BIOS–REU

Mentors & Potential Research Projects

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Bermuda Institute of Ocean Sciences
17 Biological Station, St. George's, GE01, Bermuda
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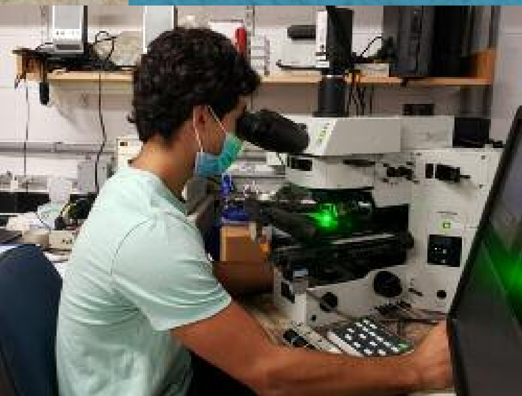
Student activities include a late night net-tow to collect plankton (left) lab work to scan and categorize copepods (center); and field work to monitor reef ecosystem health (right).

Coral Reef Systems Ecology

Potential mentors: Eric Hochberg, Yvonne Sawall, Samantha de Putron, Tim Noyes, Leo Blanco-Bercial

Coral reefs are complex ecosystems, with geological, physical, chemical, and biological processes interacting across space scales of millimeters to kilometers and time scales of milliseconds to millennia. With ever increasing threats from local and global human activities, it is important to understand those interactions and how they might be changing. The Bermuda platform has an ecological distribution of different habitats (mangroves, seagrasses, inner patch reefs, outer rim reefs, deeper terrace reefs) in close proximity to each other and which exhibit spatial and temporal gradients in environmental parameters. The scientific aim of this project is to make ongoing observations of key physical, chemical, and biological reef parameters, such as waves, currents, light, nutrients, pH, salinity, temperature, primary production, community structure (benthos, zooplankton, fish), coral condition and recruitment. Working in a team, interns will deploy and retrieve instrumentation, collect in-water data, and conduct analyses to explore system connections and determine potential drivers of variations in the benthic communities.

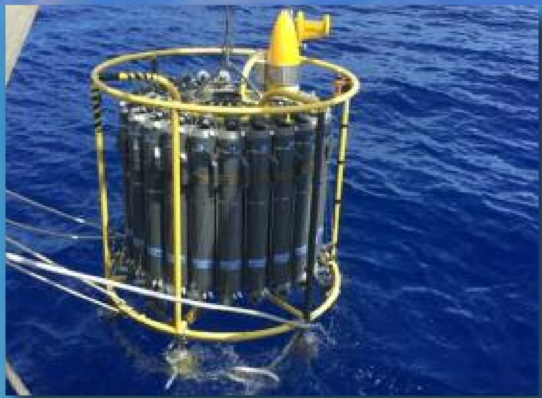


Interns working on research projects analyze samples at the microscope (left) collect microplastic samples on local beaches (center); and analyze samples in the lab (right).

Plastics in the Marine Environment

Potential mentors: Rachel Parsons, Andrew Peters

Plastic refuse introduces highly recalcitrant synthetic compounds into the environment. The impacted areas (marine and atmospheric) are inadvertently subjected to the burden of material fragmentation and chemical leaching because of chemical degradation processes such as UV irradiation and microbial degradation. Furthermore, the impact of plastics on an ecosystem or environment can greatly depend on particle size as well as chemical composition. Plastic particles ranging from 5-20mm, known as mesoplastics, have led to population declines in avian species. Microorganisms that possess the metabolic machinery to adhere, degrade and utilize plastics as carbon sources to fuel metabolic requirements have been observed in various diverse environments. This project intends to combine atmospheric, beach and marine surveys to identify plastics by size and type with identification of the microbial component of the microplastics biofilm using microscopy protocols.



Intern activities may include participating in a deep ocean glider deployment (left) or a time series research cruise (center); as well as laboratory, technical and engineering work (right).

Biological Production and Exports: Assessing the Biological Carbon Pump in the Sargasso Sea

Potential mentors: Ruth Curry, Damian Grundle

Quantifying organic carbon export (i.e. sequestration of carbon from surface waters to deep layers) in marine environments, is key to understanding the capacity of the oceans to remove CO2 from the atmosphere and act as a buffer against rising anthropogenic emissions. Despite three decades of shipboard observations at the Bermuda Atlantic Time-series Study (BATS) site, we still do not fully understand the magnitude of carbon export in the Sargasso Sea or the mechanisms which regulate it. One reason for this may be that nutrient delivery to surface waters and subsequent organic carbon export events are playing out on shorter time and spatial scales than can be resolved by monthly ship-based sampling. To address this, the Biological Production and Exports Project is using autonomous underwater gliders equipped with a suite of physical, biological and chemical sensors to continuously measure a patch of ocean offshore of Bermuda. The use of this technology allows us to track nutrient delivery to the euphotic zone, and estimate primary production and organic carbon export at temporal resolutions much higher than those obtained by ship-based sampling alone. In addition to the glider measurements, we also conduct monthly biological and chemical measurements for calibrating glider sensors, and to validate the glider estimates of primary production and organic carbon export. This project will enable two students to independently analyze different components of the program's observations (oxygen/nutrient budgets and phytoplankton/particle biomass) and participate in all aspects of glider operations (deployments and recoveries, glider piloting). Candidates should have strong organizational and analytical skills and be comfortable working with Matlab.

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