

BISC 457L: Methods in Marine Biology and Biological Oceanography

Tentative syllabus for spring semester 2016

Overview:

The course is designed to introduce students to the marine environment and to guided, independent research focusing on marine ecosystems. We will introduce students to oceanographic research and train them in the use of equipment, sampling and analytical approaches, as well as in data acquisition and processing, in an approach to expose students to authentic methods of scientific inquiry. During the class, students will learn how to use scientific methodology to evaluate global environmental issues (human impacts on coastal environments, watershed interactions, ecosystem function). One of the highlights of this class is the use of a research vessel for an oceanographic training cruise, as well as for the students' independent research project, which will take place in the last week of this class. The students will present the results of their independent research project in the form of a symposium on the last day of the class, which will be open to the public.

Location: USC Wrigley Institute for Environmental Studies (WIES), Santa Catalina Island (<http://dornsife.usc.edu/wrigley/>)

Course Dates: May 16 – June 10, 2015 (Memorial Day: May 30)

Instructor:

Dr. Wiebke Ziebis (wziebis@usc.edu)
(Office Hours: Monday 12:00-2:00 pm, or by appointment)

Teaching Assistant: TBA

Pre-requisites: BISC 103 or one of BISC-120 or BISC-121, or by special permission .
D-Clearance required.

Lecture and laboratory schedule: 4-week class during the USC Maymester (classes starting after Commencement).

The schedule during each week will vary slightly based on weather / ocean conditions.

General class schedule:

Lectures and Discussions: 8:30 am - 12 pm (Monday – Friday)

Laboratory/Field exercises: 1 – 5 pm

(exceptions are for the full-day research cruise, benthic field work may take place in the morning depending on the tides and night snorkeling will take place after sunset)

COURSE OBJECTIVES:

The main goal of this course is to foster an understanding of how the ocean works and how marine science is conducted. Training units include the use of sampling devices, *in-situ* instrumentation and analytical methods to explore the processes in the ocean and on the ocean floor. The highlight of this year's class is the use of the research vessel *Yellowfin* for an oceanographic training cruise. The vessel will also be available for the students' independent research project of week 4.

A parallel objective of this course is the development of an expertise in assessing the validity of analytical data in supporting research questions. Most importantly, this course uses an approach to expose students to authentic methods of scientific inquiry. Specific objectives include:

- To gain experience in marine related experimental techniques
- To build gradual expertise in problem-solving
- To learn how to collaborate with peers as well as to share and discuss data
- To learn and practice scientific writing and presentation skills to both scientific and broader audiences
- To develop a working knowledge of relevant literature
- To learn how to design a small research project

COURSE DESCRIPTION:

This class fits into the USC Maymester time period (the first 4 weeks after commencement). It is considered part of the Spring Semester with respect to tuition and credit load.

The course is designed to introduce students to the marine environment and to guided, independent research focusing on marine ecosystems. Students will capitalize on teamwork, data sharing and discussions. The class will end with a public symposium on Catalina Island that provides the opportunity for the students to present their research to a wider audience. During the first 3 weeks morning lectures will introduce the students to different research topics. Laboratory exercises or fieldwork will be carried out in the afternoon. Each week is designed around a specific theme and carried out as a small research project. At the end of each week the data will be presented in form of a short report and oral presentation with a following discussion. The students will practice the presentation and discussion of data, as well as speaking to a larger audience. During the first week the highlight is a one-day sea-going expedition on the Research Vessel *Yellowfin* to introduce students to oceanographic research and to train them in the use of equipment, instrumentation, sample collection and data acquisition.

Independent research project

In the fourth week of the class the students will be asked to design, plan and prepare their own research project based on skills they have learned in the class. During the 4th week the students will analyze the samples, process the data and prepare a final report on their research project. Results will also be presented in the form of a public symposium on Friday June 13, which is open to all staff and faculty, as well as to family and friends.

Expectations: It is expected that the students take primary responsibility for conducting the research of their independent project, which they are expected to finish in a timely manner. The students will develop both a detailed final written report and an oral presentation to be given at the symposium on the last Friday. We expect the participants of the class to be self-motivated, to work independently, approaching the instructor for guidance regularly, and to show greatest integrity and collegiality.

Required Readings: Each student will receive a *Laboratory Manual* for the lab and field exercises. Additional readings will be provided for discussions in form of research papers and review articles. Each student is also expected to search appropriate literature databases, read

relevant publications, and become familiar with the scientific literature relating to specific research topics.

Recommended Reading: 'How the ocean works' (editor: Mark Denny) and 'Marine Ecology' (editors: R. Barnes & R. Hughes) and selected chapters from 'Methods of Seawater Analysis' (editor: K. Grasshoff).

Schedule

LECTURES:

Week 1 INTRODUCTION TO OCEANOGRAPHY

Reading: 'How the ocean works' M. Denny (editor) Chapters 2,3 and 6-8

- Introduction to physical, chemical and biological oceanography
- The global ocean and 'Marine Protected Areas'
- Introduction to oceanographic regions and their characteristics
- Introduction to sample and data collection using oceanographic equipment
- Light and photosynthesis
- The importance of oxygen

Week 2 PLANKTON ECOLOGY – DIVERSITY OF MARINE ORGANISMS

Reading: 'How the Ocean Works' M. Denny (editor) Chapter 5; 'Marine Ecology' R.S.K. Barnes & R.N. Hughes (editors) Chapter 12

- Marine diversity – Estimates of plankton diversity
- Diversity of phytoplankton communities
- Diversity of zooplankton communities
- Food web dynamics

Week 3 THE OCEAN FLOOR – BENTHIC ECOLOGY

Reading: 'How the Ocean Works' M. Denny (editor) Chapters 4 and 9; 'Methods of Seawater Analyses' K. Grasshoff, K. Kremling, M. Ehrhardt (editors) Chapter 4; 'Marine Ecology' R.S.K. Barnes & R.N. Hughes (editors) Chapter 3

- The ocean floor – introduction to the benthic ecosystem
- Benthic biogeochemical processes and microbial communities
- Microsensor applications in microbial ecology- approaches and case studies
- The importance of oxygen – photosynthesis and respiration in the marine environment:
Bioturbation - Microbial mats
- The deep ocean and extreme environments

Week 4 HUMANS AND THE ENVIRONMENT or a related topic as INDEPENDENT RESEARCH UNIT

Reading: 'How the Ocean Works' M. Denny (editor) Chapters 10-22; 'Marine Ecology' R.S.K. Barnes & R.N. Hughes (editors) Chapter 12

This part can include studies on:

- Understanding the importance of light and nutrients for primary productivity
- Food web dynamics
- Assessment of polluted areas

Or any other related field that students want to investigate with the methods and means they learned during the previous sections.

LABORATORY EXERCISES AND FIELD TRIPS

Week 1 INTRODUCTION TO OCEANOGRAPHY

- Introduction to oceanographic instrumentation
- Introduction to water sampling and sample processing
- Oceanographic research cruise onboard R/V *Yellowfin*. Training and sampling expedition. Water column profiling and sampling:
 1. Depth profiles (300 m) of light, temperature, conductivity, oxygen, chlorophyll, turbidity, dissolved organic matter (CDOM)
 2. Water sampling for nutrients, oxygen, chlorophyll, and cell counts (microbes) (potentially quantification of coliform bacteria).
 3. Plankton tows.
- Data processing and sample analyses
- Preparation of weekly report and presentation of procedures and results
- Presentations and discussions

Week 2 PLANKTON ECOLOGY - DIVERSITY OF MARINE ORGANISMS

- Day vs. night evaluation of plankton assemblages
- Zooplankton/Phytoplankton analyses – identifying planktonic organisms, analyses of community structure.
- Benthic-pelagic coupling experiments with mussels
- Preparation of week-end report and presentation of procedures and results
- Presentations and discussions

Week 3 THE OCEAN FLOOR – BENTHIC ECOLOGY

- Sampling trip to Catalina Harbor to collect sediment cores along an intertidal transect
- Processing of sediment cores – pore water sampling and core sectioning for subsequent analyses of solutes and solids.
- Experiments on benthic photosynthesis and bioturbation
- Application of microsensors in benthic microbial ecology
- Preparation of week-end report and presentation of procedures and results
- Presentations and discussions

Week 4 **STUDENT RESEARCH PROJECT**

- The students develop a research question, design a project, as well as discuss and prepare the scientific approaches to answer this question in a timely manner and with the means that are available. The project will be based on the knowledge they have acquired during the first 3 weeks of the class. The students can consult all instructors for advice and input. The R/V *Yellowfin* will be available for their project(s).
- The students plan and prepare the research expedition as a team
- The students independently lead sampling activities and process samples and data
- The students prepare the final report and the presentations for the public science symposium at the conclusion of the Maymester. WIES staff, other classes, USC faculty, friends and family are invited to attend.

Grading: 1000 pts total: The course is structured in a way that each week will be like a short research project. Students will learn and apply different methods and collect data. On Friday of each week students will present a short presentation and a written report for feedback. During the 4th week, the students will plan, prepare and carry out their own research project / expedition and will present their findings in form of small symposium. The results from the earlier work during the first 3 week will be included and expanded upon in a final comprehensive report and presentation.

The final course grade will be based on the following criteria:

Grade	Criteria
30 %	Weekly Laboratory Reports (100 pts each, weeks 1 through 3)
30%	Weekly Oral Scientific Presentations (100 pts each, weeks 1 through 3)
5 %	Lab notebook (50 pts)
5 %	Effort, attitude, and time invested (including lab safety/organization, attention to detail, participation in lab meetings, troubleshooting, working with lab managers, etc.) (50 pts)
15%	Term scientific paper (150 pts)
15 %	Symposium Presentation (150 pts)

Policy on Missed Classes or Labs

No make-up work will be given in this course. This is an intensive class that requires active daily participation. If you have to miss class or laboratory activities due to a religious holiday or other approved reason, you must notify the Instructor **at least 7 days in advance**. If you miss class due to medical illness you must present a valid medical excuse to the Instructor **within 48h** of the missed examination or quiz. The reason for missing class must be of an urgent medical nature or totally unavoidable. If the excuse is valid, your grade for that examination may be pro-rated based on the average of your other comparable graded work and the class average for that particular missed activity. An invalid excuse will result in a score of zero for the activity missed.

If you miss the final symposium and have provided a valid medical **within 48 hours of the examination time**, a final course grade of Incomplete (IN) will be recorded, and you will be permitted to make-up symposium activities. To be assigned a course grade of Incomplete, a specific written agreement has to be completed and signed by the student and the instructor at the end of the course. Details are given in the University Catalogue.

Extra Credit: No extra credit will be given.

Students with Disabilities: Students requesting academic accommodations based on a disability are required to register with the Office of Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP and should be provided to the instructors. For more information, visit the following website:

http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html.

Statement on Academic Integrity: USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles.

Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A:

<http://www.usc.edu/dept/publications/SCAMPUS/gov/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>