

Nutrient Water Quality Standards in Illinois

Bob Mosher
Bureau of Water
Water Quality Standards Section
Illinois EPA
September 26, 2008



History of Nutrient Standards Old and New

History of Nutrient Standards in Illinois

- 0.007 mg/L total phosphorus in Lake Michigan open waters (1973)
- 0.05 mg/L total phosphorus in certain lakes (1972)
- 1.0 mg/L total phosphorus effluent standard for new and expanded discharges 1 MGD or greater (2006)
- 10.0 mg/L nitrate-nitrogen at public water supply intakes (1973)

Recent History of the Development of Nutrient Water Quality Standards

- A 1998 Vice Presidential order began a process at USEPA to have states adopt nutrient water quality standards for the following parameters:
 - Phosphorus
 - Nitrogen
 - Chlorophyll
 - Turbidity

Recent History of the Development of Nutrient Water Quality Standards

- The early part of this decade saw USEPA publish National Criteria for these four parameters
- The criteria are based on statistical derivations of data collected in broad 'ecoregions'
- States and other commenters were almost unanimously unsatisfied with these criteria

National Numeric Criteria for Streams

	Corn Belt VI	SE Forested Plains IX
Total P (mg/L)	0.076	0.037
Total N (mg/L)	2.18	0.69
Chlorophyll (ug/L)	2.7	0.93
Turbidity (FTU)	6.36	5.7

Average Illinois Concentrations

Statewide Averages 1980 – 1996

Total Phosphorus	0.38 mg/L
Total Nitrogen	5.23 mg/L
Total Suspended Solids	80.63 mg/L

Rivers and Streams

Parameter	USEPA Criteria			Illinois Median AWQMN Values (1999-2002)		
	Ecoregion VI	Ecoregion VII	Ecoregion IX	Ecoregion VI	Ecoregion VII	Ecoregion IX
Total P (mg/L)	0.076	0.033	0.037	0.17	0.11	0.18
Total N (mg/L)	2.18	0.54	0.69	5.75	5.30	1.69
Chlorophyll a (ug/L)	2.70	1.50	0.93	12.8	15.45	13.3
Turbidity (NTU)	6.36	1.70	5.70	18	17.6	24

Lakes and Reservoirs

Parameter	USEPA criteria			Illinois Median AWQMN Values (1999-2002)
	Ecoregion VI	Ecoregion VII	Ecoregion IX	Statewide
Total P (mg/L)	0.0037	0.0148	0.0200	0.072
Total N (mg/L)	0.78	0.66	0.36	1.0
Chlorophyll a (ug/L)	8.59	2.63	4.93	27.79
Secchi Depth (meters)	1.356	3.33	1.53	0.7112

Recent History of the Development of Nutrient Water Quality Standards

- Most states elected to study the **cause-effect** relationship between nutrient concentrations and adverse impacts
- Each embarked upon several years of research to arrive at this more scientific and defensible method of nutrient standard derivation

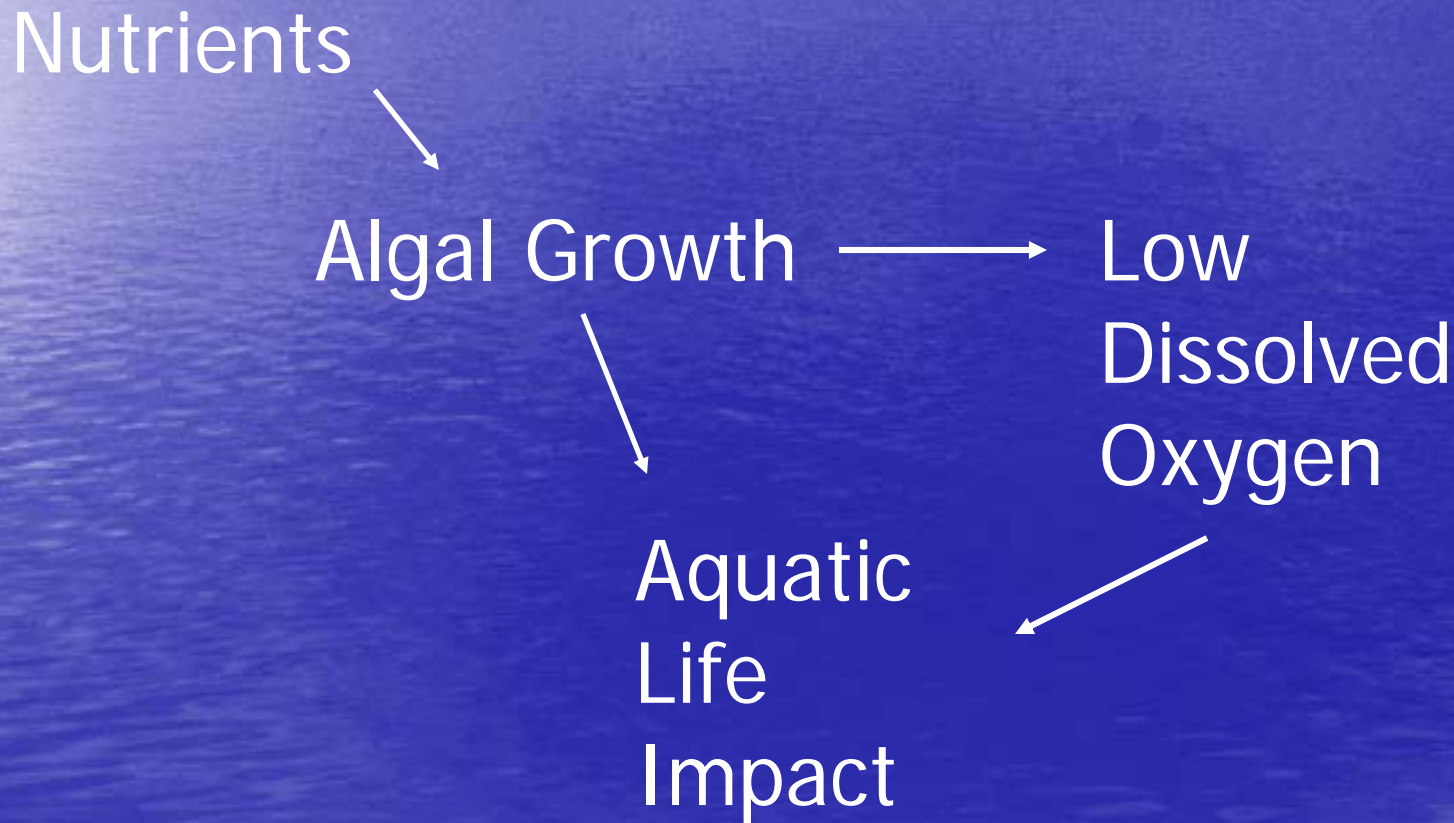
Gulf Hypoxia

- Concurrently, USEPA began addressing seasonal anoxic conditions in a portion of the Gulf of Mexico
- There has been little if any tie-in between USEPA's program to have States adopt nutrient water quality standards and the Gulf Hypoxia program

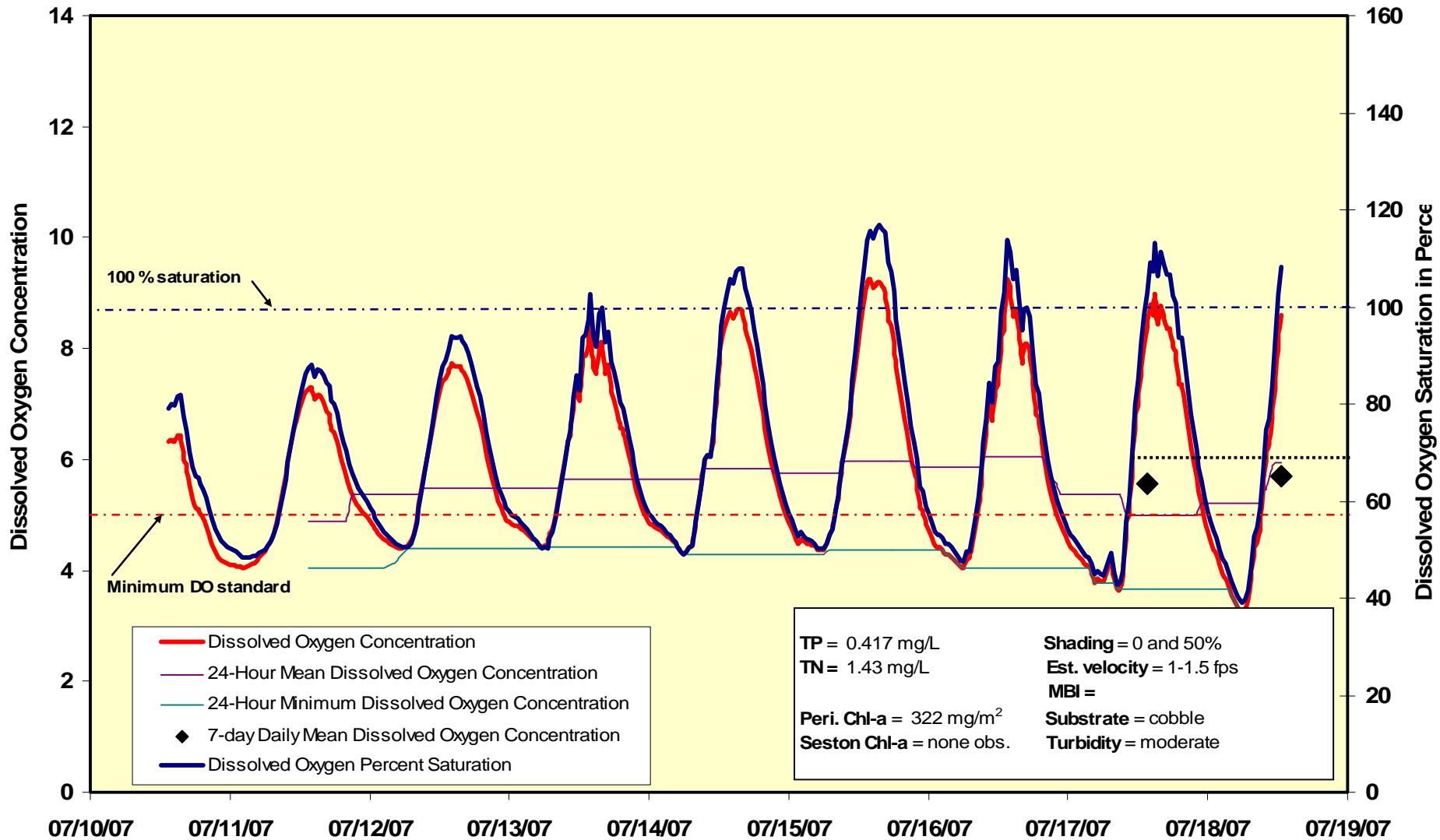


The Illinois Effort to Derive Cause-Effect Nutrient Standards

Working Theory



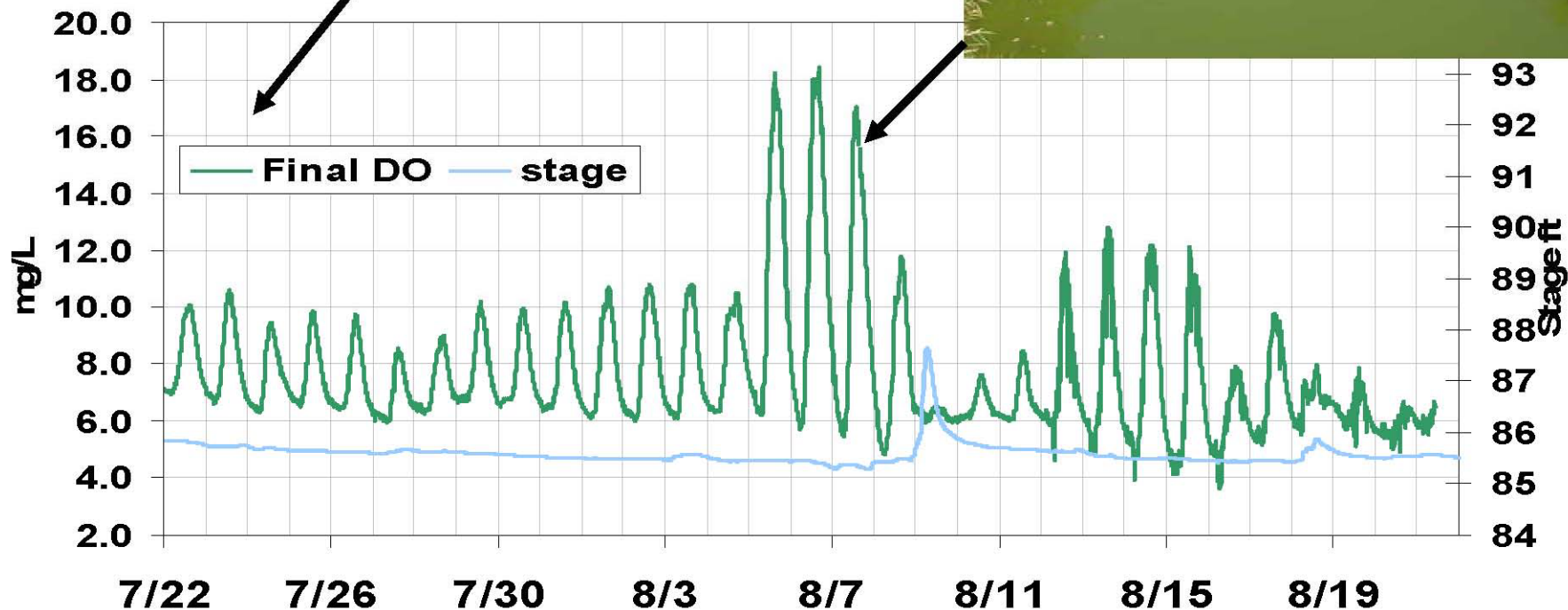
FLINT CREEK; DTZS-01



North Creek algal bloom picked up with continuous D.O. monitoring



Chl a = 7.3 $\mu\text{g/L}$
DRP = 80 $\mu\text{g/L}$
on 7/24/07



Other Mechanisms of Impact?

- Nutrients upset bacteria ecology
- Nutrients upset algal ecology
- Because the base of the food web is altered by high nutrient levels, the remainder of the food web is impacted, leading to ecological imbalance and impaired stream conditions

Illinois Efforts

- CFAR grant
 - Four teams from Illinois institutions
 - Studied nutrient dynamics in Illinois streams
 - Related nutrient concentrations to measures of stream health such as chlorophyll, habitat, macroinvertebrates
- IEPA conducted continuous dissolved oxygen monitoring
- MWRDGC Egan Plant study

Illinois Efforts

- The Illinois Nutrient Standards Workgroup has met regularly since 2002
- Stakeholders from government, agriculture, municipalities, industry, academia and environmental groups participate
- Paul Terrio of USGS Champaign has been working on IL nutrient standards for the past three years (217/328-9736)

Illinois Efforts

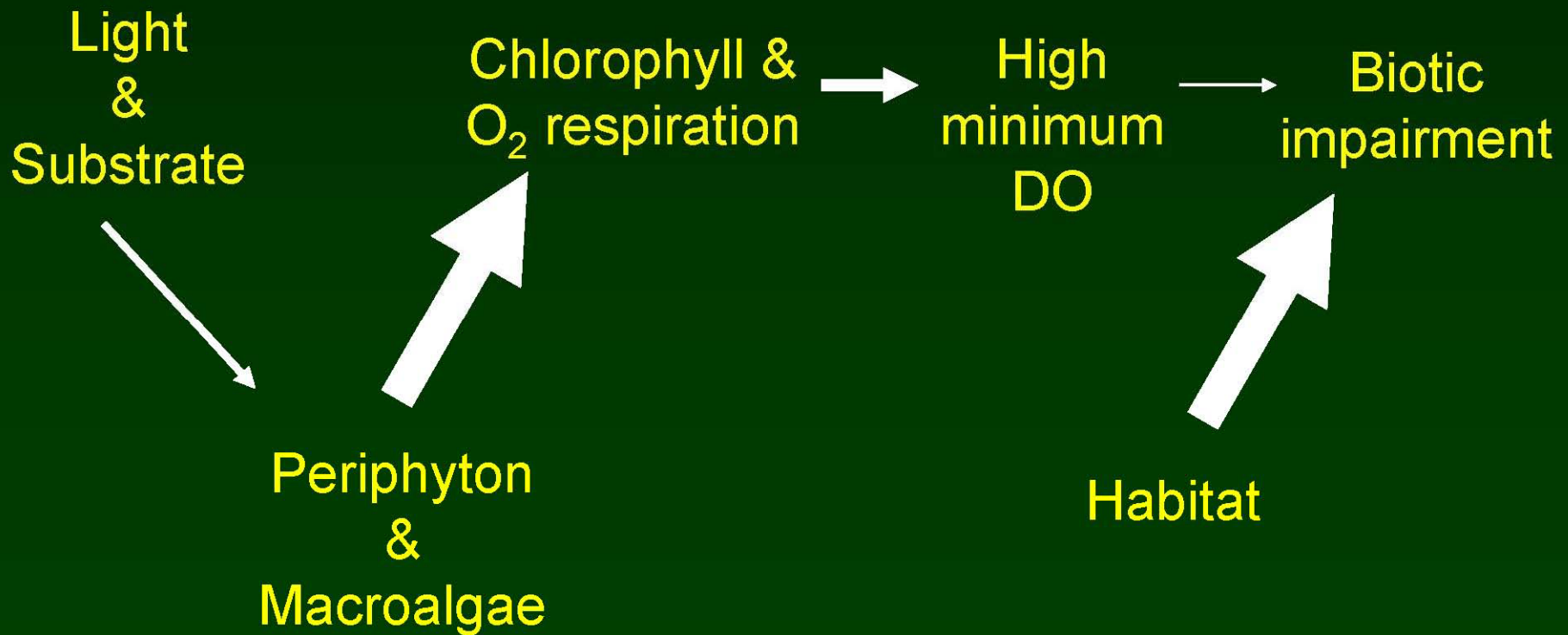
- USEPA required that States file a Nutrient Standards Development Plan
- The plan contained a time line for milestones in the process
- Currently, the plan says that Illinois will file nutrient standards with the Illinois Pollution Control Board by December, 2009

Illinois (Interim) Conclusions

- CFAR researchers generally concluded (early 2008) that their data show no reliable cause-effect relationship between nutrient concentrations in Illinois streams and adverse impacts
- Factors other than nutrients, namely habitat, were cited as better explaining stream impairment

Modified Model for Illinois (1)

Small to medium streams
(in which nutrients are almost never limiting)



Other States' Efforts

- No other Region 5 (Great Lakes) State has stream standards fully developed
- Minnesota has lakes standards for phosphorus filed for adoption
- Michigan has apparently settled on a plan that links phosphorus to stepped degradation of habitats

Different Approaches for Different Regions?

- There has been some movement toward an understanding that nutrient impacts and therefore standards will be different for highly agricultural regions
- The Southern tier of Great Lakes States seems to be having more difficulty finding relationships than the Northern tier

Where are we now?

- Phosphorus is the limiting nutrient in most IL waters and so we are focusing on this one parameter
- Confronted with the lack of clear cause-effect conclusions, IEPA proposed a phosphorus standard based on the presence of adverse impact

Dissolved Oxygen Based Phosphorus Standard

- Where algae have created an abnormal dissolved oxygen pattern, a phosphorus standard of 0.05 mg/L would apply
- This would cause point sources to remove phosphorus from effluents and non-point sources to implement control plans
- This proposal was not well received at USEPA

What's Next?

- USEPA requested all data collected by IEPA and the CFAR researchers in order to do some highly specialized statistical evaluations
- Other states have also had their data analyzed in this manner
- This data was forwarded to the contractor this summer, but the analysis has not yet begun

USEPA Nutrient Data Analysis

- The analysis compares nutrient data with stream parameters such as chlorophyll, habitat and fish and macroinvertebrate communities
- Correlations may exist that can be refined to show the nutrient concentration at which streams begin to have adverse impacts

USEPA Nutrient Data Analysis

- When completed, USEPA will explain the methodology and the results of the analysis
- If correlations are found, USEPA will very likely insist that Illinois use these findings to establish water quality standards





Lake Fork



Possibilities

- Technology based standards
- Wetlands trading