Albemarle Sound demonstration study for the National Monitoring Network for U.S. Coastal Waters and their tributaries

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What is the National Monitoring Network for U.S. Coastal Waters and their tributaries?

- The National Monitoring Network is a design that can be used to improve estuarine monitoring
  - A “Network of Networks”
  - An integrated, multidisciplinary, and multi-organizational approach to monitoring
  - It will augment existing monitoring programs and link observational capabilities
Implementation of the Albemarle demonstration project

Obj. 1: Assess current monitoring programs
• Inventory current monitoring programs in the Region
• Conduct a gap analysis to determine current monitoring needs
• Publish Albemarle Region monitoring database and report

Obj. 2: Implement monitoring to address data gaps
• Conduct a regional water-quality synoptic
• Implement a pilot monitoring program to address nutrient and phytoplankton data gaps
• Synthesize available data to report on water quality in the Albemarle Sound and provide guidance for further research and monitoring
Partner collaboration has been used

- Document current monitoring programs including
  - Location of monitoring sites
  - Agency contacts
  - Type of data collected
  - Links to on-line holdings
  - Metadata

- Identify specific management issues that research and monitoring could address

- Collaborate on monitoring and research
Develop Albemarle Monitoring Database

• Worked in partnership with Albemarle-Pamlico National Estuary Program
• Compiled information into a geospatial database that could be queried
• Database includes 19 organizations documenting 62 current monitoring, 18 current research, and 26 recently discontinued projects.
Eutrophication status of estuary unknown
Soundwide synoptic conducted

- **Objective:** Improve understanding of water quality in Albemarle Sound with a specific emphasis on eutrophication and harmful algal blooms

- **Samples Analyzed for:**
  - Phytoplankton composition, Nutrients, Silica, DOC, Cyanotoxins
  - Total Suspended Solids
  - Chlorophyll $a$, Temp, DO, pH, conductivity, turbidity, PAR, secchi depth, alkalinity
  - Pesticides (Atrazine and glyphosate)
  - Metals in water and sediment
Results from 2012 synoptic: Number of samples exceeding regulatory limits or NOAA guidelines

- **20 Sediment Samples at 20 sites**
  - ERM Lead (>8.0 ppm, 13 sites)
  - ERL for Mercury (≥ 0.15 mg/kg, 7 sites)

- **41 Water Samples at 33 sites**
  - Chl a (≥ 40 mg/L, 5 samples)*
  - high pH (≥ 8.5, 5 samples)*
  - low DO (<5 mg/L, 2 samples)*
  - Zinc (86 µg/L, 1 sample)*
  - Copper (3 µg/L, 4 samples)*
  - Cyanobacterial cell count (≥100,000 units/mL, 15 samples)**
  - TN (≥ 1 mg/L, 13 samples)
  - TP (≥ 0.1 mg/L, 7 samples)
Relationship between TN and Chl a

\[ y = 33.327x - 9.7223 \]

\[ R^2 = 0.6184 \]

\[ p < 0.0005 \]
$y = 132.9x + 11.406$

$R^2 = 0.1434$

Relationship between TP and Chl a
Chl a (mg/L)
Multidimensional Scaling suggests phytoplankton communities are different in the Currituck Sound.
Nutrient Data for Albemarle Sound

![Bar chart showing nutrient data by section and type of nutrient.](chart_image)
Benefits of Albemarle Demonstration Project

- A better understanding of current monitoring programs in the region
- An improved understanding of how water quality varies spatially and temporally in the Albemarle Sound
- Identification of areas in the region with cyanobacteria blooms that aren’t being monitored
Albemarle Demonstration project being used to build future work

- Working with UNC Coastal Studies Institute and US Army Corps of Engineers to expand continuous monitoring effort in the Albemarle Sound

- Working with Duke Masters’ students to analyze historic datasets and develop visualization tools

- Working with partners to identify funds that can be used to address monitoring gaps in the Albemarle Sound
The NMN is a design that can be used to improve regional monitoring

- The design facilitates partnerships for improving estuarine monitoring
- The design identifies potential data gaps that monitoring networks can address
Huge thanks to our partners!

• Albemarle-Pamlico National Estuary Partnership
• Division of Water Resources
  – Estuarine Monitoring Team
  – Environmental Sciences Section
• Division of Marine Fisheries
  – Elizabeth City Office
• Coastal Studies Institute
• US Fish and Wildlife Service
• US Army Corps of Engineers – Duck FRF
• Eastern North Carolina/Southeast Virginia Ecoteam
• Every person who took the time to report about their monitoring program – Thank you!
For more information:

National Monitoring Network:
http://acwi.gov/monitoring/network/design

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Relationship between Total Algal Density and Cyanobacteria

\[ y = 1.0426x + 25085 \]

\[ R^2 = 0.9456 \]
$y = 0.0578x - 0.2751$

$R^2 = 0.4553$
Relationship between Chl $\alpha$ and Cylindrospermopsin

The diagram shows the relationship between Chl $\alpha$ (in $\mu$/L) and Cylindrospermopsin concentration. The equation of the line is $y = 0.0095x + 0.105$ with an $R^2$ value of 0.1134.
Map 4.1. Location of mapped submerged aquatic vegetation (SAV) habitat in coastal North Carolina (1981-2009). See “Distribution” section for mapping efforts included. Note: Absence of SAV beds in a given area does not suggest actual presence/absence of SAV because surveys have not been conducted in all areas.
Map 8.1. Strategic Habitat Area nominations presented and approved by the Marine Fisheries Commission in January 2009.
• Continuous monitoring of DO, temp, salinity, water level, and turbidity to understand temporal dynamics
• Probabilistic sampling of nutrients in sediment and water
• Synoptic study of endocrine disrupting chemicals (EDCs)
• Deriving historical shoreline erosion rates for the sound
• Developing spatial turbidity models from remotely sensed data
• Model development to improving understanding of how physical and chemical parameters in the system impact biological endpoints (i.e. SAV distribution, oyster restoration success, spawning success, algal blooms)