





**MACOORA Sub-region Activities: Delaware Estuary**





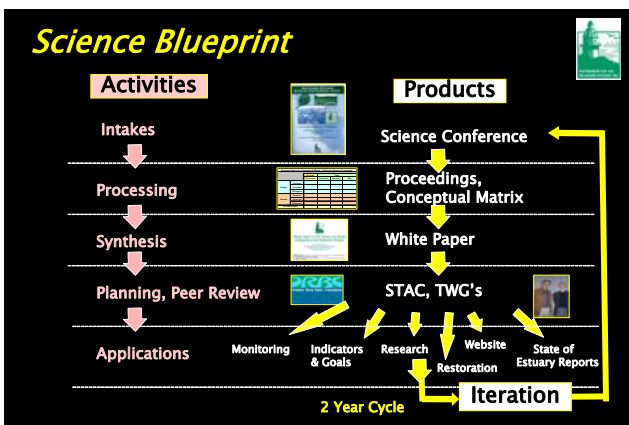
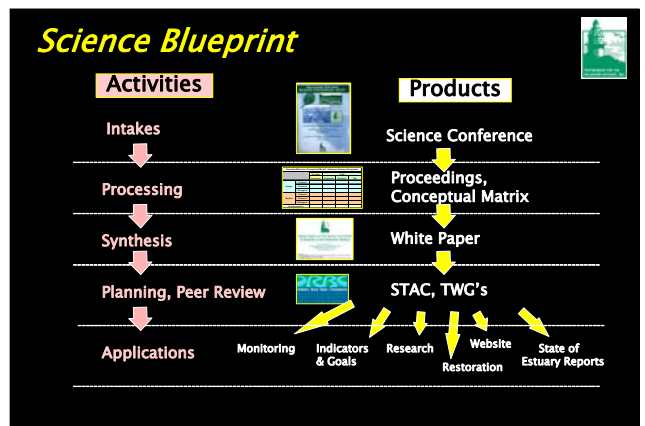
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**MACOORA Sub-region Activities: Delaware Estuary**

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**Future Activities**

**Delaware Estuary Science Conference**  
January 22-24, 2007  
[www.DelawareEstuary.org](http://www.DelawareEstuary.org)




## Future Activities

- 2007 Delaware Estuary Science Conference
- The National Water Quality Monitoring Network for U.S. Coastal Waters and their Tributaries

<http://acwi.gov/monitoring/>

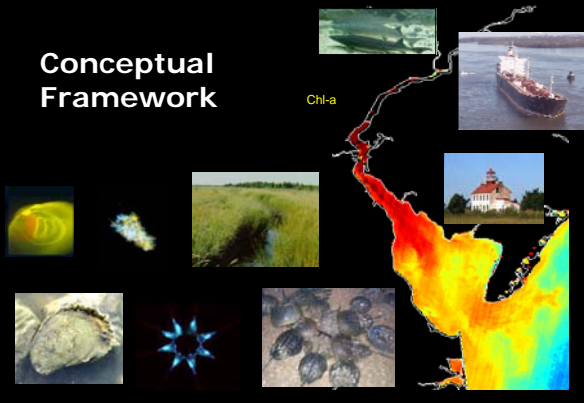


## Future Activities

- 2007 Delaware Estuary Science Conference
- The National Water Quality Monitoring Network
- Funding Mechanisms
- Conceptual Framework



## Conceptual Framework



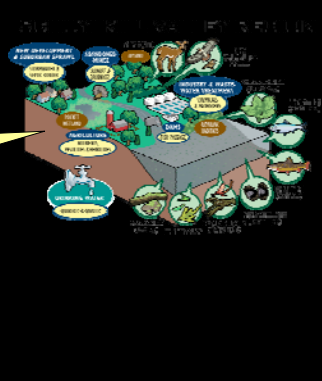
## Conceptual Framework



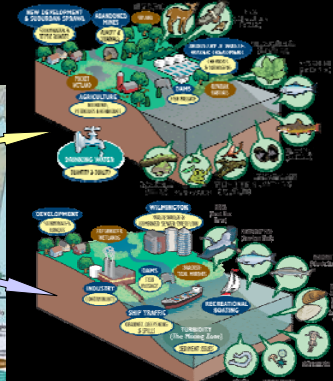
**The Delaware Estuary**  
A WATERSHED OF DISTINCTION

The name for Delaware Estuary is not only a name, it is a story. It is a story of a place that is a watershed of distinction. It is a story of a place that is a watershed of distinction. It is a story of a place that is a watershed of distinction.

## Conceptual Framework



## Conceptual Framework



## Future Activities

- 2007 Delaware Estuary Science Conference
- The National Water Quality Monitoring Network
- Funding Mechanisms
- Conceptual Framework
- Web-Based Info Clearinghouse



## Web-Based Info Node

**Monitoring**

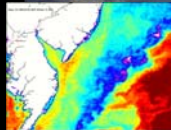
**Restoration**

**Goals**

**Indicators**

## IOOS Assets

- Existing Monitoring – e.g., DRBC Boat Run, USGS gauges, PORTS
- Some real-time data collection – e.g., T, Salinity, DO, tidal height
- Delaware Bay Observing System
- Rutgers IMCS and Univ. of Delaware remote sensing
- Rutgers COOL Room and LEO



## Science Strengths

- Excellent brain trust
- Good examples of working together



## Future

**White Paper on the Status and Needs of Science in the Delaware Estuary**

A Publication of the Partnership for the Delaware Estuary  
A National Estuary Program  
[www.DelawareEstuary.org](http://www.DelawareEstuary.org)

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**White Paper on the Status and Needs of Science in the Delaware Estuary**

**Top Six Operational Needs**

1. Strengthen **Linkages Between Science and Management**
2. Develop a **Conceptual Framework** Describing the Ecosystem
3. Implement an **Ecosystem Management** Approach
4. **Grow the Monitoring Infrastructure and Link to Improved Indicators and Goals (e.g., DEWOOS)**
5. Improve **Data** Coordination, Compatibility, Quality, Sharing, Access and Archiving
6. **Educate** Public and Build **Identity** for Defining Traits and Issues



## Technical Needs

1. Contaminants (forms, sources, fates & effects for different classes)
2. Tidal Wetlands (status, trends and relative importance of different types)
3. Ecologically Significant Species & Critical Habitats (benthos, horseshoe crabs)
4. Ecological Flows (effects of flow changes on salt balance & biota)
5. Physical-Chemical-Biological Linkages (e.g., sediment budgets, toxics & biota)
6. Food Web Dynamics (key trophic components)
7. Nutrients (forms, concentrations and fluxes)
8. Ecosystem Functions (assessment and modeling)
9. Habitat Restoration and Enhancement
10. Invasive Species (monitoring, management)



## Tidal Wetlands

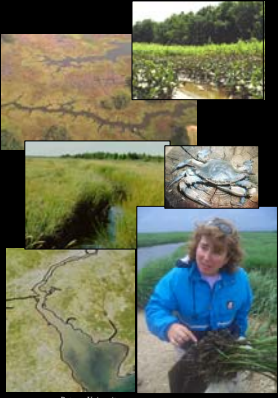
### A Signature Trait of System

- Near Contiguous Band
- Diverse: *Freshwater Tidal Marshes*  
*Brackish Marshes*  
*Salt Marshes*

Ecological Values:

Structural  
*habitat for fish and wildlife*  
*nurseries for imperiled taxa*

Functional  
*food web*  
*water quality*  
*flood protection*



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Concerns:  
Sea level rise  
Degradation  
Inundation



Long Island Hurricane  
September 1921

## Shoreline Erosion

Maurice River Mouth  
2002 aerial photograph



1890 shoreline


Courtesy D. Bushek, Rutgers

Courtesy J. Gebert, ACOE

## Holistic Monitoring

Example Matrix for Conceptual Model - Delaware Estuary Ecosystem

		Tidal			
		Freshwater	Freshwater	Brackish	Bay
Pelagic	Physical				
	Chemical				
	Biological				
Benthic	Physical				
	Chemical				
	Biological				
Socioeconomic					



## A Pilot Integrated Observing System for the Delaware Estuary:

### The Delaware Estuary Watershed to Ocean Observing System (DEWOOS)

Linking Monitoring of Watershed, Estuary, and Coastal Ocean

A Planning Concept from: Delaware River Basin Commission, University of Delaware, Rutgers University, US Geological Survey, NOAA, states of New Jersey and Delaware, Partnership for the Delaware Estuary, DE, NJ and PA Sea Grant, and others

## Operational Needs



### Top Six Operational Needs

1. Strengthen **Linkages Between Science and Management**
2. Develop a **Conceptual Framework** Describing the Ecosystem
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## Specific Goals

- Apply Integrated Ocean Observing System (IOOS) type measurements to watershed, estuary, coastal ocean
- Use as pilot for other MACOORA and national implementations
- Develop and deploy real-time sensors and interpret records
- Integrate data from both discrete sampling and continuous measurement installations throughout the estuary and coastal ocean
- Show how a cooperative regional monitoring system can be linked to and enhance National Water Quality Monitoring Network (NWQMN)

## Complexities

### Delaware Estuary Notables

Upper Watershed:  
"pristine" recreational area  
NYC water supply

Tidal River:  
4th largest US urban center  
3rd largest petrochemical port  
Major industry buildup

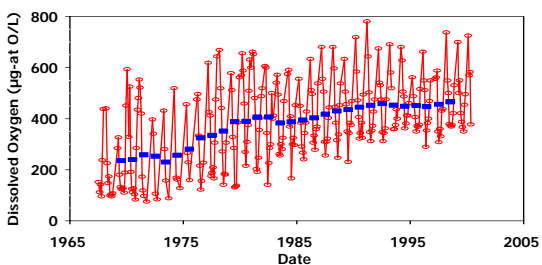
Lower Estuary:  
Water fowl, fisheries  
Major recreational area

Dense population

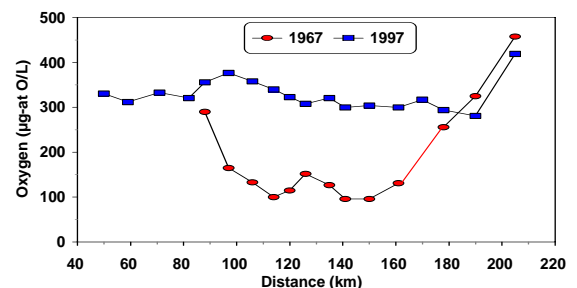


## Some Delaware Estuary Issues

- Freshwater inflow
- Water use
- Oxygen depletion
- Nutrient enrichment and biogeochemical processes
- Better linkage of physical, chemical, and biological systems
- Transportation and port security
- Estuarine sediments and beach processes
- Contaminants
- Impact of sea-level rise



Dissolved oxygen in the Delaware River near Philadelphia from DRBC Boat Run monitoring. Monthly mean concentrations (open red circles) and 5-year running average values (solid blue squares). Annual increase from 1970-1990 of 10 µg-at O/L (= 3.2 mg/L in 20 years).



Oxygen sag of earlier years extended throughout the urban reach of the Delaware River (110-160 km from mouth of Delaware Bay).

## Science and Management Challenges



- One of the largest NEP's
- Many state and federal agencies
- Complex ecosystem and issues
- Far less funding per capita than other NEP's



## Science Strengths

- Excellent brain trust
- Good examples of working together



## Monitoring Design

- Existing Monitoring – e.g., DRBC Boat Run, USGS gauges, PORTS
- Continued real-time data collection – e.g., T, Salinity, DO, tidal height
- Develop bay-mouth CODAR system
- Incorporate air monitoring sites within estuary
- Integrate with Delaware Bay Observing System
- Integrate with Rutgers LEO site monitoring

## Monitoring Infrastructure

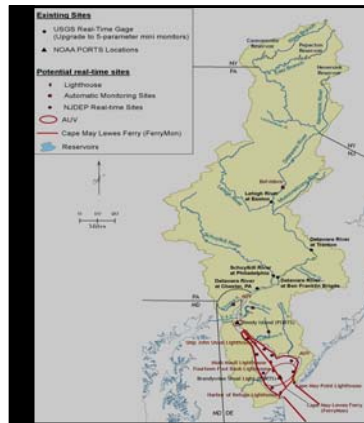
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A Pilot Integrated Observing System Linking Monitoring of Watershed, Estuary and Coastal Ocean

A Planning Concept from:  
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 US Geological Survey  
 NOAA  
 States of New Jersey and Delaware  
 Partnership for the Delaware Estuary  
 DE, NJ and PA Sea Grant



Conceptual diagram of principal ecosystem components (green), physical-chemical conditions (black), and monitoring approaches (red) in Delaware Estuary



Some components of the proposed Delaware Estuary observing system



### Some Expected Products

Provide information for ecological forecasting and environmental prediction models

Provide information for prediction and management of natural and man-made disasters

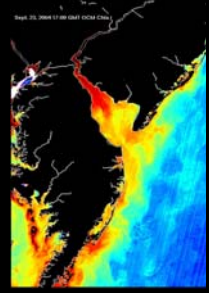
Provide information for management of physical resources (wetlands, beaches, etc.)

Enhance multiple uses of Delaware Estuary

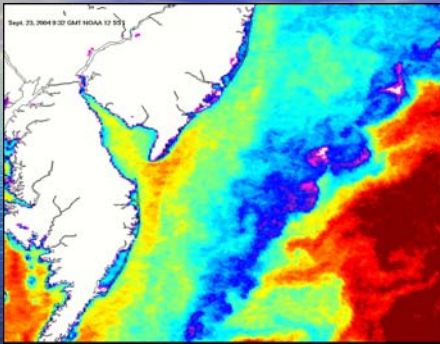
### Monitoring Infrastructure

#### Benefits of Expanded Monitoring:

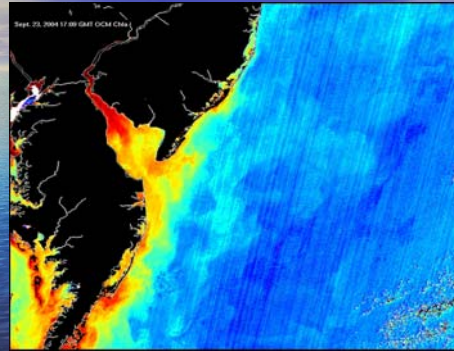
- Add new real-time data collection e.g. chlorophyll, TSS, currents
- Broaden biomonitoring of contaminants
- Improve satellite sensing of SST, chlorophyll, TSS, CDOM
- Add ferry monitoring across baymouth
- Better linkages to living resources such as oysters



NOAA-12 1-km AVHRR SST Sept. 23, 2004 9:32 GMT



Oceansat 360-m Chlorophyll Sept. 23, 2004 17:09 GMT



Oceansat 360-m True Color Sept. 23, 2004 17:09 GMT



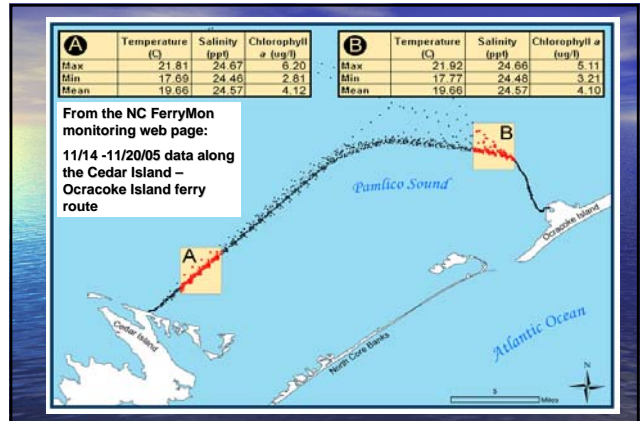
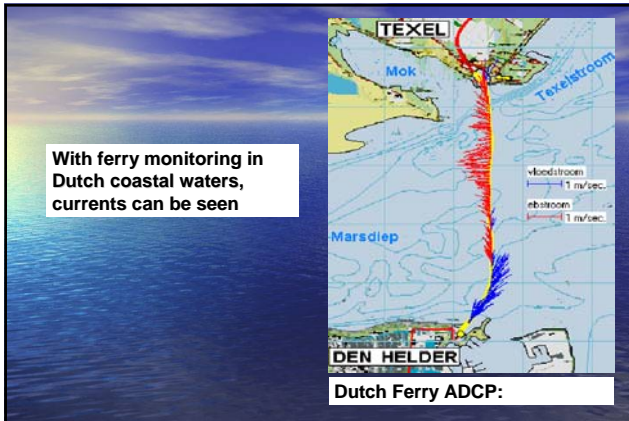
### Cape May/Lewes Ferry Instrumentation



Hull-mounted ADCP



Acoustic Doppler Current Profiler (ADCP): Measuring velocity profiles every 2 seconds



- ### Next Steps
- Establish GIS-based real-time web page to view information and data from monitoring – demonstration
  - Continue to develop local workgroup to integrate ongoing monitoring and design future needs
  - Expand planning group to diversify user group input
  - Explore NOAA and USGS support
  - Explore commercial support