

The Ocean and Global Change

SEA 3026 (4 credit hours)

~105 contact hours

Course Overview

How will the ocean and coral reefs function in the Anthropocene Era? This course will explore this question by surveying how oceanographic processes are changing across spatial scales from the global ocean to Caribbean coral reefs due to natural variability and human activities. We will add practical skills to our 'science tool kit' through data exploration exercises in R, literature review discussions, and hands-on research investigating trends in ocean properties over time in the Caribbean.

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 | SSV <i>Corwith Cramer</i> with port stops in St. Croix, Dominica, Anguilla |

Course Goals and Learning Outcomes

- 1) Create foundation in oceanography principles and processes across spatial scales from the global ocean to the Caribbean Sea to coral reefs
- 2) Investigate anthropogenic pressures facing the ocean and coral reefs and, from a scientific perspective, conservation approaches
- 3) Gain practical experience in oceanographic data collection, analysis, and reporting

Learning Approach

This course will use a combination of pedagogical tools to make learning accessible to everyone. I treat this syllabus and calendar as a living document that can be modified to set better expectations, to allow for you to shape your learning experience, and to set you up for success even when life gets hard. I encourage you to give me feedback about the course early and often so we can all get the most out of this experience and course.

Our main goal on shore is to prepare you for conducting oceanographic research at sea by building a foundation knowledge related to oceanography, coral reefs, and climate change. Additionally, we will start practicing skills needed to conduct oceanography research. While at sea, we will be conducting hands-on research to investigate regional oceanography and coral reef health throughout the Caribbean. Therefore, our course will be divided into two components:

- 1) Oceanography and Coral Reefs: These classes will introduce oceanographic processes, coral reef physiological and ecological processes, and magnitude and rates of global change over time. We will study how global and local stressors impacts coral reefs. These classes will be a combination of lectures, activities, demos, case studies, and discussions.
- 2) Lab and Data Exploration: In this session, you will explore real-world oceanographic data including data collected in the Caribbean by SEA using R and RStudio. The self-paced coding exercises allowing you to develop a new research skill or advance your ability to code in R.

This learning approach will set you up for success at sea where you will be applying your knowledge and skills on the ship and while completing coral reef research projects for your POR or DOR course.

How Learning will be Assessed:

| Assignment | Goal of Assignment | Course Goal | % of Grade |
|--|---|-------------|------------|
| Shore Component | | | |
| Weekly Learning Assessments (aka OGC Journals) | Show evidence of understanding course material | 1 | 25 |
| Island Project: Part I | Develop 'sense of place' before conducting research in the Caribbean | 1, 2 | 20 |
| Sea Component | | | |
| Laboratory Watch | Gain practical experience in conducting oceanography research at sea | 3 | 30 |
| Science Report | Gain practical experience in data analysis and reporting | 3 | 5 |
| Island Project: Part II | Understand coral reef conservation approaches being used in the Caribbean via scientific lens | 2 | 10 |

Shore Component Weekly Learning Assessments: Exams are not the most equitable way to assess learning (or my teaching), so you will be submitting weekly learning assessments, in the form of a journal, allowing me to provide regular feedback. Each learning assessment will have specific prompts related to class lectures, in-class activities, and readings. In addition, you will be asked to connect what you are learning to other courses in the program to promote interdisciplinary thinking.

Island Project Part I (on shore): We will be using *Rebuilding Coral Reefs: A Decadal Grand Challenge* (ICRS Science to Policy Paper 2021) as a blueprint for this project. This report presents three pillars for coral reef conservation: 1) Reduce Global Climate Change Threats, 2) Improve Local Conditions to Build Resilience, and 3) Invest in Active Restoration to Enhance Recovery. Working in groups, you will investigate these topics in the context of the Caribbean and one island we are visiting. You are encouraged to connect scientific knowledge to what you are learning in environmental history and communication. At the end of the shore component, you will submit a 2-page fact sheet summarizing what you have learned. Additional guidelines will be provided in class.

Laboratory Watch at Sea: Science watch activities onboard ship will be assessed in on-watch evaluations by SEA Marine Technicians (with whom you will be standing watch). Each student is an essential crew member of the ship at sea. Excellent watch-standers follow directions, ask questions, show independence, and work effectively as part of the team. They are also supportive, helpful, and reliable shipmates. Teamwork is particularly important in this course, so much so that a student's attitude and participation directly affects the physical progress and ultimate success of the voyage.

Sea Component Science Report at Sea: There will be daily science reports while at sea. These are short reports prepared by the dawn watch. Each report will be a combination of data analysis and reporting as well as description of an oceanographic process, interesting creature, or scientific equipment. The reports will collectively tell a story about global ocean change in the Caribbean by presenting past and present data collected at sea.

Island Project Part II (at sea): During our port stops at sea, you will be meeting with folks involved in coral reef conservation. After visiting your assigned island, you will be asked to prepare a short blog post describing what you have learned about community knowledge of and engagement in *Rebuilding Coral Reefs*. A good structure for the blog would be to introduce the pillars of rebuilding reefs, briefly describe what you learned on shore, and further deepen your explanations by sharing your experiences on shore at each island. You should also include discussion of oceanographic properties and trends we are observing in the Caribbean.

Extra Credit! There will be a bulletin board dedicated to 'Current Events' in the classroom. If you come across any interesting media articles about coral reefs, global change in the ocean, marine conservation, Caribbean sustainability, etc., please briefly share with class and post on the bulletin board for everyone to review. You may do this up to three times over the course of our time in Woods Hole.

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 your 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 two pages contain 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.

Required readings should be completed before class in order to get the most out of the class lectures, discussions, and activities.

Journals and assignments will be returned as quickly as possible. My goal is to return the journals with weekly learning assessment to you at the beginning of the OGC class on Monday afternoon.

| SHORE COMPONENT IN WOODS HOLE | | | | | | |
|-------------------------------|--------|------------------------|--|--|--|--|
| Day | Date | Time | Topic | Required Readings | Assignment Due Dates | |
| Weds | Jan 7 | 1015-1200 | Intro to Oceanography Courses | OGC Syllabus C325 Science Plan | | |
| Mon | Jan 12 | 1330-1600 | The Ocean's Role in Climate: Circulation | | Weds: Download R and RStudio before class. | |
| Tues | Jan 13 | 0900-1015 | Intro to Coral Reefs | Brandl et al. 2019 | Friday: OGC Journal Due by 1200. Bring to professor's Office. | |
| Weds | Jan 14 | 1500-1600 | Lab & Data Exploration | | | |
| Mon | Jan 19 | MLK Day – No Classes | | | | Weds: vote for top 2 favorite options for 'student choice' class on Feb 3 rd on Blackbaud. |
| Tues | Jan 20 | 0900-1145 | Primary and Secondary Production | | | |
| Weds | Jan 21 | 1030-1145 | Ocean Warming and Impacts | Muniz-Castillo et al. 2019 | Friday: OGC Journal Due by 1200. Bring to professor's Office. | |
| Tues | Jan 27 | 0900-1015 | Carbon Cycles | | Friday: OGC Journal Due by 1200. Bring to professor's Office. | |
| Tues | Jan 27 | 1030-1145 | Oxygen Cycles | | | |
| Weds | Jan 28 | 1330-1445 1500-1600 | Ocean Acidification and Deoxygenation; Lab & Data Exploration | | | |
| Mon | Feb 2 | 1330-1600 | Ocean Nutrients and Pollution | | Friday: OGC Journal Due by 1200. Bring to professor's Office. | |
| Tues | Feb 3 | 0900-1015 | TBD – Student Choice | TBD | | |
| Weds | Feb 4 | 1030-1145 | Lab & Data Exploration | | | |
| Mon | Feb 9 | 1330-1600 | Pool Session: Practice Reef Survey Techniques | C325 Science Plan | Monday, Feb 16 @ 0900: Submit Island Project on Blackbaud. | |
| Tues | Feb 10 | 0900-1015 | Coral Reef Conservation Techniques | Pillars for Rebuilding Coral Reefs (Intro) | | |

TBD Options: Marine Protected Areas, Sargassum, Plastics, Project Time, Flex Time (cover topics we missed, dive deeper into previous topics, R Coding)

| SEA COMPONENT ABOARD SSV CORWITH CRAMER | |
|--|--|
| Date(s) | Assignment Due Dates |
| Feb. 18 | Travel to St. Croix and Board <i>Cramer</i> . Ship Orientation Stations Begin. |
| Feb. 19 - 25 | Meet local communities and coral reef conservation practitioners in St. Croix (i.e., for Island Project, Part II). |
| Feb. 26 – Mar. 2 | Stand Laboratory Watches and Science Reports (daily). St. Croix Island Project Blogs due by Mar. 1 st |
| Mar. 3 – Mar. 12 | Meet local communities and coral reef conservation practitioners in Dominica (i.e., for Island Project, Part II). |
| Mar. 13 – Mar. 16 | Stand Laboratory Watches and Science Reports (daily). Dominica Island Project Blogs due by Mar. 16 th |
| Mar. 16 – Mar. 22 | Meet local communities and coral reef conservation practitioners in Anguilla (i.e., for Island Project, Part II). |
| Mar. 23 - 24 | Stand Laboratory Watches. Anguilla Island Project Blogs due by Mar. 25 th . |