**Title**: The dinoflagellate-specific algicide IRI-160AA: Isolation, characterization and potential impacts on ecologically relevant metazoan species
**Institution**: University of Delaware, College of Earth, Ocean, and Environment
**Investigators**: Kathryn J. Coyne, Mark E. Warner, Jonathan H. Cohen, Timothy Targett
**Total Cost**: $746,850 (no ship time requested)
**Budget Period**: Sept. 1, 2015 – Aug. 31, 2018

**Abstract:** Dinoflagellates make up about 75% of HAB species that are capable of producing toxins. These toxins can be transferred up the food web and represent a major threat to human health and marine life. Costs associated with monitoring, loss of revenue for local fisheries, and other human health-related impacts during dinoflagellate blooms can reach into the tens of millions of dollars for a single event. Previous PCMHAB-supported research to Coyne and Warner demonstrated that *Shewanella* sp. IRI-160 produces an algicidal compound, termed "IRI-160AA" that specifically targets dinoflagellates while having no effect on a broad range of other phytoplankton. Results of small scale microcosm experiments during blooms of harmful dinoflagellates were consistent with laboratory culture experiments, and demonstrated a shift in community structure after application of the algicide, with a decrease in dinoflagellates and dose-dependent increases in ciliates and diatoms. The proposed research builds on these previous results with the aim to provide management and end-users with information about the effectiveness of IRI-160AA in prevention and mitigation of harmful dinoflagellate blooms, and the potential risks to other species by application of the algicide.

Previous research was conducted with a bacteria-free filtrate of the culture medium, which could be partially purified by solid phase extraction techniques. Quantitative assessment of the impacts of IRI-160AA across a broad range of taxa for this study will require that the algicide be further purified. In preliminary work, HPLC analysis revealed the presence of four major peaks in the bioactive fraction. For this project, each of these peaks will be isolated to identify and characterize the bioactive compound. The minimum (EC5) and median (EC50) effective concentrations as well as the concentration required to cause 95% mortality (EC95) in dinoflagellates will be determined using protocols and guidelines developed by the EPA. These concentrations will then be used to assess dose response in natural community experiments conducted under bloom and non-bloom conditions. Effects on vertebrate and invertebrate species will then be determined. In support of this line of research, preliminary data shows no decrease in viability of a fish gill cell line after 24 hours exposure to the algicide. Here, the lethal and sublethal impacts of the purified algicide will be determined for copepods and blue crab larvae and megalopae stages. Primary and tertiary stress responses across a range of locally important fish species will then be assessed with the algicide alone or in conjunction with diel-cycling of dissolved oxygen as a secondary stressor. Our overall goal will be to gain more information about the impacts of the algicide on dinoflagellates and non-dinoflagellate species so that we can accurately predict the overall effects on resident populations during field application. After careful review of the results by PCMHAB management and the Transition Advisory Committee, a field demonstration will be conducted to determine the effectiveness of the algicide and overall effects on water quality and biology. The demonstration will follow guidelines for site selection and monitoring requirements provided in the draft Programmatic Environmental Assessment (PEA) for PCMHAB. Successful completion of this work will provide management with knowledge of the potential risks and benefits associated with the application of IRI-160AA as a tool to prevent or mitigate harmful dinoflagellate blooms.