SAMS-UHI

The Scottish Association for Marine Science is Scotland's oldest and largest independent marine organisation, set up in 1884 by Sir John Murray. It has an international research reputation working in a wide range of marine topics and areas – from the deep sea to coastal fringes and the Arctic to the Antarctic. We are dedicated to delivering marine science for a healthy and sustainable marine environment through research, education and engagement with society.

SAMS is a partner in UHI – University of the Highlands and Islands, Scotland newest university. We have around 150 students across undergraduate, masters and PhD. As an exchange student you will become part of our small but vibrant student community here at SAMS. It doesn't take long to get to know everyone! Staff are very friendly and there is always someone you can ask for help or advice.

SAMS is perched on the coastline on the west coast of Scotland, near Oban in Scotland. It has its own beach (actually more than one!) and there are hills and mountains not too far away. We even have a castle just a 5 minute walk away. It was recently voted one of the most beautiful campuses in the world.

If you are studying biology, zoology, ecology, environmental sciences, applied science or earth sciences spending a semester or a year at SAMS will immerse you in all things marine. Most modules will have lab and/or field work components. We believe it is important to be able to apply what you learn in the marine environment and to prepare students for life in employment and study after students have completed their degree.

With its location with direct access to a range of beaches sea lochs and coastal habitats SAMS really can call itself the #universityonthebeach!

What to Study?

As you might expect our modules are aimed at providing a good depth of understanding of the key marine science fields – marine biology, oceanography, marine geology and chemical oceanography. All our lecturers are research-active experts in their field, so you will be gaining the most up to date knowledge in your chosen modules. Depending on your level of study you can choose between the modules below. It is best to try and choose your modules from the year that best suits your level of study. The modules you can choose from are detailed below.

Guidance on module choices

Choose modules which are compatible with your course at your home institution. Your course tutor will be able to advise you on this.

Choose modules from a year which best suits your level of study. However, if you would like to choose modules across different years drop us an email so we can find the best study solution for you.

Please note, if you choose modules across different years there may be timetable clashes. It is best to avoid taking modules which are in different years, but let us know if there is modules you really want to chose.

Semester 1 (Autumn semester) - 29th Aug - 16th Dec 2022

Semester 2 (Spring Semester) - 30th January - 12th May 2023

Year 2 modules		
Autumn semester	• Chemical Oceanography • Marine Geology	
Spring semester	• Marine Biology • Physical Oceanography • Biochemistry & Molecular Biology • Marine Resources • Advanced Maths and Programming	
Year 3 modules		
Autumn Semester	• Literature Review • Marine Pollution • Marine Instrumentation & Data	• Marine Zoology • Marine Microbial Ecology
Spring Semester	• Literature Review • Marine Biotechnology • Ocean Circulation and Climate	• Marine Robotics • Marine Biogeochemical Cycling • Marine Conservation
Year 4 modules		
Autumn Semester	• Marine Environmental Impact Assessment • Behaviour & Biological Clocks	• Aquaculture • Fisheries Science • Coastal and Shelf Sea Dynamics
Spring Semester	• Polar Seas • Marine Modelling • Deep-Sea Ecosystems	• Defining the marine carbon cycle

Year 2 Modules – Autumn Semester

Chemical Oceanography (UF708492)

Module Aim

To provide a fundamental knowledge of the chemistry of the oceans and to develop a firm understanding of the interrelationships between ocean chemistry, the interrelationships between ocean chemistry, the physical environment and marine organisms.

Module Learning Outcomes

By the completion of the module you should be able to:

1. Describe the chemical composition of seawater and discuss its constant composition in the context of elemental cycling.
2. Examine the relative importance of major inputs, exchanges and sinks of chemical components in marine environments.
3. Review the chemical composition of marine sediments and develop an understanding of major chemical reactions occurring therein.
4. Demonstrate a basic understanding of the interactions between the biota, seawater and marine sediments.
5. Conduct analytical investigations of water and sediment samples to quantify selected chemical components: systematically record key information to facilitate detailed interpretation of the data.
6. learning outcomes

Assessment Summary

Written Assessment: 25%
Lab report: 25%
Exam: 50%

Marine Geology (UC108488)

Module Aim

This module aims to introduce and develop an understanding of marine Geology.

Module Learning Outcomes

By the completion of the module you should be able to:

1. Describe the principles of ocean basin formation ocean crust structure and composition and tectonic evolution.
2. Describe and explain marine sedimentary environments and processes.
3. Describe the principles of fluid flow and the mechanics of sediment transport, deposition and erosion.

Assessment Summary

1500 word report: 20%
Multiple choice test: 20%
2000 word essay: 20%
Exam: 40%

Year 2 Modules - Spring Semester

Marine Biology (UC108487)

Module Aim

The aim of this module is to develop an understanding of the diversity of life forms and ecosystems in the oceans, and of the interactions between marine organisms and their environment. We will review the structure, classification and lifestyles of the major groups of marine animals and plants, and examine the composition and functioning of the most important ecosystems in the world's oceans. The module will also provide an introduction to several important concepts and subject areas which you may go on to explore in more detail later in the degree course, including:

- Primary productivity, the factors which control it, and its role as the basis of all marine ecosystems.
- Food webs and the flow of energy and matter through ecosystems.
- Biodiversity: its definition, measurement and distribution.
- The process of evolution and its importance for the classification of organisms.

Obviously, with such a huge subject area we cannot look at all aspects in the detail they deserve. However, some subject areas covered in this module are themselves the focus of dedicated modules available later in the degree course, in particular H3 Marine Zoology, H3 Marine Microbial Ecology, H4 Deep-Sea Ecosystems, H4 Behaviour and Biological Clocks, H4 Polar Seas and H4 Defining the Marine Carbon Cycle. H2 Marine Biology is therefore intended to help inform your later module choices and provide a foundation for future study in your own areas of interest.

The ability to identify animals and plants is a fundamental skill in marine biology and the module will aim to familiarise you with the techniques and tools needed to do this, in particular the dichotomous identification key. Once these skills have been acquired you will also have the opportunity to get out of the lecture room and carry out a survey of a local shoreline. This will provide you an opportunity to practice the methods used in field research, data analysis and report-writing, building upon your experience in the Year 1 Field Course.

Module Learning Outcomes

By the completion of the module you should be able to:

1. Describe the structure, ecological characteristics and life-histories of the major groups of plants and animals in the world's oceans.
2. Identify marine organisms and to use dichotomous identification keys.
3. Explain the basic concepts underpinning biological oceanography and describe the spatial and temporal distribution of productivity in the marine environment.
4. Describe trends in the distribution of marine biodiversity in relation to geography, latitude and depth, and discuss the main hypotheses proposed to account for these patterns
5. Describe and discuss adaptations to life in various marine ecosystems.

Assessment Summary

Species Identification Assessment: 30%
Rocky Shore Fieldwork Report: 30%

Examination: 40%

Physical Oceanography (UF708489)

Module Aim

This module aims to provide an introduction to Physical Oceanography, looking at how the key drivers of ocean circulation (heating/cooling, wind, tides) lead to the observed patterns of currents and water properties.

Module Learning Outcomes

On completion of this module, students should have:
Developed an understanding of the main forcing mechanisms of the ocean circulation.
Appreciate the way in which geometry and the Earth's rotation influence global patterns of circulation and water properties.

Assessment Summary

Report on CTD/ADCP Instruments and field trip: 30%
Geostrophy exercise: 20%
Exam: 50%

Biochemistry & Molecular Biology (UC708470)

Module Aim

The aim of this module is to gain knowledge and understanding of the main biochemical processes of living cells, their interactions and controls. To outline basic techniques of molecular biology.

Module Learning Outcomes

By the completion of the module you should be able to:

1. Describe the molecular and cellular building blocks of living organisms.
2. Explain specific biochemical pathways and their role in cellular metabolism.
3. Understand chemical and thermodynamic principles underlying biochemical reactions.
4. Discuss the links between biochemistry and environment.
5. Describe and discuss some control mechanisms of biochemical reactions.
6. Understand the scope, applications and potential of selected modern molecular and biochemical techniques.

Assessment Summary

Continuous Assessment (Lab reports, Essay, short answer questions): 50%
Exam: 50%

Marine Resources (UC108491)

Module Aim

The aim of this module is to develop an understanding of the diversity and value of marine resources, their exploitation and management, and the issues facing the sustainability of exploitation at a regional and global level. It will introduce a framework for understanding different marine activities and examines their human and environmental consequences. The module covers a very wide range of subjects, from fish and seaweed to oil, deep-sea minerals, renewable energy and genetic resources. Given the time available, it is not possible to address these different aspects in

great detail, but many of them are covered by modules in their own right later in the degree course (e.g. Fisheries, Aquaculture, Molecular Biology, Marine Conservation). This module is therefore designed to serve as a general introduction to aspects of marine resource use which can be examined in more detail later if you are interested.

Module Learning Outcomes
By the completion of the module you should be able to:

1. Outline the main fisheries techniques and discuss their impact on economics and conservation.
2. Understand the potential of the oceans as a supplier of energy (fossil fuels and renewables), minerals and pharmaceuticals.
3. Discuss the potential of the marine aquaculture industry.
4. Understand different perspectives on setting environmental targets.
5. Be familiar with the concepts and values of marine ecosystem services.
6. Understand the key national and international policy and regulatory frameworks that govern the sustainable development of marine resources.

Assessment Summary
Written Report: 40%
Oral presentation: 20%
Exam: 40%

Advanced Maths and Programming (UF708496)

Module Aim
The aim of this module is to develop an understanding of the mathematical tools and techniques that are central to quantitative study of oceanography. Associated to this is the simulation of fundamental ocean processes and data analysis through computational techniques.

Module Learning Outcomes
On completion of this module students should be able to:-

1. Solve mathematical problems using techniques in the following areas:
    - Algebra
    - Scalings, approximations and estimation of physical quantities
    - Vector algebra and vector calculus
    - Complex numbers and waves
    - Ordinary differential equations
    - Partial derivatives
    - Matrix algebra
2. Apply mathematical techniques to a range of problems in marine science.
3. Develop programming skills in the following areas:-
    - Functions
    - Scoping within programs
    - UNIX/LINUX basic shell commands and scripting
    - File input/output
    - Utilisation of Matlab and Python for data handling.

Assessment Summary
Mid semester test: 15%
Computing project: 45%
Exam: 40%

Year 3 modules – Autumn Semester

Literature Review (UF909740)

Module Aim

This 20 credit (SCQF Level 9) module is delivered in Year 3 and is a core module of the BSc Marine Science Hons degree programme. You will learn the skills necessary to create a thorough and scientific literature review, a prerequisite for generating topical and relevant research.

Module Learning Outcomes

On completing the module you will have acquired a thorough knowledge of a focused scientific research question or area and the critical ability to judge the relevance and quality of existing literature. Your aim is to provide a balanced synthesis on the existing state of knowledge of your chosen topic.

On completion you will be able to demonstrate:

1. Self-directed, independent learning
2. Research skills
3. Critical reading and literature synthesis skills
4. Time management skills
5. Oral presentation skills

Assessment Summary

Oral Presentation: 30%
Literature review: 60%
Student Approach – Opinion of the advisor on student approach, effort and results: 10%

Marine Pollution (UC109735)

Module Aim

To develop an understanding of the contamination and pollution of marine environments through human activity: methods of assessment, investigations of physico-chemical interactions, assessment of factors controlling behavior and fate of contaminating and polluting events, and assessment of major biological effects

Module Learning Outcomes

On successful completion of the module students are expected to be able to:

1. Identify and examine major sources of pollutants; transport, degradation and dilution processes; and types of marine contamination on different spatio-temporal scales.
2. Discuss mechanisms by which contaminants affect biotic processes.
3. Evaluate the consequences of pollution for the functioning of marine ecosystems.
4. Interpret laboratory data in the context of field sampling strategies and theoretical concepts.
5. Critically analyse, interpret, present and discuss published literature.

Assessment Summary

Written Assessment: 30%
Presentation: 30%
Exam: 40%

Marine Zoology (UC109737)

Module Aim

The aim of the module is to help you develop an understanding of the diversity of marine animal life, the phylogeny (i.e. evolutionary history and interrelationships) of the major marine animal groups, and their structural, functional, developmental and behavioural adaptations to the marine environment.

Module Learning Outcomes

By the completion of the module you should be able to:

1. Understand the mechanism of Darwinian Natural Selection and the evidence base underlying the Theory of Evolution.
2. Understand the broad patterns in the history of marine animal life across geological time.
3. Know the key characteristics and diagnostic features of major living marine animal phyla and be aware of current hypotheses regarding their phylogenetic relationships.
4. Identify the unifying and distinguishing features of animal functional anatomy, physiology and behaviour, and relate these to adaptations to marine environmental conditions.

Assessment Summary

Presentation: 30%
Essay: 30%
Exam: 40%

Marine Microbial Ecology (UC509738)

Module Aim

To gain an understanding of the biotic and abiotic interactions governing marine microbial communities including phytoplankton, bacteria and protozoans.

Module Learning Outcomes

By the completion of the module you should be able to:

1. Describe and discuss the phylogeny of marine micro-organisms, and the detection and identification of different organisms.
2. Analyse the physiology, of marine micro-organisms, how they interact with their abiotic environment and both within and between trophic levels.
3. Assess the role of autotrophic and heterotrophic marine micro-organisms within marine ecosystems, how they influence environmental processes, and the cycling of matter and energy.
4. Analyse the influence of human activities on micro-organisms and their influence or potential influence on humans.
5. Assess the principles and importance of selected advanced microbiological techniques to the understanding of environmental interactions.

Assessment Summary

Essay: 20%
Practical: 20%
Exam: 60%

Marine Instrumental and Data (UF709798)

Module Aim

The aim of this course is to give students a deep understanding of some of the core instrumentation used in oceanography and how the data from this is properly acquired, calibrated and manipulated. It will include both in-situ and remotely sensed data.

Module Learning Outcomes

On completion of this module, students should be able to:

1. Understand the technical details of key oceanographic instruments
2. Undertake and evaluate basic calibration processes on instruments
3. Access and manipulate remote sensing data products
4. Merge data streams computationally
5. Generate quantitative conclusions from ocean data

Assessment Summary

Technical evaluation report: 20%
Data project report: 40%
Exam: 40%

Year 3 modules – Spring Semester

Literature Review (UF909740)

Module Aim

This 20 credit (SCQF Level 9) module is delivered in Year 3 and is a core module of the BSc Marine Science Hons degree programme. You will learn the skills necessary to create a thorough and scientific literature review, a prerequisite for generating topical and relevant research.

Module Learning Outcomes

On completing the module you will have acquired a thorough knowledge of a focused scientific research question or area and the critical ability to judge the relevance and quality of existing literature. Your aim is to provide a balanced synthesis on the existing state of knowledge of your chosen topic.

On completion you will be able to demonstrate:

1. Self-directed, independent learning
2. Research skills
3. Critical reading and literature synthesis skills
4. Time management skills
5. Oral presentation skills

Assessment Summary

Oral Presentation – 8 minute plus 2 minutes for questions; printed copy of slides: 30%
Literature review – 5000 word literature review: 60%
Student Approach – Opinion of the advisor on student approach, effort and results: 10%

Marine Biotechnology (UC109734)

Module Aim

The aims of this module are to develop an understanding of the principles, technology, scope and limitations of marine biotechnology.

Module Learning Outcomes

By the completion of the module you should be able to:

1. Describe and discuss the main and potential uses of marine biotechnology.
2. Access the features of the marine environment that will lead to its increasing importance in biotechnology.
3. Analyse and evaluate the use of the oceans as a source of biotechnological innovation and as an economic area for biotechnological application.
4. Understand the working principles of molecular technologies in a marine biotechnological context.
5. Evaluate the use and risks of marine biotechnology in relation to the exploitation of the marine environment by humanity.

Assessment Summary

Practical: 15%
Laboratory Write up: 25%
SOP Write up: 20%
Exam: 40%

Ocean Circulation and Climate (UF709739)

Module Aim

The aim of this module is to develop an understanding of the role of the ocean in maintaining our climate. This module emphasises the dynamics and processes of ocean circulation and ocean-atmosphere interaction that lead to the climate we expect and to the physical functioning of the coastal ocean.

Module Learning Outcomes

By the completion of the module you should understand:

1. How the ocean circulation (the wind driven and thermohaline circulations) moves energy around the Earth and to and from the atmosphere and how this contributes to maintaining our climate.
2. The circulation in the Pacific, Indian, Atlantic and Southern Oceans and how aspects of the circulation in each basin are globally important for our climate.
3. Important modes of ocean-atmosphere climate variability that are important for climate on seasonal to decadal timescales.
4. The role of the ocean in anthropogenic climate change.

Assessment Summary

Essay: 20%
Poster Presentation: 30%
Examination: 50%

Please note this module requires students to have knowledge of physical oceanography.

Marine Robotics (UC109736)

Module Aim

This module aims to develop an awareness and critical understanding of the underlying physics, engineering and data processing issues associated with modern ocean-observing systems and platforms used to support marine science. This will be done through a course of lectures and practical laboratories. The student will apply this understanding in the design and execution of a practical project involving the deployment of complementary platforms and sensors and the critical analysis and presentation results.

Module Learning Outcomes

By the completion of the module you should be able to:

1. Review the data requirements of significant research questions in ocean science along with the observational challenges raised by these requirements and discuss how technology allows these be met.
2. Demonstrate a thorough understanding of how sensors work, how to interpret their outputs, the importance of their calibration and how they may be integrated in an instrumentation package or platform.
3. Demonstrate a thorough understanding of how common measurement platforms work and discuss their relative merits.
4. Confidently perform physical and engineering calculations an evaluate the results of these calculations in terms of sensor and platform selection and operation.
5. Make confident assessments and decisions when purchasing or specifying equipment for scientific projects.

Assessment Summary

Technical Evaluation: 20%
Field Report: 35%
Oral Presentation: 5%
Exam: 40%

Marine Biogeochemical Cycling (UC109733)

Module Aim

To develop a firm understanding of the transport and transformation of elements in the natural environment, as seen in a marine context, and to evaluate the role that the oceans play in the biogeochemical cycling of these elements.

Module Learning Outcomes

1. Apply the framework of the hydrological cycle to explain in detail how elements are transported through the hydrosphere, atmosphere & biosphere.
2. Apply a critical understanding of biogeochemical processes controlling the marine cycles of carbon, nitrogen, sulphur and phosphorus, and trace metals (*e.g.* Fe, Cu, Zn).
3. Discuss the complex nature of interactions between the elemental cycles.
4. Evaluate the role of marine systems in global biogeochemical cycling, including the impact of biogeochemical processes on global climate and feedback mechanisms.

Assessment Summary

Practical: 25%

Presentation: 25%
Active module participation: 10%
Exam: 40%

Marine Conservation (UC109738)

Module Aim

The module aims to introduce students to conservation biology and its application in the marine environment. The material covered will be organised along three major themes:

- Fundamental principles of conservation biology;
- Historic and current anthropogenic impacts on marine ecosystems;
- Available tools to manage and conserve marine ecosystems.

The module material will emphasize practical approaches to address real-life marine conservation concerns.

Module Learning Outcomes

On successful completion of this module, students should be able to:

1. Demonstrate a broad and integrated knowledge and understanding of the scope of conservation science in terms of fundamental principles, including marine ecosystems, biodiversity, and ecological function;
2. Demonstrate a broad and integrated knowledge and understanding of the influence of human activities on marine ecosystems, including cumulative effects of multiple co-occurring activities and large-scale effects of climate change;
3. Critically apply theories, principles, concepts and terminology used in conservation science, including e.g. ecosystem value assessment, population dynamics, food webs and biogeography, to real-world marine conservation problems;
4. Critically evaluate available tools/approaches to mitigate pressures on, manage and conserve marine species and ecosystems.

Assessment Summary

Brief Topic Review: 20%
Project/Group Work/Oral Presentation: 40%
Exam: 40%

Year 4 modules – Autumn Semester

Marine Environmental Impact Assessment (UC110837)

Module Aim

To develop a detailed understanding of the process of Environmental Impact Assessment (EIA) in the marine environment. To be able to apply for jobs in the Environmental consultancy industry.

Module Learning Outcomes

1. To have a critical understanding of the relationship between development, economic growth and environmental quality in order to deal with the complex ethical and professional issues arising in SEIA and EIA.
2. To be able to critically identify when environmental evidence it being misused in lobbying for and against developments in the marine environment. To be able to make judgements of where environmental data/information is limited or comes from a range of sources so as to identify gaps in knowledge which require addressing in an SEIA/EIA.

3. To demonstrate a critical understanding of the various Statutory Instruments, Laws, Regulations and Directives that relate to Marine EIA.
4. To be able to apply the key steps in the process of Ecological Risk Assessment, including the derivation and use of Ecological Quality Standards. By constructing a coherent Environmental Statement for a potential marine development demonstrate a detailed knowledge and understanding of the specialism of Impact Assessment, informed by current practice at the forefront of EIA.
5. By writing an ES execute a defined project of investigation and identify draft relevant outcomes. To be able to communicate all stages of EIA with professional level peers, senior colleagues and specialists using both oral and written presentation

Assessment Summary
Oral presentation: 20%
Written report: 40%
Exam: 40%

Assessment Summary
Research proposal: 35%
Analytical Scheme: 25%
Exam: 40%

Behaviour & Biological Clocks (UC110831)

Module Aim
The survival of an individual animal is dependent upon its interaction with the environment and with other animals. If it is to survive, grow and reproduce, an animal must be physiologically adapted to the habitat in which it is living. It must also be able to change or adapt its behaviour to the prevailing physical and biotic conditions. Eventually the sum of all behaviours will determine the structure of animal populations and communities.

Studying the mechanisms animals use to find a suitable habitat, feed, avoid being eaten, reproduce and possibly migrate represents a real challenge because of the complexity of these processes. It is perhaps most appropriate to study the individual components of these mechanisms and then attempt to understand the interrelation between them such as the trade-off between foraging and exposure to predators.

And finally underlying all behavioural and physiological traits explored here are biological clocks which enable animals to predict future events and therefore time their behaviours accordingly. The molecular architecture of the biological circadian clock is rapidly being elucidated and so we are now able, for the first time, to understand how changes in the environment bring about molecular adaptation which in turn affects behaviours.

Module Learning Outcomes
1. To develop an understanding on how animals are physiologically adapted to live in the marine environment.
2. To understand the principles behind how behaviour directs habitat selection, survival and reproduction.
3. To understand the nature and function on the biological clock(s) underpinning all behaviours.

Assessment Summary
Plenary lecture day: 20%
Experimental peer reviewed paper: 20%
Review article: 20%
Exam: 40%

Coastal Shelf Sea Dynamics (UF710841)

Module Aim
The aim of this course is to develop a dynamical understanding of the physical processes which dominate the fluid dynamics in Coastal and Shelf Seas

Module Learning Outcomes
On completion of this module, students should be able to:

1. Analyse the external tide in coastal system as a shallow water wave and discuss the energy pathways from external tide to molecular dissipation.
2. Review and quantify the physical mechanisms that give rise to large regional variations in the astronomical tides.
3. Analyse the physical mechanisms of wind-driven flows, including inertial oscillations
4. Examine and discuss the physical basis of frictional boundary layers.
5. Investigate the main physical features or regions of fresh water influence (ROFIs), including estuaries and fjords.

Assessment Summary
Problem based calculation assignment: 40%
Practical: 20%
Exam: 40%

Please note this module requires students to have knowledge of physical oceanography.

Fisheries Ecology (UF710842)

Module Aim
This module aims to develop students' understanding of fisheries ecology within modern management frameworks, to understand the principles of fisheries management from biological, economic and socio-political viewpoints and to discuss fisheries issues in the context of historical perspectives and the current international focus on sustainability. The main focus of the module is on northern latitude fisheries (Europe, Canada and USA) but essential differences of these temperate/boreal systems with tropical fisheries are also covered. The module will provide a foundation for further study at higher degree level and/or for employment in the fishing industry, fishery research and management agencies or NGOs concerned with fisheries conservation issues. The module challenges students to develop a deeper understanding of the factors behind a controversial, high-profile conservation issue, namely the over-fishing problem.

Module Learning Outcomes

1. To demonstrate critical understanding of the principles, techniques and practices behind modern ecosystem-based fisheries management.

2. Be able to write simple to medium complexity computer models to simulate fish population dynamics and to implement statistically-based stock assessment approaches.
3. To apply knowledge, skills and understanding in conducting a research trawl survey and analysing the data collected.
4. To demonstrate critical analytical skills in relation to evaluation of commercial fisheries against globally accepted sustainability criteria.

Assessment Summary
Mid-semester test: 10%
Analytical Essay: 25%
Field Report: 25%
Exam: 40%

Aquaculture (UC110839)

Module Aim
The aim of this module is to develop an understanding of the principles and technology of marine aquaculture. To develop a critical approach to the sustainable development of the aquaculture industry, with particular reference to Scotland.

Module Learning Outcomes
On successful completion of the module students are expected to be able to:
1. Critically evaluate the history of aquaculture and the pressures that are driving its global expansion.
2. Analyse the physical and biological parameters that govern aquaculture production.
3. Evaluate the principal techniques and species used in aquaculture
4. Review and critically assess the sustainability and environmental impacts of global aquaculture

Assessment Summary
Practical Report: 20%
Mid-term test: 20%
Written Assignment: 20%
Exam: 40%

Year 4 modules – Spring Semester

Marine Modelling (UC110830)

Module Aim
This course will introduce students to the study of the dynamics of complex systems through the techniques of simple mathematical modelling. It will help students to use theory to model the ocean physic, the ecology of individuals and populations, ecosystems and species communities and the linkages between these levels of organisation.

Module Learning Outcomes
On completion of this module, students should be able to:
Critically understand the concepts of underlying modelling tools.
Understand the operation of modelling tools and software.
Interpret model outputs and applications for advancing critical understanding of real physical and ecological processes.

Assessment Summary
Report (Population models): 34%
Report (Physics models): 33%
Report (Food-web modelling): 33%

Please note this module requires students to have knowledge of physical oceanography.

Deep Seas (UF710836)

Module Aim
This model aims to convey an understanding of the structure, functioning and global role of deep sea ecosystems in the context of the changing image of the deep sea environment over the last century. The material covered by the module will be organised along three major themes:

1. The deep sea as a variable and dynamic environment
2. The diversity of life in the deep sea
3. Human impacts on the deep-sea environment

In the context of all three major themes, particular emphasis will be placed on recent discoveries in deep-sea biology and on the importance of sampling methods and technological advances in shaping views of the deep-sea environment.

Module Learning Outcomes

1. An understanding of the physical diversity and temporal heterogeneity of deep-sea ecosystems and their associated biological communities.
2. An understanding of the energetic basis of deep-sea ecosystems and the resultant biological adaptations of deep-sea organisms.
3. An up-to-date overview of current and predicted anthropogenic impacts on the deep sea

Assessment Summary
Poster/Oral presentation: 30%
Film making/Animation: 30%
Exam: 40%

Polar Seas (UF710829)

Module Aim
A multidisciplinary introduction to marine science in the Arctic and Antarctic, featuring lectures, tutorial discussions of current literature and laboratory classes. The approach is to engage the students with current research knowledge both to evaluate aspects of polar climate change and to develop critical thinking skills. The module covers areas of Physical Geography, Sea Ice, Oceanography, Polar Ecosystems, Marine Mammals, Deep Sea Biology, Marine Geology, Pollution and Governance. It includes an important science communication element focused on writing policy briefing documents.

Module Learning Outcomes
By the end of the module you should be able to:

1. Discuss and contrast the physical geography of the polar seas with particular attention to the ocean circulation, water mass modification, sea ice features and variability, and the interaction between the polar regions and the global ocean.

2. Discuss the unique aspects of high latitude ecosystems, including the adaptive strategies adopted by organisms to survive in polar marine environment, and critically evaluate the evidence for impact of climate change on high latitude ecosystems.
3. Discuss and contrast the governance frameworks operating in the polar marine regions.

Assessment Summary
Laboratory Report: 24%
Briefing Note: 36%
Exam: 40%

Defining the Marine Carbon Cycle (UC110832)

Module Aim
The oceanic carbon cycle is intrinsically linked in to the global carbon cycle, through atmospheric, fluvial and crustal exchange. Through internal biogeochemical mechanisms, the cycling of carbon in marine environments is intimately related to the cycling of major nutrients (*e.g.* nitrogen and phosphorus) and to the fuelling of autotrophic and heterotrophic productivity, thus controlling the localised and global oxygen mass-balance. Despite this complex role, the measurement of carbon reservoirs and the fluxes between them is often subject to significant limits and uncertainties, the definition of which is critical to our ability to predict the effects of global change. The aim of this module, therefore, is to build up a detailed understanding of the oceanic carbon cycle, and to critically evaluate the processes by which we seek to quantify its dynamics from microscopic to global scales.

Module Learning Outcomes
By the end of the module you should be able to:

1. Critically review current paradigms providing the framework for describing the marine carbon cycle.
2. Demonstrate a critical understanding of the physio-chemical and biological factors affecting the partitioning of carbon in marine environments.
3. Explore analytical techniques used for the quantification of reservoirs and fluxes of the marine carbon cycle, and assess what those measurements can reveal to us.
4. Evaluate the limits of certainty associated with laboratory, field and modelling data.

Assessment Summary
Research proposal: 35%
Analytical Scheme: 25%
Exam: 40%

Credits

All of our modules are 20 SCQF credits – equal to 10 ECTS credits. So if you decide to come for a semester you should take 3 modules (30 ECTS credits) and 6 for a full academic year (60 ECTS credits). You will receive a transcript detailing the credits gained and the areas you have studied.

Contact

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