DELAWARE CENTER FOR THE INLAND BAYS
Research. Educate. Restore.

SCIENTIFIC AND TECHNICAL ADVISORY COMMITTEE
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What we can measure vs. What we want to know.

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Old Monitoring Paradigm

- Measure what we can measure as often as we can afford to do so!
  - Useful (maybe) for status and long-term trends
  - Useful for management? (maybe not)
  - Easy to measure with sensors
    - Temperature, Salinity, Depth, pH, Turbidity (Secchi Depth)
  - Harder to measure, but useful (sampling, filtering, laboratory analysis)
    - Dissolved and Particulate Nutrients
    - Contaminants
    - Organisms (plankton, benthos, nekton)
    - Process Variables (incubations requiring labs)

Newer Monitoring Paradigm

- **"Problem-Based Monitoring."** Determine what is needed; *Don't determine what is not!*
- Focus on needs: Target problems/issues that can ultimately be ***managed!***

Geospatial Surveys
(variable x,y; fixed z,t)

Continuous Monitoring
(variable t, maybe z; fixed x,y)

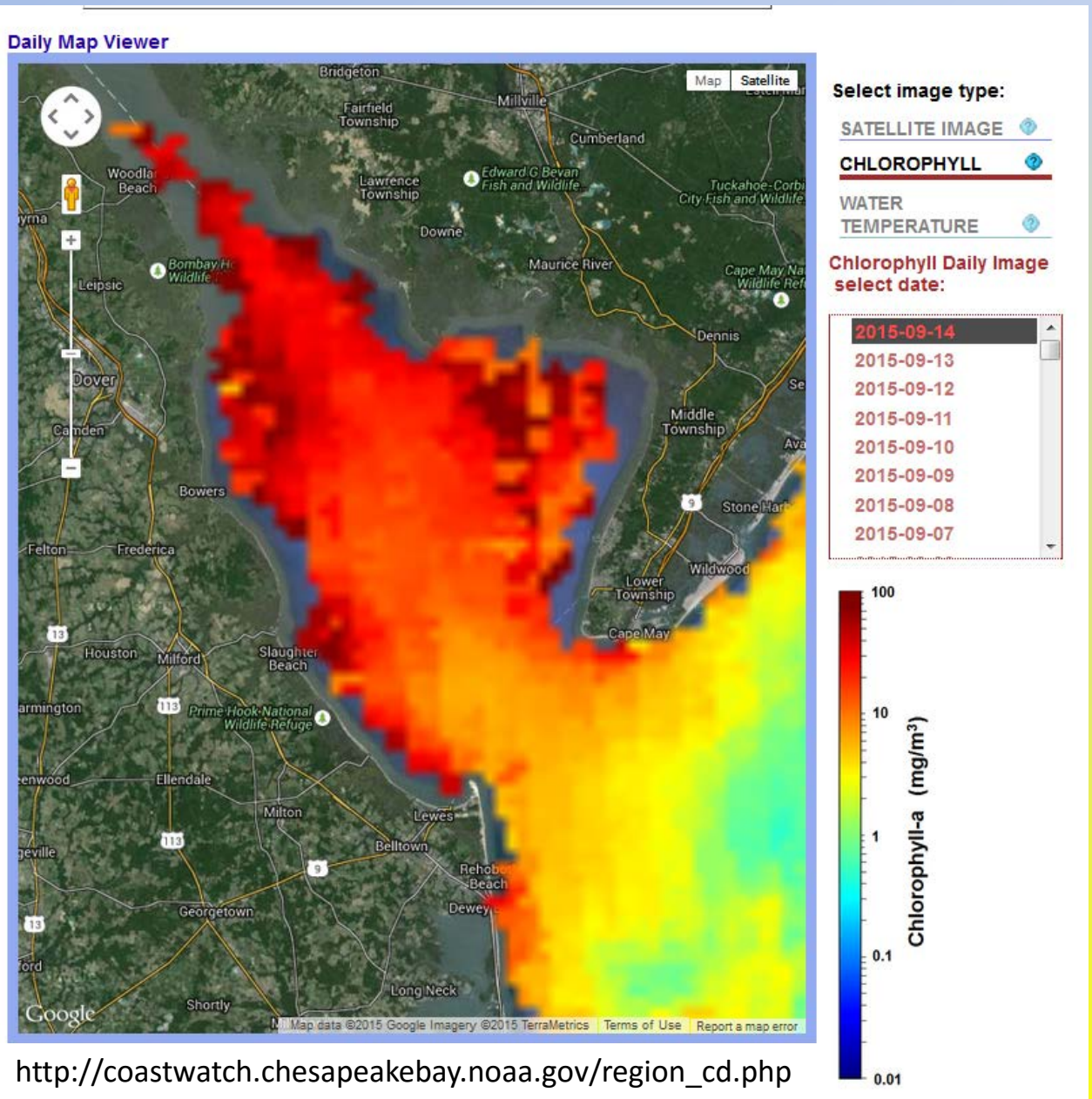
– Limited parameters (but improving)

– Limited number of instruments (expense)

– Limited deployment sites (infrastructure)

Spatial Remote Sensing of Chlorophyll in Delaware Bay

(Note pixel size is too large to permit sensing of the Inland Bays.)



http://coastwatch.chesapeakebay.noaa.gov/region_cd.php

Autonomous Platforms to get spatial resolution and parameters that cannot be sensed remotely?

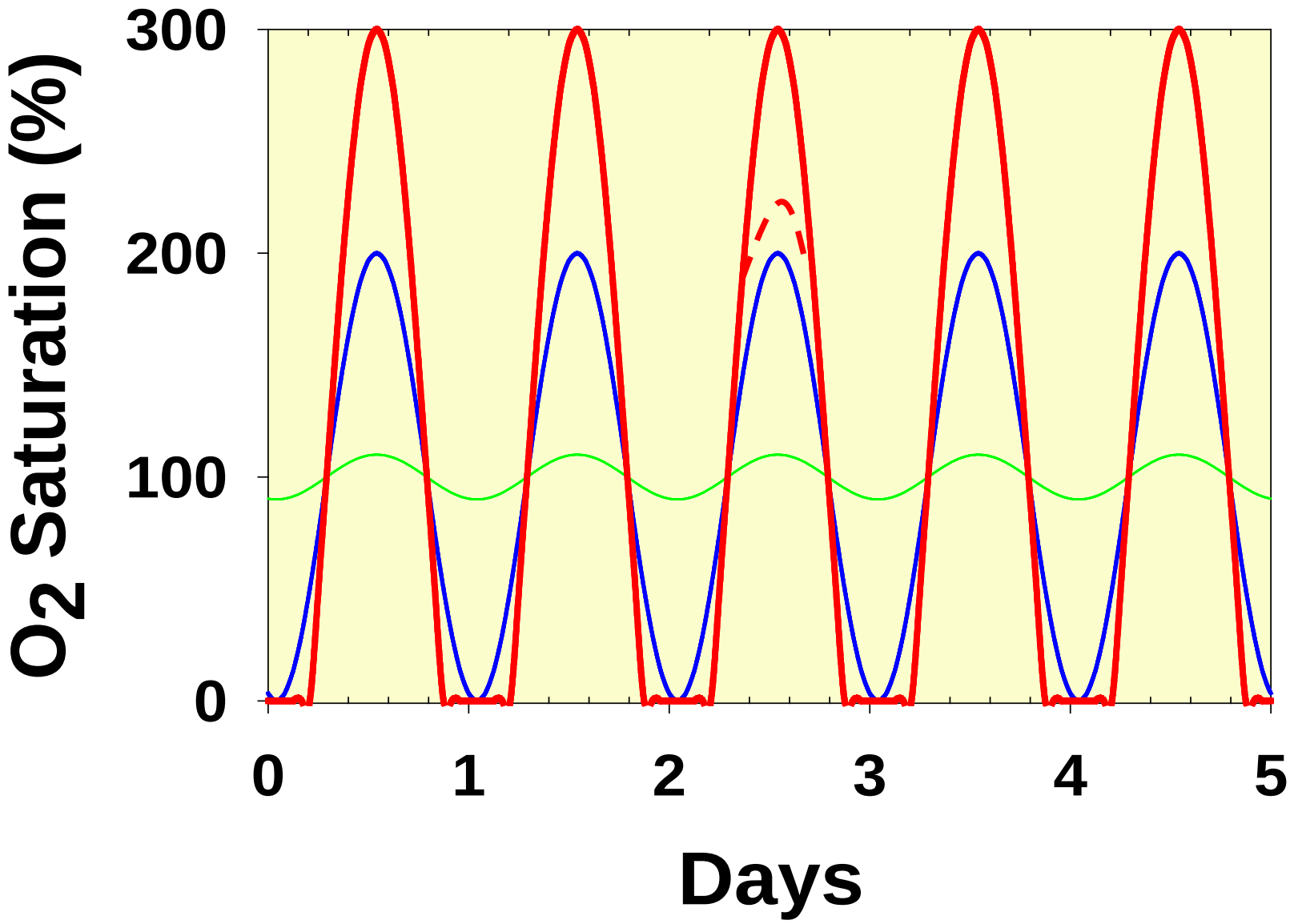
Parameters that can be Continuously Sensed

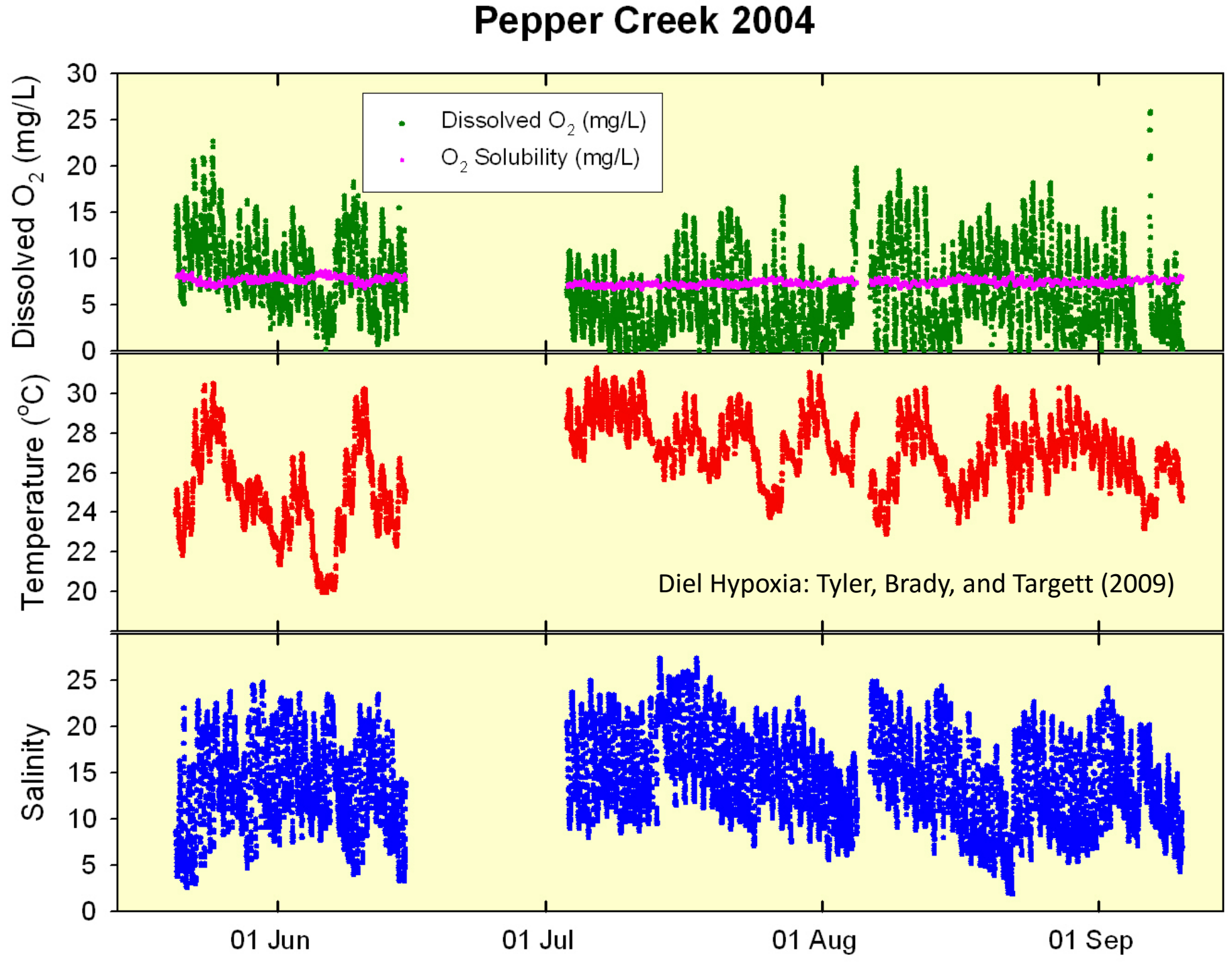
- Conductivity, Temperature, Depth
- Suspended Particles (turbidity, size, shape, species of bacteria, phytoplankton, zooplankton)
- Dissolved parameters (inorganic nutrients, some dissolved organic carbon characteristics; carbonate system characteristics: pH, T_{CO2}, P_{CO2}, alkalinity)

Continuous Sensing of Relevant Parameters focuses Attention on Processes (Rate of Change) Rather Than Instantaneous Status

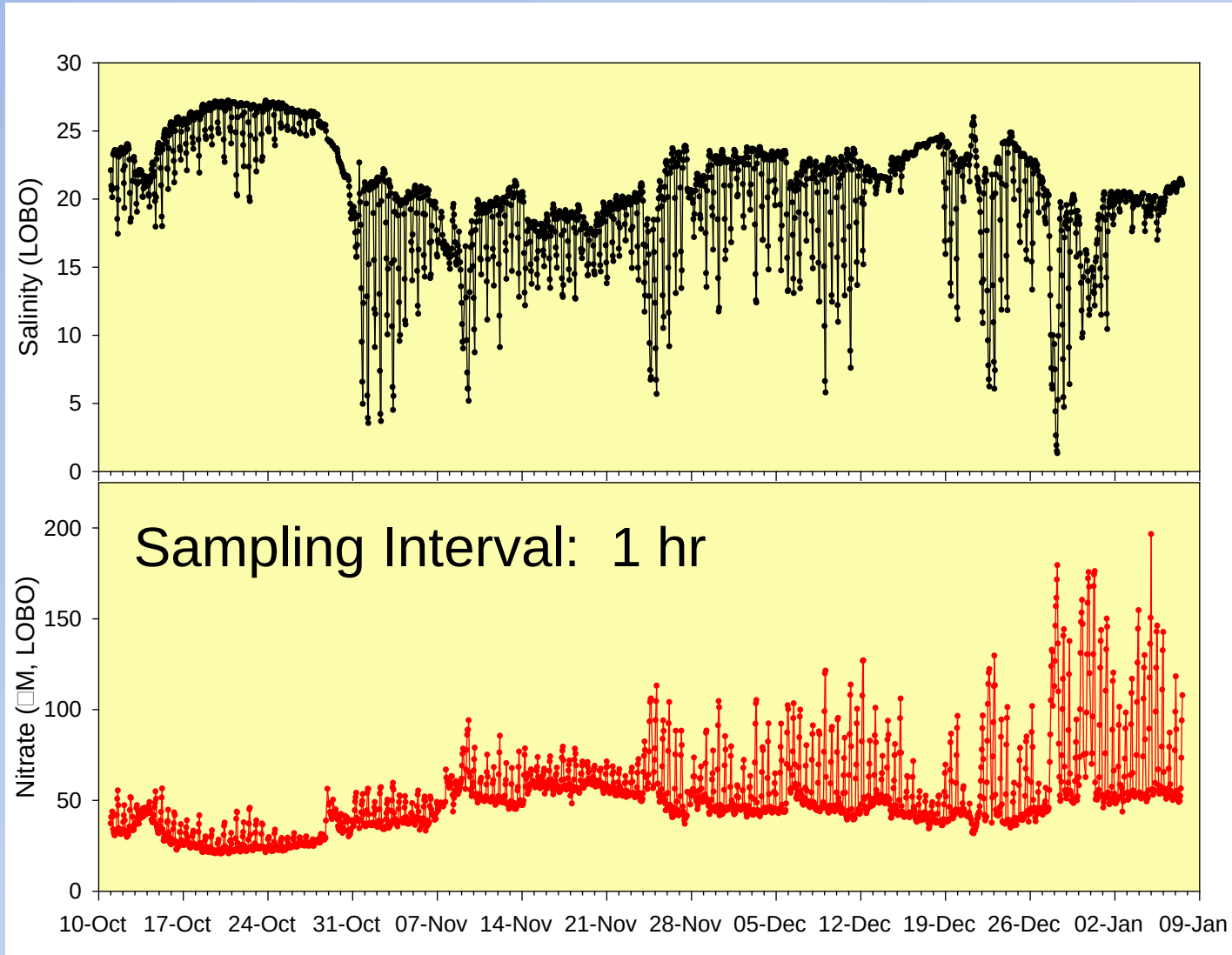
- What processes are important to our ecosystem?
- What measurements are needed to quantify the rates of these processes?
- What sensors are available to make these measurements?
- What computational support is needed to get from the measurements to the needs?

Instantaneous Measurements need Context: O_2 example




Pepper Creek 2004
Dissolved O2 (mg/L)
O2 Solubility (mg/L)
Dissolved O2 (mg/L)
Temperature (°C)
Salinity
Diel Hypoxia: Tyler, Brady, and Targett (2009)
01 Jun
01 Jul
01 Aug
01 Sep

Murderkill Estuary, Bowers DE



High Frequency Sampling Allows Observations of Cause and Effects!

Continuous Monitoring In Delaware (Delaware is rich in continuous monitoring resources, but we need to do more than collect the data!)

- USGS (Discharge Monitoring, some basic CTD measurements)
- DGS (Groundwater levels and flow; Water Quality Monitoring at Coursey Pond)
- DEOS (Aggregated weather and other data from various sources)
- DNREC* (some more advanced sensors have been deployed at Millsboro Pond and the Nanticoke River near Bridgeville)
- Kent County (Land Ocean Biogeochemical Observatory, Bowers, Delaware, operated by UD-SMSP)

Kent County LOBO

- Power and Data Cables
- STOR-X Data Logger
- WQM: CTD, Chl*a*, Turbidity
- ECO-CDS (CDOM)
- SUNA (NO_3^-)
- Cycle-PO4

Greenspan Aqualab Deployed at Nanticoke River near Bridgeville (DNREC).

YSI-EXO with S:CAN Spectrolyzer at Coursey Pond (NSF NEWRNet)

What do we really want to know?

Can automated sensors help us?

Which ones, where, and how?

What do we need to do this well?