

## **Biology of Fishes 2011** Panama

Dates: January 21–Feb 5, 2011

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Required Readings:      Papers from the primary literature for seminar are provided  
in your reader

Supplemental Books (available in library):

Reef Fish Identification: Florida, Caribbean, Bahamas, *Paul Humann & Ned DeLoach*

Reef Fish Behavior: Florida, Caribbean, Bahamas, *Ned DeLoach*

Coral Reef Fishes: Indo-Pacific and Caribbean, *Ewald Lieske & Robert Myers*

Fishes: An Introduction to Ichthyology, *Peter B. Moyle & Joseph J. Cech*

### **Course Objectives:**

This course is intended to provide you with a general understanding of the biology of fishes, and how to conduct field research on marine fishes. When you leave this course, you should have a broad understanding of fish biology and you should know how to (1) identify the common local marine fishes; (2) look for, identify, and describe patterns in their abundance, distribution, and behavior in nature; (4) develop testable hypotheses for the causes of observed patterns; and (5) design and carry out empirical tests of the predictions of hypotheses to explain observed patterns.

### **Course Overview:**

This course will combine a series of lectures, class discussions of papers from the primary literature, lab exercises, and extensive, hands-on fieldwork to teach you about the biology of fishes. Our intention is to involve you as an active participant – in lab and field work, seminars, and lectures – because doing is the best way of learning.

In lectures you will learn fundamental concepts in fish biology. You are encouraged and expected to ask questions during lecture. In seminars we will discuss recent papers in the scientific literature. The purpose of these seminars is to teach you how to critically evaluate scientific research. It is your job to read the papers assigned very carefully and discuss their strengths and weaknesses. We will direct the discussion, but we want you to do most of the talking. You will learn about how fishes function with lab and field exercises; and you will learn how to do research on fish biology with a series of field research projects. You will learn methods for studying fishes in the field; you will learn how to analyze and present the data you have collected; and you will learn how to write clear, effective, scientific research reports.

**Biology of Fishes 2011: Class Schedule**

(Class will begin at 8:15 am in the morning and 1:15 pm in the afternoon, unless we arrange otherwise)

Date	Day	Day	Morning	Afternoon	Work Due
21-Jan	Fri	1	Lecture: Introduction - C <b>Snorkel:</b> Fish Identification	Lecture: Anatomy 1 - R <u>Lab:</u> External Anatomy	
22-Jan	Sat	2	Lecture: Swimming - C <b>Dive:</b> Swimming & Feeding	Lecture: Anatomy 2 - R <u>Lab:</u> Internal Anatomy	
23-Jan	Sun		<i>Reading &amp; Research</i>		
24-Jan	Mon	3	<b>Dive:</b> Nocturnal/Diurnal Changeover Lecture: Evolution - C	Lecture: Systematics & Phylogeny - R <i>Seminar:</i> Dispersal of Reef Fish Larvae	
25-Jan	Tue	4	Lecture: Social Systems - C <b>Snorkel:</b> Class Project: Territoriality 1	Lecture: Reproduction - R <i>Seminar:</i> Evolution	seminar Q1
26-Jan	Wed		<i>Reading &amp; Research</i>		
27-Jan	Thur	5	<b>Field Exam</b>		
28-Jan	Fri	6	<b>Snorkel:</b> Class Project: Territoriality 2	Lecture: Population Ecology - R <i>Seminar:</i> Social Systems	seminar Q3
29-Jan	Sat	7	Lecture: Community Ecology - R	<b>Snorkel:</b> Class Project: Community Ecology I (shallow reef) <i>Seminar:</i> Population Ecology	
30-Jan	Sun		<i>Reading &amp; Research</i>		
31-Jan	Mon	8	<b>Dive:</b> Class Project: Community Ecology II (Forereef)	Lecture: Fisheries Biology - C <i>Seminar:</i> Community Ecology	draft of paper
1-Feb	Tue	9	<b>Dive:</b> Symbiosis: Mutualism - cleaning	<i>Seminar:</i> Fisheries Biology	community ecology lab questions
2-Feb	Wed		<i>Reading &amp; Research</i>		
3-Feb	Thu	10	<b>Dive:</b> Planktivore Foraging	<u>Lab:</u> Light trapping	final draft of paper
4-Feb	Fri		<i>Reading &amp; Research</i>		
5-Feb	Sat		<b>Written Exam</b>		
				Fish printing ( <i>optional</i> )	

## Grading

<u>Activity</u>	<u>Content</u>	<u>% of Grade</u>
Written Exam	Questions on lecture material	24
Field ID Exam	Identify fish & answer short questions about them while snorkeling	12
Class Project Paper	Write a short (10 pages maximum) paper on a class project in the format of a scientific paper	18
Community Ecology Study	Answers to a set of questions, based on your analysis of data we collect	8
Lab/Field Exercise short answer questions	Brief recap of key points from lab and field activities (5 sets worth 2 points each)	10
Seminar questions	Written answers (1 page or less) to questions about seminar papers (3 questions worth 4 points each)	12
Participation	Contribution to seminars and class projects	16
<b>Total:</b>		<b>100</b>

Your grade will be based on several components. A written exam at the end of the course will be worth 24% of your grade. It will consist of true/false, multiple choice, short answers (one word to one short paragraph), graphs, and other figures. This exam will be designed to test your ability to synthesize information from lecture and think logically about the implications of this information. Answers will be graded on factual content, logic, and clarity. The exam will be based entirely on material covered during lecture.

The remaining 76% of your grade will be based on several components: an in-field fish identification practical exam; a research report; lab/field exercise questions; seminar questions; and participation. The field exam will test your ability to identify common marine fishes while snorkeling. The research report will be based on one of our field activities and will be written in the form of a published scientific paper. We will discuss the format and expectations for this paper more detail later in the course. There will be a detailed question set on one of the field activities that we do, which will require you to analyze the data we collect in order to answer the questions. Other less involved question sets on lab and field activities will simply require a brief (<1 page) recap of what we observed and learned during those activities. The seminar questions will be based on our discussions of papers in the primary scientific literature and they will require brief but well thought out answers (2 paragraphs or so). Finally, 16% of your grade will be based on your participation in all of our class activities and seminars. The two components are weighted equally. Eager and enthusiastic participation will be rewarded. We make notes about who participated after every seminar or activity.

### A note about field activities:

You are expected to participate in all field activities. All of the field activities in this course will be done in the water, on snorkel or SCUBA (for those who are AAUS certified). If you have serious concerns about your ability to participate in the field activities, please talk to us as soon as possible.

## Seminar Readings

### Dispersal of Reef Fish Larvae (January 24):

Almany GR, ML Berumen, SR Thorrold, S Planes, and GP Jones 2007. *Local replenishment of coral reef fish populations in a marine reserve*. Science 316: 742-744

### Evolution of Fishes (January 25):

Cote IM and KL Cheney 2004. *Distance-dependent costs and benefits of aggressive mimicry in a cleaning symbiosis*. Proceedings of the Royal Society of London, Series B 271: 2627-2630

### Reproduction (January 27):

Munday PL 2002. *Bi-directional sex change: testing the growth-rate advantage model*. Behavioral Ecology and Sociobiology 52: 247-254

### Social Systems (January 28):

Munoz and Warner 2003: *Alternative contexts of sex change with social control in the bucktooth parrotfish, Sparisoma radianus*. Environmental Biology of Fishes 68: 307-319

### Population Ecology (January 29):

Taylor, TM *et al.* 2003. *Genetic evidence for local retention of pelagic larvae in a Caribbean reef fish*. Science 299: 107-109

Palumbi, SR and RR Warner 2003. *Why gobies are like hobbits*. Science 299: 51-52

Responses to Taylor and Hellberg by Colin, Taylor and Hellberg, Warner and Palumbi 2003. Science 300: 1657-1658

### Community Ecology (January 31):

Burkepile, DE and ME Hay 2010. *Impact of herbivore identity on algal succession and coral growth on a Caribbean reef*. PLoS One 5: 1-9

### Fisheries (February 1):

Sethi, SA, TA Branch, and R Watson 2010. *Global fishery development patterns are driven by profit but not trophic level*. Proceedings of the National Academy of Sciences 107: 12163-12167

Branch, TA, *et al.* 2010. *The trophic fingerprint of marine fisheries*. Nature 468: 431-435