The NCCOS Center for Coastal Environmental Health and Biomolecular Research (CCEHBR) conducts research to answer questions about the health of resources, the ecological function of coastal ecosystems, and their influences on human health The Center's scientific expertise and laboratory capabilities in environmental chemistry, physiology, toxicology, microbiology, ecology and related sciences in Charleston, SC and Oxford, MD support NOAA's mission to better understand the Earth's environment and protect its resources. CCEHBR's unique areas of expertise include: advanced analytical and biomolecular technology used in harmful algal bloom, coral disease, marine mammal, and fisheries-related investigations; nuclear magnetic resonance imagery to elucidate chemical contaminant and natural product structures; and estuarine mesocosm and coral culture and research facilities for single and multiple stressor challenge studies. The Center integrates its research skills with other elements of NCCOS and governmental and academic entities. Issues are defined with and results are communicated to stakeholders and coastal managers to help resolve complex coastal environmental problems.

Coastal Ecology and Regional Ecological Assessments

Working in partnership with NOAA, EPA and coastal states and localities, scientists survey benthic communities and habitat characteristics to support integrated assessments of environmental conditions, determine how environmental conditions change with time, and assess the social, economic and biological effects of human activities on coastal ecosystems. Key actions and accomplishments:

- Conduct and report baseline characterizations of ecological resources and potential stressor impacts throughout U.S. estuarine and coastal ocean waters, including NOAA protected areas, such as National Marine Sanctuaries and National Estuarine Research Reserves
- Develop diagnostic indicators for assessing and predicting biological consequences of chemical contamination and eutrophication
- Established joint research program with EPA and state agencies to document environmental health of South Carolina estuaries in support of biennial National Coastal Condition Reports
- Developed Integrated Ecosystem Assessment for Chesapeake Bay, addressing the state of "fishable" waters and how they might be affected by climate change and coastal development

Harmful Algal Bloom Research and Analytical Response

Using advanced technology, researchers resolve complex and novel problems to reduce the impact of harmful algal blooms (HABs) on marine animal health, human health, and quality of the coastal environment. This research, technology transfer and delivery of information has shown a proven capacity to respond to a broad array of issues caused by harmful algae and marine biotoxins. Key actions and accomplishments:

- Identified by NOAA's Science Advisory Board as "a unique and effective program within the federal government that does not exist elsewhere"
- Defined two 10-year U.S. National Plans for Marine Biotoxins and Harmful Algae
- Developed and applied analytical methods that provide first time identification of algal toxins in multiple species of marine animals, including microarray to identify genes that control algal blooms and toxin production
- Established the Volunteer Phytoplankton Monitoring network, an education and outreach program utilizing schools, NGOs and volunteer groups that spans 14 coastal states/territories and over 130 volunteer sites (http://www.chbr.noaa.gov/pmn)
- Developed and validated the first autonomous algal toxin sensor for an underwater sampling device

Land Use Impacts on Coastal Waters and Resources

Development activities alter land use and landscape ecology and lead to increased delivery of chemical and microbial pollutants into coastal waters, thereby affecting ecosystems as well as quality of life of people. Scientists use combined measures of contaminant concentrations, their toxicity to organisms, and conditions of living resources to develop statistical and spatial models for resource managers to predict impacts from coastal development, test alternative development strategies, estimate the extent and severity of coastal habitat loss and predict how changing land uses may affect coastal ecosystem health. Key actions and accomplishments:

- Assessed chemical contaminant risks in sediments that led to the development of sediment quality guidelines to manage coastal zone dredging, industrial discharges and non-point source pollution runoff
- Established unique mesocosm facility for experiments on organism under simulated field conditions (*see photo*)
- Developed analytical methods to determine the occurrence and distribution of chemical contaminants in coastal ecosystems
- Conducted microbiological research and water quality modeling to identify land-based sources of pathogens and their impacts on the health of humans, fish, and shellfish
- Developed a pilot Environmental Surveillance Network with State, Federal and Academic partners as an early warning system for unusual mortality events and use as homeland security and environmental management tools

Marine Forensics

Research and development programs are active in identifying species using protein, lipid, and DNA-based techniques. Researchers also conduct field investigations of unusual mortalities among marine animals and analyze species, parts and products to determine cause of death. Forensic and scientific capabilities support conservation and management of marine resources. Key actions and accomplishments:

- Provides 85% of all forensic law enforcement scientific support for NOAA's Fisheries Office of Law Enforcement
- Species identification analyses conducted for cases involving Endangered, Protected and Managed species, serving NOAA, USFWS, US Customs and state wildlife law enforcement agencies
- Since 1994, analysis of evidence has resulted in ~$2M fines, permit sanctions, forfeitures of goods and prison time

Disease Impacts on Marine and Estuarine Species

Biomedical approaches are used to assess adverse effects of pathogens and chemical toxicants on the health corals, marine mammals, fish and shellfish. Field and laboratory studies help diagnose health problems and pin-point causes towards achieving the goal of preventative health-care management for marine resources. Key actions and accomplishments:

- Designed and adapted diagnostic assays for identifying early-warning indicators of conditions posing risks to marine animal health and fitness
- Research on marine mammals as sentinel indicators of coastal ecosystem health to detect chemical contaminants and diseases (e.g., herpes, hepatitis, papillomas) potentially harmful to humans
- Coral Culture and Collaborative Research Laboratory provides a captive stock of corals for challenge experiments and serves as a model conservation tool by reducing the need to collect wild organisms for research purposes
- Provided scientific leadership to address Mycobacteriosis, a disease currently jeopardizing the health of the recently restored Coastal Atlantic striped bass population
- Published a Shellfish Histopathology Manual: worldwide distribution (58 countries, 1040 copies)

NOAA/NOS/NCCOS
Center for Coastal Environmental Health and Biomolecular Research
www.chbr.noaa.gov 843-762-8500