Content

Laboratory Methods in Biological Oceanography and Fishery Sciences 2
Introduction to Biological Oceanography and Fishery Sciences 3
Biodiversity of Marine Life 4
Softskills 1 - Statistics for Labmethods 5
Field Methods in Biological Oceanography and Fishery Sciences 6
Theoretical Biological Oceanography and Fishery Sciences 8
Laboratory Methods in Biochemical Ecology 9
Population Dynamics of Marine Resources 10
Plankton and Climate 11
Ecosystem Management and Environmental Policy 12
Softskills 2 - Statistics for Fieldmethods 13
Advanced Biological Oceanography 14
Advanced Fisheries Sciences 15
Marine Ecosystem Modeling 16
Ecophysiology and aquaculture 17
Project 18
External Internship 19
Final Module 20

Title:	**Laboratory Methods in Biological Oceanography and Fishery Sciences**				
Symbol:	MARSYS – 01				
Semester:	Winter				
Module type	• Compulsory module				
Formal requirements for participation	none				
Executive professor	Prof. Dr. Axel Temming, Tel.: 42838 6620, atemming (at) uni-hamburg (dot) de				
Lecturer	Dipl.-Biologe Jens-Peter Herrmann Prof. Dr. Myron Peck Prof. Dr. Axel Temming Dr. Marta Moyano				
Language	German				
Educational concept	The students have knowledge of important laboratory techniques in Biological Oceanography and Fisheries Sciences and thus the ability to keep marine organisms and to carry out and evaluate laboratory experiments.				
Contents	Basic laboratory techniques in Biological Oceanography and Fisheries Sciences; i.e. maintenance of phytoplankton and zooplankton cultures; rearing of fish; experiments on the effects of biotic (food quality and quantity, competition) and abiotic factors (temperature, salinity, oxygen content) on reproduction and growth of the different life stages of plankton organisms and fish.				
Courses:	• L: Laboratory Methods in Biological Oceanography and Fishery Sciences • S: Laboratory Methods in Biological Oceanography and Fishery Sciences • P: Laboratory Methods in Biological Oceanography and Fishery Sciences				1 SEM./HRS 1 SEM./HRS 4 SEM./HRS
Workload		*credits*	P (hrs)	S(hrs)	EP (hrs)
	• L: Laboratory Methods in Biological Oceanography and Fishery Sciences		14	14	17
	• S: Laboratory Methods in Biological Oceanography and Fishery Sciences		14	31	-
	• P: Laboratory Methods in Biological Oceanography and Fishery Sciences		56	124	-
	Total workload	9	84	169	17
Grading framework (possibly including examinations)	*Formal requirements for examinations:* Active participation, Presentation, Protocol *examinations:* Written or oral examination (graded, 100%)				
Duration	One semester				
Frequency of occurrence	annual				
Literature:	Skript; R. Harris, P.H. Wiebe, J. Lenz, H.-R. Skjoldal and M. Huntley „ICES Zooplankton Manual“				

Title:	**Introduction to Biological Oceanography and Fishery Sciences**				
Symbol:	MARSYS – 02				
Semester:	Winter				
Module type	• Compulsory module				
Formal requirements for participation	none				
Executive professor	Prof. Dr. Christian Möllmann, Phone: 42838 6621, christian.moellmann(at)uni-hamburg.de				
Lecturer	Dr. Jens Floeter Prof. Dr. Inga Hense Dr. Rolf Koppelmann Prof. Dr. Christian Möllmann Prof. Dr. Myron Peck Prof. Dr. Elisa Schaum Prof. Dr. Axel Temming				
Language	German				
Educational concept	The students have basic knowledge of the production processes and their controlling factors in the ecosystems and food webs of the different regions of the world ocean. The students will also have knowledge of important stocks of marine resources, fishing techniques and trends, and the tasks and methods of the fishery sciences. The students understand the relationship between biotic and abiotic factors influencing marine ecosystems, trophic interactions in food webs and the potential for human use. They thus know and understand basic questions, methods and the current state of knowledge in the fields of Biological Oceanography and Fishery Sciences.				
Contents	Regional Oceanography; taxonomic composition, life cycles, distribution and impact on key groups in phytoplankton, zooplankton, benthos and necton; Key habitats in shelf seas, the open oceans and the deep sea; Production processes and control structures in marine food webs; latitudinal gradients and biogeography; Life cycles of plankton species; taxonomic groups of commercial importance and their life cycles; fishing techniques and catch trends of main fish stocks using the example of e.g. cod and herring; introduction to the stock assessment, introduction to recruitment research, introduction to fisheries management.				
Courses:	• L: Basics in Biological Oceanography and Fishery Sciences • S: Current Literature in Basics in Biological Oceanography and Fishery Sciences				5 SEM./HRS 2 SEM./HRS
Workload		*credits*	P (hrs)	S(hrs)	EP (hrs)
	• L: Basics in Biological Oceanography and Fishery Sciences		*70*	*80*	*30*
	• S: Current Literature in Basics in Biological Oceanography and Fishery Sciences		*28*	*52*	*20*
	Total workload	*9*	*98*	*132*	*50*
Grading framework (possibly including examinations)	*Formal requirements for examinations:* Active participation, presentation *examinations:* Written or oral examination (graded, 100%)				
Duration	one semester				
Frequency of occurrence	annual				
Literature:	Charles B. Miller „Biological Oceanography“; Timothy R. Parsons and Carol M. Lalli „Biological Oceanography: An Introduction“; Simon Jennings, Michael J. Kaiser and John D. Reynolds "Marine Fisheries Ecology“; Michael King „Fisheries Biology, Assessment and Management“				

Title:	**Biodiversity of Marine Life**				
Symbol:	MARSYS – 03				
Semester:	Winter				
Module type	• Compulsory module				
Formal requirements for participation	none				
Executive professor	Prof. Dr. Christian Möllmann, Tel.: 42838 6621, christian.moellmann@uni-hamburg.de				
Lecturer	Dr. Jens Floeter Dr. Rolf Koppelmann Prof. Dr. Christian Möllmann Prof. Dr. Myron Peck Prof. Dr. Axel Temming				
Language	German				
Educational concept	Students have knowledge of theoretical concepts of biodiversity, marine biodiversity, in particular phyto- and zooplankton, commercial fish stocks, marine mammals and seabirds. They are capable of analysing biodiversity and know the taxonomy of important aquatic organisms with a focus on native marine regions such as the North-, and Baltic Sea. Furthermore, they know life cycles of different species and their geographical distribution.				
Contents	Marine biodiversity and its ecological background, life cycles of important marine species, current advanced topics of biodiversity research.				
Courses:	• L: Introduction to Marine Biodiversity • S: Current Topics in Marine Biodiversity Research • P: Determining and Describing of Marine Species				5 SEM./HRS 2 SEM./HRS
Workload		*credits*	P (hrs)	S(hrs)	EP (hrs)
	• L: Introduction to Marine Biodiversity • S: Current Topics in Marine Biodiversity Research • P: Determining and Describing of Marine Species		*70* *28*	*80* *52*	*30* *20*
	Total workload	*9*	*98*	*132*	*50*
Grading framework (possibly including examinations)	*Formal requirements for examinations:* Active participation. *examinations:* Protocol (pass / fail), presentation (pass / fail), written examination (graded, 100%)				
Duration	one semester				
Frequency of occurrence	annual				
Literature:	Marine Fisheries Ecology; Simon Jennings, Michel Kaiser, John D. Reynolds				

Title:	**Softskills 1 - Statistics for Labmethods**				
Symbol:	MARSYS – 04				
Semester:	Winter				
Module type	• Compulsory module				
Formal requirements for participation	none				
Executive professor	Prof. Dr. Axel Temming, Tel.: 42838 6620, atemming (at) uni-hamburg (dot) de				
Lecturer	Dr. Saskia Otto Dr. Jens Floeter Prof. Dr. Christian Möllmann Prof. Dr. Axel Temming				
Language	German				
Educational concept	Students are familiar with basic statistical procedures and can choose the appropriate methods for evaluating laboratory experiments. They also have the ability to perform statistical data analysis in various software packages.				
Contents	Introduction to statistical methods for the evaluation of laboratory experiments (accompaniment of MARSYS-01); probability calculations and theoretical distributions; basics of experimental design; parametric and nonparametric statistical tests; analysis of variance; linear and non-linear regression; multiple regression; basics of statistics in MS Excel; data analysis using commercial statistics software and the freely available software package R.				
Courses:	• L: Lecture: Introduction to Statistics for Labmethods • E: Exercise: Statistics for Labmethods				1 SEM./HRS 1 SEM./HRS
Workload		*credits*	P (hrs)	S(hrs)	EP (hrs)
	• L: Lecture: Introduction to Statistics for Labmethods		*14*	21	10
	• E: Exercise: Statistics for Labmethods		*14*	31	-
	Total workload	3	28	52	10
Grading framework (possibly including examinations)	*Formal requirements for examinations:* Active participation. Protocol *examinations:* Written examination (graded, 100%)				
Duration	one semester				
Frequency of occurrence	annual				
Literature:	Skript; Michael J. Crawley „Statistics – An introduction using R“; R.R. Sokal and F.J. Rohlf „Biometry: The principle and practice of statistics in biological research“				

Title:	**Field Methods in Biological Oceanography and Fishery Sciences**
Symbol:	MARSYS – 05
Semester:	Summer
Module type	• Compulsory module
Formal requirements for participation	none
Executive professor	Prof. Dr. Christian Möllmann, Tel.: 42838 6621, christian.moellmann (at) uni-hamburg (dot) de
Lecturer	Dr. Saskia Otto Dr. Jens Floeter Dipl.-Biologe Jens-Peter Herrmann Dr. Rolf Koppelmann Prof. Dr. Christian Möllmann Prof. Dr. Axel Temming
Language	German
Educational concept	Students are familiar with *in situ* sampling techniques in marine research. They have the ability to deploy *in-situ* sampling equipment from both research vessels and in shallow water. Furthermore, they have the ability to plan, carry out, and analyse the results of the sampling of different trophic levels of marine ecosystems in small project groups. They can set the results of these analyses in the context of current research topics of Biological Oceanography and Fisheries Sciences.
Contents	*In situ* sampling techniques of marine research, i.e., plankton nets, fishing gear, hydroacoustic methods, video-assisted zooplankton sampling, benthos grabs and dredges; basic population and community characteristics (e.g., species composition, abundance, biomass, population structures, growth, condition, reproduction, mortality) in two fundamentally different ecosystems, i.e., a pelagic ecosystem (e.g., central Baltic or southern North Sea) and a coastal ecosystem (e.g., Wadden Sea off List / Sylt); sampling from a medium size research vessel (e.g. FS ALKOR), a research cutter and in shallow water; planning, execution and evaluation of sampling.
Courses:	• L: Introduction to Field Methods in Biological Oceanography and Fishery Sciences — 1 SEM./HRS • S: Field Methods in Biological Oceanography and Fishery Sciences — 1 SEM./HRS • P: Field Methods in Biological Oceanography and Fishery Sciences — 4 SEM./HRS

Workload	*credits*	P (hrs)	S(hrs)	EP (hrs)
• L: Introduction to Field Methods in Biological Oceanography and Fishery Sciences		14	11	*20*
• S: Field Methods in Biological Oceanography and Fishery Sciences		14	31	-
• P: Field Methods in Biological Oceanography and Fishery Sciences		56	124	-
Total workload	9	84	166	20

Grading framework (possibly including examinations)	*Formal requirements for examinations:* Active participation, presentation, protocol *examinations:* Written or oral examination (graded, 100%)
Duration	One semester
Frequency of occurrence	annual
Literature:	R. Harris, P.H. Wiebe, J. Lenz, H.-R. Skjoldal and M. Huntley „ICES Zooplankton Manual“; Charles B. Miller „Biological Oceanography“; Simon Jennings, Michel J.

	Kaiser and John D. Reynolds "Marine Fisheries Ecology“; Michael King „Fisheries Biology, Assessment and Management“

Title:	**Theoretical Biological Oceanography and Fishery Sciences**
Symbol:	MARSYS – 06
Semester:	Summer
Module type	• Compulsory module
Formal requirements for participation	none
Executive professor	Prof. Dr. Axel Temming, Tel.: 42838 6620, atemming (at) uni-hamburg (dot) de
Lecturer	Prof. Dr. Inga Hense Prof. Dr. Christian Möllmann Prof. Dr. Myron Peck Prof. Dr. Axel Temming
Language	German
Educational concept	The students know and understand theoretical aspects and backgrounds in ecology with a focus on biological oceanography and fishery sciences. They can mathematically describe relevant ecological processes and have the ability to quantitatively simulate these processes on a computer.
Contents	Theoretical aspects and backgrounds in ecology with a focus on biological oceanography and fisheries; Processes at the individual level (e.g., mortality, growth, exponential function, energy budgets, metabolic theory, consumption); Processes at the population level (e.g., production, logistic population growth, cohort analysis); Species interaction processes (e.g., "allee effect", intra- and interspecific competition, mutalism, "numerical and functional response", food choice, eco-stochiometry, Lotka Volterra model); Ecosystem processes (size spectra, spatial structures, metapopulations, stability and energy fluxes in food webs.
Courses:	• L: Introduction to Theoretical Biological Oceanography and Fishery Sciences — 1 SEM./HRS • S: Theoretical Biological Oceanography and Fishery Sciences — 1 SEM./HRS • P: Theoretical Biological Oceanography and Fishery Sciences — 4 SEM./HRS

Workload	*credits*	P (hrs)	S(hrs)	EP (hrs)
• L: Introduction to Theoretical Biological Oceanography and Fishery Sciences		14	11	*20*
• S: Theoretical Biological Oceanography and Fishery Sciences		14	31	-
• P: Theoretical Biological Oceanography and Fishery Sciences		56	124	-
Total workload	9	84	166	20

Grading framework (possibly including examinations)	*Formal requirements for examinations:* Active participation, Protocol *examinations:* Written or oral examination (graded, 100%)
Duration	One semester
Frequency of occurrence	annual
Literature:	R. Harris, P.H. Wiebe, J. Lenz, H.-R. Skjoldal and M. Huntley „ICES Zooplankton Manual“; Charles B. Miller „Biological Oceanography“; Simon Jennings, Michel J. Kaiser and John D. Reynolds "Marine Fisheries Ecology“; Michael King „Fisheries Biology, Assessment and Management“

Title:	**Laboratory Methods in Biochemical Ecology**				
Symbol:	MARSYS-07				
Semester:	Summer				
Module type	• Compulsory module				
Formal requirements for participation	none				
Executive professor	Prof. Dr. Myron Peck, Tel.: 42838 6642, myron.peck@uni-hamburg.de				
Lecturer	Jens-Peter Herrmann Dr. Rolf Koppelmann Prof. Dr. Myron Peck Prof. Dr. Elisa Schaum Prof. Dr. Axel Temming				
Language	German				
Educational concept	The students have knowledge of important laboratory biochemical techniques in Biological Oceanography and thus the ability to keep marine organisms and to carry out and evaluate laboratory experiments.				
Contents	Biochemical techniques in Biological Oceanography; analysing abiotic and biotic effects on marine organisms (phyto-, zoo-, and ichthyoplankton), different photometric and chromatographic methods (e.g. enzyme activity, nucleo acids, lipids, trophic biomarker), application of methods in the areas of bioenergetics, trophodynamics, intra-, inter-specific interactions, adaptation, toxicity, planning of experimental studies.				
Courses:	• L: Laboratory Methods in Biochemical Ecology • S: Laboratory Methods in Biochemical Ecology • P: Laboratory Methods in Biochemical Ecology				1 SEM./HRS 1 SEM./HRS 2 SEM./HRS
Workload		*credits*	P (hrs)	S(hrs)	EP (hrs)
	• L: Laboratory Methods in Biochemical Ecology		*14*	*10*	*21*
	• S: Laboratory Methods in Biochemical Ecology		*14*	*31*	-
	• P: Laboratory Methods in Biochemical Ecology		*28*	*62*	-
	Total workload	*6*	*56*	*103*	*21*
Grading framework (possibly including examinations)	*Formal requirements for examinations:* Active participation, Protocol *examinations:* Written or oral examination (graded, 100%)				
Duration	One semester				
Frequency of occurrence	annual				
Literature:	Will be announced at the beginning of the module				

Title:	**Population Dynamics of Marine Resources**				
Symbol:	MARSYS-08				
Semester:	Summer				
Module type	• Compulsory module				
Formal requirements for participation	none				
Executive professor	Prof. Dr. Axel Temming, Tel.: 42838 6620, atemming@uni-hamburg.de				
Lecturer	Dr. Jens Floeter Prof. Dr. Christian Möllmann Prof. Dr. Axel Temming				
Language	German				
Educational concept	Students will have an overview of modern, theoretical methods for analysing population dynamics of marine resources in the context of ecosystem and fisheries management. They are also capable of understanding and calculating the basic models applied in fisheries assessment to derive quota advice.				
Contents	Quantitative recording of important parameters of a population and their variability; introduction to the models and concepts applied in fisheries management; methods for estimating biomass and abundance and their change by mortality, growth and reproduction; fishing mortality and natural mortality, modeling of consumption and stomach evacuation rates, fishing effort and catch per unit of effort, Shepherd model and logistic biomass growth; Beverton and Holt Model and growth overfishing, virtual population analysis and catch quota calculation; management concepts and the principle of multi-species models; food web modeling				
Courses:	• L: Population Dynamic Models • E: Modeling Marine Resources				2 SEM./HRS 2 SEM./HRS
Workload		*credits*	P (hrs)	S(hrs)	EP (hrs)
	• L: Population Dynamic Models		*28*	*40*	*22*
	• E: Models for Modeling Marine Resources		*28*	*62*	
	Total workload	*6*	*56*	*102*	*22*
Grading framework (possibly including examinations)	*Formal requirements for examinations:* Active participation, presentation *examinations:* Written or oral examination (graded, 100%)				
Duration	One semester				
Frequency of occurrence	annual				
Literature:	Will be announced at the beginning of the module				

Title:	**Plankton and Climate**				
Symbol:	MARSYS-09				
Semester:	Summer				
Module type	• Compulsory module				
Formal requirements for participation	none				
Executive professor	Prof. Dr. Myron Peck; Tel: 42838 6602; myron.peck (at) uni-hamburg (dot) de				
Lecturer	Dr. Rolf Koppelmann Prof. Dr. Myron Peck Prof. Dr. Inga Hense				
Language	German				
Educational concept	Students will know the climatic effects on plankton organisms, their populations and functional role in the ecosystem. Furthermore, they will be familiar with current literature on climate effects on plankton communities.				
Contents	Climate definition, climatic cycles, climate change, climate aerosols and their cycles, relevance for the ocean, role of plankton in climate change (e.g., carbon pump), indicators for regime shifts, climate engineering, ocean acidification				
Courses:	• L: Plankton and Climate • S: Plankton and Climate				1 SEM./HRS 1 SEM./HRS
Workload		*credits*	P (hrs)	S(hrs)	EP (hrs)
	• L: Plankton and Climate		*14*	*16*	*15*
	• S: Current Topics in Plankton and Climate		*14*	*31*	
	Total workload	*3*	*28*	*47*	*15*
Grading framework (possibly including examinations)	*Formal requirements for examinations:* Active participation, presentation *examinations:* Written or oral examination (graded, 100%)				
Duration	One semester				
Frequency of occurrence	annual				
Literature:	C.-D. Schönwiese „Klimatologie“; Charles B. Miller „Biological Oceanography“				

Title:	**Ecosystem Management and Environmental Policy**				
Symbol:	MARSYS-10				
Semester:	Summer				
Module type	• Compulsory module				
Formal requirements for participation	none				
Executive professor	Prof. Dr. Christian Möllmann, Tel.: 42838 6621, christian.moellmann@uni-hamburg.de				
Lecturer	Dr. Jens Floeter Prof. Dr. Christian Möllmann				
Language	German				
Educational concept	The students are aware of the political and legal background of environmental protection and resource management with a focus on Germany and the EU. They know various "assessment" methods in environmental protection and resource management, as well as the concepts and principles of ecosystem-based management. Students are also able to discuss and evaluate problems and conflicts within ecosystem management.				
Contents	Basic principles of the management of marine ecosystems; development of a sector-specific focus (eg fishing, pollution, etc.) on an Ecosystem Approach to Management (EAM) approach, legal and political background of EAM; international agreements and current EU directives; principles, concepts and instruments of the EAM (e.g. indicator systems, marine protected areas), case studies of the EAM; approaches to the assessment of marine ecosystems; problems between ecosystem management and nature conservation; conflicts between ecological, economic and social interest groups				
Courses:	• L: Ecosystem Management and Environmental Policy • S: Current Topics in Ecosystem Management and Environmental Policy				1 SEM./HRS 1 SEM./HRS
Workload		*credits*	P (hrs)	S(hrs)	EP (hrs)
	• L: Ecosystem Management and Environmental Policy		*14*	*16*	*15*
	• S: Current Topics in Ecosystem Management and Environmental Policy		*14*	*31*	
	Total workload	*3*	*28*	*47*	*15*
Grading framework (possibly including examinations)	*Formal requirements for examinations:* Active participation, presentation *examinations:* Written or oral examination (graded, 100%)				
Duration	One semester				
Frequency of occurrence	annual				
Literature:	ICES (2005) Guidance on the Application of the Ecosystem Approach to Management of Human Activities in the European Marine Environment. ICES Cooperative Research Report, 273, 22pp.; H.R. Skioldal and G. Bianchi „The Ecosystem Approach to Fisheries“				

Title:	**Softskills 2 - Statistics for Fieldmethods**				
Symbol:	MARSYS – 11				
Semester:	Summer				
Module type	• Compulsory module				
Formal requirements for participation	none				
Executive professor	Prof. Dr. Axel Temming, Tel.: 42838 6620, atemming (at) uni-hamburg (dot) de				
Lecturer	Dr. Saskia Otto Dr. Jens Floeter Prof. Dr. Christian Möllmann Prof. Dr. Axel Temming				
Language	German				
Educational concept	Students are familiar with advanced statistical procedures and can choose the appropriate methods for evaluating field data. They also have the ability to perform statistical data analysis in various software packages.				
Contents	Introduction to statistical methods for the evaluation of field experiments (accompaniment of MARSYS-05); Generalized Linear Models“ – GLMs, „Generalized Additive Models“ – GAMs, multivariate methods (e.g. „Principal Component Analysis“ – PCA, „Cluster Analysis“; Multidimensional Scaling“); data analysis using the freely available software package R.				
Courses:	• L: Lecture: Introduction to Statistics for Fieldmethods • E: Exercise: Statistics for Fieldmethods				1 SEM./HRS 1 SEM./HRS
Workload		*credits*	P (hrs)	S(hrs)	EP (hrs)
	• L: Lecture: Introduction to Statistics for Fieldmethods		*14*	16	15
	• E: Exercise: Statistics for Fieldmethods		*14*	31	-
	Total workload	3	28	47	15
Grading framework (possibly including examinations)	*Formal requirements for examinations:* Active participation. Protocol *examinations:* Written examination (graded, 100%)				
Duration	one semester				
Frequency of occurrence	annual				
Literature:	Skript; Michael J. Crawley „Statistics – An introduction using R“; R.R. Sokal and F.J. Rohlf „Biometry: The principle and practice of statistics in biological research“, A.F. Zuur, E.N. Ieno and G.M. Smith „Analysing ecological data“				

Title:	**Advanced Biological Oceanography**				
Symbol:	MARSYS-12				
Semester:	Winter				
Module type	• Compulsory module				
Formal requirements for participation	MARSYS-02				
Executive professor	Prof. Dr. Myron Peck; Tel: 42838 6602; myron.peck (at) uni-hamburg (dot) de				
Lecturer	Prof. Dr. Myron Peck Dr. Rolf Koppelmann Prof. Dr, Inga Hense				
Language	German				
Educational concept	The students gain a deeper insight into the current research topics in biological oceanography. They understand complex interactions between physics and biology in selected regional case studies.				
Contents	Current research themes in biological oceanography; physical and chemical effects on plankton production, microbial loop, population dynamics of zooplankton; complex trophic interactions,				
Courses:	• L: Advanced Biological Oceanography • S: Current Topics in Advanced Biological Oceanography				2 SEM./HRS 1 SEM./HRS
Workload	• L: Advanced Biological Oceanography • S: Current Topics in Advanced Biological Oceanography	*credits*	P (hrs) *28* *14*	S(hrs) *70* *46*	EP (hrs) *22*
	Total workload	*6*	*42*	*116*	*22*
Grading framework (possibly including examinations)	*Formal requirements for examinations:* Active participation, presentation *examinations:* Written or oral examination (graded, 100%)				
Duration	One semester				
Frequency of occurrence	annual				
Literature:	J. Mauchline and Alan J. Southward „The Biology of Calanoid Copepods“ ; Charles B. Miller „Biological Oceanography“				

Title:	**Advanced Fisheries Sciences**				
Symbol:	MARSYS-13				
Semester:	Winter				
Module type	• Compulsory module				
Formal requirements for participation	MARSYS-02				
Executive professor	Prof. Dr. Christian Möllmann, Tel.: 42838 6621, christian.moellmann (at) uni-hamburg (dot) de				
Lecturer	Dr. Jens Floeter Prof. Dr. Christian Möllmann Prof. Dr. Axel Temming				
Language	German				
Educational concept	The students have a deeper insight into the current research topics in fisheries sciences. They understand complex interactions between physics and biology in selected regional case studies on the recruitment success of commercially important fish species.				
Contents	Current research themes in fisheries sciences; physical and chemical effects on recruitment success; complex trophic interactions, regional differences, recruitment models, the role of recruitment for fisheries managament, discarding practice, ecosystem aspects of fisheries, e,g., benthic impact				
Courses:	• L: Advanced Fisheries Sciences • S: Current Topics in Advanced Fisheries Sciences				2 SEM./HRS 1 SEM./HRS
Workload		*credits*	P (hrs)	S(hrs)	EP (hrs)
	• L: Advanced Fisheries Sciences		*28*	*70*	*22*
	• S: Current Topics in Fisheries Sciences y		*14*	*46*	
	Total workload	*6*	*42*	*116*	*22*
Grading framework (possibly including examinations)	*Formal requirements for examinations:* Active participation, presentation *examinations:* Written or oral examination (graded, 100%)				
Duration	One semester				
Frequency of occurrence	annual				
Literature:	R.C. Chambers and Edward A. Trippel „Life History and Recruitment in Fish Populations“; L.A. Fuiman and R.G. Werner „Fishery Science“				

Title:	**Marine Ecosystem Modeling**				
Symbol:	MARSYS-14				
Semester:	Winter				
Module type	• Compulsory module				
Formal requirements for participation	none				
Executive professor	Prof. Dr. Inga Hense; Tel: 42838 6641; inga.hense (at) uni-hamburg (dot) de				
Lecturer	Prof. Dr. Inga Hense Prof. Dr. Myron Peck				
Language	German				
Educational concept	Students are able to use the “modelling Language”, to select the most appropriate methods and approaches for a number of specific applications, to formulate simple ecosystem models, to analyze and present the results. They have learned to identify and evaluate model strengths and weaknesses.				
Contents	The basics of model structures are explained, including factors and processes which are generally considered in aquatic ecosystem models. Focus will be on plankton dynamics: growth and mortality processes of phyto- and zooplankton. Examples of bio-geochemical models based on carbon and nitrogen are presented.				
Courses:	• L: Introduction to Marine Ecosystem Modeling • S: Presentation of the results from practicals • E: Practicals in Marine Ecosystem Modeling				1 SEM./HRS 1 SEM./HRS 2 SEM./HRS
Workload		*credits*	P (hrs)	S(hrs)	EP (hrs)
	• L: Introduction to Marine Ecosystem Modeling		14	*11*	*20*
	• S: Seminar - Presentation		14	*31*	
	• E: Practicals in Marine Ecosystem Modeling		*28*	*62*	
	Total Workload	*6*	*56*	*104*	*20*
Grading framework (possibly including examinations)	*Formal requirements for examinations:* Active participation, Presentation *examinations:* Written or oral examination (graded, 100%)				
Duration	Two semester				
Frequency of occurrence	annual				
Literature:	Will be announced at the beginning of the course				

Title:	**Ecophysiology and aquaculture**				
Symbol:	MARSYS-15				
Semester:	Winter				
Module type	• Compulsory module				
Formal requirements for participation	none				
Executive professor	Prof. Dr. Axel Temming, Tel.: 42838 6620, atemming (at) uni-hamburg (dot) de				
Lecturer	Dipl.-Biologe Jens-Peter Herrmann Dr. Marta Moyano Prof. Dr. Myron Peck Prof. Dr. Axel Temming				
Language	German				
Educational concept	Students understand the principles of ecophysiological acclimation of organisms and biological interactions in natural and artifical systems, with a focus on rearing organisms in a commercial environment.				
Contents	Functional diversity of aquatic organisms, ecophysiological acclimation, special metabolic pathways, measurements in the field and in the lab, commercial aquaculture, culture techniques, experiments with growth and reproduction rates in cultures, presentation of commercial aquaculture companies,				
Courses:	• L: Introduction to Ecophysiology and aquaculture • E: Practicals in Ecophysiology and aquaculture				2 SEM./HRS 2 SEM./HRS
Workload		*credits*	P (hrs)	S(hrs)	EP (hrs)
	• L: Introduction to Ecophysiology and aquaculture		28	*40*	*22*
	• E: Practicals in Ecophysiology and aquaculture		28	*62*	
	Total Workload	*6*	*56*	*102*	*22*
Grading framework (possibly including examinations)	*Formal requirements for examinations:* Active participation, Presentation *examinations:* Written or oral examination (graded, 100%)				
Duration	Two semester				
Frequency of occurrence	annual				
Literature:	David H. Evans and James B. Claiborne „The Physiology of Fishes“, M. Jobling „Fish Bioenergetics“				

Title:	**Project**				
Symbol:	MARSYS-16				
Semester:	Winter or Sommer				
Module type	• Compulsory module				
Formal requirements for participation	MARSYS- 4 & MARSYS-11				
Executive professor	N.N.				
Lecturer	N.N.				
Language	German				
Educational concept	Students acquire in-depth knowledge of selected basic and / or advanced research topics. In marine biological and fishery science project studies, the students' ability to actively develop and reflect on detailed insights will be reinforced, scientific research and the presentation of scientific findings will be intensified. Through advanced marine-biological case studies, students are introduced to ways of working and developing own ideas in a research team.				
Contents	Project specific				
Courses:	• Project Study				1 SEM./HRS
Workload	• Project Study	*credits*	P (hrs)	S(hrs)	EP (hrs)
	Total workload	*12*			
Grading framework (possibly including examinations)	*Formal requirements for examinations:* none *examinations:* Oral examination (graded, 100%)				
Duration	6 weeks during semester				
Frequency of occurrence	Each semester				
Literature:					

Title:	**External Internship**				
Symbol:	MARSYS-17				
Semester:	Winter or Sommer				
Module type	• Compulsory module				
Formal requirements for participation	none				
Executive professor	Prof. Dr. Christian Möllmann, Tel.: 42838 6621, christian.moellmann@uni-hamburg.de				
Lecturer	N.N.				
Language	German				
Educational concept	The students acquire first working experiences in the professional field and start to develop their own research network, possibly with international partner institutions.				
Contents	Applying acquired knowledge to practice; working areas, industry structure, operational procedures, biological areas in economy, administration and authorities. Working experience in either national or international universities, legal authorities (e.g., Thünen Institut) or advisory bodies (e.g., ICES). Students are individually supported in organizing their own way into their future working area. The External Internship can be coupled to the Project (MARSYS 16) or the master thesis.				
Courses:	• S: External internship • P: External internship (at least 4 weeks)				1 SEM./HRS 2 SEM./HRS
Workload		*credits*	P (hrs)	S(hrs)	EP (hrs)
	• S: External internship		*14*	*56*	*20*
	• P: External internship		*28*	*62*	-
	Total workload	*6*	*42*	*118*	*20*
Grading framework (possibly including examinations)	*Formal requirements for examinations:* none *examinations:* Project completion (confirmation of activities by the company)				
Duration	3 weeks during semester				
Frequency of occurrence	Each semester				
Literature:					

Title:	**Final Module**				
Symbol:	MARSYS – 18				
Semester:	Summer				
Module type	• Compulsory module				
Formal requirements for participation	Advanced knowledge of biology, usually proven by the successful completion of MARSYS modules amounting to 60 credit points. Sometimes specific modules are recommended.				
Executive professor	N.N.				
Lecturer	N.N.				
Language	German				
Educational concept	Students acquire in-depth knowledge of selected basic and / or current research topics.				
Contents	In-depth study of a current or fundamental biological topic in the working group of a university teacher with experimental design, preparation of a work plan and if necessary revision of it within the progress of the project, literature research (in the library and with data bases), learning the subject-specific methodology, documentation and (statistical) evaluation of data, evaluation of results following "good scientific practice", critical discussion compared to scientific publications and lectures. Oral presentation and discussion of the thesis.				
Courses:					
Workload		*credits*	P (hrs)	S(hrs)	EP (hrs)
	Total workload	*30*	*360*		
Grading framework (possibly including examinations)	*Formal requirements for examinations:* none *examinations:* Exam components of the final module are the written preparation of the master thesis (graded 100%, 27 credits) and an oral exam (pass or fail, 3 credits). The master thesis can be written in German or English. The thesis is to be preceded by a summary in English and German. (pass or fail)				
Duration	one semester				
Frequency of occurrence	Each semester				
Literature:					