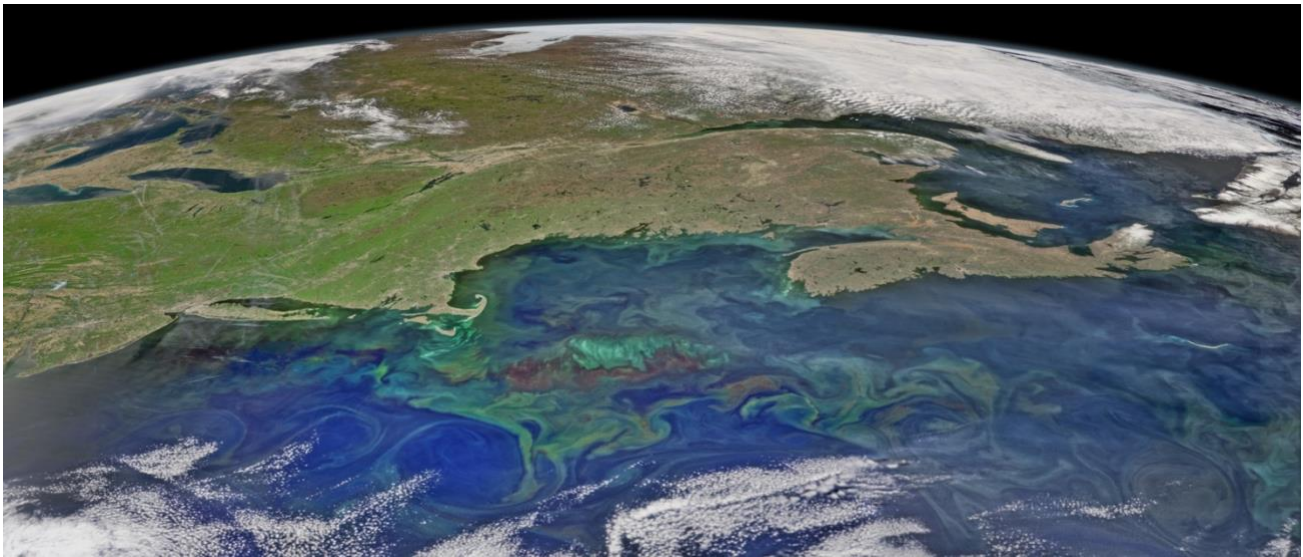


EE/BI 591 Bio-Optical Oceanography

MARINE SEMESTER - Second Block
Fall 2025 (September 29 - October 22nd)



Professor Information

Professor	Email	Office phone	Cell phone	Office Location
Cédric G. Fichot	cgfichot@bu.edu	n/a	706-254-1629	STO 141G

Teaching Fellow	Email	Office phone	Cell phone	Laboratory Location
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Course Overview

Light is crucial to the ecology and biogeochemical cycling of the upper ocean. Characterization of the temporal and spatial variability of light in the sea is fundamental to understanding and quantifying many optical, physical, biological, and chemical oceanographic processes. This course will explore how the various optically active constituents of marine waters (e.g., phytoplankton, suspended particles and sediments, organic matter, etc...) affect the in-water light field and optical properties of the water

column. It will also explore how optical measurements made in situ or remotely (ocean color remote sensing) can facilitate the study the biogeochemistry, biology, and water quality of estuarine and marine environments. This research-based course is taught over the course of October as part of the Marine Semester and is heavily based on field and laboratory work. Field work will be carried out onboard the University of New Hampshire research vessel *R/V Gulf Challenger* or *R/V Tego* in contrasted coastal waters of the Gulf of Maine, and onboard a small boat at the Plum Island Estuary in Northeastern Massachusetts.

The course is intended for upper-level undergraduate and graduate students interested in coastal oceanography and biogeochemistry, optics, and remote sensing.

Through this course, you can expect to gain:

- An understanding of the importance and nature of light in the ocean
- An understanding of the utility of optics to study marine biogeochemistry and biology
- Field experience doing oceanographic work and sampling onboard a research vessel and small boat
- Experience carrying out analyses (optical and chemical) and experiments in the laboratory
- Experience with accessing, processing, and utilizing ocean color remote sensing data
- Improve oral and writing communication skills

Prerequisites

- CH 101, CH 102, MA 121, MA 122, and ES 144 (or equivalents) or permission of instructor
- Admission to the Marine Semester

Hub Learning Outcomes

See Hub Appendix at the end of this syllabus.

Course elements

The course includes a balanced combination of lectures, field work, laboratory work (analyses and experiments), data analysis, satellite imagery analysis, oral presentations, and scientific writing.

Lectures

A number of lectures will be given throughout the course by the professor in order to familiarize the students with the fundamentals of bio-optical oceanography and ocean color remote sensing. Short lectures will also be given on how to do effective oral presentations and for efficient scientific writing.

Field Work

Field work will be carried out on day-long cruises onboard the *R/V Gulf Challenger*, *R/V Tego*, or a small boat will focus on local but contrasting coastal areas (Gulf of Maine, Plum Island Estuary, Great Bay) in terms of their optical and biogeochemical characteristics. It will involve the use of traditional oceanographic equipment (e.g., CTD, rosette, water quality sondes), water sampling and onboard processing (e.g., filtering), and the deployment and use of field optical instruments to characterize the in-water light field. Students should expect to go out at sea 3 times during the entire course.

Laboratory work

Samples collected from the boat will be brought back to the Fichot lab and analyzed for optical properties and biological and biogeochemical variables (e.g., particulate and dissolved organic carbon, chlorophyll-a).

Satellite image analysis

Students will be introduced to the use of ocean color satellite imagery analysis and the NASA software SeaDAS (<http://seadas.gsfc.nasa.gov>). Students will learn how to access, use, and interpret satellite ocean color data and will link these satellite data to data collected in the field and laboratory. Students will become familiar with using the Shared Computer Cluster and run python scripts to process imagery.

Research project

The students will work in groups to analyze, compile, and interpret all the data acquired in the field, in laboratory, from remote sensing. Each group will be required to present and discuss the results in a 20-30-min oral presentation. The professor and TF will provide guidance on how to effectively do an oral presentation, in which the students will organize, present and discuss results.

Paper presentation and discussion

Students will be put in groups of two students. Each group will be required to read a published manuscript (selected by the professor), do a 15-20 min oral presentation summarizing the important findings of the paper, and lead a class discussion on the topic. The entire class will be required to read the manuscript and will participate in the discussion.

Course Schedule

The first day will aim to familiarize students with some fundamentals of marine optics, ocean color remote sensing, coastal oceanography, and with the lab and boat operations that will be carried out the following weeks. The first week will also be used to identify important scientific questions and objectives and to define the field sampling strategy for the coming weeks. The two middle weeks will focus on data collection and analysis. Students should be flexible in their expectations because the field data collection depend strongly on weather. During the last week, the students will spend time working on the data analysis for their research projects and on their presentations.

<i>Week</i>	<i>Topic</i>
<i>Week 1</i>	<i>Introduction to marine optics and ocean color remote sensing Define project objectives and design sampling strategy Overview of boat operations / Laboratory training Field work and sampling at the Plum Island Estuary Laboratory work in Fichot Lab</i>
<i>Week 2</i>	<i>Field work and sampling in Great Bay and Gulf of Maine Laboratory work in Fichot Lab Paper presentations Data compilation and analysis Hands-on remote sensing training in computer lab</i>
<i>Week 3-4</i>	<i>Project Data Analysis Project wrap-up and presentations</i>

Grading

Students will be evaluated based on their performance in the field and in the laboratory, on the quality of the data produced, and on the content and quality of their oral presentation and poster. *No late work will be accepted.*

Summary

- Field work performance: 20%
- Laboratory work performance: 20%
- Paper presentation and discussion: 10%
- Final research project
 - Data analysis, content, and effort: 30%
 - Oral presentation: 20%

<u>Percentage</u>	<u>Letter</u>	<u>GPA</u>
93-100	A	4.0
90-93	A-	3.7
87-90	B+	3.3
83-87	B	3.0
80-83	B-	2.7
77-80	C+	2.3
73-77	C	2.0
70-73	C-	1.7
60-70	D	1
<60	F	0

Reading Material

Hand-outs will be distributed throughout the course. Published manuscripts will be chosen by the professor and presented and discussed in class by students. Below are some optional resources you might want to use.

Optional textbooks:

1. *Light and Photosynthesis in Aquatic Ecosystems (3rd edition)* by J. T. O Kirk, Cambridge University Press 2011.
2. *Light in Water* by Curtis Mobley (electronic version freely available)
3. *IOCCG reports* (all freely available at http://www.ioccg.org/reports_ioccg.html)

Safety and gear

Details will be provided before the course starts. Safety training will be provided by the University of New Hampshire staff as part of the course orientation. The University of New Hampshire will also require documents about your contact information.

Required gear to work on the boat:

Steel-toed, waterproof boots are required to work on the boat.

Recommended gear:

Waterproof and warm clothes:

- Rain gear overalls are a great way to stay dry while on deck
- Use layers so you can rapidly adapt to the weather conditions.

Software

Hands-on computer class activities will require the use of either SeaDAS or Matlab® and will be carried out in Room 435 (4th floor) in the Earth and Environment Department. Although the hands-on activities are aimed to familiarize students with using these tools, you are also strongly encouraged to get the software on your personal computers and to practice using them individually or in groups. SeaDAS is freely available from the NASA website (<http://seadas.gsfc.nasa.gov>), and university licenses for Matlab® are available for your personal computer by contacting CAS IT. Students will also become familiar with using the BU Shared Computer Cluster (SCC) and run python scripts to process high-resolution imagery.

Academic integrity

- Students must adhere to the Boston University Academic Conduct Code:
<http://www.bu.edu/academics/policies/academic-conduct-code/>
- Graduate students must adhere to the Graduate Code:
<http://www.bu.edu/cas/students/graduate/grs-forms-policies-procedures/academic-discipline-procedures/>
- For written assignments, any information presented from an outside source (books, newspapers, online sources) must be cited appropriately. Paraphrasing without citation will be considered plagiarism.
- Infractions will be handled in accordance with university policy, and can result in a zero for the assignment, or reduction in course grade.

Student with disabilities

Accommodations for students with disabilities will be provided in accordance with the policies of Boston University.