Laboratory Studies of Fishes

BIOL/MARI 4080 Winter 2024

Faculty of Science Course Syllabus (Section A)

Department of Biology

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

Course Instructor

Name	Email	Office Hours
C. Isabelle Aubé (she/her)	isabelle.aube@dal.ca	Drop-in student support available on Mondays, 12-1 pm, LSC 2123 (or by appointment)

Course Description

Through a series of laboratory exercises, the course provides students with practical experience on various topics related to the study of ichthyology. Topics shall include the following: species identification; meristics and morphometrics; use of dichotomous keys; internal and external morphology; ageing and growth determination; ecomorphological attributes; data collection and analysis.

Course Prerequisites: BIOL 3080.03 or MARI 3080.03 (Ecology & Evolution Fishes)

Course Exclusions: BIOL 3067.03, MARI 3067.03, BIOL 5067.03

Course Structure

Course Delivery: In-person, synchronous live labs. No recordings.

Lectures: None (this is a lab-based course)

Laboratories: Twelve 3-hour labs (Fridays 2:35-5:25 pm, LSC 2112)

Tutorials: None

COVID-19 Masking and Isolation protocols: https://www.dal.ca/covid-19-information-and-updates.html

Instructor EDI, Respect, Accessibility, and Empathy Statement

"I am committed to creating a respectful and inclusive learning environment that is supportive for everyone in this course. This includes an expectation that sharing ideas and learning from each other will be done in a respectful manner. I will also aim to forewarn students about potential triggers of topics, images, and videos that may be traumatizing to some (e.g., common phobias). If you have any questions, concerns, or improvements to suggest, please do not hesitate to reach out." – Isabelle (isabelle.aube@dal.ca)

Course Materials

Required textbooks, excerpts of textbooks, computer software, and other materials for the course are provided for **free in electronic format** via our course website: BIOL/MARI 4080 Laboratory Studies of Fishes (Brightspace link at dal.ca). Hard copies may be borrowed directly from the course instructor upon request. *Copyrights of these materials have been verified for educational use by Dalhousie's Killam Library and Copyright Office.*

Brightspace will also be our **communication hub** for the course regarding announcements, cancellations, deadlines, assignment submissions, grades, and any other pertinent resources.

Laboratory Equipment:

- **Closed-toed shoes** are required for each lab.
- **Disposable lab aprons and vinyl gloves** will be provided in lab if needed. You may bring your own lab coat but beware it may end up with biological fish material on it and will require regular washing between labs.
- For some labs, you will need to bring a paper **notebook** to keep detailed notes and drawings in the lab. The use of e-notebooks is at your own risk as they may get wet, dirty, and/or damaged.
- You may bring to lab your smart phone/**camera** to take photographs of the specimens and/or other digital devices to support your learning. Again, this is at your own risk as they may get wet, dirty, and/or damaged.

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Course Assessment

Component	Weight (% of final grade)	Date (see schedule)
Tests/quizzes		
External & Internal Anatomy Quiz (in lab, 30 min)	*20%*	*Fri Feb 9th*
General Fish ID Quiz (in lab, 60 min)	*20%*	*Fri Feb 16th*
Dichotomous Key Quiz (in lab, 60 min)	*10%*	*Fri Mar 15th*
Atlantic Fish ID Quiz (in lab, 60 min)	*20%*	*Mon Apr 8th*
Assignments (submitted online in Brightspace Dropbox by 11:59 pm)		
Modelling Fish Growth Results	*5%*	*Fri Mar 8th*
Life-History Research Manuscript	*25%*	*Fri Apr 5th*
Other (submitted online in Brightspace Dropbox by 11:59 pm)		
Project for bonus mark	*+3%*	*Tues Apr 9th (last day of classes)*

Conversion of numerical grades to final letter grades follows the Dalhousie Grade Scale:

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

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Course Learning Objectives

After successfully completing this course, the student will have the ability to:

- Locate and identify external and internal morphological features of most groups (e.g., Superclasses, Classes, Subclasses) of fishes.
- Identify, describe, and memorize the Latin binomials, common names, Families and Orders of fishes ranging phylogenetically from Myxiniformes (hagfish) to Salmoniformes (salmons, trouts, and chars) and from Stomiiformes (hatchetfish and viperfish) to Tetraodontiformes (puffer and tobies).
- Measure and record data related to classical meristics and morphometrics of a broad range of fishes.
- Use fish dichotomous keys.
- Determine the age of several fishes using calcified structures.
- Measure a number of different life-history variables on previously frozen Atlantic Canadian marine fishes and contribute to a class dataset.
- Incorporate growth and age data into a von Bertalanffy growth model as well as calculate life-history invariants.
- Use the R software package for statistical computing.
- Prepare and mount a whole fish skeleton.
- Prepare a written manuscript in accordance with the principles of scientific writing that includes descriptive and statistical analyses of a chosen set of life-history variables.
- Optional participation in a live fish behaviour experiment where students can gain valuable practical insights on:
    a. Fish inspection behaviours of a new foreign object, and compare male and female fish behaviour.
    b. How to collect observational data on fish behaviour.
    c. Writing a research proposal.
    d. Ethical experimental designs with live animals, including proper controls, replicates, statistical analyses, and background research materials.
    e. Submitting a video presentation of their findings and propose follow up experiments.

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Course (Tentative) Schedule and Content[1]

[1] Schedule may change to instructor's discretion.

[2] All lab assignments are submitted online via Brightspace and are due by 11:59 pm at the end of your lab day.

[3] In the event of a campus closure during the term, the Week 13 lab may be removed from the schedule.

Date	Topics	Details	Due
Week 1 (Jan 12)	**General Fish ID I & Their External Morphology**	The purpose of this lab is to identify, describe, and memorize the Orders and Families of fish specimens ranging phylogenetically from Myxiniformes (hagfish) to Salmoniformes (salmons, trouts, chars), and to familiarize students with their external morphology. The specimens examined will have been preserved in 65% ethanol.	
Week 2 (Jan 19)	**General Fish ID II & Their External Morphology**	The purpose of this lab is to identify, describe, and memorize the Orders and Families of fish specimens ranging phylogenetically from Stomiiformes (hatchetfish, viperfish) to Tetraodontiformes (puffers, tobies), and to familiarize students with their external morphology. The specimens examined will have been preserved in 65% ethanol.	
Week 3 (Jan 26)	**External & Internal Anatomy** **General Fish ID Review**	The first part of the lab will be to familiarize students with various aspects of the external and internal anatomy of fishes. Subject to availability, the specimens may represent widely distributed species in Atlantic Canada, such as Atlantic Cod, Haddock, Atlantic Salmon, Brook Trout, Striped Bass, or American Eel. Students will also locate and determine the age of these fishes, using calcified structures (otoliths). **Dissection of fresh or previously frozen specimens will be required.** The second part of the lab will be to review the Orders and Families of fish specimens representing most major groups (e.g., Superclasses, Classes, and Subclasses) of fishes, and to express some of the tremendous diversity characterized by the most speciose group of vertebrates, and to help prepare for the General ID Quiz.	
Week 4 (Feb 2)	MUNRO DAY	NO CLASS	
Week 5 (Feb 9)	**External & Internal Anatomy Assessment** **Fish Skeleton Part 1**	During the first part of the lab, students will be tested on their knowledge of fish external and internal anatomy. In the second part of the lab, students will start a 4-wk long method for cleaning and mounting of a fish skeleton, starting with de-fleshing the fish skeleton carcass and letting it soak in a soap solution for a week.	**External & Internal Anatomy Quiz (20%)**

Week 6 (Feb 16)	**General Fish ID Assessment** **Fish Skeleton Part 2**	The first part of the lab will be comprised of an Identification Quiz (Order and Families) to test the species identification knowledge gained by the students thus far. During the second part of the lab, students will further rinse and clean the fish skeleton, then letting it soak in a hydrogen peroxide solution for a week.	**General Fish ID Quiz (Order & Families) (20%)**
Week 7 (Feb 23)	STUDY BREAK	NO CLASS	
Week 8 (Mar 1)	**Fish Skeleton Part 3** **Meristics & Morphometrics** **Life-History Data Measurement, Age Determination, and Dataset Construction**	In the first part of the lab, students will rinse, sort and let their fish bones dry for another week. In the second part of the lab will include an introductory lecture on fish meristic and morphometric variables and will involve the measurement and recording of data related to classical meristic and morphometric characters of a phylogenetically broad range of fishes. In the third part of the lab, students will measure a number of different variables from a subsample of a fresh or previously frozen Atlantic Canadian species of marine fish about which very little information is currently known. Students will also determine the age of these fish, using calcified structures (otoliths). The class dataset will be used in the Week 9 lab to obtain growth models.	
Week 9 (Mar 8)	**Modelling of Fish Growth using R** **Fish Skeleton Part 4**	For the first part of the lab, the fish size(s) and age data obtained in Week 8 will be incorporated into a Von Bertalanffy growth model using R, a free software package for statistical computing. In addition to modelling growth, students will be responsible for calculating life-history invariants. Access to a laptop computer is required (one can be obtained upon request if needed). Students will submit their modelling results for grading. Each student will be responsible for resubmitting the (graded) data in the form of a research manuscript written in accordance with the principles of scientific writing that includes descriptive and statistical analyses of these data. Deadline for this manuscript is by the last day of classes. In the second part of the lab, students will start mounting their fish skeleton.	**Modelling Fish Growth Results (due Fri Mar 8 via Brightspace Dropbox) (5%)[2]**

Week 10 (Mar 15)	**Dichotomous Keys & Assessment**	The purpose of this lab will be to introduce students to the process of using dichotomous keys to identify species. ***At the end of the lab***, students will participate in a Quiz to test their ability to identify species using keys and skills acquired.	**Dichotomous Key Quiz (Genus & Species) (10%)**
Week 11 (Mar 22)	**Atlantic Fish ID**	Students will have access to fresh and/or previously frozen fish so they can practice identifying and memorizing the Latin binomials and common names of broad diversity of Atlantic fishes.	
Week 12 (Mar 29)	GOOD FRIDAY	NO CLASS	
Week 13 (Apr 5)	**Manuscript Q&A, Fish Skeleton, and Atlantic Fish ID Review** [3]	Self-directed lab where students can ask questions regarding their manuscript, continue mounting their fish skeleton, and have access to fresh and/or previously frozen fish so they can practice identifying and memorizing the Latin binomials and common names of broad diversity of Atlantic fishes. [2]	**Life-History Research Manuscript (25%) due Fri Apr 5 via Brightspace Dropbox**
Week 14 (Mon Apr 8) & (Tues Apr 9) Last day of classes	 **Atlantic Fish ID Assessment** **Open Lab/ Backup day[2]**	***These last 2 days of the term are reserved for "Friday" classes due to Munro Day & Good Friday.*** The lab will be open on Mon Apr 8 at the regular lab time. During the first part of the lab, students will be tested on their knowledge of their Atlantic Fish IDs. In the second part of the lab, students will continue mounting their fish skeleton. The lab will be open on Tues Apr 9 at the regular lab time and **may be used as a backup day[2],** and/or open for students who would like to finish mounting their fish skeleton, and/or have any questions regarding their Bonus Assignment that is **due on the last day of classes.**	 **Atlantic Fish ID Quiz (Genus & Species, and common names) (20%)** **Project for bonus mark (+3%) due Tues Apr 9 via Brightspace Dropbox**
There will be no Final Exam scheduled by the Registrar's Office for this class.			

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Course Policies on Missed or Late Academic Requirements

Students are expected to **read the course syllabus** in full and **keep track of all the deadlines**.

Students with a **Special Accommodations plan must follow their plan's guidelines** to request extensions and/or alternative testing arrangements.

Students who require an alternate deadline and/or testing date due to **cultural and/or religious holidays**, please contact the Instructor (isabelle.aube@dal.ca) beforehand.

Labs

- Due to limited availability of fresh, frozen, and preserved fish specimens, students are encouraged to **attend all labs**. Specimens may be destroyed by the end of the lab; therefore, a makeup lab may not be possible.
- For safety reasons, **no food or drink** will be allowed in the lab and students must **wear closed-toed shoes**. Students requiring periodic breaks within the lab period are reminded to **wash their hands before leaving the lab.**
- All students are required to **wash their work surfaces, tools, equipment, work gloves and/or hands with the provided disinfectant and soap before leaving the lab**.
- To minimize the smell of decaying fish, by the end of the lab, **all fresh and previously frozen biological specimens must be discarded in a labeled transparent double-bag in the freezer**.
- Highly **soiled gloves and paper towels must also be discarded in a separate labeled transparent double-bag in the freezer**.
- Preserved specimens must be **discarded according to the in-lab instructions**.
- **Late arrivals and early departures are discouraged** as they can disrupt the flow of the lab and put more setup and breakdown responsibilities on others.
- If a student **misses a Quiz, the instructor must be contacted** by email (Isabelle.aube@dal.ca) at the earliest possible time. A makeup Quiz may be granted with a reasonable excuse (determined by the instructor on a case-by-case basis). Documentation for the excuse (e.g., sick note) or a Student Declaration of Absence form will **not** be required.
- All assignments are to be submitted in the associated Brightspace Dropbox **by 11:59 pm on the due date. A 10% per day (including weekends) deduction** will be levied on all late assignments without a reasonable excuse (determined by the instructor on a case-by-case basis). If the student requires an extension due to a reasonable excuse, the student must contact the instructor by email (Isabelle.aube@dal.ca) at the earliest possible time. Documentation for the excuse (e.g., sick note) or a Student Declaration of Absence form will **not** be required.
- Unless otherwise specified, **all work must be submitted as one's own**. If you collaborate in pairs or in groups during or outside the lab, avoid plagiarism by reviewing the Academic Policy link provided in Section B of this syllabus.

- All graded components of this course are valued; therefore, **none of the missed work will be prorated**. It is the responsibility of the student (or an intermediate) to contact the instructor by email (Isabelle.aube@dal.ca) at the earliest possible time to make arrangements to complete all Quizzes and assignments in the event of missed labs.
- In the event of a **school closure (sign up at https://dalalert.dal.ca/), the lab will be cancelled or rescheduled.** More details will be provided on the BIOL 4080 Brightspace page. If labs are cancelled or rescheduled for other reasons, an announcement will be made on the BIOL 4080 Brightspace page.

Course Policies related to Academic Integrity

You may collaborate with others in this course while working on your assignments; however, **you must submit your own unique work that is appropriately referenced**.

If you collaborate with others to obtain photographs in the lab, **you must credit the person who took the photo.**

The use of generative **Artificial Intelligence (AI)** and large language models (e.g., **ChatGPT**) is not a replacement for a student's own voice and creativity. However, students may use these programs to help reduce writing workload (e.g., generate a summary of notes, create practice questions). Please note that these programs are not foolproof, and it is the student's responsibility to **verify ALL the information generated against accuracy, plagiarism, and that the work is appropriately referenced**. If you have any concerns with your use of these programs, you are encouraged to contact the Instructor (isabelle.aube@dal.ca).

The use of online assignment help tools (e.g., **Chegg®**) is considered cheating and is **prohibited to use for the assignments in this course.**

If an **Academic Integrity offence** is suspected (e.g., plagiarism or cheating) the case will be forwarded directly to an 3rd party Academic Officer as per Dalhousie University guidelines.

Faculty of Science Course Syllabus (Section B)

University Policies and Statements

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. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.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-dal/internationalization.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

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) 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/about-dal/agricultural-campus/student-success-centre.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: http://www.dal.ca/cultureofrespect.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/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

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/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at:
https://www.dal.ca/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.html

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.

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Faculty of Science Course Syllabus (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

Classroom Recording Protocol: https://www.dal.ca/dept/university_secretariat/policies/academic/classroom-recording-protocol.html

Dalhousie Grading Practices Policies: https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Grade Appeal Process: https://www.dal.ca/campus_life/academic-support/grades-and-student-records/appealing-a-grade.html

Sexualized Violence Policy: https://www.dal.ca/dept/university_secretariat/policies/health-and-safety/sexualized-violence-policy.html

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

General Academic Support – Advising (Truro): https://www.dal.ca/about-dal/agricultural-campus/ssc/academic-support/advising.html

Student Health & Wellness Centre: 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

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

Indigenous Connection: https://www.dal.ca/about-dal/indigenous-connection.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 or 902-494-6803: https://cdn.dal.ca/content/dam/dalhousie/pdf/academics/UG/indigenous-studies/Elder-Protocol-July2018.pdf

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

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

South House Sexual and Gender Resource Centre: https://southhousehalifax.ca/about/

LGBTQ2SIA+ Collaborative: https://www.dal.ca/dept/vpei/edia/education/community-specific-spaces/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/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Human Rights and Equity Services: https://www.dal.ca/dept/hres.html

Writing Centre: 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

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