Call of the Whales

UNDERWATER ROBOTS PROVIDE ROVING EARS IN THE SEA

by Stephanie Murphy

Last fall a team of researchers put two torpedo-shaped underwater robots in the Gulf of Maine "to find whales for us," said Mark Baumgartner, a biologist at Woods Hole Oceanographic Institution (WHOI). The gliders were equipped with digital acoustic monitoring (DMON) instruments to listen for whale calls and specialized software to identify the calls.

Within hours of hitting the water, they detected the calls of endangered North Atlantic right whales and reported them back to shore-based researchers in real time. The researchers alerted officials at NOAA Fisheries Service, who asked mariners to voluntarily slow their vessels to avoid striking the whales.

It marked success for an innovative WHOI-developed whale-detection system that can provide a powerful and cost-effective new tool for conservation managers. It also gives whale ecologists new means to learn about large animals that spend most of their lives out of human eyesight below the sea surface.

The labor-intensive work of surveying for whales, overseen by NOAA, is usually done by human observers on ships or airplanes, and it is limited by the conditions at sea, especially at rougher times of year, said Sofie Van Parijs at NOAA's Northeast Fisheries Science Center (NEFSC). "These gliders provide a great complement to this system. Knowing where right whales are helps you manage interactions between an endangered species and the human activities that impact those species."

The successful project was the result of years of collaboration among engineers, biologists, and physical oceanographers at WHOI, and scientists at the NEFSC Protected Species Branch in Woods Hole. The gliders are operated by Dave Fratantoni, a WHOI physical oceanographer; the DMON acoustic monitoring instrument was developed by WHOI engineers Mark Johnson and Tom Hurst; and Baumgartner, who has nearly a decade of experience identifying whale calls, wrote software for the DMON so it can recognize the unique calls of sei, fin, humpback, and right whales and keep a record of when and where it heard each call. By integrating the DMON into Fratantoni's gliders, the team could search large areas of the ocean and receive whale-detection data in real time.

Oceanographers have used gliders for about a decade. The vehicles move up, down, and laterally in a sawtooth pattern through the water by changing their buoyancy and using their short wings to provide lift. Battery-powered and exceptionally quiet, the gliders are equipped with an underwater microphone on their undersides and iridium satellite antennas on their tail sections. The vehicles surface every few hours to get a GPS position and transmit data to shoreside computers.

The DMON—a circuit board and battery about the size of a cellphone—sits inside the glider. It records audio and generates spectrograms, a visual form of the audio that facilitates complex sound analysis.

Beyond the robots' utility for whale management and conservation, they also proved useful for finding and studying whales during late fall and winter, when winds and rough seas typically make whale research difficult. Aboard their ship, the scientists also measured water temperature and salinity and collected samples of the tiny crustaceans the whales feed on—in an effort to understand the converging circumstances that make the area attractive to whales at that time, Baumgartner said. ▲

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At top, WHOI physical oceanographer Dave Fratantoni, working with WHOI biologists, uses specially equipped robotic gliders that can detect whale calls and alert scientists in real time.