Directed Oceanographic Research: Coral Reefs

SEA 3025 (4 credit hours)
~62 contact hours

Course Overview

Global declines in coral reef health and impaired ecosystem functions have been documented and Caribbean reefs are no exception. Coral reef conservation requires multiple approaches including monitoring to document anthropogenic impacts on reefs and research to understand ecosystem function and how they are responding to global change. In this course, we will learn field research techniques and reef species IDs and apply these skills in the Caribbean. The data we collect will add to SEA's long-term monitoring dataset and be shared directly with our Caribbean partners. In Woods Hole, you will develop a research proposal to be carried out during the sea component. Your progress will be guided and monitored weekly during the shore component, culminating in a research proposal paper and presentation. In the Caribbean, you will work together to collect oceanography and ecology data on coral reefs. By the conclusion of the program, you will have analyzed a subset of this data, presented your work in a research symposium, and written a scientific paper.

For this program, you will choose one research elective. DOR has pre-requisites of three lab courses or research experiences, one of which must be an upper-level lab. DOR students will work independently or in pairs.

Course Instructor

Professor of Oceanography at SEA

Contact me anytime to discuss your progress in class, ways to improve learning, or other topics!

Course Footprint

Component	Duration	Location
Shore	Jan 5 – Feb 18	Woods Hole, MA
Sea	Feb 18 – Mar 29	aboard *SSV Corwith Cramer* with port stops in St. Croix, Dominica, Anguilla

Course Goals and Learning Outcomes

1) Read and evaluate scientific literature and data sources in coral reef research
2) Develop, implement, and complete hypothesis-driven field research on Caribbean coral reefs
3) Critically analyze and interpret authentic coral reef ecology and oceanography data
4) Communicate research clearly through written and oral presentations

How we will Achieve our Learning Goals:

Assignment	% of Grade
Shore Component	
Participation in Student Hours	15
Peer Review of Research Proposals	5
Research Proposal Presentation	10
Research Proposal Paper	15
Sea Component	
Reef Critters Taxonomic ID Quiz	5
Participation in Coral Reef Snorkel Surveys	20
Final Research Presentation	10
Final Research Paper	20

Participation in Student Hours: The research proposal is scaffolded into weekly assignments and meetings to help keep you on track and provide opportunities for asking each other questions. While in the Caribbean, we will meet at least twice to discuss scientific writing and data.

Peer Review of Research Proposals: Peer review is important for assessing proposals and manuscripts under consideration for grant funding and publication in scientific journals. We will learn how to give constructive, kind reviews. You will give each other constructive feedback on your proposals during Week 5 of the shore component in Woods Hole.

Research Proposal Presentation: Each individual or research team will give a short (~15 min.) presentation outlining their research plan. Presentations will include background information, hypothesis(es) to be tested, and methods (sampling and data analysis). Additional guidelines and a rubric will be supplied during Week 2 of the shore component.

Research Proposal: During the shore component in Woods Hole, students will be guided through the rigors of the scientific process including reading of scientific journal articles to gather essential background information, developing a hypothesis, and describing field methodologies and data analysis. Each student or team is expected to write a thoughtful, well-researched, and well-planned proposal that follows the same format as the National Science Foundation's Graduate Research Fellowship Program. Additional guidelines and rubric will be supplied during Week 2 of the shore component.

Reef Critters Taxonomic ID Quiz: Near the beginning of the sea component, you will take a short practical taxonomic ID quiz to demonstrate knowledge of coral reef benthic, invertebrate, and fish identifications to be used during coral reef surveys.

Participation in Coral Reef Snorkel Surveys: Teamwork makes the dream work! Students are expected to participate in all aspects of snorkel missions including fieldwork preparation, snorkel surveys, photographic analyses, and data entry. We will have a reef debrief at the end of each snorkel mission. Students should report regular progress towards analyzing coral reef photographs and data entry during daily check-ins.

Final Research Presentation: Students will present their research to their peers and the local community in a final program symposium. Emphasis will be placed on clear visual representation of the research question, methods, and data analysis and interpretation as well as oral explanation of work. Each student is expected to contribute to the poster presentation. A rubric will be provided during the remote shore component.

Final Research Paper: Students will write a final paper following a standard format for articles published in the journal *Coral Reefs*. You should use your proposal as starting point for writing the final paper. These papers will be archived at SEA. Additional guidelines and a rubric will be provided during Week 2 of the shore component.

Course Materials for Shore

Required Textbooks: None. You should be reading (and citing) primary scientific literature for this course. I will post several e-textbooks and have textbooks you may borrow as a starting point for building your knowledge. (These textbooks cite primary literature which you can then search.) You should never pay for access to an article; let me know if you are experiencing issues.

Required Software Programs: Microsoft Office (or equivalent desktop app), R and RStudio. If you have a PC laptop, downloading CPCe may be useful.

Course Materials for Sea

Snorkel Gear: You will need a set of snorkel gear (mask, snorkel, fins) to conduct chemistry and ecology surveys of Caribbean coral reefs. SEA does have snorkel sets that can be borrowed fo rhte duration of the program; if you need to borrow gear, talk to me as soon as possible.

Thermal/Sun/Sting Protection: In addition to snorkel gear, a long-sleeved rash guard or t-shirt is required and swim leggings are highly recommended. This provides thermal and sun protection as well as protection against stings from marine life. You will be in the water for up to an hour and back-to-back days, so it is likely you will get cold. If you get cold easily, you may want to consider bringing a thin wetsuit.

Belonging, Accessibility, Justice, Equity, Diversity, and Inclusion (BeAJEDI) - Community Agreement and Class Policies

Belonging

We are committed to creating a learning environment that is welcoming, inclusive, and accessible to SEA's diverse student body and faculty. In fact, this is one of our primary responsibilities as your instructors. Everyone is expected to be respectful towards one another – even when there is a difference of opinions – to foster a positive learning environment and community. This courtesy should be extended to guests, too. Additionally, we will respect the public health and safety guidelines of local communities in which we live and study.

Accessibility

Course materials will be accessible through Blackbaud. Class presentations and required readings will be posted at least 24 hours in advance. The presentation slides will include teacher notes of what is being said in class. I am happy to provide hard copies of class material, too; please let me know if this is your preference.

You may have cell phones, food, beverages, etc. in the classroom. Likewise, feel free to stand up and move around the classroom if you are getting restless. (Students in the past have knitted or created friendship bracelets.) Please keep in mind whether your actions are respectful to yourself, your peers, and your instructor(s). We should see you are still engaged in learning and participating in class discussions and hands-on activities. If we see anything becoming a problem, we may take away these privileges.

I will be on campus at least four days a week; my door is always open to you for conversations about course materials, learning, and academic/career chats. My office is located in the Marine Dept. wing, fourth door on the right. The best way to ensure you reach me is to send an email to the professor or leave a message on the whiteboard on my door. I will answer emails within 24 hours except on the weekend. I generally do not check messages after 7 pm during the week.

Justice

We see that we in Falmouth are on the traditional homeland of the Wampanoag people who live and continue to thrive here after thousands of years of residence. We also see we will be studying the traditional islands of the Arawak, Taino, and Kalinago people. We acknowledge the painful history of colonization that has enacted forced assimilation, enslavement, genocide, violent support of plantation regimes, and efforts by many to eliminate Indigenous cultures. We respect and honor the Indigenous people and the descendants of forced migrants still connected to these lands and are eager to learn from their ways of life. We also recognize these words are not enough and need to be

followed with action steps. Thus, we are committed to ongoing efforts to decolonize our curriculum and engage in antiracist practices.

Equity

Attendance is expected, but we recognize life gets in the way sometimes. If you need to miss a class, please let us know ahead of time. This will allow us to find alternate ways to ensure you are supported, personally and academically. You will never be asked to submit 'proof' of illness or personal/family emergencies.

It is your responsibility to learn how to properly cite scholarly work by other scholars. Plagiarism and AI usage without acknowledgement will not be tolerated. Please talk to us if you would like to learn more about citations and plagiarism.

Inclusion

If you anticipate or encounter barriers to participating, please let us know immediately so we can work together to overcome this barrier. If you have a documented or undocumented disability that may require accommodations, please let us or SEA's medical affairs coordinator know as soon as possible so we are aware of possible accommodations that may be requested. Similarly, please let us know if you do not feel respected or safe in this community so we can work together to create a more inclusive environment.

Personal Accessibility Note

I have a hearing impairment. Although a cochlear implant and hearing aid help immensely, I do often rely on lip-reading. Please recognize I may not always hear you if you speak quietly, cover your mouth while talking, or talk from behind me. Know that I am trying my best.

Course Calendar for Shore and Sea Components

The next page contains our proposed course calendar which is subject to change in response to our learning pace, class cancellations due to weather, etc. Any changes in the course calendar, including due dates for assignments, will be announced verbally in class, written on the whiteboard in the class, and posted on Blackbaud.

Weekly assignments should be submitted via Blackbaud before student hours begin. Let me know if you are experiencing issues.

SHORE COMPONENT IN WOODS HOLE				
Day	**Date**	**Time**	**Topic**	**Assignments (due before class via Blackbaud)**
Weds	Jan 7	1015-1145	Intro to Oceanography Courses	Read POR-DOR Syllabus.
Fri	Jan 9	1100-1145	Scientific Writing: Lit. Review	Choose Research Elective
Tues	Jan 13	1330-1600	Pool Session I – Swim Assessment	Bring your snorkel set to the pool
Weds	Jan 14	1330-1445	History of Caribbean Reef Health	
Thurs	Jan 15	1145-1300	Student Hours	Submit Week 2 Worksheet by 1145. Sign Up for Meeting Time.
Fri	Jan 16	1100-1145	Scientific Writing: Introduction	
Weds	Jan 21	0900-1015	Reef Fishes: Roles and IDs	
Fri	Jan 23	1100-1145	Scientific Writing: Methods & Stats	Submit Week 3 Worksheet by 1145. Sign Up for Meeting Time.
Fri	Jan 23	1145-1300	Student Hours	
Weds	Jan 28	0900-1015	Reef Invertebrates: Roles and IDs	
Thurs	Jan 29	1145-1300	Student Hours	Submit Week 3 Worksheet by 1145. Sign Up for Meeting Time.
Fri	Jan 30	1100-1145	Scientific Writing: Proposals	
Weds	Feb 4	0900-1015	Reef Benthic Substrates and CPCe	Add proposal to GDrive folder before midnight.
Thurs	Feb 5	1145-1300		Submit 2 Peer Reviews by 1300
Fri	Feb 6	1100-1145	Science Communication	
Weds	Feb 11	0900-1200	Proposal Presentations	Email your slides to the professor by 0830.
Thurs	Feb 12	1145-1300	Student Hours	Feel free to stop by if you have any last-minute questions about your research proposal.
Fri	Feb 13	1600		Proposals Due (will return when you get to ship)

SEA COMPONENT ABOARD *SSV CORWITH CRAMER*	
Date(s)	**Assignment Due Dates**
Week 1	Travel to St. Croix and Board *Cramer*. Practice Reef Survey Techniques.
Week 2	Conduct Coral Reef Surveys.
Week 3	Mentor Meetings (show me expanded, revised introduction)
Week 4	Conduct Coral Reef Surveys. Mentor Meetings (show me revised methods for St Croix and Dominica)
Week 5	Conduct Coral Reef Surveys (Anguilla).
Week 6	Mentor Meetings (show me two tables/figures that address your hypothesis). Final Research Presentations (Mar. 27) and Papers Due (Mar. 28 @ 1800).