The National Estuarine Research Reserve System Wide Monitoring Program

Dwayne Porter (USC) and Whitley Saumweber (NOAA)
National Water Quality Monitoring Council Meeting
10 March, 2009
Reserves are protected for:

- Long-term research and monitoring
- Education
- Resource stewardship

27 reserves protecting 1.3 million acres estuarine lands and waters
1. Strengthen the protection and management of representative estuarine ecosystems to advance estuarine conservation, research, and education.

2. Increase the use of reserve science and sites to address priority coastal management issues.

3. Enhance peoples’ ability and willingness to make informed decisions and take responsible actions that affect coastal communities and ecosystems.
System-wide Monitoring Program

- **Goal:** Promoting stewardship of the Nation’s estuaries through science and education using a system of protected areas.

- **Purpose:** To identify and track short-term variability and long-term changes in the integrity and biodiversity of representative estuarine ecosystems and coastal watersheds for the purpose of contributing to effective national, regional, and site specific coastal zone management.
System-Wide Monitoring Program Phases

I. Abiotic Monitoring
   Water Quality & Nutrients
   Weather Parameters

II. Biological Monitoring
    Habitat Change
    Biodiversity

III. Land Cover/Use and Habitat Change
     Spatial Patterns
     Human Impacts
SWMP “Abiotic” Monitoring (Phase I)

**Parameters Monitored**

<table>
<thead>
<tr>
<th>Water parameters:</th>
<th>Weather parameters:</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>Temperature</td>
</tr>
<tr>
<td>Conductivity</td>
<td>Wind speed and direction</td>
</tr>
<tr>
<td>Salinity</td>
<td>Relative humidity</td>
</tr>
<tr>
<td>Temperature</td>
<td>Barometric pressure</td>
</tr>
<tr>
<td>Dissolved Oxygen</td>
<td>Rainfall</td>
</tr>
<tr>
<td>Turbidity</td>
<td>Photosynthetic</td>
</tr>
<tr>
<td>Nitrate</td>
<td>Active Radiation</td>
</tr>
<tr>
<td>Ammonia</td>
<td></td>
</tr>
<tr>
<td>Ortho-Phosphate</td>
<td></td>
</tr>
<tr>
<td>Chlorophyll a</td>
<td></td>
</tr>
</tbody>
</table>

- *Identify and track short-term variability and long-term changes in the integrity and biodiversity of estuarine ecosystems.*
Telemetry through Geostationary Operational Environmental Satellites (GOES)

GOES Satellite

Wallops Island Command and Data Acquisition Facility

DOMSAT

Hydrometeorological Automated Data System
NOAA's National Weather Service
Office of Hydrologic Development

NERRS/Centralized Data Management Office (CDMO)

NERRS Satellite Receive Station at the University of South Carolina, Columbia

Annualy

NODC
National Ocean Data Center Archive
SWMP “Abiotic” Monitoring (Phase I)

- Currently 111 SWMP WQ stations (nominally 4/Reserve)
- Of these, 39 are telemetered for near-RT data delivery
- There are also 28 Wx Stations (1/Reserve), all of which are telemetered for near-RT data delivery
- All non-telemetered data is archived and available in provisional form within 2 weeks of collection

- Identify and track short-term variability and long-term changes in the integrity and biodiversity of estuarine ecosystems.
WQ Station Deployment Strategy

Initial Deployment Coverage

Non-point Source-influenced

Enhanced Deployment Coverage

“Estuarine Gradients”
- Salinity
- Land-use
- Habitat
- Vertical

Reference site

Impacted site
SWMP Phase II Biomonitoring Pilot Projects

Pilot Projects: Biological Monitoring of Emergent Marshes and Submerged Aquatic Vegetation

SAV/EM Tier 2 – Habitat Quality: Ground-based Surveys of Seasonal Changes in Species & Communities

Eelgrass: Zostera marina

Cordgrass: Spartina alterniflora
SWMP Phase III: Land Use and Habitat Change

**Goals**
- Applying geospatial land use / land cover data to facilitate an understanding of changes in land use and climate on estuarine habitats
- Translating information to decision makers and the general public

**Products**
- GIS land cover datasets and change analysis for reserves and watersheds
- DEMs and Tidal Datums for each reserve and watershed
- Analysis and dissemination of trends in land use and habitat change at multiple scales to targeted audiences
The Centralized Data Management Office (CDMO) was established in 1995 as a partnership between USC and NOAA in order to support NERRS SWMP data management needs.

- develop, implement and manage the basic infrastructure and data protocol of the NERR SWMP, and
- support the assimilation and exchange of data and metadata within the NERRS framework and to outside users.
Conservatively, the CDMO reviews, archives and disseminates:

- 13.5 million data points per year for the water quality monitoring program (4 stations collecting 8 parameters every half-hour at 27 NERRS sites)
- 34.4 million data points per year for the meteorological monitoring program (1 station collecting 25 parameters quarterly, hourly and daily intervals at 27 NERRS sites)
- 31,104 data points per year for the nutrient monitoring program (4 stations collecting monthly grabs and 1 station collecting monthly diel of 6 parameters at 27 NERRS sites)
NERRS Contributes to IOOS

IOOS Development Plan defines:
1) Global Component
2) Coastal Component
   17 Federal Agencies
   11 Regional Associations

3 subsystems: Observing, Data Management and Communication, Modeling and Analysis;
2 cross cuts: Research and Development; Education

U.S.
Integrated Earth Observing System
IEOS

International
Global Earth Observing System of Systems
GEOSS

Integrated Ocean Observing System
IOOS

GOOS
Global Ocean Observing System

Slide courtesy of C. Alexander
**NERRS Data Translation Work**

- **Metadata translation effort**
  
  Developed a conversion program that takes existing metadata and reformats for importation into Meta-Door.

  Meta-Door then converts to FGDC compliance
NERRS Data Translation Work

• Metadata translation effort

Start with text

ACE Basin National Estuarine Research Reserve Water Quality Metadata Report
January-December 2000
Latest Update: May 22, 2001

I. Data Set & Research Descriptors
1. Principal investigator & contact persons:

SCDNR/Marine Resources Division
217 Fort Johnson Road
Charleston, SC 29412
(843) 762-5000

ACE Basin NERR field station
15717 Bennett's Point Road
Green Pond, SC 29441
(843) 844-8822

Contact Persons:
Dr. Elizabeth Wenner, Research Coordinator
E-mail: wenner@nrd.dnr.state.sc.us; (843) 762-5050

Saundra Upchurch, Reserve Biologist
E-mail: upchurch@nrd.dnr.state.sc.us; (843) 762-5000 ext. 2032

Amy Whitaker, Reserve Technician
E-mail: whitaker@nrd.dnr.state.sc.us; (843) 762-5000 ext. 2078

2. Entry verification:
The data are directly downloaded from the YSI Model 6000 sonde to comma-
delimited files (*.csv) and PC6000 files (*.dat). The comma-delimited files are imported into Excel 97 where they are formatted and processed by macros that are supplied by the CDMO. Various macros are designed to:

End with XML

- <metadata>
  - <dinfo>
  - <citation>
    - <citeinfo>
      - <origin>
        Principal investigator(s) and contact persons SCDNR/Marine Resources Division ACE Basin NERR field station 217 Fort Johnson Road 15717 Bennett’s Point Road Charleston, SC 29422 Green Pond, SC 29441 (843) 762-5000 (843) 844-8822 Contact Persons: Dr. Elizabeth Wenner, Research Coordinator E-mail: wenner@nrd.dnr.state.sc.us; (843) 762-5050 Saundra Upchurch, Reserve Biologist E-mail: upchurch@nrd.dnr.state.sc.us; (843) 762-5000 ext. 2032 Amy Whitaker, Reserve Technician E-mail: whitaker@nrd.dnr.state.sc.us; (843) 762-5000 ext. 2078
      </origin>
    - <pubdate>20050621</pubdate>
  - <title></title>
</metadata>
NERRS Data Translation Work

- Metadata translation effort

And publish FGDC-compliant metadata

Metadata:

- Identification Information
- Data Quality Information
- Spatial Data Organization Information
- Entity and Attribute Information
- Distribution Information
- Metadata Reference Information

Identification Information:

Citation:

Citation Information:

Originator:

Principal investigator(s) and contact persons Wendy Allen, Manager, wallen@belle.baruch.sc.edu Tracy Buck, Research Specialist, tracy@belle.baruch.sc.edu Chris Buzzelli, Research Coordinator, cbuzz@belle.baruch.sc.edu Address: Baruch Marine Laboratory University of South Carolina PO Box 1630, Georgetown, SC 29442 Phone: (843) 546-6219 Baruch
NERRS Data Translation Work: Exchanging Environmental Data for the Gulf of Maine

- Create XML from Partner Data
- Submit to Node via HTTPS (Firewall friendly)
- GoMOOS to assist with node client setup
Data Exchange Template Development

Will use:

- Exchange Network (EN) data standards
- Water Quality Exchange (WQX) 2.0 data exchange template
- any other standards/templates/schemas to help build template (NBII, JGOF, Environment Canada, IOOS, modeling, others?)
- can add things to template not covered by data standards
- consider different types of data from partners: physical/chemical, biological, spatial, modeling, buoy etc.
- do have the option of using the WQX as is