BIOE 158L: Marine Ecology Field Lab

Tentative Syllabus for Summer 2019
Where: Coastal Biology Building, Rm 155
When: Monday, Wednesday 9:00-12:30 (note that the actual schedule is dictated by the tides and we will occasionally be meeting and leaving the lab earlier than 9:00 AM)

Course website: Canvas

Instructor:
Josh Smith LML-COH 255 (JogSmith@ucsc.edu)
Office Hours: M/W 1-3pm (after class, **by appointment only @** https://www.joshuagsmith.com / MORE / Office hours)

TA: Daniel Wright
Office Hours: M/W 1-3pm

Course Objectives:
The purpose of this course is to introduce students both to commonly employed sampling designs and methods, and the diversity of coastal intertidal environments of the Monterey Bay area. The course involves class projects and supervised group research projects. Students will carry out a complete research project, including (1) the formulation of hypotheses, (2) the design and implementation of experiments, (3) collection, analysis and interpretation of data, and (4) write up and oral presentation. Because participation in this course relies heavily on your personal research effort, strong personal motivation to conduct field or lab research will be mandatory for successful completion of the course.

General Schedule:
The first half of this course involves lectures and group field trips to several locations throughout the Monterey Bay area. Lectures are held in room 115 of the Coastal Biology Building on the UCSC Coastal Science Campus (CSC). Group field trips will convene either at CSC, or at specified field sites (see below). The second half of the course involves group research and supervisory meetings (by appointment) with instructors at CSC.

Evaluation:
Students are evaluated by each of four major criteria:
(1) participation during lectures and class field trips,
(2) class project reports (in scientific format) during the first half of the class,
(3) an oral presentation of the group research project.
(4) write-up of a group research project (in scientific format) to be submitted during finals week.

These four criteria will be weighted as follows:

Class participation **10%**
- **Field Notebooks (5%)**
- **Exit Questions (5%)**

Class project reports (2) **20%**
Presentations **30%**
Group research paper **40%**

Lecture Schedule:

June 24	Course introduction**,** organizational meeting, and lecture on ecosystems of the central Coast.	**Text Pgs. 1-14**
June 26	Dune Vegetation	**Text Pgs. 15-32**
July 1	Elkhorn Slough	**Text Pgs. 33-38**
July 3	Rocky Intertidal	**Text Pgs. 39-54**
July 8	Sandy Beach	**Text Pgs. 55-65**
July 10	Classroom – Questions gallery, data analysis, and intro to independent projects	**Text Pgs. 66-85**
July 15	Independent Projects	
July 17	Independent Projects	
July 22	Independent Projects	
July 24	Project Presentations	
July 26	Project write-ups due end of the day	

Assignment schedule:

June 26	Field notebook #1 due at the end of class.
July 3	Report #1 Sand Dune Vegetation (submitted individually on Canvas, due Wednesday July 3 by midnight).
July 8	Field notebook entries #2-4 due at the end of class.

July 10	Report #2 Intertidal Zonation (submitted individually on Canvas, due Wednesday July 10 by midnight).
July 23	Group project presentation due (one submission per group) on canvas
July 24	In-class group project presentations
July 26	Final project write-ups (one submission per group) due on Canvas by 5:00pm.

Required text book:
Strunk, W. and E.B. White. 1979. (the most recent edition) *The Elements of Style*, Allyn & Bacon, Needham Heights, Massachusetts

Recommended **Experimental and sampling design texts include:**

- Cox, D.R. 1992. Planning of Experiments
- Hairston, G.H., Jr. 1989. Ecological Experiments: Purpose, Design, and Execution. Scheiner, S.M. and J. Gurevitch (eds). 2001. Design and Analysis of Ecological Experiments. Second Edition
- Underwood, A.J. 1997. Experiments in Ecology.
- Gotelli, N. J. and A. M. Ellison. 2004. A Primer of Ecological Statistics.

Field Notebooks:

One of the most powerful tools of an ecologist is a field notebook. There's no substitute for detailed notes of observations *in situ*, or as they happen in the field. Some of the greatest natural history records were derived from ecologists' field notebooks. Indeed, Darwin wrote *The Origin* based off his detailed field notes from the voyage of the *HMS Beagle*.

There are multiple roles for a field notebook. Notably (pun intended), records of time, weather, general site descriptions, and observations of species behavior can form the backbone of ecological monitoring. For each site we visit, your objective is to create an accurate written record of your field activities, investigations, observations and thoughts. Field notebooks should contain *at least* the following elements: *date/time (use 24-hour clock format – 1435 for 2:35pm, location (place, lat/long, GPS readings), weather (temperature, cloud types, wind, rain, etc.), habitat (forest, desert, intertidal), sampling strategy (e.g., line UPC, quadrat, etc.), list of species seen, vegetation, general notes.*

Here is an example of what a field notebook entry might look like:

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09 July, 2019	Weather: partly cloudy	Pg. 6
Start time: 0823	Temp: 17C	
End time: 1345		

Location: Terrace Point Rocky Intertidal

Habitat: Gentle sloping shale beds exposed to a southwest facing swell. Swell approx. 2-4 ft. Wind approx. 12 kts.

Sampling: UPC in 0.5m quadrats along a 100m transect line at every 5m interval.

Species Observed:
D. imbricata
P. californicus
A. marginata
M. californica

General Notes: The large breaking waves appeared to carve-out channels perpendicular to the water line. These channels revealed distinct vertical stratification patterns. The deeper low low-water line was the most diverse, comprised of mussels, anemones, snails, polychaetes, and various brown algae. The shallow zone was dominated by acorn barnacles. During our survey the tide came in too far to finish the 85-100 meter zones on transect.

Field lab 1: Sand dune vegetation
Our sand dune lab is intended to accomplish four things. First, we want to introduce you to a community and habitat that you may not be familiar with. Coastal Sand Dunes constitute a very small and reduced (relative to original area) habitat that contains a large number of species. Moreover, the habitat seems very simple – it is sand. Second, we want to introduce you to methods appropriate for sampling this sort of ecological community. Third, we want you to think across spatial and temporal scales and assess this community in the context of hypotheses that we will discuss in class for the maintenance of species diversity. Fourth, we want you to use the data you collect to assess the plausibility of those hypotheses.

Field lab 2: Elkhorn slough
In this lab, we will be looking at the dispersion of a mudflat snail. We are particularly interested in demonstrating how you go about sampling distributions and how to determine (analytically) the pattern of dispersion. Dispersion patterns of organisms may range from uniform (under-dispersed), to random, to clumped (aggregated, overdispersed). Often these patterns of dispersion suggest the mechanisms that cause the observed distributions. If organisms are uniformly spaced then intra-specific competition is suggested and experiments testing for it could be devised. Clumped distributions often indicate that resources are also clumped or mutualistic intraspecific interactions (e.g., facilitative settlement of conspecifics). Random distributions often indicate the lack of intraspecific interactions. Hence determining the underlying patterns of dispersion of organisms is often a key first step into a study of their ecology.

Field lab 3: Rocky intertidal – Terrace Point
We will sample the algae and invertebrates that constitute rocky intertidal communities at one site within Monterey Bay (Natural Bridges). We will quantify the relative abundances (percent cover or density) of species using uniform point contact (UPC) to estimate percent cover, and quadrats (not quadrants!) to estimate densities. Surveys will be conducted along replicate transects extending from the high to low intertidal zones to characterize community structure at each tidal zone.

Field lab 4: Sandy Beach, Twin Lakes
The goal is to get you observing nature looking for patterns and to start thinking about processes that might explain those patterns. Throughout the quarter we will use a variety of methods to quantify the distribution and abundance of organisms living on the surface of a substratum: mudflats, sandy beaches, dunes, and the rocky intertidal. Describing distributional patterns and the environmental causes of patchiness or gradients is pretty straightforward when species occur on, rather than in, habitats because the individuals are visually apparent. In these situations, it is easy to step back and see the patterns that you are endeavoring to sample. Sampling the distribution and abundance of organisms that live within a substratum (referred to as *infauna*) is another story. Here you can't see the patterns and, therefore, the approaches to sampling in an unbiased fashion are more difficult. This lab will entail examining species distribution and abundance across the shore (along a gradient from high to low tide), along shore (corresponding to horizontal patchiness or gradients), and by depth of the sand.

Class Project Reports:

You will submit two class project reports in the first half of the class. The purpose of these reports is to get you to (1) begin thinking about how to communicate science in formal writing and (2) receive feedback from instructions that you can incorporate into your final class paper. We will lecture on scientific writing on the first day of class and then revisit key concepts on July 10, before you embark on independent data collection. All of the science writing tips are posted on Canvas, **including a content rubric for how you will be grading on both your project reports and final paper.**

Project Report #1 – Dune vegetation lab
Using the summary graphs provided to you by the facilitators, develop a hypothesis (or a few hypotheses) that describes the relationship between observed species (think about diversity), distance from the beach, and dune slope. Be sure to explicitly state your questions, hypotheses, methods for testing each hypothesis, results, and your interpretation of the results.

Project Report #2 – Intertidal zonation and diversity
Using your understanding of the relationship between species richness and sampling effort, support or refute a hypothesis about a comparison of species richness across intertidal zones. Be sure to include (and correctly reference!!) a description of the summary graphs provided to you by the facilitators.