UNDERGRADUATE HANDBOOK

Department of Ocean Sciences

A guide to undergraduate programs, courses and resources

MEMORIAL UNIVERSITY

August 2021

Check for updates

TABLE OF CONTENTS

Honours in Ocean Sciences & Marine Biology 16

Courses 21

Contact Information 28

Important Links & Resources 29

APPENDIX 1 – Checklist of Program Completion 31

INTRODUCTION

What is Ocean Sciences?


© D. Howells

Ocean Sciences, or Oceanography, is a field that encompasses the study of the global marine environment from broad geographic and disciplinary perspectives. It essentially looks at the interaction between marine life and oceanic processes, covering such diverse topics as coastal and deep-sea food webs, marine animal ecology, physiology and behaviour, plankton dynamics, the effects of pollution or climate change on ocean life and ecosystems, the management and conservation of aquatic resources, and much more.

Why Study Ocean Sciences?

Our planet is predominantly covered by a vast ocean, which plays a key role in driving its climate and ecosystems, directly or indirectly affecting the lives of most of its inhabitants. Therefore, job opportunities and career perspectives for students with training in Ocean Sciences are extremely varied and rewarding.

Trainees and graduates may find work as **laboratory technicians** or **research assistants** in ocean-related fields such as:


© S. Trueman

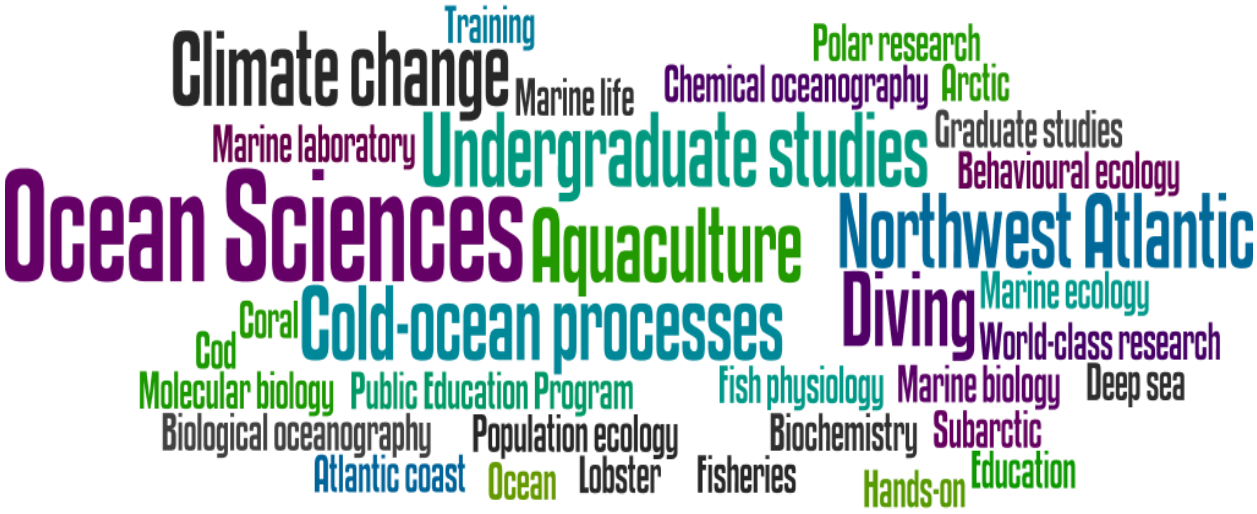
- Oceanography
- Marine biology
- Aquaculture
- Fisheries
- Wildlife management

Other potential positions may include, but are not limited to:

- Marine science educator
- Fisheries officer
- Nature interpreter
- Aquarium curator
- Environmental analyst/consultant
- Scuba diver

Importantly, students with a Major in Ocean Sciences are well prepared to undertake **graduate studies** (MSc, PhD) in various ocean-related fields, leading to further professional and academic positions in government, research or higher education.

Many websites collate information about careers in ocean-related fields, such as **Oceancareers**, **ASLO**, and **many others**. You can even take a **cool survey** to identify career paths for you in ocean sciences!



The Department of Ocean Sciences and the Ocean Sciences Centre

The **Department of Ocean Sciences** (DOS) is housed at the **Ocean Sciences Centre** (OSC) in Logy Bay, which is located approximately 10 kilometers (15 min) from the St. John's campus of Memorial University. The OSC is a major facility for marine research on the Atlantic coast and is one of Canada's largest marine laboratories. By virtue of its location, the department provides scientists and students access to the flora and fauna of the northwest Atlantic Ocean and is uniquely situated for shore-based studies of cold-ocean processes and subarctic, Arctic and deep-sea organisms.

Education and training is one of the Department's principal mandates, and is achieved by providing a stimulating, research-intensive environment in which students can develop and thrive. The Department offers **graduate** and **undergraduate** programs, as well as hands-on field and laboratory research experience through part-time and summer research positions for undergraduates. The distinctiveness of the Department's resources provides an opportunity for interdisciplinary training in cold-ocean and deep-sea research, related to:

- Physiology;
- Biochemistry;
- Molecular biology;
- Biological and chemical oceanography;
- Behavioural and population ecology;
- Aquaculture and fisheries.

Be sure to check out OceanUS – the Ocean Sciences Undergraduate Society!

UNDERGRADUATE PROGRAMS IN OCEAN SCIENCES

While this Handbook has been prepared with care to provide important and useful details about undergraduate affairs, the most accurate and up-to-date information about programs offered at Memorial University can always be found in the **University Calendar** (we are under the Faculty of Science)

Bachelor of Science with Major / Honours in Ocean Sciences

Major in Ocean Sciences / Honours in Ocean Sciences

An interdisciplinary program administered by the Department of Ocean Sciences, providing a solid foundation in ocean studies, with an emphasis on the basic principles of chemical and biological oceanography. See calendar descriptions for the **Major** and **Honours**.

Major in Ocean Sciences (Environmental Systems)

A stream of the above that provides a stronger geological and geographical context to biological and chemical phenomena in ocean sciences. It also covers such key ocean-related topics as climate change and natural hazards. **See calendar description**.

Bachelor of Science with Joint Major / Honours in Marine Biology

Jointly administered by the Departments of Ocean Sciences and Biology, these programs develop the knowledge of marine organisms at various scales, from cellular and behavioural aspects all the way to species interactions within ecosystems. See calendar description for the **Joint Major** (scroll down to 10.1.13) and **Joint Honours** (scroll down to 10.2.21).

Bachelor of Science with Minor in Ocean Sciences

Minor in Oceanography

An interdisciplinary program administered by the Department of Ocean Sciences in cooperation with the departments of Biology, Chemistry, Earth Sciences and Physics & Physical Oceanography. It is intended primarily for students in the Faculty of Science but is open to other students. **See calendar description.**

Minor in Sustainable Aquaculture and Fisheries Ecology (SAFE)

This program introduces students to aquaculture and fisheries management practices and helps prepare them for a career in applied marine fields. This interdisciplinary program is administered by the Department of Ocean Sciences in cooperation with the Marine Institute. It is intended primarily for students in the Faculty of Science but is open to other students. **See calendar description.**

Program Objectives

After completion of a Major/Honours in Ocean Sciences or in Marine Biology (4 years, full time), students are expected to have acquired the following skill sets, knowledge and aptitudes.

General skill sets

1. Communication: Graduates will practice effective communication with an awareness of audience and a sense of purpose.
2. Critical thinking: Graduates will skillfully conceptualize, apply, analyze, synthesize, and evaluate information gathered from observation, experience, reflection, reasoning, or communication.
3. Quantitative reasoning: Graduates will accurately use numbers, symbols, measurements, properties, and the relationships of quantities to make sound decisions, judgments, and/or predictions.

Specific Program Objectives of the Major in Ocean Sciences

1. Graduates will demonstrate breadth of knowledge related to ocean environments and processes, including founding principles in mathematics, biology, chemistry, physics and geology.
2. Graduates will understand the dynamic nature of oceans, and the interactions between the benthic and pelagic environments.
3. Graduates will discover and apply practical and quantitative skills appropriate to ocean sciences, including tools and analytical methods employed in modern oceanography and marine biology.
4. Graduates will integrate concepts of ocean sciences with contemporary issues in fisheries, aquaculture, climate change and pollution.
5. Graduates will demonstrate depth of knowledge in at least one of the main areas of ocean sciences, such as biology/ecology of marine organisms, physical/chemical processes in the marine environment, or interaction between earth and ocean systems.

Specific Program Objectives of the Joint Major in Marine Biology

1. Graduates will demonstrate breadth of knowledge related to ocean environments and processes, including founding principles in mathematics, biology, chemistry, physics and geology.
2. Graduates will identify and understand the basic biological levels of organization (e.g. molecules, cells, organisms, communities and ecosystems) and concepts (e.g. biodiversity, evolution).
3. Graduates will discover and apply practical and quantitative skills appropriate to marine biology, including sampling techniques, experimental methods, and principles of data analysis.
4. Graduates will integrate concepts of marine biology with contemporary issues in applied fields such as aquariology, biotechnology, fisheries, aquaculture, and conservation.
5. Graduates will demonstrate depth of knowledge in at least one of organism-level or ecosystem-level marine biology.

Perspectives

As an Ocean Sciences Major, you have the opportunity to customize your program to your personal interests and career goals. In particular, during the third and fourth years of the program, you will have a

chance to choose a disciplinary stream or select courses to make your academic record more competitive for a given employment sector. The Marine Biology Joint major is already designed for those who wish to blend a foundation in Ocean Sciences with a deeper knowledge of biological systems.

Also consider that if you want to continue your studies at the graduate level, an Honours degree is required by most institutions. In all cases, it is advisable to consult the **Academic Program Officer** early on to discuss your goals and expectations, and use the **Checklist of Program Completion** to track your progress.

First and Second Years of Program

Preparing for and Declaring an Academic Program

Ideally, a student in the first year will prepare for the Bachelor of Science Major program by taking the required 1000-level courses in English, Mathematics and in other Science subjects. In most situations, students must complete 30 credit hours and the necessary course work (see **Admission Requirements below**) before declaring a Major using a form called Declaration/Change of Academic Program (**available from the Office of the Registrar**). This completed form should be brought or emailed to the **Academic Program Officer** in the Department of Ocean Sciences for necessary approval. It then needs to be submitted to the Office of the Registrar. The same process is required to declare a Minor.

Admission Requirements

Admission to any of the programs is based on academic standing. To be considered, students must normally have completed 30 credit hours (typically = 10 courses) with a minimum of 24 credit hours in Science, and an overall average of at least 60 or 65% (depending on the program). It is recommended that the following courses be completed before admission:

1. 6 credit hours in Critical Reading & Writing (CRW), including at least one English course;
2. Biology 1001 and 1002 (with a minimum grade of 65% for marine biology programs);
3. Chemistry 1050 and 1051;
4. Earth Sciences 1000;
5. Mathematics 1000;
6. Ocean Sciences 1000 with a minimum grade of 65%; and
7. Physics 1020 or any Ocean Sciences 2XXX (depending on program).

Note that, because of scheduling and course offerings, it may take three semesters (1.5 years) to complete all these courses, especially if you have not followed the suggested time tables from the onset. Use the **Checklist of Program Completion** to keep track of your progress.

Second Year of the Program

The Majors in Ocean Sciences and Marine Biology are interdisciplinary programs that require a broader than usual introductory coursework (to adequately prepare students for higher-level courses in a diversity of marine disciplines), which is balanced by a slightly lower number of mandatory courses from the subject of the Major. Therefore, the second year of the Major program typically continues to build on the Science foundation gained during the first year, while also exposing students to a widening variety of courses in Ocean Sciences and/or Marine Biology (see **sample schedules**).

Toward the end of the second year, students may need to start making some important choices, especially if they plan to lean toward a more environmental, biological or applied stream or curriculum. Adequate preparation must be made when thinking of the advanced courses your wish to take in your **third and fourth year**, and the prerequisites they require.

Academic Counselling

Upon declaring a Major in Ocean Sciences or a Joint Major in Marine Biology, it is strongly recommended to meet with the **Academic Program Officer** at the earliest opportunity, and follow up with a meeting at least once every semester. Topics that you may want to discuss include:

- Choice of courses (see **sample schedules**)
- Stream or specialization
- Program change or withdrawal
- Academic progress
- Absences and problems
- Special circumstances
- Career planning

Students are also encouraged to seek advice from faculty members in the Department, particularly on topics related to career planning and academic development.

***** Make sure to meet with the Academic Program Offcier at the start of your final year to confirm that you are on track to meet all program requirements for timely graduation (and avoid stressful surprises).**

SAMPLE SCHEDULES

Major / Honours in Ocean Sciences

Importantly, the actual schedule **will vary depending on a student's background and specific circumstances**. Students pursuing a Bachelor of Science with a Major in Ocean Sciences will normally take the following courses during the first two years of the program:

Sample 1

Fall Semester Y1	**Winter Semester Y1**
Ocean Sciences 1000	Earth Sciences 1000
Biology 1001	Biology 1002
Chemistry 1050	Chemistry 1051
English 1090	English 1110 (or any CWR course)
Mathematics 1000	Physics 1020
Fall Semester Y2	**Winter Semester Y2**
Physics 1021	Ocean Sciences 2000
Statistics 2550	Ocean Sciences 2001
Science elective 1*	Ocean Sciences 2100
Science elective 2	Ocean Sciences 2200
Science elective 3	+ Ocean Sciences 2500 (Spring Y2)

Sample 2

Fall Semester Y1	**Winter Semester Y1**
Ocean Sciences 1000	Earth Sciences 1000
Biology 1001	Biology 1002
Chemistry 1050	Chemistry 1051
English 1090	English 1110 (or any CWR course)
Mathematics 1000	Ocean Sciences 2000 or 2100
Fall Semester Y2	**Winter Semester Y2**
Physics 1020	Ocean Sciences 2001
Statistics 2550	Ocean Sciences 2000 or 2100
Science elective 1*	Ocean Sciences 2200
Science elective 2	Physics 1021
Science elective 3	+ Ocean Sciences 2500 (Spring Y2)

***** Science electives should be chosen based on the prerequisites of anticipated senior courses in Ocean Sciences (see **list of 3XXX/4XXX courses)** in order to prepare adequately for Years 3 and 4 of the program. Recommended choices include Biology 2060, Biology 2122, Biology 2250 (or Biochemistry 2100), Biochemistry 2200, and Biology 2600.

NOTE: Students must also complete Science 1807 and 1808 (online, no credits) before registering to any course with a laboratory section. Usually, this should be done in the first semester.

Major in Ocean Sciences (Environmental Systems)

Importantly, the actual schedule **will vary depending on a student's background and specific circumstances**. Students who wish to take the Bachelor of Science with a Major in Ocean Sciences (Environmental Systems stream) may elect to take the following courses during the first two years of the program:

Sample 1

Fall Semester Y1	**Winter Semester Y1**
Ocean Sciences 1000	Earth Sciences 1000
Biology 1001	Biology 1002
Chemistry 1050	Chemistry 1051
English 1090	English 1110 (or any CWR course)
Mathematics 1000	Physics 1020
Fall Semester Y2	**Winter Semester Y2**
Physics 1021	Earth Sciences 1002
Statistics 2550	Ocean Sciences 2000
Science elective* 1 (Geography 1050)	Ocean Sciences 2001
Science elective 2 (Biology 2122)	Ocean Sciences 2100
Science elective 3 (Geography 2195)	+ Ocean Sciences 2500 (Spring Y2)

* *Some popular elective choices are suggested in parenthesis*

Sample 2

Fall Semester Y1	**Winter Semester Y1**
Biology 1001	Biology 1002
Chemistry 1050	Chemistry 1051
English 1090	English 1110 (or any CWR course)
Earth Sciences 1000	Earth Sciences 1002
Mathematics 1000	Physics 1020

It is possible to complete this first year schedule at the Grenfell Campus. However, it will delay fulfilment of the admission requirements.

Fall Semester Y1	**Winter Semester Y2**
Ocean Sciences 1000	Physics 1021
Statistics 2550	Ocean Sciences 2000
Science elective* 1 (Geography 1050)	Ocean Sciences 2001
Science elective 2 (Biology 2122)	Ocean Sciences 2100
Science elective 3 (Geography 2195)	Ocean Sciences 2200
	+ Ocean Sciences 2500 (Spring Y2)

* *Some popular elective choices are suggested in parenthesis*

NOTE: Students must also complete Science 1807 and 1808 (online, no credits) before registering to any course with a laboratory section. Usually, this should be done in the first semester.

Joint Major / Honours in Marine Biology

Importantly, the actual schedule **will vary depending on a student's background and specific circumstances**. Students pursuing a Bachelor of Science with a Joint Major Marine Biology will normally take the following courses during the first year:

Sample 1

Fall Semester Y1	**Winter Semester Y1**
Ocean Sciences 1000	Ocean Sciences 2000
Biology 1001	Biology 1002
Chemistry 1050	Chemistry 1051
English 1090	English 1110 (or any CWR course)
Mathematics 1000	Physics 1020
Fall Semester Y2	**Winter Semester Y2**
Biology 2122	Biochemistry 2201
Biology 2250	Biology 2060
Chemistry 2400	Chemistry 2401
Physics 1021	Ocean Sciences 2001
Statistics 2550	Ocean Sciences 2100
	+ Ocean Sciences 2500 (Spring Y2)

Sample 2

Fall Semester Y1	**Winter Semester Y1**
Biology 1001	Biology 1002
Chemistry 1050	Chemistry 1051
English 1090	CRW course (English 1110 or other)
Math 1090 (or 1000)	Math 1000 or general elective
Physics 1020 or 1050	Physics 1021 or 1051
Fall Semester Y2	**Winter Semester Y2**
Biology 2250	Biology 2060
Biology 2600	Biology 2900
Chemistry 2400	Chemistry 2401
Statistics 2550	Ocean Sciences 2000 or 2001 or 2100
Ocean Sciences 1000	Biochemistry 2201

NOTE*:* Please consult early with the **Academic Program Officer**. Science 1807/1808 (online, no credits) must be completed before registering to courses with a laboratory section.

THIRD AND FOURTH YEARS OF PROGRAM

While there is no need to formally specialize your program (you can keep your options open and stay flexible, mixing and matching courses along the way), those who so wish it can choose concentrations or streams in Ocean Sciences among:

Environmental Systems

This is a formal stream of the Major in Ocean Sciences, with a curriculum that blends foundation courses in earth and ocean sciences, with a focus on environmental issues. It is designed for students with special interest in geography (e.g. cartography, remote sensing), climate, natural resources and marine geology.

Marine Biology – Ecology & Evolution

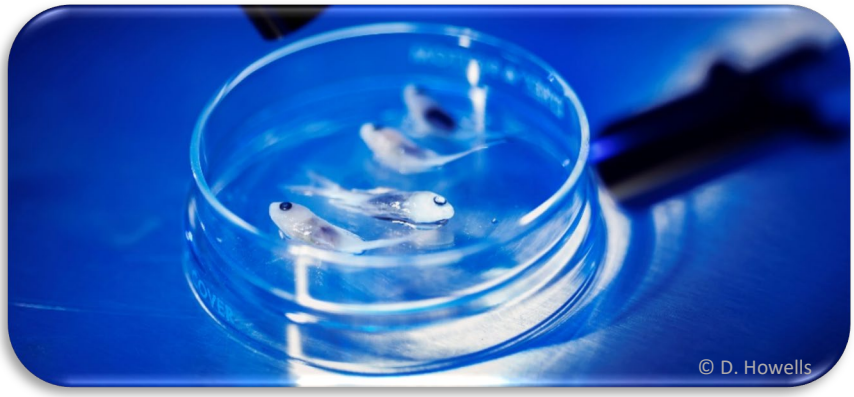
This concentration focuses on evolutionary and ecological principles at the organismal and ecosystem levels. Essentially, it centres on marine life at the macroscopic scale, including the behaviours of marine organisms, the connections among species and the interactions between living organisms and the marine environment. This concentration can be achieved either through selected curriculum within the Major in Ocean Sciences, or through the Joint Major in Marine Biology.

Marine Biology – Physiology & Molecular Biology

This is a concentration that dives deeper into the intricate workings of marine organisms. At this level of organization, students gain greater knowledge of cellular and molecular processes, right down to the genes. This concentration can be achieved either through selected curriculum within the Major in Ocean Sciences, or through the Joint Major in Marine Biology.

Applied Ocean Sciences

This curriculum specialization favours course work with a more practical approach and focuses on such topics as fisheries and aquaculture. The Department of Ocean Sciences and the School of Fisheries of the Marine Institute are currently working together to develop a Joint Major in Aquaculture & Fisheries (or a formal program along these lines) – so stay tuned.



HONOURS IN OCEAN SCIENCES & MARINE BIOLOGY

The Honours in Ocean Sciences is an interdisciplinary program that naturally complements the Major, providing an even stronger foundation in ocean studies and adding research component. Similarly, the Joint Honours in Marine Biology complements the Major of the same name. Possession of this degree will be of great advantage to students planning advanced work or graduate studies in a marine science field. Interested candidate should consult the **Department's Honours Guide** for details.

To earn an Honours in Ocean Sciences or a Joint Honours in Marine Biology, students must complete a prescribed number of credit hours, as outlined below, including a minimum number of courses at the 3000/4000 level, as well as mandatory completion of Ocean Sciences 499A and 499B, which consist of supervised research leading to the submission and oral defence of a dissertation.

The Honours program may comprise a broad base of courses following the model of the Major or be more narrowly focused, in line with the formal stream in Environmental Systems or the concentrations in marine biology. Upon admission, the student's Honours program will be defined in consultation with the student's supervisor, and approved by the Head of the Department (or delegate) in accordance with the Regulations for the Honours Degree of Bachelor of Science.

Admission Requirements for the Honours in Ocean Sciences

Admission to the Ocean Sciences Honours Program is based on academic standing. Students should be enrolled in one of the Major programs offered by the Department of Ocean Sciences before applying to the Honours, normally upon completing the third year of their program. For admission to the Honours program, students shall, at a minimum, have completed all **admission requirements for their Major program**.

Students should plan well in advance to ensure they have all the appropriate prerequisites. Entry to required courses may be limited and determined by academic performance. Students are advised to consult with the **Academic Program Officer** at the earliest opportunity to prepare adequately for program admission, or discuss academic issues (e.g. selecting courses and finding a supervisor).

Program Regulations for the Bachelor in Science with Honours in Ocean Sciences

Students must successfully complete:

1. the 30 specified credit hours required under **Admission Requirements** **for the Major in Ocean Sciences or the Major in Ocean Sciences (Environmental Systems)**;
2. Statistics 2550 or any of the courses listed in the credit restrictions of Statistics 2550;
3. Physics 1021 or 1051;
4. Chemistry 2400 (or equivalent);
5. a minimum of 12 credit hours among:
    a. Biology 2060, 2122, 2250, 2600, 2900;
    b. Biochemistry 2100, 2101 (or 2201), 3106, 3107, 3108;
6. a minimum of 45 credit hours in Ocean Sciences, including:
    a. Ocean Sciences 2000 (or Biology 3710), 2001, 2100, 2200, 2300 and 2500. Ocean Sciences 1000, completed under **Admission Requirements for the Major in Ocean Sciences or the Major in Ocean Sciences (Environmental Systems)**, will count as 3 of the required 45 credit hours in Ocean Sciences;
    b. At least 18 credit hours in Ocean Sciences at the 3000 and/or 4000 level;
    c. Ocean Sciences 499A and 499B; and
7. elective courses as necessary to make up the total of 120 credit hours, including a minimum of 15 credit hours at the 3000 and/or 4000 level in any of Biochemistry, Biology, Chemistry, Earth Sciences, Environmental Science, Geography, Ocean Sciences or Physics (these 15 credit hours can include courses completed as part of the requirements in 5b but not those required as part of 6 above).

NOTES

1. Those courses in which a grade "B" or an average of 75% or higher are required to graduate with an Honours degree (as per Clause 1, under **Academic Standing** of the **Regulations for the Honours Degree of Bachelor of Science**) are the Ocean Sciences courses at the 2000, 3000 and/or 4000 level, and 15 credit hours in courses at the 3000 and/or 4000 level in any of Biochemistry, Biology, Chemistry, Earth Sciences, Environmental Science, Geography, or Physics.

2. Chemistry 2440 will be accepted as a substitute for Chemistry 2400. However, a number of advanced Science courses may require Chemistry 2400 and 2401. Students are therefore strongly encouraged to complete the Chemistry 2400/2401 sequence or otherwise carefully plan their options.

3. Students should be aware that Biology 2250 and Biochemistry 2100 are credit restricted.

The **Honours Guide** provides more information on finding a supervisor, developing a research project, writing a thesis and preparing for the oral defence.

You can track your progress with this Honours using the **Checklist of Program Completion**.

Admission Requirements for the Joint Honours in Marine Biology

The program is jointly administered by the Department of Ocean Sciences and the Department of Biology. To be eligible for admission, students would normally follow **Admission Requirements** for the Joint Major in Marine Biology. Specifically, students must have completed Biology 2060, 2250, 2600, and 2900 and Ocean Sciences 2000 (or Biology 3710), 2001, 2100 and 2300 and obtained in these courses a grade of "B" or better, or an average of 75% or higher. Selection is based on academic performance in the required courses.

Program Regulations for the Bachelor in Science with Joint Honours in Marine Biology

The following courses will be required:

1. Six credit hours in Critical Reading and Writing (CRW) courses, including at least 3 credit hours in English courses;
2. Mathematics 1000;
3. Earth Sciences 1000;
4. Statistics 2550 or any of the courses listed in the credit restrictions of Statistics 2550;
5. Physics 1020 and 1021 (or 1050 and 1051);
6. Chemistry 1050 and 1051 (or Chemistry 1200 and 1001), and Chemistry 2400 and 2401;
7. Biochemistry 2201 or the former 2101;
8. Biology 1001, 1002, 2060, 2122, 2250 (or Biochemistry 2100), 2600, 2900, 3710 (or Ocean Sciences 2000) and 3711;
9. Ocean Sciences 1000, 2000 (or Biology 3710), 2001, 2100, 2300 and 2500;
10. Additional courses to complete a required 69 combined credit hours in Biology and Ocean Sciences with a minimum of 30 credit hours in either subject (except Biology 2040, 2041, 2120, 3053, and 3820). A minimum of 9 credit hours in Biology at the 3000/4000 level and 15 credit hours in Ocean Sciences at the 3000/4000 level is required;
11. Either Biology 499A and 499B or Ocean Sciences 499A and 499B; and
12. A sufficient number of elective courses to bring the degree total to 120 credit hours.

- *Courses cross listed between Biology and Ocean Sciences can only count for one subject or the other.*
- *A maximum of 9 credit hours can be in Biology courses with no associated laboratory/seminar.*

The **Honours Guide** provides more information on finding a supervisor, developing a research project, writing a thesis and preparing for the oral defence.

You can track your progress with this Honours using the **Checklist of Program Completion**.

Honours Dissertation

The dissertation is a crucial part of the Honours program. It involves an original piece of research undertaken under the supervision of a faculty member of the Department of Ocean Sciences (or someone holding cross-appointment or adjunct status in the department), as approved by the Head of the Department.

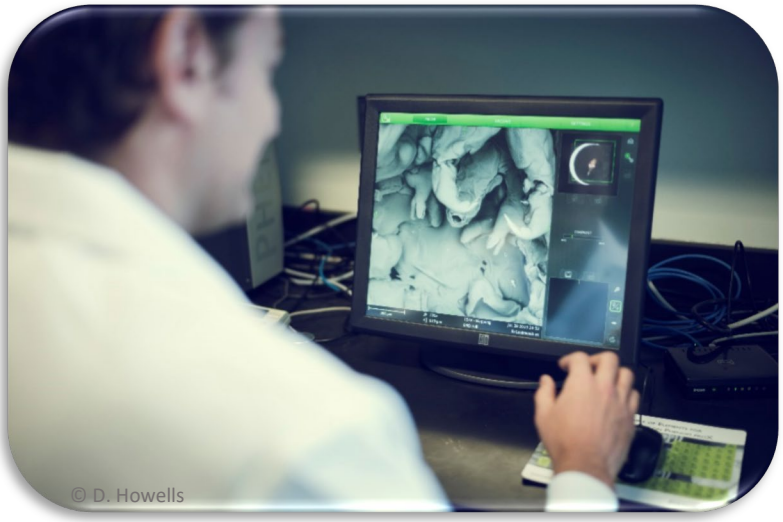
This research segment of the program corresponds to a two-semester linked course (Ocean Sciences 499A/499B; 6 credit hours), where a grade of pass in 499A is required in the first semester to proceed to 499B.

Work conducted during Ocean Sciences 499A/499B includes directed reading relevant to the dissertation topic, preparation of a dissertation outline, supervised research, data analysis and interpretation, a written dissertation and an oral defence. Electronic copies of the dissertation, complete with figures and tables, are to be submitted to the candidate's supervisor and to the Head of the Department not less than two weeks before the end of lectures in the semester in which the candidate is registered for Ocean Sciences 499B.

The candidate will be examined orally on the contents of the dissertation, normally before the last day for examinations in the semester. The examining committee shall consist of the Head of the Department (or delegate), the candidate's supervisor, and an examiner appointed by the Head of the Department in consultation with the candidate's supervisor.

IMPORTANT

Students wishing to undertake an Honours *should contact potential supervisors well ahead of time*. Students cannot enter the program until they have identified a supervisor and have agreed with the supervisor on a research topic for the Honours dissertation. A full list of current faculty members, adjuncts and cross-appointees can be found on the **departmental website**. Once a supervisor has been identified, students should contact the **Academic Program Officer** to complete the necessary paperwork.




© D. Howells

COURSES

Foundation Courses (1000/2000-level)

The following are examples of courses in Ocean Sciences that students will normally take in the first two years of the program. Importantly, there might be exceptions, as the actual selection of courses taken **will vary depending on a student's background, schedule and program requirements**. While these courses are typically offered in the same semester every year, exceptional circumstances may occur. It is the responsibility of the student to seek out the most up-to-date information on course offerings, in consultation with the **Academic Program Officer**. Always verify the published **Calendar descriptions**.

Ocean Sciences 1000

Exploration of the World Ocean is an introductory course covering the major ocean sciences (biology, chemistry, geology, physics) at a level sufficient for science majors but accessible to non-science majors. It explores phenomena occurring from the shoreline to the abyss and from equatorial to Polar Regions. It also examines principles of marine ecology as well as how the marine environment affects humans and vice versa. The course is offered either in a blended format (combining face-to-face lectures and online interactive activities in the form of virtual oceanographic expeditions) or exclusively online. *This course is a prerequisite to most subsequent courses in Ocean Sciences. It is generally taken in the first semester of the program*.

Lectures: Up to 1.5 hours per week
Online Interactive Activities: Up to 3 hours per week
Prerequisite: None

Ocean Sciences 2000

Introductory Biological Oceanography provides a general understanding of the biological processes that occur in coastal and oceanic environments. It introduces students to the major groups of bacteria, phytoplankton, invertebrates and fish, emphasizing the biotic and abiotic factors controlling primary production and marine biomass. It shows how the physical, chemical, and geological environments interact with biology to define processes and patterns affecting nutrients and life in marine ecosystems. *This course can be taken in the first or second year*. *Note the credit restriction with Biology 3710.*

Lectures: Three hours per week
Prerequisite: Ocean Sciences 1000 and a 1000-level course in one of Biology, Chemistry, Earth Sciences or Physics

Ocean Sciences 2001

Introduction to Sustainable Fisheries and Aquaculture introduces students to the breadth of aquaculture and fisheries science and the variety of animal species cultured and harvested. Basic aspects of aquaculture and fisheries and the links between the two are covered, including production systems, capture fisheries, environmental interactions, and the physiology, ecology and reproduction of finfish and shellfish in the context of their culture and harvest. *This course can be taken in the first or second year*.

Lectures: Three hours per week
Prerequisite: Ocean Sciences 1000 or Biology 1002

Ocean Sciences 2100

Introductory Chemical Oceanography (same as Chemistry 2610) provides an introduction to the fundamental chemical properties of seawater and the processes governing the concentrations of elements and compounds in the oceans. It is an introduction to the sources, distribution, and transformations of chemical constituents of the ocean, and their relation to biological, chemical, geological, and physical processes. Topics include: controls on average concentration of chemicals in the ocean; vertical and horizontal distributions of ocean constituents; air-sea interactions; production, export, and remineralization of organic matter; the ocean carbon cycle; human-induced changes; stable isotopes; and trace elements. *This course can be taken in the first or second year, but works best in the second semester for most schedules.*

Lectures: Three hours per week

Prerequisite: Chemistry 1011 or 1051 which may be taken concurrently, or Chemistry 1001

Ocean Sciences 2200

Introductory Geological Oceanography (same as Earth Sciences 2919) is a study of the formation and evolution of oceans, including plate tectonics, mid-ocean ridges (birth place of oceans), subduction zones (where oceans are consumed), sedimentary environments such as estuaries, deltas, beaches and barrier islands, continental shelves, slopes and deep abyssal plains and special topics, including anoxic events, evolution of tides, atmosphere-ocean interactions, formation of banded iron formations, snowball Earth, black and white smokers, and how Earth modulates its climate through atmosphere, hydrosphere, biosphere and lithosphere interactions.

Lectures: Three hours per week

Prerequisite: Earth Sciences 1000 with a grade of at least 55%

Ocean Sciences 2300

Introductory Physical Oceanography (same as Physics 2300) provides an introduction to the physical ocean. Ocean characteristics studied include: the properties of seawater, key features of ocean circulation, wind-forcing in the ocean, tides and shoreline processes as well as ocean coupling with the atmosphere, geosphere and cryosphere (ice) and new approaches to ocean sampling and numerical modelling. The course takes an integrated earth systems approach to the study of upwelling zones, open ocean ecosystems and climate change. *Note the credit restriction with Environmental Science 2371.*

Lectures: Three hours per week

Prerequisite: any two first-year courses in Physics (6 credit hours)

NOTE: due to the above prerequisite, this course is often taken in the third year of the Ocean Sciences programs

Ocean Sciences 2500

Introduction to Practical Ocean Sciences explores the instruments, techniques and analytical methods commonly used to study marine life and processes, chiefly focusing on the interaction between living organisms and their chemical, physical and geological environment. The course combines ship-based or shore-based sampling and data collection with laboratory investigation in an intensive 2-week long format. It is primarily intended for mid-level undergraduate students majoring in Ocean Sciences. This course will either be offered during a special session following the winter semester, or in the spring semester.

Prerequisite: Ocean Sciences 1000, and at least three of Ocean Sciences 2000 (or BIOL 3710), 2001, 2100, 2200, 2300

NOTE: This course is generally offered in the spring semester (May or June), and is designed to be taken at the end of the second year.

IMPORTANT

All courses with a laboratory/experimental component have Science 1807 (Safety in the Scientific Laboratory) and Science 1808 (WHMIS) as prerequisites. These courses are offered online and take about 2 hours to complete (there are no associated credits).

Senior Courses (3000/4000 level)

A selection of advanced course outlined below is normally taken in the last two years of the program.

Ocean Sciences 3000

Aquaculture Principles and Practices emphasizes the techniques and methods used to culture finfish and shellfish, with a primary focus on Canadian aquaculture species. Basic aspects of aquaculture will be covered, including the design and maintenance of production systems, culture techniques, and the nutrition, health, physiology and reproduction of finfish and shellfish. The laboratory portion of this course will provide students with practical experience in the maintenance of land-based aquaculture production systems and in the husbandry/culture of aquatic organisms.

Lectures: Three hours per week

Laboratory: Three hours per week

Prerequisite: Ocean Sciences 2001, or Ocean Sciences 1000 and Biology 1002

Ocean Sciences 3002

Aquaculture and Fisheries Biotechnology is an introduction to biotechnology and genetics as they are applied to aquaculture and fisheries. Topics covered include genetic variation; genetic structure of fish and shellfish populations; the genetic basis of aquaculture traits; finfish and shellfish genomic research; marker-assisted selection in aquaculture; manipulation of ploidy; genetic engineering in aquaculture; and techniques used to study the responses of aquatic animals to external stressors such as hypoxia, temperature stress, acidification, and pathogens.

Lectures: Three hours per week

Prerequisite: Biology 2250 or Biochemistry 2100 or Biochemistry 2200

Ocean Sciences 3600

Marine Microbiology provides an overview of microbial activity in the ocean, both in natural and applied settings. The focus is on interactions between microorganisms and other biota, ranging from deep-sea vent invertebrates to commercially cultured fish species. Prospective topics include effluent discharge, water quality, bacterial metabolism and nutrient cycles, bacteria-virus and bacteria-host interactions (including symbiosis and pathogenesis), and marine microbial biotechnology.

Lectures: Three hours per week

Prerequisite: Biology 2250 or Biochemistry 2100 or Biochemistry 2200

Ocean Sciences 3640

Environmental Physiology of Animals (same as Biology 3640) covers physiological adaptations of animals facilitating their survival in natural environments with emphasis on physiological and biochemical responses of animals to extreme environments. Starting with the fundamental basis of physiological mechanisms, the course explores various aspects and the integration of major physiological processes (metabolism, respiration, osmoregulation) and how these relate to ecological niche.

Lectures: Three hours per week

Prerequisite: Biology 2060; Biochemistry 3206 (or 3106)

Ocean Sciences 4000

Scientific Diving Methods is an in-depth study and application of methods routinely employed for data collection in underwater scientific research. Aspects covered include habitat mapping; installation and use of instrumentation; still and video camera techniques; planning and execution of surveys and experiments in major subtidal habitats; as well as data analysis and interpretation. Participants are trained in accordance with Memorial University of Newfoundland's Guide for Diving Safety and the Canadian Association for Underwater Science (CAUS) standards to meet the criteria for Scientific Diver I rating. This course is normally offered at the Ocean Sciences Centre in a special 2-week session at the beginning or end of the Spring semester.

Prerequisite: OCSC 2000 (or Biology 2122 and 2600; or Biology 3709; or Biology 3710; or Biology 3711; or Environmental Science 2371); Statistics 2550 or equivalent

NOTE: The following documentation must be provided to the course instructor at least four months before the first day of the course. It must be in effect until at least the last day of the course. Submission of this documentation does not guarantee acceptance into the course. Aside from course prerequisites, acceptance will be based on successful completion, before the course begins, of a diving fitness and skills evaluation in a pool environment and demonstration of understanding of the MUN Diving Safety Manual, physics and physiology of diving, and use of recreational dive tables. Nationally recognized scuba diver certification with diver rescue and accident management techniques; diver medical examination by a licensed physician knowledgeable in diving medicine; First Aid (basic), CPR (basic), and DAN oxygen first aid for scuba diving injuries administration cards; DAN membership and insurance or medical insurance covering hyperbaric treatment; diver's log book with at least 12 dives in the last 12 months including one dive in the last six months and four dives in cold (<10°C) water; cold-water scuba diving equipment complete with proper hydrostatic/VIP service tags on diving cylinders and overhaul/service receipts on regulators and buoyancy compensator devices. *All required equipment and supporting documentation is at the student's own expense.*

Ocean Sciences 4122

Advanced Studies in Marine Animal Diversity (same as Biology 4122) provides an in-depth examination of cellular, physiological, behavioural and ecological adaptations in marine animals. Lectures will be combined with discussions of relevant papers from the primary literature on topics of current interest which may relate morphology, ecology, evolution, natural history, species interactions and practical applications. Students will also gain hands-on experience by designing and conducting research projects involving live or preserved animals.

Lectures: either three hours of lecture and three hours of laboratory per week or a two-week intensive course that embodies equivalent instructional time

Prerequisite: OCSC 2000 and 2500 (or Biology 2122), and Biology 2600

Ocean Sciences 4200

Marine Omics provides an overview of marine genomics, transcriptomics, proteomics, glycomics, metabolomics, and lipidomics. Omics-based studies of a variety of marine organisms (e.g. fungi, algae, animals), as well as several industrial applications (e.g. biofuel, nutrigenomics, pharmacogenomics, aquaculture and fisheries), will be considered.

Lectures: Three hours per week

Prerequisite: OCSC 1000 and Biology 2250 (or Biochemistry 2100 or 2200), or OCSC 3002

Ocean Sciences 4300

Climate Change and Global Marine Fisheries Dynamics explores the effects of ocean-atmosphere dynamics on large scale marine ecosystem domains, with a special focus on assessing the impact of anticipated climate change on global fisheries production. The course uses a blend of lectures and computer simulation laboratories to familiarize students with current research on fisheries and climate change.

Lectures: Three hours per week

Prerequisite: OCSC 1000, 2000 (or Biology 3710) and 2001

Ocean Sciences 4400

Deep-Sea Ecology provides an overview of the physical and chemical environment of the deep sea, including hydrothermal vents and seeps, to explore adaptations in deep-sea organisms and biodiversity in this key oceanic system. The course combines lectures, seminars, discussions and computer-based laboratory tools, such as dive logs from remotely operated vehicles and data from underwater cabled observatories. It introduces students to emerging research, cutting-edge technologies, as well as natural and human impacts in the deep sea.

Lectures: Three hours per week

Laboratory: Three hours per week

Prerequisite: OCSC 2500 and at least one course in Ocean Sciences at the 3000 or 4000 level

Ocean Sciences 4500

Experimental Marine Ecology (same as Biology 4710) is a two-week intensive course that examines the ecology of cold oceans, focussing on energy flux through Newfoundland waters, and how the dynamics of this environment influence linkages among organisms in different habitats. The course is field and lab intensive, with lectures and a strong hands-on component. Students will collect field samples, identify local organisms from the plankton or the benthos, plan and conduct an experiment, and learn to interpret and present the gathered results.

Prerequisites: Science 1807 and Science 1808; BIOL 2600 or at least three of OCSC 2000 (or Biology 3710), 2001, 2100, 2200, 2300.

Note: This course is offered during two weeks of the Spring semester, likely in August.

Ocean Sciences 4601

Functional Biology of Fish (same as Biology 4601) is an introduction to anatomical physiological and cellular processes in the life cycle of fishes.

Lectures: Three hours per week

Prerequisite: Biology 2060; Biology 2210 or 3202; and Biology 3401 or 3640

Ocean Sciences 4910-4949 (Special Topics)

OCSC 4910 Hot Topics in Oceanography explores the fundamental science behind current oceanographic topics of key importance, challenging students to think of these issues from both a scientific and societal perspective. Topics of current interest are covered, for example sea level rise, ownership of the Arctic, marine protected areas, climate change, harmful algal blooms, coral reefs, and marine bioprospecting. Lectures are subdivided between learning scientific principles and using them inside student-led debates. Prerequisite: OCSC 1000 and a minimum of 3 credit hours at the 3000 level in any Science course.

OCSC 4920 Crustacean Biology covers the classification, anatomy/morphology, physiology, behaviour, ecology, fisheries and aquaculture of members of subphylum Crustacea from all environments, with an emphasis on aquatic and marine species. The course combines regular lectures with a hands-on workshop, where students can get familiar with representative specimens (e.g. crabs, lobsters, shrimps), and learn through dissections or simple behavioural experiments. Prerequisite: OCSC 1000 and 2000 (or Biology 3710), and Biology 2122 and 2600.

OCSC 4921 Reproductive Strategies of Marine Animals explores the principles and tactics of reproduction in an evolutionary ecology context, with an emphasis on adaptations to the marine environment. It focuses on the behavioural, ecological and life-history means by which marine animals maximize their lifetime reproductive success. The course covers such topics as hermaphroditism, sex ratio, reproductive allocation, mating systems, sexual selection, sexual dimorphism, and parental investment. Various reproductive strategies are exemplified in the major groups of marine animals. Prerequisite: OCSC 1000, Biology 2600 and 2900.

OCSC 4940 Immunobiology of Aquatic Organisms provides an overview of immunology of aquatic organisms. The focus is on comparative immunology, immune response to infections and environmental stressors (e.g. temperature, pollutants), and vaccinology of commercially cultured fish species. This course also covers topics related to the origin of adaptive immunity, antigen recognition and antibody diversity, memory immune response, and vaccine development. Prerequisite: Biology 2060 (or Biology 2250, or Biochemistry 2200/2100, or both Biochemistry 2200 and 2901). Biology 2060 is recommended.

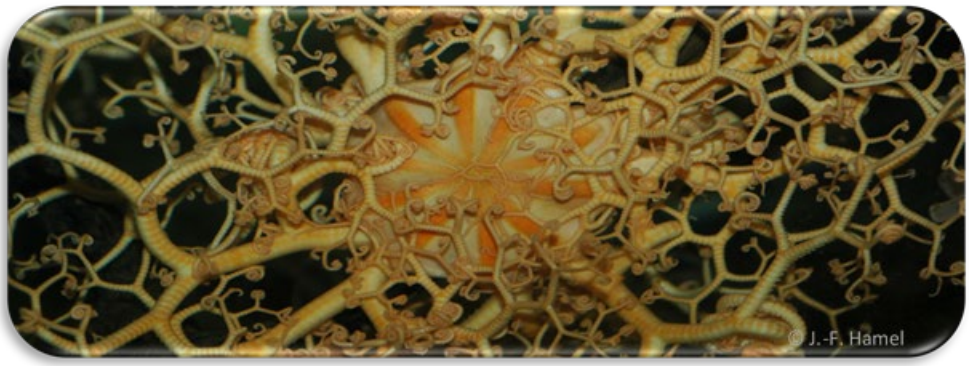
Ocean Sciences 499A and 499B

The Honours Dissertation is a two-semester linked course based on independent research conducted under the supervision of an academic supervisor, who is normally a faculty member of the Department of Ocean Sciences. This dissertation is mandatory for students pursuing the Honours in Ocean Sciences. A grade of pass in 499A is required to proceed to 499B. The final written dissertation is normally submitted before the end of the tenth week of the second semester, and an oral presentation of the completed research is delivered before the end of the semester.

Credit hours: 6

Prerequisite: Honours students in their final year or permission of the Head

See details about the dissertation here



CONTACT INFORMATION

	?	☎	
Main Office, Department of Ocean Sciences (Logy Bay)	• General inquiries • Room OS-3017	3708	**ocean@mun.ca**
Academic Program Officer (undergraduate + graduate affairs) – Danielle Nichols	• Questions about programs • Program forms • Courses offered • Scheduling • Counselling	2459	**ocean@mun.ca** **dnichols@mun.ca**
Intermediate Clerk – JoAnn Greening	• Front desk • Mail • Booking the Challenger Room • Supplies	3708	**jsgreening@mun.ca**
Departmental Secretary – Donna Inkpen	• Undergraduate secretarial matters • Stipends, payments • Reimbursements	2767	**dinkpen@mun.ca**
Administrative Staff Specialist – Marsha Roche	• Financial matters concerning policy and travel • Access card (after hours) • Travel and telephone issues • Payroll and stipend issues	3709	
Department Head – Dr. Chris Parrish		3586	**cparrish@mun.ca**
Deputy Head & Undergraduate Officer – Dr. Annie Mercier	• Undergraduate program development	2011	**amercier@mun.ca**
Deputy Head & Graduate Officer – Dr. Ian Fleming	• Graduate program development	3225	**ifleming@mun.ca**
Join us on social media **Facebook, Twitter, Instagram** **@munocean**			

The Department of Ocean Sciences is housed at the Ocean Sciences Centre (OSC) in Logy Bay. Information on how to get there (including **shuttle service**) and the full list of faculty, staff, research assistants and graduate students can be found on the Department's **website**.

IMPORTANT LINKS & RESOURCES

General

Ocean Sciences Undergraduate Society

https://www.mun.ca/osc/oceanus/

Faculty of Science Help Centres

https://www.mun.ca/science/students/help.php

Academic Advising Centre

https://www.mun.ca/regoff/advice/aac/

Procedures & Forms

From the Office of the Registrar

https://www.mun.ca/regoff/forms.php

Online Application

http://www.mun.ca/undergrad/apply/

Declaration/Change of Academic Program (Faculty of Sciences)

https://www.mun.ca/regoff/Declare-Change-Acad-Program-HSSS.pdf

Course Change Procedure and Form (Registrar)

https://www.mun.ca/regoff/registration-and-final-exams/changes-to-your-registration/electronic-submission-of-a-course-change-form/

Prerequisite Waiver

https://www.mun.ca/regoff/registration/Waiver_of_Prerequisite_2013.pdf

Other Ocean Sciences Undergrad Guidelines & Forms

https://www.mun.ca/osc/undergrad/forms/

Research, Training & Funding

Get Involved in Research

http://www.mun.ca/science/students/research.php

NSERC Undergraduate Student Research Award (USRA)

https://www.mun.ca/science/students/sura.php

Science Undergraduate Research Award (SURA)

http://www.mun.ca/science/students/sura.php

Other Scholarships

http://www.mun.ca/scholarships/scholarships/

MUCEP Positions (part-time)

https://www.mun.ca/student/student-success/work-experience/MUCEP.php

APPENDIX 1 – CHECKLIST OF PROGRAM COMPLETION

Major in Ocean Sciences

Course	Completed	Prerequisite(s)	Notes
English 1090 (or 1080)	☐	None	Or another CRW English course
Any CRW course	☐	None	Can be English 1110
Mathematics 1000	☐	MATH 1090 or test	
Physics 1020	☐	Level III MATH or MATH 1090	For admission, this course may be replaced by any OCSC 2XXX
Chemistry 1050	☐	Science 1807/1808*	
Chemistry 1051	☐	CHEM 1050	
Biology 1001	☐	Science 1807/1808*	
Biology 1002	☐	BIOL 1001	
Earth Sciences 1000	☐	None	
Ocean Sciences 1000	☐	None	Minimum grade of 65%
A Major is normally declared once the above have been completed with min grade average of 65%.			
Physics 1021	☐	PHYS 1020; MATH 1000	
Statistics 2550	☐	MATH 1000	Or equivalent
Ocean Sciences 2000	☐	OCSC 1000; any 1000-level Science course	
Ocean Sciences 2001	☐	OCSC 1000; BIOL 1002	
Ocean Sciences 2100	☐	CHEM 1051 or 1001	PR may be taken concurrently
Ocean Sciences 2200 Ocean Sciences 2300	☐	EASC 1000 Two 1000-level Physics	At least 1 of these 2 courses must be completed
Ocean Sciences 2500	☐	OCSC 1000; at least three of OCSC 2000, 2001, 2100, 2200, 2300	Offered in spring (May/June). Normally taken at the end of the second year
Minimum 3 courses in Ocean Sciences at the 3000/4000 level	☐ ☐ ☐	Specific to each course	For example, Ocean Sciences 3000, 3002, 3600, 3640, 4000, 4122, 4200, 4300, 4400, 4601 (or others, incl. 4910-4949 courses)
Additional course to reach 30 credit hours in Ocean Sciences	☐	Specific to each course	Any OCSC course at any level is eligible
Extra Science courses required to reach 78 credit hours in Science**	☐ ☐ ☐ ☐ ☐ ☐	Specific to each course	

*Science 1807 (Safety in the Scientific Laboratory) and Science 1808 (WHMIS) are required for all courses with a laboratory component. They are offered online and take about 2 hours to complete (there are no associated credits).

**Additionally, elective courses (in any subject) must be completed to reach 120 credit hours (generally equivalent to 40 courses).

Major in Ocean Sciences (Environmental Systems)

Course	Completed	Prerequisite(s)	Notes
English 1090 (or 1080)	☐	None	Or another CRW English course
Any CRW course	☐	None	Can be English 1110
Mathematics 1000	☐	MATH 1090 or test	
Physics 1020	☐	Level III MATH or MATH 1090	For admission, this course may be replaced by any OCSC 2XXX
Chemistry 1050	☐	Science 1807/1808*	
Chemistry 1051	☐	CHEM 1050	
Biology 1001	☐	Science 1807/1808*	
Biology 1002	☐	BIOL 1001	
Earth Sciences 1000	☐	None	
Ocean Sciences 1000	☐	None	Minimum grade of 65%
A Major is normally declared once the above have been completed with min grade average of 65%.			
Physics 1021	☐	PHYS 1020; MATH 1000	
Earth Sciences 1002	☐	EASC 1000	
Earth Sciences 2502	☐	EASC 1000 and 1002; CHEM 1051	
Geography 1050	☐	None	
Geography 2102 Geography 2195 Geography 2425	☐ ☐	GEOG 1050 None GEOG 1050	At least 2 of these 3 courses must be completed
Statistics 2550	☐	MATH 1000	
Ocean Sciences 2000	☐	OCSC 1000; any 1000-level Science course	
Ocean Sciences 2001	☐	OCSC 1000; BIOL 1002	
Ocean Sciences 2100	☐	CHEM 1051 or 1001	PR may be taken concurrently
Ocean Sciences 2200	☐	EASC 1000	
Ocean Sciences 2300	☐	Two 1000-level Physics	
Ocean Sciences 2500	☐	OCSC 1000; at least three of OCSC 2000, 2001, 2100, 2200, 2300	Offered in spring (May/June). Normally taken at the end of the second year
Minimum 3 courses in Ocean Sciences at the 3000/4000 level	☐ ☐ ☐	Specific to each course	For example, Ocean Sciences 3000, 3002, 3600, 3640, 4000, 4122, 4200, 4300, 4400, 4601 (or others, incl. 4910-4949 courses)
Minimum 3 courses in Geography or Earth Sciences at the 3000/4000 level**	☐ ☐ ☐	Specific to each course	Chosen among: GEOG 3120, 3140, 3250, 3425, 3510, 3905, 4050, 4060, 4250, 4917; AND EASC 3600, 4605, 4903

*Science 1807 (Safety in the Scientific Laboratory) and Science 1808 (WHMIS) are required for all courses with a laboratory component. They are offered online and take about 2 hours to complete (there are no associated credits).

**Additionally, elective courses (in any subject) must be completed to reach 120 credit hours (generally equivalent to 40 courses).

Joint Major in Marine Biology

Course	Done	Prerequisite(s)	Notes
English 1090 (or 1080)	☐	None	Or another CRW English course
Any CRW course	☐	None	Can be English 1110
Mathematics 1000	☐	MATH 1090 or test	
Physics 1020 (or 1050)	☐	Level III MATH or MATH 1090	
Physics 1021 (or 1051)	☐	PHYS 1020 or 1050, Science 1807/1808*	Or any OCSC 2XXX for admission
Chemistry 1050	☐	Science 1807/1808*	
Chemistry 1051	☐	CHEM 1050	
Biology 1001	☐	Science 1807/1808*	Minimum grade of 65%
Biology 1002	☐	BIOL 1001	Minimum grade of 65%
Ocean Sciences 1000	☐	None	Minimum grade of 65%
A Major is normally declared once the above have been completed with min grade average of 60%.			
Earth Sciences 1000	☐	None	
Statistics 2550	☐	MATH 1000	Or equivalent
Chemistry 2400 / 2401	☐ ☐	See calendar	
Biochemistry 2201	☐	CHEM 2400 and PHYS 1020 or 1050	Or former Biochemistry 2101
Biology 2060	☐	BIOL 1001/02; BIOL 2250; CHEM 2400 (or 2440)	
Biology 2122	☐	BIOL 1001/02	
Biology 2250	☐	BIOL 1001/02; CHEM 1050/51	Or Biochemistry 2100
Biology 2600	☐	BIOL 1001/02	
Biology 2900	☐	BIOL 1001/02; BIOL 2250; STAT 2550	
Biology 3711	☐	BIOL 2122 and 2660	
Ocean Sciences 2000 or Biology 3710	☐	OCSC 1000 + any Science 1XXX course BIOL 2122 and 2660	These are credit restricted; note the different PR
Ocean Sciences 2001	☐	OCSC 1000; BIOL 1002	
Ocean Sciences 2100	☐	CHEM 1051	PR may be taken concurrently
Ocean Sciences 2500	☐	OCSC 1000; at least 3 of OCSC 2000, 2001, 2100, 2200, 2300	Offered in spring (May/June).
Ocean Sciences 2200 Ocean Sciences 2300	☐	EASC 1000 Two 1000-level Physics	These courses are optional but doing one is recommended
Courses to reach 27-33 credit hours in Ocean Sciences (12 credit at the 3000/4000 level)	☐ ☐ ☐ ○ ○	Specific to each course	For example, Ocean Sciences 3000, 3002, 3600, 3640, 4000, 4122, 4200, 4300, 4400, 4601 (or others, incl. Special Topics 4910-4949 courses)
Courses to reach 27-33 credit hours in Biology (6 credit at the 3000/4000 level)**	☐ ○ ○	Specific to each course	A minimum of 60 combined credit hours from Ocean Sciences and Biology must be done, with a minimum of 27 in either subject

*Science 1807 (Safety in the Scientific Laboratory) and Science 1808 (WHMIS) are required for all courses with a laboratory component. They are offered online and take about 2 hours to complete (there are no associated credits).

**Additionally, elective courses (in any subject) must be completed to reach 120 credit hours (generally equivalent to 40 courses).

Honours in Ocean Sciences

Course	Completed	Prerequisite(s)	Notes
English 1090 (or 1080)	☐	None	Or another CRW English course
Any CRW course	☐	None	Can be English 1110
Mathematics 1000	☐	MATH 1090 or test	
Physics 1020	☐	Level III MATH or MATH 1090	For admission, this course may be replaced by any OCSC 2XXX
Chemistry 1050	☐	Science 1807/1808*	
Chemistry 1051	☐	CHEM 1050	
Biology 1001	☐	Science 1807/1808*	
Biology 1002	☐	BIOL 1001	
Earth Sciences 1000	☐	None	
Ocean Sciences 1000	☐	None	Minimum grade of 65%
A Major is normally declared once the above have been completed with min grade average of 65%.			
Physics 1021	☐	PHYS 1020; MATH 1000	
Statistics 2550	☐	MATH 1000	Or equivalent
Chemistry 2400 (or 2440)	☐	Science 1807/1808*, CHEM 1050/1051	It is strongly recommended to also complete Chemistry 2401
Ocean Sciences 2000++	☐	OCSC 1000; any 1000-level Science course	See grade requirements for courses marked ++
Ocean Sciences 2001++	☐	OCSC 1000; BIOL 1002	
Ocean Sciences 2100++	☐	CHEM 1051 or 1001	PR may be taken concurrently
Ocean Sciences 2200++	☐	EASC 1000	
Ocean Sciences 2300++	☐	Two 1000-level Physics	
Ocean Sciences 2500++	☐	OCSC 1000; at least three of OCSC 2000, 2001, 2100, 2200, 2300	Offered in spring (May/June). Normally taken at the end of the second year
Minimum 12 credit hours selected among these Biology or Biochemistry courses	☐ ☐ ☐ ☐	Specific to each course	Choice among Biology 2060, 2122, 2250, 2600, 2900; or Biochemistry 2200/2100, 2201/2101, 3206/3106, 3207/3107, 3108. See Annex table for details.
Minimum 18 credit hours in Ocean Sciences courses at the 3000/4000 level++	☐ ☐ ☐ ☐ ☐ ☐	Specific to each course	For example, Ocean Sciences 3000, 3002, 3600, 3640, 4000, 4122, 4200, 4300, 4400, 4601 (or others, incl. Special Topics 4910-4949 courses)
*Students generally apply to the Honours program while completing the third year of study**.*			
Ocean Sciences 499A and 499B	☐ ☐	Science 1807/1808*	Research project/dissertation completed over 2 semesters

Continued on next page

Additional courses to reach 45 credit hours in Ocean Sciences[++]	☐ ☐	Specific to each course	Any OCSC course at any level is eligible
Elective courses[++] required to reach 120 credit hours[§]	☐ ☐ ☐ ☐ ☐ ☐	Specific to each course	It may be required to use the general electives to get the necessary PR for some of the senior Science electives, depending on a student's interests (also see footnote)

*Science 1807 (Safety in the Scientific Laboratory) and Science 1808 (WHMIS) are required for all courses with a laboratory component. They are offered online and take about 2 hours to complete (there are no associated credits).

**Early consideration for the Honours program is at the discretion of the Head (or delegate).

[++]A grade of "B" or an average of 75% or higher is required in the following courses to graduate with an Honours degree: the courses in Ocean Sciences courses at the 2000, 3000 and/or 4000 level, and 15 credit hours in courses at the 3000 and/or 4000 level in any of Biochemistry, Biology, Chemistry, Earth Sciences, Environmental Sciences, Geography, Ocean Sciences or Physics.

[§]Students must keep in mind that the program requires a minimum of 15 credit hours at the 3000/4000 level in any of the Science subjects listed above, beyond the required 45 credits hours in Ocean Sciences.

Annex Table – Selected Courses in Biology or Biochemistry

Honours students are required to complete at least 12 credit hours (4 courses) among the following:

Course	Completed	Prerequisite(s)	Notes
Biology 2060	☐	BIOL 1001/1002; BIOL 2250; CHEM 2400 (or former 2440); PHYS 1051 or 1021; BIOC 2201 (or former 2101)	Some PR may be taken concurrently (check calendar)
Biology 2122	☐	BIOL 1001/1002	
Biology 2250	☐	BIOL 1001/1002; CHEM 1050/1051	Credit restriction with BIOC 2100 and BIOC 2200
Biology 2600	☐	BIOL 1001/1002	
Biology 2900	☐	BIOL 1001/1002; BIOL 2250; STAT 2550	
Biochemistry 2200 (or former 2100)	☐	CHEM 2400	PR may be taken concurrently; credit restriction with BIOL 2550 and former BIOC 2100
Biochemistry 2201 (or former 2101)	☐	CHEM 2400; PHYS 1020 or 1050, PHYS 1021 or 1051	PHYS 1021 or 1051 may be taken concurrently; credit restriction with BIOC 2101
Biochemistry 3206† (or former 3106)	☐	BIOC 2201 (or 2101)	Credit restriction with former BIOC 3106 course
Biochemistry 3207† (or former 3107)	☐	BIOC 2201 (or 2101); BIOC 2200 (or 2100) or BIOL 2250	Credit restriction with former BIOC 3107 course
Biochemistry 3108†	☐	BIOC 2200 (or 2100) or BIOL 2250; BIOC 2201 (or 2101)	

†These courses may count towards part of the "15 credit hours in courses at the 3000 and/or 4000 level in any of Biochemistry, Biology, Chemistry, Earth Sciences, Environmental Sciences, Geography, Ocean Sciences or Physics" for which a grade of "B" or an average of 75% or higher is required to graduate with an Honours degree.

Joint Honours in Marine Biology

Course	Done	Prerequisite(s)	Notes
English 1090 (or 1080)	☐	None	Or another CRW English course
Any CRW course	☐	None	Can be English 1110
Mathematics 1000	☐	MATH 1090 or test	
Physics 1020 (or 1050)	☐	Level III MATH or MATH 1090	
Physics 1021 (or 1051)	☐	PHYS 1020 or 1050, Science 1807/1808*	Or any OCSC 2XXX for admission
Chemistry 1050	☐	Science 1807/1808*	
Chemistry 1051	☐	CHEM 1050	
Biology 1001	☐	Science 1807/1808*	Minimum grade of 65%
Biology 1002	☐	BIOL 1001	Minimum grade of 65%
Ocean Sciences 1000	☐	None	Minimum grade of 65%
A Major is normally declared once the above have been completed with min grade average of 60%.			
Earth Sciences 1000	☐	None	
Statistics 2550	☐	MATH 1000	Or equivalent
Chemistry 2400 Chemistry 2401	☐ ☐	See calendar	
Biochemistry 2201	☐	CHEM 2400 and PHYS 1020 or 1050	Or the former Biochemistry 2101
Biology 2060§ ++	☐	BIOL 1001/02; BIOL 2250; CHEM 2400 (or 2440)	
Biology 2122++	☐	BIOL 1001/02	
Biology 2250§ ++	☐	BIOL 1001/02; CHEM 1050/51	Or Biochemistry 2100
Biology 2600§ ++	☐	BIOL 1001/02	
Biology 2900§ ++	☐	BIOL 1001/02; BIOL 2250; STAT 2550	
Biology 3711++	☐	BIOL 2122 and 2660	
Ocean Sciences 2000§ ++ or Biology 3710++	☐	OCSC 1000 + any Science 1XXX course BIOL 2122 and 2660	These are credit restricted; note the different PR
Ocean Sciences 2001§ ++	☐	OCSC 1000; BIOL 1002	
Ocean Sciences 2100§ ++	☐	CHEM 1051	PR may be taken concurrently
Ocean Sciences 2300§ ++	☐	Two 1000-level Physics	
Ocean Sciences 2500++	☐	OCSC 1000; at least 3 of OCSC 2000, 2001, 2100, 2200, 2300	Offered in spring (May/June).
*Students generally apply to the Honours program upon completing the third year of study**. They should normally have completed the courses identified with §*			
Ocean Sciences or Biology 499A	☐	Science 1807/1808*	Research project/dissertation and oral defence completed over 2 successive semesters
Ocean Sciences or Biology 499B	☐		

Continued on next page

Additional courses to reach 30-39 credit hours in Ocean Sciences++ (must include a minimum of 15 credit at the 3000/4000 level)	☐ ☐ ☐ ☐ ○ ○ ○ ○	Specific to each course	For example, Ocean Sciences 3000, 3002, 3600, 3640, 4000, 4122, 4200, 4300, 4601 (or others, including Special Topics 4910-4949 courses)
Additional courses to reach 30-39 credit hours in Biology++ (must include a minimum of 9 credit at the 3000/4000 level)	☐ ○ ○ ○ ○	Specific to each course	A minimum of 69 combined credit hours from Ocean Sciences and Biology must be completed with a minimum of 30 credit hours in either subject
Elective courses++ required to reach 120 credit hours§	☐ ☐ ☐ ☐ ☐ ☐	Specific to each course	It may be required to use the general electives to get the necessary PR for some of the senior Science electives, depending on a student's interests (also see footnote)

*Science 1807 (Safety in the Scientific Laboratory) and Science 1808 (WHMIS) are required for all courses with a laboratory component. They are offered online and take about 2 hours to complete (there are no associated credits).

§Courses that should be completed before being admitted into the program.

++A grade of "B" or an overall average of 75% or higher is required in all BIOL and OCSC courses above the 1000 level.

**Early consideration for the Honours program is at the discretion of the Head (or delegate).