



Bermuda Institute  
of Ocean Sciences



Julie Ann Wrigley  
Global Futures Laboratory  
Arizona State University

# Summer Course

## Coral Reef Ecology

2025





The Bermuda Institute of Ocean Sciences, a unit of the Julie Ann Wrigley Global Futures Laboratory, is a U.S. oceanographic research institution based in Bermuda. Founded in 1903, BIOS gained prominence after 1927 when the US National Academy of Sciences appointed the Lillie Commission to assess the needs of the U.S. oceanographic research community. Bermuda was selected as a key “substation” because it is “truly oceanic in location” and therefore in “the best situation in the North Atlantic for investigation into the phenomena that are fundamentally characteristic of the ocean basins.”

Today, ASU BIOS continues to conduct state-of-the-art oceanographic research with an emphasis on the North Atlantic Ocean and the coral reef platform of Bermuda. Because Bermuda is in the path of major ocean currents and in a region of significance with respect to climate change, our research portfolio has global relevance. We also leverages our core research to create unique educational programs at all levels—grade school through graduate school—many in collaboration with U.S. universities including; Princeton University, Furman University, Lehigh University, University of Rhode Island, Roger Williams University.

Bermuda is located in the sub-tropical Atlantic Ocean, some 600 miles from the coast of the U.S. Located in the middle of the North Atlantic Ocean, Bermuda is uniquely situated to serve as a base for research on a variety of inland, coastal, and deep water issues of both local, national and global interest. From here, scientists can easily venture into the surrounding Sargasso Sea, one of the world’s most diverse open-ocean ecosystems. Bermuda is also home to some of the world’s most northern coral reefs, allowing researchers from around the globe an opportunity to study corals outside tropical waters.





# Summer Course

## Coral Reef Ecology

### Course Syllabus

subject to change

**July 21 – August 8, 2025**

**Lead Instructor: Dr. Stuart Robertson (ASU BIOS)**

**Co-instructor: Dr. Chloe Carbonne (ASU BIOS)**

**Co-instructor: Dr. Brett Jameson (ASU BIOS)**





## Course Overview

The overall aim of this course is to study the biology and ecology of tropical corals as well as exploring their response to environmental changes, including those driven by projected global climate scenarios. The course examines the biological, physical, biogeochemical, and evolutionary processes that determine reef growth, function, and resilience, spanning scales from individual organisms to entire reef systems. Topics include coral metabolism and physiology at cellular, organismal, and community levels; determinants of community structure and diversity, focusing on trophic dynamics and species interactions; and reef resilience and acclimatization to environmental change, with an emphasis on reproduction, recruitment, symbiosis, and evolution.

Lectures will be complemented with field and laboratory exercises, where students will gain first-hand experience in coral reef research methods and health monitoring. Field activities include benthic surveys, water quality analysis, assessments of coral recruitment and recovery, bleaching and disease monitoring, fish ecology, and nocturnal reef observations. Laboratory experiments will focus on coral physiology, including symbiosis, metabolism, and environmental stress responses.

The Coral Reef Ecology course at ASU BIOS is an intensive and integrated program aimed at upper-level undergraduates, graduate students, and professionals. The course consists of lectures, precepts, laboratory exercises, field (SCUBA) surveys, and readings from primary literature, with attention given to active areas of research. It also includes input from current coral researchers working at BIOS (including Dr. Chloe Carbone and Dr. Brett Jameson), providing students with insights into ongoing studies and real-world applications. The program includes the development of an oral presentation, where students will analyze and present findings from field and lab data collected during the course.





## Reading Material

The instructors will provide relevant readings from primary scientific literature.

## Prerequisites

- Completion of University-level Biology and Ecology courses; Marine Science desirable.
- The course will require boat work and the ability to work comfortably in the water with a mask and snorkel. SCUBA certification is highly recommended, as those who are SCUBA certified\* will be able to undertake fieldwork underwater and learn scientific diving skills.

*\*To be permitted to dive at ASU BIOS, course participants must complete, and return to the Dive Safety Officer, various forms and meet certain medical safety standards, which will require a physical examination from a health practitioner prior to arrival in Bermuda. The student dive information package (SDIP), including all such forms and supplemental information, will be provided after notification of acceptance on this course. Diving participants must already be SCUBA certified (minimum of open water certified or internationally recognized equivalent). A minimum of 12 dives and at least one dive in the past six months is highly recommended.*

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## Course Structure

The course has the following components:

- ~15 lectures (approx. 1 hour long),
- at least 8 boat (SCUBA/snorkel) trips (4-6 hours each)
- at least 6 laboratory sessions (3-4 hours each, with additional time out of hours as needed)
- several precepts (0.5-1 hour each) to discuss background and methods for field and laboratory work

## Grading

Course grading will consist of quizzes, an oral presentation, a final exam and a participation mark.

## Lecture topics examples:

- Introduction to Coral Reef Ecosystems: Diversity and Importance
- Coral Evolution and Taxonomy: Origins of Reef Builders
- Reef Geology: Formation and Global Distribution
- Coral Biology: Anatomy, Physiology and Environmental Limits



*continued*

- Symbiosis on the Reef: Coral-Zooxanthellae Partnerships and Beyond
- Energy Flow and Metabolism on Coral Reefs: Nutrient Cycle and Trophodynamics
- Sponge Roles in Reef Ecosystems: The Sponge Engine
- Coral Calcification and Reef Structure: Building Underwater Cities
- Reproduction and Recruitment in Corals: Life Cycle and Larval Ecology
- Microbial Communities and Disease on Coral Reefs
- Herbivory and Competition: Dynamics of Reef Communities
- Disturbances on Coral Reefs: Resilience and Recovery
- Thermal Stress and Coral Bleaching: The Role of Environmental Change
- Ocean Acidification: Impacts on Coral Growth and Ecosystem Stability
- Human Impacts and Conservation of Coral Reefs: Challenges and Solutions

**\* Field and Laboratory Activities and Topics to include:**

- Coral community structure assessment
- Coral condition monitoring: bleaching and disease surveys
- Coral recruitment surveys
- Photomosaics for reef structure and health analysis
- Fish community structure surveys
- Macro-algal community structure assessments
- Night dive for nocturnal ecosystem observations
- Experimental set-up and coral husbandry
- Coral respirometry and photophysiology
- Analysis of coral tissue parameters following future environmental conditions
- Wreck dive to observe artificial structures

*\*Field schedules are subject to change and dependent on prevailing weather and sea conditions*





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