



ENVS/MARI 4003 Coral Reefs and Environmental Change

Faculty of Science Course Syllabus Fall 2020

Department of Earth and Environmental Science

Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people¹.

Instructor: Dr. Sue Gass | Email: susan.gass@dal.ca

Office Hours: Wednesdays 11:00 am -1:00 pm via Collaborate Ultra or another time by appointment. You can find the Collaborate Ultra sessions under “Content” within our course Brightspace.

Communication guidelines

Good communication between the Instructor and students is key to the success of students in a course. I will do my best to respond to your emails within 24 hours except over the weekend where it will be 48 hours.

Class Times: One synchronous session Thursdays 10-1130 am plus weekly independent learning

Location: We will meet for our synchronous session via Collaborate Ultra – you can find our class sessions on Brightspace in the “Content” area under “Collaborate Ultra” module and then click on the associated date/time.

Class Description

Coral reefs are iconic of highly diverse ecosystems and play a significant role in the economies of most countries where they exist. Cold-water corals are lesser known than their tropical relatives but also enhance the structural complexity and thus habitats within their deep ocean environments. Humans have changed coral reef environments and further changes are predicted to occur in the future. This class will introduce you to the biology of corals and the key characteristics that make up their environments. We will examine some of the major human impacts on these environments including warmer

¹ “Acknowledging territory shows recognition of and respect for Aboriginal Peoples. It is recognition of their presence both in the past and the present. Recognition and respect are essential elements of establishing healthy, reciprocal relations. These relationships are key to reconciliation” (CAUT Guide to Acknowledging Traditional Territory, 2016). Please take some time to learn more about reconciliation.

temperatures, acidification, pollution, and commercial activities. Finally, we will consider options to minimize further negative changes and ways to help sustain coral ecosystems into the future.

Course pre-requisites

Chem 1011/Chem 1012 and Biol 2060. Also restricted to students with six credit hours in Environmental Science or Biology or Marine Biology at or above the 3000 level.

Key knowledge or skills expected of students coming into the course:

- Student should know how to balance chemical equations
- Student should be familiar with reading scientific literature
- Students should be able to describe major drivers of and differences among marine biomes; how abiotic factors influence the distribution and abundance of organisms; and the effects of disturbance on species diversity.
- Students should be able to predict the impacts of human activities (e.g. climate change, nutrient loading) using knowledge of the major biogeochemical cycles on the planet (e.g. water, carbon and nitrogen).
- No previous knowledge of corals is required

Course learning outcomes:

- Describe the anatomy of common tropical and cold-water corals
- Describe taxonomic relationships among corals
- Describe the abiotic environment of tropical and cold-water corals
- Predict how changing environmental factors will affect corals (temperature, salinity, ocean acidification, sedimentation, excess nutrients, freshwater inputs)
- Describe the reproductive strategies of corals.
- Describe how corals feed and grow
- Describe different research methods used to measure coral growth and the impacts of changing environments on coral growth.
- Choose an appropriate research technique for measuring coral growth under different circumstances
- Carry out literature-based research and communicate the current state of knowledge on a range of topics related to corals and environmental change
- Describe the causes, the biological process, and the ecological consequences of coral bleaching.
- Choose an appropriate research method for measuring the impacts and predict coral bleaching events.
- Describe how ocean acidification may or may not hinder coral growth

- Explain the options for coral reef conservation and the challenges faced by developed and developing countries when trying to implement these measures.
- Describe the potential resilience of coral reefs to environmental change
- Critique scientific writing
- Present scientific findings from the literature to fellow students
- Critique scientific writing of peers
- Develop familiarity with the terminology used in the study of corals

Textbook and Readings

1. The Biology of Coral Reefs, 2nd Edition. Charles R.C. Sheppard et al., 2018 (required text)
2. Readings from the scientific literature (links provided via Brightspace)

Readings List:

1. Moberg, F. and C. Folke. (1999). Ecological goods and services of coral reef ecosystems. *Ecological Economics* 29: 215-233.
2. Hoegh-Guldberg, O. (1999). Climate change, coral bleaching and the future of the worlds coral reefs. *Marine and Freshwater Resesearch* 50, 839.66.
3. Hughes, T.P., J.T. Kerry, A.H. Baird, S.R. Connolly, A. Dietzel, C.M. Eakin, S.F. Heron, et al. (2018). Global warming transforms coral reef assemblages. *Nature* 556: 492-496
4. Bellwood, D.R., T.P. Hughes, C. Folke and M. Nystrom. (2004). Confronting the coral reef crisis. *Nature* 429: 827-833
5. NOAA Coral Reef Watch. (nd). Introduction Tutorial to NOAA's Coral Reef Watch program. Accessed from: <https://coralreefwatch.noaa.gov/satellite/education/tutorial/welcome.php>
6. Hoegh-Guldberg, O. P., J. Mumby, A. J. Hooten, R.S. Steneck, P. Greenfield, E. Gomez, C.D. Harvell et al. (2007). Coral reefs under rapid climate change and ocean acidification. *Science* 318: 1737-1742
7. Roberts, J.M., A. Wheeler and A. Freiwald. (2006). Reefs of the Deep: The Biology and Geology of Cold-Water. *Science* 312: 543-547.
8. Guinotte, J.M., J. Orr, S. Cairns, A. Freiwald, L. Morgan and R. Goerge. (2006). Will human-induced changes in seawater chemistry alter the distribution of deep-sea scleractinian corals? *Frontiers in Ecology and Environment* 4(3): 141–146
9. DFO (Fisheries and Oceans Canada). (2015). Coral and Sponge Conservation Strategy for Eastern Canada. Fisheries and Oceans Canada. 70 pp.

Grading scheme

Assessment component	% of Final Grade	Due Date
Assignment 1 Coral morphology	10	September 27 th
Assignment 2 Reefbase GIS	10	November 1 st
Midterm Exam	20	October 9 th
Reading the Primary Literature 5 article discussions, 3 written summaries + final reflection	30 (25% my grade; 5% peer review)	See class schedule for primary literature discussion dates Final collection and reflections due December 14 th
Research essay Introduction & Outline Final draft (B00# only, no names) Peer reviews Final paper	5 N/A 5 20	October 12 th November 15 th November 22 nd December 8 th

Work should be submitted before midnight on the due date

Mid-term exam

There will be a mid-term exam on the material covered up to and including Week 5. The mid-term is scheduled for **October 9, 2020**. You will be able to access the test via Brightspace between 8 am and 8 pm and will have 1.5 hours to complete the questions. There is no final exam in this course. Instead you will submit a collection of your primary literature article reviews with a written or recorded oral reflection.

Assignments

There will be 2 assignments. Assignment 1 is due before midnight on September 27th via Brightspace. Assignment 2 is due November 1st before midnight and should be submitted online via Brightspace. Assignment instructions are posted on Brightspace.

Synchronous session participation and attendance

Attendance and participation in class discussions and activities is recommended. However, if you are unable to attend, each session will be recorded and posted on Brightspace. You will have two choices for how you participate in the primary literature article discussions. You can either opt to join our live discussions during the last 20 minutes of our synchronous sessions on the scheduled dates, or you can participate in an asynchronous online discussion board. In both cases, you will be responsible for acting as a discussion leader once throughout the term. The instructor will send out a poll at the start of term to ask your preference.

Term Paper

Your term paper will allow you to dive deeper into an issue of greatest interest to you and share with me your individual scholarship on corals and changing environments. You may choose to write your paper on any topic that relates to coral reefs and environmental change. The marks will be broken down into three parts. You will provide me with an outline and an introduction of your paper (preferably after some initial discussions with me on your topic) by October 11th for 5% of your grade. A final draft of your paper is due on November 15th with only your B00# as your identifier and will be peer-reviewed by two fellow students. At this stage you are being graded on your reviews of your classmates' papers and not on your own paper. However, your paper should be a complete draft of your best work. Your two reviews are worth 5% total and are due on November 22nd uploaded onto Brightspace (no name, just your B00#). Your final paper is due on December 8th on Brightspace and it is worth 20% of your final grade.

A detailed description of what is required for the paper is posted on Brightspace.

Primary Literature Article Reviews

You will be asked to use web of science or google scholar to find a primary literature article that supports the findings discussed in five of our modules. Feel free to use your textbook as another way to find a relevant article. Your textbook does an excellent job at citing key references.

You are going to lead a discussion within a breakout group during one of our synchronous sessions, or in an online discussion board, about one of your papers. You will choose three of the five papers to include in your collection portfolio which will be handed in at the end of term. I will provide feedback on your first article review to make sure you are on the right track. You will include a collection of three of your primary literature summaries and a written or oral reflection on your learning in the course (detailed guidelines for the reflection will be provided) which is due on December 14th in the Brightspace assignment folder.

Your primary literature collection and reflection is worth 25% of your grade. You will also receive a peer evaluation grade worth 5% based on your performance leading the group discussion and contributing to the other student led discussions throughout the term.

Netiquette

The following guidelines were put together by Dalhousie's School for Occupational Therapy and captures how best to communicate for effective learning online. It applies nicely to our online course.

Learners should consider the following netiquette practices when interacting in the online environment.

Communicate Effectively. Carefully review your message to ensure it is well-written and conveys the intended meaning. It sometimes helps to read your post out loud. Make effective and proper use of vocabulary. Figurative language should be avoided stick to proper English so that your thoughts can be understood by all.

Be Concise. State only what is necessary to deliver the message without including unnecessary details or lengthy explanations. Express yourself clearly and to the point. Seek clarification. If something is unclear, ask for clarification. Making assumptions may cause unnecessary confusion, hardship or other negative consequences.

Be Patient. Remember, others are working on their own schedules— one of the benefits of online learning. Establish or clarify expectations surrounding time sensitive matters such as email response times. This can help avoid frustration and misunderstandings.

Support one another. Conduct yourself in a courteous manner and offer to help others. If someone is struggling with the course technology, for example, offer words of support or provide assistance. Some learners are new to online learning and may appreciate a helping hand.

Never criticize or embarrass another person. Respect the views of others. Sharing of ideas, perspectives and points of view are a critical part of the learning process. Present your alternate thoughts in a respectful and professional manner.

Be mindful of diversity. Ensure that your message is sensitive to our diverse population. Be mindful of differences in culture, ethnicity, race, language, religion, age, gender, sexuality or abilities. Make certain that your writing does include or imply meanings that may be offensive to others.

Be Professional. Individuals should conduct themselves professionally in an academic setting. Be courteous, polite, and respectful. Use proper wording and grammar and avoid use of slang, profanity, offensive content, or negative expression toward others.

Beware of expression. Emotionally driven communication can be damaging. Be prudent with the use of textual accents, emoticons, expressions that convey aggression or sarcastic remarks. For example, words or phrases in all capitals is often seen as shouting. Posting emotionally charged opinions on the web, known as flaming, is unacceptable.

Privacy. Do not share inappropriate, personal, or other non-course related details about others. Respect the privacy of other and yourself. Maintain a safe and comfortable learning environment for all learners by keeping personal, private, or potentially embarrassing information to yourself.

Cite your sources. Always include reference information for material that is not your own. Failure to disclose your sources, be it intentionally or unintentionally, could result in an academic integrity issue. If you are unsure how to cite a reference, please seek assistance.

For more details on the School of Occupational Therapy's netiquette guidelines check out this website:

<https://cdn.dal.ca/content/dam/dalhousie/pdf/faculty/faculty-health-professions/occupational-therapy/rep/NetiquetteFall2019.pdf>

Policy on late assignments

Missed or Late Academic Requirements due to Student Absence

Dalhousie students are asked to take responsibility for their own missed deadlines (3 days or less) by contacting their instructor by email **prior to** the academic requirement deadline or scheduled time **and** by submitting a completed Student Declaration of Absence (SDA) to their instructor in case of missed or late academic requirements. The SDA form can be found on our Brightspace page under "Assignments". Only **TWO** separate SDA forms may be submitted per term for this course. Once the SDA has been submitted, you will have three days to submit your assignment. If you miss the mid-term due to illness, you must follow the protocol as above and a make-up mid-term will be scheduled later.

If you think you are going to miss acting as a discussion leader during a synchronous session due to illness, then you should first ask if anyone in the group is willing to switch days with you. If you are unable to switch, then please contact the instructor and we will transfer your discussion to the asynchronous discussion board.

Assignments submitted late without prior notification **and** the submission of an SDA, or without an approved extension will be deducted 10% per day. Extensions are granted with good reason and **must be requested at least one week prior** to the assignment's original due date.

If you have any questions or concerns, please do not hesitate to reach out to the instructor.

The Meaning of Grades

Evaluation will be completed and expressed in raw marks throughout the course. Letter grades will be assigned only to the final distribution of marks for the course.

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)	

Class schedule

Week	Topic	Content	Readings	Synchronous Class
Week 1 Sept 8-13	Module 1 Introduction and Ecosystem services	<ul style="list-style-type: none"> • Introduction to the course • Value of coral reefs • Ecosystem goods and services • The Great Barrier Reef https://attenboroughsreef.com/ 	Chapter 1 Moberg and Folke (1999)	Introductions Review answers to activities Discuss course and expectations What is a coral?
Week 2 Sept 14-20	Module 2 What is a coral?	<ul style="list-style-type: none"> • Corals • Reefs • Coral Taxonomy • Coral morphology • Macroalgae 	Chapter 2	Introduction to Assignment 1 (due September 27 th)
Week 3 Sept 21-27	Module 3 Tropical corals and their abiotic environment	<ul style="list-style-type: none"> • Salinity • Temperature • Sedimentation • Light 	Chapter 3	How do we study corals in changing abiotic environments? Example sedimentation <i>First discussion of primary literature articles</i>
Week 4 Sept 28-Oct 4	Module 4 Coral growth, feeding & reproduction	<ul style="list-style-type: none"> • Coral calcification • Growth • Symbiosis • Heterotrophic feeding 	Chapter 4	Live lecture feeding and symbiosis Review term paper outline
Week 5 October 5-11	Module 4 cont'd Reproduction <u>Midterm October 9th</u>	<ul style="list-style-type: none"> • Reproduction • Recruitment 	Chapter 4	Review for the midterm
Week 6 Oct 12-18	Module 5 Coral bleaching	<ul style="list-style-type: none"> • Introduction to coral bleaching • Predicting bleaching events using remotely sensed data 	Hoegh-Guldberg et al. 1999	Review coral bleaching Review hotspots and DHWs Introduction to online activity <i>Second discussion of primary literature articles</i>
Week 7 October 19-25	Module 5 cont'd Coral bleaching	<ul style="list-style-type: none"> • Recording past bleaching events 	Hughes et al. 2018	Introduction to Assignment 2 Due November 1 st

Week 8 Oct 26-Nov 1	Module 6 Coral reefs in the modern world	<ul style="list-style-type: none"> • Coral reef fish & fisheries • Local stressors 	Chapter 7 & 8	Local stressors <i>Third discussion of primary literature articles</i>
Week 9 Nov 2-8	Module 7 Resilience	<ul style="list-style-type: none"> • Coral reef resilience and management 	Chapters 9 & 10 Bellwood et al. 2004	Management options
Week 10	Study break – Take time for yourselves, exercise, eat well and work on your term paper			
Week 11 Nov 16-22	Module 8 Cold-water corals	<ul style="list-style-type: none"> • Introduction to cold-water corals • Corals of Atlantic Canada 	Roberts et al. 2006	Corals of Atlantic Canada <i>Fourth discussion of primary literature articles</i>
Week 12 Nov 23-29	Module 9 Ocean acidification	<ul style="list-style-type: none"> • Tropical corals versus cold-water corals 	Hoegh-Guldberg et al. 2007 Guinotte et al. 2006	Review figures from Guinotte et al. 2006 in breakout groups
Week 13 Nov 30-Dec 8	Module 10 Cold-water coral conservation and management	<ul style="list-style-type: none"> • Cold-water coral conservation and management in Canada 	Coral & sponge conservation strategy for Eastern Canada 2015	Introduction to your reflection assignment <i>Fifth discussion of primary literature articles</i>

Syllabus Part B

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Missed or Late Academic Requirements due to Student Absence

As per Senate decision instructors may not require medical notes of students who must miss an academic requirement, **including the final exam**, for courses offered during fall or winter 2020-21 (until April 30, 2021).

Information on regular policy, including the use of the Student Declaration of Absence can be found here:

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

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

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>