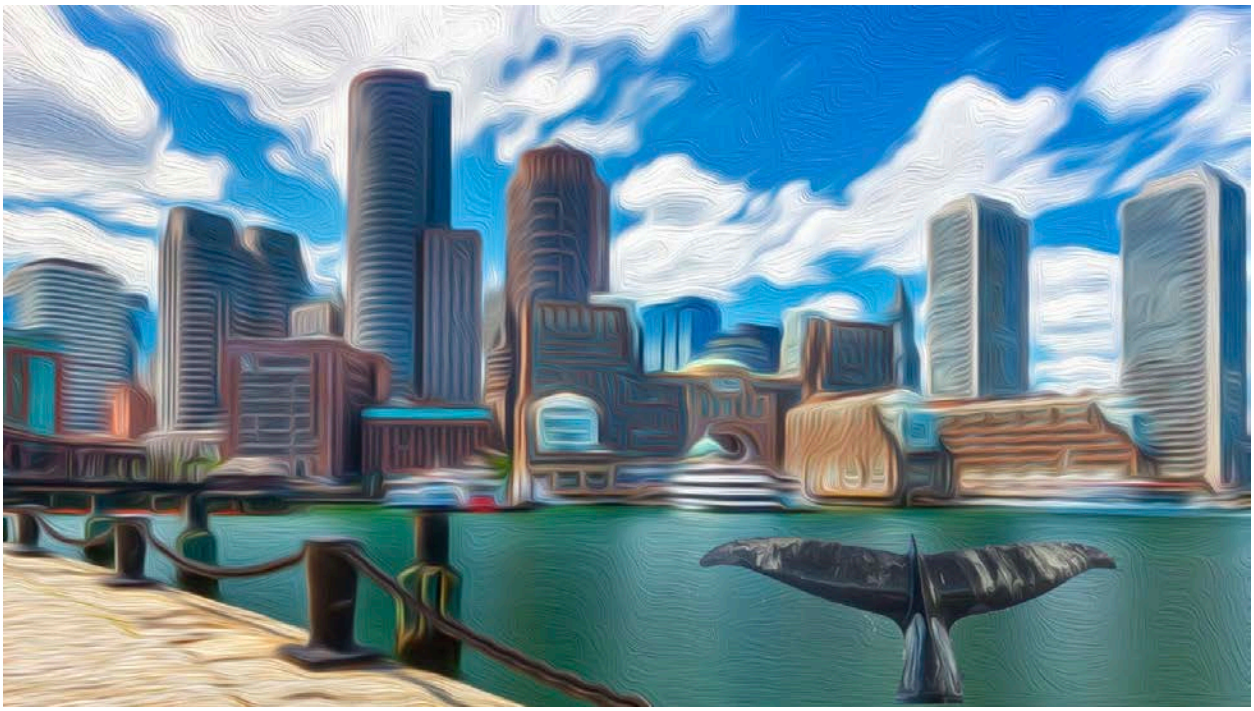


Marine Urban Ecology

BI 523 (4 credits)

Marine Semester 2025 / Block 2

Location: BRB 219

Instructors	**John R. Finnerty**	**Shalom Entner**
Office	BRB 425	BRB 317
Office Hours	By appointment; contact via e-mail	By appointment; contact via e-mail
E-mail	jrf3@bu.edu	sentner@bu.edu

Course Description: Boston is one of the world's great maritime cities. Like all of the great coastal urban centers, it owes its very existence to the sea, and to ecological services provided by the surrounding marine ecosystems and the rivers that flow into the sea. Those ecosystem services are being degraded by human activities that are particularly pronounced in our densely populated cities. ***Marine Urban Ecology*** is an emerging, interdisciplinary field that aims to understand how urbanization impacts marine ecology, and how healthy coastal ecosystems can exist in human-dominated systems. This course will focus on (1) Boston's history as it pertains to human impacts on our waterfront and coastal rivers, (2) contemporary ecological challenges of the greater Boston area, with a focus on pollution, and (3) a comparison of coastal marine biodiversity across an urban-exurban gradient. Field trips will track the course of the Charles, from its headwaters in Hopkinton to Boston Harbor and compare the biodiversity of urban and exurban examples of three critical coastal habitats: saltmarsh, beach, and rocky intertidal. In the laboratory portion of the course, students utilize a coastal marine sentinel species — the sea anemone *Nematostella vectensis* — to study the biological impacts of plastic derived chemical pollution on both organismal phenotype and gene expression, while contextualizing that research with a comparison of the plastic load in urban and exurban marine sediments.

Training you will receive in BI523:

Systematic biodiversity surveys // evaluation of human impacts on rivers and coastal waters // species identification // nature photography & videography // digital photo and video processing // saltmarsh ecology // rocky intertidal ecology // beach ecology // implementation of organismal stress exposure experiments // RNA isolation // development of scientific graphs and figures // statistical analysis // scientific presentation //

Hub Learning Outcomes. Completion of any 4-course sequence in the Marine Semester, will earn you 1 unit in each of 4 HUB areas: (1) Scientific Inquiry II, (2) Oral/Signed Communication, (3) Creativity and Innovation, and (4) Teamwork. The course activities in Marine Urban Ecology that contribute to these learning outcomes are described below.

—Scientific Inquiry II

You will conduct original research into the impacts of urbanization on the biodiversity of important coastal marine habits, including hypothesis development, data collection, statistical analysis, the generation of graphs & figures, and the preparation and delivery of a scientific talk. You will be challenged to place your research in its broader scientific and societal context, discuss its implications for marine conservation, and propose future research directions. You will also participate in a group project on the phenotypic and transcriptomic effects of a common marine pollutant on a coastal sentinel species.

—Oral and/or Signed Communication

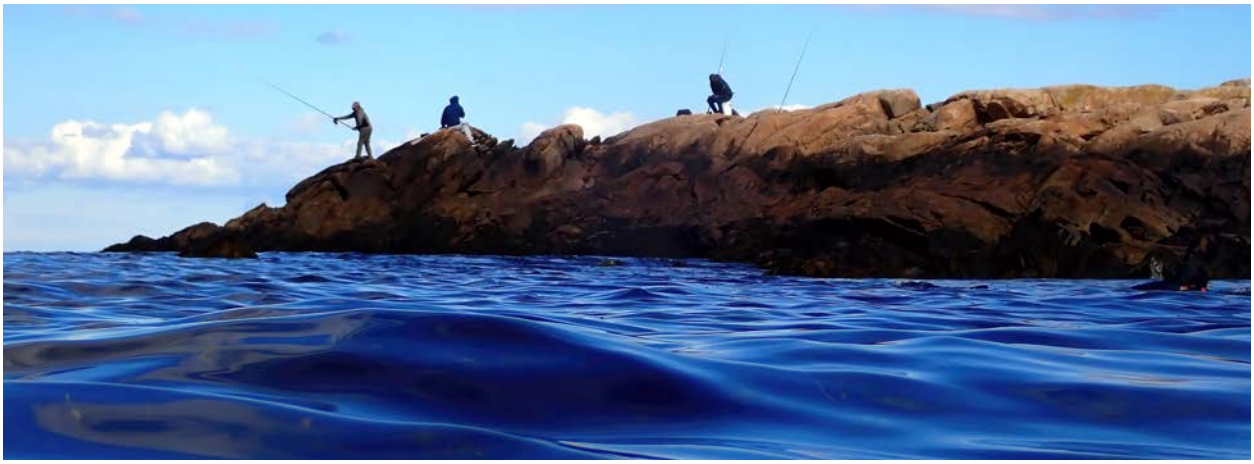
You will prepare and deliver a thoroughly-referenced, scientifically-accurate final oral presentation on your field research. This talk will incorporate original graphics and animations to assist in explaining the significance, methodology, data, and conclusions. You will also compose captions for photographs and videos related to Urban Marine Ecology in the BU Marine Program's Media Library.

—Creativity/Innovation

Your creativity will be tested in multiple ways. First, you will be challenged to develop repeatable, objective approaches for monitoring biodiversity, including the development of a panel of "indicator species" that future BUMP students can utilize to build upon your findings. You will also author educational materials targeted at a broad audience including "virtual habitat tours" and captions for photos/videos related to urban marine ecology housed in *The BU Marine Program Media Library* that are simultaneously engaging and informative.

—Teamwork/Collaboration

During the conduct of your field and laboratory research and the associated planning exercises, data analysis, and talk preparation, you will be working as part of a collaborative research team



Course Materials
Lecture handouts, research protocols, and selected readings from the scientific literature (listed by lecture). Lecture handouts, assigned readings, and protocols will be accessible in a shared folder on Google Drive: https://drive.google.com/drive/u/1/folders/1RKCNS0scUlJYN5kK54ut-AUUZDVLj_k-. Slideshows from lecture, as well as photos and videos of local field sites and organisms, can be viewed on the BU Marine Program Media Library: https://bumarine.smugmug.com/COURSES/Marine-Urban-Ecology/Marine-Urban-Ecology-2025

Assignments and Grading
- **25%** of your grade will be based on your performance as a field scientist, including your field notebook
- **25%** of your grade will be based on your performance as a laboratory scientist, including your lab notebook.
- **20%** of your grade will be based on the production of an annotated list of indicator species and your oral presentation describing the merits of your list for monitoring coastal and riverine biodiversity in the Boston Area. This will be a group project.
- **30%** of your grade will be based on your scientific deliverables
  - 5 captions or indicator species entries for the BU Marine Program Media Library
  - 1 photo-tour of a coastal or riverine site, an example of coastal or riverine infrastructure, a coastal or riverine environmental crisis, or a coastal or riverine remediation effort.

Resources/Support/How to Succeed in This Course:
1. Ask questions when you do not understand something, during lecture, field research, lab research, or small-group discussion. If you need help outside of the scheduled course meetings, please make an appointment with either Professor Finnerty or the TF.

2. Accommodations for Students with Documented Disabilities: If you are a student with a disability or believe you might have a disability that requires accommodations, please contact the Disability & Access Services at (617) 353-3658 or access@bu.edu to coordinate any reasonable accommodation requests.

Community of Learning: Class and University Policies

1. **Attendance & Absences.** Attendance at all lectures, collecting trips, and laboratory sessions is mandatory. Your final grade will be penalized 2.5% for each unexcused absence. *At any time, if you are not feeling fit to participate, you will be excused from that session's activities without penalty. Please let your instructors know when you are ill.*
2. **Turning in Assignments**. The final presentation will be given on October 23. You must provide Prof. Finnerty an electronic copy of the presentation (Powerpoint or comparable) before you give the presentation. Your scientific deliverables must be submitted via Google Drive & email by October 24 at 11:59 PM.
3. **Academic Conduct Statement.** It is each student's responsibility to know and understand the provisions of the Academic Conduct Code at Boston University. The Code is available online at https://www.bu.edu/academics/policies/academic-conduct-code/. Cases of suspected misconduct will be referred to the Dean of the College. If the Dean's office comes to the conclusion that cheating or plagiarism have occurred, a grade of zero will be awarded for the assignment in question

Course Preparation

1. **iNaturalist.** https://www.inaturalist.org/ — Obtain an account and download the free app to your phone.
2. **Merlin.** https://merlin.allaboutbirds.org/ — Download the free app to your phone.

Schedule of Course Activities

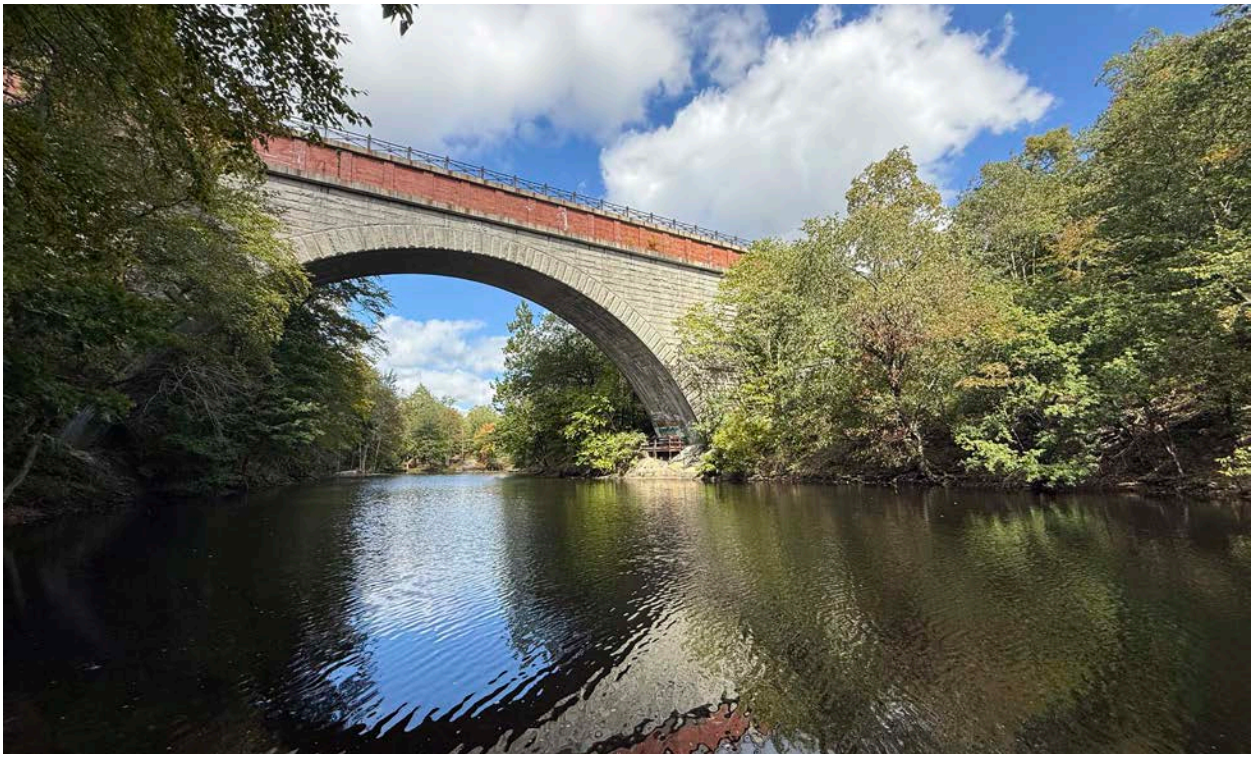
Day 1 / September 29 — RIVER WEEK	
10:00-12:00	● **COURSE INTRODUCTION** ● **LECTURE 1 Key Drivers of Marine Urban Ecology** READINGS: Lecture 1 handout; slideshow; Todd et al. (2019) Towards an urban marine ecology: characterizing the drivers, patterns and processes of marine ecosystems in coastal cities. *Oikos* 128(9):1215-42
1:30-4:00	● **FIELD TRIP PREPARATION**

Day 2 / September 30 — RIVER WEEK	
9:00-12:00	● **FIELD TRIP — Upper Charles River** ◆ Echo Lake, Hopkinton MA ◆ Shattuck Reservation, Medfield MA (Trustees of Reservations)
12:00-1:00	● **Lunch** ◆ South Natick Dam, Natick MA
1:00-?	● **FIELD TRIP — Upper Charles River (continued)** ◆ Broadmoor Wildlife Sanctuary, Natick MA (Mass Audubon)

Day 3 / October 1 — RIVER WEEK	
10:30-12:00	• **WORK ON SCIENTIFIC DELIVERABLES**
1:30-5:00	• **LECTURE 2 Boston Harbor & Its Rivers** READINGS: Lecture 2 handout; slideshow; Walsh et al. (2005) The urban stream syndrome: current knowledge and the search for a cure. *J North Amer Benth Soc* 24:706-23. • **FIELD TRIP PREPARATION**

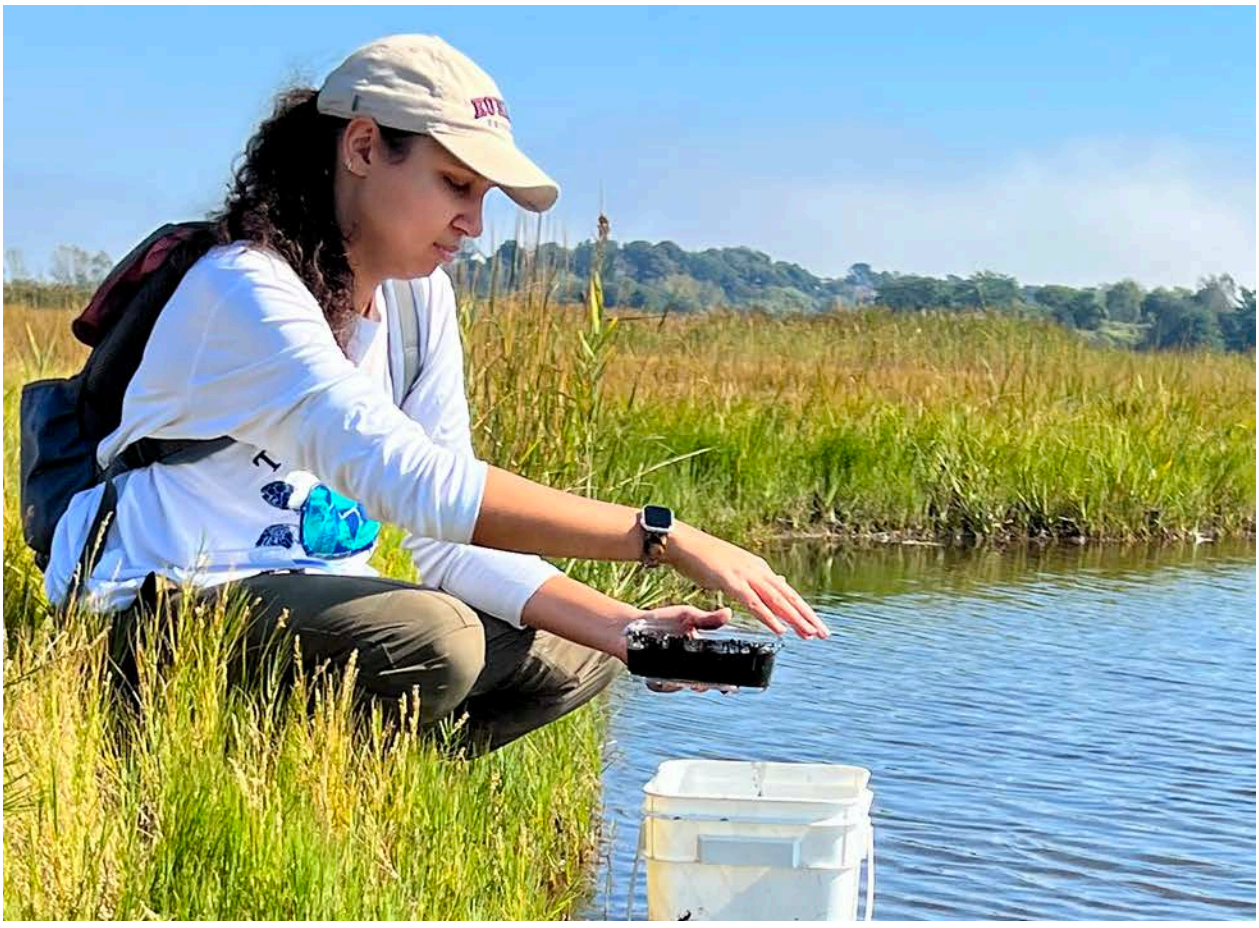
Day 4 / October 2 — RIVER WEEK	
9:00-12:00	• **FIELD TRIP — Lower Charles River** ◆ Cutler Park Reservation, Needham MA (DCR)
12:00-1:00	• **Lunch** ◆ Echo Bridge, Needham MA
1:00-?	• **FIELD TRIP — Lower Charles River (continued)** ◆ Upper Charles River Reservation, Waltham MA ◆ Moody Street Dam, Waltham MA ◆ Esplanade, Boston MA ◆ Charles River Floating Wetland, Cambridge MA

Day 5 / October 3 — RIVER WEEK	
10:30-12:00	• **LECTURE 3 Geological and Environmental History of Boston** READINGS: Lecture 3 handout; slideshow;
1:30-5:00	• **WORK ON SCIENTIFIC DELIVERABLES**



Day 6 / October 4 — SALTMARSH WEEK	
10:00-12:00	● **LECTURE 4 Saltmarsh Ecology** READINGS: Lecture 4 handout; Gedan KB, Silliman BR, Bertness MD (2009) Centuries of human-driven change in salt marsh ecosystems. *Annual Rev Mar Sci* 1(1):117-41
1:30-4:00	● **LAB RESEARCH 1.** Introduction to *Nematostella vectensis* ● **LAB RESEARCH 2.** Experimental Overview: Effects of plastic leachate on an estuarine sentinel species

Day 7 / October 7 — SALTMARSH WEEK	
9:00-12:00	● **FIELD TRIP — Urban Salt Marsh** ◆ Belle Isle Marsh Reservation, East Boston, MA **-and/or-** ◆ Squantum Marshes, Quincy, MA
1:30-5:00	● **LAB RESEARCH 3.** Biotic and microplastic analysis of marsh sediment samples



Day 8 / October 8 — SALTMARSH WEEK	
10:00-12:00	● **LITERATURE REVIEW.** ◆ Guzzetti E, Sureda A, Tejada S, Faggio C (2018) Microplastic in marine organism: Environmental and toxicological effects. *Envir Tox Pharmacol* 4:164-71. ◆ Costa TC, de Deus BC, Altomari LN, Cardoso SJ (2025) The effect of plastic pollution on coastal marine organisms–A systematic review. *Environ Mon Assessment* 197(9):1014
1:30-5:00	● **LAB RESEARCH 4.** Set up leachate exposure experiments. ● **WORK ON SCIENTIFIC DELIVERABLES**

Day 9 / October 9 — SALTMARSH WEEK	
9:00-12:00	● **FIELD TRIP — Urban Salt Marsh** ◆ Parker River / Nelson Island
2:00-5:00	● **LAB RESEARCH 5.** Biotic and microplastic analysis of marsh sediment samples

Day 10 / October 10 — SALTMARSH WEEK	
9:00-12:00	● **LAB RESEARCH 6.** RNA extraction from leachate exposed anemones
2:00-5:00	● **LAB RESEARCH 7.** Spectrophotometric analysis of extracted RNA. ● **WORK ON SCIENTIFIC DELIVERABLES**

Monday, October 13 — INDIGENOUS PEOPLES DAY — BU HOLIDAY

Day 11 / October 14 — BEACH & ROCKY INTERTIDAL WEEK

10:00-12:00	● **LITERATURE REVIEW.** ◆ Schlacher TA, Schoeman DS, Jones AR, Dugan JE, Hubbard DM, Defeo O, Peterson CH, Weston MA, Maslo B, Olds AD, Scapini F (2014) Metrics to assess ecological condition, change, and impacts in sandy beach ecosystems. *J Environ Mgmt* 144:322-35. ◆ Graells G, Nakamura N, Celis-Diez JL, Lagos NA, Marquet PA, Pliscoff P, Gelcich S (2021) A review on coastal urban ecology: research gaps, challenges, and needs. *Front Mar Sci* 8:617897.
1:30-4:00	● **FIELD TRIP PREPARATION** ● **WORK ON SCIENTIFIC DELIVERABLES**

Day 12 / October 15 — BEACH & ROCKY INTERTIDAL WEEK

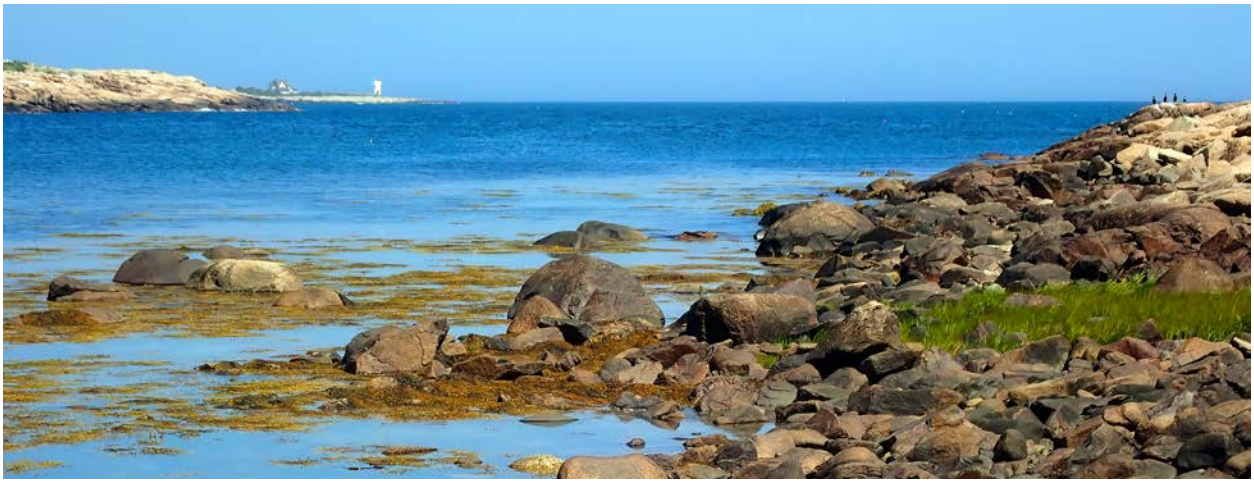
9:00-12:00	● **FIELD TRIP — Urban Beach and Rocky Intertidal** ◆ Winthrop Beach, Winthrop, MA
1:30-5:00	● **LAB RESEARCH 8.** Biotic and microplastic analysis of beach sediment samples

Day 13 / October 16 — BEACH & ROCKY INTERTIDAL WEEK

9:00-1:00	● **FIELD TRIP — Exurban Beach and Rocky Intertidal** ◆ Wingaersheek Beach, Gloucester, MA
3:00-5:00	● **LAB RESEARCH 9.** Biotic and microplastic analysis of beach sediment samples

Day 14 / October 17 — BEACH & ROCKY INTERTIDAL WEEK

10:00-12:00	● **MEET WITH PROFESSOR FINNERTY**
1:30-4:00	● **WORK ON SCIENTIFIC DELIVERABLES**



Day 15 / October 20 — HARBOR WEEK	
9:00-12:00	● **FIELD TRIP — Boston Harbor** ◆ Charlestown Naval Shipyard Park
2:00-5:00	● **MEET WITH PROFESSOR FINNERTY** ● **TALK PREPARATION**

Day 16 / October 21 — HARBOR WEEK	
9:00-12:00	● **FIELD TRIP — Boston Harbor** ◆ Castle Island
2:00-5:00	● **WORK ON SCIENTIFIC DELIVERABLES** ● **TALK PREPARATION**

Day 16 / October 22 — HARBOR WEEK	
10:00-12:00	● **PRESENTATIONS & COURSE WRAP-UP**
12:00-1:00	● **CELEBRATION!**