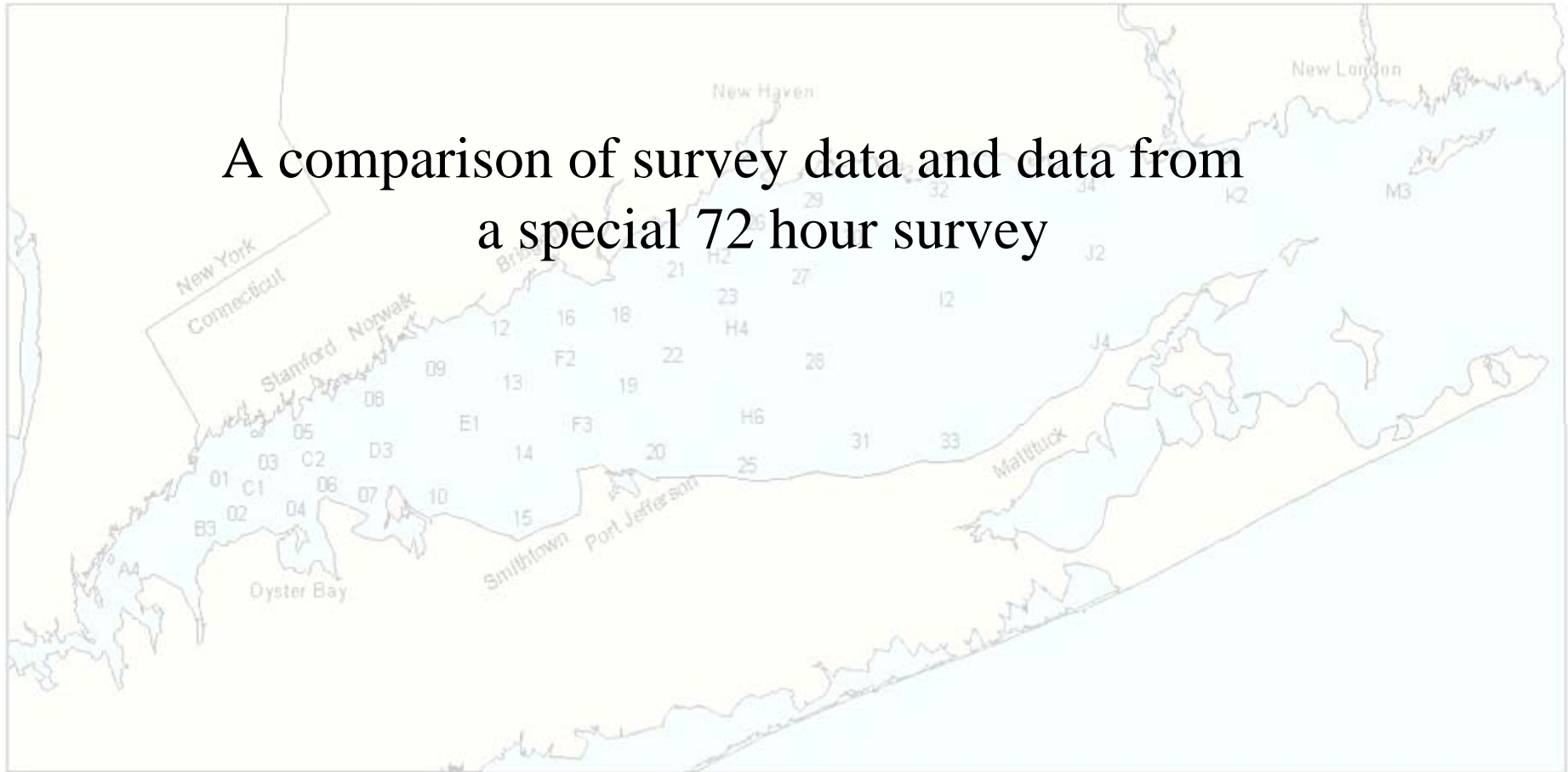
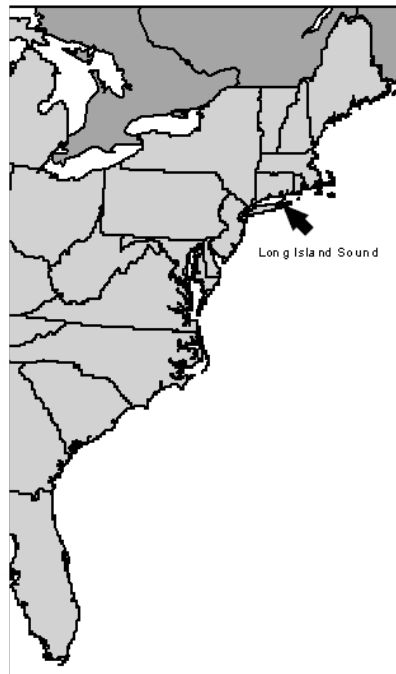


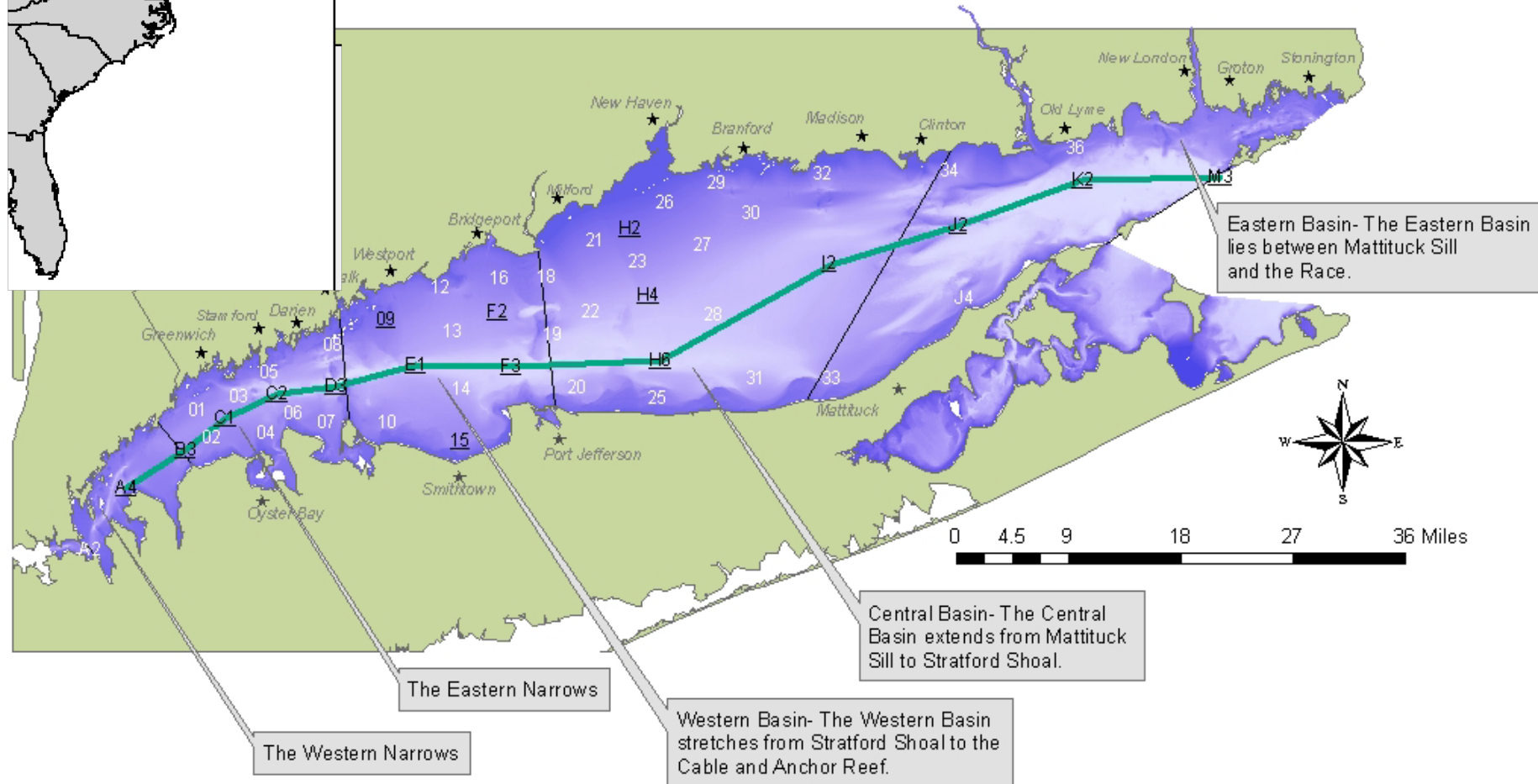
Connecticut Department of Environmental Protection Long Island Sound Water Quality Monitoring Program

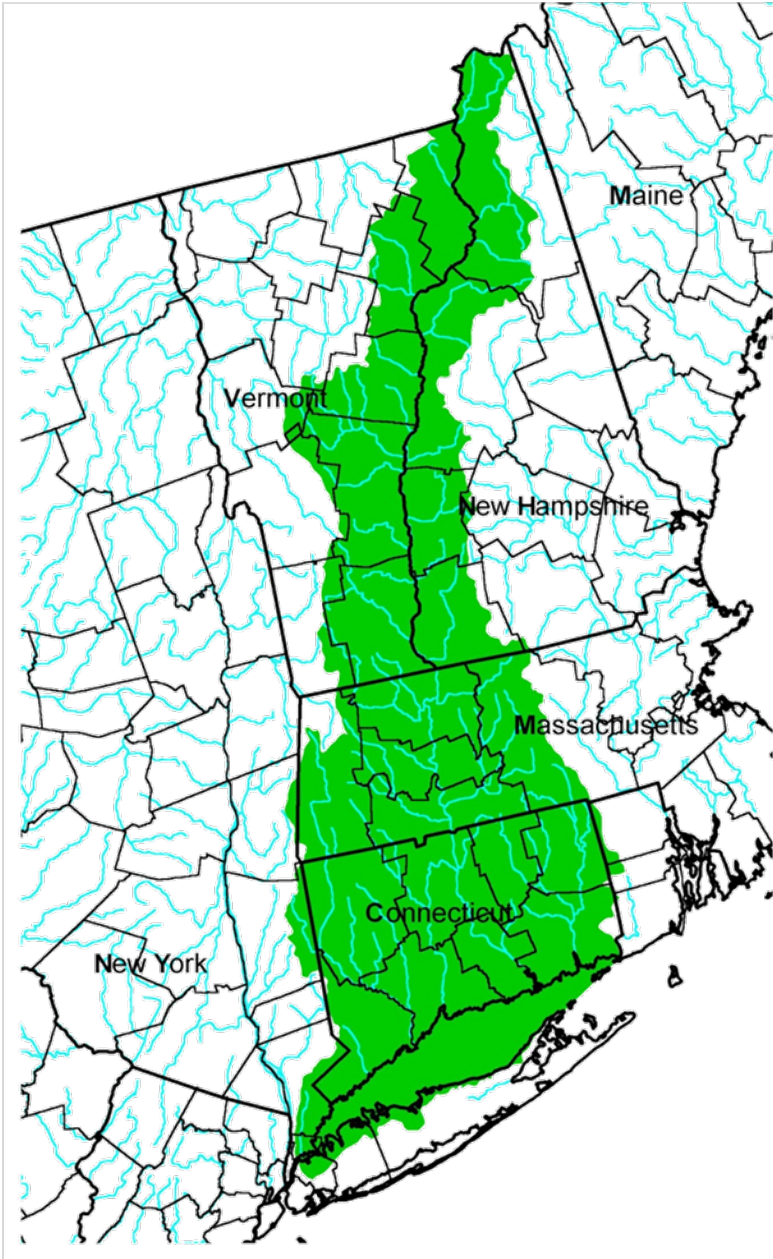
A comparison of survey data and data from
a special 72 hour survey





Long Island Sound basins



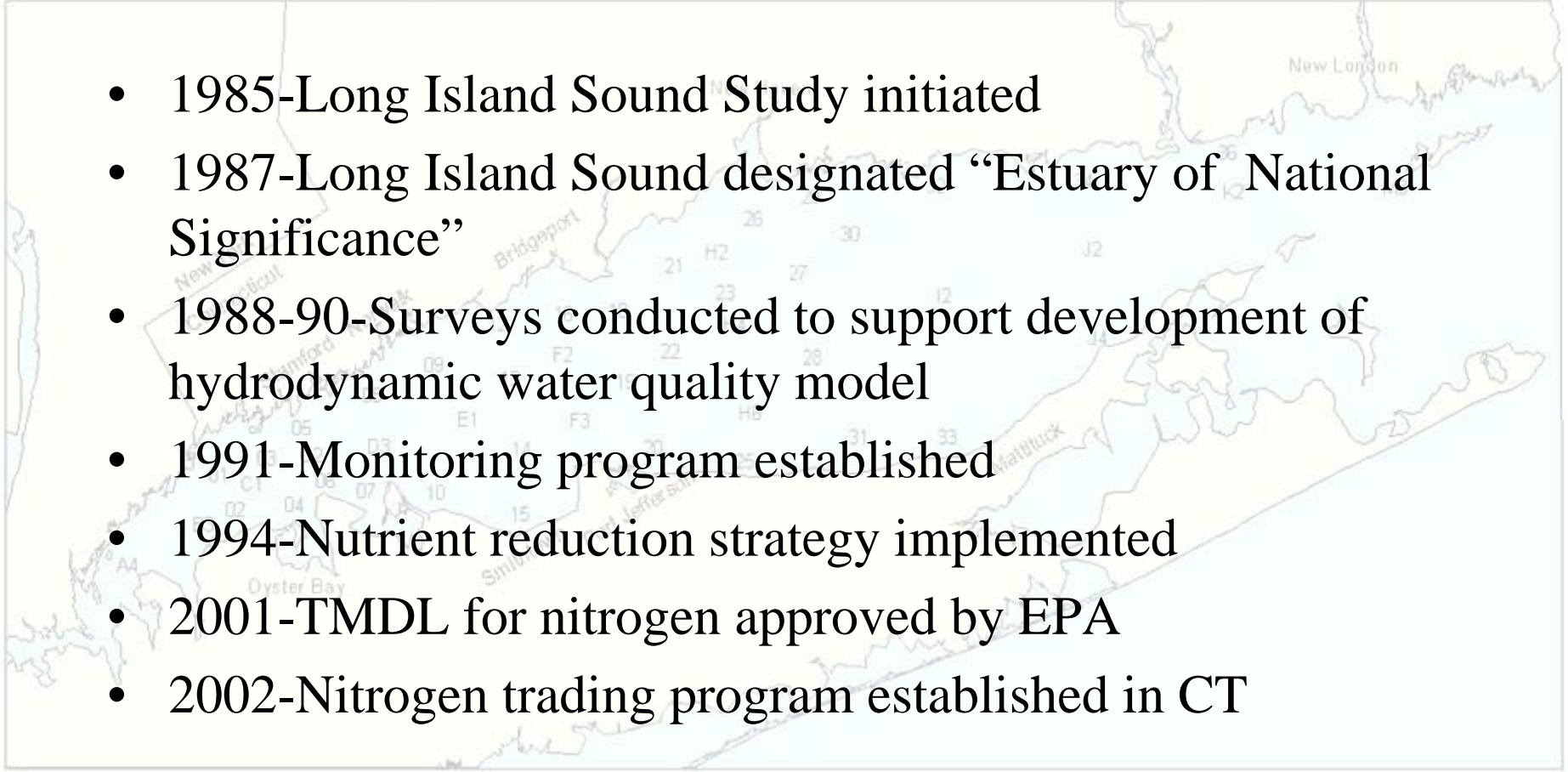


Long Island Sound Watershed

Covers nearly 17,000 sq miles
extending from Long Island NY
into portions of eastern Canada

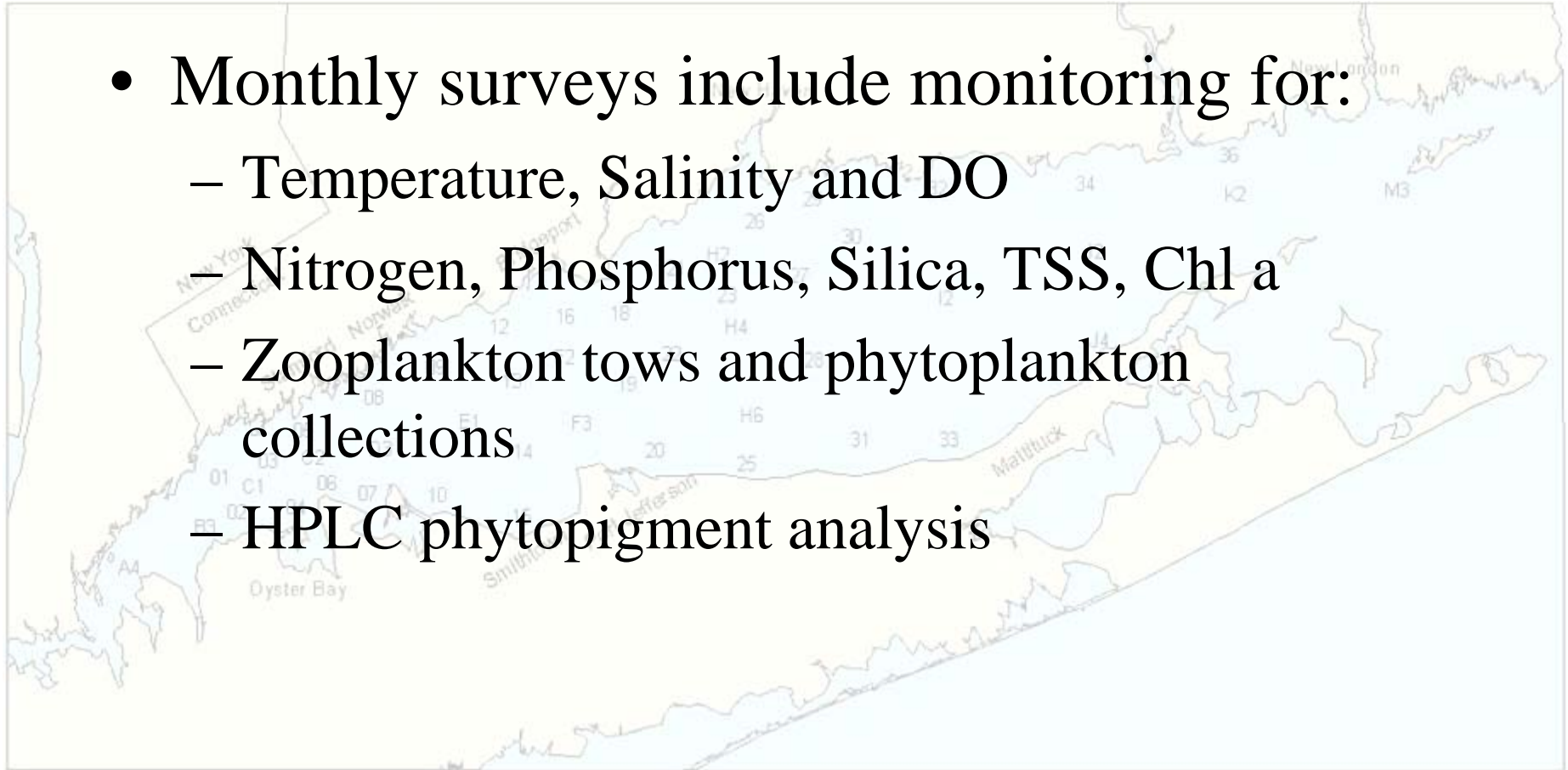
Majority of watershed is the
drainage basin of the
Connecticut River the largest
freshwater discharge into LIS

Program Background

- 
- A map of Long Island Sound and the surrounding regions of New York and Connecticut. The map shows the coastline of Long Island, with labels for New York City, New Rochelle, Bridgeport, and New London. It also shows the Sound itself, with various numbered points (e.g., 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100) and the names of the states: New York and Connecticut. The map is a light blue and yellow color scheme.
- 1985-Long Island Sound Study initiated
 - 1987-Long Island Sound designated “Estuary of National Significance”
 - 1988-90-Surveys conducted to support development of hydrodynamic water quality model
 - 1991-Monitoring program established
 - 1994-Nutrient reduction strategy implemented
 - 2001-TMDL for nitrogen approved by EPA
 - 2002-Nitrogen trading program established in CT

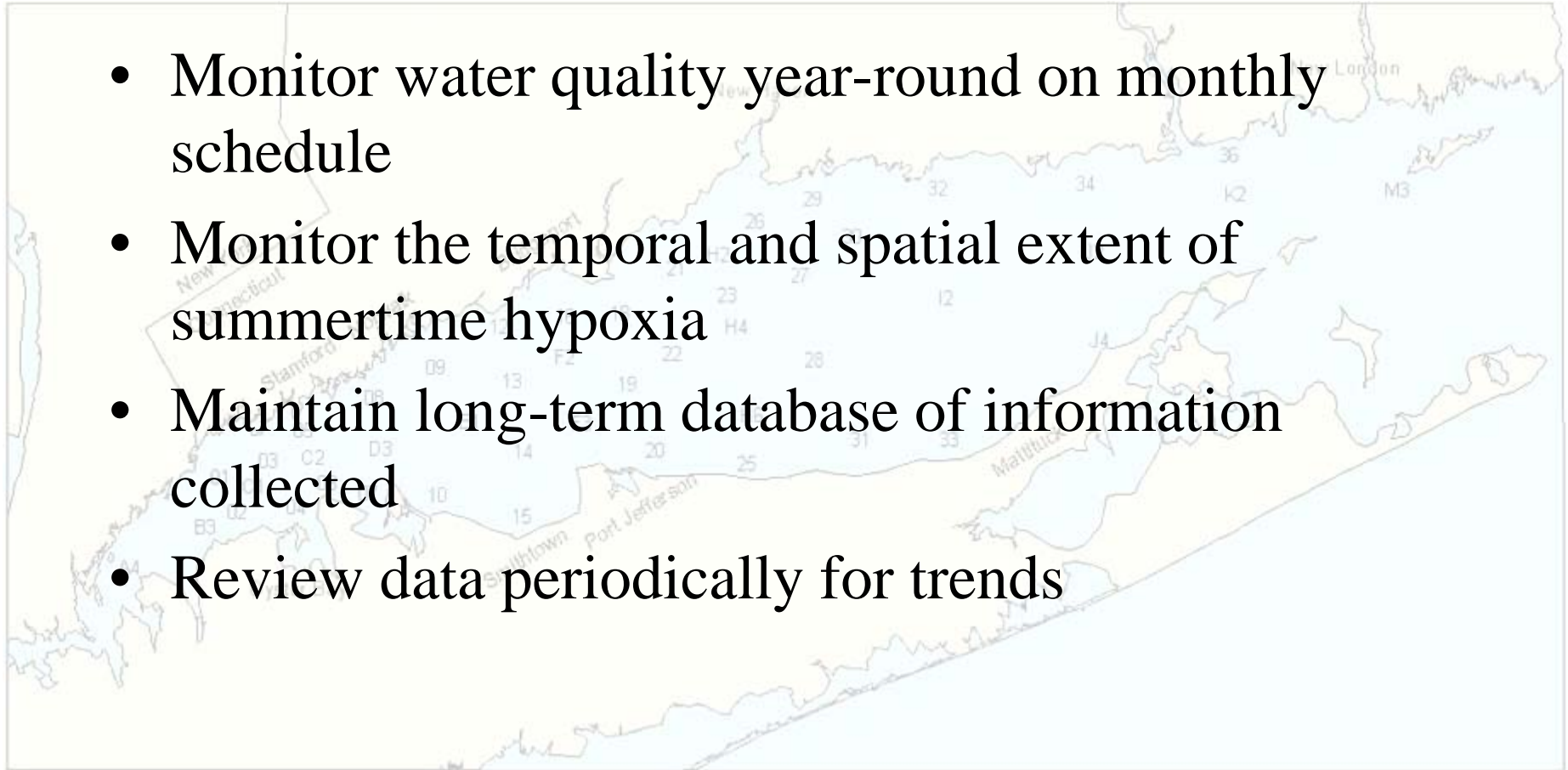
What are we monitoring?

- Monthly surveys include monitoring for:
 - Temperature, Salinity and DO
 - Nitrogen, Phosphorus, Silica, TSS, Chl a
 - Zooplankton tows and phytoplankton collections
 - HPLC phytopigment analysis



Goals and Objectives

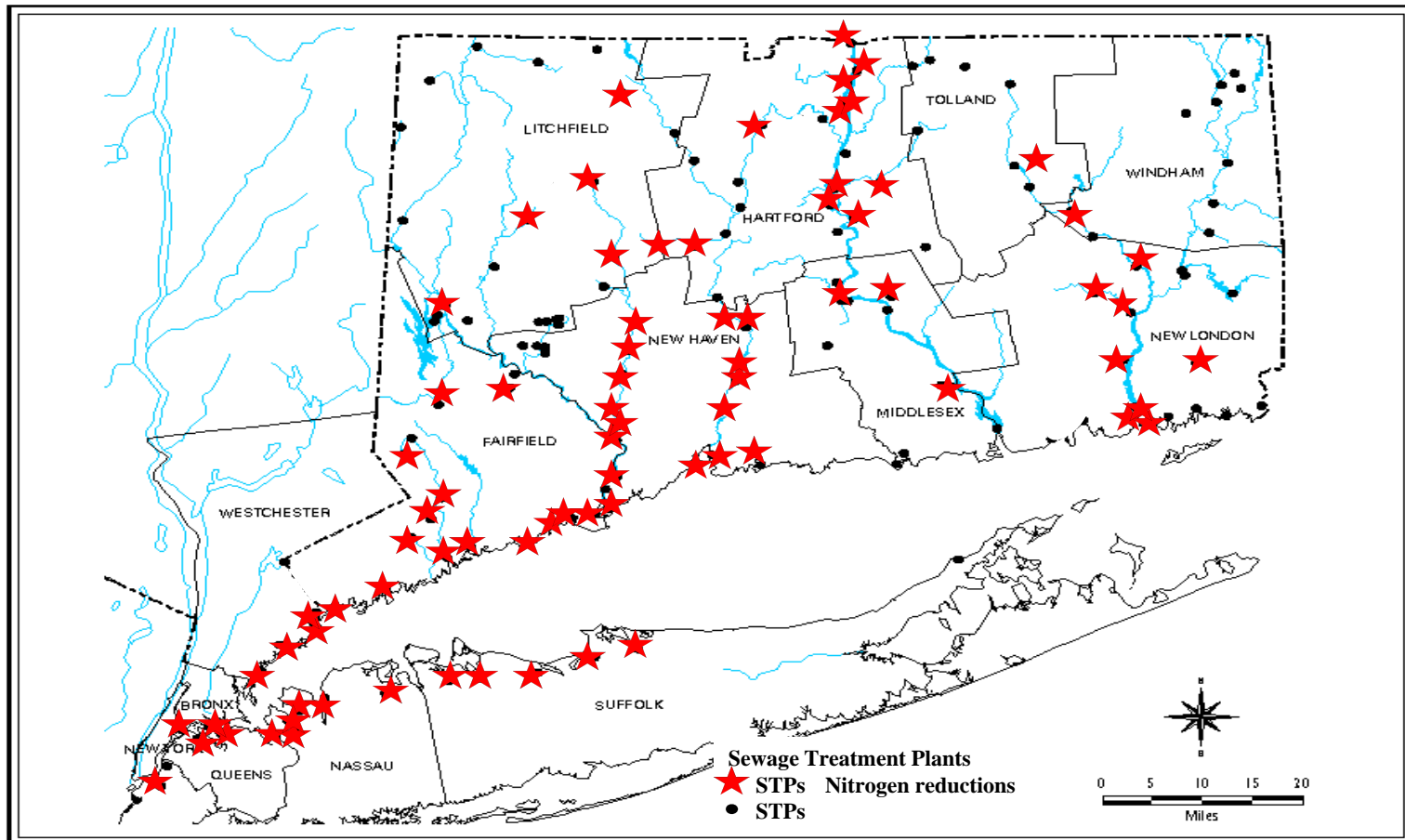
- Monitor water quality year-round on monthly schedule
- Monitor the temporal and spatial extent of summertime hypoxia
- Maintain long-term database of information collected
- Review data periodically for trends



Goals and Objectives

- Assess long-term results of specific management actions, such as the nutrient reduction strategy
- Provide managers and policy-makers with information on conditions and trends
- Make data available for researchers and other interested individuals and groups

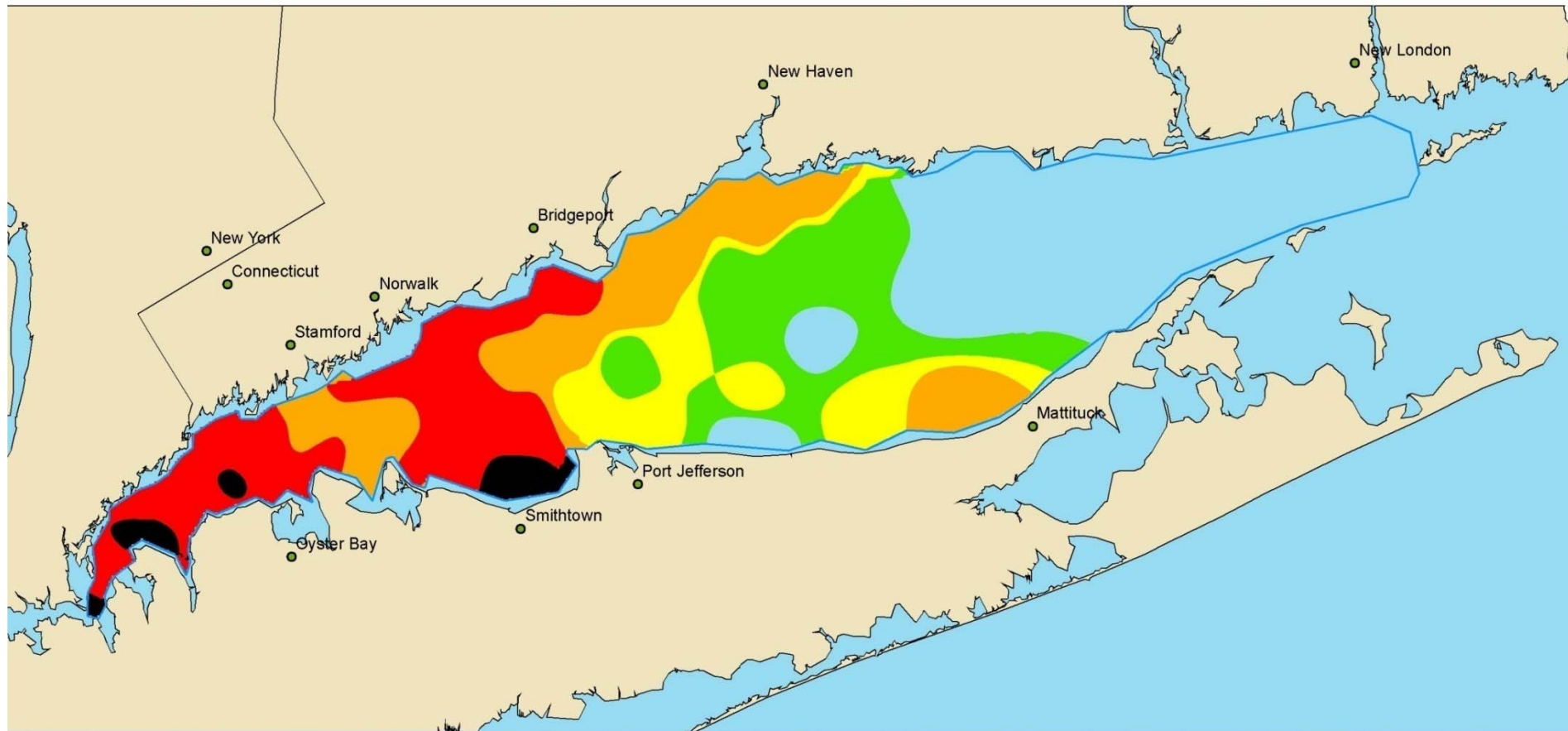
Treatment plants NY and CT



Hypoxia

- Low dissolved oxygen
 - Hypoxia in Long Island Sound occurs annually starting late June to early July with a maximum typically in August and subsiding in September
 - Has affected from 5% to nearly 50% of LIS study area
 - 65% of the stations we survey have been hypoxic at least once during the past 18 years

August 1-4, 1994



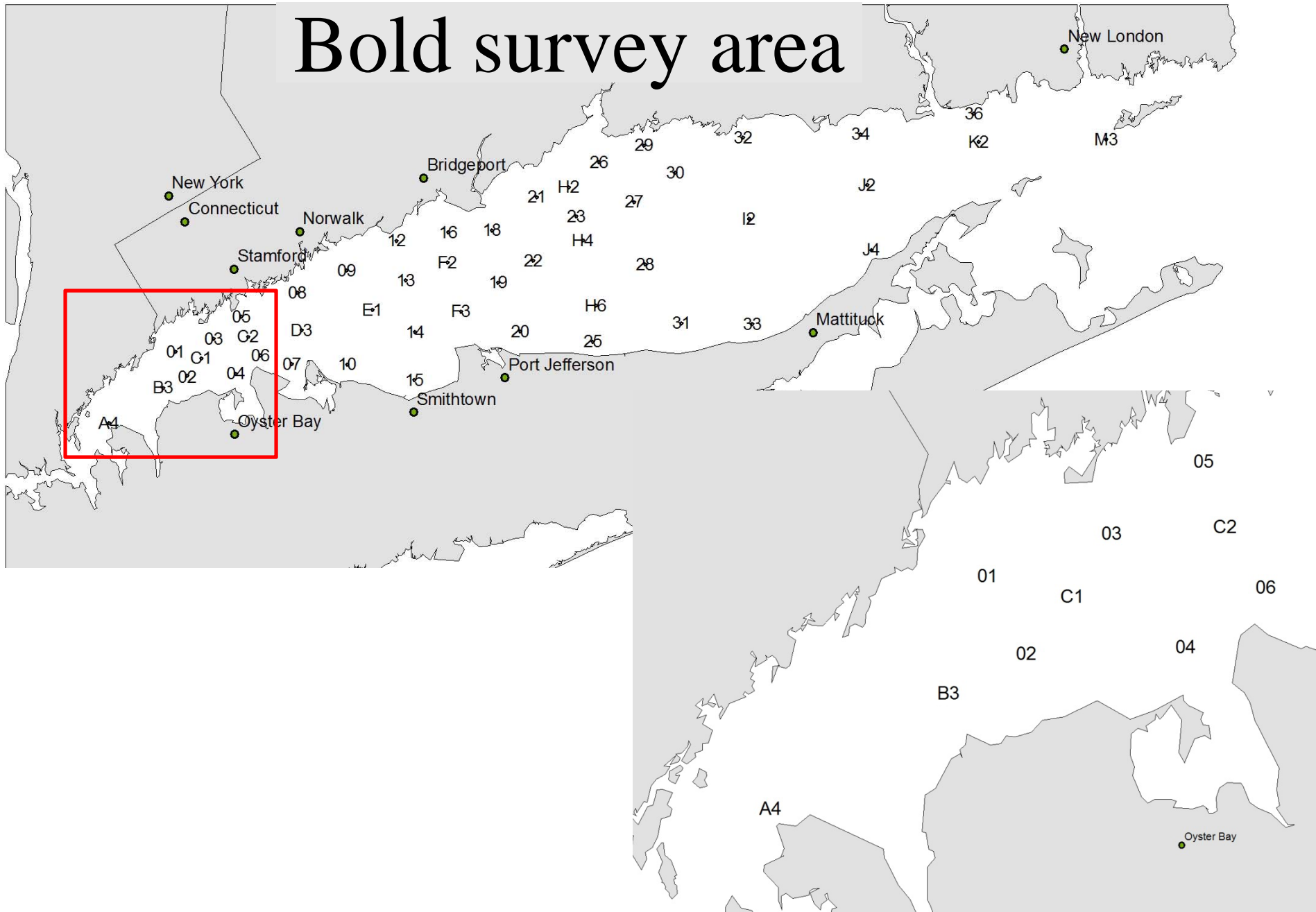
OSV Bold



Survey Background

- The objective of the survey aboard the Bold was to assess the short-term variability in water quality measurements (specifically dissolved oxygen and nutrients). Quantifying this short-term variability would be helpful in the interpretation of monthly and bi-weekly data collected as part of the Monitoring program, and in the consideration of alternate sampling schemes.
- Data will contribute to a better understanding of the current method of estimating hypoxic area on a biweekly basis with regard to its accuracy and representation of the event over the course of the summer months.

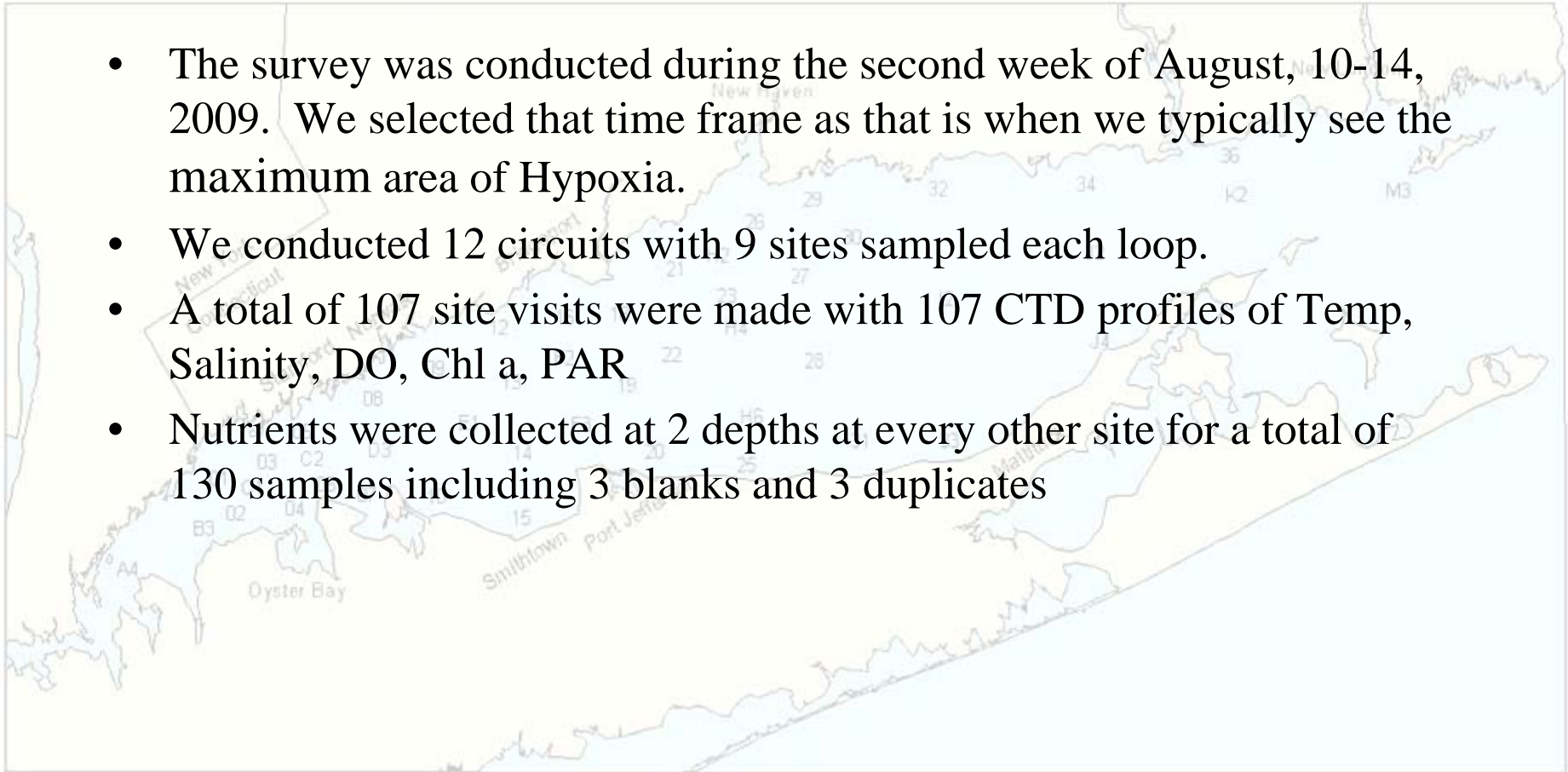
Bold survey area



Boldly going where we **have** gone before...

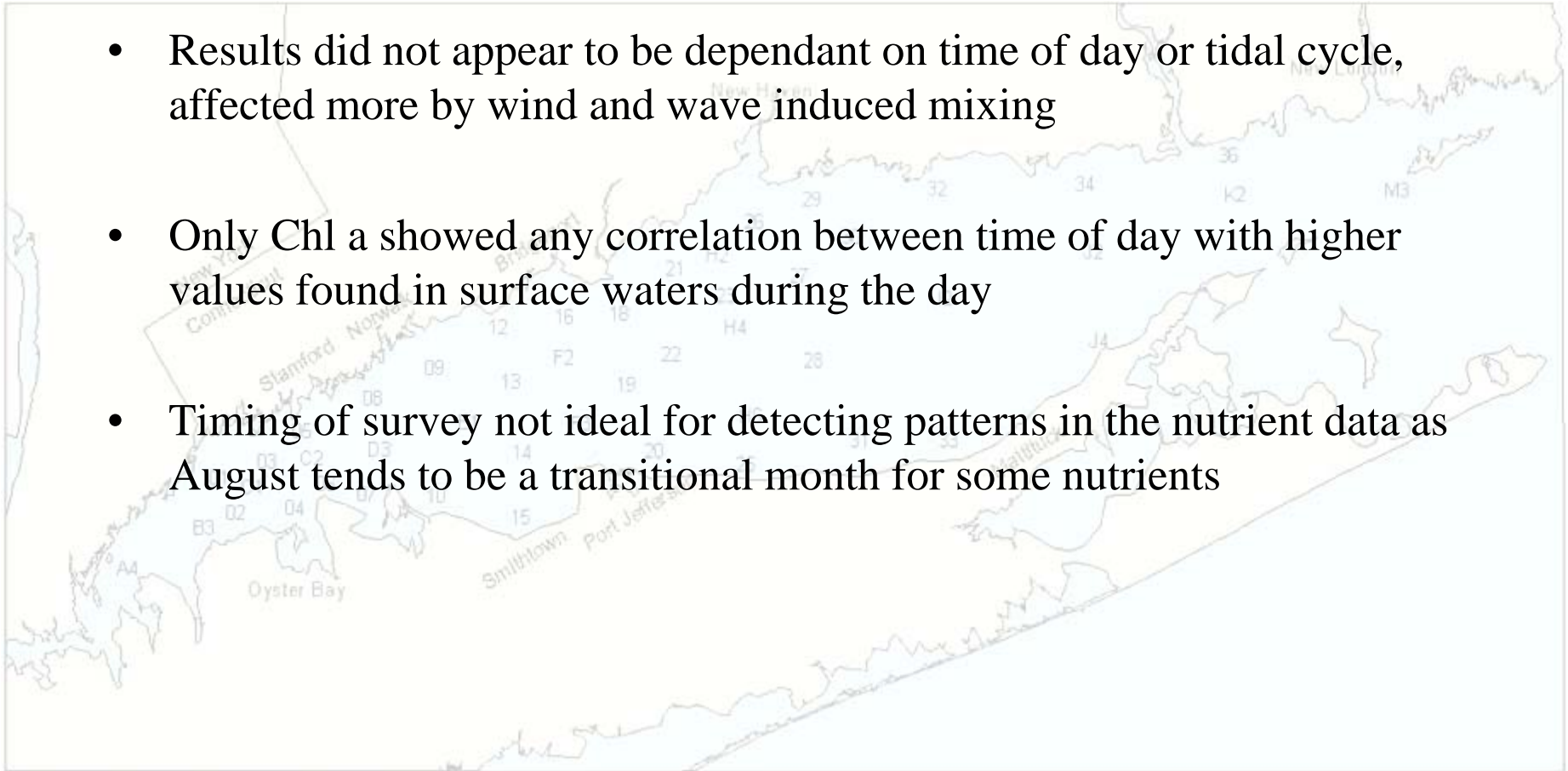
and going there again and again and again

- The survey was conducted during the second week of August, 10-14, 2009. We selected that time frame as that is when we typically see the maximum area of Hypoxia.
- We conducted 12 circuits with 9 sites sampled each loop.
- A total of 107 site visits were made with 107 CTD profiles of Temp, Salinity, DO, Chl a, PAR
- Nutrients were collected at 2 depths at every other site for a total of 130 samples including 3 blanks and 3 duplicates

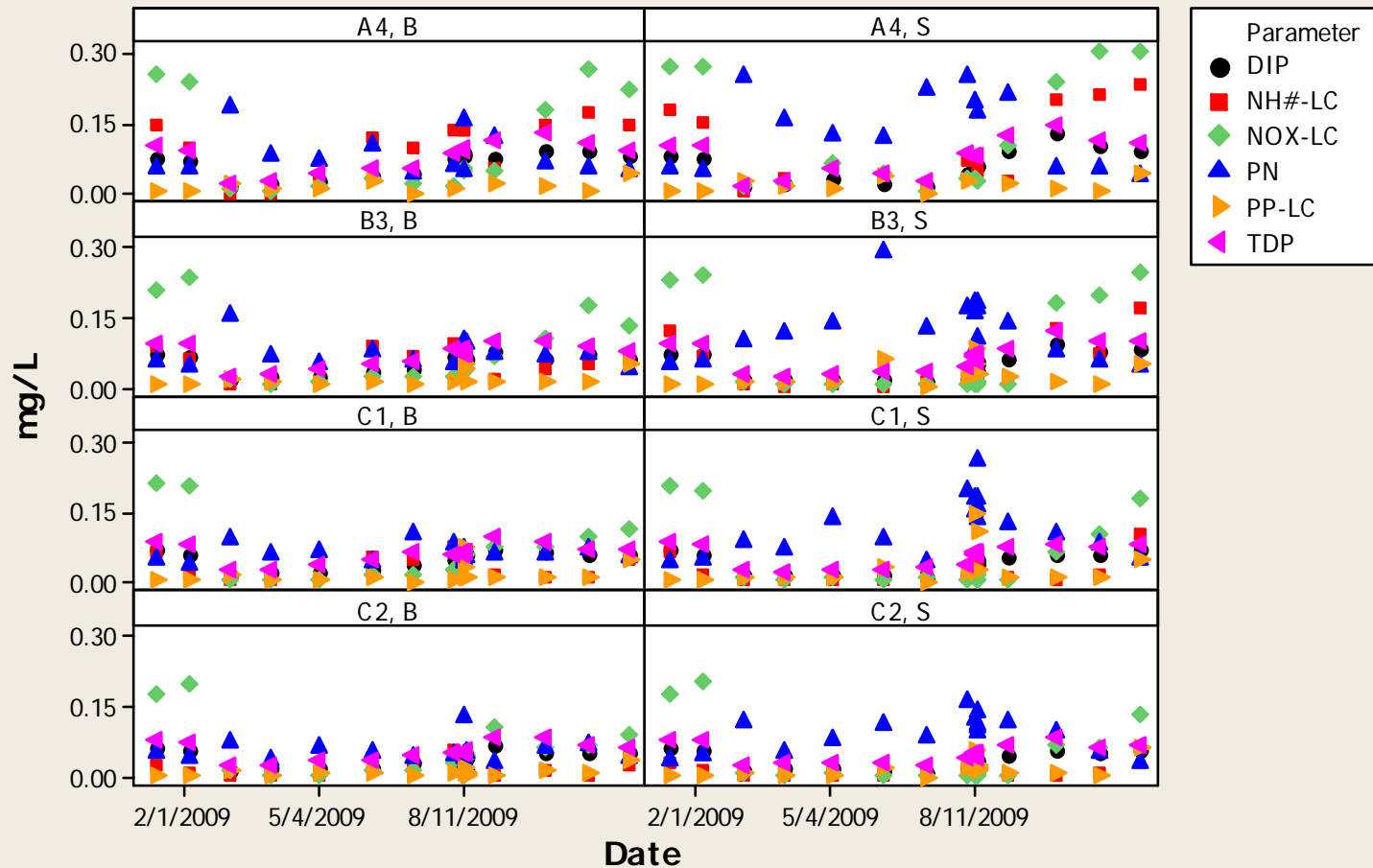


Nutrient results

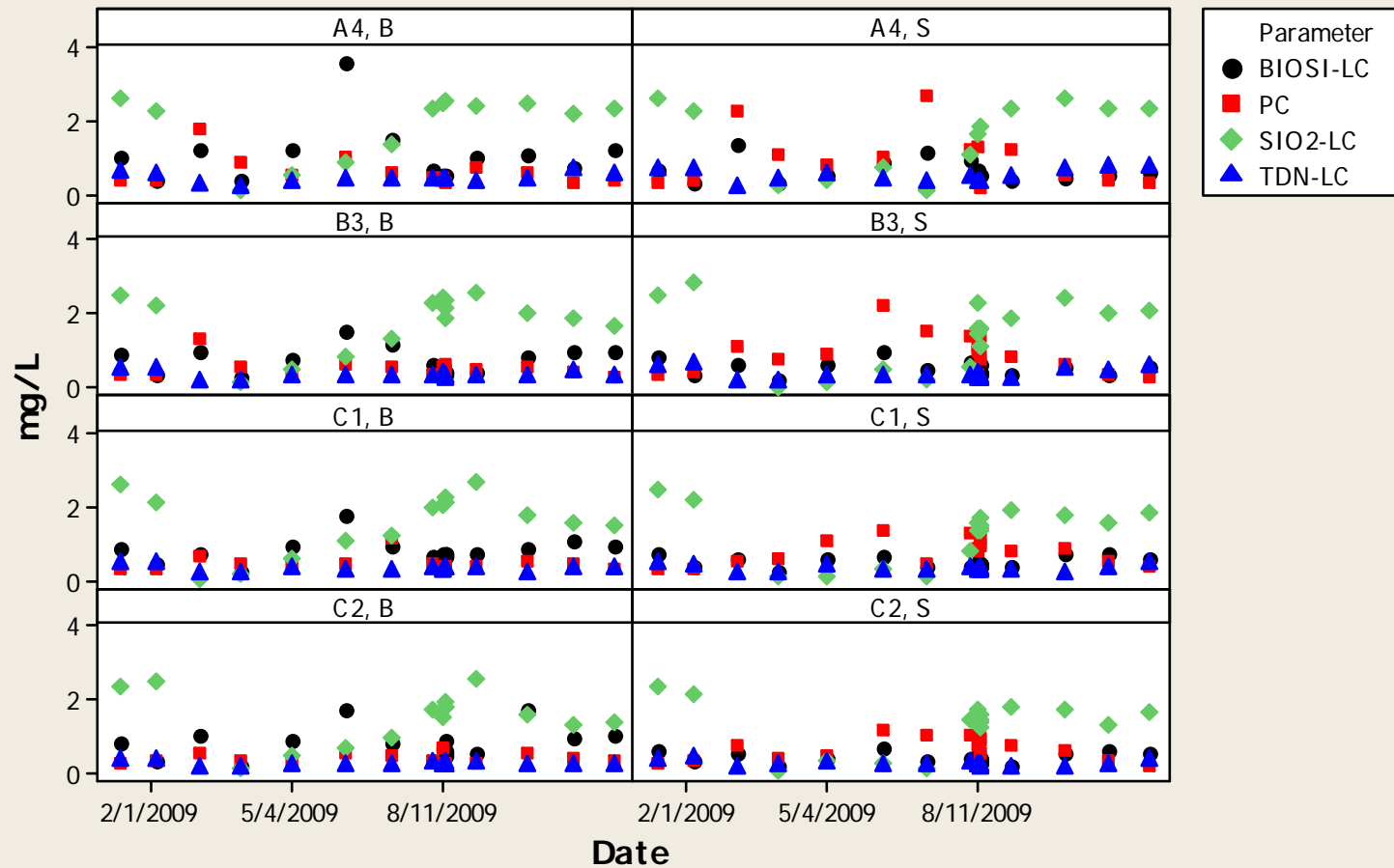
- Results did not appear to be dependant on time of day or tidal cycle, affected more by wind and wave induced mixing
- Only Chl a showed any correlation between time of day with higher values found in surface waters during the day
- Timing of survey not ideal for detecting patterns in the nutrient data as August tends to be a transitional month for some nutrients



Nutrient results

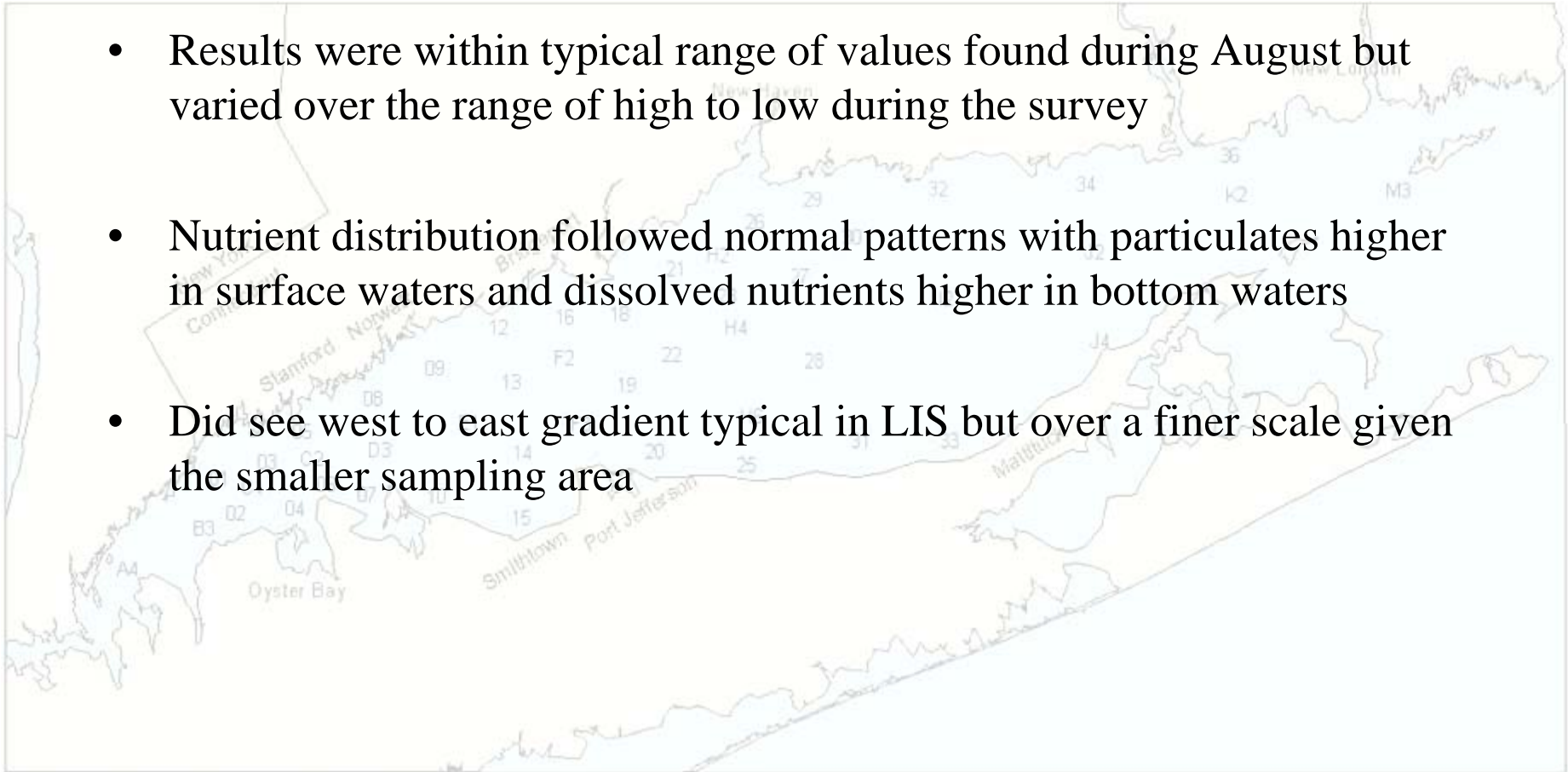


Nutrient results

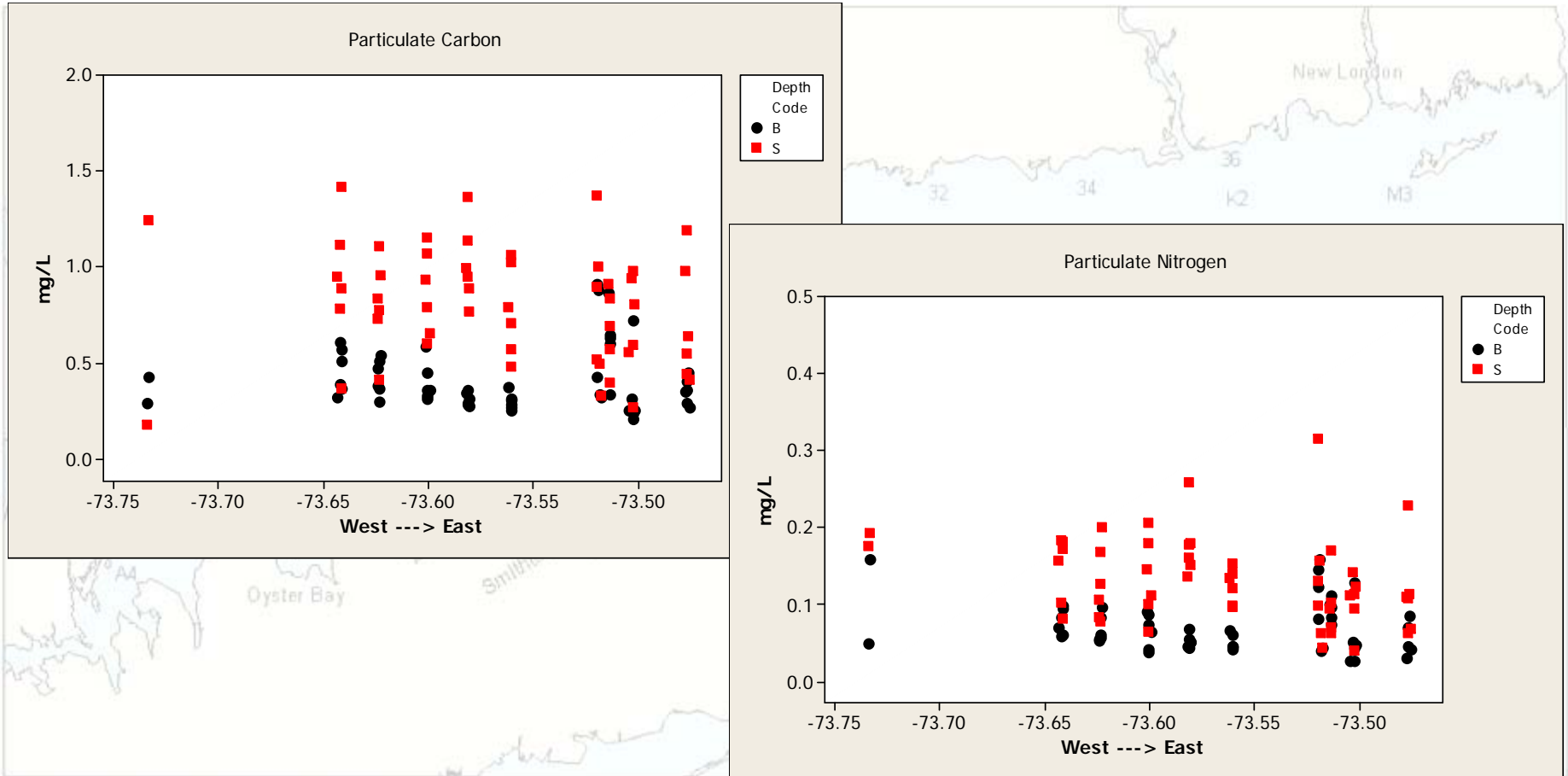


Nutrient results

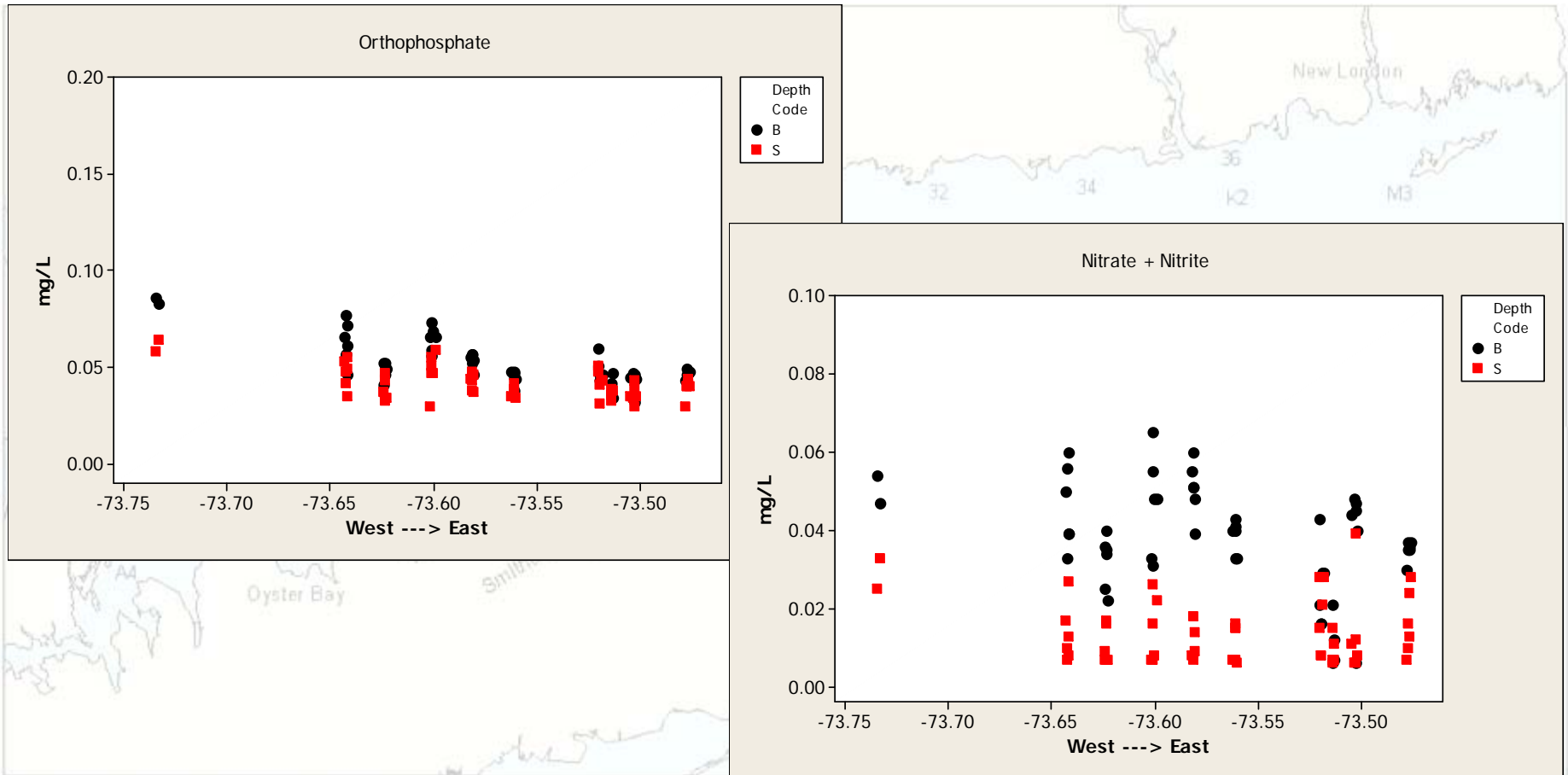
- Results were within typical range of values found during August but varied over the range of high to low during the survey
- Nutrient distribution followed normal patterns with particulates higher in surface waters and dissolved nutrients higher in bottom waters
- Did see west to east gradient typical in LIS but over a finer scale given the smaller sampling area



Nutrient results



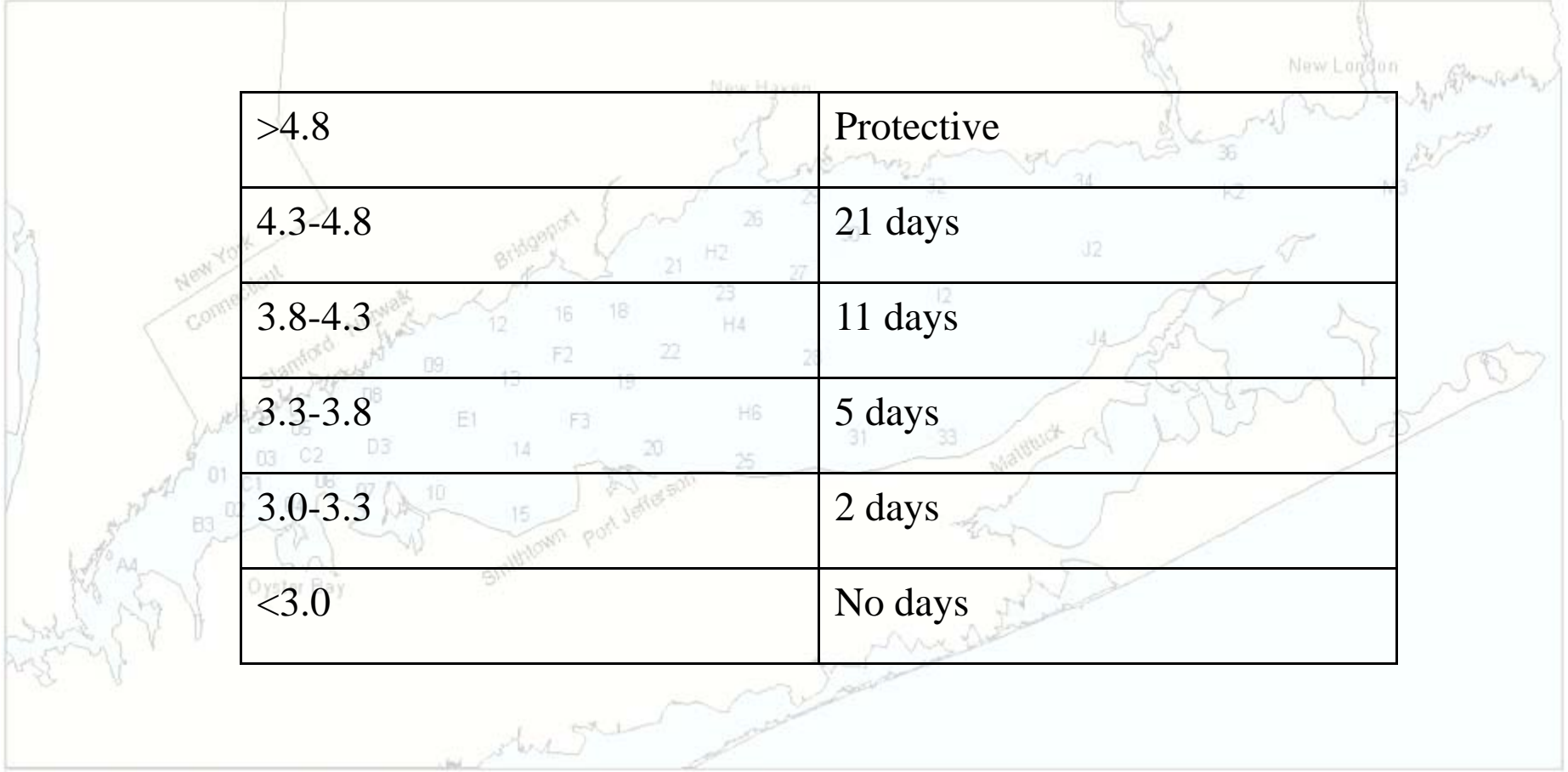
Nutrient results



Dissolved oxygen results

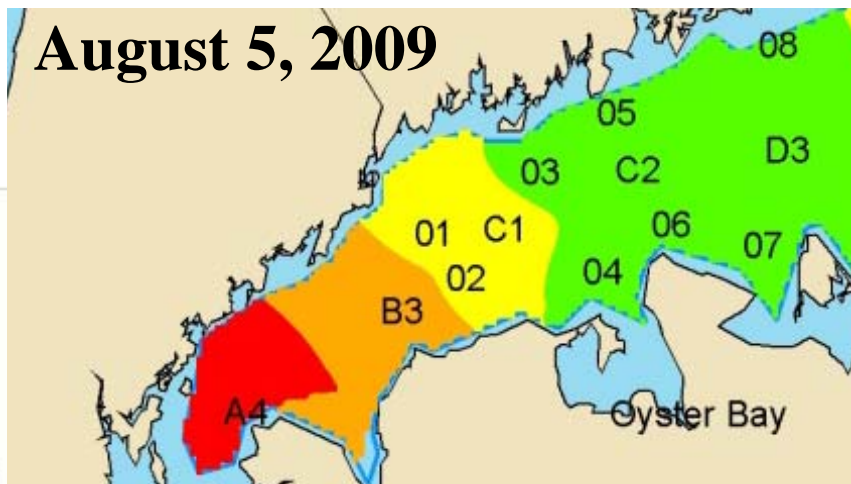
- Results from the survey showed that dissolved oxygen levels varied by as much as 6 mg/L over the three day survey
- Our current survey design does not capture these changes
- Water quality standards associated with time within DO range so we may be over or underestimating the impact of hypoxia

Water quality standards

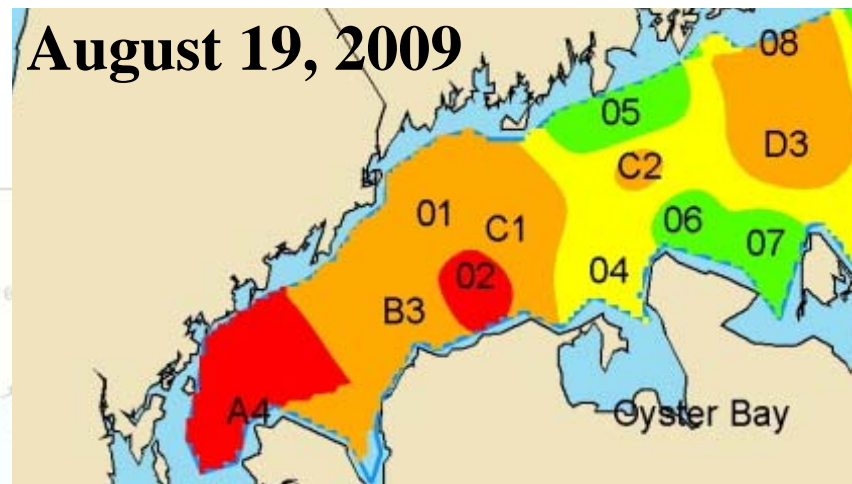
A map of Long Island Sound and the surrounding areas, including New York, Connecticut, and New Jersey. The map shows various monitoring stations marked with letters and numbers, such as E1, F2, H2, J2, and others. The stations are distributed across the Sound, with some clusters in the western part near New York City and others further east.

>4.8	Protective
4.3-4.8	21 days
3.8-4.3	11 days
3.3-3.8	5 days
3.0-3.3	2 days
<3.0	No days

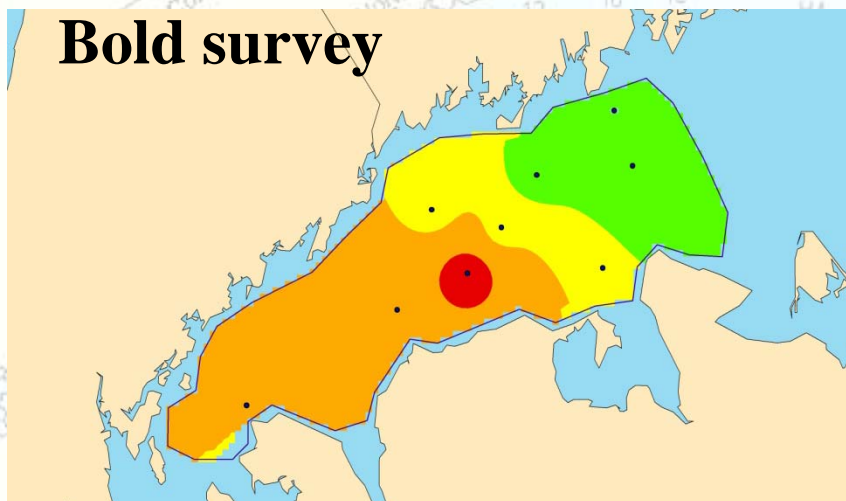
August 5, 2009



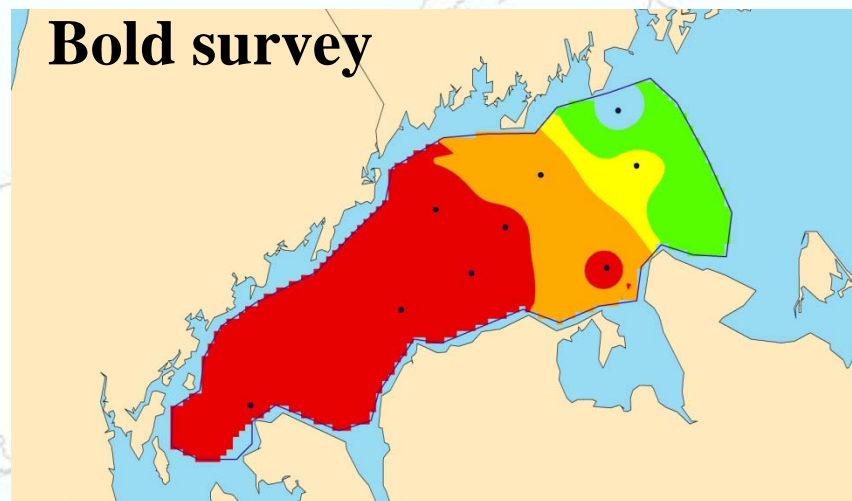
August 19, 2009



Bold survey

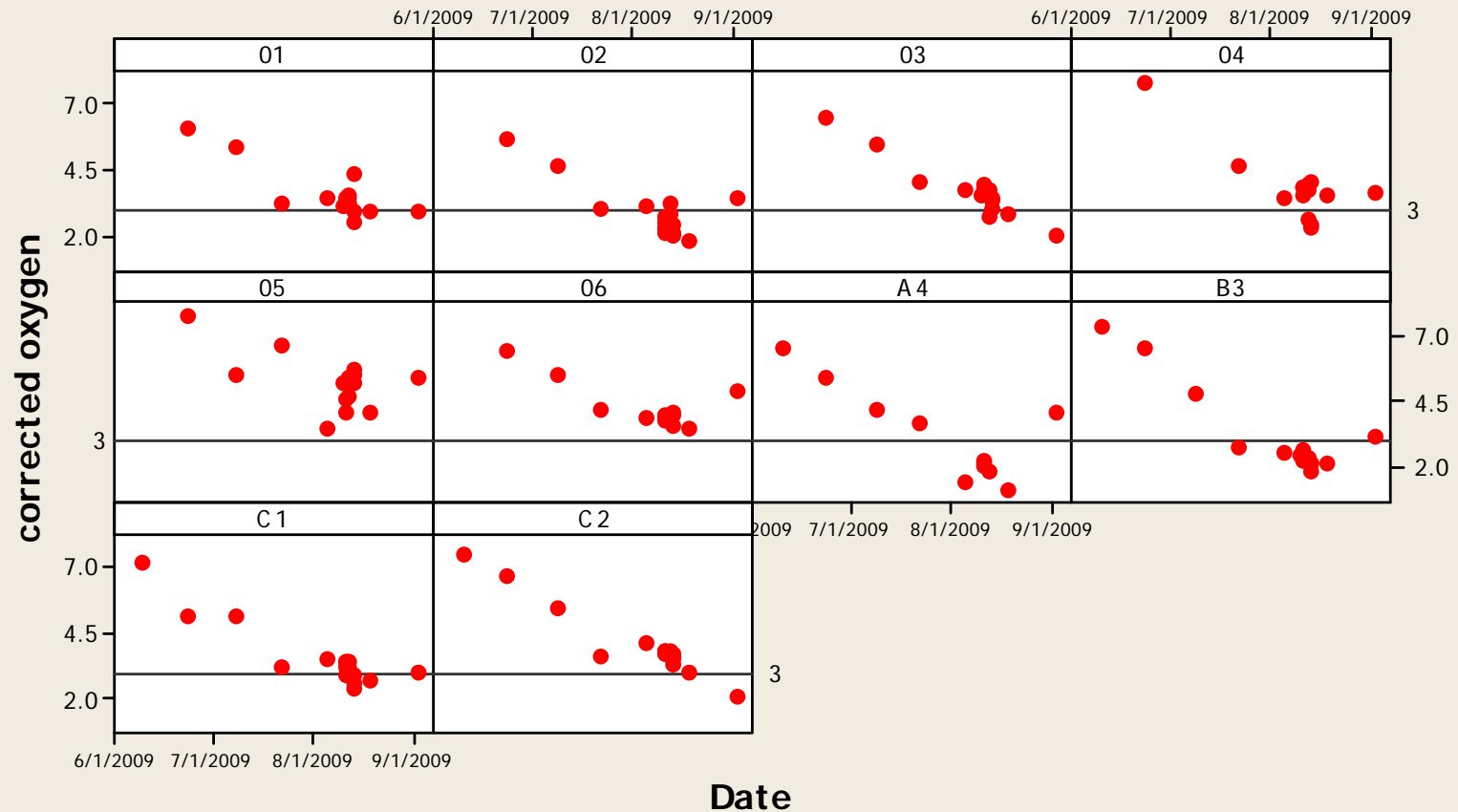


Bold survey



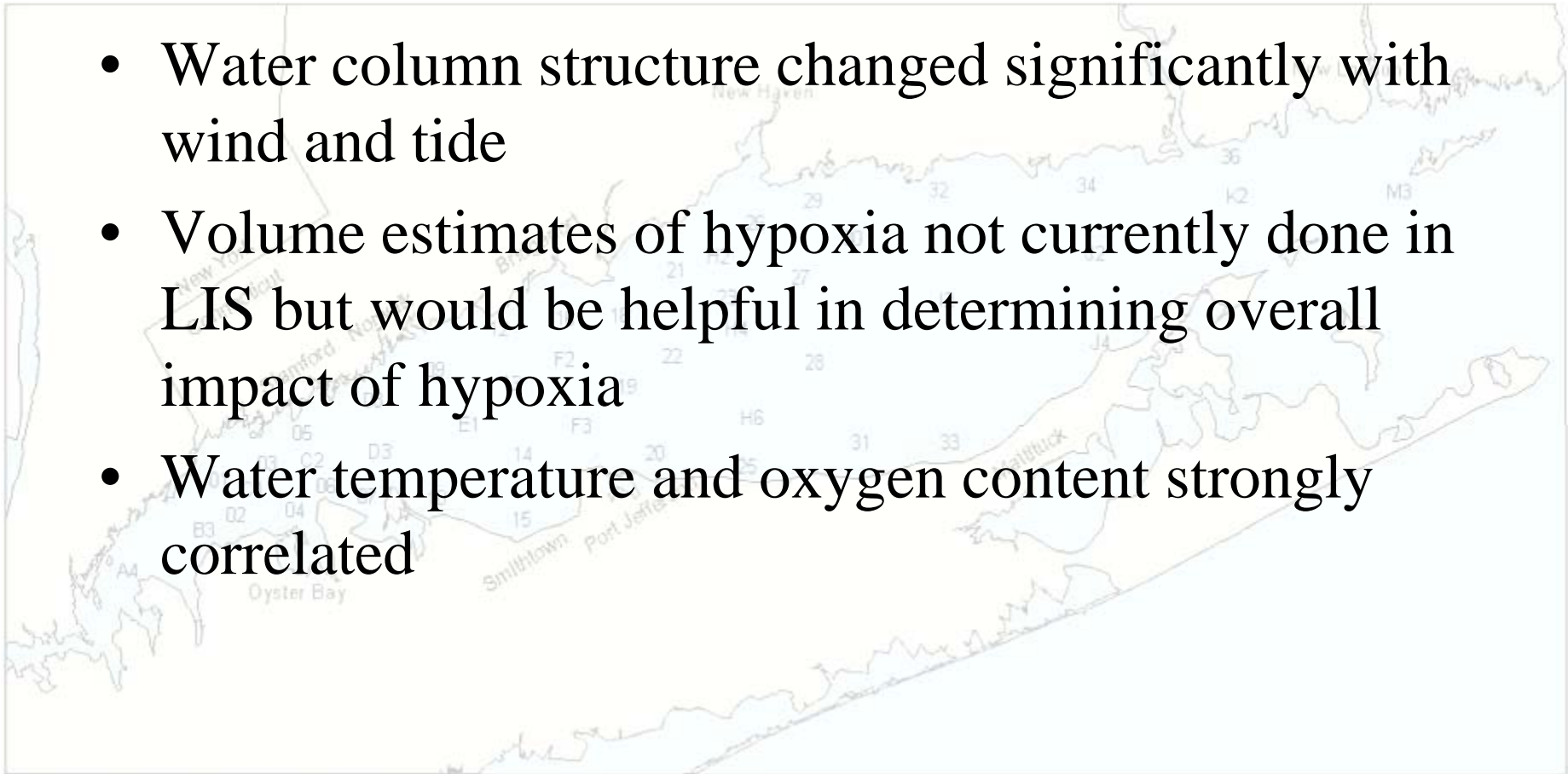
Data from Bold survey

Scatterplot of corrected oxygen vs Date

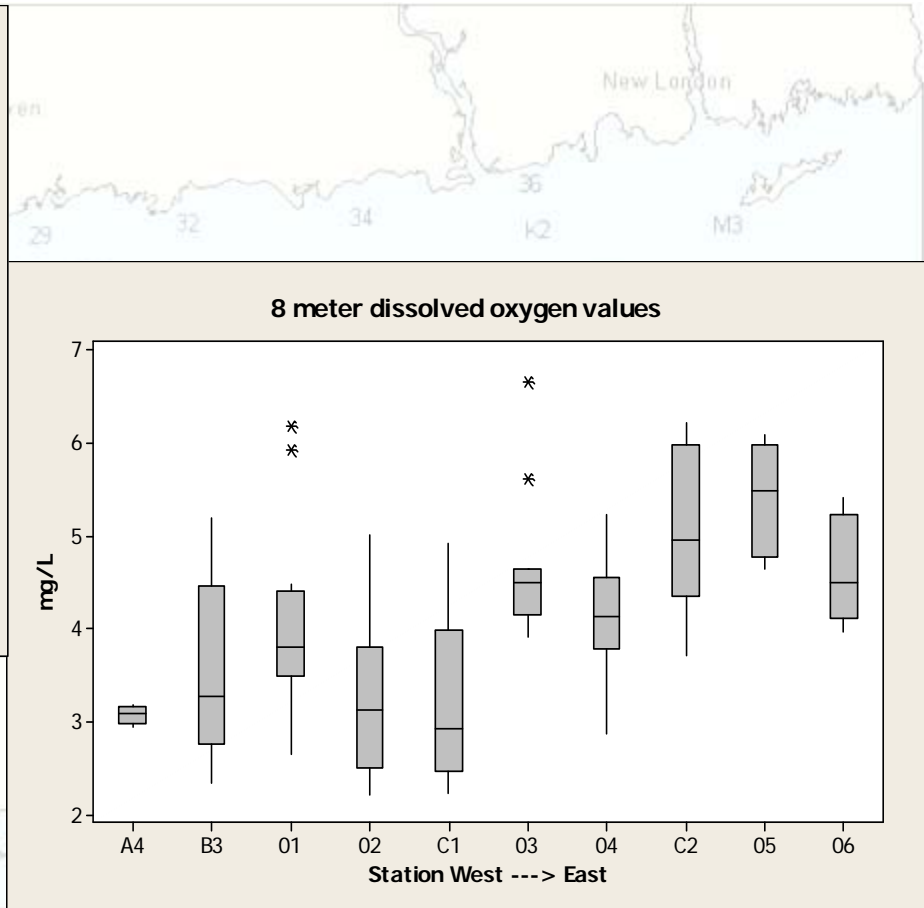
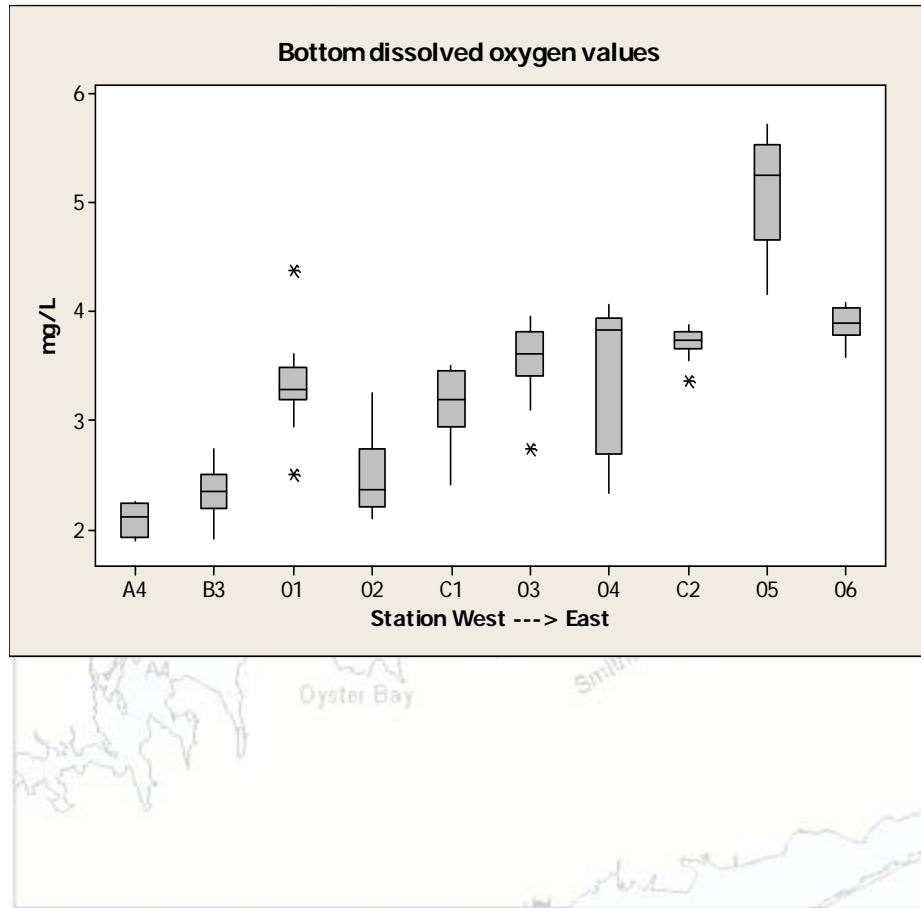


Dissolved oxygen results

- Water column structure changed significantly with wind and tide
- Volume estimates of hypoxia not currently done in LIS but would be helpful in determining overall impact of hypoxia
- Water temperature and oxygen content strongly correlated

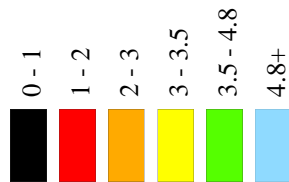
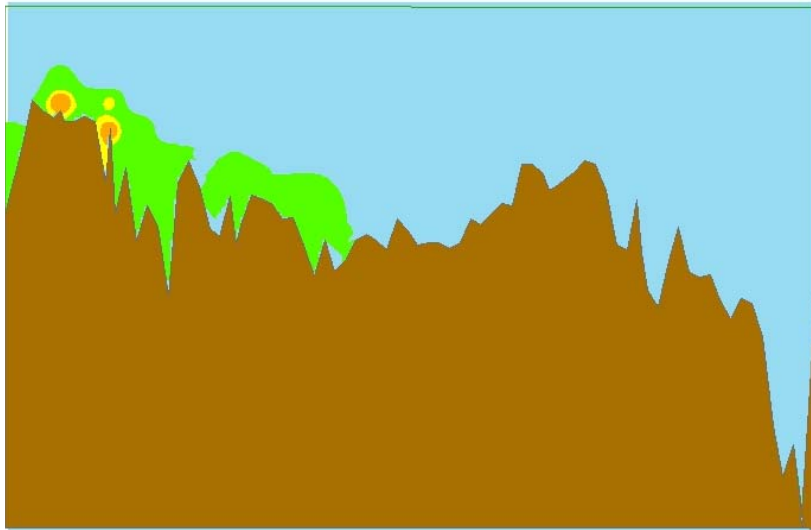


Dissolved oxygen results

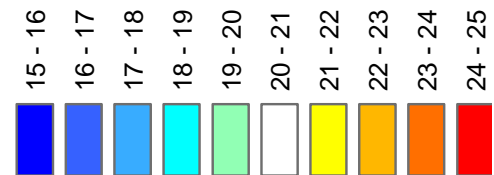
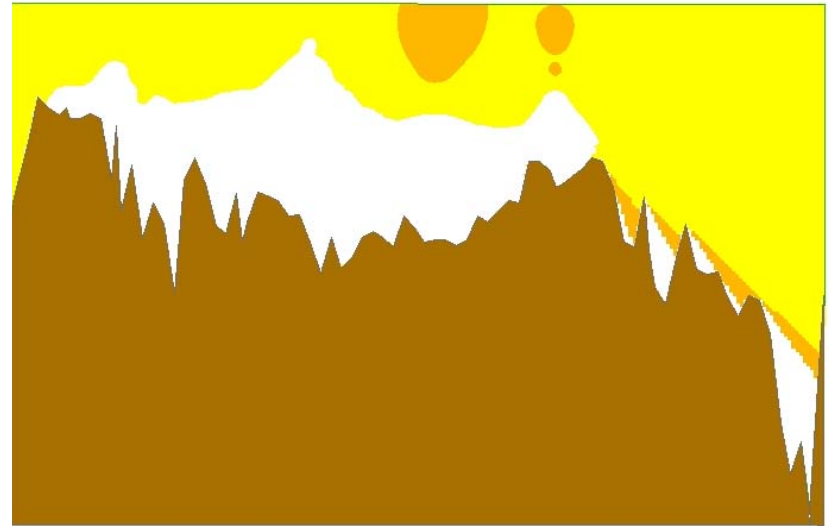


1997

Dissolved Oxygen

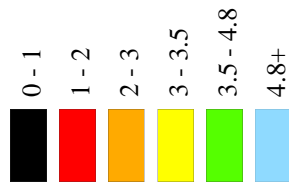
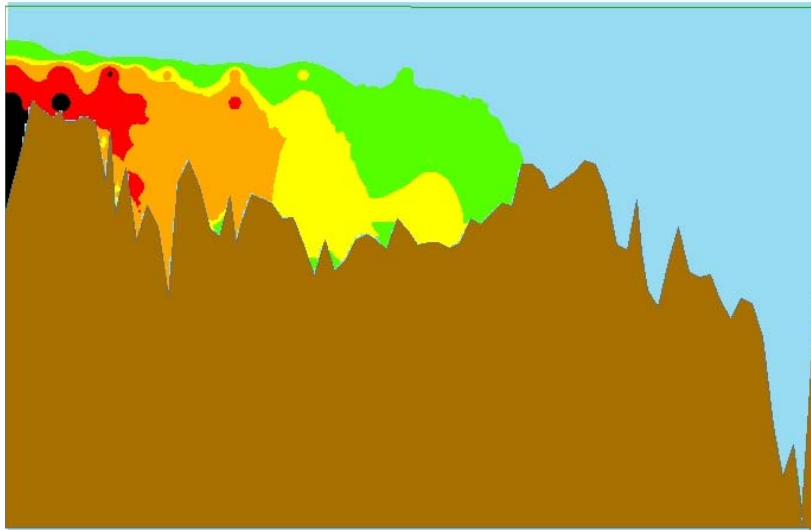


Temperature

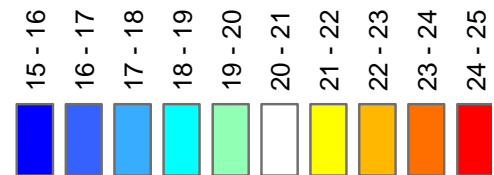
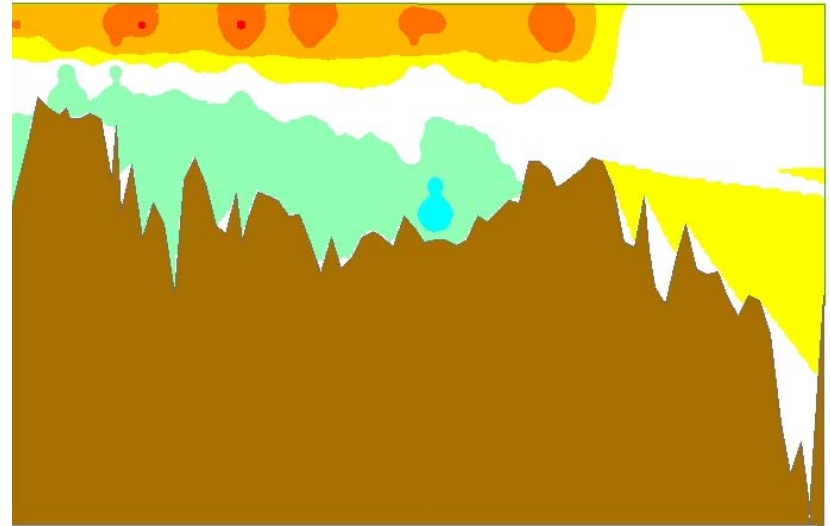


2003

Dissolved Oxygen



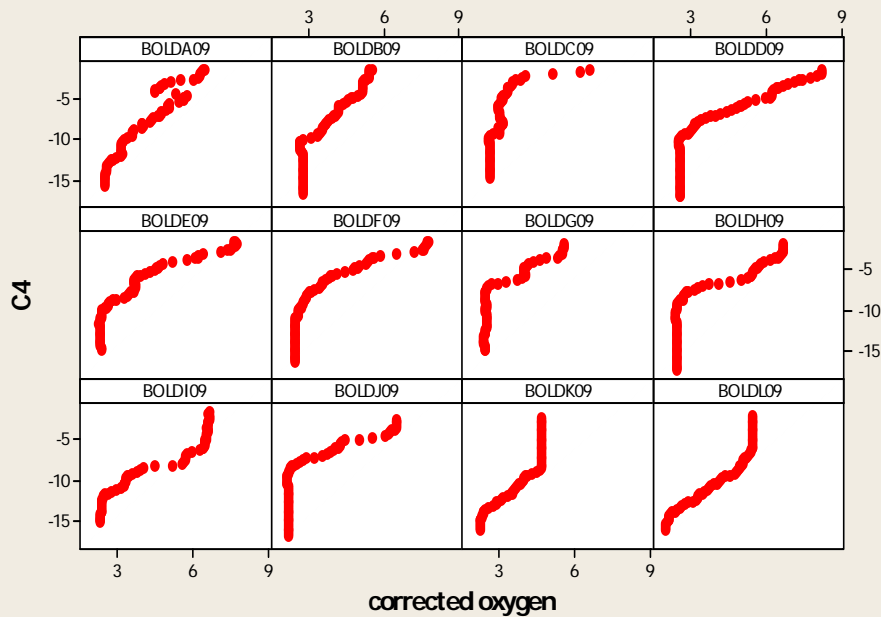
Temperature



Data from Bold survey

Dissolved oxygen profiles

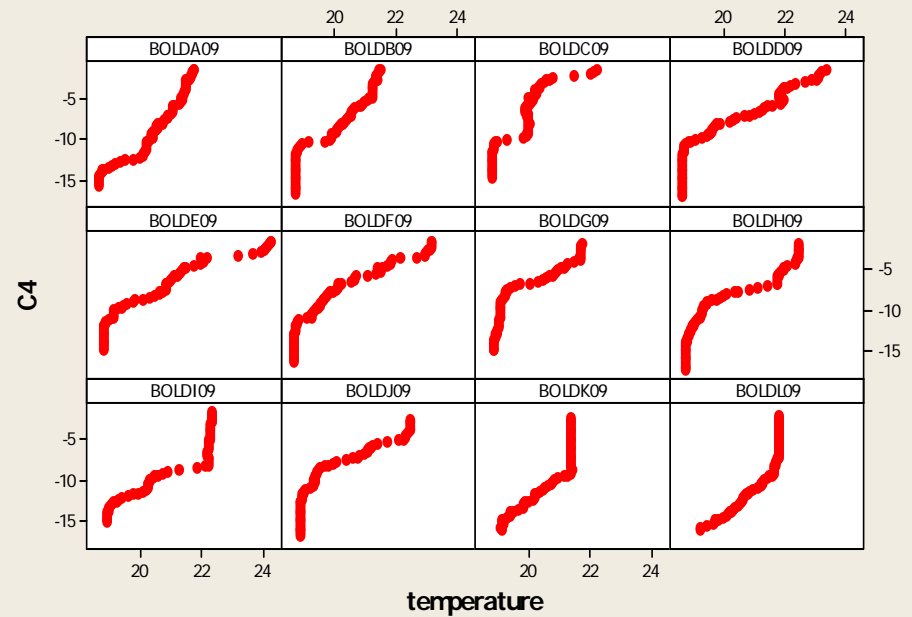
Scatterplot of C4 vs corrected oxygen



Panel variable: Cruise

Temperature profiles

Scatterplot of C4 vs temperature



Panel variable: Cruise

Conclusions

- Saw first hand the effects of wind events on the water column structure
- Considering only the bottom water DO values misses the actual impact of the hypoxic event
- Temperature could be useful to quantify short-term variability or to estimate the overall volume of hypoxia
- Timing of survey may not have been ideal for determining short term variation in nutrient levels

Acknowledgements



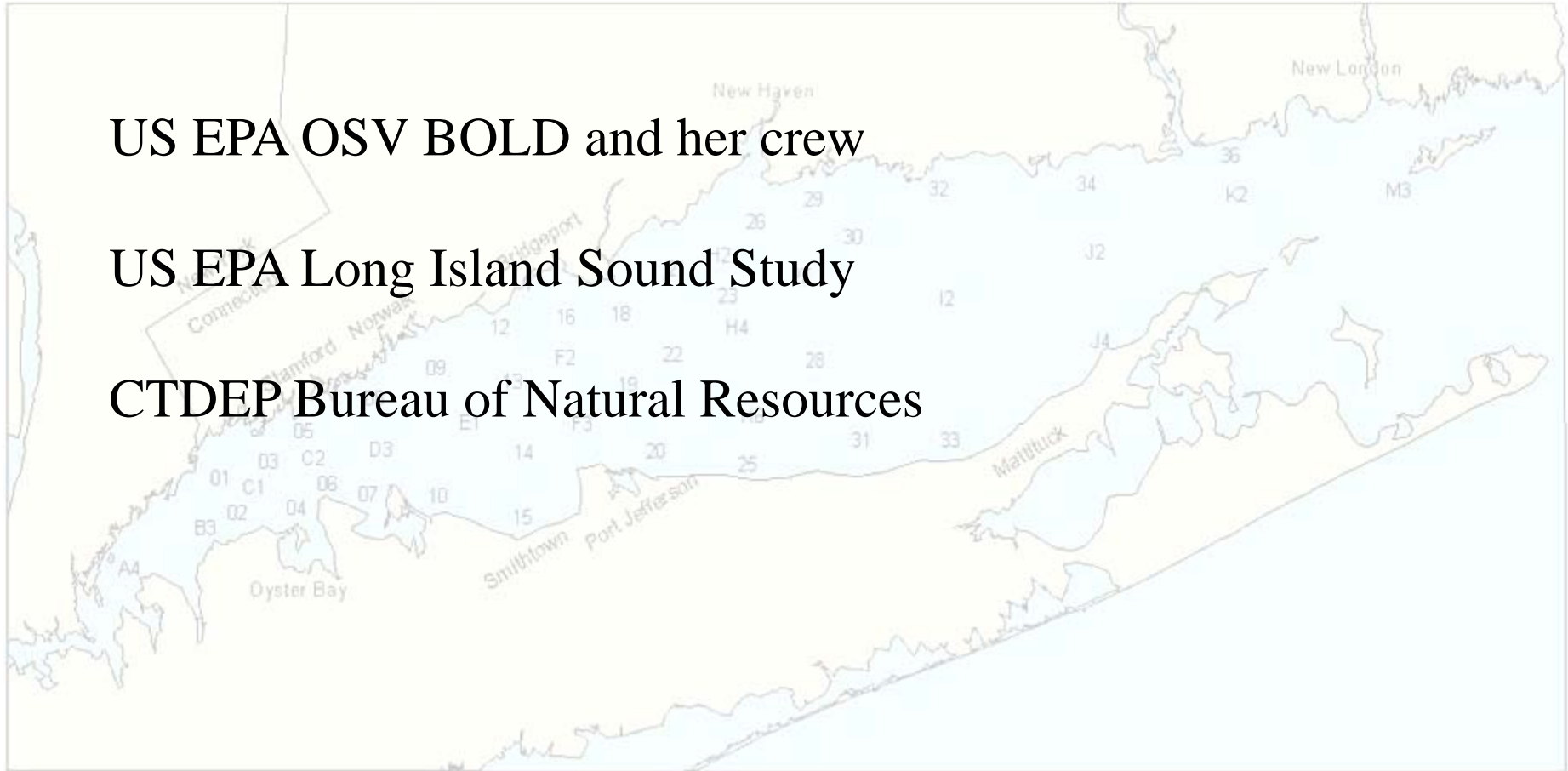
Mark, Katie, Matt, Christine, Justin, Michelle

Acknowledgements

US EPA OSV BOLD and her crew

US EPA Long Island Sound Study

CTDEP Bureau of Natural Resources



OSV Bold

West coast 2011

East coast 2012-13

Visit EPA website at www.epa.gov/owow/osvbold/

Contact number 202-566-1200.

