Department of Biology

Master in Biological Sciences: Research and Applications

MSc in
Applied Ecology - Management of Ecosystems and Biological Resources

Guide and Course Outlines

Academic year 2021-2022

Patras, Greece
2021

Table of contents

1. Course guide and organization

The 18-month duration MSc curriculum in Applied Ecology - Management of Ecosystems and Biological Resources consists of six (6) compulsory courses that are divided into two (2) semesters (**Table 1**), as well as the implementation and evaluation of the MSc thesis (corresponding to 40 ECTS) during the second and third semester.

Table 1. Course allocation in semesters, including teaching stuff, hours and ECTS.

No	Course	Teaching stuff (including scientific area of interest)	Number of hours	Credits (ECTS)
1st semester				
1	Sampling Design, Environmental Data Analysis and Ecological Models	**Koutsikopoulos K.** (Professor in Marine Ecology and Fishery Resources) **Giokas S.** (Professor in Biodiversity and development of terrestrial organisms) **Tzanatos E.** (Assistant Professor in Marine Ecology and Fisheries Management)	30	7
2	Biodiversity assessment and monitoring of species and habitats	**Giokas S.** (Professor in Biodiversity and development of terrestrial organisms) **Dimopoulos P.** (Professor in Herbal and Ecology) **Panitsa M.** (Associate Professor in Flora and Phytogeography) **Dimitrellos G.** (PhD, Laboratory Teaching stuff, in Ecology and Forestry) **Mitsainas G.** (Lecturer in Mammal Biodiversity) **Spanou S.** (PhD, Laboratory Teaching stuff, in Herbal and Ecology)	30	8
3	Environmental Planning and Management of Natural Areas	**Papastergiadou E.** (Professor, in Plant Ecology and Inner Water Habitat Management) **Dimopoulos P.** (Professor in Herbal and Ecology) **Panitsa M.** (Associate Professor in Flora and Phytogeography) **Mitsainas G.** (Assistant Professor in Mammal Biodiversity) **Dimitrellos G.** (PhD, Laboratory Teaching stuff, in Ecology and Forestry) **Spanou S.** (PhD, Laboratory Teaching stuff, in Herbal and Ecology)	30	7
4	Fish population Dynamics and Management of Marine Biological Resources	**Koutsikopoulos K.** (Professor in Marine Ecology and Fishery Resources) **Makridis, P.** (Associate Professor, in Aquaculture) **Tzanatos E.** (Assistant Professor in Marine Ecology and Fisheries Management)	30	8
2nd semester				
5	Assessment and management of aquatic ecosystems	**Papastergiadou E.** (Professor, in Plant Ecology and Inner Water Habitat Management) **Makridis, P.** (Associate Professor, in Aquaculture) Dailianis S. (Associate Professor, in Aquatic Toxicology)	30	10
6	The Impact of Environmental Stresses on the Mediterranean Plants	**Grammatikopoulos G.** (Associate Professor, in Plant Physiology) **Petropoulou G.** (Associate Professor, in Plant Physiology) **Adamidis G.** (Assistant Professor, in Functional Plant Biology)	30	10

The 1st semester is implemented from the beginning of November to the middle of February of the next year, including exams in each course, followed by the 2nd semester till April. During the curriculum, seminars will be scheduled by invited instructors from different national and international institutes.

Repeat exams in each course are commonly performed in September, after the completion of both semesters.

After the completion of teaching courses, all MSc students are asked to implement their diploma thesis in order to complete their studies (duration 12 months), after consultation with a member of the teaching stuff (supervisor).

2. Description and Content of Courses

2.1 Sampling Design, Environmental Data Analysis and Ecological Models

Abstract: Sampling methods and strategies. Estimators. Types of data. Collection and organization of ecological data. Analysis methods per question and data type. The concept of ecological models. Types of models. Construction of models. Examples and applications.

Syllabus: Sampling, estimation and estimators: basic concepts. The concepts of representative sample, accuracy and bias. Organization of sampling. Sampling strategies and estimators (simple random, stratified, multi-stage, systematic). Data Types (Properties and Constraints). Collection and organization of ecological data. Analysis methods according to queries and data type (real examples using SPSS & other software). Tests for Differences (parametric and non-parametric tests). Relationship Tests (correlation, regression). Explorative methods (multivariate analysis). Presentation and interpretation of results. The concept of the model. The model as a tool for understanding and describing systems and mechanisms. Model types, features and uses, model variables and external parameters. Create models. Interpolation-extrapolation. Customization, control and model improvement. Empirical models. Creating an empirical model Importing variables. Ways to associate variables. Multi-variable models. Scale interactions. Detailed models. Status Variables-Flow Variables. Create a detailed model. Numerical methods of integrating equations, scale choices, parameter homogenization. Examples and applications from case studies.

2.2 Biodiversity assessment and monitoring of species and habitats

Abstract: Levels and estimators of biodiversity. Biodiversity patterns. Methods for the estimation and analysis of biodiversity. Implementation of the Directive 92/43/EC. Examples and applications. Fieldwork.

Syllabus: Basic concepts and principles, at different levels (from genes to ecosystems), biodiversity patterns with emphasis on plant diversity. World, Mediterranean and Greek biodiversity centers. Directive 92/43 / EU and the ecological network of protected areas Natura 2000. The National Biodiversity Strategy and Action Plan for Greece. Methods and techniques for sampling and measuring Biodiversity. Methods and techniques for analyzing Biodiversity parameters. Methodology and results of monitoring and assessment of habitats' conservation status. Methodology and results of monitoring and assessment of plant species conservation status. Species and habitat types databases, Geographic databases. Case studies from the Greek territory and Mediterranean area / Biodiversity and monitoring of plant taxa in island ecosystems. IUCN Criteria, Red Data Lists. Field sampling protocols to monitor and assess flora and fauna species conservation status. Field sampling protocols to monitor and assess habitat types' conservation status.

2.3 Environmental Planning and Management of Natural Areas

Abstract: Principles of environmental planning. Protected areas and habitats. Management Plans. Examples and applications. Fieldwork.

Syllabus: Principles, goals and methodology for the organization of management plans. Monitoring of protected areas. Organization and effectiveness of management plans for natural areas, habitats and

species. Criteria of ecological assessment. Protected areas and Habitats. Framework of management and operation. Environmental framework and designation of protected areas. Management of Mediterranean type ecosystems and basic principles of Ecotourism. Island ecosystems and their management. Implementation of Geographical Information Systems in ecosystems management. Management case studies.

2.4 Fish population Dynamics and Management of Marine Biological Resources

Abstract: Exploitation, monitoring and management of marine biological resources. Population and fish stocks. Parameters of population dynamics. Methods for stock assessment. Aquacultures.

Syllabus: Exploitation of marine biological resources and the necessity for monitoring and management. Population and stock, interrelations between biology and exploitation. Parametres determining the dynamics of a population: growth, mortality, reproduction. Main parametres used in the quantification of exploitation (fishing effort, selectivity, fishing mortality, CPUE). Global models: Logistic model of population growth, surplus production models. Analytical models: Age frequency, age-length keys, Virtual Population Analysis (VPA), yield-per-recruit. Protocols, procedures and collection of data on fishing activity, fishing effort and yield. Modern methods in stock assessment. Fisheries management and the Ecosystem Approach to Fisheries Management. Interactions between fisheries and environment. Fish behavior in aquaculture.

2.5 Assessment and management of aquatic ecosystems

Abstract: Principles for the management of aquatic ecosystems. Implementation of Water Framework Directive WFD 2000/60EU. Typology of aquatic ecosystems. Monitoring and assessment tools. Main pollutants of aquatic environment. Ecological risk assessment. Organisms as bioindicators and biomarkers. Protection of coastal areas. The impact of aquacultures on the aquatic environment. Genetic pollution.

Syllabus: General principles of water ecosystem management. Water Framework Directive WFD 2000 / 60EE. Aquatic Ecosystem Typology - Classification Systems. Aquatic Ecosystem Monitoring and Evaluation Tools. Biological Qualitative Elements (phytoplankton, macrophytes, macroinvertebrates, fish) as indicators of Eco-water Quality Assessment. Aquatic Ecosystem Monitoring and Evaluation Tools - Degradation Problems - Anthropogenic Effects. Main pollutants in the aquatic environment - Input of pollutants into aquatic ecosystems. Ecological risk assessment. Xenobiotic substances and aquatic organisms. Impact assessment of aquatic organisms: principles of toxicity / ecotoxicology and methods. Use of biomarkers and biomarkers in water pollution bio-monitoring strategies. Protection of coastal urban areas - Municipal waste management and the role of Biological Purification Units. Water quality monitoring chart for coastal areas. Design of in vitro exposure experiments for aquatic organisms. Analysis of data from in vitro toxicity experiments on aquatic organisms. Statistical processing of data from toxicity experiments using SPSS statistical package. Impact of aquaculture on the marine environment and genetic pollution. Cultivation of microbes and their use for capturing exhaust. Organic aquaculture (Wheat cultivation and disinfection using essential oils. Microbiological analysis).

2.6 The Impact of Environmental Stresses on the Mediterranean Plants

Abstract: Functional adaptations of plants to the Mediterranean environment. Main factors of environmental stress and methods for assessing their impact. The impact of climate change on the Mediterranean plants.

Syllabus: Functional adaptations of plants to the Mediterranean environment. Main factors of environmental stress and methods for assessing their impact: solar radiation, drought, temperature, salinity, heavy metals, air pollution. The impact of climate change on the Mediterranean plants: temperature increase, CO_2 increase, greenhouse effect, change of the precipitation pattern, desertification, enhanced of UV-B radiation.

3. Course outlines

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**GBIO_OKYA1**	**SEMESTER**	1st
COURSE TITLE	Sampling Design, Environmental Data Analysis and Ecological Models		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, Laboratory Exercises		10 (3 lectures + 7 laboratory exercises	7
COURSE TYPE	Specialised general knowledge, 2) skills development		
PREREQUISITE COURSES	NO. Formally, there are no prerequisite courses. Nevertheless, a good knowledge of ecology and some expertise of basic statistics is recommended		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
URL			

Learning outcomes

At the end of the course, students should be able to: (1) formulate valid scientific questions and hypotheses about the ecology of organisms, (2) understand sampling methods and strategies, (3) to design ecological experiments and sampling, (4) to analyze ecological data according to query and data type, (5) understand the concepts and types of ecological models, (6) to construct ecological models.

General Competences

At the end of the course, students will have developed the following skills: (1) ability to design simple yet valid experiments to study the ecology of organisms, (2) ability to analyze primary ecological data, (3) ability to evaluate and present ecological analyses.

Teaching and Learning methods-Evaluation

DELIVERY	Face to Face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	(1) Use of computers and special software during the course by the instructors and the students. (2) Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures (3 weeks x 3 hours per week)	9
	Laboratory Exercises (3 weeks x 7 hours per week)	21
	Home study	145
	Course total (25 hours per one ECT)	**175**

STUDENT PERFORMANCE EVALUATION	Preparation and Presentation of Laboratory Exercises (at the end of the semester) Grading scale: 1-10. Passing grade: 5 Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A

Attached bibliography

- Chalmers N, Parker P (1989) The OU Project Guide: Fieldwork and Statistics for Ecological Projects. Field Studies Council, Open University.
- Dytham C (2003) Choosing and Using Statistics. Blackwell Science.
- Fowel J, Cohen L, Jarvis P (1998) Practical Statistics for Field Biology. John Wiley & Sons.
- Gotelli NJ, Ellison AM (2004) A Primer of Ecological Statistics. Sinauer Associates.
- Krebs CJ (1999) Ecological Methodology. Addison-Welsey.
- Quinn GP, Keough MJ (2002) Experimental Design and Data Analysis for Biologists. Cambridge University Press.
- Ruxton CD, Colegrave N (2003) Experimental Design for the Life Sciences. Oxford University Press.
- Zar JH (1998) Biostatistical Analysis. Prentice Hall.

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**GBIO_OKYA2**	**SEMESTER**	1st
COURSE TITLE	Biodiversity Assessment and biomonitoring of species and habitats		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, Laboratory Exercises		30	8
COURSE TYPE	1) Specialised general knowledge, 2) skills development		
PREREQUISITE COURSES	NO. Formally, there are no prerequisite courses. Nevertheless, a basic knowledge of General Biology, Botany and Zoology, Mapping of species and habitats is recommended.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
URL	https://eclass.upatras.gr/courses/BIO334/		

Learning outcomes

At the end of the course, the student will be able to: 1) understand the basic concepts of surveillance, monitoring of species and habitat types in the context of implementing the relevant European Union Directives, 2) have the knowledge of the methodologies for implementing monitoring plans for species and habitats in different types of ecosystems; 3) understand the methods of assessing the conservation status of species and habitat and collect data in the field based on standardized protocols for the assessment of pressures/threats and structures and functions regarding habitat types, as well as for the assessment of population parameters and pressures/threats for plant and animal species, 4) strengthen his/her efficiency to compile information in a coherent system/unit.

General Competences

At the end of the course, the student will have developed the following skills: 1) Ability to demonstrate knowledge and understanding of essential data, concepts and theories of monitoring and assessment of species' and habitats' conservation status, 2) Ability to apply this knowledge and understanding of the results of the assessment of conservation status and their link to management issues for the conservation of species and habitats within the targeted integrated nature conservation in protected areas 3) Ability to collaborate with others on interdisciplinary environmental issues; 4) Research and study skills needed for continuous professional development.

Teaching and Learning methods-Evaluation

DELIVERY	Face to Face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	(1) Use of computers and special software during the course by the instructors and the students. (2) Support of educational procedure with use of the e-class electronic platform.

TEACHING METHODS	Activity	Semester workload
	Lectures	35
	Laboratory Exercises	10
	Literature study	55
	Writing project	55
	Home study	45
	Course total (25 hours per one ECT)	**200**
STUDENT PERFORMANCE EVALUATION	Elaboration & Presentation of Laboratory Exercises (at the semester's end) Grading scale: 1-10. Passing grade: 5 Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A	

Attached bibliography

- Dimopoulos P., Pantis J., Vagenas D., Tzanoudakis D. (Editors) 2009. Manual for Sustainable Management of Protected areas.
- Tsiripidis I., Xystrakis F., Kallimanis A.S., Panitsa M., P. Dimopoulos (2018). A bottom-up approach for the quantitative assessment of habitats structures and functions conservation status. Rendiconti Lincei. Scienze Fisiche e Naturali: 1-16.
- Dimopoulos, P., I. Tsiripidis, F. Xystsrakis, A. Kallimanis & M. Panitsa (2018): Methodology for monitoring and conservation status assessment of the habitat types in Greece. Ministry of Environment and Energy, National Center for the Environment and Sustainable Development. KATAGRAMMA Editions. ISBN 978-960-99033-2-5. 128 pages. Athens.
- European Commission (2006): Assessment, Monitoring and Reporting Under Article 17.
- Evans D, Arvela M (2011) Assessment and reporting under Article 17 of the Habitats Directive—explanatory notes & guidelines for the period 2007–2012—final Draft. European Topic Centre on
- Biological Diversity. Council Directive 79/409/EEC. On the Conservation of wild birds. Official Journal of European Communities
- Council Directive 92/43/EEC. On the Conservation of Natural Habitats and of Wild Fauna and Flora. Official Journal of European Communities.

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**GBIO_OKYA3**	**SEMESTER**	/ 1st
COURSE TITLE	Environmental Planning and Management of Natural Areas		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**	
Lectures, Laboratory Exercises	30	7	
COURSE TYPE	1) Specialised general knowledge, 2) skills development		
PREREQUISITE COURSES	NO. Formally, there are no prerequisite courses. Nevertheless, a basic knowledge of General Biology, Botany and Zoology is recommended.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
URL	https://eclass.upatras.gr/courses/BIO317/		

Learning outcomes

By the end of the course each student will be able: (1) Understand the basic principles of organization and management of protected areas, the policy for nature and the Directives of European Union, 2). Gain knowledge for environmental strategic plan, the national conservation and management for nature and biodiversity, as well as the new qualifications for the implementation of Management Plans, 3). Apply the sustainable management principles in the implementation of Management Plans in NATURA 2000 sites and management of natural resources, 4). Strengthen their efficiency to compile information in a coherent system/unit.

General Competences

At the end of the course each student will be able: (1) Ability to demonstrate knowledge and understanding of essential facts, concepts, principles and theories of Ecology and Management of Natural ecosystems and areas,

2). Ability to apply such knowledge and understanding to the solution of environmental conservation and Management issues, 3). Ability to interact with others on environmental multidisciplinary problems e.g. as a staff of Management Bodies of protected areas, 4). Study skills needed for continuing professional development.

Teaching and Learning methods-Evaluation		
DELIVERY	Face to Face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	(1) Use of computers and special software during the course by the instructors and the students. (2) Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures	24
	Laboratory Exercises	6
	Literature study	50
	Writing project	50
	Home study	45
	Course total (25 hours per one ECT)	**175**
STUDENT PERFORMANCE EVALUATION	Elaboration & Presentation of Laboratory Exercises (at the semester's end) Grading scale: 1-10. Passing grade: 5 Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A	

Attached bibliography

- Alexander M., 2008. Management planning for nature conservation. A theoretical basis & practical guide.
- Dimopoulos P., Pantis J., Vagenas D., Tzanoudakis D. (Editors) 2009. Manual for Sustainable Management of Protected areas.
- Nature Conservancy Council (GB) 1988. Site management plans for nature conservation. A working guide. 40 p.
- Οδηγία 79/409/ΕΟΚ. «Περί διατηρήσεως των αγρίων πτηνών».
- Οδηγία 92/43/ΕΟΚ. «Για τη διατήρηση των φυσικών οικοτόπων καθώς και της άγριας πανίδας και χλωρίδας».
- Παπαστεργιάδου Ε., Τσιαούση Β., Ντάφης Σ., και Γκατζογιάννης Σ. 1995. Προδιαγραφές σύνταξης ολοκληρωμένων διαχειριστικών σχεδίων προστατευόμενων περιοχών. Ελληνικό Κέντρο Βιοτόπων Υγροτόπων (ΕΚΒΥ), 51 σελ.
- Perennou, C., J. L. Lucchesi, P. Gerbeaux & J. Roche. 1996. A Management Plan for a Mediterranean Wetlands. Commission of European Communities, Tour du Valat, Arles, France. (MedWet).
- Ramsar Bureau, 1998. Guidelines on Management Planning for Ramsar sites and other Wetlands, 5p.
- Wood, J. B. and A. Warren. 1978. A Handbook for the preparation of Management Plans. Conservation Course format Revision 2. University College of London. 40 p.

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**GBIO_OKYA4**	**ΕΞΑΜΗΝΟ ΣΠΟΥΔΩΝ/ SEMESTER**	1st
COURSE TITLE	Fish Population Dynamics and Management of Marine Biological Resources		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, Laboratory Exercises	10 (8 Lectures, 2 Laboratory exercises)	8

COURSE TYPE	1) Specialised general knowledge, 2) skills development.
PREREQUISITE COURSES	NO. Formally, there are no prerequisite courses. Nevertheless, a good knowledge of ecology and some knowledge of marine ecology, ichthyology and aquaculture is recommended.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
ΗΛΕΚΤΡΟΝΙΚΗ ΣΕΛΙΔΑ ΜΑΘΗΜΑΤΟΣ (URL)	

Learning outcomes

By the end of the course each student will be able: (1) to know the structure and the functioning of the system "fisheries" (fishing gears, technical characteristics, relevant administration structures and scientific bodies) with an emphasis on Mediterranean and Greek fisheries, (2) to set and to make reasonable scientific questions regarding fish stock dynamics and state hypotheses regarding the effects of human exploitation, (3) to understand the methods of sampling for fisheries data and to be able to design sampling strategies and prepare sampling protocols, (4) to analyze fisheries data as well as study and answer questions regarding fish stock dynamics and fisheries management, (5) to understand the concepts and the different approaches used in fish stock assessments, (6) to be familiar with the various types of fisheries management measures and how they may affect fish stocks and the entire system of fisheries and (7) to comprehend basic principles of fish ethology and their applications in aquaculture.

General Competences

At the end of the course each student will be able: (1) to design and manage projects (related with the study and management of fisheries), (2) to work independently and in a team, (3) to search for, analyse and synthesize data, metadata and information, with the use of the necessary technology and (4) to work in an interdisciplinary environment.

Teaching and Learning methods-Evaluation

DELIVERY	Face to Face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	(1) Use of computers and special software during the course by the instructors and the students. (2) Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	***Activity***	***Semester workload***
	Lectures (3 weeks x 8 hours per week)	24
	Laboratory exercises (3 weeks x 2 hours per week)	6
	Home study	170
	Course total (25 hours per one ECT)	**200**
STUDENT PERFORMANCE EVALUATION	Elaboration & Presentation of Laboratory Exercises (at the semester's end) Grading scale: 1-10. Passing grade: 5 Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A	

Attached bibliography

- Pitcher T. J., Hart P. J. B. (1982). Fisheries Ecology. Chapman & Hall.
- Hilborn R., Walters C. J. (1992). Quantitative Fisheries Stock Assessment: Choice, Dynamics and Uncertainty. Chapman and Hall.
- Jennings S., Kaiser M. J., Reynolds J. D. (2001). Marine Fisheries Ecology. Blackwell Science.
- Vandermeer J. H., Goldberg D. E. (2003). Population Ecology: First Principles. Princeton University Press.
- Walters C. J., Martell S. J. D. (2004). Fisheries Ecology and Management. Princeton University Press.
- King M. (2007). Fisheries Biology, Assessment and Management. Blackwell Science.
- Belgrano A., Fowler C. W. (2011). Ecosystem-Based Management for Marine Fisheries. Cambridge University Press.
- Hurtingford, F., Jobling. M., and Kadri, S. (2012). Aquaculture and Behavior. Willey Blackwell.

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**GBIO_OKYA1**	**SEMESTER**	2nd
COURSE TITLE	Assessment and management of aquatic ecosystems		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**		**CREDITS**
Lectures, Laboratory Exercises	30		10
COURSE TYPE	1) Specialised general knowledge, 2) skills development.		
PREREQUISITE COURSES	NO. Basic knowledge of General Ecology, Botany and Zoology.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
URL	https://eclass.upatras.gr/courses/BIO314/ http://www.biology.upatras.gr/index.php?option=com_content&view=article&id=38&Itemid=310		

Learning outcomes

The main objective of the course is to acquire the necessary knowledge as well as the appropriate methodological approaches related to the rational assessment and management of aquatic ecosystems. At the end of the course, the student will be able to (a) assess the risks posed by aquatic ecosystems, (b) use appropriate tools to deal with ecological risks, (c) apply the legislative framework (WFD 2000 / 60EE Framework Directive), (d) to implement appropriate methodological approaches for assessing the health status of aquatic ecosystems, and (e) to propose solutions and strategies for ensuring the sustainable development/management of aquatic ecosystems.

General Competences

At the end of the lesson, the *degree-holder* will have developed the following General Skills:

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Decision-making
- Working independently
- Team work
- Working in an international environment
- Working in an interdisciplinary environment
- Project planning and management
- Respect for the natural environment
- Criticism and self-criticism
- Production of free, creative and inductive thinking.

Teaching and Learning methods-Evaluation

DELIVERY	Face to Face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	(1) Use of computers and special software during the course by the instructors and the students. (2) Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures	30
	Laboratory practice	6
	Literature study	50
	Writing project	50

	Home study	114
	Course total (25 hours per one ECT)	**250**
STUDENT PERFORMANCE EVALUATION	Written exams or project presentation (at the semester's end), in Course theory, accounting for the 100% of the Final Grade. Grading scale: 1-10. Passing grade: 5 Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A	

Attached bibliography

- Aguiar FC, Segurado P, Urbanic G, Cambra J, Chauvin C, Ciadamidaro S, Dörflinger G, Ferreira J, Germ M, Manolaki P, Minciardi MR, Munné A, Papastergiadou E, Ferreira MT. 2014. Comparability of river quality assessment using macrophytes: a multi-step procedure to overcome biogeographical differences. *Sci Total Environ* 476–477: 757–767.
- De Wilde, A.J., Knoben, R.A. & van Poppel, J.W. 2002. Setting Class boundaries for the classification of rivers and lakes in Europe, Royal Haskoning, Netherlands, Final report, 22p.
- EC Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000. *Establishing a framework for Community action in the field of water policy*, Official Journal of the European Communities L 327: 1-72.
- Manolaki P., Guo Kun, Cristiana Vieira, Eva Papastergiadou, Tenna Riis 2019. Hydromorphology as a controlling factor of macrophytes assemblage structure and functional traits in the semi-arid European Mediterranean streams. *Sci Total Environ* DOI 10.1016/j.scitotenv.2019.134658
- Raven, P.J., Holmes, T.H., Dawson, F.H., Fox, P.J., Everard, M., Fozzard, I.R. & Rouen, K.J. 1998. River Habitat Survey, the physical character of rivers and streams in the UK and Isle of Man. River Habitat Survey, Report.
- Stefanidis, K., Eva Papastergiadou 2019. Linkages between Macrophyte Functional Traits and Water Quality: Insights from a Study in Freshwater Lakes of Greece. *Water* 11, 1047; DOI 10.3390/w11051047.

Scientific journals of interest:
Aquatic Ecology
Freshwater biology
Hydrobiologia
Science of Total Environment
Water
Water Resources Management

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**GBIO_OKYB2**	**SEMESTER**	2nd
COURSE TITLE	The Impact of Environmental Stresses on the Mediterranean Plants		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, Laboratory Exercises		14 days (2 h per day)	10
COURSE TYPE	1) Specialised general knowledge, 2) skills development.		
PREREQUISITE COURSES	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
URL	https://eclass.upatras.gr/courses/BIO219/		

Learning outcomes

At the end of the course the student is expected to have assimilated (1) the basic functional adaptations of plants to the stresses of the Mediterranean climate, (2) the main environmental stressors and methods for their assessment, (3) the effects of climate change on the Mediterranean plants. In addition, upon the course completion he / she will be able to analyze and present a research topic of the course subjects as well as to design a research project for its approach.

General Competences

At the end of the lesson, the *degree-holder* will have developed the following General Skills:

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Working independently

- Production of free, creative and inductive thinking

Teaching and Learning methods-Evaluation		
DELIVERY	Face to Face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	(1) Use of computers and special software during the course by the instructors and the students. (2) Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures	28
	Independent study and analysis of bibliography	102
	Study, preparation, presentation of independent project	120
	Course total (25 hours per one ECT)	**250**
STUDENT PERFORMANCE EVALUATION	Evaluation language: Greek Methods of evaluation: - written examination with multiple choice questions - oral examination of individual work Grading scale: 1-10. Passing grade: 5 Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A	

Attached bibliography

- Plant stress physiology G. Karabourniotis, G. Liakopoulos, D. Nikolopoulos. *Embryo Press, 2016 (in greek)*
- Plant Growth and Climate Change James I. L. Morison, Michael D. Morecroft. *Willey 2008*
- *Selected papers*