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
Symbiosis and Competition FEX	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.

Mangrove and Seagrass Organisms ID (5%)
In class, students will be introduced to the taxonomic classification and trophic 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).

Symbiosis and Competition FEX (15%)
Students will employ the knowledge gained on fish behavior, competition and symbiosis on the coral reef to identify and document symbiotic and competitive interactions in the field. As a buddy group (2-3 people) they will film instances of these behaviors in the field, and individually compose an Instagram post around one of them.

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 and health of the corals found on the coral reefs surrounding South Caicos. They will calculate biodiversity indexes and statistically analyze their data. Students write a scientific-style paper with results and discussion sections. Students will work in small groups 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

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 important to note that these slides only contain key points and illustrations; it is helpful for students to also take notes during lectures.

Peer Evaluation – A major part of research, be it the humanities or science, requires collaborative work. In this course, you will be required to evaluate your classmates on all collaborative work. This peer evaluation will form part of your final grade for group assignments. Acquiring the ability to evaluate project partners honestly and constructively is essential to your future career paths.

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 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.

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 assigned to anyone caught cheating or aiding another person to cheat, either actively or passively (e.g., allowing someone to look at your exam or report). 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.

Appropriate use of technology - SFS has worked hard to provide internet access to all its staff and students. Inappropriate uses include gaming or video/music downloading. Laptops/tablets are permitted in lectures for the sole purpose of note taking. Any inappropriate use (e.g. accessing the internet, working on assignments, gaming etc.) will result in this privilege being withdrawn. Cellphones are not permitted in lectures.

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 at least a 10% penalty (depending on how late it is). Assignments will be handed back to students after a one-week grading period.

Participation – Participation in all components of the program is mandatory, as there will be no spare time to catch up on any missed classes. Missing even one lecture or discussion can significantly affect the experience you and your classmates have while at CMRS. Within our teaching environment, there is no reason to miss classes. You will get as much out of this course as you put into it, so please dive in. In all circumstances, we expect you to respect yourself and your fellow students. Dissent and discord are expected, but disrespect will not be tolerated.

Course Content

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

No	*Title and outline*	*Type*	*Hours*	*Readings*
TME 01	**Course Introduction** Course components, assessments and dates, expectations, and some basic ecological concepts.	L	1.0	
TME 02	**Diversity of Marine Life** The organization of life, taxonomic nomenclature and characteristics and ecological roles of common marine taxa.	L	1.0	Castro, P., & Huber, M. E. (2008).
TME 03	**Marine Life Field Exercise** In-water observations of common marine taxa.	FEX	4.0	
TME 04	**Mangrove and Seagrass Organisms ID Slideshow** Introduction to the taxonomic characteristics of mangroves and associated organisms.	L	1.0	
TME 05	**Mangrove and Seagrass Organisms Field ID FEX** In-water identification of mangroves and associated organisms.	FEX	2.0	
TME 06	**Mangrove and Seagrass Organisms ID DEX** In-class identification of organisms photographed during FEX.	DEX	1.0	
TME 07	**Seagrass Biology** Global distribution, anatomy, growth, habitat, photosynthetic adaptations and reproduction of seagrasses.	L	1.0	
TME 08	**Seagrass Communities** Epibiota, mobile fauna and species interactions in seagrass beds.	L	1.0	Unsworth, R. K., et al. (2015).
TME 09	**Mangrove Biology** Global distribution, environmental challenges, reproduction, and dispersal of mangroves.	L	1.0	Romañach, S., et al. (2018).
TME 10	**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	1.0	
TME 11	**Mangrove and Seagrass Organisms ID Quiz** In-water species identification quiz.	T	1.0	
TME 12	**Seagrass Research Methods and FEX dry run** Overview of seagrass research methods and on-land practice time of methods use later in the field.	L	2.0	
TME 13	**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	

No	Title and outline	Type	Hours	Readings
TME 14	**Seagrass FEX** In-water assessment of seagrass abundance.	FEX	4.0	
TME 15	**Seagrass DEX** Time allocated to work on Seagrass FEX short report.	DEX	1.0	
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 taxonomic characteristics of corals and other reef-associated invertebrates.	L	1.0	
TME 18	**Coral Reef Invertebrates ID FEX** In-water identification of corals and associated organisms.	FEX	2.0	
TME 19	**Coral Reef Invertebrates ID DEX** In-class identification of organisms photographed during FEX.	DEX	1.0	
TME 20	**Coral Reef Formation and Structure** Reef classification, zonation, constituents, and growth. Types of calcium carbonate and factors limiting reef formation.	L	2.0	
TME 21	**Coral reef communities** Reef fishes, algae, sponges and other invertebrates and their interactions with each other.	L	1.0	Gouezo, M. et al. (2019)
TME 22	**Coral Reef Fish ID Slideshow** Introduction to the taxonomic characteristics of reef-associated fish.	L	1.0	
TME 23	**Coral Reef Fish Field ID FEX** In-water identification of reef-associated fishes.	FEX	2.0	
TME 24	**Coral Reef Fish Field ID DEX** In-class identification of fishes photographed during FEX.	DEX	1.0	
TME 25	**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, T. A., et al. (2005) Hoegh-Guldberg, O., & Bruno, J. F. (2010).
TME 26	**Coral Reef Invertebrates and Fishes ID Quiz** In-water species identification quiz.	T	1.0	
TME 27	**Mangrove-Seagrass-Coral Connectivity** Biogeochemical and ecological among the three marine ecosystems examined in this course.	L	1.0	Mumby, P. J., et al. (2004).
TME 28	**Octopus Biology and Ecology** An in-depth overview of octopus anatomy, biology, behavior, and ecology.	**L**	1.0	O'Brien, C.E., et al. (2019). Doubleday, Z. A., et al. (2016).

No	*Title and outline*	*Type*	*Hours*	*Readings*
TME 29	**Ecological Impacts of MPAs** Direct and indirect effects of Marine Protected Areas (MPAs).	L	1.0	Sala, E., et al. (2021).
TME 30	**Reef Organism Behavior** Reproduction, cleaning stations, feeding and competition among reef fishes.	L	2.0	
TME 31	**Symbiosis and competition on coral reefs** Symbiosis, parasitism, competition and co-evolution of the organisms inhabiting coral reefs.	L	2.0	Bshary, R., et al. (2006). Munday, P. L., et al. (2006).
TME 32	**Symbiosis and competition FEX** In water observation and filming of examples of symbiosis and competition.	FEX	2.0	
TME 33	**Symbiosis and competition DEX** In water observation and filming of examples of symbiosis and competition	DEX	1.0	
TME 34	**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	2.0	
TME 35	**Coral and Fish Biodiversity FEX** In-water assessment of Biodiversity abundance.	FEX	6.0	
TME 36	**Biodiversity indexes and Biodiversity 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 37	**Coral and Fish Biodiversity report DEX** Time allocated to work on Biodiversity FEX short report.	DEX	1.0	
TME 38	**Exam Review**	L	1.0	
TME 39	**Exam** Open book exam covering the entire course's content.	T	2.0	
TME 40	**Exam Debrief & Discussion of ways anthropogenic change might be mitigated.** Explanation of exam answers and highlighting of common mistakes and misconceptions. Discussion of topics covered in Duarte et al., 2020.	L	1.0	Duarte, C. M., et al. (2020).
	Total Hours		**61**	

Reading List

Readings

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.
3. Doubleday, Z. A., Prowse, T. A., Arkhipkin, A., Pierce, G. J., Semmens, J., Steer, M., ... & Gillanders, B. M. (2016). Global proliferation of cephalopods. Current Biology, 26(10), R406-R407.
4. 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.
5. 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.
6. 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.
7. Hoegh-Guldberg, O., & Bruno, J. F. (2010). The impact of climate change on the world's marine ecosystems. Science, 328(5985), 1523-1528.
8. 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.
9. 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.
10. O'Brien, C.E., Ponte, G., & Fiorito, G. (2019). Octopus.
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. Sala, E., Mayorga, J., Bradley, D., Cabral, R. B., Atwood, T. B., Auber, A., ... & Lubchenco, J. (2021). Protecting the global ocean for biodiversity, food and climate. Nature, 592(7854), 397-402.
13. 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.

ID Reference books (in classroom):

1. Humann, P., & Deloach, N. (1994). Reef Coral Identification. Paramount Miller Graphics.
2. Humann, P., Deloach, N., & Wilk, L. (2002). Reef Creature Identification: Florida, Caribbean, Bahamas.
3. Humann, P., Deloach, N., & Wilk, L. (2002). Reef Fish Identification: Florida, Caribbean, Bahamas.
4. Kaplan, E. H. (1999). A field guide to southeastern and Caribbean seashores: Cape Hatteras to the Gulf coast, Florida, and the Caribbean (Vol. 36). Houghton Mifflin Harcourt.
5. Littler, D. S., Littler, M. M., Bucher, K. E., & Norris, J. N. (1989). Marine plants of the Caribbean; a field guide from Florida to Brazil. Smithsonian Institution Press.