

ESCI 597 BIOLOGICAL OCEANOGRAPHY

Spring 2005

Instructor: Dr. Suzanne Strom
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Course meeting times:
Monday 9:30 to 12:20 (ES 345)
Wednesday 2:00 to 5:00 (SPMC)

Office hours: On campus, I will be available after the Monday lecture for as long as necessary. Otherwise I can be reached at any time at SPMC either by phone or by e-mail (or in person, of course!). I strongly encourage you to contact me by email if you have any questions regarding the problem sets. I will put together a class email list and can send helpful information to everyone if I know ahead of time where people are getting confused.

TEXTS

The text for the course is:

Miller, C.B. Biological Oceanography. 2004. Blackwell.

Other useful biological oceanography texts:

Lalli, C. M. and T. R. Parsons. Biological Oceanography: An Introduction (2nd edition). 1997. Butterworth-Heinemann, Oxford. (An upper undergrad/early grad-level text. More general than Miller.)

Mann, K.H. and J.R.N. Lazier. Dynamics of Marine Ecosystems (2nd edition). 1996. Blackwell. (Excellent on biological-physical interactions; assumes considerable bio ocean background.)

Milne, D.H. Marine Life and the Sea. 1995. Wadsworth. (Upper undergrad-level text; quite good on phytoplankton processes, nutrient cycling.)

Valiela, I. Marine Ecological Processes (2nd edition). 1996. Springer-Verlag. (More organism-oriented than L+P, M+L; ecological concepts applied to marine ecosystems.)

Useful texts for general oceanography background:

Thurman, H.V. Introductory Oceanography. (10th edition) 2003. Prentice-Hall. (Undergrad text that is more process-oriented and quantitative than most; good graphics and data but uneven writing. Earlier editions [e.g. 8th, 9th] aren't that different.)

Open University Series (mostly excellent grad-level texts with useful imbedded questions):

Ocean Circulation (2nd edition). 2001. Butterworth-Heinemann.

Waves, Tides and Shallow-water Processes. 1989. Elsevier.

Seawater: Its Composition, Properties and Behaviour (2nd edition). 1995. Elsevier.

The Ocean Basins: Their Structure and Evolution. 1989. Elsevier.

Ocean Chemistry and Deep-Sea Sediments (2nd edition). 2003. Butterworth-Heinemann.

Additional readings will be provided from the primary literature.

GOALS FOR THIS COURSE:

- To understand the major biological processes in the marine planktonic environment, and how these interact with physical and chemical features of the ocean;
- To improve your problem-solving skills, i.e. ability to frame questions and then to answer them, both qualitatively and quantitatively;
- To gain some familiarity with the primary oceanographic literature, and to improve your ability to extract information and ideas from the scientific literature in general;
- To work with methods and instrumentation that can be applied to your own research, present and future.

SCHEDULE

Monday classes		Wednesday classes	
		30 Mar	Introduction, history and philosophy of bio ocean Look at plankton
4 Apr	Global ocean circulation; regional processes; S, T and density distributions	6 Apr	Burrows Bay cruise: measurement of T, S, O ₂ , light, collection of water samples
11 Apr	Phytoplankton and light: Photosynthesis, mixing, critical depths; Growth rates and scaling issues	13 Apr	Measurement of photosynthesis
18 Apr	Nutrient (N, P) cycling: uptake, regeneration, new production Spring phytoplankton blooms	20 Apr	Algal pigment analysis
25 Apr	Microbial loop: bacteria, DOM, protists and other microzooplankton	27 Apr	Zooplankton morphology and behavior lab: Life at low Reynolds number
2 May	Zooplankton feeding and growth	4 May	Microscopy, counting and imaging: applications to grazing measurement
9 May	Zooplankton reproduction and mortality	11 May	Midwater organisms; material fluxes in the mesopelagic zone
16 May	Biomes 1: HNLC regions (Southern Ocean, Equatorial and Subarctic Pacific); Arctic Ocean	18 May	TBA
23 May	Biomes 2: Subtropical gyres; coastal oceans	25 May	Iron limitation workshop
30 May	Memorial Day: no class	1 Jun	Fisheries oceanography: fish stocks and climate variability
6 Jun	Finals week: oral presentations (schedule TBA)		

ASSIGNMENTS

Readings: In addition to the background material found in the course text, I will provide supplemental text materials as appropriate. Also, we will read several key papers from the primary oceanographic literature for each of the major topics addressed in the course. Typically I have selected one classic paper and one that is more recent and controversial. At the graduate level and beyond, much of the information you need will never be available in a book (by definition, since you are beginning to conduct original research!) Therefore it is important to learn to glean information and ideas from the primary scientific literature. Developing this skill is one of our course goals. You should come to class having read the assigned materials and with notes in hand. There will be a student discussion leader (or two) selected in advance for each week's discussion section. Guidelines for leading a discussion will be provided. We will spend a portion of each week's Monday class time discussing the assigned readings.

Problem Sets (3): These will consist of questions and quantitative problems that test your knowledge of the material and build your problem-solving skills. Many will use oceanographic data collected during our laboratory sessions or by other scientists. Analysis and interpretation of these data will broaden your understanding of the processes we are studying. These assignments will require some mathematical calculation, graphing, and short (one to several paragraph) written interpretation of key concepts.

Marine Ecosystem Investigation: For this project, you will choose a non-planktonic marine environment that particularly interests you and will conduct your own literature-based investigation of how the dominant environmental factors shape the structure and function of that environment's food web. This is the basis for much environmental science, and is the approach I will be taking in teaching you about planktonic ecosystems. In addition to giving you a chance to apply and extend the basic principles you have learned in class, through oral presentations we will all learn more about the range of ecosystems and adaptive strategies present in marine environments.

The investigation has several elements. First, you choose a topic. Second, you hand in an outline of your major points along with a list of at least some of your literature sources. Finally, you give a 15 min. oral presentation of your findings, accompanied by a 3-4 page (double-spaced) write-up of your major points. This write-up should be accompanied by a properly formatted reference list. A more detailed information sheet on this project will be provided.

IMPORTANT DATES

Apr. 18:	ME Investigation topics chosen
Apr. 20:	First problem set due
May 4:	Second problem set due
May 9:	ME Investigation outlines due*
May 25:	Third problem set due
Finals week:	ME Investigations due; oral presentations

GRADING

ASSIGNMENT TYPE	% OF GRADE
3 Problem Sets (20% each)	60
Marine ecosystem investigation*	30
Discussion preparedness, participation	10
TOTAL	100

*I will not grade the ME Investigation outlines themselves; however, you must turn in an outline to receive full credit for the ME Investigation.

READINGS FROM MILLER (unless otherwise noted):

	Reading
Week 2 (April 4)	from Mann and Lazier (1st ed.): Chapter 3: pp 61-70 Chapter 4: pp 111-117 Chapter 5: pp 161-170 Chapter 8: pp 291-312
Week 3 (April 11)	Chapter 2 Chapter 3: pp 46-56
Week 4 (April 18)	Chapter 3: pp 56-68 Chapter 1
Week 5 (April 25)	Chapter 5
Week 6 (May 2)	Chapter 6 Chapter 7
Week 7 (May 9)	Chapter 8 Chapter 11
Week 8 (May 16)	Chapter 10: pp 215-222 and 228-230
Week 9 (May 23)	Chapter 10: pp 222-228 and 230-231
Week 10 (May 30)	Chapter 15 Chapter 16