BIOS–REU

Mentors & Potential Research Projects

2024

Bermuda Institute of Ocean Sciences
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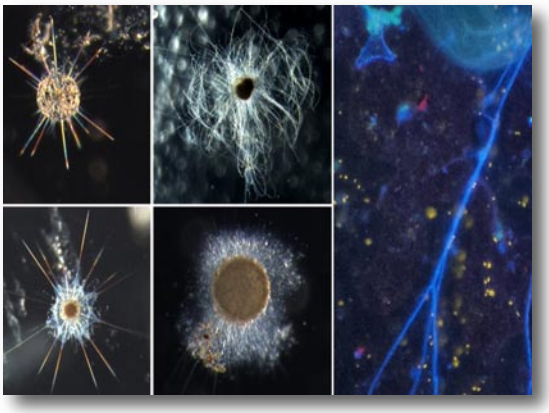
Bermuda Institute of Ocean Sciences

ASU Julie Ann Wrigley Global Futures Laboratory Arizona State University

1. Image analysis of zooplankton

Amy Maas

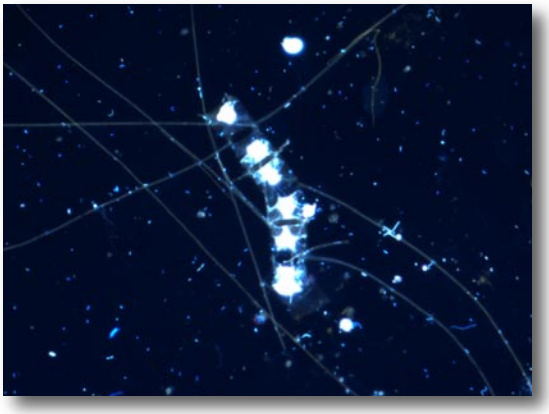
The study of the small floating animals that inhabit the oceans - the zooplankton - has recently been revolutionized by instruments that can photograph these tiny animals, rapidly providing information on abundance, diversity and even the ecosystem function of whole communities. Comparing these new measurements with older datasets requires careful cross-comparison. Potential projects include: validation of conversions between animal mass and image area; exploration of community diversity in day versus night; or analysis of how changing environments change the abundance and size of a specific group.



2. Protist plankton

Leocadio Blanco-Bercial

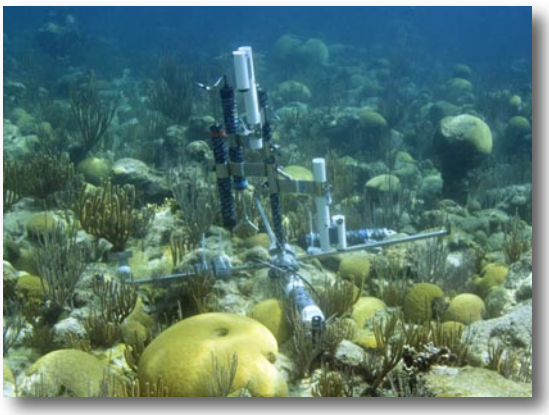
Protists, unicellular or multicellular eukaryotes, comprise more than 95% of the eukaryotic diversity. In the oceans, they include from tiny cell, slightly larger than bacteria, to colonies reaching several centimeters in length, from naked cells to cells bearing extremely complicated and delicate skeletons, and form photosynthetic forms to carnivores. Projects can include from responses of cultures to nutrients to field observations; from microscopy-oriented to semiautomated imaging. Projects can be discussed with the student to find a common place of interest.



3. Marine microbial oceanography

Rachel Parsons

Microbial Oceanography involves a broad suite of genomic, ecological, oceanographic and biogeochemical approaches to evaluate microbial process, structure and function on various scales from organism to ecosystem. Potential projects include: studying ocean deoxygenation and oxygen minimum zones; exploring the microbiome of the floating seaweed Sargassum; developing image analysis protocols for enumeration of bacteria and viruses; determining sewage indicator species and the occurrence of antibiotic resistant bacteria; and assessing the microbial colonization of marine microplastics.



4. Coral reef systems ecology: Scaling processes across organisms, communities, and ecosystems

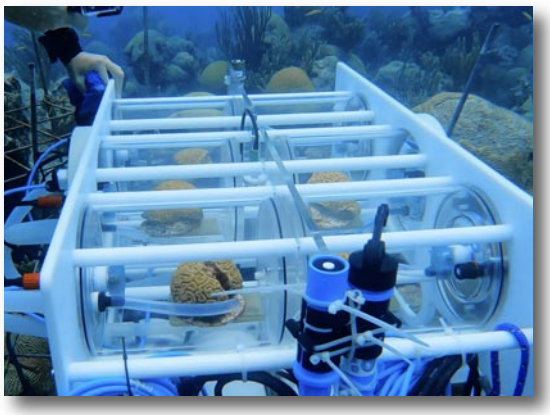
Eric Hochberg

The future of coral reefs depends not only on what organisms are present, but also how the system functions. Various algae, corals, and sediments form reef communities that, in turn, build a reef ecosystem. Ecological processes of the community are not necessarily the sum of the organism processes. So, to predict reef futures, we need to study functioning across organisms and communities. This project uses in-water and remote sensing data, as well as a basic ecological model, to investigate reef system function.

5. Coral thermal tolerance and resilience

Yvonne Sawall, Samantha de Putron, Brett Jameson, Chloe Carbonne

Increases in the frequency and intensity of marine heatwaves are threatening tropical corals worldwide. Our research aims to understand the capacity of corals to acclimatize to changing conditions, the physiological and genetic mechanisms that foster resilience, and the potential to use stress conditioning to enhance coral thermal tolerance. Potential projects will focus on assessing coral response to natural and simulated thermal fluctuations using mesocosm studies and determining coral performance by physiological response at the colony and tissue levels.



6. Reef biogeochemistry and coral metabolism

Yvonne Sawall, Damian Grundle

Assessing the impact of mesoscale eddies on reef biogeochemistry and coral metabolism. This exciting NSF-funded project will provide the student with the opportunity to conduct lab-based water quality measurements and learn how to process large(r) data sets from data loggers deployed in the ocean. The data sets include environmental as well as coral metabolism data. Additionally, there will likely be opportunities to conduct some fieldwork.

7. Fish community assessment with eDNA metabarcoding

Tim Noyes

The decreasing cost and increasing reliability of eDNA metabarcoding through next-generation sequencing (NGS) has allowed non-invasive biomonitoring of inherently difficult biomes to be assessed. Such approaches have the potential to provide a more “complete” biodiversity assessment due to efficiency in detecting cryptic, low-abundance, transient and rare taxa. Potential projects include: assessing community biodiversity, exploring the value of ‘molecular by-catch’ i.e., non-target DNA sequences, investigate the compositional patterns of the fish communities from different ecosystems. Projects can be discussed with the student to find a common place of interest.

8. Physical Oceanography – Mesoscale Eddy Transformations in the Sargasso Sea

Rod Johnson

Beyond the seasonal cycle, mesoscale eddies (length scales 100km’s; timescales months to years) are found to be the dominant source of physical and biogeochemical variability at the Bermuda time-series sites (BATS, Hydrostation S) in the Sargasso Sea. It is unclear how these systems decay or reform and recent modelling suggests that wind – eddy interactions may act to transform the eddies to different types - a significant advancement in understanding ocean transport. Potential projects include the use of global ocean modelling products with the BATS data to investigate eddies and the physical and biogeochemical changes. Students will have the opportunity to participate on research cruises and assist with eddy sampling strategies.

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