

# Dropping a Laboratory into the Sea

## REVOLUTIONARY SENSOR DETECTS TOXIC MARINE ORGANISMS

by Stephanie Murphy and Kate Madin

**A** new instrument that can provide early warnings of harmful algal blooms (HABs) and other toxic organisms in the ocean has successfully passed its first long-term test at sea.

The revolutionary instruments, called Environmental Sample Processors, or ESPs, are molecular biology labs packed inside canisters the size of kitchen trash cans. Mounted on moorings, they sample seawater, filter out cells, and break them apart to release their DNA and telltale chemicals. They rapidly analyze the DNA and specific chemicals at sea to identify and count cells living in the ocean. Then they transmit the information in real time to scientists ashore, said Don Anderson, a senior scientist at Woods Hole Oceanographic Institution (WHOI).

WHOI researchers deployed two ESPs in New England waters in the spring of 2013, and the samplers provided a continuous stream of data until they were retrieved in July. That spanned the bloom season of *Alexandrium fundyense*, single-celled algae that produce toxins that cause paralytic shellfish poisoning. The ESPs also autonomously detected and measured concentrations of *Pseudo-nitzschia*, a diatom responsible for amnesic shellfish poisoning. The further good news was that the populations of neither of these organisms rose to harmful levels this year.

“This deployment is a critical step toward our long-term dream of having a network of instruments moored along the coast of the Gulf of Maine, routinely providing data on the distribution and abundance of HAB cells and toxins,” said Anderson, the project’s principal investigator. “The technology will greatly enhance management capabilities and protection of public health in the region.”

The ESP was developed by Chris Scholin, a former MIT-WHOI Joint Program graduate student with Anderson and now president and chief executive officer of the Monterey Bay Aquarium Research Institute (MBARI). Earlier models of the ESP

were built, tested, and used by MBARI researchers, predominantly on the West Coast. The instruments deployed in the Gulf of Maine this year were the first commercially available ESPs, manufactured at McLane Research Laboratories in Falmouth, Mass., under a license from Spyglass Biosecurity.

The two ESPs deployed in 2013 were called “ESPchris,” named for Scholin, and “ESPdon,” named for Anderson.

Data collected by ESPs “will be extremely valuable for ongoing forecasting activities,” said WHOI senior scientist Dennis McGillicuddy, co-principal investigator of the project, who has used a model to forecast HABs since

A ‘red tide’ of algae stretches 20 miles off La Jolla, Calif., in 2005. Some blooms are toxic.

2008. Data collected by ESPs help ground-truth and improve the forecast model, he said. “In the longer term in which we expect more ESPs to be available, we envision assimilating these data into the model, in much the same way the weather service uses meteorological observations.” ▲

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