The NCA in New Hampshire

Lessons learned from seven years of probabilistic monitoring in a small estuary

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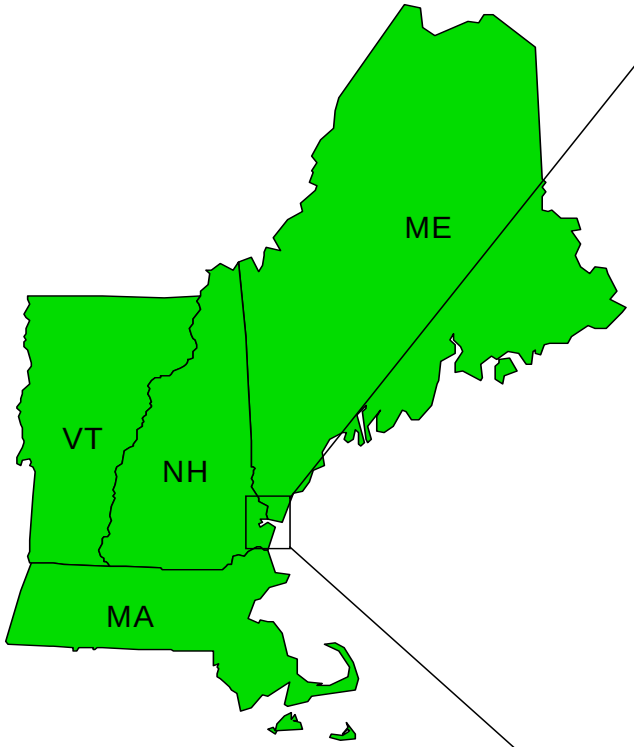
Partners and Acknowledgments

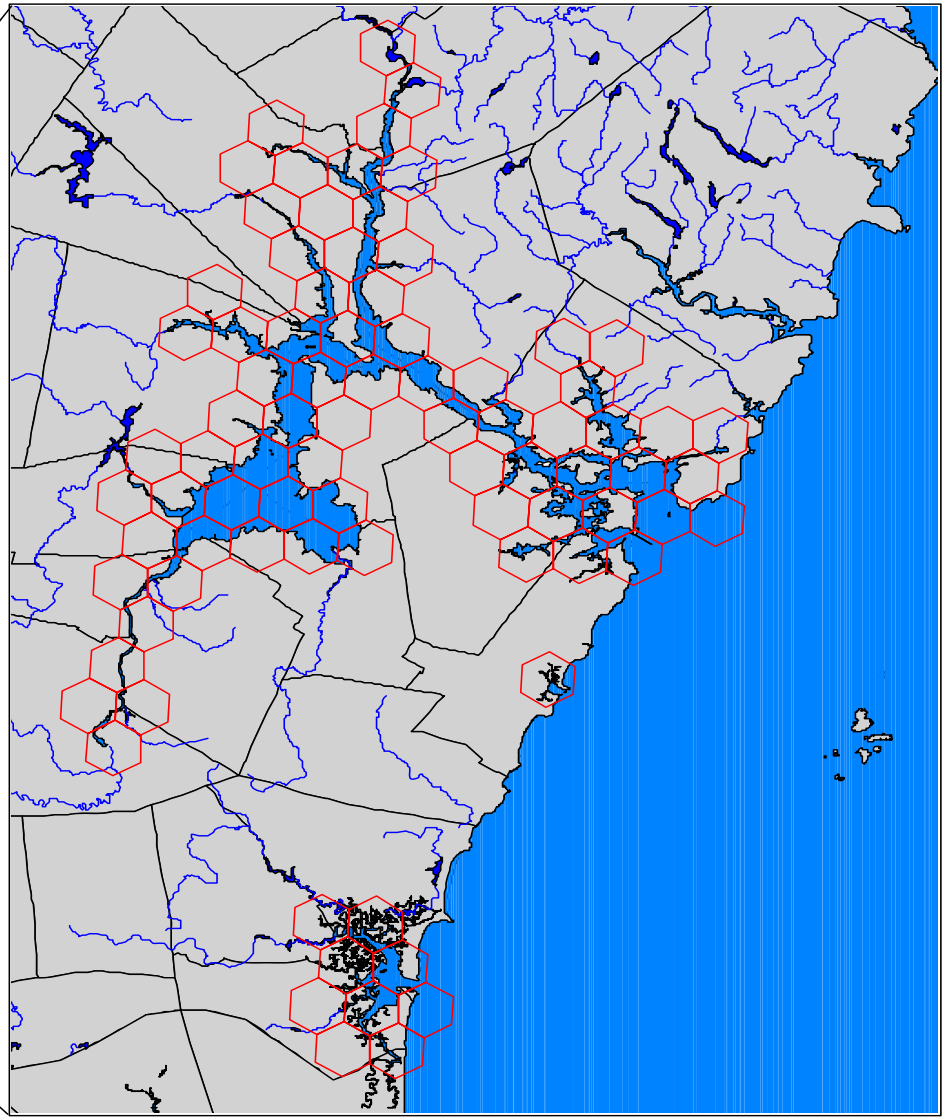
The NH NCA is a partnership of:

- UNH (field operations)
- EPA (funding, protocols)
- DES (planning, quality control)

National Coastal Assessment Study Area, 2002-2005



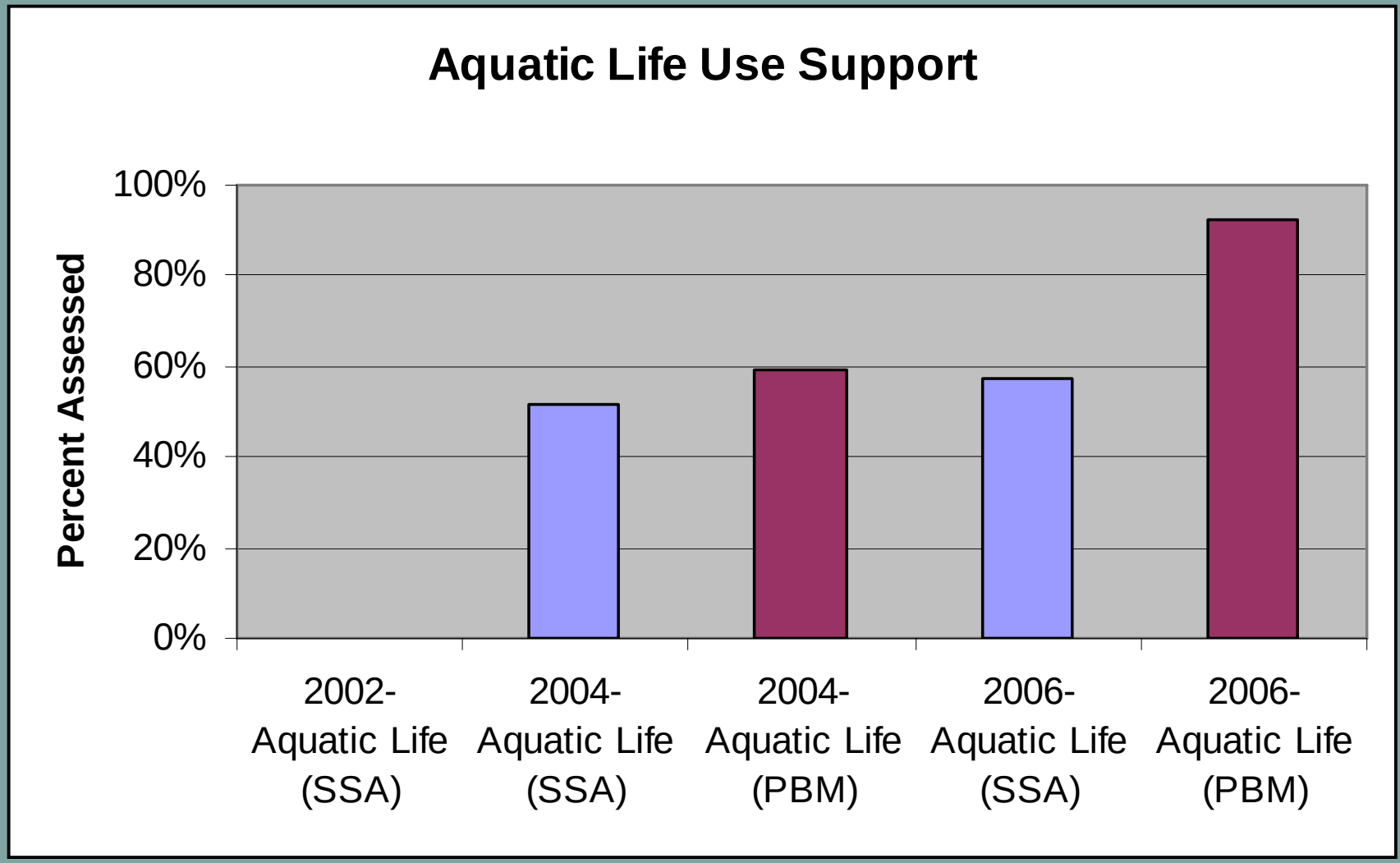
Resource area = 56.3 km2
Hexagon area = 3.2 km2



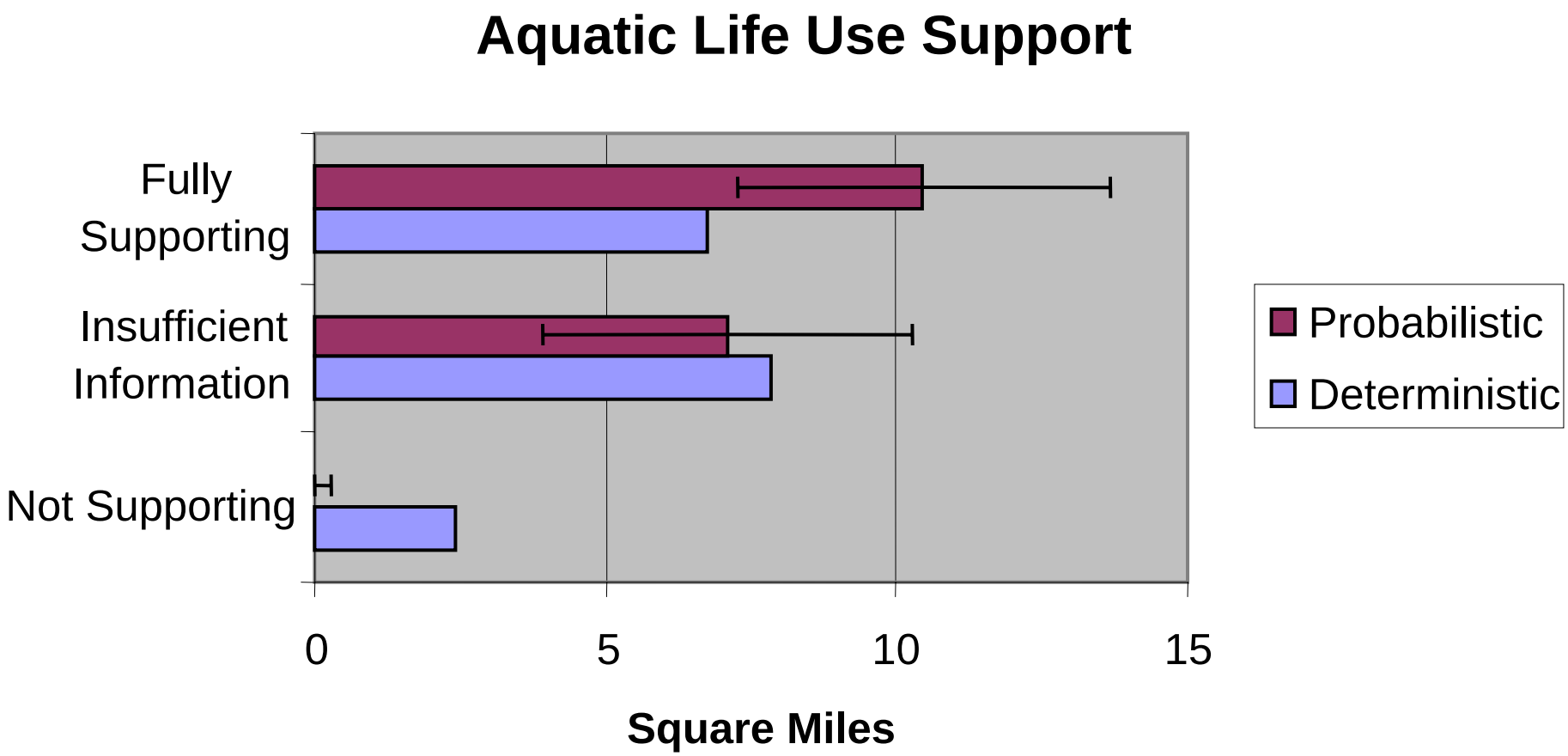
Successes of the NCA Program in New Hampshire

- Expected Benefits
  - Improved 305b reporting
  - State of the Estuaries reports
  - Development of state capacity
- Unexpected Benefits
  - Detection of sediment hot spots
  - Cost savings for other sampling
  - “Meta-trend” detection

Improved 305b Reporting



Improved 305b Reporting



State of the Estuaries Report

Do sediments in the estuaries contain toxic contaminants that might harm benthic organisms?

YES BUT RARELY. ORGANISMS LIVING IN THE SEDIMENTS MIGHT BE ADVERSELY AFFECTED BY TOXIC CONTAMINANTS IN ONLY 0.3 PERCENT OF THE ESTUARIES.

WHY THIS IS IMPORTANT

Toxic contaminants accumulate in estuarine sediments, and therefore organisms living in the sediments are especially at risk of being impacted by these pollutants. Furthermore, toxic contaminant concentrations in sediments can provide information on both historical and current pollution of the estuaries.

EXPLANATION

Approximately 12 percent of the estuarine sediments had at least one contaminant with concentrations greater than a screening value (Figure 3). Concentrations above screening values have the potential to pose a threat to organisms that live in the sediments. Elevated levels of contamination occur mainly in the tidal rivers, especially the Cocheco River. The chemicals that exceeded screening values were chromium, lead, silver, polycyclic aromatic hydrocarbons, and the pesticide DDT. Another important observation was the consistently low levels of almost all contaminants at sites in Little Harbor, Little Bay, Hampton-Seabrook Harbor, and in the outer portion of Portsmouth Harbor.

Screening values were set conservatively; therefore, concentrations above screening values do not necessarily mean that organisms in the sediments will be affected by the contaminants. Actual effects on benthic organisms were determined using sediment toxicity and benthic community surveys. These tests showed that the organisms in the sediments were affected by toxic contaminants in only two locations out of 70 tested, or 0.3 percent of the estuary (Figure 4). The two locations were in the Cocheco River and the Lamprey River (Figure 5). Therefore, in most of the locations where toxic contaminants in sediments were above screening values, the organisms did not appear to be affected by the contamination.

The absence of apparent effects on organisms in the sediments does not necessarily mean all aquatic species are unaffected. First, the sediment toxicity and benthic community surveys are only capable of detecting significant impacts to the benthic community. More subtle impacts might have been missed. Second, benthic organisms are just one of many possible aquatic species groups. For bioaccumulative compounds, such as mercury and PCBs, species in higher trophic levels could be at risk even if impacts to benthic organisms are not observed. Finally, the sediments have only been tested for the typical suite of toxic contaminants, not for new classes of chemicals which are emerging as possible threats, such as personal care products and pharmaceuticals.

Water Quality

NHEP Goal: No impacts to benthic communities due to sediment contamination.

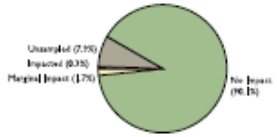
UNH technician preparing to collect a sediment sample from Great Bay

NHEP

Concentrations of toxic contaminants relative to screening values (SVs) (Figure 3)

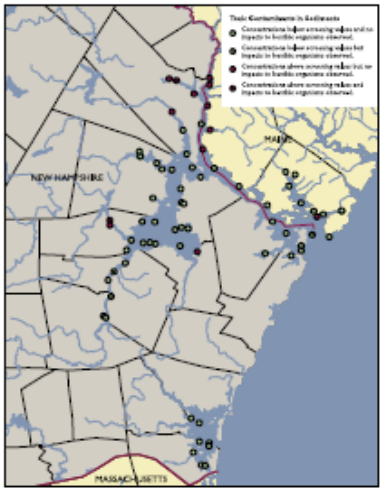
Data Source: EPA, NHDES, and UNH, National Coastal Assessment Survey (2000-2001)

Effects of toxic contaminants on benthic organisms (Figure 4)



Data Source: EPA, NHDES, and UNH, National Coastal Assessment Survey (2000-2001)

Locations of toxic contamination in sediments and impacts to benthic organisms (Figure 5)



Data Source: EPA, NHDES, and UNH, National Coastal Assessment Survey (2000-2001)

VOLUNTEERS CRITICAL IN MONITORING FRESHWATER RIVERS

The quality of freshwater river systems that eventually flow into the estuaries has a large impact on the overall condition of the estuaries. The NHDES Volunteer River Assessment Program (VRAP) organizes water quality monitoring by watershed organizations and other volunteers for freshwater streams and rivers in the coastal watershed. VRAP volunteers measure water quality parameters such as temperature, pH, dissolved oxygen, turbidity, and specific conductance. Recent VRAP water quality reports are available for the Bellamy, Cocheco, Isinglass, Lamprey, and Oyster rivers at www.des.nh.gov/wmb/VRAP.

The Coastal Volunteer Biological Assessment Program (CVBAP) was established in 2005 by the NHDES Biomonitoring Unit and the NH Coastal Program to educate the public about water quality issues as interpreted through biological data (aquatic macroinvertebrates), build a constituency of volunteers to practice sound water quality management at the local level, and supplement biological data collected by NHDES. The Cocheco River Watershed Coalition, Exeter River Local Advisory Committee, and Oyster River Watershed Association are participating in the program. Through CVBAP these groups' existing water quality monitoring efforts are expanded to include collection of biological data.

NHEP

NH DES technicians collecting aquatic invertebrates from the Oyster River

Development of State Capacity

X = DES lead

	Field	Water	Fish	Sediment	Tissue	Add ons	Design	Analysis
00-01	X		X					
2002	X		X			X		
2003	X		X			X	X	X
2004	X	X	X			X	X	X
2005	X	X	X			X	X	X
2006	X	X	X			X	X	X
2007	X	X					X	X

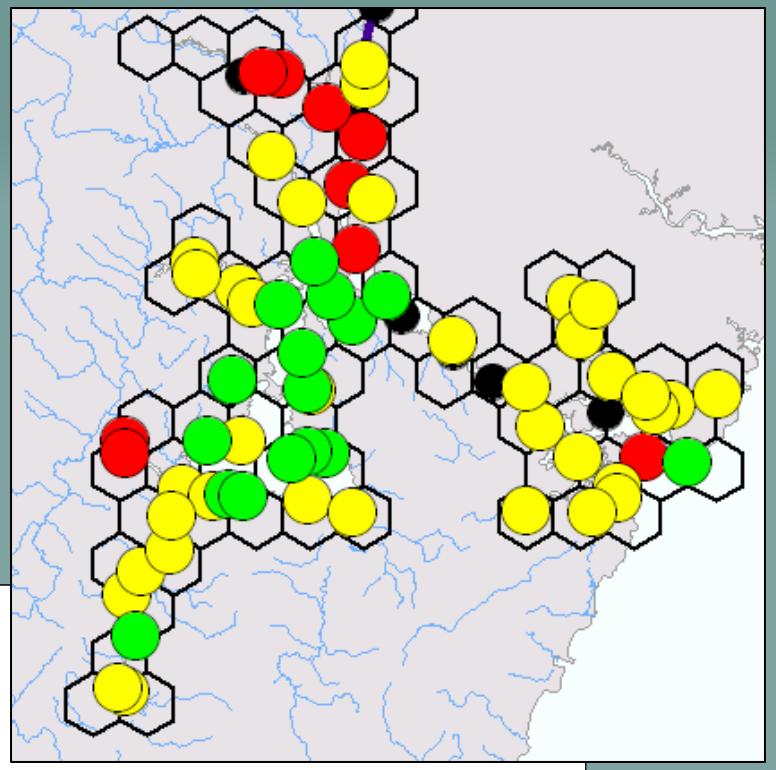
Unexpected Benefits

- Detecting hot spots
- Optimization of estuarine sampling design
- Trend detection

NewHampshire EstuariesProject

Benzo(a)pyrene in Great Bay – Piscataqua sediments and fish.

Sites in Great Bay Piscataqua where
[Benzo(a)pyrene] > PEC (red)
[Benzo(a)pyrene] > TEC and < PEC (yellow) [Benzo(a)pyrene] < TEC (green)

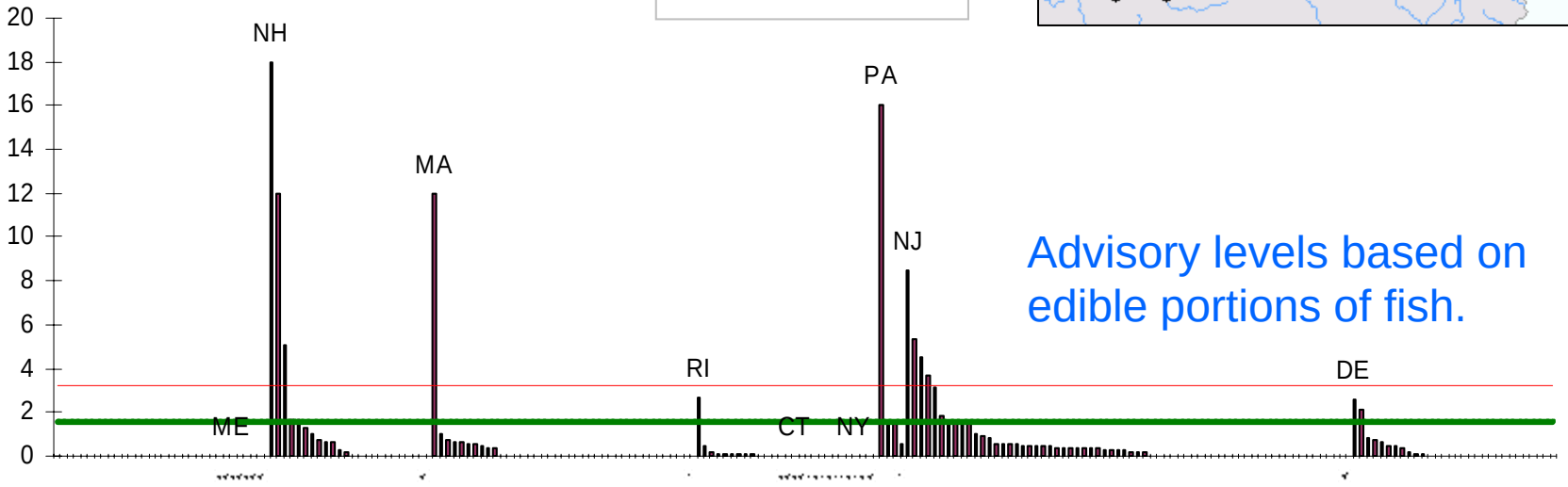


[Benzo(a)pyrene] in whole fish

NCA Fish Tissue -- by state

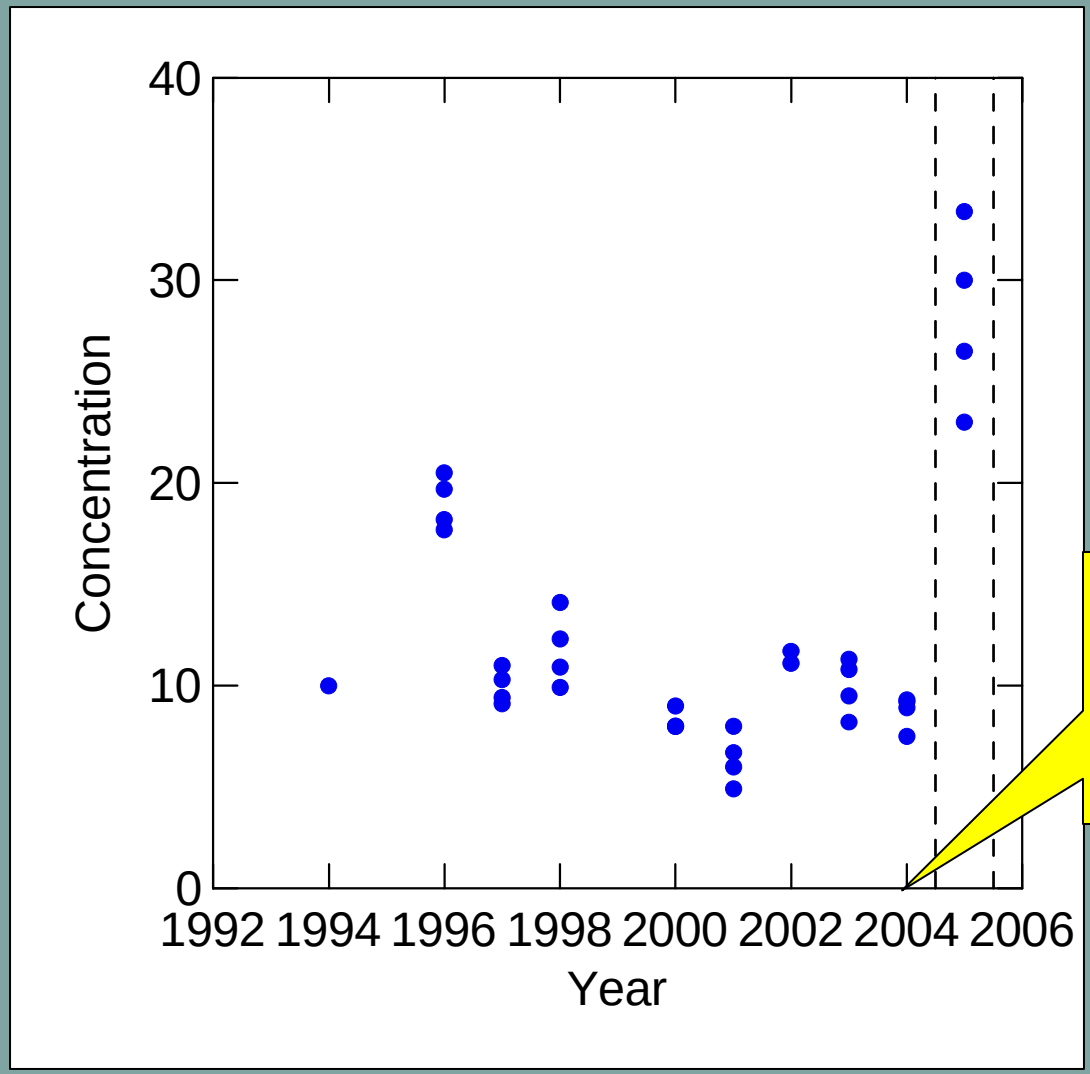
Concentrations in whole fish.

EPA Fish advisory limits:
3.2 ppb
1.6 ppb



Advisory levels based on edible portions of fish.

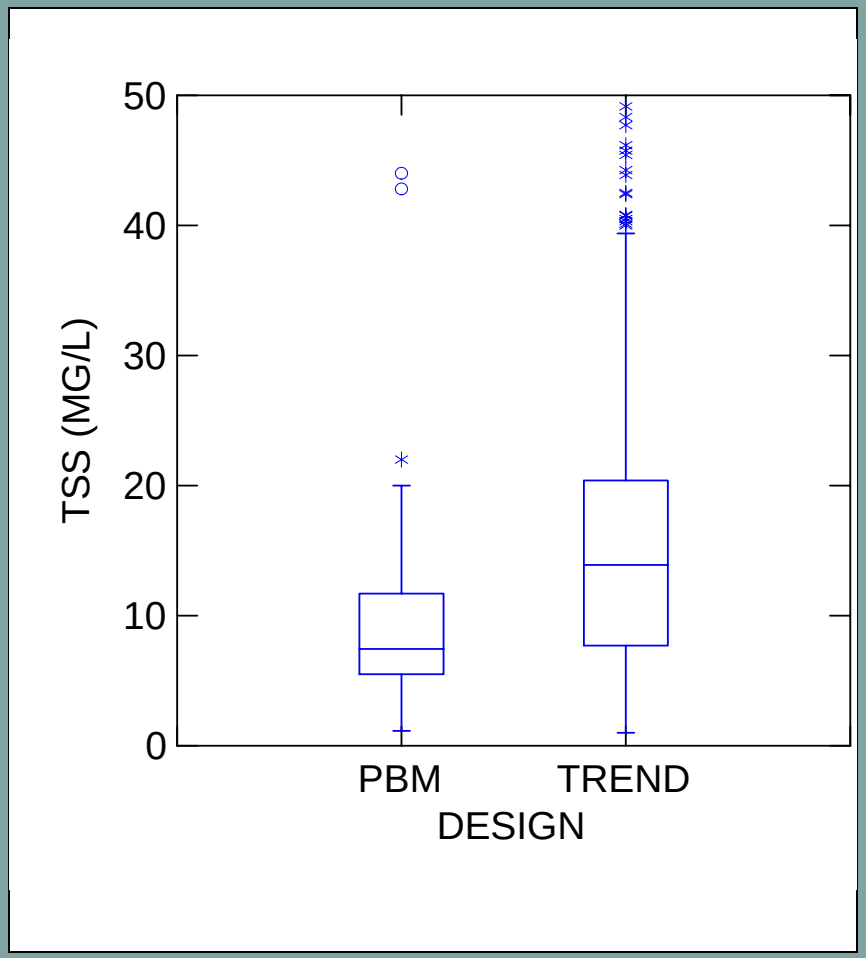
Benzo(a)pyrene in Mussel Tissue

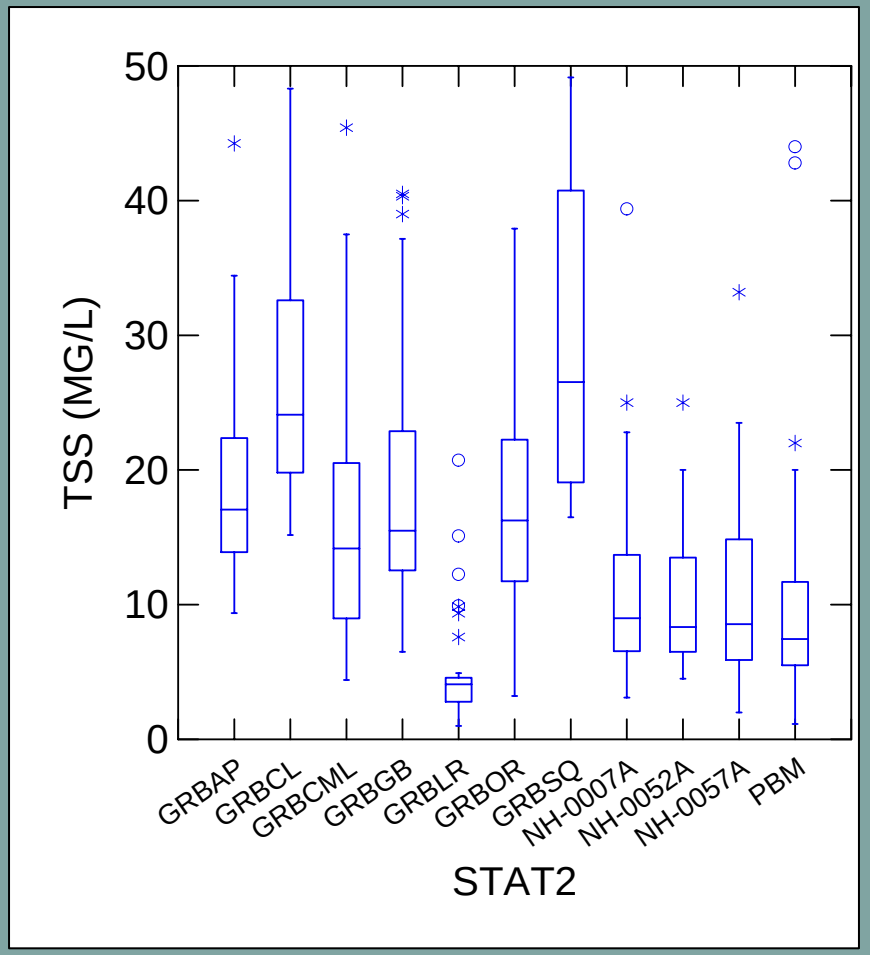


Optimizing Sampling Designs

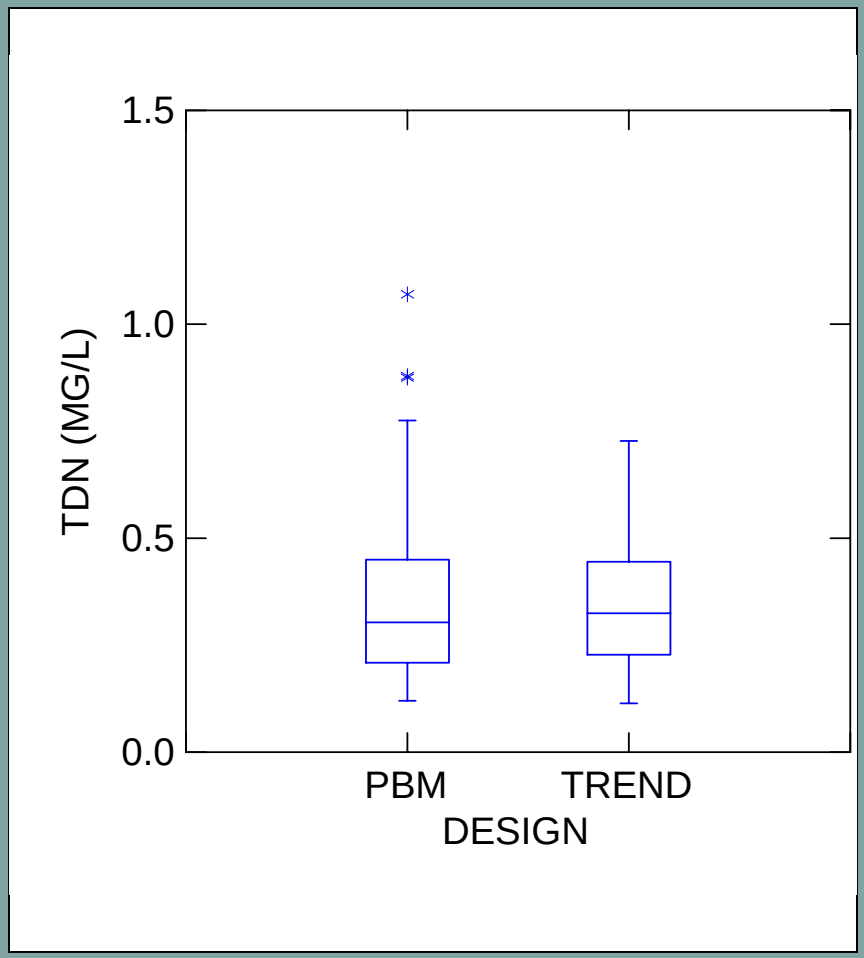
- NHEP compared the ranges of concentrations detected by PBM sampling and trend stations:
  - DIN, TSS, Chla: Trend sampling captures a greater range than PBM.
  - TDN, PN, PC, PO4, SiO2, bacteria: PBM captures the same range as trend sampling.

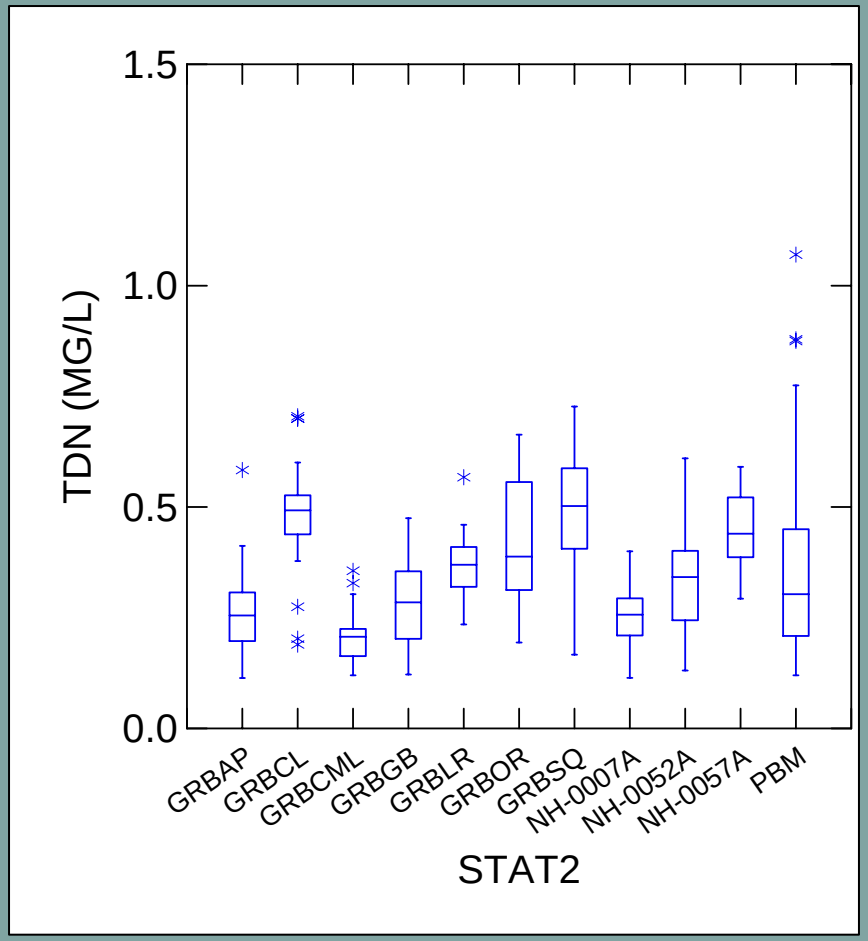
Suspended Sediment





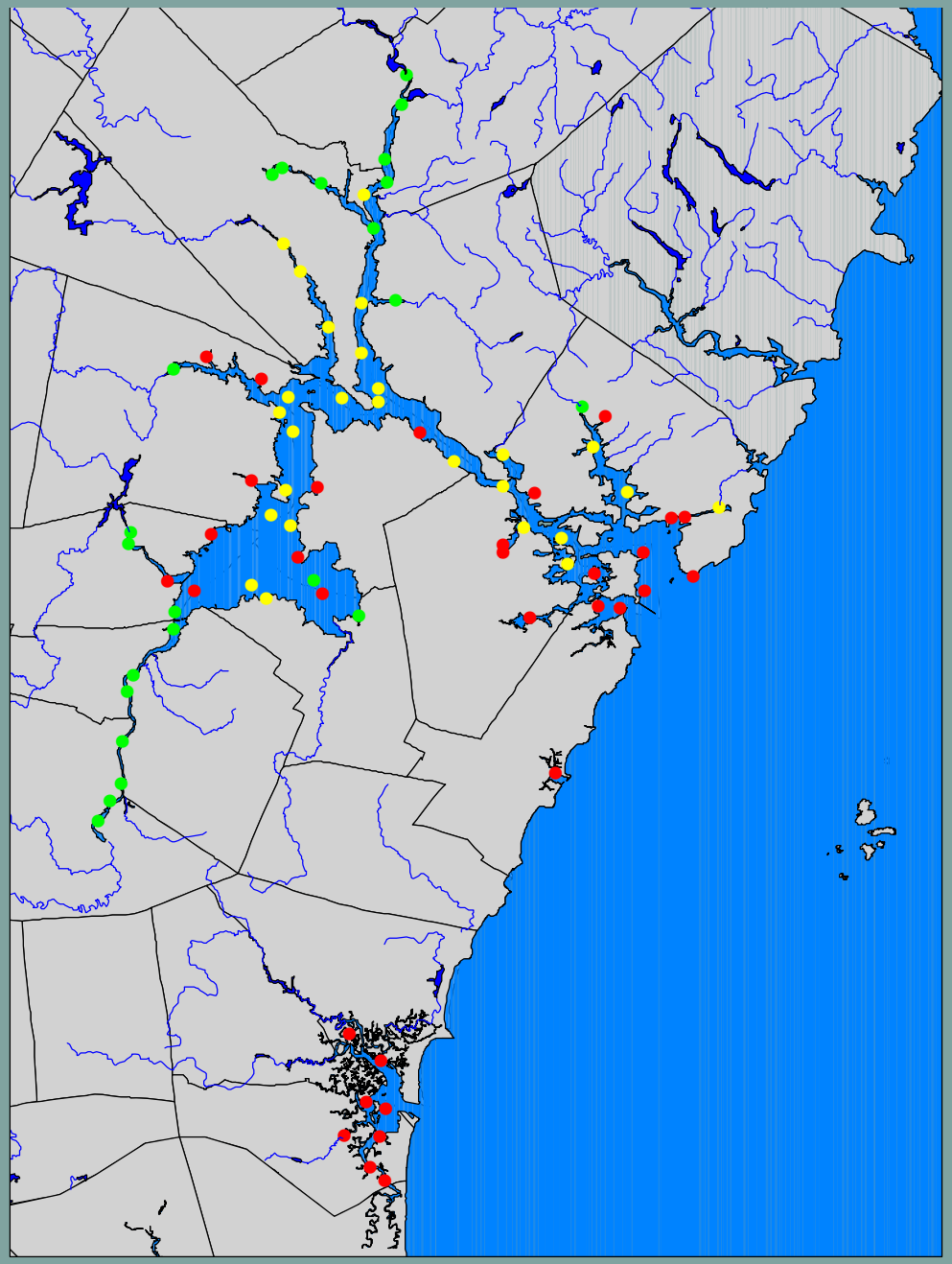
Total Dissolved Nitrogen



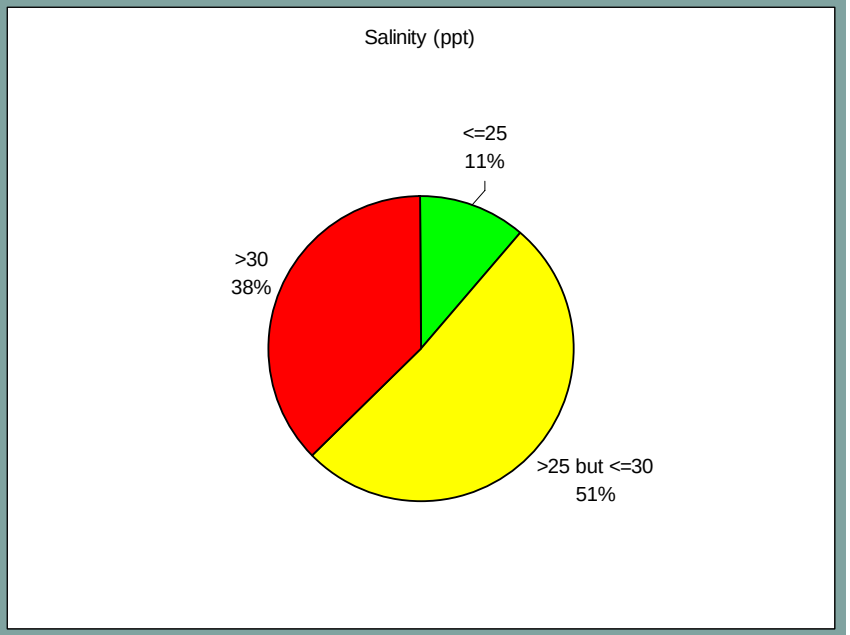


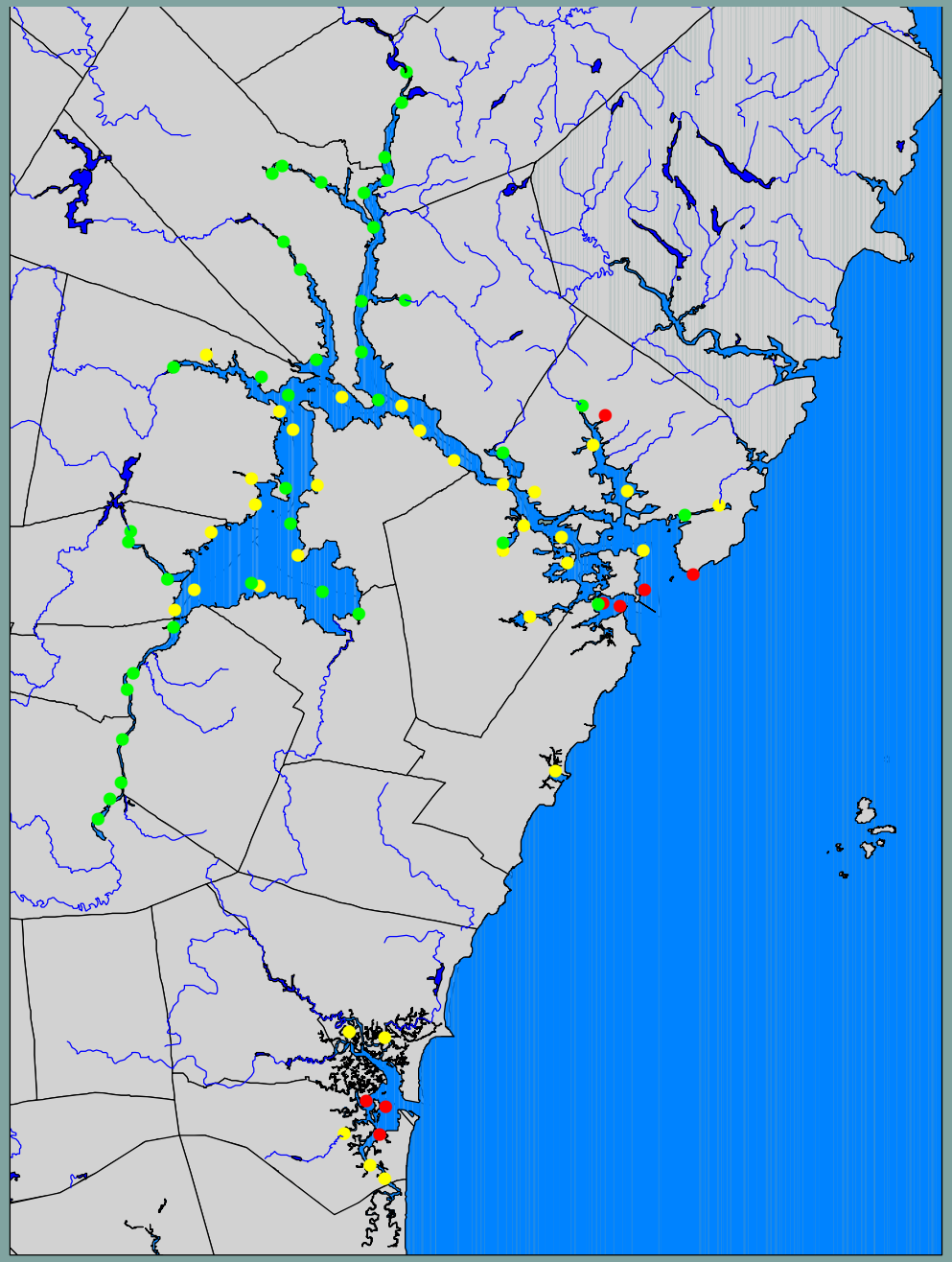
Meta-Trend Detection

- Comparison of CDFs between designs, years
- Able to detect large scale trends
- More sensitive than trend station monitoring?

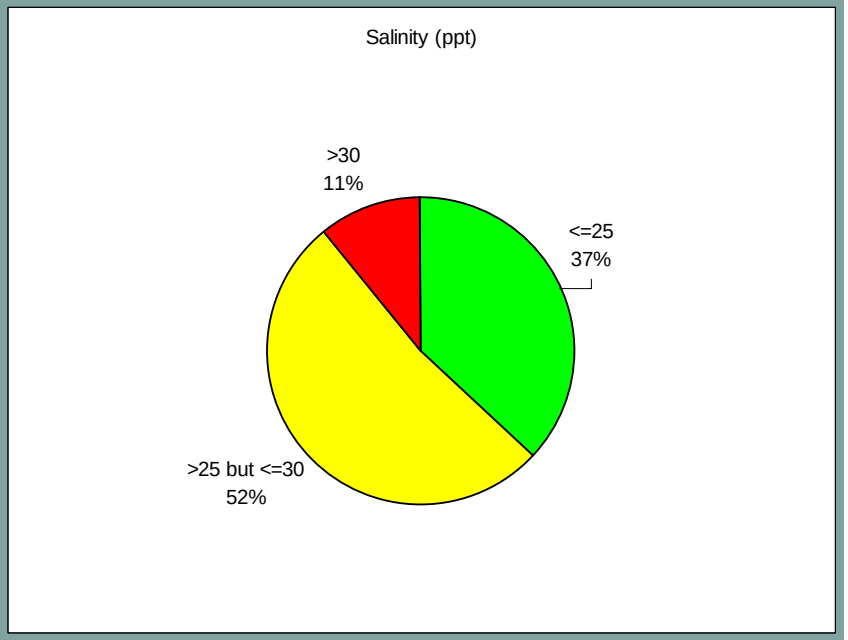


Salinity 2002-2003

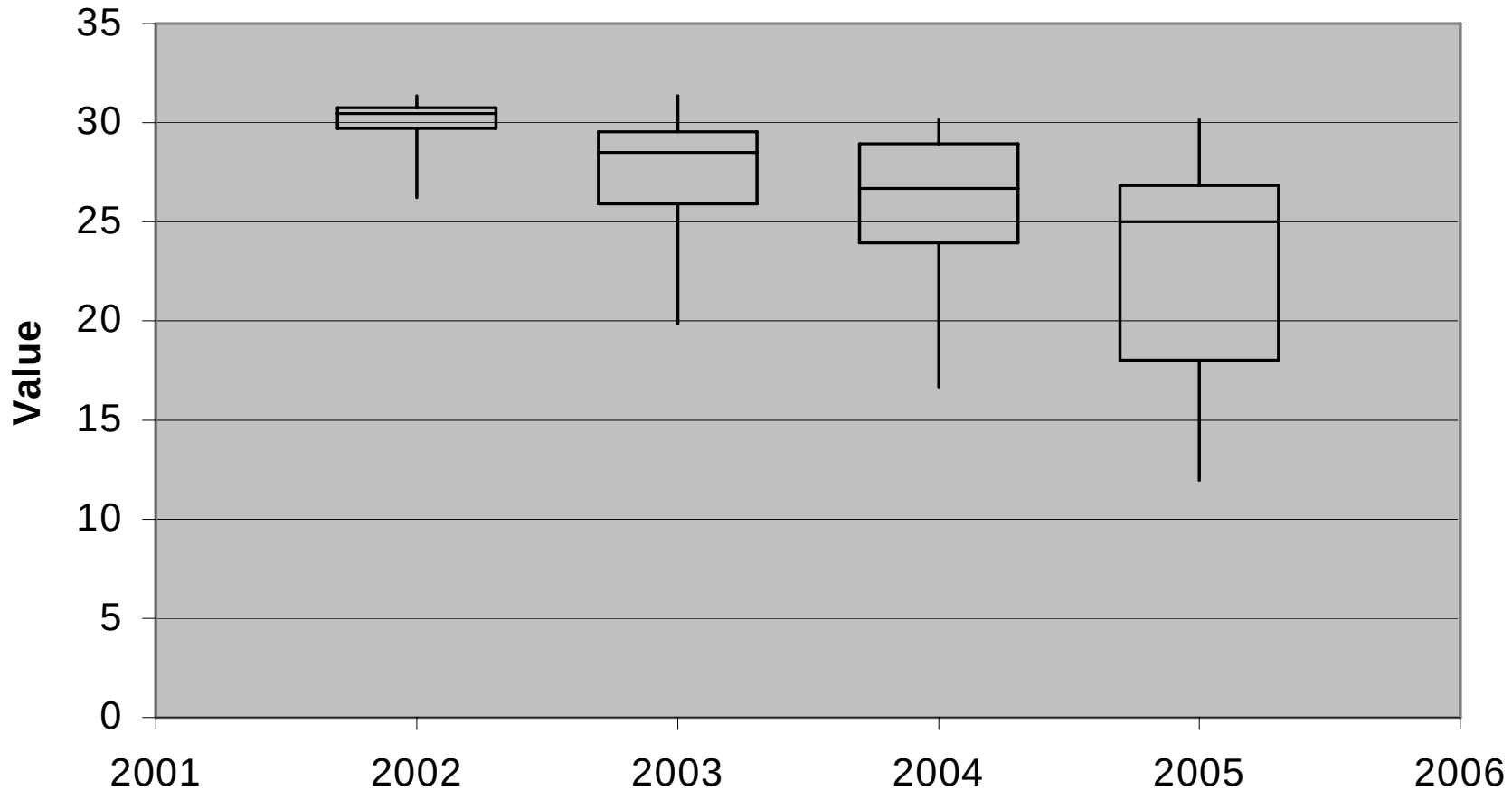




Salinity 2004-2005

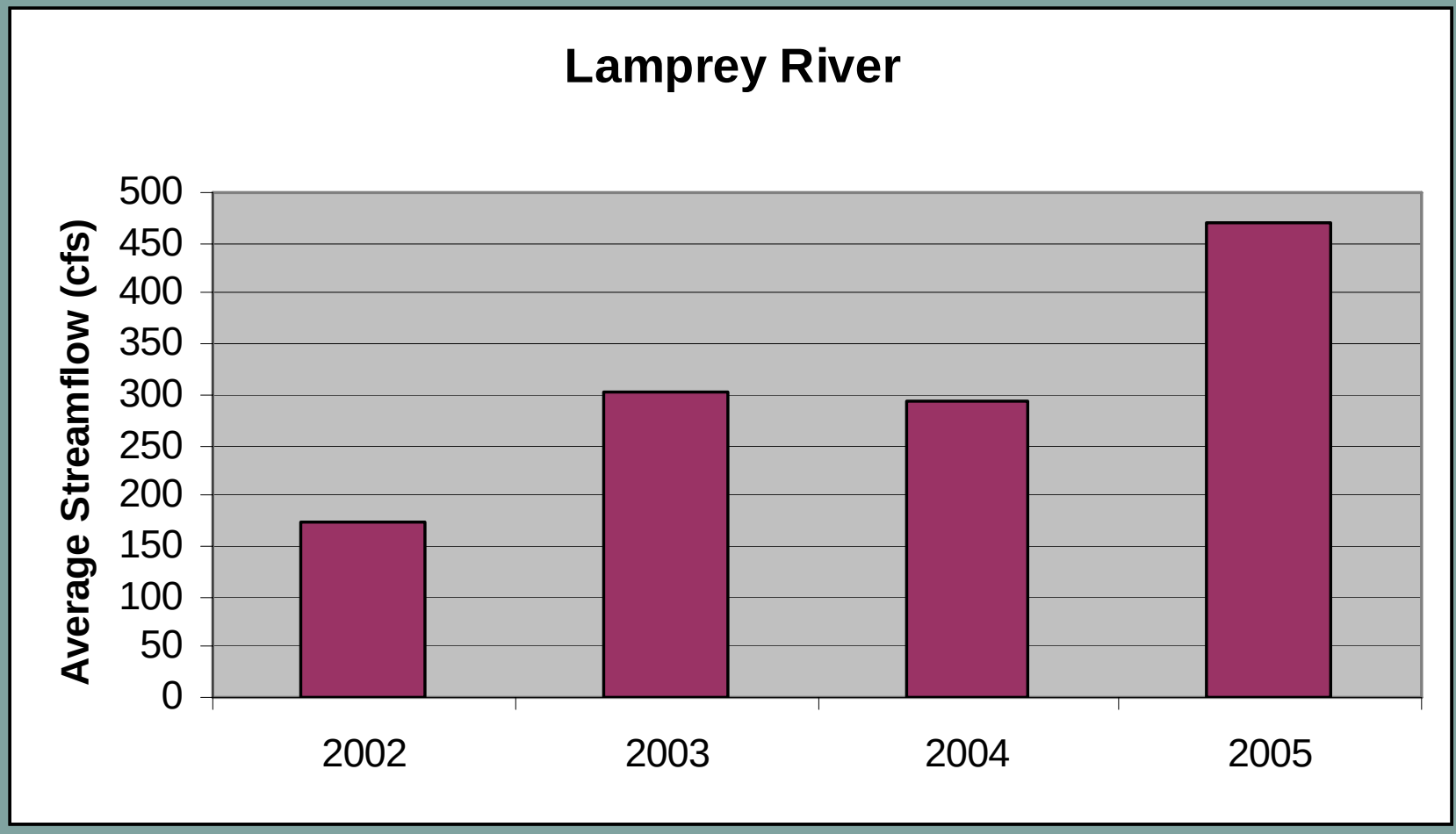


Salinity 2002-2005

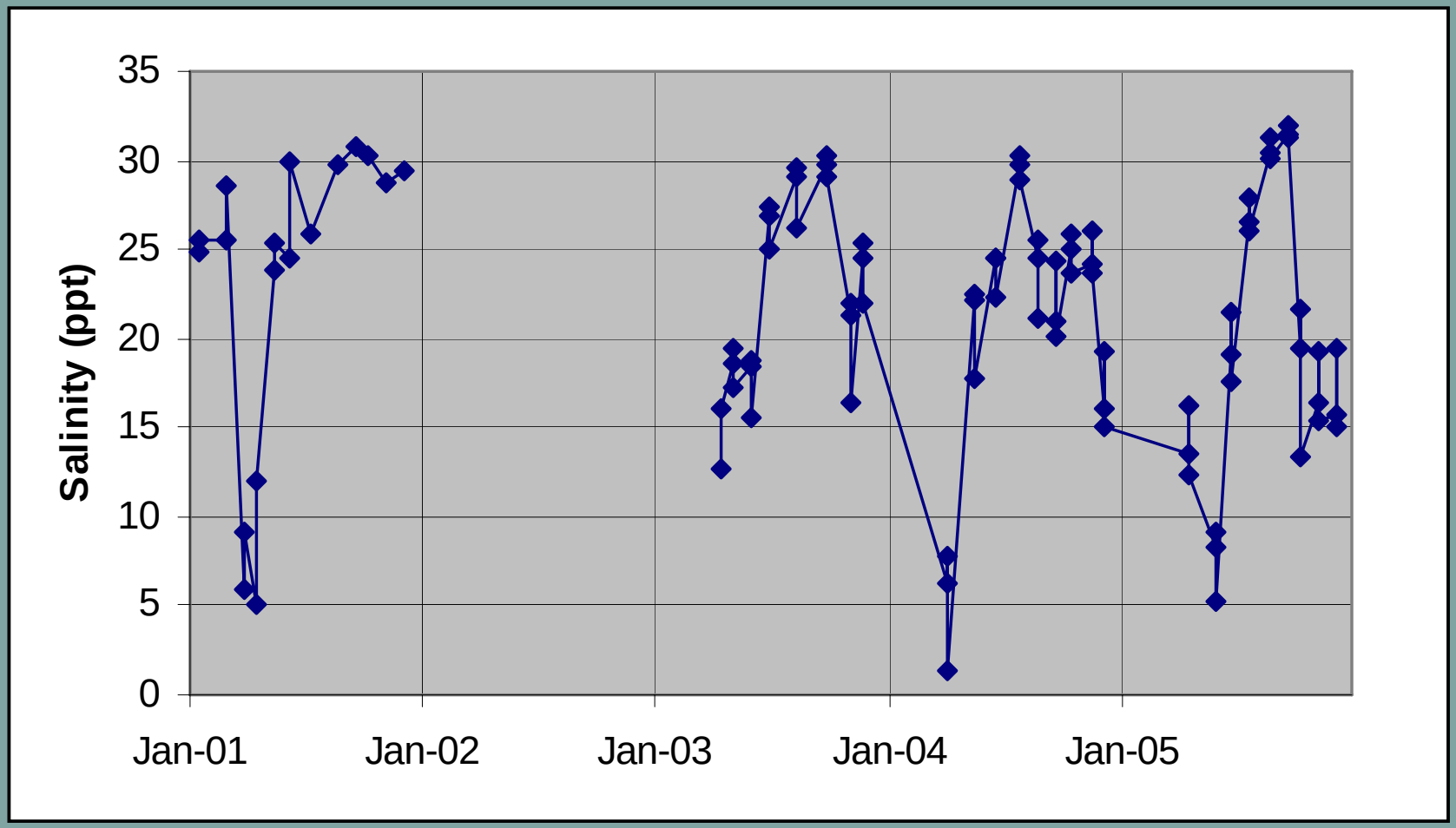


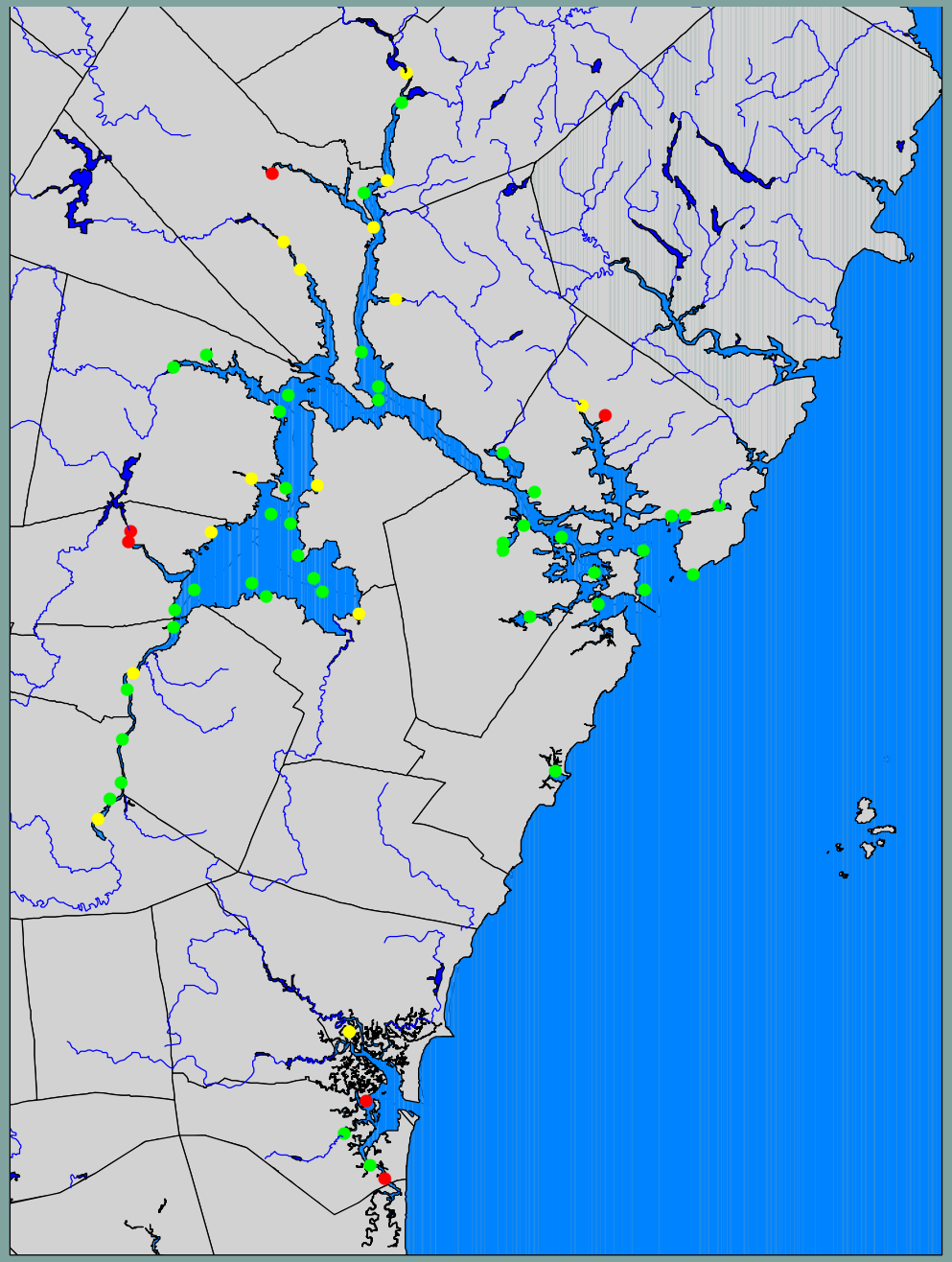
Percentiles calculated from station weighted cumulative distribution function.

Streamflow 2002-2005

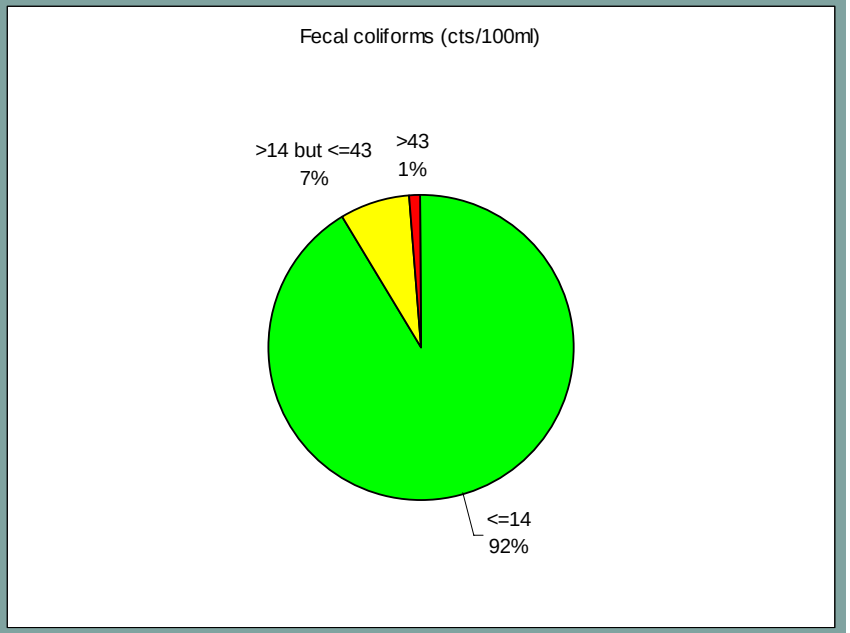


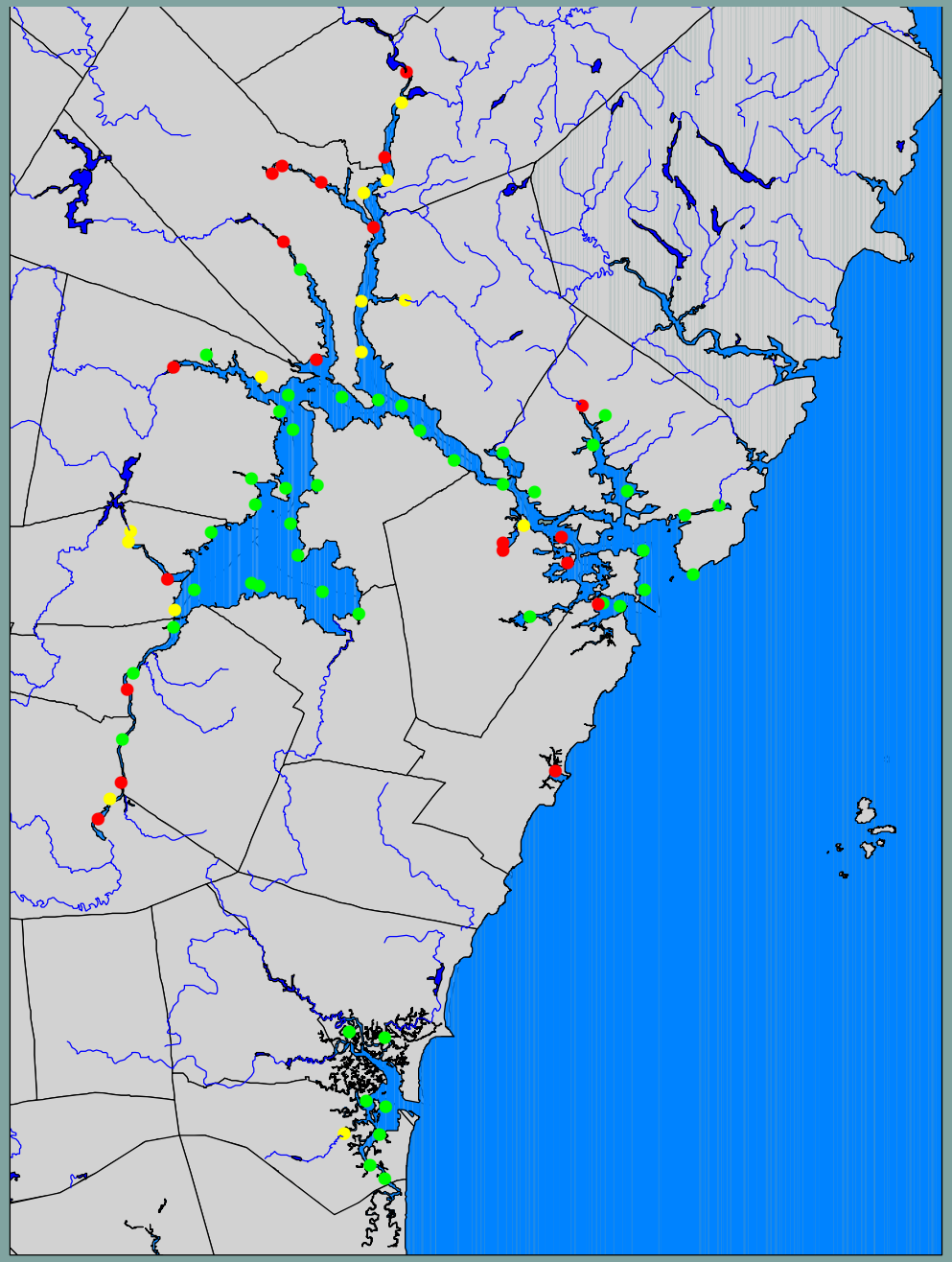
Salinity at Adams Point



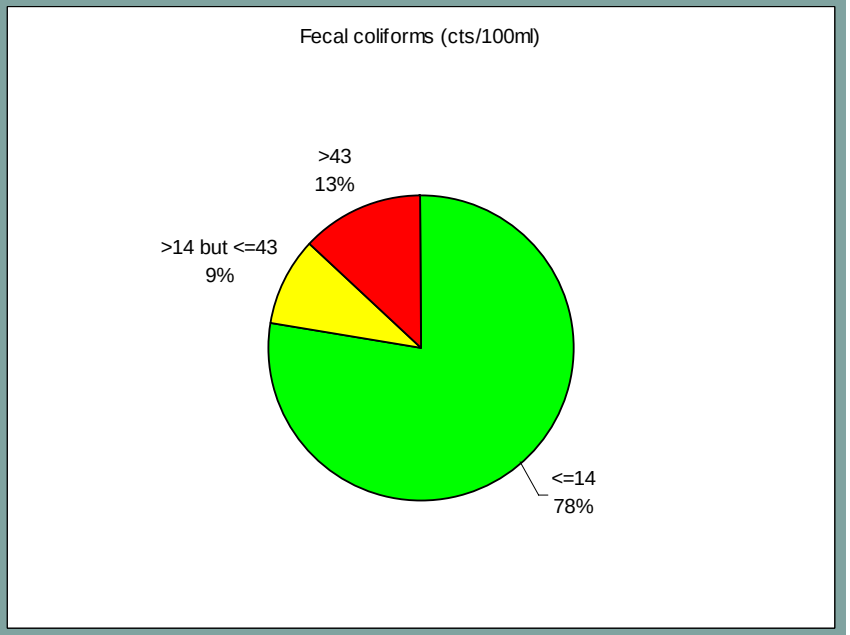


Fecal Coliforms 2002-2003

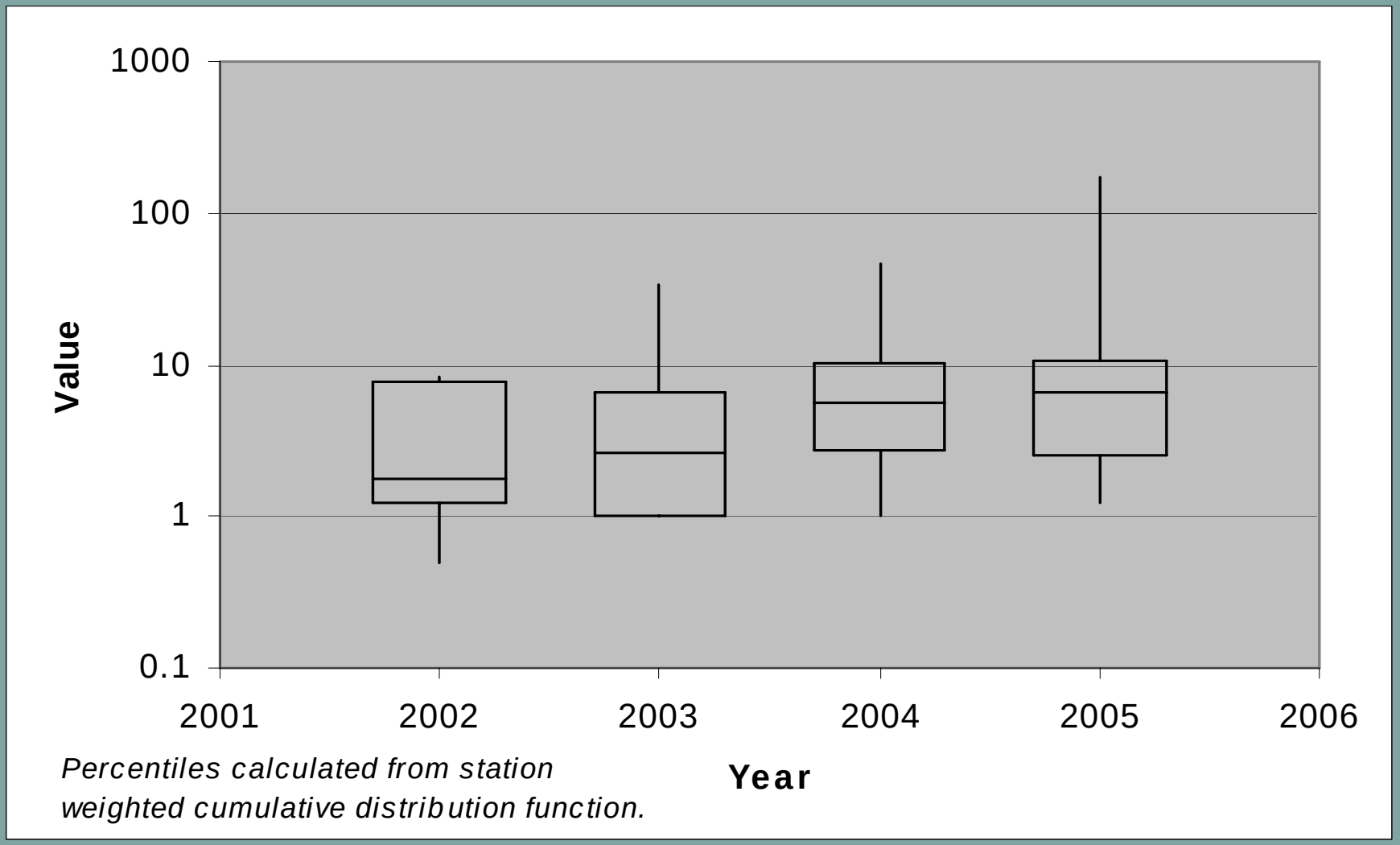




Fecal Coliforms 2004-2005



Fecal Coliforms 2002-2005



Percentiles calculated from station weighted cumulative distribution function.

Summary

- NCA produced expected benefits of improving 305b reporting and building state capacity.
- Also produced unexpected benefits from high station density in NH.
  - Hot spot detection
  - Optimization of sampling designs
  - Meta-trend detection