UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche
ACADEMIC YEAR	2023/2024
MASTER'S DEGREE (MSC)	BIODIVERSITY AND ENVIRONMENTAL BIOLOGY
INTEGRATED COURSE	BIOLOGICAL ANALYSIS OF AQUATIC ECOSYSTEMS - INTEGRATED COURSE
CODE	23329
MODULES	Yes
NUMBER OF MODULES	2
SCIENTIFIC SECTOR(S)	BIO/05, BIO/03
HEAD PROFESSOR(S)	NASELLI FLORES LUIGI Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	MAURO MANUELA Ricercatore a tempo determinato Univ. di PALERMO NASELLI FLORES LUIGI Professore Associato Univ. di PALERMO
CREDITS	12
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**MAURO MANUELA** Wednesday 13:00 15:00 Via Archirafi, 18- Primo piano **NASELLI FLORES LUIGI** Monday 10:30 11:30 Studio del docente, Via Archirafi, 28 - I piano Wednesday 10:30 11:30 Studio del docente, Via Archirafi, 28 - I piano Friday 10:30 11:30 Studio del docente, Via Archirafi, 28 - I piano

DOCENTE: Prof. LUIGI NASELLI FLORES

PREREQUISITES	Good high-school mathematical skills and a basic knowledge of general Ecology are necessary to fruitfully attend the course.
LEARNING OUTCOMES	Knowledge and understanding The goals of the class is to get critical tools aimed at (i) identifying and understanding the regulation role of the biota in the different aquatic ecosystems, (ii) selecting and identifying the tropho-dynamic structure of ecological communities and (iii) analysing the biological interactions allowing ecosystem functioning. Applying knowledge and understanding Ability to autonomously build a bio-analytical protocol sized on specific environmental features to be investigated. Ability to illustrate both graphically and orally the results achieved. Making judgements The course is aimed at developing a basic knowledge to evaluate the implications deriving from the selection of biological variables and the general results achieved through the analysis itself. Ability to analyse the principal features deriving from a biological assessment of (local and regional) communities and metacommunities. Communication skills The course will promote the ability to explain and sustain operative choices according to the biological structure and to the environmental features of the different ecosystems. In addition, the ability to underline the importance and the necessity to biologically monitor and control the environment even in (apparently) unimpacted ecosystems. Learning skills The course is aimed at developing the ability to critically analyse specialised scientific literature on the topics of the course. It is also aimed at facilitating the study required in a second-level degree or master course.
ASSESSMENT METHODS	Written test at the end of the course with possible oral integration. The test is aimed at ensuring the acquisition of the ability to determine the ecological status of an aquatic ecosystem through: the study and analysis of graphs taken from international literature (Responses to stress in aquatic organisms); an appropriate morpho-functional analysis of biological assemblage structures provided by the teacher (Analysis of aquatic ecosystems). This analysis will be aimed at providing information on the ecological status of an ecosystem. The test consists of 2-3 open-ended questions aimed at providing a general assessment of all the cultural aspects that make up the two modules of the course. Furthermore, an evaluation based on the ability to describe the ecological conditions of an ecosystem on the basis of the characteristics of the indicators provided will be carried out. The vote is made up of the answers to the three proposed levels of analysis. Ability to make a basic assessment by analyzing the autoecology of individual species (18-20), basic knowledge of the relationships between morphological characteristics of organisms and their interpretative value (21-23), ability to make an advanced assessment based on 'use of the autoecological characteristics (including the phenotypic variability) of the populations and of the synecological ones of the communities' (24-27), ability to make forecasts on the future ecological state of the ecosystem (28-30 cum laude).
TEACHING METHODS	Frontal lectures (10 CFU, 80 h) and classroom/lab exercises (2 CFU, 24 h). Lectures will be given in English if the class includes foreign students or upon request of the students.

MODULE
ANALYSIS OF AQUATIC ECOSYSTEMS

Prof. LUIGI NASELLI FLORES

SUGGESTED BIBLIOGRAPHY

Testi consigliati:
- Domenico D'Alelio, 2021. La microgiungla del mare. Hoepli. ISBN: 978-88-203-9569-8
- Colin S. Reynolds, 2006. The Ecology of Phytoplankton. Cambridge University Press. ISBN: 978-05-216-05199
Articoli su riviste internazionali selezionati dal docente saranno distribuiti agli studenti all'inizio del corso. Gli articoli consentiranno agli studenti di approfondire tutti gli aspetti trattati nel corso. La lista, in relazione ai costanti progressi scientifici in tale ambito, sara' aggiornata e modificata anno per anno.

Textbooks:
- Domenico D'Alelio, 2021. La microgiungla del mare. Hoepli. ISBN: 978-88-203-9569-8
- Colin S. Reynolds, 2006. The Ecology of Phytoplankton. Cambridge University Press. ISBN: 978-05-216-05199
Articles on international journals will be given out by the lecturer at the beginning of the course. These articles will allow the students to learn about the topics of the course. The list of articles may change from one year to another, to include the newest and most relevant publications.

AMBIT	50506-Discipline del settore biodiversità e ambiente
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52

EDUCATIONAL OBJECTIVES OF THE MODULE

According to the "manifesto" of the 2nd-grade course in Biodiversity and Environmental Biology, the goal of the module "Aquatic Ecosystem Analysis", in the frame of the I.C. "Biological Analysis of Aquatic Ecosystems", is to give to students a good knowledge on the scientific methods necessary to develop a critical vision on the role exerted by the organisms and their interactions on a suitable (meta)ecosystem functioning. The course is also aimed at highlighting how human impacts on the biological structure of ecosystems may cause a threat to human survivorship. The cultural and technical skills useful to be an expert in the biological management will be also provided. Biological "deviations" will be also analysed in relation to ecotoxicological aspects dealing with the functioning of different aquatic ecosystems.

SYLLABUS

Hrs	Frontal teaching
8	Introduction to the course. Analysis of the ecological problems coming from the human use of natural resources. Human-induced impacts on the different ecosystems at a global scale.
8	Analysis of the biological structures in the different ecosystem typologies. Biodiversity and its role in maintaining the emergent properties of ecosystems: stability, resilience, resistance. Trend of biological diversity in aquatic ecosystems over the past 60 years. Importance of biological redundancy. Analysis of human impacts on aquatic ecosystems. Functioning of inland water ecosystems in the Mediterranean area.
8	Ecological relationships among the different biological compartment of ecosystems. Functional roles of organisms and analysis of their functional traits. Relationships between morphology and function in analysing the biological structure of ecosystems.
8	Morpho-functional traits and ecological role of organisms. Functional classifications vs. taxonomic classifications. How to identify and measure morpho-functional traits of ecological communities. Protocols for the analysis of the ecological state of ecosystems through the analysis of morpho-functional traits of organisms.
8	Functional classifications of aquatic vegetation and their use in the analysis of ecosystems. C-S-R-classification of phytoplankton and ecosystem trajectories. Functional analysis of zooplankton and macroinvertebrates. Fish functional groups

Hrs	Practice
12	Applications of morpho-functional analysis for the ecological characterization of aquatic ecosystems. Graphic determination of C-S-R strategies and assessment of their ecological significance. Identification of morpho-functional traits of phytoplankton and their use in assessing the ecological status of an aquatic ecosystem. Analysis of aquatic ecosystems through simulations of phytoplankton assemblages.

MODULE
STRESS RESPONSES IN AQUATIC ORGANISMS

Prof.ssa MANUELA MAURO

SUGGESTED BIBLIOGRAPHY

Hickman, C.P., Keen, S.L., Eisenhour, J.E., Larson, A., l'Anson, H. (ed.18), 2020. Fondamenti di Zoologia. McGraw-Hill. ISBN/EAN: 9788838697005
Hickman, C.P., Keen, S.L., Eisenhour, J.E., Larson, A., l'Anson, H. (ed.18), 2020. Zoologia. McGraw-Hill. ISBN/EAN: 9788838696947
Stephen Miller and Todd A. Tupper. (ed.11), 2019. Zoology. McGraw-Hill. ISBN: 1259880028
Publications and other material provided by the teacher.

Per approfondimenti:
Casiraghi, M., de Eguileor, M., Cerrano, C., Puce, S. Zoologia. Seconda edizione. 2023. UTET
Hickman, C.P., Keen, S.L., Eisenhour, J.E., Larson, A., l'Anson, H. (ed.18), 2020. Diversità animale. McGraw-Hill. ISBN/EAN: 9788838697036

AMBIT	50506-Discipline del settore biodiversità e ambiente
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52

EDUCATIONAL OBJECTIVES OF THE MODULE

The module aims to provide the student with the basics for the study of biodiversity of aquatic ecosystems. It provides the basic elements to evaluate the effects of stressful conditions (anthropic and natural) on the health status of aquatic organisms. A path that will begin with the study of the basic notions concerning biodiversity, the causes of biodiversity loss, animal biology, knowledge of immune and behavioral responses to stressful conditions. All starting from general concepts and then focusing entirely on aquatic life. It will make it possible to provide the tools useful for exploiting the results of scientific research, case studies that will be illustrated, to manage, contain and mitigate the impacts on freshwater and marine organisms. Therefore, new approaches will be provided for the assessment of the health status of aquatic biodiversity. Furthermore, the possibilities of obtaining bioactive molecules from these organisms, mainly produced following mechanisms of protection or restoration of homeostasis, will be described.

SYLLABUS

Hrs	Frontal teaching
5	Introduction to the course. Basic concepts of animal biology: from eukaryotes, prokaryotes, autotrophs and heterotrophs to the concept of biodiversity and species. Possible causes and consequences of biodiversity loss in general with a focus on aquatic organisms. Notes on evolutionary and adaptation theories, the concept of speciation, natural selection, genetic drift and stabilizing or directional selection.
8	Notes on regional, national and international regulations on the protection of biodiversity. Animal development, homeostasis, osmotic regulation, excretion and thermoregulation.
5	Stressful conditions affect species distribution. Molecular analysis for the study of species distribution and environmental DNA as a new tool for the census of biodiversity. Case of studies of environmental DNA assessment in freshwater environments.
10	The immune system and animal behavior as tools for assessing the health of marine biodiversity. Anthropogenic pollution of aquatic environments and climate change: biomarkers and bioindicators.
7	Case studies for the evaluation of anthropogenic impacts on biodiversity through the study of the immune and behavioral responses of marine organisms. Focus on the immune system of some invertebrate species and its use in the evaluation of anthropogenic impacts
5	Marine biodiversity as a source of bioactive molecules, potential, uses and applications.

Hrs	Workshops
12	Exercises on different marine invertebrate species - maintenance, sampling and evaluation of biological parameters. The exercises will be carried out in the laboratories.