

# Water Properties in Quartermaster Harbor

## Focus on Nitrogen, Oxygen & Phytoplankton

Jill Gable – Grant Project Officer, EPA

Curtis DeGasperi – Project Manager, KC

Eric Ferguson – **Surface/Groundwater monitor**, KC

Many UWT Students

Kim Stark - Marine monitoring, KC

Cheryl Greengrove – **Marine monitoring**, UWT

Julie Masura – Marine monitoring, UWT

Skip Albertson – **Marine Modeler**, Ecology

Larry Stockton – **Policy & Public Outreach**, KC



<http://www//kingcounty.gov/qmhnitrogenstudy>

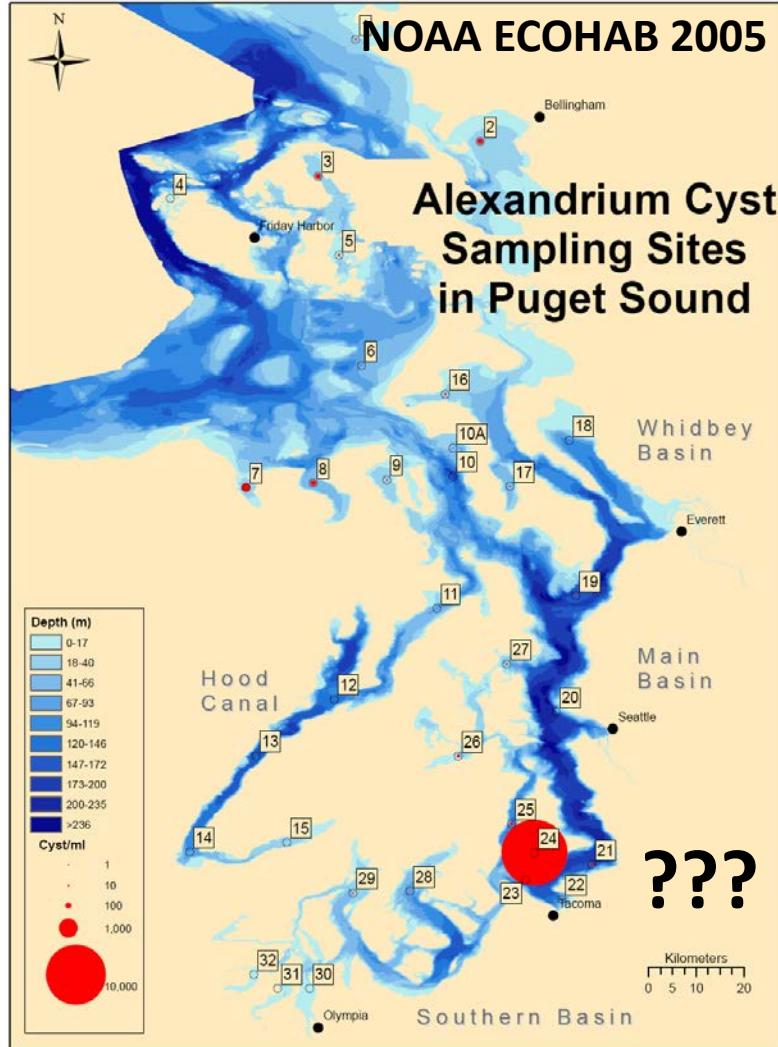


Quartermaster Harbor  
Nitrogen Management Study

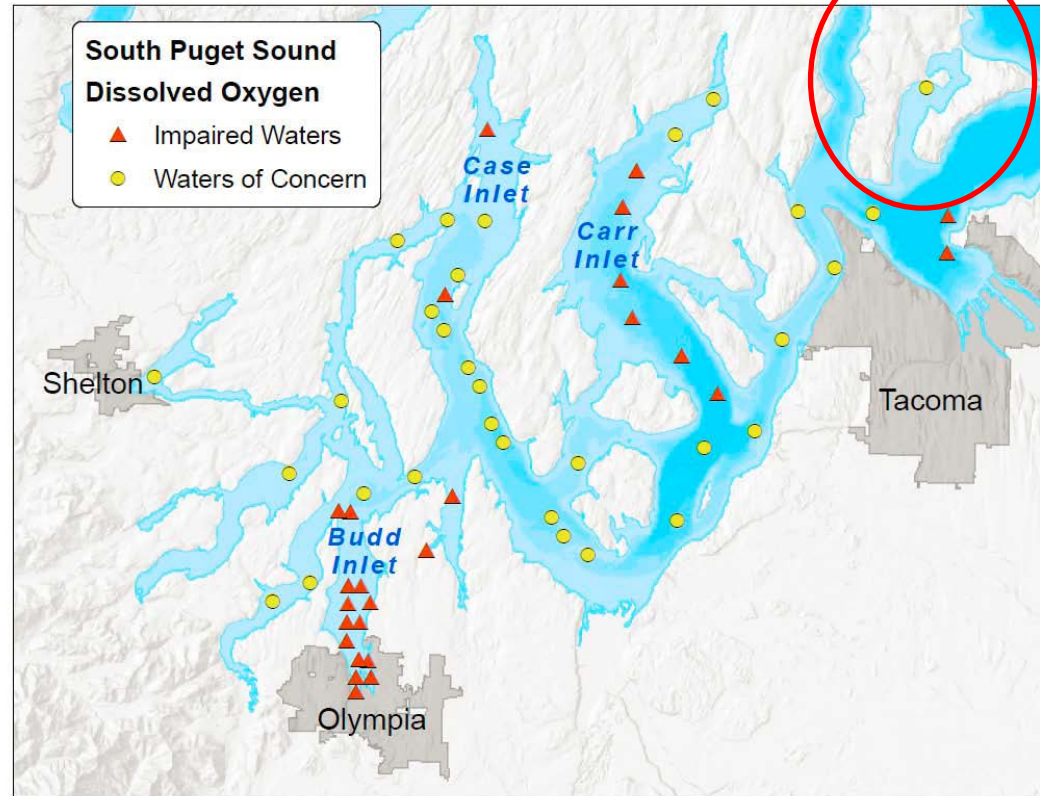


# Why Quartermaster Harbor?

Harmful Algal Bloom - PSP

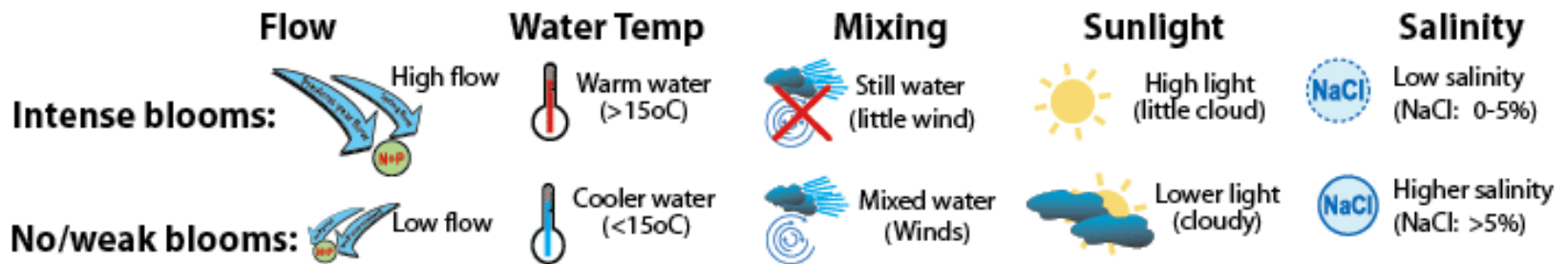
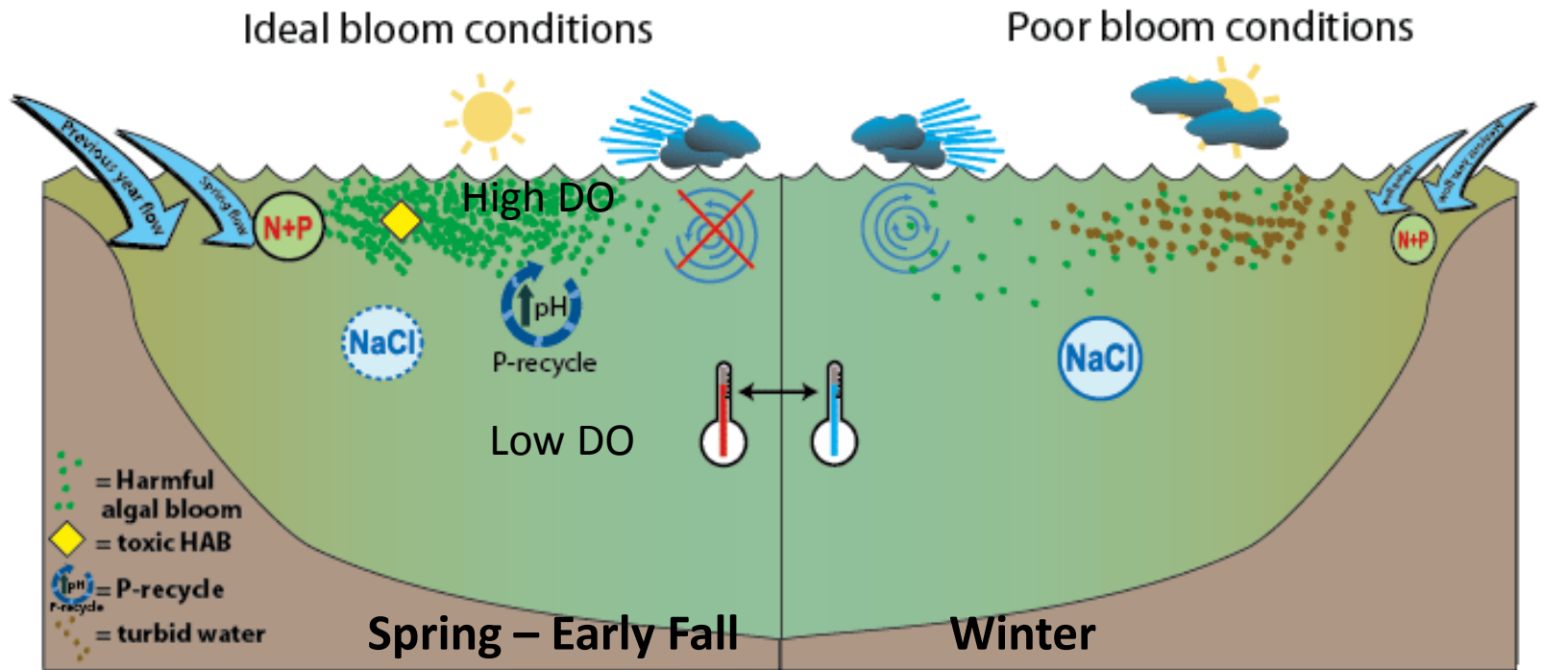


Low Oxygen

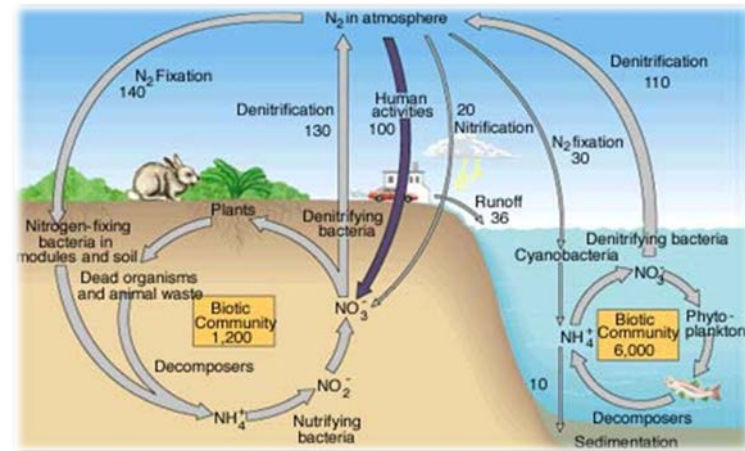


Washington State Department of Ecology 2011

# Nutrients, Algal Blooms and Oxygen



# Sources of Nitrogen to Quartermaster Harbor

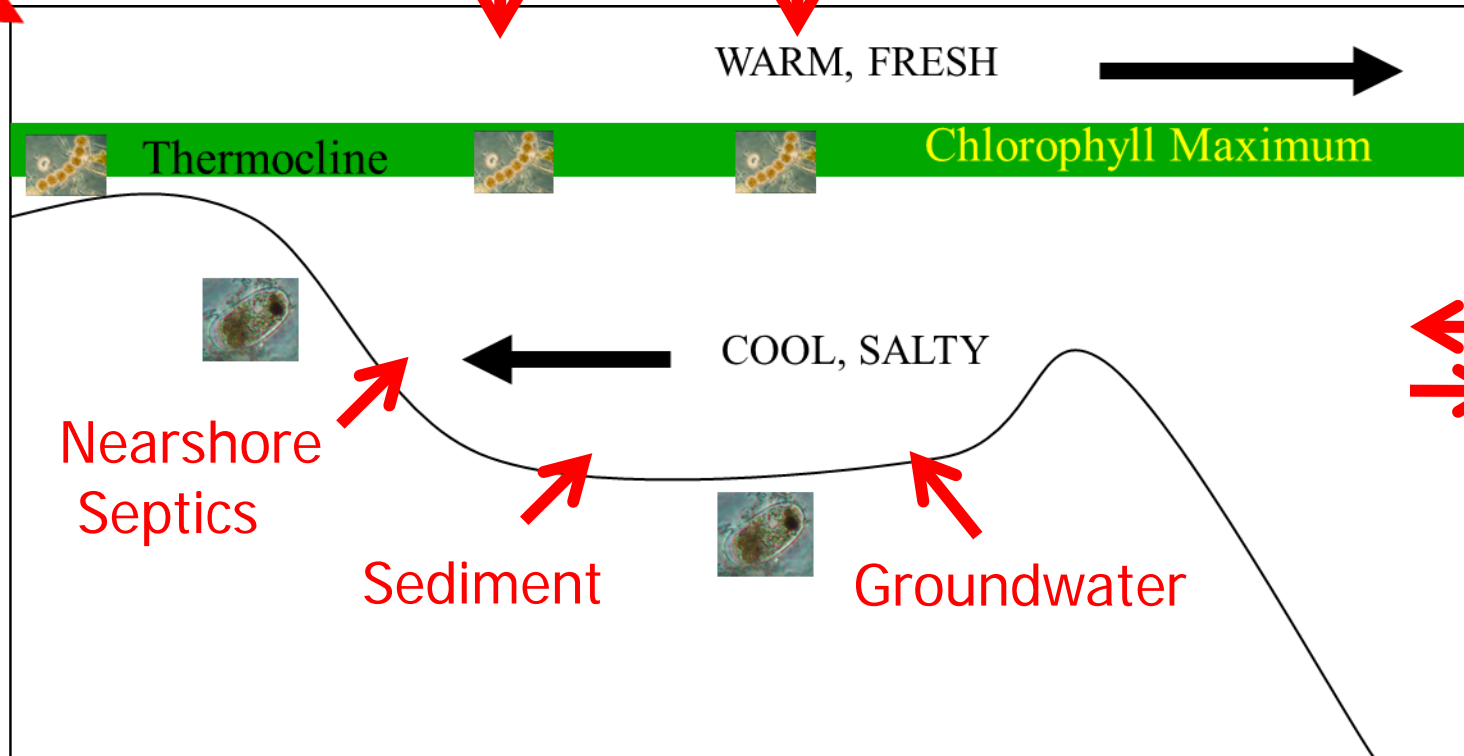


## Streams

- Livestock
- Fertilizer
- Alders

## Boats

## Atmosphere

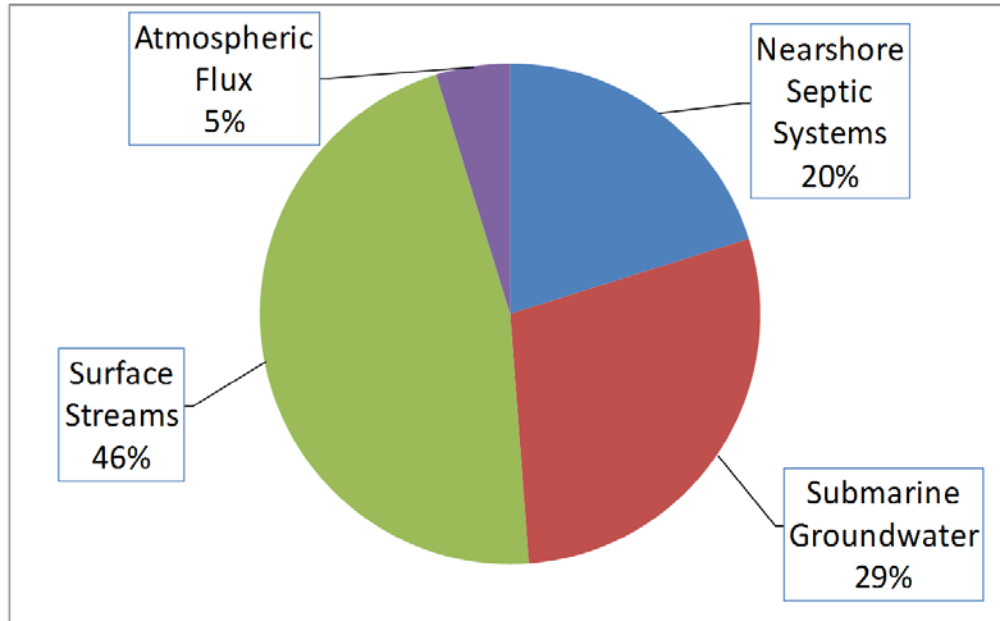


# Nitrogen Loading in Quartermaster Harbor

External N inputs assessed

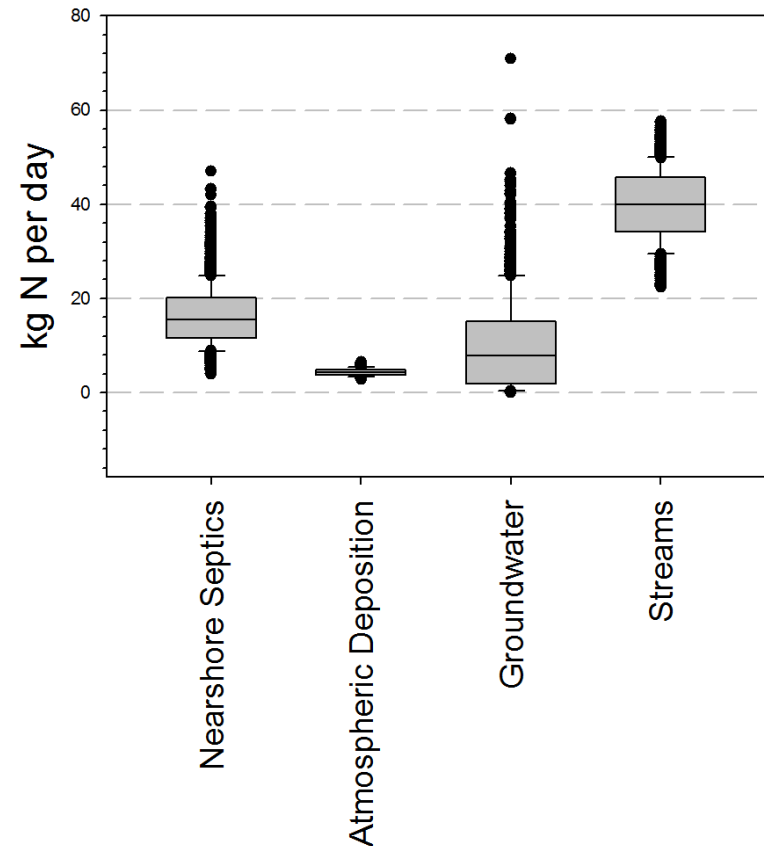


- Atmospheric deposition
- Stream inputs
- Groundwater
- Shoreline septic systems
- Benthic flux - Sediments

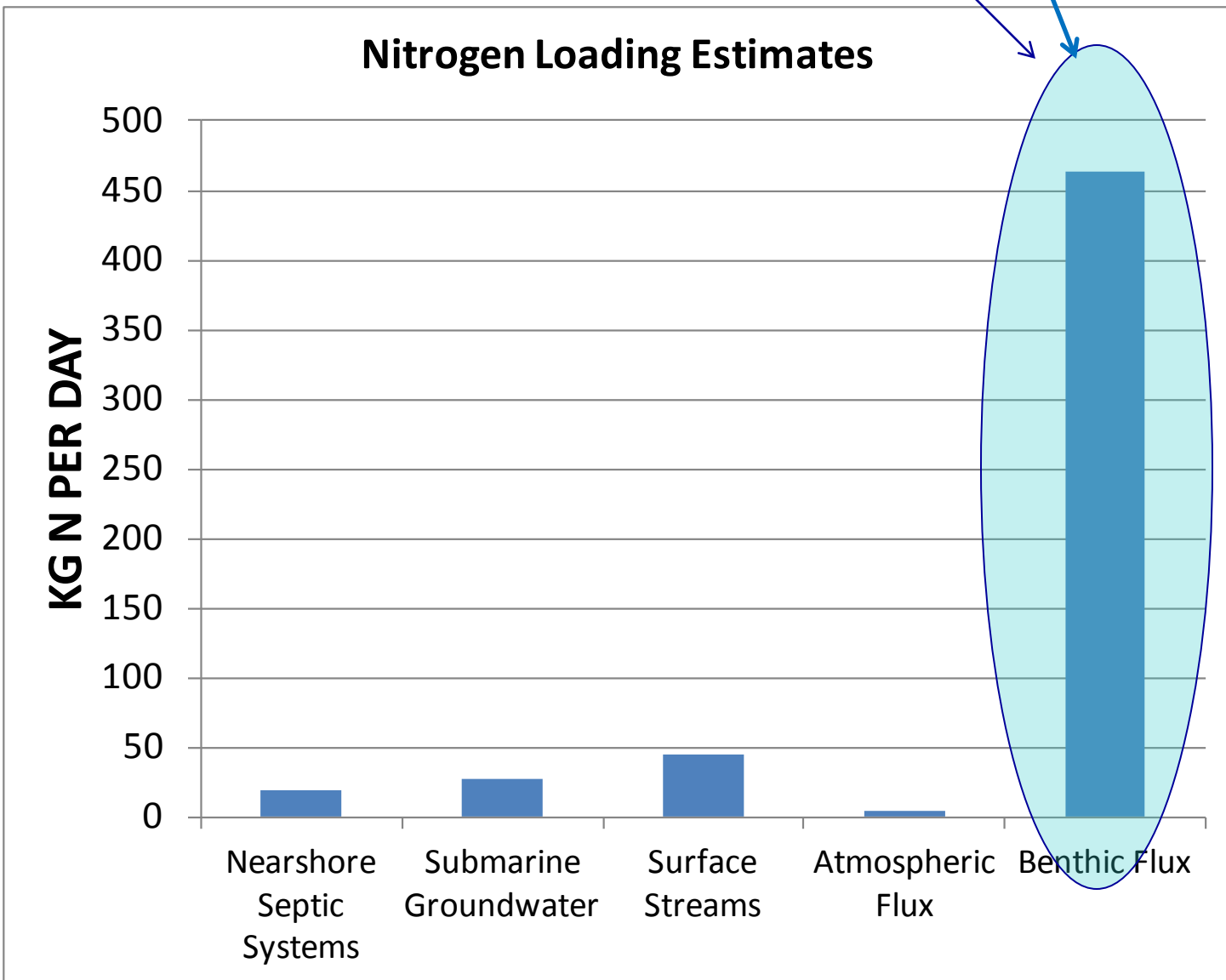


## Uncertainty in Nitrogen Loading

Nitrogen Loading to Quartermaster Harbor



Seasonal Load (late summer)?



# UWT

Oct. '06 – present

# Marine Sampling

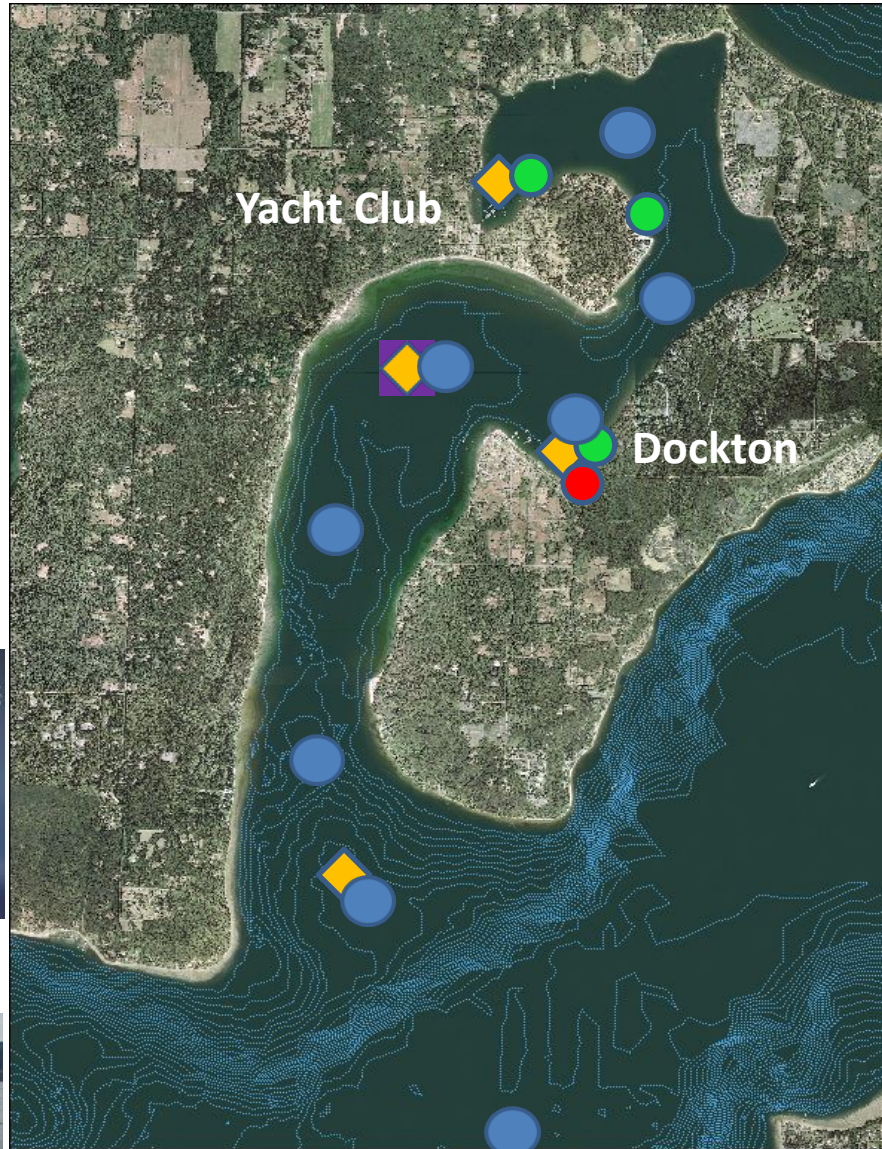
# King County

2009 -present

- **CTD/Water**
- Monthly Sampling
- Temperature
- Salinity
- Density
- Oxygen
- Chlorophyll
- Transmissivity
- Licor
- Nutrients
- Plankton



- ◆ **Mooring**
- Temperature
- Salinity
- Density
- Oxygen



- Water - monthly** ●
- salinity, temp, DO, TSS, chlorophyll, nutrients, bacteria, phytoplankton (bi-weekly Apr-Oct)

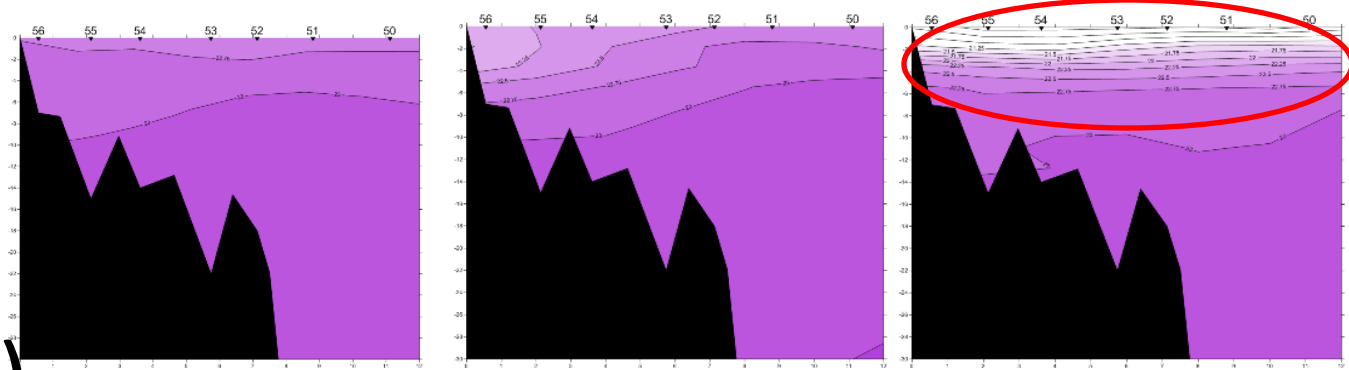


- Moorings** ◆
- salinity, temp, DO, pH
- turbidity, chlorophyll
- nitrate at outer buoy

- Meteorological Station** ●



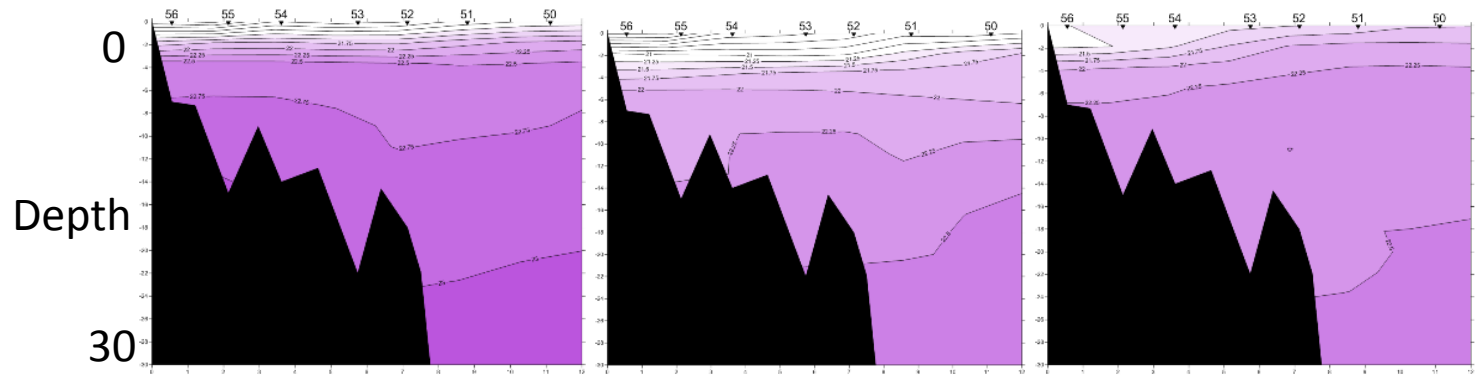
# QMH Density (Sigma-t)



February 2009

March 2009

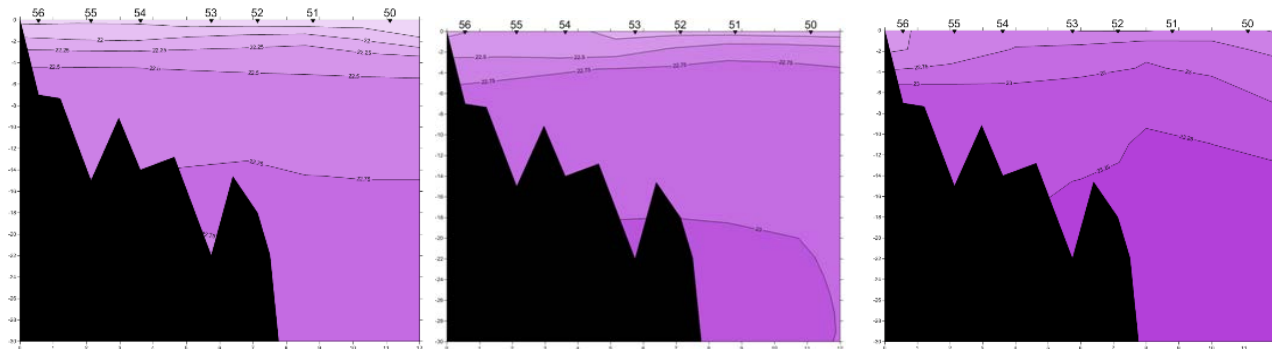
April 2009



May 2009

June 2009

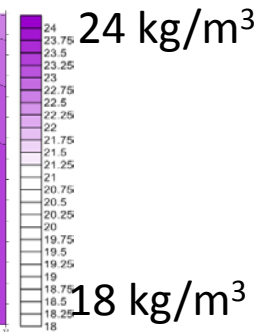
July 2009



August 2009

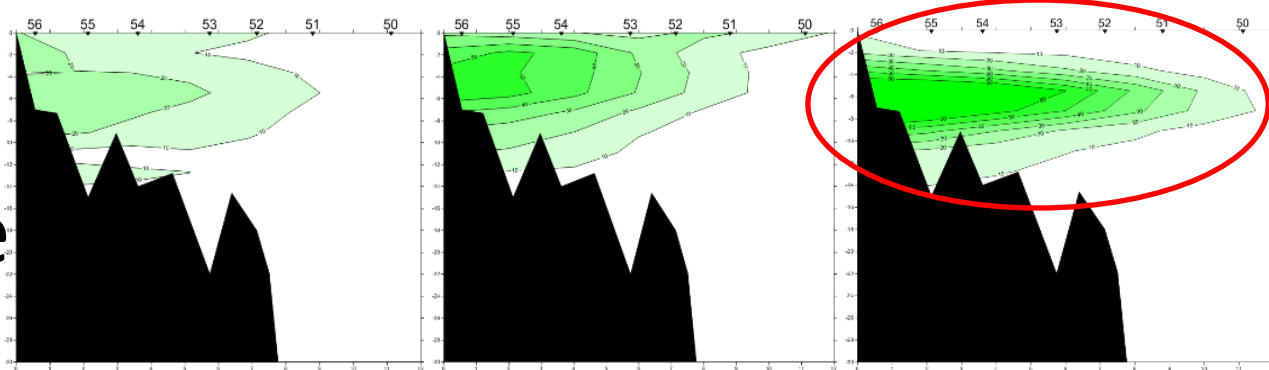
September 2009

November 2009





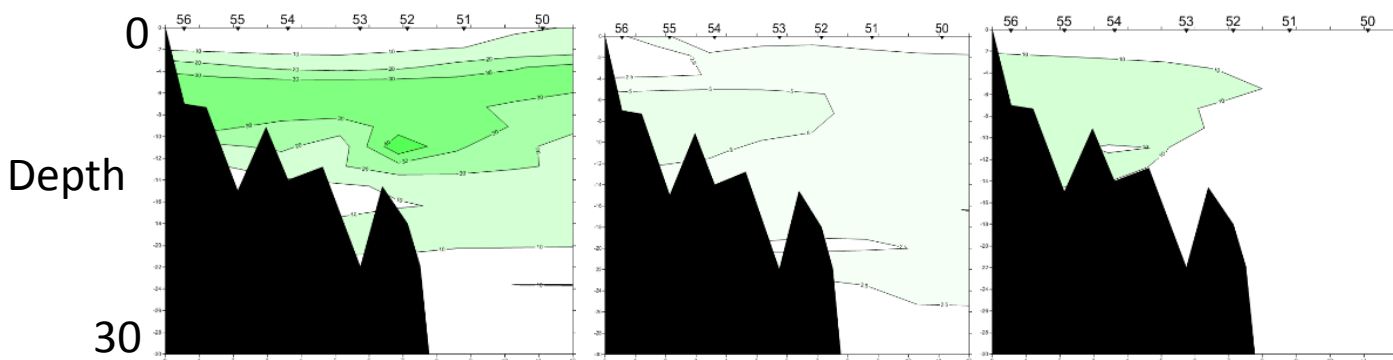
# QMH Fluorescence



February 2009

March 2009

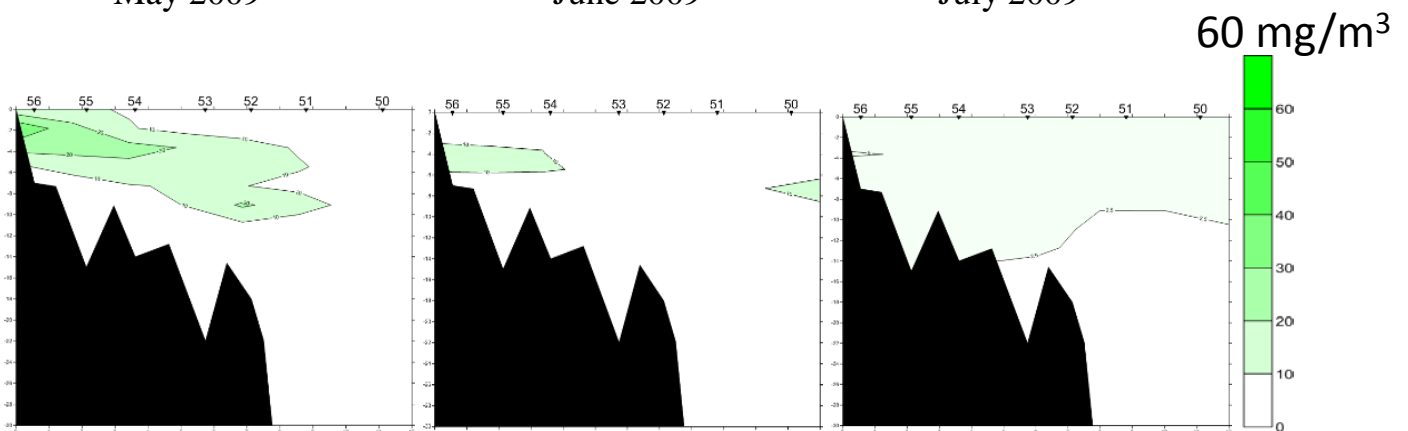
April 2009



May 2009

June 2009

July 2009



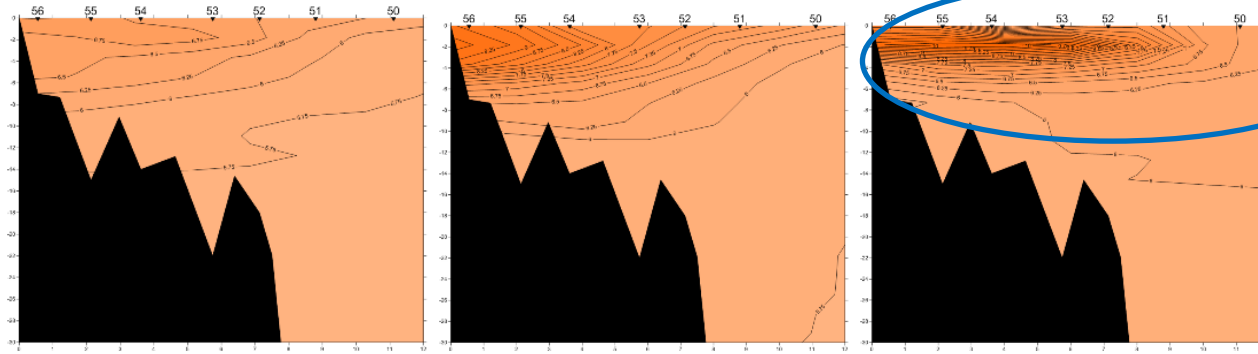
August 2009

September 2009

November 2009

0  $\text{mg/m}^3$

# QMH Oxygen

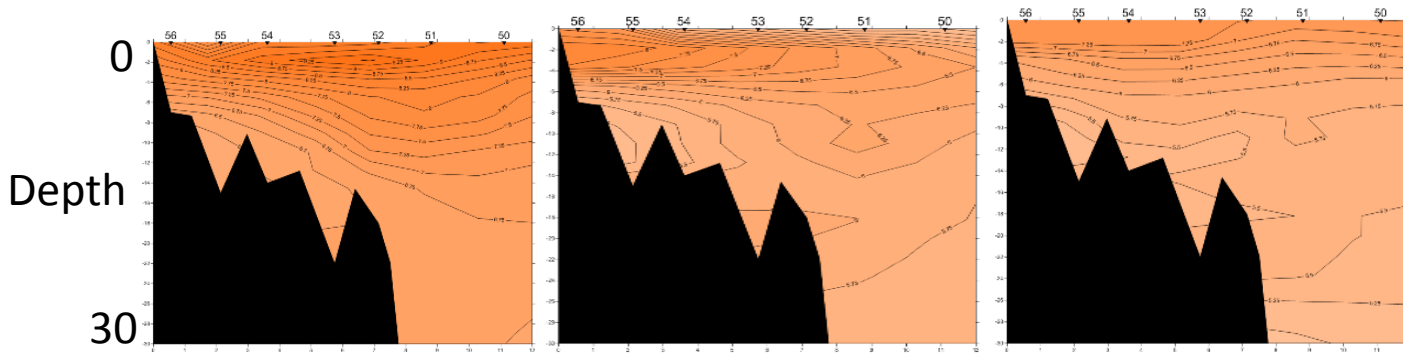


High

February 2009

March 2009

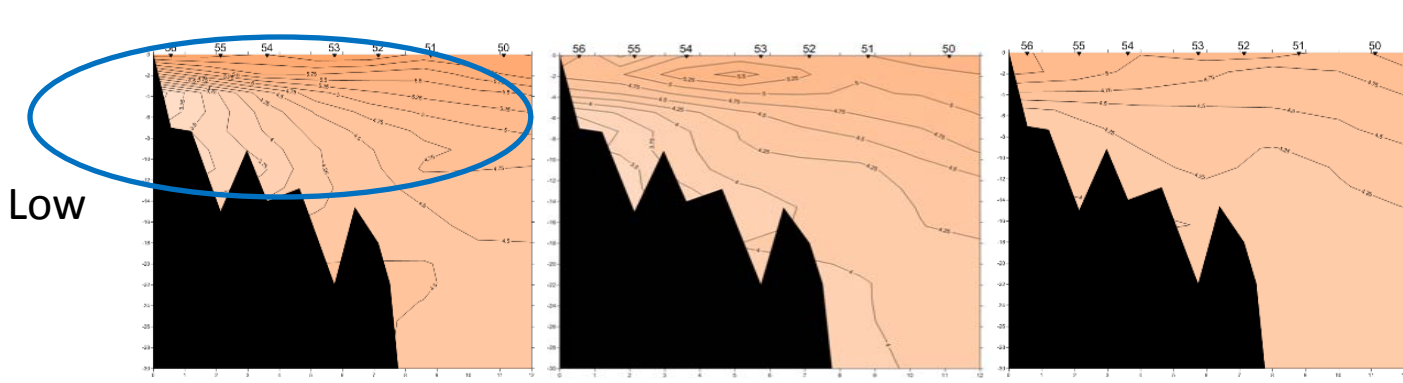
April 2009



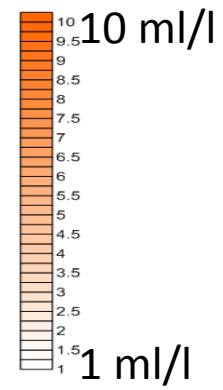
May 2009

June 2009

July 2009



Low

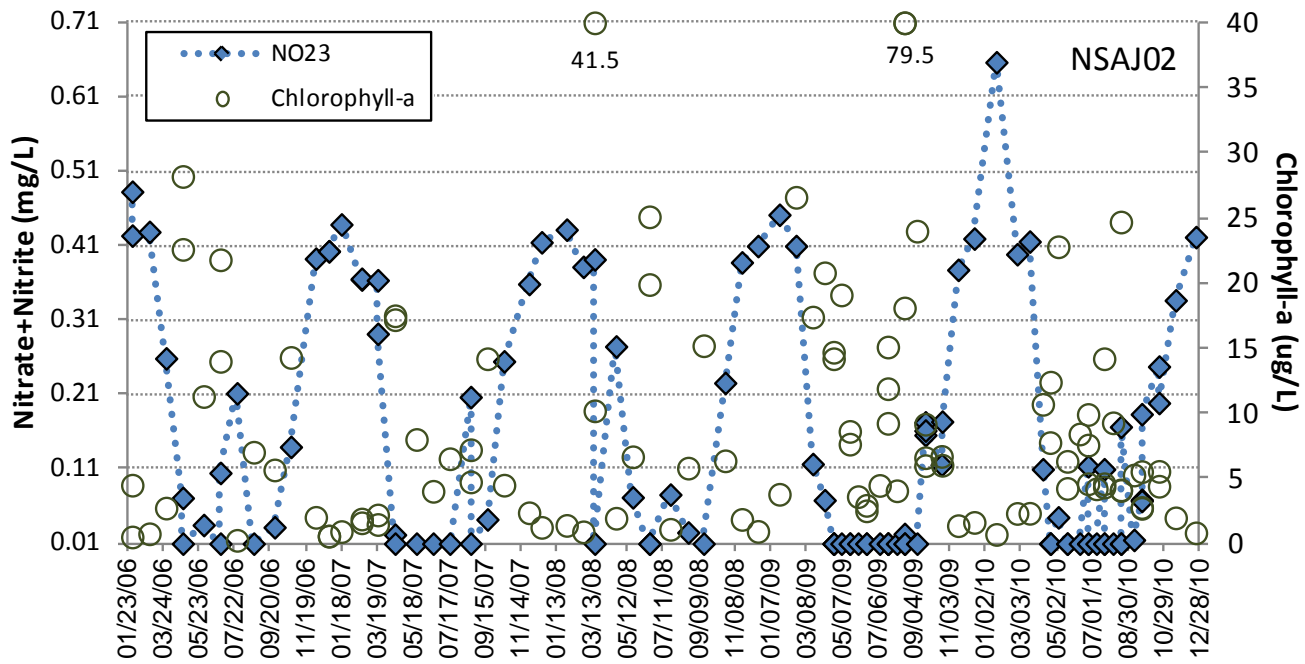


August 2009

September 2009

November 2009

Dockton

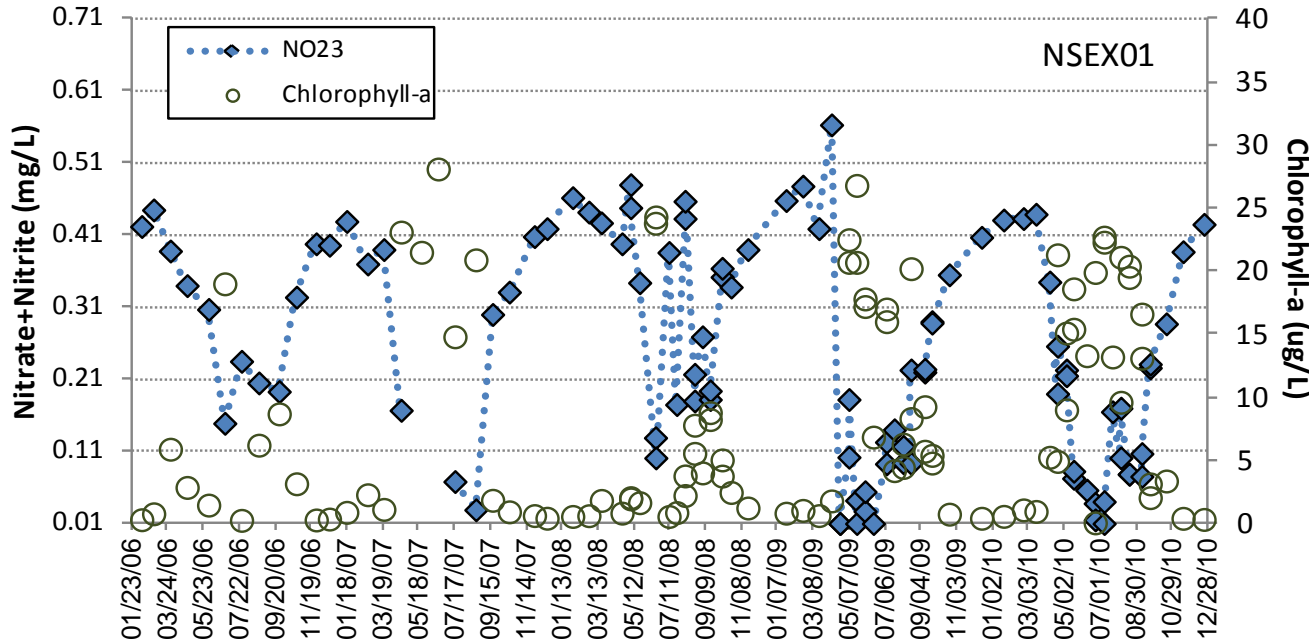


Nitrate & Nitrite  
Chlorophyll-a

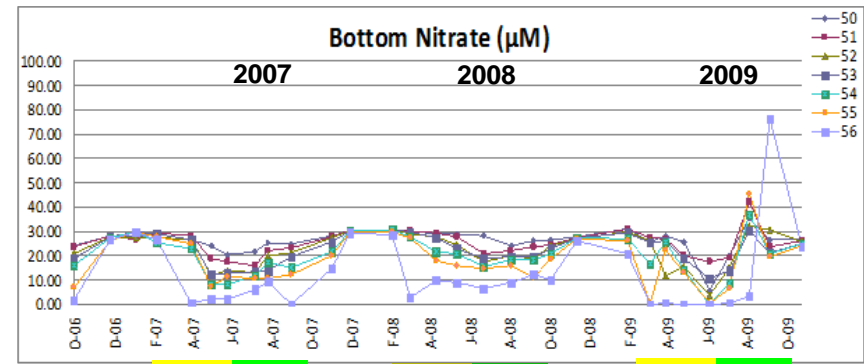
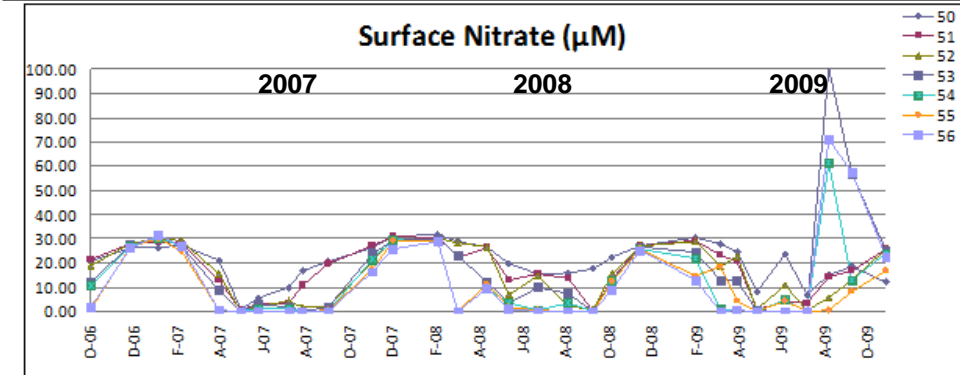
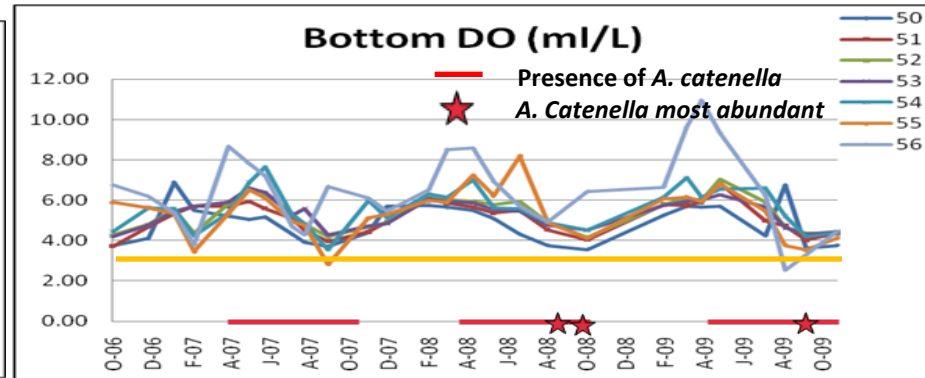
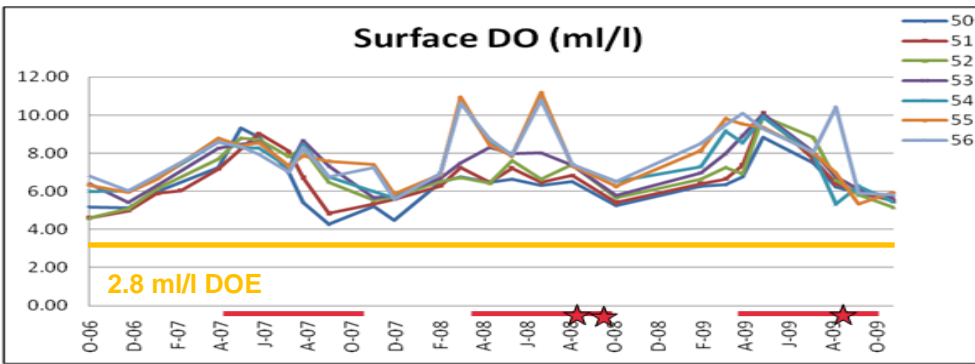
Jan 2006

Dec 2010

East  
Passage



# Seasonal Patterns in Nutrients & Phytoplankton



Sp Su

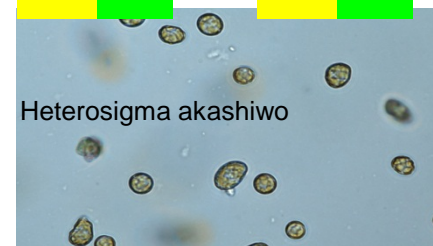
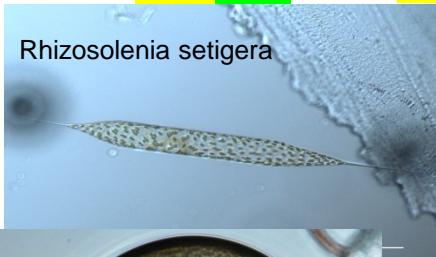
Sp Su

Sp Su

Sp Su

Sp Su

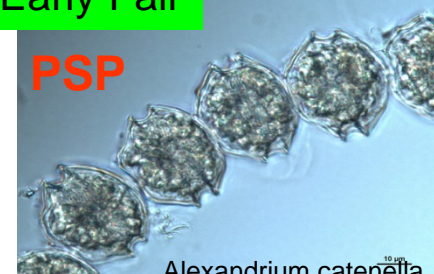
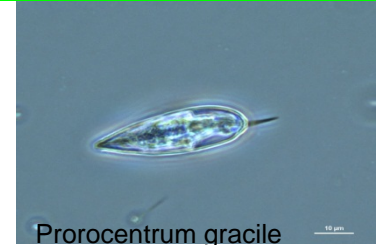
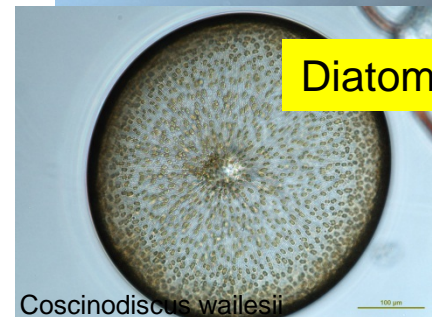
Sp Su

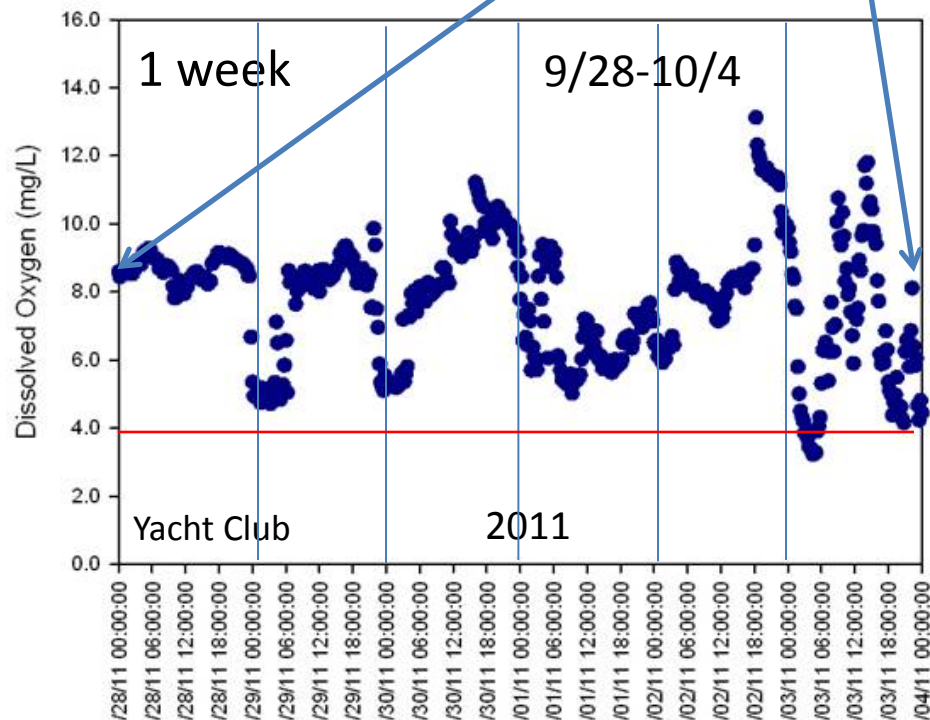
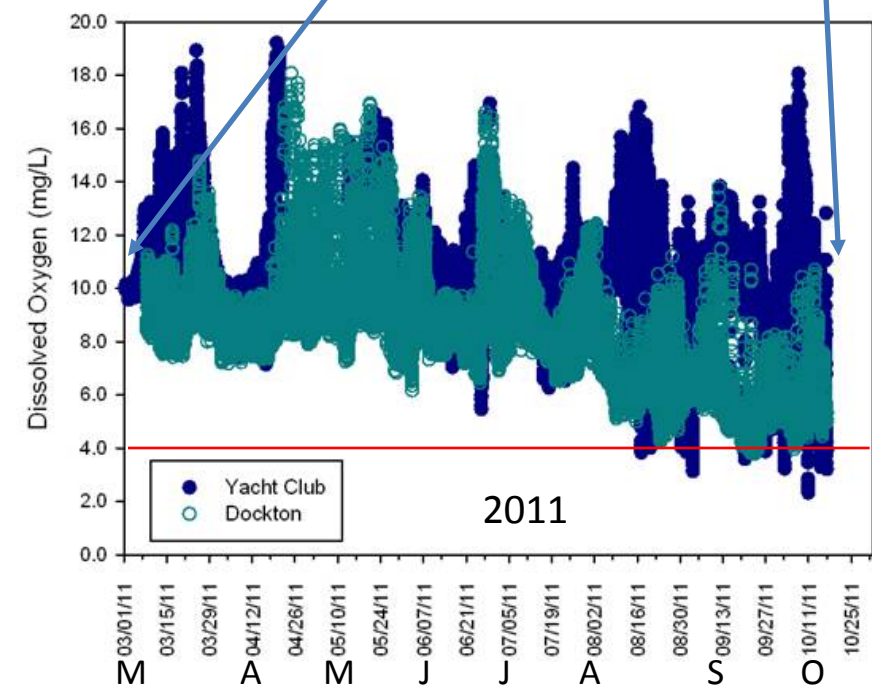
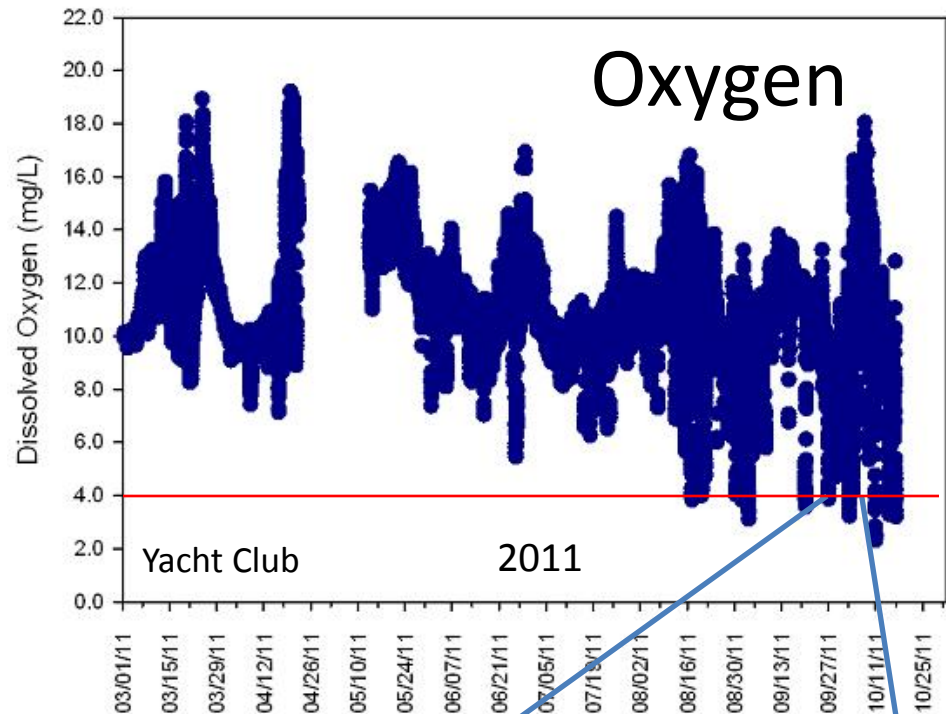
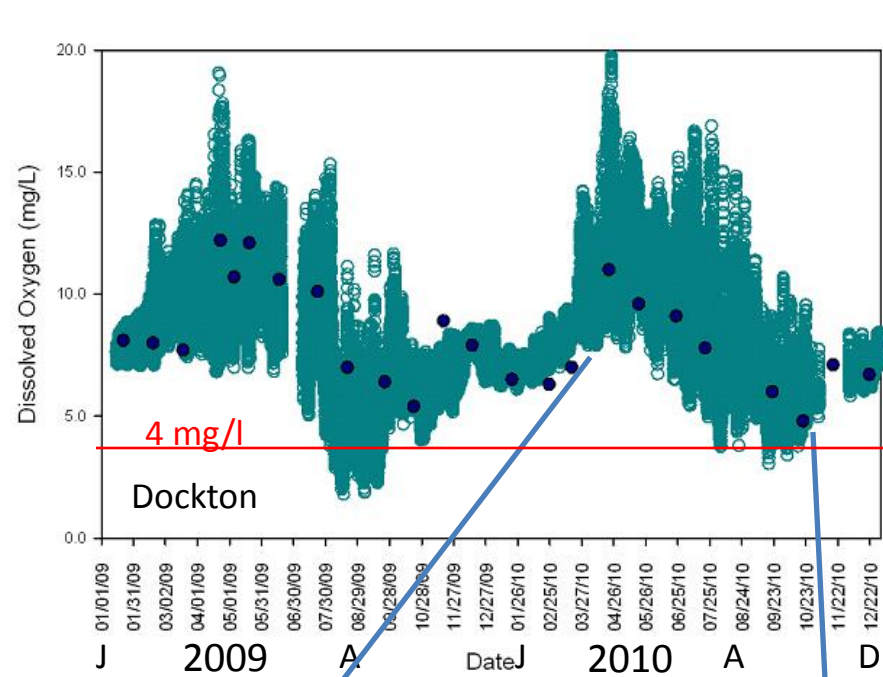


All Photos by  
G. Hannah  
King County

Diatoms – Spring/Early Summer

Dinoflagellates – Summer/Early Fall



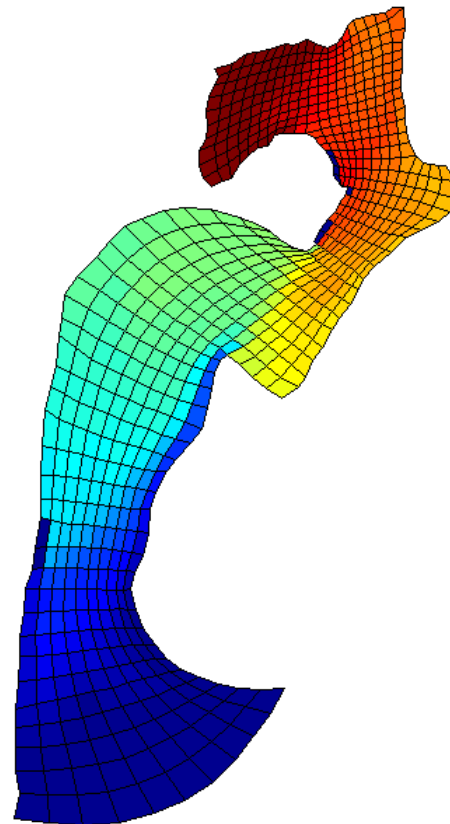


# Nitrogen Load, Phytoplankton & **Flushing** affect Oxygen Levels in QMH

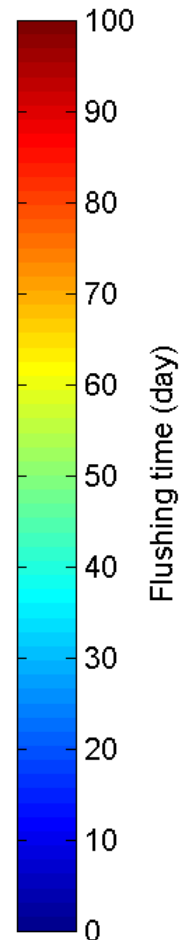
October 2009<sub>v</sub> near-surface

POSTER 46  
Skip Albertson

Seasonal variations in  
flushing time for  
Quartermaster  
Harbor, an enclosed  
Puget Sound Estuary



Mean flush: 23.6 days





# Questions?

