US EPA ARCHIVE DOCUMENT

NewHampshire EstuariesProject

Detecting Water Quality Patterns in New Hampshire's Estuaries Using National Coastal Assessment Probability-Based Survey Data

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NewHampshire EstuariesProject

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

UNIVERSITY of NEW HAMPSHIRE

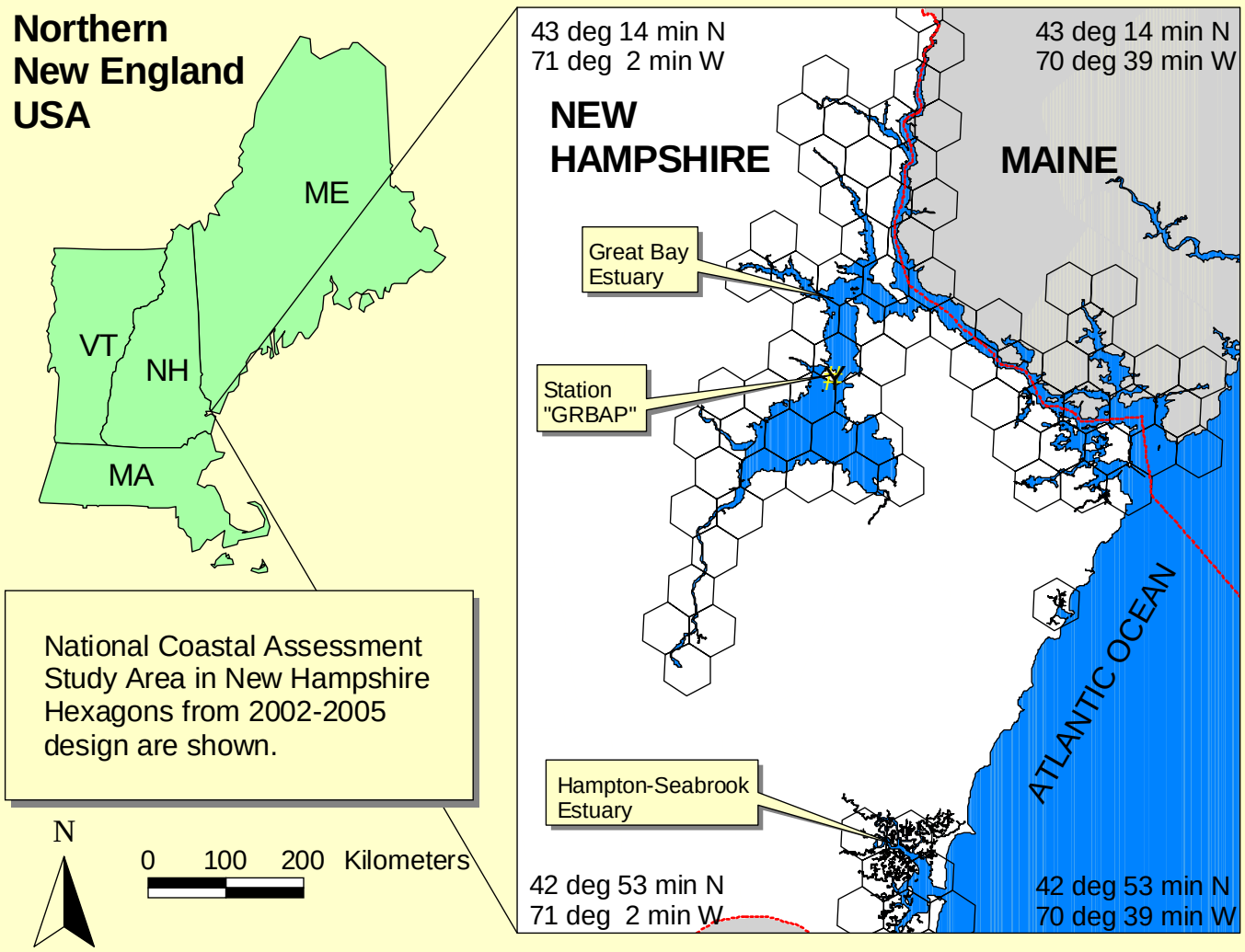
Introduction

- Probability-based monitoring (PBM) of NH's estuarine waters has been done annually since 2000.
- The small study area resulted in dense sampling network.
- Fixed station monitoring for trends was also conducted at representative station.
- Climate variables (temp, rainfall) recorded for Portsmouth NH.

Research Questions

- Can probability-based sampling data, expressed as estimated proportions, be used for trend and correlation analysis in a small estuary?
- If so, how do the results of trend and correlation analyses with probability-based data compare to the results when the same tests are run using data from traditional fixed station monitoring?

Study Area


Northern
New England
USA
ME
VT
NH
MA
National Coastal Assessment Study Area in New Hampshire Hexagons from 2002-2005 design are shown.
N
0 100 200 Kilometers
43 deg 14 min N
71 deg 2 min W
43 deg 14 min N
70 deg 39 min W
NEW HAMPSHIRE
MAINE
Great Bay Estuary
Station "GRBAP"
ATLANTIC OCEAN
Hampton-Seabrook Estuary
42 deg 53 min N
71 deg 2 min W
42 deg 53 min N
70 deg 39 min W

Methods

- Monitoring designs
  - PBM: 25-40 station visits per year, stratified random (2000-2005), GRTS (2006)
  - Fixed Station: Monthly visits on high and low tide in 2000-2006
  - Index Period: July 1 to September 30
- Parameters
  - Temperature, Salinity, Dissolved Oxygen, Chlorophyll-*a*, Nitrogen (NH4, NO23), Orthophosphate, Suspended Solids, Fecal Coliforms.
  - Summer air temperature and rainfall in Portsmouth.

Methods (cont.)

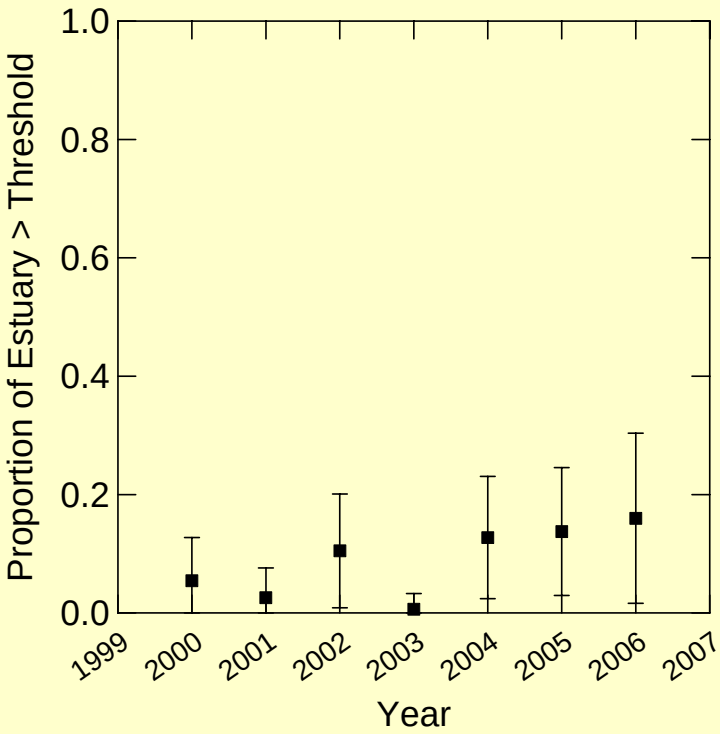
- Data Processing
  - PBM: Estimated proportions of the estuary above thresholds using Horvitz-Thompson estimator method.
  - Fixed Station: Compute median value for each parameter for each summer season.
- Statistical tests
  - Mann-Kendall test for trends in both datasets.
  - Spearman Rank Correlation test with climate variables.
  - Equal number of values from each program were used to ensure equal statistical power.

Results-Trend Analysis

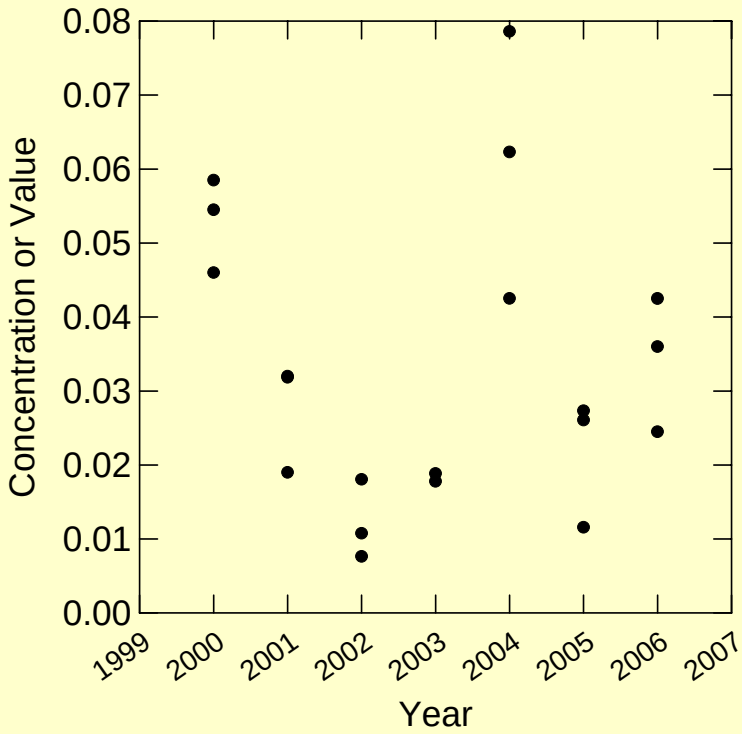
- Significant trends were detected from both datasets (0.1 significance level) but they did not match.
  - Two parameters, nitrogen as nitrate and nitrite and fecal coliform bacteria, showed significant trends using the probability-based dataset.
  - Two different parameters, chlorophyll *a* and total suspended solids, showed significant trends using the fixed station dataset.

Nitrogen as Nitrate and Nitrite

a. Probability-Based Surveys

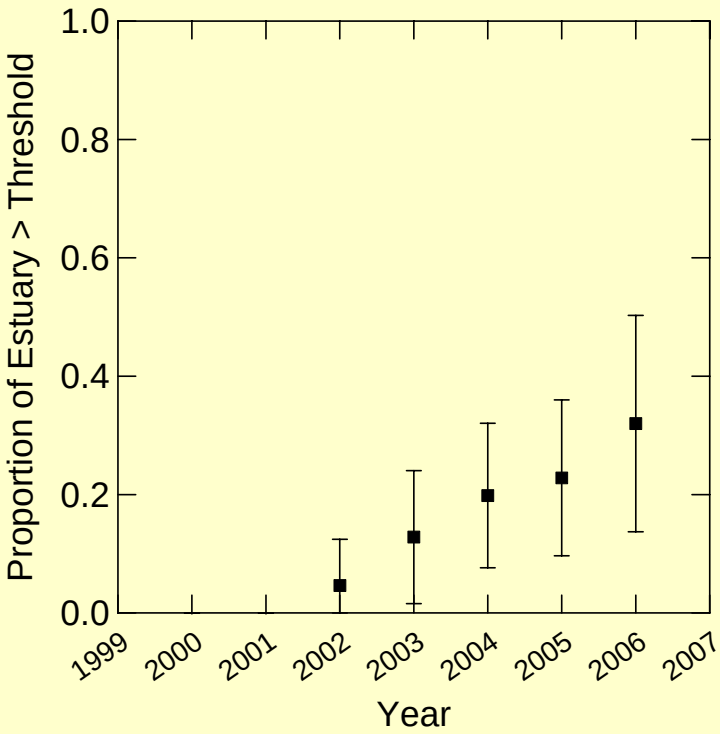


b. Grab Samples from Fixed Station

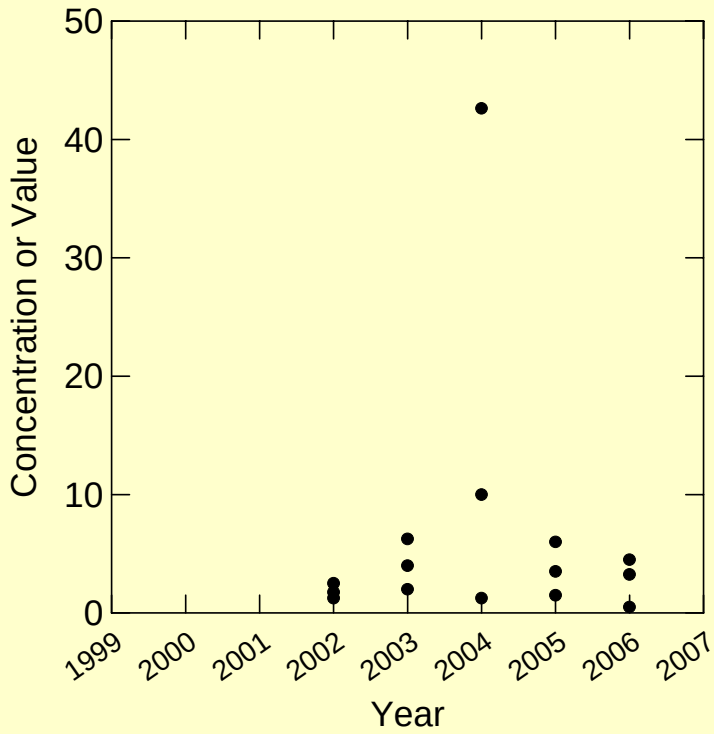


Fecal Coliform Bacteria

a. Probability-Based Surveys

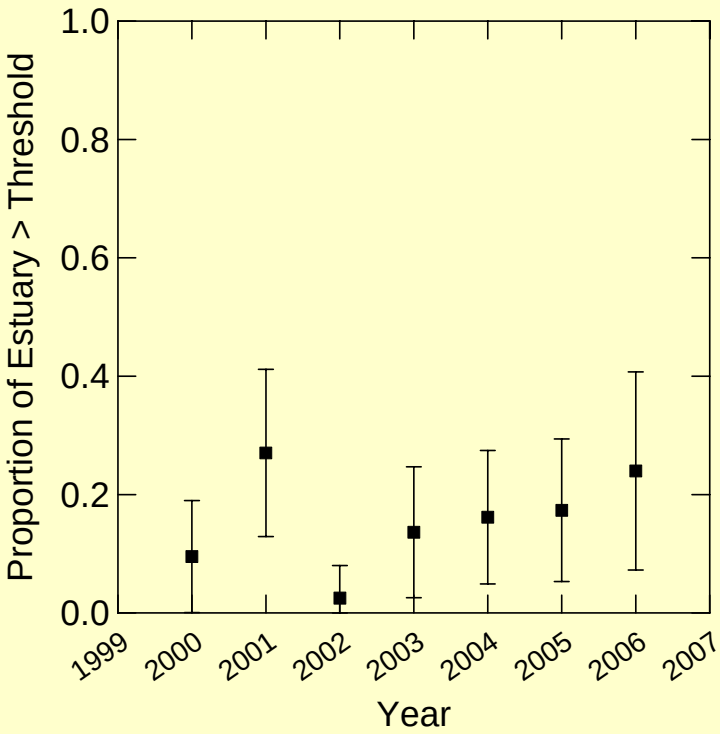


b. Grab Samples from Fixed Station

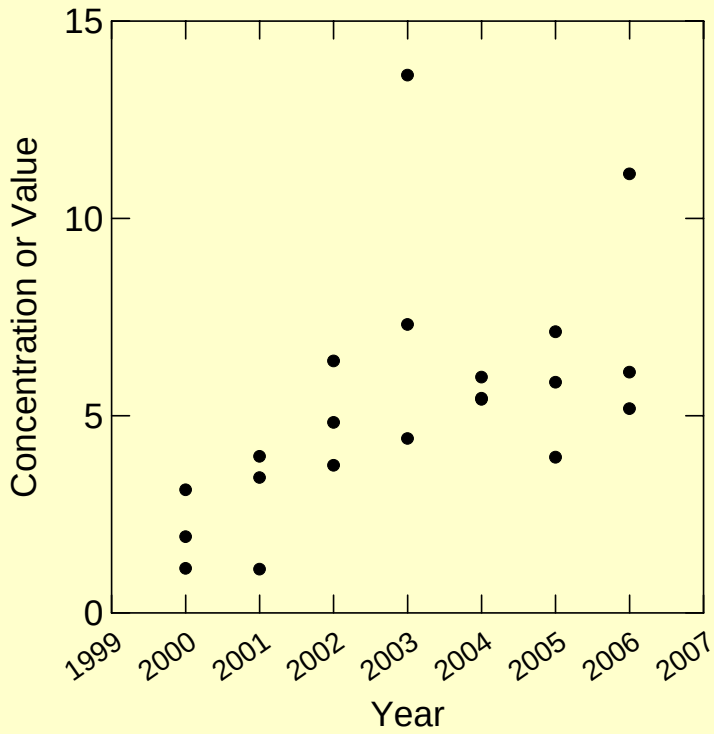


Chlorophyll-*a*

a. Probability-Based Surveys

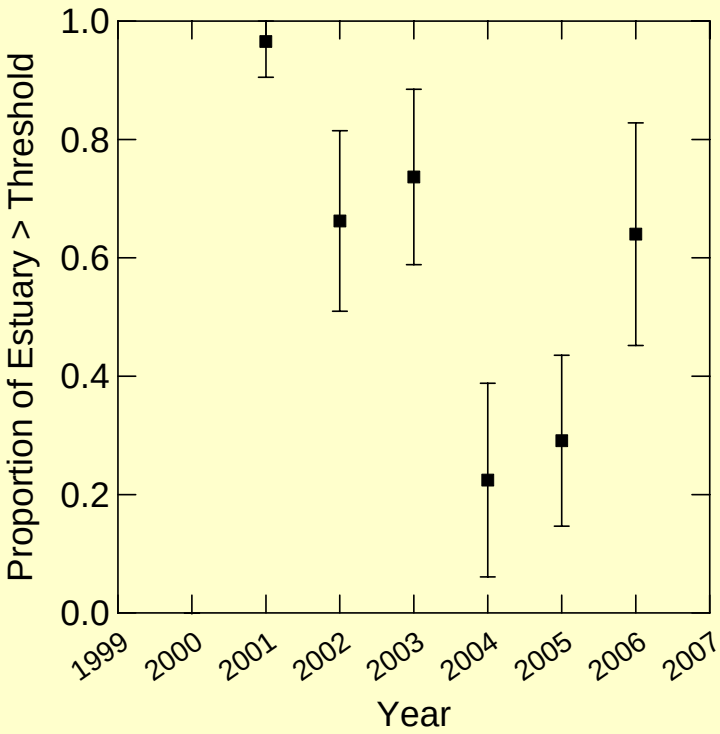


b. Grab Samples from Fixed Station

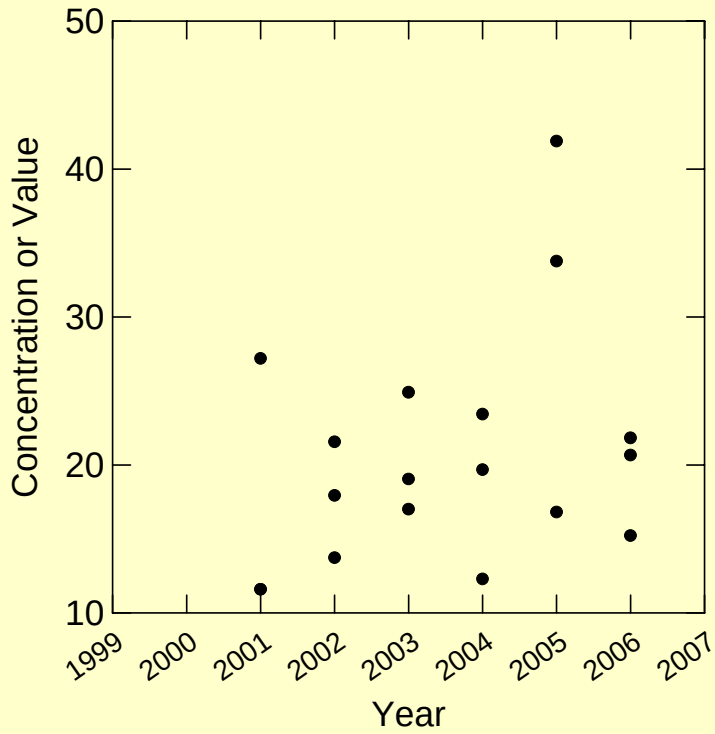


Suspended Solids

a. Probability-Based Surveys



b. Grab Samples from Fixed Station



Results-Climate Correlation

- Correlations detected for both datasets
- Probability-Based Monitoring:
  - Salinity and Summer Rainfall (-)
- Fixed Station Monitoring:
  - Water Temperature and Summer Rainfall (+)
  - Chlorophyll-a and Summer Rainfall (+)
  - Fecal Coliforms and Summer Rainfall (+)
  - Chlorophyll-a and Air Temperature (+)

Conclusions

- Estimated proportions from PBM surveys were useful for detecting trends and correlations.
- However, the trends and correlations evident from probability-based surveys were different than those detected using data from monthly monitoring at a fixed station.
  - Distributed nature of the PBM design, which places stations in all sections of the estuary
  - Estimated proportions for PBM datasets reduces variability in volatile parameters

Challenges

- If trends detected by probability-based surveys differ from the trends that have been typically detected from fixed station monitoring, the results will be confusing to managers.
- Another challenge of using probabilistic monitoring data for trend detection is the lack of agreed-upon methods for calculating trend statistics.

Contact Information

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