ACADEMIC YEAR 2024/2025

General information	
Name of the integrated course	**ECOLOGY AND SUSTAINABILITY OF MARINE RESOURCES**
Integrated teaching modules	**Marine Ecology;** **Sustainable Fishery and Farming.**
Degree course	Science of Marine Productions and Resources – L38
Academic Year	Second year
European Credit Transfer and Accumulation System (ECTS)	12
Language	BIO/07
Period of teaching	Italian
Attendance	March-June 2024

Teacher	**e-mail address**	**phone**
Francesca Capezzuto	francesca.capezzuto@uniba.it	080-5443708
Pasquale Ricci	pasquale.ricci@uniba.it	080-54433347

Headquarters	Taranto, at the former Second Faculty of Mathematical, Physical and Natural Sciences; Via Alcide de Gasperi, (Quartiere Paolo VI) - 74123 Taranto
Virtual rooms	Microsoft Teams platform
Tutoring (time and day)	Reception with the lecturer agreed by email

Syllabus	
Learning Objectives	• To acquire knowledge on the marine ecology according to a systemic and holistic view of functioning of the marine ecosystems in which the abiotic and biotic components integrate and interact and the adaptations and specializations of marine organisms (benthos, plankton, nekton) take place with respect to the different factors and different ecosystem conditions. • To provide the basic knowledge of fisheries biology and the principles of sustainability in aquaculture starting from the concepts of fisheries science (biological resources, stocks, evaluation and management of fisheries resources) and aquaculture (farming techniques, environmental impacts and mitigation measures) to the relevant regulations in the field of marine productions. In addition, the course provides the tools for the analysis of biological characteristics of the catch, the recognition of fishing gear, aquaculture plant types and basic skills for the analysis of marine production data.
Course prerequisites	Basic knowledge in physic, chemistry, botanic, zoology, ecology

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Contents of the teaching module: **Marine Ecology** **Teacher:** **Francesca Capezzuto** **Lectures** **ECTS:** **5** **Hours:** **40**	INTRODUCTION TO THE MARINE ENVIRONMENT. The oceans: extension and volume. Physico-chemical parameters of the water. Salinity, temperature, light, pressure. Compensation depth of carbonate. Geomorphology of the marine bottom. Oceanic deposit sediment. Movement of the sea: currents, tides and wave. Comparison between marine and terrestrial ecosystems. Evolution, three-dimensionality and connectivity in the marine environment. The producers and the food chains in the marine ecosystems. ADAPTATION AND SPECIALIZATION OF THE MARINE ORGANISMS. Structure, dispersion and locomotion. Metabolism and nutrition. Density and viscosity of the marine waters and buoyancy adaptation of plankton and nekton. Main adaptation to temperature (tolerance limits), salinity (osmoregulation) and oxygen scarcity (respiratory system). Adatpation to air exposure. Adaptation to pressure and absence of light. Bioluminescence. Sound, electric and mechanic reception systems. Support structures and bioconstructions. Biotoxins in the sea. MARINE BIODIVERSITY. Measure of the biodiversity. Biodiversity gradients. Biodiversity and stability/functioning of the ecosystems. Hypotheses and models on the biodiversity conservation. Biodiversity hot-spot. Main causes of biodiversity loss. BENTHOS. Classification of the benthos. Benthic bionomics and biocenoses. Zonation of the benthos. Plans of phytal and aphytal systems. Role of the physico-chemical and biological factors. Communities of hard and soft substrates. Biocenoses of particular ecological and conservation importance. PLANKTON. Characteristics and classification of plankton: functional, dimensional and taxonomic. Distribution of the plankton. Plankton organisms. Inverse relation between size and abundance. Global distribution of the plankton. Migration of the plankton. Successions in the planktonic communities. Plankton paradox. Light, nutrients and life cycles as factors explaining the dynamic of the plankton communities. Influence of the meio-fauna to the plankton composition. Anthropogenic activities, eutrophication and algal bloom. NEKTON. Nekton organisms: characteristics and adaptations. Geographic and bathymetric distribution of the nekton. Species and populations of the nekton. Invertebrates: cefalopods and crustaceans. Cartilaginous and teleost fishes. Analysis of sexual maturity in cefalopods, crustaceans, cartilaginous and teleost fishes. Xeronekton: reptiles, birds and mammals. Life cycles, food, reproduction and behaviour. Nekton migrations. Migratory triangle of Harden-Jones. Role of nekton in the trophic web. Match-mismatch hypothesis. Direct and indirect effects in the trophic webs. Human predation on the nekton by means of fishing. “Fishing down marine food webs”. ECOSYSTEM FUNCTIONING. Life and development strategies. Evolutive constraints and environmentl drivers. Resistance forms. Supply side ecology. Primary productivity. Secondary production. Metabolism and detritus production. Particulate organic matter (POM), dissolved organic matter (DOM) and correlated processes. Microbial loop and viral shunt. Carbon flows. Pelagic-benthic coupling and benthic boundary layer. Trophic webs: grazing and dead organic matter. Bottom-up, top-down and wasp-waist controls. Key species and trophic cascading. Goods and ecosystem services. DEEP SEA ECOSYSTEMS. Physico-chemical conditions of deep sea. Biodiversity. Trofic webs and organisms. Adaptation to: low temperature, absence of light, food scarcity and low densities. Bio-ecological features across the bathymetric gradient. Biodiversity hot-spot: submarine canyons; seamounts; cold-water corals; hydrotermal vents; cold seep; whale carcass. Abyssal plan. Hypoxic and anoxic systems (dead zones). Deep Hypersalin Anoxic Basins.

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	MEDITERRANEAN. Origin. Geomorphology, hydrography and biology. Biodiversity. Anthropogenic pressures. Hypoxic and anoxic zones in the Mediterranean. Eutrophication. Marine litter. Fishery and aquacolture. Non Indigenous Species (NIS). Climate change and effects on the organisms and ecosystems. Management measures and ecosystem approach. Barcelona Convenction. EU Marine Framework Strategy Directive. ECOSISTEMS OF CORAL REEFS AND POLAR ECOSYSTEMS. Tropical coral reefs. Biodiversity. Symbiosis between zooxanthellae and corals. Limiting factors. Coral bleaching. Trophic webs and ecosystem functioning. Arctic and antarctic ecosystems. Sympagic communities. Biodiversity and endemisms. Trophic webs and ecosystem functioning.
Contents of the teaching module: **Sustainable Fishery and Farming** **Teacher:** **Pasquale Ricci** **Lectures** **ECTS:** **5** **Hours:** **40**	<u>Fisheries Biology</u> 1. Concepts of Natural Resources, Exploitation and Stocks. 2. Approaches to evaluating the exploitation of fishery resources. 3. Monitoring of biological resources: sampling designs and methodologies, data collection and analysis. 4. Analysis of biological characteristics of the catch. 5. Fishing gear: characteristics, target species, fishing effort, impacts on species, habitats and ecosystem. 6. Assessment of the state of biological resources: exploitation indicators and monospecific, multi-species and ecosystem modelling approaches. 7. Reference regulations for national and global fisheries management. <u>Aquaculture</u> 1. Aquatic organisms of interest for aquaculture. 2. Environmental impacts of aquaculture farms. 3. Quality and safety of aquaculture products. 4. Integrated multi-trophic aquaculture.

Biosafety rules for the attendance of practical activities.	The laboratories are equipped with all the facilities and management systems suitable for the analysis of marine resources in a controlled environment.

Materail for the personal study	
Books and bibliography	**Marine Ecology** • Danovaro R., 2013. Biologia marina, Biodiversità e funzionamento degli ecosistemi marini. CittàStudi Ed. DeAgostini. • Castro P., Huber M.E., 2011. Biologia Marina. McGraw-Hill. Nybakken J.W., 1977. Marine Biology. An ecological approach. Addison-Wesley Educational Publishers Inc. **Sustainable Fishery and Farming** • AA:VV. 2011. Lo Stato della pesca e dell'acquacoltura nei mari italiani. A cura di Cautadella S. e Spagnolo M. 2011 Ministero delle Politiche Agricole, Alimentari e Forestali. • Massimo Spagnolo. *Elementi di Economia e Gestione della Pesca.* Milano, Ed. Franco Angeli, 2006.

	• Micheal King. *Fisheries Biology, Assessment and Management*. Fishing News Books, Blackwell Publishing Ed.s, Oxford, 1995. FAO. 2024. *The State of World Fisheries and Aquaculture 2024* – Blue Transformation in action. Rome. https://doi.org/10.4060/cd0683en
Additional materials	During the course, students will be provided with ppt presentations and additional bibliographic references, scientific articles and links to websites related to fisheries science and aquaculture.

Work schedule			
Hours			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Individual study
300	**80**	**20**	**200**
ECTS			
12	***10***	***2***	

Teaching strategy	Lectures and seminars by means of Power Point, practical exercises in the laboratory

Expected learning outcomes	
Knowledge and understanding ability	To acquire knowledge on the factors and components of the marine environment. To acquire knowledge on the adaptation and specialization of marine organisms (benthos, plankton, nekton) with respect to different ecosystemic conditions. To acquire knowledge on the marine biodiversity, structure and functioning of marine ecosystems. To acquire knowledge on the intraspecific and interspecific processes which regulate structure and dynamic of marine populations and communities, even in relation to human activities. To know the basics of fisheries biology, aquaculture and sustainability concepts. To know and understand the assessment approaches used in marine resource management. To understand the effects of anthropogenic pressures and impacts on marine ecosystems from fisheries and aquaculture activities.
Applied knowledge and understanding ability	Application of acquired knowledge for a professional growth aimed to the management of the marine environment and its biodiversity in a eco-friendly and sustainable way. Ability to autonomously collect, process and analyse scientific data relating to fisheries catches. Ability to independently identify commercial and protected species and fishing gear. Application of parameter estimation methods inherent to stock assessments and fisheries sustainability.
Soft skills	• *Making informed judgments and choices* Acquisition of autonomy in the evaluation and interpretation of experimental data and of examined studies, functional to the application of management and conservation measures of the marine environment with respect to the various anthropogenic pressures. Contextualization of the environmental problem in question, with interpretation and evaluation of the data collected, processed and analyzed aimed at the

	preparation of experimental models. • *Communicating knowledge and understanding* Acquisition of the scientific terminology related to the marine ecology with the aim to understand the relative topics and to be able to communicate the scientifc knowledge. • *Capacities to continue learning* Acquisition of the critical and speculative capacity in dealing with the topics and issues of the marine ecology, promoting the desire of knowledge and an autonomous learning even through consultation of books, scientific pubblications, partecipation to conferences and workshops as well as exploring the web.

Assessment and feedback	
Methods of assessment	Oral examination
Evaluation criteria	• *Knowledge and understanding* Verification of the acquisition of the topics covered. In addition to the acquisition of concepts, the ability to make connections among the various marine ecosystems according to an holistic point of view is evaluated. • *Applying knowledge and understanding* Verification of the acquisition of the topics covered for the purpose of managing the marine environment and its biodiversity in an environmentally friendly and sustainable way. • *Autonomy of judgment* Knowing how to interpret experimental data and case studies as well as trends in ecological models shows maturity in the preparation and is positively judged. • *Communication skills* Knowing how to communicate the contents of marine ecology in a clear and scientifically correct way is essential to decision-making and is considered fundamental for the positive outcome of the examination. • *Capacities to continue learning* Assessment of the critical and speculative capacity in dealing with the topics and problems of marine ecology.
Criteria for assessment and attribution of the final mark	Clarity, correctness and completeness of the presentation associated with the critical and holistic sense of presenting the topics are the criteria for measuring learning and attribution of marks. The vote is expressed out of thirty. The exam is considered passed when the grade is greater than or equal to 18. Scores higher than 27/30 will be awarded to students whose papers meet all the abilities listed in the above criteria. To achieve a score of 30/30 cum laude, the student must, on the other hand, demonstrate excellent knowledge of all the topics covered during the course
Other comments	

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