Kiel University
Christian-Albrechts-Universität zu Kiel

Faculty of Mathematics and Natural Sciences

Module Catalogue

Will be updated after summer semester 2024

for Biological Oceanography

Master, 1-Subject

Version 2016

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Prologue

The Master of science (M.Sc.) programme “Biological Oceanography” provides knowledge andskills in a number of disciplines that address various areas of the global ocean as a complexsystem. The curriculum is focussed on biology and imparts knowledge in chemistry, geology, physics and mathematics. The first 2 semesters have been set for the theoretical and practical fundament for the systemic analysis of the marine environment. Building on this knowledge, graduatesbegin in the 2nd semester to form their individual focus within the curriculum in compulsory/elective and elective modules. Already in the 2nd semester, the students take part in theory and practice of running research projects.With preparatory modules in the 3rd semester and the realization of the master's thesis in the 4thsemester, the graduates have formed and proven their professional scientific expertise.Within the third semester there is a window of mobility to leave the curriculum for a certain timegetting to know other universities.An additional window of mobility is given by the fact that students have the possibility to do themaster thesis abroad.Graduates are able to identify marine organismic communities (zoology, botany, microbiology) andto characterize them using modern methods (physiology, biochemistry, genetics, evolutionary bio-logy and genetics, molecular biology, taxonomy, etc.), their physico-chemical environment, nutri-ent requirements and interactions of seabed and atmosphere (inorganic chemistry and analysis,geology, physics (especially oceanography and meteorology)) and population changes (statistics) to determine and assess their importance in the marine context. The thesisshows that the graduates are able to analyze and solve complex biological problems in a clear cutstructure within a defined period of time. They are trained to connect aspects from different disci-plines and to communicate their results to the scientific community as well as to the public.The ability to cross-system considerations and use of resulting synergies is more and moreimportant where results out of basic research are included as well as application aspects are con-sidered in decision processes.This versatility is reflected by the wide range of professional activities.Graduates are especially qualified for work in the fields

- Research and teaching, for example of marine science institutes, universities.
- Marine environmental monitoring for environmental authorities and fisheries research insti-tutions.
- Environmental Management: Assessment and monitoring of existing biological, energy andmineral resources and their environmentally friendly use.
- Private sector: e.g. environmental analysis, marine consultants, maritime technology (ship-ping, pipeline projects, offshore wind farms, etc.) Food industry (marine food supplements)Pharmacy and medicine (biologically active ingredients from the sea).
- Science journalism, science publishers

Minimum entrance requirements:
1. Bachelor of Science degree, minimum grade 2.5 or B-.
2. 30% of your total ECTS points should entail biological modules.
3. proficiency in English (mandatory for non native speakers): TOEFL, IELTS, CAE, CEFR etc.
Further details:http://www.geomar.de/studieren/msc-biological-oceanography/how-to-apply/.

Name	Code
Biological Oceanography	85|712|-|H|2016|1200
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	120
Evaluation	Graded

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	-

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Module Name	Module Code
Introduction to Biological Oceanography	MNF-bioc-101
Module Coordinator	
PD Dr. Frank Melzner	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	6
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 hours
Total Workload	180 hours
Contact Time	42 hours (3 SWS x 14 weeks)
Independent Study	138
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Introduction to Biological Oceanography Veranstal-tung_1	Compulsory	
Further Information on the Courses			
Class Title (Teaching Form):Introduction to Biological Oceanography (Lecture) Contact Time / Group Size: 3 hrs per week / 40 students Lecturers: Prof. Dr. Martin Wahl Prof. Dr. Ulf Riebesell Dr. Frank Melzner Completion Module: MNF-bioc-102 Following Module: MNF-bioc-201			

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Written Examination: Introduction to Biolo-gical Oceanography	Written Examina-tion	Graded	Compulsory	100

Course Content
This module will provide a broad overview of the functioning of marine ecosystems and the interactions-between organismal groups that determine the cycling of bio-reactive elements in the ocean. Topics to becovered include:Physicochemical conditions in the ocean: large and small scale heterogeneity.Functional groups: micro-organisms, phytoplankton, zooplankton, benthos animals, algae, fishes, sea birds,mammals.Ecophysiology: light and photosynthesis, physiology of picoplankton, primary production, nutrients, microbialloop.Populations and communities: distribution, growth, age structure and demography, interactions, food webs.Biogeochemical cycles: classification of elements and their residence times, sources and sinks of elements,linking c to N, Si, P and Fe, microbiology of C-, N- and S-cycle.Diversity: patterns, significance and loss.Global Change: ocean acidification, global warming and “TheFuture Ocean”.
Learning Outcome
On completion of this module students should be able to discuss and link key concepts in biological oceanography and fish ecology. They should have an understanding of the importance of functional groups of organisms both in shaping the food web including nekton as well as in elemental fluxes. Students should haveenough knowledge to able to read and critically judge current literature on the topics covered.
Reading List
Sommer, U. 2005: Biologische Meereskunde; 2. Auflage, Springer Berlin.Lalli, C.M. &Parsons, T.R. 1993. Biological Oceanography: An Introduction. Open University, PergamonPress.Additional current literature and lecture notes will be distributed during the semester.

Use	Compulsory / Optional	Semester
Bachelor, 1-Subject, Physics of the Earth System: Meteorology - Oceanography - Geophysics, (Version 2007)	Compulsory	-
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Compulsory	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Compulsory	-
Master, 1-Subject, Biology, (Version 2021)	Compulsory	-
Master, 1-Subject, Biology, (Version 2015)	Compulsory	-
Master, 1-Subject, Biology, (Version 2011)	Compulsory	-
Master, 1-Subject, Biology, (Version 2007)	Compulsory	-
Master, 1-Subject, Materials Science and Engineering, (Version 2018)	Compulsory	-

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Module Name	Module Code
Practical Courses in Biological Oceanography	MNF-bioc-102
Module Coordinator	
Dr. Henk-Jan Hoving	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	10
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 h
Total Workload	180 h
Contact Time	--
Independent Study	-
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Internship	Practical Courses in Biological Oceanography Veran-staltung_1	Compulsory	
Exercise	Practical Courses in Biological Oceanography Veran-staltung_2	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Written Examination: Practical Courses in Biological Oceanography	Written Examina-tion	Graded	Compulsory	100
Further Information on the Examination(s)				
Written protocols or oral presentations (pass / fail) with pass as prerequisite for graded written examination (100% of the final mark).				

Course Content
This module consists largely of practical courses introducing the main methods used in marine biological research. Students will work in small groups on experimental and methodological aspects of research and will gain experience in field research on board a ship. The practical work will focus on ecology and systematics of marine microalgae and protists, zooplankton and micronekton, and top predators such as seals and whales. Furthermore, the students will be introduced into benthos ecology and marine biogeochemistry. Two module parts will also focus on fish anatomy and the ecology of fish larvae.
Learning Outcome
Students should leave this module with skills that enable them to make measurements of key variables and parameters of marine ecosystems as well as be able to interpret the results they obtain. They will gain experience in taking samples on board a research ship and using standard oceanographic equipment.
Reading List
Important literature will be introduced during the course. Detailed methodological instructions and accompanying notes will be distributed during the practical course. Updated information concerning the course will also be communicated via OLAT.
Additional Information
The Practical will be conducted in one group of maximal 20 students

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Compulsory	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Compulsory	-

Module Name	Module Code
Introduction to Chemical Oceanography	MNF-bioc-103
Module Coordinator	
Prof. Dr. Eric Pieter Achterberg	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	45 hours
Independent Study	105 hours
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compulsory/Optional**	**SWS**
Lecture	Introduction to Chemical Oceanography Veranstaltung_1	Compulsory	1
Exercise	Introduction to Chemical Oceanography Veranstaltung_2	Compulsory	3

Further Information on the Courses

Chemical Oceanography (Lecture) Prof. Dr. Eric Achterberg Chemical Oceanography Exercise) Dr. Martha Gledhill	2 hr per week / 50 students 1 hrs per week / 50 students

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Written Examination: Introduction to Chemical Oceanography	Written Examination	Graded	Compulsory	60

Course Content

Topics to be covered are:
- Basic concepts and principles in marine chemistry.
- Major elemental cycles.
- Chemical interactions (river-ocean, sediment-ocean, atmosphereocean).
- Air-sea gas exchange.

Learning Outcome

Students will gain demonstrable abilities to evaluate the role of ocean chemistry in major elemental cycles and be able to use these to understand interdisciplinary concepts and principles associated with them.

Reading List

Recommendations for textbooks and relevant literature will be made during the course.

Use	Compulsory / Optional	Semester
Bachelor, 1-Subject, Physics of the Earth System: Meteorology - Oceanography - Geophysics, (Version 2007)	Compulsory	-
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Compulsory	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Compulsory	-

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Module Name	Module Code
Introduction to Marine Geology	MNF-bioc-104-01a
Module Coordinator	
Prof. Dr. Jens Greinert	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	3
Evaluation	Graded
Duration	1 Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 h
Total Workload	90 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Introduction to Marine Geology Veranstaltung_1	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Introduction to Marine Geology Prüfung_1	Written Examination	Graded	Compulsory	-

Course Content
Topics of the lectures include: General introduction to marine geology, geophysics, tectonics, sedimentology and ocean morphology; geological resources; oceanic sediments and microfossils in relationship to the modern ocean system; degradation of organic matter; dissolution and precipitation of carbonate minerals; evolution of marine biogeochemical cycles; global change recorded within oceanic sediments. The topics of the hands-on parts of seminars, laboratory work and computer exercises include: Ocean technology & methodologies for ocean observations; morphological exploration of the seafloor, quantifying geochemical fluxes (Fick's first law, box models); modern methods in paleoclimatic research.
Learning Outcome
The course objective is to provide basic knowledge on Marine Geology. The course focuses on all aspects of Marine Geology and is the basis for more advanced courses in biological oceanography.

Reading List
The Seafloor, an introduction to Marine Geology, Seibold & Berger (2017), Springer Marine Geology, Kennet (1982), Prentice-Hall Marine Geochemistry, 3rd Edition, Chester & Jickells (2012), Wiley-Blackwell Scientifc papers as fit

Use	**Compulsory / Optional**	**Semester**
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	.

Module Name	Module Code
Doing Science	MNF-bioc-110
Module Coordinator	
PD Dr. Frank Melzner	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	6
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 hours
Total Workload	180 hours
Contact Time	60 hours
Independent Study	90 hours
Teaching Language	English

Module Courses

Course Type	Course Name	Compul-sory/Optional	SWS
Lecture	Doing Science Veranstaltung_1 Vorlesung	Compulsory	1
Practical exercise	Doing Science Veranstaltung_2 praktische Übung	Compulsory	3

Further Information on the Courses

Key Scientific Skills (Lecture) Prof. Dr. Martin Wahl Dr. Mark Lenz	1 hr per week / 35 students
Key Scientific Skills (Practical Exercise) Prof. Dr. Martin Wahl Dr. Mark Lenz	2 hrs per week / 35 students

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Presentation: Doing Science	Presentation	Graded	Compulsory	100

Course Content
This module aims at teaching and practicing specific skills necessary for participating in scientific research. Topics to be covered are: Recognition of scientifically interesting questions, formulation of hypotheses, gathering data and designing experiments. Analysis of results and graphic presentation. Written and Oral Scientific Communication. Critical review of scientific literature. Writing a proposal.
Learning Outcome
This module will equip students to pursue independent scientific research, be able to critically read and judge scientific literature and communicate their results lucidly in oral and verbal form.
Reading List
Doing Science - Design, Analysis and Communication of Scientific Research von Ivan Valiela, Oxford, University Press, 2001. Quinn, G.P. and Keough, M.J. Experimental design and data analysis for biologists, Cambridge University Press.
Additional Information
This module will consist of mostly interactive modes of learning including periodic home assignments, giving short talks and refereeing individual topics.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	-

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Module Name	Module Code
Advanced Studies in Biological Oceanography	MNF-bioc-201
Module Coordinator	
Prof. Dr. Alexandra Worden	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	1 Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Advanced Studies in Biological Oceanography Veran-staltung_1	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Advanced Studies in Biological Oceanogra-phy Prüfung_1	undefiniert	Graded	Compulsory	-

Course Content

This module will provide an advanced overview of the functioning of marine ecosystems and the interactions between organismal groups that determine the cycling of bio-reactive elements in the ocean. Topics to be covered include a depend understanding of Physicochemical conditions in the ocean, Functional groups, Ecophysiology, Populations and communities, Biogeochemical cycles, Diversity, Global Change.
Special focus will be put an key concepts in

- Stress ecology & transcription analysis (Stress, interaction between stressors, biotic modulation of stress, quantitative genetics of stress genes in fucoid algae and shore crabs, gene expression responses of shore crabs to ocean acidification),
- Chemical Ecology (main principles and regulation of predator-prey- and host-pathogen interactions, substrate recognition, anti-fouling defences),
- Population genetics & evolution: (gene flow & dispersal estimates, marine speciation, phylogeography & hybridisation, selection & adaptation, rapid evolutionary processes, marine genomics, DNA sequence analysis of immune genes in coastal fish, microsatellite genotyping of an invasive jellyfish),
- Plankton Ecology and Pelagic Biogeochemistry (seawater carbonate system, carbon and nutrient cycling, nutrient limitation, competition, grazing) and
- Microbial Ecology, Microbial Interactions and Marine Biotechnology (ecophysiology of microbial groups and their genetic analysis in the environment, microbial CO2-fixation, secondary metabolites of marine microorganisms, marine biotechnological applications) and other advanced topics.

Learning Outcome

This module confers the ability to discuss and link advanced key concepts (based on MNF-bioc-101) in biological oceanography and fish ecology with a deeper understanding of the importance of functional groups of organisms both in shaping the food web including nekton as well as in elemental fluxes. Students should have enough knowledge to be able to read and critically judge current literature on advanced topics covered (e.g. Marine Molecular and Chemical Ecology, Plankton Ecology and Pelagic Biogeochemistry, Microbial Ecology, Microbial Interactions and Marine Biotechnology).

Reading List

Lalli C. M. & Parsons T. R. (1997). Biological Oceanography: An Introduction. Butterworth-Heinemann Oxford, 314 pp.
Parsons T.R., Takahashi M. & Hargrave B. (1984). Biological Oceanographic Processes. Pergamon Press Oxford, 330 pp.
Ocean Biogeochemistry, (2003), M.J.R. Fasham (ed.) Springer Verlag, Berlin. ISBN 3-540-42398-2
Townsend, C.R., Harper, J.L. & Begon M.E. (2002) Essentials of Ecology. 2nd edition. Blackwell, Oxford – or any other standard textbook of ecology.
R.T. Paine (1994) Marine Rocky Shores and Community Ecology: An Experimentalist's Perspective. Ecology Institute, Oldendorf
Pitcher, T.J. and P.J.B. Hart. 1992. Fisheries Ecology. Chapman & Hall, London. 414 pp.
Helfman, G.S, Bruce, B. and E.F. Douglas. 1997. The Diversity of Fishes. Blackwell Science. 528 pp.
Nelson, J.S. 2006. Fishes of the World. Wiley.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	.

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Module Name	Module Code
Advanced Practical Course in Biological Oceanography	MNF-bioc-202
Module Coordinator	
Dr. Marco Scotti	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	1 Semester - verschiedene Blockkurse
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Advanced Practical Course in Biological Oceanography Veranstaltung_1	Compulsory	
Lecture	Advanced Practical Course in Biological Oceanography Veranstaltung_2	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Advanced Practical Course in Biological Oceanography Prüfung_1	undefiniert	Graded	Compulsory	-

Course Content

Section A: Marine Molecular and Chemical Ecology:
We aim at dividing the entire group into smaller groups of 3-5- students who will work on one continual project in one of the lecture topics for 3 weeks. At the end of the course, time will be given to mutually exchange information among groups. Additionally, practical courses are aimed at teaching laboratory skills in addressing research questions on selected topics (Stress ecology & transcription analysis: Stress, interaction between stressors, biotic modulation of stress, quantitative genetics of stress genes in fucoid algae and shore crabs , gene expression responses of shore crabs to ocean acidification - Chemical Ecology: Main principles and regulation of predator-prey- and host-pathogen interactions, substrate recognition, antifouling defences - Population genetics & evolution: gene flow & dispersal estimates, marine speciation, phylogeography & hybridisation, selection & adaptation, rapid evolutionary processes, marine genomics, practical DNA sequence analysis of immune genes in coastal fish, microsatellite genotyping of an invasive jellyfish).
A weekly tutorial will update students and lecturers on progress made and clarify open questions.
Section B: Plankton Ecology and Pelagic Biogeochemistry
Practical courses are aimed with a mesocosm experiment for an intergrated study of specific topics (e.g. seawater carbonate system, carbon and nutrient cycling, nutrient limitation, competition, grazing).
A weekly tutorial will update students and lecturers on progress made and clear outstanding questions.
Section C: Microbial Ecology, Microbial Interactions and Marine Biotechnology
Practical courses are aimed at teaching laboratory skills in addressing research questions on selected topics (e.g. ecophysiology of microbial groups and their genetic analysis in the environment, microbial CO2-fixation, secondary metabolites of marine microorganisms, marine biotechnological applications etc.)
A weekly tutorial will update students and lecturers on progress made and clarify open questions.

Learning Outcome

Section A: Marine Molecular and Chemical Ecology
On completion of this course, the students should have an in-depth understanding of stress reactions, chemical interactions and evolutionary processes in marine ecosystems. They should be able to understand the design of experiments / sampling schemes, and the concept of molecular markers. They will learn to conduct experiments, retrieve and evaluate data and put their findings into the context of the scientific literature on chemical ecology, population genetics and evolutionary biology.
Section B: Plankton Ecology and Pelagic Biogeochemistry
On completion of this course, the students should have an in-depth understanding of plankton ecology and pelagic biogeochemistry. They should be able to understand the design of experiments and sampling schemes, conduct experiments, retrieve and evaluate data and put their findings into the context of the scientific literature on pelagic ecology and biogeochemistry.
Section C: Microbial Ecology, Microbial Interactions and Marine Biotechnology
On completion of this course, the students should have an in-depth understanding of marine microbial ecology and its contribution to biogeochemical cycles. They should be able to understand the design of experiments and sampling schemes, conduct
experiments, retrieve and evaluate data and put their findings into the context of the scientific literature on marine.

Reading List
Section A: Lalli C. M. & Parsons T. R. (1997). Biological Oceanography: An Introduction. Butterworth-Heinemann Oxford, 314 pp. Parsons T.R., Takahashi M. & Hargrave B. (1984). Biological Oceanographic Processes. Pergamon Press Oxford, 330 pp. Ocean Biogeochemistry, (2003), M.J.R. Fasham (ed.) Springer Verlag, Berlin. ISBN 3-540-42398-2 Section B: Lalli C. M. & Parsons T. R. (1997). Biological Oceanography: An Introduction. Butterworth-Heinemann Oxford Townsend, C.R., Harper, J.L. & Begon M.E. (2002) Essentials of Ecology. 2nd edition. Blackwell, Oxford – or any other standard textbook of ecology. R.T. Paine (1994) Marine Rocky Shores and Community Ecology: An Experimentalist's Perspective. Ecology Institute, Oldendorf Further literature recommendations will be communicated in the course Section C: Pitcher, T.J. and P.J.B. Hart. 1992. Fisheries Ecology. Chapman & Hall, London. 414 pp. Helfman, G.S, Bruce, B. and E.F. Douglas. 1997. The Diversity of Fishes. Blackwell Science. 528 pp. Nelson, J.S. 2006. Fishes of the World. Wiley.
Additional Information
This Module comprises of 3 main sections (A, B, C) containing different practical/exercise combinations. Students must choose two practical/exercise combinations of different sections: Section A: Chemical Ecology and Fish Ecology Section B: Plankton Ecology and Pelagic Biogeochemistry Section C: Microbial Ecology, Microbial Interactions and Marine Biotechnology.

Use	**Compulsory / Optional**	**Semester**
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	.

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Module Name	Module Code
Biological Modelling and Biostatistics	MNF-bioc-220-01a
Module Coordinator	
Prof. Dr. Andreas Oschlies	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	60 hours
Independent Study	90 hours
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Biological Modelling and Biostatistics Veranstaltung_1	Compulsory	1
Practical exercise	Biological Modelling and Biostatistics Veranstaltung_2	Compulsory	1
Lecture	Biological Modelling and Biostatistics Veranstaltung_3	Compulsory	1
Practical exercise	Biological Modelling and Biostatistics Veranstaltung_4	Compulsory	1

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Protocol: Biological Modelling and Biostatistics	Protocol	Graded	Compulsory	50
Written Examination: Biological Modelling and Biostatistics	Written Examination	Graded	Compulsory	50

Course Content

Modelling:
The unit will be delivered through a combination of lectures and computer-based accompanying assignments. The course will teach how to use relatively simple mathematical methods to understand in a quantitative manner how planet Earth and its inhabitants interact. Modelling concepts will be presented and applied to simple aquatic ecosystems. Students will learn how to use computer-based interactive modelling platforms to build, apply and analyse simple numerical models.
Biostatistics:
The theoretical part of the course is structured into following chapters:
1. Selected Literature
2. Concepts in statistical modelling
3. Analysis of Variance
4. Regression
5. Multifactorial ANOVA designs
6. Multiple Regression
7. Mixed Effect Modelling
8. Repeated Measure designs
10. Model simplification
11. Analysis of Covariance
The applied part of the course using R provides insight into following topics:
1. Processing Data
2. Data exploration and data visualization
3. Diagnostics in R
4. General Linear Models in R
5. Model simplification in R

Learning Outcome

Modelling:
The class shall
- educate the students in quantitative environmental and Earth system science,
- strengthen the students' quantitative and computational skills,
- provide understanding of a variety of forward and inverse modelling approaches, and
- develop an understanding of the creation and application of numerical models.
Biostatistics:
The class is intended to impart basic and advanced concepts of univariate biostatistics to biology students. To consolidate their theoretical knowledge, it will be taught together with applications using real and virtual data sets from marine ecology by using the free statistical software package R (learning-by-doing principle). The course will enable students to apply the concepts of statistical modelling to data from experimental or observational studies. Furthermore, they will deepen their understanding of experimental designs and will learn how to identify the appropriate statistical method to analyse a given set of data. Lectures and exercises about the most common applications of general linear models, such as Analysis of Variance and Multiple Regression, will supplement this module.

Reading List

Literature references will be provided in the individual lectures.
The course is based on two manuscripts, one covers the theory, the other R applications; both will be issued as handouts to the students on a chapter-by-chapter basis.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	-

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Module Name	Module Code
Introduction to Physical Oceanography	pherIPO
Module Coordinator	
PD Dr. Katja Heubel	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	1 Semester
Frequency	Only takes place during summer semesters
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Introduction to Physical Oceanography Veranstal-tung_1	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Written Examination: Introduction to Physi-cal Oceanography	Written Examina-tion	Graded	Compulsory	100

Course Content
Topography of the sea bed, composition and physical properties of sea water and sea ice, sound, heat bud-get, mean sea salt stratification, characteristic water masses, wind induced ocean currents, geostrophic cur-rents, thermohaline circulation, regional oceanography, tides, ocean currents
Learning Outcome
The students have developed a basic knowledge of the the structure and dynamics of the ocean. They are able to understand the most important physical mechanisms in the ocean and to apply this knowledge in the study of subject-specific topics of the continuing modules of meteorology and physical oceanography.

Reading List
Oceanography - An Introduction. Pergamon Press, 6 th edition, 555 pp. Bearman, G. (Ed.), 1989: Waves, tides and shallow-water processes. Pergamon Press, Oxford (Open Univ.), reprinted with corrections 1991,1995, 1997, 187 pp. Bearman, G. (Ed.), 1989: Ocean circulation. Pergamon Press, Oxford (Open Univ.), reprinted with corrections 1998, 238 pp. Bearman, G. (Ed.), 1998: The ocean basins: their structure and evolution. Pergamon Press, Oxford (Open Univ.), 2nd edition, 185 pp. Tomczak, M. and J.S. Godfrey, 1994: Regional Oceanography: An Introduction. Pergamon Press, 422 pp.

Use	**Compulsory / Optional**	**Semester**
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Compulsory	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Compulsory	-

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Name	Code
Current Topics Compulsory Elective- 2. Semester	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	-

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Module Name	Module Code
Current Topics in Marine Biogeochemistry I	MNF-bioc-231
Module Coordinator	
Prof. Dr. Ulf Riebesell	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Contact Time	45 hours
Independent Study	105 hours
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Current Topics in Marine Biogeochemistry I Veranstal-tung_1	Compulsory	
Lecture	Current Topics in Marine Biogeochemistry I Veranstal-tung_2	Compulsory	
Further Information on the Courses			
Current Topics in Biogeochemistry (Lecture) Prof. Dr. Ulf Riebesell Prof. Dr. Arne Körtzinger Current Topics in Biogeochemistry (Seminar with invited speakers)			

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Written Examination: Marine Biogeoche-mistry I	Written Examina-tion	Graded	Compulsory	100

Course Content
On-going research in marine biogeochemistry will be presented and critically discussed. Current topics will be from a broad area of marine sciences with relevance to marine biogeochemistry, including molecular biology and genetics, physiology, ecology, to marine chemistry, isotope geochemistry, atmospheric chemistry, to ecosystem and biogeochemical modelling.
Learning Outcome
This module serves two purposes: In the lectures students will be taught the basics of marine biogeochemical cycling, with particular focus on the carbon, nitrogen and iron cycles. In the seminar series students will be exposed to current research topics, new developments and novel scientific concepts in the area of marine biogeochemistry. On successful completion of this module, students will be familiar with biogeochemical processes involving the ocean's major bioactive elements. They will have a basic understanding of the physical, chemical, and biological processes driving fluxes between the different marine carbon pools, between land, ocean and atmosphere. Students will learn about the dynamics of the marine carbon, nitrogen and iron cycle on time scales from seconds (seawater carbonate system), to months (seasonal cycles), to years (inter-annual variability), to tens of thousands of years (glacial/interglacial periods) and will be able to identify feedback mechanisms in the climate system. They will be aware of the present and projected future impacts of human activities on marine ecosystems and biogeochemistry. The seminar series will provide students with the opportunity to improve their competence to critically evaluate on-going research, participate in scientific discussions, select their own research questions, formulate testable hypotheses, and select state-of-the-art methodologies. By experiencing the interdisciplinary nature of marine sciences, students will develop the ability to place results in a specific area into the larger context of understanding the role of the ocean in the earth system.
Reading List
Relevant literature will be provided during the module.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-

↑

Module Name	Module Code
Current Topics in Marine Ecology I	MNF-bioc-232
Module Coordinator	
Dr. Elizabeta Briski	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Current Topics in Marine Ecology I Veranstaltung_1	Compulsory	
Lecture	Current Topics in Marine Ecology I Veranstaltung_2	Compulsory	
Further Information on the Courses			
Current Topics in Marine Ecology I (Lecture) Prof. Dr. Martin Wahl Prof. Dr. Stefanie Ismar Current Topics in Marine Ecology I (Seminar) Prof. Dr. Martin Wahl Prof. Dr. Stefanie Ismar			

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Presentation: Marine Ecology I	Presentation	Graded	Compulsory	100

Course Content
In this module current activities marine plankton and benthos research will be presented and discussed in the context of the actual theoretical framework. The lecture will cover patterns and mechanisms of pelagic and benthic food web organisation from costal to off-shore and surface to deep ecosystems.

Learning Outcome
The students will get knowledge and understanding of the current marine ecological research activities (pelagic and benthic) at IFM-GEOMAR and their scientific background. The goal of the lecture is to convey a basic understanding of and current research topics in ecological processes and patterns in selected marine pelagic ecosystems.
Reading List
Literature will be given during the module.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-

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Module Name	Module Code
Current Topics in Fish Ecology and Aquaculture	MNF-bioc-233
Module Coordinator	
Prof. Dr. Reinhold Hanel	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Current Topics in Fish Ecology and Aquaculture Ver-anstaltung_1	Compulsory	
Lecture	Current Topics in Fish Ecology and Aquaculture Ver-anstaltung_2	Compulsory	
Lecture	Current Topics in Fish Ecology and Aquaculture Ver-anstaltung_3	Compulsory	
Further Information on the Courses			
Fish Ecology (Excursion) Prof. Dr. Reinhold Hanel Fish Ecology (Exercise) Faunistics and Ecology of the Mediterranean Sea (Seminar)			

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Protocol: Fish Ecology and Aquaculture	Protocol	Graded	Compulsory	100

Course Content
This module will give insight into the flora and fauna of the Mediterranean Sea, the role of environmental parameters and different methods to explore the littoral zone. Topics to be covered include: Taxonomy and ecology of key species of different marine littoral habitats. Ecology and behaviour of Mediterranean fish species. Mediterranean benthos: Taxonomy, habitats and life forms.
Learning Outcome
On completion of this module, students will have gained a basic knowledge on biodiversity and ecology of the littoral zone of the Mediterranean Sea, with special focus on fish, macrophytes and macrozoobenthos. They will have an understanding of different functional groups of organisms, their interactions and the principal abiotic factors shaping their environment.
Reading List
Among others: Hofrichter, R. 2002. Das Mittelmeer – Fauna, Flora, Ökologie. Teile 1-3. Spektrum Verlag. Riedl, R. 1984. Fauna und Flora des Mittelmeers. Verlag Paul Parey, Hamburg – Berlin.
Additional Information
This module will take place as a 2-weeks block course in Calvi, Corsica.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-

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Module Name	Module Code
Multidisciplinary Oceanography Research	MNF-bioc-301
Module Coordinator	
Prof. Dr. Ulf Riebesell	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	10
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 hours
Total Workload	300 hours
Contact Time	112 (2x2 SWS Practical + 3 SWS Colloquium + 1 SWS Exercise) x 14 weeks)
Independent Study	188 hours
Teaching Language	English

Entry Requirements as Stated in the Examination Regulations
All the compulsory modules of the first and second semesters of MNF-bioc-…

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Internship	Multidisciplinary Oceanography Research Veranstal-tung_1	Compulsory	2
Seminar	Multidisciplinary Oceanography Research Veranstal-tung_2	Compulsory	3
Field trip	Multidisciplinary Oceanography Research Veranstal-tung_3	Compulsory	2
Exercise	Multidisciplinary Oceanography Research Veranstal-tung_4	Compulsory	1

Further Information on the Courses

Class Title (Teaching Form): Advanced Laboratory Course (Practical)
Contact Time / Group Size: 2 hrs per week / 30 students
Lecturers:
Prof. Dr. Ute Hentschel Humeida
Prof. Dr. Thorsten Reusch
Prof. Dr. Anja Engel
Prof. Dr. Martin Wahl
Prof. Dr. Steffi Ismar
Prof. Dr. Reinhold Hanel
Prof. Dr. Ulf Riebesell
et al.
Class Title (Teaching Form): Colloquium
Contact Time / Group Size: 3 hrs per week / 50 students
Lecturers: various
Class Title (Teaching Form): Research Cruise or Field Course(Practicals)
Contact Time / Group Size: 9 days or equivalent
Lecturers:
Dr. Jörg Süling
Dr. Jamileh Javidpour
Dr. Cornelia Jaspers
Class Title (Teaching Form): Tutorial & Thesis Proposal (Exercise)
Contact Time / Group Size: 1 hrs per week / 30 students
Lecturers:
Prof. Dr. Ute Hentschel Humeida
Prof. Dr. Thorsten Reusch
Prof. Dr. Anja Engel
Prof. Dr. Martin Wahl
Prof. Dr. Steffi Ismar
Prof. Dr. Reinhold Hanel
Prof. Dr. Ulf Riebesell
et al.

Prerequisits for Admission to the Examination(s)

All the compulsory modules of the first and second semesters of MNF-bioc-…

Further Requirements for Awarding ECTS Credits

Oral presentation of thesis proposal.

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Written thesis proposal: Multidisciplinary Oceanography Research	Assignment	Graded	Compulsory	-
Further Information on the Examination(s)				
Examination prerequiste (Prüfungsvorleistung): oral presentation of thesis proposal. Examination: written thesis proposal (graded).				

Course Content
This Module will offer an overview into multidisciplinary oceanographic research from a wide range of topics. These will cover all aspects of oceanography. Weekly colloquia of the Research Divisions at the GEOMAR will give an overview on the current research. These cover topics of interest to all disciplines at the GEOMAR and are held by internal as well as invited speakers.
Learning Outcome
Students will gain an insight into the ideas that drive major multidisciplinary research projects. They should be able to link applied and fundamental research. This module aims at encouraging students to think laterally between scientific disciplines.
Reading List
Selected literature will be recommended during the Colloquia series.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Compulsory	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Compulsory	-

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Module Name	Module Code
Summer School or Internship	MNF-bioc-310
Module Coordinator	
PD Dr. Frank Melzner	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Takes place every semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	80 hours
Independent Study	70 hours
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Summer School or Internship Veranstaltung_1	Compulsory	
Further Information on the Courses			
Class Title (Teaching Form): Summer School (Practical) Class Title (Teaching Form): Internship (Project) Contact Time / Group Size: - / 30 students Lecturers: Prof. Dr. Oscar Puebla			

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Protocol: Summer School / Intership	Protocol	Graded	Compulsory	100
Further Information on the Examination(s)				
Summer School: protocol (100%), Internship: protocol (100%). Information for the preparation of the protocols is provided on OLAT				

Course Content
Students will choose between participation in an intensive 2-week summer school or an equivalent to 150 hours internship at a maritime company or office. This can be fulfilled in agreement with the company or office as part time practical.
Learning Outcome
On completion of this module students will have a more firm basis for career choice either in fundamental science or applied oceanography in a variety of settings. Students will also have the opportunity to demonstrate skills in communication, application of theoretical knowledge and lateral thinking in a practical setting.
Reading List
Relevant literature will be distributed within the respective courses.
Additional Information
A ship cruise might be part of the Summer School.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Compulsory	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Compulsory	-

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Name	Code
Current Topics Compulsory Elective - 3. Semester	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	10
Evaluation	Graded

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	-

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Module Name	Module Code
Current Topics in Marine Biogeochemistry II	MNF-bioc-331
Module Coordinator	
Prof. Dr. Ulf Riebesell	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Contact Time	75 h
Independent Study	75 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Current Topics in Marine Biogeochemistry II Veran-staltung_1	Compulsory	
Lecture	Current Topics in Marine Biogeochemistry II Veran-staltung_2	Compulsory	
Lecture	Current Topics in Marine Biogeochemistry II Veran-staltung_3	Compulsory	
Further Information on the Courses			
Current Topics in Marine Biogeochemistry II (seminar) Prof. Dr. Ulf Riebesell Dipl.-Biol. Annegret Stuhr Current Topics in Marine Biogeochemistry II (lecture) (lectures by invited speakers) 2 hrs per week / 30 students 3 hrs per week / 30 students			

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Presentation: Marine Biogeochemistry II	Presentation	Graded	Compulsory	100

Course Content
On-going research in marine biogeochemistry will be presented and critically discussed. Current topics will be from a broad area of marine sciences with relevance to marine biogeochemistry, including molecular biology and genetics, physiology, ecology, to marine chemistry, isotope geochemistry, atmospheric chemistry, to ecosystem and biogeochemical modelling.
Learning Outcome
Students will obtain a broad overview of current research topics, new methodologies, novel scientific concepts, and latest developments in the area of marine biogeochemistry. Upon successful completion of this module, students will have improved their competence to critically evaluate on-going research, participate in scientific discussions, select their own research questions, formulate testable hypotheses, and select state-of-the-art methodologies. By experiencing the interdisciplinary nature of marine sciences, students will develop the ability to place results in a specific area into the larger context of understanding the role of the ocean in the earth system.
Reading List
Relevant literature will be given out during the module.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Optional	-
Master, 1-Subject, Biology, (Version 2021)	Optional	-
Master, 1-Subject, Biology, (Version 2015)	Optional	-
Master, 1-Subject, Biology, (Version 2011)	Optional	-
Master, 1-Subject, Biology, (Version 2007)	Optional	-

↑

Module Name	Module Code
Current Topics in Marine Ecology II	MNF-bioc-332
Module Coordinator	
Dr. Elizabeta Briski	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	75 hours: ((1 SWS Lecture + 2 SWS Exercise + 2 SWS Seminar) x 15 weeks)
Independent Study	75 hours
Teaching Language	English

Entry Requirements as Stated in the Examination Regulations

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Current Topics in Marine Ecology II Veranstaltung_1	Compulsory	
Lecture	Current Topics in Marine Ecology II Veranstaltung_2	Compulsory	

Further Information on the Courses

Current Topics in Marine Ecology II (Lecture)
Prof. Dr. Stefanie Ismar
Prof. Dr. Martin Wahl

Current Topics in Marine Ecology II (Exercise)
Prof. Dr. Stefanie Ismar
Prof. Dr. Martin Wahl

Current Topics in Marine Ecology II (Seminar)
Prof. Dr. Stefanie Ismar
Prof. Dr. Martin Wahl

1 hrs per week / 30 students
2 hrs per week / 30 students
2 hr per week / 30 students

Prerequisits for Admission to the Examination(s)

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Presentation: Marine Ecology II	Presentation	Graded	Compulsory	100

Further Information on the Examination(s)

Graded oral presentation (100% of final mark).

Course Content

In this module current activities marine plankton and benthos research will be presented and discussed in the context of the actual theoretical framework. The latter will be the content of the lecture part.

Learning Outcome

The students will get knowledge and understanding of the current marine ecological research activities at IFM-GEOMAR and their scientific background and an insight into currently important questions, approaches, models and theories in benthic ecology.

Reading List

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Optional	-
Master, 1-Subject, Biology, (Version 2021)	Optional	-
Master, 1-Subject, Biology, (Version 2015)	Optional	-
Master, 1-Subject, Biology, (Version 2011)	Optional	-
Master, 1-Subject, Biology, (Version 2007)	Optional	-

Module Name	Module Code
Current Topics in Fish Ecology	MNF-bioc-334
Module Coordinator	
Dr. Catriona Clemmesen-Bockelmann Prof. Dr. Thorsten Reusch	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	one Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	70 hours: ((3 SWS Lecture + 2 SWS Seminar) x 14 weeks)
Independent Study	80 hours
Teaching Language	English

Entry Requirements as Stated in the Examination Regulations
MNF-bioc-201

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Current Topics in Fish Ecology Veranstaltung_1	Compulsory	1
Lecture	Current Topics in Fish Ecology Veranstaltung_2	Compulsory	2
Seminar	Current Topics in Fish Ecology Veranstaltung_3	Compulsory	2

Further Information on the Courses

Class Title (Teaching Form): Fish Systematic, Biology and Evolution (Lecture)
Contact Time / Group Size: 1 hrs per week / 25 students
Lecturers:
Prof. Dr. Reinhold Hanel

Class Title (Teaching Form): Dynamics, Assessment and Management of Exploited Marine Fish Populations (Lecture)
Contact Time / Group Size: 2 hrs per week / 25 students
Lecturers:
Prof. Dr. Joachim Gröger

Class Title (Teaching Form): Current Topics in Fish Ecology (Seminar)
Contact Time / Group Size: 2 hrs per week / 25 students
Lecturers:
Prof. Dr. Oscar Puebla
Dr. Olivia Roth
Prof. Dr. Thorsten Reusch

Prerequisits for Admission to the Examination(s)

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Written Examination: Fish Ecology	Written Examination	Graded	Compulsory	50
Oral Presentation: Fish Ecology	Presentation	Graded	Compulsory	50

Course Content

Basics in fish systematics, biology, biodiversity and evolution and on current topics in fish ecology. Students will learn to critically evaluate primary literature, extract information, present the content in a brief and concise way and will have to lead and structure scientific discussions.

Learning Outcome

Students will be presented with information on current research topics in fish ecology, fisheries biology, evolutionary ecology and aquaculture.

Reading List

Will be distributed at beginning of course

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Optional	-
Master, 1-Subject, Biology, (Version 2021)	Optional	-
Master, 1-Subject, Biology, (Version 2015)	Optional	-
Master, 1-Subject, Biology, (Version 2011)	Optional	-
Master, 1-Subject, Biology, (Version 2007)	Optional	-

Module Name	Module Code
Fundamentals and Current Topics in Biogeochemical Modelling	MNF-bioc-335
Module Coordinator	
Prof. Dr. Andreas Oschlies	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Contact Time	60 h
Independent Study	90 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Fundamentals and Current Topics in Biogeochemical Modelling Veranstaltung_1	Compulsory	
Lecture	Fundamentals and Current Topics in Biogeochemical Modelling Veranstaltung_2	Compulsory	

Further Information on the Courses

Current Topics in BGC modelling (Seminar)
Prof. Dr. Andreas Oschlies
Dr. rer. nat. Markus Pahlow
Dr. rer. nat. Markus Schartau
Fundamentals in BGC modelling (Lecture)
Prof. Dr. Andreas Oschlies
Dr. Markus Pahlow
Dr. Markus Schartau
Dr. Wolfgang Koeve
Dr. Iris Kriest
Dr. Ivy Frenger
Dr. Heiner Dietze
Dr. Ulrike Loeptien
Dr. Angela Landolfi
2 hrs per week / 15 students
2 hrs per week / 15 students

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Presentation: Fundamentals and Current Topics in Biogeochemical Modelling	Presentation	Graded	Compulsory	100

Course Content

The students will develop a seminar presentation on a current topic of marine biological modelling. Preparation of the presentation involves the study of recent literature and some understanding of new modeling concepts. The assessment is based on the oral presentation in the seminar.
The lecture series covers the fundamentals in marine biogeochemical modelling, with focus on regional to global three-dimensional models:
models of ocean circulation, air-sea gas exchange, organic matter production in the surface ocean, transport and remineralisation of organic matter; practical applications; use of logical arguments; resolution matters; time scales; model assessment.

Learning Outcome

The students will become acquainted with the fundamentals of global biogeochemical modelling as well as current concepts used in state-of-the-art biogeochemical and ecological models, their specific advantages and disadvantages and potential pitfalls in working with these models and their output.

Reading List

Literature references will be provided in the individual lectures.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-

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Module Name	Module Code
Master's Thesis	MNF-bioc-401
Module Coordinator	
PD Dr. Frank Melzner	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	30
Evaluation	Graded
Frequency	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Master's Thesis	Written Examination	Graded	Compulsory	60

Course Content
Learning Outcome
Reading List

Use	**Compulsory / Optional**	**Semester**
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	-

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Name	Code
Optionals	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	10
Evaluation	Graded

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	-

↑

Module Name	Module Code
Current Topics in Marine Biogeochemistry I	MNF-bioc-231
Module Coordinator	
Prof. Dr. Ulf Riebesell	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Contact Time	45 hours
Independent Study	105 hours
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Current Topics in Marine Biogeochemistry I Veranstal-tung_1	Compulsory	
Lecture	Current Topics in Marine Biogeochemistry I Veranstal-tung_2	Compulsory	
Further Information on the Courses			
Current Topics in Biogeochemistry (Lecture) Prof. Dr. Ulf Riebesell Prof. Dr. Arne Körtzinger Current Topics in Biogeochemistry (Seminar with invited speakers)			

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Written Examination: Marine Biogeoche-mistry I	Written Examina-tion	Graded	Compulsory	100

Course Content
On-going research in marine biogeochemistry will be presented and critically discussed. Current topics will be from a broad area of marine sciences with relevance to marine biogeochemistry, including molecular biology and genetics, physiology, ecology, to marine chemistry, isotope geochemistry, atmospheric chemistry, to ecosystem and biogeochemical modelling.
Learning Outcome
This module serves two purposes: In the lectures students will be taught the basics of marine biogeochemical cycling, with particular focus on the carbon, nitrogen and iron cycles. In the seminar series students will be exposed to current research topics, new developments and novel scientific concepts in the area of marine biogeochemistry. On successful completion of this module, students will be familiar with biogeochemical processes involving the ocean's major bioactive elements. They will have a basic understanding of the physical, chemical, and biological processes driving fluxes between the different marine carbon pools, between land, ocean and atmosphere. Students will learn about the dynamics of the marine carbon, nitrogen and iron cycle on time scales from seconds (seawater carbonate system), to months (seasonal cycles), to years (inter-annual variability), to tens of thousands of years (glacial/interglacial periods) and will be able to identify feedback mechanisms in the climate system. They will be aware of the present and projected future impacts of human activities on marine ecosystems and biogeochemistry. The seminar series will provide students with the opportunity to improve their competence to critically evaluate on-going research, participate in scientific discussions, select their own research questions, formulate testable hypotheses, and select state-of-the-art methodologies. By experiencing the interdisciplinary nature of marine sciences, students will develop the ability to place results in a specific area into the larger context of understanding the role of the ocean in the earth system.
Reading List
Relevant literature will be provided during the module.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-

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Module Name	Module Code
Current Topics in Marine Ecology I	MNF-bioc-232
Module Coordinator	
Dr. Elizabeta Briski	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Current Topics in Marine Ecology I Veranstaltung_1	Compulsory	
Lecture	Current Topics in Marine Ecology I Veranstaltung_2	Compulsory	
Further Information on the Courses			
Current Topics in Marine Ecology I (Lecture) Prof. Dr. Martin Wahl Prof. Dr. Stefanie Ismar Current Topics in Marine Ecology I (Seminar) Prof. Dr. Martin Wahl Prof. Dr. Stefanie Ismar			

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Presentation: Marine Ecology I	Presentation	Graded	Compulsory	100

Course Content
In this module current activities marine plankton and benthos research will be presented and discussed in the context of the actual theoretical framework. The lecture will cover patterns and mechanisms of pelagic and benthic food web organisation from costal to off-shore and surface to deep ecosystems.

Learning Outcome
The students will get knowledge and understanding of the current marine ecological research activities (pelagic and benthic) at IFM-GEOMAR and their scientific background. The goal of the lecture is to convey a basic understanding of and current research topics in ecological processes and patterns in selected marine pelagic ecosystems.
Reading List
Literature will be given during the module.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-

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Module Name	Module Code
Current Topics in Fish Ecology and Aquaculture	MNF-bioc-233
Module Coordinator	
Prof. Dr. Reinhold Hanel	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Current Topics in Fish Ecology and Aquaculture Ver-anstaltung_1	Compulsory	
Lecture	Current Topics in Fish Ecology and Aquaculture Ver-anstaltung_2	Compulsory	
Lecture	Current Topics in Fish Ecology and Aquaculture Ver-anstaltung_3	Compulsory	
Further Information on the Courses			
Fish Ecology (Excursion) Prof. Dr. Reinhold Hanel Fish Ecology (Exercise) Faunistics and Ecology of the Mediterranean Sea (Seminar)			

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Protocol: Fish Ecology and Aquaculture	Protocol	Graded	Compulsory	100

Course Content
This module will give insight into the flora and fauna of the Mediterranean Sea, the role of environmental parameters and different methods to explore the littoral zone. Topics to be covered include: Taxonomy and ecology of key species of different marine littoral habitats. Ecology and behaviour of Mediterranean fish species. Mediterranean benthos: Taxonomy, habitats and life forms.
Learning Outcome
On completion of this module, students will have gained a basic knowledge on biodiversity and ecology of the littoral zone of the Mediterranean Sea, with special focus on fish, macrophytes and macrozoobenthos. They will have an understanding of different functional groups of organisms, their interactions and the principal abiotic factors shaping their environment.
Reading List
Among others: Hofrichter, R. 2002. Das Mittelmeer – Fauna, Flora, Ökologie. Teile 1-3. Spektrum Verlag. Riedl, R. 1984. Fauna und Flora des Mittelmeers. Verlag Paul Parey, Hamburg – Berlin.
Additional Information
This module will take place as a 2-weeks block course in Calvi, Corsica.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-

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Module Name	Module Code
Element cycles in the ocean - Stoffkreisläufe im Meer	MNF-bioc-250
Module Coordinator	
Prof. Dr. Hermann Bange	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	3
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 hours
Total Workload	90 hours
Contact Time	28 hours (2 SWS Lecture x 14 weeks)
Independent Study	62 hours
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Element cycles in the ocean - Stoffkreisläufe im Meer Veranstaltung_1	Compulsory	
Further Information on the Courses			
Class Title (Teaching Form): Marine biogeochemical cycles (Lecture) Contact Time / Group Size: 2 hrs per week / 20 students Lecturers: PD Dr. Hermann W. Bange This lecture is interdisciplinary. Students interested in chemical oceanography, biological oceanography,marine microbiology and Earth system science are welcome. The lecture will be given regularly every week. Please check UnivIS for exact dates.			

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Examination: Element cycles in the ocean - Stoffkreisläufe im Meer	Presentation	Graded	Compulsory	100
Further Information on the Examination(s)				
A graded oral exam.				

Course Content
(i) Evolution of biogeochemical cycles (ii) Basic principles and concepts (iii) Nitrogen cycle (incl. N2 fixation, nitrification, denitrification, anammox) (iv) Phosphorus cycle (v) Sulphur cycle (vi) Silicon cycle (vii) Trace metal cycles (focus on iron) (viii) Coupling of biogeochemical cycles
Learning Outcome
The goal of this lecture is to gain a deeper understanding of the marine biogeochemical cycles in the water column and their interactions with the atmosphere.
Reading List
1) "Earth System Science – From biogeochemical cycles to global change" ed. MC Jacobson et al., Academic Press, 2000. 2) "Biogeochemistry – An analysis of global change", 2. Auflage, WH Schlesinger, Academic Press, 1997. 3) "Ocean Biogeochemical Dynamics", JL Sarmiento and N Gruber, Princeton University Press, 2006. 4) "Introduction to Marine Biogeochemistry", 2nd edition, SM Libes, Academic Press, 2009

Use	Compulsory / Optional	Semester
Bachelor, 1-Subject, Physics of the Earth System: Meteorology - Oceanography - Geophysics, (Version 2007)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Optional	-

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Module Name	Module Code
Biogeochemistry of Marine Sediments I	MNF-bioc-251
Module Coordinator	
Dr. Stefan Krause	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Contact Time	30 h
Independent Study	120 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Biogeochemistry of Marine Sediments I Veranstal-tung_1	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Manuscript: Biogeochemistry of Marine Sediments I	Written Report	Graded	Compulsory	100

Course Content
This module provides a comprehensive overview of microbial processes at the interface between the marine biosphere and geosphere. Topics will include redox reactions in oxygenated and reduced sediments (e.g. nitrate reduction, sulfate reduction, methanogenesis, and methane oxidation), element cycling, microbial photosynthesis, chemosynthesis, nitrogen fixation, fermentation, and isotope fractionation. The subject will be taught with examples from a variety of marine settings reaching from coastal to deep-sea as well as from polar to tropical environments.

Learning Outcome
In this module students will learn basic microbial reactions that are connected to biodegradation, element cycling, and synthesis in marine sediments. After completion of the module students should be familiar with the principles of microbial redox reactions and able to interpret for example geochemical gradients that are shaped through biological activity. Furthermore the module offers an interdisciplinary basis to understand biogeochemical processes in benthic environments.
Reading List
Canfield et al.: “Advances in Marine Biology: Aquatic Geomicrobiology”, Elsevier, ISBN: 0-12-026147-2; Konhauer: “Introduction to Geomicrobiology”, Blackwell, ISBN: 0-632-05454-9; Schulz et al.: “Marine Geochemistry”, Springer, ISBN: 3-540-66453-X
Additional Information
This lecture is interdisciplinary and addresses students from the fields of biological oceanography, geochemistry, and microbiology. The lecture will be given regularly every week.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-

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Module Name	Module Code
Mechanisms of biomineralization	MNF-bioc-255
Module Coordinator	
Dr. Nina Keul	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	3
Evaluation	Graded
Duration	ein Semester
Frequency	Takes place every semester
Workload per ECTS Credit	30 hours
Total Workload	90 hours
Contact Time	28 hours (2 SWS Lecture x 14 weeks)
Independent Study	62 hours
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Mechanisms of biomineralization Veranstaltung_1	Compulsory	
Further Information on the Courses			
Class Title (Teaching Form): Mechanisms of biomineralization (Seminar) Contact Time / Group Size: 2 hr per week / 40 students Lecturers: Dr. Nina Keul Completion Module: MNF-bioc-355 Following Module: None.			

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Presentation: Mechanisms of biomineralization	Presentation	Graded	Compulsory	100
Further Information on the Examination(s)				
oral presentation (100%)				

Course Content
This module will provide a broad overview on general principles in marine animal physiology. This includes: principles of cell biology and thermodynamics, metabolism & excretion, respiration and circulation, ion- and osmoregulation, response to key abiotic factors (oxygen, salinity, and temperature). In addition, special physiological adaptations to life in extreme habitats will be discussed (e.g. cold seeps, hydrothermal vents, mud flats, polar oceans, deep sea etc.)
Learning Outcome
The goal of this module is to introduce the students to the physiological diversity of marine invertebrate and vertebrate metazoans. Special attention will be given to physiological challenges associated with the specific abiotic environment of the Baltic Sea.
Reading List
During the first session the student are encouraged to participate in shaping the course content (selection from a list of possible topics to be covered). Current literature and lecture notes will be distributed during the lecture according to the students choices.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Optional	-

↑

Module Name	Module Code
Marine Biodiscovery and Biotechnology	MNF-bioc-260
Module Coordinator	
Prof. Dr. Deniz Tasdemir	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	2 weeks block course
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Contact Time	80 h
Independent Study	70 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Marine Biodiscovery and Biotechnology Veranstal-tung_1	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Presentation: Marine Biodiscovery and Biotechnology	Presentation	Graded	Compulsory	100

Course Content
Basics and methodology in Marine Biotechnology
Learning Outcome
Understanding of methodological approaches in marine natural product chemistry and biotechnology, lab skills in natural compound chemistry and biodiscovery, scientific presentation skills
Reading List
Will be provided at the introductory meeting

Additional Information
2 weeks block course will be given subsequent to the exam period.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-

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Module Name	Module Code
Sea Bird Ecology	MNF-bioc-264
Module Coordinator	
apl.-Prof. Dr. rer. nat. Stefan Garthe	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Contact Time	60 h
Independent Study	90 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Sea Bird Ecology Veranstaltung_1	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Written Examination: Sea Bird Ecology	Written Examina-tion	Graded	Compulsory	100

Course Content
This course will have two main goals. One is to provide an overview of key aspects of the life history of sea-birds, with practical elements studying seabird behaviour, seabird distrubution at sea, diet and feeding ecology as well as habitat choice. Secondly, the students will learn with which methods seabird ecology may be studied, including observations and experiments in the field and in the lab. Also, data collected during the course will be analysed and written up in a protocol.

Learning Outcome
On completion of this course students should have aquired an advanced knowledge of key aspects of the life history of seabirds. This includes an understanding of seabird behaviour, distribution, diet and habitat choice. Also, students should have understood the use of seabirds to indicate changes in the marine environment.
Reading List
Literature and lecture notes will be distributed before and during the course.
Additional Information
This module will take place as an 7-days block course around the end of May / beginning of June at the “Forschungs- und Technologie-Zentrum Westküste” in Büsum.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-

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Module Name	Module Code
Advanced course in Polar Ecology	MNF-bioc-266
Module Coordinator	
Prof. Dr. Dieter Piepenburg	
Organizer	
Faculty of Mathematics and Natural Sciences	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	1 Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	MNF-bioc-266 Advanced course in Polar Ecology Ver-anstaltung_1	Compulsory	
Lecture	MNF-bioc-266 Advanced course in Polar Ecology Ver-anstaltung_2	Compulsory	
Lecture	MNF-bioc-266 Advanced course in Polar Ecology Ver-anstaltung_3	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
MNF-bioc-266 Advanced course in Polar Ecology Prüfung_1	undefiniert	Graded	Compulsory	-

Course Content
The module provides in-depth information about dominant sympagic, pelagic and benthic organisms (including micro-organisms) and their specific environments in the polar regions of both hemispheres. The course will also cover topics of land-sea interactions, e.g. in estuaries and shelf ecosystems. Besides presenting the current knowledge on the general biology and ecology of these organisms, special topics such as threats, population status and conservation issues of habitats for individual species are also addressed with special respect to warming and subsequent men-made changes. The course is a combination of a series of lectures and a literature seminar with oral presentations of the students.
Learning Outcome
The objective of this module is to introduce students to the biology and ecology of polar environments in different regions. After completion of the module, students should have a sound knowledge on diversity, habitats, life cycles, feeding ecology and adaptations in biology, physiology and behaviour of marine and terrestrial polar organisms.
Reading List
Hempel, G., Hempel, I. (eds) 2009: Biological studies in polar Oceans – exploration of life in icy waters. Wirtschaftsverlag NW, Verlag für neue Wissenschaft, Bremerhaven. Seminar papers will be distributed during the course.
Additional Information
This module will also offer a one-day excursion, either to the Alfred-Wegener-Instutute of Polar und Marine Research in Bremerhaven (AWI), or the Hamburg Ice Tank Facilitiy (HSVA)

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	.

↑

Module Name	Module Code
Identification and taxonomy of marine invertebrates	MNF-bioc-267
Module Coordinator	
PD Dr. Frank Melzner	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	56 hours ((1 SWS Lecture / 3 SWS Practical) x 14 weeks)
Independent Study	94 hours
Teaching Language	English

Entry Requirements as Stated in the Examination Regulations
MNF-bioc-101, MNF-bioc-102

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Identification and taxonomy of marine invertebrates Veranstaltung_1	Compulsory	
Lecture	Identification and taxonomy of marine invertebrates Veranstaltung_2	Compulsory	
Lecture	Identification and taxonomy of marine invertebrates Veranstaltung_3	Compulsory	

Further Information on the Courses

Class Title (Teaching Form): Marine Phyla and Communities (Lecture)
Contact Time / Group Size: 1 hr per week / 20 students
Lecturers: various lecturers

Class Title (Teaching Form): Identification of marine animal taxa
(Practical)
Contact Time / Group Size: 3 hr per week / 20 students
Lecturers: S. Ismar, G. Steffen

Prerequisits for Admission to the Examination(s)

MNF-bioc-101, MNF-bioc-102

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Homework or Manuscript: Identification and taxonomy of marine invertebrates	Other	Graded	Compulsory	-
Practical identification protocol: Identification and taxonomy of marine invertebrates	Protocol	Graded	Compulsory	100

Further Information on the Examination(s)

Manuscript or Homework 100%.

Course Content

This course will provide knowledge of the morphology of marine animals and algae communities from the Baltic Sea and develop the capacity of correct and scientific identification of marine invertebrate and some selected vertebrate taxa. A further important aspect is to gain an understanding of the variety of life histories that are possible and realized in the marine environment.

Learning Outcome

The objective of this course is to enable students to identify marine animals, to provide thorough knowledge of the local flora and fauna, and to gather practical experience of sample collection at sea.

Reading List

Additional Information
The course will be held bilingually. A major portion of the identification keys is in German since no English translations are available yet.

Use	Compulsory / Optional	Semester
Bachelor, 1-Subject, Physics of the Earth System: Meteorology - Oceanography - Geophysics, (Version 2007)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Optional	-
Master, 1-Subject, Biology, (Version 2021)	Optional	-
Master, 1-Subject, Biology, (Version 2015)	Optional	-
Master, 1-Subject, Biology, (Version 2011)	Optional	-
Master, 1-Subject, Biology, (Version 2007)	Optional	-

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Module Name	Module Code
New Aspects of Meteorology and Oceanography: Carbon Cycling in Changing Cimate	MNF-bioc-271
Module Coordinator	
Prof. Dr. Birgit Schneider	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Contact Time	35 h
Independent Study	115 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compulsory/Optional**	**SWS**
Lecture	New Aspects of Meteorology and Oceanography: Carbon Cycling in Changing Cimate Veranstaltung_1	Compulsory	
Lecture	New Aspects of Meteorology and Oceanography: Carbon Cycling in Changing Cimate Veranstaltung_2	Compulsory	
Lecture	New Aspects of Meteorology and Oceanography: Carbon Cycling in Changing Cimate Veranstaltung_3	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Presentation: New Aspects of Meteorology and Oceanography: Carbon Cycling in Changing Cimate	Presentation	Graded	Compulsory	100

Course Content
The seminar is divided into interactive lectures connected to a student part with presentations and exercises. The student part includes studying and presenting recent articles on modern aspects of carbon in the climate-system. Within teams the students should learn to analyze and discuss scientific papers and IPCC chapters in more detail. Finally, a synthesis paper will be developed by all participants together.
Learning Outcome
This interdisciplinary seminar should give an introduction into the role of carbon (including the greenhouse gases CO2 and methane) in the climate-system, with a focus on the coupling of atmosphere, ocean and solid earth. The seminar will teach the basics of the earth's climate history, with an emphasis on the cycling of carbon through atmosphere, ocean, sediments and biosphere. Climate change issues will be discussed interactively with the students along the current IPCC assessment.
Reading List
John Houghton, Global Warming: The Complete Briefing, Cambridge University Press Additional literature and lecture notes will be distributed.
Additional Information
Formal subscription to this course via OLAT and participation in a planning meeting is mandatory; please check UnivIS for more information

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-

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Module Name	Module Code
New Developments in Marine Microbiology I	MNF-bioc-272
Module Coordinator	
Prof. Dr. Ute Hentschel Humeida	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	2
Evaluation	Graded
Frequency	
Teaching Language	German

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	MNF-bioc-272 New Developments in Marine Microbio-logy I Veranstaltung_1	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
MNF-bioc-272 New Developments in Marine Microbiology I Prüfung_1	undefiniert	Graded	Compulsory	-

Course Content
Learning Outcome
Reading List

Use	**Compulsory / Optional**	**Semester**
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	.

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Module Name	Module Code
New Trends in Marine Biodiscovery	MNF-bioc-274
Module Coordinator	
Prof. Dr. Deniz Tasdemir	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	2
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	60 h
Contact Time	30 h
Independent Study	30 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	New Trends in Marine Biodiscovery Veranstaltung_1	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Presentation: New Trends in Marine Biodiscovery	Presentation	Graded	Compulsory	100

Course Content
Basics, new trends and methodology in Marine Biodiscovery
Learning Outcome
Understanding of scientific and methodological approaches as well as innovative trends in marine natural product chemistry and biodiscovery, scientific presentation skills
Reading List

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-

↑

Module Name	Module Code
Invasion Ecology	MNF-bioc-275
Module Coordinator	
Dr. Elizabeta Briski	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	3
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	90 h
Contact Time	30 h
Independent Study	60 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Invasion Ecology Veranstaltung_1	Compulsory	
Lecture	Invasion Ecology Veranstaltung_2	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Presentation: Invasion Ecology	Presentation	Graded	Compulsory	100

Course Content
The format will consist of lectures, seminars illustrating case studies from ongoing projects, presentation (by the students) of selected papers, and discussions. Each student will also identify a topic of interest, present it to the group. The topic could be any specific theory (e.g. enemy-release hypothesis, invasion meltdown, propagule pressure), or question (e.g. human disturbance of habitats, unintentional transport due to globalization, adaptation, ocean acidification, global warming …) with an explicit link to invasion ecology in marine habitats.

Learning Outcome
The students should leave this course with a basic understanding of natural history, evolution, ecology and impacts of non-indigenous species. A particular emphasis will be given to the different theories in invasion ecology such as propagule pressure, empty niche and enemy-release hypotheses. Further focus of the course would be on transport vectors and pathways, role of disturbance, biotic interactions, and evolution and adaptation of non-indigenous species. Students will be exposed to current research in the area, techniques, type of data and analyses commonly used.
Reading List
Relevant literature will be distributed within the respective courses.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-

↑

Module Name	Module Code
Air-Sea-Exchange	MNF-bioc-277
Module Coordinator	
Prof. Dr. Anja Engel	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	1 Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	MNF-bioc-277 Air-Sea-Exchange Veranstaltung_1	Compulsory	
Lecture	MNF-bioc-277 Air-Sea-Exchange Veranstaltung_2	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
MNF-bioc-277 Air-Sea-Exchange Prü-fung_1	undefiniert	Graded	Compulsory	-

Course Content
This module provides a comprehensive overview of biogeochemical processes at the interface between the ocean and the atmosphere. Topics will include models/theory of gas transfer, physical and chemical influences on gas exchange, quantification of gas exchange and methods of research, microbial control on the sea surface microlayer, microbial trace gas cycling, and the role of air-sea exchange processes in climate change. The subject will be taught through lectures and student led discussions of relevant scientific literature.

Learning Outcome
In this module students will learn the basics of air-sea gas exchange and biological production of the sea surface microlayer. The influence of the sea surface microlayer on gas exchange and primary aerosol formation will be discussed. Furthermore the module offers an interdisciplinary basis to understand biogeochemical processes at the surface of the ocean and in the lower atmosphere. There will be a secondary, but major, focus on the critical reading and discussing of international scientific publications.
Reading List

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Compulsory	.

↑

Module Name	Module Code
Geomicrobiology: accessing the hidden uncultured microbial majority in seafloor habitats	MNF-bioc-279
Module Coordinator	
Prof. Dr. Mirjam Perner	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	2 Wochen Blockkurs
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	150h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	MNF-bioc-279 Geomicrobiology: accessing the hidden uncultured microbial majority in seafloor habitats Ver-anstaltung_1	Compulsory	
Lecture	MNF-bioc-279 Geomicrobiology: accessing the hidden uncultured microbial majority in seafloor habitats Ver-anstaltung_2	Compulsory	
Lecture	MNF-bioc-279 Geomicrobiology: accessing the hidden uncultured microbial majority in seafloor habitats Ver-anstaltung_3	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
MNF-bioc-279 Geomicrobiology: accessing the hidden uncultured microbial majority in seafloor habitats Prüfung_1	undefiniert	Graded	Compulsory	-

Course Content
Lecture topics include the metagenome of different seafloor habitats: sediments, rocks and hydrothermal vents. Both, sequenced-based and activity-based screens will be presented. The drawbacks and benefits of metagenomic technology will be assessed. The role and relevance of these processes for the local benthic habitat and the global Ocean will be discussed. Practical: metagenomic fosmid libraries will be constructed. Metagenomic fosmid inserts will be sequenced and activity-based screens will be performed for seeking enzymes from the metagenome.
Learning Outcome
Seminar: In this seminar, students will study basic principles for accessing the uncultured microbial majority in seafloor habitats. Students will get an overview of the work that has been done in this area of research. Techniques, their benefits and drawbacks for accessing the uncultured microbial community will be discussed. Lecture: In the lecture, basic principles of how to analyse the uncultured microbial community will be introduced. Current studies will be addressed and different tools for accessing information from the metagenome will be presented. Students will acquire an integrative view of the metagenome in seafloor habitats and how to link this knowledge to local environmental processes. Practical: Within the practical, students will be trained in modern metagenomic techniques relevant for experimental approaches in Geomicrobiology. Students will be distributed in small groups to conduct experiments.
Reading List

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	.

↑

Module Name	Module Code
Coastal Fish Ecology	MNF-bioc-280
Module Coordinator	
PD Dr. Katja Heubel	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	6
Evaluation	Graded
Duration	10 Tage Blockkurs
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 h
Total Workload	180 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	MNF-bioc-280 Coastal Fish Ecology Veranstaltung_1	Compulsory	
Lecture	MNF-bioc-280 Coastal Fish Ecology Veranstaltung_2	Compulsory	
Lecture	MNF-bioc-280 Coastal Fish Ecology Veranstaltung_3	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
MNF-bioc-280 Coastal Fish Ecology Prü-fung_1	undefiniert	Graded	Compulsory	-

Course Content
Current topics in Ecology of marine and estuarine fish (esp. life history, spatial and temporal aspects of ecology, adaptations to abiotic and biotic environments, effects due to anthropogenic stressors). The role of fish in the ecosystem • Methods and design for field experiments • Fish diversity, ecology, and behaviour • Trophic interactions, diet and feeding ecology • Variety of fishing and sampling methods • Methods for field experiments • Ecological laboratory methods • Collection, handling, analysis, presentation, and interpretation of data • Typical life forms and communities of tidal mud flats and estuaries
Learning Outcome
Students who successfully completed this course … • have acquired detailed knowledge regarding the ecology of coastal marine and estuarine fish with a special emphasis on integrating eco-evolutionary concepts and gaining insights in related key aspects of conservation and biodiversity of fish and its community and environment. • have acquired first experiences on conducting and analyzing experiments on fish behaviour. • are able to use a variety of different fishing, sampling, and laboratory methods that are needed as a tool for projecting different kind of studies in the field of fish ecology. • can independently carry out small scientific projects related to the topic of the module. • have learned how to present research results in oral and written form and to critically discuss scientific publications related to the topic of the module on a professional level. • have acquired detailed knowledge on the coastal biodiversity and on the functioning of littoral and estuarine ecosystems (incl. tidal flats, salt marsh, shores). • are able to transfer skills acquired in this module to other fields of biology.
Reading List

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	.

↑

Module Name	Module Code
Marine Evolutionary Genomics	bioc281-01a
Module Coordinator	
Prof. Dr. Reid Brennan	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	1 Semester
Frequency	Only takes place during summer semesters
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Teaching Language	English

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Marine Evolutionary Genomics Prüfung_1	undefiniert	Graded	Compulsory	-

Course Content

The format will consist of lectures, presentation (by the students) of selected papers with discussions, and hands on exercises in evolutionary genomics. Each student will also perform a literature review and synthesis on an approved topic of interest that will be presented to the group. The topic can be any specific theory (e.g. ecological speciation, genetic isolation by distance), technique (e.g. RAD sequencing, parentage analysis) or question (e.g. connectivity among marine protected areas, ecological forensics, stock identification for fisheries, genomic bases of local adaptation, ocean acidification, global warming) with an explicit link to marine sciences and genetics/genomics.

Learning Outcome

The students should leave this course with strong foundation and understanding of evolutionary genomics. Learning goals include:

- fundamental principles in evolutionary genetics, transcriptomics, epigenetics, evolution, etc.
- techniques, type of data and analyses comminly iúsed and how to apply them.
- realized and potential contributions of these approaches in marine sciences. A particular emphasis will be given to the links between the questions addressed, the methods used, underlying theory, interpretation, and application of the results.

Reading List

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	.

↑

Module Name	Module Code
Current Topics in Marine Biogeochemistry II	MNF-bioc-331
Module Coordinator	
Prof. Dr. Ulf Riebesell	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Contact Time	75 h
Independent Study	75 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Current Topics in Marine Biogeochemistry II Veran-staltung_1	Compulsory	
Lecture	Current Topics in Marine Biogeochemistry II Veran-staltung_2	Compulsory	
Lecture	Current Topics in Marine Biogeochemistry II Veran-staltung_3	Compulsory	
Further Information on the Courses			
Current Topics in Marine Biogeochemistry II (seminar) Prof. Dr. Ulf Riebesell Dipl.-Biol. Annegret Stuhr Current Topics in Marine Biogeochemistry II (lecture) (lectures by invited speakers) 2 hrs per week / 30 students 3 hrs per week / 30 students			

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Presentation: Marine Biogeochemistry II	Presentation	Graded	Compulsory	100

Course Content
On-going research in marine biogeochemistry will be presented and critically discussed. Current topics will be from a broad area of marine sciences with relevance to marine biogeochemistry, including molecular biology and genetics, physiology, ecology, to marine chemistry, isotope geochemistry, atmospheric chemistry, to ecosystem and biogeochemical modelling.
Learning Outcome
Students will obtain a broad overview of current research topics, new methodologies, novel scientific concepts, and latest developments in the area of marine biogeochemistry. Upon successful completion of this module, students will have improved their competence to critically evaluate on-going research, participate in scientific discussions, select their own research questions, formulate testable hypotheses, and select state-of-the-art methodologies. By experiencing the interdisciplinary nature of marine sciences, students will develop the ability to place results in a specific area into the larger context of understanding the role of the ocean in the earth system.
Reading List
Relevant literature will be given out during the module.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Optional	-
Master, 1-Subject, Biology, (Version 2021)	Optional	-
Master, 1-Subject, Biology, (Version 2015)	Optional	-
Master, 1-Subject, Biology, (Version 2011)	Optional	-
Master, 1-Subject, Biology, (Version 2007)	Optional	-

↑

Module Name	Module Code
Current Topics in Marine Ecology II	MNF-bioc-332
Module Coordinator	
Dr. Elizabeta Briski	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	75 hours: ((1 SWS Lecture + 2 SWS Exercise + 2 SWS Seminar) x 15 weeks)
Independent Study	75 hours
Teaching Language	English

Entry Requirements as Stated in the Examination Regulations
MNF-bioc-101, MNF-bioc-102

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Current Topics in Marine Ecology II Veranstaltung_1	Compulsory	
Lecture	Current Topics in Marine Ecology II Veranstaltung_2	Compulsory	

Further Information on the Courses

Current Topics in Marine Ecology II (Lecture)
Prof. Dr. Stefanie Ismar
Prof. Dr. Martin Wahl

Current Topics in Marine Ecology II (Exercise)
Prof. Dr. Stefanie Ismar
Prof. Dr. Martin Wahl

Current Topics in Marine Ecology II (Seminar)
Prof. Dr. Stefanie Ismar
Prof. Dr. Martin Wahl

1 hrs per week / 30 students
2 hrs per week / 30 students
2 hr per week / 30 students

Prerequisits for Admission to the Examination(s)

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Presentation: Marine Ecology II	Presentation	Graded	Compulsory	100

Further Information on the Examination(s)

Graded oral presentation (100% of final mark).

Course Content

In this module current activities marine plankton and benthos research will be presented and discussed in the context of the actual theoretical framework. The latter will be the content of the lecture part.

Learning Outcome

The students will get knowledge and understanding of the current marine ecological research activities at IFM-GEOMAR and their scientific background and an insight into currently important questions, approaches, models and theories in benthic ecology.

Reading List

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Optional	-
Master, 1-Subject, Biology, (Version 2021)	Optional	-
Master, 1-Subject, Biology, (Version 2015)	Optional	-
Master, 1-Subject, Biology, (Version 2011)	Optional	-
Master, 1-Subject, Biology, (Version 2007)	Optional	-

↑

Module Name	Module Code
Current Topics in Fish Ecology	MNF-bioc-334
Module Coordinator	
Dr. Catriona Clemmesen-Bockelmann Prof. Dr. Thorsten Reusch	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	one Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	70 hours: ((3 SWS Lecture + 2 SWS Seminar) x 14 weeks)
Independent Study	80 hours
Teaching Language	English

Entry Requirements as Stated in the Examination Regulations
MNF-bioc-201

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Current Topics in Fish Ecology Veranstaltung_1	Compulsory	1
Lecture	Current Topics in Fish Ecology Veranstaltung_2	Compulsory	2
Seminar	Current Topics in Fish Ecology Veranstaltung_3	Compulsory	2

Further Information on the Courses

Class Title (Teaching Form): Fish Systematic, Biology and Evolution (Lecture)
Contact Time / Group Size: 1 hrs per week / 25 students
Lecturers:
Prof. Dr. Reinhold Hanel

Class Title (Teaching Form): Dynamics, Assessment and Management of Exploited Marine Fish Populations (Lecture)
Contact Time / Group Size: 2 hrs per week / 25 students
Lecturers:
Prof. Dr. Joachim Gröger

Class Title (Teaching Form): Current Topics in Fish Ecology (Seminar)
Contact Time / Group Size: 2 hrs per week / 25 students
Lecturers:
Prof. Dr. Oscar Puebla
Dr. Olivia Roth
Prof. Dr. Thorsten Reusch

Prerequisits for Admission to the Examination(s)

Prerequisites: MNF-bioc-201

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Written Examination: Fish Ecology	Written Examination	Graded	Compulsory	50
Oral Presentation: Fish Ecology	Presentation	Graded	Compulsory	50

Course Content

Basics in fish systematics, biology, biodiversity and evolution and on current topics in fish ecology. Students will learn to critically evaluate primary literature, extract information, present the content in a brief and concise way and will have to lead and structure scientific discussions.

Learning Outcome

Students will be presented with information on current research topics in fish ecology, fisheries biology, evolutionary ecology and aquaculture.

Reading List

Will be distributed at beginning of course

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Optional	-
Master, 1-Subject, Biology, (Version 2021)	Optional	-
Master, 1-Subject, Biology, (Version 2015)	Optional	-
Master, 1-Subject, Biology, (Version 2011)	Optional	-
Master, 1-Subject, Biology, (Version 2007)	Optional	-

Module Name	Module Code
Fundamentals and Current Topics in Biogeochemical Modelling	MNF-bioc-335
Module Coordinator	
Prof. Dr. Andreas Oschlies	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Contact Time	60 h
Independent Study	90 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Fundamentals and Current Topics in Biogeochemical Modelling Veranstaltung_1	Compulsory	
Lecture	Fundamentals and Current Topics in Biogeochemical Modelling Veranstaltung_2	Compulsory	

Further Information on the Courses

Current Topics in BGC modelling (Seminar)
Prof. Dr. Andreas Oschlies
Dr. rer. nat. Markus Pahlow
Dr. rer. nat. Markus Schartau
Fundamentals in BGC modelling (Lecture)
Prof. Dr. Andreas Oschlies
Dr. Markus Pahlow
Dr. Markus Schartau
Dr. Wolfgang Koeve
Dr. Iris Kriest
Dr. Ivy Frenger
Dr. Heiner Dietze
Dr. Ulrike Loeptien
Dr. Angela Landolfi
2 hrs per week / 15 students
2 hrs per week / 15 students

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Presentation: Fundamentals and Current Topics in Biogeochemical Modelling	Presentation	Graded	Compulsory	100

Course Content

The students will develop a seminar presentation on a current topic of marine biological modelling. Preparation of the presentation involves the study of recent literature and some understanding of new modeling concepts. The assessment is based on the oral presentation in the seminar.
The lecture series covers the fundamentals in marine biogeochemical modelling, with focus on regional to global three-dimensional models:
models of ocean circulation, air-sea gas exchange, organic matter production in the surface ocean, transport and remineralisation of organic matter; practical applications; use of logical arguments; resolution matters; time scales; model assessment.

Learning Outcome

The students will become acquainted with the fundamentals of global biogeochemical modelling as well as current concepts used in state-of-the-art biogeochemical and ecological models, their specific advantages and disadvantages and potential pitfalls in working with these models and their output.

Reading List

Literature references will be provided in the individual lectures.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-

↑

Module Name	Module Code
Advanced Biological Modelling	MNF-bioc-341
Module Coordinator	
Prof. Dr. Andreas Oschlies	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	56 hours ((2 SWS Lecture / 2 SWS Exercise) x 14 weeks)
Independent Study	94 hours
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Advanced Biological Modelling Veranstaltung_1	Compulsory	
Lecture	Advanced Biological Modelling Veranstaltung_2	Compulsory	

Further Information on the Courses

Class Title (Teaching Form): Advanced Biological Modelling (Lecture)
Contact Time / Group Size: 2 hrs per week / 15 students
Lecturers:
Prof. Dr. Andreas Oschlies

Class Title (Teaching Form): Advanced Biological Modelling (Exercise)
Contact Time / Group Size: 2 hrs per week / 15 students
Lecturers:
Prof. Dr. Andreas Oschlies

Prerequisits for Admission to the Examination(s)

Prerequisites: MNF-bioc-220 or equivalent. Basic knowledge of MATLAB.

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Written Examination: Advanced Biological Modelling	Written Examina-tion	Graded	Compulsory	100

Further Information on the Examination(s)

Graded protocol

Course Content

The unit will be delivered through a combination of lectures and computer-based accompanying assign-ments. Students will use higher-level programming languages to manipulate numerical models provided by the organizers. We will discuss typical model errors and provide strategies for error minimization. At the end of the course, students will develop their own simple models to address a scientific problem of their choice.

Learning Outcome

The class shall
educate in different modelling approaches in environmental and Earth system science,
strengthen the students' quantitative and computational skills, and
the students are supposed to learn how to develop, set up, run, and analyse simple numerical models.

Reading List
Literature references will be provided in the individual lectures.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Optional	-

↑

Module Name	Module Code
Current Topics in Biogechemical Modelling	MNF-bioc-342
Module Coordinator	
Prof. Dr. Andreas Oschlies	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	3
Evaluation	Graded
Duration	ein Semester
Frequency	Takes place every semester
Workload per ECTS Credit	30 hours
Total Workload	90 hours
Contact Time	28 hours (2 SWS Seminar x 14 weeks)
Independent Study	62 hours
Teaching Language	English

Entry Requirements as Stated in the Examination Regulations			
Prerequisites: MNF-bioc-220			
Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Current Topics in Biogechemical Modelling Veranstal-tung_1	Compulsory	
Further Information on the Courses			
Class Title (Teaching Form): Advanced Biological Modelling (Seminar) Contact Time / Group Size: 2 hrs per week / 15 students Lecturers: Prof. Dr. Andreas Oschlies Dr. rer. nat. Markus Pahlow Dr. rer. nat. Markus Schartau			
Prerequisits for Admission to the Examination(s)			
Prerequisites: MNF-bioc-220			

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Presentation: Current Topics in Biogeochemical Modelling	Presentation	Graded	Compulsory	100
Further Information on the Examination(s)				
Graded oral presentation.				

Course Content
The students will develop a seminar presentation on a current topic of marine biological modelling. Preparation of the presentation involves the study of recent literature and some understanding of new modeling concepts. The assessment is based on the oral presentation in the seminar.
Learning Outcome
The students will become acquainted with current concepts used in biogeochemical and ecological models and their specific advantages and disadvantages. They will learn to analyse and interpret model results, and how to assess the quality of models.
Reading List
Literature references will be provided in the individual lectures.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Optional	-

↑

Module Name	Module Code
Climate-relevant trace gases in the ocean - Klimarelevante Spurengase im Ozean	MNF-bioc-350
Module Coordinator	
Prof. Dr. Hermann Bange	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	3
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 hours
Total Workload	90 hours
Contact Time	28 hours (2 SWS Lecture x 14 weeks)
Independent Study	62 hours
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	Climate-relevant trace gases in the ocean - Klimarele-vante Spurengase im Ozean Veranstaltung_1	Compulsory	
Further Information on the Courses			
Class Title (Teaching Form): Climate relevant trace gases in the ocean (Lecture) Contact Time / Group Size: 2 hr per week / 20 students Lecturers: Prof. Dr. Hermann W. Bange			

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Examination: Climate-relevant trace gases in the ocean - Klimarelevante Spurengase im Ozean	Oral Examination	Graded	Compulsory	100
Further Information on the Examination(s)				
A graded oral exam.				

Course Content
(i) significance of oceanic trace gases for greenhouse effect and ozone hole (ii) chemical and physical properties of dissolved gases (iii) models of air-sea gas exchange (iv) methods to measure dissolved trace gase (incl. guided lab tour) (v) marine biogeochemistry of selected trace gases (N2O, CH4, DMS, COS, CO, halocarbons, H2, NH3, OVOCs)
Learning Outcome
The goal of this lecture is to gain a deeper understanding of the distribution and biogeochemical pathways of climate relevant trace gases in the ocean. Additionally the students will gain insights into the mechanisms of air-sea gas exchange as well as the role of the ocean as source or sink of atmospheric trace gases and the implications for the atmosphere (greenhouse effect, ozone hole).
Reading List
1) "Earth System Science – From biogeochemical cycles to global change" ed. MC Jacobson et al., Academic Press, 2000. 2) "Biogeochemistry – An analysis of global change", 2. Auflage, WH Schlesinger, Academic Press, 1997. 3) „Chemie der Atmosphäre – Bedeutung für Klima und Umwelt", TE Graedel and PJ Crutzen, Spektrum Akademischer Verlag, 1994.
Additional Information
This lecture is interdisciplinary. Students interested in chemical oceanography, biological oceanography,marine microbiology and Earth system science are welcome. The lecture will be given regularly every week. Please check UnivIS for exact dates.

Use	Compulsory / Optional	Semester
Bachelor, 1-Subject, Materials Science, (Version 2018)	Optional	-
Bachelor, 1-Subject, Materials Science and Engineering, (Version 2014)	Optional	-
Bachelor, 1-Subject, Materials Science and Engineering, (Version 2011)	Optional	-
Bachelor, 1-Subject, Physics of the Earth System: Meteorology - Oceanography - Geophysics, (Version 2007)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Optional	-

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Module Name	Module Code
Marine Microbiology	MNF-bioc-353
Module Coordinator	
Priv.-Doz. Dr. Avan Antia	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	2
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 hours
Total Workload	60 hours
Contact Time	28 hours (2 SWS Seminar x 14 weeks)
Independent Study	32 hours
Teaching Language	English

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Further Information on the Examination(s)				
A written and graded examination (100% of final mark).				

Course Content
This module will address different stages of manuscript writing and publishing answering basic questions such as: When are my data ready for publishing? Where should I publish? How do I structure the manuscript? How to present the data? What is my message? What are the Does and Don’ts of scientific writing? How to deal with the reviewers and editors? How to manage my coauthors? The module will be an interactive seminar.
Learning Outcome
In this module students will be introduced into the process of manuscript publishing in peer-reviewed scientific journals. The goal of the module is to provide insights into the fun and frustration of paper writing, important rules on manuscript structuring and scientific language as well as how to deal with the reviewing process. After completion of the module students should be familiar with the general principles of a successful publishing process.

Reading List
Day: “How to write and publish a scientific paper”, Oryx Press, ISBN: 1-57356-165-7; Day: “Scientific English”, Oryx Press, ISBN: 0-89774-989-8; San Francisco Edit: http://www.sfedit.net/newsletters.htm

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2007)	Optional	-

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Module Name	Module Code
How to make and keep a habitable planet - biogeochemistry-climate feedbacks and astrobiology	MNF-bioc-357
Module Coordinator	
Prof. Dr. Andreas Oschlies	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	42 hours: ((2 SWS lecture + 1 SWS exercise) x 14 weeks)
Independent Study	108 hours
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compulsory/Optional**	**SWS**
Lecture	How to make and keep a habitable planet - biogeochemistry-climate feedbacks and astrobiology Veranstaltung_1	Compulsory	
Lecture	How to make and keep a habitable planet - biogeochemistry-climate feedbacks and astrobiology Veranstaltung_2	Compulsory	
Further Information on the Courses			
Class Title (Teaching Form): How to make and keep a habitable planet – biogeochemistry-climate feedbacks and astrobiology (Lecture) Contact Time / Group Size: 2 hrs per week / 30 students Class Title (Teaching Form): How to make and keep a habitable planet – biogeochemistry-climate feedbacks and astrobiology (Exercise) Contact Time / Group Size: 1 hrs per week / 30 students Lecturers: Prof. Dr. Andreas Oschlies			

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Written Examination: How to make and keep a habitable planet - biogeochemistry-climate feedbacks and astrobiology	Written Examination	Graded	Compulsory	100
Further Information on the Examination(s)				
Written examination (graded).				

Course Content
Evolution of Earth, “young faint sun” paradox, role of physical and biogeochemical feedbacks, evolution of life and its impact on Earth’s atmosphere and climate. Climate variability, snowball Earth events, glacial cycles, and the anthropocene. Discussion of where and how to look for life on other planets.
Learning Outcome
The main goal of this seminar is to discuss recent hypotheses on how life and biogeochemical cycles developed on Earth or could develop on other planets, and how Earth has remained habitable for a very long time. Students will learn about biogeochemical-climate feedbacks operating on Earth and other planets, and gain practice in interpreting controversially discussed hypotheses about planetary evolution.
Reading List
Ruddiman, W., “Earth’s Climate: Past and Future”, Freeman, NY, 465 pp; Schlesinger et al: “Biogeochemistry”, Elsevier; Kump, Kasting & Crane “The Earth System” Pearson Education; Gilmour & Sephton: “Astrobiology”, Cambridge Open University.
Additional Information
This course is interdisciplinary and addresses students from the fields of physical oceanography and meteorology, biological oceanography, geology, and microbiology.

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Optional	-

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Module Name	Module Code
Food-Web interactions in the Wadden Sea	MNF-bioc-360
Module Coordinator	
Prof. Dr. Deniz Tasdemir	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	2 Wochen Blockkurs
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Teaching Language	English

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Further Information on the Examination(s)				
Oral presentation (100%)				

Course Content
Basics and methodology in Marine Biotechnology
Learning Outcome
Understanding of methodological approaches in marine natural product chemistry and biotechnology, lab skills in natural compound chemistry and biodiscovery, scientific presentation skills.
Reading List
Will be provided at the introductory meeting

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-
Master, 1-Subject, Biological Oceanography, (Version 2012)	Optional	-

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Module Name	Module Code
New Trends in Marine Biotechnology	MNF-bioc-374
Module Coordinator	
Prof. Dr. Deniz Tasdemir	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	2
Evaluation	Graded
Duration	ein Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 h
Total Workload	60 h
Contact Time	30 h
Independent Study	30 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	New Trends in Marine Biotechnology Veranstaltung_1	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
Oral Presentation: New Trends in Marine Biotechnology	Presentation	Graded	Compulsory	100

Course Content
Basics and methodology in Marine Biotechnology
Learning Outcome
Understanding of scientific and methodological approaches and new, innovative trends in marine natural product chemistry and biotechnology, scientific presentation skills
Reading List

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	-

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Module Name	Module Code
Microbial Ecology, molecular techniques and genomics of the Baltic Sea	bioc378-01a
Module Coordinator	
Dr. David Needham	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	1 Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**

Short Summary
Marine microbial systems are challenging to study because they are composed of organisms that are extremely diverse, tiny, and mostly uncultivated. For this reason, in large degree, microbial ecology is a methods-driven field, with major insights often following advances in technology or novel applications of existing. In this course, we will discuss the dominant and unique features of the Baltic Sea microbial ecosystem and review state-of-art molecular techniques and their potential application to unraveling microbial mysteries. Example topics covered will include for example (as chosen by students), single-cell sequencing and physiological measurements, nucleic acid-isotope labelling approaches, genetic engineering of natural communities, fluorescence-based molecular microscopic analyses, Raman spectroscopy, viral tagging, chemotaxis assays. In the last third of the course, we will dive deeper into genomic techniques and analyze novel molecular and genomic data from the Baltic Sea related to cycling of carbon and nitrogen.
Course Content
The format will consist of lectures, presentation (by the students) of selected papers with discussions, and hands on exercises in microbial genomics.

Learning Outcome
The students should leave this course with strong foundation and understanding of Baltic Sea Microbiology, the state-of-the-art in microbial ecological methods, and bioinformatic skills. Learning goals include: • Diversity, ecology, and genomics of Baltic Sea Microbiology • Molecular ecological tools, • Practical experience with novel sequence and genomic data from the Baltic Sea
Reading List

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	.

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Module Name	Module Code
Geomicrobiology: from sediments to bacteria: turnover rates, enzyme activities and genetics	MNF-bioc-379
Module Coordinator	
Prof. Dr. Mirjam Perner	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	5
Evaluation	Graded
Duration	2 Wochen Blockkurs
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 h
Total Workload	150 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compulsory/Optional**	**SWS**
Lecture	MNF-bioc-379 Geomicrobiology: from sediments to bacteria: turnover rates, enzyme activities and genetics Veranstaltung_1	Compulsory	
Lecture	MNF-bioc-379 Geomicrobiology: from sediments to bacteria: turnover rates, enzyme activities and genetics Veranstaltung_2	Compulsory	
Lecture	MNF-bioc-379 Geomicrobiology: from sediments to bacteria: turnover rates, enzyme activities and genetics Veranstaltung_3	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
MNF-bioc-379 Geomicrobiology: from sediments to bacteria: turnover rates, enzyme activities and genetics Prüfung_1	undefiniert	Graded	Compulsory	-

Course Content
Lecture topics include: microbially mediated hydrogen-, carbon-, iron-, sulfur-cycling. The role and relevance of these processes for the local benthic habitat and the global Ocean will be discussed. Enzymes associated with these processes will be discussed. Practical experiments will be related to determining turnover rates of specific compounds and measuring activities of enzymes from incubation experiments. Spectrophotometry and Gaschromatograhy will be used. Additionally, PCR will be conducted to prove the presence of genes encoding respective enzyme activities. Research projects will be closely aligned with ongoing research in the working group Geomicrobiology.
Learning Outcome
Seminar: In this seminar, students will study basic principles of benthic bio-geo-coupling processes in an interactive fashion. The seminar aims at developing an understanding of the important role microorganisms play for cycling distinct chemical compounds, e.g. carbon, hydrogen, iron nitrogen, sulfur on the seafloor. Students will learn how to gather information on element cycling from the primary literature and to prepare oral presentations. Lecture: In the lecture, basic principles of microbially mediated element cycling e.g. carbon, hydrogen, iron nitrogen, sulfur on the seafloor will be taught in an interactive fashion. We will address microbial turnover rates, enzyme activities and genes relevant for element cycling in benthic habitats. Students will acquire an integrative view of bio-geo-coupling processes. Practical: Within the practical, students will be trained in modern techniques relevant for experimental approaches in Geomicrobiology. Students will be distributed in small groups to conduct experiments. Focus will lay on hydrogen and sulfur cycling.
Reading List

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	.

↑

Module Name	Module Code
Sustainable Ocean Food Production and Security	MNF-bioc-380
Module Coordinator	
Prof. Dr. Thorsten Reusch	
Organizer	
Helmholtz-Zentrum für Ozeanforschung (GEOMAR)	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination Office of the Department of Biology	

ECTS Credits	6
Evaluation	Graded
Duration	1 Semester
Frequency	Only takes place during winter semesters
Workload per ECTS Credit	30 h
Total Workload	180 h
Teaching Language	English

Module Courses			
Course Type	**Course Name**	**Compul-sory/Optional**	**SWS**
Lecture	MNF-bioc-380 Sustainable Ocean Food Production and Security Veranstaltung_1	Compulsory	
Lecture	MNF-bioc-380 Sustainable Ocean Food Production and Security Veranstaltung_2	Compulsory	

Examination(s)				
Examination Name	**Type of Examination**	**Evaluation**	**Compulsory / Optional**	**Weighting**
MNF-bioc-380 Sustainable Ocean Food Production and Security Prüfung_1	undefiniert	Graded	Compulsory	-

Course Content
Hosting some of the world's most productive ecosystems, the global ocean plays an increasingly important role in providing food to an ever growing world population. However, global change, pollution, and overexploitation put the ocean's contribution to human well-being at risk. One key question for science and society is: How can we sustain marine food production for a growing world population? Integrated approaches involving multidisciplinary science, practice, and education may promote a solution-oriented understanding and development toward a sustainable future ocean food security. The interdisciplinary lecture will give an introduction to the various fields of marine food science in the context of past practices and future sustainable development goals (Agenda 2030). Topics include nutritional, environmental (including marine diseases), economic and societal aspects of marine resources for human nutrition as well as future food production and security. One focus will be placed on whether nations depending of fisheries, such as the West-African countries (i.e., Senegal or Ghana), benefit from the ocean food based value chain. Selected case studies will be presented and discussed. Students will lead the seminar's discourse. They will present ocean food related research chosen according to their individual disciplinary background and interest and will moderate the discussion.
Learning Outcome
The topic sustainable marine food production and security cuts across scientific, environmental and social systems and students will be encouraged to build multidisciplinary knowledge. The goal of this module is to promote an interdisciplinary thinking about complex marine issues, which represents an important skill for careers in- or outside academia.
Reading List

Use	Compulsory / Optional	Semester
Master, 1-Subject, Biological Oceanography, (Version 2016)	Optional	.

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