

**Faculty of Science Course Syllabus (Section A)**  
**Department of Biology**  
BIOL/MARI 4080  
Laboratory Study of Fishes  
Winter 2023

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

**Instructor:** C. Isabelle Aubé; [isabelle.aube@dal.ca](mailto:isabelle.aube@dal.ca); LSC 2123; Office hrs Mondays: 12-1 pm

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

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

**Tutorials:** None

**Course delivery:** In-person (not recorded)

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

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### **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**

Prerequisites: BIOL 3080.03 or MARI 3080.03

Exclusions: BIOL 3067.03, MARI 3067.03, BIOL 5067.03

### **Course Exclusion**

None

### **Course Objectives/Learning Outcomes**

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 Myxiniiformes (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.

### Required 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.*

### Course Assessment

Component	Weight (% of final grade)	Date
<b>Tests/quizzes</b>		
<i>External &amp; Internal Anatomy Quiz (30 min)</i>	20%	<i>Fri Feb 10<sup>th</sup>, 2023</i>
<i>General Fish ID Quiz (60 min)</i>	20%	<i>Fri Feb 17<sup>th</sup>, 2023</i>
<i>Dichotomous Key Quiz (60 min)</i>	10%	<i>Fri Mar 17<sup>th</sup>, 2023</i>
<i>Atlantic Fish ID Quiz (60 min)</i>	20%	<i><u>Mon</u> Apr 10<sup>th</sup>, 2023</i>
<b>Assignments (submitted in Brightspace Dropbox)</b>		
<i>Modelling Fish Growth Results</i>	5%	<i>Fri Mar 10<sup>th</sup>, 2023 <u>at end of lab</u></i>
<i>Life-History Research Manuscript</i>	25%	<i><u>Thurs</u> Apr 6<sup>th</sup>, 2023</i>
<b>Other</b>		
<i>Project for bonus mark</i>	+3%	<i><u>Tues</u> Apr 11<sup>th</sup>, 2023 (last day of classes)</i>

### 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)		

## Course Policies

- 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.
- All assignments are to be submitted in the associated Brightspace Dropbox. 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](mailto: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.
- If a student misses a quiz or a presentation, the instructor must be contacted by email ([Isabelle.aube@dal.ca](mailto:Isabelle.aube@dal.ca)) at the earliest possible time. A makeup quiz or presentation 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 graded components of this course are valued; therefore, none of the missed work will be prorated. It is the responsibility of the student to contact the instructor by email ([Isabelle.aube@dal.ca](mailto:Isabelle.aube@dal.ca)) at the earliest possible time to make arrangements to complete all quizzes, assignments and presentations 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 Schedule and Content<sup>1</sup>**

<b>Date</b>	<b>Topics</b>	<b>Details</b>	<b>Due</b>
Week 1 (Jan 13)	<b>General Fish ID I &amp; Their External Morphology</b>	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 20)	<b>General Fish ID II &amp; Their External Morphology</b>	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 27)	<b>External &amp; Internal Anatomy</b>  <b>General Fish ID Review</b>	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). <b>Dissection of fresh or previously frozen specimens will be required.</b>  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 3)	MUNRO DAY	NO CLASS	
Week 5 (Feb 10)	<b>External &amp; Internal Anatomy Assessment</b>  <b>Fish Skeleton Part 1</b>	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.	<b>External &amp; Internal Anatomy Quiz (20%)</b>

<sup>1</sup> Schedule may change to instructor's discretion.

Week 6 (Feb 17)	<b>General Fish ID Assessment</b>  <b>Fish Skeleton Part 2</b>	<p>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.</p> <p>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.</p>	<b>General Fish ID Quiz (Order &amp; Families) (20%)</b>
Week 7 (Feb 24)	STUDY BREAK	NO CLASS	
Week 8 (Mar 3)	<b>Fish Skeleton Part 3</b>  <b>Meristics &amp; Morphometrics</b>  <b>Life-History Data Measurement, Age Determination, and Dataset Construction</b>	<p>In the first part of the lab, students will rinse, sort and let their fish bones dry for another week.</p> <p>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.</p> <p>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.</p>	
Week 9 (Mar 10)	<b>Modelling of Fish Growth using R</b>  <b>Fish Skeleton Part 4</b>	<p>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.</p> <p>In the second part of the lab, students will start mounting their fish skeleton.</p>	<b>Modelling Fish Growth Results (due <u>at end of lab</u> via Brightspace Dropbox) (5%)</b>

Week 10 (Mar 17)	<b>Dichotomous Keys &amp; Assessment</b>	The purpose of this lab will be to introduce students to the process of using dichotomous keys to identify species. <b><i>At the end of the lab</i></b> , students will participate in a Quiz to test their ability to identify species using keys and skills acquired.	<b>Dichotomous Key Quiz (Genus &amp; Species) (10%)</b>
Week 11 (Mar 24)	<b>Atlantic Fish ID</b>	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 31)	<b>Manuscript Q&amp;A, Fish Skeleton, and Atlantic Fish ID Review <sup>2</sup></b>	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. <sup>2</sup>	<b>Life-History Research Manuscript (25%) due <u>Thurs Apr 6</u> via Brightspace Dropbox</b>
Week 13 (Apr 7)	GOOD FRIDAY	NO CLASS	<b>See above</b>
Week 14  ( <u>Mon Apr 10</u> )  &  ( <u>Tues Apr 11</u> ) Last day of classes	<b>Atlantic Fish ID Assessment</b>    <b>Open Lab/ Backup day<sup>2</sup></b>	<b><i>These last 2 days of the term are reserved for "Friday" classes due to Munro Day &amp; Good Friday.</i></b>  The lab will be open on <u>Mon Apr 10</u> 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 <u>Tues Apr 11</u> at the regular lab time and <b>may be used as a backup day<sup>2</sup></b> , 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 <b>due on the last day of classes</b> .	<b>Atlantic Fish ID Quiz (Genus &amp; Species, and common names) (20%)</b>  <b>Project for bonus mark (+3%)</b>
<b>There will be no final exam scheduled by the Registrar's Office for this class.</b>			

<sup>2</sup> In the event of a campus closure during the term, this lab may be removed from the schedule.

## Faculty of Science Course Syllabus (Section B) BIOL/MARI 4080

### University Policies and Statements

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

#### 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](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](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](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](mailto:elders@dal.ca)).

**Information:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

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

<https://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=117&chapterid=-1&topicgroupid=31821&loaduseredits=False>

#### University Grading Practices

[https://www.dal.ca/dept/university\\_secretariat/policies/academic/grading-practices-policy.html](https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html)

**Faculty of Science Course Syllabus (Section C)**  
BIOL/MARI 4080

**Student Resources and Support**

**Advising**

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

**Science Program Advisors:** <https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>

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

**Black Students 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/current-students.html](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](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](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.html](https://www.dal.ca/campus_life/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](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>

**Dalhousie COVID-19 information and updates:** <https://www.dal.ca/covid-19-information-and-updates.html>