DALHOUSIE UNIVERSITY

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

MARI 3602.03 — BIOL 5602.03
Introduction to Aquaculture
Winter 2019

Instructor: Dr. Diego Ibarra | *e-mail:* Diego.Ibarra@dal.ca | *Office:* LSC-3625 (Oceanography)

Office hours: by appointment

Lectures: Tue, Thu 13:05 - 14:25 | **Location:** Studley LSC-COMMON AREA C244

TA: Jessica Bennett | email: js344308@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 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 micro nutrients 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 from time to time 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
Aquaculture Initiative (Presentation) †	13	13	Mar-25 @ 11:59 pm
Aquaculture Initiative (vote distribution)	2	2	Mar-30 @ 11:59 pm
Final exam	35	20	Scheduled by Registrar
Research paper	-	30	One week after final exam @ 11:59 pm
TOTAL	/100	/100	

† Team work component

Daily Quizzes
At the beginning of most lectures, a written quiz (approx. 10 minutes) will be applied to test the material taught during the previous lecture. Students are required to bring and use a **hand-written "cheat-sheet"** for each Daily Quiz. Cheat-sheets not meeting specifications (see below) will result in a zero grade in the

corresponding quiz. Note that appropriate documentation (e.g. Declaration of Absence form, doctor's note, etc.) is required to justify missed quizzes. **Please email the Teaching Assistant (and Cc the Instructor), before or on the day you missed a quiz,** with a brief explanation of why you missed the class and attach any supporting documentation.

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.
- Size: each cheat-sheet is limited to one side of a letter-sized sheet of paper.
- Content: Anything you want, but **must** demonstrate effort to synthetize lecture content.

Aquaculture Initiative

Teams of two students will propose to the class (via a PowerPoint presentation) an "Initiative" directly related to aquaculture. This exercise is meant to stimulate creativity and "out-of-the-box-thinking", therefore the term "initiative" is purposely left vague and open to student interpretation. Examples of "initiatives" could include (1) an aquaculture farm with innovative characteristics or in an innovative place, (2) a new method for culturing a species, (3) a new method of distribution of aquaculture products, (4) a new feed source for aquaculture species, (5) an "app" to improve aquaculture husbandry, (6) an Non-Governmental-Organization for promoting aquaculture in rural areas, (7) a new "standard" to track product sustainability, (8) a new instrument to improve aquaculture monitoring, (9) or anything else, as long as it is innovative and directly related to aquaculture.

The "initiative" will be presented to the class via a PowerPoint presentation. See below for details on the requirements for the presentations. After all initiatives are presented, each student will allocate votes among all the presented initiatives, depending on the individual merits of each proposal. See below for details on how the process of vote allocation will work.

Proposal presentation: Each team will have **6 minutes** to present their proposals (including questions and setup time). Students should upload their presentations, in PowerPoint or PDF format, to Brightspace. The order of presentation will be randomly determined by blindly drawing names out of a box to determine the name of the following presenter. While not all team will present on the same day, **all teams must have their presentations finished and uploaded to Brightspace the night before the first day of presentations (by 11:59 pm).** The proposals will be marked using the rubric below.

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Rubric: Aquaculture Initiative (Proposal Presentation)

Component	Comments	Weight (%)
Time	Presentation kept within allotted time	10%
Clarity of oral presentation	Delivery of material clearly and concisely	10%
Clarity of slides	Use figures, graphs and images effectively. Text should be minimal and for the purpose of aiding the audience (not the presenter)	10%
Responses to questions	Demonstrate a clear understanding of the problem and the proposed "initiative"	10%
Content	**Catchy title** – Arguably, your title is a "one-word" or "one-phrase" pitch of your initiative. The title is how people will remember and refer to your "initiative", and thus it is a very important part of your work. It needs to be easy to remember (i.e. "catchy"), but it also needs to describe, and ultimately sell, your product to the audience.	10%
	Rationale – Why is your "initiative" needed? What gap or demand or need it will be fulfilling? What is the problem?	10%
	Description – What is your "initiative"? What are its main distinguishing features?	10%
	Why is it innovative or novel? – Why is your "initiative" special? Are there other products or "initiatives" similar to your proposed one? If so, how is yours different?	10%
	Cost – How much money will you need to develop your "initiative"? How are you going to spend the money?	10%
Obtained votes	See "Vote distribution" section (below)	10%
	TOTAL:	100%

Vote distribution: After all "initiatives" are presented, a Google-Spreadsheet with the titles of all proposed "initiatives" will be made available to all students. Each student will have 1000 votes, and each students will distribute their votes among all proposed initiatives (**EXCEPT their own**). The criteria to assign votes is purposely left a bit vague; in essence, students should give more votes to what they think are better and more innovative ideas. However more specific criteria like profitability or capacity to increase quality of life in the community can also be taken into account.

After all students finish distributing their votes, the "Obtained votes" section (see rubric above) will be computed for all proposals, where the "initiative" that raised the most votes will get the full 10%.

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.

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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 Aquaculture 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 Aquaculture. 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%

Final exam

Unlike Daily Quizzes, it is **NOT** allowed to bring a cheat-sheet to the final exam.

Conversion of numerical grades to Final Letter Grades

Undergraduate students follows the Dalhousie Common Grade Scale. Graduate students follows a more strict 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**		

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Course Policies

Attendance is mandatory: Students are required to attend to all classes, and to remain in class for its entire duration. Note that appropriate documentation (e.g. Declaration of Absence form, doctor's note, etc.) is required to justify missed classes**. Please email the Teaching Assistant (and Cc the Instructor), before or on the day you missed a class,** with a brief explanation of why you missed the class and attach any supporting documentation.

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

Late assignments: A 10% reduction in grade will be applied for every day an assignment is late.

Assignment submission: Assignments should be submitted via Brightspace as .pdf file by 11:59 pm on the due date.

Course Content

Week	Day	Date	Topic
1	Tue	Jan-8	Syllabus and course presentation | Background
1	Thu	Jan-10	History | Production and trends
2	Tue	Jan-15	Physicochemistry of water
2	Thu	Jan-17	Physicochemistry of sediments
3	Tue	Jan-22	Sources of water | Culture systems 1
3	Thu	Jan-24	Culture systems 2
4	Tue	Jan-29	Microalgae (biofuels) and other live feed | Macroalgae
4	Thu	Jan-31	Bivalves and other mollusks
5	Tue	Feb-5	Shrimps and other crustaceans
5	Thu	Feb-7	Freshwater finfish (carp and tilapia)
6	Tue	Feb-12	Salmonids
6	Thu	Feb-14	Marine finfish
7	Tue	Feb-19	Study break
7	Thu	Feb-21	Study break
8	Tue	Feb-26	Aquaculture engineering 1
8	Thu	Feb-28	Aquaculture engineering 2
9	Tue	Mar-5	Field trip (Aquatron)
9	Thu	Mar-6	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	Student presentations
12	Thu	Mar-28	Student presentations
13	Tue	Apr-2	Economics and business planning in aquaculture
13	Thu	Apr-5	Aquaculture legislation and regulations in Nova Scotia and Canada

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

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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

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

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

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).
Information: 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

University Grading Practices
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

Student Resources and Support

Advising

General Advising 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

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

International Centre: 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

Studying for Success: 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

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

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