



## **Advanced Topics in Biological Oceanography: Biodiversity (4 credits)** **CAS NS 450 BIOD (4 credits)**

### **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 Education Association. One introductory science course and one 200-level science lab or consent of instructor.

**Program Director :** SEA Faculty

**Teaching Assistant :**

### **Course Philosophy and Approach:**

Advanced Topics in Biological Oceanography: Biodiversity is a core course within the Marine Biodiversity and Conservation (MBC) program. Collectively, the MBC 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 interdisciplinary seminar 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 Pacific.
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 a research proposal.

## Evaluation:

Class Preparation/Participation (pre-class & in-class)	10%
Lab & Data Analysis Assignments	15%
Contributions to Sheet Anchors	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 Sheet Anchors: As we progress through field, lab, bioinformatic, and science communication content, you will be assigned relevant content to add as entries to your sheet anchor. These assignments are designed to help you process and synthesize these practical applications, as well as hone your observational skills.

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\_2024Mar20.

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).

**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 on Blackbaud.

## S314 Shore Calendar – OCE

**\*\*This calendar is preliminary and subject to change\*\***

Date	Time	Course	Topic	Reading	Assignments Due
Week 1 (February)					
19 M	1600	ALL	Welcome & Campus Orientation		
20 T	0900-1015	ALL	Program Goals & Expectations		
	1030-1200	ALL	Student Campus Life Intro		
	1330-1345	OSPP	OSPP/AOPR Course Intro	Course syllabi	
	1400-1500	OCE	OCE/DOR Course and Research Intro	Course syllabi and Cruise Prospectus	
	1515-1615	NS	NS Course Intro	Course syllabus	
21 W	0900-1100	NS			
	1130-1600	ALL	<p><b>Woods Hole Field Trip -</b>  <b>meet at vans at 1130</b>  <b>SWOPE for ID cards 1200</b>  <b>followed by MBL / WHOI</b>  <b>Library tour</b></p>	Pack a lunch – eat in WH on field trip	
	1930 – 2030	NS	Illustration w Capt Allison		
22 H	0900 - 1100	OSPP			
	1330 - 1630	OCE	Intro to Physical Oceanography; Reading a Scientific Paper	Segar Oceanography - Critical Concepts #1 (Density and Layering in Fluids), #3 (Convection and Convection Cells), #6	

				(Salinity, Temp, Pressure), #12 (Coriolis), #13 (Geostrophic Flow)	
23 F	0900-1200	NS			
24 Sa					OCE/DOR research topic choices due 23:59
Week 2 (February - March)					
25 Su					
26 M	1000 - 1200	NS			
	1930 - 2030	NS	Illustration w Capt Allison		
27 T	0900 - 1100	OSPP			
	1330-1630	OCE	Intro to Stats; Sci comm writing storytelling; Intro to R exercise	Install and open R at least the evening before this section starts	
28 W	0900-1100	NS			
	1130-1630	OCE	<b>Plankton Lab Field Trip Zoo and Phyto Collecting in Eel Pond 1130-1230 Lunch in the field (weather dependent) Afternoon Bioblitz in lab 1400-1630</b>	Pack a lunch	<b>Using lab space</b>  Intro to R exercise due 23:59
29 H	0900 - 1100	OSPP			

	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)	
01 F	0900-1100	NS			
	1330 – 1500	OCE	Research Group Meetings		Biodiversity R exercise due 23:59
02 Sa					
Week 3 (March)					
03 Su					
04 M	1000 – 1200	NS			
					Oce Research Proposal Intro Draft due 23:59
	1930 - 2030	NS	Illustration w Capt Allison		
05 T	0900 - 1100	OSPP			
	1330 - 1630	OCE	DNA, Molecular Ecology and Evolution; paper discussion; Sci comm writing finer points	Budd et al 2023; Martin et al 2018	
06 W	0900-1100	NS			
	1130 - 1630	OCE	DNA extraction lab		<b>Using lab space</b>
	1830-1930	ALL	Packing for Sea Discussion		

07 H	0900 - 1100	OSPP			
	1330 - 1630	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	
08 F	0900 - 1100	NS			
	1330 - 1500	OCE	Research Group Meetings		OCE R exercise Physical and Chemical due 2359
09 Sa					
Week 4 (March)					
10 Su					
11 M	1000 - 1200	NS			
					OCE proposal poster due 23:59
	1930 - 2030	NS	Illustration w Capt Allison		
12 T	0900 - 1100	OSPP			
	1200 - 1300	ALL	Pizza with the President: The North Pole		
	1330 - 1630	OCE	Guest Lecture Kelly Spears; Population Genomics in the Ocean	Villacorta-Rath et al 2022; Oleksiak chapter	OCE Proposal Intro (revised) and remaining outline due. 23:59
13 W	0900 - 1100	NS			
	1330 - 1430	OCE	MBC: DNA amplification lab		Using lab space
14 H	0900 - 1200	OCE	Guest Lecture Carolyn Tepolt WHOI, marine molecular ecology	Tepolt papers	



	1330 – 1630	OSPP	<b>WBNERR field trip</b>		
	1900 – 2000	OCE	<b>Poster Session</b>		
15 F	0900 - 1100	NS			
	1200 - 1500	ALL	<b>Pool Safety Field Trip – Massachusetts Maritime Academy</b>		
16 Sa					
Week 5 (March)					
17 Su					
18 M					
19 T	0900 – 1100	OSPP			
					OCE take home questions due 23:59
20 W					
21 H	0900 – 1100	OSPP			
22 F					
	1330 – 1500	OCE	Research Group Meetings		OCE – final proposal due 23:59

23 Sa					
Week 6 (March)					
24 Su			Depart for NZ		
25 M	0900-1045		travel		
26 T			Arrival in NZ		