

Sea Education Association
Plastics and Biodiversity in the Sargasso Sea (C326)

Advanced Topics in Biological Oceanography: Biodiversity (4 credits, 55+ contact hours)

SEA 4501W - (WI)

Contact Info:

Professor

xx, Teaching Assistant:

Course Catalog Description:

In-depth treatment of a single topic in biological oceanography. Extensive review of classical and contemporary literature. Introduction and practice of current laboratory techniques. Oral presentation and written research proposal required. Topics may include marine plankton ecology, marine biodiversity, and satellite oceanography.

Prerequisites:

Admission to SEA Semester. One introductory science course and one 200-level science lab or consent of instructor.

Program Director

Professor office hours by appointment

Teaching Assistant

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Course Philosophy and Approach:

Advanced Topics in Biological Oceanography: Biodiversity is a core course within the *Plastics and Biodiversity in the Sargasso Sea (PBS)* program. Collectively, the *PBS* courses provide the context, tools, and opportunity for students to make authentic contributions to the international effort to understand and conserve high seas ecosystems. This course builds scientific foundations in understanding marine biodiversity using ecological and molecular tools.

Global and regional patterns of marine biodiversity are examined through literature review. Connections between biodiversity, ecosystem function, and conservation are explored during discussion sessions. Underlying principles and current research applications in population genetics and phylogenetics are taught by experts in the field. Field research is central to the

study of marine biodiversity. Laboratory exercises emphasize current techniques for assessing marine biodiversity using both morphological and molecular methods in preparation for fieldwork at sea. Throughout the first five weeks, students will explore the scientific process as they develop research inquiries, plan sample collection strategies and craft a collaborative research proposal focused on a select group of ecologically and/or economically important organisms. *Advanced Topics in Biological Oceanography* serves as the precursor to *Directed Oceanographic Research*.

Learning Outcomes:

Students will be able to. . .

1. describe regional oceanography and biodiversity status in the Sargasso Sea.
2. employ current methods for measuring and assessing marine biodiversity.
3. read, analyze, and evaluate scientific literature to determine promising and critical lines of biodiversity research.
4. compose and present a research proposal.

Evaluation:

Class Preparation/Participation (pre-class & in-class)	10%
Lab & Data Analysis Assignments	15%
Contributions to Journals	10%
Take-home Assessment	20%
Research Proposal Draft Assignments	10%
Oral Defense of Research Proposal (Poster)	20%
Research Proposal (Written)	15%

Assignments:

Class Preparation/Participation: The ideal format of this class is not uni-directional didactic lectures, but rather active learning and discussion, involving participation from everyone involved. To encourage preparation and meaningful class participation, everyone will be expected to read assigned papers prior to class and will be asked to contribute questions prior to guest speaker events. In addition, a portion of the grade will consist of your level of in-class participation.

Lab & Data Analysis Assignments: These assignments evaluate application of skills in morphological, molecular, and statistical techniques. There will be in-class lab assignments (laboratory methods and bioinformatic tutorials), which may require completion during out-of-class time.

Contributions to Journals: As we progress through field, lab, bioinformatic, and science communication content, you will be assigned relevant content to add as entries to your journal. These assignments are designed to help you process and synthesize these practical applications, as well as hone your observational skills. You will not be asked to turn in the physical journal, just to scan and submit relevant assigned contributions.

Take-home Assessment: An open-note analysis-based assessment will evaluate your understanding of core concepts presented in readings and during lecture, laboratory, and tutorial sessions.

Research Proposal Draft Assignments: Through a series of research group meetings, we will work through the steps of research proposal preparation – discussing successful proposal elements, identifying relevant literature, and drafting proposal sections. Thoughtful and well-prepared participation during research group meetings is expected of each student.

Oral Defense of Research Proposal: Each research group will share their plan in a poster presentation prior to departure for the cruise.

Research Proposal Written Sections: Each research group will generate collaborative proposal for original research. The proposal introduction will include a thorough introduction to the subject, statement of a research question, and hypotheses. Collaborative research will result in one final product per team; all team members earn the same grade.

Submitting Assignments:

All assignments should be neatly edited and formatted and include your name and a heading (i.e. the assignment title and date). Unless otherwise directed, all assignments are to be submitted *electronically only*, by the specified deadline, using Blackbaud.

Assignments must be submitted via Blackbaud as Microsoft Word, PowerPoint or Excel documents (or compatible non-MS correlates), as appropriate based on the assignment. All assignments must be submitted with the following file name format:

[YourLastNameHere_Nameofassignment_date]. For example, if I were submitting my take-home exam, I would name it Kingston_BIODtakehome_2025Mar20.

For team/group assignments, one person in the group should upload the assignment to Blackbaud. Remember to include all group member names in document file name.

IMPORTANT! Late assignment submissions will not be accepted. Internet issues are not an excuse for late submission unless the SEA IT staff informs us that the entire SEA network is down. We maintain very high standards in this course because a key objective of MBC is to teach you professional skills that will help you succeed in the professional practice of marine science and conservation.

Expectations and Requirements:

- Punctual attendance is required at every class meeting.
- Active participation in class discussion is expected.
- The policy on academic accuracy, quoted below, will be strictly followed in this class.

The papers that you submit in this course are expected to be ***your original work***. You must take care to distinguish your own ideas and knowledge from wording or substantive information that you derive from one of your sources. The term “sources” includes not only published primary and secondary material, but also information and opinions gained directly from other people and text from any site on the Internet.

The responsibility for learning the proper forms of citation lies with you. Quotations must be placed properly within quotation marks and must be cited fully. In addition, all paraphrased material must be acknowledged completely. Whenever ideas or facts are derived from your reading and research, the sources must be indicated. (Harvard *Handbook for Students*, 305).

Accessibility and Accommodations:

All accommodation requests will be confidential; students with documented disabilities who require learning accommodations should contact your professor, or the Academic Dean, , with as much preparatory time as possible in order to facilitate execution of learning accommodations.

Required Readings:

Selected excerpts from Segar’s Introduction to Ocean Sciences (available online) and articles from the primary literature will be made available on Blackbaud.

Supplementary Reading:

For your enrichment, an extensive collection of relevant articles from the primary literature will also be made available on Blackbaud and on the course hard drive at sea.

Class Schedule:

A detailed Biodiversity class schedule and assignment due dates can be found below in the Grid Calendar and will be posted weekly on Blackbaud.

Reading list – BIOD

Segar Oceanography - Critical Concepts #1 (Density and Layering in Fluids)

Critical Concept #3 (Convection and Convection Cells)

Critical Concept #6 (Salinity, Temp, Pressure)

Critical Concept #12 (Coriolis)

Critical Concept #13 (Geostrophic Flow)

Ch 12 Foundations of Life in the Oceans

Critical Concept #14 (Photosynthesis, Light, and Nutrients)

Critical Concept #17 (Species Diversity and Biodiversity)

Kara Lavender Law et al, Plastic Accumulation in the North Atlantic Subtropical Gyre, *Science*, 1185 (2010); 329, DOI: 10.1126/science.1192321

Amaral-Zettler et al. 2015. The biogeography of the Plastisphere: implications for policy. *Front Ecol Environ*; 13(10): 541–546, doi:10.1890/150017

Selections from Shumway and Ward, *Plastics in the Sea*. 2025. Academic Press. ISBN: 978-0-12-822324-6

Hirai et al 2020. Large-scale metabarcoding analysis of epipelagic and mesopelagic copepods in the Pacific. *PLoS One*.

Biodiversity paper - Gotelli & Colwell 2001. Quantifying biodiversity: procedures and pitfalls in the measurement and comparison of species richness. *Ecology Letters*.

Villacorta-Rath et al 2022. Disentangling genetic from environmental effects on phenotypic variability of southern rock lobster (*Jasus edwardsii*) postlarvae. *Ecology and Evolution*.

Population Genomics chapter - Oleksiak . 2018. Adaptation Without Boundaries: Population Genomics in Marine Systems. In Om P. Rajora (ed.), *Population Genomics: Concepts, Approaches and Applications*.

Peijnenburg & Goetze. 2013. High evolutionary potential of marine zooplankton. *Ecology and Evolution*.

Blakeslee et al 2021. Invasion of the body snatchers: the role of parasite introduction in host distribution and response to salinity in invaded estuaries. *Proceedings of the Royal Society B*.

Segar Oceanography - Critical Concept #9 (The Global Greenhouse Effect)

Ch 5 Water and Seawater

Segar access online:

Introduction to Ocean Sciences. 5th edition (ver 5.11), Published 2024

<https://www.reefimages.com/>

C326 Shore Calendar – OCE

****This calendar is preliminary and subject to change****
Please check Blackbaud for each course for final readings,
assignments, deadlines, and updates

Date	Time	Course	Topic	Reading	Assignments Due
Week 1 (March)					
03 T	1600	ALL	Welcome & Campus Orientation		
04 W	0900-1030	ALL	Program Goals & Expectations		
	1100-1230	ALL	Campus Orientation and Student Life		
	1400-1530	OCE	Course Intro		
05 H	1300 - 1500	OCE	Course Intro; Research Topic Intros	Course syllabus; Research Prospectus	
06 F	1130 – 1700	ALL	Woods Hole Field Trip - meet at SEA vans at 1130 WH tour/ history, pack a lunch, ID cards at 1300 followed by MBL / WHOI Library tour (1400);	Pack a lunch for field trip	
07 Sa					
Week 2 (March)					
08 Su					
09 M					

10 T	1330 - 1630	OCE	Intro to Physical Oceanography; Reading a Scientific Paper; Sci comm writing storytelling	Segar Oceanography - Critical Concepts #1 (Density and Layering in Fluids), #3 (Convection and Convection Cells), #6 (Salinity, Temp, Pressure), #12 (Coriolis), #13 (Geostrophic Flow)	
			Community Meeting		
11 W	1215 - 1630	OCE	Plankton Lab Field Trip Zoo and Phyto Collecting in Eel Pond Lunch in the field (weather dependent) Afternoon Bioblitz in lab	Pack a lunch	Using lab space OCE/DOR research topic choices due 23:59
12 H	1330 - 1630	OCE	Intro to Stats; Intro to R exercise	Install and open R at least the evening before this section starts	
13 F	1030 - 1130	OCE	Research Group Meetings		Intro to R exercise due 23:59
	1230 - 1600	OCE	WBNERR Field Trip 1pm until 5pm, depart SEA 1230		
14 Sa					
Week 3 (March)					
15 Su					
16 M					
17 T	1330 - 1630	OCE	Oceanography - nutrients and primary productivity; Biodiversity; Biodiversity R exercise	Ch 12 Foundations of Life in the Oceans; Critical Concept #14 (Photosynthesis, Light, and Nutrients); Critical Concept #17 (Species Diversity and Biodiversity); Biodiversity papers (Gotelli & Colwell 2001)	Oce Research Proposal Intro Draft due 23:59

			Community Meeting		
18 W					
	1300 – 1630	OCE	DNA extraction lab (early start); DNA, Molecular Ecology and Evolution (during tissue digest of lab)		Using lab space Biodiversity R exercise due 23:59
	1900 – 2000	ALL	Packing for and Life at Sea Discussion		
19 H					
	1030 – 1200	OCE	Research Group Meetings		
	1330 – 1630	OCE	Guest lecture (Tepolt) paper discussion; Sci comm writing finer points	Budd et al 2023; Martin et al 2018	
20 F					
	0800~1700		Field Trip to New Bedford	King, <i>et al.</i> "Captain Joy's Last Voyage," <i>Earth Island Journal</i> ; Sigler, "When We See Whales" <i>Sea History</i>	Bring journal, pack lunch and snacks, dress for walking and being outside for part of the day
21 Sa					
Week 4 (March)					
22 Su	1500-1700		Marine illustration workshop (optional)		Meet at Madden Center, might go into the field depending on weather
23 M					
24 T	0900 – 1200	OCE	DNA amplification lab; Population Genomics in the Ocean	Villacorta-Rath et al 2022; Oleksiak chapter	Using lab space

	1330 - 1630	OCE	Mesopelagic food webs, carbon pump; paper discussion		OCE proposal poster due 23:59
			Community Meeting		
25 W					OCE Proposal Intro (revised) and remaining outline due. 23:59
26 H	1230-1530		Pool Safety Field Trip - Massachusetts Maritime Academy		Lifeguard:
	1900-2030	OCE	Poster Session		
27 F	0900 - 1200	OCE	Carbon Cycle/ Biogeochem in the ocean; R data analysis exercises Physical and Chemical Ocean Properties	Critical Concept #9 (The Global Greenhouse Effect); Segar Ch 5 Water and Seawater	
	1330 - 1500	OCE	Research Group Meetings		
			Pebble art! Go to beach to collect, then make some stuff		
28 Sa					
Week 5 (March - April)					
29 Su					
30 M					
31 T					OCE take home questions due 23:59
01 W					OCE R exercise Physical and Chemical due 2359
02 H					

	1300-1600	OSPP/EH	Workshop for projects		
03 F		OSPP and EH	OSPP and EH presentations		
	1330 - 1500	OCE	Research Group Meetings		OCE - final proposal due 23:59
04 Sa		Packing/ Field Day			
Week 6 (March)					
05 Su			Students Depart for STX		