ECOHAB: *Karenia*

RECENT FINDINGS:
2007 RESEARCH CRUISE

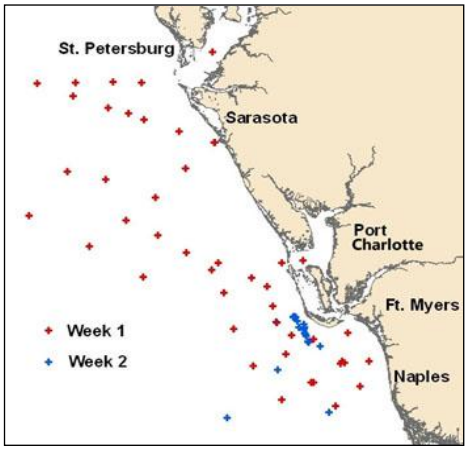
Why Do Scientists Conduct Research Cruises?

Algal blooms, such as those caused by *Karenia brevis*, the Florida red tide organism, are complex. Environmental conditions can never be completely replicated in the laboratory, and research cruises allow scientists to document natural conditions to answer questions that cannot be answered with laboratory studies alone. The chemical, physical, and biological data collected during a research cruise help scientists understand how and where algal blooms are likely to occur and what nutrient and environment circumstances contribute to their persistence.

Aggregation of *Karenia brevis* in surface patches during the 2007 ECOHAB cruise; note the difference in water color, which indicates different concentrations of *Karenia brevis*

Surface aggregation of the nitrogen-fixing cyanobacterium *Trichodesmium*, with *Karenia* cells underneath, during the 2007 ECOHAB cruise; large blooms of *Trichodesmium* often precede or co-occur with *Karenia brevis* blooms in southwest Florida

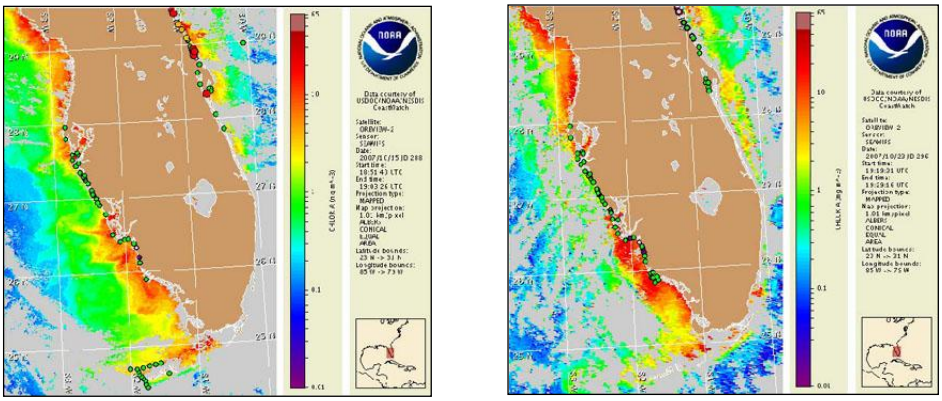
2007 ECOHAB Cruise Overview



Station locations for the October 10–27 ECOHAB research cruise

The first annual research cruise of the ECOHAB: *Karenia* program took place from October 10 to 27, 2007, aboard the R/V Pelican, a 116-foot University-National Oceanographic Laboratory System (UNOLS) research vessel. The purpose of the cruise, one of four scheduled for the 5-year grant, was to map water quality and measure nutrient processes in estuarine to offshore waters of Florida from Tampa Bay to Naples and to track and study these nutrient processes in a red tide bloom off Sanibel Island. Twenty-two scientists from the Florida Fish and Wildlife Research Institute, Mote Marine Laboratory, University of Maryland, Virginia Institute of

Marine Science, University of Delaware, University of Southern California, Rutgers University, University of Miami, and Old Dominion University participated in the 2-week cruise.



Oct 18, 2007 Oct 25, 2007

Calculated chlorophyll imagery from a NOAA satellite for the first and second week of the cruise; red areas represent high chlorophyll concentrations and possible algal blooms

Photo Credit: NOAA

Deployment of surface drogue to track red tide

The cruise was divided into two segments, or legs, each of which had separate goals. During the first leg of the cruise, scientists mapped water quality and measured biological and nutrient processes in estuarine, coastal, and offshore waters of southwest Florida, where red tides typically occur. During the second leg of the cruise, scientists tracked a patch of red tide off Sanibel Island using a surface drogue and examined the nutrient dynamics within that red tide patch over time. The drogue was equipped with a global positioning system (GPS) unit and was set adrift in the bloom for 5 days. The location (latitude and longitude) of the bloom was recorded every 15 minutes for later analysis, thereby tracking the movement of the bloom. In addition, water samples were collected continually near the drogue to track which nutrients were being used by the bloom and at what rates.

What Did Scientists Do on the ECOHAB Cruise?

An important activity conducted during the ECOHAB research cruise is the collection of water samples for measurements and use in experiments. Upon reaching a station, a rosette sampler mounted with a conductivity, temperature, and depth recorder (called a CTD) and Niskin sampling bottles was lowered through the water to the bottom. The CTD measures how physical (water temperature, salinity, and density); chemical (dissolved

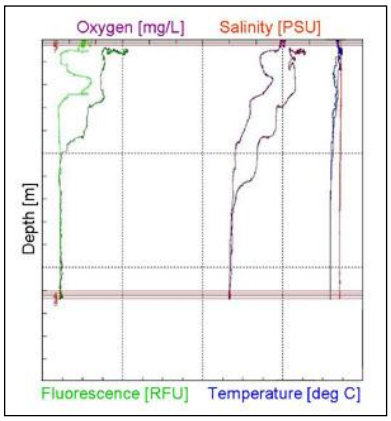
Rosette sampler with CTD and Niskin bottles being lowered for water collection

oxygen); and biological (chlorophyll *a* fluorescence) characteristics change with water depth and produces a profile of these parameters in the water column. Closure of the Niskin bottles can be triggered from the ship, allowing seawater to be collected at selected depths.

Once the CTD is back on deck, the science crew collects the seawater samples from the Niskin bottles and takes them to the ship's laboratory.

Scientists collecting seawater samples from Niskin bottles after a station CTD deployment

Ship's computer lab, where CTD deployment is controlled



Example of data output from a CTD; the graph shows the vertical profiles of temperature, salinity, dissolved oxygen, and chlorophyll *a* fluorescence in the water column

The scientists also collect marine organisms for experiments during the ECOHAB research cruise using plankton nets that are pulled, or towed, through the water. The mesh nets are designed to capture phyto-plankton and zooplankton. One genus of phytoplankton that is collected during a net tow is *Trichodesmium*, a nitrogen-fixing cyanobacterium that can form blooms resembling sawdust or oil slicks floating on the water's surface. *Trichodesmium* blooms often precede or co-occur with *K. brevis* blooms in southwest Florida.

A plankton net towed along the surface to collect *Trichodesmium*

Water filtration for nutrient analysis

Some of the water samples collected are processed and analyzed in the ship's laboratory, while others may be frozen for later analysis at land-based facilities. Nutrient concentrations are analyzed in the ship's laboratory using a nutrient autoanalyzer. Biological processes that are measured include the uptake rates of different forms of nitrogen and phosphorus by red tide cells as well as other processes that influence nutrient supply to *Karenia* blooms, such as zooplankton grazing and nitrogen fixation.

Analysis of nutrient concentrations in seawater using a nutrient autoanalyzer

Scientist counting *Karenia brevis* cells in a preserved water sample to calculate cell concentration

Concentrations of *K. brevis* in water samples collected from different depths are measured in the ship's laboratory as well. Water samples are preserved with Lugol's solution. A known volume is extracted from the water sample and is placed under a light microscope; then, the number of cells within that volume are counted.