Modul manual for the master´s programme

Biodiversity and Ecosystem Health

- Version 25th Mai 2023 -

Index

List of abbreviations

CP	Credit Points
E	Elective
EC	Exercise course
Ex	Excursion
FW	Framework for staged and modularised study programmes at the Johann Wolfgang Goethe University Frankfurt am Main of 30th April 2014 as amended on 22nd Dezember 2020
L	Lecture
MM	Mandatory Module
N. N.	Nomen Nominandum, unnamed person
P	Practical course
PC	Participation certificate
S	Seminar
SoSe	Sommer semester/term
SWS	Semester hours per week
UD	University Department
WS	Winter semester/term

Overview study programme

	1st Semester	**2nd Semester**	**3rd Semester**	**4th Semester**
1st half of the lecture period	Basic module (15 CP)	Elective module BEH-Div-n or BEH-Eco-n or optional module (15 CP)	Elective module BEH-Div-n or BEH-Eco-n or optional module (15 CP)	Master thesis (30 CP)
2nd half of the lecture period	Elective module BEH-Div-n or BEH-Eco-n or optional module (15 CP)	Elective module BEH-Div-n or BEH-Eco-n or optional module (15 CP)	Research project (15 CP)	

Basic Module (Mandatory module)

BEH-Basic	Biodiversity and Ecosystem Health	Mandatory module	**15 CP** (450 hours, h)	
			Hours of presence 10,5 SWS / 158 h	**Self-study 292 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes				

Content

The basic module "Biodiversity and Ecosystem Health" focuses on basic knowledge, advanced content, and scientific methods of the topic complexes biodiversity and ecosystem health.

The contents of the basic lecture are fundamental theoretical concepts from the areas of biodiversity research, evolutionary biology, ecology, ecotoxicology, conservation biology and social-ecological research, which allow a scientific understanding of biological processes of global change. They are reflected and focused on by a theoretical exercise accompanying the lecture.

Parallel to the basic lecture, the students participate in practical exercises in which they learn and apply basic methods related to the respective lecture contents. Those students who are well acquainted with some methods due to corresponding focal points in the Bachelor's degree support the knowledge transfer as student experts. Exercises on species knowledge and ecological topics will partly take place in the field.

Soft skills, such as scientific writing, scientific English, the use of programmes and databases, as well as presenting and reflecting on scientific content, will be taught in exercises through appropriate practical tasks, discussions, short presentations and short protocols.

Within the framework of the lecture series, research topics are presented by working groups that offer elective modules.

Learning outcomes / Competence goal

In this module, students acquire theoretical knowledge of biodiversity, evolutionary biology, ecology, ecotoxicology, conservation biology and social ecology for a scientific understanding of biological processes of global change. For this purpose, they acquire basic practical skills for research in these scientific fields as well as basic skills that are indispensable for scientific work.

Through the basic lecture "Biodiversity and Ecosystem Health", students understand the basic and advanced biological backgrounds of current challenges of global change. Interdisciplinary, advanced topics are also important. Through the associated theoretical exercises, they deepen their knowledge.

Through the practical exercises, the students gain insights into scientific research on various topics and apply different methods under guidance. They repeat theoretical knowledge from the basic lecture, supplement this knowledge with applied aspects and reflect on it through insights into scientific research. Student experts acquire teaching and leadership skills.

Through the lecture series, students receive an overview of current research on biodiversity, evolutionary biology, ecology, ecotoxicology, conservation biology and social ecology of the working groups involved in the study programme so that they can specifically set personal priorities for further study in the elective area and the Master thesis.

After completing this module, the participants are familiar with the basic knowledge and current research concepts of the above-mentioned subject areas, as well as the principles and requirements of good scientific practice and occupational safety. They are also able to acquire missing knowledge and skills independently.

Participation requirements for the module	none
Recommended prior knowledge	none
Teaching offer	
Teaching formats	lecture, exercises
Exam language	English
Modul duration	1 semester. The module takes place as a block within the first seven weeks of the winter semester.
Frequency of the offer (offering period)	each winter semester
Module coordinator	Prof. Dr. Meike Piepenbring
Semester-long certificate	
Certificate of attendance	Active participation in the practical exercises.
Course credits	tests, short protocols and short presentations in the exercises
Module examination	**Form of examination (Scope/duration)**
Components of cumulative module examination	**written exam in the basic lecture:** Contents of the basic lecture, 120 min

Event overview							
	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Biodiversity and Ecosystem Health (basic lecture)	L	3	6	X			
Biodiversity and Ecosystem Health (theoretical exercises)	EC	1,5	2	X			
Biodiversity and Ecosystem Health (practical exercises)	EC	4	4	X			
Lecture Series	L	2	3	X			
Total Sum		**10,5**	**15**				

Elective courses

BEH-Div-n Biodiversity and Evolutionary Biology

BEH-Div-1 Diversity and Evolution of Plants

BEH-Div-1	Diversity and Evolution of Plants	Elective course	**15 CP** (450 hours, h)	
			Hours of presence 13 SWS / 182 h	**Self-study 268 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		M.Sc. Umweltwissenschaften / FB 11		
Content				
Lecture and seminar: The lecture and the seminar impart theoretical knowledge on the diversity and evolution of plants. The focus is on vascular plants, their morphological, anatomical and molecular diversity, their phylogeny, evolution and biogeography. The following topics are covered: Diversity, systematics, phylogeny and biogeography of vascular plants, as well as the theoretical basis and methods of phylogenetic analysis. Special reference is made to morphological, anatomical, plant-geographical and molecular trait complexes. Further important topics are plant diversity in the context of global change, impacts of humans and climate, ecosystem functions and ecosystem services of plants, as well as aspects of nature conservation. **Practical course:** The practical course serves for a better understanding and expansion of the theoretical knowledge in the field of plant diversity and evolution imparted by the lecture and the seminar. The practical course focuses on the diversity and evolution of flowering plants, their biogeography, the reconstruction of phylogeny and trait evolution, as well as current changes and conservation of plant diversity. The following topics are covered: Diversity, morphology and systematics of diverse systematic groups of vascular plants, phylogenetic reconstruction methods, dating of phylogenetic trees and trait evolution. The methodological spectrum includes fieldwork, morphological, anatomical and ecological studies, work with scientific plant collections, identification of plants, and taxonomy. The methodological spectrum includes fieldwork as well as methods for morphological, anatomical and ecological investigation. These methods include the use of scientific plant collections, light microscopy, scientific drawing, DNA isolation and sequence analysis, the combination of molecular and morphological data, as well as the compilation and interpretation of phylogenies. Part of the practical course can be carried out as an excursion outside Frankfurt.				
Learning outcomes / Competence goal				
Lecture and seminar: By attending the lecture and contributing to the seminar, students will be familiar with important groups of vascular plants, their evolution, biogeography and economic importance. They will acquire a deeper understanding of plant diversity and will be able to recognize important groups, important species and their morphological characteristics. Students will understand the role of important drivers for plant evolution and phylogenetic reconstruction methods. They will be able to understand the origin and distribution of plant diversity and its current change due to the influence of humans and climate, as well as nature conservation problems. **Practical course:** Through the practical course, students learn about the system of flowering plants, important plant groups and evolutionary processes. They will be familiarised with aspects of diversity change and conservation. By working on hypotheses and methods of phylogenetic analysis, they will be able to understand phylogenetic analyses, carry them out themselves and assess the opportunities and limitations of these methods. The students will be familiarised with the importance, use and development of scientific collections (herbaria and living collections).				
Participation requirements for the module		Successful exam of the basic lecture of the basic module		
Recommended prior knowledge		none		
Teaching offer				
Teaching formats		lectures, seminar, practical exercises, excursions		
Exam language		English		
Modul duration		1 semester. The module takes place as a block within the second half of the lecture period of the summer semester.		
Frequency of the offer (offering period)		each summer semester		
Module coordinator		N. N.		
Semester-long certificate				
Certificate of attendance		Regular attendance and active participation in the seminar and the practical course. Active participation in the seminar is given through a lecture and participation in the discussions.		
Course credits		none		
Module examination		**Form of examination (Scope/duration)**		
Components of cumulative module examination		**written exam in the lecture**: Contents of the lecture and the seminar, 60 min (weighting of the grade 50%).		

				practical course protocol: approx. 20 pages (weighting of the grade 50%)			
Subject focus				Organismic diversity			
Event overview							
	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Diversity and Evolution of Plants	L	2	3		X		
Diversity and Evolution of Plants	S	1	2		X		
Diversity and Evolution of Plants	P	10	10		X		
Total sum		**13**	**15**				

BEH-Div-2 Evolutionary Genomics of Vertebrates

BEH-Div-2	Evolutionary Genomics of Vertebrates	Elective course	**15 CP** (450 hours, h)	
			Hours of presence 13 SWS / 182 h	**Self-study 268 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		M.Sc. Umweltwissenschaften / FB 11		
Content				
The lecture, seminar and practical course offers the opportunity to sequence, assemble, annotate and publish a complete vertebrate (fish) genome starting from the tissue. Selected aspects of genome sequencing, assembly and annotation, phylogeny, genomics and evolution will be covered. The course thus introduces the topic of biodiversity genomics. The complete genome of a vertebrate will be sequenced, assembled and annotated using NGS techniques (mostly nanopore) starting from tissue. The first step will be the phylogenetic and population genetic analyses and interpretation of the genome data. In the last week, the whole course will work on the first steps to publish the data in a peer-reviewed journal ('paper writing'). However, co-authorship can only be granted to those students who successfully bring the genome to publication in the weeks following the course together with the supervisor. So far, four genomes have been published in this way since 2018. The lectures begin with an introduction to the general topic and the specific questions to be addressed in field of the genomics and evolution. In parallel, there is an introduction to NGS data, UNIX and the scripting language PYTHON to be able to successfully modify existing programmes. Various scientists from the Biodiversity and Climate Research Centre (BiK-F), the LOEWE Centre for Translational Biodiversity Genomics and the University will give guest lectures in their special fields (e.g. retroposon, bioinformatics, adaptation, phylogeography) and provide insights into current research.				
Learning outcomes / Competence goal				
After completing the module, students can independently sequence, assemble, and annotate genomes. Insight into use of NGS data is provided. Interaction with a range of scientists will prodive an insight into current research in the field.				
Participation requirements for the module		Successful exam of the basic lecture of the basic module.		
Recommended prior knowledge		Knowledge of bioinformatics (e.g., via the module "Molecular Evolution and Bioinformatics").		
Teaching offer				
Teaching formats		lectures, seminar, practical exercises		
Exam language		English		
Modul duration		1 semester. The module takes place as a block within the second half of the lecture period of the winter semester.		
Frequency of the offer (offering period)		each winter semester		
Module coordinator		Prof. Dr. Axel Janke		
Semester-long certificate				
Certificate of attendance		Regular and active participation in the seminar and the practical course. Active participation in the seminar is given through a lecture and participation in the discussions.		
Course credits		none		
Module examination		**Form of examination (Scope/duration)**		
Components of cumulative module examination		**written exam of the lecture**: Contents of the lecture and the seminar, 60 min (weighting of the grade 50%). **protocol of the practical course: approx.** 30 pages (weighting of the grade 50%)		
Subject focus		Evolutionary Biology		

Event overview							
	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Evolutionary Genomics of Vertebrates	L	2	3	X			
Evolutionary Genomics of Vertebrates	S	1	2	X			
Evolutionary Genomics of Vertebrates	P	10	10	X			
Total sum		**13**	**15**				

BEH-Div-3 Integrative Biodiversity Research in Zoology

BEH-Div-1	*Integrative Biodiversity Research in Zoology*	Elective courses	**15 CP** (450 hours, h)	
			Hours of presence 13 SWS / 182 h	**Self-study 268 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		M.Sc. Umweltwissenschaften / FB 11		
Content				
Lecture and seminar: The lecture and seminar provide basic knowledge in animal biodiversity research. Theoretical basics, recording methods, identification, taxonomic revision and systematics of selected animal groups are covered. The taxonomy, systematics, morphology and ecology of these animal groups and their research in the field and laboratory are presented. Working methods of current biodiversity research are illustrated with newly collected samples and museum material. Furthermore, topics such as the history of taxonomy and systematics, species concepts, formalisms of species description, as well as methods of species delimitation and phylogenetic tree reconstruction are discussed. Furthermore, the application of collection techniques and creating and maintaining collection databases are taught. **Practical course**: The practical course improves the understanding of the basic knowledge of integrative biodiversity research taught in the lecture and seminar. It focuses on technical procedures and methods for the sorting, recording, identification, revision and systematics of species and higher taxa using examples of selected animal groups curated at Senckenberg. The thematic orientation of the practical module parts is based on current research questions. It includes, among others, the following topics: Species description, DNA-barcoding, bioacoustics, morphology, phylogenetic tree reconstruction, and biogeography. In addition to field and laboratory work, the course teaches collection techniques and establishing and curating collection databases. The excursions/field parts can be offered as part of the practical course at suitable locations outside Frankfurt.				
Learning outcomes / Competence goal				
Lecture and seminar: Students will have acquired an overview of various methods used in integrative biodiversity research and will be familiar with the basics of taxonomy and systematics. They will be familiar with the application and limitations of the methods presented, as well as the approaches to interpreting and combining the individual taxonomic lines of evidence. They will have a secure, structured and comprehensive knowledge of the aforementioned course contents, know the relevant technical terms and be able to apply these confidently. After completing the module, the students will be familiar with methods of taxonomy and systematics, zoological nomenclature, and important groups of organisms. They will be able to address and characterise these and several of their characteristic representatives. Students will be familiarised with the importance, use and development of scientific collections. Practical course: Through the practical course, students will gain a solid overview of the methods of integrative biodiversity research of selected groups of organisms and be able to apply these independently. They will be familiar with the most important field and laboratory methods and will also be able to evaluate and maintain zoological collections.				
Participation requirements for the module		Successful exam of the basic lecture of the basic module		
Recommended prior knowledge		none		
Teaching offer				
Teaching formats		lectures, seminars, practical courses, excursions		
Exam language		English		
Modul duration		1 semester. The module takes place as a block within the second half of the lecture period of the summer semester.		
Frequency of the offer (offering period)		each summer semester		
Module coordinator		Prof. Dr. Angelika Brandt und Prof. Dr. Gunther Koehler		
Semester-long certificate				
Certificate of attendance		Regular and active participation in the seminar and the practical course. Active participation in the seminar is through a lecture and participation in the discussions. Active participation in the practice includes scientific drawings.		
Course credits		none		
Module examination		**Form of examination (Scope/duration)**		
Components of cumulative module examination		**written exam of the lecture**: Contents of the lecture and the seminar, 60 min (weighting of the grade 50%). **protocol of the practical course: approx.** 10-15 pages (weighting of the grade 50%)		
Subject focus		Organismic Diversity		

Event overview							
	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Integrative Biodiversity Research in Zoology	L	2	3		X		
Integrative Biodiversity Research in Zoology	S	1	2		X		
Integrative Biodiversity Research in Zoology	P	10	10		X		
Total sum		**13**	**15**				

BEH-Div-4 Biosequence Informatics

BEH-Div-1	Biosequence Informatics	Elective course	**15 CP** (450 hours, h)	
			Hours of presence 13 SWS / 182 h	**Self-study 268 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		M.Sc. Umweltwissenschaften / FB 11		
Content				
Lecture and seminar: Through lecture and seminar, selected topics and methods from molecular evolution, functional gene and genome analysis and phylogenetic tree reconstruction are addressed from the perspective of bioinformatics. The expansion of high-throughput DNA sequencing and the associated availability of comprehensive genetic and genomic sequence information from almost any organism means that biological sequences increasingly dominate the database of evolutionary analyses. Full exploitation of the information content of the data and correct interpretations are inextricably linked to three questions: How does one process, organise and analyse datasets from high-throughput DNA sequencing with FAIR principles in mind? How do DNA sequences and the proteins encoded in them change over time? What can we learn about their evolutionary history and function from comparing present-day sequences? What assumptions and (evolutionary) concepts underlie common bioinformatic sequence analysis algorithms, and how can these influence the analysis results? **Practical course**: The practical course takes place in a computer laboratory. Using genome or transcriptome sequencing data, students will learn the basic processing of molecular sequence data using simple Bash scripts, the management of raw and metadata in databases, the analysis of genomic and transcriptomic shotgun sequence datasets using current software, and the assembly and annotation of simple genomes and/or transcriptomes. The performance of phylogenetic, phylogenomic and functional analyses is taught and practised by building on these data.				
Learning outcomes / Competence goal				
Lecture and seminar: Students learn the essential concepts of analysing biological sequence datasets from genomics and transcriptomics. They are familiar with the flow of information from the sequence read to the comparative analysis of genomes and gene sets. They are familiar with basic concepts in processing and managing biological sequence data. They know relevant algorithmic approaches in analysing biological sequences against a functional and evolutionary background. They can assess their potential but also their limitations in the context of comparative genome analyses. In addition, they learn to critically examine current work in the field of bioinformatics sequence analysis. **Practical course**: Students learn the essential concepts of analysing biological sequence datasets from genomics and transcriptomics against an evolutionary background. After successfully completing the module, the students are familiar with web-based project documentation. They are able to perform flexible problem-oriented data processing using Bash scripts. In addition to the use of bioinformatics standard tools for processing and managing biological sequence data sets, the students learn to assemble small and simply structured genomes independently and to analyse them according to given functional and evolutionary questions.				
Participation requirements for the module		Successful exam of the basic lecture of the basic module.		
Recommended prior knowledge		Being familiar with working with computers is an advantage..		
Teaching offer				
Teaching formats		lectures, seminars, and practical courses		
Exam language		English		
Modul duration		1 semester. The module takes place as a block within the first half of the lecture period of the winter semester.		
Frequency of the offer (offering period)		each winter semester		
Module coordinator		Prof. Dr. Ingo Ebersberger		
Semester-long certificate				
Certificate of attendance		Regular and active participation in the seminar and the practical course. Active participation in the seminar is given through a lecture and participation in the discussions.		
Course credits		none		
Module examination		**Form of examination (Scope/duration)**		
Components of cumulative module examination		**written exam of the lecture**: Contents of the lecture and the seminar, 60 min (weighting of the grade 50%). **protocol of the practical course: approx.** 20-30 pages (weighting of the grade 50%)		
Subject focus		Evolutionary Biology		

Event overview							
	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Biosequence Informatics	L	2	3			X	
Biosequence Informatics	S	1	2			X	
Biosequence Informatics	P	10	10			X	
Total sum		**13**	**15**				

BEH-Div-5 Mycology

BEH-Div-5	*Mycology*	Elective course	**15 CP** (450 hours, h)	
			Hours of presence 13 SWS / 182 h	**Self-study 268 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		M.Sc. Umweltwissenschaften / FB 11		

Content

Lecture and seminar: The lecture and the seminar provide theoretical knowledge on diverse topics of mycology. Fungi and fungus-like organisms are presented with their diverse morphological structures, lifestyles, interactions and phylogenetic lines of evolution. Special emphasis is placed on understanding the functions of fungi in ecosystems and the importance of fungal diversity for the robustness and resilience of biotic communities in times of global change.

The following topics are covered: Morphology and systematics of diverse systematic groups of fungi and fungus-like organisms (protozoans and relatives of algae), ecosystem functions provided by fungi (destruents, mycorrhizal fungi, parasites), asexual fungi, fungi causing damage (poisonous fungi, plant parasites - phytopathology, human-pathogenic fungi, building mycology, etc.) as well as beneficial fungi (edible mushrooms, medical applications, food technology, building materials, etc.).

Practical course: The practical course includes practical work in the field (excursions) and laboratory for a better understanding of fungal diversity and to expand the theoretical knowledge in mycology taught in the lecture and the seminar. The focus of the practical course is on fungi with their diverse ecological functions, morphological structures and phylogenetic lines of evolution.

The methodological spectrum covers fieldwork, ecological observations and analyses, identification work, light microscopy, scientific drawings, taxonomy, dealing with microfungi in culture, i.e., microbiological methods, and scanning electron microscopy.

In addition to direct observations of the diversity of fungi in nature, samples from the field are analysed using "environmental DNA (eDNA)", i.e. “metabarcoding”, to detect hidden species and the biodiversity of entire ecosystems. These data allow comparisons of fungal communities at different sites and analyses of the ecological functions of fungi.

Learning outcomes / Competence goal

Lecture and seminar: After attending the lecture and the seminar, students will be familiar with important groups of fungi and know their ways of life, morphological characteristics and interactions with other living organisms. They will understand this complexity as a result of evolutionary processes. Students will be able to explain why fungi and their diversity are indispensable for the robustness and resilience of ecosystems. In addition, they will be able to evaluate useful aspects of fungi and the importance of fungi as harmful organisms.

Practical course: After completing the practical course, students can recognise, characterise and determine important fungal groups, genera and species based on macro- and microscopic features. They are familiar with the forms and functions of fungi in nature and can assess both the benefits and possible damage caused by fungi in the anthropogenic environment. By working with microfungi, they become familiar with topics and methods of microbiology.

By working with eDNA, module participants learn about modern methods for analysing fungal diversity and can assess the strengths and weaknesses of traditional vs. modern research approaches.

Participation requirements for the module	Successful exam of the basic lecture of the basic module
Recommended prior knowledge	Botanical knowledge (e.g., by the module "Diversity and Evolution of Plants")
Teaching offer	
Teaching formats	lectures, seminars, practical courses, excursions
Exam language	English
Module duration	1 semester. The module takes place as a block within the first half of the lecture period of the winter semester.
Frequency of the offer (offering period)	each winter semester
Module coordinator	Prof. Dr. Meike Piepenbring (responsible) and Prof. Dr. Imke Schmitt
Semester-long certificate	
Certificate of attendance	Regular and active participation in the seminar and the practical course. Active participation in the seminar is given through a lecture and participation in the discussions. Active participation in the practical course includes scientific drawings.
Course credits	none
Module examination	**Form of examination (Scope/duration)**
Components of cumulative module examination	**written exam of the lecture**: Contents of the lecture and the seminar, 120 min (weighting of the grade 50%). **protocol of the practical course:** approx. 20 pages (weighting of the grade 50%)
Subject focus	Mycology / Organismic Diversity

Event overview							
	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Mycology	L	2	3			X	
Mycology	S	1	2			X	
Mycology	P	10	10			X	
Total sum		**13**	**15**				

BEH-Div-6 Paleobiology and Environment

BEH-Div-6	*Paleobiology and Environment*	Elective course	**15 CP** (450 hours, h)	
			Hours of presence 13 SWS / 182 h	**Self-study 268 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		M.Sc. Umweltwissenschaften / FB 11		
Content				
Lecture and seminar: Lecture and seminar serve to convey and discuss factual knowledge and theoretical foundations in palaeobiology and evolution of vertebrates, morphology and anatomy, as well as functional morphology and evolutionary ecology of mammals and humans. In detail, the following topics are covered: Evolution of vertebrates, the origin of mammals, comparative anatomy, morphology and adaptation of mammals (skeleton, skull, dentition), morphometrics and functional analyses of the mammalian masticatory system, habitats and food resources, ecology of Africa, evolutionary ecology of early hominids, palaeoanthropology, actualistic comparisons and modelling in palaeobiology. **Practical course:** In the practical course, students gain an integrative understanding and expand the theoretical factual knowledge imparted by the lecture and seminar in the subjects of vertebrate evolution and palaeobiology, ecology, evolutionary morphology and anatomy, as well as functional morphology and evolutionary ecology of mammals and humans. During the first three weeks parallel to the lecture, the following topics are covered: Evolution of vertebrates, the origin of mammals, comparative anatomy, mammalian morphology and adaptation (skeleton, skull, dentition), morphometrics and functional analyses of mammalian dentition, habitats and food resources, ecology of Africa, evolutionary ecology of early hominids, palaeoanthropology, actualistic comparisons and modelling in palaeobiology. Day excursions (UNESCO World Heritage fossil site Grube Messel) are integrated into the basic practical course. During the following three weeks, students work in one of the ongoing research projects of the Departments of Palaeoanthropology, as well as Messel Research and Mammalogy at the Senckenberg Research Institute and Natural History Museum Frankfurt, with a focus on the academy project ROCEEH, palaeoanthropology and primatology, mammal evolution and morphometrics, palaeoclimate reconstruction, savannah ecology or Messel research. The methodological spectrum includes morphological and ecological analyses, collection work, microscopy, 3-D topometry, image analysis techniques, programming in R, modelling, and taxonomic and construction morphology applications.				
Learning outcomes / Competence goal				
Lecture and seminar: Students will be theoretically familiar with the basics of vertebrate palaeobiology and evolution and palaeoanthropology, be able to distinguish morphological and ecological factors in the evolution of tetrapods, and assess the relationship between mammalian diversity and functional and constructional morphological evolutionary processes as a function of ecological parameters. **Practical course:** The students will be practically familiar with the basics of vertebrate evolution and palaeobiology and palaeoanthropology, know significant methods for the analysis of morphological and ecological factors in the evolution of vertebrates, as well as be able to discuss and interpret function- and construction-morphological evolutionary processes in consideration of ecological parameters.				
Participation requirements for the module		Successful exam of the basic lecture of the basic module		
Recommended prior knowledge		none		
Teaching offer				
Teaching formats		lectures, seminars, practical courses, excursions		
Exam language		English		
Module duration		1 semester. The module takes place as a block within the first half of the lecture period of the winter semester.		
Frequency of the offer (offering period)		each winter semester		
Module coordinator		Apl. Prof. Dr. Ottmar Kullmer, PD Dr. Krister Smith		
Semester-long certificate				
Certificate of attendance		Active participation in the practical course includes the completion of exercises.		
Course credits		none		
Module examination		**Form of examination (Scope/duration)**		
Components of cumulative module examination		**seminar talk**: 30 min (weighting of the grade 50%). **protocol of the practical course: approx.** 20 pages (weighting of the grade 50%)		
Subject focus		Evolutionary Biology		

Event overview							
	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Paleobiology and Environment	L	2	3			X	
Paleobiology and Environment	S	1	2			X	
Paleobiology and Environment	P	10	10			X	
Total sum		**13**	**15**				

BEH-Div-7 Specialised Phytopathology

BEH-Div-1	*Specialised Phytopathology*	Elective courses	**15 CP** (450 hours, h)	
			Hours of presence 13 SWS / 182 h	**Self-study 268 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		M.Sc. Umweltwissenschaften / FB 11		
Content				
Lecture and seminar: The module chooses an organismal approach to different disciplines and links aspects of ecology, biodiversity, evolutionary biology, genetics, genomics and physiology by taking an in-depth look at an ecologically significant group. The module includes a lecture and a seminar to teach and discuss theories and facts about the ecology, diversity and evolution of oomycetes, a neglected group of eukaryotes that represent an important pillar in terrestrial, limnic and marine ecosystems worldwide as destructors, pathogens and parasites. The following topics are covered: Ecology and evolution of oomycetes, molecular and ecological host-pathogen interaction, and diversity of organisms (both in terms of hosts and oomycetes). Furthermore, evolutionary aspects of complexity development, reduction, and ecological redundancy are addressed. **Practical course:** The practical course, divided into field and laboratory parts, deepens and expands the contents taught in the lecture and seminar. The focus is on the ecology and diversity of oomycetes in their interaction with other organisms, especially with plants and algae. The method spectrum includes ecological fieldwork in Germany and/or in other European countries, with corresponding experimental designs, collections, observations and analyses, if necessary, experiments in the field and the laboratory, light microscopy, if necessary, chemical (e.g. HPLC) investigations, molecular biological investigations (nucleic acid extraction, PCR, sequencing, molecular phylogenetic or population genetic analyses), genomics, if necessary S1 work (PCR cloning, vector design, transient expression).			
Learning outcomes / Competence goal				
Lecture and seminar: After completing the module, students will be familiar with important groups of oomycetes and other microorganisms, especially those interacting with plants and algae, and will be able to characterise them. They will have acquired a comprehensive knowledge of the ecology, evolution and diversity of oomycetes and host-pathogen interaction. They know the basic ecological, (molecular)biological and evolutionary theoretical background of host-symbiont interaction and ecological redundancy**.** **Practical:** After completing the module, students will be familiar with important groups of oomycetes, especially those that live in pathogenic symbiosis with plants and algae. They will be able to address and characterise the most important groups of oomycetes, as well as characteristic representatives of them. They have a good overview of the ecology and evolution of oomycetes in general and of a selected group in particular. They can plan projects at the interface between field and laboratory and critically examine the possibilities and limitations of different research methods.			
Participation requirements for the module		Successful exam of the basic lecture of the basic module		
Recommended prior knowledge		none		
Teaching offer				
Teaching formats		lectures, seminars, and practical courses		
Exam language		English		
Module duration		1 semester. The module takes place as a block within the first half of the lecture period of the summer semester.		
Frequency of the offer (offering period)		each summer semester		
Module coordinator		Prof. Dr. Marco Thines		
Semester-long certificate				
Certificate of attendance		Regular and active participation in the seminar and in the practical course. Active participation in the seminar is given through a lecture and participation in the discussions. Active participation in the internship includes writing short protocols.		
Course credits		none		
Module examination		**Form of examination (Scope/duration)**		
Components of cumulative module examination		**written exam in the lecture:** Contents of the lecture and the seminar, 60 min (weighting of the grade 50%) **protocol of the practical course:** approx**.** 20 pages (weighting of the grade 50%)		
Subject focus		Mycology / Organismic Diversity		

Event overview							
	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Evolution and Ecology of Oomycetes	L	2	3		X		
Diversity and Interaction of Oomycetes	S	1	2		X		
Ecology, Diversity and Evolution of Oomycetes	P	10	10		X		
Total sum		**13**	**15**				

Elective moduls

BEH-Eco-n Ecology and Ecosystem Health

BEH-Eco-1 Diversity, Behavior and Ecosystem Functions of Birds and Mammals

BEH-Eco-1	***Diversity, behavior and ecosystem functions of birds and mammals***	**Elective course**	**15 CP** (450 hours, h)	
			Hours of presence 13 SWS / 182 h	**Self-study 268 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		M.Sc. Umweltwissenschaften / FB 11		
Content				
Lecture and seminar: The lecture and seminar convey theoretical knowledge and provide a comprehensive overview of the theoretical foundations and important methods of organismic and trait-based biodiversity and ecosystem research, with a particular focus on global biodiversity patterns, behaviour (e.g., animal movements) and ecosystem functions (e.g., seed dispersal) of birds and mammals. The lecture also covers the influence of abiotic and biotic factors on animal movement, ecological communities and ecosystem functions. Furthermore, the consequences of human impacts on ecosystems are addressed, and their consequences for regional and global conservation priorities and the preservation of functional ecosystems are discussed. In the seminar, students briefly present current research questions and publications from the subject area and discuss these with their peers. **Practical course:** The practical course includes ornithological excursions and ecological fieldwork (e.g., observations of frugivorous birds along a land-use gradient) as well as statistical modelling (e.g., modelling of animal movements and projections of future species distributions under climate change scenarios). The course and the student projects that are conducted as part of the practical focus on biodiversity patterns, animal movements and ecosystem functions of birds and mammals. The practical teaches key statistical methods in biodiversity and ecosystem research (including ANOVA, linear regressions, and trait-based analyses). Modelling exercises, data analyses and visualizations are done by the students using the software R. The fieldwork part of the practical is taught outside of Frankfurt (usually five days of field excursion).			
Learning outcomes / Competence goal				
Lecture and seminar: The lecture and seminar provide students with an overview of community and functional ecology, movement, and macroecology. After completing the course, the students have a solid and structured knowledge of the mentioned contents, know the relevant technical terms of ecological research, can use them correctly and relate them to other subject areas of biodiversity and ecosystem research. **Practical course:** After completing the practical course, the students have basic knowledge of ornithological fieldwork and statistical modelling and are capable of using key statistical methods of biodiversity and ecosystem research in the R software. After completing the module, students are able to design and carry out a research project in biodiversity and ecosystem research and analyse the collected data quantitatively.			
Participation requirements for the module		Successful exam of the basic lecture of the basic module		
Recommended prior knowledge		none		
Teaching offer				
Teaching formats		lectures, seminars, practical courses, excursions		
Exam language		English		
Module duration		1 semester. The module takes place as a block within the second half of the lecture period of the summer semester.		
Frequency of the offer (offering period)		each summer semester		
Module coordinator		Prof. Dr. Thomas Müller (responsible) and PD Dr. Matthias Schleuning		
Semester-long certificate				
Certificate of attendance		Regular and active participation in the lectures, seminar and the practical course. Active participation in the practical course includes the completion of exercises.		
Course credits		none		
Module examination		**Form of examination (Scope/duration)**		
Components of cumulative module examination		**seminar presentation:** 10 minutes (weighting of the grade 50%) **student project report:** max. 10 pages (weighting of the grade 50%)		
Subject focus		Ecology		

Event overview							
	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Diversity, Behavior and Ecosystem Functions of Birds and Mammals	L	2	3		X		
Diversity, Behavior and Ecosystem Functions of Birds and Mammals	S	1	2		X		
Diversity, Behavior and Ecosystem Functions of Birds and Mammals	P	10	10		X		
Total sum		**13**	**15**				

BEH-Eco-2 Plant Evolutionary Ecology and Global Change

BEH-Eco-2	*Plant Evolutionary Ecology and Global Change*	Elective course	**15 CP** (450 hours, h)	
			Hours of presence 13 SWS / 182 h	**Self-study 268 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		M.Sc. Umweltwissenschaften / FB 11		
Content				
Lectures and seminars: The lectures and seminars serve to convey theoretical knowledge in the research field of the evolutionary ecology of plants, both in general and in the context of global change. The following topics are covered: (i) Spatial structure of intraspecific phenotypic variation; (ii) Causes of trait variation (e.g., evolutionary forces, phenotypic plasticity, maternal effects, epigenetics) and the effects of abiotic and biotic factors on plant fitness; (iii) Consequences of phenotypic variation for adaptation of plant populations (e.g., phenotypic evolution and adaptation in the context of global change, functional diversity, evolutionary agriculture, conservation and restoration); (iv) Experimental and data analysis methods (e.g., from experimental plant ecology, ecophysiology, quantitative genetics, population genetics, ecological genomics, evolution experiments, herbarium research). In the seminars, this knowledge is deepened by reading scientific articles, with participants taking turns to introduce the articles and critically discussing the content of the articles. **Practicals**: The practicals consist of an experiment with a concluding symposium as well as workshops on experimental design and data analysis and visualisation. In the practicals, participants choose an evolutionary-ecological research topic, design an experiment in the greenhouse or climate chambers, and carry it out. Ecological and physiological measurement methods are applied, and the data collected are statistically evaluated. Participants present their results in a public symposium and write a protocol about their experiment. In workshops with homework, basic concepts of experimental design, as well as skills for data analysis and visualisation in the statistical programme R, are taught.				
Learning outcomes / Competence goal				
Lectures and seminars: Students will be familiar with plant evolutionary ecological research after completing the lectures and seminars. **Practicals:** Students will be familiar with plant evolutionary ecological research and with the effects of global change on plant populations. After completing the practicals, students will be familiar with classical evolutionary ecological experiments and with selected ecological and physiological methods. Participants will have gained experience with data analysis in evolutionary ecology and with presenting results orally.				
Participation requirements for the module		Successful examination of the basic lecture of the basic module.		
Recommended prior knowledge		none		
Teaching offer				
Teaching formats		lectures, seminars, and practical courses		
Exam language		English		
Module duration		1 semester. The module takes place as a block within the second half of the lecture period of the winter semester.		
Frequency of the offer (offering period)		each winter semester		
Module coordinator		Prof. Dr. Johannes Fredericus Scheepens		
Semester-long certificate				
Certificate of attendance		Regular and active participation in seminars and practical courses. Active participation in the seminars is attested through an oral presentation and participation in the discussions.		
Course credits		none		
Module examination		**Form of examination (Scope/duration)**		
Components of cumulative module examination		**seminar presentation:** 20 minutes (weighting of the grade 50%) **protocol of the experiment in the practicals:** 15-30 pages (weighting of the grade 50%)		
Subject focus		Evolutionary Biology / Ecology		

Event overview							
	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Plant Evolutionary Ecology and Global Change	L	2	3	X			
Plant Evolutionary Ecology and Global Change	S	1	2	X			
Plant Evolutionary Ecology and Global Change	P	10	10	X			
Total sum		**13**	**15**				

BEH-Eco-3 Evolutionary Ecology and Environmental Analytics

BEH-Eco-3	*Evolutionary Ecology and Environmental Analytics*	Elective course	**15 CP** (450 hours, h)	
			Hours of presence 13 SWS / 182 h	**Self-study 268 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		M.Sc. Umweltwissenschaften / FB 11		

Content

Lecture and seminar: The lecture and seminar provide theoretical knowledge on environmental stressors and evolutionary ecology in aquatic systems. In addition, the basics of chemical analysis and chemical risk assessment of single substances and complex mixtures in the environment will be taught. As an interdisciplinary module, it links various sub-areas of limnological and aquatic ecological basic knowledge with modern approaches of evolutionary ecology and -ecotoxicology to investigate multiple stressors combining chemicals and abiotic factors. It also introduces modern environmental analytical and assessment methods for pollutant mixtures. The lecture and seminar will build up the theoretical knowledge, which is deepened in the practical module on different case studies in the area of Frankfurt and Leipzig, Germany.

Lecture: Special knowledge of limnoecology, including multiple environmental stressors and evolutionary ecology, is imparted. In detail, the following topics are addressed: Basic terms and concepts of limnology, stress ecology, evolutionary ecology and toxicology, genetic adaptations and selection, natural and anthropogenically influenced conditions (eutrophication, water acidification, pollution, climate change), methods of rehabilitation and restoration of water bodies, methods of monitoring aquatic communities according to the EU Water Framework Directive, stream monitoring with invertebrates and fish, weight-of-evidence studies, biomarkers and sediment monitoring.

In the second part of the lecture, methodological aspects of the chemical analysis of environmental contaminants (target and non-target analysis) and modern methods of mixture assessment are taught. This includes using databases and approaches for identifying risk drivers by combining chemical-analytical and bioanalytical methods with balancing approaches, statistical methods and effect-directed analysis.
Seminar: Current focus topics on new findings and principles in the fields of stress ecology, evolutionary ecology, evolutionary ecotoxicology and environmental chemistry.
Practical course: The practical course will apply the methodologies taught during the theoretical module in the areas of evolutionary ecology, stress ecology and environmental chemistry in aquatic systems. The practical course focuses on teaching the general and specific technical procedures for a comprehensive and interdisciplinary assessment of multiple stressors of aquatic systems with methods from the fields of ecology, evolutionary ecology and toxicology, bioanalytics, environmental analysis and assessment. In addition, the module also focuses on the acquisition of media competence of the course participants in developing medial projects related to the scientific content discussed in the course.
The practical course is divided into four topics: (a) multiple stressors and evolutionary ecology, (b) film course on medial competence in science communication, , (c) excursion to the Helmholtz Centre for Environmental Research and close catchment areas for research topics of the course, (d) environmental chemistry.
One part of the practical course will teach the basics of science communication and media competence led by a television journalist (Wolfgang Kübel). A hands-on camera training will be offered, and the students will develop scripts and ideas for a short movie clip about the topics of the practical course (accompanying internship parts 2 and 3). In addition, the students practise their appearance in interview situations in front of the camera.
Another part of the practical course will address aspects of evolutionary ecology and multiple stressors with field and laboratory experiments. Within this, biodiversity analysis of invertebrate communities of freshwater ecosystems will be performed to evaluate the ecological state. Additionally, he highly topical research field of environmental DNA (eDNA) will be presented in a lecture. Samples will be collected by the students in the field and used in follow-up laboratory experiments. The laboratory work will focus on a multiple-stressor scenario in aquatic representative model species (*Danio rerio*, *Daphnia magna*, *Gammarus pulex*). The stressors cover a chemical stressor and two abiotic stressors. The methodologies to study multiple stressor scenarios cover acute toxicity testing, biomarker analysis and behavior analysis.
The third part of the practical course includes an excursion to stress and research hot spots in Saxony-Anhalt, including sampling and laboratory analysis at the Helmholtz Centre for Environmental Research. The basics of environmental analysis, especially organic environmental pollutants, including sampling, sample preparation and analysis using LC- and GC-MS, data evaluation, and mixture assessment, are taught.

Learning outcomes / Competence goal

Lecture and seminar: After completing the lecture and seminar, the students will be theoretically familiar with the basics of limnoecology, including multiple environmental stressors and evolutionary ecology. They will also be able to distinguish and assess the physical and ecological functioning of standing and flowing waters, compare ecosystem relationships and processes in different aquatic ecosystems (incl. ecosystem functions and ecosystem services), evaluate the role of aquatic ecology in the context of multiple environmental stressors and evolutionary ecology and interpret the different effects of impairments. Students are familiar with the theoretical principles of chemical analysis of environmental contaminants (target and non-target analysis) and with modern methods of mixture assessment and can apply balancing concepts.

The students can communicate subject- and addressee-related in speech and writing, using visualisation, presentation and moderation techniques.

Practical course: After completing the practical course, the students have a broad knowledge of stress ecology, evolutionary ecology and environmental analysis methods and are familiar with the current procedure of assessing flowing water ecosystems using biological and chemical analytical methods. They are able to plan corresponding investigations reliably, master the methods to be used and independently evaluate and present the results obtained. In addition, the practical laboratory work will deepen scientific and independent work according to internationally standardised methods. The students will be able to define their research hypotheses and develop experimental setups to study those hypotheses. Thus, they have the necessary practical and theoretical knowledge to interpret correlations between the water status, its chemical, physical and structural conditions, and the biocoenoses. The students have acquired media competence and are familiar with the basics of science communication. Additionally, the students can communicate science in speech and writing, using techniques such as visualisation, presentation and moderation of (environmental) scientific content. They will also design a scientific poster and learn how to write a manuscript.

Participation requirements for the module	Successful exam of the basic lecture of the basic module
Recommended prior knowledge	Basic ecotoxicological and chemical knowledge (e.g., through the module "Environmental Toxicology and Chemistry").

Teaching offer	
Teaching formats	lectures, seminars, practical courses and excursions
Exam language	English
Module duration	1 semester. The module takes place as a block within the second half of the lecture period of the summer semester.
Frequency of the offer (offering period)	each summer semester
Module coordinator	Prof. Dr. Henner Hollert
Semester-long certificate	
Certificate of attendance	Regular and active participation in the seminar and practical course. Active participation in the seminar is given through a lecture and participation in the discussions.
Course credits	none
Module examination	**Form of examination (Scope/duration)**
Components of cumulative module examination	**written exam of the lecture**: Contents of the lecture and the seminar, 60 min (weighting of the grade 50%). **protocol of the practical course: approx.** Approx. 30 pages (weighting of the grade 50%)
Subject focus	Evolutionary Biology / Ecotoxicology

Event overview

	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Evolutionary Ecology and Environmental Analytics	L	2	3		X		
Evolutionary Ecology and Environmental Analytics	S	1	2		X		
Evolutionary Ecology and Environmental Analytics	P	10	10		X		
Total sum		**13**	**15**				

BEH-Eco-4 Aquatic Ecology

BEH-Eco-4	*Aquatic Ecology*	Elective course	**15 CP** (450 hours, h)	
			Hours of presence 13 SWS / 182 h	**Self-study 268 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		M.Sc. Umweltwissenschaften / FB 11		
Content				
Lecture and seminar: The lecture and seminar teach theoretical knowledge of limnology. The focus is on linking all sub-areas of limnological and aquatic ecological basic knowledge concerning water protection, the management of water quality, and the state of water bodies. In detail, the following topics are dealt with intensively: Water as a habitat, hydrobiology, discharge components, characteristics of standing and flowing waters, chemical-physical factors in waters, substance balance or substance cycles, nutrient distribution, lake and flowing water types, zoning of waters, biotic communities and colonisation of water bodies, food chains or food webs in limnic systems, ecosystem functions and ecosystem services, plankton, neuston/pleuston, benthon, nekton, anthropogenic (material and hydraulic) pollution and renaturation of water bodies, water body structure mapping and biological water quality assessment, macroinvertebrate community analyses, EU Water Framework Directive and management concepts for water bodies. **Practical course:** The practical course should lead to a better understanding and expansion of the theoretical knowledge in water ecology taught in the lecture or seminar. The focus of the practical course is to teach the general approach as well as the specific technical procedures and methods for a comprehensive assessment of inland waters. In the practical course, a comprehensive faunistic inventory and limnological assessment of various low mountain range waters is carried as part of excursions, whereby polluted as well as particularly near-natural and worthy-of-protection sections are recorded. The methodological spectrum considered includes the planning, implementation and evaluation of chemical and biological sampling and the graphical processing and statistical validation of the results. Based on the recording of the current water body status (current status), deficient water body sections are identified, and measures for their revitalisation are formulated in order to guarantee important ecosystem functions and ecosystem services.				
Learning outcomes / Competence goal				
Lecture and seminar: After completing the lecture and seminar, students will be theoretically familiar with the basics of limnology, will be able to distinguish and assess the physical and ecological functioning of standing and flowing waters, will be able to compare ecosystem relationships and processes in different aquatic ecosystems, will be able to assess the role of aquatic ecology in relation to environmental protection and will be able to interpret the different effects of impairments. **Practical course:** After successfully completing the practical course, the students are familiar with the current procedure of assessing flowing water ecosystems. They can reliably plan corresponding investigations, master the methods to be used, and independently evaluate and present the results. They thus have the necessary practical and theoretical knowledge to be able to interpret connections between the water situation with its chemical, physical and structural conditions and the biocoenoses.				
Participation requirements for the module		Successful exam of the basic lecture of the basic module. This module is taught in German. Therefore, German language skills are required.		
Recommended prior knowledge		knowledge of inorganic and organic chemistry		
Teaching offer				
Teaching formats		lectures, seminars, practical courses and excursions		
Exam language		German		
Module duration		1 semester. The module takes place as a block within the first half of the lecture period of the summer semester.		
Frequency of the offer (offering period)		each summer semester		
Module coordinator		Dr. Matthias Oetken		
Semester-long certificate				
Certificate of attendance		Regular and active participation in the seminar and practical course. Active participation in the seminar is given through a lecture and participation in the discussions.		
Course credits		none		
Module examination		**Form of examination (Scope/duration)**		
Components of cumulative module examination		**written exam of the lecture**: Contents of the lecture and the seminar, 60 min (weighting of the grade 50%). **protocol of the practical course:** 20 - 30 pages (weighting of the grade 50%)		
Subject focus		Ecology		

Event overview							
	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Aquatic Ecology	L	2	3		X		
Aquatic Ecology	S	1	2		X		
Aquatic Ecology	P	10	10		X		
Total sum		**13**	**15**				

BEH-Eco-5 Conservation Biology

BEH-Eco-5	*Conservation Biology*	Elective course	**15 CP** (450 hours, h)	
			Hours of presence 13 SWS / 182 h	**Self-study 268 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		M.Sc. Umweltwissenschaften / FB 11		
Content				
Lecture and seminar: The lecture and seminar teach theoretical knowledge about conservation biology and applied ecology. The following topics are covered: Introduction to conservation biology as a scientific discipline, basics of biodiversity research, the value of and threats to biodiversity, nature conservation as an instrument for the conservation of biodiversity - nature conservation management (e.g. protected areas, biotope protection, species protection, restoration ecology), national and international legal bases for nature conservation, methods for nature conservation assessment. **Practical course:** As a supplement to the lecture and seminar of the same name, the practical course includes practical tasks as an integrative combination of theoretical communication of factual knowledge, practical testing and consolidation in the laboratory and in the field (excursions). The focus of the course is on the application and implementation of theoretical nature conservation knowledge in order to answer nature conservation questions. This includes the formulation of nature conservation questions, the development of a suitable study concept, the collection of relevant data, the evaluation and the nature conservation interpretation. The results are discussed in the context of nature conservation management for biodiversity conservation and with relevant stakeholders (e.g. land users).				
Learning outcomes / Competence goal				
Lecture and seminar: After completing the lecture and seminar, the students will be theoretically familiar with the scientific foundations of biological nature conservation. Furthermore, the students will be able to explain the complexity of biodiversity, its threats and the importance of its protection. After completing the module, the students will know the effectiveness and the background of nature conservation instruments and the associated methods. They will also be familiar with the most important legal foundations of nature conservation. **Practical course:** After completing the practical course, the students will be familiar with the scientific principles of biological nature conservation and have the methodological background for the complete processing of nature conservation issues and their implementation. Students can present nature conservation results and critically discuss the contents.				
Participation requirements for the module		Successful exam of the basic lecture of the basic module.		
Recommended prior knowledge		none		
Teaching offer				
Teaching formats		lectures, seminars, practical courses and excursions		
Exam language		English		
Module duration		1 semester. The module takes place as a block within the first half of the lecture period of the summer semester.		
Frequency of the offer (offering period)		each summer semester		
Module coordinator		N.N.		
Semester-long certificate				
Certificate of attendance		Regular and active participation in the seminar and practical course. Active participation in the seminar is given through a lecture and participation in the discussions.		
Course credits		none		
Module examination		**Form of examination (Scope/duration)**		
Components of cumulative module examination		**written exam of the lecture**: Contents of the lecture and the seminar, 60 min (weighting of the grade 50%). **protocol of the practical course:** Max. 10 pages (weighting of the grade 50%)		
Subject focus		Ecology		

Event overview							
	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Conservation Biology	L	2	3		X		
Conservation Biology	S	1	2		X		
Conservation Biology	P	10	10		X		
Total sum		**13**	**15**				

BEH-Eco-6 Parasitology and Infection Biology

BEH-Eco-6	*Parasitology and Infection Biology*	Elective course	**15 CP** (450 hours, h)	
			Hours of presence 13 SWS / 182 h	**Self-study 268 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		M.Sc. Umweltwissenschaften / FB 11		
Content				
Lecture and seminar: The lecture and seminar teach theoretical knowledge in parasitology and infection biology. The focus of the courses is to impart current knowledge on significant pathogens and parasites (parasitoses, zoonoses), special interactions in the host-pathogen/parasite interaction, strategies of pathogens/parasites in the infestation and manipulation of the respective end hosts, intermediate hosts and vectors, special features of the immune response and defence, pathology, genetics and epidemiology in parasitic infections, as well as prevention and control of parasites and their vectors or intermediate hosts. In addition, the course teaches the basics of the metabolic-physiological functional systems. Evolutionary, ontogenetic and ecophysiological aspects are also presented. **Practical course:** The practical course is an integrative combination of theoretical imparting of factual knowledge, practical testing and deepening of the basics of ecological parasitology, infection biology and animal physiology. The course provides up-to-date knowledge and practical skills on important pathogens and parasites (parasitoses, zoonoses), special interactions in the host-pathogen/parasite interaction, strategies of pathogens/parasites in infestation and manipulation of the respective end hosts, intermediate hosts and vectors, special features of the immune response and defence, pathology, genetics and epidemiology in parasitic infections, as well as prevention and control of parasites and their vectors or intermediate hosts. In addition, the course teaches the basics of metabolic-physiological functional systems and evolutionary, ontogenetic and ecophysiological aspects. Parts of the practical course can be offered in the context of fieldwork (excursions) at suitable locations outside Frankfurt, possibly outside Germany and the lecture period.				
Learning outcomes / Competence goal				
Lecture and seminar: After completing the lecture and seminar, the students have acquired a comprehensive knowledge of the globally significant pathogens, parasites and parasitoses of humans as well as of farm and wild animals, with a particular focus on the host-pathogen/parasite interaction, their life cycles and transmission mechanisms. They have a secure, structured and comprehensive knowledge of the abovementioned teaching. They know the relevant technical terms of parasitology, infection biology and epidemiology and can use them purposefully and securely. The students can scientifically work on topics such as the identification, description, distribution, transmission and spreading ability of pathogens/parasites using classical, molecular, experimental, and field-based methods. **Internship:** Upon completion of the internship, students will have acquired a comprehensive knowledge of the globally significant pathogens, parasites and parasitoses of humans as well as livestock and wildlife, with a particular focus on host-pathogen/parasite interaction, their life cycles and transmission mechanisms. They have a secure, structured and comprehensive knowledge of the abovementioned teaching. They know the relevant technical terms of parasitology, infection biology and epidemiology and can use them purposefully and securely. The students can scientifically work on topics such as identifying, describing, distributing, transmitting, and spreading the ability of pathogens/parasites with classical, molecular, experimental and field-based methods.				
Participation requirements for the module		Successful exam of the basic lecture of the basic module. This module is taught in German. Therefore, German language skills are required.		
Recommended prior knowledge		none		
Teaching offer				
Teaching formats		lectures, seminars, practical courses and excursions		
Exam language		German		
Module duration		1 semester. The module takes place as a block within the first half of the lecture period of the winter semester.		
Frequency of the offer (offering period)		each winter semester		
Module coordinator		Prof. Dr. Sven Klimpel		
Semester-long certificate				
Certificate of attendance		Regular and active participation in the seminar and practical course. Active participation in the seminar is given through a lecture and participation in the discussions.		
Course credits		none		
Module examination		**Form of examination (Scope/duration)**		
Components of cumulative module examination		**written exam of the lecture**: Contents of the lecture and the seminar, 60 min (weighting of the grade 50%). **protocol of the practical course:** 15-20 pages (weighting of the grade 50%)		
Subject focus		Ecology		

Event overview							
	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Parasitology and Infection Biology	L	2	3			X	
Parasitology and Infection Biology	S	1	2			X	
Parasitology and Infection Biology	P	10	10			X	
Total sum		**13**	**15**				

BEH-Eco-7 Ecotoxicology

BEH-Eco-7	*Ecotoxicology*	Elective course	**15 CP** (450 hours, h)	
			Hours of presence 13 SWS / 182 h	**Self-study 268 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		M.Sc. Umweltwissenschaften / FB 11		

Content

Lecture and seminar: The lecture and seminar teach theoretical knowledge in ecotoxicology. General and in-depth specific knowledge about the behaviour and effects of chemicals in the environment, their effects on organisms and biocoenoses, and the assessment of the risk they pose to ecosystems are imparted.

The following thematic focal points are dealt with: Production and release of pollutants, pathways of pollutants into ecosystems, the behaviour of pollutants in environmental compartments, long-range transport of chemicals, persistence and abiotic transformation, the fate of pollutants in terrestrial and aquatic ecosystems, toxicokinetics and toxicodynamics, uptake and accumulation of pollutants, distribution, transformation and excretion by organisms, Characterisation of poisoning, mechanisms of action and concentration-response relationships, biological test methods, effect characterisation at different levels of biological integration (including ecosystem functions and ecosystem services), environmental risk assessment of chemicals, threshold values and their derivation, biomonitoring and bioindication, case studies of pollutant effects.

Practical course: The research-oriented practical course is intended to lead to a better understanding and expansion of the theoretical factual knowledge in the subject of ecotoxicology imparted by the lecture and seminar. The practical course focuses on teaching the general procedure and the specific technical procedures and methods for analysing possible environmental hazards and risks caused by chemicals.
For selected test substances, the procedure of an environmental risk assessment is taught through practical tasks. For this purpose, the students are instructed to plan corresponding experimental work, carry it out, evaluate it, and statistically validate their results. The experiments include in vitro and in vivo test procedures with animals, plants and microorganisms, from which mechanism-specific activities (modes of action), toxicological parameters and effect thresholds are to be derived. In addition, substance reports on the tested substances investigated are to be prepared based on literature and database research, including determining representative exposure levels in the environment. The results of the impact analysis and the researched exposure level serve as a basis for assessing the environmental risk for the investigated test substances.
The methodological spectrum considered in the practical course includes the planning, implementation and evaluation of newly developed and already standardised in vitro and in vivo test procedures according to OECD and DIN/ISO guidelines, the analysis of structural, physiological and developmental biological parameters in the test organisms taking into account molecular methods, the graphical processing and statistical validation of the results, the implementation of literature and database research and the preparation of substance reports for risk assessment.

Learning outcomes / Competence goal

Lecture and seminar: Students acquire general and in-depth specific knowledge on the behaviour and effects of chemicals in the environment, their effects on organisms and biotic communities, and the assessment of the risk they pose to ecosystems, including the influence on ecosystem functions and ecosystem services.

After completing the lecture and seminar, the students have a comprehensive knowledge of the production and release of pollutants, their entry pathways into ecosystems, the behaviour in environmental compartments, and the long-range transport of chemicals. They can estimate the persistence and abiotic transformation of pollutants and assess their fate in terrestrial and aquatic ecosystems. They master the principles and in-depth knowledge of toxicokinetics and toxicodynamics. They can describe the uptake and accumulation of pollutants, their distribution, transformation and excretion by organisms, and characterise poisonings concerning their underlying mechanisms of action and concentration-response relationships. They acquire the necessary knowledge of the various biological test methods and their application in ecotoxicological research and routine, including regulatory practice. The principles and special design of environmental risk assessment of different groups of chemicals are mastered, as well as the basics of deriving threshold values for environmental chemicals. The students acquire in-depth knowledge of the basic procedures of biomonitoring and bioindication, which are exemplified by case studies of pollutant effects.

Practical course: During the practical course, the students acquire extensive knowledge of the current procedure of an environmental risk assessment of chemicals and try it out on practical examples. They can reliably plan corresponding test series, master the methods to be used, can select and apply suitable test procedures and are able to evaluate, statistically validate and interpret the results obtained independently. They thus have the necessary practical and theoretical knowledge to conduct an environmental risk assessment for chemicals and critically question the corresponding results.

Participation requirements for the module	Successful exam of the basic lecture of the basic module. This module is taught in German. Therefore, German language skills are required.
Recommended prior knowledge	knowledge of inorganic and organic chemistry.
Teaching offer	
Teaching formats	lectures, seminars and practical courses
Exam language	German
Module duration	1 semester. The module takes place as a block within the second half of the lecture period of the winter semester.
Frequency of the offer (offering period)	each winter semester
Module coordinator	Prof. Dr. Jörg Oehlmann
Semester-long certificate	

Certificate of attendance	Regular and active participation in the seminar and practical course. Active participation in the seminar is given through a lecture and participation in the discussions.
Course credits	none
Module examination	**Form of examination (Scope/duration)**
Components of cumulative module examination	**written exam of the lecture**: Contents of the lecture and the seminar, 60 min (weighting of the grade 50%). **protocol of the practical course:** 25-40 pages (weighting of the grade 50%)
Subject focus	Ecotoxicology

Event overview

	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Ecotoxicology	L	2	3	X			
Ecotoxicology	S	1	2	X			
Aquatic Ecotoxicology	P	10	10	X			
Total sum		**13**	**15**				

BEH-Eco-8 Environmental Toxicology and -chemistry

BEH-Eco-8	*Environmental Toxicology and -chemistry*	Elective course	**15 CP** (450 hours, h)	
			Hours of presence 13 SWS / 182 h	**Self-study 268 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		M.Sc. Umweltwissenschaften / FB 11		

Content

Lecture and seminar: The lecture and seminar teach theoretical knowledge in environmental toxicology and chemistry. The contents of the module are taught in a combination of traditional lectures and seminars with expert lectures and modern teaching methods. For example, goal-oriented project work in small teams is used, in which the writing, oral presentation, and defence of a third-party funding proposal before a selection committee is simulated.

Lecture: History of environmental pollution, important substance groups, substance properties, distribution and effects of chemicals in the environment depending on their structure and properties, exposure and effect assessment for organisms using environmental chemistry and effect-based methods, levels of ecotoxicological effects (molecular effects, cell, individual to ecosystem, including ecosystem functions and ecosystem services), quantification of environmental risk including uncertainty analysis, in vitro systems and mechanism-specific bioassays, marine ecotoxicology, weight-of-evidence concepts, adverse outcome pathway (AOP), sediment assessment strategies, alternative methods to animal testing.

Seminar: The seminar addresses changing current focus topics on the behaviour of organic compounds in the environment and the effects of chemicals and different environmental compartments on in vitro test systems and organisms, their extrapolation to the population and community level using complex experiments and mathematical models.

Practical course: The research-oriented practical course intends to understand better and expand the theoretical knowledge in environmental toxicology and chemistry taught in the lecture-seminar module. The practical course focuses on teaching the general procedure and the specific technical procedures and methods for analysing possible environmental hazards and risks from complex mixtures, such as wastewater or sediments.

The module teaches the procedure of an environmental risk assessment for selected wastewater/sediments in practical exercises using a case study as an example. For this purpose, the students are instructed to plan corresponding experimental work, carry it out in the context of field trips, evaluate it, and statistically validate their results. The experiments include effect-based methods (EBM) with a focus on mechanism-specific toxicity, in vitro and in vivo test procedures with animals, plants and microorganisms, from which mechanism-specific activities (modes of action), toxicological parameters and effect thresholds are to be derived and the exposure situation evaluated. Test procedures with bacteria, algae and animals at individual and population levels; acute and mechanism-specific test procedures (cytotoxicity, teratogenicity, dioxin-like, endocrine and genotoxic effects; histology, biomarkers, genomics and proteomics; mutagenicity tests and Ah receptor agonists will be taught.

The methodological spectrum considered in the practical course includes the planning, implementation and evaluation of newly developed and already standardised in vitro and in vivo test procedures. Knowledge of important DIN,

ISO, OECD methods and GLP are taught, and alternative methods to animal experiments are discussed. In addition, statistical evaluation methods are applied, and prospective damage potential calculations are carried out. The design and implementation of retrospective monitoring and the evaluation of complex data sets (a combination of laboratory and field data) are also dealt with in a case study in the form of a role-play.

Learning outcomes / Competence goal

Lecture and seminar: Students gain insights into the transformation and transport processes of chemicals in the environment depending on their chemical and physico-chemical properties and environmental conditions. They should acquire the competence to estimate and assess eco-chemical processes. The aim is to assess the exposure of organisms in soils and waters based on knowledge of the distribution and transformation mechanisms of pollutants. The students will further gain insights into the effects of environmental chemicals on organisms and in vitro test systems. They will learn to assess the effects of chemicals individually and in combination with other xenobiotics and natural influencing factors. They will also apply mathematical modelling for effect prediction on in vitro systems, individuals (QSAR) and risk assessment for populations and communities up to ecosystem functions and ecosystem services. The aim is to combine eco-chemical and ecotoxicological results and to be able to assess them prospectively using mathematical models.

Furthermore, the critical handling of integrated concepts such as weight-of-evidence strategies, adverse outcome pathway strategies and alternative methods to animal experiments should be learned. As a learning outcome and competence, graduates should acquire the ability to understand ecotoxicological effects and environmental chemical processes and the resulting exposure of organisms and be able to apply this understanding in their studies. They should be able to develop strategies to investigate and evaluate ecotoxicological effects and the behaviour of environmental chemicals. After completing this module, the students should also be able to communicate in a subject- and addressee-related manner, both verbally and in writing, about the topics they are working on, using techniques such as visualisation, presentation and moderation independently. They thus have the necessary practical and theoretical knowledge to conduct an environmental risk assessment for chemicals and critically question the corresponding results.

Practical course: After completing the practical course, the students are familiar with the current procedure of an environmental risk assessment of complex environmental samples. They can reliably plan the corresponding series of investigations, master the methods used, and select and apply suitable test procedures. They can independently evaluate, statistically validate and interpret the results obtained. The students should also learn how to present their experiments' findings graphically and interpret the content. They should learn how to critically discuss the experimental findings with the help of current international literature and how to present them scientifically as a poster/role play. Thus, they have the necessary practical and theoretical knowledge to conduct an environmental risk assessment for complex environmental samples and critically question the corresponding results.

Participation requirements for the module	Successful exam of the basic lecture of the basic module.
Recommended prior knowledge	knowledge of inorganic and organic chemistry.
Teaching offer	
Teaching formats	lectures, seminars, practical courses and excursions

Exam language	English
Module duration	1 semester. The module takes place as a block within the second half of the lecture period of the winter semester.
Frequency of the offer (offering period)	each winter semester
Module coordinator	Prof. Dr. Henner Hollert and Dr. Sabrina Schiwy
Semester-long certificate	
Certificate of attendance	Regular and active participation in the seminar and practical course. Active participation in the seminar is given through a lecture and participation in the discussions.
Course credits	none
Module examination	**Form of examination (Scope/duration)**
Components of cumulative module examination	**written exam of the lecture**: Contents of the lecture and the seminar, 60 min (weighting of the grade 50%). **protocol of the practical course:** approx. 30 pages (weighting of the grade 50%)
Subject focus	Ecotoxicology

Event overview

	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Environmental Toxicology and -chemistry	L	2	3	X			
Environmental Toxicology and -chemistry	S	1	2	X			
Environmental Toxicology and -chemistry	P	10	10	X			
Total sum		**13**	**15**				

BEH-Eco-9 Zoo- and Wildlife Biology

BEH-Eco-9	*Zoo- and Wildlife Biology*	**Elective course**	**15 CP** (450 hours, h)	
			Hours of presence 13 SWS / 182 h	**Self-study 268 h**
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		M.Sc. Umweltwissenschaften / FB 11		
Content				
Lecture and Seminar: The lecture and seminar are designed to provide theoretical factual knowledge on relevant zoo and wildlife biology topics. Emphasis is placed on imparting current knowledge about: Conceptual foundations of zoo animal biology, species conservation work of zoos, animal ethics and husbandry conditions, enrichment and training, population biology and conservation breeding programs, educational work and outreach processes, enclosure design, veterinary aspects, and methods of zoo and wildlife research (e.g., behavioral research, visitor studies). **Practical course**: The internship includes several partial internships at the Opel Zoo in Kronberg, the Frankfurt Zoo and/or in the field on current zoo and wildlife biology issues, as well as in-depth excursions to develop special topics (including conservation breeding programs and species conservation work, educational work and zoo pedagogy). The course provides theoretical knowledge about zoo and wildlife biology research methods and their practical application. The thematic orientation of the practical module components is based on current research questions. Within the practical course, the following topics are covered, among others: Behavioral research on selected examples: Community husbandry, habitat and behavior enrichment in zoo animals, chronobiology, animal-human interaction, visitor studies, husbandry and care of zoo animals, communication in zoo- and wild animals, comparative research in zoo and field. The excursions can be offered at suitable locations outside Frankfurt, possibly outside Germany and during the lecture period.				
Learning outcomes / Competence goal				
Lecture and seminar: Students will be comprehensively familiar with the scientific basics of zoo and wildlife biology after completing the lecture and seminar. They will have a secure, structured and comprehensive knowledge of the aforementioned course contents, know the relevant technical terms of zoo and wildlife biology and be able to apply them confidently. Students will be familiar with and able to apply methodological approaches to zoo and wildlife research. **Practical course:** Students will be familiar with practical aspects of the scientific principles of zoo and wildlife biology upon completing the practicum. They will learn various methods of behavioral research. They will also have gained insight into the educational work of zoos and have practical experience in visitor studies. Upon completing the module, students should be able to design and conduct a scientific research project and statistically analyze the data collected.				
Participation requirements for the module		Successful exam of the basic lecture of the basic module.		
Recommended prior knowledge		none		
Teaching offer				
Teaching formats		Lectures, seminars, practical courses and excursions		
Exam language		English		
Module duration		1 semester. The module takes place as a block within the first half of the lecture period of the summer semester.		
Frequency of the offer (offering period)		each summer semester		
Module coordinator		Prof. Dr. Paul Dierkes und Prof. Dr. Lisa M. Schulte		
Semester-long certificate				
Certificate of attendance		Regular and active participation in the seminar and practical course. Active participation in the seminar is given through a lecture and participation in the discussions.		
Course credits		none		
Module examination		**Form of examination (Scope/duration)**		
Components of cumulative module examination		**written exam of the lecture**: Contents of the lecture and the seminar, 60 min (weighting of the grade 50%). **protocol of the practical course:** approx. 30 pages (weighting of the grade 50%)		
Subject focus		Organismic diversity		

Event overview							
	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Zoo- and Wildlife Biology	L	2	3		X		
Zoo- and Wildlife Biology	S	1	2		X		
Zoo- and Wildlife Biology	P	10	10		X		
Total sum		**13**	**15**				

Optional Module (mandatory module)

BEH-Optional	***Optional Module***	**Mandatory module**	**15 CP** (450 hours, h)	
			Hours of presence depending on the chosen activities	**Self-study** depending on the chosen activities
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		-		
Content				
For the optional module, single or multiple modules, as well as other activities, can be chosen from the following possibilities for a total of 15 CP: - Elective courses of the **Master's programme Biodiversity and Ecosystem Health** that have not been studied before, and other modules/courses that are smaller than 15 CP and offered by lecturers of the department. - Lectures, seminars, tutorials or practical courses of **other master's programmes at Goethe University** with subject-related relevance to the master's programme Biodiversity and Ecosystem Health - CPs acquired at another **university in Germany or abroad** with subject-related reference to the Master's programme Biodiversity and Ecosystem Health (e.g. in the context of ERASMUS studies, workshops, summer schools) - A **professional internship or research internship** in Germany or abroad carried out under the guidance of a Ph.D. scientist. The content of these activities must be related to the Master's programme, Biodiversity and Ecosystem Health. However, they must not be covered by an elective module of the programme and must not be directly related to a Master's thesis. (subject to approval! See below). - **Excursion** under the guidance of a scientist with a doctorate (with protocol) (subject to approval! see below) - **University language course** - Workshops on key competencies (**soft skills**) for further scientific development and other subject-related further training courses				
Learning outcomes / Competence goal				
Depending on the selection, students acquire the following competencies: - deepening of subject-specific knowledge (knowledge of species, specialized knowledge, knowledge of methods, ecological experience, ...) through broad content and/or methodological orientation - acquisition of interdisciplinary knowledge - individual profile formation - career-relevant orientation and qualification - extension of academic general education - intercultural competence - language skills - locating the own subject studies in the context of other scientific disciplines - acquisition of competencies in the field of interdisciplinary and non-specific key qualifications - acquisition or deepening of key competencies (soft skills)				
Participation requirements for the module		The participation requirements specified for the respective modules apply.		
Recommended prior knowledge		none		
Teaching offer				
Teaching formats		result from the offer		
Exam language		result from the offer		
Module duration		result from the offer		
Frequency of the offer (offering period)		result from the offer		
Module coordinator		Prof. Dr. Henner Hollert		
Special notes		Recommendations of modules offered by Goethe University that can be used for the optional module are published on the website of the Master's program. Suppose one or more modules are to be taken that are not among the recommendations. In that case, an informal application must be submitted in advance to the module coordinator so that it can be checked whether the subject-related reference is given. This also applies to business and research internships, excursions, and other activities not included in the list on the homepage. In the case of lectures in which coursework and/or a module final examination is scheduled, these services must be provided. Written examinations must be passed. Lectures without a module final examination cannot be credited under the optional module. In the case of activities for which certificates without CP indication are issued, the following rules apply for guidance (not binding): 1 CP corresponds to a workload of 30 hours (attendance and self-study). 1 SWS lecture corresponds to 1.5 CPs 1 SWS seminar corresponds to 2 CPs (extensive preparation)		

				1 SWS practical course corresponds to 1 CP (with protocol) One week of field/laboratory/operational internship (Mon-Fri, 8 h each) corresponds to 2.5 CPs if a protocol is prepared.			
Semester-long certificate							
Certificate of attendance				result from the offer			
Course credits				result from the offer			
Module examination				**Form of examination (Scope/duration)**			
Module final exam				result from the offer. Grades do not impact the overall grade for the master's degree.			
Event overview							
	Teaching formats	**SWS**	**CP**	**Semester**			
				1	**2**	**3**	**4**
Event name	[diverse]	…	…	X	X	X	
Event name	[diverse]	…	…	X	X	X	
Total Sum		…	**15**				

Research Project (Mandatory module)

BEH-FP	Research Project	Mandatory module	total 450 hours (h)	
			Hours of presence variable	Self-study variable
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		-		
Content				
The module comprises a practical course and the working group seminar to provide the student with the essential theoretical principles and experimental techniques of the discipline intended for the master's thesis in such an intensive way that the master's thesis can be successfully completed within the available time frame. In the practical part, methodological preparatory work for the master's thesis can be carried out, such as establishing research methods, cultivating or keeping the organisms studied, or familiarizing oneself with the organisms of study areas or collections (in the case of faunistic, floristic or systematic studies).				
Learning outcomes / Competence goal				
After completing the module, students will be theoretically and practically familiar with the basics of the chosen subfield directly related to the master's thesis. The research project protocol should be written in direct connection with the research internship. It should describe background information, working hypotheses, methodological notes, preliminary results and a concept for the master's thesis.				
Participation requirements for the module		min. 60 CP (basic module; three elective modules or two elective modules and the optional module)		
Recommended prior knowledge		-		
Teaching offer				
Teaching formats		seminars, practical courses		
Exam language		English or German		
Module duration		1 Semester (second half of the semester)		
Frequency of the offer (offering period)		every semester, also during the lecture-free period		
Module coordinator		Prof. Dr. Meike Piepenbring		
Semester-long certificate				
Certificate of attendance		active participation in the practical exercises		
Course credits		none		
Module examination		**Form of examination (Scope/duration)**		
Module final exam		**research protocol:** ca. 30 pages		
Module grade		Grade of the protocol		

Event overview

	Teaching formats	SWS	CP	Semester			
				1	2	3	4
Research internship in a working group of the student's choice	P	13	13			X	
Working group seminar	S	1	2			X	
Total sum		**14**	**15**				

Master Thesis (Mandatory module)

BEH-MA	Master Thesis	Mandatory module	Total 900 hours (h)	
			Hours of presence variable	**Self-study** variable
Module assignment		M.Sc. Biodiversity and Ecosystem Health / FB 15		
Applicability of the module for other degree programmes		-		
Content				
As part of the master thesis, the student works on a questions independently, comprehensively and in depth according to scientific methods within a given time. The work can be experimental, empirical or analytical. The results must be summarized in a written master thesis in scientific publication style.				
Learning outcomes / Competence goal				
The students demonstrate their ability to work comprehensively and in-depth on a scientific problem with practical application of appropriate research methods. They are able to write a thesis in scientific publication style.				
Participation requirements for the module		min. 75 CP. The module "Research Project" must be successfully completed.		
Recommended prior knowledge		none		
Teaching offer				
Teaching formats		Master Thesis		
Exam language		English or German		
Module duration		1 Semester (6 Months)		
Frequency of the offer (offering period)		every semester, also during the lecture-free period		
Module coordinator		Prof. Dr. Meike Piepenbring		
Semester-long certificate				
Certificate of attendance		none		
Course credits		none		
Module examination		**Form of examination (Scope/duration)**		
Module final exam		Master Thesis (ca. 40-100 pages)		
Module grade		graded Master Thesis		

Event overview

	Teaching formats	**SWS**	**CP**	**Semester**			
				1	2	3	4
Master Thesis	Thesis	30	30				X
Total Sum		**30**	**30**				