

## *An in situ holographic imaging system for measuring distributions of Karenia brevis*

Aditya Nayak, Timothy Moore, Malcolm McFarland, Lisa Nyman

Recurring blooms of the ‘red tide’ causing organism *Karenia brevis* are a serious ongoing concern along the southwestern coast of Florida. These blooms have caused substantial damage to local marine ecosystems, including massive fish kills and marine megafauna mortalities, as well as severely impacted local economies. Detecting *K. brevis* cells directly in the natural environment is the best way to monitor all bloom stages, including early phases which are hard to identify from satellite or other observations not linked to cell counts.

Our project will use a novel instrument –an underwater holographic microscope (AUTOHOLO) – developed at Florida Atlantic University (FAU) to acquire digital pictures of plankton in the water column that will be processed for identification using machine learning software. We will develop this software specifically for identifying blooms of *K. brevis* along Florida’s gulf coast. Holography allows for imaging all plankton within a large sample volume, thus enabling visualization of live organisms in their natural environment. The instrument has recently been adapted for autonomous deployment in coastal waters, thus enabling rapid identification and quantification of plankton composition, including potentially *K. brevis* abundance, over time. The AUTOHOLO will be deployed on the West Florida Shelf during observed bloom events, in coordination with FWC-FWRI, using an adaptive sampling strategy, including existing routine field operations and directed event responses. The success of this project will provide a novel tool to perform high resolution, 3D spatial surveys and high frequency time series measurements, which will help address several important but poorly understood aspects of *K. brevis* dynamics, spanning various bloom phases. Other plankton community characteristics can also be determined, which may influence *K. brevis* bloom development, progression, and/or termination. Ultimately, direct and rapid detection of *K. brevis* cell concentration and spatial distribution in the environment enabled by this instrument, could potentially provide critical information for both public alerts and scientists studying *K. brevis* bloom dynamics.