

Field Experience in Biology of Coral Reefs (BIOL 453L)

Syllabus March 16-April 30, 2019

Phillip Dustan, Department of Biology

College of Charleston, Charleston, SC

Among the most spectacular of all ecosystems, coral reefs form in the world's tropical oceans through the action of animals and plants. They are the largest and most complex biological structures on earth. Although they cover less than one percent of the earth's surface, they are reservoirs for much of the ocean's biodiversity, housing some of nature's most intricate ecological secrets and treasures.

Coral reefs are also the most productive ecosystems in the sea and provide significant ecological goods and services, estimated at about \$375 billion annually (1997 dollars) with more recent estimates topping 9 trillion dollars in 2015. Their physical structures protect thousands of miles of coastline from the fury of tropical storms, tsunamis, and many low-lying islands threatened by rising seas.

The intricate adaptations for survival that have evolved over an immense span of time make reefs vulnerable to human activities. For example, excess nutrients support algal overgrowth, while over-fishing alters the food web. The extent to which reefs in remote locations are now showing signs of stress, especially bleaching and disease, points to the critical role that coral reefs play as indicators of declining ocean health.

This course is an optional Laboratory for Biology of Coral Reefs. It is a field trip to explore the reefs of the Florida Keys, March 17-22, 2019 with subsequent follow-up and discussion. It will provide a real-world field trip introduction to Caribbean coral reef communities and their conservation. . Emphasis is placed on learning through field experiences. This course is limited to 12 students due to the complex travel and logistics of diving. The cost of the trip will be approximately \$400, including all accommodations, and round trip travel from Charleston to Key Largo.

The group will stay at Amy Slates Amoray Resort on Key Largo, (www.amoray.com). That's Amoray Dive Resort is a fully equipped dive resort with an excellent dive locker, boats, and personnel. Their boats, diving equipment and the SCUBA air compressors are professionally maintained. The quality of the air is excellent.

The goals of this course are to:

- 1) Introduce students to Caribbean coral reef environments: mangroves, seagrasses, coral reefs, and islands.
- 2) Explore the complex and distinctive natural features of tropical communities and to become familiar with ecological processes as they apply to tropical ecosystems
- 3) Witness the nature of human impacts and management in such systems to gain an appreciation for conservation biology.
- 4) Learn about the abiotic forcing functions control the ecology of coral reefs including reef morphology and coral distribution.
- 5) Learn how to carry out make field observations and carry out sampling and field experiments.
- 6) Improve scientific SCUBA diving skills.

Prerequisites include: BIOL 111, 112, 341, and current enrollment in Biology of Coral Reefs. This course is open to graduate students and undergraduates, and continuing students enrolled in Biology of Coral Reefs.

Critical Thinking:

Critical thinking is the common denominator between all forms of analysis. As a graduate student, there is no more important goal than that of developing your mind, as everything you do in your life will be affected by your mind and how it operates. The quality of your learning is affected by the quality of your thinking about learning. The quality of your personal relationships is affected by the quality of your thinking about those relationships. To take command of the thinking that controls your life, you must cultivate your intellect". (Refer to www.criticalthinking.org)

Requirements:

Field Journal / Dive Log detailing each dive including: description of reef habitat, species encountered, environmental conditions and dive statistics compatible with PADI Dive Log procedures (depth profile, time in/out, time at depth, etc.)

Graduate Student higher-level learning outcomes and additional workload:

The Biology of Coral Reefs is a combined undergraduate and graduate course. Undergraduate students are expected to take leadership roles with respect to the discussion of papers, organism identification, and dive debriefings.

Honor Code: All of your work must be your own original work and must not have been submitted for a grade in any other class while at the College of Charleston or elsewhere. Furthermore, no project done in this class can be submitted for grading in any other future or present course. To do so will be construed as a clear violation of the Honor Code.

Internet Materials: Any information you quote for a paper or presentation must come from the peer-reviewed scientific literature and not a website. Use search engines such as the Web of Science or Google Scholar. Search journals such as Coral Reefs, Limnology and Oceanography, Marine Biology, Marine Ecology Progress series, etc.

Grading Policy:

A: 92-100 excellent and creative	A-: 89-92	
B+: 86-89 very good	B: 82-86 good	B-: 79-82
C+: 76-79 fair	C: 72-76 acceptable	C-: 69-72
D+: 68-69 passing	D: 65-68	D-: 63-65
F :> 63	XF Failure due to Academic Dishonesty	

Final grades are supposed to reflect how much you have progressed and/or learned in the time span of a course. With this in mind, one could suggest that an average student receives an average grade, a very good student a higher grade, and an excellent and creative student the highest grade.

Sidebar Knowledge

This course will focus on the corals and the coral reef ecosystem. Within the context of the course students will be required to draw on knowledge from earlier classes. Since this course will be taught at the undergraduate and graduate levels it is expected that students will have varied educational backgrounds. I will help you with sidebar information (selected readings, lectures, websites, etc.) on selected topics to help students will become knowledgeable in areas that are important framework fundamentals to the study of coral reefs. A partial list follows:

- Geological time line of Earth history and the fossil record
- Principles of general oceanographic circulation
- Theories on the origin of life and biodiversity
- Theory of Evolution by Natural Selection
- Photosynthesis and the pathways of carbon
- Density dependence and the growth and regulation of populations

Reference Texts:

Reference suitable for keeping: *A Field Guide to Coral Reefs, Eugene Kaplan. Peterson Field Guide Series. This is an excellent pocket field guide to Caribbean coral reefs.*

Office Hours:

9-10 Tues/Thurs or by appointment.
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Field Experience in Biology of Coral Reefs (BIOL 502)

Syllabus March 5-12, 2016

Phillip Dustan, Department of Biology
College of Charleston, Charleston, SC

Among the most spectacular of all ecosystems, coral reefs form in the world's tropical oceans through the action of animals and plants. They are the largest and most complex biological structures on earth. Although they cover less than one percent of the earth's surface, they are reservoirs for much of the ocean's biodiversity, housing some of nature's most intricate ecological secrets and treasures.

Coral reefs are also the most productive ecosystems in the sea and provide significant ecological goods and services, estimated at about \$375 billion annually (1997 dollars) with more recent estimates topping 9 trillion dollars in 2015. Their physical structures protect thousands of miles of coastline from the fury of tropical storms, tsunamis, and many low-lying islands threatened by rising seas.

The intricate adaptations for survival that have evolved over an immense span of time make reefs vulnerable to human activities. For example, excess nutrients support algal overgrowth, while over-fishing alters the food web. The extent to which reefs in remote locations are now showing signs of stress, especially bleaching and disease, points to the critical role that coral reefs play as indicators of declining ocean health.

This course is an optional Laboratory for Biology of Coral Reefs. It is a Study Abroad field trip to explore the reefs of Glover's Atoll, Belize, March 5-12, 2016. It will provide a real-world field trip introduction to Caribbean coral reef communities and their conservation. . Emphasis is placed on learning through field experiences. This course is limited to 12 students due to the complex travel and logistics of diving. The cost of the trip will be approximately \$2400-2700, including all accommodations, diving, and travel from the US. You must be a certified SCUBA diver to participate. If you are a foreign student you must secure the appropriate visa documentation if necessary.

Belize is in the heart of the tropical Caribbean with an extremely diverse reef flora and fauna. In the 1970's, Glover's Reef Atoll was identified by a group of coral reef scientists convened by the Smithsonian Institution as the best site in the Caribbean to carry out long-term, multi-disciplinary coral reef studies. They felt that Glover's Atoll possessed the optimum reef development in terms of the population density and species diversity of reef corals and associated organisms. It still possesses a wide diversity of reef types ranging from shallow patch reefs in the lagoon to spectacular vertical walls along the seaward edge of the platform. A number of excellent dive sites wrap around the southern tip of the atoll. The sites vary in their weather exposure so a safe, relatively calm lee sea can be found under most sea conditions. The reefs have not been immune to ecological stress though and, while they are still beautiful, there are unmistakable signs of ecological degradation.

The group will stay at the Isla Marisol Resort on Southwest Caye, Glovers Atoll Belize (<http://islamarisolresort.com/>). IMR is a fully equipped dive resort with an excellent dive locker, boats, and personnel. Their boats, diving equipment and the SCUBA air compressors are professionally maintained. The quality of the air is excellent. Dive masters associated with Isla Marisol Resort will accompany and supervise every dive.

The goals of this course are to:

- 7) Introduce students to Caribbean coral reef environments: mangroves, seagrasses, coral reefs, and islands.
- 8) Explore the complex and distinctive natural features of tropical communities and to become familiar with ecological processes as they apply to tropical ecosystems

- 9) Witness the nature of human impacts and management in such systems to gain an appreciation for conservation biology.
- 10) Learn about the abiotic forcing functions control the ecology of coral reefs including reef morphology and coral distribution.
- 11) Learn how to carry out make field observations and carry out sampling and field experiments.
- 12) Improve scientific SCUBA diving skills.

Prerequisites include: BIOL 111, 112, 341, and current enrollment in Biology of Coral Reefs. This course is open to graduate students and undergraduates with Junior or Senior status that have completed at least 15 hours of Biology and have a GPA of 3.0 or higher. Students not meeting these requirements may enroll with the permission of the instructor and departmental chair. Students must be a certified SCUBA diver, or have completed their classroom and pool qualifications for certification to participate in this course.

Critical Thinking:

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Theory of Evolution by Natural Selection
Photosynthesis and the pathways of carbon
Density dependence and the growth and regulation of populations

Reference Texts:

Reference suitable for keeping: *A Field Guide to Coral Reefs*, Eugene Kaplan. *Peterson Field Guide Series*. This is an excellent pocket field guide to Caribbean coral reefs.

Supplemental texts include:

Life and death of coral reefs, Charles Birkland. (out of print and expensive but very good)

Aquarium Corals by Eric Borneman, T.E.H Publications 2004

The Great Barrier Reef Expedition <https://archive.org/details/GreatBarrierReef1Yong>

Coral reefs in the microbial seas. Forest Rohwer, with M Youle and D. Vosten. 2010. Plaid Press.

Office Hours:

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Introduction to Caribbean Coral Reefs
Spring Break 2019: BIOL 453L (1 credit)
March 17 – 21, 2019

Florida Keys Field Trip Schedule (March 17-21):

- Mar 17 Depart Charleston for Key Largo in CofC Van.
Arrive estimated time 1800 hrs. to Amy Slate's Amoray Dive Resort
- Mar 18 Gear check and orientation.
Afternoon reef dive to patch reef or fore-reef terrace habitat
Review underwater photographs from dive
Evening discussion on reef habitats and zonation
- Mar 19 Morning dive to fore-reef
After lunch lecture/discussion
Review underwater photographs from dive
Evening discussion on reef habitats and zonation
Afternoon excursion to Windley Key State Park
- Mar 20 Morning dive to Molasses Reef
Dive debriefing
Wash and dry gear
After dinner discussion
Pack van for early morning departure.
- Mar 21 Morning departure from Key Largo to Charleston.
Estimated time of arrival 1800 hrs.

The general schedule:

- 0630 Breakfast**
- 0830 Morning dive**
- 1200 Lunch**
- 1400 Afternoon Dive**
- 1800 Dinner**

Grading Rubric:

	Excellent 4	Above Average 3	Average 2	Below Average 1
Question selection	Identifies a creative, focused, and manageable topic that addresses potentially significant yet previously less explored aspects of the topic.	Identifies a focused and manageable/doable topic that appropriately addresses relevant aspects of the topic.	Identifies a topic that while manageable/doable, is too narrowly focused and leaves out relevant aspects of the topic.	Identifies a topic that is far too general and wide-ranging as to be manageable and doable.
Existing knowledge, research, and/or views	Synthesizes in depth information from relevant sources representing various points of view/approaches.	Presents in depth information from relevant sources representing various points of view/approaches.	Presents information from relevant sources representing limited points of view/approaches.	Presents information from irrelevant sources representing limited points of view/approaches.
Methods	All elements of the methodology or theoretical framework are skillfully developed.	Critical elements of the methodology or theoretical framework are appropriately developed however more subtle elements are ignored or unaccounted for.	Critical elements of the methodology or theoretical framework are missing, incorrectly developed or unfocused.	Inquiry design demonstrates a misunderstanding of the methodology or theoretical framework.
Analysis	Organizes and synthesizes evidence to reveal insightful patterns, differences, or similarities related to focus.	Organizes evidence to reveal important patterns, differences, or similarities related to focus.	Organizes evidence but the organization is not effective in revealing important patterns, differences or similarities.	No apparent organization. Evidence is not used to support assertions.
Organization	The presentation is carefully organized and provides convincing evidence to support conclusions.	The presentation has a focus and provides some reasonable evidence to support conclusions.	There is some organization, but the speaker occasionally goes off topic. Evidence used to support conclusions is weak.	No apparent organization. Evidence is not used to support assertions.
Content	The content is accurate and comprehensive. Listeners are likely to gain new insights about the topic. Clear and creative graphics	The content is generally accurate and reasonably complete. Listeners may develop a few insights about the topic. Interesting graphics	The content is sometimes inaccurate or incomplete. Listeners may learn some isolated facts, but they are unlikely to gain new insights about the topic. Acceptable graphics	The content is inaccurate or overly general. Listeners are unlikely to learn anything or may be misled. Poor graphics
Delivery	The speaker is professional, relaxed, and comfortable and interacts effectively with listeners.	The speaker is generally relaxed and comfortable. Listeners are generally recognized and understood.	The speaker occasionally appears anxious or uncomfortable, and may occasionally read notes, rather than speak. Listeners are often ignored or misunderstood.	The speaker appears anxious and uncomfortable and reads notes, rather than speaks. Listeners are ignored.