APPLIED ECOLOGY

COURSE CATALOGUE 2022 / 2023

Winter semester /Bachelor level

COURSE INFORMATION	
Course name	Ecophysiology of marine organisms
Semester	III
ECTS points	7
Course status	Compulsory
Course leader	Tatjana Dobroslavić, PhD, Asst. Prof.
Department, room no.	Ćira Carića 4, D30
Phone	020/445-868
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Course assistant/associate	
Department, room no.	
Phone	
e-mail	
COURSE DESCRIPTION	
Course content	
The diverse habitats inhabited by marine organisms vary considerably in terms of biotic and abiotic factors. Successful maintenance of populations under challenging environmental conditions requires physiological adaptations. The content of the course covers the basic physiological principles and major physiological characteristics of marine organisms, particularly fishes and mollusks. Teaching materials and worked topics are used to introduce students to the physiological adaptations of organisms to changing environmental conditions. The lectures are structured according to the following guidelines: basic physico-chemical and biological characteristics of marine habitats; interaction aquatic organism - aquatic environment; physiology of marine organisms; hormonal balance and physiological adaptations of organisms in different aquatic habitats.	
Learning outcomes	

Upon successful completion of this course, students will be able to:

- describe the basic physiological and biochemical processes of marine organisms

- describe the adaptations of organisms to various biotic and abiotic parameters

- explain the basic physiological principles of marine organisms

- describe the physiological principles of functioning of selected marine organisms

- relate changes in ecological conditions to the functioning of the organism in the aquatic environment.

TEACHING MODE	
☒Lectures	☒Consultations
☐Seminars and workshops	☒Laboratory
☒Exercises	☐Field work
☐Independent assignments	☒Mentoring
☒Multimedia and internet	☐Exams
☐Distance learning	

EXAMINATION METHOD	
☒ Oral	Other:
☒ Written	Click here to enter text.
☒ Partial exam	

READING	
Compulsory reading	
1.	Evans, D.H., Claiborne, J.B. 2005. The Physiology of Fishes, Third Edition. CRC Press, pp. 616 (selected chapters)
2.	Lucu, Č. (2012). Fiziologija prilagodbe životinja u vodenom okolišu. Profil, pp. 244
3.	Prosser, C.L. 1991. Comparative Animal Physiology, Fourth Edition - Environmental and Metabolic Animal Physiology. Willey & Sons, pp. 466 (selected chapters)
Optional reading	
1.	Randall, D., Burggren, W., French, K. 2001. Eckert Animal Physiology. Mechanisms and adaptation. W. H. Freeman, pp. 752

2.	Willmer, P., Stone G., Johnston, I. 2005. Environmental Physiology of Animals. Blackwell publishing, pp. 779
3.	Gosling, E. 2008. Bivalve Molluscs: Biology, Ecology and Culture. John Wiley & Sons, pp. 456
4.	Alday-Sanz, V. 2010. The Shrimp Book. Independent Publishers Group, pp. 920
5.	Scientific papers in consultation with the course leader and according to the specific interests of the students.

LIST OF TOPICS

No.		Hours		
		L	**E**	**S**
1.	**Biological molecules**	3	0	0
2.	**Enzymes**	2	0	0
3.	**Cell metabolism**	3	0	0
4.	**Structure of the cell membrane - active and passive transport**	3	1	0
5.	**Ion and water channels**	3	1	0
6.	**Nervous system**	3	2	0
7.	**Muscular system**	3	2	0
8.	**Hormones and hormonal regulation**	4	2	0
9.	**Stres**	3	1	0
10.	**Gas exchange and respiration**	3	1	0

11.	**Basic principle of adaptations**	4	1	0
12.	**Temperature adaptation**	3	2	0
13.	**Marine environment**	3	1	0
14.	**Shorelines and estuaries**	3	1	0
15.	**Special aquatic habitats**	2	0	0
	TOTAL HOURS	**45**	**15**	**0**

OTHER RELEVANT INFORMATION

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COURSE INFORMATION	
Course name	Aquaculture technology
Semester	
ECTS points	3
Course status	Elective
Course leader	Marina Brailo, PhD, Assistant professor
Department, room no.	Department of Applied Ecology, Ćira Carića 4, D29
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Course assistant/associate	Click here to enter text.
Department, room no.	Click here to enter text.
Phone	Click here to enter text.
e-mail	Click here to enter text.

COURSE DESCRIPTION
Course content
The course deals with the basics of aquaculture technology and the historical overview of technology development. Students get acquainted with the water characteristics and the basics of hydraulics. An overview of algae, bivalves, cephalopods, crabs, echinoderms and fish farming is given as well as various production systems (pond, lagoon, flow-through, cage, recirculated) are included. Students will learn basic characteristics of equipment (pumps, filters...) for aquaculture facilities and the basics of nutrition and reproduction of farmed organisms. Design, construction, automation and monitoring of aquaculture farming systems will be discussed. Classes are carried out through lectures, exercises and seminars that follow the topics of lectures. Active participation of students in the teaching process is achieved by independent task solving and the presentation of seminars with a chosen topic.
Learning outcomes
After successful mastering of a course, students will be able to:

- identify the characteristics of water as a growing medium and maintain its optimal quality with respect to the farmed species
- apply different technologies for farming of various aquatic organisms
- select and handle the appropriate equipment for farming of aquatic organisms
- design and sketch an aquaculture facility
- plan work activities in an aquaculture facility

TEACHING MODE

☒Lectures	☒Consultations
☒Seminars and workshops	☒Laboratory
☒Exercises	☒Field work
☒Independent assignments	☒Mentoring
☒Multimedia and internet	☒Exams
☐Distance learning	

EXAMINATION METHOD

☐ Oral	Other:
☒ Written	
☒ Partial exam	

READING

Compulsory reading

4.	Landau, M. 1992. Introduction to Aquaculture. New York, John Wiley & Sons, Inc., 440 pp.
5.	Timmons, M. B., Losordo, T. M. 1994. Aquaculture Water Reuse Systems: Engineering, Design and Management. Elsevier. Amsterdam, 333 pp.
6.	Avault, J.W. 1998. Fundamentals of Aquaculture. A step-by-step guide to commercial aquaculture. AVA Publishing Company Inc., 889 pp.
7.	Lekang O.-I. 2007. Aquaculture Engineering. Oxford, Blackwell Publishing, 340 pp.
8.	Tidwell, J. H. 2012. Aquaculture Production Systems. Oxford, Wiley- Blackwell, 421 pp.

Optional reading

6.	Timmons, M. B., Ebeling, J. M. 2013. Recirculating Aquaculture, Third Edition, Ithaca Publishing Company, NY, 788 pp.
7.	Stickney R. 1994. Principles of aquaculture. John Willey and sons Inc. 502 pp.
8.	Lucas, J. S., Southgate. P. C. 2012. Aquaculture: Farming Aquatic Animals and Plants, second edition, Wiley-Blackwell, Chichester, 629 pp.
9.	Articles from scientific and professional journals agreed with the course leader according to special interests of the students

LIST OF TOPICS

No.		Hours		
		L	**E**	**S**
16.	Historical overview of aquaculture technology development	**2**	**1**	**1**
17.	Water characteristics and basics of hydraulics	**2**	**1**	**1**
18.	Overview of algae farming	**2**	**1**	**1**
19.	Overview of bivalves farming	**2**	**1**	**1**
20.	Overview of cephalopods farming	**2**	**1**	**1**
21.	Overview of crabs farming	**2**	**1**	**1**
22.	Overview of echinoderms farming	**2**	**1**	**1**
23.	Overview of fish farming	**2**	**1**	**1**
24.	Basic design and construction of a pond system	**2**	**1**	**1**
25.	Basic design and engineering of flow-through system	**2**	**1**	**1**

26.	Basic design and construction of cage system	**2**	**1**	**1**
27.	Basic design and construction of recirculated system	**2**	**1**	**1**
28.	Basic characteristics of equipment for aquaculture facilities	**2**	**1**	**1**
29.	Technological basics of nutrition of farmed organisms	**2**	**1**	**1**
30.	Basics of reproduction technology	**2**	**1**	**1**
	TOTAL HOURS			

OTHER RELEVANT INFORMATION

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COURSE INFORMATION	
Course name	Aquaristics
Semester	III. (Winter)
ECTS points	3
Course status	Elective
Course leader	doc. dr. sc. Kruno Bonačić
Department, room no.	Department of applied ecology, D31
Phone	+385 20 445 898
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Course assistant/associate	izv. Prof. dr. sc. Marijana Pećarević
Department, room no.	Department of applied ecology, D28
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COURSE DESCRIPTION
Course content
The course includes different topics, from setting up aquariums and equipment requirements to maintaining aquariums and keeping plant and animal species. The aquarium as a self-contained ecosystem in the context of biological processes as well as physical and chemical properties of water will be covered. The circulation of matter in the system will also be addressed, with special emphasis on the nitrogen cycle. The importance and methods of monitoring of physico-chemical parameters in the aquarium, as well as adapting processes of the species will be explained. During the practical course, students will equip, scape, stock and maintain their own freshwater aquariums and learn how to breed common freshwater species in captivity.
Learning outcomes

After the completed course, students will be able to: explain the basic concepts of setting up and maintaining an aquarium, list the filtration methods and the necessary equipment for the aquarium, describe the methods of keeping live organisms and adaptation of species to the aquarium, apply gained knowledge and plan, set up and maintain their own aquarium.

TEACHING MODE	
☒Lectures	☒Consultations
☐Seminars and workshops	☒Laboratory
☒Exercises	☐Field work
☒Independent assignments	☐Mentoring
☒Multimedia and internet	☒Exams
☐Distance learning	

EXAMINATION METHOD	
☒ Oral	Other:
☒ Written	Click here to enter text.
☒ Partial exam	

READING

Compulsory reading

1.	Walstad, D.L. , Ecology of the planted aquarium: A Practical manual and ScientificTreatise for the Home Aquarist, Echinodorus Publishing, Chapel Hill, North Carolin, 2013., pp. 1-193
2.	Click here to enter text.
3.	Click here to enter text.
4.	Click here to enter text.

5.	Click here to enter text.
Optional reading	
1.	Click here to enter text.
2.	Click here to enter text.
3.	Click here to enter text.
4.	Click here to enter text.
5.	Click here to enter text.

LIST OF TOPICS

No.		Hours		
		L	**E**	**S**
1.	Introduction	2	3	0
2.	Equipment for setting up an aquarium	2	3	0
3.	Aquarium substrates	2	3	0
4.	Mechanical filtration	2	3	0
5.	Biological filtration	2	3	0
6.	Aquarium lighting	2	3	0
7.	Physical water parameters	2	3	0
8.	Chemical water parameters	2	3	0
9.	Aquarium maintenance	2	3	0

10.	Acclimation of organisms to aquarium conditions	2	3	0
11.	Aquarium plants	2	3	0
12.	Managing algae in an aquarium	2	3	0
13.	Aquarium animals	2	3	0
14.	Feeding aquarium organisms	2	3	0
15.	Identifying and treating diseases of aquarium organisms	2	3	0
	TOTAL HOURS	**30**	**45**	**0**

OTHER RELEVANT INFORMATION

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COURSE INFORMATION	
Course name	Marine Fishery
Semester	V.
ECTS points	6
Course status	Compulsory
Course leader	Prof.dr.sc Branko Glamuzina
Department, room no.	Ćira Catića 4, B
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Course assistant/associate	Luka Glamuzina,
Department, room no.	Laboratory for mariculture, Bistrina, Ston
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e-mail	Luka.glamuzina@unidu.hr

COURSE DESCRIPTION
Course content
Knowledge of the basics of marine fishery in the world, the EU and the Republic of Croatia is acquired. The historical reasons for the decline of traditional fisheries, as well as the beginnings and development of various models of fishery management are elaborated. Fisheries are compared with traditional inland agronomic activities. The status of marine fisheries in the world is being studied according to the 2010-2020 FAO analyzes. European, Mediterranean and Croatian sea fisheries are covered in detail, especially from the aspect of employment in other EU countries. According to the principle of "Case study", the main types of EU marine fisheries important for our students are processed: cod, flatfish, small blue fish, and mussels, and some other potentially important species. The ecological, economic and market aspects of sea fishing will also be addressed. Curriculum: 1. Definition, goals and history of marine fisheries 2. History and state of marine bioresources; Fisheries and principles of livestock management 3. Historical development and perspectives of bio-stock management 4. The state of marine fisheries in the world 5. Division by method of catching - types of fishing 6. Croatian fisheries in the EU: the most important species 7. in the EU 8. Economy, finance and management in marine fisheries 9. Perspectives of marine fisheries in the Republic of Croatia and EU-strategic plans.
Learning outcomes

After successfully mastering the course, students will be able to:

1. Explain the basic concepts and elaborate the status of sea fishing in the world, the EU and the Republic of Croatia.

2. Describe the characteristics and limitations of traditional fisheries and the developmental aspects of modern capture-based aquaculture — examples of tuna and eel.

3. Describe and compare different fishing industries and fishing techniques.

4. Know the state of the Republic of Croatia in sea fishing and the characteristics of the main Croatian fishing stocks.

5. Discuss the perspectives of the EU and the Republic of Croatia in marine fisheries, know the strategic nationals and EU plans.

6. Explain and discuss the positive and negative consequences of modern sea fishing from the ecological aspect

TEACHING MODE	
☒Lectures	☒Consultations
☒Seminars and workshops	☒Laboratory
☒Exercises	☒Field work
☐Independent assignments	☐Mentoring
☒Multimedia and internet	☒Exams
☐Distance learning	

EXAMINATION METHOD	
☒ Oral	Other:
☒ Written	Click here to enter text.
☒ Partial exam	

READING	
Compulsory reading	
9.	Cetinić, P. 2007. Introduction on Marine Fishery. Learning material.

10.	FAO, 2010-2020. The State of World Fishery and Aquaculture (SOFIA). www.fao.org
11.	http://www.fao.org/fishery/en: different materials selected by student interest
Optional reading	
10.	Scientific and professional articles and studies
11.	Fishery management plans of different EU countries and EU Common Fishery policy

No.		Hours		
		L	**E**	**S**
31.	History of marine fishery	3	1	1
32.	Recent status of marine fisheries and marine resources	3	1	1
33.	Marine fisheries in Europe and the EU	3	1	1
34.	Mediterranean marine fishery	3	1	1
35.	Marine fishery in the Adriatic Sea	3	1	1
36.	Types of sea fishing	3	1	1
37.	Coastal and estuarine fishery	3	1	1
38.	Offshore fishery	3	1	1
39.	Fishing techniques and tools	3	1	1
40.	Characteristics of the sector and important species in Croatian marine fisheries	3	1	1
41.	Tuna and eel fisheries - world and EU policy	3	1	1
42.	Fishing for small pelagic fish	3	1	1

43.	Fishing for crustaceans, shellfish and other marine organisms	3	1	1
44.	Processing and marketing of seafood products	3	1	1
45.	EU fisheries policy and Croatian strategic documents	3	1	1
	TOTAL HOURS	**45**	**15**	**15**

OTHER RELEVANT INFORMATION
Participation in field activities on fishing boats and active work in exercises with coastal fishing gear is mandatory.

Course name	General Biology
Semester	Winter
ECTS points	6
Course status	Compulsory
Course leader	Josip Mikuš, PhD, Associate professor
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Course assistant/associate	Karlo Maškarić, Master in Ecology and Nature Protection
Department, room no.	D25
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COURSE DESCRIPTION

Course content

Course objective: introduction to the basic postulates of the structure and functioning of the living world and its relationship with an inanimate environment. Through the course student will be able to comprehend a wide range of events and relationships between the molecular level of matter and energy transport and the transfer of hereditary information across the cell, tissue and body levels to the population and all taxonomic categories of the living world and their relation to the ecosystem environment and the whole biosphere. In order to better understand other subjects in Aquaculture, the student has to understand the essential elements of cellular structure and function, basic physiological processes, organization and structure of the living world in all present-day domains and kingdoms with an emphasis on the structure and function of organic systems.

Teaching is organized through lectures, exercises and independent work of students through interactive lectures and presentations. Students have been facilitated by distance learning.

Lectures are mandatory as well as exercises that accompany the topic of lectures. Students are required to pass a written exam in the exercise. The colloquium can be passed through four written tests at the completion of individual units during the semester.

Learning outcomes

The General Biology course enables students to acquire the basic knowledge needed to understand the contents of more advanced courses. After successfully mastering the subject, the student will know the basics of biology, morphology, anatomy, physiology, and reproduction of plant and animal organisms. Student will understand mutual phylogenetic connections and the overall evolution of life. Based on the knowledge of the role of individual groups and their structural and functional properties, the student will understand the complexity of the living world and the ecological linkage and condition of all living beings. After the practical exercises from the practical part of the course, the student will be able to work independently in the biological laboratory, use the microscope, and dissect and study the live material and the fixed material.

TEACHING MODE	
☒Lectures	☒Consultations
☐Seminars and workshops	☒Laboratory
☒Exercises	☐Field work
☒Independent assignments	☐Mentoring
☒Multimedia and internet	☒Exams
☒Distance learning	

EXAMINATION METHOD	
☒ Oral	Other:
☒ Written	Click here to enter text.
☒ Partial exam	

READING	
Compulsory reading	
12.	Raven, P. H., Johnson, G. B., Mason, K. A., Losos, J., Duncan, T. 2020. Biology (12th edition). McGraw-Hill Higher Education, 1472 pp.
Optional reading	
12.	Purves, K. W., Sadava, D., Orians, G. H., Craig Heller, H. 2004. Life. The Science of Biology. Sinauer Associates, 1120 pp.
13.	Dictionary of Biology 1996. Third edition. Oxford University press

LIST OF TOPICS

No.		Hours		
		L	**E**	**S**

46.	Biology – the science of life; Sub-disciplines of biology; Research methods in biology; Overview on the history of biology.	3	2	-
47.	General functional and structural characteristics of living organisms; Levels of organization of life.	3	2	-
48.	Life and chemistry; Small and large molecules; Basic evolution.	3	2	-
49.	Cell – a basic structural unit of life; Prokaryotic and eukaryotic cell; Plant and animal cell.	3	2	-
50.	Cell structure and function; Cell membrane; Cell organelles; Cell physiology basics: chloroplast and photosynthesis; mitochondria and cellular respiration.	3	2	-
51.	The cell nucleus; DNA and RNA: structure and function; DNA replication; Ribosomes and protein synthesis; Cell cycle, mitosis and meiosis.	3	2	-
52.	Basic biological systematics; Carolus Linnaeus and binomial nomenclature; Viruses; Domains Archaea and Bacteria.	3	2	-
53.	Domain Eucarya: autotrophic protists (Phycobionta: Euglenophyta, Pyrrophyta, Chrysophyta; Chlorophyta, Phaeophyta, Rhodophyta)	3	2	-
54.	Heterotrophic protists; Fungi (Mycota); Plants (Bryophyta, Pteridophyta, Cormobionta); Plant tissues.	3	2	-
55.	Animal cell types; Tissues, organs and organ systems; Integumentary system.	3	2	-
56.	Skeletal system; Muscular system.	3	2	-
57.	Nervous system; Digestive system.	3	2	-
58.	Respiratory system; Cardiovascular system.	3	2	-
59.	Endocrine system; Excretory system; Reproductive system; Embryonic and postembryonic development.	3	2	-

60.	Animal behavior; Taxonomic classification of living organisms.	3	2	-
	TOTAL HOURS	**45**	**30**	**0**

OTHER RELEVANT INFORMATION
Click here to enter text.

Summer semester / Bachelor level

COURSE INFORMATION	
Course name	Fish Ecology
Semester	III
ECTS points	3
Course status	Compulsory
Course leader	Prof. Vlasta Bartulović, PhD
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Phone	+385 (0)20 445 863
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Course assistant/associate	
Department, room no.	
Phone	
e-mail	

COURSE DESCRIPTION
Course content
The aim of the course is to introduce students with fish life habitats, their diversity, a variety of habitats and relationships, specific examples of life forms and strategies, morphological and physiological adaptations and behaviors. Students will also be familiar with the degradation of habitats and other factors affecting fish populations. Teaching is organized in the form of lectures, exercises and seminars. Exercises and seminars follow the themes of lectures.
Learning outcomes
After completing this course, students will be able to: 1. recognize the basic ecological categories of the aquatic environment and the basic taxonomic division of the fish with the main characteristics. 2. link the basic biotic and abiotic features of the marine environment with a special life form. 3. determine the trophic categories, basic ecological hypotheses related to the problem.

4. determine the basics of the zoogeography of fish, distinguish the basic zoogeographic regions and the most important provinces of the same.

5. describe the basics of fish reproduction and their different reproductive strategies.

6. describe the basics of fish behavior.

7. divide the basic coastal habitats, their characteristics and their structure.

TEACHING MODE	
☒Lectures	☒Consultations
☒Seminars and workshops	☒Laboratory
☒Exercises	☐Field work
☒Independent assignments	☒Mentoring
☒Multimedia and internet	☒Exams
☐Distance learning	

EXAMINATION METHOD	
☒ Oral	Other:
☒ Written	Click here to enter text.
☒ Partial exam	

READING

Compulsory reading

13.	Wootton, R.J. 1996. Fish ecology. Springer-Science+Business Media, B.V.
14.	Diana, J.S., 2003. Biology and ecology of fishes. Cooper Publishing Group, 496p
15.	Jardas, I., 1996. Jadranska ihtiofauna. Školska knjiga, Zagreb, 533p

Optional reading

1.	Moyle, P.B. and Cech, J.J.Jr, 1996. Fishes. An introduction to ichthyology. Prentice Hall, New Jersey, 589p.

3.	Scientific and professional papers in accordance with student interests			
LIST OF TOPICS				
No.		**Hours**		
		L	**E**	**S**
61.	Properties of water	2		
62.	Diversity of fishes - the Agnatha	2	2	
63.	Diversity of fishes - Chondrichthyes	2	2	
64.	Diversity of fishes - Osteichthyes	2	2	
65.	Effects of abiotic environmental identities on distribution	2		
66.	Biotic factors and the structure of fish communities	2		
67.	Migration, territoriality and shoaling in fishes	2		
68.	Feeding and Growth	2	2	
69.	Reproduction	2	2	

70.	Population dynamics	2		
71.	Habitats. Coastal habitats	2		
72.	Special habitats	2		
73.	Zoogeography of marine fish	2		
74.	Environmental degradation	2		
75.	Fisheries and aquaculture	2		
	TOTAL HOURS	**30**	**10**	**5**

OTHER RELEVANT INFORMATION
Click here to enter text.

COURSE INFORMATION	
Course name	Biomedical exploration of the sea
Semester	Spring (IV.)
ECTS points	3
Course status	Elective
Course leader	assoc. prof. Sanja Tomšić
Department, room no.	Department of applied ecology
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Course assistant/associate	Click here to enter text.
Department, room no.	Click here to enter text.
Phone	Click here to enter text.
e-mail	Click here to enter text.

COURSE DESCRIPTION

Course content

This course will provide a detailed introduction to marine natural products (MNPs). Integral themes encompass natural organic compounds produced by marine organisms as a source of medicines, the origin of modern and traditional medicines widely used in contemporary therapies. Furthermore, the diversity of interactions among marine organisms belonging to various trophic levels, their chemical communication and hierarchical relationships, followed by ecological, reproductive and nutritional aspects of particular species or groups of organisms. Finally, interdisciplinary (biology-chemistry-ecology) analysis of interactions in communities and their applications in aquaculture, cell culture and metagenomics will be discussed. The course will summarize principle marine organisms that have been studied as a source of natural products and how they are collected, processed, and screened for biological activities.

Learning outcomes

With successful completion of the course, students will be able to:

- differentiate and compare available strategies and culture methods for valuable marine species used in biomedical research

- discus and reference chemical interactions in nature and how they affect abundance and distribution of organisms and biochemicals

- recognize how these interactions have evolved and the biosynthetic origin of the molecules mediating the interactions

- experiment with reproductive biology and early developmental stages, growth and development, as well as adaptations in captivity

- use experimental data to select valuable species for aquacultre and production of MNPs.

TEACHING MODE	
☒Lectures	☒Consultations
☒Seminars and workshops	☒Laboratory
☒Exercises	☒Field work
☒Independent assignments	☒Mentoring
☒Multimedia and internet	☒Exams
☐Distance learning	

EXAMINATION METHOD	
☒ Oral	Other:
☒ Written	Click here to enter text.
☐ Partial exam	

READING	
Compulsory reading	
16.	Le Gal, Y., Ulber, R. 2005. Marine Biotechnology II. Springer Berlin Heidelberg New York. Str. 261
17.	Se-Kwan Kim 2013. Marine Microbiology. Bioactive Compounds and Biotechnological Applications. Wiley-VCH Verlag GmbH & Co. str. 549
Optional reading	
14.	Students will be guided by teaching staff to use internet sources (PDF-documents, research papers) in accordance with assigned themes and seminar topics and/or specific interest of a particular student.

LIST OF TOPICS				
No.		Hours		
		L	E	S
76.	Blue biotechnology	2	1	
77.	Marine invertebrates – a source of valuable chemicals	2	1	
78.	Marine chemical communication	2	1	
79.	Primary and secondary products of metabolism	2	1	
80.	Hiearchy in the community	2	1	
81.	Review of taxonomically important classes	2	1	
82.	Sponges	2	1	
83.	Cnidarians	2	1	
84.	Echinoderms and molluscs	2	1	
85.	Algae	2	1	
86.	Microbiome	2	1	
87.	Chemical ecology	2	1	
88.	Marine biomaterials	2	1	
89.	Bio-engineering	2	1	

90.	Metagenomics	2	1	
91.				
92.				
93.				
	TOTAL HOURS	**30**	**15**	

OTHER RELEVANT INFORMATION
Click here to enter text.

COURSE INFORMATION	
Course name	Plankton ecology

Semester	Spring
ECTS points	3
Course status	Elective
Course leader	Josip Mikuš, PhD, Associate professor
Department, room no.	D25
Phone	020/445864
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COURSE DESCRIPTION

Course content

A brief history of plankton research and the most famous expeditions. General characteristics of plankton. Plankton as a living form (virioplankton, bacterioplankton, phytoplankton, zooplankton). Autotrophic, heterotrophic and mixotrophic organisms. Methods of sampling and determination of phytoplankton (abundance, biomass, primary production). Phytoplankton taxonomy. Phytoplankton in the Mediterranean and the Adriatic Sea. Toxic phytoplankton species. Pigments. Zooplankton systematics. Zooplankton research methods. Population density and biomass. Interspecific relationships. Spatial and temporal distribution of dominant zooplankton groups. The main characteristics of zooplankton in the Mediterranean and the Adriatic Sea. Physical and chemical factors affecting spatial and temporal distribution of plankton. Trophic relationships in the pelagic zone. Ballast water transport of zooplankton.

Learning outcomes

After successfully completing the course, the student will be able to use general and specific knowledge about the ecology of plankton, theoretical basics, terminology and functionality of the marine ecosystem. It will provide knowledge on the application of ecological principles and principles in the protection of natural resources and the importance of maintaining the biodiversity of pelagic zone in the ocean and sea. Specific chapters provide access into practical approaches to study and exploitation of marine ecosystems for aquaculture and other purposes.

TEACHING MODE

☒Lectures ☒Seminars and workshops ☒Exercises ☐Independent assignments ☒Multimedia and internet ☒Distance learning	☒Consultations ☒Laboratory ☒Field work ☒Mentoring ☒Exams

EXAMINATION METHOD	
☒ Oral ☒ Written ☒ Partial exam	Other: Click here to enter text.

READING

Compulsory reading

18.	Castellani, C., Edwards, M. 2017. Marine plankton. A practical guide to Ecology, Methodology, and Taxonomy. Oxford University Press, Oxford, 694 pp.
19.	Barnes, R. S. K., Huges, R. N. 1982. An introduction to Marine Ecology, Blackwell Science, UK, London, 351 pp.

Optional reading

15.	Newell, G. E., Newell, R. C. 1963. Marine Plankton. A practical guide. Hutchinson Educational, 221 pp.
16.	Todd, C. D., Laverack, M. S., Boxshall, G. A. 1996. Coastal Marine Zooplankton. A practical manual for students. 2nd ed. Cambridge University Press, 106 pp.

LIST OF TOPICS

No.		Hours		
		L	**E**	**S**
94.	An introduction with a brief history of plankton research.	2	1	-
95.	General characteristics of plankton.	2	1	-

96.	Bacterioplankton.	2	1	-
97.	Methods of sampling and determination of phytoplankton.	2	1	-
98.	Phytoplankton productivity, Phytoplankton taxonomy.	2	1	-
99.	Phytoplankton of the Mediterranean and the Adriatic Sea.	2	1	-
100.	Toxic phytoplankton species.	2	1	-
101.	Zooplankton Methodology: sampling and analysis. Zooplankton systematics.	2	1	-
102.	Zooplankton population density and biomass.	2	1	-
103.	Zooplankton interspecific relationship.	2	1	-
104.	Spatial and temporal distribution of dominant zooplankton groups.	2	1	-
105.	Physical and chemical factors affecting spatial and temporal distribution of plankton.	2	1	-
106.	The main characteristics of zooplankton in the Mediterranean and the Adriatic Sea.	2	1	-
107.	Trophic relationship in the pelagic zone.	2	1	-
108.	Ballast water transport of plankton.	2	1	-
	TOTAL HOURS	**30**	**15**	**0**
OTHER RELEVANT INFORMATION				

COURSE INFORMATION

Course name	Aquaculture and Environment
Semester	Summer
ECTS points	3
Course status	Compulsory
Course leader	Ana Bratoš Cetinić, PhD, Asst. Prof.
Department, room no.	D 32
Phone	020445787
e-mail	abratos@unidu.hr
Course assistant/associate	Sanja Grđan, MA in mariculture
Department, room no.	D29
Phone	020445732
e-mail	sanja.grdjan@unidu.hr

COURSE DESCRIPTION

Course content

Basic and applied biological knowledge related to the environmental impact of aquaculture facilities and operations. The objective is to acquire the knowledge necessary for successful production in typical Mediterranean farms in accordance with the principles of sustainable fish and shellfish production.
Impact of aquaculture on the environment: physical and chemical, landscape, analysis of negative impacts of different facilities: tuna cages and cages for sea bass and sea bream, shellfish farms, hatchery.
Aquaculture as a vector of non-native species and various pathogens. Chemical pollution monitoring. Effects on seagrass meadows and plankton communities. Management of farms. Introduction of new species and potential risks to native ecosystems and species.

Learning outcomes

Students will know the basics of aquaculture in the marine environment. Students will be able to relate the basic biological, physical and chemical characteristics to the technological requirements of sustainable aquaculture production from the perspective of reducing negative impacts on the environment. Students will acquire theoretical and practical knowledge on how to actively present aquaculture as a positive rural activity and a good representation of its negative impacts on the public, as well as how to resolve potential conflicts between different users of the marine environment.

TEACHING MODE	
☒Lectures ☒Seminars and workshops ☒Exercises ☒Independent assignments ☒Multimedia and internet ☐Distance learning	☒Consultations ☒Laboratory ☒Field work ☒Mentoring ☐Exams
EXAMINATION METHOD	
☒ Oral ☒ Written ☒ Partial exam	Other: Click here to enter text.
READING	
Compulsory reading	
20.	Black, D.K., 2001. Environmental Impacts of Aquaculture. Blackwell; 1 edition (January 8, 2001). Pp 320
21.	Pillay, TVR., 2004. Aquaculture and the Environment. Perendale Publishers. Pp. 189.
22.	FAO (2009) Environmental impact assessment and monitoring in aquaculture. FAO Fisheries and Aquaculture Technical Paper. No. 527. Rome, FAO. 675p
23.	IUCN (2007). Guide for the Sustainable Development of Mediterranean Aquaculture. Interaction between Aquaculture and the Environment. IUCN, Gland, Switzerland and Malaga, Spain. 107 p
24.	IZOR LabDU (2004) STUDIJA UTJECAJA NA OKOLIŠ ZA ZAHVAT MARIKULTURE NA PODRUČJU AKVATORIJA MALOSTONSKOG ZALJEVA I MALOG MORA (STRATEŠKA PROCJENA UTJECAJA NA OKOLIŠ)
Optional reading	
17.	Wurts WA (2000) Sustainable Aquaculture in the Twenty-First Century Reviews in Fisheries Science, 8(2): 141-150

18.	MZOIP, IZOR (2012) Početna procjena stanja i opterećenja morskog okoliša hrvatskog dijela Jadrana. 111p

LIST OF TOPICS

No.		Hours		
		L	**E**	**S**
109.	Introduction; basics of water environment; hidrology.	**2**	**1**	**1**
110.	Inland waters	**2**	**1**	**1**
111.	Marine Environment	**2**	**1**	**1**
112.	Interactions between aquaculture and the environment	**2**	**1**	**1**
113.	Marine farms - ecological consideration	**2**	**1**	**1**
114.	Environmental impact assessment - legal framework and studies	**2**	**1**	**1**
115.	Aquaculture farms in the Mediterranean and in Europe; National Strategic Development Plan for Aquaculture	**2**	**1**	**1**
116.	The impact of climate change on aquaculture	**2**	**1**	**1**
117.	Domestication of farmed organisms	**2**	**1**	**1**
118.	Introduction of non-native species into aquaculture	**2**	**1**	**1**
119.	Capture of wild stocks for aquaculture (spat/fry and juveniles)	**2**	**1**	**1**
120.	Feed ingredients in the environment	**2**	**1**	**1**

121.	Organic matter in wastewater	**2**	**1**	**1**
122.	Transmission of pathogens; Therapeutic and other products	**2**	**1**	**1**
123.	Multitrophic integrated marine farming	**2**	**1**	**1**
			30	**15**

COURSE INFORMATION

Course name	Marine mammal ecology
Semester	Spring
ECTS points	3
Course status	Elective
Course leader	Prof. Vlasta Bartulović, PhD
Department, room no.	D 33
Phone	+385 (0)20 445 863
e-mail	vlasta@unidu.hr
Course assistant/associate	
Department, room no.	
Phone	
e-mail	

COURSE DESCRIPTION

Course content

The aim of the course is to introduce students with the general characteristics of marine mammals: their evolution, systematics, anatomy, physiology and life cycle. Also, students will be familiar with the social organization and behavior of marine mammals, the relationship between human and sea mammals and the protection of endangered species. Students will be familiar with mammalian species that permanently or occasionally inhabit the Adriatic. The course is organized in the form of lectures and exercises that are designed in the form of student seminars and follow the themes of lectures.

Learning outcomes

After completing this course, students will be able to:

1. Describe the evolution of marine mammals.

2. Identify and classify marine mammals.

3. Explain the anatomy, physiology and life cycle of marine mammals.

4. Describe the diet and geographic distribution of particular groups.

5. Discussing the social organization among marine mammals, their life cycle and the relationship between humans and marine mammals 6. Discuss the threats and the measures for protection of marine mammals

TEACHING MODE	
☒Lectures ☒Seminars and workshops ☒Exercises ☒Independent assignments ☒Multimedia and internet ☐Distance learning	☒Consultations ☐Laboratory ☐Field work ☒Mentoring ☒Exams

EXAMINATION METHOD	
☒ Oral ☒ Written ☒ Partial exam	Other: Click here to enter text.

READING	
Compulsory reading	
25.	E.C.M. Parsons, 2012, An Introduction to Marine Mammal Biology and Conservation 1st Edition; Jones & Bartlett Learning; 1 edition
Optional reading	
1.	Evans, P.G.H. 1987. The natural history of whales and dolphins. Facts on file publications.
2.	Riedman, M. 1990. The Pinnipeds. Seals, Sea Lions and Walruses. University of California Press
3.	Scientific and professional papers in accordance with student interests

LIST OF TOPICS		
No.		**Hours**

		L	E	S
124.	Marine mammal evolution.	2		1
125.	Marine mammal classification and diversity	2		1
126.	Adaptation to a marine environment	2		1
127.	Underwater sound	2		1
128.	Polar bears – ecology and status	2		1
129.	Otters - ecology and status	2		1
130.	Sirenians - ecology and status	2		1
131.	Pinnipeds - ecology and status	2		1
132.	Mysticeti: the baleen whales - ecology and status	2		1
133.	Odontoceti: the toothed whales - ecology and status	2		1
134.	Delphinidae: the oceanic dolphins	2		1
135.	Humans and marine mammals	2		1

136.	Threats to cetaceans and pinnipeds	2		1
137.	Marine mammal protection	2		1
138.	Marine mammals in the Adriatic Sea	2		1
	TOTAL HOURS	**30**		**15**

OTHER RELEVANT INFORMATION
Click here to enter text.