DolMICROBE Public Abstract

Title: The significance of doliolid microbial interactions: Do doliolids fundamentally alter the trophic structure and productivity of sub-tropical continental shelf food webs?

Gelatinous zooplankton play crucial but poorly understood roles in food webs and element cycling in the world's oceans. This is especially true for smaller mucus-feeding gelatinous animals including the pelagic tunicates (salps, pyrosomes, larvaceans, and doliolids). Because doliolids form massive blooms in particle and nutrient-rich waters of the world's continental shelves, often exceeding 1,000 zooids m⁻³ and extending 100's of km, they are especially likely to alter structure and function of marine food webs. Compared to periods when crustacean zooplankton (copepods) are the primary consumers of phytoplankton and, in turn, nourish larger species (fish, birds, marine mammals), we hypothesize that doliolid dominance enhances microbial loop processes and results in a decrease in the efficiency of trophic transfer to consumers. In this project, we will investigate the role that doliolids play in linking and modifying microbial loop and classical food web processes in subtropical continental shelf systems. In addition to the project's focus on a central theme in biological oceanography, the results of this project will be of broader interest. Specifically, gelatinous zooplankton remain a poorly resolved component of ecosystem models, and a better understanding of how these communities interact with microbial processes and are influenced by chemical and physical conditions will improve predictions of population- and ecosystem-level responses to the myriad of environmental stressors that mechanistically link to the ocean's economic and societal value. The project will also support a targeted effort to increase the representation of African Americans in the Ocean Sciences, will provide experiential research opportunities to K-12 educators, support 2 PhD students and several undergraduate students, and involve an investigator at the beginning of his academic career.

The long-term goal of this project is to understand the ecological function of doliolids on subtropical continental shelves and their influence on microbial processes. In association with monthly oceanographic field expeditions on mid-continental shelf at 31°N and two longer longitudinal expeditions complemented with experimental studies, the project will investigate the relationship between doliolid abundance and life stage composition, their spatial relationships to marine snow aggregates and other zooplankton, water column microbial activity, bacterial production, and net system productivity. Utilizing a constellation of modern and classical approaches in microbial and zooplankton ecology, including the first ever deployment of an in situ zooplankton imaging system in the South Atlantic Bight, microbial metagenomics and transcriptomics, and stable isotope-based tracer experiments, these studies will allow the testing of three fundamental hypotheses. First, independent of total shelf productivity, the presence and abundance of doliolids is quantitatively correlated with heterotrophy compared to periods when doliolids are not abundant. Second, doliolids predictably shape continental shelf microbial communities, activity, and function, and third, doliolids are detrital feeders benefiting nutritionally from the consumption of microbial enriched aggregated particles and fecal material - the pool to which they also contribute.