



# Continuous Nitrate-Concentration Data from a Small Agricultural Ditch in Indiana

Relation to streamflow and inferences to  
biological processes that affect nitrogen cycling

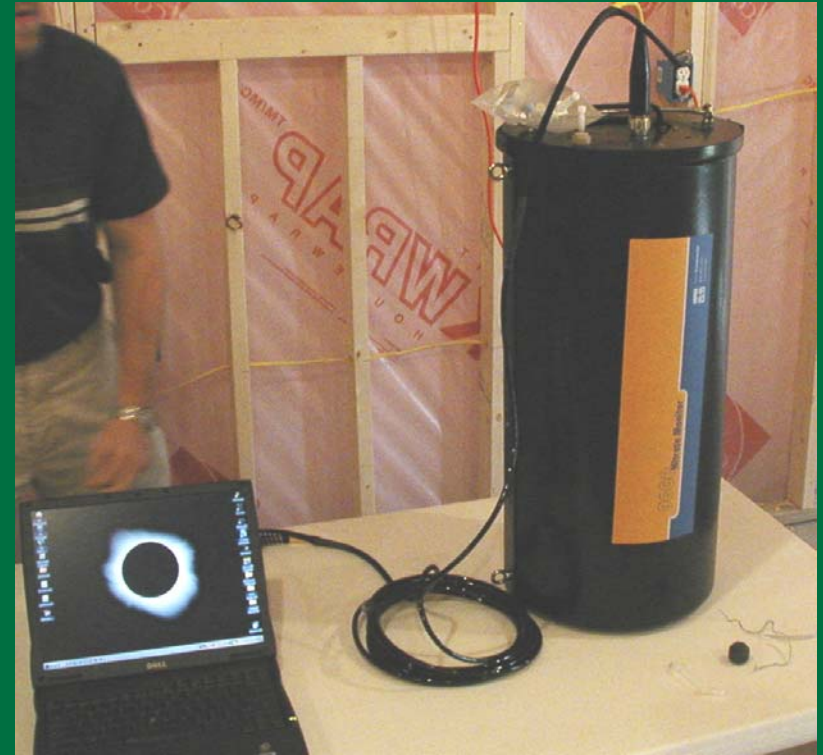
Timothy R. Lathrop

# Overview

- Study Details
- Site Introduction
- Sampling Methods
- Sample Results
- Conclusion

# Study Details

- Joint study between the U.S. Geological Survey and YSI, Inc.
- Record and compare continuous nitrate concentrations
- Identify changes in nitrate levels resulting from streamflow and biological processes



YSI 9600 Nitrate Monitor

# Site Introduction

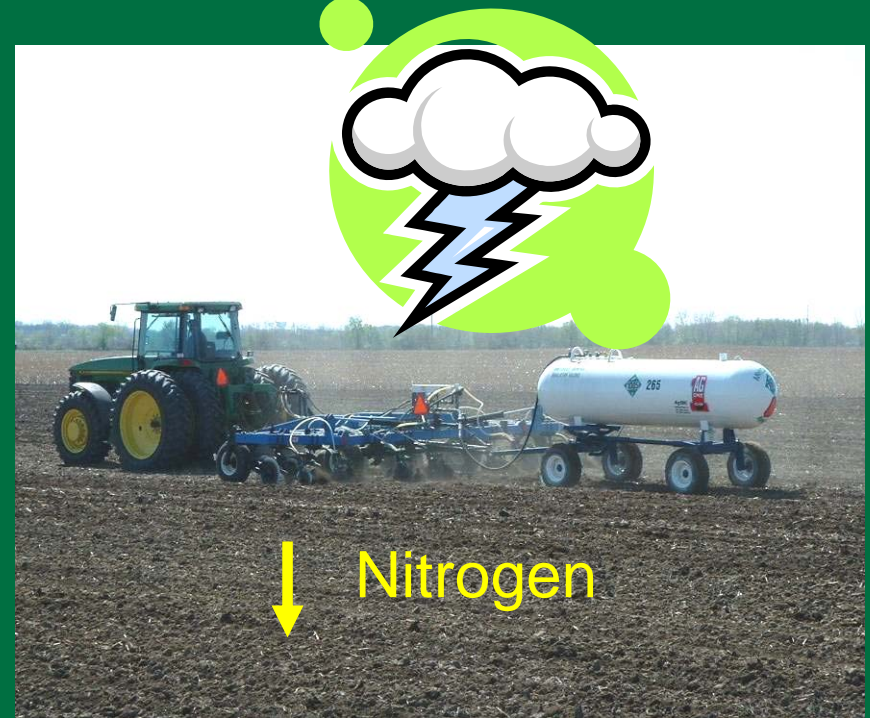
- Leary Weber Ditch near Mohawk, Ind.
- Primarily fed by tile drains





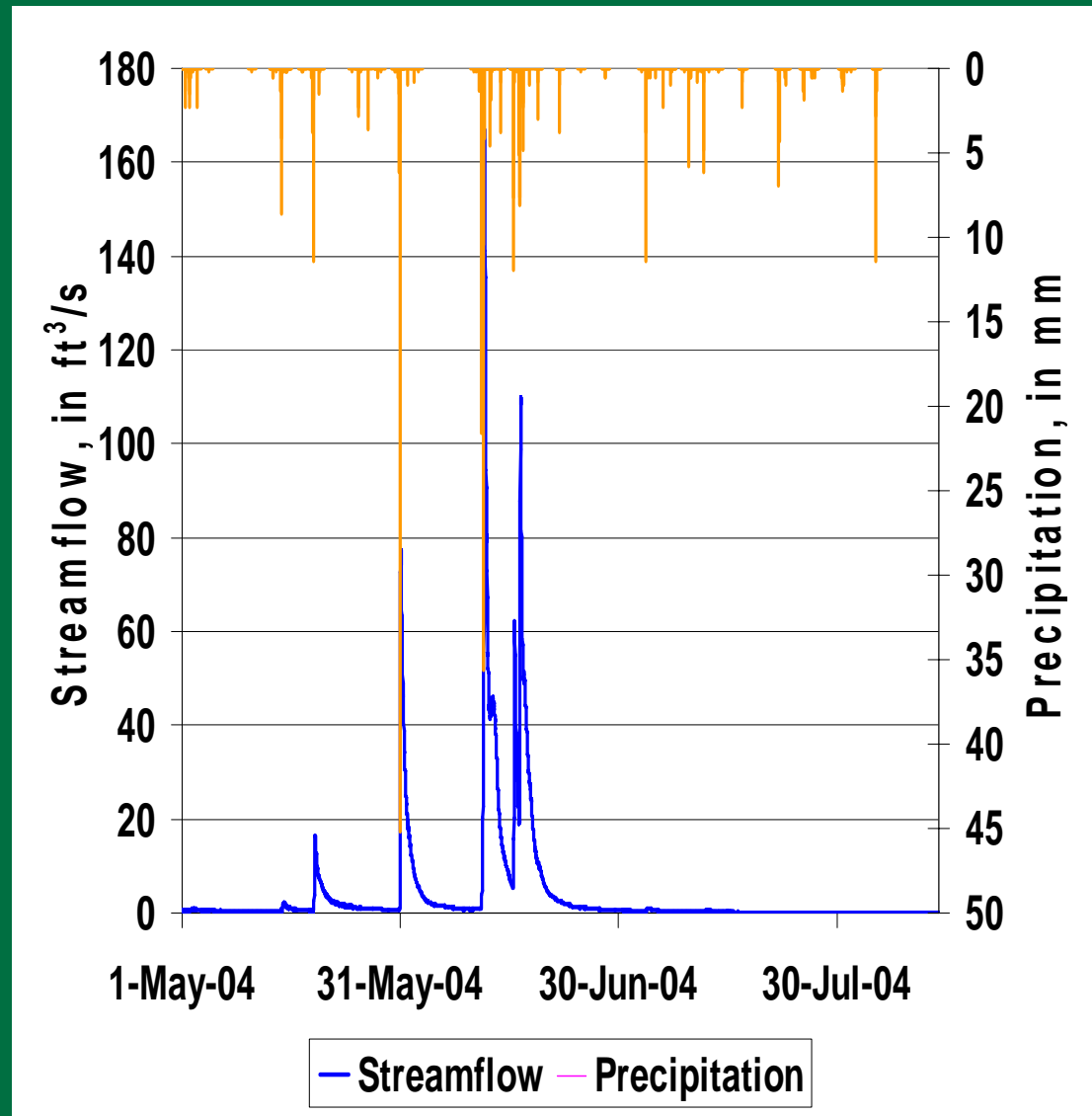
# Site Introduction (cont.)

- Land use — row-crop agriculture, 87 percent of Leary Weber Ditch watershed
  - 47 percent, corn
  - 39 percent, soybeans
- Chemical application
  - Herbicides
  - Insecticides
  - Fertilizers - nitrogen
- Precipitation



# Leary Weber Ditch Streamflow

- Mean daily streamflow, 3.35 ft<sup>3</sup>/s
- Little to no ground-water input
- 73 days of no flow
- Role of precipitation
- Nitrate level



# Sampling Methods

## YSI 9600 Nitrate Monitor

- Allows continuous recording of nitrate levels at variable sampling intervals
- Uses standard absorbance spectroscopy compared to a standard
- Automatic calibration
- Waste system included



# Sampling Methods (cont.)

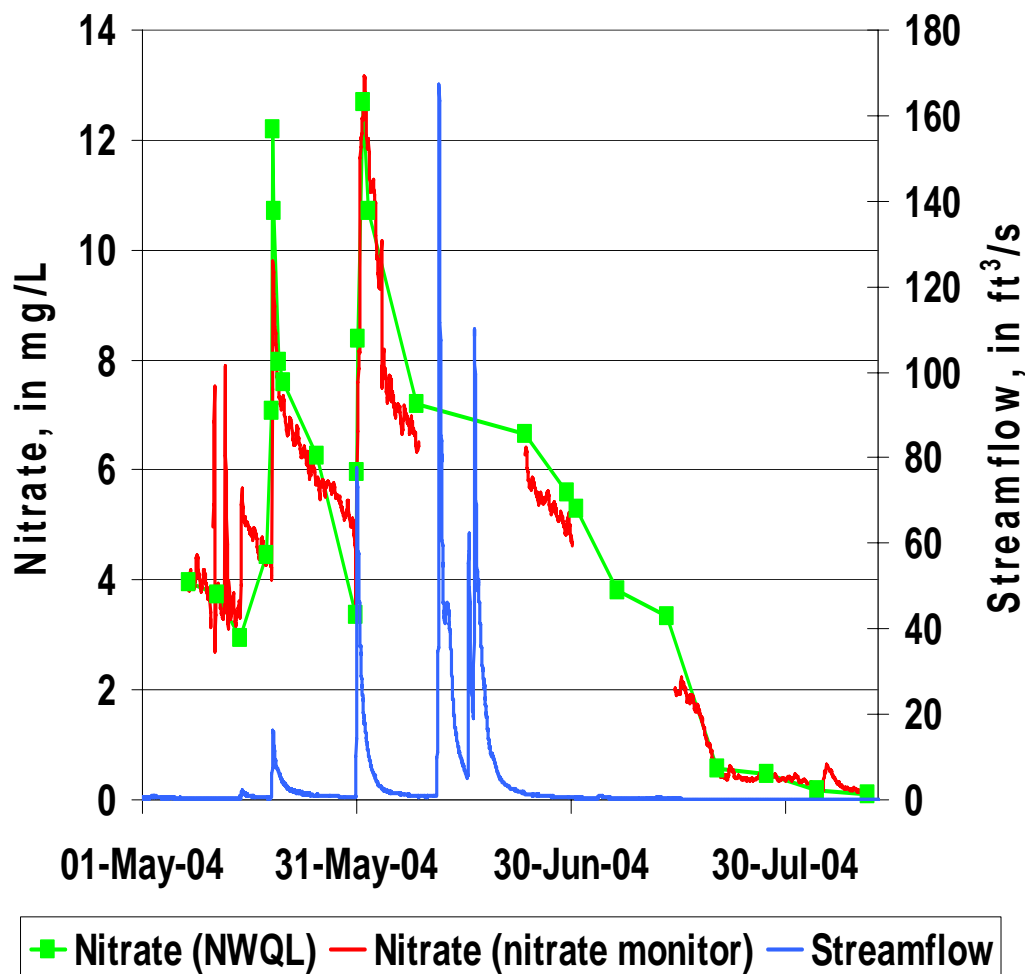
- Wading sample
  - National Field Manual for the Collection of Water-Quality Data
  - Samples analyzed at National Water Quality Laboratory (NWQL)
- Auto sampler
  - Buhler-Montec Xian 1000 and Isco
  - Samples analyzed at (NWQL)





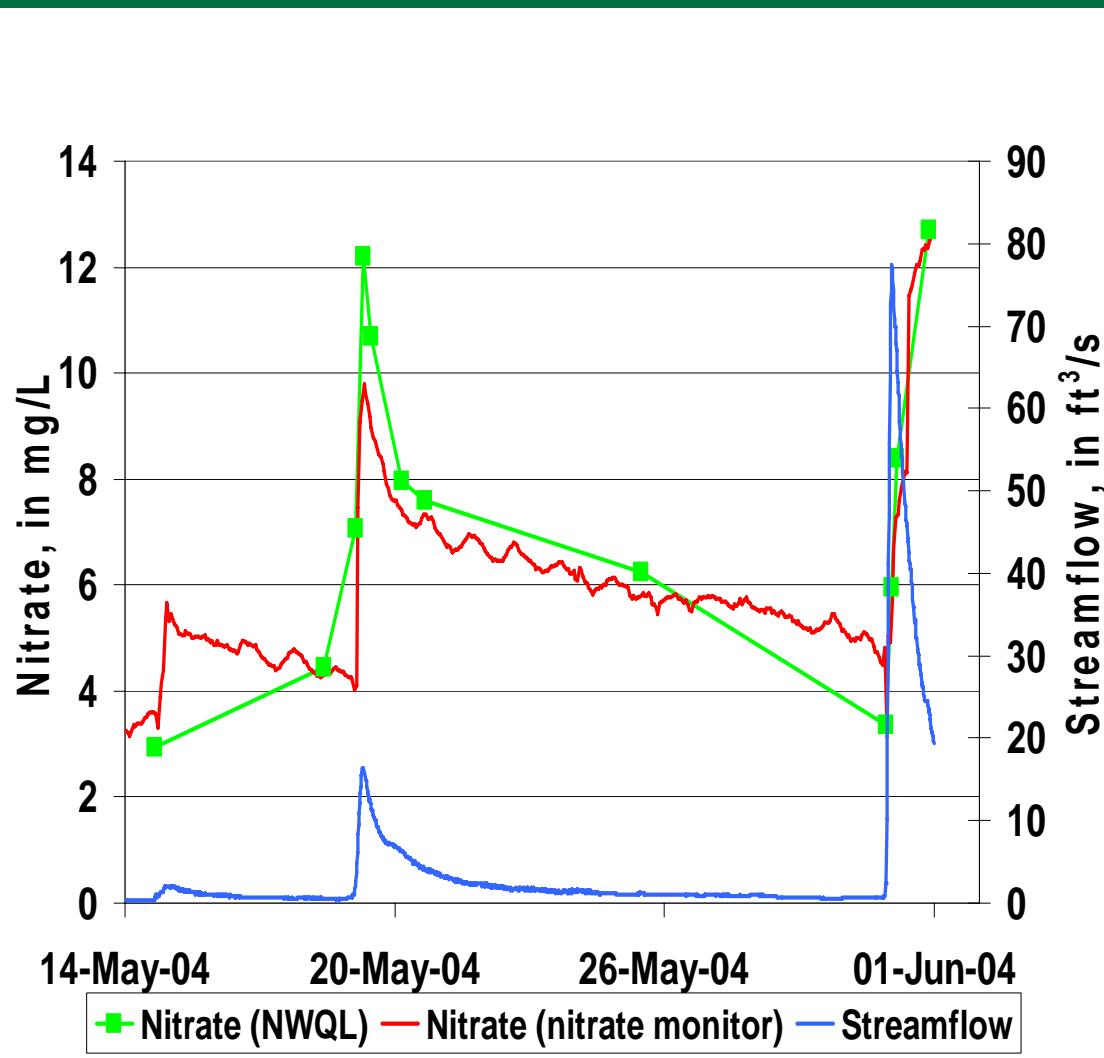
# Method Comparison

- Samples collected during storms and at base flow
- Nitrate levels spike during storms and fall as streamflow decreases



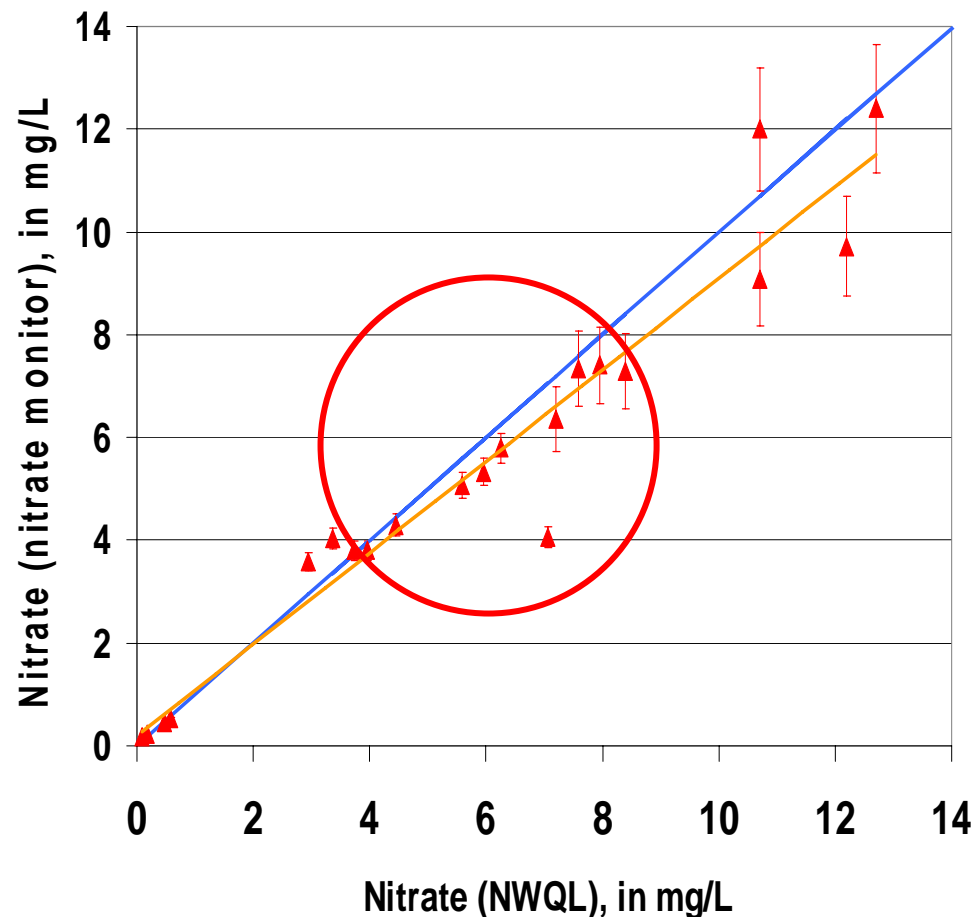
# Closer Look

- Nitrate (discreet sample) shows relation with streamflow
- Nitrate (nitrate monitor) exhibits a more-focused picture



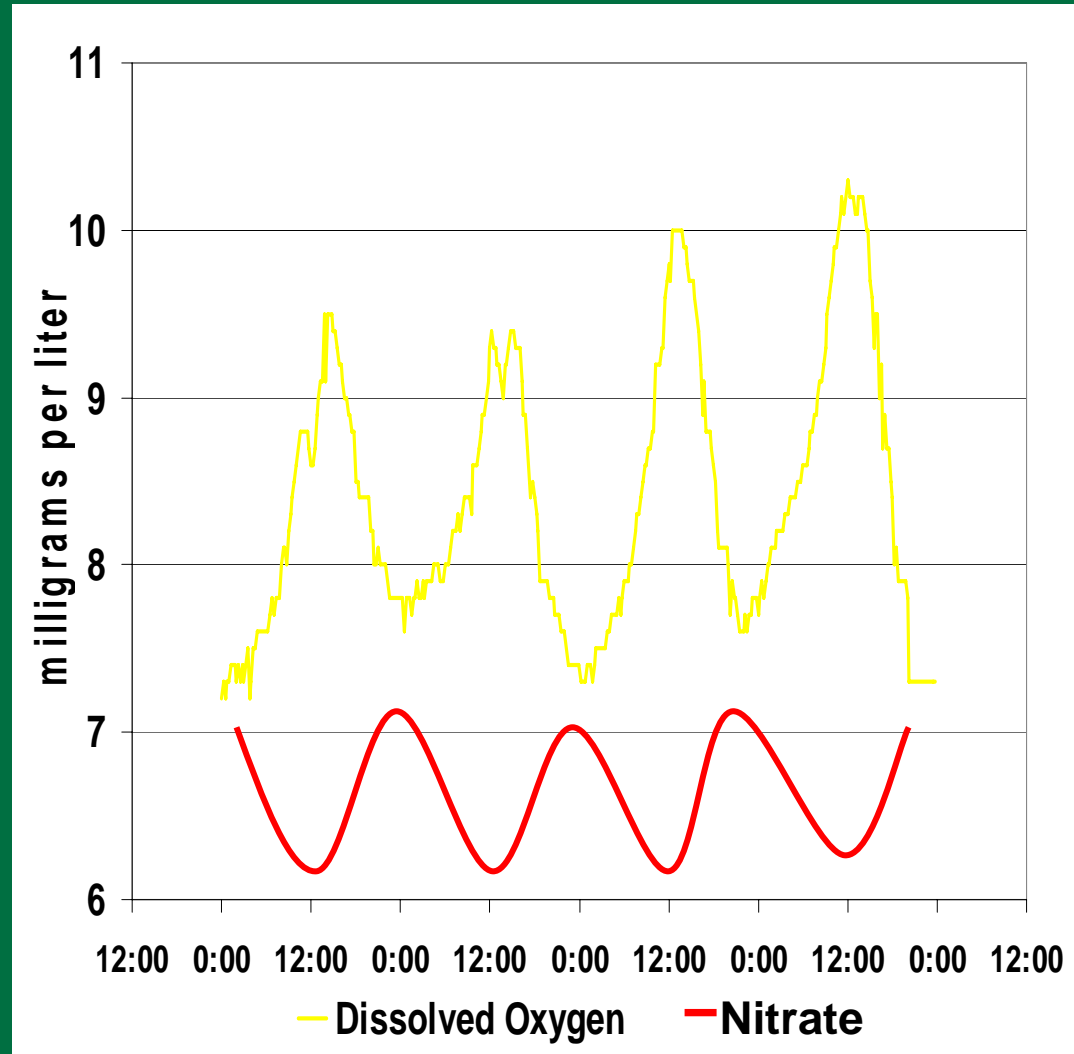
# Equipment accuracy

- Accurate to 5 percent of the reading or 0.2 mg/L nitrate-N in the 0 to 6 mg/L range
- Accurate to 10 percent of the reading in the 6 to 10 mg/L range
- Nitrate diurnal curves mostly in 4 to 8 mg/L range

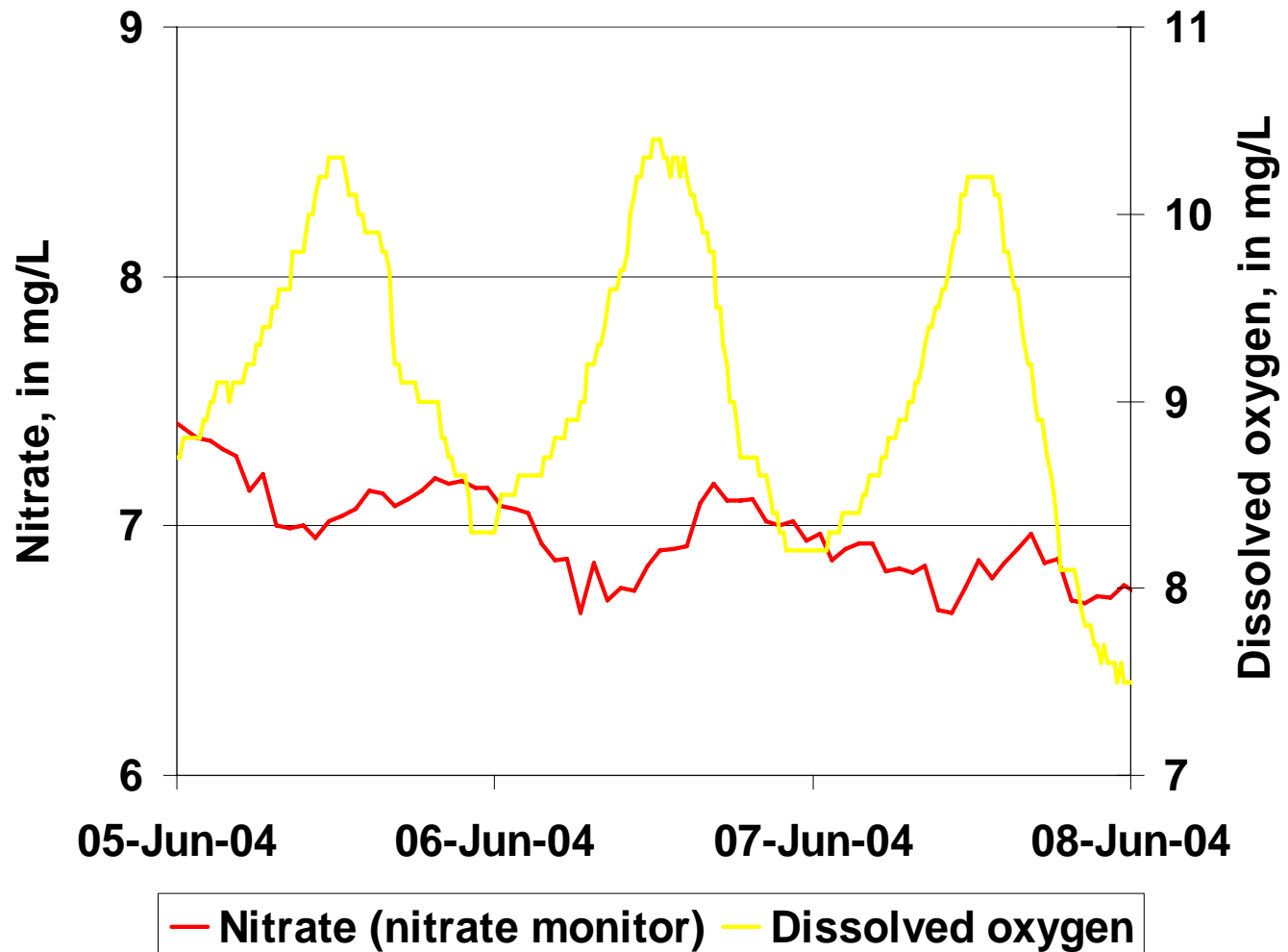


# Algae effect

- Dissolved Oxygen (DO) is oxygen gas ( $O_2$ ) dissolved in water
  - Atmosphere
  - Plants
- Photosynthesis – carbon dioxide + light + water → sugars + oxygen gas
- Nutrient uptake, specifically nitrate

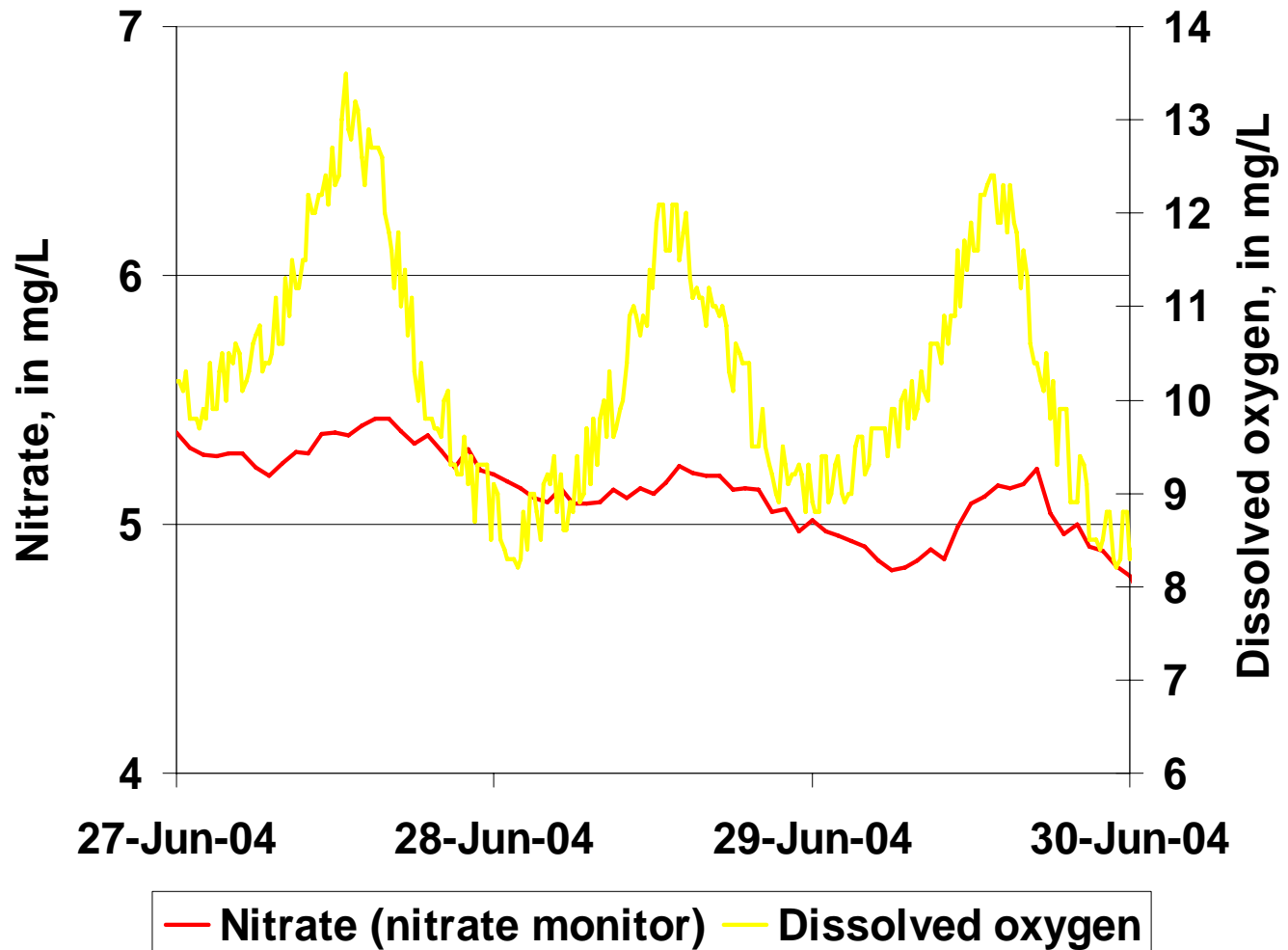


# Example of DO/Nitrate curve exhibiting inverse relation



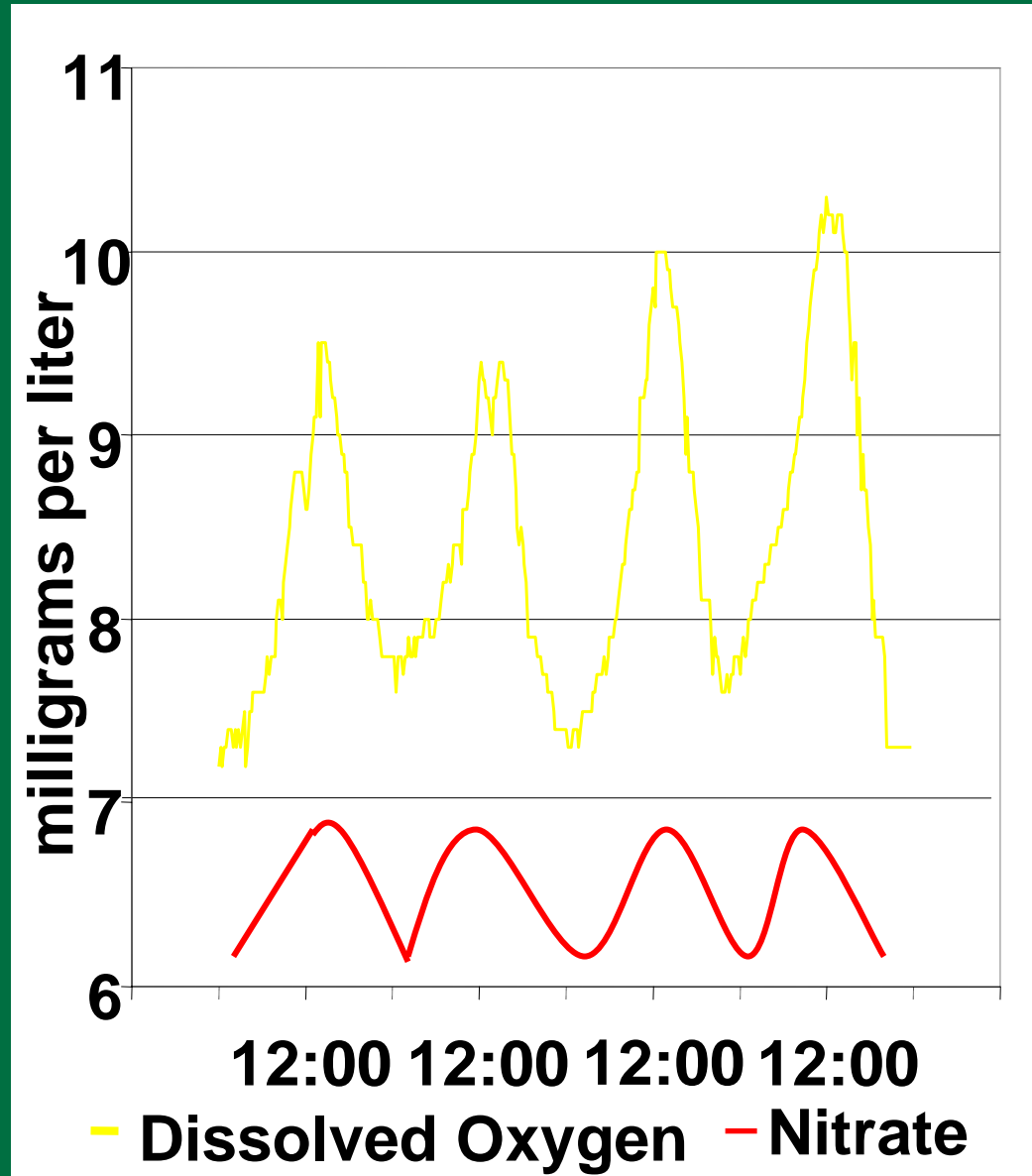


# Example of DO/Nitrate curve exhibiting mirror relation



# Role of benthic algae

- Benthic algae
  - concentrated at the sediment/water interface
  - nitrifiers, denitrifiers
- Nitrification – conversion of ammonium into nitrate, in the presence of oxygen
- Denitrification – conversion of nitrate into gaseous nitrogen, in the absence of oxygen



# **Conclusion –**

## **Continuous nitrate data are preferable**

- Ideal for event-based sampling
- Accurate data
- Higher data resolution
- Present a more “in focus” picture

## For more information:

<http://www.usgs.gov> or  
<http://in.water.usgs.gov>

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