



THE SCHOOL
FOR FIELD STUDIES

Tropical Coastal Ecology

SFS 3790

Syllabus

The School for Field Studies (SFS)
Center for Tropical Island Biodiversity Studies
Bocas del Toro, Panama

This syllabus may develop or change over time based on local conditions, learning opportunities, and faculty expertise.
Course content may vary from semester to semester.



COURSE CONTENT SUBJECT TO CHANGE

Please note that this is a copy of a recent syllabus. A final syllabus will be provided to students on the first day of academic programming.

SFS programs are different from other travel or study abroad programs. Each iteration of a program is unique and often cannot be implemented exactly as planned for a variety of reasons. There are factors which, although monitored closely, are beyond our control. For example:

- Changes in access to or expiration or change in terms of permits to the highly regulated and sensitive environments in which we work;
- Changes in social/political conditions or tenuous weather situations/natural disasters may require changes to sites or plans, often with little notice;
- Some aspects of programs depend on the current faculty team as well as the goodwill and generosity of individuals, communities, and institutions which lend support.

Please be advised that these or other variables may require changes before or during the program. Part of the SFS experience is adapting to changing conditions and overcoming the obstacles that may be present. In other words, the elephants are not always where we want them to be, so be flexible!

Course Overview

Tropical Coastal Ecology (TCE) is a course that provides fundamental knowledge necessary to understand the main ecological processes and interactions in a fragile marine island ecosystem. Basic ecological principles are paired with field observation and measurement to understand the interdependencies of species, populations, communities and ecosystems in the coastal and marine environment, and with particular attention to the management of resources and environments.

Our studies will focus on the shallow marine and coastal environments of Bocas del Toro with an emphasis on coral reef, seagrass and mangrove habitats. We will study the biology, ecology and behavior of key species, including those that form habitats and those that are important resources to the people of Bocas del Toro through fisheries and tourism. Finally, we will consider the impact of anthropogenic disturbance and global climate change to the island ecosystem and organisms living there, as well as discuss possible management solutions.

Learning Objectives and Outcomes

Students will:

1. Develop an understanding of the main ecological processes and interactions that occur in coastal island environments;
2. Understand the biology and ecology of the species important to the economy and coastal ecosystems of Bocas del Toro;
3. Be able to identify key species by observation;
4. Understand the importance of scientific information for the conservation of species and the management of marine protected areas;
5. Comprehend and be able to choose the most appropriate techniques to collect and analyze data collected in coastal and marine environments;
6. Identify threats to the coastal ecosystem of Bocas del Toro and develop and discuss solutions to these problems;
7. Improve communication skills to both scientific and broader audiences through written assignments, oral presentations, and the creation of social media and educational materials.

Study Topics

We will cover the following topics this semester, some of which will be overarching themes for several classes and others that will be touched on more briefly:

- Species ID and taxonomy
- Mangrove and seagrass ecosystems
- Coral reef ecosystems
- Marine ecology and species interactions
- Marine Protected Areas
- Pacific and Caribbean marine ecosystems
- Threats and impacts (fisheries, climate change, invasive species, plastics)
- Effects of tourism on local marine populations

Assessment

The evaluation breakdown for the course is as follows:

Assessment Item	Value (%)
Species identification quizzes	15
Short assignments	15
Response letter	15
Field report	25
Participation and conduct	10
Final exam	20
TOTAL	100

Species identification quizzes

There will be a series of three quizzes of species identification (fish, invertebrates, and corals) to assist with identifying marine organisms in the field. Quizzes will primarily be conducted in-class but may also involve a field component.

Short assignments

Students will submit a series of short assignments that will incorporate both individual and group learning in the classroom and field. These will include, but are not limited to: creating power point slides for a student-guided lecture; writing short reports based on field exercises; conducting photo identification of organisms; and creating educational materials in the form of social media posts and organism identification entries.

Response letter

Students will write a letter to the members of the scientific community engaged in a debate regarding the validity of coral restoration projects. This letter will take into account the statements made by experts in the field, and use scientific literature to support the stance that the student takes.

Field report

In order to gain experience with scientific writing, as well as think critically about the field work conducted as part of class, students will write detailed Results and Discussion portions of a field report. Students may also be asked to complete edits of this assignment to improve their scientific writing skills and prepare for Directed Research.

Participation and conduct

This grade will be based on: a) participation in class discussions and evidence of completing assigned readings and homework assignment; b) active participation during in-class workshops; c) timely and proper submission of data from field exercises; d) conduct and preparedness in the field; and e) working well with group members during field work and in-class exercises.

Final Exam

The final exam will be in the style of essays or sections of scientific reports and will require students to use their knowledge of coastal ecosystems covered in the course, as well as the assigned readings

assigned and related discussions. The assignment will require students to think critically about issues in Bocas del Toro and use their scientific writing skills. Students will be allowed to utilize their field journals when completing their final exam. Topics will rely heavily on field-based observations; therefore, well-written field journals will be advantageous.

Grading Scheme

A	95.00 - 100%	B+	86.00 - 89.99%	C+	76.00 - 79.99%	D	60.00 - 69.99%
A-	90.00 - 94.99%	B	83.00 - 85.99%	C	73.00 - 75.99%	F	59.99-00.00%
		B-	80.00 - 82.99%	C-	70.00 - 72.99%		

General Reminders

Lectures & field briefings are held at the Center. It is mandatory to attend all lectures and briefings. PDFs of the lecture presentations will be provided to students via the Tropical Coastal Ecology course folder on the Student Folder of the Z drive. However, it is important to take notes in class in addition to the information provided in the PDFs.

Readings: Assigned readings will be available on the student server. It is important that you read all materials before class so that we are able to have engaging class discussions and keep the topics and material reviewed in this course at a high caliber. Additional reading may be needed to complete some of the course assignments.

Plagiarism and Cheating: Using ideas and materials of others without giving due credit is cheating and will not be tolerated. A grade of zero will be earned when anyone is caught cheating, plagiarizing, or aiding another person to cheat, either actively or passively (e.g., allowing someone to look at your exam or your written assignment for the purposes of copying content). Unless specifically stated otherwise, all assignments should be individual pieces of work.

Appropriate use of technology: Students may use laptops during class for class purpose only; however, please do not abuse this privilege. There should be no phone use during class.

Participation: Students are expected to attend every class and participate fully in all class discussions and field exercises, as well as complete all assignments on time. Students will be graded on their participation as well as conduct in the field.

Deadlines: Deadlines are set for several reasons:

1. Deadlines are a part of working and academic life to which students need to become accustomed.
2. Deadlines promote equity among students.

3. Deadlines allow faculty ample time to review and return assignments before others are due.

As such, deadlines are firm and extensions will only be considered under the most extreme circumstances. Late assignments will incur a 10% penalty for every day that they are late. This means an assignment that is ten minutes late will have 10% removed, an assignment that is one day and ten minutes late will have 20% removed, and so on. Assignments will be handed back to students in a timely manner.

Assignment submission: All written assignments need to be submitted via email to ckovacs@fieldstudies.org as an attached Word document (Pages or PDF are also accepted, but Word is preferred if possible) no later than the deadline. Deadlines are specified on each assignment's guidelines.

Naming assignments:

Word documents, Excel documents, and PDFs for all individual assignments, exams, and reports should be saved as... **FirstName_LastName_Assignment**

Example... John_Smith_Literature Review

Preferred citation style for journal articles is APA format:

Last, F. M., & Last, F. M. (Year Published). Article title. *Journal Name, Volume(Issue)*, pages.

Example

Jacoby, W. G. (1994). Public attitudes toward government spending. *American Journal of Political Science, 38(2)*, 336-361.

Field Requirements

Snorkeling gear required for every snorkel event: (you are responsible for your gear!)

- Mask
- Snorkel
- Fins
- Waterproof notebook or dive slate and pencil
- Full water bottle
- Long sleeve rash guard/shirt (required on all snorkels)
- Dry bag
- Rain jacket (It can be very cold on the ride home)
- Life vest
- Waterproof camera (if you have one)
- Towel / snack (optional)

Before each field exercise, please ensure that you and your snorkel buddy have all of the required field equipment (dive slates or waterproof notebooks, pencils, transects, dive weights, etc) and that your dive slate or notebook has been set up to collect data in the field. You are responsible for bringing your equipment to the field and back to the Center, rinsing it with fresh water upon return, and storing it safely.

Course Content

Type- L: Lecture, **FL:** Field Lecture, **W:** Workshop, **FEX:** Field Exercise, **T:** Test, **G:** Guest Lecture

<i>Lecturers</i>	<i>Type</i>	<i>Total Time (hrs)</i>	<i>Readings</i>
<p>TCE 01 – Introduction to the Formation and Ecology of Panama</p> <p>BioMuseo in Panama City: Formation of the isthmus of Panama and its effect on the ecology of the region; introduction to marine species in the Caribbean and Pacific</p>	FL	1	
<p>TCE 02 Course Introduction</p> <p>Course overview, introduction to assignments, expectations</p>	L	0.5	Syllabus for Tropical Coastal Ecology
<p>TCE 03 Introduction to Tropical Coastal Ecology and Basics of Oceanography</p> <p>Introduction to general ecological principles and how oceanography influences the ecosystems we study; practice examining the local coastal ecosystem and asking research questions</p>	L/W	2	News article of your choosing
<p>TCE 04 Ecology of Bocas del Toro</p> <p>How the geography and history of Bocas del Toro has influenced the ecology of the region, with particular attention to the different coral reef habitats</p>	L	1.5	<p>Cramer (2013) History of human occupation and environmental change in Western and Central Caribbean Panama (subsection)</p> <p>Lirman and Mate (2018) Status of coastal habitats of Bocas del Toro, Panama: Coral reefs and seagrass meadows. Subsection of Coastal Resources of Bocas del Toro</p>

<p>TCE 05 Species ID and Taxonomy</p> <p>Taxonomic hierarchy, the organization of life, identification of organisms seen during orientation snorkel using books and online guides</p>	L/W	1	Review the structure and function of key marine species using the Caribbean species guides (Humann and Deloach) for reef fish, reef critters and corals – field ID books found in the lab
<p>TCE 06 Fish ID and Behavioral Ecology</p> <p>How to identify key fish species seen in the area; reproduction, behavior, and interactions in coral reef fish; how fish behavior affects their ecology; field methods in behavioral ecology</p>	L	1.5	Humann and Deloach – Fish ID (books in lab)
<p>TCE 07 Fish ID and Behavioral Ecology Snorkel</p> <p>Identify fish species based on characteristics learned in lecture. Observe and record behavior of fish as it pertains to feeding, cleaning, territoriality, and symbiotic relationships with other organisms</p>	FEX	3	
<p>TCE 08 Mangrove Ecology</p> <p>Identification of species in Bocas del Toro, features, importance, and threats</p>	L	1.5	Student directed based on assigned presentation question – see “Mangroves” in “Extra resources for assignments” folder
<p>TCE 09 Algae and Marine Plant Taxonomy and Ecology</p> <p>Taxonomy of phytoplankton, macro algae, and marine plants; the beneficial and harmful roles of algae; seagrass ecology</p>	L	1.5	Read abstract, Fig 5, and conclusion of: Carruthers et al. (2005). Lagoon scale processes...
<p>TCE 10 Life in Mangrove and Seagrass Ecosystems</p> <p>Identify macroalgae, invertebrate, and fish species living in the mixed habitat found at the edge of seagrass beds and mangroves</p>	FEX	2	Reference: Field Guide to Common Marine Algae of the Bocas del Toro Area - I and II (PDF guides)

<p>TCE 11 Invertebrate Taxonomy</p> <p>Taxonomy of invertebrate phyla and identification of invertebrates seen in the mangroves and seagrasses</p>	W	1.5	<p>Humann and Deloach – Reef Creature (books in lab)</p> <p>Collin et al. (2005). Photographic identification guide to some common marine invertebrates of Bocas Del Toro, Panama.</p>
<p>TCE 12 Ecology and Conservation of invertebrates in Bocas del Toro and around the Caribbean</p> <p>Ecology of marine invertebrates; discussion of key invertebrates and issues facing them in Bocas and in the wider Caribbean</p>	L	1.5	<p>Student choice of scientific article to discuss in class – see folder for options</p>
<p>TCE 13 Impact of Development on Coastal Ecosystems</p> <p>Panama’s mangrove laws; Bocas’ history of filling mangroves; coastal development; shoreline stabilization</p>	L	1.5	<p>Catellanos-Galindo (2018). Panama’s impotent mangrove laws.</p>
<p>TCE 14 Survey Methods: Transects</p> <p>Discussion of field techniques and practice conducting surveys using a transect</p>	L/W	1.5	<p>For reference: Hill and Wilkinson (2004). Methods for ecological monitoring of coral reefs. p.16</p>
<p>TCE 15 Invertebrate Substrate Surveys</p> <p>Survey for key invertebrates and record data on substrate type</p>	FEX	2	
<p>TCE 16 Ecological Interactions in Mixed Habitat Ecosystems</p> <p>Examine ecological interactions in a mixed mangrove, reef, and seagrass habitat and record behavioral information, photos, and video for a social media education assignment</p>	FEX	2	

<p>TCE 17 Field Data Management</p> <p>Utilize data recorded during invertebrate surveys to practice data management using excel</p>	W	1.5	
<p>TCE 18 Coral Reefs</p> <p>Coral taxonomy, coral reef ecology, reef structure and the importance of structural complexity of reefs, ecological effects of human impacts on coral reefs in Bocas and the decline of 3D reefs in Bocas</p>	L	1.5	<p>Seeman et al. (2013) Assessing the ecological effects of human impacts on coral reefs in Bocas del Toro, Panama.</p> <p>Optional: Graham and Nash (2013). The importance of structural complexity in coral reef...</p>
<p>TCE 19 Coral Reef and Fish Surveys</p> <p>Substrate surveys of coral reefs and accompanying fish surveys at two unique coral reef sites in the archipelago</p>	FEX	4	
<p>TCE 20 MPA Design Theory and Workshop</p> <p>Ecological and socio-economic factors; levels of protection; the history and efficacy of the Isla Bastimentos National Marine Park</p>	L	1.5	<p>Guerron-Montero (2005). Marine Protected Areas in Panama: Grassroots activism and advocacy.</p>
<p>TCE 21 Disease and Other Threats to Coral Reefs</p> <p>Diseases affecting coral reefs and the recent outbreak of SCTL disease; the causes of coral bleaching and the effects on reefs; how to monitor reef health</p>	L	1.5	<p>Please read and explore the following webpages:</p> <p>https://www.agrra.org/coral-disease-outbreak/</p> <p>https://www.agrra.org/coral-reef-monitoring/coral-indicator/</p>
<p>TCE 22 Coral Reef Health in a Protected Area: Field</p> <p>Survey for markers of decline in reef health within a MPA, including coral disease and bleaching</p>	FEX	3	

<p>TCE 23 Coral Reef Health in a Protected Area: Discussion</p> <p>Discussion of coral species observed and disease or other stressors affecting each species; group assignment summarizing results</p>	W	1.5	
<p>TCE 24 Fisheries</p> <p>The state of global fisheries, how tourism has influenced fisheries in Bocas, and an introduction to the lobster fishery in Bocas</p>	L	1	Dorsett and Rubio-Cisneros (2019) Many tourists, few fishes: Using tourists' and local's knowledge to assess seafood consumption on vulnerable waters of the archipelago of Bocas del Toro
<p>TCE 25 The Lobster Fishery in Bocas del Toro</p> <p>Guest lecture by local lobster fishermen about methods used, changes over time, and issues in the lobster fishery today</p>	GL	1	Ehrhardt and Lopez (2018). The lobster fishery and management challenges in the Bocas del Toro region, Panama (chapter from Coastal Resources of Bocas del Toro)
<p>TCE 26 Coral Restoration Methods: Visit to Coral Restoration Panama</p> <p>Participate in upkeep of coral nursery and learn methods used in creating artificial reefs and fragmentation and growing of corals</p>	FEX	4	
<p>TCE 27 Coral Genetics and Conservation</p> <p>Coral genetics, the influence of monoculture and decreased genetic diversity on coral reefs</p>	GL	1	Baums (2008) A restoration genetics guide for coral reef conservation.
<p>TCE 28 Coral Restoration Methods: Discussion</p> <p>Are coral nurseries, fragmentation, and reef restoration projects necessary or fruitless?</p>	L/W	1	Email thread from Coral-List; choice of articles from the folder on the Z drive as necessary
<p>TCE 29 Climate Talks</p> <p>How do actions in Bocas del Toro affect global climate change, and vice versa?</p>	L/W	2	Ripple et al. (2017) World Scientists' Warning to Humanity: A Second Notice

<p>TCE 30 Invasive Species</p> <p>Global and regional: what are they, what are the impacts, how do they get there?</p>	L	1	<p>Hixon et al. (2016) Lionfish: a major marine invasion</p> <p>Palmer et al. (2016) Invasive Lionfish reduce the density but not the genetic diversity of a native reef fish</p>
<p>TCE 31 Lionfish Dissection and Data Analysis</p>	W	2	
<p>TCE 32 Pollution and Plastics Workshop</p> <p>Beach cleanup and data comparison of two local beaches with different oceanic and land influences, discussion of waste management and regulations in Bocas and worldwide</p>	FEX/ W	3.5	<p>Lavendar Law et al. (2010) Plastic Accumulation in the North Atlantic Subtropical Gyre</p> <p>Optional: Xanthos and Walker (2017) International policies to reduce plastic marine pollution from single-use plastics: A review</p>
<p>TCE 33 Coastal Marine Mammals</p> <p>General taxonomy, ecology, and conservation of coastal marine mammals</p>	L	1	
<p>TCE 34 The Effects of Tourism on the Dolphin Population of Bocas: Part 1</p> <p>Threats facing dolphins in Bocas del Toro; field methods used to study bottlenose dolphins</p>	L	1	<p>May-Collorcado. Panacetacea: Protocol for field methods. Read pages 17-26</p> <p>Choice of articles on Bocas' dolphin population (see folder on Z drive)</p>
<p>TCE 35 The Effects of Tourism on the Dolphin Population of Bocas: Part 2</p> <p>Assess the impacts of tourism on the resident population of dolphins in Bocas Del Toro</p>	FEX	1.5	

TCE 36 Sea Turtle Ecology and Threats in Bocas del Toro	GL	1	Meylan et al. (2013). Sea turtles of Bocas del Toro Province and the Comarca Ngobe-Bugle, Republic of Panama
TCE 37 Final Exam	T	2	
TCE 38 Oceanography and Marine Ecology of the Caribbean and Pacific Coasts Differences in physical conditions on the two coasts and the effect on marine life.	L	1	
TCE 39 Pacific Coral Reefs Conduct a snorkel survey to identify new species and assess similarities and differences between marine life on the Caribbean and Pacific coasts	FEX	2	
TCE 40 Pacific Coastal Ecosystems Explore the sandy and rocky intertidal zones of Pacific islands	FEX	1	
Total Hours		67	