

**2004-2005 Coastal Ocean Research and Monitoring Program
(CORMP)**

**University of North Carolina at Wilmington
NOAA Award #NA16RP2675
Progress Report, August 1, 2004 to January 31, 2005**

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This progress report is for NOAA grant #NA16RP2675 for the period 1 August 2004 to 31 January 2005. The following report will detail progress during this time period in various components of CORMP and the report is organized to be consistent with the major CORMP components outlined in the 2004-2005 proposal Table of Contents.

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2.5 Data

A. Field Activities

- OB27 Sampling. Sampling activities at OB27 continued during this period. Instrumentation was deployed and recovered twice over the reporting period. All data recovered and downloaded successfully, and are of good quality.
- Ongoing 6-week deployments of the PCADP data at OB27.
- Continuous 3-month deployments of the ADCP at OB3.
- Sediment tubes were retrieved from OB3 and OB27 every six weeks.
- Bi-monthly surface grabs and boxcores were collected along transects established adjacent to the ADCP now deployed in the vicinity of the CFR plume

B. Lab Activities

- Graduate student, Chris Canaday, has been working on the ADCP and pressure data collected at our moorings up to April 2004. a data quality report was issued to CORMP management on September 17, 2004. Data were mostly of good quality, however, some issues were noted with regards to sampling that seriously degrade the usefulness of the data being collected.

- Temperature, pressure and conductivity data quality from the OB1-4 moorings up to April 2004 were evaluated. A report was issued to CORMP management on August 9, 2004. Data quality problems have continued at these sites over the entire time period. A solution to these problems was proposed and is being tested at the same sites and at the new plume mooring.
- All PCADP data have been downloaded, reviewed for QA/QC, and archived

C. Research and Data Products

- *Presentations*

18th DUNCOC Symposium, Beaufort, NC, November 19-20, 2004. Dr. Bingham gave a presentation entitled "Shallow Water Temperature Response to Passing Hurricanes in Onslow Bay, NC, 1999".

- *Publications*

Quattrini, A. M., D. G. Lindquist, F. M. Bingham, T. E. Lankford and J. J. Govoni, 2005. Distributions of larval Fishes among Water Masses in Onslow Bay, North Carolina: Implications for Cross-shelf Exchange. *Fisheries Oceanography*, 14:3, 1-19.

Blanton, Brian O.; Werner, Francisco E.; Seim, Harvey E.; Luettich, Richard A., Jr.; Lynch, Daniel R.; Smith, Keston W.; Voulgaris, George; Bingham, Frederick M.; Way, Francis. Barotropic tides in the South Atlantic Bight. *J. Geophys. Res.*, Vol. 109, No. C12, C12024

Ben Speckhart, Marine Science Masters student defended his thesis on August 16, 2004. Title: "Observational Analysis of Shallow Water Response to Hurricanes in Onslow Bay, NC in 1999"

D. Accomplishments and Constraints

- Significant progress has been made in constructing the CORMP website. It now displays real time data from a number of observational sources in the Cape Fear region. It has a simple and well-designed interface to archived data as well.
- As a result of discussions at the Columbia Meeting on Dec. 7, 2004, we have purchased the carolinaoceans.com domain name. This is envisioned as a combined North Carolina / South Carolina "one-stop shop" for ocean observations. Discussions have been ongoing with Caro-COOPS, SEACOOS, SECOORA and the National Weather Service with regards to design and implementation of this website. A meeting of all parties involved was held on February 4, 2005.
- Bingham attended the QARTOD Meeting in Norfolk, VA on February 28 - March 2, 2005. A detailed report from the meeting was issued to CORMP management on March 7, 2005. This will be discussed in more detail on the next progress report.
- Bingham attended "Real-time Data QA/QC Workshop". Columbia, SC. December 7, 2004.
- Bingham attended web seminars on "ADCP Waves Measurement Techniques - I" and on "ADCP Waves Measurement Techniques - II". Tuesday, Nov. 9 and Tuesday Nov. 30, 2004. Given by Paul Devine from RD Instruments.
- Obtained necessary permits to deploy pier moorings.
- Instrumentation, including ADCP with wave upgrade, has finally been successfully deployed in Long Bay. We have now obtained our first data set for this site. During this

deployment however, battery failure near the end of the deployment resulted in collection of only 4 weeks of data. We have now adjusted the sampling strategy to conserve power.

2.6 Modeling

- For the 2004-2005 project year, the goal of the CORMP modeling effort is to establish a demonstration scenario of the plume and water quality modeling in the Cape Fear River Estuary (CFRE). From August 1, 2004 to January 31, 2005, we have made substantial progress in following areas:
 - 1) Meteorological support: Continue to develop a state of the art hurricane wind model which is necessary for storm surge and ecological modeling;
 - 2) Physical aspect of CFRE plume: Simulations of physical (salinity) plumes under climatological runoff and wind conditions;
 - 3) Data preparation for ecological modeling: Data preparation for boundary conditions of the 22 simulated state variables in the water quality model;
 - 4) Ecological modeling: Ecological model grid generation;

- Meteorological support: The focus of this component of the modeling effort was focused on the generation of accurate hurricane wind forcing. We have developed an improved asymmetric hurricane wind model which utilizes available real-time observations, National Hurricane Center track and intensity predictions, and a parametric model to simulate time-dependent hurricane wind field diagnostically and prognostically.

- CFRE physical plume: Seasonal mean climatological winds were used to test the hydrodynamic model with respect to its performance on salinity plume simulation. During the fall (September-November) mean monthly winds in the CFRE region are southwestward. Mean monthly winter winds are initially southwestward during the December and turn southward in January and by late February are directed southeastward. Spring is a transition season, with mean wind vectors directed towards the northeast in late May. In the summer (June and July) the Bermuda-Azores high pressure system strengthens and the Icelandic low pressure cell weakens causing the winds to blow stronger and directed northeastward. Based on the general seasonal wind distribution of Cape Fear River Estuary discussed above, we run our model to the Cape Fear River Estuary, Long bay associated with the North, Northeast, South, Southwest direction. As an example, the evolution of the salinity plume under northerly winds is shown below.

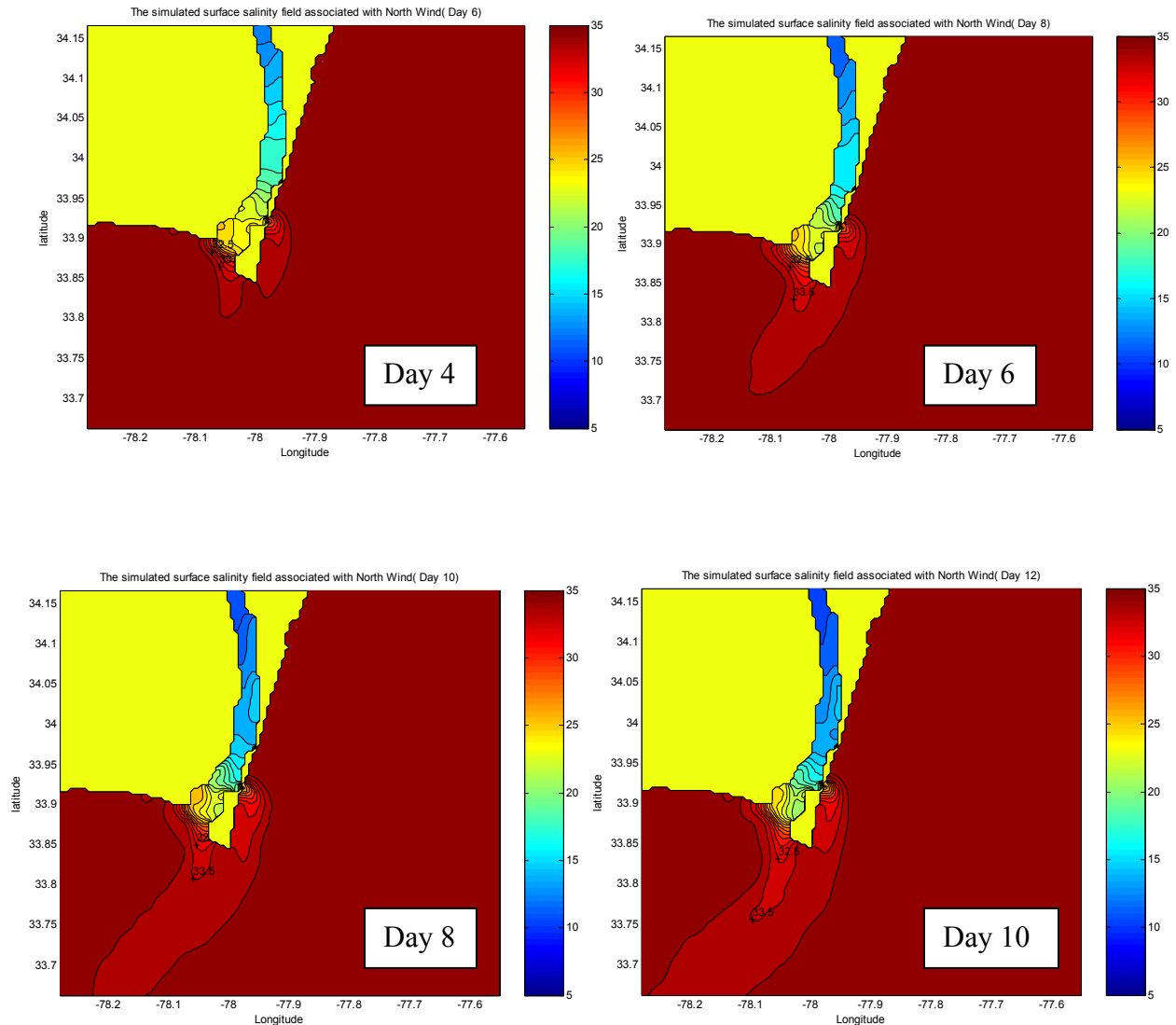


Figure 1. Evolution of the salinity plume driven by northerly winds over a 10 day period.

- Ecological model data preparation: During this reporting period the model team:
 1. has experimented and generated a spatially varying curvilinear-orthogonal grid to best incorporate the existing monitoring stations and at the same time to boost computational efficiency.
 2. has extracted high resolution bathymetry data in and near CFRE and merged them with the newly generated grid. Special effort has been made to ensure the narrow and curvy channel and several islands inside CFRE be represented.
 3. has examined data availability in model boundary conditions as well as cruise and monitoring periods and stations maintained by CORMP for selection of the model simulation period for the demonstration project.
 4. has searched and extracted river discharge and water quality data (include organic carbon, ammonium, nitrite, nitrate, phosphate, organic nitrogen, organic phosphorus, total suspended solids, fraction of fine solids, and chlorophyll a) from USGS gage

stations. Programs are being built to analyze the data and prepare for river boundary conditions.

- Ecological model development: A substantial effort has been made to develop a computationally efficient, spatially varying model grid with higher resolution inside CFRE and gradually lower resolution in the continental shelf off the coast. Different from the storm surge modeling effort of FY03-04, a much longer model simulation time (from months to years) is required for mainly two reasons. First water quality parameters usually have a longer spin-up time; Second, the rates of the biological and geochemical processes simulated in the water quality model are much slower than those of the hydrodynamic processes represented in the storm-surge model. Computational efficiency is hence a crucial factor to be considered in grid generation.

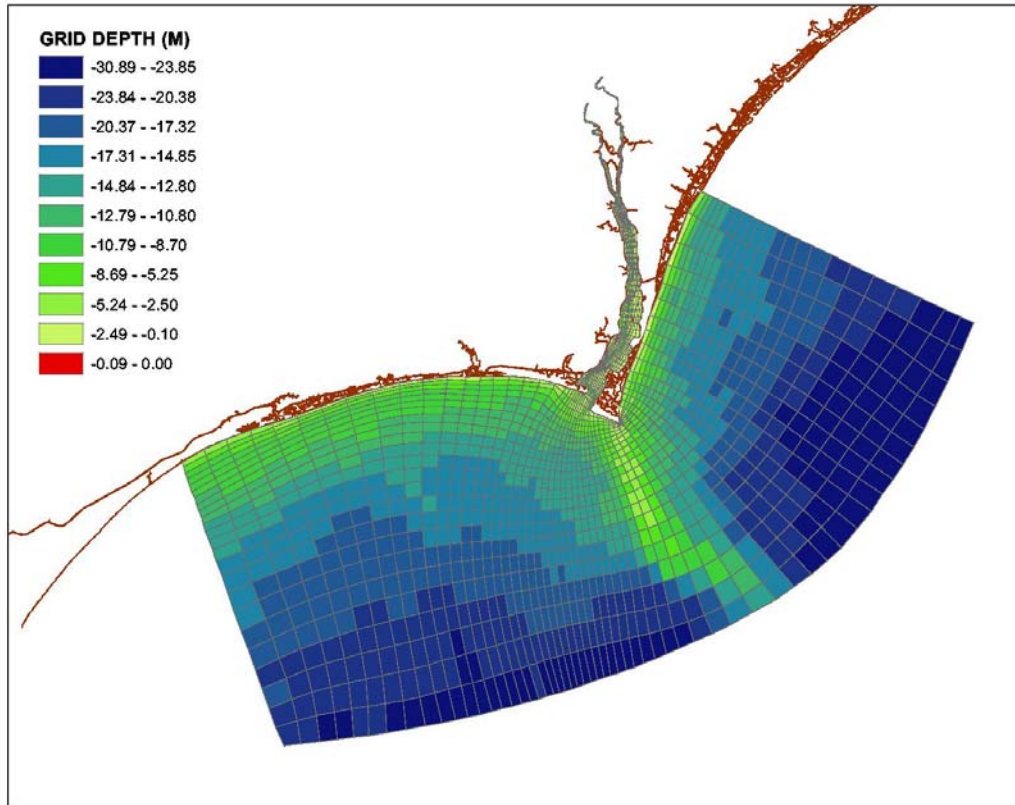


Fig. 2. Ecological model Grid.

3.0 Coastal Ocean Fisheries: An Ecosystem Approach in the Mid-South Atlantic Bight

A. Field Activities

- Water quality sampling in the Cape Fear River Plume (CFP) occurred in September, October, November, December 2004, and January 2005. Samples were collected for the following parameters: depth, water temperature, pH, conductivity, salinity, turbidity, dissolved oxygen (all at three depths), ammonium, nitrate, orthophosphate, silicate, and chlorophyll *a*.
- Sampling for nutrients and chlorophyll at the Onslow Bay stations was successfully performed on September 23 and November 16, 2004, and on January 19, 2005.
- Water column total suspended solids were measured at the surface, mid-depth, and near-bottom at all plume sampling sites on each of the bi-monthly RV Cape Fear Long Bay cruises. In addition, these samples were analyzed for % loss on combustion at 500 degrees Celsius.
- Surface sediment grabs, collected using a petite ponar grab sampler, were collected bi-monthly at each of the Long Bay plume sampling stations.
- Benthic sampling locations for the CFP for this proposal year have been modified from the 03-04 sampling year. The current sampling locations are CFP1, CFP2, CFP6, CFP8, and CFP9. CFP8 and CFP9 are new stations off the Lockwood Folly River. CFP3 and CFP4 were dropped from the previous sampling design. benthic grab samples were collected on August 8, 2004 and August 11, 2004 and a second sampling was conducted November 30, 2004. On August 8, 2004 grab samples were collected from CFP1, CFP2, CFP6, and CFP8, five replicate grabs were collected at each station. However the grab sampling device was lost while attempting to sample CFP9. The crew marked the location of the grab with GPS and returned to the site with divers on August 11, 2004. After retrieving the grab sampler CFP9 was sampled. All samples were accounted for, logged and preserved the day of collection. On November 30, 2004 grab samples were collected at all stations (CFP1, CFP2, CFP6, CFP8, and CFP9), with full replication at all sites. All samples were logged and preserved on the day of collection.
- Benthic sampling for the three Onslow Bay locations (OB5, OB15, and OB27) was conducted by divers utilizing specially designed core samplers. Sampling was conducted on July 26, 2004 and October 7, 2004. On each date five replicate cores were collected from each site. All core samples were logged and preserved on the date of collection.
- Monthly blue crab samples were collected for this project from June 2004 to October 2004. The period from June to October represents the critical time period for blue crab recruitment into the estuary as well as the spawning period when these crabs tend to migrate within the estuary, towards the estuary mouth. Trawls sampling was conducted at ten locations within and outside the mouth of the Cape Fear River and ten locations outside the mouth of the Carolina Beach inlet. This sampling was conducted using a 20 foot tri net, used by the Division of Marine Fisheries for monitoring crab and shrimp populations. Each sample consisted of a single ten minute tow. All organisms caught were identified and counted. All blue crabs (*Callinectes sapidus*) and the related species (*Callinectes similes*) are measures for carapace width, sex, and spawning stage. Trawl samples were collected from the Carolina Beach sites on August 18, 2004, September 23, 2004, October 27, 2004 and October 28, 2004 and sites were sampled around the mouth of the Cape Fear River on August 19, 2004, September 22, 2004, and October 26, 2004.
- At each CFR plume and Onslow Bay station, surface water samples were collected, and SeaWiFS –channel reflectances were measured at the surface using a Satlantic Micro-

SAS, while depth-dependent reflectances were measured by conducting profiles with a Satlantic MicroPro free-fall radiometer. Deployment of SeaWiFS –channel Satlantic sensors was discontinued after Jan 1, 2005 and efforts refocused on data evaluation. The attenuation of photosynthetically active radiation (PAR) was measured by profiling with a Licor irradiance meter.

- The Chelsea Fast Repetition Rate Fluorometer (FRRF) was deployed in vertical profiling mode at ~3 stations per cruise (depending on time availability) during September and January cruises. A benthic sled was constructed for benthic deployment, and benthic FRRF tows were initiated during January cruises. The sled configuration will be used for conducting FRRF measurements in the near-bottom chlorophyll maximum layer.
- Deployments of SCUFA fluorescence and turbidity monitoring units at bottom depths shifted from OB 5 to a site in the CFR Plume and from OB 27 (after 3 years) to OB 2M to assist in eventual development of a shelf carbon flux model.

B. Lab Activities

- Samples for water-quality parameters (nutrients, chlorophyll *a*, etc.) have all been processed in the laboratory for the CFR plume trips. Samples for Onslow Bay have been processed in the laboratory through December 2004. Field and laboratory data have all been entered into Excel files.
- Box cores continue to be photographed, described, and subsampled. Relief peels have been taken and archived. Selected boxcore images are available in digital form on the CORMP website.
- All water samples collected through the reporting period have been analyzed for TSS concentration and % organic content. These data have been archived and tabular results have been prepared for posting to the CORMP database.
- The grain size and percent organic content of all grab samples have been completed and are up to date. These data are now in preparation for entry into the CORMP database.
- River discharge, precipitation and wave data for the vicinity of the CFR plume have been obtained from the USGS and USACE. These data will be used to evaluate concentration and surface sediment granulometry changes in upper Long Bay.
- SCUFA data have been downloaded regularly, quality checked, plotted, and displayed on the CORMP web site.
- Benthic sediment samples have been collected and analyzed for chlorophyll *a* regularly, results plotted and displayed on the CORMP web site.
- Inherent optical properties of surface water samples from cruises were analyzed; total attenuation, and contributions to total attenuation such as CDOM absorption, particulate (detrital + pigment) absorption, and detrital absorption were determined.
- Satellite remote sensing: Scripts were completed to automate the receipt, geographic projection, and graphical display of MODIS SST and Chlorophyll products on the web in near real-time (<http://cormp.org/MODIS/>).

C. Research and Data Products

- We now have an extensive CORMP data set on the CFR plume that spans the period February 2000 through the present. During this project year sampling was discontinued at Stations CFRP3 and CFRP4, and sampling was added at Stations CFRP8 and CFRP9. The reasoning behind this was that the first three years of our CORMP occurred during drought

years; upon cessation of the drought in early 2003 the plume was noted to extend further into oceanic waters. Stations 8 and 9 are farther offshore and allow us to capture more offshore effects of the plume, especially following major terrestrial rain events.

- Summaries of research results are maintained on the sediment transport CORMP homepage (<http://people.uncw.edu/lynnl/comp/bbl.html>)
- Bi-monthly in situ measures of vertical grain size distributions in the plume are available from September 2003 to November 2004.
- Contour maps of suspended sediment grain size, salinity, and suspended sediment concentration have been completed for the vicinity of the CFR plume.

- *Presentations*

Wren, P.A., and L.B. Cahoon. Bottom boundary layer delivery of chlorophyll *a* and POC to a hard bottom reef community in Onslow Bay, North Carolina. ASLO meeting, Feb., 2005. This work developed near-bottom flow and biomass data into material transport estimates for the OB27 site based on CORMP SCUFA and PC-ADP data.

McGee, D.K., R.A. Laws, and L.B. Cahoon. A deep water benthic diatom assemblage from outer shelf-upper slope sediments, Onslow Bay, N.C. ASLO meeting, Feb., 2005. This work demonstrated the presence of a viable benthic diatom assemblages at depths and light flux levels much lower than all previous reports have indicated.

Wendy L. Woods, Piotr Kowalczyk, Timothy T. Wynne, Richard P. Stumpf, Varis Ransibrahmanakul, Michael J. Durako, William J. Cooper, David H. Wells, Jason J. Souza. 2004. Ocean color remote sensing in southeastern U.S. coastal waters and evaluation of atmospheric correction improvements to radiometric match-ups. Ocean Optics XVII, 25-29 Oct 2005, Fremantle, Australia.

Cahoon, L. B. Riverview and the Hurricane Floyd flood, B.F. Grady Elementary School, Atkinson, NC, Mrs. Burgess' 8th grade science class, Sept. 28, 2004.

Cahoon, L. B. UNCW's Coastal Ocean Research and Monitoring Program: An Overview, Cape Fear Power Squadron, Sept. 27, 2004.

Slattery, M. and Leonard, L. 2004. Effects of the Cape Fear River plume on inner shelf sedimentation, Long Bay, NC. 2004. Southeastern NC. Southeastern Estuarine Research Society, Wilmington, NC. p. 29.

Wren, P.A. and Leonard, L.A. 2004. The effects of tropical cyclones on sediment transport patterns adjacent to a hardbottom reef in Onslow Bay, NC., EOS Trans. AGU 85(47), Fall Meet. Suppl., Abstract OS21B-1237.

Alphin, T, Posey, M. Lankford, T. Cape Fear River plume fisheries and benthic monitoring. 2005 Benthic Ecology Meetings.

- *Publications*

- Mallin, M.A., L.B. Cahoon and M.J. Durako. 2005. Contrasting food-web support bases for adjoining river-influenced and non-river influenced continental shelf ecosystems. *Estuarine, Coastal and Shelf Science* 62:55-62.
- Quattrini, A. M., D. G. Lindquist, F. M. Bingham, T. E. Lankford and J. J. Govoni, 2005. Distributions of larval Fishes among Water Masses in Onslow Bay, North Carolina: Implications for Cross-shelf Exchange. *Fisheries Oceanography*,14:3, 1-19.
- Dafner, E.V., M.A. Mallin, J.J. Souza, H.A. Wells and D.C. Parsons. (In press). Nitrogen and phosphorus species in the coastal and shelf waters of southeastern North Carolina, Mid-Atlantic U.S. coast. *Marine Chemistry*.
- Wren, P.A. and L. A. Leonard. (In press). Sediment transport on the mid-continental shelf in Onslow Bay, North Carolina during Hurricane Isabel. *Estuarine, Coastal, and Shelf Science*.
- Kowalczyk, P., J. Stoń, W. J. Cooper, R. F. Whitehead, and M. J. Durako. (in press). Characterization of chromophoric dissolved organic matter (CDOM) in the Baltic Sea by excitation emission fluorescence spectroscopy. *Marine Chemistry*.
- Cahoon, L.B., M.A. Mallin, F.M. Bingham, S.A. Kissling, and J.E. Nearhoof. Effects of Hurricane Floyd on the lower Cape Fear River Estuary and coastal ocean, submitted to *Estuarine, Coastal and Shelf Science*.
- Lankford, T. In preparation. Influences of the Cape Fear River discharge plume on fisheries recruitment. *Estuaries*.

D. Accomplishments and Constraints

- Productivity: We continue to make great progress in addressing our objectives as stated in the 2003-2004 CORMP proposal. One of our principal objectives was to determine if benthic primary producers dominate in clear, nutrient-poor waters and phytoplankton dominate in waters with higher attenuation coefficients and nutrient levels. The Mallin, Cahoon and Durako paper (see above) is now published and demonstrates that planktonic chlorophyll and nutrients in the nearshore Long Bay well-exceed those of nearshore and offshore Onslow Bay. Likewise, suspended sediments and CDOM from river discharge contribute to much higher light attenuation in the plume-influenced area of Long Bay than in any portion of Onslow Bay that this program samples.
- Water Quality: We are pleased to say that two new CORMP-related water quality papers have been accepted for publication, both in *Marine Chemistry* (see Dafner et al. and Kowalczyk et al. in press, above). One of the key issues the Dafner et al. paper brings out is how organic nutrient species dominate the pools of total nitrogen and total phosphorus in local coastal marine waters. As most nutrient distribution and nutrient limitation papers are primarily concerned with inorganic nutrients, this provokes thought that the organic nutrient pool may play a larger role in driving coastal primary production than generally considered. This provides a theoretical basis for future research activities along these lines.
- Bio-Optics: Collaborative research continued with Drs. Rick Stumpf, Varis Ransibrahmanakul and Timothy Wynne (NOAA National Ocean Service, Center for

Coastal Monitoring and Assessment). The focus of this work is the improvement of coastal water products with improved atmospheric correction. NOAA/NOS has provided satellite data processed with an atmospheric correction including absorbing aerosol correction. These data will be compared with satellite data processed using the standard SeaDAS software (no absorbing aerosol correction) and also compared to in situ measurements from the same day, to determine whether better agreement is observed. The goal of this research is the quantitative use of ocean color data for the retrieval of biogeochemical surface water constituents such as chlorophyll and CDOM concentrations, facilitating long-term monitoring efforts.

- Bio-Optics: Consultation with Robert Arnone (Naval Research Laboratory, Stennis Space Center, MS) has indicated the need for continuing coastal water radiance data in support of ocean color validation and atmospheric correction algorithm improvement. The technical feasibility of outfitting a CORMP NODC buoy with a SeaPRISM radiometer is being investigated, with the intent to pursue a collaboration in which CORMP would provide NRL with radiometer data in support of NRL coastal validation work for MODIS and follow-on ocean color missions, and NRL would provide CORMP with improved coastal ocean color products for the region.
- Sediment dynamics: Recruited M.S. student (L. Davis) to complete thesis work on sediment transport in Long Bay.
- Benthic Ecology: CORMP program data collected as part of the blue crab habitat utilization project was used to leverage funds from the North Carolina Blue Crab Program to extend the scope of future sampling efforts to include the entire mesohaline and oligohaline regions of the Cape Fear estuary. These data will model the distribution of blue crabs from the coastal ocean to the tidal freshwater regions of the Cape Fear estuary.
- Benthic Ecology: In addition to the information collected on the size, abundance, spawning condition of blue crabs we also collected data on the size and density of the two main commercially important species of shrimp, the brown shrimp (*Farfantepenaeus aztecus*) and the white shrimp (*Litopenaeus setiferus*). This information was provided to the North Carolina Division of Marine Fisheries as part of data sharing partnership and was used to open and close the commercially shrimp harvesting grounds in the Cape Fear region. In future seasons this data will be provided in a web based format to allow instantaneous access to the data.
- Fisheries: A partnership between UNCW CORMP and the NOAA/Rutgers University/CMER Bluefish Research Program has been organized to expand spatial coverage of larval fish sampling in Onslow Bay. Sampling is scheduled to begin in summer 2005 and will enhance our ability to document influences of the CFR plume on fish recruitment. CORMP researchers will team with investigators from other coastal states (NY, NJ, MD and FL) to develop a synoptic, coastwide index of juvenile fish recruitment to assist state and federal fisheries managers with stock assessments and development of fisheries management plans.
- We continue to build up a solid data-base to be used for a modeling effort to assess the impact of terrestrial rainfall and runoff on the chemical, geological, biological and optically-active constituents of the plume. The expansion of our sampling regime into stations farther from shore allows for a better analysis of terrestrial-originated hydrological impacts to the coastal ocean.

- In accord with continued field sampling in Onslow Bay and the Cape Fear Plume, the database of optical parameters in coastal waters was extended, providing additional matchup days for satellite data intercomparisons and algorithm development.

4.0 Data Management

A. Activities

- On July, 2004 Xiaoyan Qi met with data managers in Caro-COOPS to talk about the prototype of the new version of Meta-DOOR and how CORMP can possibly use current version of Meta-DOOR to create FGDC-compliant metadata. Data managers between CORMP and Caro-COOPS start the dialog.
- September, 2004 Dr. Lee Dantzler and Xiaoyan Qi met with Sara-Haines and Dr. Harvey Seim in University of North Carolina at Chape Hill to discuss how CORMP and NCCOOS can possibly cooperate in Carolina water area.
- November, 2004 Xiaoyan Qi participated in the SEACOOS workshop.
- December, 2004 Dr. Fred Bingham and Xiaoyan Qi met with data managers from Caro-COOPS, CMO and OHH to share the experience and get to know who is doing what.
- January, 2005 CORMP Data manager reported the progress made to SAB.

B. Accomplishments

- July, 2004 CORMP bought Dell Precision 670 workstation with Red Hat Linux Enterprise Version 3.0 installed.
- Apache webserver and PostgreSQL database server were set up on this workstation.
- DODS netCDF server and DODS Relational Database Server were installed on this workstation.
- Most of Cruise Data and Mooring data from CORMP operation team and CORMP research team were put into the centralized PostgreSQL database system.
- “Graph and Download” webpage was developed to visualize the CORMP cruise CTD data.
- “Graph and Download” webpage was built to visualize the CORMP mooring data.
- A system which can automatically retrieve streamflow data from USGS webpages and calculate the Cape Fear River discharge was set up.
- CORMP main page was updated to combine the new developed components.
- CORMP webpage was hosted on CORMP precision 670 workstation.
- www.cormp.org started running since November 1st.
- October, 2004 CORMP bought a Dell PowerEdge 2650 Server. This server was set up the same as CORMP workstation. CORMP webpage was moved to Dell Poweredge server after initial testing, configuration and installation.
- CORMP workstation is kept as a development server while CORMP PowerEdge 2650 serves the webpage to public. These two machines are mirrored with each other.

C. Future Plans

- Continue to build the CORMP data management system.
- Create FGDC-compliant metadata to make sure data disseminated from website are complete and with high quality.

- Working with CORMP team and other IOOS to set up QA/QC standards.
- Build an instrument and operation tracking system to better manage the instruments and make stations, instruments and operations information visible to public.
- Be ready for the incoming real-time data streams.
- Learn and build WFS, WMS services with Mapserver.

5.0 Education and Outreach

A. Education

- The CORMP marine science professional development pilot program for middle and high school teachers has been highly successful. Five science teachers from New Hanover, Onslow, Bladen, and Brunswick County Schools participated. The initial summer workshop was held July 26 - 29 at the U-CW Center for Marine Science and 1-day Saturday seminars were held on Nov. 11, Oct. 23, Dec. 24, and Feb. 26. The final two meetings will be held during April and May, 2005. Activities and lesson plans using CORMP resources and archived data have been developed during the Saturday sessions. Teachers continue to be enriched from their interactions with CORMP researchers and are implementing hands on, science based activities in their classrooms based on their enhanced content knowledge.
- With the success of the previous professional development program, CORMP has scheduled two summer programs for 2005. Each summer session can accommodate 10 middle and high school science teachers.
- CORMP is continuing to work with the UNCW Science and Math Education Center (SMEC). SMEC Director and Co-Director, Karen Shafer and Bill Kawczynski remain involved in the CORMP education pilot program and are facilitating teacher recruitment for the 2005 CORMP Summer Teacher Workshop. The goal is to recruit teachers from around the state, not just coastal counties.
- CORMP has been trying to implement the Data Visualization Tools (DVT, see details on this effort below) developed at the UNCW School of Education and has had some success; however, due to the large volume of data in the DVT's teachers are finding them difficult to implement in the classroom. The teachers are providing feedback on ways to enhance the DVT's and make them more effective.
- CORMP is in the process of developing short DVD movies for use in middle and high school classrooms. The DVD's will include interviews with CORMP scientists who will explain their field and lab work and discuss how their research benefits the environment. Another set of DVD's will provide footage of CORMP field operations, highlighting the equipment used in the field to collect data, diving operations, and underwater video of flora and fauna in the region. CORMP met with Dustin Miller, Director of UNCW-TV, regarding production of these DVD's and how CORMP and UNCW-TV can partner in the future.
- The Teacher and Student Resources link on the CORMP website has been updated to include lesson plans, video footage and photographs for use in the classroom.

1) Data Visualization Tool Development

- Improvements and updates to the CORMP data visualization tool (*Riverview*) continue. The tool can be accessed at <http://www.uncw.edu/riverview/>. Lesson plans for the *Riverview* website are being developed and will be ready for teacher workshops this summer.

- A “view station” option was added to the DVT for easier viewing of the data on any given day.
- *Riverview* has been submitted for peer review to iLumina the National Science Digital Library an NSF supported project.
- *Riverview* has also been submitted for peer review to Marlot the Multimedia Educational Research for Learning and Online Teaching digital library.
- During the last 6 months the *Riverview* website has been presented to teachers and researchers at selected conferences and seminars. Selected presentations include:
 - “*Riverrun, Riverview and OceanView*” to the New River Round Table, Jacksonville, NC. September 2004.
 - “*Using Interactive Technologies to Facilitate Scientific Inquiry,*” The Watson School of Education Technology Conference, Wilmington, NC. Summer 2004.
 - “*Riverview an Interactive Data Visualization Tool.* To the secondary science teachers in Onslow County. Winter 2005.
- *Riverview* presentations to University teacher preparation and graduate in-service classes include:
 - School of Education-Secondary Science Methods (graduate and undergraduate)
 - School of Education-Middle School Science Methods
 - Environmental Studies Department-Using Advance Technologies to Teach about the Environment (graduate and undergraduate)
 - School of Education Special Program NC-Quest (a UNCW graduate in-service science and mathematics methods course for middle school science teachers)

B. Outreach:

- Partnerships have been established with the following organizations:
 - Johnnie Mercer’s Pier, Wrightsville Beach, NC and Long Beach Pier, Long Beach, NC. Both of these piers will serve as shore based, real-time mooring locations for CORMP monitoring equipment.
 - US Marine Corp Base Camp Lejeune to purchase, with CORMP, an NDBC buoy to be deployed in Onslow Bay, NC in June 2005.
 - US Army Corp of Engineers will be provided with the wave data collected from the pier based moorings. USACE will process the data for use in their shoreline erosion models. All processed data will be provided back to CORMP researchers.
 - The National Weather Service, Caro-COOPS and CORMP are jointly working together to create a new NWS Marine Weather webpage specifically for the NC/SC coastlines. This site is currently under development and will be ready for preview in May 2005.
 - MarineQuest, located at the UNCW Center for Marine Science is developing a program including CORMP archived data to enhance New Hanover and Pender County’s science curriculum.
- CORMP has hosted meetings with local super users to provide them with information on the program and the mooring systems that are being deployed over the summer. These groups are working with CORMP to provide feedback on buoy placement and possible applications for the data being collected.
 - North Carolina State Ports
 - US Coast Guard Marine Safety Office, Wilmington Office

- Cape Fear River Pilots Association
 - US Army Military Ocean Terminal Sunny Point
- CORMP participates in the NWS Carolina Marine Advisory Council (CMAC) meetings. These meetings include recreational, commercial, and government interest, so they provide a useful platform for CORMP information to be disseminated. NWS also sponsors the Rip Current Awareness Strategies Team (RCAST). Real-time data collected at the two pier sites will be used by NWS to predict where rip currents will most likely occur in coastal counties. CORMP is also working with RCAST to develop informational materials to increase public awareness concerning rip currents.
- CORMP is actively participating in local and regional meetings. Some of these include: Outreach & Education informational meeting in Raleigh, NC; SEACOOS 2004 fall meeting, Charleston, SC; and, Waves Workshop, Columbia, SC.
- The CORMP public awareness campaign has kicked off. CORMP staff have been involved in school classroom visits, judged local middle school science fairs, and given talks to scuba clubs and civic groups. CORMP flyers and brochures are being printed so they can be distributed to local fishers, boaters and beach-goers. Seminars have been scheduled to coincide with buoy deployment at West Marine, Boater's World, local tackle shops, and civic clubs/organizations.
- CORMP submitted a \$5000 grant proposal to the UNCW Information Technology department to purchase equipment beneficial for use in educational seminars and website development. The grant was fully funded and, based on the grant, the IT department has asked CORMP to participate in the UNCW technology showcase, which is open to the public, highlighting innovative programs at UNCW.
- CORMP PI has continued collaboration with NC Dept. of Agriculture and Consumer Services Emergency Planning Division regarding possible ocean disposal of mass animal mortalities in the event of disaster. CORMP oceanography input will be critical in development of this project. Developed detailed field experimental protocol to be incorporated into preliminary science proposal.
- Awarded an Innovative Technology Award by UNCW for hardware and software to support CORMP outreach endeavors
- Awarded "Coastal Climatology Products for Recreation and Tourism End-Users in Southeastern NC (PI-Gamble, Co-PI Leonard), NOAA-CSC (\$74,890)" will support outreach and web development initiatives

6.0 Program Management

A. Cooperative and Interoperability Efforts

- L. Leonard attended the SECOORA workshop in Jacksonville, FL in December 2004.
- L. Leonard attended the COTS/ONR WORKSHOP in November 2004 in Charleston, SC. At this meeting, she agreed to co-chair the "Common Interface" workgroup for the IOOS-open IOOS Interoperability II demonstration.
- Initiated a partnership with the USACE to exchange wave data and to acquire wave processing algorithms for use with pier-based data once these systems are up and running.

B. Facilities and Equipment

- NURC Glider: With the purchase of a Webb glider AUV by the National Undersea Research Center (NURC) and UNCW, an efficient new platform for shelf-wide observations

became available to CORMP. To take advantage of construction-time engineering cost savings, sensors will be purchased for incorporation into the NURC-owned glider during construction, in exchange for glider deployment time. Sensors purchased include an Aanderaa shallow water Oxygen Optode and Wetlabs optical sensors consisting of: a scattering and attenuation meter (SAM), a chlorophyll *a* fluorometer, a chromophoric dissolved organic matter (CDOM) fluorometer, and a backscatter sensor. In conjunction with simultaneous ship-based water samples, glider data can be used to investigate the nature and concentration of suspended particles, as well as chlorophyll *a*, CDOM and oxygen distributions, and their relationship to the shelf-wide temperature and salinity structure provided by the onboard CTD. Bimonthly deployments of the NURC glider in shelf waters can be used to provide (along-shelf) model domain boundary conditions and cross-shelf physical, chemical, and bio-optical properties. Such observations can be used to investigate a number of phenomena relevant to NC coastal waters, such as: event-scale shelf-break nutrient upwelling, the dependence of water column light attenuation on the relative concentrations of optical constituents, effects of water column stability and cross-shelf circulation on phytoplankton concentrations and production, factors contributing to low-oxygen bottom waters, the ground-truthing of remotely sensed ocean color including the effect of sub-pixel chlorophyll variability, and the spatial extent of sediment resuspension events observed in mooring data and in extreme resuspension events occasionally observed during diving activities. As a relevant footnote, our operations team has experienced zero visibility conditions at our OB27 site during the last two sample cruises.

C. Field Operations

Accomplishments

- 3 Onslow Bay cruises were successfully completed on the following dates: 9/23/04, 11/16/04, and 1/19/05.
- 5 Cape Fear River Plume cruises were successfully completed on the following dates: 9/10/04, 10/1/04, 11/11/04, 12/14/04, and 1/10/05. The 8/04 cruise was cancelled due to Tropical Storm Gustav.
- LB1M mooring was established in the plume and is currently instrumented with an ADCP, CT logger, and fluorometer.
- UNCW/NCSU mooring turnarounds were completed at OB1, OB2 and OB3 during October 2004 and January 2005.
- Operations team made trips in September and October 2004 to assist Caro-COOPS with diver recovery of science frames off Fripp Island and Sunset Beach.
- Dive statistics: 187 total dives conducted on 24 dive missions
- Samples collected/processed: 1980 water/benthic samples collected
1890 water/benthic samples processed

Constraints

- CTD problems have resulted in a backlog of data which needs to be processed as well as a failed cruise in January (later rescheduled and completed).
- CMS marine operations/electronics techs are working with CORMP to remedy problems.

D. New Hires and Sub Awards

- New full-time technician, Steve Hall, began working with operations team on January 3, 2005.
- Hired D. Kennedy as a marine/mooring engineer to construct pier moorings and assist with offshore moorings.