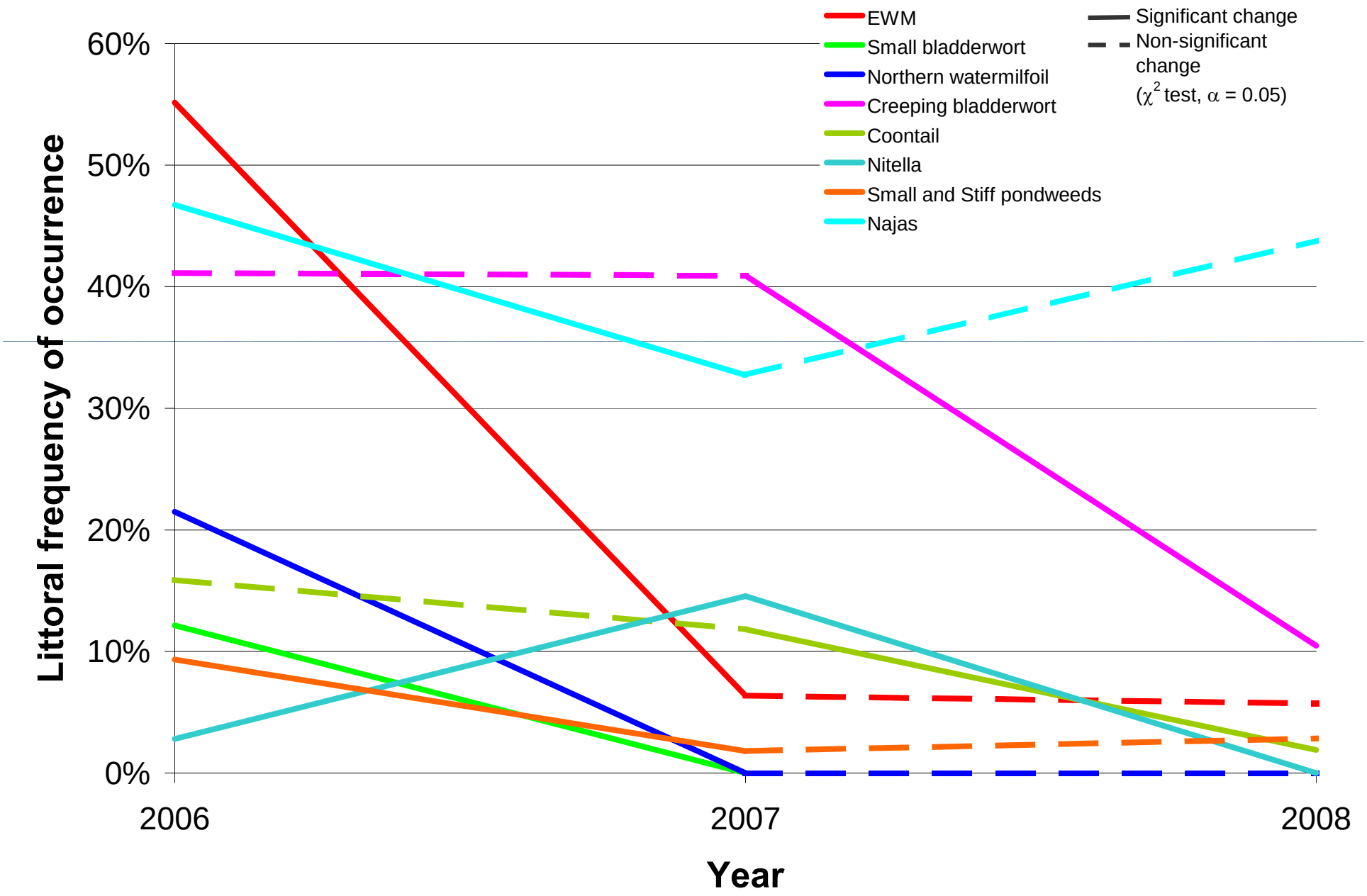
Fish 96hr LC50

(concentration at which 50% of fish fry were dead after 96 hours)

- Brook trout fry - **760 µg/L (ppb)**
- Walleye fry - **660 µg/L (ppb)**
- Fathead minnow - **2220 µg/L (ppb)**
- In addition, the 48-hr LC50 for the amphipod *Hyallela azteca* was determined to be **600 µg/L (ppb).**

Paul, E., Johnson, S, and Skinner, K.M. 2006. Fish and Invertebrate Sensitivity to the Aquatic Herbicide Aquakleen, Journal of Freshwater Ecology, vol 21. 163 - 168.

Spring Lake Macrophytes following large scale 2,4-D treatments



Considerations for large-scale projects:

- Stable state shift possible? (Mixed vs shallow lake, algal vs plant dominated)
- New introduction to previously uninfested region of state?
- Restoration vs nuisance relief goals?
- Ability of native plants to recolonize areas when milfoil dies off?
- Likelihood of success and long term efficacy?
- Cost!!

Management Questions

When do risks of chemical treatment outweigh benefits of managing EWM or CLP?

- Species diversity, scale issues, toxicity risk, water quality concerns, extent of infestation

Choosing the right management tool for the situation:

- Pioneer, expanding or established infestation
- Transferability of results from small to large scale
- Isolated beds vs scattered colonies
- Different approaches depending upon species of concern

How do we move forward in an adaptive management framework – setting goals, monitoring, and evaluation?

Working Definitions

- Small scale = <10 acres or 10% of littoral zone
- Large scale = Between 10 and 160 acres and less than 50% of littoral zone
- Whole-lake scale = >160 acres or 50% of littoral zone

Applicability

- Treatments involving *established populations* of Eurasian water milfoil and/or curly-leaf pondweed
- All grant funded projects
- All "large-scale" and whole lake scale NR107 permits (> 10 acres or >10% of lake area)
- Projects outside the current "confines" of NR107:
  - *e.g. the proposed chemical application is for waters beyond 150 feet from shore or along undeveloped shorelines (excluding parks) OR*
  - *involving an experimental use permit (field evaluation use permits); OR*
  - *not in accordance with label instructions and uses (use of granular 2,4-D at a "whole-lake" scale?)*

Large to whole lake scale treatment expectations

- Approved APM plan following APM Guide
- A recent baseline aquatic plant survey using the Point-Intercept (PI) method
- A map documenting the proposed treatment areas following Pre and Post treatment evaluation protocol
- Monitoring and evaluation plan
- Technical review by statewide team (esp. for first-time, whole lake or experimental projects)
- Meets NR107 and NR150 requirements

NR 107 Aquatic Plant Management – Conditions

NR 107.08 Conditions of the permit.

(1) The department may stop or limit the application of chemicals to a body of water if at any time it determines that **chemical treatment will be ineffective**, or will result in unreasonable restrictions on current water uses, **or will produce unnecessary adverse side effects on nontarget organisms**.

(3) Chemical applications on lakes and impoundments are limited to waters along developed shoreline including public parks **except where approval is given by the department for projects of public benefit**.

(4) Treatment of areas containing high value species of aquatic plants shall be done in a manner which will not result in adverse long–term or permanent changes to a plant community in a specific aquatic ecosystem.

Treatment Considerations

- Timing
- Herbicide products and formulations
- Application rates
- Weather conditions
- Flowing water
- Lake type
- Target and non-target plant species

Timing: "early season" approach

- Target window is after ice out, but before water has warmed for optimal native plant growth
- EWM/CLP should be actively growing, but before reaching full growth stage; 6 inches or more – may require site visit
- generally mid-April to mid-May, depending on climate and latitude;
- Endothall has minimum temperature requirements, while other herbicides do not (55 – 60 degrees F)
- Treatments after June 1 only if cool spring

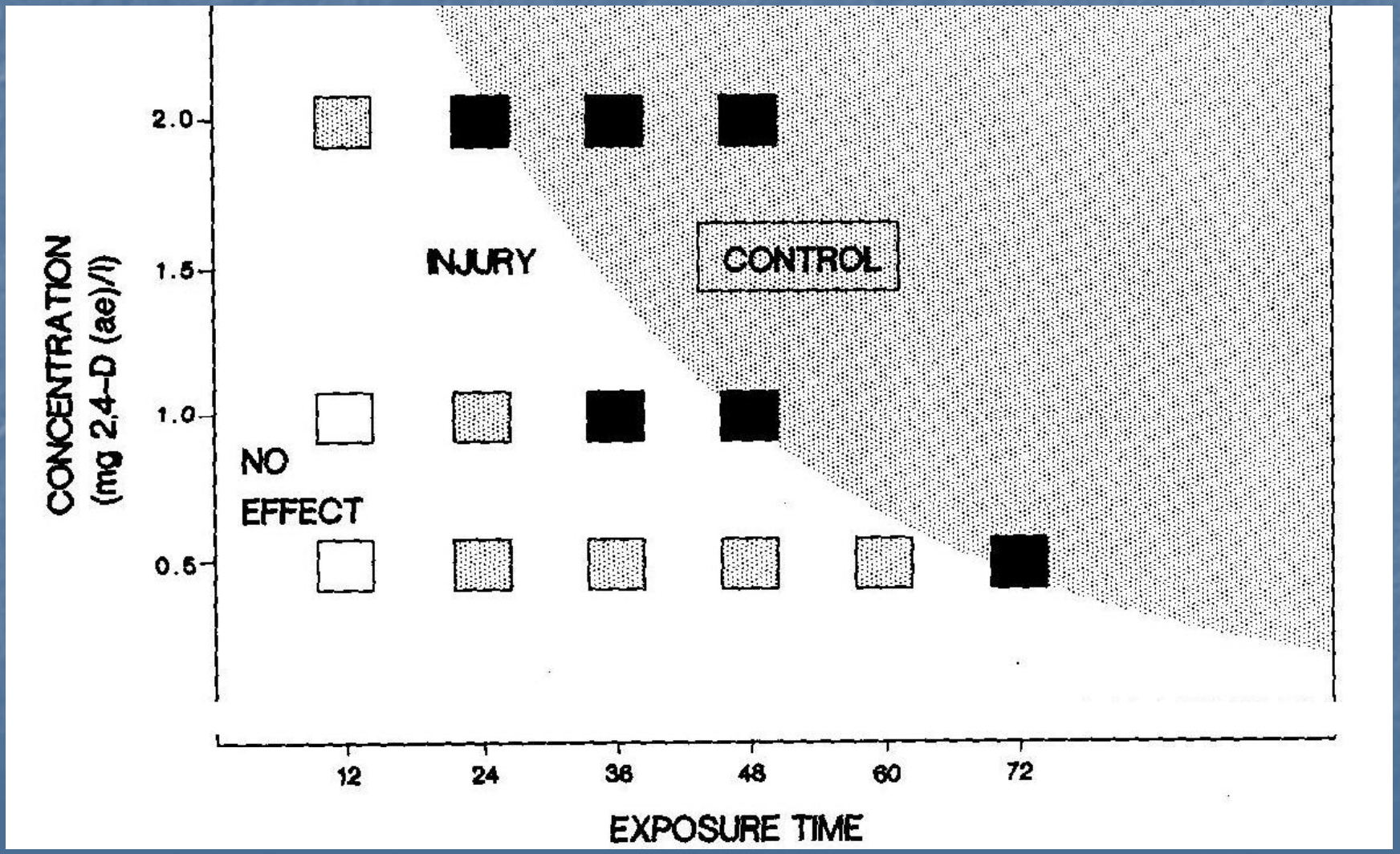
Application Timing/Phenology

Early Spring Herbicide Applications

Blackhawk Lake, Eagan, MN

- Exotic species small and most vulnerable
- Native species are dormant
- Minimal microbial degradation

Concentration/Exposure Time Relationship



J. Aquat. Plant Manage 30: 1-5

Common Aquatic Pesticides

- **2,4-D**
  - AquaKleen
  - DMA 4
  - Navigate
  - Weedar 64
- Copper
  - Aquatrine
  - Captain
  - Clearigate
  - Cutrine plus
  - Komeen
  - K-Tea
  - Nautique
- **Diquat**
  - Reward
  - Weedtrine
- **Endothall**
  - Aquathol-K
  - Hydrothol 191
- **Fluridone**
  - Avast
  - Sonar
- Glyphosate
  - Aquapro
  - Eagre
  - Rodeo
- Triclopyr
  - Renovate
- Imazapyr
  - Habitat
- Imazamox
  - Clearcast

http://ohioline.osu.edu/a-fact/0004.html

http://ace.ace.orst.edu/info/extoxnet/ghindex.html

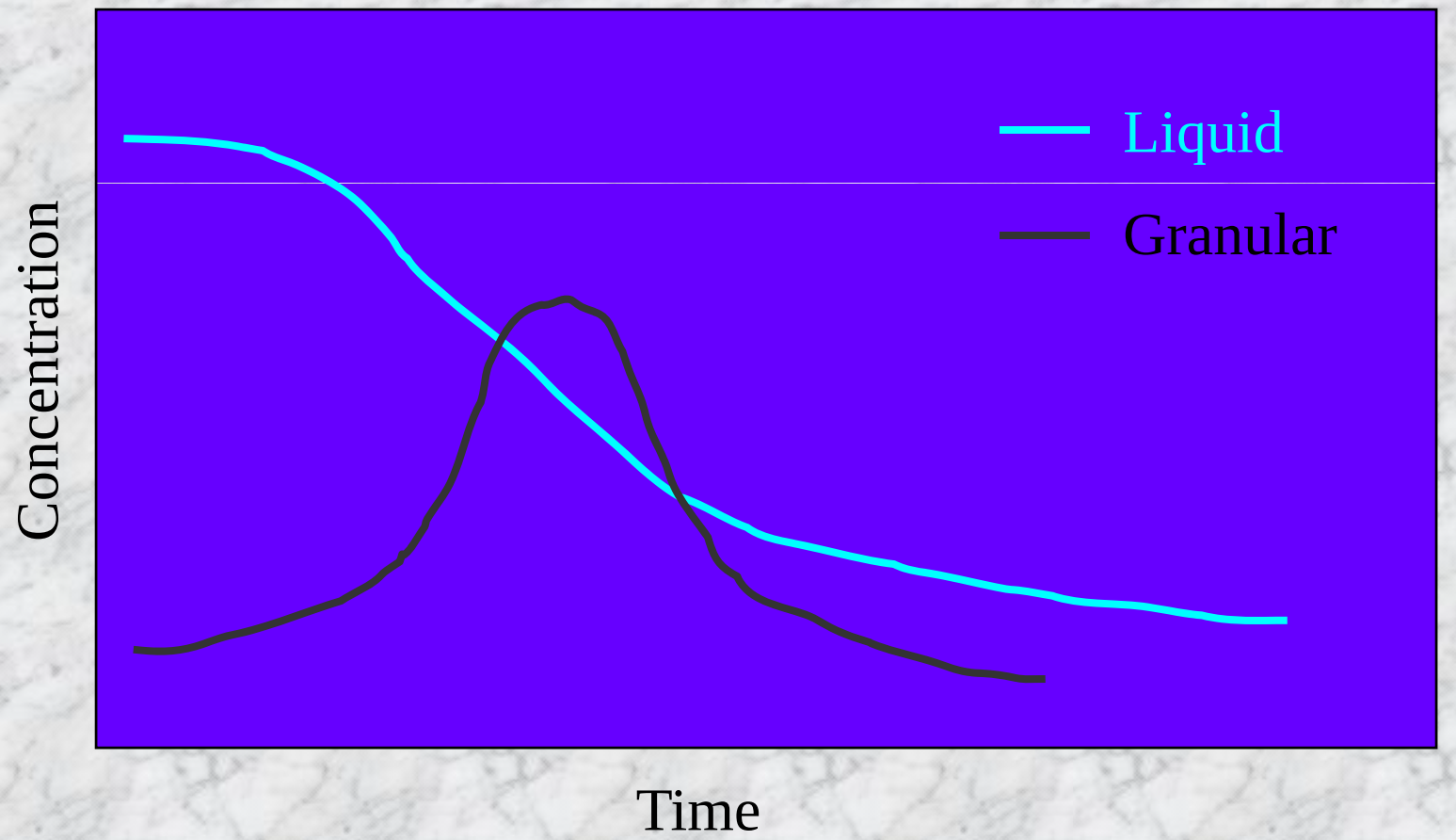
Choosing the Right Product –

- **2,4-D** (systemic herbicide, widespread and historical use, Northern water milfoil and other dicots may be affected by treatments at higher rates)
- **fluridone** (not appropriate for eutrophic lakes or flowing water; also impacts many pondweed species (see susceptibility spreadsheet from ISS)
- **endothall** (contact herbicide, useful for CLP treatments, or applications where selectivity is not as critical)
- **triclopyr** (not much experience using it in WI, but may be useful in conjunction with whole-lake scale treatments, similar to 2,4-D, expensive)
- **combinations (**e.g. low-dose 2,4-D and endothall for combined CLP/EWM treatments)

Granular vs Liquid?

- Liquid for whole lake scale treatments or large areas with mixed plant community; granular for smaller scale areas or defined beds of EWM
- Granular formulations release active ingredient over a longer period of time, and may be more suited to situations where herbicide exposure time is a concern
- For a given lake, liquid herbicides may be appropriate in some areas while granular herbicides may be more appropriate in other areas.
- Liquid herbicide formulation might be appropriate for an initial treatment, and granular formulations might be appropriate in following years

Granular Vs Liquid



Application rates

- Application rates for liquid and granular formulations are not interchangeable.
- Application rates should be based on concentration-exposure time considerations.
  - Lower for large scale treatments or when target plants are mixed in with natives;
  - Higher where exposure times may be seriously reduced (isolated beds or spot treatments)
- Water depth should be factored in to achieve target concentration (rather than relying on pounds per acre)
- Must not exceed label guidelines, but maximum rates may be too high if being used at whole lake scale

2,4 - D Min & Max Application Rates

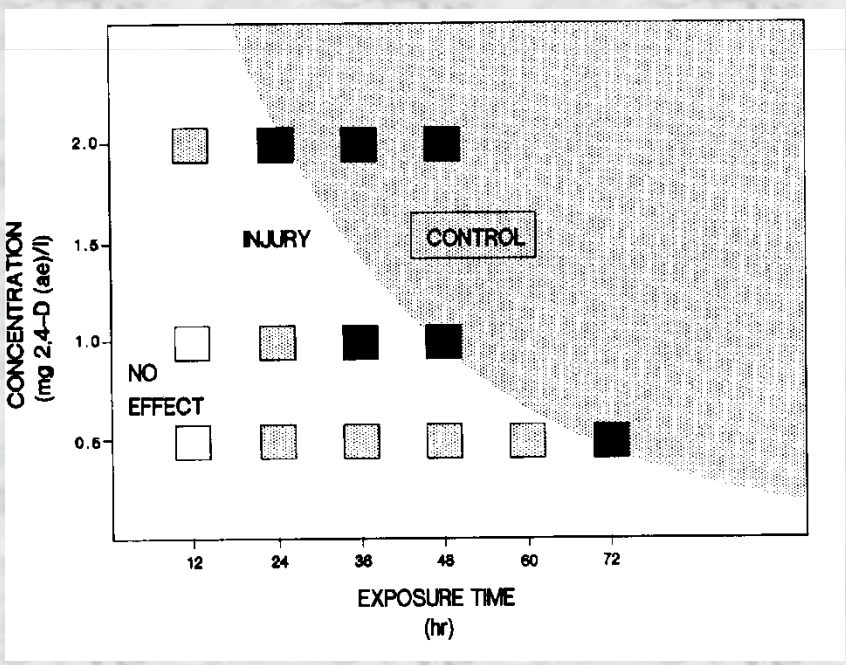
ppm = $\frac{\text{Lbs active ingredients (ai)}}{\text{ac-feet x 2.7}}$ (1 ac-ft = 2,700,000 lbs)

100 lbs in 8 feet of water

1.28 ppm = $\frac{\text{27.6 lbs ai}}{\text{8 x 2.7}}$

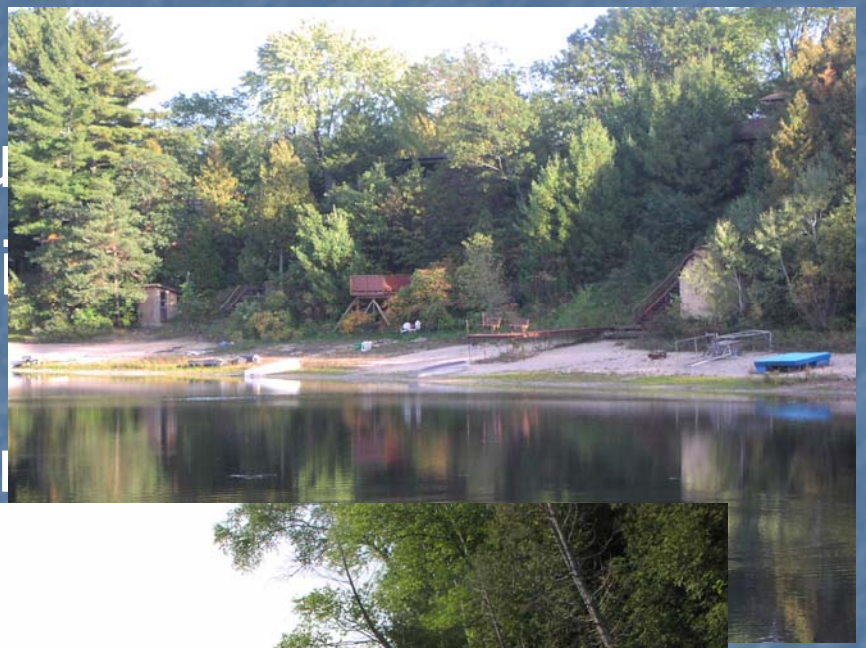
200 lbs in 4 feet of water

5.11 ppm = $\frac{\text{55.2 lbs ai}}{\text{4 x 2.7}}$



Lake-specific considerations

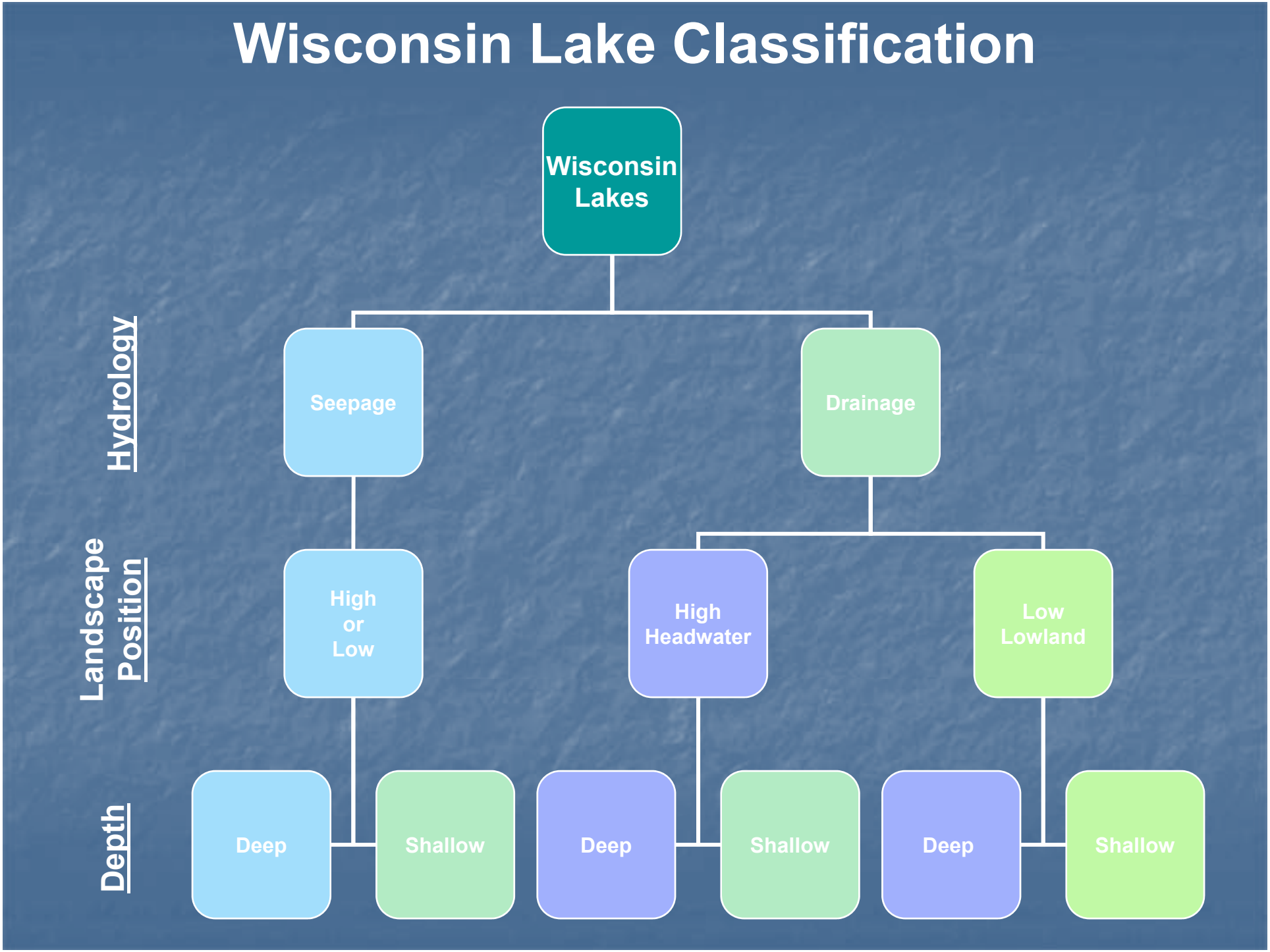
- Trophic status and produ
- Hydrology and flow consi
  seepage lake)
- Lake depth (littoral domi



Lake-specific considerations

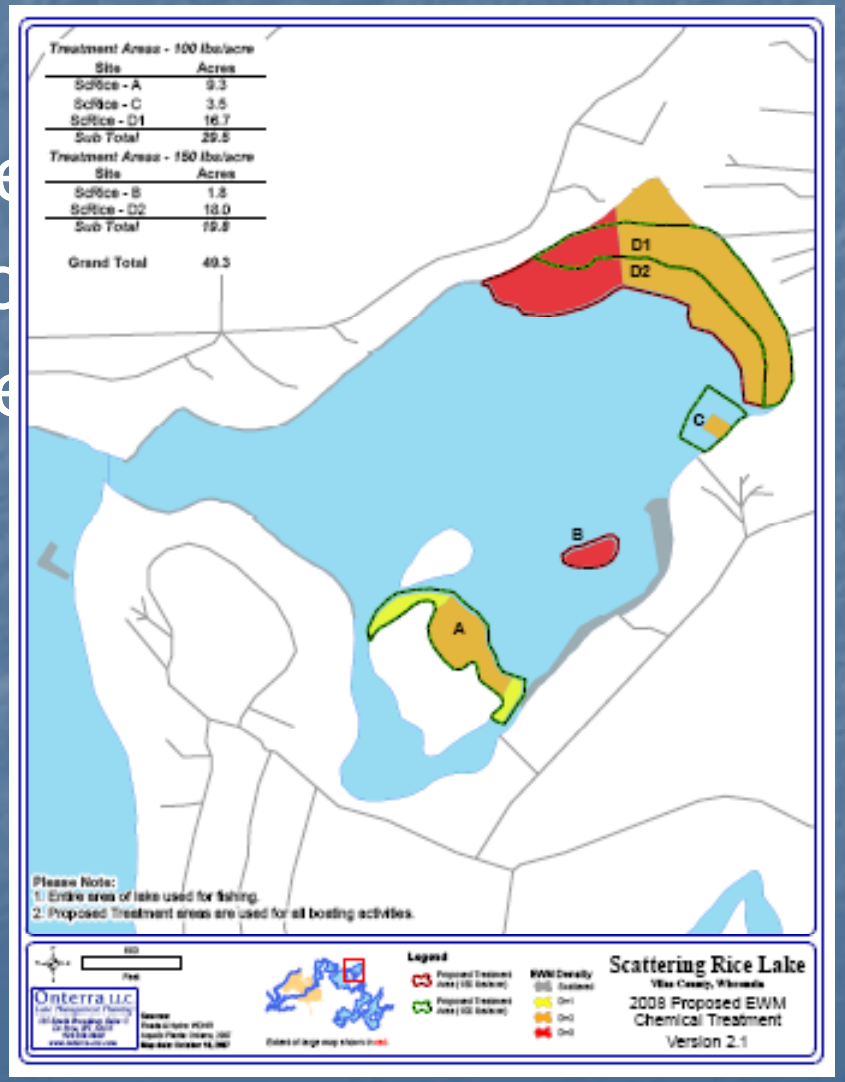
- Extent and density of inva n
- Native species of concern er dicots, pondweeds, etc)

Wisconsin Lake Classification



Treatment area configuration

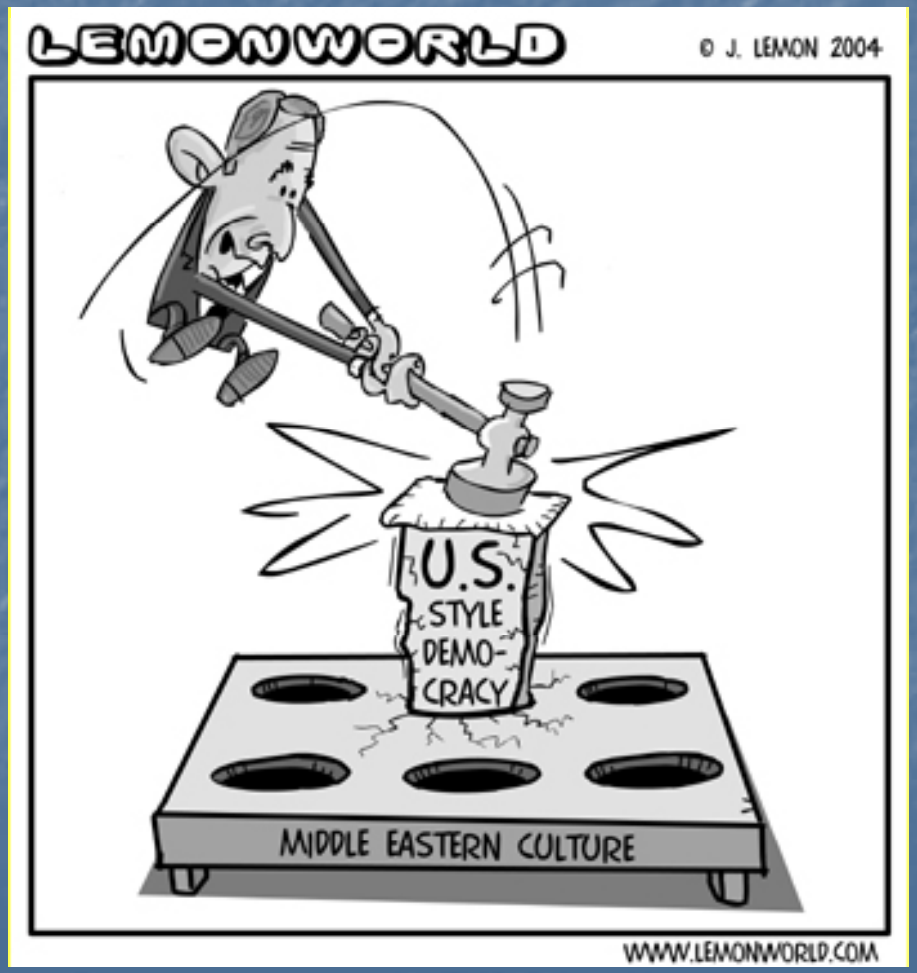
- Shoreline vs mid-lake tre
- Scattered colonies vs isc
- Littoral zone vs large are



Whole-lake vs partial lake scale?

- If treatment area represents more than 50% of the lake area (shallow lakes) or volume (deep lakes), then consider whole-lake treatment
- Target application rates should be adjusted downward

Bottom line – one size does not fit all



Other considerations

- Weather conditions – calm weather, low winds, esp for liquid applications and endothall products
- Flowing water considerations – granular products may need to be applied at higher concentrations in order to maintain effectiveness in flowing water.
- Specified in permit conditions or supervision may be required

Supervision and reporting

- All large scale to whole lake treatments should be supervised by DNR staff, especially if trying to determine optimal treatment timing or ensure that conditions of the permit are being followed
- Possible role for DATCP staff
- Treatment records need to be filled out and submitted within 30 days of application.
- Compliance and enforcement

Contingency plan – What happens if something goes wrong?

- Dissolved oxygen sags
- Fish kills
- Spills, or problems with applications (injuries, accidents, etc)
- Weather conditions or growth of EWM prevent proper treatment

Post-treatment monitoring and evaluation (compliance)

- Aquatic plant surveys (treatment effectiveness and native impact/response)
- Dissolved oxygen (negative impacts on DO levels from decaying vegetation)
- Water quality (clarity, chl a, TP, pH, etc: algal response to nutrients released from decaying vegetation or less competition from macrophytes)
- Residuals (effectiveness of treatments and safety thresholds)

Monitoring and Evaluation

1) What are the primary and secondary ecological effects (both intended and unintended)?

-Vegetation (exotic and native)

-Water quality (algae, dissolved oxygen)

-Fisheries (habitat, residual toxicity)

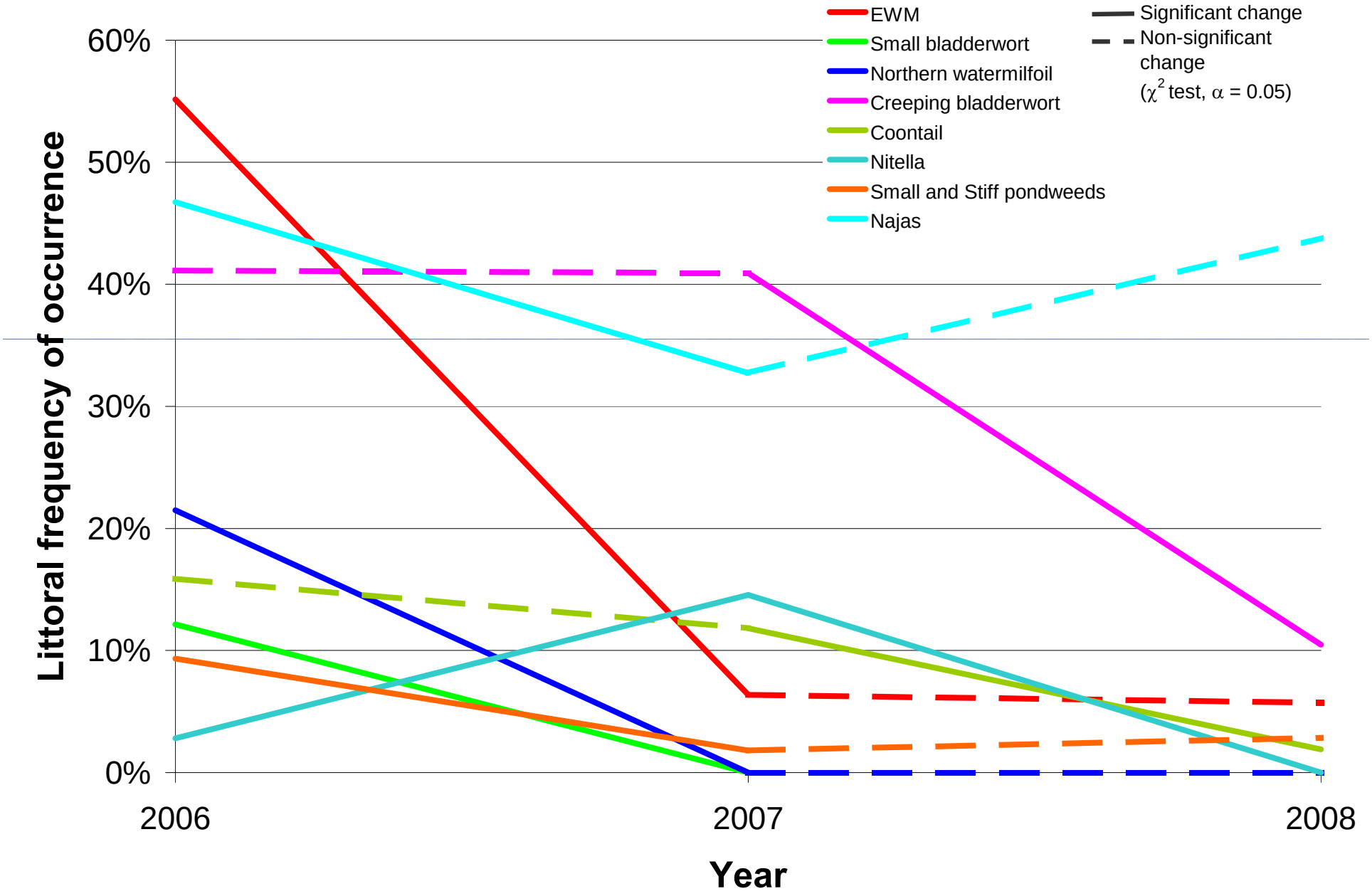
2) What are long term costs and benefits?

Technical review of DATA
N > 1, generalize effects

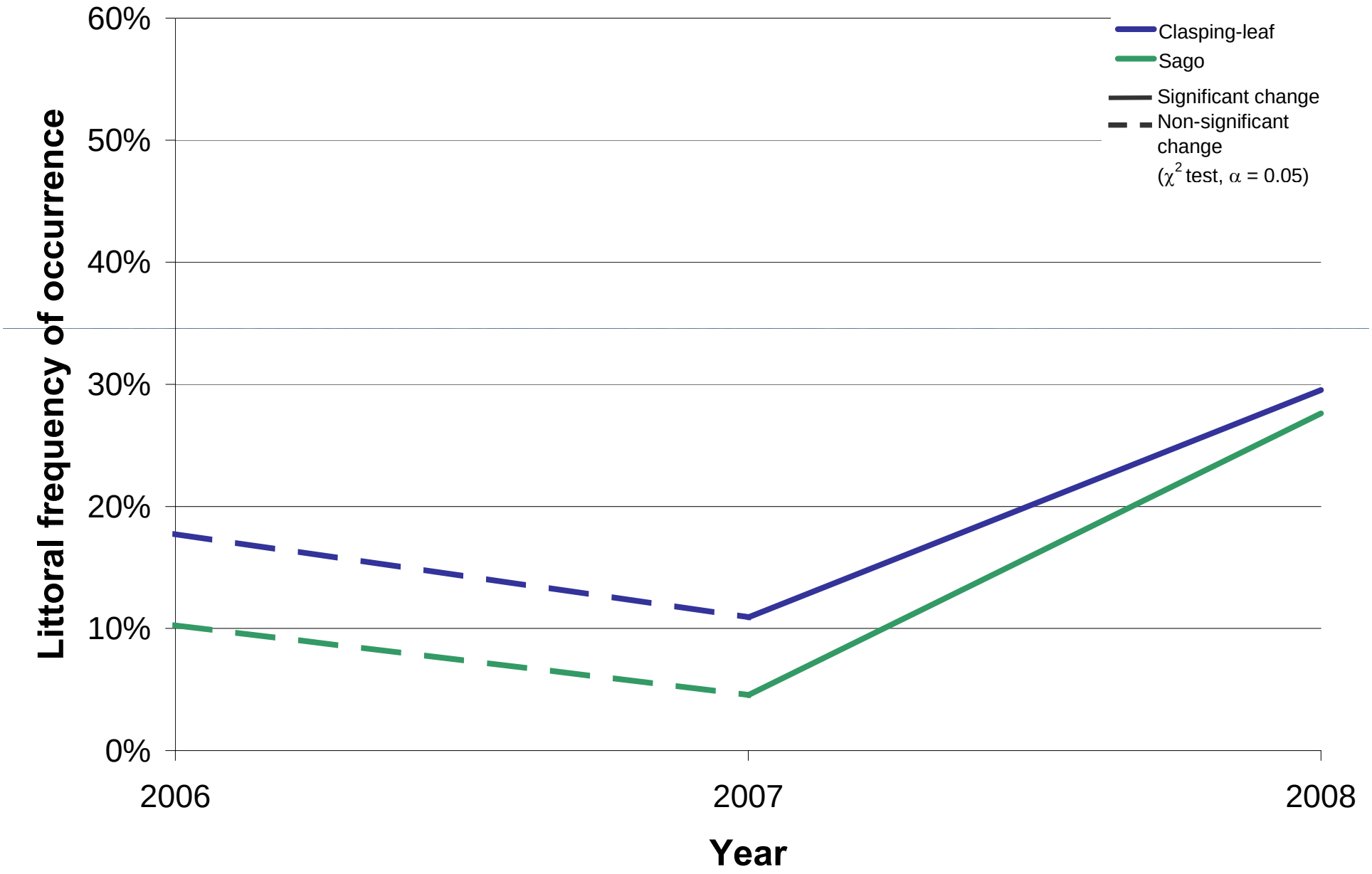
Aquatic plant surveys

- Follow *Pre and Post Treatment Evaluation of Aquatic Plant Community* protocol
- For whole lake scale projects, a whole lake PI survey should be conducted.
- For large scale projects, use targeted monitoring in treatment areas
- Appropriate targets for determining "success" should be specified in plan
- Use standardized reporting spreadsheets and stats packages from ISS

Spring Lake Macrophytes



Spring Lake Macrophytes



Spring Lake, Legend Chain

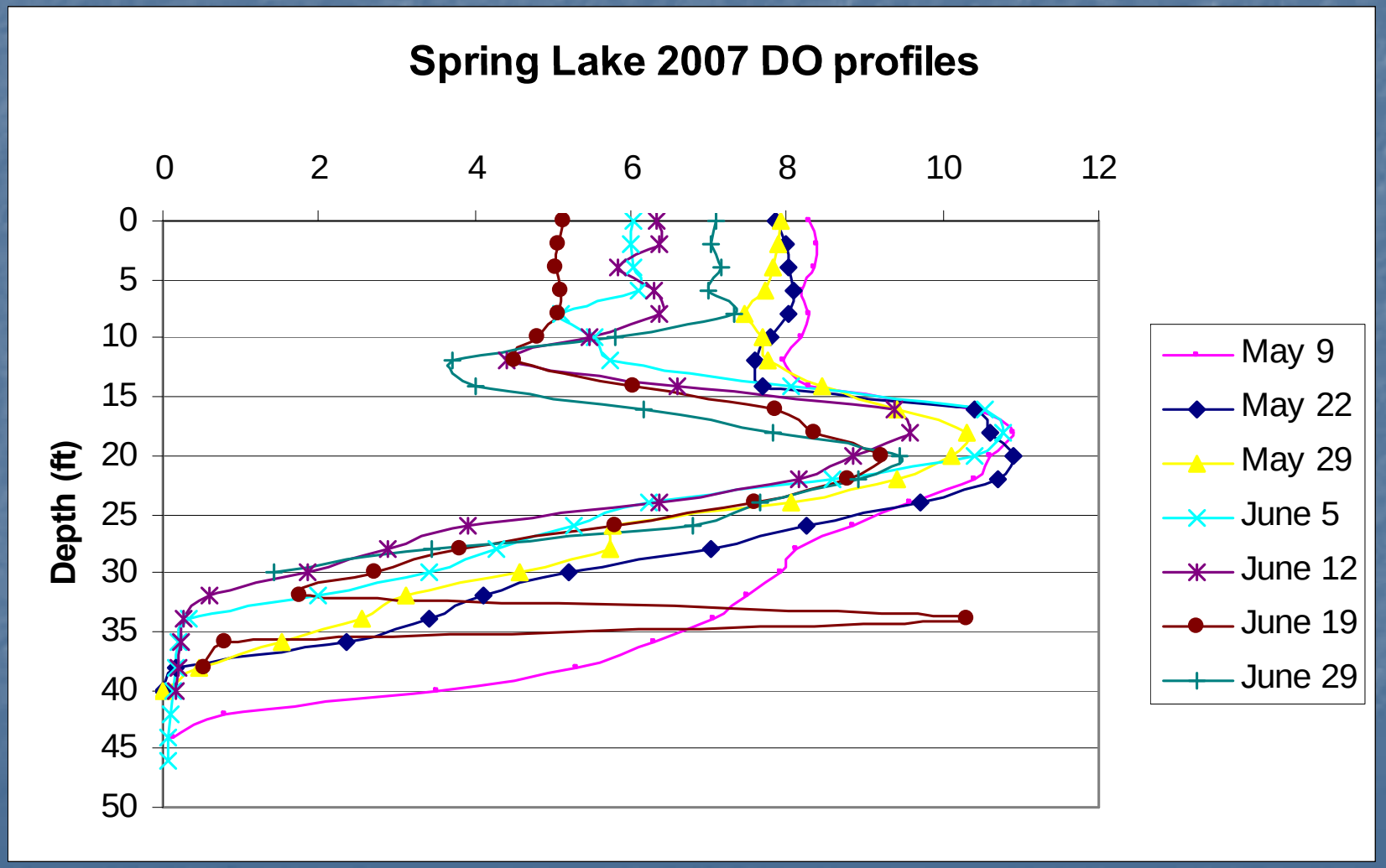
Littoral frequencies of occurrence by year and significance of between-year changes (Chi-square test, a = 0.05)

Species	2006	2007	2008	2006-2007	2007-2008
EWM	**55%**	**6%**	**6%**	**0.000**	**n.s.**
Najas	**47%**	**33%**	**44%**	**0.035**	**n.s.**
Chara	45%	46%	51%	n.s.	n.s.
Creeping bladderwort	**41%**	**41%**	**10%**	**n.s.**	**0.000**
Illinois & Variable pondweeds	40%	35%	25%	n.s.	n.s.
Wild celery	36%	36%	45%	n.s.	n.s.
Elodea	36%	49%	49%	n.s.	n.s.
Illinois pondweed	**36%**	**35%**	**20%**	**n.s.**	**0.017**
Common bladderwort	32%	41%	32%	n.s.	n.s.
Robbins pondweed	29%	36%	37%	n.s.	n.s.
Northern watermilfoil	**21%**	**0%**	**0%**	**0.000**	**---**
Clasping-leaf	**18%**	**11%**	**30%**	**n.s.**	**0.001**
Flat-stem	17%	12%	19%	n.s.	n.s.
Coontail	**16%**	**12%**	**2%**	**n.s.**	**0.004**
Small bladderwort	**12%**	**0%**	**0%**	**0.000**	**---**
Sago	**10%**	**5%**	**28%**	**n.s.**	**0.000**
Small & Stiff pondweeds	**9%**	**2%**	**3%**	**0.015**	**n.s.**
Small pondweed	**7%**	**1%**	**0%**	**0.028**	**n.s.**
Variable pondweed	**5%**	**0%**	**5%**	**0.022**	**0.021**
Water marigold	5%	1%	0%	n.s.	n.s.
Large-leaf pondweed	4%	2%	4%	n.s.	n.s.
Nitella	**3%**	**15%**	**0%**	**0.002**	**0.000**
Stiff pondweed	3%	1%	3%	n.s.	n.s.
fil algae	**2%**	**8%**	**1%**	**0.034**	**0.012**
Water star-grass	2%	0%	0%	n.s.	---
White-stem pondweed	2%	5%	3%	n.s.	n.s.
Watersheild	1%	1%	0%	n.s.	n.s.
Spatterdock	1%	2%	3%	n.s.	n.s.
moss	1%	0%	0%	n.s.	---
White water lily	0%	2%	0%	n.s.	n.s.
Pickerelweed	0%	2%	0%	n.s.	n.s.
Needle spikerush	0%	1%	0%	n.s.	n.s.
Stiff water crowfoot	0%	1%	0%	n.s.	n.s.
Arrowhead sp.	0%	1%	0%	n.s.	n.s.

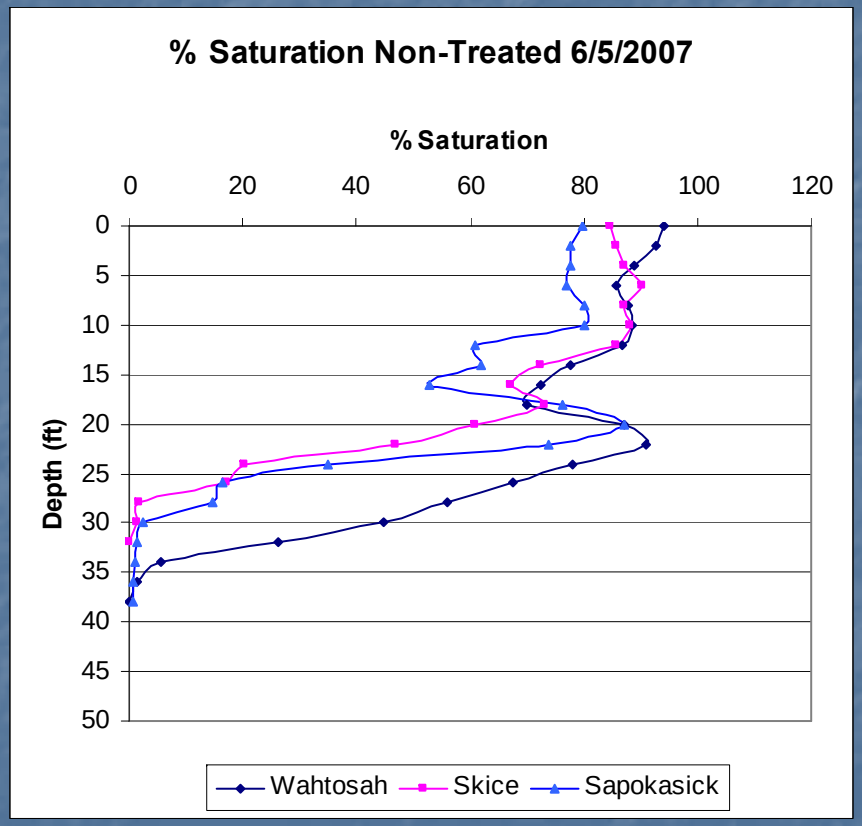
Dissolved oxygen (negative impacts on DO levels from decaying vegetation)

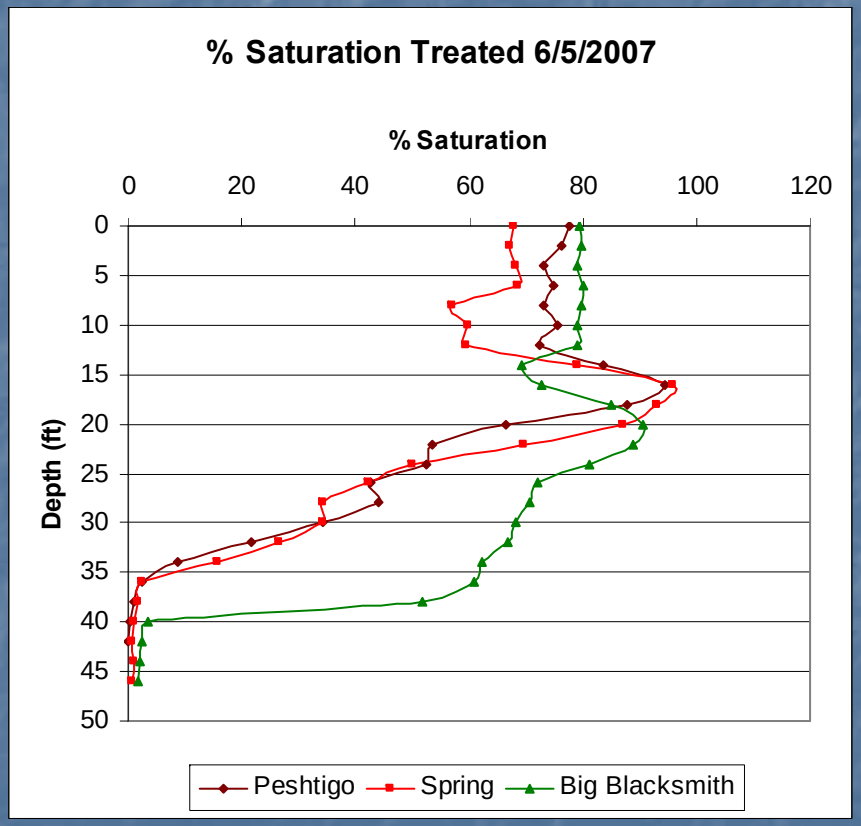
- Warranted for whole lake scale projects and treatments in confined bays or channels
- If possible, collect profiles the year before treatment and/or in reference (untreated) locations
- Profiles in treatment areas and mid-lake as a reference point, along with temperature and % saturation
- Start prior to treatment, 4-6 weeks following treatments and monthly thereafter
- Take profiles at roughly the same time each day
- 5 mg/L is a useful standard for determining impact, especially in shallow waters or epilimnion

Dissolved Oxygen

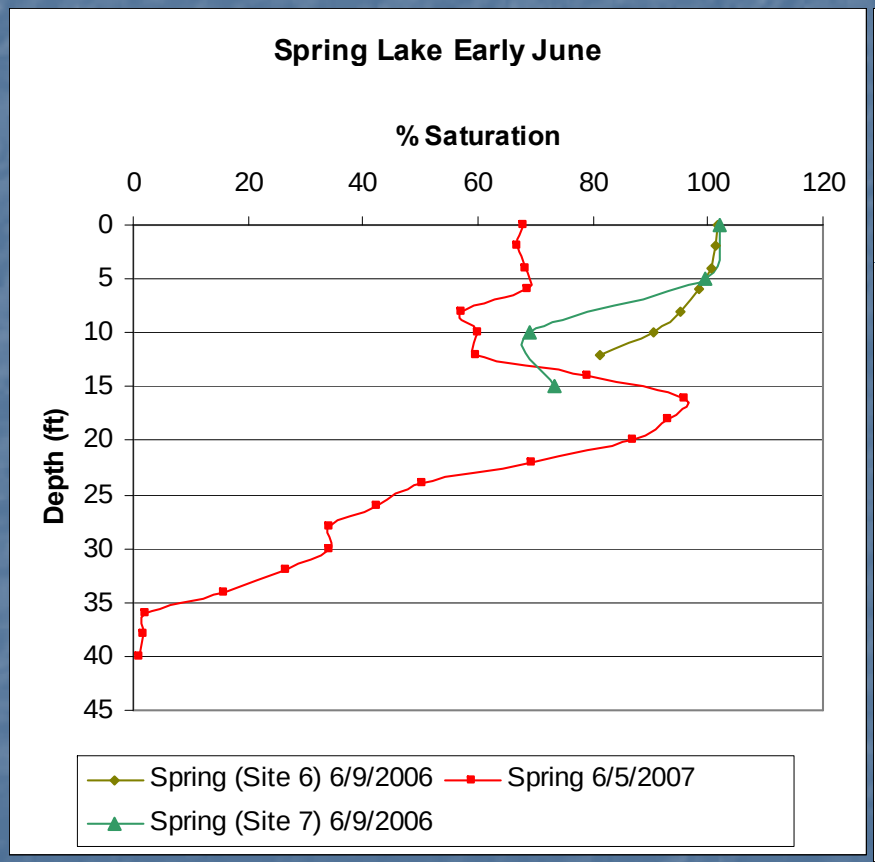


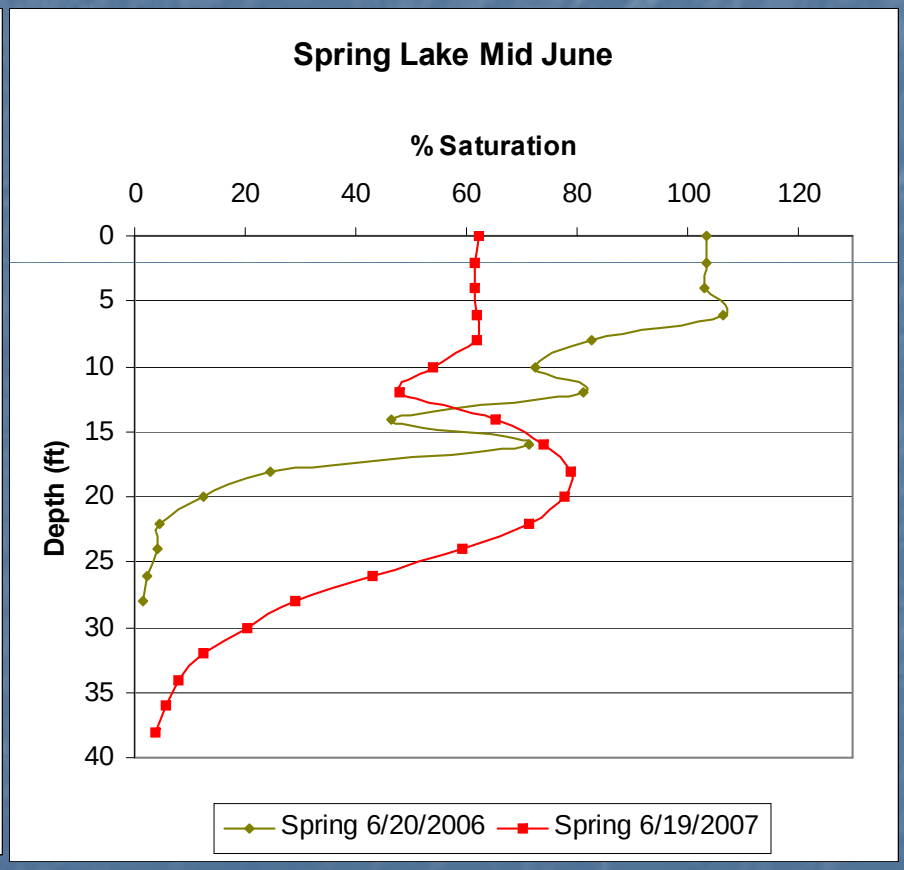
Dissolved Oxygen % Saturation (14 DAT)





Spring Lake
2006 vs 2007



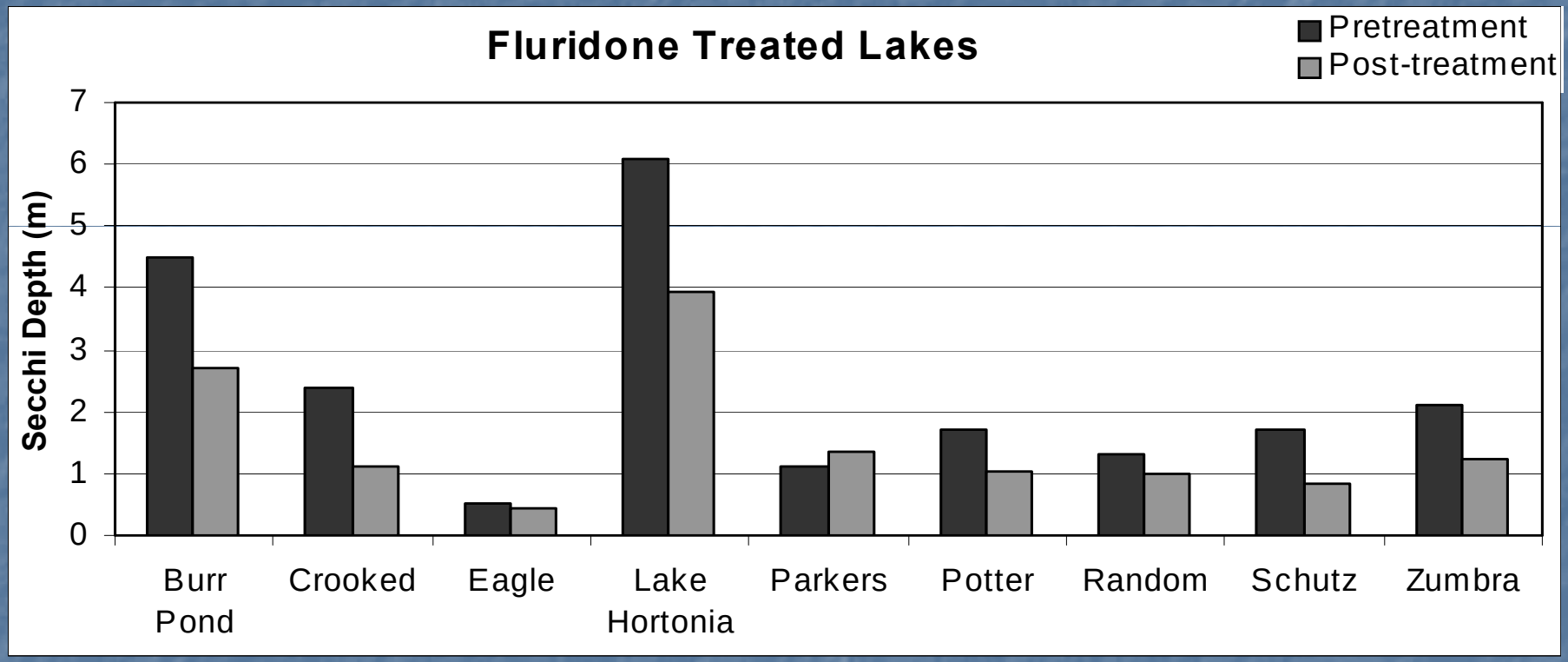


Water quality

- Warranted for whole lake scale projects and treatments in confined bays or channels
- Chlorophyll and TP most important for eutrophic systems where "switch" to algal dominance is a concern
- If possible, collect samples the year before treatment and/or in reference (untreated) locations.
- Samples from treatment areas and mid-lake as a reference point
- Start prior to treatment, 4-6 weeks following treatments and monthly thereafter
- Involve CLMN for long term monitoring, especially on whole lake scale projects

Effects on Water Clarity

(from Wagner et al, 2007)



Reductions in secchi depth in 80% of treated lakes (P = 0.003) due to increased algae (late summer samples)

Residuals (effectiveness of treatments and safety thresholds)

- Advised for large scale and whole-lake scale projects
- Collect samples from multiple sites within treatment areas and mid-lake as a reference point (mid-depth or multiple depths)
- Ideally pre-treatment (0) and 1, 4, 7, 14, 28 DAT
- May need to be more frequent or longer duration, depending upon treatment scenario
- Label use restrictions for irrigation or drinking water intakes are useful guidelines for evaluation (e.g. 100 ppb and 70 ppb for 2,4-D respectively)
- Possible ecological thresholds (reference EPA and USFS websites)

2,4-D Toxicity Thresholds

- EPA Safe Drinking Water < 70 µg/L
- EPA Safe Irrigation Water <100 µg/L
- EPA Safe Child Swimming <900 ug/L
- Walleye fry 96hr LC50 = 660 µg/L
- Amphipod 48hr LC50 = 600 µg/L

2007 treatments

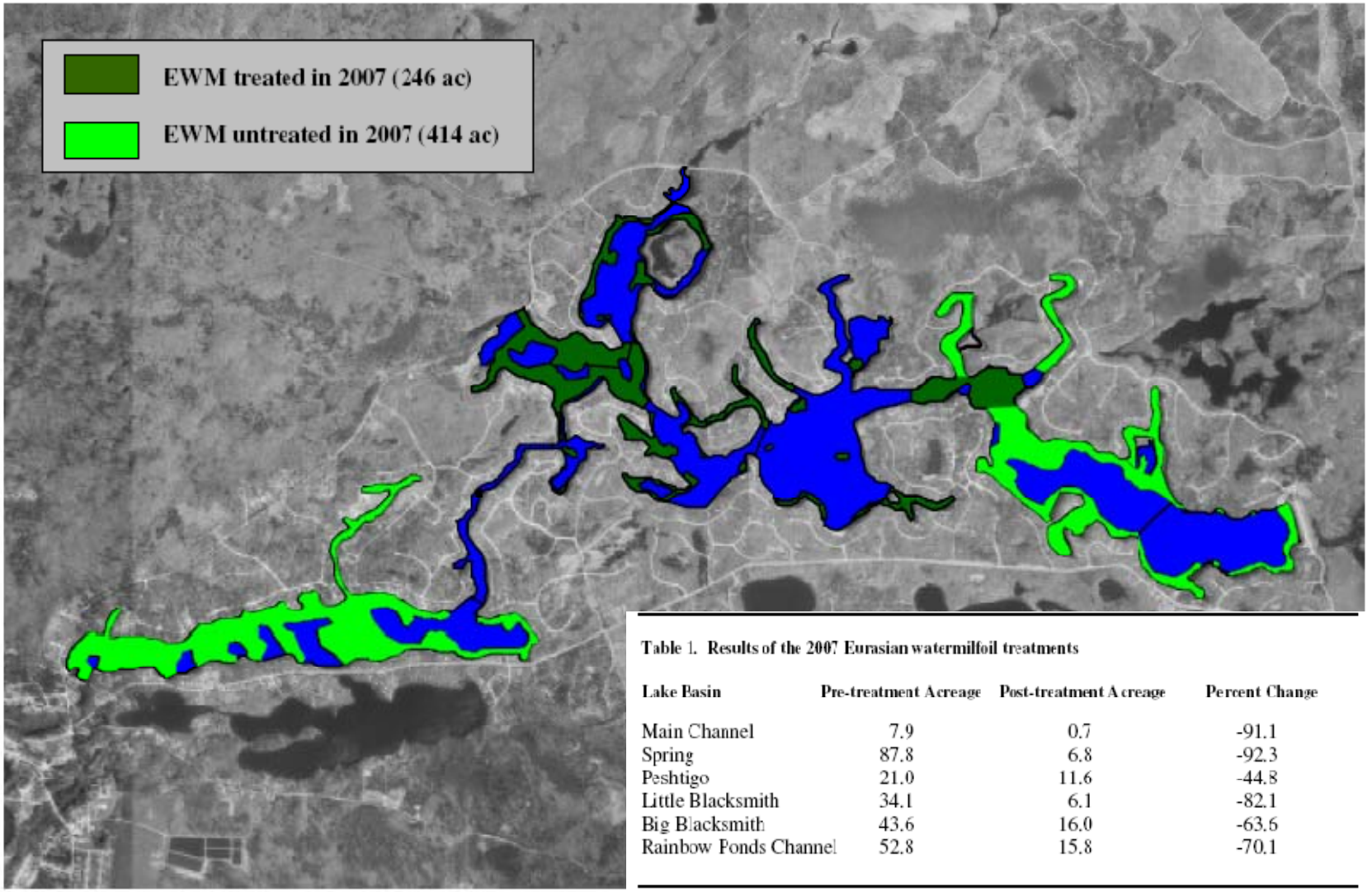
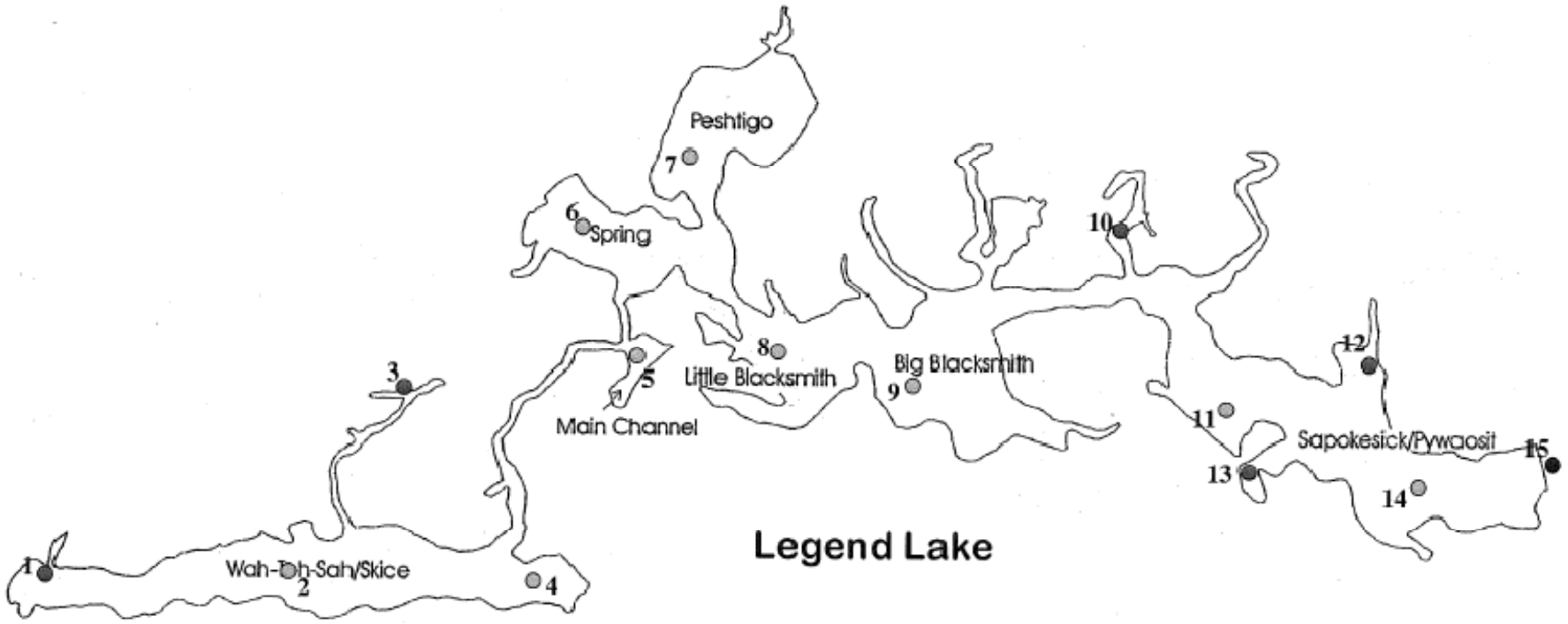


Table 1. Results of the 2007 Eurasian watermilfoil treatments

Lake Basin	Pre-treatment Acreage	Post-treatment Acreage	Percent Change
Main Channel	7.9	0.7	-91.1
Spring	87.8	6.8	-92.3
Peshtigo	21.0	11.6	-44.8
Little Blacksmith	34.1	6.1	-82.1
Big Blacksmith	43.6	16.0	-63.6
Rainbow Ponds Channel	52.8	15.8	-70.1

Residual Monitoring - Legend

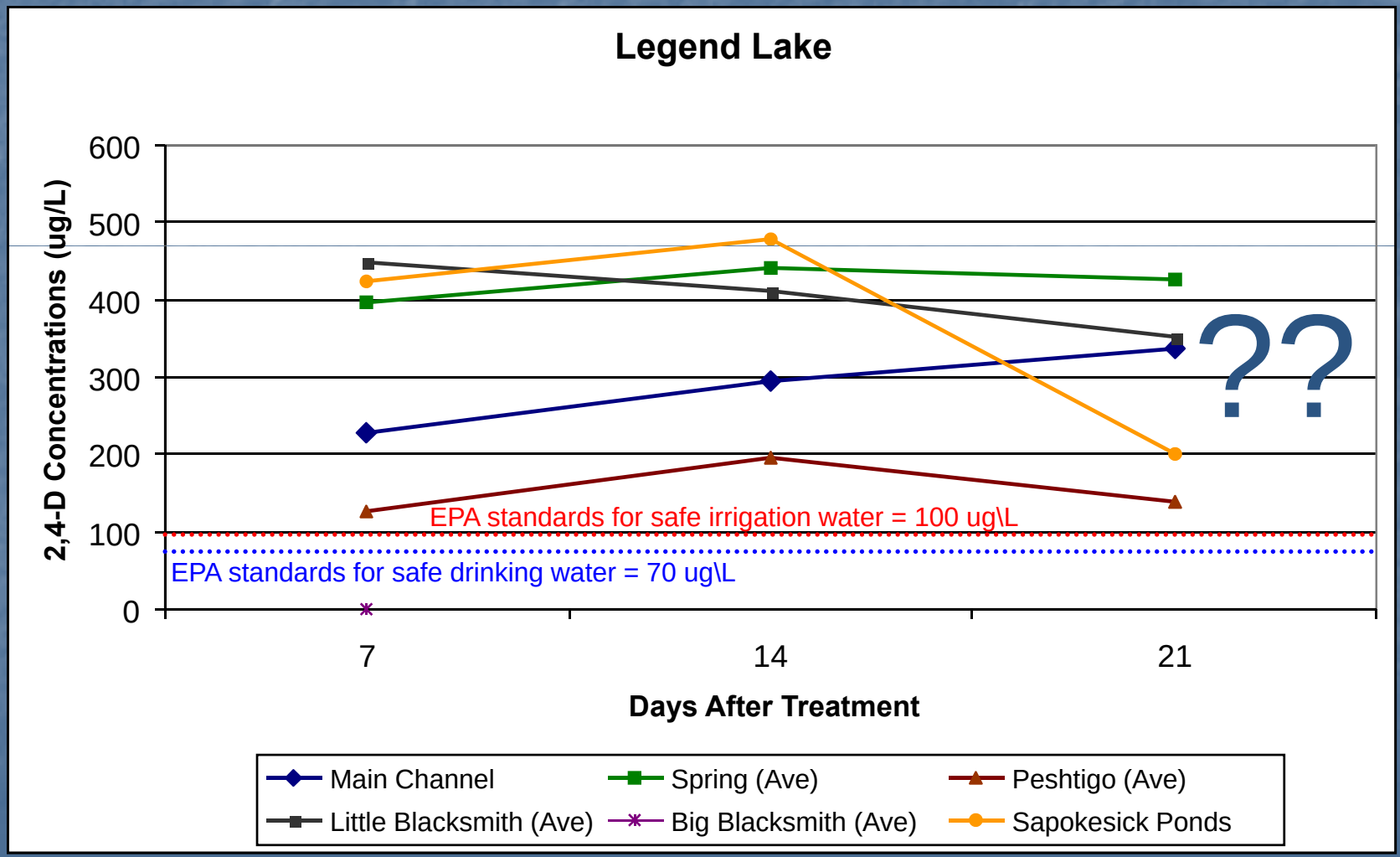
Figure 9 - 2008 Water Quality, Dissolved Oxygen, and 2,4-D Monitoring Sites



- Chl-a, TP, Secchi depth, DO & Temp profiles, 2,4-D
- DO & Temp profiles, 2,4-D
- Stream flow, TP, 2,4-D

2008/Z200605909-MONITOR SITES-2008.DOC

2,4-D residuals from 2007



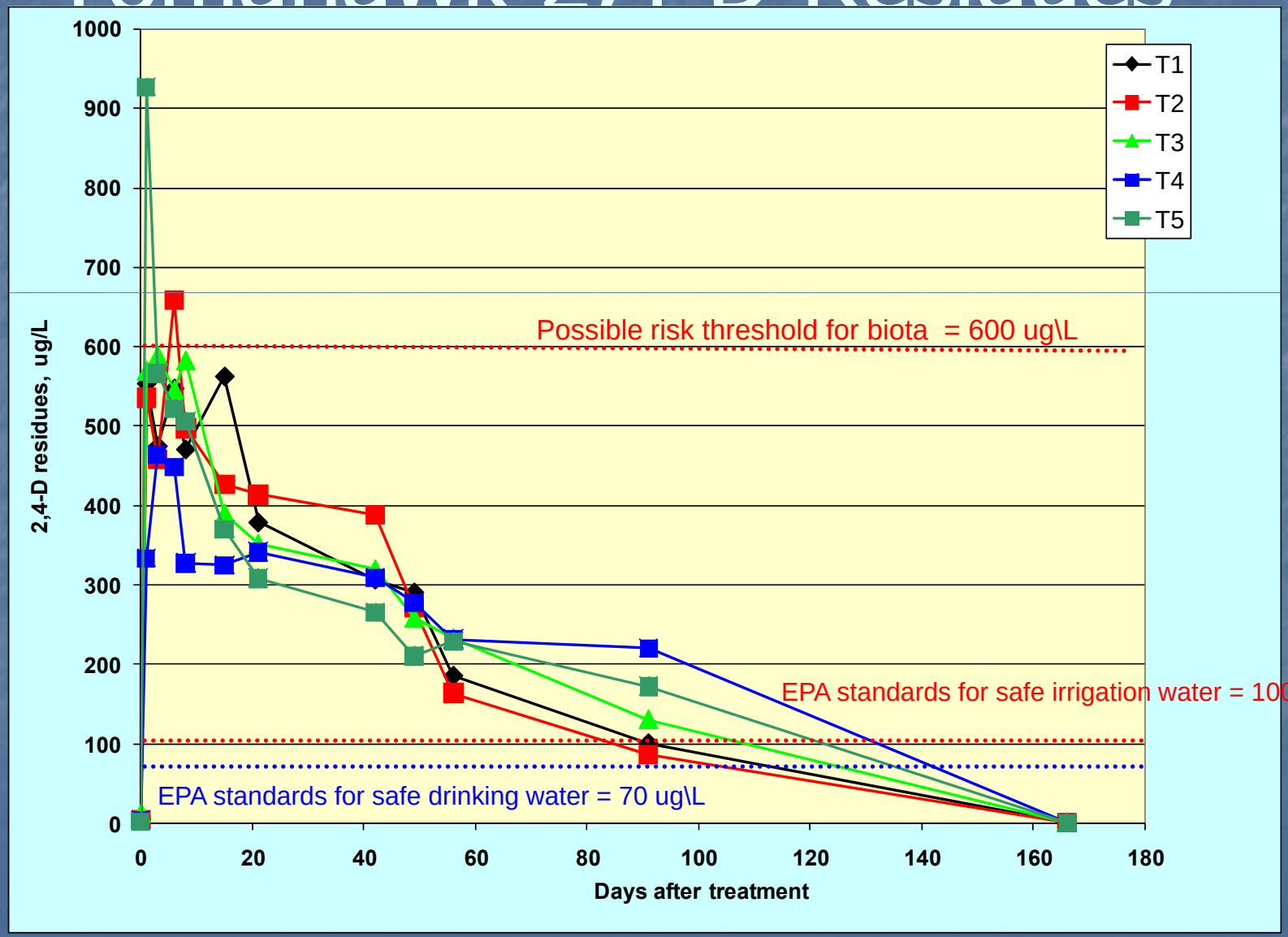
Residual analytical options (2,4-d ELISA)

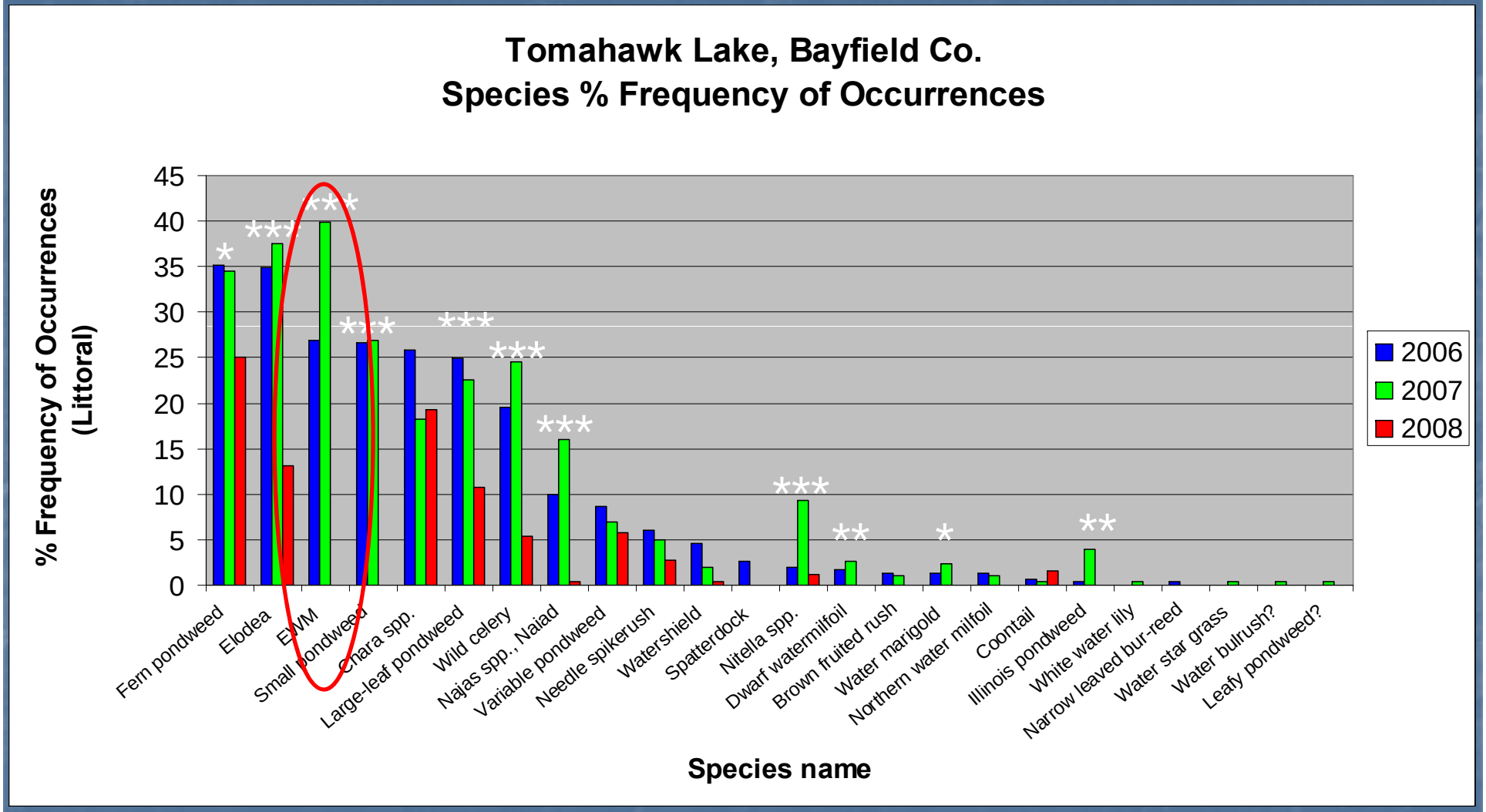
- Private certified laboratories
- State Lab of Hygiene
  - Not set up to do routine sampling
  - Best if multiple projects or lakes where many samples will be collected at the same time
- Corps of Engineers research agreement
  - Work with DNR contact
  - Whole-lake scale or "research" projects
  - Other herbicides

Ongoing Research/Evaluation

- Eagle River Chain, Vilas Co.
- Tomahawk Lake, Bayfield Co.
- Turville Bay, Lake Monona, Dane Co.
- Several other whole-lake scale projects being evaluated (e.g Legend Lake)

Tomahawk 2,4-D Residues



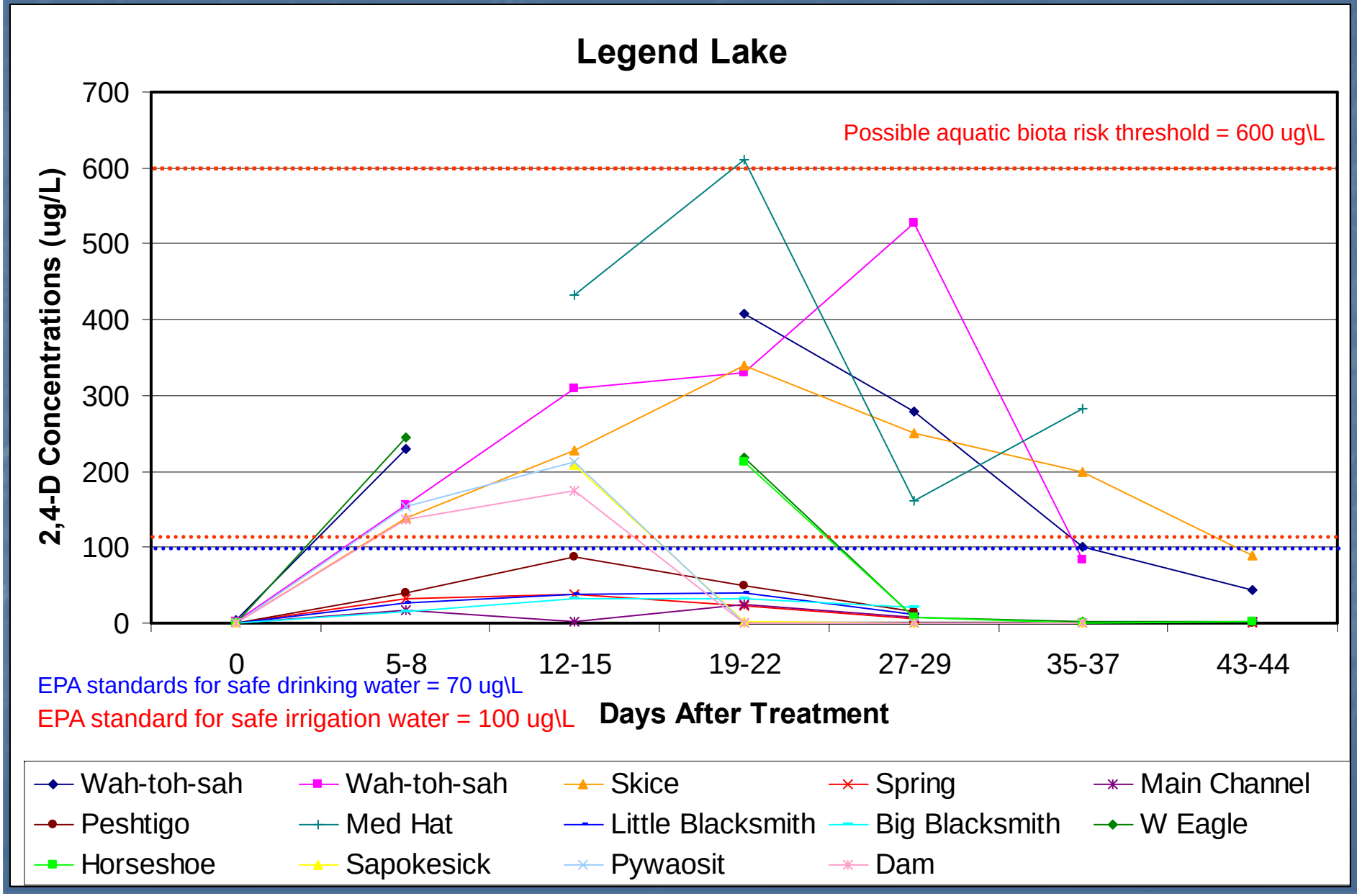


* = p ≤ 0.05

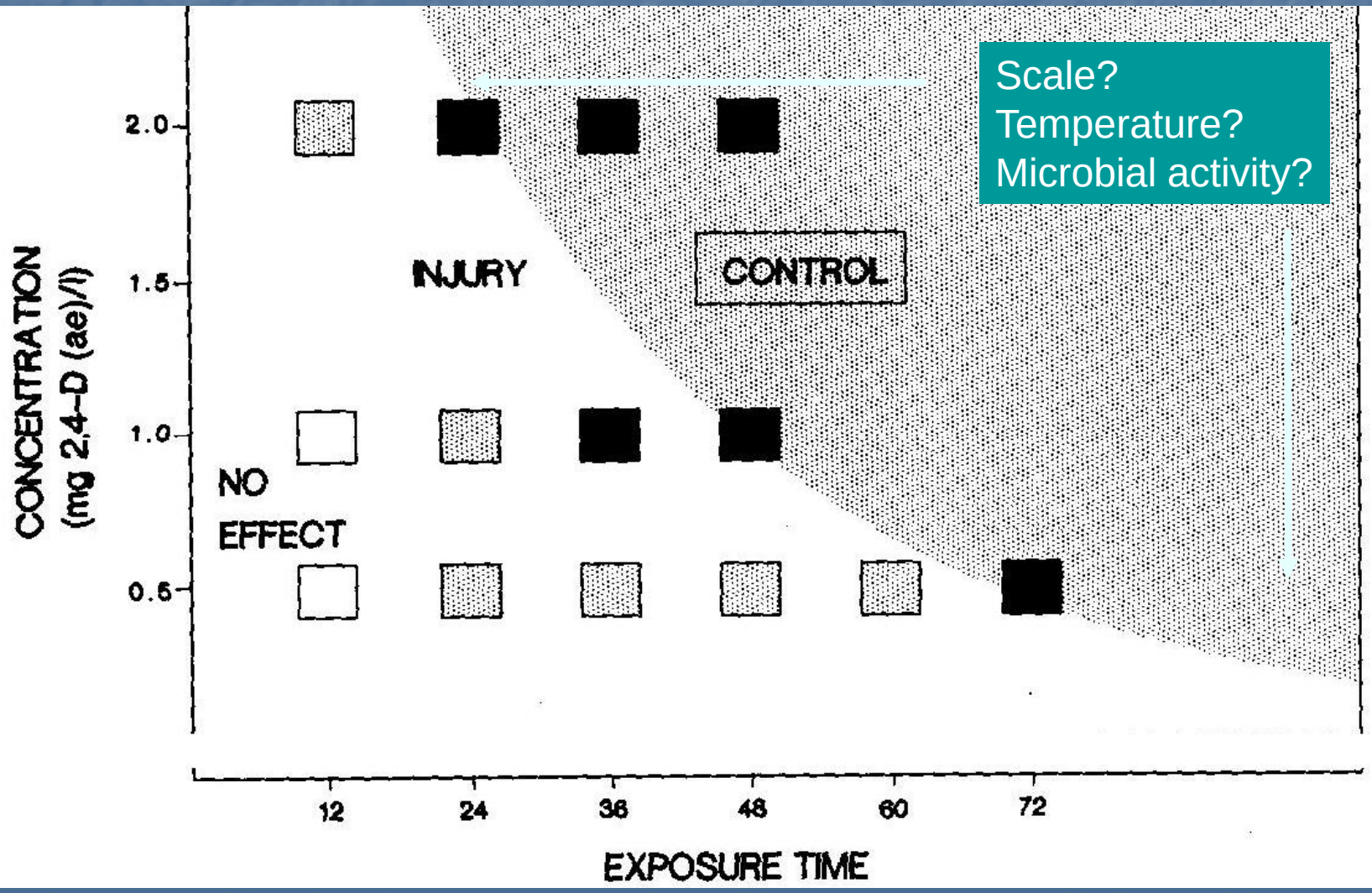
** = p ≤ 0.01

*** = p ≤ 0.001

2,4-D residuals from 2008



Concentration/Exposure Time Relationship 2,4-D



J. Aquat. Plant Manage 30: 1-5

Final Thoughts

- Early spring, large scale treatments in northern lakes may result in longer persistence of herbicides than expected
- Label concentrations (application rates) may not be applicable (too high)
- Residual monitoring is important, both to understand treatment efficacy, as well as ecological risks

Acknowledgements

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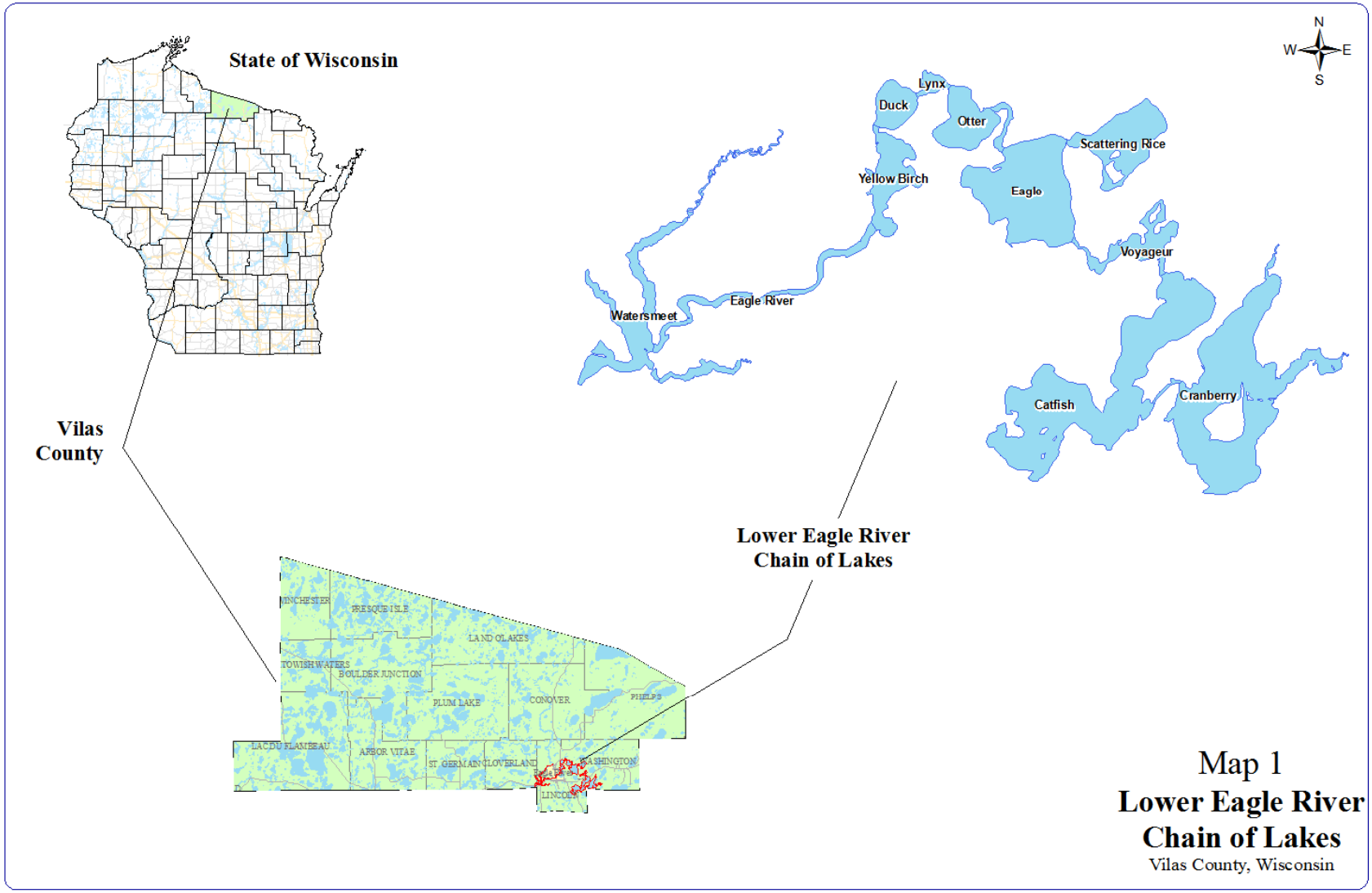


Map 1

Lower Eagle River Chain of Lakes

Vilas County, Wisconsin

Application of Navigate to the Eagle River Chain May 28 – June 2, 2008

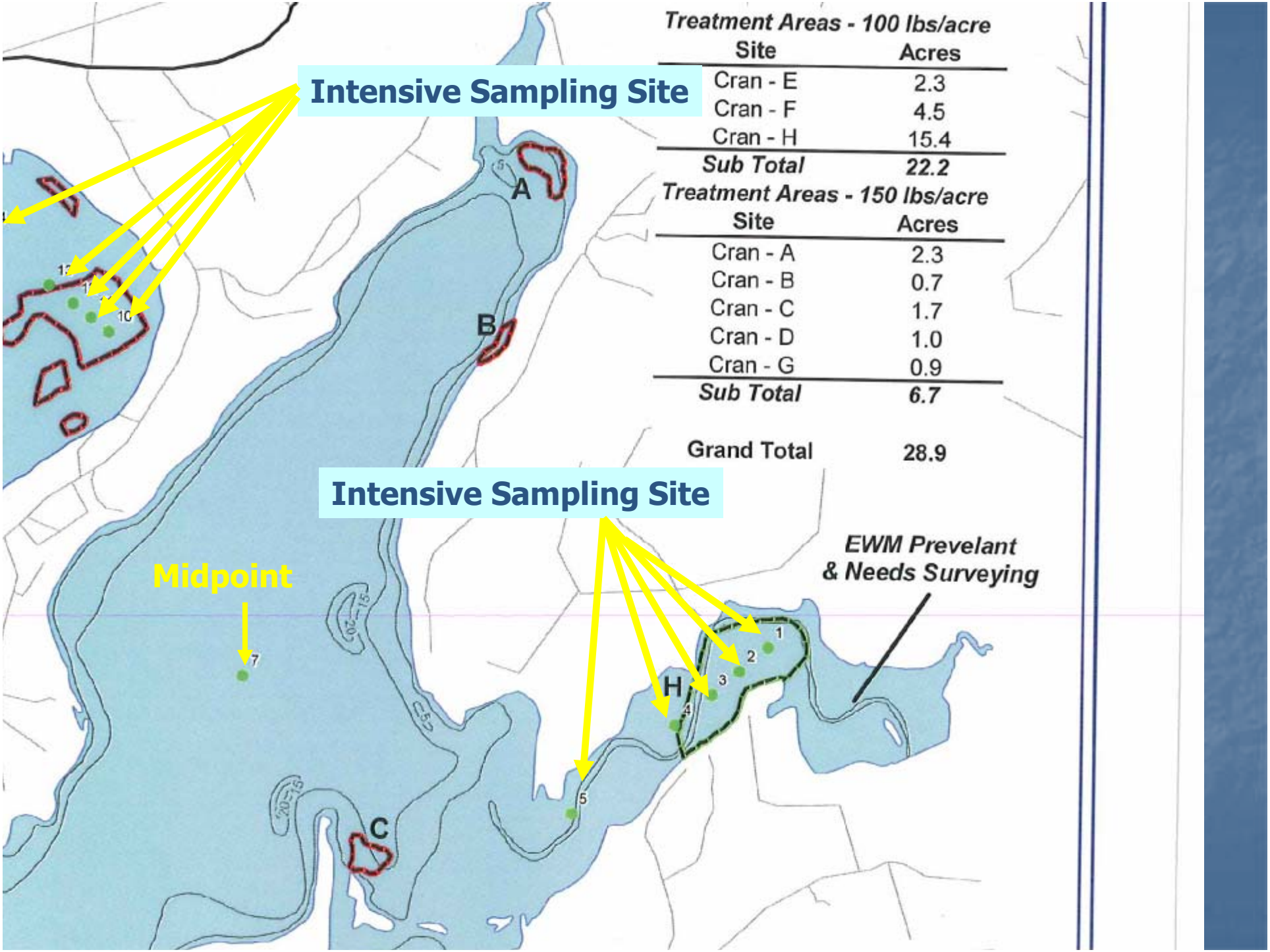
The treatment plots received 100 lbs/acre or 150 lbs/acre of Navigate® 2,4-D

Contractor applied 24,725 pounds (lbs) of Navigate® to chemically treat 188 acres of Eurasian water milfoil

Eagle River Chain Residual Study

Intensive sampling (Total samples = 240)

- Plots: up to 4, representing sand and muck bottom sites, and low and high EWM density
- Stations: 5 total per plot, along a transect: 3 within (center, halfway to shore and halfway to lake), 1 at the edge of the treatment area (50 m?), and one outside the plot toward the middle of the lake (500 m?)
- Depths: 2 per station - 1/3 and 2/3 of the water depth
- Frequency: 6 events (1 week pre-application, 1, 7, 14, 21, and 28 days after treatment)



Treatment Areas - 100 lbs/acre

Site	Acres
Cran - E	2.3
Cran - F	4.5
Cran - H	15.4
Sub Total	***22.2***

Treatment Areas - 150 lbs/acre

Site	Acres
Cran - A	2.3
Cran - B	0.7
Cran - C	1.7
Cran - D	1.0
Cran - G	0.9
Sub Total	***6.7***

Grand Total	**28.9**

Sites sampled day 0, 1, 4*, 7, 14, 21, 28 post-application

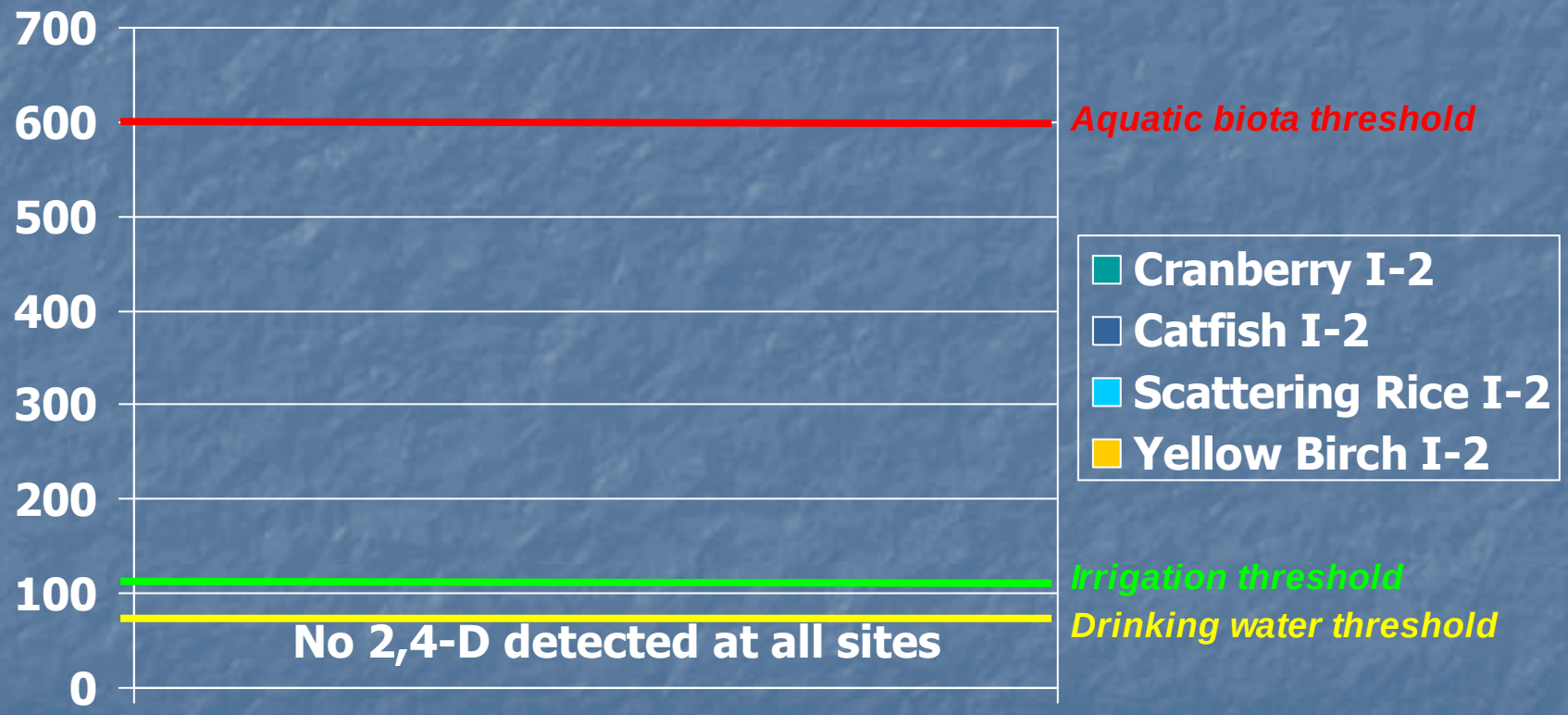
*Day 4 samples at intensive sample sites only

RaPID Assay® 2,4-D Test Kit

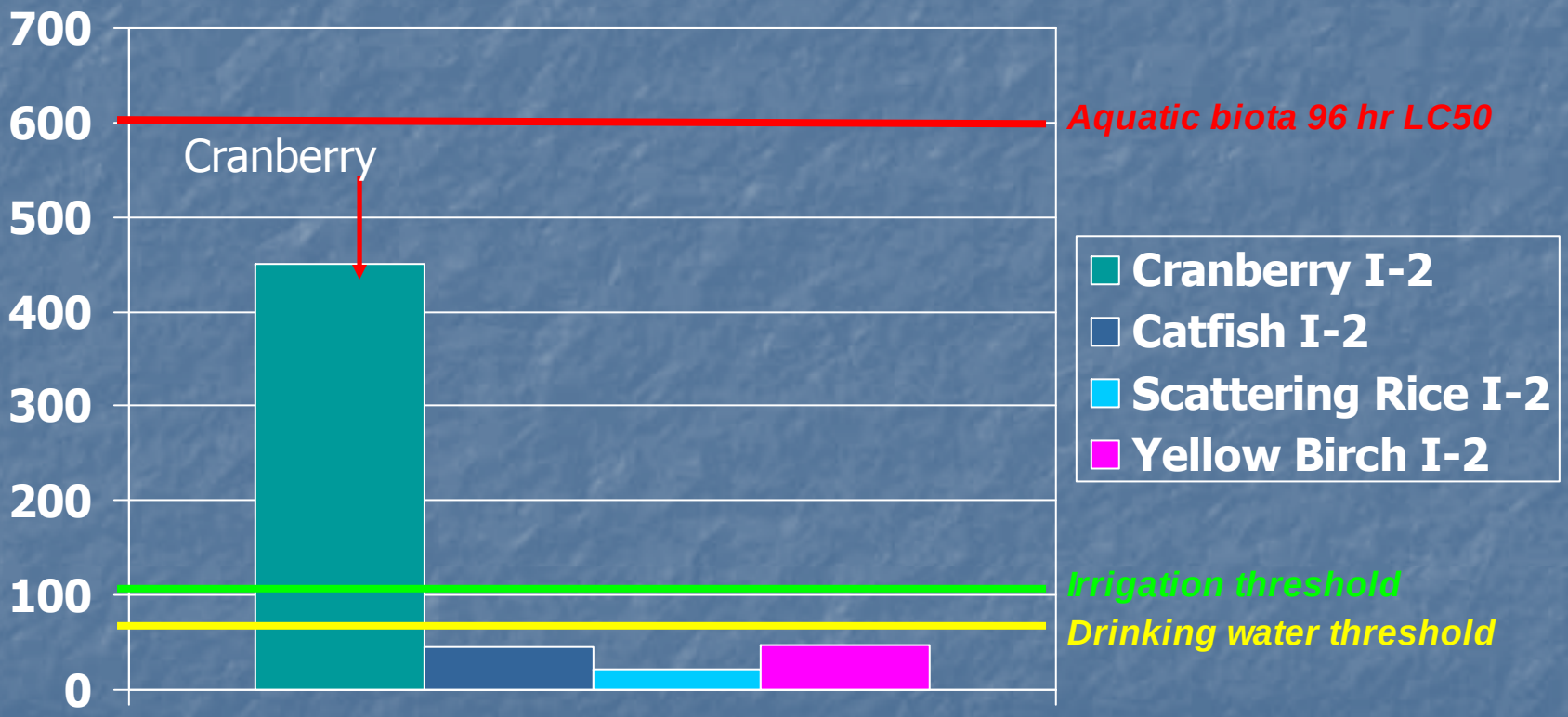
2,4-D Toxicity Thresholds

- EPA Safe Drinking Water < 70 µg/L
- EPA Safe Irrigation Water <100 µg/L
- EPA Safe Child Swimming <900 ug/L
- Walleye fry 96hr LC50 = 660 µg/L
- Amphipod 48hr LC50 = 600 µg/L

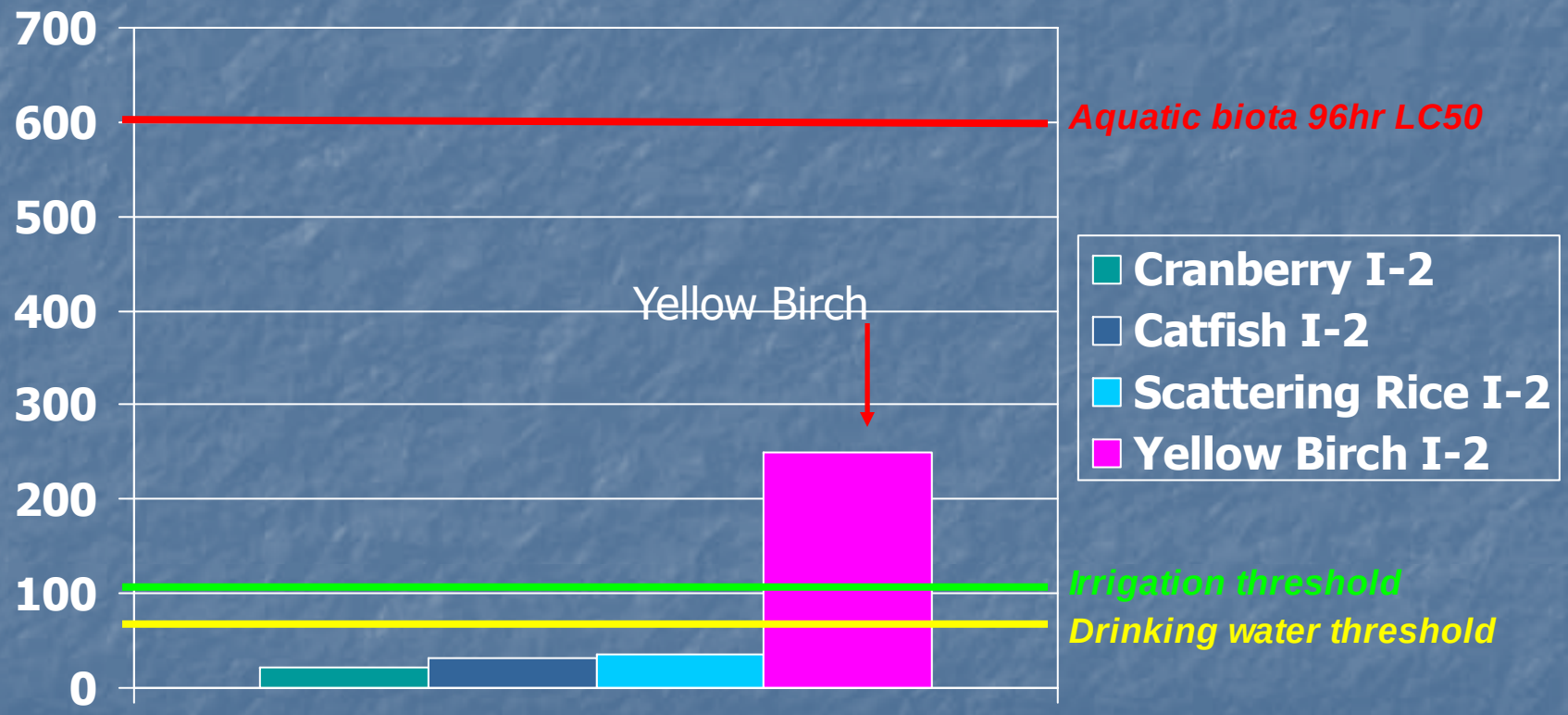
Intensive Monitoring Centerpoint Pre-application



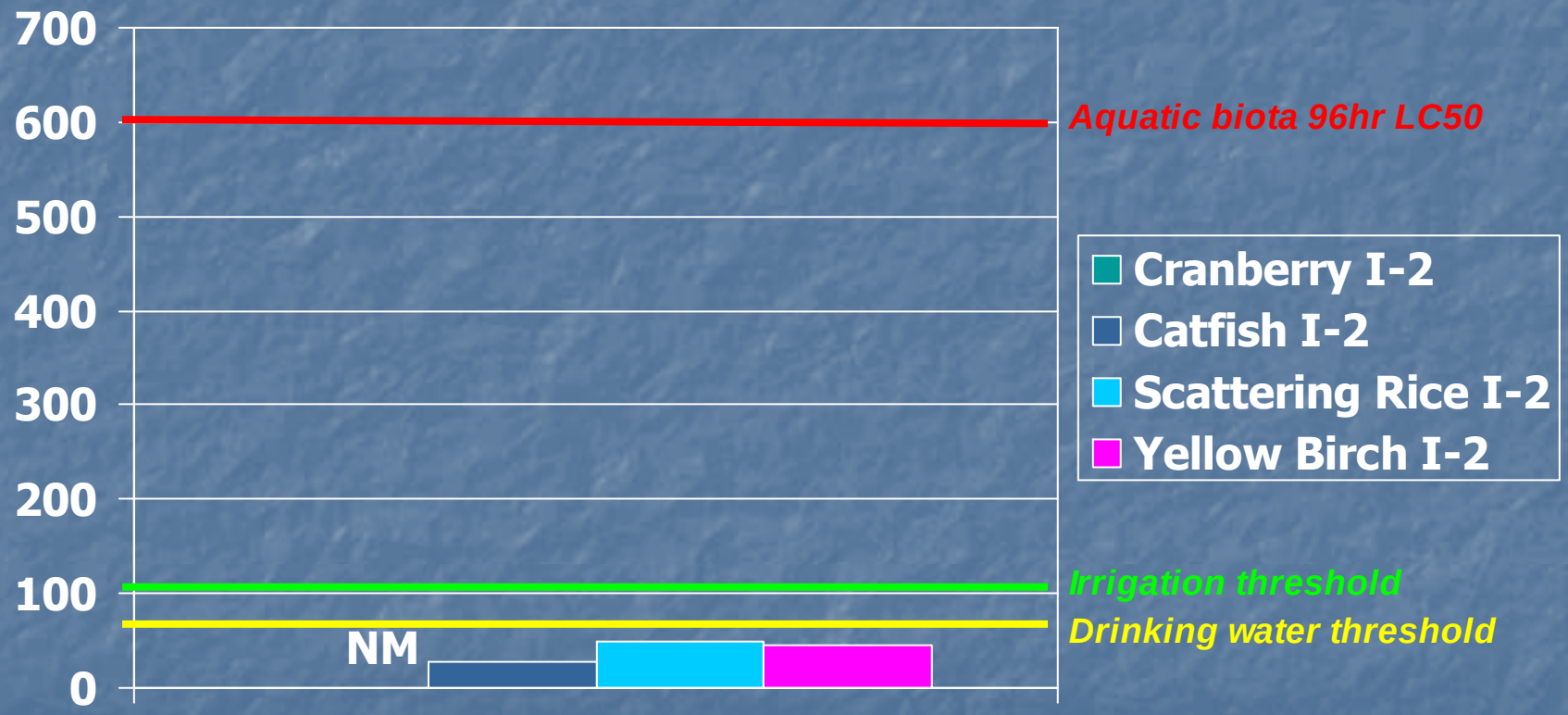
Intensive Monitoring Centerpoint Day 1



Intensive Monitoring Centerpoint Day 4



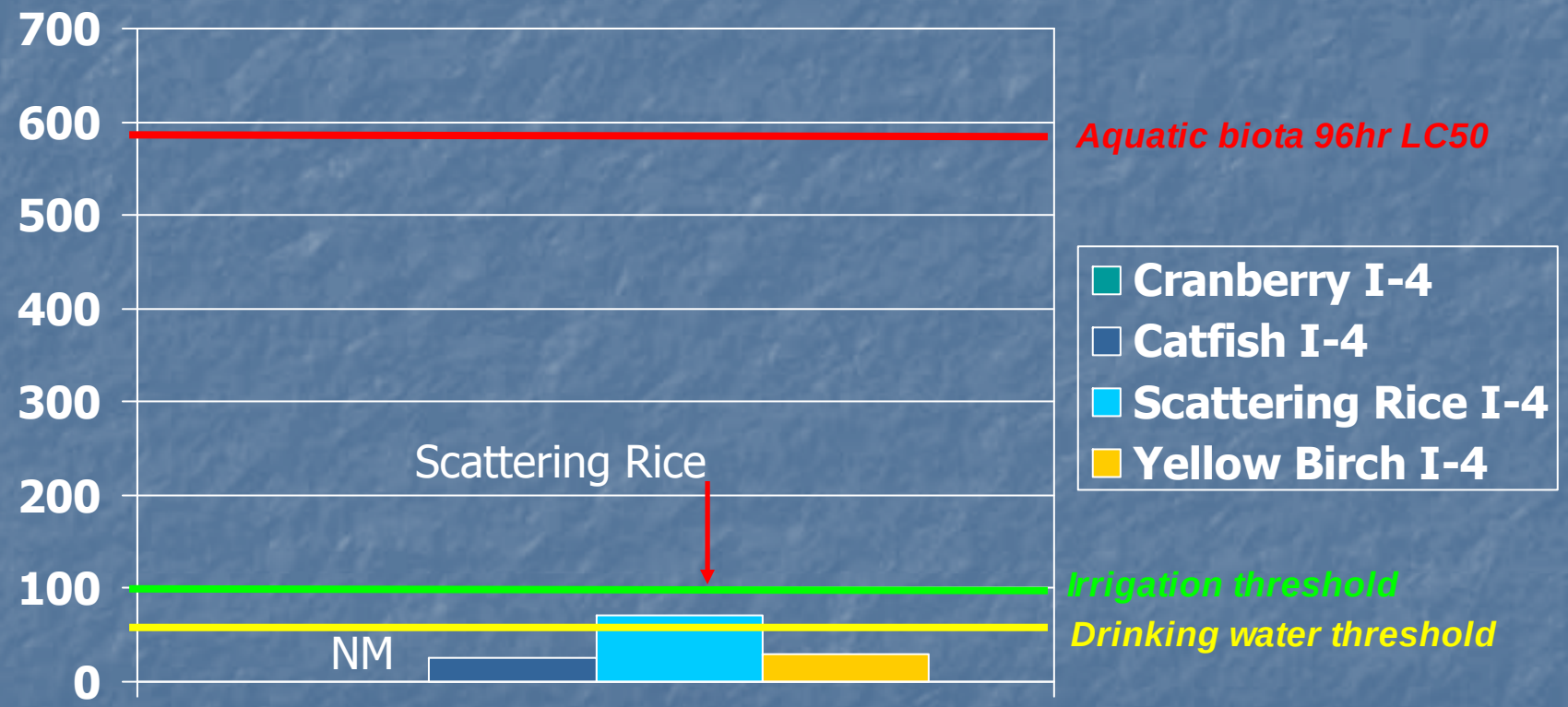
Intensive Monitoring Centerpoint Day 7



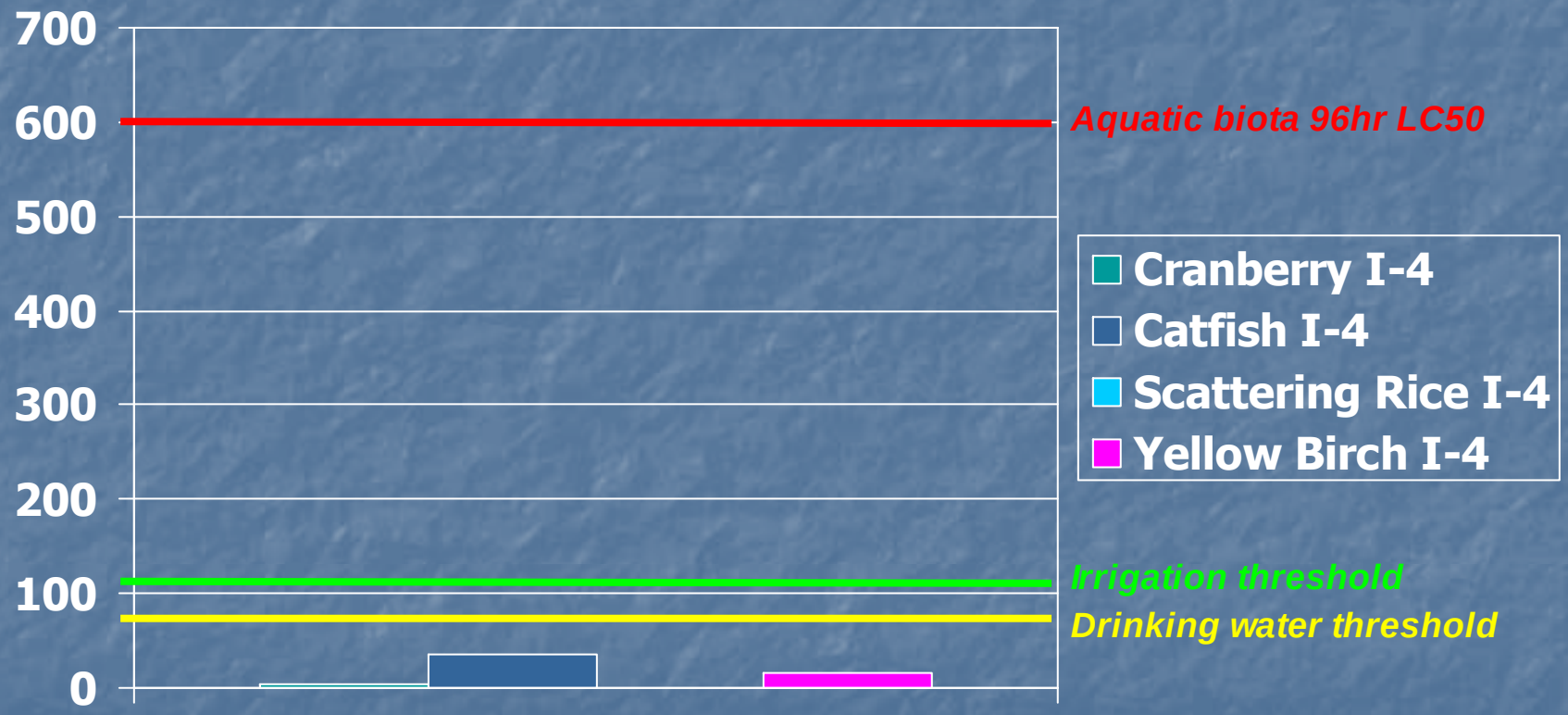
Intensive Monitoring Site 4

(50 feet outside of treatment bed)

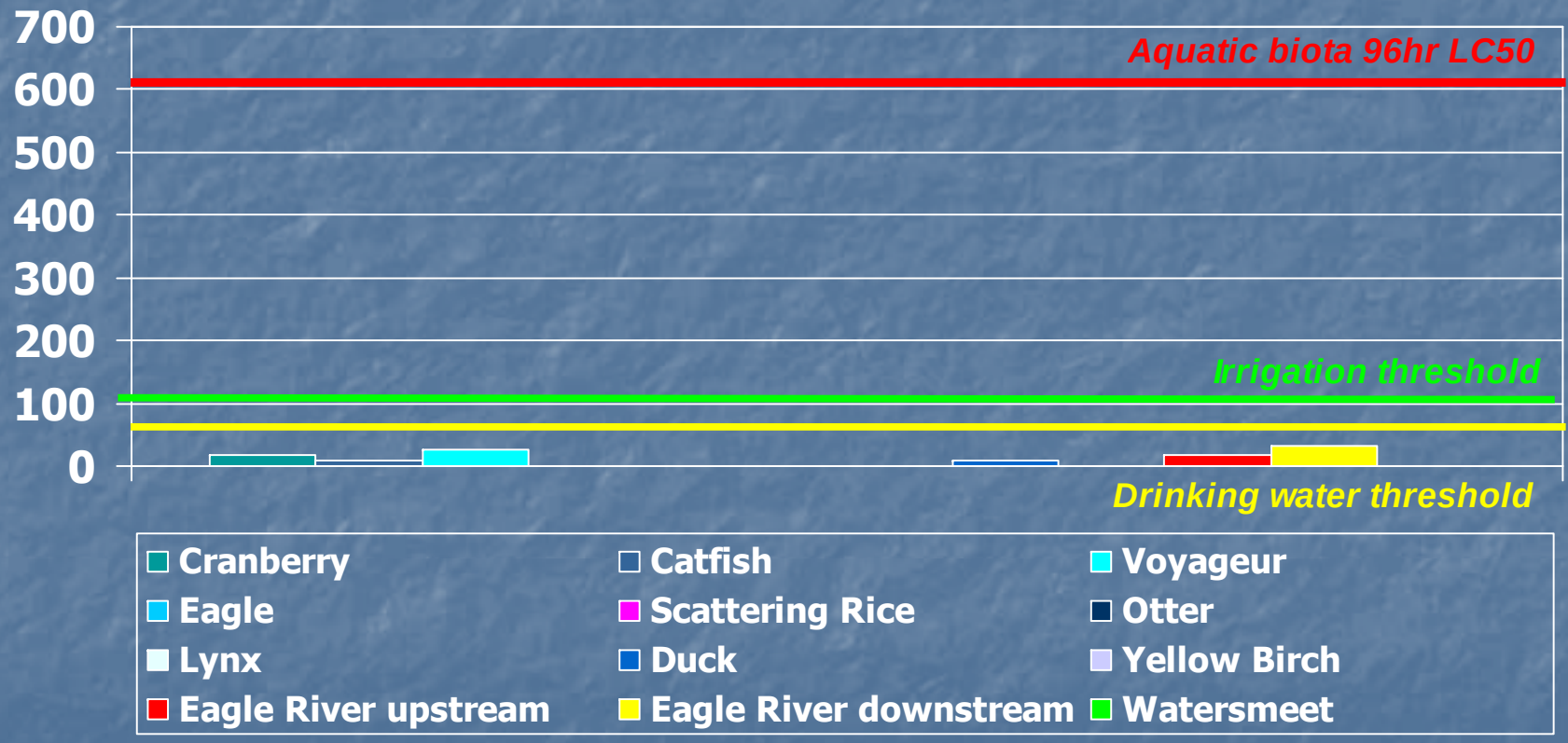
Day 7



Intensive Monitoring Site 4
Day 14



Mid-Basin Sample
Day 14



Conclusions - Residuals

- No detectable 2,4-D measured prior to application
- Maximum measured 2,4-D concentration day 1 post-application= 450 ug/L (Cranberry Lake)
- Significant difference in max concentration and breakdown patterns over time between lakes.
- No monitoring sites exceeded 70 ug/L day 14 or beyond.
- No Mid-Basin sites exceeded 70 ug/L at any time.

Eagle River Chain EWM Data

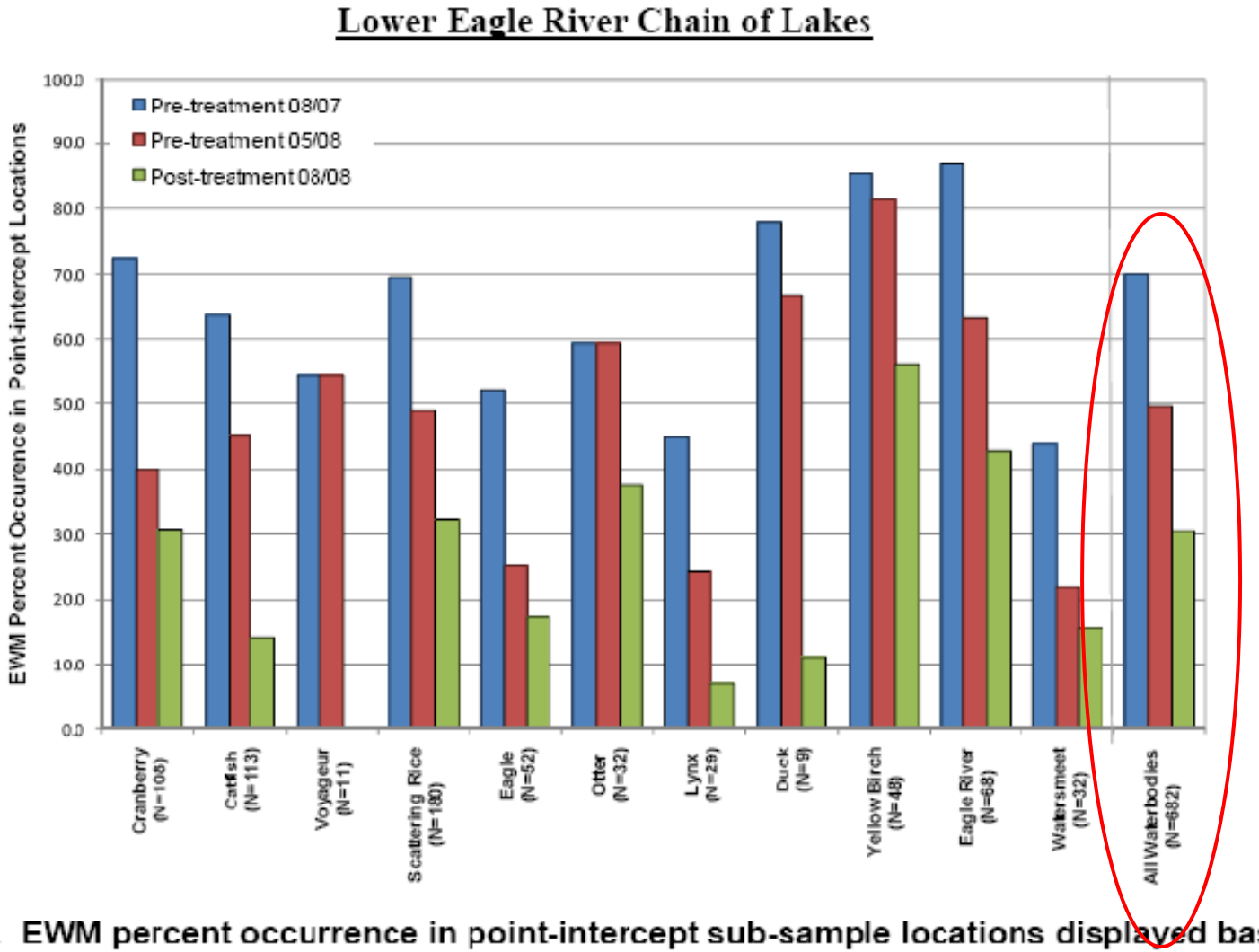


Figure 34. EWM percent occurrence in point-intercept sub-sample locations displayed based on treatment sites on the Eagle River Chain of Lakes.

Eagle Chain Macrophyte Data

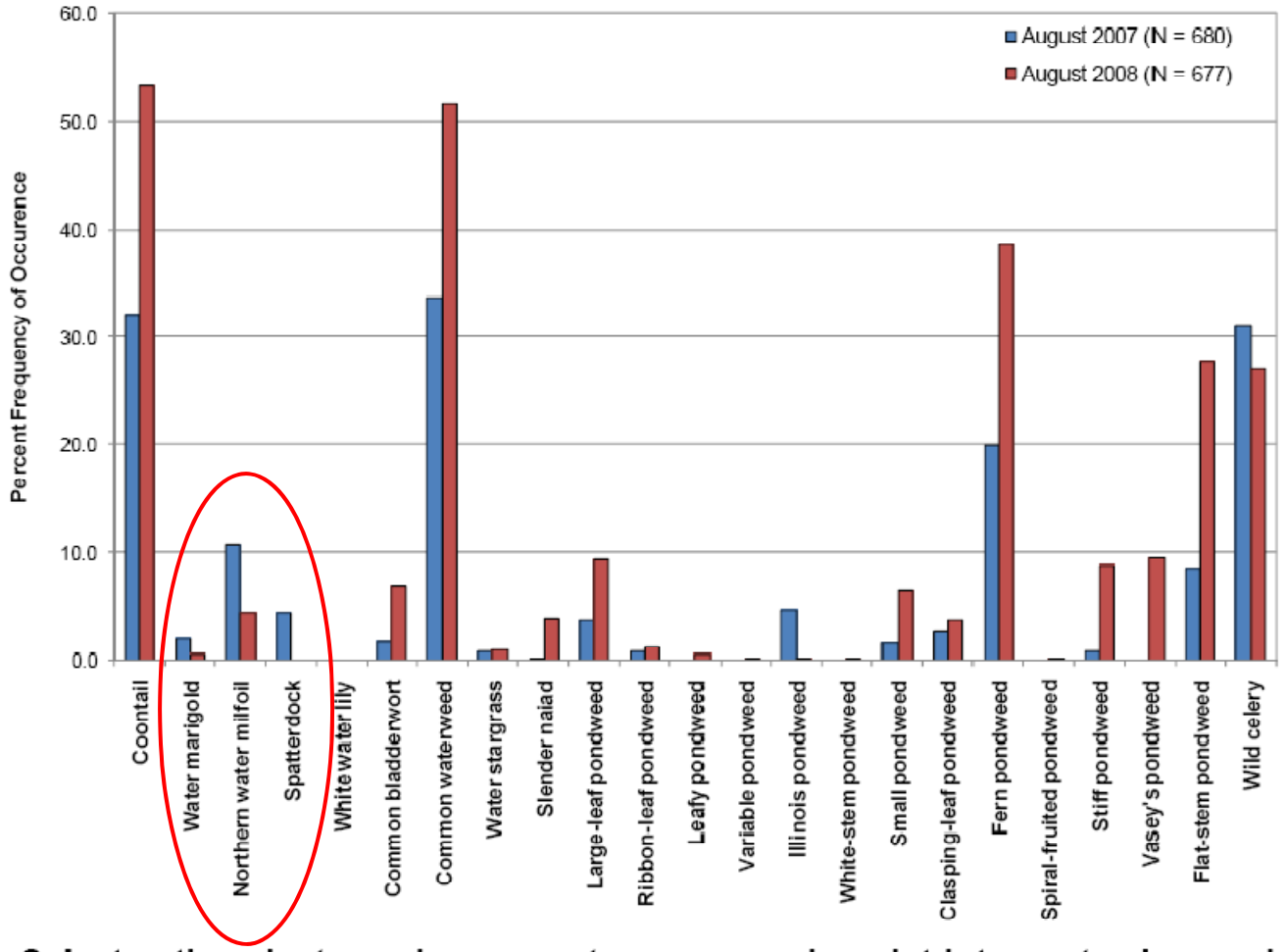


Figure 36. Select native plant species percent occurrence in point-intercept sub-sample locations on the Lower Eagle River Chain of Lakes. First six species are broadleaf species (dicots).

Selective early spring control of Eurasian watermilfoil,
Town of Barnes, Bayfield Co.

***Partners*:**

WI Department of Natural Resources

US Army Corps of Engineers

Town of Barnes

Volunteers

Background:

1. EWM discovered in Tomahawk and Sandbar Lakes in 2004

2. Town of Barnes reacts with Survey of 27 Lakes – no other EWM

3. Interest to control EWM:

    a. Isolated infestation located in and around many other lakes
    b. Risk to nearby lakes
    c. Restore recreational uses
    d. Could increase and spread coverage within lakes
    e. Possible research opportunity?

Tomahawk & Sandbar: Study design

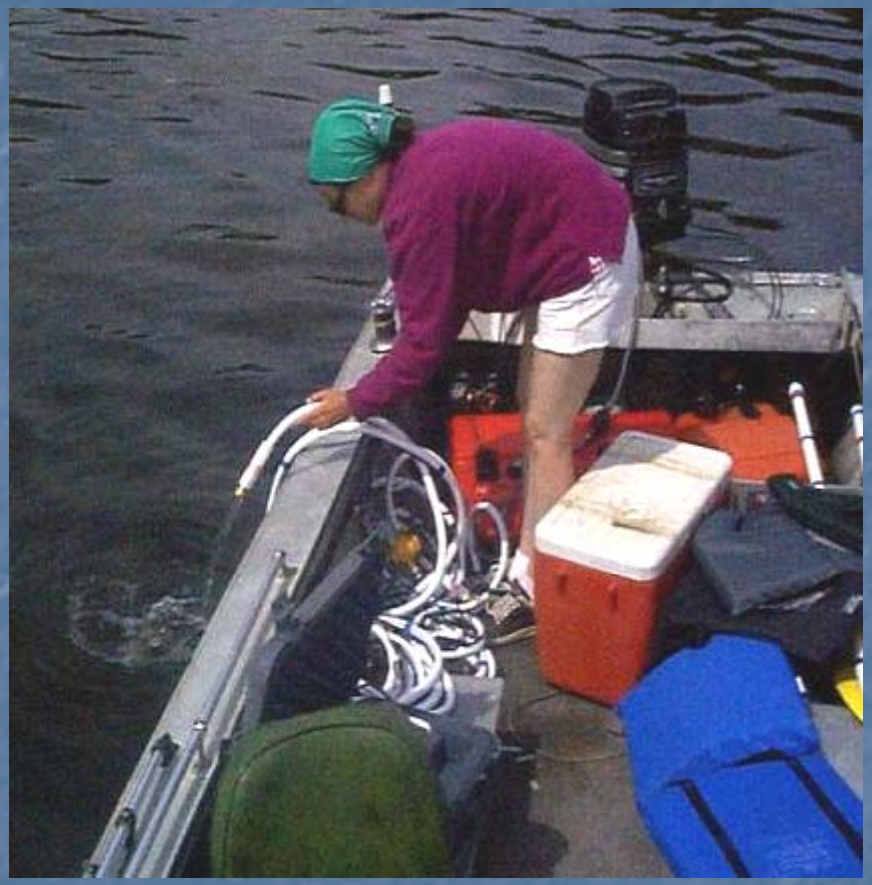
- Tomahawk – early season low dose 2,4-D (0.5 mg/L ae) treatment to whole lake (May 20, 2008)
- Sandbar – reference lake
- PI Surveys conducted on Tomahawk: 2006-2008
- PI Surveys conducted on Sandbar: 2007-2008
- Biomass collected in 2007 & 2008 surveys

Slide 89

MN1 one of john's slides says "ae" and another says 'ai'. i'm unsure which one is correct.
Michelle E. Nault, 2/26/2009

Tomahawk Treated Area

Water Residue Sampling



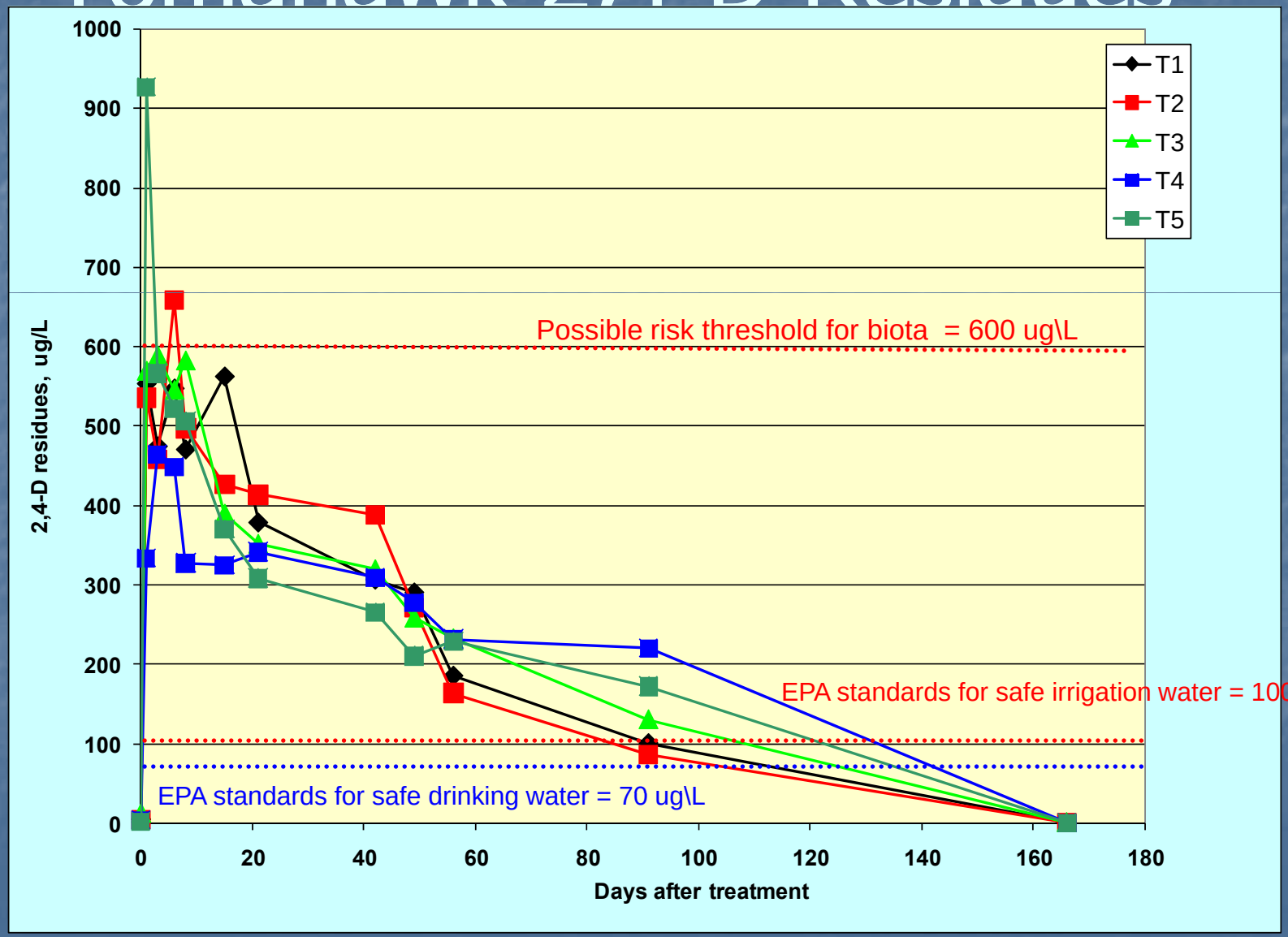
- 2,4-D residues

Pre, 1, 2, 3, 5, 7, 14, 21, 28, 35, and 42 days after treatment

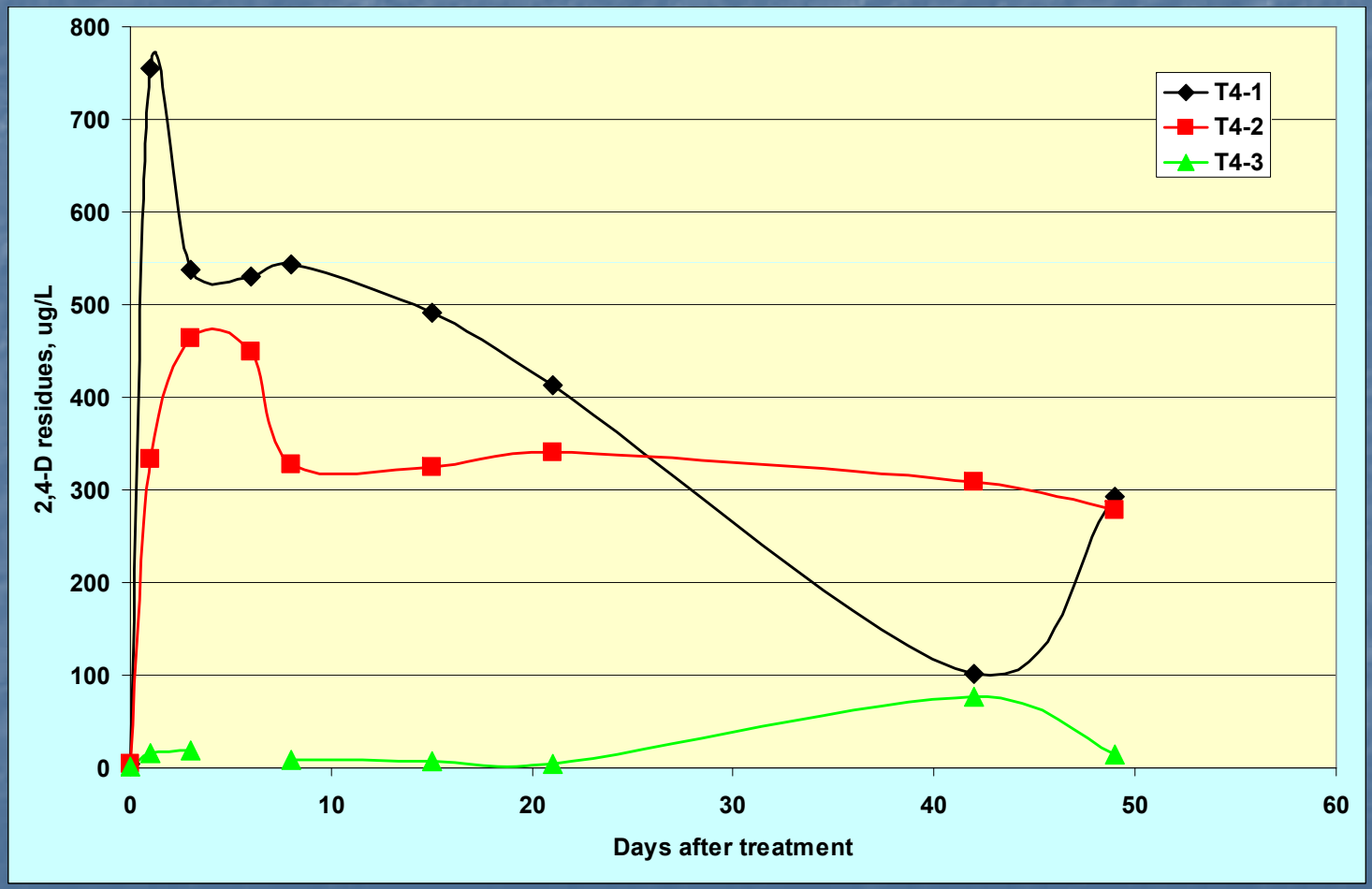
Tomahawk, Sandbar, and ground water

Residue Sample Locations

Tomahawk 2,4-D Residues



Tomahawk 2,4-D Residues vs. depth

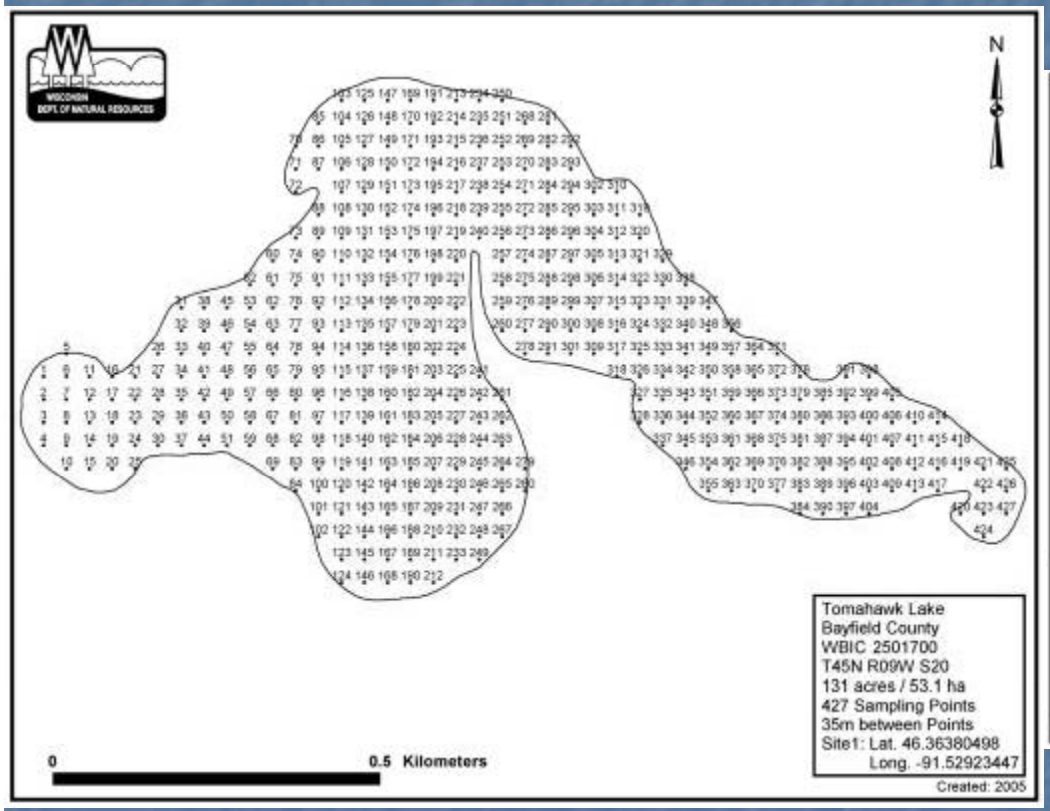


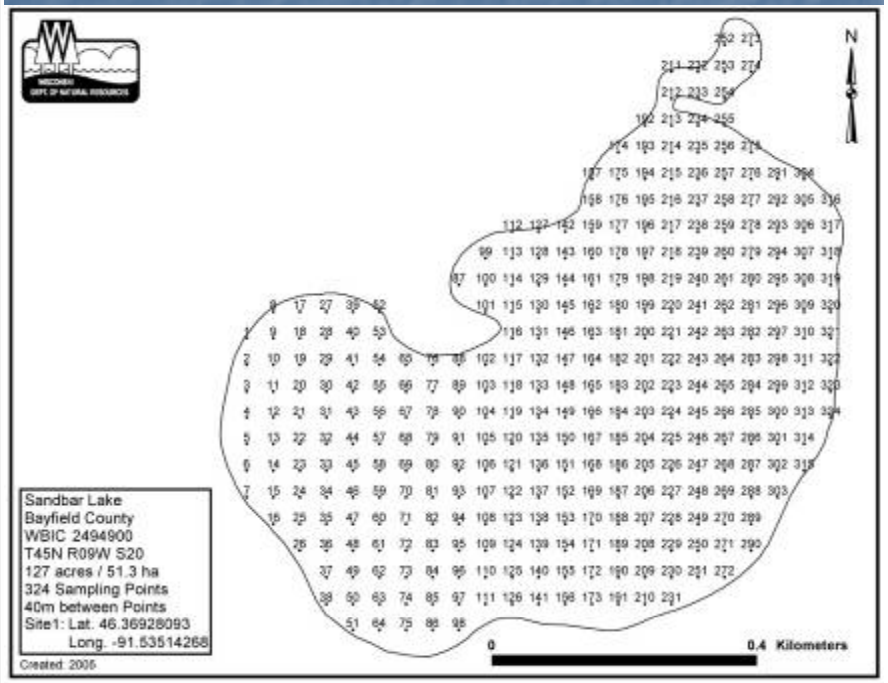
Sandbar and ground water residues

Sandbar Lake **NOT DETECTED**

Ground water **NOT DETECTED**

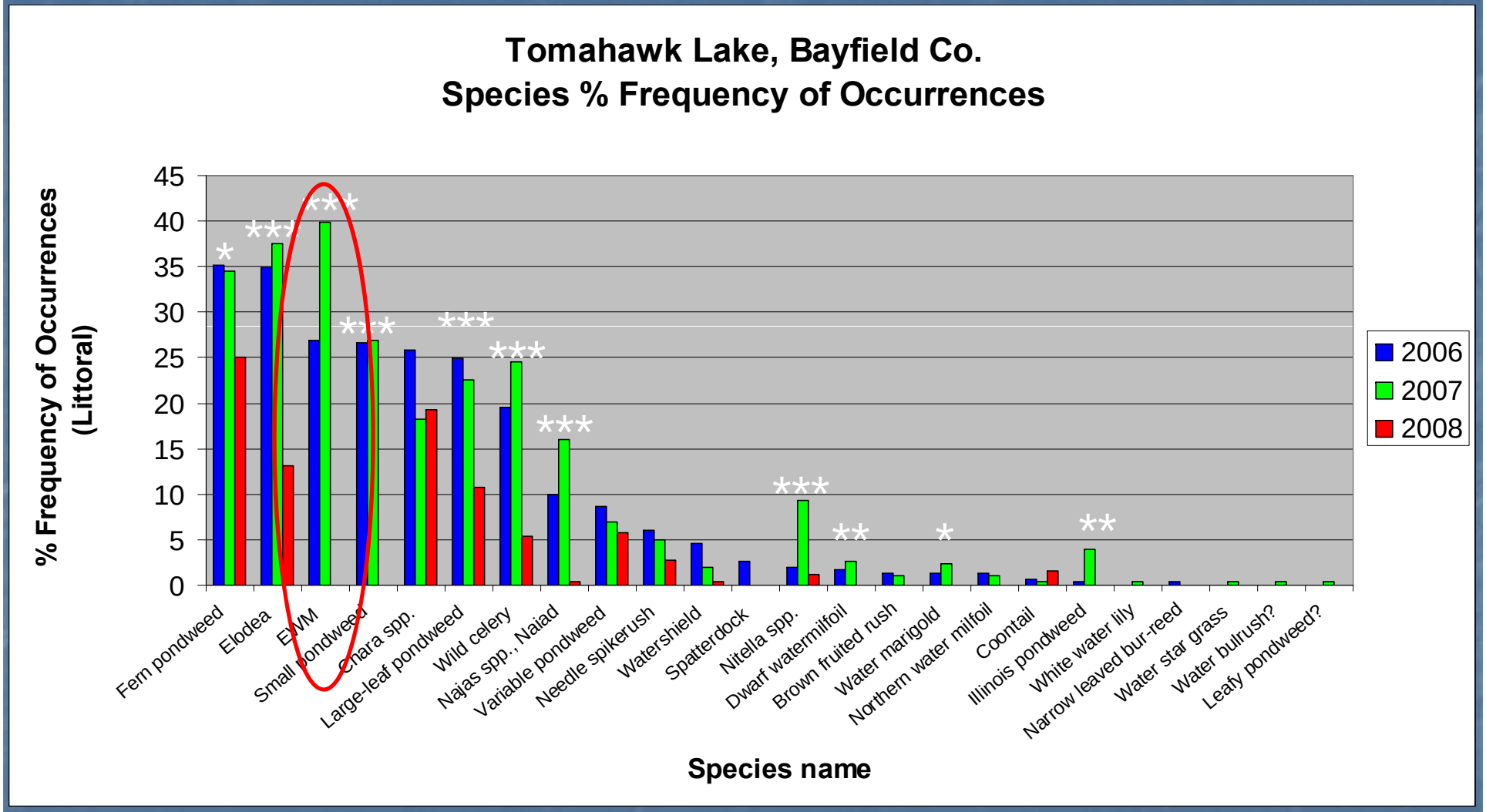
Point-intercept plant surveys





Tomahawk Lake, Bayfield Co. 2006 - 2008 Summary Stats

	Pre-treatment		Post-treatment
	2006	**2007**	**2008**
# points sampled	315	313	299
# of sites with vegetation	256	260	141
littoral FOC	85.1	86.4	54.2
simpsons diversity	0.89	0.90	0.81
avg. # species per site (littoral)	2.4	2.6	0.9
avg. # species per site (vegetated sites)	2.8	3.0	1.6
avg. # natives per site (littoral)	2.1	2.2	0.9
avg. # natives per site (vegetated sites)	2.5	2.7	1.6
species richness	20	22 (2 unverified)	11
species richness (+ visuals)	25	25	13



* = p ≤ 0.05

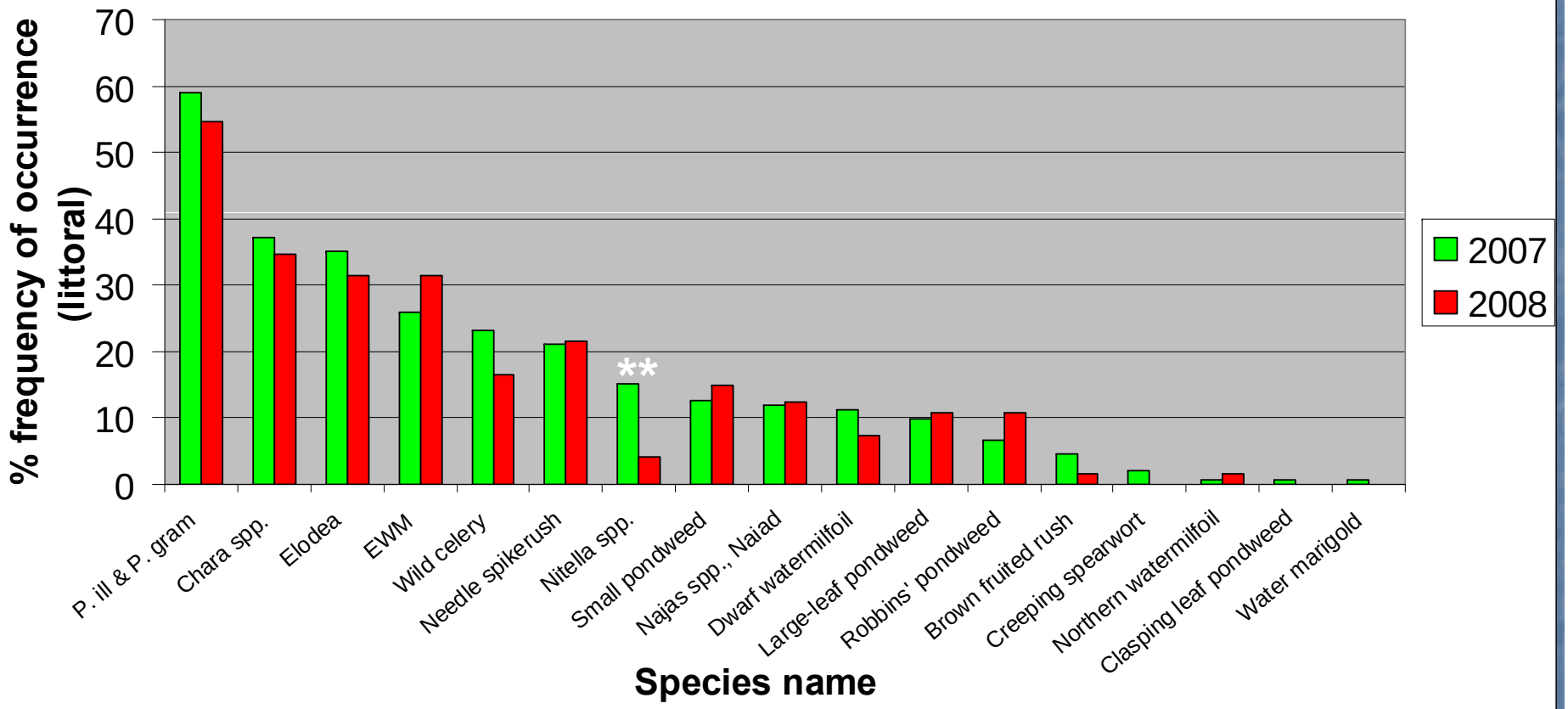
** = p ≤ 0.01

*** = p ≤ 0.001

Sandbar Lake, Bayfield Co.
2007 - 2008 Summary Stats

	2007	2008
# points sampled	190	125
# of sites with vegetation	131	107
littoral FOC	86.8	88.4
simpsons diversity	0.89	0.88
avg. # species per site (littoral)	2.8	2.5
avg. # species per site (vegetated sites)	3.2	2.9
avg. # natives per site (littoral)	2.5	2.2
avg. # natives per site (vegetated sites)	2.90	2.6
species richness	17	14
species richness (+ visuals)	19	14

Sandbar Lake, Bayfield Co.



* = p ≤ 0.05
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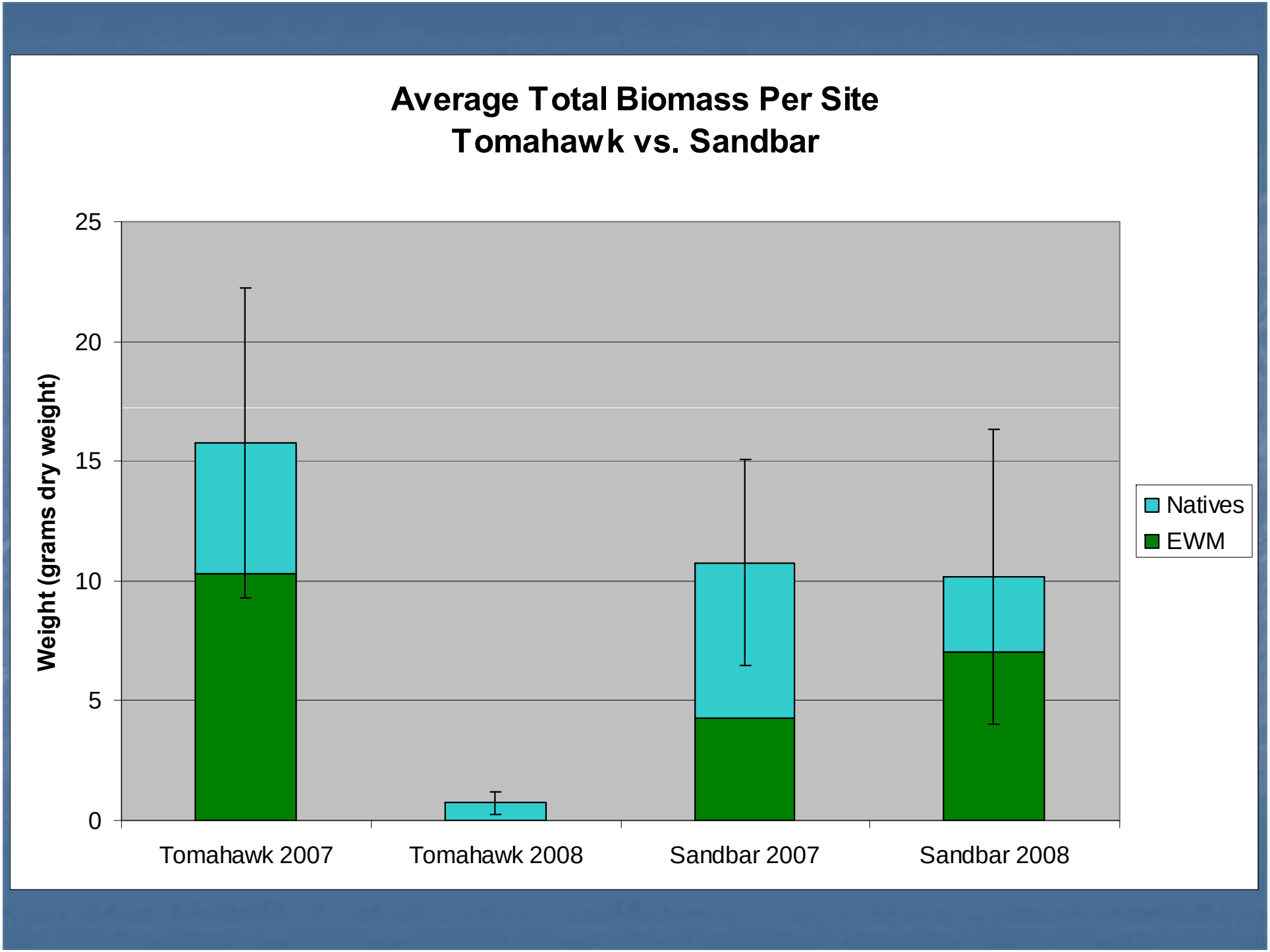
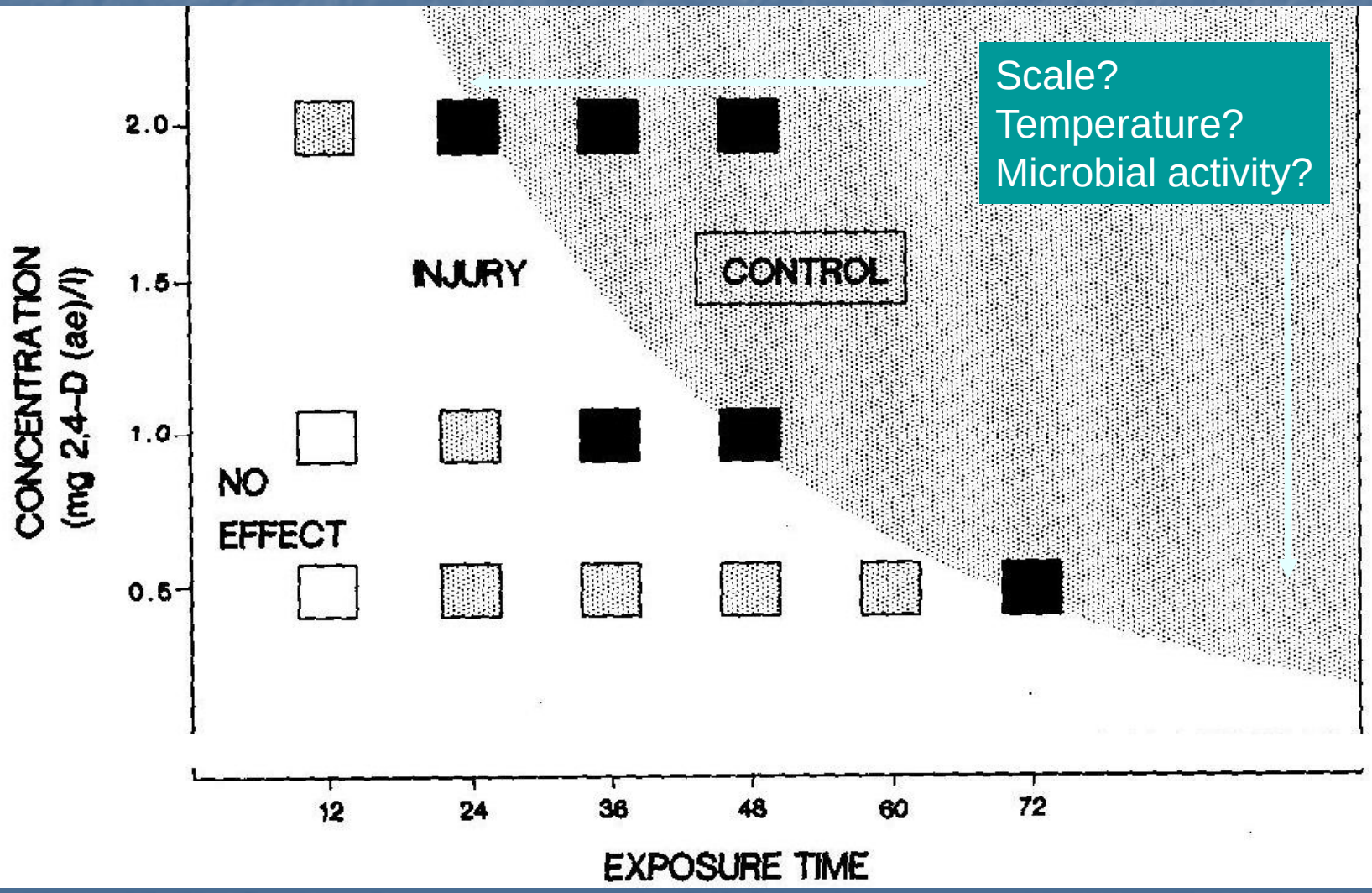
*** = p ≤ 0.001


Average Total Biomass Per Site
Tomahawk vs. Sandbar
Weight (grams dry weight)
25
20
15
10
5
0
Tomahawk 2007
Tomahawk 2008
Sandbar 2007
Sandbar 2008
Natives
EWM

Concentration/Exposure Time Relationship 2,4-D



J. Aquat. Plant Manage 30: 1-5

Final Thoughts

- Early spring, large scale treatments in northern lakes may result in longer persistence of herbicides than expected
- Label concentrations (application rates) may not be applicable (too high)
- Residual monitoring is important, both to understand treatment efficacy, as well as ecological risks

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- Unified Lower Eagle River Chain of Lakes Commission
- Legend Lake Protection and Rehabilitation District
- Town of Barnes EWM Committee, Bayfield Co

DATCP and NR107 – keep or use to introduce Matt

NR 107 Aquatic Plant Management – Chemical Use.

"NR 107.01. Purpose. The purpose of this chapter is to establish procedures for the management of aquatic plants and control of other aquatic organisms pursuant to s. 227.11 (2) (a), Stats., and interpreting s. 281.17 (2), Stats. A balanced aquatic plant community is recognized to be a vital and necessary component of a healthy aquatic ecosystem. ***The department may allow the management of nuisance-causing aquatic plants with chemicals registered and labeled by the U.S. environmental protection agency and labeled and registered by firms licensed as pesticide manufacturers and labelers with the Wisconsin department of agriculture, trade, and consumer protection.*** *Chemical management shall be allowed in a manner consistent with sound ecosystem management and shall minimize the loss of ecological values in the water body."*

NR107 and DATCP

NR 107.05 Issuance of permit.

(3) The department may deny issuance of the requested permit if:

(a) The proposed chemical is not labeled and registered for the intended use by the United States environmental protection agency and both labeled and registered by a firm licensed as a pesticide manufacturer and labeler with the Wisconsin department of agriculture, trade and consumer protection;

NR107 and DATCP

NR 107.08 Conditions of the permit.

(5) Treatment shall be performed by an applicator currently certified by the Wisconsin department of agriculture, trade and consumer protection in the aquatic nuisance control category whenever:

(a) Treatment is to be performed for compensation by an applicator acting as an independent contractor for hire;

(b) The area to be treated is greater than 0.25 acres;

(c) The product to be used is classified as a "restricted use pesticide";

or

(d) Liquid chemicals are to be used.

Exemptions

(2) The treatment of purple loosestrife is exempt from ss. NR 107.04 (2) (a) and (3), and 107.08 (5).

(3) The use of chemicals in private ponds is exempt from the provisions of this chapter except for ss. NR 107.04 (1), (2), (4) and (5), 107.05, 107.07, 107.08 (1), (2), (8) and (9), and 107.10.

(4) The use of chemicals in accordance with label instructions is exempt from the provisions of this chapter, when used in:

(a) Water tanks used for potable water supplies;

(b) Swimming pools;

(c) Treatment of public or private wells;

(d) Private fish hatcheries licensed under s. 95.60, Stats.;

(e) Treatment of emergent vegetation in drainage ditches or rights–of–way where the department determines that fish and wildlife resources are insignificant;

(f) Wastewater treatment facilities

Discussion items – Grey areas

- Are all invasive plants in aquatic areas considered to be "aquatic plants or organisms"?
- What constitutes "waters of the state"?
  - wetlands with no standing water, exposed shorelines below the OHWM, groundwater, stormwater detention ponds, registered fish farms, cranberry bogs, etc.
- When do I need an NR107 permit?
  - "Wet Socks" rule
- When do I need to be certified?

Example: Private Ponds

- Definition:
  - located entirely on the land of an applicant,
  - no surface water discharge or a discharge that can be controlled to prevent chemical loss, and
  - without access by the public
- Still need an NR107 permit (unless registered as a fish rearing facility) and pay application fee
- Department may still deny or condition permit
- Do not need to be a certified applicator (unless required by the product label)
- Still need to follow label guidelines

Example: *Phragmites* control on Lake Michigan shorelines

- An NR 107 permit is always required if the proposed treatment area is wet at the time of treatment. This means that you would get your socks wet if you stood without wearing shoes. No permit needed if the area is dry.
- Regardless if wet or dry, a product with an aquatic label must be used. Habitat®, Rodeo®, and Aquaneat® have aquatic labels. Other Glyphosate formulations may also have aquatic labels. Roundup® does not have an aquatic label, so it cannot be used even on dry exposed beach areas.
- Habitat® can only be applied by an applicator certified by the Department of Agriculture, Trade and Consumer Protection (DATCP) in the aquatics and mosquito category 5.