

OCN 628 - BENTHIC BIOLOGICAL OCEANOGRAPHY

Fall 2012, MWF 830-920 am, **POST 708**; Lab F 230-500 pm, MSB 315
Instructor: Craig Smith, office hours: MW 1430-1530 MSB 617
Guest lecturers: Bob Richmond, Rob Toonen, Pavica Srsen, Laura Grange, Les Watling

OUTLINE OF LECTURES

Date	Topic
I. INTRODUCTION	
Aug 20	A. Course Goals and Characteristics of Benthos
II. THE PHYSICAL ENVIRONMENT	
22	A. Physics of Bottom-Boundary Layers
24, 24 _{lab}	B. Sediments--Structure, Flux and Transport
III. MICROBIAL PROCESSES AND GEOCHEMISTRY	
27, 29	A. Microbial Processes
31	B. Basic Sediment Geochemistry
Sept 5 (*SQ 1 ass.)	C. Diagenetic Modeling
IV. BASIC BIOLOGICAL CONSIDERATIONS	
	A. The Organisms (handout only)
7, 10 (*SQ 1 due)	B. Sources of Data a) Observation, Sampling, Experiments
12, 14	C. Benthic Consumption
17, 19	a) Deposit feeding
21 (SQ 2 ass.)	b) Suspension feeding c) Scavengers
24	D. Food Webs and Energy Flow
26	E. Development Types and Dispersal
28 (SQ 2 due)	F. Recruitment and Adult-Larval Interactions
V. OBSERVED PATTERNS AND SOME EXPLANATIONS cont.	
1. Soft-Bottom Habitats	
Oct 1	A. Within Community Patterns
3	B. Across Community Correlations and Pollution Gradients
5	C. Depth Zonation
5	***** MIDTERM EXAM IN LAB FRIDAY OCT 5TH *****
8, 10	2. Seamounts and Canyons - Grange

- 12 D. Pelagic-benthic Coupling (esp. High Latitudes) – Srsen
- 15, 17, 19 3. Coral Reefs - Introduction; coral spawning, hybridization and speciation; recruitment of corals; the effects of environmental quality of reproduction and recruitment success – **Bob Richmond**
- 24, 26 4. Population connectivity – Toonen
- 29 No Class**
- 31 5. Vents, Seeps, Whale Falls and Other Reducing Habitats
 Nov 2 (SQ 3 ass.) A. Vent-Seep Habitat Characteristics
 2_{lab} B. Microbiology
 5 C. Macrobiology
 7 E. Other reducing habitats
 F. Ecology of Whale Falls

VI. COMMUNITY-LEVEL PROCESSES

1. Population Interactions
- 9_{lab} Bottom Trawling Impacts – Watling
- 9 (SQ 3 due), 14 A. Disturbance, Colonization, Succession
 a) Sources and scales of disturbance
 b) Modes and rates of colonization
 c) Models and mechanisms of succession
- 16 ***** PROPOSAL TOPICS DUE NOV 16*******
- 16 B. Competition
 19 C. Trophic-group Amensalism and Predation

VII. HUMAN IMPACTS AND ECOSYSTEM MANAGEMENT

- 26 1. Species Invasions - Mangroves: A Hawaiian Invasion
 28, 30 2. Anthropogenic changes in benthic habitats
- 30_{lab} *******PROPOSAL PRESENTATIONS*******
- Dec 3 no class**
- 5 3. Antarctic Ecosystems and Climate Change – Grange
- 11 ***** PROPOSALS DUE IN MY EMAIL BOX BY NOON, TUES DEC 11 *******
- 13 ***** PROPOSAL REVIEWS DUE IN MY EMAIL BOX BY NOON, THURS DEC 13 *******
- 14 ***** FINAL EXAM, FRIDAY DEC 14 *******
7:30-9:30 am, POST 708

*SQ = Study Question. NB: CRS will on a research cruise in Norway 8-29 October and at the Deep-Sea Biology Symposium in New Zealand 3-5 December

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SCHEDULE OF LABORATORIES

Fall 2012, Friday 230-500 pm, 315 MSB (usually!)

Instructor: Craig Smith

Guest Lecturer/Discussion Leaders: Grieg Steward, Bob Richmond, Pavica Srsen, Les Watling,
Laura Grange

Date	Topic

8/24	<i>BBC Blue Planet Tidal Flat Ecology</i>
8/31	Macrobenthos methods and field trip to Paiko Lagoon
9/7	Sediment Microbiology/Virology - Steward
9/14	Analysis of macrobenthic samples from sand and mud habitats
9/21	Discussion # 1
9/28	Deposit feeding – live observations and experiments
10/5	Review session followed by Midterm Exam
10/12	Discussion #2 – led by Srsen
10/19	Corals field trip – Richmond
10/26	<i>BBC Blue Planet: The Deep Ocean</i> - Grange
11/2	Discussion # 3
11/9	Bottom Trawling Impacts – Watling; Sediment traps: theory, design, pitfalls, application
11/16	Mangrove field trip
11/23	Holiday
11/30	Proposal presentations

Student Learning Outcomes:

- 1) Students will develop an understanding of how biological and physical processes influence the abundance, biodiversity and productivity of seafloor organisms in space and time in the ocean.
- 2) Students will develop an understanding (both qualitative and quantitative) of the influence of seafloor biological processes on the transformation and fluxes of energy and materials in the oceans.
- 3) Students will develop an understanding of the impact and management of human activities on seafloor ecosystems, including known impacts of fishing, eutrophication, and climate change, and the principles of marine protected area design.
- 4) Students will gain experience in critical thinking and discussion of research questions and scientific papers in biological oceanography.
- 5) Students will gain experience in writing and reviewing NSF style proposals for research funding.

GRADING OUTLINE

Research success in biological oceanography, and other sciences, is largely a function of one's ability to (1) synthesize current knowledge and identify new research problems and design innovative approaches, (2) make insightful contributions during group discussions (e.g., seminars, scientific meetings, workshops) and (3) write effective grant proposal and papers. The grading of this course is designed to help you to develop these abilities.

The 100 total grading points to be awarded during the course will be distributed as follows:

--- 3 short (2-3 pp.) study questions.....	15 pts (5 ea)
--- Participation in 3 discussions.....	15 pts (5 ea)
--- Term paper (NSF-style Proposal), including 12-minute oral presentation	26 points
--- Proposal review.....	4 points
--- First midterm exam.....	20 points
--- Final exam.....	20 points
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	100 points

Study Questions: These will deal with topics of current interest in benthic biological oceanography. Topics will be selected, with your input, approximately one week before essays are due. Essays written for study questions should emphasize critical thinking, synthesis and creativity (e.g., review of a recent scientific paper, new approaches or points of view, testing of a long-standing hypothesis, identification of mistakes made by earlier investigators). These are designed to be warm-ups for writing the proposal due near the semester's end. Essays should be no longer than two typed, doubled spaced pages (excluding references). There will be no penalty for conciseness. Also, be sure to cite references you've used (scientists become upset when they are not credited for their ideas or data).

Discussions: We will have three 1-hour discussions of 2 recent research papers of current interest. At the beginning of each discussion, one previously unannounced person will summarize each paper, stating the author's hypotheses and goals, scientific approach, results and conclusions. We will then discuss the strengths and weaknesses of the work, the overall significance, and possible follow-up studies. Points earned (5 per discussion) will be based on the relevance and frequency of

your comments, etc. Perpetual silence is the greatest sin you can commit in this part of the course.

Laboratory Exercises: These will consist of field trips and lab demonstrations supplemented with lectures. Performance in labs will not be graded explicitly (i.e., no points will be earned) but attendance is mandatory. Absentia will lead to loss of points from your course total.

Term Paper: Twenty-six percent of your grade will be based on a project proposal you will write, using NSF guidelines (see handouts and proposals in MSB 602). Proposals should be written on a topic in marine benthic ecology of your choosing; topics should be cleared with me, however. Some cooperation in proposal writing is acceptable; e.g., two of you may wish to study different aspects of the same system or problem. Remember, however, that each student must turn in a separate, self-contained proposal and that you are being graded, in part, on your originality. **Proposal topics must be selected by Nov 16.** When you have narrowed your focus to one or several topics, come talk with me to discuss topic suitability, relevant recent references, etc. Four percent of your grade will be based on the review of a peer's (classmate's) proposal, using NSF guidelines.

During the last laboratory of class on Friday 30 Nov, each student will make a 12 minute oral presentation of their proposal, explaining the general problem, the specific hypotheses to be tested, the approach to be used to test hypotheses, and the anticipated outcome(s). A brief statement of the significance of the proposed research should also be given. Presentations will be limited to 12 minutes to allow us to get through all presentations.

An electronic version of your proposal must be emailed to me by noon on Tue, 11 Dec. I will then email to each of you a classmate's proposal to review. **An electronic version of your proposal review must be emailed to me by noon on Thurs, 13 Dec.** For your proposal review, follow the guidelines given in the handout on proposal evaluation.

Exams: A **midterm exam**, worth 20% of your grade, will be given in the lab **Friday, 5 October, 2:30-4:00 in MSB 315.** A **final exam**, worth 20% of your grade, will be given **Friday 14 Dec, 7:30-9:30 in POST 708.**