

Real-time Water Quality Monitoring Network in New Jersey Coastal Waters

Robert Connell

New Jersey Department of Environmental Protection
Water Monitoring and Standards
Bureau of Marine Water Monitoring



Overview

- Continuous monitoring is needed in NJ's coastal waters for management decisions relating to:
 - Public Health
 - Fisheries Management
 - Ecosystem Health
- The NJDEP network of coastal, real-time monitors is now being augmented by a network being established by Monmouth University.
- Expansion of the existing network will be enhanced by the use of:
 - Open Source software
 - Data Standards
 - QA Standards



Why do we need continuous water quality monitoring?

- Need to use where changes over time are more critical than changes spatially
- Need to characterize rapid water quality changes (on the order of hours or minutes vs days or weeks)
- Need to know conditions at a specific time
- Need to have concurrent measures of multiple parameters to establish relationships.



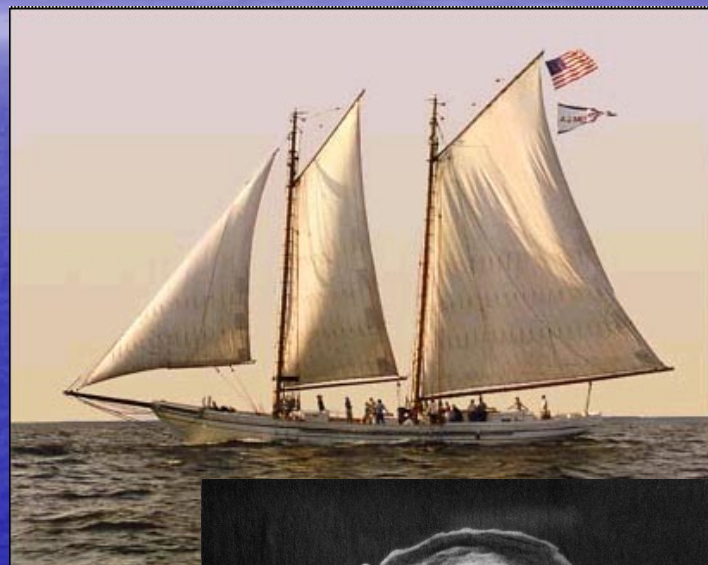
Some management applications for continuous monitoring data:

- Assess trends and patterns in water quality.
- Need water quality data for calibration of remote sensing.
- Providing data necessary for assessing the impacts of fresh water withdrawal on estuarine fisheries.
- Recognizing high risk periods for pathogens in seafood.
- What are the average and min/max DO, chlorophyll and turbidity levels for development of eutrophication indicators and reference conditions?



Shellfish harvesting is a significant part of NJ's coastal economy

- About 30,000 metric tons harvested in 2006
- Dockside value of \$100,000,000 annually
- Eastern oyster in Delaware Bay is a part of NJ's harvest



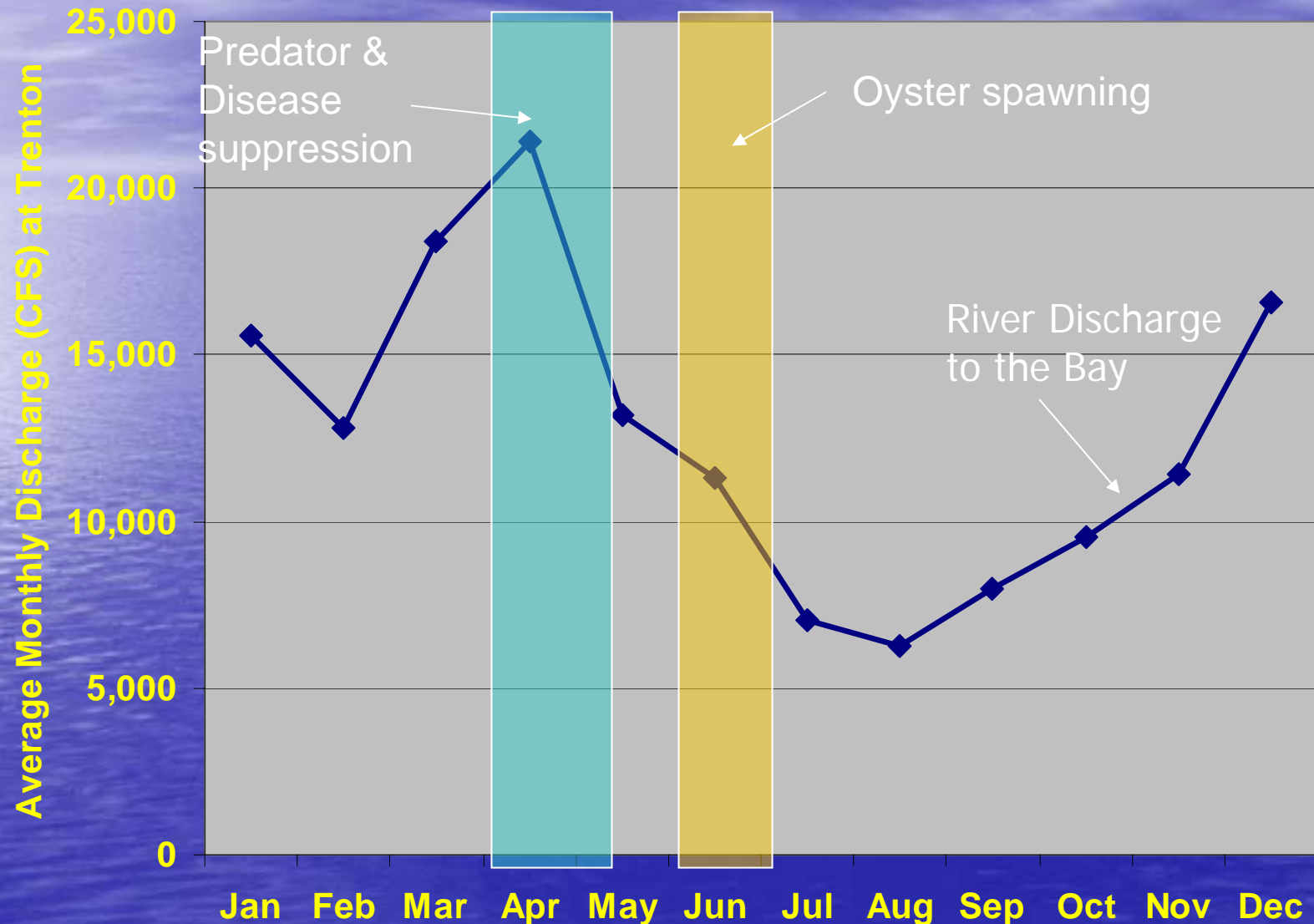
Fisheries Management

Water Withdrawals – Delaware Watershed

- NY and PA would like to retain more water in the Spring and release in the Summer for trout production
- No net change for withdrawal, just a change to seasonal withdrawals



How much water can be withheld during peak flow before predators and disease interfere with successful reproduction of oyster populations?



Need for Continuous Monitoring Data

Need continuous measurements of salinity over the oyster beds during various flow conditions to accurately model the response of salinity to water withdrawals upstream and to determine the risk to the oyster resource posed by the withdrawals.



Public Health

Predicting Pathogen Risk

- *Vibrio parahaemolyticus* (Vp)
 - Bacterium that occurs naturally in coastal waters and can be filtered from the water by molluscan shellfish (such as oysters).
 - Growth is primarily in response to temperature and salinity conditions.
 - Consumption of Vp by humans can results in nausea, vomiting, and other symptoms.
 - Shellfish harvest can be limited during periods of high growth of this pathogen, thereby protecting public health.



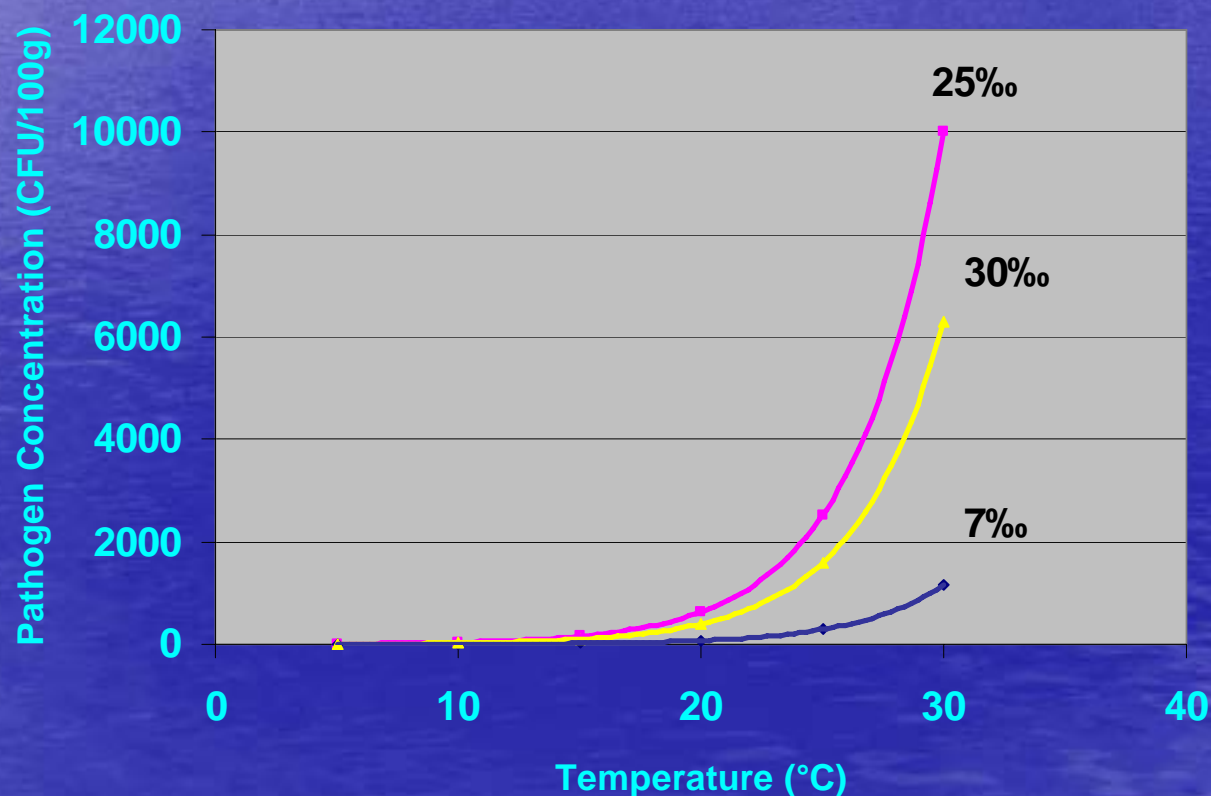
Pathogen Growth Model

$$\log([pathogen]) = -2.6 + 0.12(Temp) + 0.18(Sal) - 0.004(Sal^2) + 1$$

Where:

Temp = temperature (°C)

Sal = salinity (‰)



Need for Continuous Monitoring Data

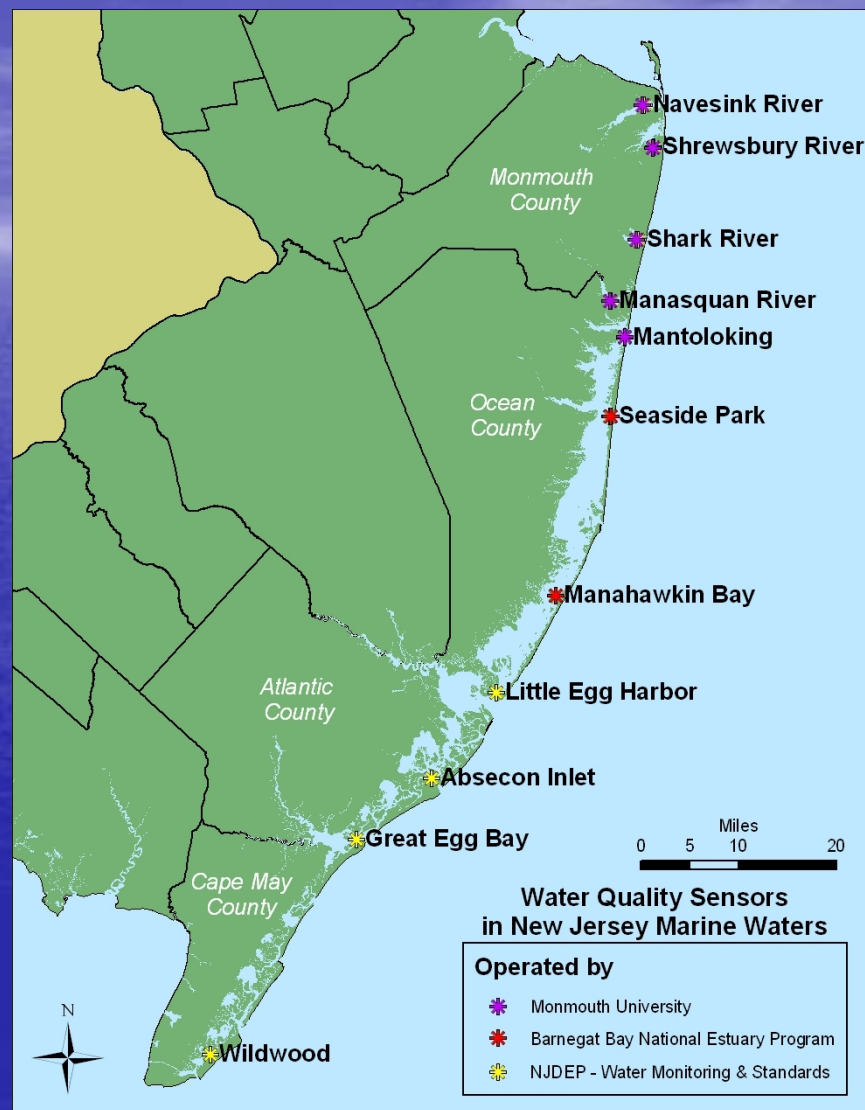
By knowing the temperature and salinity conditions over oyster beds, we can more accurately determine when there is a need to restrict harvest or implement other *Vibrio* control measures.

Continuous monitoring can provide the necessary data.



Continuous Monitors in NJ Coastal Waters

- Readings every 15 minutes
- Updates posted to the Internet every hour.
- Eight different parameters are recorded by the buoys these include:
 - Dissolved oxygen
 - pH
 - Salinity
 - Temperature
 - Turbidity
 - Chlorophyll a



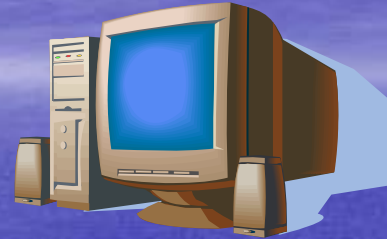
Internet

Cell Phone Telemetry

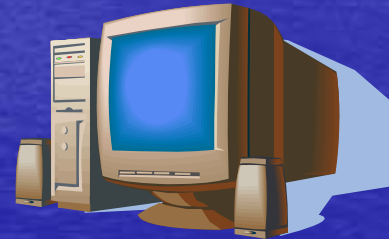
Telemetry

Data
Acquisition

Sensors



Data
Acquisition
Server
(Windows)



Web
Server
(Linux)

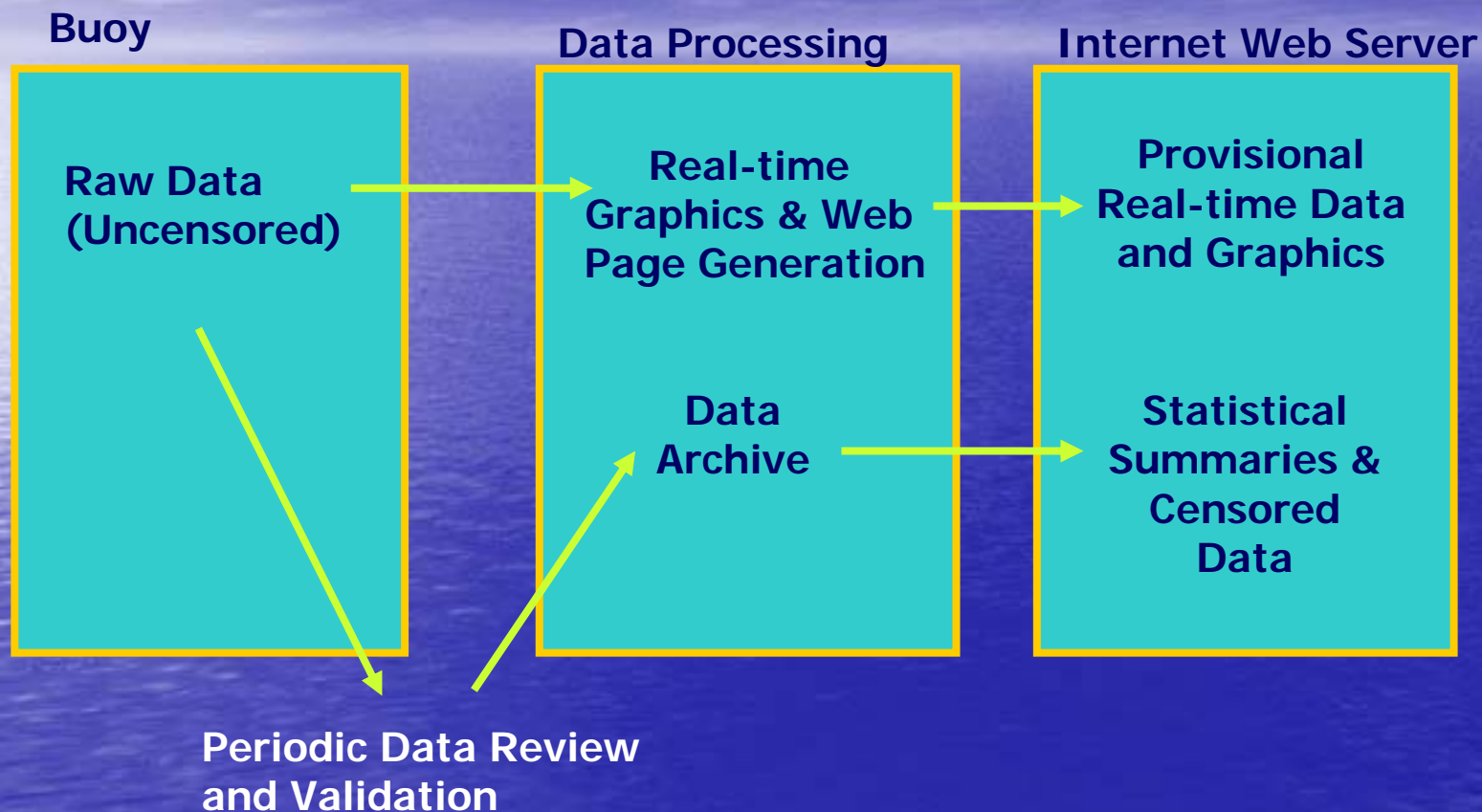


Data
Users




NJDEP Water Monitoring and Standards


Data Flow:



User Interface

njhome | my new jersey | people | business | government | departments

new jersey
department of environmental protection



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Water Quality Sensors


What are they?


There are nine buoys in the coastal waters of New Jersey that contain water quality sensors. The three buoys in Cumberland County are updated bi-monthly; the remaining buoys are automatically updated (when operational). The automated buoys have a solar power source and telemetry for transmitting the data to a base station operated by the New Jersey Department of Environmental Protection.


What do they measure?


Each buoy is equipped with sensors to measure water temperature, salinity, dissolved oxygen, pH, turbidity and chlorophyll a. Temperature and salinity are very basic measurements that determine what types of marine animals and plants could thrive in the location. Dissolved oxygen and pH provide information how favorable the waters could be for the plants and animals that are present. Turbidity tells us how far light can penetrate into the water for plants to use. Chlorophyll a is a measure of the amount of plant material suspended in the water. Typically this suspended plant material is microscopic plants called phytoplankton.

Legend

 Water Quality Sensors


 Counties


 Marine Water

 Delaware/Pennsylvania

Miles

0 2.5 5 10 15 20



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NJDEP Water Monitoring and Standards

CURRENT CONDITIONS
As of 10/1/2007 4:02:01 PM

Temperature	22.63	C	Chart
Salinity	28.28	PPT	Chart
Dissolved Oxygen	3.99	mg/L	Chart
pH	8.42		Chart
Turbidity	1152.70	JTU	Chart
Chlorophyll a	28.50	ug/L	Chart

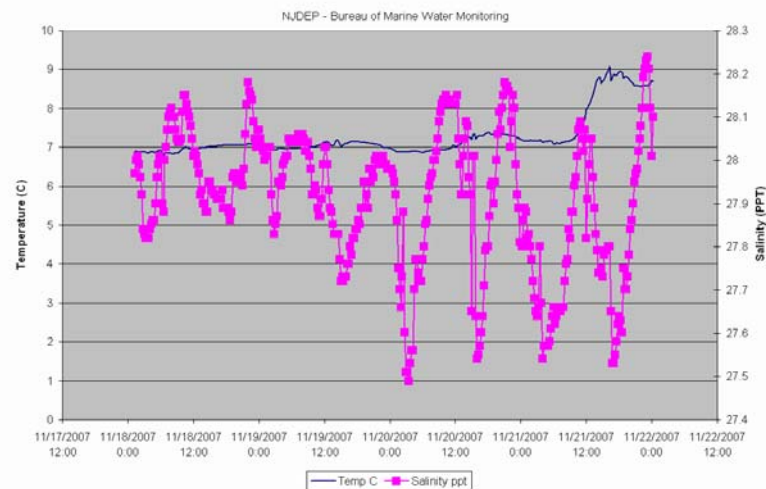
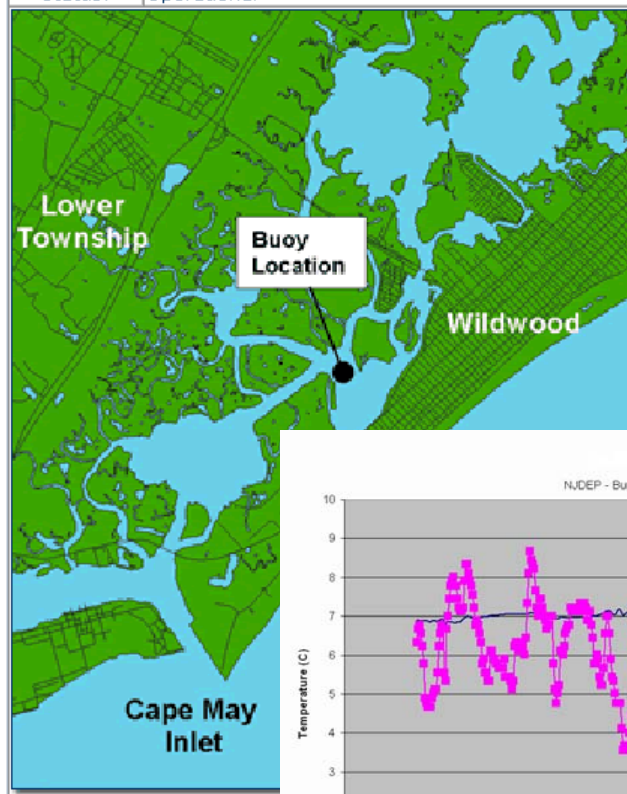
Real-time data have not been reviewed. They are Provisional Data. Use with caution.

PAST RESULTS

Check back soon for archived data.

SENSOR INFORMATION

Location:	Wildwood
Coordinates:	38 58' 41" N 74 50' 46" W
Sensors:	Temperature, salinity, dissolved oxygen, pH, turbidity, & chlorophyll a
Status:	Operational



Lakes Bay Sonde Water Quality Summary NJDEP - Marine Water Monitoring

Statistical Summary for Lakes Bay from 1/1/2004 to 1/1/2006

Records shown 1 - 8 of 8

Parameter	Average	Minimum	Maximum	Readings
Chlorophyll ug/l	17.170285424515	0.11	54.6	20706
DO Conc	6.5916065158018	0.5	12.6	20504
DO%	84.601178946375	30	146.9	21146
pH	7.9450294018818	7.5	8.46	23808
Salinity ppt	26.009705208142	14.02	32.98	21812
SpCond mS/cm	40.625310537654	23.18	50.26	21817
Temp	19.275059719068	-0.57	29.61	23778
Turbidity NTU	19.065327820437	0	150.2	16930

Select parameter for data listing below:

Parameter: 

List Raw Data



Expansion of the network will require:

- Open Source software
 - Ability to share software with partners
 - Ability for partners to modify/improve software (development of a “community” approach)
- Data Standards
 - So that partners can speak the same “language”.
- Quality Assurance Standards
 - So that partners can compare and combine their data.



Summary

- There are a number of management applications for continuous monitoring data in NJ's coastal waters
- NJ has started a network of real-time, continuous monitors in its coastal waters.
- Expansion of this network will require new approaches that utilize software that can be readily distributed and data standards.

