

Project: Kelp Forest Array

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Goals

The Kelp Forest Array (KFA) is a state-of-the-art cabled platform for observational and experimental science aimed at monitoring and understanding local impacts of global climate change. Increasing climate change and ocean acidification pressures require the establishment of long-term, baseline monitoring methods to document how a currently healthy system changes and to understand effects of climate change in relation to this natural variability. Current monitoring practices limit resolution and longevity of baseline data sets.

The KFA is located among the kelp forests of California's Monterey Bay. Its goals are to cultivate observational and experimental science to help our understanding of the local impacts of global climate change and human activities. This project enables researchers to gather oceanographic data metrics such as water temperature, current speed and direction, dissolved oxygen concentration, salinity and acidification (pH) in real time as well as support intensive collaborative short-term experiments. The array's data communication and power supply enable the capabilities of an onshore laboratory to exist in the natural ocean environment.



Early career science fellow Jamie Dunckley conducting underwater research using the KFA.

Project Updates

The KFA team, in collaboration with the Hopkins's Marine Life Observatory (MLO) and the Stanford Environmental Fluid Mechanics Laboratory (EFML), conducted two major experiments in the summer/fall upwelling seasons of 2015 and 2016. These experiments used multiple sensing moorings spaced throughout the nearshore kelp forest to capture variability of hypoxic and low-pH events associated with non-linear internal tides and their physical interaction with kelp canopy and rocky topography. Increased ocean acidification and expansion of the oxygen minimum zones— both tied to climate change—are likely to enhance the frequency and intensity of these events on the KFA study site.

As of 2015, the underwater research node known as the Kelp Forest Array (KFA) has been collecting data for three years in the kelp forest off Hopkins Marine Station, yielding a dataset of high-resolution, real-time environmental parameters (e.g. temperature, salinity, velocity, oxygen, pH, turbidity, chlorophyll). We have expanded our suite of observing capabilities on the KFA to include a pH sensor and video camera as well as a string of cabled temperature and oxygen sensors. This string of instruments now allows us to capture the vertical spatial variability of nearshore events. The development of a “booster” node system will extend the array's range of observations to deeper parts of the kelp forest. In preparation for the new node's creation, autonomous measurements of temperature, oxygen, and pH are being collected at the expansion site during this year's upwelling season.

The results of a KFA-hosted experiment using the Monterey Observatory Tower Node (MOTOWN) were published in the *Journal of Geophysical Research – Oceans* (Walter et al. 2014). This research helped coastal oceanographers examine mixing rates and efficiency during shoaling internal wave events. It furthered the scientific understanding of how layers of coastal

waters mix and informed the design of Hopkins Marine Station's ongoing kelp forest research projects.

In the 2015 field season, the array also hosted the Monterey Bay Aquarium Research Institute's shallow water Free Ocean Experiment (swFOCE) system, and collected data to help contextualize field experiments run at Hopkins Marine Station. The swFOCE system is designed to look at the effects of ocean acidification on a controlled biological experiment.

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