Using multiple lines of information to develop eelgrass-based nutrient criteria for New Hampshire's Great Bay Estuary

(1) Water Quality Issue (such as D.O, HABs, Floatables, Toxics, Sediment)

Increasing nitrogen concentrations and declining eelgrass beds in the Great Bay Estuary, NH are clear indicators of impending problems for the state's estuaries.

(2) User Community: Who cares and benefits from products?

Coastal and inland managers including NH Department of Environmental Services(NHDES) and the Piscataqua Region Estuaries Project (PREP); scientists; public and industry in the watershed of the Great Bay Estuary

(3) Process (coupling monitoring, models and other tools for enhanced assessment that benefits management decisions from the watersheds to nearshore to coasts)

- Networks: Integration across multiple networks and programs
- Integration of models and other assessment tools with monitoring
- Integrated water-quality assessment

Multiple lines of information were used in developing the nutrient criteria including multiple years of grab samples, in situ autonomous observations including stream gauges, aerial eelgrass mapping, and hyperspectral aerial remote sensing. Observing assets from local volunteers, the University of New Hampshire, the state environmental agency, the US Geological Survey, the Great Bay National Estuarine Research Reserve, and the Northeastern Regional Association of Coastal Ocean Observing Systems were integrated to provide a robust dataset for successful analysis and publication of estuary nutrient criteria.

(4) Outcomes

- Management outcome/decision that results from the assessment; and (or)
- Development of dynamic management tools: Applications to support or inform decision-making (preferably in real-time and in predictive mode)

The establishment of nutrient criteria will result in substantial effort and cost to individuals, municipalities, and industries in the watershed for nutrient reductions from point and nonpoint sources, so criteria must be fully supported by data.

(5) Metrics for tracking success and measuring performance ("Return on Investment")

Continued monitoring of water quality and eelgrass will be essential to measure performance once the criteria are ratified.

(6) Value added from advances in technology (i.e. sensors), assessment tools, or process

Development of these water quality criteria depended on advanced buoy and remote sensing technologies as well as novel analytical techniques.

(7) Gaps and needs for improved outcomes

n/a at this time

Recreational Beach Bacteria Modeling and Forecasting and Consequences to Public Health

Presented by: Shannon Berry – S.C. DHEC, Dr. Heath Kelsey - NOAA, Dr. Dwayne Porter – University of S.C.

(1) Water Quality Issue

Need for predictive capabilities for bacterial contamination at coastal beaches

(2) User Community

State Beach Program, general public

(3) Process

a.) Integration of state program, IOOS observation, and remote sensing data
b.) Empirical modeling to develop predictive model for bacterial concentrations based on environmental factors
c.) Ensemble model approach - Classification And Regression Trees (CART), and regression modeling.

(4) Outcomes

a.) Improved and more timely information for public
b.) Efficiency of effort on the part of state program staff

(5) Metrics for tracking success and measuring performance

Model validation, periodic model re-evaluation, intervention analysis

(6) Value added from advances in technology

a.) NEXRAD precipitation data extraction: programming and GIS tools developed
b.) Data management – SQL database development, seamless data integration, automated data feed
c.) Remote access to data sources, through network and telemetry

(7) Gaps and needs for improved outcomes

a.) Increased asset coverage for improved spatial resolution of observation data
b.) Beachgoer data: who is using the beach (how many people, birds, dogs, etc)
c.) Research: Bacterial source tracking, effects of tropical rain events, sediment resuspension

Examples of Spatial and Ecosystems Connectivity across the West Florida Shelf and the Southeast U.S.

(1) Water Quality Issue (such as D.O, HABs, Floatables, Toxics, Sediment)
HABs, D.O., Fisheries, Source waters

(2) User Community: Who cares and benefits from products?

Agencies (local, state, and federal), public, commercial and recreational fishers, scientists

(3) Process (coupling monitoring, models and other tools for enhanced assessment that benefits management decisions from the watersheds to nearshore to coasts)

- Networks: Integration across multiple networks and programs
- Integration of models and other assessment tools with monitoring
- Integrated water-quality assessment

a. Coordinating coastal ocean observations with coastal ocean circulation models;
b. Downscaling from deep to the coastal ocean and estuaries with multiple models: HYCOM, ROMS, FVCOM;
c. Coordinating agency-derived water quality observations with academic institution R&D: HABs and other measures by the FWC with observations/models both by USF and NCSU;
d. Using new instrument delivery systems with real time telemetry (USF BSOP and subsequently gliders);

(4) Outcomes

- Management outcome/decision that results from the assessment; and (or)
- Development of dynamic management tools: Applications to support or inform decision-making (preferably in real-time and in predictive mode)

Development of an automated, internet accessible red tide tracking tool (USF and FWC).
Publications in refereed professional journals.
Initiation of a Center for Prediction of Red Tide (CPR) for coupled, physical-biological models joint between USF and the FWC (State of Florida funding subsequently retracted by the Governor due to state budget woes).

(5) Metrics for tracking success and measuring performance ("Return on Investment")
Observations and model simulation comparisons are ongoing for circulation and sea level, plus more limited T/S assessments. D.O., nuts, HABs are awaiting more routine data collection and more complete water quality/ecological models, where ecological model is defined as a coupled, physical-biological model with a sufficient number of biological state variables to be representative of HABs and fisheries.

(6) Value added from advances in technology (i.e. sensors), assessment tools, or process
Bottom Stationed Ocean Profiler for use with gliders in sustained, synoptic mapping missions.

(7) Gaps and needs for improved outcomes
A quantitative understanding of the interrelated, spatial and trophic level connections defining the ecosystem is required for Ecosystems-Based-Management. This begins with uniting nutrients with light to fuel primary productivity and continues with the distribution of water properties to facilitate trophic interactions. Fundamental is the ocean circulation. Hence no improved outcomes will result

until the gap in building and sustaining COOS (including coordinated models) is filled. The same can be said for Marine-Spatial-Planning.

Hypoxia in an Urbanized Southeastern Coastal Embayment: Science to Management

(1) Water Quality Issue (such as D.O, HABs, Floatables, Toxics, Sediment)
D.O., Hypoxia, episodic flounder jubilees – Long Bay, North Carolina and South Carolina

(2) User Community: Who cares and benefits from products?
Coastal zone, stormwater, and fisheries managers, scientists, local communities, public, fishers

(3) Process (coupling monitoring, models and other tools for enhanced assessment that benefits management decisions from the watersheds to nearshore to coasts)

- Networks: Integration across multiple networks and programs
- Integration of models and other assessment tools with monitoring
- Integrated water-quality assessment

a. Long Bay Working Group (LBWG) established as a collaboration of academic (USC, CCU, UNC-W), state government (SCSGC, SCDHEC, SCDNR), RA (SECOORA), and local communities.
b. Continuous D.O. and other water quality data collection on private piers.
c. Continuous physical measurements (e.g., wind, tide, currents).
d. Development of a numerical model to describe wind-driven circulation patterns in Long Bay and association continuous data collections.
e. Surveys of nearshore nutrients, organic matter, and phytoplankton biomass; and vertical structure water column physical properties.
f. Coordinated event sampling by LBWG: flounder catches, water quality, nutrients, phytoplankton, groundwater.
g. Measurements of pelagic respiration rates and manipulative experiments in nearshore waters.
h. Characterization of groundwater inputs.

(4) Outcomes

- Management outcome/decision that results from the assessment; and (or)
- Development of dynamic management tools: Applications to support or inform decision-making (preferably in real-time and in predictive mode)

Improved coupling of nearshore and offshore processes.
Development of a conceptual model with some threshold information to predict hypoxia formation.

(5) Metrics for tracking success and measuring performance ("Return on Investment")
Determining the relative role of land and offshore contributions.

(6) Value added from advances in technology (i.e. sensors), assessment tools, or process
n/a at this time.

(7) Gaps and needs for improved outcomes

Continuous and additional physical, water quality, and biogeochemical data collection to understand the input of oxygen demanding substances from coastal development and oxygen budget to develop management actions. Additional funding being sought from NOAA.

Spatial and Temporal Dissolved Oxygen Concentrations and Oxygen Depletion in the Delaware River Basin Demonstration Area of the National Monitoring Network for Coastal Waters and Their Tributaries

(1) Water Quality Issues:

- **Evaluation of the spatial (horizontal and vertical) and temporal distribution (status, trends, and real time) of dissolved oxygen (DO) and DO depletion in the Delaware River Basin from the head of tide to the Atlantic Ocean.**
- **Determination of the aquatic health of the water in rivers above the head of tide, estuaries, wetlands, coastal areas, ocean areas of the Delaware Basin as per criteria set by the Delaware River Basin Commission (DRBC) and the individual states in the Basin (New York, Pennsylvania, New Jersey and Delaware).**
- **Evaluation of the use of continuous, real time, discrete, and probabilistic observations of DO by agencies including DRBC, USGS, USEPA, NOAA, States, and water utilities.**
- **Evaluation of the effects of nutrients on DO concentrations in water**
- **Relation of DO depletion to the biology of the Delaware Basin and shad population**

(2) User Community: Who cares and benefits from these products?

- **Federal (NOAA, USEPA, USGS, USCOE), Interstate (DRBC), State (NY, PA, NJ, DE), and local water-quality managers and scientists**
- **water and wastewater utilities**
- **commerce as the Delaware Estuary is one of the Nation's largest ports**
- **fishermen and the public.**

(3) Process: (coupling monitoring, models and other tools for enhanced assessment that benefits management decisions from the watersheds to nearshore to coasts)

- **Networks: Integration across multiple networks and programs**
  - **NOAA: NERRS, PORTS, Mussel Watch,**
  - **USEPA: NCA**
  - **USGS: NAWQA; Continuous/real time and di**
  - **DRBC: Boat Run**
- States
- Universities
- PDE
- **Linking continuous monitoring stations, discrete, and probabilistic data to DRBC / State Water Quality Criteria by Zone;**
- **Integration of applications and models and other assessment tools with monitoring**
  - **Philadelphia Water Department's River Cast is a real time system that estimates the health of the surface water in the Schuylkill (http://www.phillyrivercast.org)**
  - **Delaware River Real Time Monitoring for Real Time Management by Yagecic**
  - **Nowcasting to Protect Public Water Supply: Using Real Time Data in an Emergency Flow and Transport Model by Suk and Yagacic**
  - **Delaware Valley Early Warning System for water utilities http://www.delawarevalleyews.org/EWS**
  - **SPARROW models at different scales to estimate nutrient loads to river/estuary**
  - **Probability of contamination of groundwater and surface water in NJ**

(4) Outcomes: Management outcomes/decision that results from the assessment and (or) development of dynamic management tools: Applications to support or inform decision-making (preferably in real-time and in predictive mode)

- **Coordination with Federal, Interstate, State, and local water quality managers to plan for short term and long term remediation of water quality---improvements to wastewater treatment and nonpoint source controls**
- **Improvements to wastewater treatment and nonpoint source controls**
- **The City of Philadelphia is planning to implement $1.6 billion dollars over the next 20 years for CSO and nonpoint controls---Green Cities Clean Water Program**
- **More refined assessment and coordination among water-quality-data users**
- **Adaptive monitoring in cases where DO exceeds a water-quality criterion in an area**

(5) Metrics for tracking success and measuring performance (Return on Investment)

- **Need to conduct a cost/benefit analysis for different observation methods**
- **Better integrated assessment over time by using all the data**
- **Monitoring at a more valuable frequency?**

(6) Value added from advances in technology (i.e. sensors), assessment tools, or process

- **Directly feeding the data from sensor into frameworks that use the data**
- **React to problems in real time—not several months or years later**
- **Better able to determine diurnal, seasonal, and monthly variability of DO and other water-quality in different compartments of the system.**

(7) Gaps and needs from improved outcomes

- **Need better coverage of real time DO in shallow waters in estuary near streams**
- **Need better coverage at the boundary of the system by using the Cape May Ferry**
- **Need sensors that correspond to assessment such as nitrate and ammonia / phosphorus**
- **Opportunities to look at combined parameters for resource-specific assessments.**

NJDEP Remote Sensing for HAB Monitoring in Coastal Waters of New Jersey

(1) Water Quality Issues:

- **Use of aircraft remote sensing to enhance public health protection through improved monitoring for HABs.**

(2) User Community: Who cares and benefits from products?
States, water quality managers, seafood consumers, seafood industry, recreational bathers.

(3) Process (coupling monitoring, models and other tools for enhanced assessment that benefits management decisions from the watersheds to nearshore to coasts)
Networks: Integration across multiple networks and programs
Integration of Models and other assessment tools with monitoring
Integrated Water-Quality Assessment

- **After completion of a flight, data is uploaded to the Internet within minutes.**
- **Web access is user-friendly with a familiar map interface**
- **Data will be readily integrated into the MARCOOS network for overlay with other data sources.**

(4) Outcomes

- **Mangement outcomes/decision that results from the assessment and (or)**
- **Development of dynamic management tools: Applications to support or inform decision-making (preferably in real-time and in predictive mode)**

Since HAB monitoring requires costly vessel sampling to determine what species is blooming, the aircraft remote sensing allows coverage of a much larger area and in a short time-frame with the ability to then target the costly vessel sampling to the actual location of a bloom.

(5) Metrics for tracking success and measuring performance (Return on Investment)
 # HAB blooms identified over a given time period.

(6) Value added from advances in technology (i.e. sensors), assessment tools, or process

- **Greater spatial and temporal coverage**
- **Ability to target costly sampling to waters with greatest need.**

(7) Gaps and needs from improved outcomes

- **Telemetry link to speed data flow**
- **Better sensors (e.g. push-broom type) to provide raster versus current point measurement.**
- **Capability for recording and analyzing multiple wavelengths to identify different types of blooms.**