Preventing Eutrophication

Scientific Support for Dual Nutrient Criteria

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SUMMARY

- Pollution from Nitrogen (N) and Phosphorus (P) sources is a leading cause of degradation of U.S. water quality.

- Excessive N and P increase the production of plant (both algal and vascular plants) and microbial biomass. This causes a depletion of:
  - dissolved oxygen
  - reduced transparency
  - changes in biotic community composition

BACKGROUND

- These changes in aquatic life and excessive amounts of nutrients can also:
  - Degrade aesthetics of recreational waters, and
  - Increase the incidence of harmful algal blooms (HABs).

- Endangering human health through the production of toxins, and
- Contamination of recreational and drinking water resources.

BACKGROUND, continued

- Under the Clean Water Act, both states and tribes are responsible for establishing water quality standards.
  - Designated uses.
  - Establish criteria to protect those uses.
  - Develop anti-degradation policies and implementation methods.
  - Provide for the protection of downstream waters.
- Development of a numeric nutrient criteria is one aspect for a coordinated and comprehensive approach to nutrient management and water quality standards.

WHY DEVELOP CRITERIA FOR BOTH N AND P?

- The traditional method focuses on a single limiting nutrient (i.e., N or P) based on a paradigm.
  - N-limited in marine water, and
  - P-limited in freshwaters.
- This leads to an overly simplistic model for management of nutrient pollution.

TROPHIC STATUS MAY VARY SPATIALLY AND TEMPORALLY.

- Nutrients vary across a landscape.
  - Climate
  - Flow
  - Geology
  - Soils
  - Biological processes, and
  - Human activities

- Criteria for **BOTH** N and P provide the greatest likelihood of protection.

AQUATIC FLORA AND FAUNA HAVE DIVERSE NUTRITIONAL NEEDS.

- Some species may exhibit N limitation while other show P limitation or co-limitation by both N and P.

- Criteria for **BOTH** N and P provide the greatest likelihood to protect aquatic systems.

N FIXATION DOES NOT FULLY OFFSET N DEFICIENCY.

- N is highly variable across waterbody types.
- Scientific evidence indicates that N fixation is not able to fully offset N deficiency in either fresh or marine waters.
- Numeric criteria for **BOTH** N and P are likely to be more effective in protecting aquatic systems.

N & P HAVE A ROLE IN PROTECTING DOWNSTREAM WATERS.

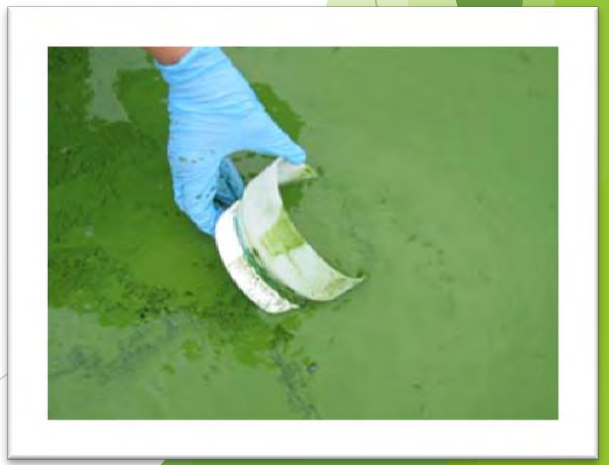
- Nutrient concentrations in streams may not trigger an adverse effect until some distance downstream where other factors:
  - Light
  - Temperature
  - Substrate, or
  - Velocity

  no longer suppress the response to nutrients.

CONTROLLING ONLY P MAY NOT PREVENT HABs IN FRESHWATER

- Certain harmful algal taxa thrive, and are even more toxic, in conditions where N is disproportionately available relative to P.

- Toxic algae such as cyanobacteria possess unique physiological characteristics that allow them to out compete other species in N-rich/P-poor conditions.



CONCLUSION

- Nutrient pollution is a major cause of degradation in U.S. waters.
- Given that:
  - Aquatic systems are dynamic and complicated; and
  - Downstream waters need protection.
- Scientific evidence supports criteria for BOTH N and P.

For more information:

http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/guidance_index.cfm

Photos retrieved from :

http://www2.epa.gov/nutrientpollution/problem (slide 2)

http://www2.epa.gov/nutrientpollution/effects (slide 3)

http://www2.epa.gov/nutrientpollution/effects-environment (slide 5)

http://www.scienceclarified.com/El-Ex/Eutrophication.html (slide 7)

http://ks.water.usgs.gov/cyanobacteria (slide 10)