

**Faculty of Science Course Syllabus**  
**Department of Biology**  
**BIOL/MARI 4080**  
**Laboratory Study of Fishes**  
**Winter 2020**

**Instructor:** C. Isabelle Aubé      isabelle.aube@dal.ca      Office: LSC 2123

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

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

**Tutorials:** None

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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 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 fish.
- identify, describe, and memorize the Latin binomials, common names, families and orders of fish ranging phylogenetically from Myxiniiformes (hagfish) to Salmoniiformes (salmons, trouts, and chars) and from Stomiiformes (hatchetfish and viperfish) to Tetraodontiiformes (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 fish 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>General Fish ID Quiz</i>	20%	<i>Jan 30<sup>th</sup>, 2020</i>
<i>Dichotomous Key Quiz</i>	10%	<i>Feb 6<sup>th</sup>, 2020</i>
<i>External &amp; Internal Morphology Quiz</i>	20%	<i>Feb 27<sup>th</sup>, 2020</i>
<i>Atlantic Fish ID Quiz</i>	20%	<i>Apr 2<sup>nd</sup>, 2020</i>
<b>Assignments (submitted in Brightspace Dropbox)</b>		
<i>Modelling Fish Growth Results</i>	5%	<i>Mar 5<sup>th</sup>, 2020 (due end of lab)</i>
<i>Life-History Research Manuscript</i>	25%	<i>Apr 6<sup>th</sup>, 2020 (due last day of classes)</i>
<b>Other</b>		
<i>Project for bonus mark</i>	3%	<i>Apr 6<sup>th</sup>, 2020 (due last day of classes)</i>

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

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

Week 1 (Jan 9)	<b>External Morphology &amp; Fish ID I</b>	The purpose of this lab is to familiarize students with the external morphology of fish specimens ranging phylogenetically from Myxiniiformes (hagfish) to Salmoniiformes (salmons, trouts, chars), as well as identify, describe, and memorize the Latin binomials, common names, families, and orders. As with several labs, the specimens examined will have been preserved in 65% ethanol.	
Week 2 (Jan 16)	<b>External Morphology &amp; Fish ID II</b>	The purpose of this lab is to familiarize students with the external morphology of fish specimens ranging phylogenetically from Stomiiformes (hatchetfish, viperfish) to Tetraodontiformes (puffers, tobies), as well as identify, describe, and memorize the Latin binomials, common names, families, and orders. As with several labs, the specimens examined will have been preserved in 65% ethanol.	
Week 3 (Jan 23)	<b>Fish ID Review Part 1</b>	The purpose of this lab will be to review the families and orders 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.	
Week 4 (Jan 30)	<b>Fish ID Assessment</b>  <b>External (Review) &amp; Internal Morphology</b>	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.  The second part of the lab will be a review of external morphology and to familiarize students with various aspects of the internal morphology 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. <b>Dissection of fresh or previously frozen specimens will be required.</b>	<b>General Fish ID Quiz (Order &amp; Families) (20%)</b>
Week 5 (Feb 6)	<b>Dichotomous Keys</b>	The purpose of this lab will be to introduce students to the process of using dichotomous keys to identify species. <b>At the end of the lab</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>

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

Week 6 (Feb 13)	<b>Meristics &amp; Morphometrics</b>  <b>Life-History Data Measurement, Age Determination, and Dataset Construction</b>	<p>The first 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 second 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. The subsample(s) of fish used for this part of the lab will be the same species used for the upcoming morphology quiz (e.g. cod, mackerel, or hake...).</p>	
Week 7 (Feb 20)	STUDY BREAK	NO CLASSES	
Week 8 (Feb 27)	<b>Quiz on External and Internal Morphology</b>  <b>Fish Skeleton Part 1</b>	<p>During the first part of the lab, students will be tested on their knowledge of fish external and internal morphology.</p> <p>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.</p>	<b>External &amp; Internal Morphology Quiz (20%)</b>
Week 9 (Mar 5)	<b>Modelling of Fish Growth using R</b>  <b>Fish Skeleton Part 2</b>	<p>For the first part of the lab, the fish size(s) and age data obtained in Week 6 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>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>Modelling Fish Growth Results (due at end of lab via Brightspace Dropbox) (5%)</b>

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

Week 10 (Mar 12)	<b>Fish Skeleton Part 3</b>  <b>Fish ID Review Part 2</b>	<p>In the first part of the lab, students will rinse, sort and let their fish bones dry for another week.</p> <p>During the second part of the lab, 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.</p>	
Week 11 (Mar 19)	<b>Fish Skeleton Part 4</b>	Students will mount their fish skeleton.	
Week 12 (Mar 26)	<b>Manuscript Q&amp;A, Fish Skeleton, and Fish ID Review Part 3 <sup>2</sup></b>	Self-directed lab where students can ask questions regarding their manuscript, finish 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>	
Week 13 (Apr 2)		<b>Atlantic Fish ID Quiz (Genus &amp; Species, and common names) (20%)</b>	
Last day of classes (Mon Apr 6)		<b>Life-History Research Manuscript due via Brightspace Dropbox (25%)</b>	

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

<sup>2</sup> In the event of a campus closure during the term, this lab will 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://www.dal.ca/academics/important\\_dates.html](https://www.dal.ca/academics/important_dates.html)

### **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)

### **Missed or Late Academic Requirements due to Student Absence (policy)**

[https://www.dal.ca/dept/university\\_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html](https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html)

## **Student Resources and Support**

### **Advising**

General Advising [https://www.dal.ca/campus\\_life/academic-support/advising.html](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](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/services-support/student-health-and-wellness.html](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](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>