

**Summary and Discussion Notes from Long Bay Hypoxia Study Workshop
June 14, 2005, Baruch Institute for Marine and Coastal Sciences, Kimbel Center, Georgetown,
South Carolina**

Major Goals

1. Review of what is known about the Summer 2004 event
2. Identify ongoing monitoring and research of relevance to Long Bay
3. Agree to prioritized list of additional data, information and research needs
4. Identify those willing to participate in a sampling response plan for future events

Overview Presentations of Event and Ongoing Monitoring Efforts in Long Bay

Available online at: <http://carocoops.org/hypoxia>

- **Overview of July 2004 Long Bay Hypoxia Event;** Denise Sanger, South Carolina Department of Health & Environmental Control – Office of Ocean & Coastal Resource Management (SCDHEC/OCRM)
 - High Flounder catches / lethargic fish in the surf zone and at local piers initially triggered the collection of observations
 - Hypoxia appears to have occurred from July 15-23 2004 and was located between Pawleys Island and Apache Pier
 - Coastal Carolina University (CCU) Data collected in the last few days from Springmaid, 2nd Avenue, Apache and Cherry Grove Piers
 - Indicated stratification with thermoclines and oxyclines around 3m depths particularly at Springmaid and 2nd Ave.
 - South Carolina Department of Natural Resources (SCDNR) data showed dissolved oxygen (DO) levels ranging from 0.66 mg/L – 2.8 mg/L in affected areas; Hypoxia is characterized by DO levels < 2 mg/L
 - Data from University of South Carolina (USC) show upwelling favorable conditions present in Long Bay during event including low water temperatures and persistent alongshore winds from the southwest
 - Three Potential Hypotheses for hypoxia which are not mutually exclusive
 - Gulf Stream intrusions, with upwelling favorable winds and stratification
 - Locally heavy rainfall causing stormwater discharge from beach outfalls, ocean outfalls and swashes
 - Regionally heavy rainfall and local estuarine discharge
- **Introduction to Local, State, Federal and Regional Monitoring Efforts;** Dwayne Porter, Baruch Institute, University of South Carolina (USC)
 - Super-National Programs - Oceans.US – coordinated Integrated Ocean Observing Systems
 - National Programs - NOAA and USGS efforts
 - Regional Associations, Federations and Programs - SECOORA; SEACOOS; SEAMAP; MARMAP
 - Sub-Regional Programs - Caro-COOPS; CORMP; SABSOON
 - State & Coastal Programs - SCDHEC and SCDNR efforts
 - Local Programs - Counties; cities; developer efforts; permitting
 - Academic Efforts - USES and LU-CES studies
- **Southeast Atlantic Coastal Ocean Observing System (SEACOOS);** George Voulgaris, Dept. of Geological Sciences, USC

- Goal of SEACOOS to increase quality and quantity of data collected from coastal ocean in the southeast
 - Covers coastal currents; Florida Current; Gulf Stream
 - SC Nearshore Monitoring system for SEACOOS covers:
 - Sediment transport; coastal circulation; waves; winds and freshwater discharge from rivers
 - Observing Subsystems consisting of:
 - Information management systems
 - Modeling and prediction
 - Outreach and Education
 - Two Key Phases in Program
 - Phase 1: Deployment and maintenance of nearshore circulation and wave direction monitoring sites at 2 locations along SC Coast (i.e. Springmaid and off Folly Beach)
 - Phase 2: Providing real time/hourly data for wave height, direction, period, current and wind-speed
 - SC Coastal Erosion Study
 - Model Development for Long Bay to evaluate erosion and surf zone conditions
- **Carolinas Coastal Ocean Observing and Prediction System (Caro-COOPS);** Braxton Davis, Baruch Institute, USC; SCDHEC/OCRM
 - User-driven system of integrated coastal and ocean observations and information products
 - Small-scale focus; tailored to meet local public data/monitoring needs
 - Four major components
 - Moorings & buoys; data management; integrated information delivery and probability (storm-surge) models
 - Current system composed of:
 - 4 Instrumental Moorings & 3 Water-level stations; pier-based, nearshore and offshore (i.e. Sunset Beach Pier; Sunset Nearshore; Capers Island; Capers Nearshore; Capers Mid-Shelf; Fripp Inlet; Fripp Nearshore)
 - All stations provide real-time hourly observations of temperature, wind speed & direction; pressure; water level and surface water temperature
 - Nearshore and offshore moorings measure bottom temperatures and currents, salinity, solar intensity, and chlorophyll
 - Caro-COOPS moorings could serve as possible platform for DO meter
 - **Coastal Carolina University (CCU)'s Environmental Quality Lab – Investigation of Ocean Outfalls in Myrtle Beach, SC;** Susan Libes, CCU
 - Stormwater pipes – switch from outfalls on beach to outfalls in ocean which are 1,000 feet offshore and approx. 60 inches in diameter
 - City of Myrtle Beach has contracted with CCU to monitor:
 - Onshore water quality in pipe (e.g. DO, enterococci, nutrients and oxygen demand)
 - Nearshore water quality at end of pipe
 - Flows through pipe
 - Currently a lack of all stormwater inputs, not just ocean outfalls is needed

- **SCDHEC Ocean and Coastal Water Quality Monitoring;** Sally Knowles, SCDHEC/Bureau of Water (BOW)
 - SCDHEC-BOW routinely monitors water quality for a variety of regulatory purposes which is mainly focused inland on upland input and loading
 - Routine Ambient Monitoring – Riverine and estuarine areas
 - Physical & chemical properties of water column and sediment
 - Biological communities and fish tissue
 - Monitoring Network
 - Fixed Stations – Monitored monthly for long term trends
 - Cyclical basin stations – Monitored monthly for 5 years; spatially dense location
 - Probability based stations – Randomly located statewide for statistical purposes, monitored for a year; SCECAP Program
 - Shellfish Management Areas – Monitored for sanitation purposes
 - Monthly Sampling of oyster growing waters
 - Beach Monitoring for safe swimming
 - 117 sites every 2-3 miles along coast
 - Tier 1 (high priority sites) sampled weekly, most of Grand Strand is Tier 1

- **South Carolina Department of Natural Resources (SCDNR) Ocean Monitoring Programs;** David Whitaker, SCDNR
 - Fish catch information is collected from boat lands and piers
 - Southeast Area Monitoring and Assessment Program –South Atlantic (SEAMAP-SA) Shallow Water Trawl Survey
 - Long-term trends and abundance of benthic epi-nekton collected from Cape Hatteras to Cape Canaveral since early 90s
 - High Priority organisms collected for measurement include: crustaceans, finfish and turtles
 - Measure salinity, temperature, wave-height
 - Three Sampling periods per year
 - April-May; July-August; October-November
 - 4 Trawl Sample sites off Grand Strand
 - Possibility of finding flounder spawning grounds to designate as EFH
- **SC Harmful Algal Bloom Program;** Alan Lewitus, SCDNR Marine Resources Research Institute; Baruch Institute, USC
 - Five Objectives for Harmful Algal Blooms (HABs)
 - Distribution; seasonal/annual trends; environmental factors, early warning and rapid response; public awareness
 - Phytoplankton Monitoring Network
 - Fish Kill Response vs. HAB response
 - HAB response identifies and tests for toxins

A. Discussion on Research Coordination

1. Information/Data Needs and Priorities for Better Understanding the Long Bay System

- Need for Historic Information
 - Proxies for past hypoxia
 - Other times when high flounder catches were noted; shark absence at specific piers; strange fish behaviors
 - Historical anecdotal evidence to link with scientific data
 - Pier surveys; press clippings; fishing activity reports
 - Recreational/Commercial fisheries records, catches and dates

- Tie dates of proxies to other historical data measurements
 - Remote Sensing
 - Chlorophyll / biological measurements
 - Circulation patterns
 - Current dynamics
 - “where waters came from and when”
- CCMA (NOAA) will provide data for sea-surface temperature and chlorophyll from 1985-2004
- SECOORA creation of GIS based eco-system management website could assist in coordination and linking of data and events
- Data Needed for Determining Inputs and Baseline Measurements
 - Terrestrial Boundary Conditions
 - Sources of terrestrial inputs into Long Bay
 - Role of Gulf Stream ‘risk factors’ and other large scale processes that affect Long Bay
 - “If ___ happens then hypoxia conditions might occur”
 - Meteorological Data
 - Winds and rainfall conditions in recent past
 - Occurrences of up-welling favorable conditions
 - Overall Water Budget for Long Bay with contributions of:
 - Rivers; estuaries, stormwater and Gulf Stream
- Need for Development of a Conceptual Model
 - Base model on what is currently known
 - Identify missing information and gaps
 - Consideration of scale that needs to be covered with model
- Need to obtain funding for research

2. Possible Data Sources and Other Current/Past Local Studies

- United States Geological Survey (USGS) Data
 - Discharge data from Winyah Bay and Cape Fear River
 - Water Quality Data since 1983
 - 15-18 Stations; measurements of water level and DO
 - Locations in Little River and Winyah Bay
 - Withers Swash Study
 - Turbidity and Enterococci data
- Myrtle Beach Stormwater Discharge Data
 - Models of stormwater discharge amounts
- SEAMAP-SA Trawl Survey Data
 - Records of catches and bottom surveys from past 10 years
- Records from NOAA’s National Buoy Data Center
 - Provide current and wind data
- National Estuarine Research Reserve – North Inlet-Winyah Bay Data
 - Plankton sampling
 - Long-term meteorological data
 - Water Quality Measurements
- WQ-208 Program
 - Hydrodynamic model for Total Maximum Daily Loads (TMDL) of the Intracoastal Waterway (ICW) since 1987
- Salinity Intrusion Model for ICW
- University of North Carolina Wilmington - Cape Fear Watershed data

- EPA Stormwater Outfall bacteria
- 3. Possibility of adding instrumentation/tasks to current projects**
- SEAMAP/MARMAP – DO (?); CTD casts
 - DHEC/DNR Inland WQ sampling (?)
 - DHEC Pier Sampling
 - SEACOOS/Caro-COOPS could begin monitoring of stratification

Sampling Strategy in Event of Hypoxia Occurrence

1. Triggers for increased sampling/monitoring

- Strange fish behaviors
 - Sharks; rays; flounder; invertebrates & others
 - Possible fact sheet creation for existing hotlines; pier personnel; local press
- Stratification and DO from Buoys – Springmaid Pier SEACOOS station
 - 2-6 weeks hopeful installation on Springmaid
- DO Probes for on-site monitoring
 - People and Probes may be available could be obtained from:
 - CCU; NI-WB NEER; OCRM-EQC
 - NOAA; DNR

2. Initial Response and Coordination

- Develop document for response hotline and commonly contacted numbers that filters public reports on fish kills, odd fish behavior, water abnormalities; list of triggers
- Tie hypoxia response into HAB Response Plan & fish kill response; primary contact with report
 - Generate list of questions to ask caller to determine event
- Large Response Pool – people willing to possibly assist if available when hypoxia event occurs
 - Protocol depending on level of problem
 - Who gets contacted when
 - Contact List for those involved
 - Shared responsibility based on availability for data collection
 - Website; listserv development for rapid contact to begin data collection
 - Conduct workshop to develop response plan and coordination

3. Media / Public Information and Relations

- Link between public and scientists
 - Team Coordinator / DHEC Media Relations – Thom Berry
- Pro-Active Media Activity, is it needed
 - Let public know what is going on and that the state is on top of it
 - Public education – “if you see...call...”
 - Handouts, posters, signs at piers
 - 1-800 number for reports
- Need to be Press-ready
 - Ability to state what happened, causes, what is known and not known and what is being done
 - Calm public fears – not a spill or HAB

4. Who’s willing to participate?

- Half-day workshop for willing participants to discuss design and resources