

## Marine Biology/ Biology of the Sea Spring 2012

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### Philosophy & Goals:

We have a very unique opportunity to study in our own Marine Biology Field Station located in the Florida Keys, an outstanding biological habitat of global significance. Our major goal is to learn marine science by “doing it”, often with long days in the sun and long evenings in the lab! In addition to scientific study and research in this system, the course offers the valuable experience of living within the small community of Layton, which exemplifies some of the challenges and opportunities related to resource management and conservation. By living and studying together within a community (both ours and more broadly Layton) we’ll also emphasize the social process of science.

### Course Themes:

- Through a comparative analysis of marine and terrestrial systems, we will explore fundamental **theories in ecology** and thereby better understand their limits and applications
  - Lectures and readings
- By learning to **identify a variety of marine plants and animals**, we will become better able to understand the patterns of species distributions and their key roles in community ecology
  - Field visits and species list
- Through field work we will learn to **notice patterns, develop questions, plan experiments, implement experiments**, and analyze/critique our data.
  - Independent research project

### Resources:

#### Required “texts”

*Marine Biology 2012 Reader* (Provided)

*Marine Biology Field Notebook* (Provided)

The “text” of nature – use of Keys and Guides to identify species

Moodle links and resources for statistics and paper examples

### Daily routines:

The following routines will serve as key parts of our time together, which we will complete each morning before lecture.

*Species of the day* –

*Recording of water use each morning* –

*Quote of the previous day* –

*Opening poem, insight, or journal entry* –

## Course Framework:

We will divide the course content into the following three areas. Each of these sections will be included in your field notebook.

### 1. Natural History: Species List & Habitats

We will explore a variety of marine habitats in both lecture and field visits. For each habitat you will include the following in your field notebook:

- Lecture notes on ecology of habitat
- Completed data sheet from field investigations (when relevant)
- Species list and taxonomic groups
- Drawings of species

- A) Open Ocean – Epipelagic Zone
- B) Mangrove
- C) Seagrass beds
- D) Soft Bottom
- E) Hardbottom
- F) Coral Reefs
- G) Rocky Shore

### 2. Ecology theories

We will explore the following themes via lectures and readings.

- A) Water chemistry & living in the ocean
- B) Comparative analysis: terrestrial vs marine
- C) Community ecology and structure
  1. Trophic Cascades
  2. Grazing & Herbivory
  3. Competition & Mutualisms
- D) Nutrient cycling & productivity
- E) Fisheries management & conservation

### 3. Research Practices

We will explore the following steps in the research process – which each student is responsible to record in their field notebook.

#### Preliminary work

Noticing patterns  
 Developing questions  
 Experimental development  
 Statistical analysis

#### Research implementation

During your experiment record the following every day:

**Date:** *beginning/ending time and date*

**personnel:** *who helped, who did what*

**location:** *where were you sampling*

**weather/environment:** *observations about tides, weather, water*

**procedure:** *paragraph outlining procedure*

**replicates completed:** *how many replicates etc.*

**notes:** *drawings, questions, reminders*

We will work to master and experiment with some of the following statistical and research skills.

*Statistical skills*

Quantify diversity of habitats (species richness, Shannon Wiener, similarity indices, etc.)

Quantify population dispersion (Poisson distribution with Chi-square)

Determine if means are statistically different (t-tests)

*Research techniques*

Nearest Neighbor methods for density

Quadrat sampling for percent cover and diversity

Plankton tow and microscopic analysis

Use of dichotomous keys for species identification

<b>Course Assessment:</b>
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**Field Notebook (individual) 200 pts**

*50 pts per each of the following sections*

1. Habitat notes and drawings
2. Species list (details provided in the notebook)
3. Ecological theories
4. Research Practices

**Final Paper (group) 200 pts**

*100 pts per each of the following sections*

1. Proposal and presentation
2. Final Paper and presentation

**Final Exam 200 pts**

*100 pts per each of the following sections*

1. Species practical (identifying species)
2. Written exam on habitats and ecological theories

## Final Paper details

The Marine Biology course is largely a field course. We will intensively explore the marine coastal ecosystem in multiple daily field investigations. However, doing specimen collection and fieldwork is just one part of research. For fieldwork to be relevant we'll need to spend ample time in specimen identification and study of the relevant ecological theories collected from scientists studying the organisms for centuries before us (translated read the literature!).

The goal of the project during the Marine Biology course is to integrate all of the above processes by doing the following:

- a. Learn to **identify** species that comprise the coastal habitat ecosystems
- b. Observe and **notice patterns** related to the ecology of the organisms
- c. Devise a short **experiment** that tests the utility of the patterns you've identified.

## Week Two

### 1. Written Paper & Proposal (Monday April 30<sup>th</sup> 7:00 pm):

At the beginning of week two on Monday evening at 7:00 pm, your group will turn in a written research proposal that aims to experimentally test a question your group is curious about, based on observations made in week one. The format of that paper is as follows (bold terms should serve as headings in the paper):

- a. Title page with authors
- b. **Introduction** to ecological pattern with citations
- c. **Hypotheses**
- d. **Methods & Experimental Design**
  - i. Graphical representation of experiment?
  - ii. Number of replicates?
  - iii. How often will data be collected?
  - iv. What measurements will be taken?
- e. **Statistical Analysis**
- f. **Conclusions** (Relevance to issues in Marine Ecology)
- g. **References**

### 2. Oral Presentation (Monday April 30<sup>th</sup> 7:00 pm):

Your group will present a formal oral presentation to the group in order to get feedback from your peers and instructors before implementing your project.

1. Your **presentation** should be 10 minutes long. It should include slides that address the above sections in your research paper.
2. The ENTIRE goal of the research presentation is to elicit conversation and get feedback from your scientific colleagues about your question and research design. Engage us!



<b>Week Three</b>
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We'll use one field visit each day for your group to continue to gather data to implement your research project that your team has developed in week one.

**3. Written Paper (Friday May 11<sup>th</sup> at 9:00 am):**

We will have *The-Third-Annual-Marine-Biology-Mini-Conference* where your group will present the findings of your experiment. Your research paper will be similar to the proposal, but you will **add the following sections to the sections a-g from assignment two:**

- h. **Results**
  - i. Figures and Tables should be nested within the paper and correctly labeled
  - ii. Several paragraphs should describe the data in words.
- i. **Analysis & Discussion**
  - iii. What does your data suggest about your hypotheses?
  - iv. What affected the outcomes?
  - v. What further questions does your project raise?
  - vi. What NEW observations and patterns did you notice?
- j. **Conclusions/Relevance to Marine Ecology**
- k. **Acknowledgements**
- l. **References**

**4. Oral Presentation (Friday May 11<sup>th</sup> at 9:00 am):**

Your group will present a formal oral presentation to the group in order to convince us of the utility of your experiment.

1. Your presentation should be 10 minutes long. It should include slides that address the above sections in your research paper (with a review of the sections a-g).
2. The goal of this event is different than assignment three. By carefully scrutinizing your experiment and results, your goal is to articulate and defend the conclusions you've made. (Example: We failed to demonstrate that fish forage preferentially on *Thalassia*...)