LF216-15 Biological Oceanography

25/26

Department
Life Sciences
Level
Undergraduate Level 2
Module leader
David Scanlan
Credit value
15
Module duration
5 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

The overall aims of the module are to introduce the students to the major marine habitats, the ecologically significant groups of organisms, and the biological processes in the oceans that play a crucial role in regulating the global fluxes of major elements. The module also aims to introduce students to the contemporary techniques for the study of biodiversity and ocean productivity and how they are contributing to significant advances in our knowledge of biological ocean processes. Finally, the module aims to examine how anthropogenic influences are influencing the marine environment and, thereby, the climate.

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Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

1. The ocean and coastal environment (ARGP) - Introduction. Ocean circulation (surface circulation, upwellings, thermoclines, conveyors etc.) and other significant physico-chemical features of the marine environment (nutrients, salinity, pressure). Ocean realms and provinces.
2. Marine biodiversity (ARGP) - Concepts (e.g. genetic, biological, ecosystem diversity); assessment (direct and indirect). Comparison with terrestrial environments. Biological and environmental significance. (This lecture is particularly relevant to lecture 8 Molecular Approaches).
   3 From shallow to deep sea environments (DJS) - Definition of basic terms (plankton, pelagic etc.). Distributions of the classical, major marine systems (kelp beds, mangroves, seagrasses, coral reefs and sediments). Areal extent, productivity and biodiversity of each habitat. 4-5 How to sample the oceans (DJS) - Introduction to the major groups of organisms in the marine food web. The Microbial Loop. Major groups of phytoplankton. SHOULD BE AS FOLLOWS: 3 From shallow to deep sea environments (DJS) - Definition of basic terms (plankton, pelagic etc.). Distributions of the classical, major marine systems (kelp beds, mangroves, seagrasses, coral reefs and sediments). Areal extent, productivity and biodiversity of each habitat. 4-5 How to sample the oceans (DJS) - Introduction to the major groups of organisms in the marine food web. The Microbial Loop. Major groups of phytoplankton. 6 Photosynthetic picoplankton (DJS) - Discovery, physiology, adaptation to light climate, seasonal cycles, differences in pigment composition between the genera Synechococcus and Prochlorococcus. 7 Biogeochemical cycles (DJS) - The role of micro-organisms in the cycling of carbon, nitrogen, phosphorus and sulphur. What limits photosynthesis in the sea? 8 Nitrogen fixation in the sea. Microbiology of hydrothermal vent communities and adaptation to living at depth. (DJS) 9 Marine microbial interactions (DJS) - From single cells to streamlined genomes and microbial interdependence; ecological theories (red vs black queen); positive and negative interactions, viral lysis and grazing. 10 Molecular approaches (DJS) - Molecular approaches to assessing genetic diversity in the marine environment; the 'great plate count anomaly'; 16S rRNA analysis; PCR approaches. 11 Anthropogenic effects on the oceans (DJS) – increasing atmospheric CO2 and the buffering effect of the oceans, ocean acidification, eutrophication and harmful blooms. 12 Global climate change (ARGP) - Effects of changes in CO2 levels, temperature and sea-level rise. Increasing UV levels and biological consequences. Stress interactions. Socioeconomic implications. 13 Plankton, fisheries and protected areas (ARGP) - Spawning areas and other critical phases of migratory fishery species. Determination of spawning areas by plankton sampling. Marine reserves and protected areas. 14 Gulf War (ARGP) - Introduction and major events. Changes in zooplankton. Impact on the sea surface microlayer. Toxicity testing. Special assessment techniques for reef corals. Wider implications and conclusions. 15 Shifting marine environmental baselines (ARGP). Assessing anthropogenic impact on marine systems over a historical timescale using examples from fisheries and coral reefs.

Learning outcomes

By the end of the module, students should be able to:

- Level 5 understanding of the physicochemical nature of the oceans in relation to the physiology of the major groups of oceanic organisms contributing to biogeochemical cycling
- Level 5 understanding of the techniques used for identifying novel major groups of microorganisms
- Level 5 understanding of the major oceanic food chains and concepts such as “the microbial loop.”
- Level 5 understanding of the ocean as the main driver of global biogeochemical cycles (e.g. the great oxygenation event and the buffering of anthropogenic CO2 emissions)
- Level 5 understanding of the types of interactions that occur and evolutionary theories that have developed from studying these habitats
- Level 5 understanding of the key features of classical and specialized marine habitats, and the nature of marine biodiversity.
- Level 5 understanding of acute anthropogenic impacts on the marine environment (using the Gulf War, marine plastic debris and the fisheries industry as example), and chronic impacts on the marine environment (using global climate change as an example).
- Level 5 understanding of marine protected areas as a mechanism for managing biological resources.

Indicative reading list

Part A: Biological Oceanography
Some material from the second year Microbiology text book (Biology of Microorganisms, 15th edn. - Madigan, Bender, Buckley, Sattley, Stahl) will be useful for this module.

Lalli, C. M. and Parsons, T. R. Biological Oceanography: An Introduction, 2nd edn. (Butterworth Heinemann, 1997).
Munn, C. Marine Microbiology, 2nd edn. (Garland Science, 2011).
Part B: Ecological Principles and Processes

Krebs, C.J. Ecology: the experimental analysis of distribution and abundance. 6th Edition. Pearson Benjamin Cummings, San francisco

Townsend, C. R., Begon, M. and Harper, J. L. (2008) Essentials of Ecology,
3rd Edition. Blackwell Publ., Oxford.

Mayhew, P. J. (2006). Discovering Evolutionary Ecology; Bringing Together Ecology and Evolution. Oxford University Press.

Spellerberg, I. (2005). Monitoring Ecological Change, 2nd Edition. Cambridge University Press.

Subject specific skills

the physicochemical nature of the oceans in relation to the physiology of the major groups of oceanic organisms contributing to biogeochemical cycling.
the techniques used for identifying novel major groups of microorganisms.
the major oceanic food chains and concepts such as “the microbial loop.”
the ocean as the main driver of global biogeochemical cycles (e.g. the great oxygenation event and the buffering of anthropogenic CO2 emissions)

the types of interactions that occur and evolutionary theories that have developed from studying these habitats
the key features of classical and specialized marine habitats, and the nature of marine biodiversity.
acute anthropogenic impacts on the marine environment (using the Gulf War, marine plastic debris and the fisheries industry as example), and chronic impacts on the marine environment (using global climate change as an example).
marine protected areas as a mechanism for managing biological resources

Transferable skills

Self directed learning
Adult learning
critical appraisal of source material

Study

Study time

Type	Required
Lectures	15 sessions of 1 hour (7%)
Other activity	10 hours (4%)
Private study	125 hours (56%)
Assessment	75 hours (33%)
Total	225 hours

Private study description

Self directed learning and revision for end of year exam

Other activity description

Authentic assessment, based on a common problem or dataset researchers would deal with on a regular basis in the academic environment. This is in-line with both AQSC and RSB requirements on assessments

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group D1

	Weighting	Study time
In-Module Assessment	30%	30 hours
Authentic assessment, based on a common problem or dataset researchers would deal with on a regular basis in the academic environment. This is in-line with both AQSC and RSB requirements on assessments		
Online Examination	70%	45 hours
45 min short answer paper / 45 min essay paper		

Assessment group R1

	Weighting	Study time
In-person Examination - Resit	100%	
45 min SAQ paper / 45 min essay paper		

Feedback on assessment

There is no feedback for Y2 short answer examinations.

Past exam papers for LF216

Availability

Courses

This module is Core optional for:

- UBSA-3 Undergraduate Biological Sciences
  - Year 2 of C100 Biological Sciences
  - Year 2 of C100 Biological Sciences
  - Year 2 of C102 Biological Sciences with Cell Biology
  - Year 2 of C103 Biological Sciences with Environmental Resources
  - Year 2 of C104 Biological Sciences with Microbiology
  - Year 2 of C105 Biological Sciences with Molecular Genetics
  - Year 2 of C107 Biological Sciences with Virology
- Year 2 of ULFA-C1A1 Undergraduate Biological Sciences (MBio)
- Year 2 of ULFA-C113 Undergraduate Biological Sciences (with Placement Year)
- Year 2 of ULFA-C1A5 Undergraduate Biological Sciences with Industrial Placement (MBio)