THE SCHOOL FOR FIELD STUDIES

Tropical Marine Ecology
SFS 3730

Syllabus
4 credits

The School for Field Studies (SFS)
Center for Marine Resource Studies (CMRS)
South Caicos, Turks and Caicos Islands

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.

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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 they may present. In other words, this is a field program, and the field can change.

Course Overview

Marine ecology is the study of how marine organisms interact with their biotic and abiotic environments. In this course we will focus on the biological processes and trophic webs that exist in the ecosystems that dominate the shallow coastal areas of the tropical western Atlantic, i.e. mangrove forests, seagrass meadows and coral reefs, as well as the behavior and biology of the organisms that inhabit them. Furthermore, we will explore the ways in which Marine Protected Areas, climate change and hurricanes can affect ecological processes, and we will learn some of the practical field data collection techniques that can be employed to assess marine communities.

Learning Objectives

After completing this course, students should:

1. Understand the various levels of ecological organization.

2. Understand the concepts of energy flow and biogeochemical cycling in marine ecosystems.

3. Be able to identify, and understand the ecological importance of, common marine macroalgae, plants, invertebrates and vertebrates in the tropical western Atlantic.

4. Understand the direct and indirect effects of Marine Protected Areas, climate change and hurricanes on marine communities.

5. Be competent in the collection and analysis of field data; in particular, relating to biodiversity and habitat assessment of seagrass meadows and biodiversity and health assessment of corals.

6. Understand how species on the coral reef interact with each other through competition and symbiosis and learn about behaviors of fish and marine invertebrates.

7. Learn the fundamentals of ecological data collection, analysis and writing scientific reports.

Assessment

Students will be assessed in a variety of ways during the Marine Ecology course, including written exams, field quizzes, short reports, documentation of field observation and a popular science article. The written exam at the end of the class accounts for 25% of the final grade, with the remaining 75% being accounted for by field-based activities and participation (see below). The written exam at the end is academically rigorous and will require students to display an in-depth understanding of the material covered in class and the associated readings.

Assessment Item	Value (%)
Participation	5
Mangrove and Seagrass Organisms ID	5
Seagrass FEX	15
Coral Reef Invertebrates and Fishes ID	10
Reading Quizzes	15
Coral and Fish Biodiversity FEX	25
Final Exam	25
TOTAL	**100**

Participation (5%)
Active participation in the entire course is crucial to a successful learning experience. A participation grade will be given assessing students' active participation in class discussions, lectures and field work, as well as attendance/punctuality in lecture and field activities.

Mangrove and Seagrass Organisms ID (5%)
In class, students will be introduced to the taxonomic classification and biological characteristics of local mangrove and seagrass species and their associated macroalgae, invertebrates, and fishes. This briefing will be followed by an in-water observation session, a desk-based taxonomic review session, and an in-water identification quiz (taken individually).

Seagrass FEX (15%)
Students will employ the practical seagrass field techniques that have been covered in class to assess the abundance of seagrass species and macro invertebrates living in the seagrass bed. They will use R Studio to statistically analyze the data they collect and write up the results from their study in a scientific paper style results section. Students will work in groups of 3-4 in the field, and compose a results section based on the data individually.

Coral Reef Invertebrates and Fishes ID (10%)
In class, students will be introduced to the taxonomic classification and trophic characteristics of local corals, other invertebrates and fishes that are common on local reefs. This briefing will be followed by two in-water observation sessions, a desk-based taxonomic review session, and an in-water identification quiz (taken individually).

Reading Quizzes (15%)
Several of the lectures are paired with required readings (see Course Content below). These readings are meant to supplement material covered in class, and to familiarize students with scientific writing. At the start of each lecture with an accompanying reading, a short multiple choice/true false/fill in the blank quiz on the contents of the reading will be administered.

Coral and Fish Biodiversity FEX (25%)
Students will employ the practical coral reef field techniques that have been covered in class to assess the biodiversity of the corals and fishes found on the reefs surrounding South Caicos. They will calculate biodiversity indices and statistically analyze their data. Students will also practice writing a scientific paper style results and discussion sections. Students will work in groups of 2-4 to complete this assessment.

Final Exam (25%)
This is given at the end of the course and is based on the lectures and readings from the entire course. The exam is an open book exam. **PLEASE BE AWARE THAT YOU NEED TO PREPARE FOR YOUR EXAM AS YOU PROGRESS THROUGH THE COURSE.** Sometimes the days before exams can be busy with other course activities/assignments. This is logistically unavoidable, so please ensure that you make full use of the time available earlier in the semester. This graded individually.

Grade corrections in any of the above items should be requested in writing at least 24 hours after assignments are returned. No corrections will be considered afterwards.

Grading Scheme

A	95.00 - 100.00%	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	0.00 - 59.99%
		B-	80.00 - 82.99%	C-	70.00 - 72.99%		

General Reminders

Honor Code/Plagiarism – SFS places high expectations on their students and we hold students accountable for their behaviors. SFS students are held to the honor code below. SFS has a zero-tolerance policy towards student cheating, plagiarism, data falsification, and any other form of dishonest academic and/or research practice or behavior. Unless specifically stated otherwise, all assignments should be individual pieces of work. These assignments should attribute all statements of fact to the original source of that information using proper and consistent in-text citations and reference list. Use of AI is prohibited. Any SFS student found to have engaged in or facilitated academic and/or research dishonesty will receive no credit (0%) for that activity.

> *"SFS does not tolerate cheating or plagiarism in any form. While participating in an SFS program, students are expected to refrain from cheating, plagiarism and any other behavior which would result in a student receiving credit for work which they did not accomplish on their own. Students are expected to report any instance of cheating or plagiarism by others."*

Deadlines – Deadlines for written and oral assignments are instated to promote equity among students and to allow faculty ample time to review and return assignments before others are due. As such, deadlines are firm; extensions will only be considered under extreme circumstances. Late assignments will incur a penalty of 10% of your grade for that assignment for each day late. After two days past the deadline, assignments will no longer be accepted. Grade corrections for any assessment item should be requested in writing at least 24 hours after assignments are returned. No corrections will be considered afterwards.

Content Statement – Every student comes to SFS with unique life experiences, which contribute to the way various information is processed. Some of the content in this course may be intellectually or emotionally challenging but has been intentionally selected to achieve certain learning goals and/or showcase the complexity of many modern issues. If you anticipate a challenge engaging with a certain topic or find that you are struggling with certain discussions, we encourage you to talk about it with faculty, friends, family, the HWM, or access available mental health resources.

Lectures – Lectures and 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 Marine Ecology course folder on SharePoint; however, it is helpful for students to also take notes during lectures.

Readings – Assigned readings will be available on SharePoint. You are expected to be familiar with these readings during the associated lecture; the readings are designed to supplement the lecture content. A quiz on the reading will occur at the beginning of the lecture, and a discussion of the reading may take place during the lecture. You are expected to be familiar with the content of all assigned readings for the written exam.

Participation – Since we offer a program that is likely more intensive than you might be used to at your home institution, missing even one lecture can have a proportionally greater effect on your final grade simply because there is little room to make up for lost time. Participation in all components of the course is mandatory, it is important that you are prompt for all activities, bring the necessary equipment for field exercises and class activities, and simply get involved.

Course Content

Type - L: Lecture, **FEX:** Field Exercise, **T:** Test, **DEX:** Desk Exercise, **P:** Presentation

*Readings in **bold** are required

No	*Title and outline*	*Type*	*Hours*	*Readings*
TME 01	**Course Introduction** Course components, assessments and dates, expectations and some basic scientific concepts.	L	0.75	
TME 02	**Diversity of Marine Life** The organization of life, nomenclature, characteristics and ecological roles of common marine taxa.	L	1.25	Castro et al., 2008
TME 03	**Marine Field Exercise** In-water observations of common marine taxa.	FEX	2.0	
TME 04	**Mangrove Biology** Global distribution, environmental challenges, reproduction and dispersal of mangroves.	L	1.0	**Romañach et al., 2018**
TME 05	**Mangrove Communities, Forest Structure & Nutrients** Classification schemes, forest zonation, inorganic nutrients, nutrient recycling and limitation of mangles. Community zonation, epibiota, below- and above-water mobile fauna and species interactions around mangroves.	L	1.0	
TME 06	**Conch, Lobster, Grouper Biology** Taxonomy, distribution and habitat requirements, anatomy, feeding, reproduction and growth of three species important to the history, economy and culture of the TCI.	L	1.5	
TME 07	**Mangrove and Seagrass Organism ID Slideshow** Introduction to the taxonomic characteristics of mangroves and associated organisms.	L	1.5	
TME 08	**Mangrove and Seagrass Organism ID FEX** In-water identification of seagrass, mangroves and associated organisms.	FEX	1.0	
TME 09	**Mangrove and Seagrass Organisms ID DEX** In-class ID of organisms photographed during ID FEX.	DEX	1.0	
TME 10	**Seagrass Biology** The global distribution, anatomy, growth, habitat, photosynthetic adaptations and reproduction of seagrasses.	L	1.0	
TME 11	**Seagrass Communities** Epibiota, mobile fauna and species interactions in seagrass beds.	L	1.0	**Unsworth et al., 2015**

No	*Title and outline*	*Type*	*Hours*	*Readings*
TME 12	**Mangrove and Seagrass Organisms ID quiz** In-water species identification quiz.	T	1.0	
TME 13	**Seagrass Research Methods and FEX dry run** Overview of seagrass research methods and on-land practice of methods used later in the field	L	2.0	
TME 14	**Seagrass FEX** In-water assessment of seagrass and associated organism abundance.	FEX	4.0	
TME 15	**Ecological Impacts of MPAs** Direct and indirect effects of Marine Protected Areas	L	1.0	**Kleitou et al., 2024**
TME 16	**Coral Biology** Global distribution, taxonomy, anatomy, growth, reproduction, feeding, nutrients, aggression and defense of corals.	L	1.0	
TME 17	**Coral Reef Invertebrates ID Slideshow** Introduction to the taxonomy and biological characteristics of corals and other reef-associated invertebrates.	L	1.0	
TME 18	**Seagrass field exercise DEX** Instructional PowerPoint and time allocated to work on Seagrass FEX short report.	L & DEX	1.0	
TME 19	**Coral Reef Invertebrates ID FEX** In-water identification of corals and associated organisms.	FEX	1.0	
TME 20	**Coral Reef Invertebrates ID DEX** In-class ID of organisms photographed during FEX.	DEX	1.0	
TME 21	**Coral Reef Fish ID Slideshow** Introduction to the taxonomic characteristics of reef-associated fish.	L	1.5	
TME 22	**Coral Reef Fish Field ID FEX** In-water identification of reef-associated fishes.	FEX	1.0	
TME 23	**Coral Reef Fish Field ID DEX** In-class identification of fishes photographed during FEX.	DEX	1.0	
TME 24	**Coral Reef Formation and Structure** Reef classification, zonation, constituents and growth. Types of calcium carbonate and factors limiting reef formation.	L	1.0	
TME 25	**Coral Reef Communities** Reef fishes, algae, sponges and other invertebrates and their interactions with each other.	L	1.0	**Gouezo et al., 2019**
TME 26	**Octopus Biology and Ecology** An in-depth overview of octopus anatomy, biology, behavior and ecology.	L	1.5	
TME 27	**Coral Reef Invertebrates and Fishes ID Quiz** In-water species identification quiz.	T	1.0	

No	*Title and outline*	*Type*	*Hours*	*Readings*
TME 28	**Effects of Climate Change and Hurricanes on Marine Ecosystems** The effects of a changing climate on mangroves, seagrass, coral reefs and the abiotic properties of marine ecosystems.	L	1.0	**Gardner et al., 2005; Hoegh-Guldberg & Bruno 2010**
TME 29	**Mangrove-Seagrass-Coral Connectivity** Biogeochemical and ecological among the three marine ecosystems examined in this course.	L	1.0	**Mumby et al., 2004**
TME 30	**Predation and Defense in Marine Organisms** A broad overview of hunting strategies and methods of predator evasion in marine organisms.	L	2.0	**Bshary et al., 2006; Matchette et al., 2023**
TME 31	**Reproductiveand Life History Strategies in Marine Organisms** A broad overview of behaviors associated with mating, egg laying and parental care in marine organisms.	L	1.0	
TME 32	**Symbiosis and competition in Marine Organisms** Mutualism, commensalism, parasitism, competition and co-evolution of the organisms inhabiting coral reefs and other marine ecosystems.	L	1.75	**Munday et al., 2006**
TME 33	**Coral and Fish Biodiversity FEX briefing and dry run** Briefing on field exercise and short report writing and an on-land practice of survey.	L	1.75	
TME 34	**Coral and Fish Biodiversity FEX** In-water assessment of Biodiversity abundance.	FEX	3.0	
TME 35	**Biodiversity indexes and FEX report** Introduction to Biodiversity indexes as a measure of biodiversity and statistical analysis of biodiversity in relation to depth, site and organism type.	L	1.0	
TME 36	**Coral and Fish Biodiversity report DEX** Time allocated to work on Biodiversity FEX short report.	DEX	0.0	
TME 37	**Tropical Marine Ecosystem Resilience, Rehabilitation and Recovery** Exploration of tropical marine ecosystems' natural resilience, and anthropogenic efforts to protect and restore them.	L	1.5	**Duarte et al., 2020**
TME 38	**Exam review** An overview of exam format and time for questions.	L	1.0	
TME 40	**Exam Debrief & Course Wrap-up** Explanation of exam answers and highlighting of common mistakes. In class discussion of course contents.	L	1.0	
	Total		50	
	UMN Instructional Hours		60	

**UMN defines an instructional hour as a 50-minute block. SFS syllabi are written in full 60-minute hours for programming purposes. Therefore 50 full hours = 60 UMN instructional hours (for four credit courses) and 25 full hours = 30 UMN instructional hours (for two credit courses).*

Reading List

*Readings in **bold** are required

1. **Bshary, R., Hohner, A., Ait-el-Djoudi, K., & Fricke, H. (2006).** Interspecific communicative and coordinated hunting between groupers and giant moray eels in the Red Sea. PLoS biology, 4(12), e431

2. Castro, P., & Huber, M. E. (2008). Marine Biology, 7th edition: Chapters 5 - 9. This reading is optional but strongly recommended, particularly for students who do not have a strong biological background.

3. **Duarte, C. M., Agusti, S., Barbier, E., Britten, G. L., Castilla, J. C., Gattuso, J. P., ... & Worm, B. (2020).** Rebuilding marine life. Nature, 580(7801), 39-51.

4. **Gardner, T. A., Cote, I. M., Gill, J. A., Grant, A., & Watkinson, A. R. (2005).** Hurricanes and Caribbean coral reefs: impacts, recovery patterns, and role in long-term decline. Ecology, 86(1), 174-184.

5. **Gouezo, M., Golbuu, Y., Fabricius, K., Olsudong, D., Mereb, G., Nestor, V., ... & Doropoulos, C. (2019).** Drivers of recovery and reassembly of coral reef communities. Proceedings of the Royal Society B, 286(1897), 20182908.

6. **Hoegh-Guldberg, O., & Bruno, J. F. (2010).** The impact of climate change on the world's marine ecosystems. Science, 328(5985), 1523-1528.

7. **Kleitou, P., Rees, S.E., Kletou, D., Harris, H.E., Cai, L.L., Green, S., Hadjioannou, L., Savva, I., Giovos, I., Jimenez, C. and Hall-Spencer, J.M. (2024).** Marine protected areas can increase the abundance of invasive lionfish (Pterois miles). Conservation Science and Practice, p.e13147.

8. **Matchette, S. R., Drerup, C., Davison, I. K., Simpson, S. D., Radford, A. N., & Herbert-Read, J. E. (2023).** Predatory trumpetfish conceal themselves from their prey by swimming alongside other fish. Current Biology, 33(15), R801-R802.

9. **Mumby, P. J., Edwards, A. J., Arias-González, J. E., Lindeman, K. C., Blackwell, P. G., Gall, A., & Wabnitz, C. C. (2004).** Mangroves enhance the biomass of coral reef fish communities in the Caribbean. Nature, 427(6974), 533.

10. **Munday, P. L., Wilson White, J., & Warner, R. R. (2006).** A social basis for the development of primary males in a sex-changing fish. Proceedings of the Royal Society B: Biological Sciences, 273(1603), 2845-2851.

11. **Romañach, S. S., DeAngelis, D. L., Koh, H. L., Li, Y., Teh, S. Y., Barizan, R. S. R., & Zhai, L. (2018).** Conservation and restoration of mangroves: Global status, perspectives, and prognosis. Ocean & Coastal Management, 154, 72-82.

12. **Unsworth, R. K., Collier, C. J., Waycott, M., Mckenzie, L. J., & Cullen-Unsworth, L. C. (2015).** A framework for the resilience of seagrass ecosystems. Marine pollution bulletin, 100(1), 34-46.