Status of Numeric Nutrient Standards Development for Montana's Waters

Michael Suplee, Ph.D.

Water Quality Standards Section

MT Department of Environmental Quality

Presentation to the Statewide TMDL Advisory Group

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Overview

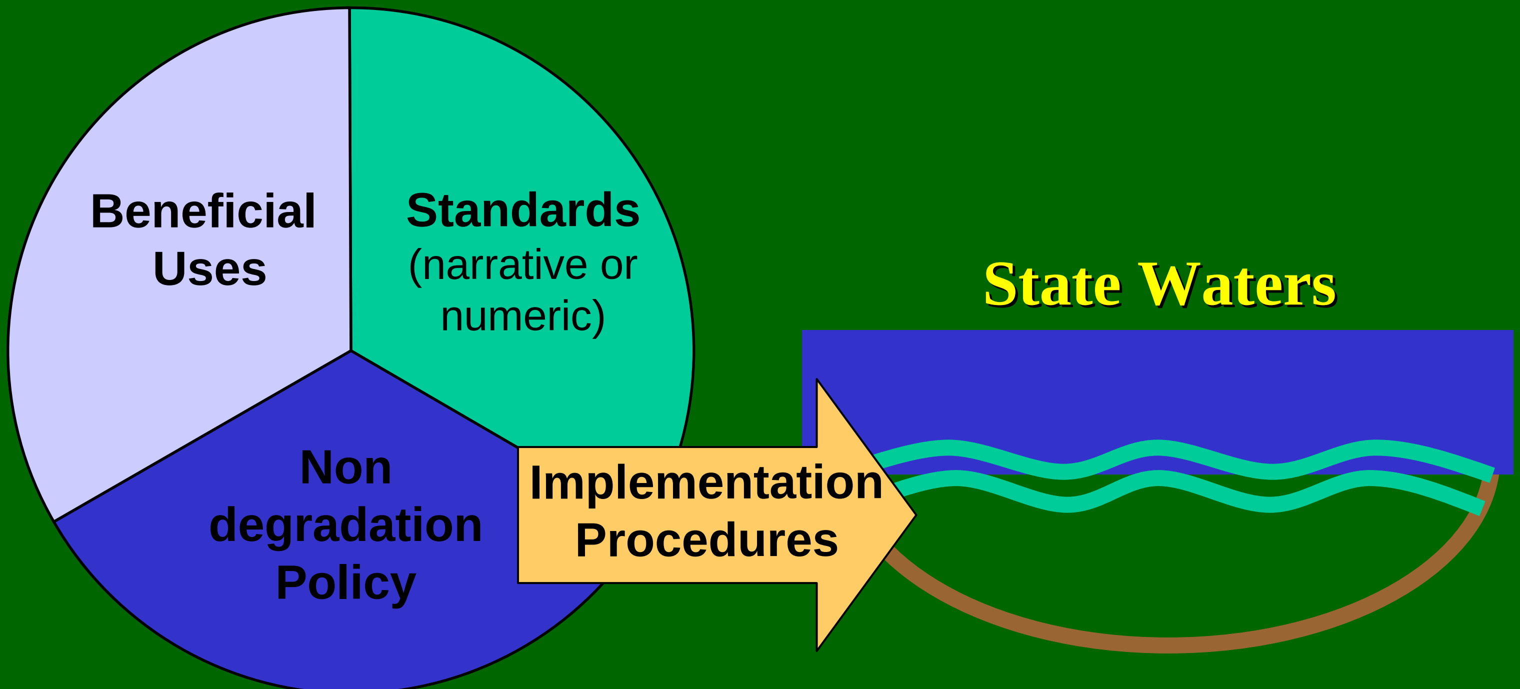
- What is a water quality standard?
- Numeric nutrient standards
  - Progression of adoption expectations over time
  - DEQ’s approach to developing & implementing the standards
    - Scientific basis (summary)
    - Comparison to other work from around the world
  - Legislative activity to address cost of meeting standards
    - Senate Bill 95 / MCA 75-5-313
    - Nutrient Work Group
    - Nutrient Trading Policy

What is a Water Quality Standard?

Combination of:

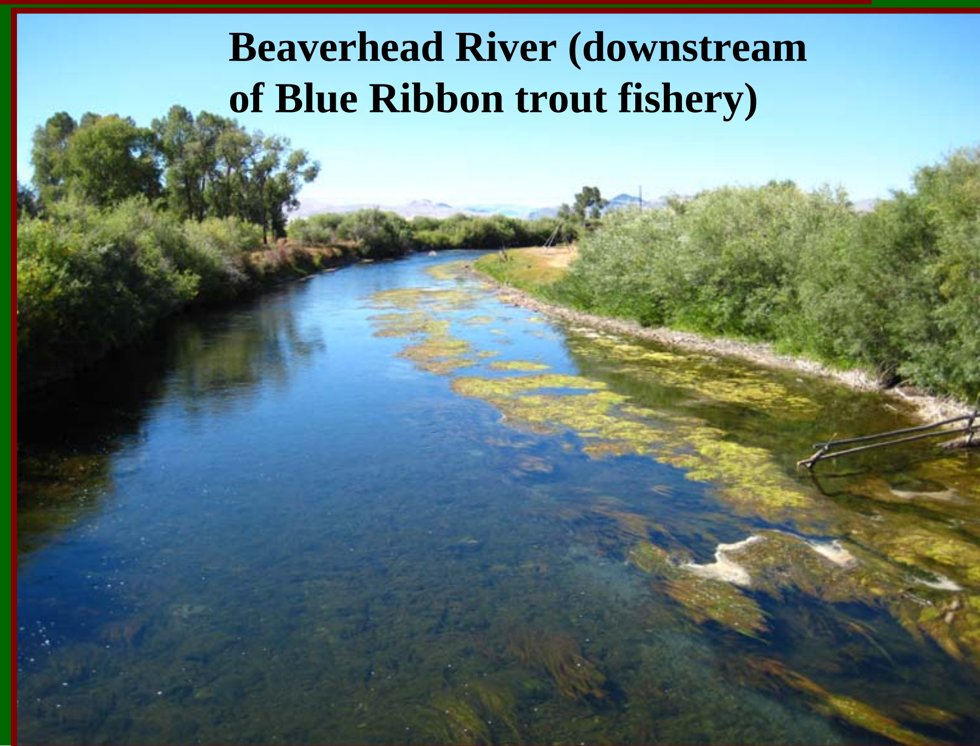
1. Designated Beneficial Uses
   - Bathing, swimming & recreation
   - Drinking
   - Fish & associated aquatic life
   - Agriculture & industrial use
2. Narrative statements or numbers that define level of protection (criteria)
3. Nondegradation Policy

Water Quality Standards



Why Nutrient Standards?

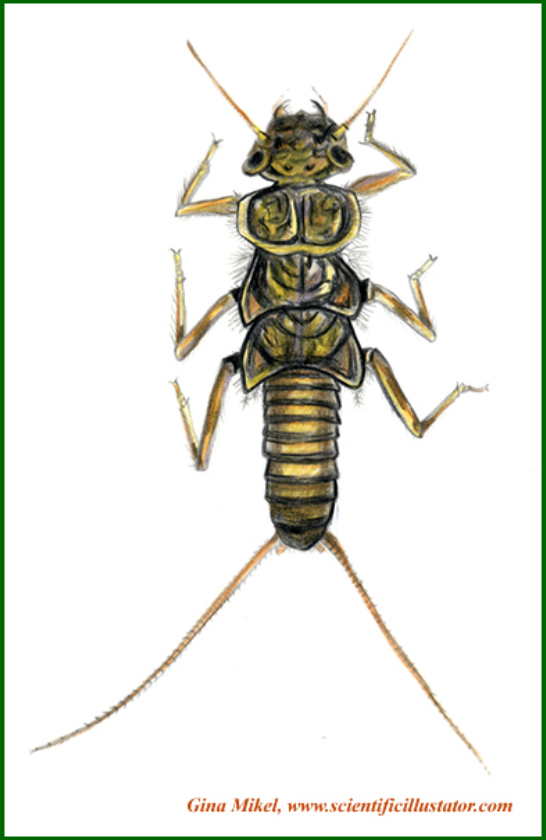
- Nitrogen & phosphorus cause over-fertilization of aquatic habitats, causing adverse impacts to recreation, fish and aquatic life uses
  - Freshwater, estuarine, and marine problem
- Nationally, nutrient enrichment ranks among the top causes of water resource impairment
- Nutrients are among MT DEQ’s top 3 most-common cause of impairment to streams on the 303(d) list



Nuisance algal growth

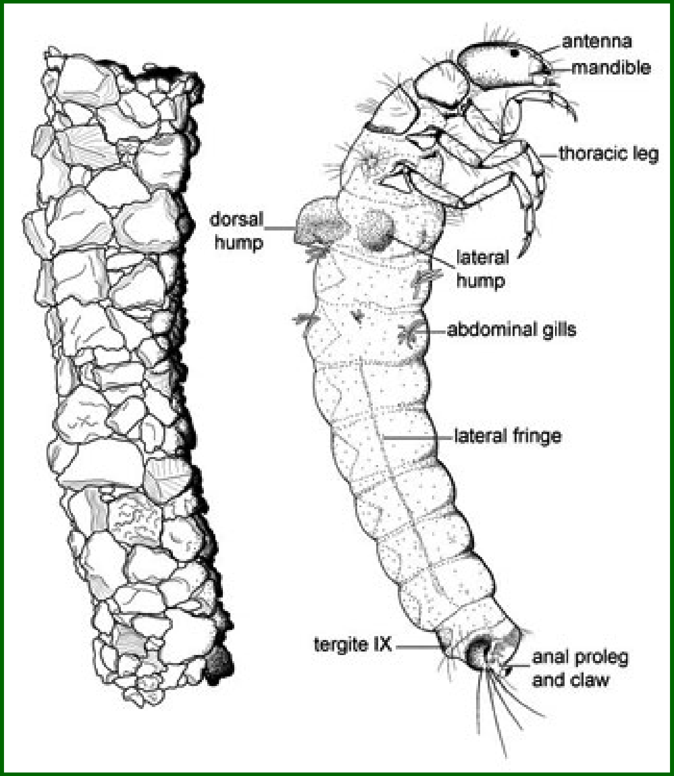
Science:
Clean water fauna, western MT

Ephemeroptera (Mayfly)

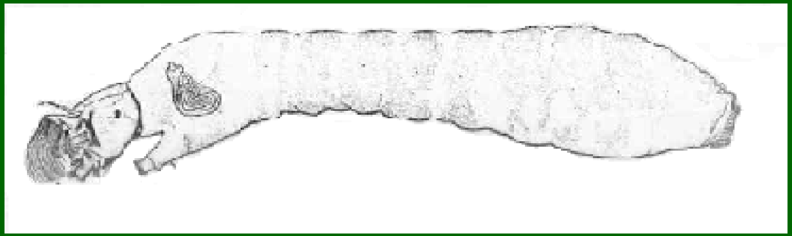


Plecoptera (Stonefly)

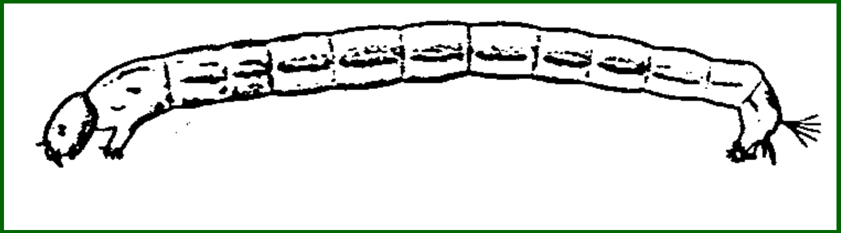
Trichoptera (Caddisfly)



Science: In western Montana streams, these fauna are generally tolerant of pollution. Large numbers of these types of organisms, in the absence of key EPT taxa, generally indicates poor water quality

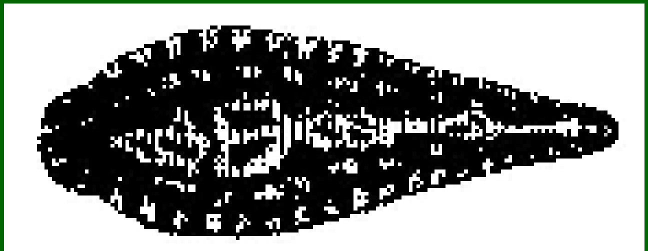


Blackfly Larva

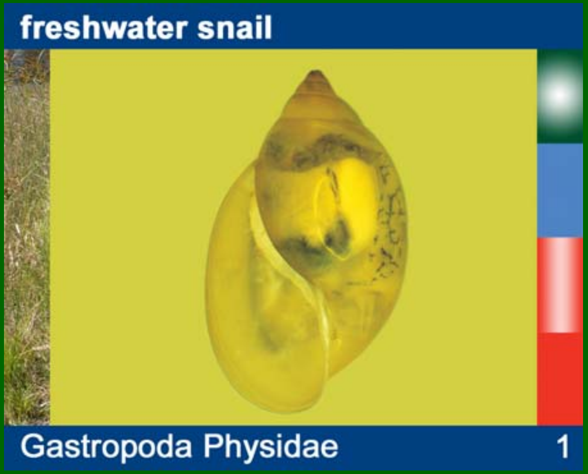


Midge Larva

Aquatic Worms



Some Leeches



EPA National Strategy for Numeric Nutrient Standards- Expectations over Time

•1998: "EPA expects all States and Tribes to adopt and implement numerical nutrient criteria into their water quality standards by December 31, 2003."

•2001: EPA softened expectations for states to adopt standards by 2003

- •States develop plans/schedule for nutrient standards adoption
- •States conduct scientific studies at the State/regional level

All states now in process of development; some standards in law

EPA National Strategy for Numeric Nutrient Standards – Recent National Developments

NATIONAL

- August and September 2009
  - EPA Office of Inspector General: EPA needs to accelerate nutrient standards adoption
  - EPA Nutrient Innovations Task Group: Nutrient pollution is a serious problem, needs to be better addressed
  - Science Advisory Board: Provided considerable critique of EPA's latest criteria-development guidance; much improved methodology expected early next year

EPA National Strategy for Numeric Nutrient Standards – Recent State Developments

FLORIDA

•14 Jan 2009: EPA told Florida to adopt nutrient standards for freshwaters within 1 yr; 2 yrs for estuaries

•21 Aug 2009: Consent decree between Environmental Groups and EPA says numeric criteria will be adopted on schedule

•14 Jan 2010: EPA will be promulgating numeric nutrient standards for FL streams & lakes (estuaries to follow in 1 yr)

WISCONSIN

✓23 Nov 2009: EPA informed by group of environmental groups their intent to sue EPA for failing to promulgate numeric nutrient standards for Wisconsin

Nutrient Standards

- Montana has been developing statewide numeric nutrient standards since 2001

- Current standard applicable to nutrients is <u>narrative</u>:
  - "State surface waters must be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will……..
    (e) create conditions which produce undesirable aquatic life."
    - How green is too green? (excess algae)
    - Other undesirable changes in aquatic life (e.g., macroinvertebrate communities, affects on fisheries)

Why move to numeric nutrient criteria if existing criteria address related water quality problems?

- Current standards address undesirable water quality *effects*; DEQ still has to address the fundamental *cause* of the problem

- Nutrients very commonly associated with low dissolved oxygen, nuisance algal growth, change in aquatic life from clean-water to tolerant fauna
  - excess nutrients are *cause* of the unwanted *effect*

MT Nutrient Standards Status

Plan: numeric nutrient standards for all surface waters

- Standards in place for Upper Clark Fork R. since 2002
- Wadeable streams & rivers
  - Basic science largely done, particularly for western MT
    - Refining and improving
  - Stakeholder input, then presentation to BER (2010?)
- Large Rivers
  - Case-by-case, water-quality modeling approach
  - Yellowstone River segment first case study; results in Feb 2010
- Lakes
  - Worked to fill data gaps from 2003-2008
  - Database compilation and first analytical steps next

Montana DEQ's Approach

- <u>Science</u> establishes the base numeric criteria
- <u>Policy</u> addresses the difficulties of meeting the criteria

Science: How are criteria derived?

Nutrient criteria development across a large, diverse state like Montana required 3 major parts:

1) Identification of appropriate geographic zones in which specific nutrient criteria (e.g., total P, total N) would apply

2) Understanding of cause-effect (i.e., stressor-response) relationships between nutrients and beneficial uses
   - Requires determining “harm to use”
   - Different expectations for different regions of the state

3) Water quality data from reference sites
   - ➢ Data from 2 and 3 can then be viewed together

Science: Identifying an Appropriate Geospatial Frame (i.e., where will criteria apply?)

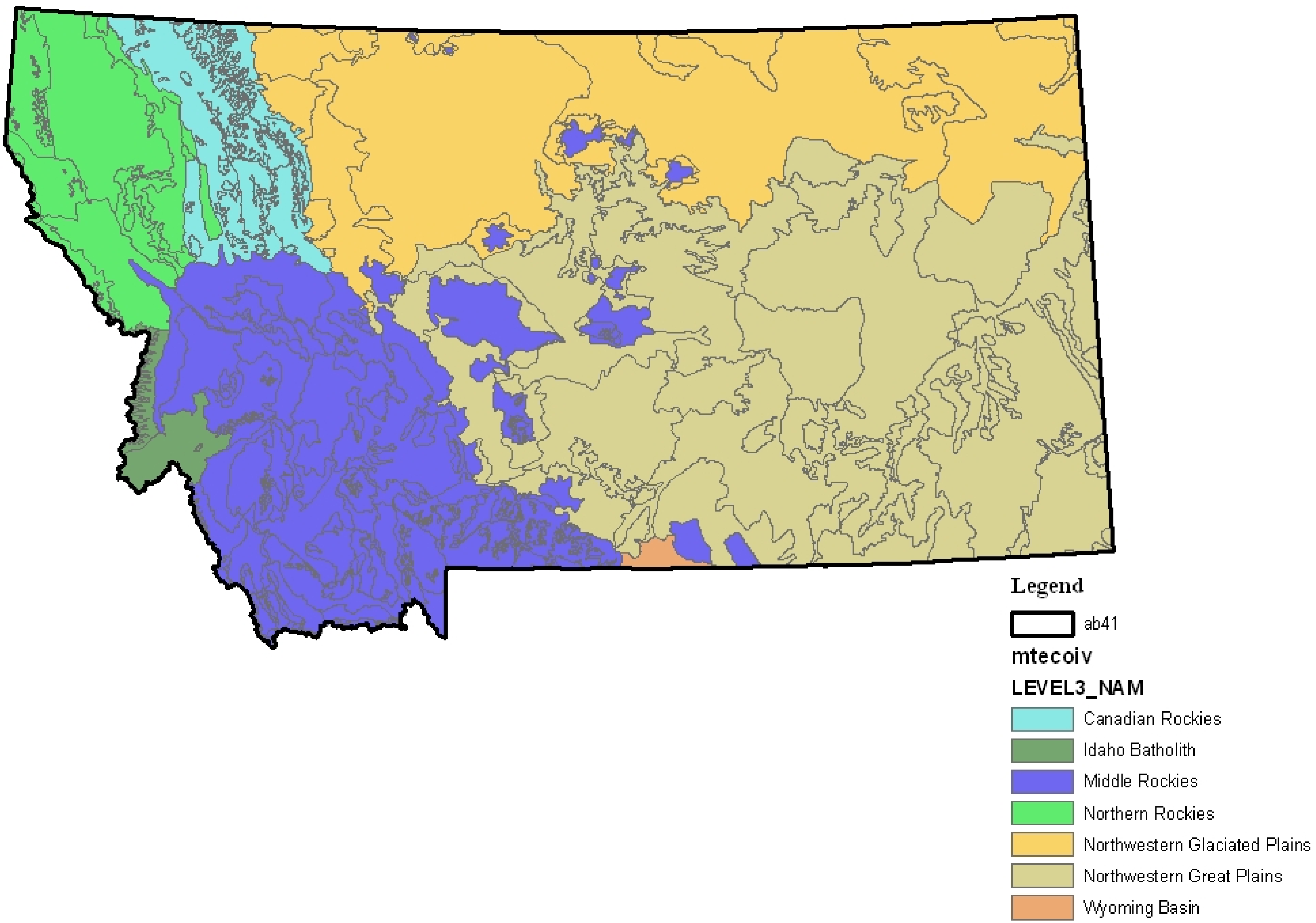
- Nutrient concentrations vary naturally — geology, soils, climate, vegetation
- DEQ needed a practical, easily-applied geospatial framework that explained a good proportion of nutrient-concentration variability in wadeable streams
  - Ecoregions (developed by Jim Omernik)
  - Lithology
  - Strahler Stream Order
- The best geospatial frame maximizes the variance between zones and minimizes the variance within zones
- Focused on reference stream data to determine zones

Science: Conclusions about the Geospatial Frames

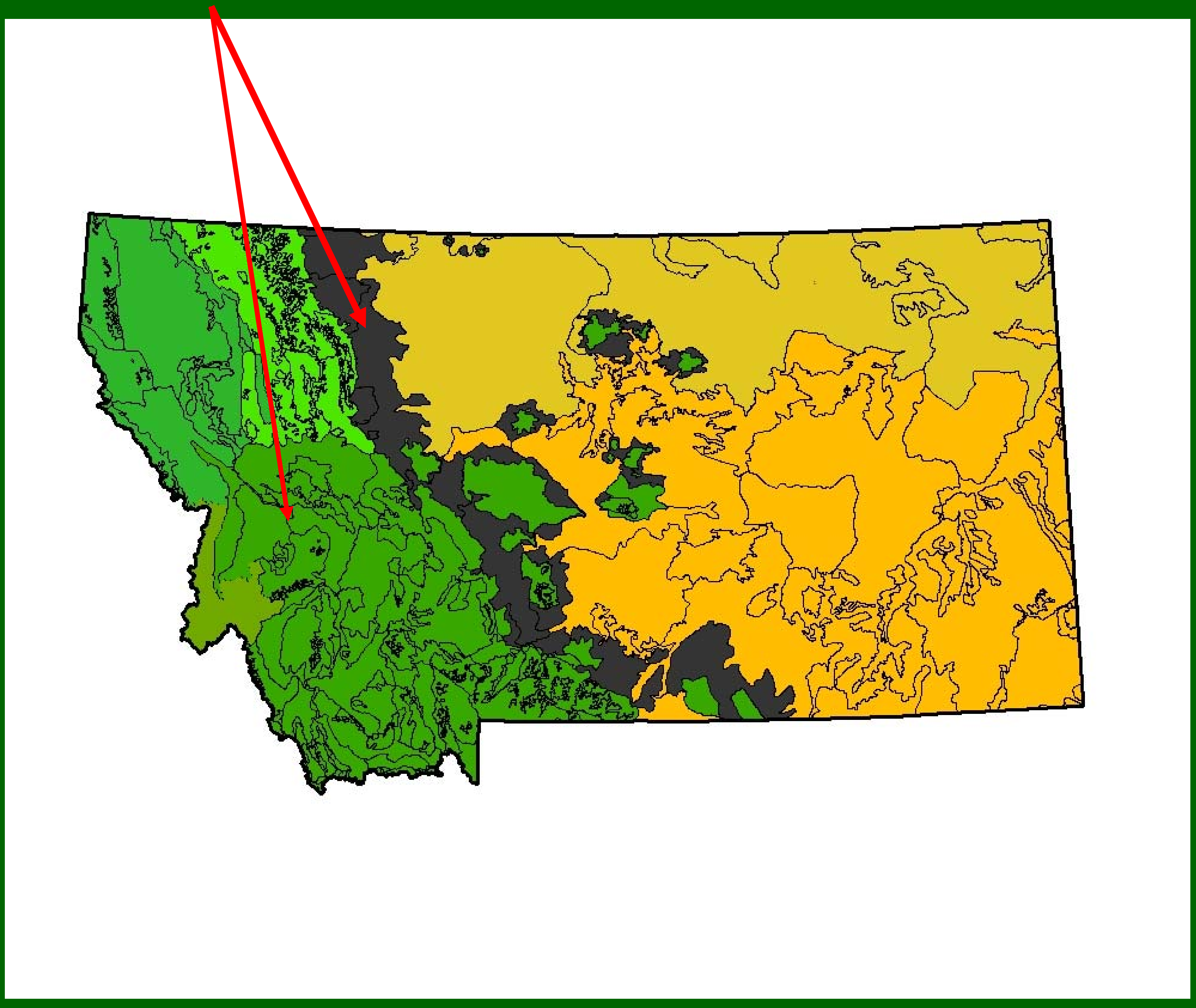
- Level III & IV ecoregions worked better than lithology and stream order, in terms of both significantly explaining variation in nutrient concentrations and practicality of application

- Ecoregions explained sufficient spatial variability in nutrients to be used as a basis to establish criteria across Montana
  - Typically explain 60-78% of variation in reference stream data, depending on test type, nutrient, season

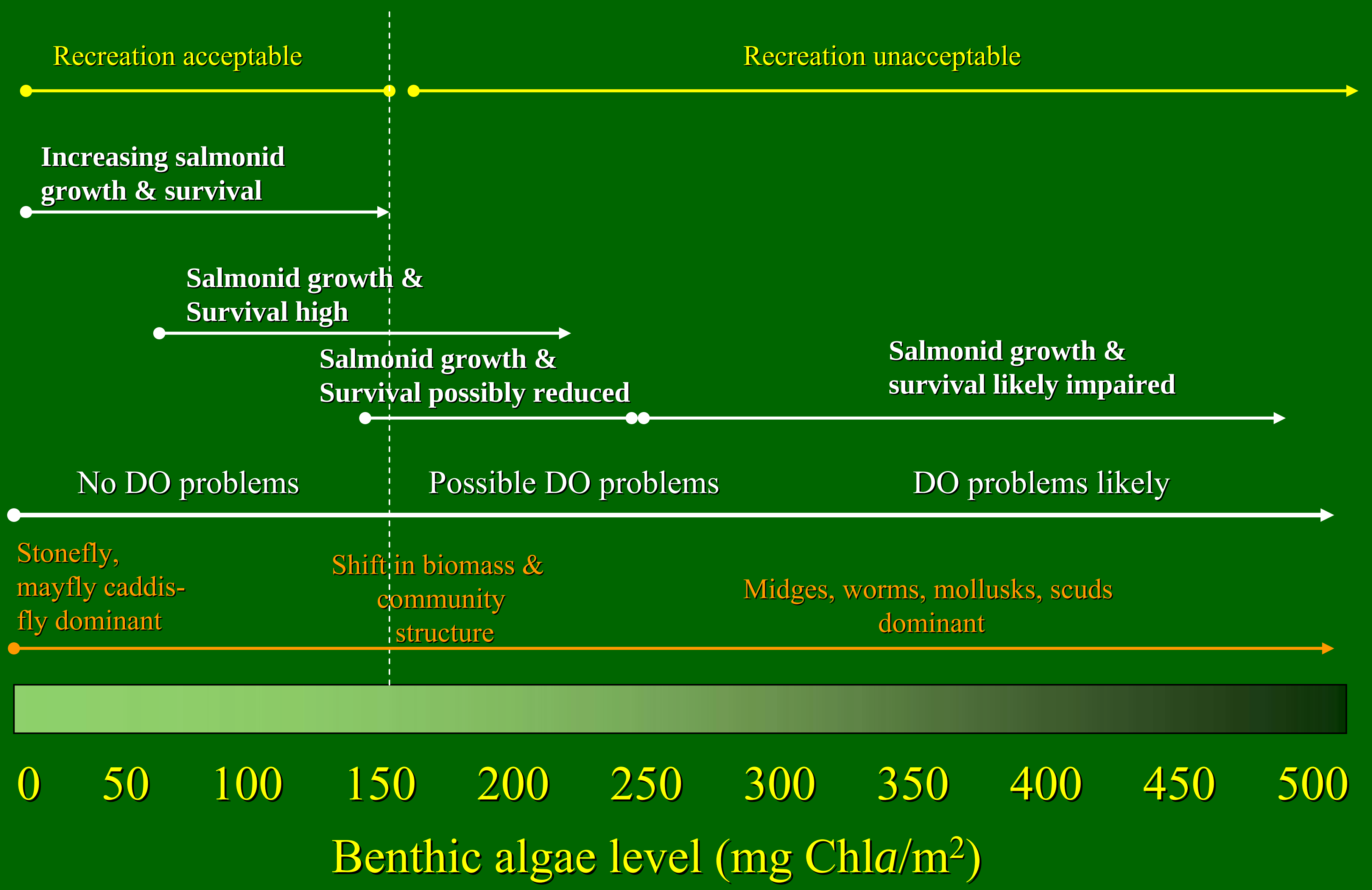
Level III Ecoregions of MT (Woods et al. 2002)



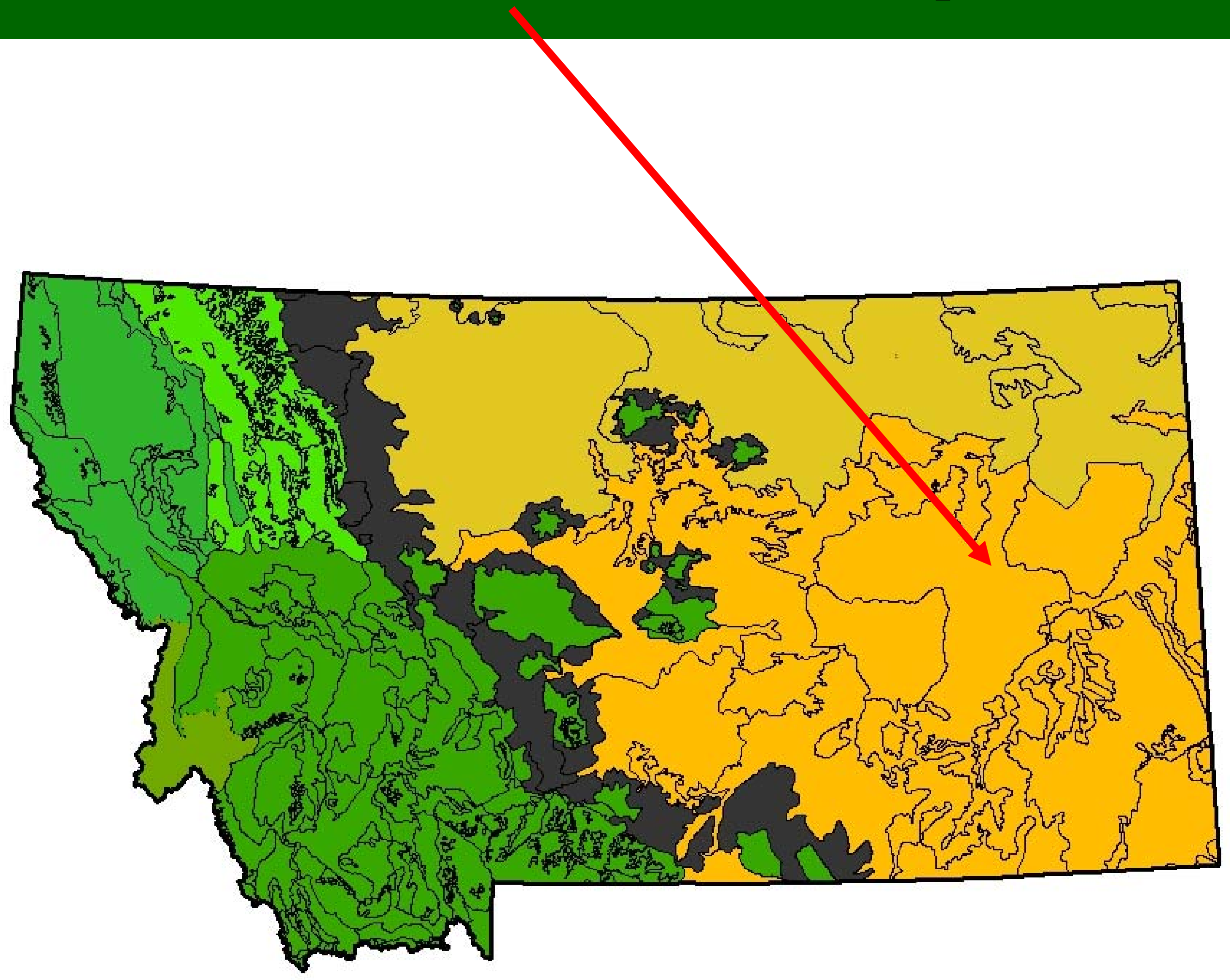
Wadeable Streams: Western Montana and transitional zones



Actual/likely affects on stream uses at varying algae levels (western MT)



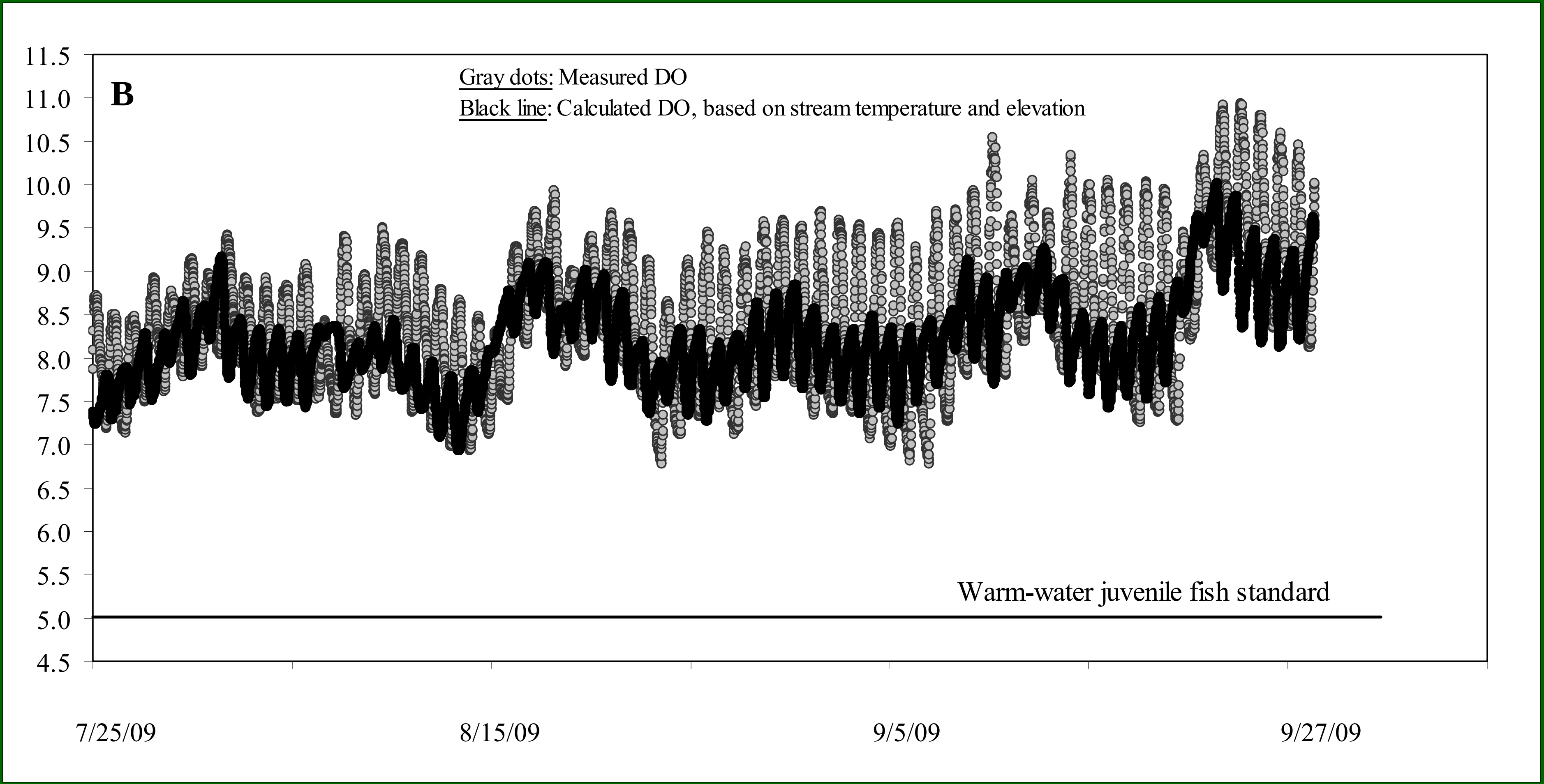
Wadeable Streams: Eastern Montana prairie streams



Eastern Montana prairie streams have a fundamentally different ecology

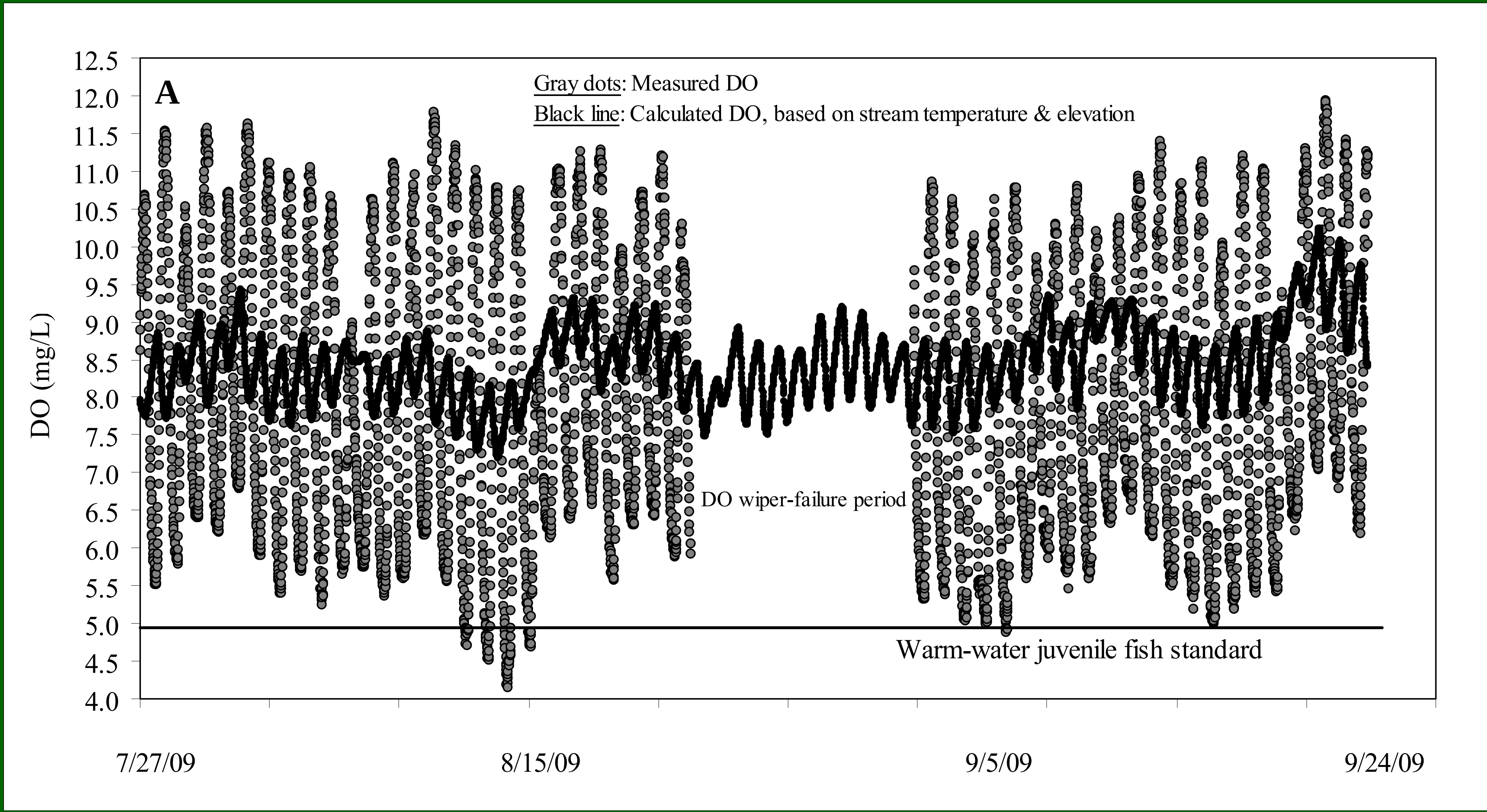
- Algal growth naturally higher, more macrophytes
- Dissolved oxygen problems have been linked to excess nutrients in Montana prairie streams (Suplee *et al*. 2008)
- Nitrate appears to be very important in driving productivity of these streams
  - Naturally turbid, often have high phosphorus content

Science: Harm-to-Use: Aquatic Life Thresholds



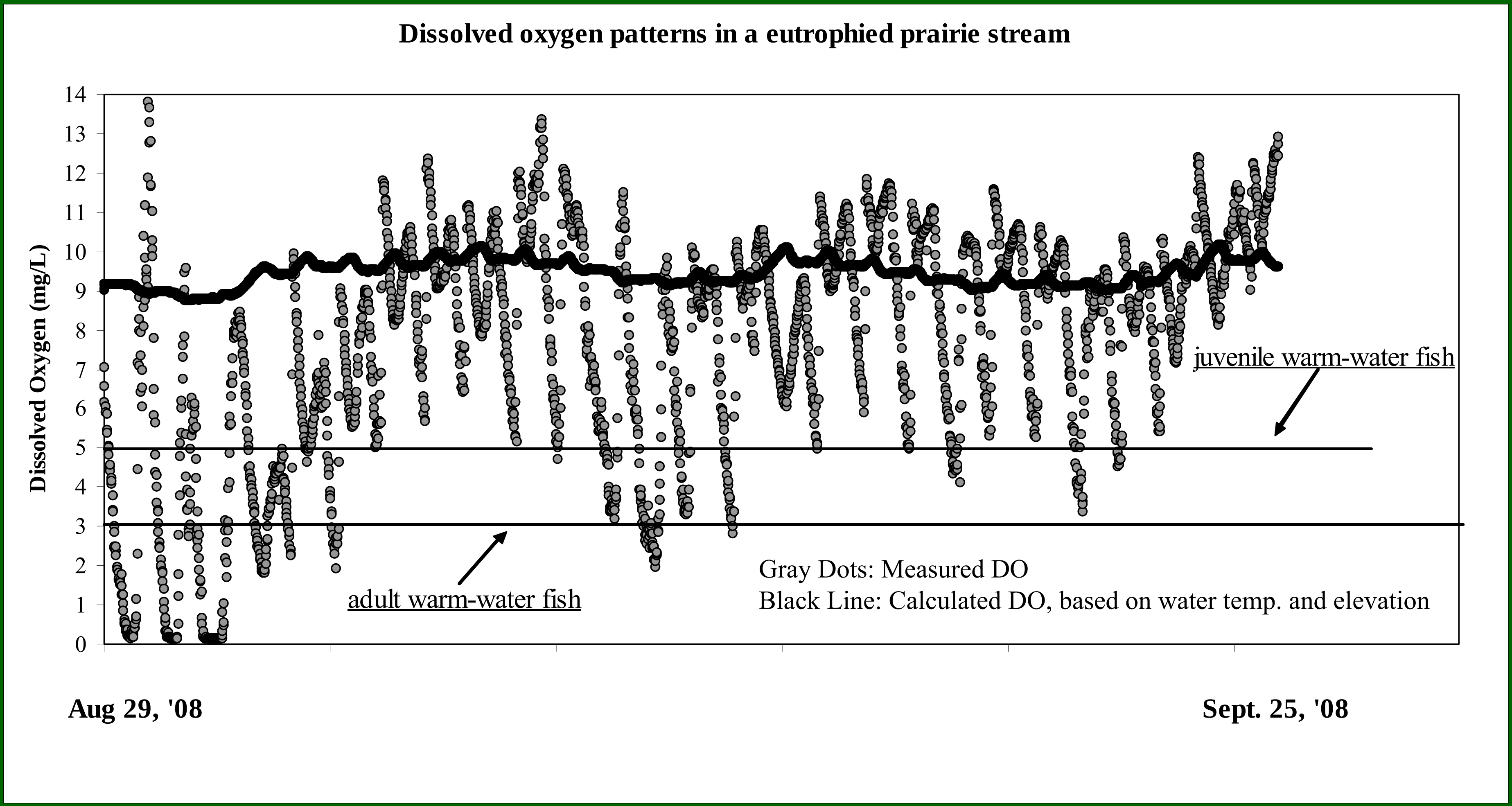
In eastern MT reference prairie streams, DO standards are met almost all the time, as in this case…

Science: Harm-to-Use: Aquatic Life Thresholds



…or as in this case; another eastern MT reference prairie stream

Science: Harm-to-Use: Aquatic Life Thresholds



…but not in streams where eutrophication has become significant

Science: Montana's Draft Criteria Compared to Other Studies/Criteria in Temperate Streams

Source	Location	Concentration Shown Would:	Nutrient (mg/L)	
			Total N	Total P
***Draft* DEQ Values**	**Middle Rockies Ecoregion, Montana**	**Prevent nuisance algal growth**	**0.320**	**0.048**
Perrin *et al.* (1987)	British Columbia, Canada	Prevent nuisance algal growth	0.4	0.02
Miltner & Rankin (1998)	Ohio	Protect fish communuties	n/a	0.06
Chételat *et al.* (1999)	Ontario & Quebec, Canada	Prevent nuisance algal growth	n/a	0.04 to 0.07
Wang *et al.* (2007)	Wisconsin	Protect fish and macroinvertebrate communities	0.99	0.073
Dodds *et al.* (2006)	North American, Austrailian, New Zealand and European temperate streams	Prevent nuisance algal growth	0.578	0.080
ANZECC & ARMCANZ Trigger Values (2000)	New Zealand (upland rivers)	Prevent nuisance algal growth & cyanobacterial blooms	0.295	0.026
ANZECC & ARMCANZ Trigger Values (2000)	Australia (upland rivers)	Prevent nuisance algal growth & cyanobacterial blooms	0.250	0.02

Note: Montana's standards would apply only in summer

Policy: Economic Considerations

- We are building in an option for communities to receive relief from very stringent requirements based on:
  - – Ability to pay for treatment (affordability)
  - – Availability of treatment technology (limits of technology)

Case-by-case evaluations

- *These options apply only to wastewater treatment beyond the federally mandated technology-based regulations (i.e., National Secondary Standards)*

Policy: Senate Bill 95 (2009 Legislature) Now MCA 75-5-313

- Gives DEQ authority to adopt "temporary nutrient criteria" specific to a point-source discharge permitee
  - Temporary nutrient criteria based on a demonstration that economic impacts would occur due to trying to meet the "base numeric nutrient criteria".
  - Temporary criteria would be in place ≤ 20 years, subject to 5-year reviews
  - Same for limits-of-technology based temporary criteria

OVERALL: Law allows Montana to implement numeric nutrient criteria in a staged manner, allowing critical time to better address all sources of nutrient pollution (point and nonpoint) and for treatment technology to improve/come down in cost

Policy: MCA 75-5-313

- Created the "Nutrient Work Group"
  - Broad cross-section of MT stakeholders
  - Advise DEQ on numeric nutrient standards, especially implementation policy

- Nutrient trading policy in development
  - Will allow for creation of nutrient credits and trading between point sources and point source-nonpoint sources

- Questions???

THANK YOU

msuplee@mt.gov