

ES 383 The Ocean Environment: Setting the Scene

4 credit hours

Textbooks

Optional Text: *An Introduction to the World's Oceans*, 10th Edition, 2009, by Keith A. Sverdrup and E. Virginia Armbrust ISBN-13 9780073376707

Optional Text: First 4 chapters of *Introduction to Marine Biogeochemistry*, 2nd ed, 2009, by Susan M. Libes (assigned by B. Twinning), ISBN: 978-0-12-088530-5

Additional resources that you can use

Online Reference Texts: *Introduction to Physical Oceanography*, 2009, by Robert Stewart,

http://oceanworld.tamu.edu/resources/ocng_textbook/PDF_files/book.pdf

Our Ocean Planet: Oceanography in the 21st Century, 2008, by Robert Stewart,

<http://oceanworld.tamu.edu/resources/oceanography-book/contents2.htm>

Oceanography Special Volumes: <http://www.tos.org/oceanography/issues/archive.html>

Moodle Page: <http://moodle.colby.edu/course/view.php?id=14533>

Web sites of interest

American Geophysical Union

www.agu.org

Assoc. Sciences Limnology and Oceanogr

www.aslo.org

The Oceanography Society

www.tos.org

Bigelow Laboratory and many others

www.bigelow.org

Scripps Institution of Oceanography

www.sio.ucsd.edu

Meeting times: Lectures: 9-11:30am, except Th 9/11: 1-3:30pm (with a 10 min break)

Labs: 9-12am, except 9/16 and 9/19: 1-4pm

Location: Bigelow B102 lectures, except 9/19 Ocean Modular; all labs in Ocean Modular

Instructor: Dr. Patricia Matrai, Bigelow Laboratory for Ocean Sciences

e-mail: pamatrai@colby.edu, pmatrai@bigelow.org [both arrive at the same place]

phone: 207-315-2567 x305

office hours: Daily, 11:30am-12:30pm, B216

Lab Assistant: Dr. Jochen Nuester, jnuester@bigelow.org, B204

Course Description:

The intersection of marine physical sciences and policy requires an understanding of the systems bounding the oceans, be it the solid container below it (sea floor) or the gaseous layer above it (atmosphere), and the physical, chemical, and geological processes controlling and modifying the aqueous environment for the life dwelling within. This will set the stage to cover the sea floor, plate tectonics, sediments, beaches, and estuaries as a link to bottom-living organisms that will be discussed later in the semester. We will address physico-chemical properties of seawater (salinity, density, sound, light) as a link to understanding how marine organisms cope with saltwater, photosynthesis, planetary greenhouse gases, etc., all of which will be addressed later in the semester. Ocean in motion will explore where and why water flows, as a link to organisms dispersal and migration (latitudinal or intertidal) to be discussed later in the semester. The course will introduce modern methods in ocean observing,

including remote sensing, ocean and ice-tethered observing platforms, autonomous sampling, and time-series stations. Readings will also link oceanic processes to human processes, whether policy, geoengineering, sustainability, or other.

Course Outline:

Lectures on each meeting day will generally break out into two one-hour lecture topics with a 10 minute break after the first hour. Part of the second hour of most sessions will be used for discussions of readings, led by each student on a rotating basis. Labs will include a short tutorial, hands on activities, use of spreadsheets, resulting in lab reports that will usually include a problem set. A field trip to Cobscook Bay to study tides, waves, and the resulting intertidal benthic zonation will occur September 26-27, 2012. See table below for lecture topics and assigned readings based on the specific lecture number. Schedule and topics are subject to change; however this will be announced in class prior to any revisions to the course calendar below.

At any point during the semester, if you encounter difficulty with the course or feel you could be doing better, please come see me. Don't wait until the week before the final! For problems with writing or time management, consult with me or Ben Twinning!

Course Calendar:

Date	Lecture Topic
Monday, September 09	Lecture A1: a) Introduction, Geography, History, Tools of the 21st century, climate Lecture A1: b) Hydrologic cycle, land and water, reservoirs and residence time READING: Nicholls (2011) Planning for the impacts of sea level rise. <i>Oceanography</i> 24(2):144-157
Tuesday, September 10	Lab 2: Boat Sampling - 1
Wednesday, September 11	Lecture A2: a) Sea floor, sediments as habitat Lecture A2: b) Plate tectonics READING: Lundsten et al. (2010) Biological characterization of a whale-fall near Vancouver Island, British Columbia, Canada. <i>Deep Sea Research Part I</i> 57(7): 918-922
Thursday, September 12	Lab A1: Sediment texture, composition, sedimentation
Friday, September 13	Lecture A3: a) Water properties: heat capacity, cohesion, surf tension, density (T, S, P); some biological adaptations Lecture A3: b) Salt water (major, minor, constant proportions) READING: Moore et al. (2002) Whale calls and sound. <i>Oceanography</i> 15(3):20-25
Saturday, September 14	
Sunday, September 15	
Monday, September 16	Lab A2: Polar regions: Salinity, density, convection under ice, buoyancy
Tuesday, September 17	Lab 3: Boat Sampling-2
Wednesday, September 18	Lecture A4: a) pH, gases, organics and/or Biological adaptations to sea water properties

	Lecture A4: b) Thermohaline circulation: density structure, gliders, satellites READING: Cable et al. (2002) Phosphate uptake in coastal limestone aquifers: a fresh look at wastewater management. <i>ASLO Bulletin</i> 11(2): 1-4
Thursday, September 19	Lab A3: Distributions of nutrients, temperature, oxygen, density, chl, PP: JGOFS data plotting
Friday, September 20	Lab A4: Distributions of nutrients, temperature, oxygen, density, chl, PP: JGOFS data analysis and interpretation
Saturday, September 21	
Sunday, September 22	
Monday, September 23	IR/ ROR
Tuesday, September 24	Lecture A5: a) Polar ice Lecture A5: b) Air, winds, meteorology READING: Shinn et al. (2000) African dust blights Caribbean corals. <i>Geophys. Res. Letters</i> , 27(19):3029-3032; Prospero (2006) Saharan dust impacts and climate change. <i>Oceanography</i> 19(2):60-61 Lab A5: Light in the ocean (w/ BBalch)
Wednesday, September 25	Lecture A6: a) Climate and teleconnections (AO, ENSO, ArcO, etc.): large-scale patterns Lecture A6: b) Ocean structure: Atl., Pac., Indian, Arctic, Antarctic, coastal ocean-riverine interactions READING: Pascual et al. (2000) Cholera Dynamics and El Niño-Southern Oscillation. <i>Science</i> 289:1766-1769
Thursday, September 26	FIELD trip to MDIBL and Cobscook Bay - Lect A7&Lab A6: a)TIDES & WAVES READING: Pineda et al. (2007) Larval transport and dispersal in the coastal ocean and consequences for population connectivity. <i>Oceanography</i> 20(3):22-39
Friday, September 27	FIELD trip to Cobscook Bay - Lect A7&Lab A6: b) Intertidal zonation & ecology DISCUSSION: Careers in marine sciences
Saturday, September 28	
Sunday, September 29	
Monday, September 30	Lecture A8: a) Surface circulation: Ekman, gyres, western intensification, con/divergence, fronts, eddies Lecture A8: b) Surface currents= Where does water flow? Interannual variability READING: Chang et al. (2011) 2010 oil spill: trajectory projections based on ensemble drifter analyses. <i>Ocean Dynamics</i> DOI 10.1007/s10236-011-0397-4; Davidson et al. (2009) Applications of GODAE ocean current forecasts to search and rescue and ship routing. <i>Oceanography</i> 22(3):176-181

Grading Policy:

Class participation:	10%
Lab reports and problem sets:	30%
Readings and discussion:	30%
Final Exam:	30%
Total	100%

Evaluations:

Participation will be evaluated through your contributions to class discussions and engagement with the course materials. You're encouraged to ask questions during lectures and be an active participant.

Lab reports and problem sets Labs will involve observations, doing experiments, analyzing data and a written report of the results. Wed lab reports are due the following Monday and Friday lab reports are due the following Wed. Late labs will NOT be accepted; you may e-mail them on the due date, if need be. Homework is due at the beginning of the next lab period. Late homework will result in a 1 pt. deduction per day late.

Readings and discussion Twice a week one paper will be assigned for reading and discussion. At random (but I will remember), one of you will take turns being responsible for summarizing the paper and leading the discussion. Each of you is responsible for asking **at least one** question to the group or the discussion leader. Come prepared!

Final Exam will be a take home exercise due in 5 days after receiving it at the same time it was made available. Failure to make an exam or turn in assignments will result in a grade of zero (0).

Academic Honesty:

Academic dishonesty will not be tolerated. This is particularly important as you will almost always be working in pairs or as a group, which is encouraged! Exams and lab reports must be your own work and thought, except when done jointly during the lab period. Use of other people's work without acknowledging their contribution is plagiarism and is a serious offense. Plagiarism includes verbatim copying, paraphrasing (changing a few words here and there), and structural plagiarism (borrowing the structure or outline of somebody else's work without acknowledgement). Students cheating on exams will receive an F in the assignment and may receive a failing grade for the course. Any case will be reported to Department Chair and the Dean of Students, possibly resulting in academic probation or suspension from the college, as noted in both the student handbook and college catalog. See specific statement from the online Colby College Catalogue here:

http://www.colby.edu/academics_cs/catalogue/2013_2014/about/aca_procedures.cfm

Attendance:

Attendance is required at all classes. Please contact the professor if you must miss a class. Unexcused absences will be reflected in the Class Participation portion of your grade.

Cell phone policy:

The use (even a look!) of cell phones or other personal electronic communication devices during class is strongly discouraged. Please silence your device before class. All such devices must be put away during exams.