

Ocean Ecological Health: New Tools and Applications

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Water Monitoring and Standards

Why Do We Need A Benthic Indicator?



“Ensuring the health of our ocean ecosystems and the resources they provide is paramount to Mid-Atlantic oceanfront states like New Jersey. Any threat to these natural resources brings economic consequences that threaten jobs, local economies, and our economic well being.”

Governor Jon S. Corzine, 2009

“A comprehensive and coordinated national ocean policy requires moving away from the current fragmented, single-issue way of doing business and toward ecosystem-based management. This new approach considers the relationships among all ecosystem components, and will lead to better decisions that protect the environment while promoting the economy and balancing multiple uses of our oceans and coasts.”

Admiral James D. Watkins, Chairman, President's Ocean Commission, 2004

Regulatory Requirements

- * CWA Section 305 (b)

Statewide Water Quality Assessment

- * CWA Section 303(d)

ID waters which are impaired

- * CWA Section 403(c)

Determine whether a discharge may cause unreasonable degradation of the marine environment



National Aquatic Resource Surveys

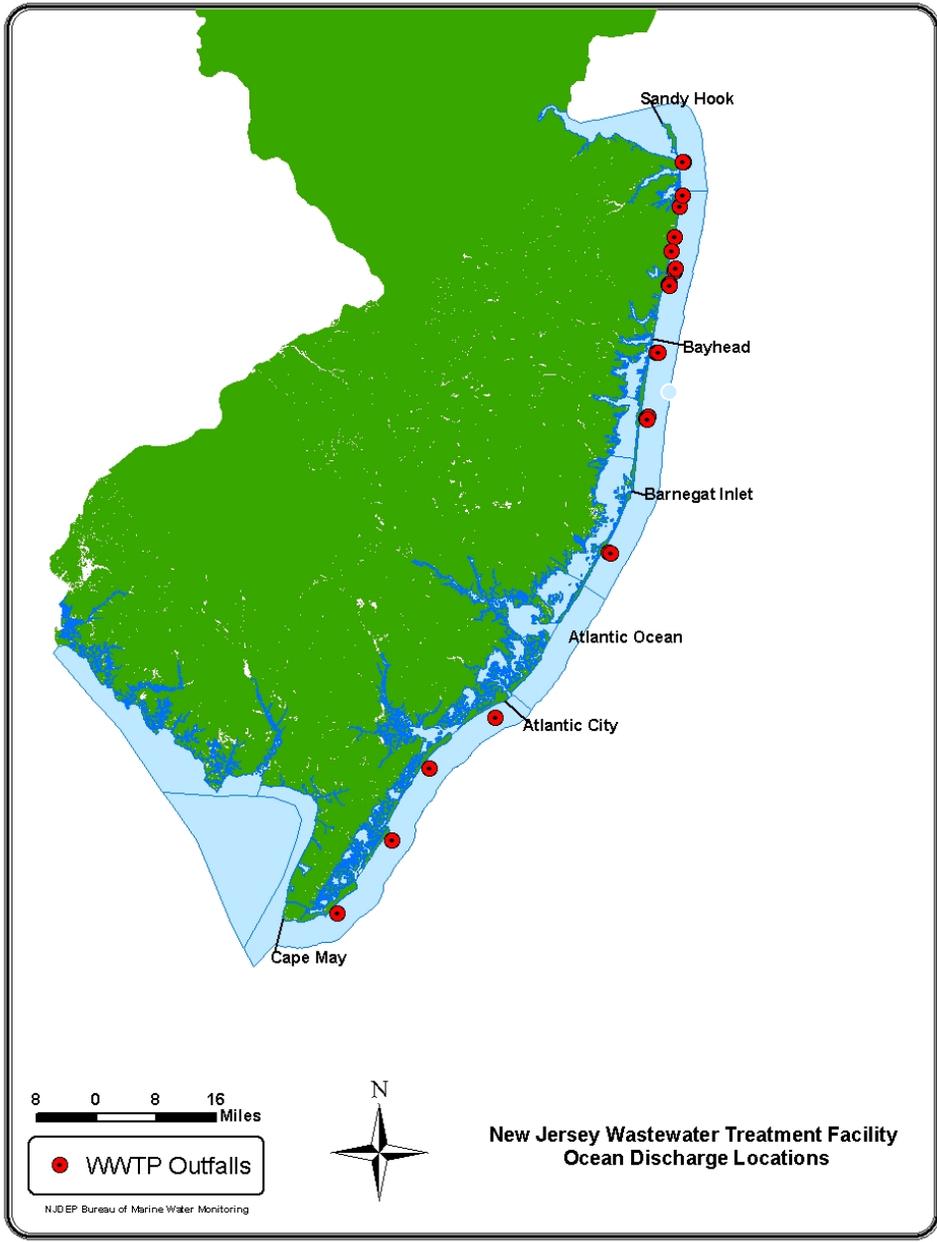
Figure 1: Schedule for Surveys of the Nation's Waters

General schedule of activities by water resource type:

Not oceans until now

	FY06	FY07	FY08	FY09	FY10	FY11
Coastal	Lab,data	Report	Research	Design	Field	Lab,data
Streams	Report	Research	Design	Field	Lab,data	Report*
Lakes, reservoirs	Design	Field	Lab,data	Report	Research	Design
Rivers	Research	Design	Field	Lab,data	Report*	Research
Wetlands	Research	Research	Research	Research	Design	Field

Coastal waters were the first National Survey in 2000. However, to date, the coastal survey (National Coastal Assessment) has only involved the nation's estuarine (bay) waters, not the ocean waters.





Ocean Ecosystem Assessment Project



The Ocean Ecosystem Assessment Project is a collaborative initiative of state and federal government agencies

- ✧ NJDEP Water Monitoring & Standards
- ✧ USEPA Region 2 Monitoring & Assessment
- ✧ USEPA ORD – Atlantic Ecology Division
- ✧ Rutgers University – Institute of Marine and Coastal Sciences

Funding: USEPA Regional Environmental Monitoring & Assessment Program (REMAP)



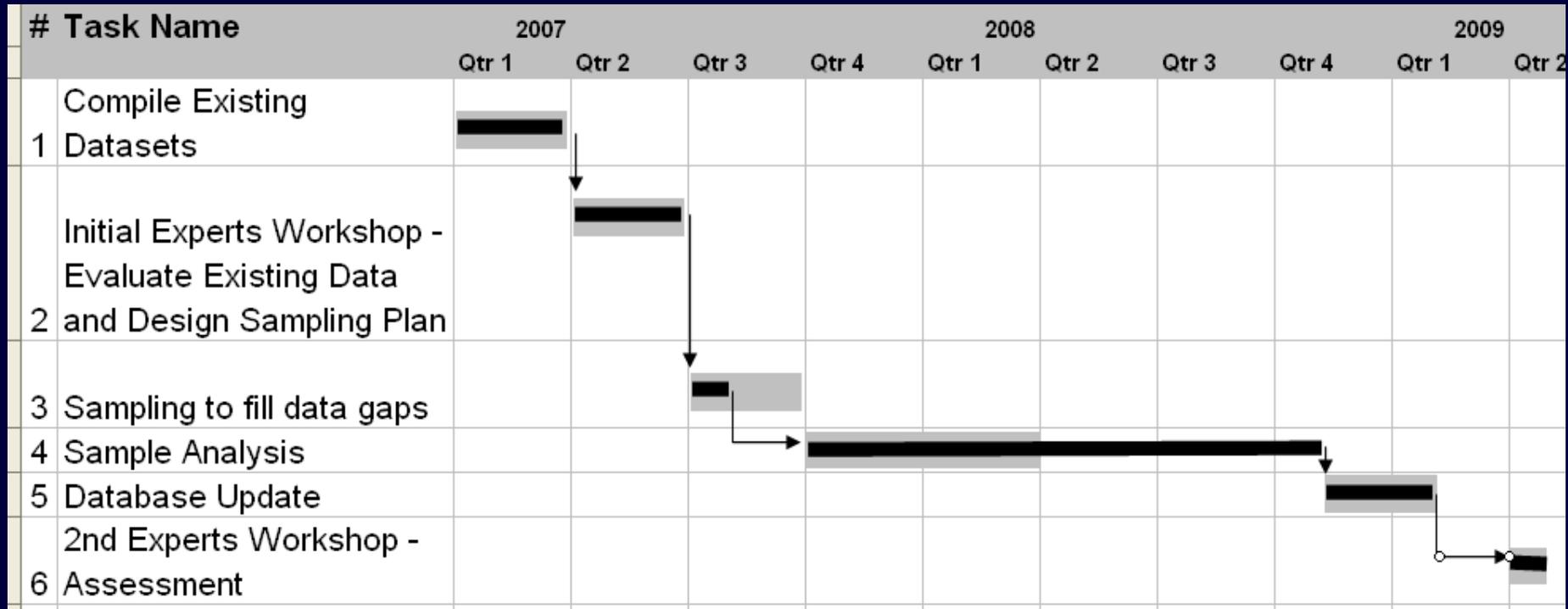
Goals

Enable the Department:

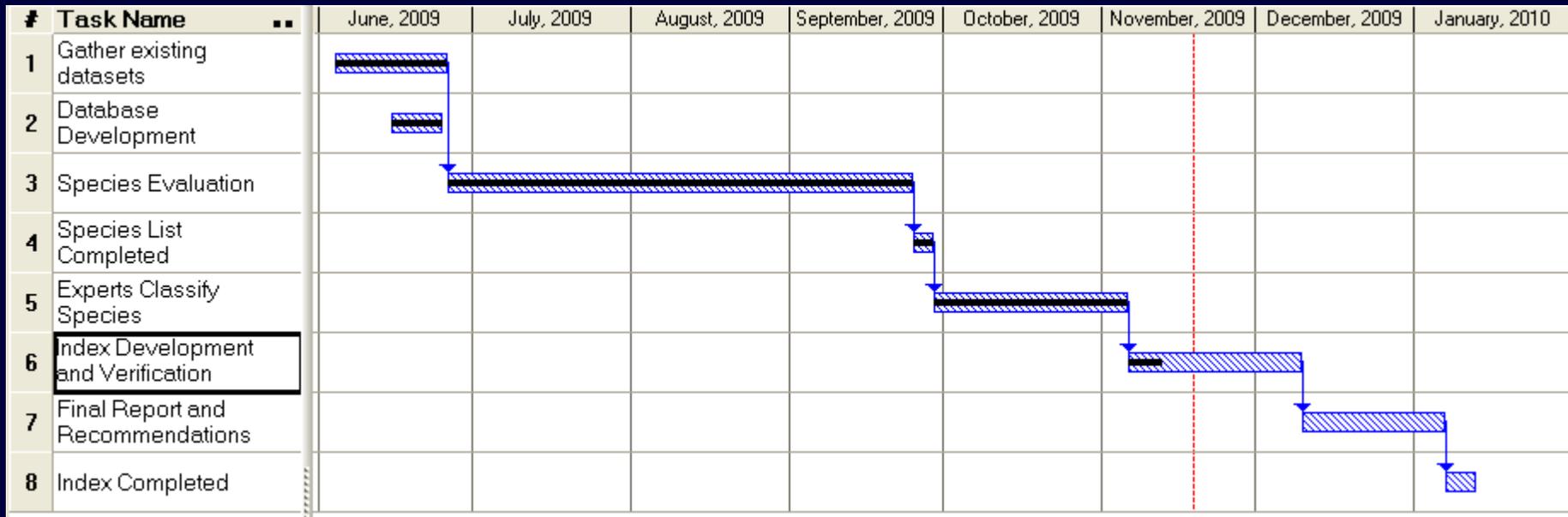
- ✦ To assess the Aquatic Life Designated Use in coastal waters as required under Sections 305(b) and 303(d) of the CWA
- ✦ Assess whether or not there are impacts from discharges to the ocean under Section 403(c) of the CWA



Project Timeline



2009 Timeline



Historical Datasets Evaluated by Rutgers IMCS

- * U.S. Army Corps of Engineers
- * Minerals Management Service
- * National Coastal Assessment EPA
- * New Jersey Geological Survey Geo Data
Bathymetric Data
- * EPA REMAP
- * Omni Environmental Corporation. 1995
- * Rutgers



1st Experts Workshop (Nov 2006)

Recommendations

- ✦ The process for calibration and validation must be clearly established for the project.
- ✦ The sampling design, number of replicates, type of grab, sieve size, level of taxonomic analysis, and strata must also be established as early as possible for summer 2007 sampling.
- ✦ The investigators must consider the level of taxonomic identification of the samples (e.g. oligochaetes).



Types of Data

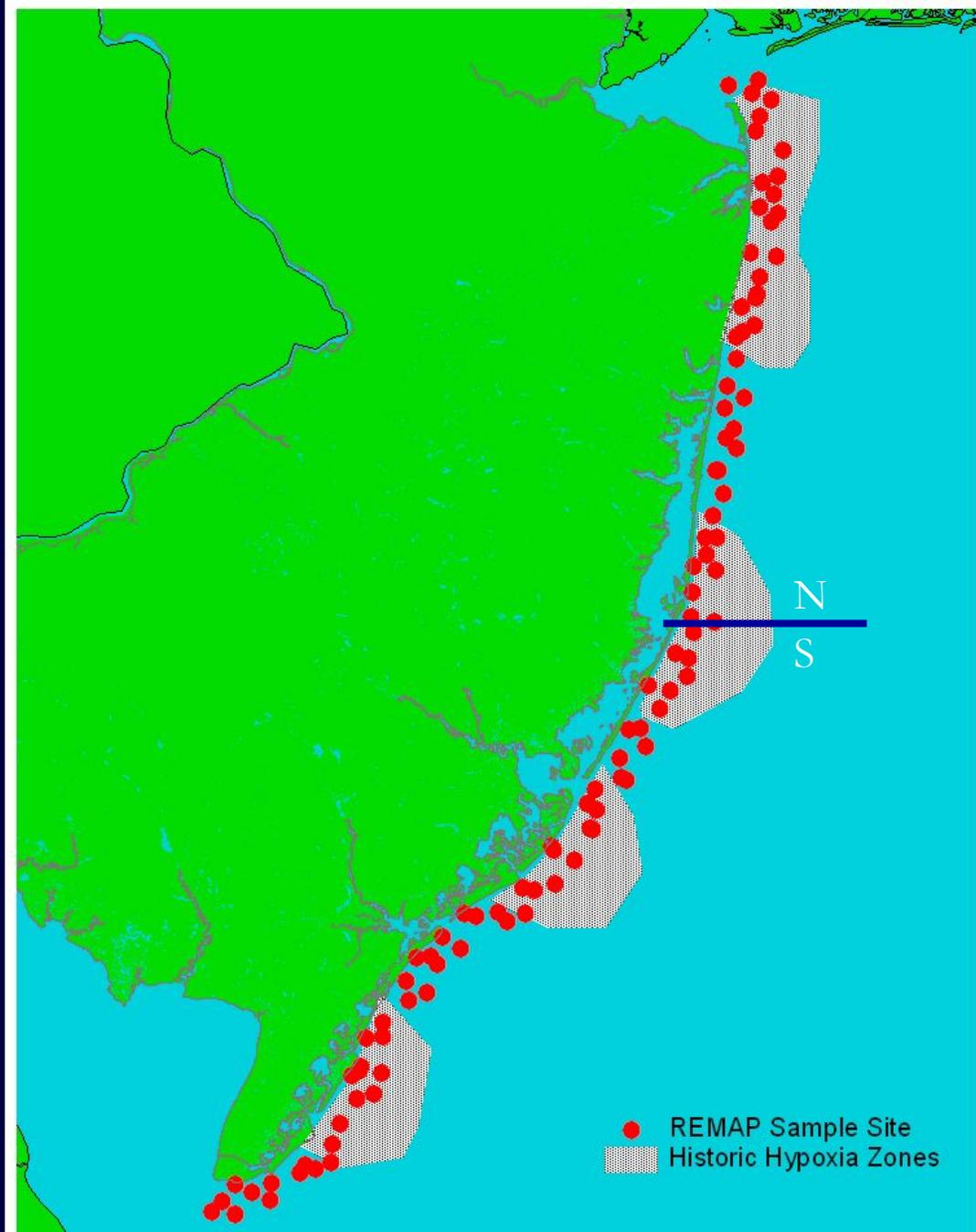
- ✧ Water column profile (DO, pH, salinity, temperature, depth, chlorophyll, and clarity)
- ✧ surficial sediment, top 2-3 cm, (total organic carbon; and grain size)
- ✧ benthic macroinvertebrate community structure (richness and abundance)
- ✧ habitat (general habitat-type; presence/absence: exotic species, submerged aquatic vegetation, and anthropogenic debris or perturbation).



Design for August/Sept 2007 Sample Collection

Probabilistic design that incorporates the strata agreed on by the workshop attendees.

Mixing zones were not specifically targeted, but may be included. Later sampling to be performed to capture mixing zone effects.



Abundant Species:



Polygordius (Polychaete worm)



Donax variabilis (Coquina clam)



Nucula proxima (Atlantic Nutclam)

Abundant Species:



Ascidiacea (Sea Squirt)



Mytilus edulis (Blue Mussel)

Abundant Species:

Petricola pholadiformis
(False Angel Wing)

Matthew McConaughey
was wrong in "Sahara".



Sensitive Species:

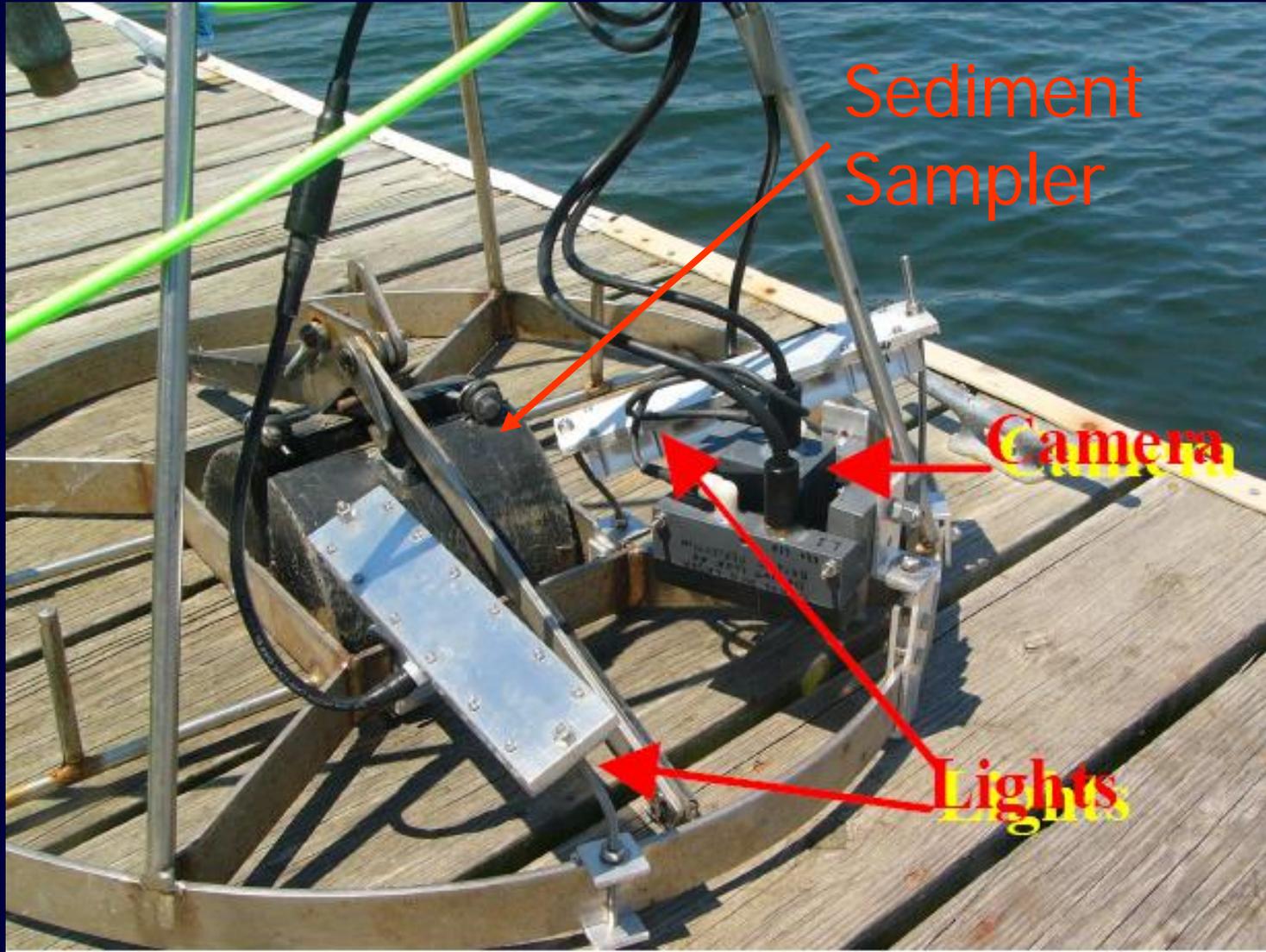


Asteroidea (starfish)



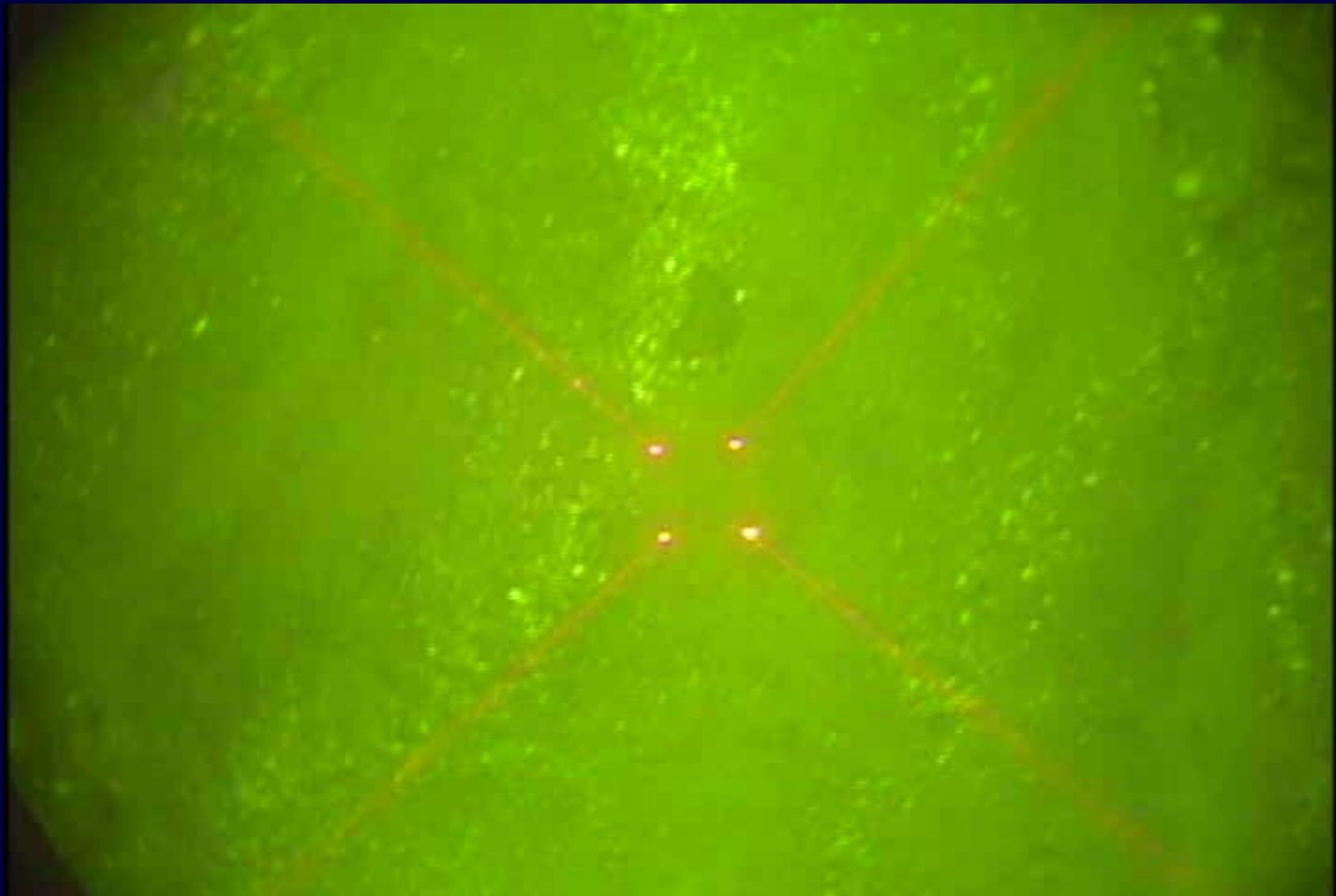
Echinoidea (sand dollar)

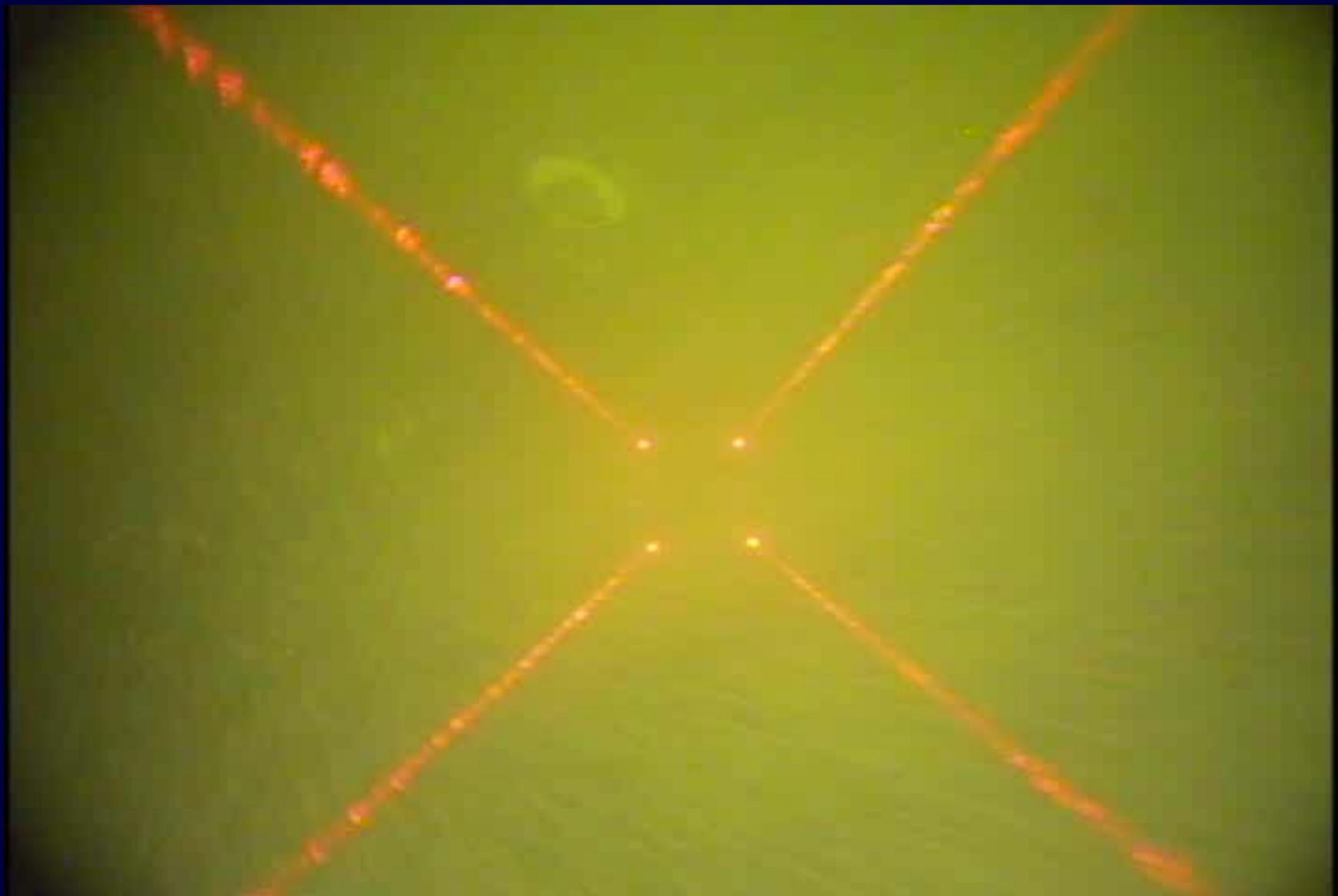
Modified Van Veen Dredge with Plan View Camera

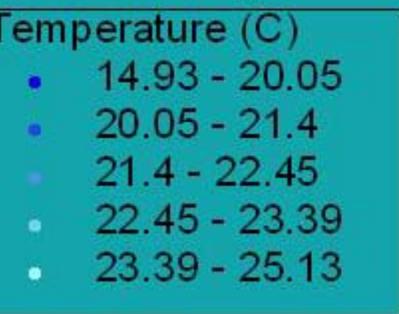
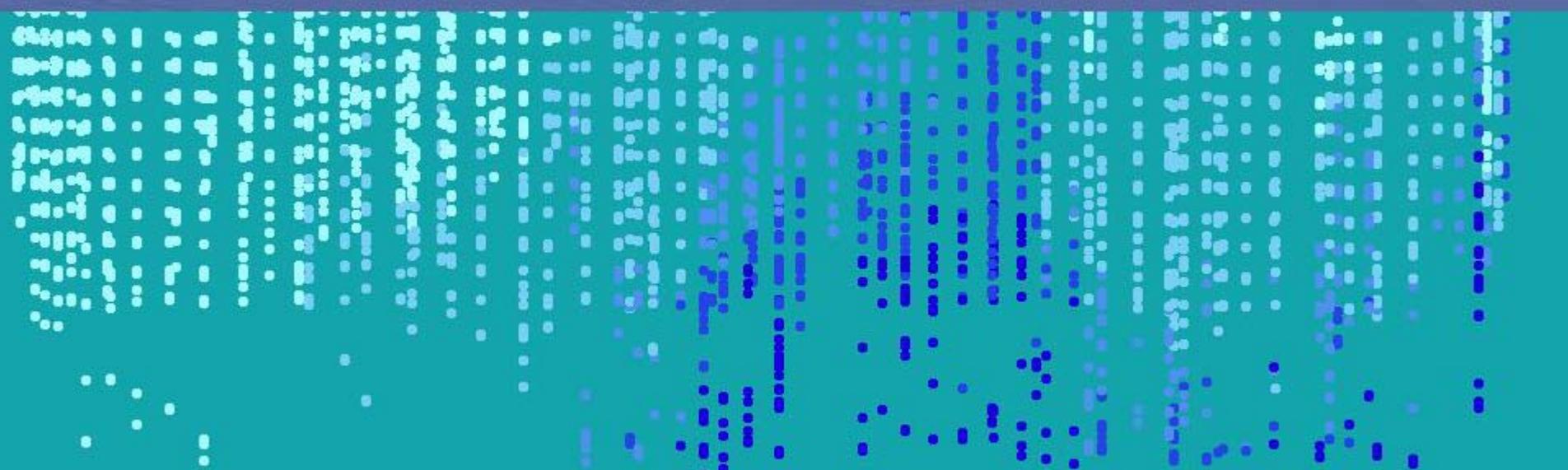


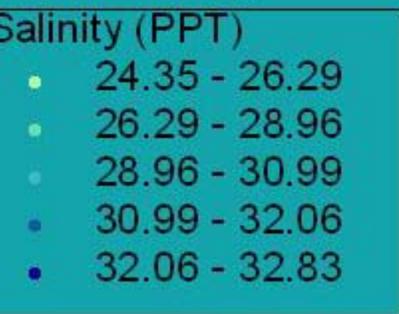
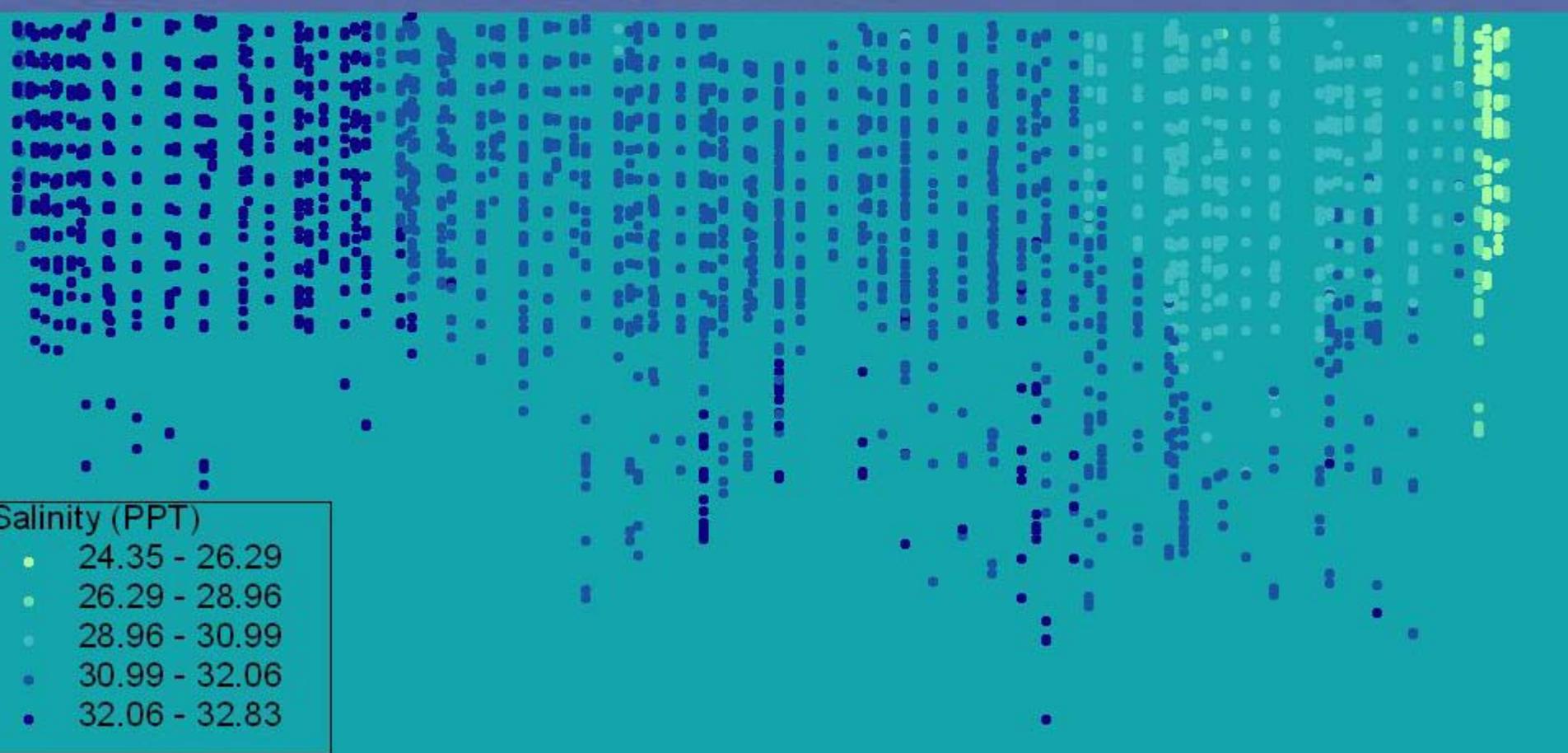
2009 Sampling







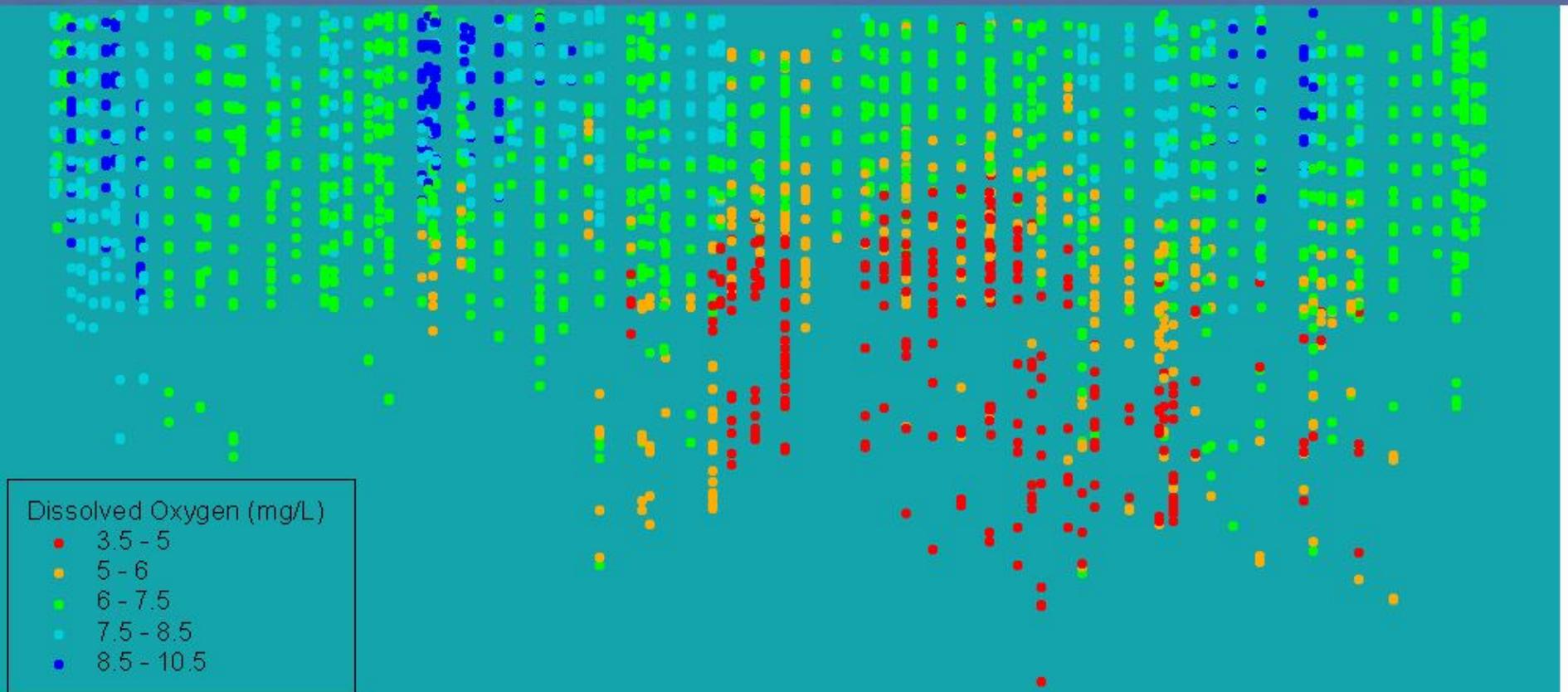






Chlorophyll a ($\mu\text{g/L}$)

- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 25
- 25 - 50





CANDIDATE METRICS FOR BENTHIC INDEX

Taxonomic Composition

Diversity Measures (Shannon Weiner Index)

Faunal Abundance (e.g. Bivalves, Gastropods, Polychaetes)

Biomass and Species Dominance

Percent Abundance of Pollution Tolerant Taxa

Percent Abundance of Pollution Sensitive Taxa



2nd Experts Workshop - Recommendations

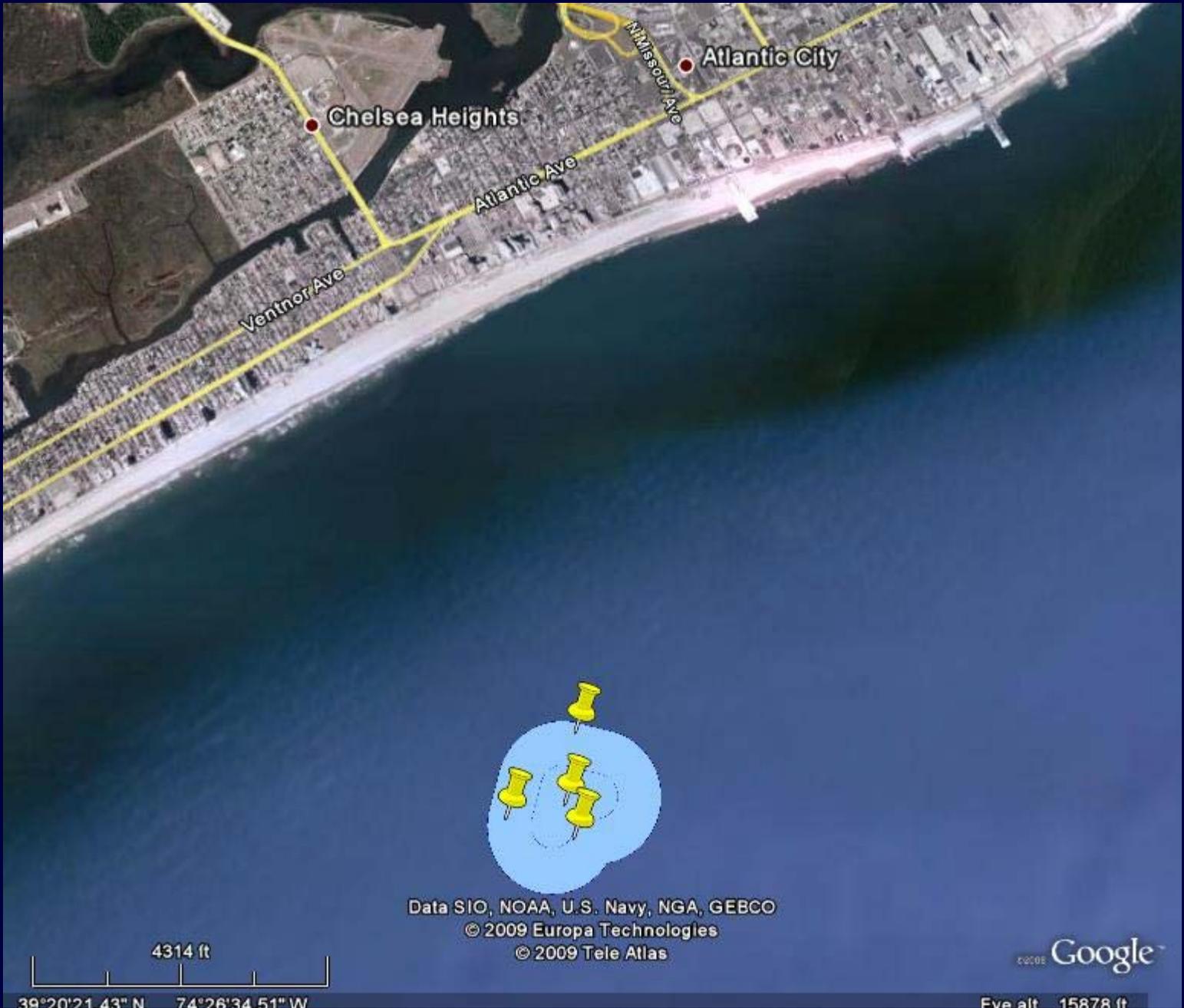
- Species tolerance index best meets NJ's needs for ocean assessment
 - It is habitat independent.
 - The presence/absence of species is a sensitive metric.
 - Easy to calculate and to explain to the public.
- Must identify and sample "impaired" sites to provide sufficient range in the data for calibration of the metric.



Additional Data Collection 2009

- 53 Stations
 - 9 discharge area - 3 locations per outfall randomly selected from an area beginning at the boundary of the 100 meter mixing zone and extending out 200 meters.
 - 30 new, randomly selected sites for background conditions.
 - 10 original sites from 2007 re-sampled to assess interannual variation.
 - 4 “impaired” sites – 6 mile dredge spoils site and the 12 mile sludge dump site. Two sites were sampled at each of these locations.





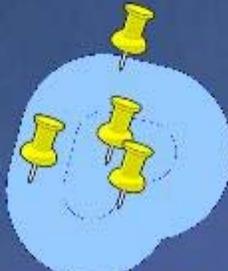
Chelsea Heights

Atlantic City

Atlantic Ave

Ventnor Ave

N. Missouri Ave



Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2009 Europa Technologies
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4314 ft

39°20'21.43" N 74°26'34.51" W

Google

Eye alt 15878 ft



Next Steps

- ✧ **Recommendations and Index from Rutgers by 12/31/09**
- ✧ **Complete Lab Analysis of 2009 samples – Spring of 2010**
- ✧ **Summer 2010 Sampling**
 - ✧ **3 samples at each of NJ's 14 ocean discharges**
 - ✧ **Additional background and revisit sites to assess interannual variability**
- ✧ **Assessment of ocean discharges – Spring 2011**



"... a model for cooperation among public agencies to better gauge the health of the environment."

Asbury Park Press September 5, 2007

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