DALHOUSIE UNIVERSITY

Faculty of Science Course Syllabus
Department of Biology
MARI 3650 Ocean Technology for the Observation, and Conservation of Marine Species
Dalhousie University, Seaside Summer Course, **Summer 2021**

Instructors: Scott McIlveen, s.mcilveen@dal.ca, 647-545-9644 & Dr. Charles Bangley, charles.bangley@dal.ca

Lectures: TBD

Laboratories/Tutorials: TBD

Field trips: TBD

Course Description
This course offers lectures, labs, and field trips that explore the emerging field of ocean technology and observation efforts that are applied to the conservation of marine species. Students learn about applications of ocean technology, including remotely operated vehicles, acoustic receivers, and other tools used to track, manage, and conserve species.

Course Prerequisites
Introductory Ecology (BIOL 2060)

Course Exclusion
N/A

Overview
This course introduces students to a diverse set of tools and techniques used to observe ocean conditions, monitor marine species, and further sustainability goals in the aquatic environment. The ocean is an extremely complex and dynamic system, home to countless marine species. Warming ocean conditions, overfishing, plastic pollution, among many other factors, mean they now face more anthropogenic pressure than ever. Marine technology is becoming increasingly important as a tool to inform aquatic species conservation and management measures. In this course, students will learn about a diverse set of ocean technology used in marine observation, aquaculture, and green energy sectors to inform and improve management in a changing global climate. This course also explores how the information is collected, analyzed, and disseminated

to the decision makers. A key component to this course, is the opportunity to take learned theoretical knowledge into the field. Field trips will allow the students to get hands-on experience with ocean technology and provide students with opportunities to communicate with leading experts in the sector. Throughout the course, guest lectures from industry and academia will explore current developments in ocean technology and share their expertise is this growing Nova Scotian sector.

Course Objectives/Learning Outcomes
By the end of this course, students will be able to:

Lecture:

- Explain the physical and biogeochemical processes of the world's oceans and their influence on animal movements and behaviour;
- Understand the need for the inclusion of biological variables into the global ocean observing system;
- Describe various types of ocean technology used in the tagging and monitoring of aquatic species;
- Identify the challenges of tracking aquatic species in their environment;
- Compare and contrast the uses of acoustic and satellite telemetry as tools for tracking organisms;
- Analyze/Summarize ocean technology strategies used for the conservation and management of aquatic species by countries and international bodies;
- Assess the applications of emerging ocean technologies as conservation and management tools;
- Recognize that the conservation of marine species entails a multisectoral approach which includes food and energy security

Lab:

- Operate ocean technology in a controlled lab setting;
- Demonstrate familiarity with various pieces of field equipment and their uses;
- Interpret data sets on aquatic animal movements and make objective decisions for novel conservation strategies;

Field:

- Ability to work and collect data in the field;
- Deploy various ocean technology in a field setting;
- Engage with experts in the field to collaborate on projects that further ocean observation;

Course Materials
There are no required texts for this course. Literature will be made available through Brightspace. Students are expected to do readings prior to coming to class.

Course Assessment

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (<50)
A- (80-84)	B- (70-72)	C- (55-59)	

Quiz 1: Marine Ecological Processes (5%)

Quiz 2: ROVs, AUVs, Gliders (5%)

Lab Quiz 1: Acoustic Receivers, Moorings (15%)

Lab Quiz 2: Data Visualisation (15%)

Group Collaboration (20%)

- *Participation* (10%)
- *Peer-review* (5%)
- *Metacognition* (5%)

Students will be assessed on their participation and ability to work collaboratively in lab and field activities. Tasks will be assigned to groups during lab sessions. Students must be participating in group work and demonstrate their resourcefulness and ability to actively solve problems.

Novel Tech Assignment (Individual) (40%)

- *Project Proposal* (5%)
- *Oral Presentation* (10%)
- *Final Report* (25%)

Students will design a study with a focus on ocean technology as a tool. This will include a budget, logistics, and experimental design. Prior to completing assignment students must submit a proposal which will include a brief overview of the experimental design and technology that will be used to carry out study. Students must also include an annotated bibliography with five sources.

Other course requirements:
Students should be capable of spending several hours on a boat.

Course Policies
*Please note: Our ability to offer this course in-person for Summer 2021 will depend on the health and safety regulations in place at the time. If in-person field courses are not permitted, this course will be cancelled.

Late submissions: Late submissions will be docked 10% per day late unless the student is excused previous to the assignment due date or due to circumstances beyond his or her control

Mandatory attendance: You are expected to attend all lectures, tutorials, and field sessions. As this is a summer intensive course, any missed days will put you significantly behind. Make sure to ask an instructor for materials in the case of a missed lecture.

Scheduling changes: We will do our best to adhere to the provided schedule. As there is a field component of this course, weather may force us to be flexible with our scheduling. We will do our best to provide you with ample warning time should there be a cancellation or change of schedule.

Course Content/Schedule (tentative)

Date	**Session**	**Type**	**Activity**	**Additional Resources**
Day 1	AM	Lecture	Welcome, Intro to course, rationale for ocean observation	*Readings:* 1. Envisioning the Future of Aquatic Animal Tracking: Technology, Science, and Application (Lennox et al., 2017)
		Lecture	Marine Ecological Processes	
	PM	Lecture	Marine Ecological Processes cont'd, Ecophysiology, Tour of facilities	
		Activity	Split into groups, tour of facilities	
Day 2	AM	Guest Lecture	Innovasea: Intro to biologging, acoustic telemetry	*Readings:* 1. Aquatic animal telemetry: A panoramic window into the underwater world. (Hussey et al., 2015) 2. Genesis and evolution of bio-logging devices: 1963-2002 (Kooyman, 2004)
		Lecture	Project planning and management	
	PM	Lecture	Acoustic receivers	
		Lab	Acoustic receivers	
Day 3	AM	Eval	Quiz: Marine Ecological Processes	QUIZ today *Watch:* What is a mooring: https://www.youtube.com/watch?v=uraxcRqlrcw&ab_channel=TTIDE
		Lecture	Moorings	
	PM	Lecture	Electronics and sensors	

		Guest Lecture	eOceans: Citizen science and ocean observation	
Day 4	AM	Field	Deployment in the field with Innovasea	Students should come prepared in appropriate attire Groups A & B deployment in the a.m. Groups C & D deployment in the p.m. Groups C & D group work in the a.m. Groups A & B group work in the p.m.
	PM	Field	Deployment in the field with Innovasea	
Day 5	AM	Lecture	CEOTR Gliders	This day will take place entirely at COVE. Students are expected to find their way there via transit. *Readings:* 1. The Slocum Mission. (Stommel, 1989) 2. Ocean Research Enabled by Underwater Gliders (Rudnick, 2019)
	PM	Lab	Glider mission planning	
		Field	Glider Launch	
Day 6	AM	Eval	Lab quiz	LAB QUIZ 1 today *Readings:* 1. Eyes in the sea: Unlocking the mysteries of the ocean using industrial, remotely operated vehicles (ROVs). (Macreadie et al., 2018)
		Lecture	Remotely Operated Vehicles	
	PM	Lab	Remotely Operated Vehicles	
Day 7	AM	Field	Shark tagging trip	Students should come prepared in appropriate attire Groups A & C will go on tagging trip Groups B & D see day 8 schedule
	PM	Field	Shark tagging trip	
Day 8	AM	Eval	Quiz	Groups B & D will go on tagging trip Groups A & C see day 8 schedule *Readings:* 1. Acoustic telemetry and fisheries management. (Crossin et al., 2017)
		Lecture	Resource management strategies	
	PM	Field	Overview of assignment	
		Ind. time	Time to work on proposal	
Day 9	AM	Lecture	Intro to observing systems around the globe	*Readings:* 1. A Global Ocean Observing System (GOOS), Delivered Through Enhanced Collaboration Across Regions, Communities, and New Technologies. (Moltmann et al., 2019) Assignment proposal due at 11:59 p.m.
		Guest Lecture	Some Global Observing Systems	
	PM	Lab	Arduino Activity	
		Lecture	Side scan sonar	
	AM	Field	NSCC Mooring Collab	Students should come prepared in appropriate attire

Day 10	PM	Field	NSCC Mooring Collab	
Day 11	AM			*Readings:* 1. To share or not to share in the emerging era of big data: Perspectives from fish telemetry researchers on data sharing. (Nguyen et al., 2016) 2. Ocean Data Product Integration Through Innovation- The Next Level of Data Interoperability (Buck et al., 2019)
		Guest Lecture	Innovasea: Data Session	
	PM	Lab	Innovasea Data Lab	
Day 12	AM	Eval	Lab quiz	LAB QUIZ 2 today *Readings:* *1.* Future Vision for Autonomous Ocean Observations. (Whitt et al. 2020) 2. Current developments and future prospects of offshore wind and ocean energy. (Esteban & Leary, 2011)
		Lecture	Data Offload, Maintenance, Refurbishment	
	PM	Lab	Data Offload, Maintenance, Refurbishment	
		Guest Lecture	Jim Hanlon	
Day 13	AM	Field	Day at COVE	Students should come prepared with questions for industry experts
	PM	Field	Day at COVE	
Day 14	AM	Lecture	Presentations	Assignment due at 11:59 p.m.
	PM	Lecture	Rest of presentations and BBQ (?)	

University Policies and Statements:

Academic Integrity:
At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility:
The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia). Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct:
Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. Code: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Diversity and Inclusion – Culture of Respect:
Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness Statement: http://www.dal.ca/cultureofrespect.html

Recognition of Mi'kmaq Territory:
Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca). Information: https://www.dal.ca/campus_life/communities/indigenous.html

Important Dates in the Academic Year (including add/drop dates)
https://www.dal.ca/academics/important_dates.html
University Grading Practices
https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html
Missed or Late Academic Requirements due to Student Absence (policy)

https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html

Student Resources and Support

Advising

General Advising https://www.dal.ca/campus_life/academic-support/advising.html

Science Program Advisors: https://www.dal.ca/faculty/science/current-students/academic-advising.html

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Black Students Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html

Academic supports

Library: https://libraries.dal.ca/

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Copyright Office: https://libraries.dal.ca/services/copyright-office.html

Fair Dealing Guidelines https://libraries.dal.ca/services/copyright-office/fair-dealing.html

Other supports and services

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html

Student Advocacy: https://dsu.ca/dsas

Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Safety

Biosafety: https://www.dal.ca/dept/safety/programs-services/biosafety.html

Chemical Safety: https://www.dal.ca/dept/safety/programs-services/chemical-safety.html

Radiation Safety: https://www.dal.ca/dept/safety/programs-services/radiation-safety.html

Scent-Free Program: https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html