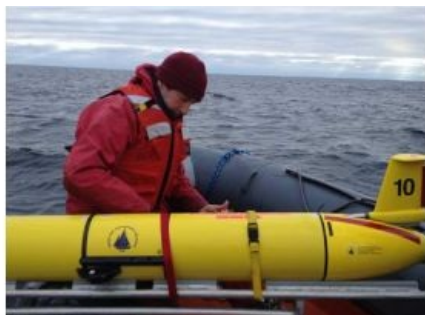


Gliders Detect Endangered Whales



Two gliders equipped with instruments designed to 'listen' for the calls of baleen whales detected nine endangered North Atlantic right whales in the Gulf of Maine, USA, in December 2012. The robots reported the detections to shore-based researchers within hours of hearing the whales (i.e. in real time), demonstrating a new and powerful tool for managing interactions between whales and human activities.

The team of researchers, led by Woods Hole Oceanographic Institution (WHOI, USA) scientists Mark Baumgartner and Dave Fratantoni, reported their sightings to the USA-based NOAA, which is responsible for enforcing the Marine Mammal Protection Act.

First Detection of Several Species

The project employed ocean-going gliders equipped with a digital acoustic monitoring (DMON) instrument and software allowing the vehicle to detect and classify calls from four species of baleen whales – sei, fin, humpback, and right whales. The gliders' real-time communication capabilities alerted scientists to the presence of whales in the research area, in the first successful use of technology to report detections of several species of baleen whales from autonomous vehicles.

The oceanographic research project was underway from 12 November to 5 December 2012, operating in an area called the Outer Fall, about sixty miles south of Bar Harbor, ME, USA, and 90 miles northeast of Portsmouth, NH. Right whales are thought to use this area every year between November and January as a mating ground.

First Reports Within Hours of Deployment

Two gliders were deployed by Ben Hodges and Nick Woods, also of WHOI, on 12 November from the University of New Hampshire's 50-ft research vessel, the *Gulf Challenger*. The vehicles surveyed the area for two weeks, sending data to the researchers every two hours via satellite, prior to the scientific team's arrival 28 November on the University of Rhode Island's research vessel *Endeavor*. The gliders continued to survey for another week before being recovered by the *Endeavor* on 4 December. Two gliders were deployed in the central Gulf of Maine to find whales. The first reports of hearing whales came within hours of hitting the water.

Using the gliders's [reconnaissance data and continued real-time updates](#), the science team was able to locate whales in just a few hours of searching. The whale detection system provides conservation managers with a cost-effective alternative to ship- or plane-based means of identifying the presence of whales, and gives whale ecologists new tools for understanding large animals that spend most of their lives out of human eyesight below the sea surface. Whale researchers want to learn what draws whales to this part of the ocean during the late fall and winter. The labour-intensive work of surveying for whales, overseen by NOAA, is usually done by human observers on ships or airplanes, and is limited by the conditions at sea.

Years of collaboration

The success of the project is a result of years of productive collaboration among engineers, biologists and physical oceanographers at WHOI, scientists at the NEFSC Protected Species Branch in Woods Hole, and federal funders like the Office of Naval Research and NOAA's Applied Science and Technology Working Group Program via the Cooperative Institute for the North Atlantic Region (CINAR). The gliders are operated by Fratantoni, a 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 to enable it to recognise unique calls of sei, fin, humpback, and right whales, and to keep a tally of when and where it heard each call. By integrating the DMON into Fratantoni's gliders, the team had the ability to search large areas of the ocean and to receive data in real time.

Pitch Track from Spectrogram

The DMON – a circuit board and battery about the size of an iPhone – sits inside the glider recording audio and generating spectrograms, a form of the audio that facilitates complex sound analysis. From the spectrogram, Baumgartner's software generates a "pitch track," a visual representation of a whale call, and estimates which species of whale made the call based on characteristics of the pitch track. Tallies of each species' detected calls and even a small subset of detected pitch tracks can be transmitted to shore by the vehicle.

Image: Chief scientist Mark Baumgartner secures a glider (with its wings removed) after it was recovered on 4 December from its three-week mission. The gliders are equipped with an underwater microphone and an iridium satellite antenna. The vehicle surfaces every few hours to get a GPS position and transmit data to shore-side computers. (Image Courtesy: Nadine Lysiak, Woods Hole Oceanographic

