BISC 457L: Methods in Marine Biology and Biological Oceanography

Spring semester 2018

Overview:

The course is designed to introduce students to the marine environment and to conducting independent research focusing on marine ecosystems. We will introduce students to oceanography/marine biology and train them in the use of state-of-the-art oceanographic equipment, sampling and analytical approaches. They will learn data acquisition and processing, and will be exposed to authentic methods of scientific inquiry. Highlights of this class include the use of a real research vessel (R/V Yellowfin) for a one-day sea-going expedition, exploration of the coastal environment by kayak, as well as guided snorkeling trips. No prior exposure to oceanography or marine biology is required. It is not necessary to have any snorkeling, diving of kayaking experience. Together with the professional and highly trained education staff at the Wrigley Institute we make sure that every student will be exposed to the marine environment in a fun and safe way. Each week of the class is designed as a research project. While we guide student through different topic during the first 3 weeks of the course, with lectures in the morning followed by field and laboratory work in the afternoons, the students will design, plan and carry out an independent project in the 4th week. 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, and students can invite friends and family to join us on the island for this event. This is always a big success and another highlight of the class. We hope to welcome you 'on board' - this class is open to students of any level and major.

More information can be found here: https://dornsife.usc.edu/biology-457l/

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

Course Dates: May 18 – June 12, 2020 (Memorial Day: May 25)

Instructor:

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

Teaching Assistant: TBA

D-Clearance is required for this course. Please contact Prof. Ziebis via email (wziebis@usc.edu)

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

Lecture and laboratory schedule:

The schedule during each week will vary slightly based on weather / ocean conditions.
General class schedule:
Lectures: 9 am - 12 pm (Monday – Friday), Laboratory/Field exercises: 1 – 5 pm

Costs: *(Excluding Spring Tuition)*
Lab Fee: $200
Room & Board: ~ $1,300 *(for entire 4 weeks on the island, with 3 meals per day, including weekends)*
TOTAL: ~ $1,500

PLEASE NOTE: A **$400 non-refundable deposit is due upon student acceptance** of a Maymester course. This deposit will be charged to the student's account and **reimbursed during the first week of the Maymester program.** While most spring courses allow for an add/drop period, **Maymester courses require immediate commitment** due to travel arrangements and budgeting.

NEW: SOAR funding is available for qualifying students.

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. 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 Ssemester with respect to tuition and credit load.
The class counts for the Marine Biology Minor
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 forth 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 8, which is open to all staff and faculty, as well as to family and friends.

Expectations: It is assumed 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, to approach the instructors 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 in form of research papers and review articles. Each student is also expected to search appropriate literature databases.
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 – BENHIC 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 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.

- Sample analyses and data processing
- Preparation of weekly report and presentation of procedures and results
- Presentations and discussions

Week 2 PHOTOSYNTHESIS IN THE OCEAN

- Diversity of marine phototrophic organisms
- The importance of light and nutrients for photosynthesis
- Photosynthesis and the global carbon cycle
- Ways to measure photosynthetic rates
- The importance of oxygen
- Experiments determining the photosynthetic activity of macroalgae
- Using oxygen microsensors to measure benthic photosynthesis and respiration
- Sample analyses and data processing
- 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
- Chemical and microbiological analyses
- Experiments on bioturbation
- Application of microsensors in benthic microbial ecology
- Sample analyses and data processing
- 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 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/