

SUSTAINABILITY AND THE OCEANS

Scripps scientists are always finding new ways to study human impact on our oceans and creating innovative tools for sustainable management of fisheries and ecosystems.

In the past year, professor Bradley Moore and researcher Abraham El Gamal from the Scripps Center for Oceans and Human Health identified an enzyme in marine bacteria that could help break down hazardous industrial chemicals.

In another study, Scripps grad student Timothy Rowell and Scripps marine ecologist Octavio Aburto-Oropeza partnered with local fishermen in the Gulf of Mexico to find a surprising new tool for fishery management: the fishes' own mating calls. The Gulf Corvina is a fish native to the Gulf of Mexico, and every year all 2 million of these fish come together for a mating frenzy, distinguished by the earsplitting sounds of the male mating calls. An underwater microphone that measures the mating calls found that if they were on land, the songs would be "louder than a rock concert."



GC MARINE PROGRAM

Fishermen in the Gulf of Mexico

The downside to the din is that it makes it easy for fishermen to scoop up huge amounts of corvina at once; the noise leads them right to the fish. Because the entire species spawns in one location, this makes the Gulf Corvina very vulnerable to overfishing, but monitoring the species population had been too difficult and expensive—until now. Rowell and Aburto-Oropeza along with co-authors from the University of Texas at Austin have found an upside to the fish noise: it can be used to estimate the population size, and thus used to design effective management practices to protect Gulf Corvina from overfishing.

The new technique relies on underwater microphones and is cheaper than most traditional methods. Local fishermen collaborated with the scientists on the project, and Aburto-Oropeza says he hopes they can be trained to use the hydrophones to monitor the Gulf Corvina themselves. After all, "they're the ones most interested in sustainability," he said.



RESEARCH HIGHLIGHTS

Research Highlights Scripps Oceanography is one of the most important centers for global science and education in the world. Hundreds of research programs covering a wide range of scientific areas are underway on every continent and in every ocean.



CLIMATE CHANGE IMPACTS AND ADAPTATION



Researchers Capture Large-Scale Antarctic Melt Event

Scripps scientists had a hand in making the first comprehensive atmospheric measurements on the West Antarctic Ice Sheet since the 1960s. In 2016, Scripps scientists were on the frozen continent to document a melting episode on a landbound mass of ice larger than Mexico.

The West Antarctic Ice Sheet experienced substantial surface melt through the austral summer of 2015-16 during one of the largest El Niño events of the past 50 years. A science team conducting the ARM West Antarctic Radiation Experiment (AWARE) led by

Scripps researchers reported that El Niño likely delivered warm air bearing moisture and extensive cloud cover over the ice sheet, causing the melt. Melted snow was spotted over most of the Ross Ice Shelf, a thick platform of floating ice that channels about a third of the ice flowing from the West Antarctic Ice Sheet into the ocean.

"We were extraordinarily fortunate to be able to deploy state-of-the-art equipment to West Antarctica just before this large melt event occurred," said AWARE principal investigator Dan Lubin, a research physicist at Scripps

Oceanography. "These atmospheric measurements will help geophysical scientists develop better physical models for projecting how the Antarctic ice sheet might respond to a changing climate and influence sea-level rise."



INNOVATIVE TECHNOLOGY: ROBOTIC PLANKTON MIMIC OCEAN LIFE



This year, Scripps researchers developed underwater robots that mimic plankton to study ocean currents and the microscopic organisms that drift with them.

Scripps research oceanographer Jules Jaffe designed and built miniature autonomous underwater explorers to study small-scale environmental processes taking place in the ocean. The ocean-probing instruments are equipped with temperature and other sensors to measure surrounding ocean conditions while the robots “swim” up and down to maintain a constant depth by adjusting their buoyancy.

The robotic plankton were tested by Jaffe and Scripps biological oceanographer Peter Franks during an experiment in which a swarm of 16 grapefruit-sized underwater robots were deployed off the coast north of Scripps. The robotic swarm was programmed to stay 10 meters (33 feet) deep, and three-dimensional location information was collected every 12 seconds revealing where the swarm moved.

The experiment helped researchers confirm that free-floating plankton can use physical dynamics of the ocean—in this case internal waves—to increase their concentrations to congregate into swarms to fulfill their

fundamental life needs. The research team hopes to build more to study the movement of larvae, monitor harmful red tide blooms, and track oil spills.

This technology builds on Scripps' history of innovative ocean observation, including the Argo free-drifting profile floats, the Coastal Data Information Program (CDIP), and High Frequency Radar surface current measurements.

RESILIENCE TO HAZARDS: WILDFIRE WARNING

In California, a longer fire season is becoming the new norm and wildfires are a growing hazard facing the entire state.

Over the last decade, a collaborative team of researchers at UC San Diego built a network across areas most prone to wildfires in San Diego's back country, creating a multi-hazard detection system with a microwave communications network, seismic sensors, wildfire monitoring, meteorological capabilities, and more.

In Oct. 2017, San Diego Gas & Electric (SDG&E) partnered with UC San Diego to install 15 high-definition cameras that offer a live-streaming view of San Diego's biggest fire threat areas. The new Alert SDG&E Cameras have live and time-lapse video, can pan-tilt-zoom, use near-infrared capabilities for night vision, and link to incident command centers to notify fire officials when smoke appears.

The cameras are controlled by San Diego fire agencies, SDG&E, and UC San Diego. The public can access the cameras at alertwildfire.org/sdgc.



HUMAN HEALTH & THE OCEANS

Toxic Sea Sponges and Pollutants in Yellowfin Tuna

Researchers at Scripps continued to unravel complex connections between human health and the oceans. Scripps postdoctoral researcher Vinayak Agarwal and graduate student Jessica Blanton led a team of collaborators from several universities in a study that discovered that microbes in sea sponges produce chemicals very similar to polybrominated diphenyl ethers (PBDEs). PBDEs are a type of flame-retardant that are added to foam, textiles, and electronics. These human-made industrial chemicals are powerful endocrine disruptors that mimic the activity of the human body's most active thyroid hormone.

"For many years scientists were finding clues that suggested nature was making these compounds," said study author Bradley Moore, a professor at the Scripps Center for Marine Biotechnology and Biomedicine and the Skaggs School of Pharmacy and Pharmaceutical Sciences at UC San Diego. "Now that we understand how they are produced in the marine

environment, we are exploring why they exist, and the human health concerns associated with them."

Human-made PBDEs are part of a class of compounds known as persistent organic pollutants (POPs) that includes pesticides and other industrial chemicals that accumulate in organisms—including fish and humans—and lead to negative health impacts.

In a separate study, a team led by Scripps postdoctoral researcher Sascha Nicklisch found that levels of POPs in the muscle tissue of yellowfin tuna vary widely depending on where they are caught. Levels were as much as 36 times higher in tuna caught in the more industrialized areas of the northeast Pacific Ocean and northeast Atlantic Ocean than in tuna caught in the west Pacific Ocean and Indian Ocean. This new information suggests that catch location could be used to guide consumer choices and to help reduce exposure to these pollutants.



Scripps Center for Marine Archaeology Debuts

Scripps Oceanography and the Department of Anthropology at UC San Diego launched the Scripps Center for Marine Archaeology (SCMA). SCMA researchers will conduct fieldwork at key underwater and coastal archaeological sites around the world, studying the influence of marine environments on human cultures.

First Glimpse of Ruby Seadragon Caught in the Wild



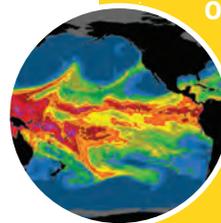
In April 2016, Scripps marine biologists Josefina Stiller and Greg Rouse were part of the scientific team that made the first-ever field sighting of the Ruby Seadragon, spotted near Western Australia's Recherche Archipelago. This rare glimpse of the third species of seadragon was captured on a video that now has more than 1.8 million views on YouTube.

Scripps Science Informs SUPER Act Bill



Driven by research on short-lived climate pollutants conducted at Scripps by atmospheric scientist Veerabhadran Ramanathan, in June 2017 Rep. Scott Peters (CA-52) and Rep. Carlos Curbelo (FL-26) introduced the bipartisan Super Pollutant Emissions Reduction (SUPER) Act, to help reduce the emission of climate pollutants including black carbon, hydrofluorocarbons, and methane.

'Atmospheric River' Becomes an Official Meteorology Term



Scripps research meteorologist F. Martin Ralph led an American Meteorological Society (AMS) effort to define atmospheric rivers, the study of which Ralph has pioneered, and add it to the AMS glossary in 2017. The definition of the phenomenon vital to the water supply of California is "a long, narrow, and transient corridor of strong horizontal water vapor transport that is typically associated with a low-level jet stream ahead of the cold front of an extratropical cyclone."