THE SCHOOL FOR FIELD STUDIES

Tropical Marine Ecosystems: Monitoring and Management
SFS 3530

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

The Turks and Caicos Islands (TCI) advertises itself to tourists as "Beautiful by Nature." Indeed, the tourism that the country's economy is heavily dependent on is driven by its stunning marine environment, which is characterized by extensive coral reefs, seagrass meadows and mangrove forests. However, the health of these ecosystems, and therefore the "Beautiful by Nature" motto, is under threat. At the local level, unsustainable and damaging fishing practices, increased water-based recreational activities, and coastal development are potentially major sources of disturbance. Furthermore, the ocean impacts of global climate change or pollution will continue to negatively affect marine organisms and ecosystem processes, adding an additional layer of complexity to the problem.

Tropical Marine Ecosystems - Monitoring and Management is an interdisciplinary four-week summer course that highlights the ecological characteristics and current threats to coastal ecosystems, in addition to exploring existing and potential environmental management approaches that would encourage the sustainable development of small island nations such as the TCI. Course participants will gain knowledge of tropical marine ecosystem function and connectivity and will be introduced to the most pressing threats at the intersection of marine conservation and economic development.

The course has two main themes:

Marine Ecosystem Ecology and Monitoring

Students will be introduced to the ecological characteristics of coral reefs, seagrass meadows and mangrove forests, including the biology of key organisms in each. The numerous ways in which these ecosystems are inter-connected and inter-dependent will also be discussed. This will be followed by an exploration of the multiple anthropogenic threats that the ecosystems face, including hurricanes, pollution, and climate change. Students will learn different techniques to monitor the health of these marine ecosystems.

Marine Ecosystem Management

After introducing students to the ecology and threats to the Turks and Caicos Islands marine ecosystems, a broader context of managing these ecosystems will be introduced. The class will examine management and advisory bodies of these ecosystems; how marine protected areas can be a tool for conservation and the impacts of these tools; engage stakeholders with design and implementation of management plans.

Both themes will be analyzed and discussed during lectures, discussions, workshops and exercises. Students will spend time snorkeling and/or diving (diving not mandatory to participate in the course) in mangrove, seagrass, and coral reef environments. Material taught in class and learned in the field will be assessed through a variety of assignments and a final exam.

Learning Objectives

1. Gain a baseline understanding of coastal tropical marine ecosystems, their ecology, connectivity, ecosystem goods and services, and threats to their future good health.
2. Recognize and identify a broad range of organisms that characterize these ecosystems in the tropical northwestern Atlantic.
3. Develop skills, both in and out of water, to monitor the health and conservation status of tropical marine ecosystems.
4. Gain an understanding of international and local management approaches that affect the conservation status of tropical marine ecosystems.

Assessment

Students will participate in several field exercises to view and identify the organisms that characterize coral reef, seagrass and mangrove ecosystems. Students will practice different monitoring techniques used in these ecosystems. Students will also take part in field exercises and workshops that allow them to live the stakeholder experience and monitor the effectiveness of our marine protected areas. In addition, students will be responsible for reports and data management.

Assessment Item	Value (%)
ID Field Notebook	15
ID Quiz	15
Conch FEX Poster	15
Biodiversity FEX Report	15
Reading Quizzes	10
Stakeholder Debate	20
Participation/Peer Evaluations	10
TOTAL	**100**

ID Field Notebook (15%)

The purpose of this assignment is to create a comprehensive field notebook documenting marine species found in the Turks and Caicos Islands. Your field notebook will serve as a natural history guide, recording observations of various marine organisms including seagrass, mangroves, fish, corals, and other invertebrates. This assignment will help you develop skills in species identification, observation, documentation, and ecological understanding.

ID Quiz (15%)

In class, students will be introduced to the taxonomic classification and trophic characteristics of local fish, coral and species living in mangroves and seagrass beds. The briefings will be followed by an in-water observation session, a desk-based taxonomic review session, and an identification quiz.

Conch FEX Poster (15%)

During this field exercise, the students will work in groups to employ visual survey methods outlined during the lectures to collect data on the size & age structure of the queen conch (Aliger gigas) population according to habitat type both inside and outside a Marine Protected Area (MPA). The second objective of the field exercise is to enhance student ability to analyze data and produce an accurate and coherent scientific poster. You will be working as partners (groups of two). Students will be assessed based on their ability to create a scientific poster in a coherent and logical way, as well as data entry and management.

Biodiversity FEX Report (15%)

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 will also practice writing scientific paper style results and discussion sections. Students will work in groups of two to complete this assessment.

Reading Quizzes (10%)

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 and reading quizzes will be given for all of the readings.

Stakeholder Debate (20%)

This assessment requires no prior preparation. On June 28th, students will be given a fictitious land or marine use scenario and assigned a stakeholder. Students will then come up with a position on their scenario from the perspective of their assigned stakeholder and debate with other stakeholders. Students will be marked on how persuasive they are in pursuing stakeholder interests and how they strategize and position themselves with reference to other stakeholders.

Participation/Peer Evaluations (10%)

Active participation in the entire course is crucial to a successful learning experience. A participation grade will be given assessing the active participation in the reading discussion, lectures, and field work. In addition, a major part of research, be it the humanities or science, requires collaborative work. In this course, you will be working on many group projects, presentations, and writing. You will be required to evaluate your classmates on all collaborative work. This peer evaluation will form part of your final grade. Acquiring the ability and skillset to evaluate each other honestly and constructively is essential to your future career paths.

Grading Scheme

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.

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 and Misconduct – 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*. Using the ideas or material of others without giving due credit is cheating and will not be tolerated. 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 each day you are late. After two days past the deadline, assignments will no longer be accepted without prior permission from faculty.

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 etc) will result in this privilege being withdrawn. Cellphones are not permitted in lectures.

Readings – You are expected to have read all the assigned readings prior to each class. Assigned readings will be available on the student server. Anything contained in the readings is fair game for the exams. You may read some things you don't agree with, but that is part of being a scholar.

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.

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.

Course Content

Type- L: Lecture, **FEX:** Field Exercise, **DEX:** Desk Exercise, **D:** Discussion/Documentary

***Required readings are in bold**

Code	*Title and Outline*	*Type*	*Hours*	*Readings*
WMC 1	**Course Introduction – SFS teaching and research** Outline of the summer program at CMRS including an introduction to course structure and expectations	L	1.0	
WMC 2	**History of the Turks and Caicos Islands** Students will be exposed to the Turks and Caicos Islands history, including the past industries that have fallen, the current status of the economy and the evolution of TCI government. We will begin with time prior to Columbus "landfall", eras of slavery and finish with the current situation in South Caicos.	FEX	1.0	**Sadler, H. E. (1997).** **Mills, C (Ed.). (2008).**
WMC 3	**Marine Resource Overview and History** A brief history of fishing & humanity's association with the sea with regards to fishing and fish survey gears. We will also explore the concept of the "Shifting Baseline Syndrome."	FEX	1.0	**Plumeridge & Roberts (2017)**.

WMC 4	**Marine Field Exercise** In-water observations of common marine taxa and an introduction to the Field ID Field Notebook.	FEX	2.0	
WMC 5	**Marine Conservation and Socio-Ecological Issues** We will explore the different topics covered in the documentary *Seaspiracy*, as well as critically examine the information presented in the film.	D	3.0	
WMC 6	**Mangrove and Seagrass Communities ID slide Show** Taxonomic and trophic characteristics of the plants, macroalgae and invertebrates that characterize mangrove and seagrass ecosystems.	L	1.0	*Reference Book:* Littler et al. (1999). Marine plants of the Caribbean.
WMC 7	**Mangrove Biology and Ecology** An intro to the biology of mangrove trees and their adaptations for life in the marine environment as well as epibiota, below- and above-water mobile fauna and species interactions around mangroves.	L	1.0	**Romañach et al., (2018).**
WMC 8	**Seagrass Biology and Ecology** An intro to the biology of seagrasses and their adaptations for life in the marine environment, as well as epibiota, mobile fauna and species interactions in seagrass beds.	L	1.0	**Unsworth, et al. (2015)**.
WMC 9	**Mangrove and Seagrass Communities FEX** In-water identification of organisms covered during SME05. Snorkeling required.	FEX	1.0	
WMC 10	**Mangrove & Seagrass ID DEX** Review of organisms found and ID'd during the FEX	DEX		
WMC 11	**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	
WMC 12	**Coral Reef Biology & Ecology** An introduction to the biology of corals and the ecological characteristics of coral reefs as well as reef fishes, algae, sponges and other invertebrates and their interactions with each other.	L	1.0	**Gouezo, et al. (2019)**.
WMC 13	**Reef Organism ID slideshow** Taxonomic and trophic characteristics of reef fish and invertebrates.	L	1.0	*Reference book:* Humann and DeLoach (2013). Reef fish ID.
WMC 14	**Reef Organism ID FEX** In-water identification of fishes covered during SME13. Snorkeling required.	FEX	1.0	
WMC 15	**Reef Organism ID DEX** Desk-based review of the organisms from field ID session	DEX	1.0	

WMC 16	**TCI Conch Fisheries** An overview on TCI conch fishery status, regulations, and management strategies.	L	1.0	**Ulman, et al. (2016).** Lockhart, et al. (2007).
WMC 17	**TCI Lobster Fisheries** An overview on TCI Lobster fishery status, regulations, and management strategies.	L	1.0	
WMC 18	**Introduction to MPAs and Fisheries Impacts** Management of entire ecosystems is difficult with a variety of needs and uses by multi-users. Often Marine Protected Areas are tools that can assist with the management of differing ecosystems. This lecture will introduce what MPAs are and how they can be designed and used as a management tool.	L	1.0	Grorud-Colvert et al. (2021).
WMC 19	**Ecological Impacts of MPAs** What ecological changes take place within a Marine Protected Area, and can these changes lead to benefits for fisheries beyond the boundaries of the MPA?	L	1.0	**Sala, et al. (2021).**
WMC 20	**Social and Economic Impact of MPAs** Impacts of MPAs on humans.	L	1.0	**West, et al. (2006).** **Casola, et al. (2022).**
WMC 21	**Introduction to Conch FEX** This briefing will introduce the students to the underwater survey method often used for assessment of different species, habitat and substrate. This exercise will introduce students to data collection to assess abundance, size-class, habitat use, and overall habitat availability for the Queen conch (*Aliger gigas*).	L	1.0	
WMC 22	**Conch FEX** A field activity involving the underwater visual assessment of the Queen conch both inside and outside an MPA. Included will be specific measurement of size and age structure, habitat coverage and overall abundance.	FEX	8.0	
WMC 23	**Introduction to Fisheries Management** This is a desktop exercise where we will explore fisheries management practices and policy effectiveness on fisheries.	DEX	2.0	
WMC 24	**ID Quiz** A field-based test that will require students to scientifically identify the species learned during mangrove and seagrass, coral invertebrate and reef fish ID slide shows and FEX.	FEX	2.0	

WMC 25	**Conch FEX Analysis and Write Up** A briefing on data analysis and poster creation and expectations. Data collected during the Conch FEX will be analyzed and a scientific poster prepared.	DEX	1.0	
WMC 26	**Impacts of Climate Change on Fisheries** A look at the causes of climate change; impacts of temperature change; the process and effects of ocean acidification on marine systems and fisheries.	L	1.0	**Lam, et al. (2020).**
WMC 27	**Impacts of Hurricanes on Fisheries** We will consider how hurricanes impact fisheries and other marine species as well as human livelihoods.	L	1.0	
WMC 28	**Biodiversity FEX briefing and dry run** Briefing on field exercise and on-land practice of survey.	L	2.0	
WMC 29	**Biodiversity FEX** In-water assessment of biodiversity abundance.	FEX	3.0	
WMC 30	**Biodiversity DEX** Introduction to Biodiversity indices as a measure of biodiversity, scientific report writing, and time allocated to work on the Biodiversity Report.	DEX	1.0	
WMC 31	**Ecosystem Connectivity** The biogeochemical and ecological linkages between coral reefs, seagrass meadows and mangroves.	L	1.0	**Mumby, et al. (2004).**
WMC 32	**Restoration and Rehabilitation** The degradation of coastal and marine habitat due to human activity and, to a lesser extent, natural events, is pervasive and has direct and measurable effects on marine ecosystem communities and processes. Restoration ecology seeks to mitigate anthropogenic biological and physical degradation by restoring impacted habitats. We review restoration and rehabilitation practices.	L	1.0	**Duarte, et al. (2020).**
WMC 33	**Stakeholder Mock Debate** This stakeholder negotiation simulation will demonstrate the politics, values, power differentials, and knowledge involved in developing marine protected areas in developing countries.	DEX	4.0	
	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

***Required readings are in bold**

1. **Casola et al., (2022).** Drivers of long-term support for marine protected areas in The Bahamas. Ocean & Coastal Management, 217, 106000.
2. **Duarte et al., (2020).** Rebuilding marine life. Nature, 580(7801), 39-51.
3. **Gouezo et al., (2019)**. Drivers of recovery and reassembly of coral reef communities. Proceedings of the Royal Society B, 286(1897), 20182908.
4. Grorud-Colvert et al., 2021. The MPA Guide: A framework to achieve global goals for the ocean. Science, 373(6560), eabf0861.
5. **Lam et al., (2020).** Climate change, tropical fisheries and prospects for sustainable development. Nature Reviews Earth & Environment, 1(9), 440-454.
6. Lockhart et al., (2007). Fisheries of the Turks and Caicos Islands: Status and Threats. GCFI 58: 67-72
7. **Mills, C (Ed.). (2008).** A History of the Turks and Caicos Islands. Macmillan: Oxford. Chapter 1; 10-13, 16; 25.
8. **Mumby et al., (2004).** Mangroves enhance the biomass of coral reef fish communities in the Caribbean. Nature, 427(6974), 533.
9. **Plumeridge, A. A., & Roberts, C. M. (2017).** Conservation targets in marine protected area management suffer from shifting baseline syndrome: A case study on the Dogger Bank. Marine pollution bulletin, 116(1-2), 395-404.
10. Reference book: Humann and DeLoach (2013). Reef fish identification.
11. Reference Book: Littler et al. (1999). Marine plants of the Caribbean.
12. **Romañach et al., (2018).** Conservation and restoration of mangroves: Global status, perspectives, and prognosis. Ocean & Coastal Management, 154, 72-82.
13. **Sadler, H. E. (1997).** Turks Islands Landfall: A History of the Turks and Caicos Islands. United Cooperative Printers Ltd: Kingston. p. 96-101; 132-151; 259-264.
14. **Sala et al., (2021).** Protecting the global ocean for biodiversity, food and climate. Nature, 592(7854), 397-402.
15. **Ulman et al., (2016).** Conched out: Total reconstructed fisheries catches for the Turks and Caicos Islands uncover unsustainable resource usage. Frontiers in marine Science 3:71
16. **Unsworth et al., (2015).** A framework for the resilience of seagrass ecosystems. Marine pollution bulletin, 100(1), 34-46.
17. **West et al., (2006).** Parks and peoples: the social impact of protected areas. Annu. Rev. Anthropol., 35, 251-277.