

Faculty of Science and Faculty of Graduate Studies Course Syllabus
Department of Biology

MARI 3602.03 — BIOL 5602.03
Introduction to Aquaculture
Winter 2024

Instructor: Dr. Diego Ibarra | e-mail: Diego.Ibarra@dal.ca | Office: LSC-5014 (Biology)

Questions **MUST be posted in Brightspace's Discussion boards** (see guidelines below). Only use email for private/personal matters.

Lectures: Tue, Thu - 2:35 pm to 3:55 pm | Location: LSC-PSYCHOLOGY P4260

Course delivery: In-person. However, in some circumstances (e.g. a pandemic), we could switch to online teaching, if needed.

TA: Natalie Klinard | email: natalie.klinard@dal.ca

Course Description

This course offers a lecture-based introductory overview of aquaculture; the culturing and rearing of aquatic plants and animals. Lectures will deal with the following topics: (1) general overview of aquaculture; (2) physical and chemical properties of the aquatic environment; (3) site selection; (4) aquatic engineering; (5) aquaculture modeling; (6) finfish culture; (7) bivalve culture; (8) crustacean culture; (9) seaweed culture; (10) health and pathology; (11) growth and nutrition; (12) genetics and reproduction; (13) legal, economic, social and environmental considerations; (14) sustainability issues. These topics will be covered with both a Maritimes and a global perspective.

This course is designed to familiarize students with the multi-disciplinary nature of aquaculture as a field. The introduction will describe the state of aquaculture production in the world. The main body of the course is divided in three sections covering the aquatic milieu, species specific culture techniques, and general biological principles. The amount of interplay between various physical, biological and species-specific aspects will be shown in each topic. We will overview legal, economic and social considerations and we will look at some of the controversies surrounding aquaculture environmental sustainability. This is an introductory class, and most topics will not be covered in fine detail. However, I expect student to get a clear appreciation of the underlying principles of aquaculture and how these come into play in chosen examples of aquaculture practices.

Course format

This course will be delivered face-to-face. However, if needed (e.g. a pandemic), we can switch to an online format.

Course Prerequisites

Undergraduate	Graduate
BIOL 2003.03 – Animal Diversity OR Instructor's approval	Instructor's approval

Course Objectives/Learning Outcomes

- Describe the historical and current state of aquaculture in the world
- Describe the basic physical-chemical parameters of water that are relevant to aquaculture
- Explain current culture systems and associated basic engineering aspects
- Characterize the biology and culture of 8 major groups of cultured aquatic organisms
- Explain basic reproductive physiology and the application of genetic tools to aquaculture
- Identify the important macro and micronutrients relevant to fish nutrition and feed formulation
- States the main factors related to aquatic health and disease and their interplay
- Describe the main economic, legal and social contexts associated with aquaculture
- Discuss the various point of views related to aquaculture environmental impacts and sustainability
- Extract information from relevant aquaculture-related sources for presentation (Class presentation)

Course Materials

Textbook (optional):

- Aquaculture. Farming Aquatic Animals and Plants. 2nd edition 2012. J. Lucas and P. Southgate (Editors), 629 pp.
OR
- Aquaculture. Farming Aquatic Animals and Plants. 2003, J. Lucas and P. Southgate (Editors), 502 pp.

Class notes:

Class notes are posted on Brightspace. Announcements and additional material will be posted regularly and students should check the site frequently.

Other useful reading material:

Encyclopedia of Aquaculture. (2000). R. Stickney (Editor) *This is an excellent and relatively up-to-date source of information.	SH 20.3 E53
Principles of Aquaculture. R Stickney	SH 135 S74 1994
Introduction to aquaculture. M. Landau	SH 135 L36 1992
Ecological Aquaculture. The evolution of the blue revolution B. Costa-Pierce	SH 135 E35 2002
Cold-water aquaculture in Atlantic Canada A. Boghen	SH 37 C64 1995

Course Assessment

Component	Weight (% of final grade)		Date
	Undergraduate	Graduate	
Daily Quizzes	50	35	Every lecture
Midterm exam	25	15	See schedule below
Mini Final exam	25	20	See schedule below
Research paper	-	30	One week after final exam @ 11:59 pm
TOTAL	/100	/100	

Daily Quizzes

During most lectures, an online quiz (approx. 10 minutes) will be applied to test the material taught during the previous lecture (plus one question from previous quizzes). Please bring your laptop (charged) and your phone as a backup. For each quiz, students are **required** to make and use **hand-written “cheat-sheets” (one cheat-sheet per .pdf lecture)**. **A photo of each cheat-sheet must be uploaded to its corresponding Brightspace dropbox BEFORE you do the quiz.**

Cheat-sheets not meeting specifications (see below) will result in a **zero grade** in the corresponding quiz. See below for missed quizzes and corresponding penalties.

Cheat-sheet specifications:

- Cheat-sheets are personal. **Copying somebody else’s cheat-sheet is a serious plagiarism offence** requiring the instructor to report all involved parties to the Academic Integrity Office.
- Cheat-sheets **MUST** be hand-written on paper. Digitization, electronic manipulation, photocopying, photographing and/or printing of cheat-sheets is not allowed.
- On your cheat-sheet, write your name, B00 number, date and Quiz number.
- Content: Anything you want, but you **must** demonstrate an effort to synthesize lecture content.
- Size: each cheat-sheet is limited to one side of a letter-sized sheet of paper.
- A photo of each cheat-sheet must be uploaded to its corresponding Brightspace dropbox BEFORE you do the quiz.
- Do one cheat-sheet per .pdf lecture. Some days we’ll go over more than one lecture during the class. For these days, make sure you upload separate cheat-sheets for each of the .pdf lectures.

Missed quizzes. If you don’t do a quiz, it will be marked as a zero (note: lowest marked quiz is **NOT** dropped). However, if you miss a quiz, you are allowed to schedule a make-up quiz within 2 weeks of missing the quiz, to avoid getting a zero. **Email the TA (and Cc the Instructor)** to schedule a make-up quiz (note that the TA is the one in-charge of scheduling the make-up quizzes and exams; thus, emailing only the instructor will delay the process). Students are allowed to re-schedule two quizzes during the course (for any reason) without any penalty. After that, penalties will apply depending on the number of quizzes missed according to the table below. Note that the penalties apply regardless of the reason why you missed the quiz, except in the following two cases: (1) Students that enrol late can get exemptions for the quizzes missed before they enrolled to the class (up to two weeks from the start of class). (2) Students with prolonged illness (e.g., mono) or other serious extenuating circumstances can contact the instructor to arrange for quiz exemptions; note that in these extenuating cases, a Student Access Advisor from Student Affairs may need to be involved.

Quiz missed (then re-scheduled)	Penalty (% deduction)
1 st quiz missed	0%
2 nd quiz missed	0%
3 rd quiz missed	-5%
4 th quiz missed	-10%
5 th quiz missed	-20%
6 th quiz missed	-40%
7 th quiz missed	-60%
8 th quiz missed	-80%
9 th quiz missed	-90%
10 th quiz missed and beyond	-100% (i.e. you are not allowed to take the quiz)

Missed cheat-sheets. If you don't do, or forget to submit a cheat-sheet, the mark of the corresponding quiz will be changed to a zero. This will happen within a few weeks after the quiz is done, once the TA marks the cheat-sheets. If you did not submit a cheat-sheet, email the TA to arrange for a late submission to get your grade restored (or partially restored, if penalties apply, see below). Students are allowed to "late submit" up to two cheat-sheets during the course (for any reason) without any penalty. After that, penalties will apply depending on the number of cheat-sheets submitted late according to the same penalty scheme as the "Missed Quizzes table" shown above.

Midterm and Mini Final exams

Unlike Daily Quizzes, it is **NOT** allowed to bring cheat-sheets to the Midterm and the Mini Final exams.

Missed Midterm and Mini Final exams. Email **the TA (and Cc the Instructor)** to schedule a make-up exam (note that the TA is the one in-charge of scheduling the make-up quizzes and exams; thus, emailing only the instructor will delay the process). Please arrange for a make-up exam as soon as you know that you will not be able to do the exam at the normal time.

Research paper (Graduate students only)

Each graduate student needs to prepare a *Literature Review* "manuscript" following the "Review Articles" guidelines in the "[Guide for Authors](#)" from the journal *Aquaculture*. The manuscript must provide objective critical evaluation of the subject. It cannot consist solely of a summary of the available literature. Evaluation of the quality of existing data, the status of knowledge, and the research required to advance knowledge of the subject are essential.

Students are encouraged to discuss their interests and propose subject ideas to the instructor. However, the subject of the review will ultimately be appointed by the instructor. If the student is registered for the *Graduate Certificate in Aquaculture*, the subject of the review must also be approved by the Certificate Coordinator.

Rubric: Research paper

Component		Comments	Weight (%)
Format		Manuscript must follow the formatting guidelines from the "Guide for Authors – Type of paper: Review Articles" from the journal <i>Aquaculture</i> https://www.elsevier.com/journals/aquaculture/0044-8486/guide-for-authors	5%
Clarity		Writing style must be clear and concise. The main content must be divided using headings carefully chosen to assist the reader to understand the content	10%
Critical thinking		The manuscript cannot be a simple summary of literature. Students must demonstrate the ability to evaluate the quality of the available knowledge and to provide suggestions for further advance the subject	10%
Content	Title	Follow instructions in "Guide for Authors – Type of paper: Review Articles" from the journal <i>Aquaculture</i> . https://www.elsevier.com/journals/aquaculture/0044-8486/guide-for-authors	5%
	Abstract		10%
	Table of contents		5%
	Introduction		5%
	Content sections		30%
	Conclusions		10%
	References		10%
TOTAL:			100%

Conversion of numerical grades to Final Letter Grades

Undergraduate students follow the [Dalhousie Common Grade Scale](#). Graduate students follow a stricter scale, where a minimum of 70% (B-) is required to pass.

%	Undergraduate			Graduate		
	Letter Grade	Grade Point Value	Definition	Letter Grade	Grade Point Value	Definition
90 - 100	A+	4.30	Exceptional	A+	4.30	Exceptional
85-89	A	4.00	Excellent	A	4.00	Excellent
80-84	A-	3.70	Very Good	A-	3.70	Very Good
77-79	B+	3.30		B+	3.30	
73-76	B	3.00	Good	B	3.00	Good
70-72	B-	2.70		B-	2.70	
65-69	C+	2.30	Satisfactory	F	0.00	Failure
60-64	C	2.00		F		
55-59	C-	1.70		F		
50-54	D	1.00	Marginal Pass	F		
<50	F	0.00	Failure	F		

Course Policies

Attendance is mandatory: Students are required to attend to all classes, and to remain in class for its entire duration.

Missing a class:

- Refer to the sections of *Missed quizzes*, *Missed cheat-sheets*, or *Missed exams* for further instructions.
- Fill in a [Student Declaration of Absence \(SDA\) form](#) and upload it to the Brightspace Dropbox designated for SDAs.
- Students with an Accessibility or Accommodation Plan in place **do not** need to submit SDA form.

Brightspace will be used to post lectures, updates and announcements.

Course Content			
Week	Day	Date	Topic
1	Tue	Jan 9	Syllabus and course presentation Background
1	Thu	Jan 11	History Production and trends
2	Tue	Jan 16	Physicochemistry of water
2	Thu	Jan 18	Physicochemistry of sediments
3	Tue	Jan 23	Sources of water Culture systems 1
3	Thu	Jan 25	Culture systems 2
4	Tue	Jan 30	Microalgae (biofuels) and other live feed Macroalgae
4	Thu	Feb 1	Bivalves and other mollusks
5	Tue	Feb 6	Shrimps and other crustaceans
5	Thu	Feb 8	Freshwater finfish (carp and tilapia)
6	Tue	Feb 13	Salmonids
6	Thu	Feb 15	Marine finfish
7	Tue	Feb 20	STUDY BREAK
7	Thu	Feb 22	STUDY BREAK
8	Tue	Feb 27	MIDTERM
8	Thu	Feb 29	Aquaculture engineering 1
9	Tue	Mar 5	Aquaculture engineering 2
9	Thu	Mar 7	Aquaculture modelling
10	Tue	Mar 12	Genetics and reproduction
10	Thu	Mar 14	Nutrition
11	Tue	Mar 19	Diseases
11	Thu	Mar 21	Sustainability and controversies
12	Tue	Mar 26	Aquaculture legislation and regulations in Nova Scotia and Canada
12	Thu	Mar 28	Economics and business planning in aquaculture
13	Tue	Apr 2	Course review, exam preparation and Student Rating of Instruction (SRI)
13	Thu	Apr 4	MINI FINAL

NOTE: Lecture dates and topics may change depending on course pace and weather-related class cancellations.

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.

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>