An Academy First

Cadets deploy solar-powered data buoy in southeast Alaska

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1/c Sydney Mills (left), Biologist Lauren Bell (center), and 1/c Eva Sandri (right) prepare a sonde to measure sea conditions within kelp forests in Sitka Sound, Alaska.

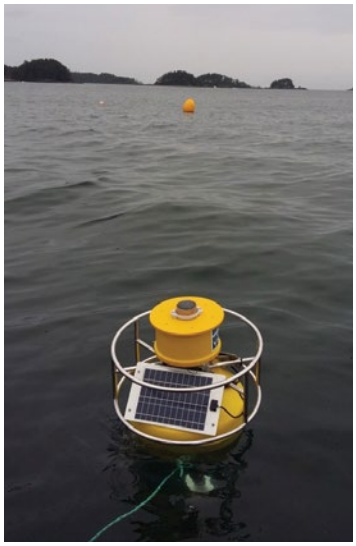
This summer, Marine and Environmental Science cadets 1/c Sydney Mills and 1/c Eva Sandri deployed the Coast Guard Academy's first autonomous oceanographic data buoy. Situated in nearshore Sitka Sound, Alaska, the instrument produces a continuous stream of scientific data on sea conditions in a region renowned for its abundant natural resources and productive commercial fisheries.

The initiative was part of a 6-week summer internship program offered by the USCGA Science Department, in partnership with the Sitka Sound Science Center and USCG Air Station Sitka. The buoy system will play a central role in a long-term monitoring study investigating the potential impacts of climate change on kelp forests and their role in coastal resilience.

Manufactured by YSI Inc., Yellow Spring, Ohio, the EMM68 Harbor Buoy weighs less than 150 lbs, making it possible for a team of two to assemble and deploy it from a small boat. Two solar panels affixed to the floatation device power a sonde instrument, which is suspended two meters underwater in protective housing. The sonde is equipped with several probes that measure sea surface temperature, salinity, dissolved oxygen, pH, and fluorescence. These parameters are used by oceanographers to characterize physical processes in the ocean, including those that influence marine ecosystem dynamics.

The buoy also serves as its own Wi-Fi hotspot. Every 15 minutes, data are transmitted to a password-protected website hosted by Storm Central, a partner of YSI Inc. The data are accessible from any computer connected to the internet, providing users with a near real-time view of ocean conditions in Sitka Sound, Alaska.

USCGA cadets and researchers at the Sitka Sound Science Center plan to use the data to better understand the impacts



L: The USCGA data buoy in nearshore Sitka Sound, Alaska. R: 1/c Sydney Mills examines live fish eggs for the aquarium at the Sitka Sound Science Center.

of global climate change on kelp forests in the region. Kelps are cold-water seaweeds that often do poorly when sea surface temperatures rise, as shown in past El Nino events affecting the western U.S. It is not clear how kelp will respond to long-term climate change, but their loss would have negative impacts on the many organisms they support, including fish of commercial value that fuel local economies.

To understand these and other impacts, scientists need access to oceanographic data collected by instruments just like the one deployed this summer by Mills and Sandri. Data from northern regions are in especially high demand because the effects of global climate change are expected to be more pronounced in the Arctic than anywhere else in the world.

Deploying the instruments, however, is not always easy. Mills and Sandi spent countless hours calibrating probes and troubleshooting cellular communications in the field, working closely with YSI Inc. technicians calling in from the Lower 48. The cadets also designed a custom anchoring array to protect the buoy against rough seas, tidal currents, and local boat traffic. Twice during the summer, Mills and Sandri took to the skies aboard a MH-60T Jayhawk helicopter, courtesy of USCG Air Station Sitka, and assessed the buoy's location relative to the greater mosaic of kelp forests in Sitka Sound.

Along with deploying the buoy, Mills and Sandri collected information on the spatial extent of kelp beds relative to specific environmental factors, such as tidal stage and time of year. Utilizing skiffs, kayaks, and mobile GPS units, the cadets systematically measured the perimeter of several kelp beds tagged for long-term monitoring, then analyzed the data using geospatial software. They also developed a new protocol for measuring kelp blade density in the field, which is another indicator of ecosystem health. The plan is to compare their results to those collected by last year's cadet interns, ENS Karisa Maurer ('16) and ENS Aimee Valencia ('16), and to data collected by collaborators studying kelp forest ecology and climate change at the University of California-Santa Cruz.

Although two years of data are not enough to detect responses by kelp beds to long-term global climate change, information collected by the cadets will serve as a valuable baseline against which future trends can be compared. Indeed, it is through the ongoing partnership with Sitka Sound Science Center and USCG Air Station Sitka that the collective efforts of current and future cadets will make valuable and lasting contributions to our understanding of kelp ecology, climate change, and coastal resilience in southeast Alaska.

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