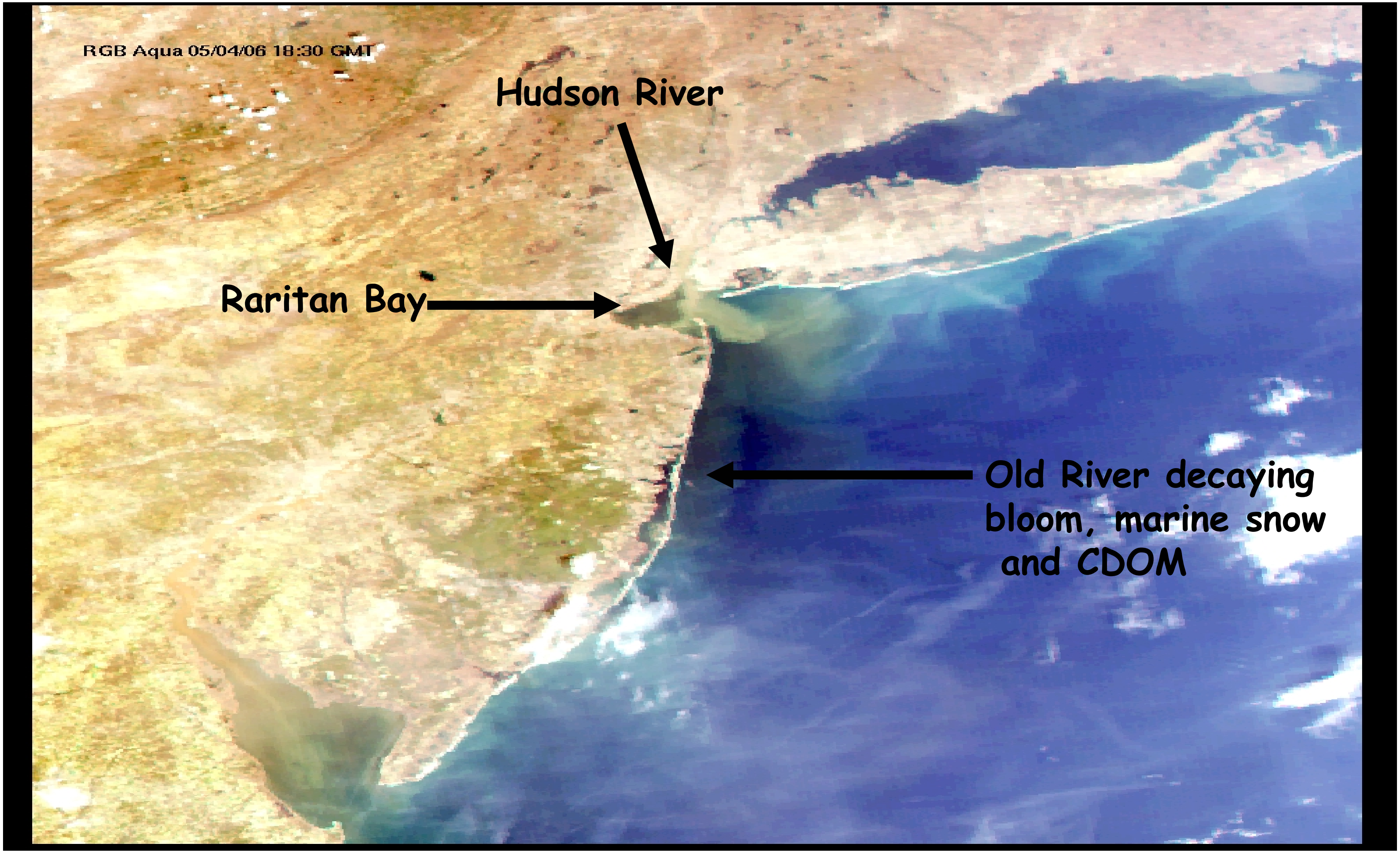
PART 3 – THE BEACHES



Bob Chant (Rutgers), Scott Glenn (Rutgers), Bob Houghton (Lamont), Bernie Gardner (U. Mass), John Wilkin (Rutgers), John Reindfelder (Rutgers), Bob Chen (U.Mass). 2006. An Interdisciplinary Process Study of the Hudson River Plume in an Operational Research Observatory. Lagrangian Transport & Transformation Experiment. Powerpoint. Rutgers.

Greaseballs

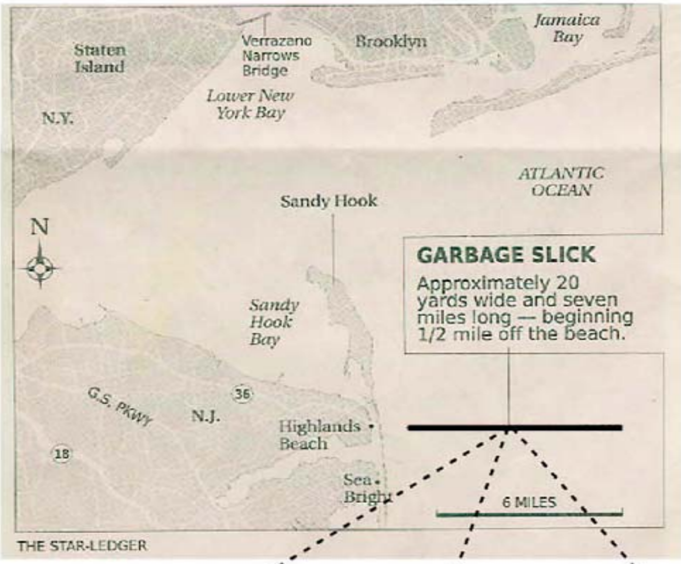
Winds hold stream of garbage offshore in northern Monmouth

BY TOM FEENEY
Star-Ledger Staff

Environmental officials discovered a seven-mile-long trash slick off the northern New Jersey Shore during a helicopter flyover yesterday morning, a day after syringes, grease balls and other garbage washed ashore in Sea Bright.

No beaches were closed, and the garbage was not thought to pose a threat to human health, officials said.

The debris was probably flushed into the New York Harbor through combined sanitary and stormwater sewer systems by heavy rains to the

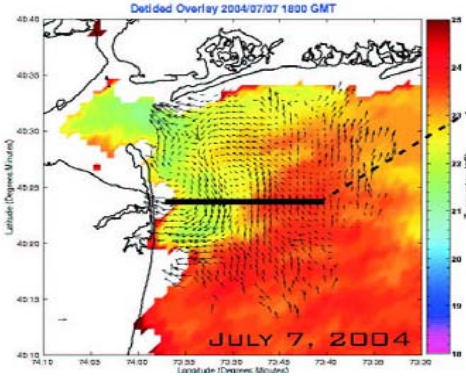


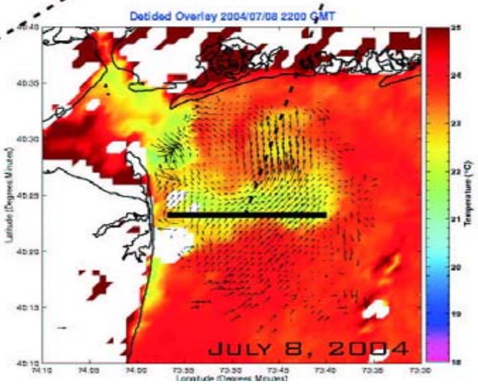
sewage. Somtetimes when it rains, the volume of water in the system is more than the sewer plants can handle, so the untreated excess empties into the estuary at designated overflow points.

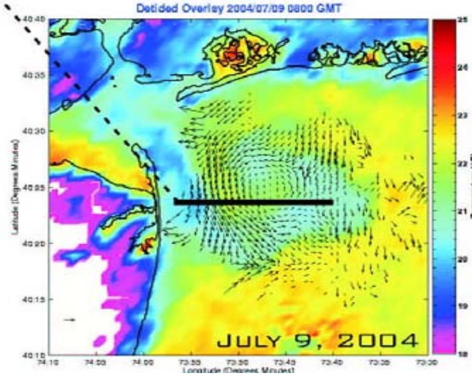
There are 640 legal combined sewer overflows from Raritan Bay north to Connecticut, Simmons said.

"This problem has been going on for at least the 18 years I've been in this position," Simmons said. "We've talked about it a lot, but we don't seem to be able to come up with an efficient way of controlling the solids."

If screens were placed over the ends of the outflow pipes, large solid





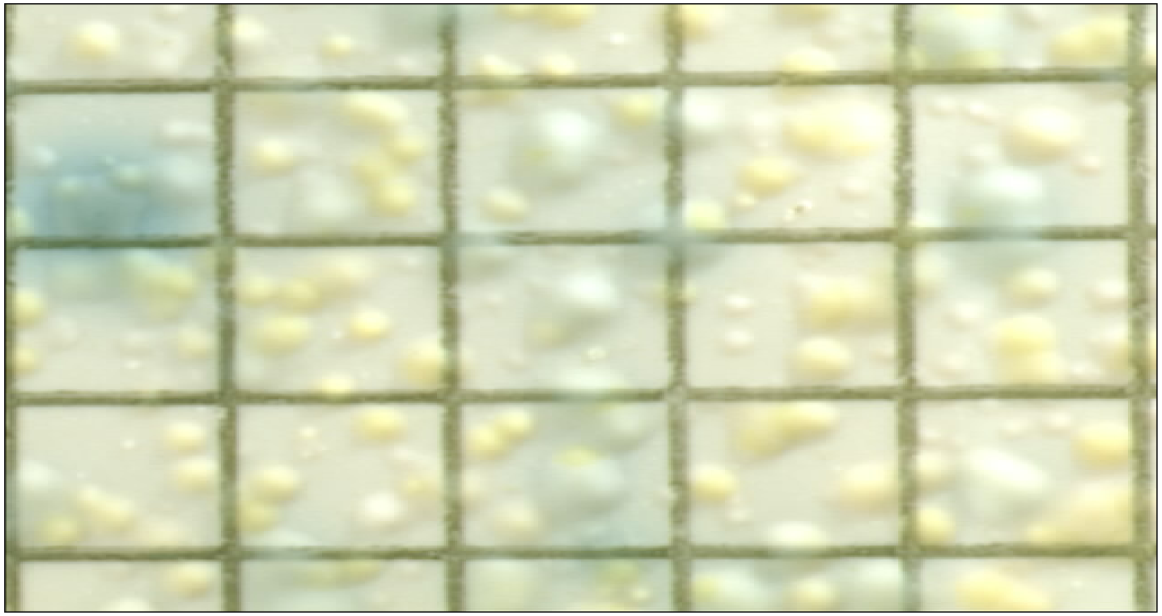


2004. Hugh Roarty Ph.D., Institute of Marine and Coastal Sciences, Rutgers. http://marine.rutgers.edu/mrs/people/hroarty.htm

Sept. 2005, Ocean Area E, Sandy Hook.

Samples taken in dry weather, onshore wind, around 9:00 AM or earlier.

No bather load.



In 2005, yellow staphylococcal growth on mEI agar (USEPA Method 1600).PCR-identified by NJPHI as ***Staphylococcus*, Non Aureus.**
In 2006, the yellow growth was tentatively identified in the MCHD lab (BioMerieux API STAPH kits) as *near to* ***Staphylococcus warneri*** or ***S. pasteuri***

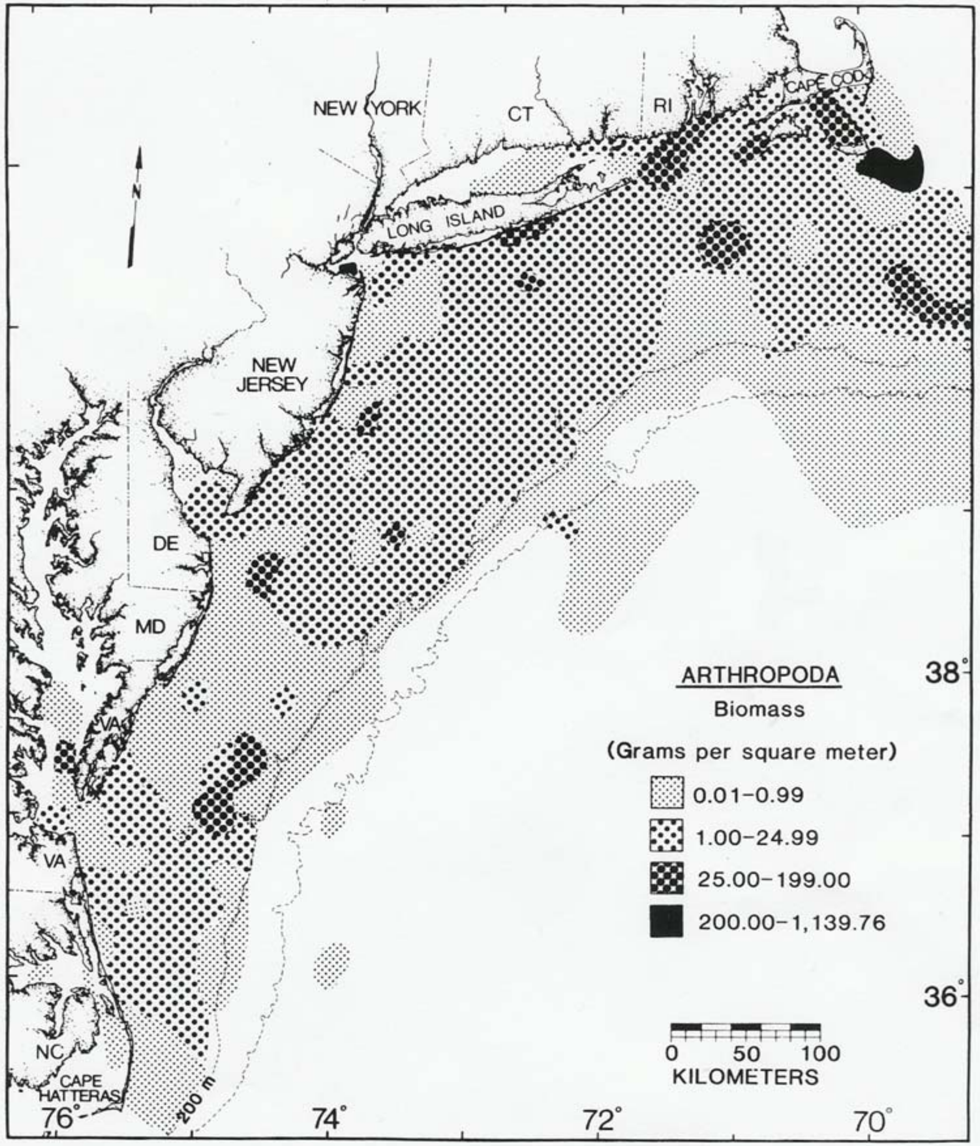


Figure 7. Geographic distribution of the biomass of Arthropoda, expressed as damp weight per square meter of bottom area. The high levels south of Cape Cod are barnacles, of limited values to fish: the remaining levels and distributions are mainly amphipods and decapods. From Wigley and Theroux (1981).

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Arthropod Biomass in the Middle Atlantic Bight - 1988

2 Most Dense Areas:

Sandy Hook Bay (amphipods – crustaceans; and decapods - shrimp)

Cape Cod (barnacles)

Cook, S. 1988. Physical Oceanography of the Middle Atlantic Bight. In Pacheco, A. 1988. Characterization of the Middle Atlantic Water Management Unit of the Northeast Regional Action Plan. NOAA Technical Memorandum NMFS_F/NEC-56. US Department of Commerce. National Oceanic and Atmospheric Administration. Sandy HooK Lab, National Marine Fisheries Service, Highlands NJ.

BACTERIA IN MARINE BIOFILMS

Table 1. List of bacterial species isolated from marine natural biofilms

Group	Strain No.	Colony				Closest match	Similarity (%)
		Color	Form	Elevation	Margin		
α-Proteobacteria	13737*	ivory	circular	convex	entire	*Ochrobactrum anthropi*	100.00
α-Proteobacteria	13733*	orange	circular	convex	entire	*Paracoccus carotinifaciens*	100.00
γ-Proteobacteria	13703*	yellow	circular	convex	entire	*Pseudoalteromonas piscicida*	100.00
γ-Proteobacteria	13704	yellow	circular	raised	entire	*Pseudoalteromonas piscicida*	100.00
γ-Proteobacteria	13687*	cream	circular	flat	erose	*Pseudoalteromonas agarovorans*	100.00
γ-Proteobacteria	13684	ivory	circular	flat	entire	*Pseudoalteromonas agarovorans*	100.00
γ-Proteobacteria	13716*	yellow	irregular	raised	undulate	*Pseudomonas aeruginosa*	99.13
γ-Proteobacteria	13723*	yellow	circular	convex	entire	*Shewanella baltica*	100.00
γ-Proteobacteria	13719	cream	circular	raised	entire	*Shewanella baltica*	100.00
γ-Proteobacteria	13705*	ivory	irregular	raised	erose	*Vibrio parahaemolyticus*	100.00
γ-Proteobacteria	13706	ivory	irregular	raised	lobate	*Vibrio parahaemolyticus*	100.00
γ-Proteobacteria	13721*	ivory	circular	raised	entire	*Vibrio pomeroyi*	99.71
γ-Proteobacteria	13732	ivory	irregular	raised	undulate	*Vibrio pomeroyi*	99.71
CFB	13731*	yellow	circular	raised	entire	*Cytophaga latercula*	97.97
CFB	13685*	orange	circular	convex	entire	*Tenacibaculum mesophilum*	99.71
CFB	13683	fluorescent	irregular	flat	lobate	*Tenacibaculum mesophilum*	99.71
CFB	13688	yellow	irregular	flat	undulate	*Tenacibaculum mesophilum*	99.71
CFB	13692	fluorescent	irregular	flat	lobate	*Tenacibaculum mesophilum*	99.71
CFB	13701	yellow	irregular	raised	lobate	*Tenacibaculum mesophilum*	99.71
CFB	13712	yellow	circular	flat	entire	*Tenacibaculum mesophilum*	99.71
High GC, Gram+	13707*	yellow	circular	convex	entire	*Arthrobacter nicotianae*	97.40
High GC, Gram+	13710	yellow	circular	convex	entire	*Arthrobacter nicotianae*	97.40
High GC, Gram+	13720	cream	circular	convex	entire	*Arthrobacter nicotianae*	97.40
High GC, Gram+	13729*	white	circular	convex	entire	*Brevibacterium casei*	100.00
High GC, Gram+	13730	ivory	circular	convex	entire	*Brevibacterium casei*	100.00
High GC, Gram+	13686*	yellow	irregular	convex	erose	*Brevibacterium epidermidis*	99.13
High GC, Gram+	13689	white	irregular	flat	erose	*Brevibacterium epidermidis*	99.13
High GC, Gram+	13690*	orange	irregular	flat	erose	*Tsukamurella paurometabola*	98.55
Low GC, Gram+	13724*	yellow	filamentous	raised	erose	*Bacillus macroides*	100.00
Low GC, Gram+	13717*	white	circular	convex	entire	*Staphylococcus haemolyticus*	100.00
Low GC, Gram+	13691*	white	circular	convex	entire	*Staphylococcus warneri*	100.00

<- *S. warneri*

*The 17 strains that were finally identified.

Freshwater Iron bacteria biofilms also “bloom” during dry weather, then are diminished by storms.

Lee, Y et al. 2003. Culture and Identification of Bacteria from Marine Biofilms. Journal of Microbiology, Vol 41 No.3, p. 183-188. http://mamidi.kordi.re.kr/paper/jm03-biofilm.pdf . Other references not included here.

TIDAL TRAPPING and TIDAL PUMPING

The phenomena of tidal trapping in coves and inlets along the Hudson River may be relevant to investigating how bacteria might adapt to an increase in residence time due to transient “ponding” at certain river and bay beach configurations during changes in the tide.

Geometry irregularities can temporarily trap a water parcel as it passes by and then release it at some later time.

This effectively removes a small amount of water from the original main channel water mass and then adds it back later to a new main channel water mass.

For example, a water parcel with low salinity is removed from its original low salinity main channel water mass, and then added later to a new main channel water mass with higher salinity” (Blumberg, 2004).

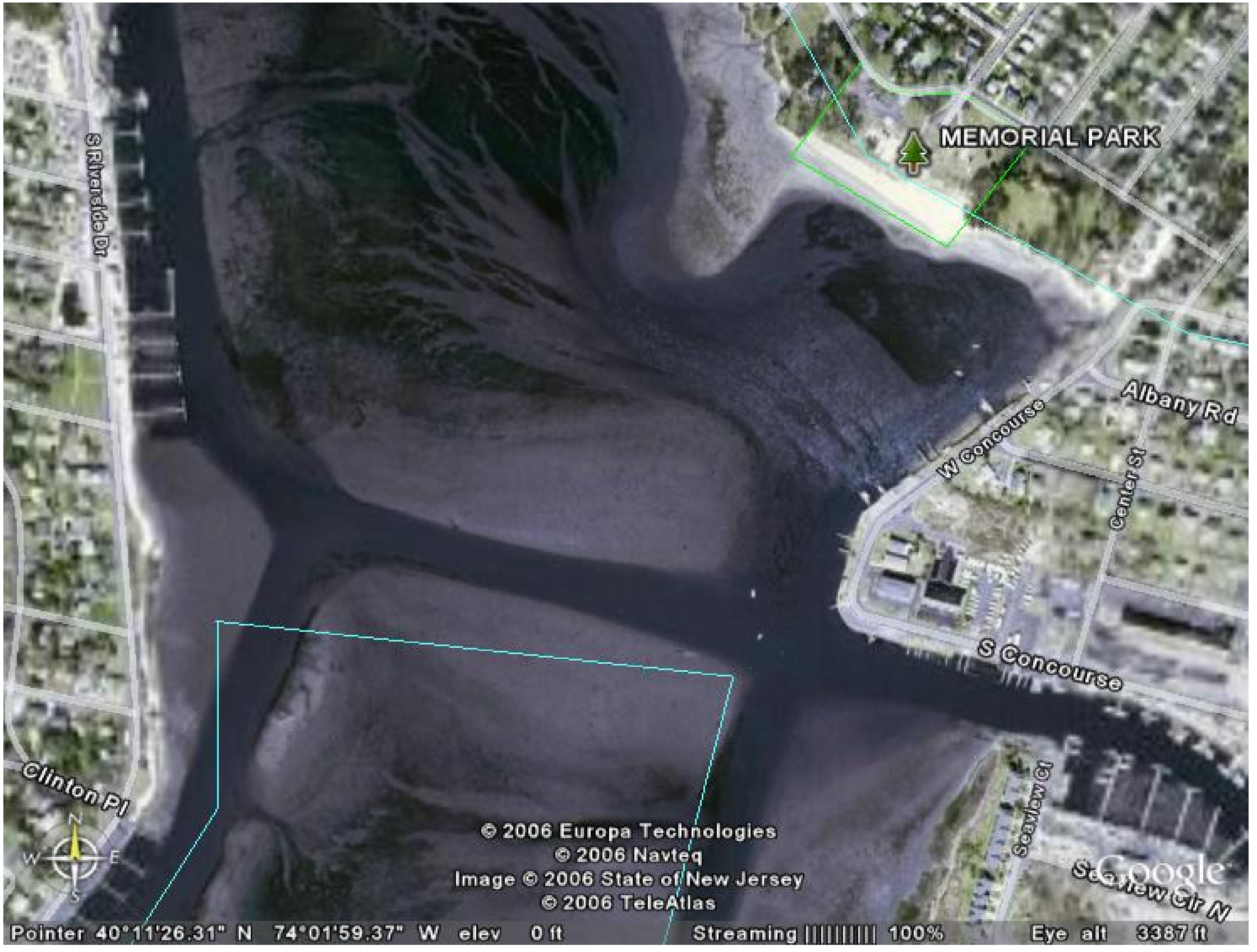
Tidal pumping amplifies the current.

Blumberg, A and Hellweger, F. 2004. Hydrodynamics of the Hudson River Estuary. Stevens Institute of Technology, Hudson NJ. http://www1.coe.neu.edu/~ferdi/files/hres2004.pdf

Allenhurst Ocean Beach Closings in 2004 and 2005: Mussels, seagulls, cove-shape

Sea gulls and mussels are also at Phillips Av. Beach in Deal, without an L jetty, but there are only sporadic bacteria exceedances.

SHARK RIVER - L St. Beach Belmar (just east of Maclearie Park)



Shark River Yacht Club at Clinton Pl vs. Memorial Park Beach :

Few bacteria exceedances vs. permanent closure since the mid 1990's.

PART 4 – PREDICTIVE MODELING

This research has yet to be incorporated into the CCMP program, which since 1986 has limited its interpretation of bacterial dynamics in the environment almost exclusively to rainfall.

While many Microbial Source Tracking (MST) projects are being enthusiastically funded now to locate illicit connection between sewers and storm drains, much of the research is revealing that human-sourced bacteria contribute less than animal/non point bacteria regarding the total numbers of indicator bacteria in the environment.

If in the long run non human, non point pollution proves to be the crucial source of total bacteria levels that are closing bathing beaches, it will take a significant amount of time for society to implement effective BMPs.

In the intervening years or decades, it would be useful and more protective of the public health to use the vast amounts of CCMP data that has accumulated be able to forecast bacterial conditions at beaches, rather than to continue limiting ourselves to waiting for sampling results as we have been doing for twenty years.

Modeling can reduce the present time-lag in the assessment of human health risks.
http://bathingwater.dhigroup.com/services/WaterQualityForecast.html

Since 2004, the USGS developed a "NowCasting Beach Advisory" model to predict Escherichia coli levels at beaches on the Great Lakes by comparing wave height, weighted rainfall in the past 48 hours, and log10 turbidity - and found that, in contrast to conditions at ocean beaches, waves and turbidity in lakes can be more predictive of elevated E. coli levels than rain due to fine sediment resuspension.

Their model explains 38 percent of the variability in E. coli concentrations. A threshold probability of 29% was established as the criteria to post an advisory against swimming.

The model predicted exceedance of the swimming standard more accurately than using the previous days E. coli sampling results. They found that closing a beach after waiting for a lab analysis resulted in closing beaches more than was necessary (Francy and Darner, 2006). http://www.ohionowcast.info/ohionowcastunderstand.htm **.**

Francy, D. and Darner, R. 2006. Procedures for Developing Models To Predict Exceedances of Recreational Water-Quality Standards at Coastal Beaches. U.S. Geological Survey, Techniques and Methods 6–B5. http://pubs.water.usgs.gov/tm6b5/

Denmark Bathing Water Forecast (BWF) predicts the bathing water quality today and up to 4 days ahead; just like the weather forecast.

Managers get an operational online system with real-time and forecast data.

Tourists and residential users will know whether the beach is open and safe to use right away. **The risk of diseases after visiting the beach is reduced.**

http://bathingwater.dhigroup.com/services/WaterQualityForecast.html.

Two NJ institutions that have been modeling these complexities for more than a decade.

Since late fall 2006, Stevens' **Chromophoric Dissolved Organic Matter (CDOM) model** has been tracking dissolved organic material in NY Harbor. CDOM is essentially a surrogate for stormwater and sediment resuspension, the most significant sources of rain related indicator bacteria. The CDOM model produces 48-hr graphical forecasts for CDOM concentrations from five endpoints including the Hudson and Raritan rivers (Blumberg, 2006).

Most relevantly, the CDOM model is a modification of an available "**pathogen fate model**" that Stevens has already developed.

This research has yet to be incorporated into the NJ CCMP program, which since 1986 has limited its interpretation of bacterial dynamics in the environment almost exclusively to rainfall.

About 10 years ago, California, and then the Great Lakes region took the lead on beach related research.

The BeachNet listserv is a valuable source of the latest information http://www.great-lakes.net/lists/beachnet/beachnet.info.

Blumberg, A and Hellweger, F. 2004. Hydrodynamics of the Hudson River Estuary. Stevens Institute of Technology, Hudson NJ. http://www1.coe.neu.edu/~ferdi/files/hres2004.pdf

Blumberg, A. 2006 . Email. August 18, 2006. Dept of Civil, Environmental and Ocean Engineering. Stevens Institute of Technology. Castle Point on Hudson. Hoboken, NJ.

FORECASTING CAN BECOME PART OF AN APPROACH TO GET AROUND THE PRESENT 24-HOUR LAG TIME

Q-PCR – EPA in Edison is partnering with NJCCMP to get samples in 2007.

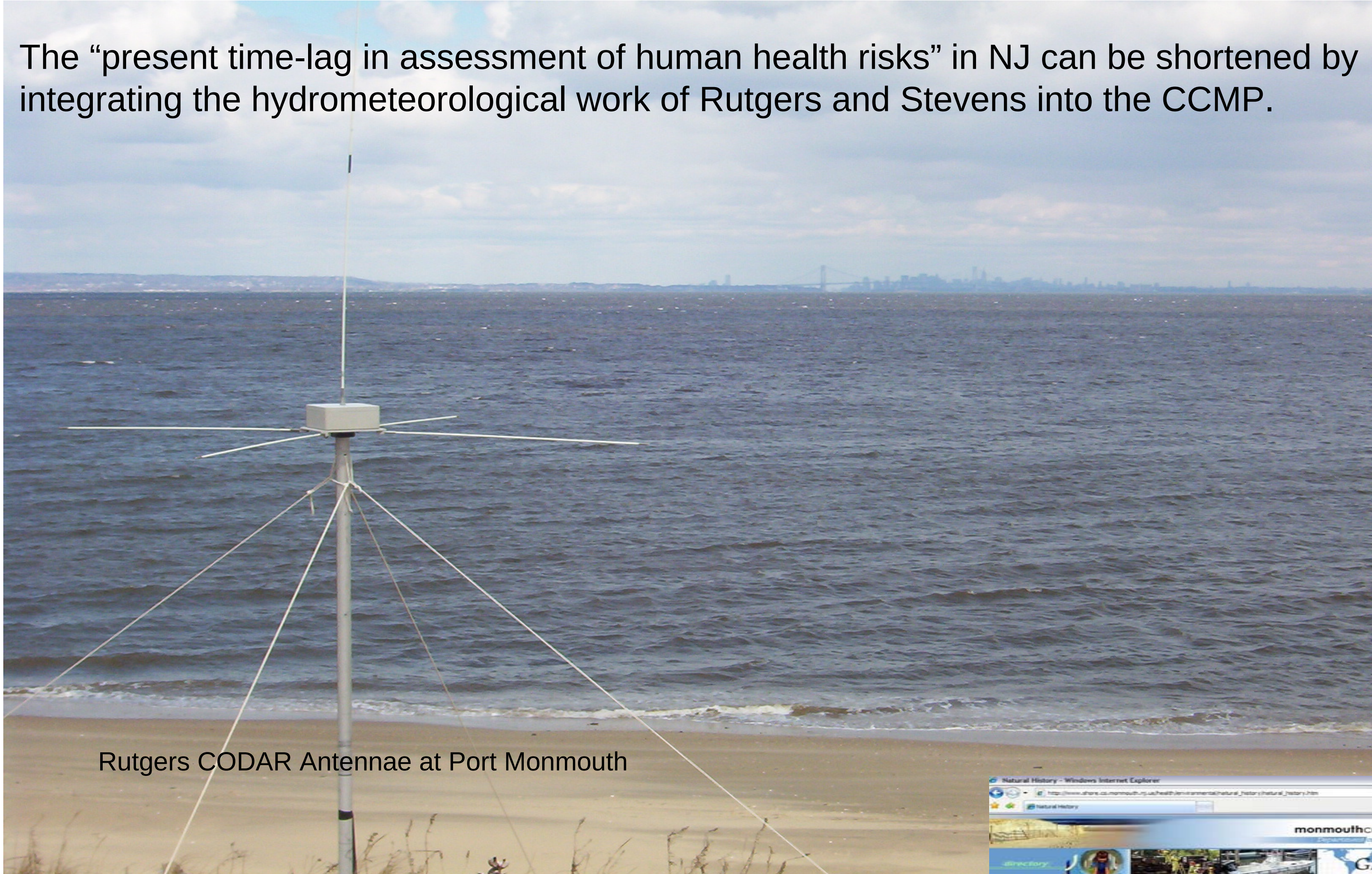
FORECASTING/MODELING - integrate the hydrometeorological work of Rutgers and Stevens into the CCMP.

MST RESEARCH – continue the research into human indicators. This is a "shake-out" period. Techniques that are difficult to perform and that produce ambiguous results should be passed over for the most promising techniques. That way negative research is still progress.

OPTICAL BRIGHTENERS – MCHD, building on the initial research of the DEP and COA, has purchased a Fluorometer and is presently evaluating its efficiency in locating illicit connections within storm drain systems, for investigations, not monitoring. If this technique proves effective, it can become a practical tool for municipal DPW and sewer departments.

LOW IMPACT DEVELOPMENT – the long term goal is a commitment to reducing storm water volume.

The “present time-lag in assessment of human health risks” in NJ can be shortened by integrating the hydrometeorological work of Rutgers and Stevens into the CCMP.



Rutgers CODAR Antennae at Port Monmouth

For links to the papers and the websites used in this report, read

“Coastal Currents and Water Quality” and

the “Ocean” and “Estuary” sections of “Natural Features of MC” at

http://www.visitmonmouth.com/health/environmental/natural_history/natural_history.htm