Integrated Approaches for Coastal Monitoring

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Developments in Coastal Water Quality Monitoring

- Increasing use of automated sensors and new monitoring platforms is producing a wealth of water quality data on coastal waters.
- New and traditional monitoring systems produce data at widely varying frequencies and geographic scales using very different data formats.
Data Sources

Traditional Fixed-Station Boat Sampling

Microbial

Phytoplankton
Species ID

Bacterial

Viral

Macroscopic Biota for measuring Ecosystem Health
Data Sources

Real-time & Near Real-time Monitoring

Real-time Monitoring Buoy

Slocum Glider

Remus AUV
Data Sources

Remote Sensing

Land-Based

Satellite

Aircraft

Surface Currents (CODAR)

Weather Radar

MODIS
The Challenge...

- To integrate these various data sources at the regional, national and global level to translate this wealth of data into readily accessible information for short-term and long-term management decisions on coastal water quality.
Examples of Data Integration

- National - NOAA’s NowCoast
- Regional - Chesapeake’s Eyes on the Bay
Gulf of Mexico Harmful Algal Bloom Bulletin
27 March 2006
NOAA Ocean Service
NOAA Satellites and Information Service
Last bulletin: March 20, 2006

Conditions Report
No impacts are expected in any Florida Counties this week. Due to current harmful algal bloom inactivity, bulletins are issued each Monday, until conditions warrant continuance of twice weekly bulletins.

Analysis
No *K. brevis* was detected last week in any samples from Citrus to Monroe County, or in offshore samples collected south of the Keys. Chlorophyll levels remain elevated (approximately 3-5 µg/L) in a band along the Gulf coast of the lower Keys. Samples for the past few weeks have not indicated the presence of *K. brevis* in this area, and conditions are not favorable for new bloom formation. Reports of discolored water are possible north of Marathon.

There is currently a satellite navigation issue that is resulting in a shift...
### Marine Water Monitoring

**Automated Sensor - Absecon Channel**

- **Location:** Just north of the Vincent Haneman Bridge in Absecon Channel
- **Coordinates:** 39° 23’ 15” N 74° 25’ 34” W
- **Sensors:** Temperature, salinity, dissolved oxygen, pH, turbidity, chlorophyll a
- **Status:** Operational

#### CURRENT CONDITIONS

As of 12/14/2005 2:02:01 AM

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>11.87°C</td>
<td></td>
</tr>
<tr>
<td>Salinity</td>
<td>22.80 PPT</td>
<td></td>
</tr>
<tr>
<td>Dissolved Oxygen</td>
<td>7.31 mg/L</td>
<td></td>
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<tr>
<td>pH</td>
<td>7.83</td>
<td></td>
</tr>
<tr>
<td>Turbidity</td>
<td>3.20 JTU</td>
<td></td>
</tr>
<tr>
<td>Chlorophyll a</td>
<td>1.80 µg/L</td>
<td></td>
</tr>
</tbody>
</table>
Discharge, cubic feet per second

Most recent value: 7,340  04-12-2006  11:45

USGS 01463500 DELAWARE RIVER AT TRENTON NJ

Download a presentation-quality graph

Daily mean flow statistics for 4/12 based on 92 years of record in ft³/sec
Recent Water and Habitat Conditions in Maryland’s Chesapeake Bay and Coastal Bays

Emerging new monitoring technologies coupled with traditional monitoring programs are allowing natural resource managers and the public to better understand, evaluate, preserve and restore the health of Maryland’s water and living resources. The water and habitat quality monitoring data we collect are used to help us characterize existing conditions and long-term trends, detect water quality changes in response to management actions, protect living resources, and develop the most cost-effective solution to restore our Bays and tributaries.

Click the markers on the map below to see the latest Fixed Station Monthly Monitoring data, Continuous Monitoring data, and Water Quality Mapping data collected by Maryland’s Chesapeake Bay & Coastal Bays Water Quality Monitoring Programs.

Click Stations for Data

Monitoring Type:
Continuous Monitoring Stations

Data Variables:
Water Temperature, Salinity, Dissolved Oxygen, Water Clarity (Turbidity), Chlorophyll, pH

Data Frequency:
Data Collected Every 15 Minutes

Data Geographical Distribution:
Data Collected Throughout Maryland’s Chesapeake and
Corsica River - Cedar Point

Meter Depth:
Suspended, 1 meter Below the Surface

Station Depth:
1.9 meters (MLW: Mean Low Water)

Coordinates (NAD83):
Latitude: 39.0632°
Longitude: -76.1073°

Water Quality Data

Note: Missing data may result from equipment malfunctions or the rejection of “bad” data during quality assurance and quality control checks.
The yellow shaded area represents the range of monthly mean values that have occurred from 1985 to 2004. The blue line shows the monthly mean values for each month over that same time period. The red line shows what the current year's conditions are and how they compare to the range and the average values we've seen.

2006 **Bottom Water Dissolved Oxygen**
Upper Eastern Shore / Lower Chester River (ET4.2)
Map Query Results

Chester River - 6/9/2005

Dissolved Oxygen (mg/L)
- 0 - 2.5
- 2.5 - 5
- 5 - 7.5
- 7.5 - 10
- 10 - 12.5
- 12.5 - 15

Salinity (ppt)
- 0 - 2.5
- 2.5 - 5
- 5 - 7.5
- 7.5 - 10
- 10 - 12.5
- 12.5 - 15
- 15 - 17.5
- 17.5 - 20

Temperature (°C)
- 10 - 12.5
- 12.5 - 15
- 15 - 17.5
- 17.5 - 20
- 20 - 22.5
- 22.5 - 25
- 25 - 27.5
- 27.5 - 30

Turbidity (NTU)
- 0 - 7.5
- 7.5 - 15
- 15 - 22.5
- 22.5 - 30
- 30 - 37.5
- 37.5 - 45

Chlorophyll (ug/L)
- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 100
- 100 +

Chester River
(Upper - 6/9/05; Lower 6/9/05)
Data Uncorrected for Time of Day Influences
Inverse Distance Weighted Interpolation
Preliminary Data - Not to be Used Without DNR Permission
© July 2005, Maryland Department of Natural Resources
Lpper/Lower Cruise Division
MODIS - Satellite Imagery

Choose a True Color Image:

04/11/2006
04/10/2006
04/09/2006
04/08/2006
04/07/2006
04/05/2006
04/04/2006

or a Data Map:

04/11/2006 - Turbidity
04/11/2006 - Temperature
04/11/2006 - Chlorophyll
04/10/2006 - Turbidity
04/10/2006 - Temperature
04/10/2006 - Chlorophyll
04/09/2006 - Turbidity

Chlorophyll
April 11, 2006

Satellite: Aqua
Instrument: MODIS
1 KM Resolution

This image is available at Maryland DNR's:
www.eyesonthebay.net

MODIS data courtesy of the Ocean Biology Processing Group at NASA/GSFC
oceancolor.gsfc.nasa.gov
Integrated Systems for the Mid-Atlantic

• Mid-Atlantic Coastal Ocean Observing Regional Association (MACOORA)
  – This recently formed organization is planning to integrate coastal ocean observing for the Mass - Va. Region.
  – Pilot projects and user surveys are being planned.
  – Handouts on MACOORA are available at this workshop
Benefits for NJ coastal waters

Example: Better characterization and understanding of phytoplankton blooms
January 23, 2006
1.6” recorded at Atlantic City, NJ
Routine Boat Sampling

Nitrate & Nitrite vs Salinity
Barnegat Bay @ Seaside Park

$R^2 = 0.0126$
Routine Boat Sampling

Orthophosphate vs Salinity
Barnegat Bay @ Seaside Park

$R^2 = 0.15$
Ammonia vs Salinity
Barnegat Bay @ Seaside Park

R² = 0.2248
Benefits for NJ coastal waters

Example: Better characterization and understanding of important ecosystem measures such as dissolved oxygen
Dissolved Oxygen Trends & Patterns

![Map of Dissolved Oxygen Trends]

- **DO Min (mg/L):**
  - 0 - 2
  - 2 - 3
  - 3 - 5
  - 5 - 20

*2006, NJDEP Bureau of Marine Water Monitoring, based on USEPA data from STORET*
Need better understanding of DO and its relation to ecosystem health in ocean waters

• What is the duration of low DO levels?
• What is the geographical extent of areas of low DO?
• What measurable impacts are there to the biota?
• New technologies and methods now being developed will help us to answer these questions.
Integrating coastal monitoring systems helps us to better manage our coastal waters by:

- By providing more complete monitoring coverage (temporal and spatial)
- By providing the means to better assess cause and effect relationships
- By allowing us to develop better models of coastal water quality conditions
Average Dissolved Oxygen Levels
1995 - 2000

Ave. DO (mg/L)
- 0 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 12

Coast