

# Nutrient Dynamics in the Ocean

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Lab Review 2008



# AOML nutrient program Contribution to NOAA's mission

## Ocean and Climate

Water mass tracer in ocean circulation

Quantifying oceanic uptake of CO<sub>2</sub>

## Ecosystem

Source and transport of nutrient

Cycling of nutrient within ecosystem

(e.g., sediment/water)

# Outline

## Cutting Edge technology development

EPA standard methods

Underway instrumentation

Liquid waveguide

## Preeminent Research

Phosphorus cycle in Florida

Nutrient input ot coastal water

Repeat Hydrography



- nitrate/nitrite
- ammonium
- silicate
- total N
- total P

United States Environmental Protection Agency

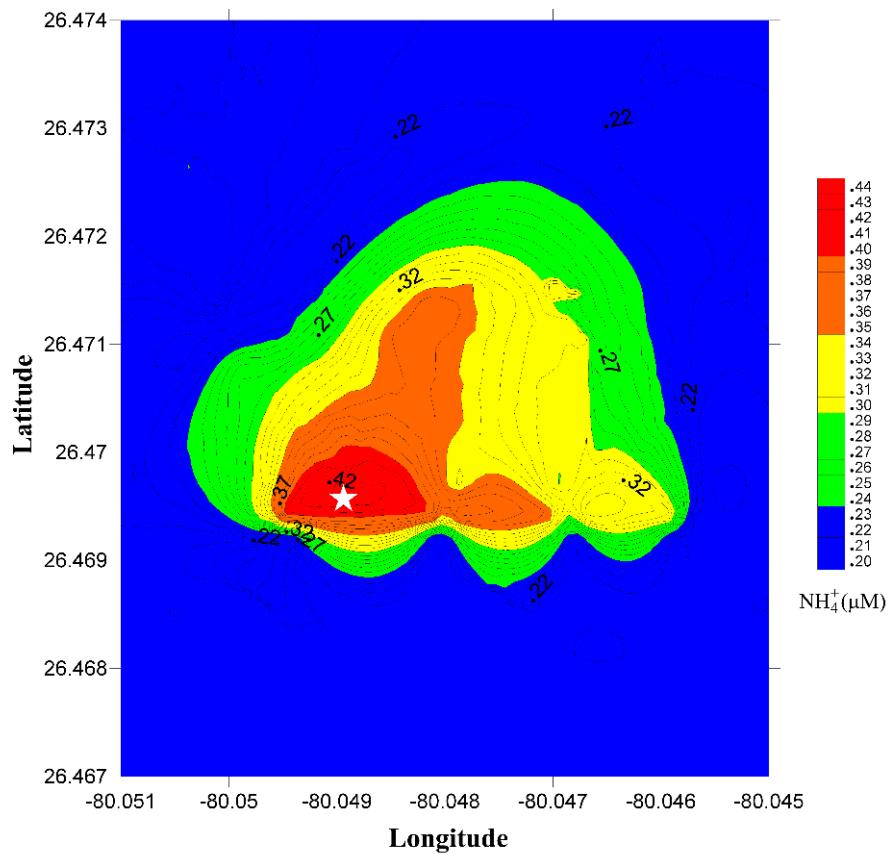
Office of Research and Development  
Washington, DC 20460

EPA/600/R-97/072  
September 1997

 **EPA Methods for the Determination of Chemical Substances in Marine and Estuarine Environmental Matrices - 2<sup>nd</sup> Edition**

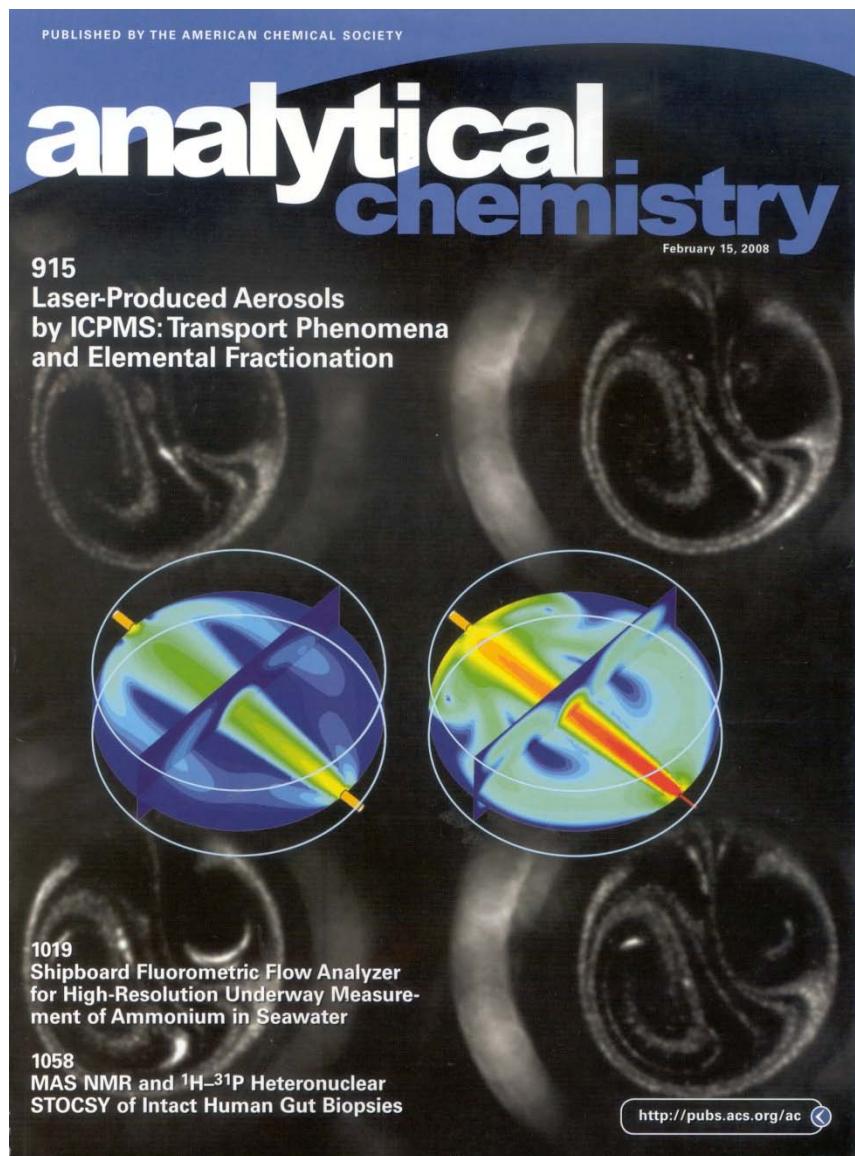


A detailed black and white line drawing of various marine organisms. At the top left, a small fish swims upwards. To its right is a large, textured rock or coral formation. Below the rock, a large, branching sea fan or anemone extends downwards. To the right of the sea fan, a small, translucent jellyfish with long tentacles is shown. Further to the right, a larger, more rounded fish swims towards the viewer. The entire scene is set against a plain white background.

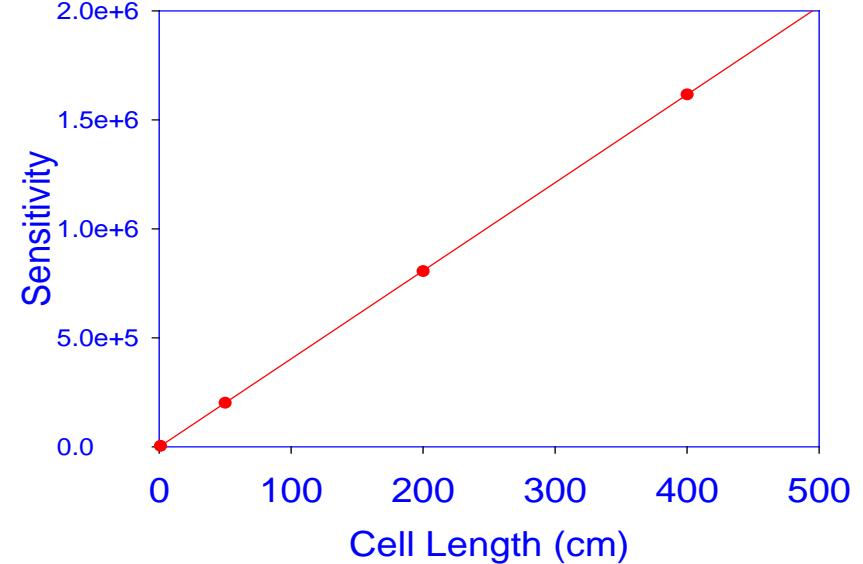
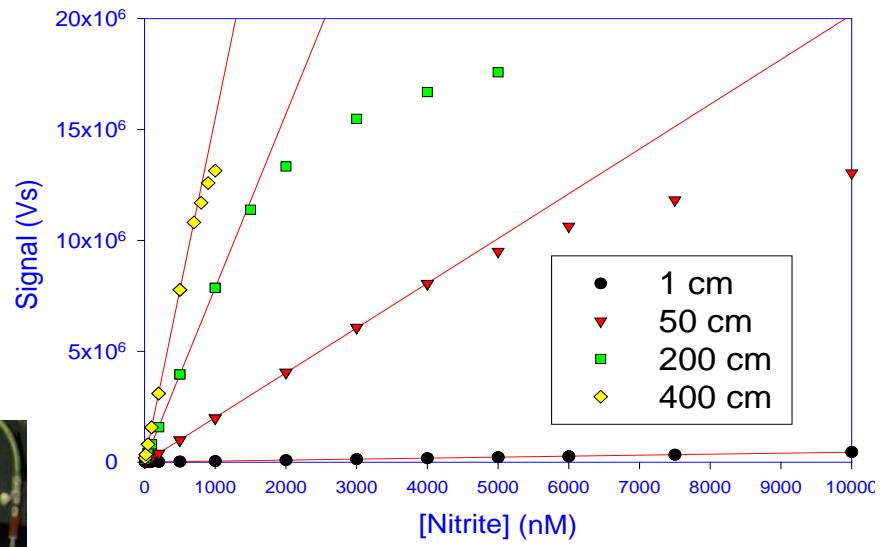
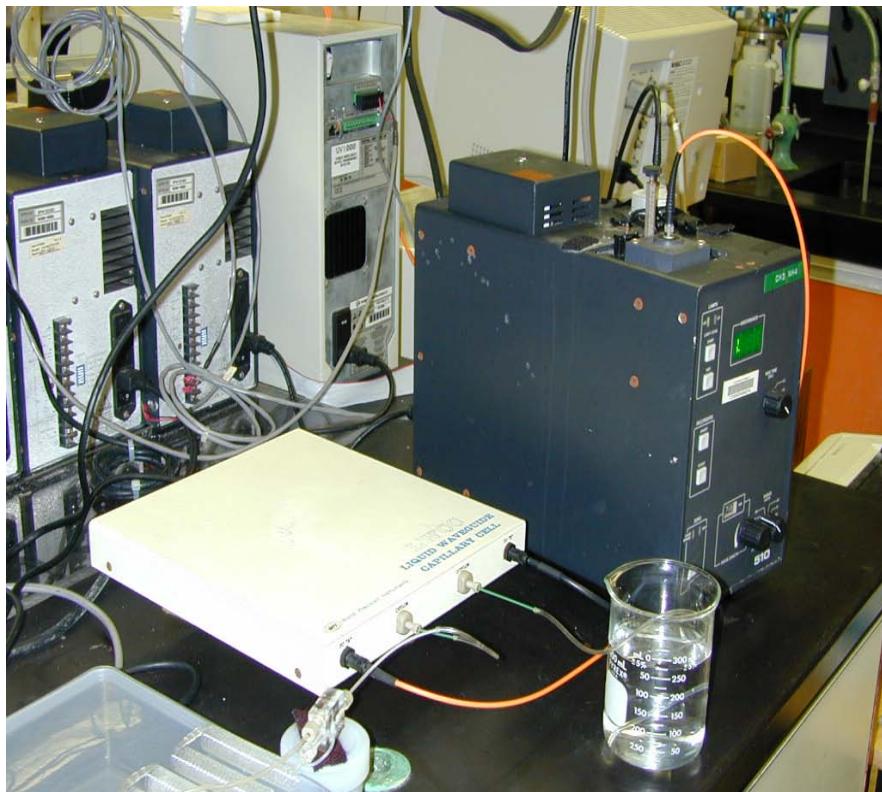
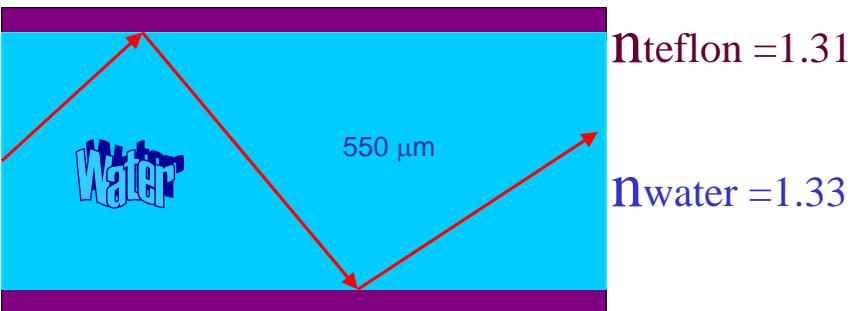


Mapping ammonia dispersion in  
an oceanic outfall

Amomthammarong & Zhang 2008



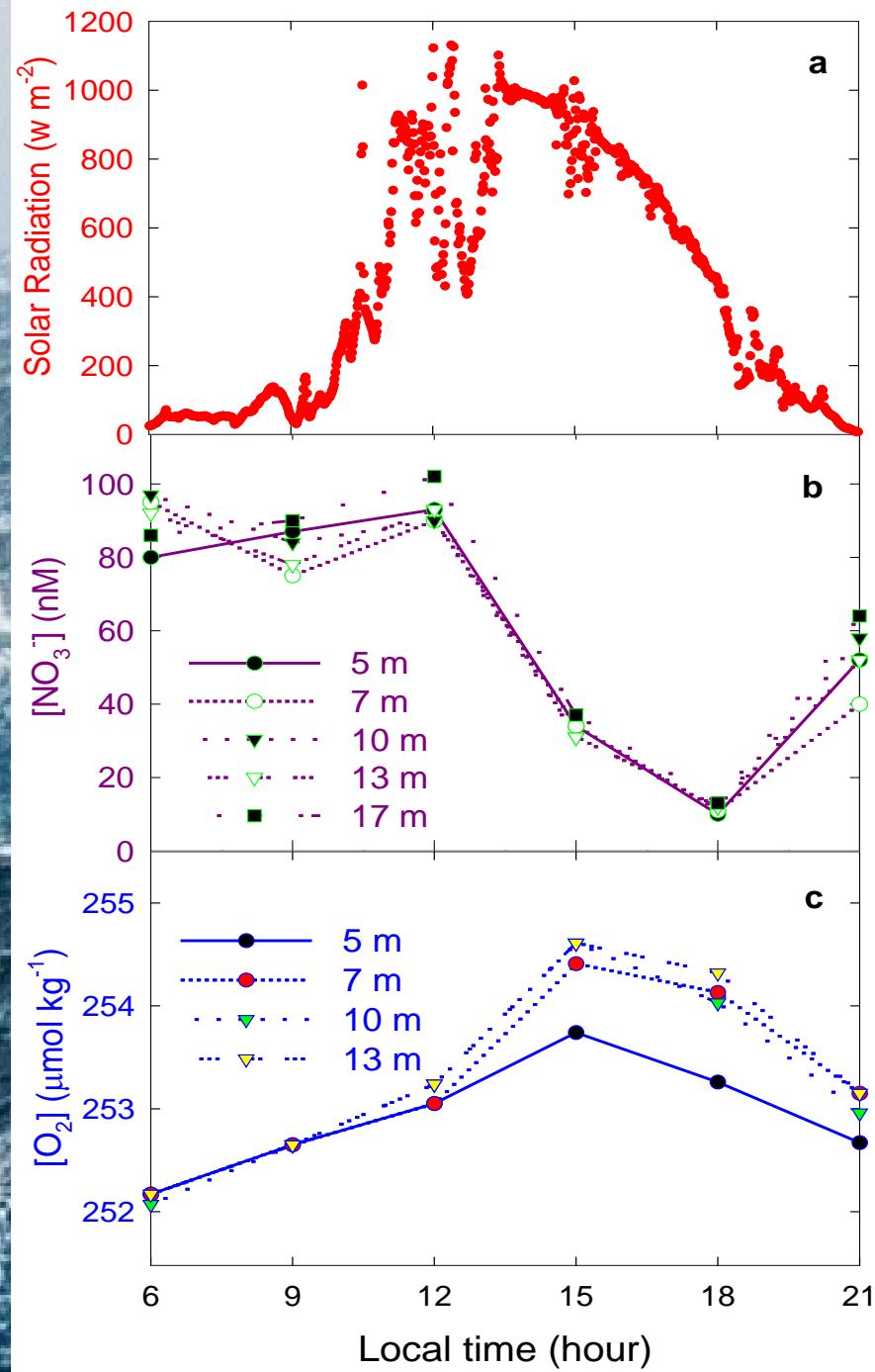
# Sensitivity Enhancement by Liquid Waveguide



Zhang 2006 Analytical Science

# Oceanic photosynthesis observed from diel cycle of nitrate at nM levels

Zhang et al,  
GRL 2001



# Parameters essential to model sediment/water exchange of phosphate

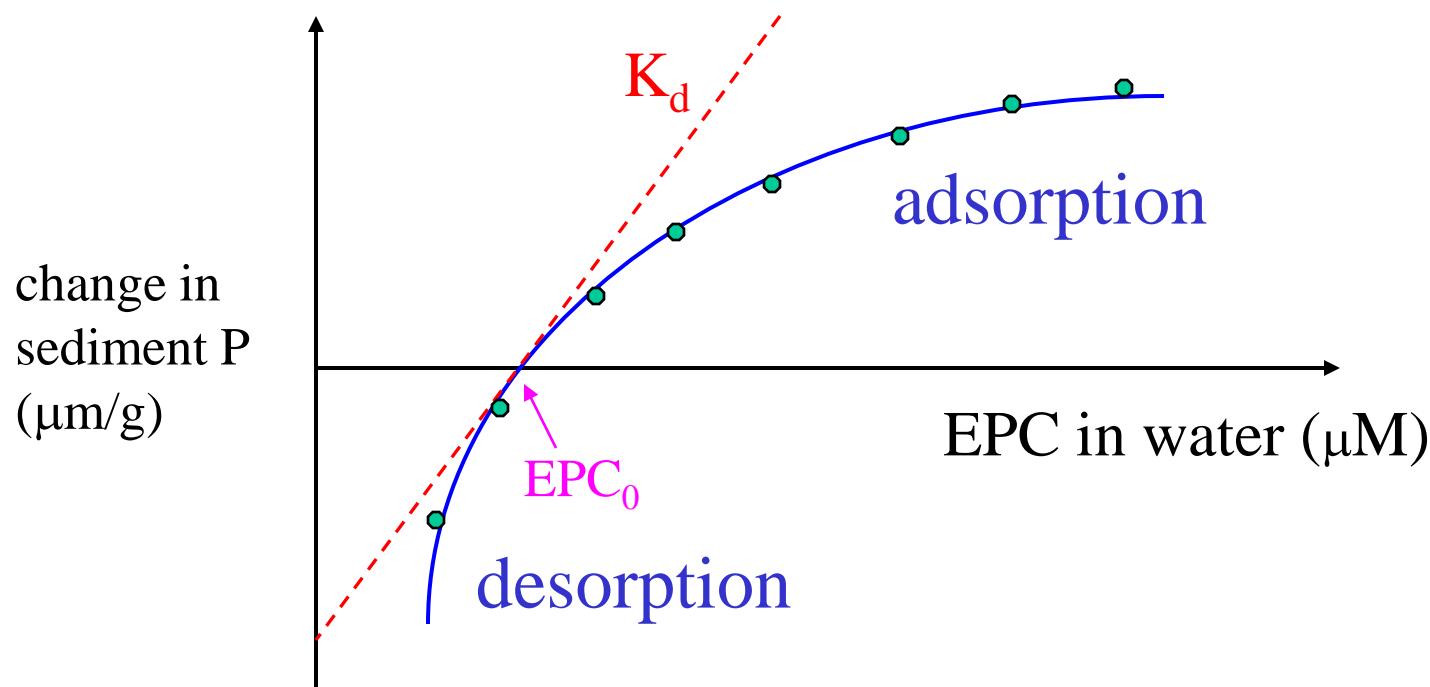
## 1. Distribution coefficient

$$K_d = P_{\text{sediment}} / P_{\text{water}}$$

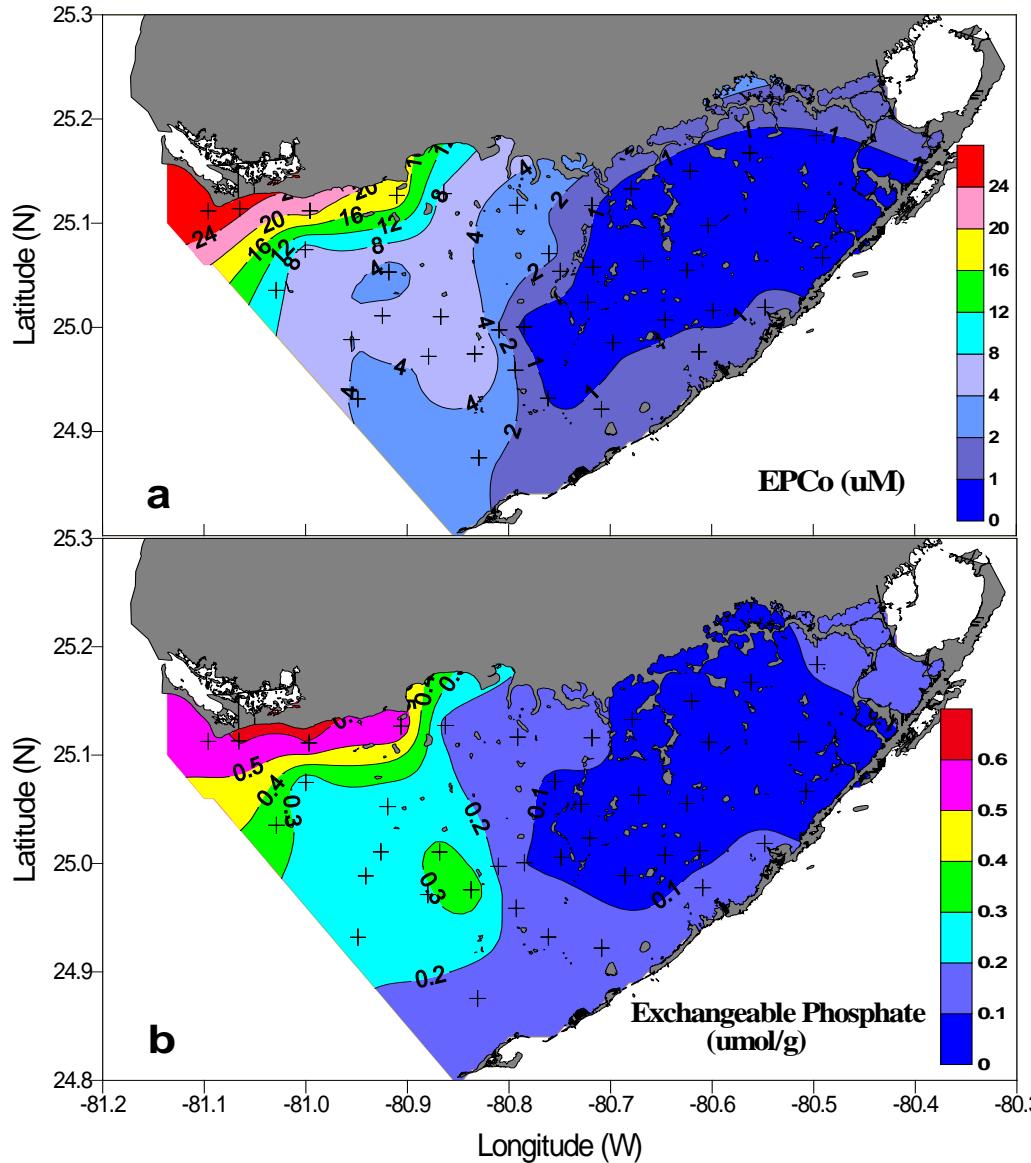
## 2. Zero Equilibrium Phosphate Concentration ( $EPC_0$ )

water P concentration at which no exchange of P between sediment and water

# Sorption experiments to quantify $K_d$ and $EPC_0$



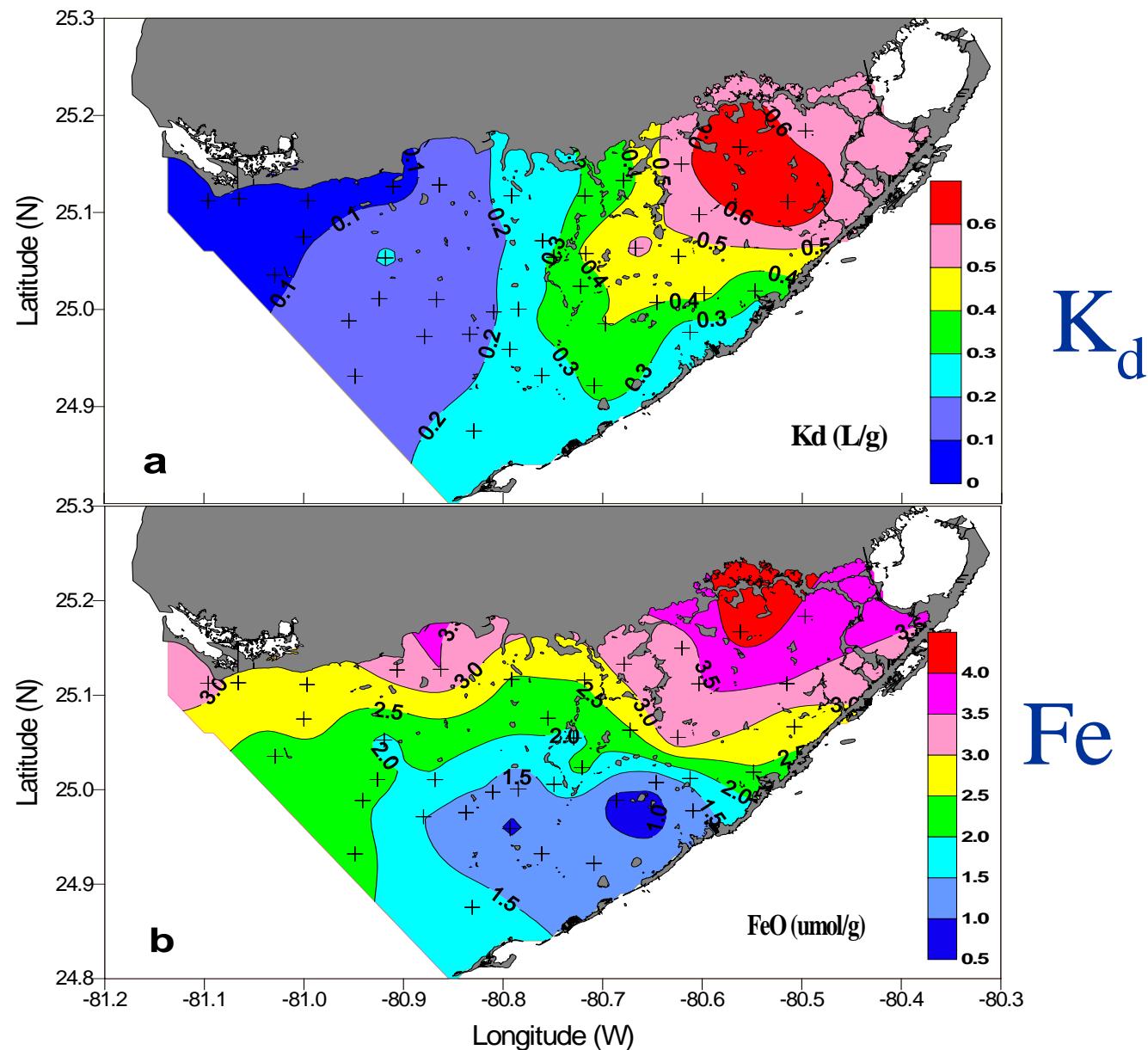
# Spatial distribution of $EPC_0$ and $P_{exch}$ in Florida Bay



$EPC_0$

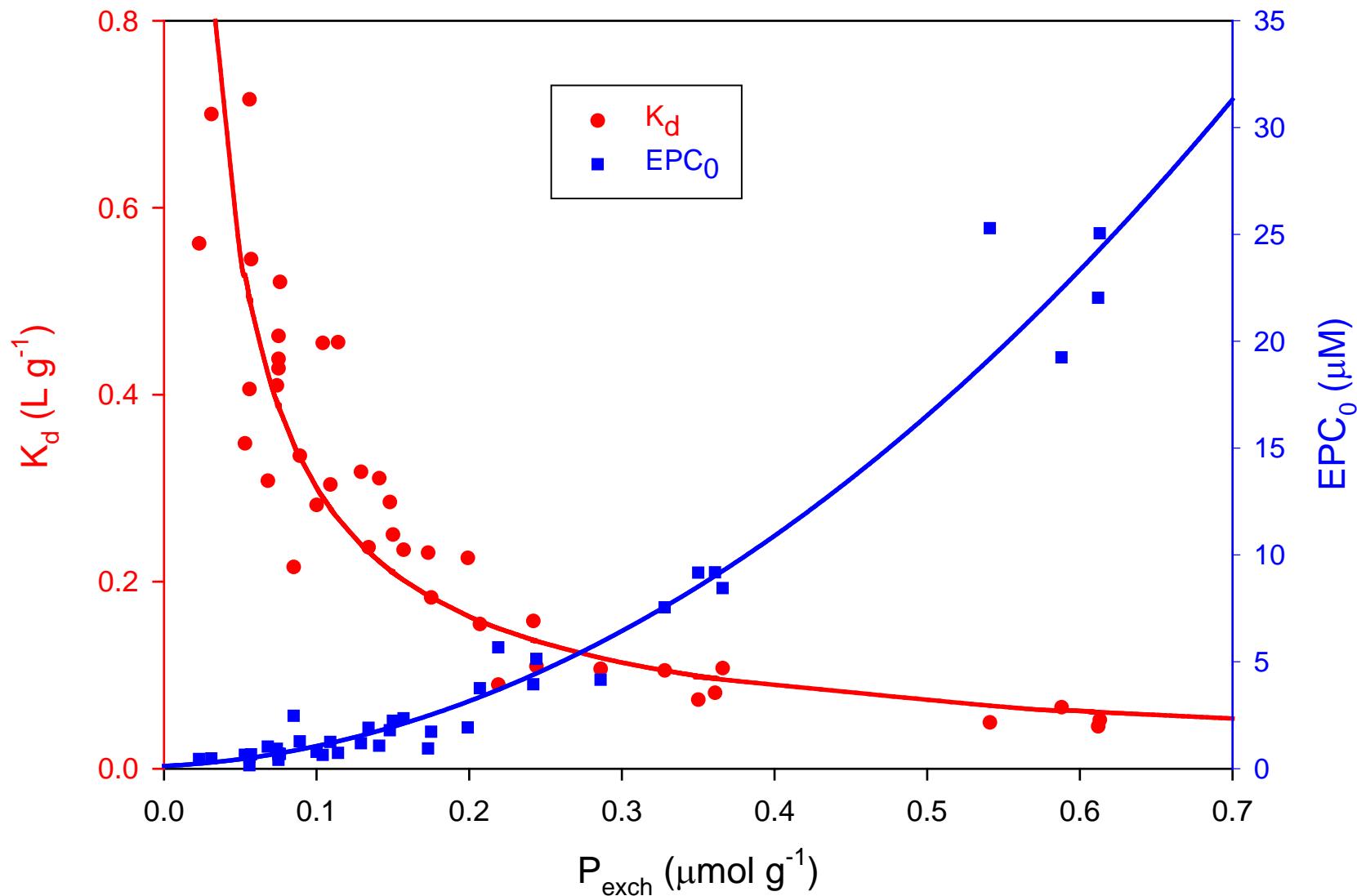
$P_{exch}$

# Spatial distribution of $K_d$ and Fe in Florida Bay

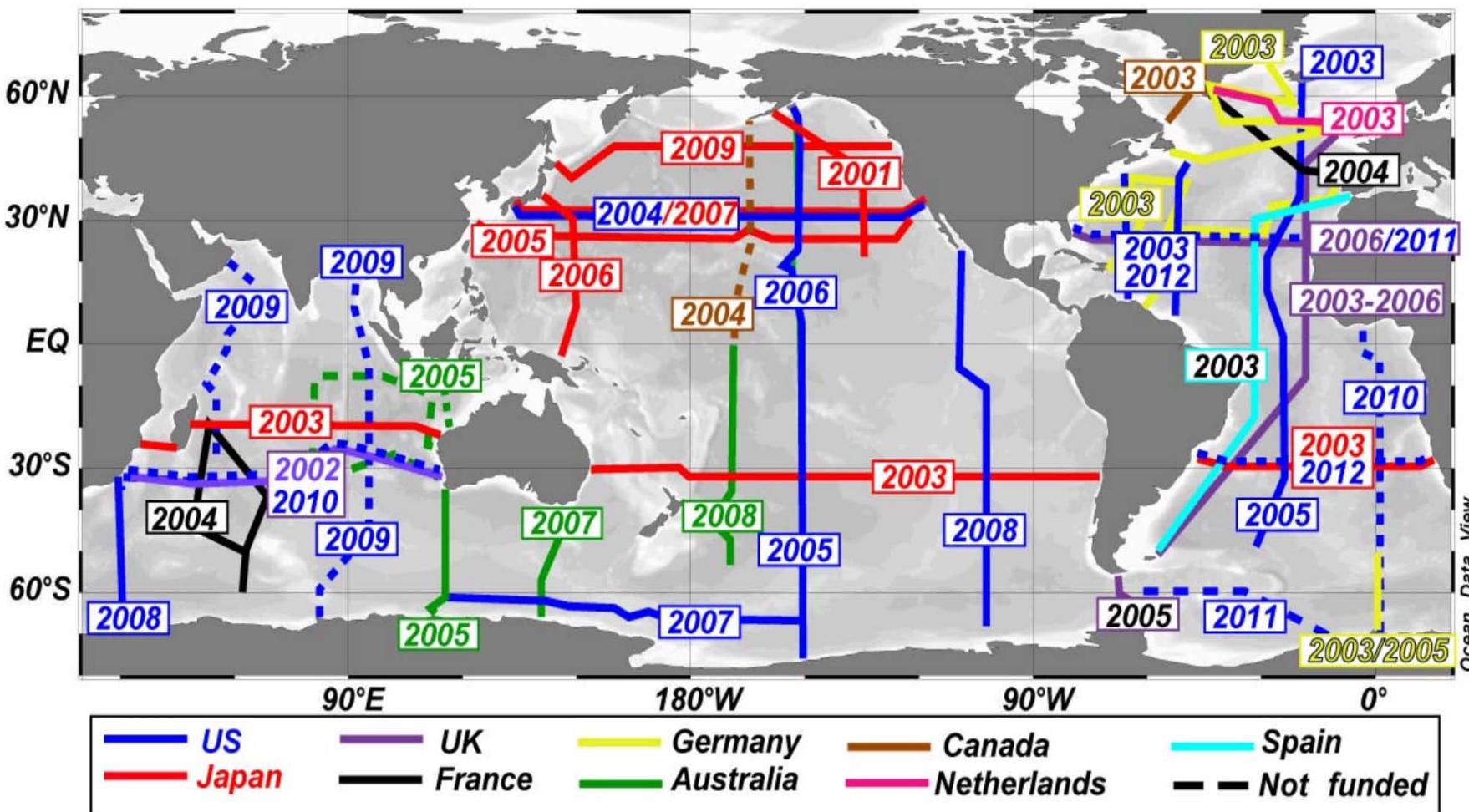


# $EPC_0$ and $K_d$ as a function of $P_{\text{exch}}$ in Florida Bay

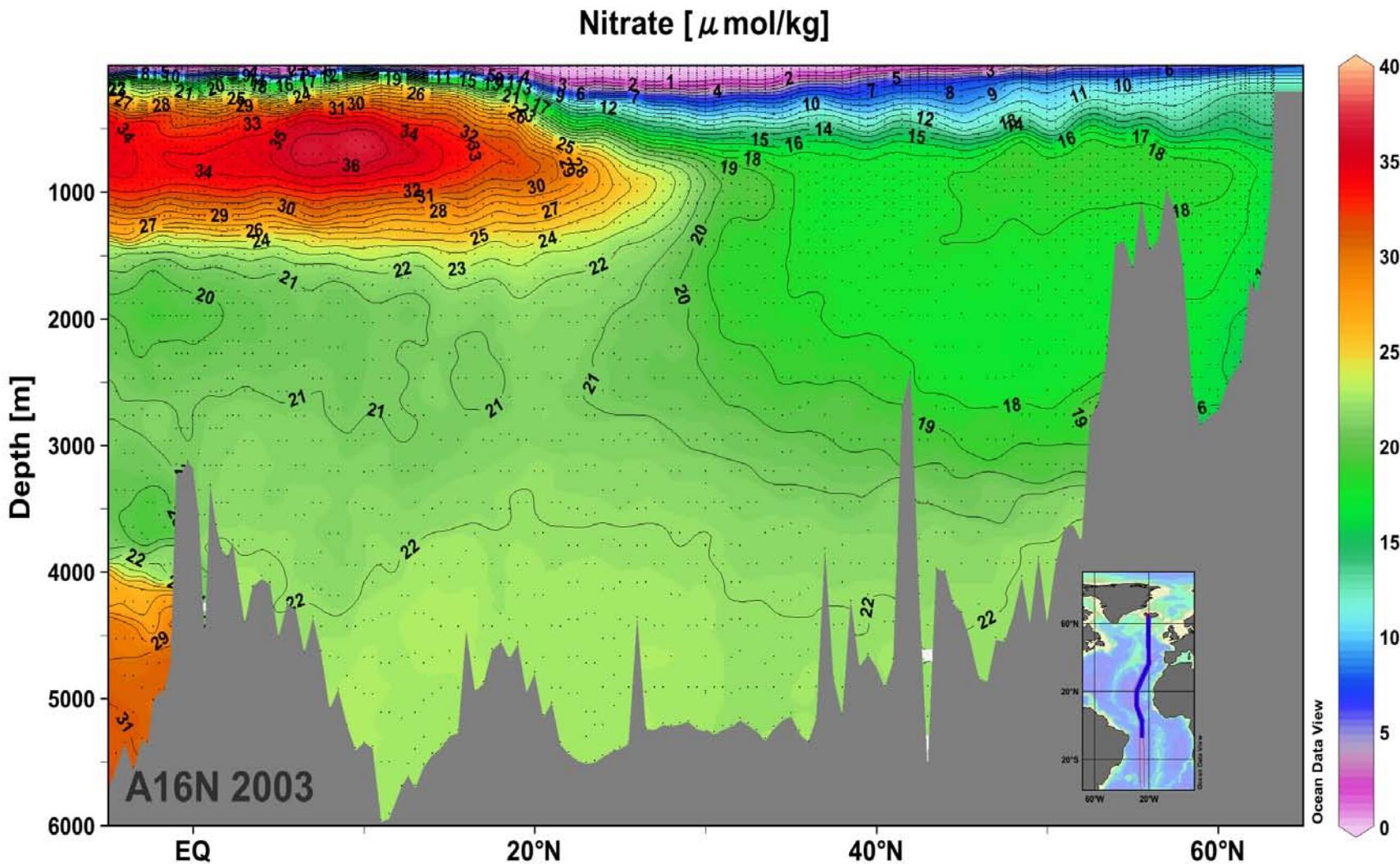
Zhang & Huang, ES&T 2007

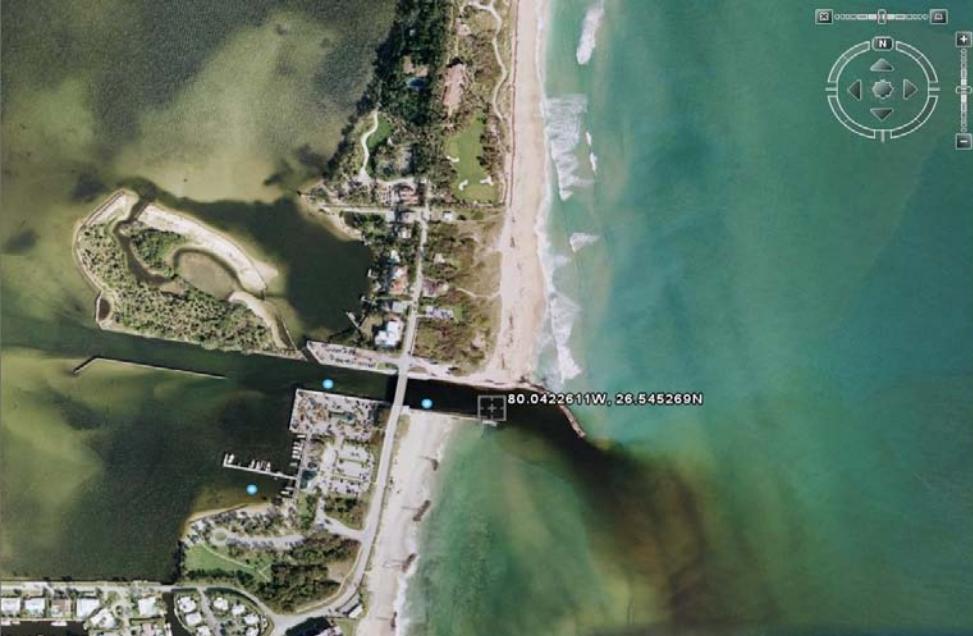


# Repeat Hydrography CO<sub>2</sub>/tracer Program hydrographic sections

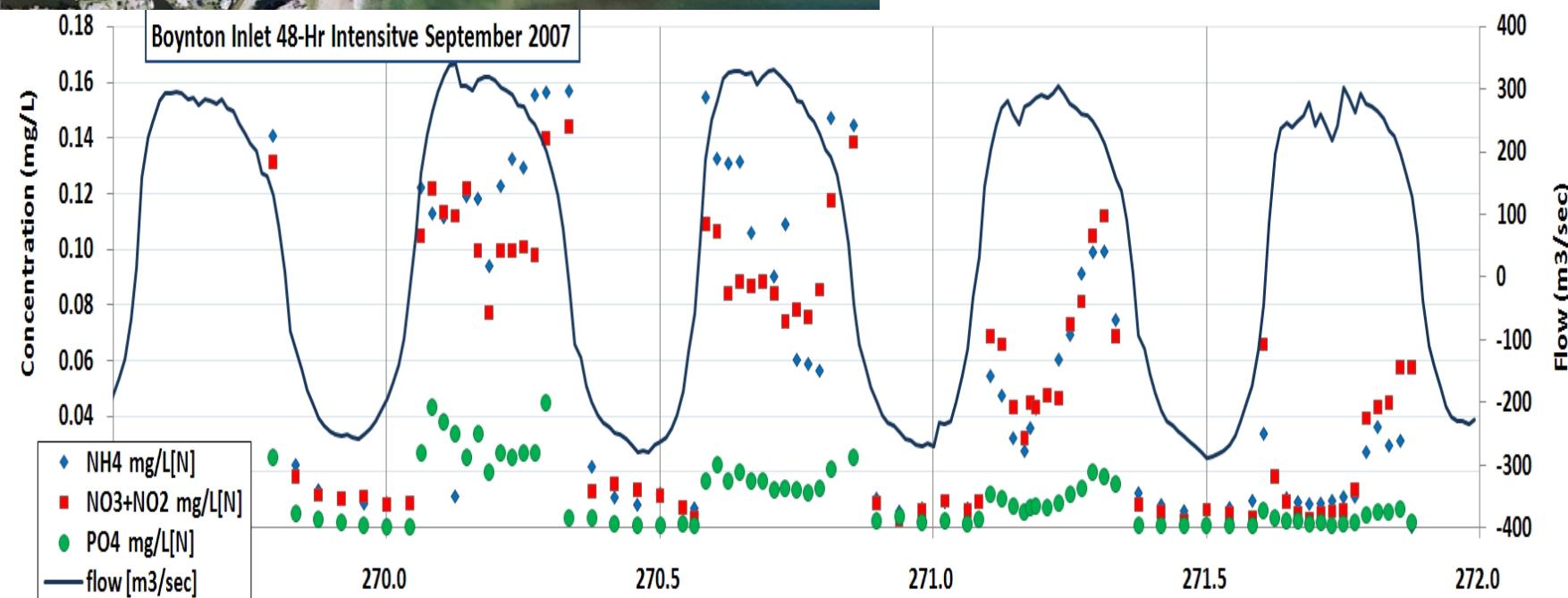


# Nitrate in North Atlantic





# Tide induced nutrient flux to coastal waters



# Outlook & challenges

## Nutrient Dynamics/Ecosystem Functioning

- Shipboard underway measurement for oligotrophic ecosystem
- In situ nutrient sensors for time-series monitoring(e.g. coral reefs)
- Developing Certified Reference Materials (CRM) to Improve accuracy