Research Supporting Coastal & Ocean Management: Florida 2005-2006

POLLUTION

Florida Bay Characteristics Used to Predict Mercury Bioaccumulation Hotspots in the Gulf of Mexico and Florida

NCCOS is developing methods to identify coastal areas with high mercury concentrations in fish. This will allow coastal managers to take remedial action and limit consumption that endangers human health. NCCOS research has documented the high mercury concentrations in fish from eastern Florida Bay. Effective mercury methylation, oligotrophy, shallow depth, and limited physical flushing were identified as important characteristics contributing to high mercury concentrations. Initial application of data from NOAA's National Estuarine Eutrophication Assessment identified several estuaries likely to have high mercury concentrations because of their shallow depth and poor flushing. Efforts are underway to incorporate measures of oligotrophy and mercury methylation potential in this predictive model. Existing data from NOAA's National Status and Trends Program and EPA's database "The Occurrence of Mercury in the Fishery Resources of the Gulf of Mexico" (http://www.epa.gov/gmpo/mercury.html) are being employed to test these predictions. For more information contact David.W.Evans@noaa.gov.

NCCOS Research Applied to Identify Areas and Species Susceptible to Coastal Disasters

NCCOS research on land use and coastal storm runoff in Florida's St. Johns River watershed can be used to help identify geographic locations and species susceptible to coastal disasters, focus post-storm ecological assessments, improve mitigation planning, and promote responsible pesticide use. The research focuses on land use-based risk assessment, toxicity assessments of three pesticides with the potential to exceed levels of concern, and transport and fate modeling of the same three pesticides. For more information contact Tom.Siewicki@noaa.gov.

Hotspot for Mercury in South Florida Fish Due to *in situ* Processes and Watershed Sources

Important recreational gamefish in Eastern Florida Bay, including spotted seatrout and red drum, have mercury concentrations high enough to trigger consumption advisories. Everglades restoration will alter water deliveries to coastal waters and may change the delivery of methylmercury to these areas. NCCOS research indicates that the high mercury levels are due to both importation of mercury from the Everglades watershed, and local attributes that enhance mercury methylation and bioaccumulation through the bay's food web. These attributes include shallow depth, carbonate sediments, restricted flushing, and low productivity that are found in some other south Florida coastal waters. This new knowledge will be integrated into ongoing monitoring plans through which the Comprehensive Everglades Restoration Plan assures successful adaptive management as restoration progresses. These results have been reported in a recent publication in the Bulletin of Marine Science. For more information contact David.W.Evans@noaa.gov.

Toxicity Evaluation Finds Mosquito Insecticide May be Toxic to Important Salt Marsh Species

NCCOS experiments indicate that the mosquito control insecticide 'Scourge' is highly toxic to grass shrimp, an ecologically important species in salt marsh ecosystems. Adult and larval grass shrimp (*Palaemonetes pugio*) were affected by Scourge concentrations that may exist after spray applications; larvae were more sensitive than the adults. The scientists also found, however, that Scourge degraded rapidly in water and that the presence of sediments reduced its toxicity. These findings will be helpful in assessing the relative risk associated with different mosquito control insecticides applied in estuaries. This research was recently published in *the Journal of Environmental Science and Health*. For more information, contact Pete.Key@noaa.gov.

Bacteria Resistant to Multiple Antibiotics Found in Wild Dolphin Populations

NCCOS scientists found antibiotic-resistant *Escherichia coli* bacteria in wild dolphin populations in the Indian River Lagoon, FL and Charleston Harbor, SC. Dolphins harboring multiple antibiotic drug resistant *E. coli* were

isolated from wild captured dolphins. *E. coli* from 20% of the FL dolphins and 70% of SC dolphins exhibited resistance to one or more of 26 antibiotics evaluated. This study, part of NCCOS' larger Dolphin Health and Risk Assessment Project assessing dolphin health relative to environmental factors, furthers understanding of the transfer and potential impacts of antibiotic resistance in coastal dolphins. For more information contact John.Bemiss@noaa.gov.

Disease and Contaminants Impact Dolphins Health in FL and SC Respectively
From 2003-2005, over 200 dolphins have been captured near Charleston, SC and in Indian River Lagoon, FL to assess their health and identify health threats and links to possible environmental stressors. Data indicate that dolphins from Indian River Lagoon exhibit high incidence of infectious diseases such as lobomycosis and papilloma virus, while Charleston dolphins exhibit elevated body burdens of contaminants. For more information contact Pat.Fair@noaa.gov.

NOAA Workshop Spurs Further Study of Metal Contamination in Florida Coastal Waters
Copper concentrations in sediments and oysters from Florida's St. Lucie Estuary and Indian River Lagoon are among the highest in the country. By quantifying trace metal contamination in sediments, NCCOS is helping Florida resource managers identify potential biological impacts to fish and shellfish and restore oysters. The data is available at the National Status and Trends (NS&T) Program's data portal. For more information contact Jawed.Hameedi@noaa.gov.

CORAL REEF ECOSYSTEMS AND SEAGRASS

Commercial Lobster Fishing Practices Determined to Cause Minimal Damage to Florida Keys Seagrass
Standard commercial lobster fishing practices (i.e., lobster traps that remain on seagrass beds for four weeks) should not result in significant injury to the beds in the Florida Keys National Marine Sanctuary. However, it was found that lobster traps remaining on seagrass beds for six weeks have the potential to impact these systems, as reflected by significantly decreased seagrass densities after six-week soak times. Impact recovery varies by seagrass species - the density of turtle grass (*Thalassia testudinum*) recovered within four months, but manatee grass (*Syringodium filiforme*) density had not returned to control values eight months after trap removal. Information on trap-induced injuries and seagrass recovery will help managers plan for trap-retrievals following storms which can delay trap recovery and result in significant habitat injuries. This research was conducted in collaboration with the Monroe County Commercial Fishermen, Inc. For more information contact Amy.Uhrin@noaa.gov.

NCCOS Continues Technology Transfer of Coral Reef Recovery Forecasting Tool
NCCOS scientists have developed a new tool to forecast coral reef recovery from vessel grounding damage. Accurate recovery forecasts are necessary for developing a cost basis for restoration and settlement in claims cases. The model, an extension of the NCCOS Seagrass Recovery Modeling tool, estimates a recovery trajectory for coral reef grounding injuries in the Florida Keys National Marine Sanctuary, and is based on damage assessment reports, monitoring data from NOAA and non-NOAA entities, and data from the peer-reviewed literature. For more information contact Greg.Piniak@noaa.gov.

Large-Scale Coral Reef Mapping Project Assists Southeast Florida Coral Reef Monitoring and Management
Mapping coral reefs is critical to successful marine management plans and decision-making. Newly completed detailed maps of portions of southeast Florida reefs from 0-100' depth are being used to assess biodiversity and biogeological resources of the reefs and to monitor the reef's status. Aerial photographs, light detection and ranging (LIDAR) data, multibeam sonar data from a variety of sources, and laser and mutlibeam bathymetry have been synthesized in a circulating database product. The maps are being used by the Broward County Environmental Protection Department, scientist, and others to design and conduct research, monitoring, and management projects. The work also has implications for oil spill clean up response and planning, underwater construction, sand mining, and identifying fish habitat. For more information contact David.Hilmer@noaa.gov.

Newly Generated 20-year Timeseries Improves Understanding, Monitoring, and Management of Florida Bay Seagrass
New analyses by NCCOS scientists have shown that two different satellites can be cross calibrated allowing generation of a twenty year timeseries for turbid water and albedo (reflectivity) data. This allows scientists to

monitor changes and discover patterns in seagrass beds and turbidity which pre-date field monitoring programs; the findings can then be related to current conditions. This information allows coastal managers and scientists to improve monitoring designs and to better plan resource management activities. For more information, contact Timothy.Wynne@noaa.gov.

NCCOS Scientists Increase Understanding of Commercially Important Deepwater Seagrass Meadows along the Florida Shelf

NCCOS scientists are studying one of the largest contiguous seagrass ecosystems in the world, approximately 4 million acres of seagrass growing at water depths of 10 to 35 meters on the eastern edge of the West Florida Shelf. Seagrass in this ecosystem produces an estimated 456 million grams of organic carbon per day during the growing season of May through October and supports valuable commercial and recreational fisheries on the shelf. Results of a series of research cruises aboard the NOAA Ship Ferrel in the southeastern region of the west Florida Shelf extended our knowledge of the distribution, abundance and productivity of these relatively deepwater seagrasses dominated in the region by *Halophila decipiens,* a small, seasonally ephemeral species which produces seeds to persist from year to year. A publication documenting this study will appear in the Journal of Aquatic Botany. For more information contact Jud.Kenworthy@noaa.gov.

New Protocol to Help Manage Fish Habitats of Bahamas Islands, Florida Keys

Scientists from NCCOS and University of Miami developed a protocol for characterizing nearshore fish habitats and fish communities which will support the management of these resources. The protocol characterizes coastal fish habitats and fish communities based on responsiveness of diversity and species richness indices of fish species to benthic characteristics (presence of seagrass meadows, macroalgal beds, and bare sand) and anthropogenic activities (shoreline alterations and invasion by exotic coastal plants). The protocol was developed in the Bahamas and can be applied to coastal island systems that have geology, spatial complexity, and climate similar to those of the Islands of the Bahamas and Florida Keys. For more information, contact Vanessa.Nero@noaa.gov.

Long-Term Coral Decline Observed in Florida Keys National Marine Sanctuary

The Coral Reef Evaluation and Monitoring project (CREMP) reported a sanctuary-wide decline in stony coral cover and species numbers since 1996. From 1996 to 2003, the number of coral species declined at 72% of the 101 sampling stations, increased at 14%, and remained unchanged at 13% of the stations. Sanctuary-wide, stony coral cover declined from 11.9% to 7.2%. However, fewer stations had diseased stony corals, and the number of species with disease and the number of diseased colonies declined. For more information, please contact Larry.Pugh@noaa.gov.

Channel Habitats in Biscayne National Park Serve as Nurseries for Coral Reef Fishes

NCCOS and NPS scientists are applying landscape ecology methods developed within the Florida Keys National Marine Sanctuary to better understand the functions and improve the management of channel and adjacent bank habitats in Biscayne National Park. New findings show that in addition to serving as bay-to-reef ecological transitions, some channel habitats function as nurseries and others resemble reefs, providing shelter to high densities of fishes and crustaceans that feed in the adjacent landscape. Thus, channel and bank habitats serve various functions that differ with location in the landscape and can include nursery areas for coral reef fishes. For more information contact John Burke@noaa.gov.

HARMFUL ALGAL BLOOMS

NCCOS Finding Attributing Most Estuarine Fish Lesions to a Water Mold Helps Managers in NC and FL Allay Public Fears Concerning Lesion Events

Estuarine fish along the east coast of the United States experience seasonal epidemics of deep, aggressive skin ulcers often coincident with large fish kill events that have raised public concern about water quality and toxic algae. NCCOS scientists developed molecular assays and helped the NC Division of Water Quality to shown that the water mold *Aphanomyces invadans*, a species that is not indicative of environmental pollution or toxicity, caused most observed ulcers in the Neuse and Pamlico Rivers. NCCOS scientists are also helping The Florida Fish and Wildlife Commission in their evaluation of fish lesions thus helping environmental managers to provide the public with timely and accurate information to help allay fears concerning lesion events. The assay is reported in a paper in press in Applied and Environmental Microbiology. For more information contact Mark.W.Vandersea@noaa.gov.

NCCOS Improving Harmful Algal Bloom Forecast Capabilities for the Southwest Coast of Florida
Data from satellites on light absorption at the sea surface is usually insufficient to distinguish between phytoplankton species. NCCOS scientists are using the second derivative method to look at changes in spectral curvature to separate *Karenia brevis* blooms from other non-toxic blooms, such as *Rhizosolenia* and *Trichodesmium*. They are also investigating if backscatter, relative to chlorophyll absorption, may provide improvements in current *K. brevis* detection and forecasting capabilities. For more information, contact Michelle.Tomlinson@noaa.gov.

ECOHAB Researchers Study Emerging Saxitoxin Threat in Florida
Saxitoxin is a neurotoxin produced by certain species of marine dinoflagellates and is more commonly associated elsewhere with Paralytic Shellfish Poisoning (PSP). Saxitoxins were first detected in Florida puffer fish in 2002 following a number of puffer fish poisoning incidents and were attributed to the dinoflagellate *Pyrodinium bahamense* in central Florida's Indian River Lagoon (IRL). This discovery led to an intensive state monitoring program for saxitoxins. High levels of saxitoxins resulted in an extended harvesting ban on puffer fish in the IRL in 2002. More recently, shellfish closures have been ordered in one area where the potential for PSP events are being monitored and managed accordingly. CSCOR-funded researchers from the Florida Fish and Wildlife Conservation Commission (FFWC) are investigating underlying causes of this new threat to enable future mitigation. For more information contact Cary.Lopez@noaa.gov.

New Website Improves Access to BreveBuster Data for Real-time Harmful Algal Bloom (HAB) Detection
NCCOS-funded researchers at the Mote Marine Laboratory in Florida revealed a new website (http://hyperion.mote.org/socool/) where the public can access BreveBusters information on real-time conditions of the Florida HAB, *Karenia brevis.* BreveBusters, or cylindrical devices that can optically detect *Karenia brevis* blooms, are moored in Sarasota and Charlotte Harbor. They report real-time bloom conditions as a red-tide similarity index every two hours. Telemetered data allow for early detection and continuous monitoring of bloom events, ultimately improving the efficiency of event response and mitigation by coastal managers, as well as enabling industries and beachgoers to better prepare for bloom effects. Continuous, real-time data also enhances NOAA's integrated HAB forecasting system in the region, especially as more BreveBusters are added to the network. The development of this new capability exemplifies NCCOS's ongoing commitment to improve communication among scientists and managers and to facilitate the decision-making process. For more information, contact Cary.Lopez@noaa.gov.

New Skin Lesion Molecular Probes Improve Fish Management
NCCOS researchers have developed molecular probes to screen large numbers of environmental samples for the pathogenic water mold *Aphanomyces invadans,* thought to be responsible for skin lesions and fish kills in fall the spring and fall in estuaries of the southeastern US. Identification of infection sources and the conditions that promote growth and transmission of this pathogen will help resource managers forecast when lesion events are likely to occur and perhaps to develop mitigation strategies. Examinations of fish in estuaries of North Carolina and Florida last summer detected the water mold in most of the skin lesions sampled. An important question yet to be answered concerning *A. invadans* pathogenesis is how natural infections are initiated. For more information contact Wayne.Litaker@noaa.gov.

NCCOS Supports Response to Harmful Algal Bloom, Animal Mortalities in Florida
NCCOS responded to a request for assistance from the State of Florida regarding widespread animal mortalities, abundance of *Karenia brevis*, and low oxygen in bottom waters on the west Florida shelf. NCCOS is providing funds to assist the State of Florida in mapping the area with low oxygen and high *Karenia brevis* abundance. Such research and data will assist in the development of tools and information for coastal managers to use in reducing the public health risks and economic impacts of HABs. For more information contact Quay.Dortch@noaa.gov.

Rapid Analysis of Phytoplankton Composition Improved for Southeastern US Estuaries
An NCCOS funded project isolated algae from southeastern US estuaries, determined their pigment composition, and used the pigment ratios to calibrate analyses of phytoplankton composition in the region. The best way to determine phytoplankton composition is by counting cells, but this is a very time consuming process that requires a high level of taxonomic expertise. More recently High Pressure Liquid Chromatography (HPLC) has been used as a fast method to distinguish major phytoplankton groups that can be used to indicate

changing environmental quality. This calibration will increase the utility of pigment HPLC for monitoring water quality in southeastern US estuaries. For further information contact Quay.Dortch@noaa.gov.

NCCOS Scientists Improve Detection Capabilities for Florida Red Tides
As part of an ECOHAB funded project aimed at enhancing harmful algal bloom HAB monitoring and research capabilities, NCCOS scientists have developed a species-specific molecular probe for detecting *Karenia brevis*, the Florida red tide organism. The ability to distinguish *K. brevis* from similar, closely related species at a genetic level using microscopic as well as automated analyses will improve the speed and accuracy of enumerating this toxic HAB species. This new tool has the potential to benefit existing *K. brevis* monitoring and research programs in Florida, Texas, and other coastal states on the Gulf of Mexico. Field evaluation trials are now underway. For more information contact Greg.Doucette@noaa.gov.

Florida Red Tide May Threaten Migrating Manatees
Researchers are monitoring conditions associated with a red tide outbreak in the Gulf of Mexico for potential human and marine mammal health threats. Past HAB-related manatee mortality events have been preceded by conditions similar to this bloom. The "unseasonable" bloom formed about 30 miles off Tampa Bay, FL and recently moved nearer shore and south. Red tide blooms in this area typically occur between August and September. MERHAB scientists are exploring a hypothesis that excess nutrients from last year's hurricanes may have fueled this bloom. The MERHAB-supported Florida red tide monitoring program has developed autonomous sampling platforms that incorporate physical, chemical and biological sensor packages, (e.g. the optical plankton discriminator, the Brevebuster, and genetic and whole cell probes). The toxin, cell, and water quality information these tools deliver allow researchers to fine-tune field sampling and initiate predictive models of bloom movement and human health or environmental impacts. This powerful monitoring system has given marine mammal staff time to alert the public and prepare to care for the region's endangered manatees in the event that they are impacted. For more information contact Marc.Suddleson@noaa.gov.

Low Oxygen Waters and Marine Mortalities Mapped off Florida Coast
NCCOS funded mapping of an area10 miles off the west coast of Florida where low oxygen was observed and bottom-dwelling organisms, fish, and turtles died. The large area of low oxygen waters was associated with high abundance of *Karenia brevis*, a toxic alga that frequently blooms in that area. The algal bloom began in January, resulted in manatee deaths in March, and persisted in localized areas through the summer. It is hypothesized that part of the bloom became trapped below a strong thermocline and killed some organisms which decomposed and depleted the bottom water oxygen, which then killed more organisms. It took about 18 months for fish populations to recover after a similar event occurred in 1971. For more information contact Quay.Dortch@noaa.gov.

INVASIVE SPECIES

Indo-Pacific Lionfish Density and Distribution Increasing
A continuous distribution of lionfish were observed from Northern Florida to Cape Hatteras, NC, in water depths of 90 to 260 feet, during both diver and remotely operated vehicle surveys. Diver surveys also suggest that lionfish density may be increasing off the coast of North Carolina, but that cool bottom water temperatures in winter may limit lionfish distribution. Lionfish may be restricted to water depths of 90 to 260 feet because these waters are close to the Gulf Stream and stay relatively warm through the winter. More research is necessary to determine the impact lionfish may have on native communities in the Atlantic. For more information contact Paula.Whitfield@noaa.gov.