

**Syllabus: Biological Oceanography MASC 504, BIOL 657, ENVR 520 (4 credits)
University of North Carolina at Chapel Hill**

Instructors:

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Teaching Assistant:

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Meeting Times and Locations:

Lectures: Tues/Thurs from 2:00-3:15pm (Murray Hall, Rm. G201)
Recitation: Four one-hour sessions (select Fridays, time and place TBD)

Prerequisites: For graduate students there are no prerequisites to take this course. For undergraduate students, please contact the instructors for permission.

Course Description: Biological oceanography is the study of marine organisms, their quantitative distributions in time and space and their interactions with each other and their ocean environment. The course is divided into 5 units. The first unit provides a brief history of biological oceanography and reviews the physical and chemical processes in the ocean that influence marine biota. In the second, third and fourth units we will explore the diversity of pelagic and benthic marine organisms, bioelemental cycling within these life forms and the factors that influence their abundance and distributions. In the last unit we will learn about the consequences of shifts in the ocean biota throughout geological time and how they may be affected by future climate change.

Units: 1. Introduction and Overview
2. Primary Production - Formation of organic matter
3. Secondary Production and the Microbial Loop - Cycling of organic matter
4. Benthos, Nekton and Fisheries Oceanography - Higher trophic level organic matter
5. Deciphering the past and predicting the future

Student Learning Outcomes: After completing this course, you should be able to:

1. Define the major life forms in the ocean, describe the characteristics that differentiate these life forms and how these forms interact with each other.
2. Explain how marine organisms influence the cycling of bioelements, particularly carbon.
3. Define the environmental factors and processes that control the abundance and distributions of marine organisms in space and time on a variety of scales.
4. Describe methodological approaches for evaluating the biomass, growth, and mortality of plankton, nekton, and benthic marine organisms, including their strengths and weaknesses.
5. Explain how marine organisms have influenced the evolution of Earth and predict how ocean biota will be affected by future climate changes.

Course Readings: There is no required textbook. We do recommend the following two books for additional reading to help assimilate the concepts we will cover in this course. These books will also be made available in the Kenan Science Library located in room G301 of Venable Hall.

1. Lalli, CM & TR Parsons (1997) Biological Oceanography, An Introduction, (Second Edition), Elsevier Butterworth-Heinemann Publishing
2. Miller, CB (2004) Biological Oceanography, Wiley Blackwell Publishing

Readings will also be assigned from the primary scientific literature and made available on Sakai in advance. There are two categories of readings: a) Required readings and b) Non-required readings. Some of these readings will be discussed during the scheduled recitations. You will be responsible for absorbing and comprehending the required reading assignments for the problem sets and exams.

Field Trip: We plan on a field trip to UNC’s Institute of Marine Sciences (IMS) in Morehead City. Using IMS as our base, we will explore the Rachel Carson National Estuarine Research Reserve and the Neuse River Estuary. You will be introduced to many of the marine life forms we have discussed during lecture and oceanographic instrumentation at IMS. Note that lectures are scheduled during these trips and that attendance is required. Transportation (university van) and lodging (IMS dorms) will be provided, but each participant will contribute funds for food. Due to space limitations with transportation and boats, the class will be divided into two separate groups for the field trip (see possible dates below). We will be leaving for IMS on the Thursday afternoon, which may require you to miss other classes on the Friday. Please arrange with your instructor/classmates in these classes to obtain materials you will miss.

Group A: 4-Apr to 7-Apr
 Group B: 11-Apr to 14-Apr

Date	Day	Event
4-Apr or 11-Apr	Th	Travel to IMS leaving UNC-CH in late afternoon
5-Apr or 12-Apr	F	Rachel Carson NERR
6-Apr or 13-Apr	S	Neuse River Estuary sampling
7-Apr or 14-Apr	Su	Sample analysis at IMS, returning to CH by late afternoon

Note: Itinerary subject to change

Grading: You will be expected to have a thorough understanding of both the basic theory we cover as well as the empirical studies that test this theory. Your grasp of material presented in lectures and field excursions will be evaluated in two exams. These exams will be a combination of short answer and essay questions. You will also be assigned problem sets (PS) that will test your ability to comprehend and synthesize the material discussed in lecture and the assigned readings. PS will be posted on Sakai one week prior to the recitation (see lecture schedule) and are due at the beginning of the recitation. Late PS will not be accepted. There will be 4 PS assigned in the semester. Group work on PS is encouraged, but you must turn in an assignment that reflects your individual work and responses. As part of a group, you will also be required to complete a field trip assignment and make a short (20 minutes) team presentation to the class presenting your results from the field trip sampling for which you will be graded.

Midterm	30%
Final Exam	30%
Problem Sets	20%
Field Trip Presentation	10%
Field Trip Assignment	5%
Participation	5%

Student Responsibilities: All work done in this class must be carried out within the letter and spirit of the UNC Honor Code (see pages 419-421 of the Undergraduate Bulletin 2012-2013). You are also responsible for consulting with me if you are unclear about the meaning of plagiarism or about whether any particular act on your part constitutes plagiarism. Please talk to me if you have any questions about how the Honor Code pertains to this course.

Feedback: Your feedback on how the course is progressing is important to us. At any time throughout the semester we encourage you to provide us with feedback regarding any aspects of

the course. There will also be an anonymous online evaluation at the end of the semester to allow you to provide structured feedback.

Lecture Schedule:

AM Dr. Adrian Marchetti
 JF Dr. Joel Fodrie
 JPB John Paul Balmonte

Date	Day	Lec#	Unit	Topic	By
10-Jan	Th	1	1	Introduction and historical overview of biological oceanography	AM
15-Jan	T	2	1	General principles and nomenclature	AM
17-Jan	Th	3	1	The physical ocean environment	AM
22-Jan	T	4	1	The chemical ocean environment	AM
24-Jan	Th	5	1	Ecological geography of the oceans	AM
29-Jan	T	6	2	Phytoplankton diversity and primary productivity	AM
31-Jan	Th	7	2	Regulation of primary productivity: physical controls and light	AM
1-Feb	F		1	Recitation #1: Problem set #1 due	AM
5-Feb	T	8	2	Regulation of primary productivity: macro- and micronutrients	AM
7-Feb	Th	9	2	Phytoplankton ecology	AM
12-Feb	T	10	3	Zooplankton diversity	AM
14-Feb	Th	11	3	Grazing by zooplankton: top-down control	AM
15-Feb	F		2	Recitation #2: Problem set #2 due	AM&JPB
19-Feb	T	12	3	Bacterial and Archaeal diversity	JPB
21-Feb	Th	13	4	Phys-Bio Interactions I: Life in moving flow	JF
26-Feb	T	14	3	Viruses	AM
28-Feb	Th	15	3	Microbial loop and the biological pump	AM
5-Mar	T			Midterm Exam Review	AM
7-Mar	Th			Exam I	
12-Mar	T			No class - spring break	
14-Mar	Th			No class - spring break	
19-Mar	T	16	5	Paleoceanography	AM
21-Mar	Th	17	5	Ocean fertilization: past and present	AM
22-Mar	F		3	Recitation #3: Problem set #3 due	AM&JPB
26-Mar	T	18	4	Phys-Bio Interactions II: Flux-divergence	JF
28-Mar	Th	19	4	Community organization and biological interactions	JF
2-Apr	T	20	4	Nekton diversity and reproductive/larval ecology	JF
2-Apr	T			Field trip assignment due	
4-Apr	Th	21	4	Fisheries resource management	JF
04-07 Apr				Field trip to IMS (Group A): Estuary and Coastal Oceanography	AM&JF
5-Apr	F	22	4	Benthic communities (Group A)	JF
9-Apr	T	23	5	Climate change effects on marine organisms	AM
11-Apr	Th	24	5	Marine genomics	AM
11-14 Apr				Field Trip to IMS (Group B): Estuary and Coastal Oceanography	AM&JF
12-Apr	F	22	4	Benthic communities (Group B)	JF
16-Apr	T	25	5	Natural Climate Cycles	JF
18-Apr	Th			Student Presentations	AM
19-Apr	F		4	Recitation #4: Problem set #4 due	JF&JPB
23-Apr	T			Student Presentations	AM
25-Apr	Th			Final Exam Review	AM&JF
7-May	T			Exam II (12-2pm)	

(Schedule subject to change)