



S F S THE SCHOOL
FOR FIELD STUDIES

Marine Fauna: Ecology and Conservation

SFS 3131

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

This course covers a variety of organisms that play critical roles in marine ecosystems. These organisms often exhibit specific ecological traits, such as habitat specialization and distinct behavioral responses to environmental and human-driven changes. Many species are highly vulnerable to anthropogenic impacts, such as overfishing, ecotourism and threats to their habitat, as well as their slow population recovery rates. Understanding the current status of their populations and habitats is vital for their conservation and management.

In this four-week summer course, we will explore the ecological importance and conservation status of fauna that are prominent in the coastal waters of the tropical Atlantic, namely elasmobranchs (sharks and rays), oceanic and reef fishes, sea turtles, and corals. The course will consist of lectures and field-based activities that provide students with an understanding of the diversity and ecological characteristics of these animals. Furthermore, the field activities will introduce students to the practical techniques that are commonly employed to study and assess marine fauna, which is transferable to other species in different ecosystems and useful for students' future career.

The course will take place at the Center for Marine Resource Studies on South Caicos, Turks and Caicos Islands (TCI), which is at a pivotal time in its development. Until recently, the island's economy centered around small-scale local fisheries, but a growing tourism industry and recent devastation from Hurricanes Irma and Maria have meant major changes to the community and marine ecosystem. As climate events continue to perturb the marine environment and the economy and the population grow and diversify, so too do the demands on the marine environment. Marine fauna play important roles in the TCI, both ecologically and economically, making this the perfect place to take a deep dive into their characteristics, threats, and conservation.



A spotted eagle ray (*Aetobatus narinari*) near shallow reefs of South Caicos Island

Learning Objectives

After completing this course, students should be able to:

1. Describe the trophic position, ecological niches and inherent biological traits of marine fauna.
2. Understand patterns of marine biodiversity and the impact of anthropogenic and environmental pressures on species distribution.
3. Competently and safely collect biological data in the field by applying a variety of sampling approaches.
4. Critically evaluate, analyze, interpret, summarize and present field data for specialist and non-specialist audiences.

Assessment

Students will be assessed through a combination of a final exam, an informational video, a popular science article, a scientific poster, and a research article. Each of these assessments is designed to evaluate different skills and areas of knowledge. The informational video will require students to effectively communicate complex concepts in an engaging and visually appealing format. The popular science article will test their ability to explain scientific ideas to a general audience in a clear and accessible manner. The scientific poster will challenge students to distill their research findings into a concise, visually oriented presentation, showcasing their ability to highlight key information and use visual aids effectively. The research article will demand a high level of technical writing, requiring students to present their data and analyses in a structured and scholarly format. Proficiency in word processing software (e.g., Microsoft Word,) and spreadsheet software (e.g., Microsoft Excel) will be beneficial for creating and formatting these written reports.

Assessment Item	Value (%)
Ecotourism	20
Biodiversity	20
BRUVs	20
Tag and Release	20
Final Exam	20
TOTAL	100

Ecotourism (20%)

In this advanced field exercise, students will delve into the intricate dynamics between ecotourism and animal behavior through the innovative use of drones. As participants snorkel in the captivating marine environment, drones will meticulously observe and record their interactions with southern stingrays, sharks, and turtles from an aerial perspective. By employing analytical tools such as Image J, students will quantitatively assess various behavioral parameters including angle of approach and flight distance, shedding light on the potential impacts of ecotourism on these marine species. Subsequently, students will articulate their insights and findings in preparing an informational video, fostering critical thinking and scientific communication skills essential for future endeavors in marine conservation and research.

Biodiversity assessment (20%)

During this exercise, students will be conducting underwater transect surveys to assess coral and fish biodiversity on the reefs of South Caicos using both snorkel and SCUBA methods. This study aims to determine the relationship between coral diversity, fish diversity, and reef depth by surveying multiple transects at varying depths. Through this in-situ assessment, we will practice biodiversity quantification

techniques and enhance our understanding of reef ecosystems. The findings will be synthesized into a popular science article that highlights the ecological importance of the eastern Caicos Bank and its role in the spatial ecology of marine species.

Baited Remote Underwater Video Stations (20%)

Baited Remote Video Stations or 'BRUVS' have become an important tool in assessing the abundance and diversity of predatory marine animals. Baited cannisters attract predators from the surrounding area, and their interaction with the bait is recorded on underwater cameras, allowing researchers to document what species are present. In this exercise, students will employ BRUVS to compare predator species assemblages inside and outside the Admiral Cockburn Land and Sea National Park (ACLSNP), one of the marine reserves adjacent to South Caicos. Students will also be introduced to the techniques commonly used by researchers to quantify and compare biodiversity between study sites. The assessment for this exercise is a group scientific poster, similar to those presented by researchers at scientific meetings.

Tag and Release (20%)

One of the oldest but still most common approaches to understanding the movement patterns and habitat use of marine animals is to mark individuals in some way, facilitating their identification during future encounters. This usually entails attaching a numbered tag to the animal, giving it a unique ID. In this exercise, students will use baited drumlines to capture juvenile lemon sharks in a nearby nursery area, collect biological information from them, and tag them with Passive Integrated Transponder (PIT) tags. By comparing data and recaptures across years, important information about habitat use, growth rates, sex ratios, and residency patterns can be generated. The assessment for this exercise is an individual research article, similar to the 'short communications' that are published in some scientific journals.

Final Exam (20%)

The final exam will assess student understanding of the material covered in lectures and assigned readings. This one-hour exam will include multiple choice, multiple answer, matching, labelling, and ordering type questions. It is important to note that this is a short and busy semester, with limited time available for designated study periods. Consequently, students are strongly advised to review lecture notes and assigned readings as the course progresses.

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

Lectures, Workshops & Field Briefings – are held at the Center. It is mandatory to attend all lectures, workshops and briefings. PDFs of presentation slideshows will be provided to students via a shared drive; however, it is important to note that these slides only contain key points and illustrations; it is essential that students also take notes during lectures. Students are permitted to make audio recordings of lectures with permission from the lecturer on the understanding that any such recordings are for personal use only (i.e., they cannot be shared or distributed).

Readings – Assigned readings will be available on the student server. You are expected to be familiar with these readings prior to the associated lecture. The readings will be discussed during the lecture.

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

Appropriate use of technology – SFS has worked hard to provide internet access to all its staff and students but is limited in capacity, so there can be no inappropriate uses (gaming or video/music downloading). Screens (laptops and tablets) are permitted during lessons for taking notes, however inappropriate use will result in the loss of this privilege. Phones are not permitted in class.



A marine sea turtle being examined by an SFS student

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. 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.

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

*Readings in **bold** are required

No.	Title and Description	Type	Hours	Readings
MF01	Course Overview - Course components - Assessments and dates - Expectations - Academic guidelines	L	1.5	
MF02	Fundamental Ecological Concepts - The organization of life - Taxonomic nomenclature - Ecological entities - Ecological processes	L	1.0	Burkholder, et al. (2013).
MF03	Sharks and Rays - Taxonomic diversity - Shark and ray anatomy - Reproductive strategies - Trophic ecology - Sharks and rays of the TCI	L	1.0	Henderson, et al. (2021).
MF04	Bony Fishes - Taxonomic and trophic diversity - Fish anatomy - Reproductive strategies - Commercially important species in the TCI	L	1.0	
MF05	Ecotourism FEX Briefing - Background - Objectives - Methods - Assessment	L	1.0	
MF06	Biodiversity FEX Briefing - Background - Objectives - Methods - Assessment	L	1.0	Flowers, et al. (2017).

No.	Title and Description	Type	Hours	Readings
MF07	BRUVS FEX Briefing • Background • Objectives • Methods • Assessment	L	1.0	Bruns, S. & Henderson, A. C. (2020).
MF08	Tag and Release FEX Briefing • Background • Objectives • Methods • Assessment	L	1.0	Henderson, A. C., McClellan, K. & Calosso, M. (2010).
MF09	Sea Turtles • Reptile taxonomy • Turtle anatomy • Global distributions of sea turtle species • Life-histories • Trophic ecology	L	1.0	Bechhofer, J. & Henderson, A.C. (2018).
MF10	Turtle Policy and Culture in the TCI • Talkin' Turtle in the Big South documentary	L	1.0	Richardson, et al. (2009).
MF11	Marine Mammals • Mammal taxonomy • Cetaceans • Pinnipeds • Sirenians	L	1.0	Castelblanco-Martínez, et al. (2012).
MF12	Human Impacts on Marine Animal Behavior • Intentional interactions (marine tourism) • Unintentional interactions	L	1.0	Brakes & Dall (2016).
MF13	Ecotourism FEX • Fieldwork • Video footage analysis	FEX	5.0	
MF14	Biodiversity FEX • Fieldwork • Photo annotation in I3S	FEX	5.0	Den Hartog & Reijns (2014).
MF15	BRUVS FEX • Fieldwork • Video footage analysis	FEX	5.0	
MF16	Tag and Release FEX • Fieldwork • Data entry	FEX	5.0	
MF17	Threats and Conservation Issues • Fisheries • Habitat loss • Pollution • Climate change	L	1.0	Grose, et al. (2020).

No.	Title and Description	Type	Hours	Readings
MF18	Methods of Exploitation • Passive fishing techniques • Active fishing techniques	L	1.0	King, M. (2007).
MF19	Management and Conservation Approaches • Fishery controls • Marine Protected Areas (MPAs) • Public awareness • Intergovernmental organizations • Non-governmental organizations	L	1.0	Conners, et al. (2022).
MF20	Assessing Abundance and Distribution • Absolute abundance • Relative abundance • Spatial mapping • Experimental design	L	1.0	King, M. (2007).
MF21	Capture and Handling Techniques • Ethical considerations • Adapting commercial fishing techniques for research • Post-release survival	L	1.0	
MF22	Tagging and Tracking Techniques • Ethical considerations • Applied marks • Acoustic approaches • Satellite approaches • Impacts on behavior	L	1.0	
MF23	Scientific Methods with Drones • Ethical considerations • Applications in Wildlife Research • Challenges and Limitations	L	1.0	
MF24	Understanding Evolutionarily Significant Units • What are ESUs? • Distinguishing species • Distinguishing populations/stocks	L	1.0	
MF25	Course Review	L	1.5	
MF26	Ecotourism FEX Debrief • Review of FEX objectives • Summary of achievements • Identification of issues • Instructions for assessment preparation	L	1.0	
MF27	Biodiversity FEX Debrief • Review of FEX objectives • Summary of achievements • Identification of issues • Instructions for assessment preparation	L	1.0	

No.	Title and Description	Type	Hours	Readings
MF28	BRUV FEX Debrief - Review of FEX objectives - Summary of achievements - Identification of issues - Instructions for assessment preparation	L	1.0	
MF29	Tag and Release FEX Debrief - Review of FEX objectives - Summary of achievements - Identification of issues - Instructions for assessment preparation	L	1.0	
MF31	Ecotourism FEX Write-Up Designated time for preparation of the Drone FEX assessment	DEX		
MF32	Turtle FEX In-field demonstration of turtle capture, work-up and tagging techniques	FEX	3.0	
MF33	Biodiversity FEX Write-Up Designated time for preparation of the Biodiversity FEX assessment	DEX		
MF34	BRUV FEX Write-Up Designated time for preparation of the BRUV FEX assessment	DEX		
MF35	Turtle FEX Debrief - Review of FEX activities - Summary of historical turtle research data in the TCI - In-class discussion.	L	1.0	
MF36	Tag and Release FEX Write-Up Designated time for preparation of the Tag and Release FEX assessment	DEX		
	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

1. **Bechhofer, J. & Henderson, A.C. (2018).** Transient nocturnal site fidelity in juvenile green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) sea turtles on the shallow nearshore coral reefs of South Caicos, Turks and Caicos Islands. *Tropical Zoology*, 31:1, 44-54.
2. **Brakes, P. & Dall, S. R. X. (2016).** Marine mammal behavior: A review of conservation implications. *Frontiers in Marine Science*, 3:87.

3. Bruns, S. & Henderson, A. C. (2020). A baited remote underwater video system (BRUVS) assessment of elasmobranch diversity and abundance on the eastern Caicos Bank (Turks and Caicos Islands); an ecosystem in transition. *Environmental Biology of Fishes*, 103: 1001-1012.
4. **Burkholder, D. A., Heithaus, M. R., Fourqurean, J. W., Wirsing, A., & Dill, L. M. (2013).** Patterns of top-down control in a seagrass ecosystem: could a roving apex predator induce a behaviour-mediated trophic cascade?. *Journal of Animal Ecology*, 82(6), 1192-1202.
5. **Castelblanco-Martínez, D.N., Barba, E., Schmitter-Soto, J.J., Hernández-Arana, H.A. and Morales-Vela, B. (2012).** The trophic role of the endangered Caribbean manatee *Trichechus manatus* in an estuary with low abundance of seagrass. *Estuaries and Coasts*, 35, pp.60-77.
6. **Connors, M. G., Sisson, N. B., Agamhoue, P. D., Atkinson, P. W., Baylis, A. M., Benson, S. R., ... & Maxwell, S. M. (2022).** Mismatches in Scale Between Mobile Marine Megafauna and Global Marine Protected Areas. *Frontiers in Marine Science*, 9: 897104
7. **Den Hartog, J. & Reijns, R. (2014).** I3S Spot Manual. <https://reijns.com/wp-content/uploads/2020/01/I3S-Spot.pdf>
8. Flowers, K. I., Henderson, A. C., Lupton, J. L. & Chapman, D. D. (2017). Site affinity of whitespotted eagle rays *Aetobatus narinari* assessed using photographic identification. *Journal of Fish Biology*, 91: 1337-1349.
9. **Grose, S. O., Pandleton, L., Leathers, A., Cornish, A. & Waitai, S. (2020).** Climate Change will Re-draw the Map for Marine Megafauna and the People Who Depend on Them. *Frontiers in Marine Science*, 7: 547
10. Henderson, A. C., McClellan, K. & Calosso, M. (2010). Preliminary assessment of a possible lemon shark nursery in the Turks & Caicos Islands, British West Indies. *Caribbean Journal of Science*, 46: 29-38.
11. **Henderson, A. C., Smith, C., Bell, K., Gomez, T., Jourdan, A., & Lenain, E. (2021).** Demographic characteristics of sharks in the sublittoral environment of the Turks and Caicos Islands. *Environmental Biology of Fishes*, 104(9), 1121-1137.
12. King, M. (2007). *Fisheries Biology, Assessment and Management*. Oxford: Blackwell Publishing.
13. **Richardson, P.B. et al. (2009).** Marine turtles in the Turks and Caicos Islands: remnant rookeries, regionally significant foraging stocks, and a major turtle fishery. *Chelonian Conservation and Biology*, 8: 192-207.