



Outstanding Accomplishments in Research

Ecological Monitoring and Forecasting

Research is at the center of all National Oceanic and Atmospheric Administration services. NOAA's Office of Oceanic & Atmospheric Research (OAR) conducts research, develops products, and provides scientific understanding and leadership to support NOAA's mission to meet our nation's economic, social and environmental needs.

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NOAA is a leader in pulling together experts in diverse disciplines to study entire ecosystems – from atmospheric and oceanic processes in play to the micro-universe of plant and animal organisms within it. NOAA is integrating biological, chemical, and physical data to produce ecosystem forecasts to predict outbreaks of potentially damaging environmental conditions before they occur.

New Test for Red Tide and Fecal-Indicating Bacteria

NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) developed techniques for red-tide and fecal-indicating bacteria markers indicative of human sources of fecal pollution, and a viral pathogen. The methods can be used to rapidly screen water samples for the presence of microbial contaminants and work is underway to integrate them into semi-automated detection platforms. This tool will assist resource managers in making improved, timely decisions regarding human health and safety.

Regional Climate and Ecosystems

NOAA scientists are at the forefront of studying climate change and modeling what the effects will be on the Earth. Researchers at NOAA's Great Lakes Environmental Research Laboratory (GLERL) have developed the Coupled Hydrosphere-Atmosphere Research Model (CHARM) to enable a valid assessment of the impact of how climate change might affect the climate and ecology of the Great Lakes. The CHARM model provides a realistic surface-atmosphere feedback portrayal, and accounts for runoff from land surfaces. It allows researchers to predict that global warming likely will bring higher temperatures and increased precipitation to the Great Lakes. Development of a second generation of CHARM is underway to help answer questions about greenhouse warming effects on Great Lakes water quantity.



Stunning yellow *Enallopsammia* stony coral with pink *Candidella* teeming with brittle stars off New England. Image courtesy of the Mountains in the Sea Research Team; the IFE Crew; and NOAA.

Coral Reefs

In 2006, researchers at NOAA's Joint Institute for Marine and Atmospheric Research (JIMAR) and partners, including NOAA's Pacific Islands Fisheries Science Center, began to deploy Ecological Acoustic Recorders (EARs) to monitor patterns of change in the ambient sound field at remote coral reef ecosystems in the Pacific. EARs collect time-series data that will allow coastal resource managers and enforcement personnel to remotely detect ecologically significant events and anthropogenic disturbances such as vessel intrusions or the use of explosives.

Modeling for Marine Management

Effective marine management and conservation planning require a better understanding of the movement of young marine animals, including small larvae. The tiny larvae are impossible to follow directly, but models of ocean currents make it possible to predict their movements. A computer model newly developed by researchers funded by NOAA's Florida Sea Grant Program and partners, combines ocean current simulations and genetic forecasting to help scientists predict animal dispersion patterns and details of the ecology of coral reefs across the Caribbean Sea. The work enables scientists to field-test such predictions and hone their understanding of how marine larvae disperse in the environment and influence the structure of adult populations.

Is the Beach Safe Today?

NOAA researchers and operational forecasters are working together and with other agencies and academic scientists to gather information on ecological conditions that can make swimming unsafe in a particular area, and getting that information out to beachgoers. Regional forecast systems for microbial contamination are being developed by NOAA's Great Lakes Environmental Research Laboratory (GLERL), the Michigan Sea Grant program and NOAA's Cooperative Institute for Limnology and Ecosystems Research (CILER) at the University of Michigan, as well as NOAA's National Ocean Service. Together forming the Center of Excellence for Great Lakes and Human Health (CEGLHH), NOAA and others are integrating resources into research plans and coordinating expertise in order to predict when contaminants threaten recreational waters in the Great Lakes. Observations coordinated by GLERL feeds a model that predicts bacterial counts for E. coli based on rainfall, wave heights, and the direction of lake currents, in order to determine when

counts are high enough to threaten human health. NOAA's Atlantic and Oceanographic and Meteorological Laboratory also has developed techniques for red-tide and bacteria markers indicating human sources of fecal pollution. This tool can be used to rapidly screen environmental water samples for the presence of microbial contaminants, assisting beach and resource managers to make more accurate and timely decisions on health and safety.

Forecasting Coral Reef Conditions

To monitor conditions that affect coral reefs, as well as to develop modeling systems to forecast conditions of reef ecosystems, NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) is installing monitoring stations at major United States coral reef areas. Station sensors measure conditions in the atmosphere and oceans, and provide near real-time "alerts" to conditions of stress in monitored reef areas. Data collected under NOAA's Integrated Coral Observing Network (ICON) are saved and processed at AOML.

PREEMINENT RESEARCH

Observations of current conditions in an ecosystem form the basis of forecasts. Observations can be used to understand the many variables that contribute to the health or stress on an ecosystem, and the data are applied as input to forecast models that predict the influencing factors and stressors on an entire ecosystems. In addition to gathering data and forecasting basic physical conditions such as temperature or precipitation, NOAA research is integrating biological, chemical, or physical data to produce whole ecosystem forecasts. The forecasts can predict outbreaks of potentially damaging environmental conditions before they occur. NOAA's work in ecological forecasts enables successful management of valuable ecosystems.

VALUE TO SOCIETY

NOAA's work to understand and predict conditions that threaten coastal and ocean ecosystems and resources will help to mitigate harmful impacts, reducing the costs and increasing the value to coastal states and the Nation in maintaining marine economies. For example, the average economic impact from Harmful Algal Blooms in the United States has been conservatively estimated at \$82 million a year, and just one bloom event can cost local coastal economies tens of millions of dollars. Coral bleaching threatens a worldwide economy around reef tourism and fisheries estimated to be in the neighborhood of \$375 billion annually. Coastal recreation draws millions of participants, bringing billions of dollars to coastal economies. Increases in these numbers are expected, especially for beach-going recreation.

To Learn More, Visit These Sites:

National Sea Grant College Program: <http://www.seagrant.noaa.gov/>

Great Lakes Environmental Research Laboratory: <http://www.glerl.noaa.gov/>

Atlantic Oceanographic and Meteorological Laboratory: <http://www.aoml.noaa.gov>

Center of Excellence for Great Lakes and Human Health: <http://www.glerl.noaa.gov/res/Centers/HumanHealth/>

Brochure on Beach Closures: <http://www.glerl.noaa.gov/pubs/brochures/beachclosures.pdf>

To Work or Study at OAR, Visit These Sites:

NOAA Careers: <http://www.careers.noaa.gov>

Hollings Scholarships: <http://www.orau.gov/noaa/HollingsScholarship/>

Knauss Fellowships: <http://www.seagrant.noaa.gov/knauss/>



The Florida "red tide" occurs almost annually along portions of the state's Gulf Coast. Just one harmful algal bloom event can impose millions of dollars in losses upon local coastal communities. Image courtesy of P. Schmidt, Charlotte (FL) Sun.