



**Dalhousie University**  
**Faculty of Science/ Department of Oceanography**  
**OCEA4320/Credit Hours: 3/Seafloor Mapping**  
**Winter 2026**

**Class hours: 2, Classroom Location - Studley LSC-OCEANOGRAPHY O3652**  
**(Wednesday and Friday 0935-1025)**

**Computer Lab hours: 2, Classroom Location - Studley LSC-BIOL&EARTH B3111**  
**(Monday 0835-1025)**

*Dalhousie University operates in the unceded territories of the Mi'kmaw, Wolastoqey, and Peskotomuhkati Peoples. These sovereign nations hold inherent rights as the original peoples of these lands, and we each carry collective obligations under the Peace and Friendship Treaties. Section 35 of the Constitution Act, 1982, recognizes and affirms Aboriginal and Treaty rights in Canada.*

*We recognize that African Nova Scotians are a distinct people whose histories, legacies, and contributions have enriched the part of Mi'kma'ki known as Nova Scotia for over 400 years.*

**Instructor:** Craig J. Brown

**Lectures:** Wednesday/Friday 0925-1025

**Computer Labs:** Monday 0835-1025

**Office:** Room 4634, Life Sciences Centre, 1355 Oxford Street,

**Office Phone:** +1-902-494-7177

**Office Hours:** By appointment (to be set up by email)

**Email:** [craig.brown@dal.ca](mailto:craig.brown@dal.ca)

**Course delivery:** In-person

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### **Course Description**

A graduate-level course on ocean mapping technologies and techniques for study of the seabed environment. Acoustic remote sensing technologies, ground-validation techniques, and data processing and integration methods using geospatial software are covered. The focus of the course is on how these approaches are used to study and map the geology and biology of the ocean floor.

### **Course Prerequisites**

Permission of instructor

### **Course Exclusion**

None

### **Learning Objectives**

With successful completion of the course, students will be able to:

Learning Outcome #1: Understand the basic theoretical concepts behind underwater acoustic remote sensing and seafloor mapping technologies;

Learning Outcome #2: Describe and explain the techniques for the acquisition, processing and interpretation of seafloor surveying and exploration data sets;

Learning Outcome #3. Analyse and interpret a diverse set of seafloor geospatial data for the solution of an academic/industrial problem.

Learning Outcome #4: Develop a range of key skills including numeracy, cartography, problem solving, presentation and communication appropriate to this area.

### Course Materials

Reading material will be drawn from the peer-reviewed literature and assigned associated with the lecture material. All required course material will be made available through Brightspace. The following will also be used as reference material for the course.

- Lurton, X., Lamarche, G. (Eds) (2015) Backscatter measurements by seafloor-mapping sonars. Guidelines and Recommendations. 200p. <http://geohab.org/wp-content/uploads/2014/05/BSWGREPORT-MAY2015.pdf>
- Finkl, C.W. Makowski, C. (Eds) (2016) Seafloor Mapping along Continental Shelves: Research and Techniques for Visualizing Benthic Environments. Springer. 293p.

Students will also require an external hard drive for data storage (ideally USB-3 or USB-C and a minimum 100GB capacity).

### Course Assessment

Grades will be based on six requirements, and a grading rubric for each assessment will be made available through Brightspace:

Assessment	Date of evaluation	Weight
Lab assignments (x3)	Due in week 3, 5 and 7	30% (10% each)
Essay	Due in week 9	10%
Mid term test	Week 6	15%
End of term test	Week 12	15%
Cartography assignment (Group)	Week 8	10%
Map Project	Week 12	20%

Grades will be assigned as below using the Dalhousie Common Grade Scale:

A+ (90-100)	B+ (77-79)	F (0-69)
A (85-89)	B (73-76)	
A- (80-84)	B- (70-72)	

### Lab assignments

There will be three lab assignments, each worth 10%, which will test the students understanding of the analysis and interpretation of a range of seafloor geospatial data sets. These assignments will focus on: 1) Seafloor thematic map production 2) Seafloor bathymetric data; 3) Seafloor backscatter data. Software: ESRI ArcPro and QPS Qimera, Fledermaus and FMGT

### Essay

Graduate students in the class will write an essay on a seafloor mapping technology of their choice, undertaking a deeper dive into the scientific and technical literature. Detailed instructions on what is

required will be provided at the start of term. Students may choose to write their essay on any appropriate seafloor mapping technique, reviewing how the technology operates, seafloor mapping/scientific applications of the technique, and limitations. I will approve the topic of your paper once you have selected it (by end of week 3). You will then provide me with an outline of your paper by the end of week 5 (Title, subheadings providing structure to your paper, bullet points under each section outlining content, and listing key references for the paper). Your completed term paper will be due end of week 9 (8-10 pages, double spaced excluding reference list). This will 10% mark in total.

### **Class tests**

Tests will be held in week 6 and 12 to test understanding of the lecture material. Each test will be worth 15%.

### **Cartography: Group assignments**

In small groups, you will select a publicly available seafloor data set to present as a cartographic map. This will be produced as a poster-sized output and graded based on cartographic quality and content of the map, scientific interpretation, and quality of data processing. The class will present these maps in Week 8. This will carry a grade of 10%.

### **Map Project**

The map project will build toward the production of a seafloor thematic map. Individually, you will present the results from the map project, providing a description of the underlying methods you used to map the seafloor, details on the analysis undertaken, and a summary of the seafloor characteristics which you were able to deduce and interpret from the mapping exercise. This will be documented as an ESRI Story Map, worth 20%.

### **Course Policies on Missed or Late Academic Requirements**

Dalhousie students are asked to take responsibility for their own short-term absences (5 days or less) by contacting their instructor by phone or 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 Student Declaration of Absence forms may be submitted per term for this course. Once the SDA has been submitted, alternate arrangements for the missed or late assignment will be at the discretion of the instructor.

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 are ill for the class test you must contact the instructor by email and submit an SDA. A make up test will be scheduled for the week following the originally scheduled test.

### **Course Policies related to Academic Integrity**

The use of Large Language Models (LLMs) such as ChatGPT are not permitted in producing the written assignments for this course. Assignments are designed to develop students' own knowledge and understanding on the topics covered during the course, and to share their own personal views on the topics covered, rather than falling back on the generic voice of artificial intelligence. If use of LLMs is suspected following grading of submitted work, a follow up oral

discussion on the topic of the assignment will be scheduled with the course instructor. If the use of LLMs is suspected following this oral discussion with the student, the matter will be referred to the Academic Integrity Officer.

### Course Content

Week (dates)	Lesson (M/W/F)	Topics	Activity
1 (7-9 Jan)	W	Course introduction	Lecture 1
	F	Seafloor measurements - history and basics	Lecture 2
2 (12-16 Jan)	M	Intro – data import and software orientation	Lab 1
	W	Thematic maps (plus cartography tips and tricks)	Lecture 3
	F	Navigation and positioning	Lecture 4
3 (19-23 Jan)	M	Bathymetric data processing I	Lab 2
	W	Underwater acoustic wave propagation	Lecture 5
	F	Reflection, scattering and target strength	Lecture 6
4 (26-29 Jan)	M	Bathymetric data processing II	Lab 3
	W	Transducers and receivers	Online Lecture 7
	F	Backscatter processing	Online Lecture 8
5 (2-6 Feb)	M	Data visualization and export	Lab 4
	W	Online lecture review	Review
	F	MUNRO DAY – NO CLASS	No Class
6 (9-13 Feb)	M	Backscatter data processing I	Lab 5
	W	Weather contingency/recap lecture	Review
	F	Class test 1	Test
16-20 February - Winter study week			
7 (23-27 Feb)	M	Backscatter data processing II	Lab 6
	W	Singlebeam echosounders	Lecture 9
	F	Multibeam echosounders	Lecture 10
8 (2-6 Mar)	M	Cartography Assignment - presentations	Presentations
	W	Sidescan sonars	Lecture 11
	F	Subbottom profilers	Lecture 12
9 (9-13 Mar)	M	Seafloor Mapping Project	Lab 8
	W	Mapping platforms	Lecture 13
	F	Ground-truthing approaches	Lecture 14
10 (16-20 Mar)	M	Seafloor Mapping Project	Lab 9
	W	Airborne remote sensors	Lecture 15
	F	Benthic Habitat Mapping	Lecture 16
11 (23-27 Mar)	M	Seafloor Mapping Project	Lab 10
	W	Benthic Habitat Mapping	Lecture 17
	F	Water column mapping	Lecture 18
12 (30 Mar -3 Apr)	M	Seafloor Mapping Project	Lab 11
	W	Geological/Biological/Archaeological applications	Lecture 19
	F	GOOD FRIDAY – NO CLASS	No class
6-9 Apr	M	Seafloor Mapping Project	Lab 12
	W	Weather contingency/recap lecture	Review
	TH	Class test 2	Test

## **SECTION B: University Policies and Statements**

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

### **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 at 1321 Edward St or [elders@dal.ca](mailto:elders@dal.ca). Additional information regarding Mi'kmaq and Indigenous Relations (including the Elders in Residence program, Land Acknowledgements, Understanding Our Roots, and much more) can be found at: <https://www.dal.ca/about/mission-vision-values/mikmaq-indigenous-relations.html>

### **Internationalization**

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: <https://www.dal.ca/about/mission-vision-values/global-relations.html>

### **Academic Integrity**

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all 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. Additional academic integrity information can be found at: [https://www.dal.ca/dept/university\\_secretariat/academic-integrity.html](https://www.dal.ca/dept/university_secretariat/academic-integrity.html)

### **Accessibility**

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre ([https://www.dal.ca/campus\\_life/academic-support/accessibility.html](https://www.dal.ca/campus_life/academic-support/accessibility.html)) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro ([https://www.dal.ca/campus\\_life/ssc.html](https://www.dal.ca/campus_life/ssc.html)).

### **Conduct in the Classroom – Culture of Respect**

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

## **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 (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: <https://www.dal.ca/about/mission-vision-values/equity-diversity-inclusion-and-accessibility/about-office-equity-inclusion.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. The full Code of Student Conduct can be found at: <https://www.dal.ca/content/dam/www/about/leadership-and-governance/governing-bodies/code-student-conduct.pdf>

### **Fair Dealing Policy**

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at: <https://www.dal.ca/content/dam/www/about/leadership-and-governance/university-policies/fair-dealing-policy.pdf>

### **Student Use of Course Materials**

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.

## SECTION C: Student Resources and Support

### University Policies and Programs

Important Dates in the Academic Year (including add/drop dates):

[http://www.dal.ca/academics/important\\_dates.html](http://www.dal.ca/academics/important_dates.html)

Classroom Recording Protocol: <https://www.dal.ca/content/dam/www/about/leadership-and-governance/university-policies/class-recording-protocol.pdf>

Dalhousie Grading Practices Policies: <https://www.dal.ca/content/dam/www/about/leadership-and-governance/university-policies/grading-practices-policy.pdf>

Grade Appeal Process: [https://www.dal.ca/campus\\_life/academic-support/grades-and-student-records/appealing-a-grade.html](https://www.dal.ca/campus_life/academic-support/grades-and-student-records/appealing-a-grade.html)

Sexualized Violence Policy: <https://www.dal.ca/content/dam/www/about/leadership-and-governance/university-policies/sexualized-violence-policy.pdf>

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

### Learning and Support Resources

General Academic Support – Advising (Halifax): [https://www.dal.ca/campus\\_life/academic-support/advising.html](https://www.dal.ca/campus_life/academic-support/advising.html)

General Academic Support – Advising (Truro): [https://www.dal.ca/campus\\_life/ssc.html](https://www.dal.ca/campus_life/ssc.html)

Student Health & Wellness Centre: [https://www.dal.ca/campus\\_life/health-and-wellness.html](https://www.dal.ca/campus_life/health-and-wellness.html)

On Track (helps you transition into university, and supports you through your first year at Dalhousie and beyond): [https://www.dal.ca/campus\\_life/academic-support/On-track.html](https://www.dal.ca/campus_life/academic-support/On-track.html)

Indigenous Student Centre: [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

Mi'kmaq and Indigenous Relations: <https://www.dal.ca/about/mission-vision-values/mikmaq-indigenous-relations.html>

Elders-in-Residence (The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit the office in the Indigenous Student Centre or contact the program at [elders@dal.ca](mailto:elders@dal.ca) or 902-494-6803: <https://www.dal.ca/about/mission-vision-values/mikmaq-indigenous-relations/elders-in-residence-and-traditional-knowledge-keepers.html>

Black Student Advising Centre: [https://www.dal.ca/campus\\_life/communities/black-student-advising.html](https://www.dal.ca/campus_life/communities/black-student-advising.html)

International Centre: [https://www.dal.ca/campus\\_life/international-centre.html](https://www.dal.ca/campus_life/international-centre.html)

LGBTQ2SIA+ Collaborative: <https://www.dal.ca/about/mission-vision-values/equity-diversity-inclusion-and-accessibility/about-office-equity-inclusion/community-specific-groups/lgbtq2sia-collaborative.html>

Dalhousie Libraries: <http://libraries.dal.ca/>

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

Dalhousie Student Advocacy Services: <https://www.dsu.ca/dsas?rq=student%20advocacy>

Dalhousie Ombudsperson: [https://www.dal.ca/campus\\_life/safety-respect/ombudsperson.html](https://www.dal.ca/campus_life/safety-respect/ombudsperson.html)

Human Rights and Equity Services: <https://www.dal.ca/about/mission-vision-values/equity-diversity-inclusion-and-accessibility/about-office-equity-inclusion/human-rights-and-equity-services.html>

Writing Centre: [https://www.dal.ca/campus\\_life/academic-support/writing-and-study-skills.html](https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html)

Study Skills/Tutoring: [http://www.dal.ca/campus\\_life/academic-support/study-skills-and-tutoring.html](http://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html)

Faculty of Science Advising Support: <https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>

## **Safety**

Biosafety: <http://www.dal.ca/dept/safety/programs-services/biosafety.html>

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

Radiation Safety: <http://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

Laser Safety: <https://www.dal.ca/dept/safety/programs-services/radiation-safety/laser-safety.html>