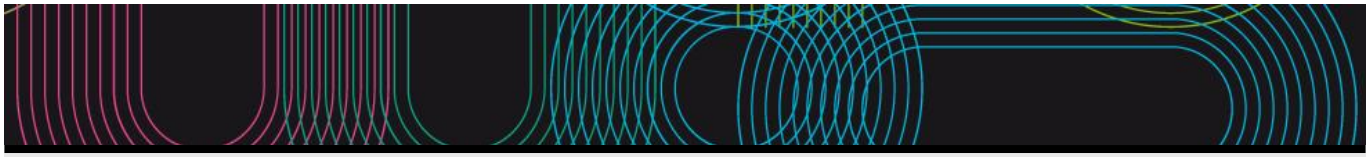

(*)Facultade de Bioloxía

Presentación

http://bioloxia.uvigo.es/en/faculty/presentation

Dean Team

(*)
http://bioloxia.uvigo.es/gl/facultade/equipo-decanal

Web

http://bioloxia.uvigo.es/en/

Máster Universitario en Biología Marina

Subjects

Year 1st

Code	Name	Quadmester	Total Cr.
V02M098V01101	The Marine Environment: Physical Oceanography	1st	3
V02M098V01102	Marine Botany	1st	3
V02M098V01103	Marine Zoology	1st	3
V02M098V01104	Marine Microbiology	1st	3
V02M098V01105	Marine Ecology	1st	3
V02M098V01106	Physiology of Marine Organisms	1st	6
V02M098V01107	Molecular Basis of Adaptation to the Marine Environment	1st	3
V02M098V01108	Techniques to Study Marine Organisms	1st	3
V02M098V01109	Experimental Design and Information Resources	1st	3
V02M098V01201	Sampling Techniques for Identification of Marine Organisms and Communities	2nd	6
V02M098V01202	Cartography, GIS and Remote Sensing	2nd	3
V02M098V01203	Environment Management: Socio-economics, Environmental Education and Legislation	2nd	3

V02M098V01204	Conservation Biology	2nd	3
V02M098V01205	Genetic Diversity and its Application to Study of Marine Organisms	2nd	6
V02M098V01206	Marine Pollution and Ecotoxicology	2nd	3
V02M098V01207	Biology of Exploited and Potentially Exploitable Species	2nd	6
V02M098V01208	Evaluation and Exploitation of Coastal Resources	2nd	3
V02M098V01209	Fishery and Exploitation of Fishery Products	2nd	3
V02M098V01210	Spatial Statistics and Modelling	2nd	3
V02M098V01211	Invasive Species and Fouling	2nd	3
V02M098V01212	Biology of the Development of Marine Organisms	2nd	3
V02M098V01213	Toxicity and Detoxification Mechanisms of Xenobiotic Compounds	2nd	3
V02M098V01214	Marine Genomics	2nd	3

Year 2nd

Code	Name	Quadmester	Total Cr.
V02M098V01301	Internships	1st	18
V02M098V01302	Final Year Dissertation	1st	12

IDENTIFYING DATA

The Marine Environment: Physical Oceanography

Subject	The Marine Environment: Physical Oceanography			
Code	V02M098V01101			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	1st
Teaching language	Spanish Galician			
Department				
Coordinator	García Estévez, José Manuel Besteiro Rodríguez, Celia			
Lecturers	Besteiro Rodríguez, Celia García Estévez, José Manuel			
E-mail	jestevez@uvigo.es celia.besteiro@usc.gal			
Web				
General description	Main properties of the oceanic basins and the sediments that the ocean. Physical properties of the seawater. Chemical Properties of the seawater. The movements of the sea: the marine currents and the oceanic circulation; the waves; the tides. The coast: coastal waters and sea magins.			

Training and Learning Results

Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	(*)Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	(*)Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	(*)Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B5	Desarrollo de la habilidad de elaboración, presentación y defensa de trabajos e informes técnicos
C1	Conocimiento físico-químico del medio oceánico y costero
C13	Divulgación de conocimientos de la biología y el medio marinos: programas de formación y docencia; planificación y dirección de acuarios, museos, centros de interpretación ambiental, parques naturales y espacios naturales protegidos
C14	Elaboración, discusión, interpretación, asesoramiento y peritaje de informes científico-técnicos, éticos, legales y socioeconómicos relacionados con el ámbito marino y pesquero
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D3	Desarrollo de las capacidades de trabajo en equipo, enriquecidas por la pluridisciplinariedad
D5	Desarrollo de las habilidades de comunicación y discusión de planteamientos y resultados

Expected results from this subject

Expected results from this subject	Training and Learning Results

Comprise the meaning of Oceanography and know the main sources of his knowledge.	A1 A2 A3 A5 B1 B2 B5 C1 D1 D2
Purchase knowledges on the main strokes of the oceanic basins and his evolution to the step of the time.	A1 A3 A5 B1 B2 C1 D1 D2 D3
Understand the origin and distribution of the sediments and his relation with other oceanic processes.	A1 A2 A3 B1 B2 C1 D1 D2
Know the penetration of the solar radiation in coastal and oceanic waters.	A1 A2 A3 A4 A5 B1 B2 C1 D5
Explain the behaviour of the temperature and the salinity of the waters of the ocean.	A1 A2 A3 A4 A5 B1 B2 B5 C1 C13 D1 D2 D5
Know the applications of the diagram T-S in the analysis of the masses of water.	A1 A2 A3 A4 A5 B1 B2 C1 D1 D2 D3

Purchase knowledges of the basic strokes of the oceanic circulation, superficial and subsuperficial, waves and tides.	A1 A2 A3 A4 A5 B1 B2 C1 C13 C14 D1 D2 D5

Contents	
Topic	
The OCEANOGRAPHY.	Concept and divisions. Historical development of the Oceanography.
The OCEANIC BASINS.	Origin and evolution of the oceans. The oceanic basins. The geological regions of the ocean. Geography of the current oceanic basins.
The OCEANIC SEDIMENTS.	Origin. Classification. Mechanisms of control of the accumulation of oceanic sediments. Distribution of the oceanic sediments.
PHYSICAL PROPERTIES OF THE WATER OF THE Mar.	Temperature. Salinity. Density. Solar radiation and illumination. Transparency and penetration of the light. Viscosity and superficial tension. Pressure. Propagation of the sound.
CHEMICAL PROPERTIES OF THE WATER OF THE Mar.	Chemical properties of the pure water. Chemical composition of the water of the mar. Classification of the chemical elements. Greater and lower constituents. Micronutrients. Gases dissolved. Organic matter.
The MOVEMENTS OF THE SEA: The MARINE CURRENTS And The OCEANIC CIRCULATION.	The marine currents. Types of currents. The oceanic circulation. Superficial circulation. Deep circulation. Circulation thermohaline and the big oceanic conveyor.
The MOVEMENTS OF THE SEA: The WAVES	Definition. Characteristics. Classification and types of waves. Origin of the waves. Interaction with the coast. Measurement and forecast of the wave regime. Energy of the waves and its usages. Biological importance of the waves.
The MOVEMENTS OF THE SEA: The TIDES	Definition. Characteristics. Origin of the tides. Explanatory theories. Classification of the tides. Oceanic tides and anfidrómic systems. Measurement and forecast of the tides. Energy of the tides and its industrial use. Biological importance of the tides.
The COAST: COASTAL WATERS And SEA MARGINS.	The COAST. Coastal terminology. Classification and development of the coast. Coastal waters and sea margins. Deep seas.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	15	35	50
Mentored work	5	10	15
Presentation	3	7	10
Essay questions exam	2	0	2
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Exposition of the main concepts of the course and approach of interactive activities, where the students will be able to formulate questions and comments
Mentored work	Destined interactive sessions to integrate and apply the knowledges purchased in the masterclasses
Presentation	Development of the competitions that allow the put in practice of the oceanographic knowledges purchased

Personalized assistance	
Methodologies	**Description**
Lecturing	It attended the *todalas questions risen pole students in real time
Mentored work	It follows the *desenvolvemente of the work in the classroom of personal and interactive way
Presentation	It helps *à presentation of the contained that owes to have a correct exhibition.

Assessment

	Description	Qualification	Training and Learning Results			
Lecturing	Continuous evaluation of the assistance and attitude of the students in the lecture sessions	10	A1 A2 A3 A4 A5	B1 B2 B5	C1 C14	D1 D2 D3 D5
Mentored work	Evaluation of the knowledges purchased by means of the manufacture in group of one work related with the contained of the subject. The relation of works will be proposed by the professor.	25				D1 D2
Presentation	Continuous evaluation of the knowledges purchased by means of the public presentation of the work previously mentioned	15	A4 A5			D2
Essay questions exam	Evaluation of the knowledges purchased by means of the realization of an examination written in regard to the contained of the subject	50	A1 A2 A3 A4 A5	B1	C14	D1 D2

Other comments on the Evaluation

In the first opportunity we take into account the four metodologies. In the second one, to assessment will realize it by means of a written proof, keeping the assessments of the continuous avaliation continuous obtained along the course.
For the students that do not developed the activities of continuous avaliation (assistance to sessions and elaboration and presentation of the homework), the written proof will suppose the 100% of the qualification.

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Other comments

It is recommended to work actively the subject in a continuous way during the course.

IDENTIFYING DATA				
Marine Botany				
Subject	Marine Botany			
Code	V02M098V01102			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	1st
Teaching language	Spanish			
Department				
Coordinator	García Estévez, José Manuel Peña Freire, Viviana			
Lecturers	García Estévez, José Manuel López Rodríguez, María del Carmen Peña Freire, Viviana			
E-mail	jestevez@uvigo.es vpena@udc.es			
Web				
General description	(*)Estudio de los principales organismos (fitoplancton y fitobentos) que se desarrollan en el medio marino, así como de los factores que condicionan su distribución.			

Training and Learning Results	
Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	(*)Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	(*)Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	(*)Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B6	Desarrollo de la curiosidad científica, de la iniciativa y la creatividad
C2	Conocimiento de la diversidad de organismos marinos y sus estrategias adaptativas
C3	Conocimiento y comprensión de las interacciones de los organismos marinos y los ecosistemas marinos y costeros
C7	Catalogación, evaluación, conservación, restauración y gestión de áreas marinas y litorales protegidos. Elaboración, asesoramiento legal y ejecución de planes de ordenación del litoral
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma
D5	Desarrollo de las habilidades de comunicación y discusión de planteamientos y resultados

Expected results from this subject	Training and Learning Results
New	A1 A3 A4 B6 D1
New	B1 C2 C3 C7
New	A2 C7 D1 D5

New	A5 B2 D4

Contents	
Topic	
Generalities	Unit 1. Marine habitat. Introduction and general characters. Influential environmental factors in the photosynthetic organisms: light, temperature, substrata, hydrodinamism, tides, salinity, pH, nutrients and polution. Interactions between organisms: predation, simbiosis, epibiosis, endobiosis, parasitism. Unit 2. Phytoplankton. General characters, importance, floristic groups and populational dynamics. Unit 3. Phytobenthos. General characteristics of their communities. Classification of bentic organisms according to sustrata. Unit 4. Phytobenthos. Ecophysiology. Adaptations to the habitat conditions . Morphological diversity, life histories, biological types and vital forms.
Diversity	Unit 5. Descriptive and systematics of red seaweeds (Rhodophyta): main groups and characteristic species. Unit 6. Descriptive and systematics of Brown seaweeds (Ochrophyta): main groups and characteristic species. Unit 7. Descriptive and systematics of green seaweeds (Chlorophyta): main groups and characteristic species. Unit 8. Descriptive and systematics of other benthic organisms: Cyanophyta, seagrass, fungi and lichens: main groups and characteristic species.
Ecology and biogeography	Unit 9. Ecology of the phytobenthos. Distribution of the marine organisms: vertical or zonation, temporal sucession and spatia or biogeographic . Diagrams of zonation of the littoral and nomenclature. Unit 10. Biogeography. Definition, methodology and indexes. Factors in the distribution of the marine vegetation: temperature and latitude. Unit 11. Marine vegetation in the Atlantic North and Mediterranean. Unit 12. Marine vegetation of the Iberian Peninsula and of Galicia. Exposed coasts, semiexposed and protected sites. Diversity, descriptive and zonation.

Planning	Class hours	Hours outside the classroom	Total hours
Lecturing	12	18	30
Seminars	8	24	32
Seminars	2	2	4
Mentored work	0	9	9

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	Description
Lecturing	FACE-TO-FACE CLASSES FOR EXHIBITION, BY PART OF THE PROFESSOR, OF THE CONTENTS OF THE MATTER And THE DEVELOPMENT OF THE *TEMARIO, EXPLANATION OF CONCEPTS And APPROACH OF THE SEMINARS.
Seminars	AUTONOMOUS WORK OF THE STUDENT FOR THE STUDY And ASSIMILATION OF THEORETICAL And PRACTICAL CONCEPTS, AS WELL AS FOR THE RESEARCH OF INFORMATION And BIBLIOGRAPHY FOR THE REALISATION OF THE WORKS RELATED WITH THE SEMINARS.
Seminars	You INTERVIEW WITH THE *PROFESORADO FOR THE ADVICE And DEVELOPMENT OF THE ACTIVITIES OF THE MATTER IN THE PROCESS OF THE LEARNING.

Mentored work	WORKS/DOCUMENTS/INFORMATION ELABORATED BY THE STUDENT, OF AUTONOMOUS WAY, FOR THE DEVELOPMENT OF THE SEMINARS. ALWAYS, UNDER THE GUIDELINES OF THE PROFESSOR IN WHAT it CONCERNS To THEMATIC, QUESTIONS To DEVELOP And USES OF SOURCES OF INFORMATION.

Personalized assistance

Methodologies	Description
Seminars	It will attend to the students personally via face-to-face in the classroom, by telematic systems and by email, as well as in the office (Monday to Weednesday (4 to 6 p.m.).

Assessment

	Description	Qualification	Training and Learning Results			
Lecturing	Evaluation by means of an objective proof written that will include ask type test, definitions, short questions and subjects to develop.	70	A2 A3 A4	B1 B2	C2 C3 C7	D1 D5
Seminars	Evaluation of the attitude and the degree of participation (asks/answer) by part of the student in each one of the seminars.	20	A1 A2 A3 A5	B1 B2 B6	C7	D4
Mentored work	Evaluation of the content and quality of the work realised by the student in the thematic of the seminars.	10	A2 A4	B6		D1 D5

Other comments on the Evaluation

A minimum mark of 4 out of 10 in the written test (exam) is required.
For cases of fraudulent performance of exercises or tests, the provisions of the Regulations on the assessment of students' academic performance and the review of grades shall apply.

Sources of information

Basic Bibliography

Complementary Bibliography

Lobban, C.S. & P.J. Harrison, **Seaweed ecology and physiology**, 1994
Graham, L. E., J. M Graham & L. W. Wilcox, **Algae**, 2009
Dawes, C.J., **Marine Botany**, 1997
Lüning, K., **Seaweeds their environment, biogeography and ecophysiology**, 1990
Reviers, B de, **Biologie et phylogénie des algues, tome 1, 2**, 2002, 2003
Hoek, C. van den, D.G. Mann, H.M. Jahns, **Algae: An Introduction to phycology**, 1995
Guiry & Guiry, **http://www.algaebase.org/**, continuo
Green, E.P. & F.T. Short, **World Atlas of Seagrasses**, 2003
Guillén, JE., Ruiz, JM, Otero, M, Díaz-Almela, E., **Atlas de las praderas marinas de España**, 2015
Hurd, C.L., P.J. Harrison, K. Bischof & C.S. Lomman, **Seaweed Ecology and Physiology**, Cambridge, 2014
AlgaeTraits: a trait database for (European) seaweeds, **https://algaetraits.org/**, continuo
Guía online algas de Asturias, **http://www.asturnatura.com/**,
Algas marinas bentónicas Mediterráneo y Atlántico, **http://manuel.gonzales.free.fr/#gsc.tab=0**,
Useful Marine Plants of the Asia-Pacific Region Countries, **http://www.imb.dvo.ru/misc/algae/index.php/en/intro2**,

Recommendations

Subjects that continue the syllabus

Biology of Exploited and Potentially Exploitable Species/V02M098V01207
Invasive Species and Fouling/V02M098V01211
Sampling Techniques for Identification of Marine Organisms and Communities/V02M098V01201

Subjects that are recommended to be taken simultaneously

Marine Ecology/V02M098V01105
Physiology of Marine Organisms/V02M098V01106
Marine Zoology/V02M098V01103

Other comments

To know general aspect of Botany and Phycology (diversity, systematics, reproduction, life histories).

IDENTIFYING DATA				
Marine Zoology				
Subject	Marine Zoology			
Code	V02M098V01103			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	1st
Teaching language	Spanish Galician			
Department				
Coordinator	García Estévez, José Manuel Besteiro Rodríguez, Celia			
Lecturers	Besteiro Rodríguez, Celia García Estévez, José Manuel			
E-mail	jestevez@uvigo.es celia.besteiro@usc.gal			
Web				
General description	In this matter expose : - The models of organisation of the main groups of marine animals .- The morphological diversity and the adaptations to the different habitats, ways of life, feeding and reproduction. - The systematic of the main groups. - The fauna of the *sustratos rocky and **sedimentarios of the coastal and deep systems.			

Training and Learning Results	
Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	(*)Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	(*)Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	(*)Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B6	Desarrollo de la curiosidad científica, de la iniciativa y la creatividad
C2	Conocimiento de la diversidad de organismos marinos y sus estrategias adaptativas
C14	Elaboración, discusión, interpretación, asesoramiento y peritaje de informes científico-técnicos, éticos, legales y socioeconómicos relacionados con el ámbito marino y pesquero
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma
D7	Desarrollo de habilidades para la divulgación de ideas en contextos tanto académicos como no especializados

Expected results from this subject	
Expected results from this subject	Training and Learning Results
*Knowledge of wool *diversity of marine *organisms *and *his *adaptative *strategies	A1 A2 B1 D1 D2
New	A1 A2 B1 C2 D1 D2

New	A1 A2 B1 C2 D1 D2
New	A1 A2 B1 C2 D1 D2
New	A1 A2 B1 C2 D1 D2
New	A1 A2 A3 A4 A5 B1 B6 C2 C14 D1 D2 D4 D7

Contents	
Topic	
Architectural patterns of the animals.	The form and the corporal design like adaptation to the means **bentónico and **peláxico. Colonial forms and **gregarias. The skeletal *structures. The movements. Systems of defence. **Coloracións. Shelters and territoriality. Interspecific *relations. The feeding. The asexual *reproduction.
**Poríferos	The *individualisation. The *sustrato and the **hidrodinamismo like *determinantes of the corporal form. The skeletal *trainings. The leak like way of life. Evolution of the types of organisation second the internal circuit of water. Asexual *and sexual reproduction.
*Metazoan **diblásticos	**Cnidarios. You form them *polyp and *jellyfish. Exclusive cells: the **cnidocitos. Classification.- **Hidrozoos. Individual and colonial forms. Colonies **hidroides **peláxicas. **Hidromedusas. Colonies **peláxicas mixed. Special structures for the *flotation, the trip and the capture of the food.- **Cubozoos.- **Escifozoos. Structure. The *swimming by **pulsacións **natatorias.- **Antozoos. Structure. Solitary forms, colonial and **pseudocoloniales. Colonies corneas. The coral reefs.-**Ctenóforos.
*Metazoan **triblásticos	**Turbelarios. **Gnatostomúlidos. **Gastrotricos. **Quinorrincos *Nematodes. **Nemertinos. **Priapúlidos. **Carácteres Singular. Ways of life. Ecology.
Molluscs	Mantle, cavity **paleal and *radula.- **Solenogastros. **Caudofoveados. **Monoplacóforos. **Poliplacóforos. **Carácteres Singular. Ways of life. Ecology.- *Gasteropods. The ventilation **paleal. The *solidez of the *gusanillo *asymmetric. The reduction of the shell in the **Opistobranquios. *Locomotion, *swimming and *flotation. Feeding. The put.-Bivalve. The shell. The mantle. The *ornamentación. The feeding. The **sifóns and the welding of the mantle. Mechanisms of burial, fixation and **retropropulsión. Bivalve **epifáunicos, **perforadores and **xilófagos.- **Escafópodos. **Carácteres Singular. Ways of life. Ecology.- Cephalopods. The shell. The *swimming. The capture of the preys. The courtship and the posture.

*Annelids **Poliquetos	The corporal model generalised. The *locomotion **parapodial. The *elytrons. The movements *excavadores. **Poliquetos **tubícolas, **perforadores, **intersticiais and **simbiontes. The **depredación. **Sedimentívoros No **seletivos and **seletivos superficial and **subsuperficiais. The leak.
**Sipuncúlidos. **Equiúridos	**Carácteres Singular. Ways of life. Ecology.
Crustaceans	Generalities: the corporal regionalisation and the appendix **birrámeo.- **Remipedios, **Cefalocáridos, **Maxilópodos. **Carácteres Singular. Ways of life. Ecology.- **Malacostráceos: **Filocáridos And **Eumalacostráceos. The *swimming **pleopodal and the fan discharge. Forms **reptantes: caves and shelters. Territoriality. **Decápodos **Braquiuros And **Anomuros: adaptative *diversity.
**Lofoforados	**Briozoos. Colonies **estoloniais, **incrustantes, **arbusculares and **foliáceas. Colonies **estenolaemadas, **ctenostomadas and **quilostomadas. **Avicularias And **vibracularias. The colonial growth. The *protrusion of the **lofóforo. The feeding.- Quotation of **Foronídeos, **Braquiópodos and **Ectoproctos.**Quetognatos. **Carácteres Singular. Ways of life. Ecology.
*Echinoderms	The *shell **dermatoesquelético, the *symmetry and the orientation.- **Asteroideos. The system **ambulacral. The burial. The carnivorous *feeding.- **Ofiuroideos. The *locomotion **braquial. The burial. The feeding.- **Equinoideos. The *shell: regular and irregular hedgehogs. The feeding **raspadora: the *torch of **Aristótele. The *excavation. The feeding **sedimentívora: spines and podiums.- **Holoturoideos. The corporal orientation: **bivio and *trivium. The different ways of life: buccal podiums. The feeding **suspensívora, **detritívora and **sedimentívora. The *tubules of **Cuvier.- Quotation of **Crinoideos.- **Hemicordados. **Tunicados. **Carácteres Singular. Ways of life. Ecology.
**Cefalocordados. Vertebrates	The **esquelete *axial: **notocorda and vertebral column.- **Condrictios. *Swimming by waves of **contración. The stability, direction and control of the *swimming. The predatory feeding.- **Osteíctios. The *swimming. Alimentary diets. The feeding *rapaz and **planctívora. Social behaviour. Cares **parentais.- Mammalian *Cetáceos. Modifications of the plan of organisation **mammaliano for the aquatic life. Adaptation to the variations of hydrostatic *pressure: **narcose and *decompression. The feeding **planctívora (**Mistacocetos). The carnivorous *feeding (**Odontocetos). The **ecolocación. Communication and social behaviour.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	12.5	37.5	50
Mentored work	4	8	12
Presentation	2	6	8
Seminars	2	0	2
Essay questions exam	3	0	3
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Kinds *presenciais stop the exhibition by part of the Professor of the contained of the *temario of theory.
Mentored work	Practices varied (*pizarra, problems, computer) in the that employ tools *manipulativas own of the subject.
Presentation	Presentation and debate of the contained and of the resulted of works developed pole student.
Seminars	*Titorías Customized. Resolution to the students of doubts envelope the theoretical content of the subject.

Personalized assistance	
Methodologies	**Description**
Seminars	Resolution to the students of doubts envelope the theoretical content of the subject
Presentation	It helps @perante orientation of the @docente to the correct design of the exhibitions, the *dicción and the defence of the works *expositivos.

Assessment

	Description	Qualification	Training and Learning Results
Lecturing	Continuous evaluation of the assistance and attitude of the students in the lecture sessions	10	A1 B1 C14 D1 A2 D2 A3 A4 A5
Mentored work	Evaluation of the knowledge purchased by means of the elaboration in group of one work related with the program of the subject. The relation of works will be proposed by the professor.	25	D1 D2
Presentation	Continuous evaluation of the knowledge purchased by means of the public presentation of the work previously mentioned	15	A4 D2 A5 D4 D7
Essay questions exam	Evaluation of the knowledge purchased by means of the realization of an written exam related to the subject program	50	A1 B1 C2 D1 A2 B6 C14 D2 A3 D4 A4 D7 A5

Other comments on the Evaluation

In the first opportunity we take the four metodologies. In the second one, the avaliation will be realized by means of a written exam, keeping the qualifications obtained during the course for the contiuous avaliation.

For the students that do not developed the activities of continuous avaliation (class attendance and elaborationn and presentation of the homework), the written proof will suppose the 100% of the rating.

Sources of information

Basic Bibliography

Complementary Bibliography

Barnes, R.D., **Zoología de los invertebrados.**, 1989,

Barnes, R.S.K., Callow, P., Olive, P.J.W., Golding, D.w. & Spicer, J.J., **The invertebrates: a synthesis.**, 2001,

Brusca, R.C. & Brusca, G.J., **Invertebrates**, 2002,

Castro, P. & M.E. Huber., **Biología marina.**, 2007,

Cognetti, G., Sará, M. & G. Magazzú., **Biología marina.**, 2001,

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Hickman, C.P., Roberts, L.S. & Larson, A., **Principios integrales de Zoología.**, 2009,

Kardong, K.V., **Vertebrados: anatomía comparada, función, evolución.**, 2007,

Mader, S.S., **Biología.**, 2008,

Moutou, F., **Los mamíferos en su medio.**, 1993,

Varios Autores., **Galicia. Natureza. Zooloxía. Tomo XXXVII: Zooloxía I; Tomo XXXVIII: Zooloxía II; Tomo XXXIX: Zooloxía III; Tomo XL: Zooloxía IV.**, 2002,

Ruppert, E.E. & Barnes, R.D., **Zoología de los invertebrados.**, 1996,

Young, J.Z., **La vida de los vertebrados.**, 1985,

Hondt, J.L.d', **Les invertebrés marins méconnus**, 1999,

Bayer, F.M. & H.B. Owre, **The free-living lower Invertebrates.**, 1968,

Campbell, A.C., **Guía de campo de la flora y fauna de las costas de España y de Europa.**, 1983,

Fretter, V. & A. Graham., **A functional anatomy of Invertebrates.**, 1976,

Gardiner, M.S., **Biología de los Invertebrados**, 1978,

Hayward, P.J. & J.S. Ryland., **Handbook of the Marine Fauna of North-West Europe.**, 1975,

Hayward, P.J. & J.S. Ryland., **The Marine Fauna of the British Isles and North-West Europe, vol 1: Introduction and Protozoans to Arthropods**, 1990a,

Hayward, P.J. & J.S. Ryland., **The Marine Fauna of the British Isles and North-West Europe, vol 2: Molluscs to Chordates.**, 1990b,

Hayward, P.J., T. Nelson-Smith & C. Shields, **Guía de identificación de la flora y fauna de las costas de España y Europa.**, 1998,

Kaestner, A., **Invertebrate Zoology, vol III.**, 1970,

Kaestner, A., **Invertebrate Zoology, vol I.**, 1967,

Recommendations

Subjects that continue the syllabus

Sampling Techniques for Identification of Marine Organisms and Communities/V02M098V01201

Subjects that are recommended to be taken simultaneously

Marine Botany/V02M098V01102
The Marine Environment: Physical Oceanography/V02M098V01101

Other comments

It recommends update the knowledges of Zoology purchased in the degree or the degree.

IDENTIFYING DATA				
Microbioloxía Mariña				
Subject	Microbioloxía Mariña			
Code	V02M098V01104			
Study programme	Máster Universitario en Bioloxía Mariña			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1	1c
Teaching language	Castelán			
Department				
Coordinator	García Estévez, José Manuel Herrero López, Concepción			
Lecturers	Balboa Méndez, Sabela Barja Pérez, Juan Luis García Estévez, José Manuel Herrero López, Concepción			
E-mail	jestevez@uvigo.es herreroc@udc.es			
Web	http://masterbiologiamarina.uvigo.es/gl/			
General description	Nesta materia preténdese que el alumno: - Coñeza a contribución da Microbioloxía a os coñecementos Oceanográficos. - O papel dos microorganismos mariños no cambio climático. - A importacia da simbiose de microorganismos fotosintéticos e quimioautotrofos para a vida dalgúns ecosistemas mariños - As aplicacións biotecnolóxicas de microorganismos mariños e as implicacións sanitarias para as persoas e organismos cultivados por elas			

Resultados de Formación e Aprendizaxe	
Code	
A1	Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
C4	Conocimiento y búsqueda del potencial interés económico y biotecnológico de los organismos marinos
C6	Conocimiento, identificación y evaluación de la calidad ambiental del medio marino y de la legislación vigente. Dirección de consultorías ambientales
C8	Conocimiento y manejo de la metodología de investigación, de las técnicas muestreo e instrumentales y de análisis de datos aplicados al medio marino
C10	Inspección y asesoramiento técnico en la evaluación, explotación y gestión de pesquerías, extracción de recursos e instalaciones de acuicultura
C12	Control de calidad y seguridad de alimentos y de productos de transformación y biotecnológicos de origen marino
C14	Elaboración, discusión, interpretación, asesoramiento y peritaje de informes científico-técnicos, éticos, legales y socioeconómicos relacionados con el ámbito marino y pesquero
D3	Desarrollo de las capacidades de trabajo en equipo, enriquecidas por la pluridisciplinariedad

Resultados previstos na materia	
Expected results from this subject	Training and Learning Results

Que o alumno: - Busque e coñeza o potencial interese económico e biotecnolóxico dos organismos mariños	A1 A2 A3 A4 A5 B1 C4 D3
Que o alumno coñeza, identifique e avalíe a calidade ambiental do medio mariño e da lexislación vixente. Xestione consultorías ambientais.	A1 A2 A3 A4 A5 B1 C6 D3
Que o alumno sexa capaz de manexar a metodoloxía de investigación, da técnicas mostraxe e instrumentais e de análises de datos aplicados ao medio mariño	A1 A2 A3 A4 A5 B1 C8 D3
Que o alumno poida inspeccionar e asesorar tecnicamente na avaliación, explotación e xestión de pesqueiras, así como na extracción de recursos e instalacións de acuicultura	A1 A2 A3 A4 A5 B1 C10 D3
Que o alumno avalíe a calidade e seguridade de alimentos e de produtos de transformación e biotecnolóxicos de orixe mariña	A1 A2 A3 A4 A5 B1 C10 C12 D3
Que o alumno sexa capaz de elaborar, discutir, interpretar, asesorar e peritar informes científico-técnicos, áticos legais e socioeconómicos relacionados co ámbito mariño e pesqueiro	A1 A3 A4 B1 C6 C8 C10 C12 C14 D3

Contidos
Topic
A microbioloxía nos estudos Oceanográficos
Diversidade e función dos microrganismos mariños
Métodos en Microbioloxía mariña
Importancia dos microorganismos para o funcionamento dos ecosistemas peláxicos: o bucle microbiano
Simbiose entre macro e microorganismos
Microorganismos e cambio climático
Aspectos biotecnolóxicos dos microorganismos mariños.
Os microorganismos como patóxenos de animais mariños. Aspectos sanitarios da Microbioloxía Mariña

Importancia económica e perspectivas futuras.

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	14	28	42
Seminario	4	24	28
Resolución de problemas e/ou exercicios	2	2	4

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Metodoloxía docente	
	Description
Lección maxistral	Clases con contidos teóricos. Os contidos básicos son proporcionados aos alumnos vía rede.
Seminario	Presentación oral e/ou escrita de traballos científicos, informes tácnicos o proxectos

Atención personalizada	
Methodologies	**Description**
Lección maxistral	Durante o desenvolvemento da materia atenderanse as necesidades e consultas do alumnado relacionadas coa mesma, proporcionándolle a orientación e apoio que sexan necesarios, tanto de forma presencial como non presencial
Seminario	Se darán ao alumno indicacións do traballo a desenvolver

Avaliación						
	Description	Qualification	Training and Learning Results			
Lección maxistral	Avalíase na proba mixta Asimesmo poderá terse en conta a asistencia, actitude, participación e traballo do alumno nas sesión na aula	0	A1 A2 A3 A4 A5	B1	C4 C6 C8 C10 C12	D3
Seminario	Térase en conta o traballo entregado o exposto. No caso de non participar neste tipo de metodoloxía docente a avaliación corresponde engadirase a da proba mixta	20				
Resolución de problemas e/ou exercicios	Avaliación do proceso de aprendizaxe mediante exame escrito tipo test	80	A1 A2 A3 A4 A5	B1	C4 C6 C8 C10 C12	D3

Other comments on the Evaluation

Bibliografía. Fontes de información

Basic Bibliography

Complementary Bibliography

Kirchman DL 2008, **Microbial ecology of the oceans**, 2nd. edition, 2008

Kiorboe T 2008, **A mechanistic approach to pankton ecology**, 3rd edition, 2008

Madigan, M.T., Martinko, J.M., Bender, K.S., Buckley, D.H. & Stahl, D.A., **Brock. Biología de los microrganismos**, 14ª ed, 2015

Munn, C. 2020, **Marine Microbiology. Ecology an Applications**, 3rd ed, 2020

Pérez-Nieto, T. 2001, **Conceptos básicos de microbiología marina**, 1ª, 2001

Rotter et al. (2021), **The Essentials of Marine Biotechnology**, Frontiers in Marine Science. 8: 629629, 2021

Willey, J.M., Sandman K & Wood, D. 2020, **Prescott's Microbiology**, 11th ed,

Recomendacións

Other comments

Recoméndase cursar previamente unha Microbioloxía xeral de licenciatura ou grao.

IDENTIFYING DATA

Ecoloxía Mariña

Subject	Ecoloxía Mariña			
Code	V02M098V01105			
Study programme	Máster Universitario en Bioloxía Mariña			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1	1c
Teaching language	Castelán			
Department	Dpto. Externo Ecoloxía e bioloxía animal			
Coordinator	Fernández Suárez, Emilio Manuel			
Lecturers	Fernández Suárez, Emilio Manuel Jabalera Cabrerizo, Marco Olabarria Uzquiano, Celia Riveiro Alarcón, María Isabel Teira Gonzalez, Eva Maria			
E-mail	esuarez@uvigo.es			
Web				
General description	A materia Ecoloxía Mariña márcase como obxectivo fomentar a capacidade dos alumnos para comprender os procesos de circulación da materia e os fluxos de enerxía nos diferentes ecosistemas mariños, así como para comprender as bases da diversidade e os procesos de organización e estrutura destes ecosistemas. Materia do programa English Friendly. Os/ as estudantes internacionais poderán solicitar ao profesorado: a) materiais e referencias bibliografías para o seguimento da materia en inglés, b) atender as titorías en inglés, c) probas e avaliacións en inglés.			

Resultados de Formación e Aprendizaxe

Code	
A1	Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B5	Desarrollo de la habilidad de elaboración, presentación y defensa de trabajos e informes técnicos
B6	Desarrollo de la curiosidad científica, de la iniciativa y la creatividad
C1	Conocimiento físico-químico del medio oceánico y costero
C2	Conocimiento de la diversidad de organismos marinos y sus estrategias adaptativas
C3	Conocimiento y comprensión de las interacciones de los organismos marinos y los ecosistemas marinos y costeros
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D5	Desarrollo de las habilidades de comunicación y discusión de planteamientos y resultados

Resultados previstos na materia

Expected results from this subject	Training and Learning Results

(*)Capacidade para comprender a metodoloxía científica e as tecnoloxías aplicadas á investigación na área da Ecoloxía	A1 A2 A3 A4 A5 B1 B2 B5 B6 C1 C2 C3 D1 D2
(*)Capacidade para analizar e comprender a relación entre os organismos e os factores ambientais	A1 A2 A3 A4 A5 B1 B2 B5 B6 C1 C2 C3 D1 D2 D5
(*)Capacidade para comprender os procesos de circulación da materia e o fluxo de enerxía no Ecosistema	A1 A2 A3 A4 A5 B1 B2 B5 B6 C1 C2 C3 D1 D2 D5
(*)Capacidade para comprender e analizar os procesos básicos das relacións entre organismos (*intra-*ínterespecíficas).	A1 A2 A3 A4 A5 B1 B2 B5 B6 C1 C2 C3 D1 D2 D5

(*)Capacidade para comprender as bases da diversidade e os procesos de organización e estrutura dos ecosistemas	A1 A2 A3 A4 A5 B1 B2 B5 B6 C1 C2 C3 D1 D2 D5
(*)Habilidade para o manexo da bibliografía relacionada cos distintos campos da ecoloxía	A1 A2 A3 A4 A5 B1 B2 B5 C1 C2 C3 D1 D2 D5

Contidos	
Topic	
Introdución á Ecoloxía Mariña	Presentación da materia. O proxecto de investigación. Aproximacións metodolóxicas ao estudo dos ecosistemas mariños. O ser humano na natureza: sistemas socioecolóxicos. Funcións, servizos, beneficios e contribucións da natureza. Principios para o mantemento dos servizos ecosistémicos.
Ecosistemas planctónicos:	Produción primaria: factores limitantes, control hidrodinámico e variabilidade. Produción nova e rexenerada. Produción secundaria. Descomposición da materia orgánica. O bucle microbiano. Interaccións tróficas.
Ecosistemas nectónicos	Produción nectónica global. Datos globais. Estratexias de vida e migracións. Abundancia de peces e variabilidade hidroclimática: efectos do cambio global. Efectos top-down: pesca e cambios na estrutura da comunidade.
Ecosistemas bentónicos de substrato duro.	Comunidades bentónicas de substrato duro. Estrutura da comunidade. Diversidade. Organización trófica. Factores que controlan a estrutura da comunidade: competencia, depredación, perturbación físicas. Papel das interaccións positivas: facilitación. Papel das especies invasoras. Sucesión ecolóxica. Cambio global e estrutura de comunidades.
Ecosistemas *bentónicos de substrato brando	Comunidades bentónicas someras de substrato brando. Reaccións de oxidación da materia orgánica. Procesos bioxeoquímicos en medios anóxicos. Subministro de servizos ecosistémicos. Papel das interaccións entre especies. Aplicacións da ecoloxía isotópica: orixe da materia, eutrofización e estrutura trófica.

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	15	35.1	50.1
Presentación	1.8	7.2	9
Seminario	4	0	4
Resolución de problemas e/ou exercicios	2	0	2
Estudo de casos	0	2	2
Proxecto	0	6	6
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Metodoloxía docente	
	Description
Lección maxistral	Utilizarase a metodoloxía de sesión maxistral para traballar os contidos fundamentais da materia
Presentación	Presentación oral e/ou escrita de traballos científicos, informes técnicos ou proxectos
Seminario	Reunións do grupo de traballo co/os docentes para aclarar dúbidas e organizar o traballo.

Atención personalizada	
Methodologies	**Description**
Lección maxistral	Durante as sesións maxistrais os alumnos recibirán atención personalizada por parte do profesor atendendo a todas as cuestións que se expoñan.
Presentación	Atención na elaboración e consello para a presentación e defensa
Seminario	Modelo de corresponsabilidade no exercicio docente, *tutorías de índole organizativa ou de interese académico.
Tests	**Description**
Estudo de casos	*Tutorías personalizadas para a resolución de casos

Avaliación						
	Description	Qualification	Training and Learning Results			
Resolución de problemas e/ou exercicios	Avaliación do proceso de aprendizaxe mediante exames escritos ou orais nos que se avaliará a adquisición dos principais conceptos teóricos e a capacidade de relación. Poderán incluír probas de formato diverso: tipo test, probas de ensaio, preguntas de razoamento, preguntas tema e curtas,resolución de problemas, e/ou casos prácticos. Para aprobar a asignatura será necesario acadar una calificación de a lo menos 4 puntos sobre 10 neste exame.	40	A2 A3 A4	B2 B5	C1 C2 C3	D1 D2
Estudo de casos	Ao longo do curso, realizaranse tres probas curtas consistentes na resolución de supostos baseados en resultados experimentais relacionados cos contidos impartidos. Estas probas se realizarán en horario de clase e a data de realización se anunciará con a lo menos 10 días de antelación. Estas probas representarán, no seu conxunto, un 25% da calificación final.	25	A2 A3 A4	B2 B5	C1 C2 C3	D1 D2
Proxecto	Avaliación da capacidade de elaborar unha proposta de proxecto científico a partir das explicacións dadas en clase e do traballo persoal do estudantado.	35	A1 A2 A3 A4 A5	B1 B2 B5 B6	C1 C2 C3	D1 D2

Other comments on the Evaluation

Na avaliación de xullo teranse en conta os méritos obtidos nos items que se evaluan efectuados durante o curso, non así as probas escritas finais.

Bibliografía. Fontes de información

Basic Bibliography

Mann, K.H., **Ecology of coastal waters with implications for management**, 2º, Blackwell, 2000

Complementary Bibliography

Recomendacións

IDENTIFYING DATA

Physiology of Marine Organisms

Subject	Physiology of Marine Organisms			
Code	V02M098V01106			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Míguez Miramontes, Jesús Manuel			
Lecturers	Blanco Imperiali, Ayelén Melisa Conde Sieira, Marta González Rodríguez, Luis Lopez Patiño, Marcos Antonio Míguez Miramontes, Jesús Manuel Soengas Fernández, José Luis			
E-mail	jmmiguez@uvigo.es			
Web				
General description	Study of the functioning of marine organisms (animals and plants) and the mechanisms that enable their relationship with the environment. Special attention to those physiological aspects more related to the integration of the information coming from the marine environment and the searching for specific reponses.			

Training and Learning Results

Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	(*)Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	(*)Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	(*)Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B3	Aprendizaje de diversas técnicas y métodos analíticos tanto en el medio natural como en el laboratorio
B5	Desarrollo de la habilidad de elaboración, presentación y defensa de trabajos e informes técnicos
B6	Desarrollo de la curiosidad científica, de la iniciativa y la creatividad
C2	Conocimiento de la diversidad de organismos marinos y sus estrategias adaptativas
C3	Conocimiento y comprensión de las interacciones de los organismos marinos y los ecosistemas marinos y costeros
C8	Conocimiento y manejo de la metodología de investigación, de las técnicas muestreo e instrumentales y de análisis de datos aplicados al medio marino
C10	Inspección y asesoramiento técnico en la evaluación, explotación y gestión de pesquerías, extracción de recursos e instalaciones de acuicultura
C13	Divulgación de conocimientos de la biología y el medio marinos: programas de formación y docencia; planificación y dirección de acuarios, museos, centros de interpretación ambiental, parques naturales y espacios naturales protegidos
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D3	Desarrollo de las capacidades de trabajo en equipo, enriquecidas por la pluridisciplinariedad
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma
D5	Desarrollo de las habilidades de comunicación y discusión de planteamientos y resultados
D6	Desarrollo de las capacidades de reflexión sobre responsabilidades sociales y éticas

Expected results from this subject

Expected results from this subject	Training and Learning Results
(*)Know the characteristics of the sensory systems and of the nervous system and the *sús importance in the *adaptacón the marine means.	A1 A3 B1 B2 C2 C3 D1
(*)Capacity for *evaluar and interpret the operation of the systems *fisiolóxicos	A1 A2 B2 B6 C2 C3 C13 D1 D2
New	A2 A3 B1 B2 C10 D4
(*)Capacity to analyse samples of animal and vegetal origin	A1 A2 B3 C8 D1 D2 D3
(*)And interpret experimental results applying knowledges *fisiológicos.	A2 A5 B2 C8 C10 D3 D4
(*)*Capacidad To obtain information and interpret experimental results applying knowledges *fisiológicos.	A3 A4 A5 B5 C10 D2 D3 D5 D6
(*)Capacity for *presentacion and discussion of works in public	A4 B6 C13 D5

Contents

Topic	
MODULE I. PHYSIOLOGY OF MARINE PLANTS	Topic 1. Adaptations to the marine environment Topic 2. Mechanisms of inorganic carbon uptake Topic 3. Stress responses: oxidative stress in the marine environment
MODULE II. PHYSIOLOGY OF MARINE ANIMALS	Topic 1. Sensory physiology in marine animals. Topic 2. Neuroendocrine and endocrine systems in marine animals. Integrated responses in fish: stress response; reproductive activity; biological rhythms. Topic 3. Circulation in aquatic animals. Topic 4. Aquatic respiration Topic 5. Excretion, water and ion balance in marine animals.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	30	45	75
Laboratory practical	6	9	15
Seminars	6	30	36
Mentored work	2	0	2
Case studies	1	9	10
Research based methodologies	2	8	10
Essay questions exam	2	0	2

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Classroom session in which the teacher will present the basic contents of the subject matter. The student must follow the presentation and may intervene when additional information is required and/or when there is a debate, whether it is generated by the teacher or at the initiative of the students themselves.
Laboratory practical	The students will have the opportunity to participate in laboratory sessions with an eminently practical content. Different experimental and analytical protocols will be tested, to later discuss them in a reasoned way from the point of view of their physiological significance.
Seminars	Classroom sessions in which specific topics of the subject will be developed in relation to the proposed topics. The students will have to carry out bibliographic works on topics proposed by the teacher and/or by the students themselves and that will be the object of exposition and later debate in class.
Mentored work	Follow-up by the teaching staff of the students' work corresponding to the seminars and the internship report.
Case studies	Classroom work with questions to be answered by the students.
Research based methodologies	From real situations the students must search for bibliography to find adaptive solutions of plant organisms to their environment.

Personalized assistance

Methodologies	Description
Lecturing	The teachers will receive comments and questions from the students during the lecture sessions, and can also attend to the students during the tutorial hours.
Seminars	During the seminar sessions the students can interact with the teachers individually and can also make use of the tutorial hours in case of doubts or need of information, especially for the preparation of the assignments.
Laboratory practical	Although the practicals are done in small laboratory groups, there will be the possibility to interact individually with the teachers whenever necessary to solve doubts or receive more precise information
Mentored work	The teachers follows up the seminar work and the elaboration of the internship report.
Research based methodologies	The teachers will attend to any questions that may arise during the elaboration of the work.

Assessment

	Description	Qualification	Training and Learning Results			
Laboratory practical	There will be 2 laboratory practices of Animal Physiology. The evaluation of these practices will include: -50% of the grade for attendance to the practical sessions. -50% of the grade for the practical report.	13.333	A1 A2	B1 B3 B5	C8 C10	D3 D5
Seminars	In conjunction for the two modules, Animal Physiology and Plant Physiology. Group work (2-3 students) on a topic proposed by the professor and brief presentation of the same in a class session at the end of the course. Integration seminar at the end of the course on adaptations of organisms to the marine environment.	30	A1 A4 A5	B1 B2 B5 B6	C2 C3	D2 D3 D4 D5
Case studies	Integration seminar at the end of the course on adaptations of organisms to the marine environment.	3.333	A1 A2 A4	B2 B5 B6	C8 C13	D4 D6

Research based methodologies	The questions are corrected and returned to the students with the result of the solution found. The final result of the deliveries is evaluated according to the solution found by the students.	20	A1 A2 A4	B2 B5 B6	C3 C13	D3 D5
Essay questions exam	It constitutes the final exam and is focused on the theoretical contents of the subject in the part of Animal Physiology. It may include multiple-choice questions, development questions and case resolution.	33.333	A1	B5	C2 C3	D1

Other comments on the Evaluation

Qualifications, minimum scores and second chance

Students must complete all the proposed activities. In case of not doing any of them, the grade will be zero, and as such it will be considered in the final grade of the subject.

CALCULATION OF THE FINAL SCORE: the score obtained by the student in each module will be taken into account, applying the following ponderation according to the weight of the module: Final overall grade = 0.66 x (grade of the module Animal Physiology) + 0.33 x (grade of the module Plant Physiology).

To succeed in the subject it will be essential to obtain a minimum grade of 4 (out of 10) in each of the modules separately. In addition, in the FA module it is essential to obtain a minimum of 3.5 points out of 10 in the final exam. In case of not achieving this score, it will be that grade that will appear in the overall grade of the subject.

SECOND CHANCE: The components of the final grade in the first opportunity are maintained for the second opportunity. However, neither the practicals nor the seminars will be recoverable in the second opportunity. Attendance to these activities is mandatory within the deadlines established in the calendar, and the grade obtained in the first opportunity will be maintained for the second opportunity.

Global evaluation

Students may request a global evaluation, which will entail the waiver of the continuous evaluation. The global evaluation will allow obtaining 100% of the score of the subject by means of a test on the official date set for the final exam, both in the first opportunity and in the second one.

The test may include: - Objective response questions, ii) Developmental questions, iii) Case studies, iv) Case studies.

The global evaluation does not exempt the completion of the internships and seminars of the subject. The grade obtained in these activities will be part of the overall evaluation grade, with the percentage previously indicated. If these activities are not carried out, the final grade of the subject will be 0 points.

Sources of information

Basic Bibliography

Larkum, A.W.D., Douglas, S., Raven, J.A., **Photosynthesis in algae (Advances in Photosynthesis and Respiration)**, Ed. Kluwer Academic, 2003

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Hill, R.W., Wyse, G.A., Anderson, M., **Fisiología animal**, Ed. Panamericana, 2006

Evans, D.H., **The physiology of fishes**, Ed. CRC Press, 2006

Bernier, N.J., Van der Kraak, G., Farrel, A.P., Brauner, C.J., **Fish Neuroendocrinology**, Ed. Academic Press, 2009

Farrel A.P., **Encyclopedia of fish physiology: from genome to environment**, Volúmenes 1, 2 y 3, Ed. Academic Press, 2011

Complementary Bibliography

Ostrander, G.K., **The laboratory fish**, Ed. Academic Press, 2000

Taiz, L., Zeiger, E., **Plant physiology**, Sianuer Assoc., cop Sunderland, 2010

Buesseler, K.O., Boyd, P.W., **Will ocean fertilization work?**, Science 300 (5616), pp. 67-68, 2003

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Sarthou, G., Timmerman, K.R., Blain, S. Treguer, P., **Growth physiology and fate of diatoms in the ocean: A review**, Journal of Sea Research, 53 (1-2 SPEC ISS), pp. 25, 2005

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Bentley, P.J., **Comparative vertebrate endocrinology**, Ed. Cambridge Univ Press, 1998

Breidbach, O., Kutsch, W., **The nervous system of invertebrates: an evolutionary and comparative approach**, Ed. Birkhauser, 1995

Evans, D.H., **Osmotic and ionic regulation. Cells and animals**, Ed. CRC Press, 2009

Hazon, N., Flik, G., **Osmoregulation and drinking in vertebrates**, Ed. Bios Scientific, 2002

Liem, K.F., Bemis, W.E., Walker, W.F., Grande, L., **Functional anatomy of the vertebrates**, Ed. Hartcourt College Publ., 2001

Reinecke, M., **Fish endocrinology**, Ed. Science Publ., 2006

Withers, P.C., **Comparative animal physiology**, Ed. Saunders College Publ., 1992

Rocha, M.J., Arukwe, A., Kapoor, B.J., **Fish Reproduction**, Ed. CRC Press, 2008

Recommendations

IDENTIFYING DATA				
Molecular Basis of Adaptation to the Marine Environment				
Subject	Molecular Basis of Adaptation to the Marine Environment			
Code	V02M098V01107			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	1st
Teaching language	Spanish			
Department				
Coordinator	San Juan Serrano, María Fuencisla			
Lecturers	San Juan Serrano, María Fuencisla			
E-mail	fsanjuan@uvigo.es			
Web				
General description	Molecular mechanisms underlying the phenomenon of adaptation. Integration of the biochemistry compared.			

Training and Learning Results	
Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	(*)Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	(*)Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	(*)Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B5	Desarrollo de la habilidad de elaboración, presentación y defensa de trabajos e informes técnicos
B6	Desarrollo de la curiosidad científica, de la iniciativa y la creatividad
C2	Conocimiento de la diversidad de organismos marinos y sus estrategias adaptativas
C3	Conocimiento y comprensión de las interacciones de los organismos marinos y los ecosistemas marinos y costeros
C13	Divulgación de conocimientos de la biología y el medio marinos: programas de formación y docencia; planificación y dirección de acuarios, museos, centros de interpretación ambiental, parques naturales y espacios naturales protegidos
C14	Elaboración, discusión, interpretación, asesoramiento y peritaje de informes científico-técnicos, éticos, legales y socioeconómicos relacionados con el ámbito marino y pesquero
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma
D7	Desarrollo de habilidades para la divulgación de ideas en contextos tanto académicos como no especializados

Expected results from this subject	
Expected results from this subject	Training and Learning Results
Knowledge of basic mechanisms and adaptive strategies at molecular level	A1 A2 A3 B2 B6 C2 C3 C13 D1 D2 D4

Integration ability to understand the molecular basis of adaptive phenomena from the perspective of comparative biochemistry.	A2 A3 B6 C2 D1 D2
Ability to evaluate and interpret the effects of environmental changes from marine environment on organisms and their interactions.	A2 A3 B2 C2 C3 C14 D1 D2
Ability to obtain information, analyse it critically and apply it to the interpretation and sustainability of marine environments.	A2 A3 A5 B2 B6 C13 C14 D1 D2 D4
Ability to develop individual and / or team works, and to expose them and discuss them in public.	A3 A4 A5 B2 B5 B6 C13 D1 D2 D4 D7

Contents	
Topic	
Biochemical adaptation: basic mechanisms and strategies.	Biochemical adaptation. Basic mechanisms of the biochemical adaptation. The time of the biochemical adaptation.
Adaptive points of cellular metabolism.	Points of metabolic adaptation in glycolysis. Origin and phylogenetic distribution of the urea cycle. Adaptations of mitochondrial energy metabolism.
Adaptation of enzymes to metabolic functions.	Mechanisms of enzymatic regulation.
Molecular and metabolic adaptation to the physical-chemical factors of the marine environment: Adaptation to the limited oxygen availability.	Anaerobic metabolism of marine invertebrates. Anaerobic metabolism of marine vertebrates. Adaptation to hypoxia.
Molecular and metabolic adaptation to the physical-chemical factors of the marine environment: Adaptation to salinity.	Osmoregulation in aquatic organisms. Response regulation to osmotic shock.
Molecular and metabolic adaptation to the physical-chemical factors of the marine environment: Adaptation to temperature.	Compensatory mechanisms from poikilotherm organisms to temperature changes. Acclimatization mechanisms to temperature. Adaptation to ice.
Molecular and metabolic adaptation to the physical-chemical factors of the marine environment: Adaptation to pressure.	Effects of the hydrostatic pressure on the biological systems. Mechanisms of perception and compensation to the changes of pressure.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	10	20	30
Lecturing	10	20	30
Seminars	4	10	14
Objective questions exam	1	0	1
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	In master sessions the teacher will give the fundamental concepts so that the student understands the bases of Adaptation at the Molecular and Metabolic level.
Lecturing	In master sessions the professor will give the fundamental notions so that the student understands the molecular and metabolic mechanisms of adaptation to the variable factors of the marine environment.
Seminars	In seminars, students will work aspects or bibliographic data related with subject, and will elaborate coments and oral and/or written presentations.

Personalized assistance	
Methodologies	**Description**
Lecturing	The doubts resolution and necessary orientation in the personal work of the student will be attended through voluntary tutorships.
Seminars	The doubts resolution and necessary orientation in the personal work of the student will be attended through voluntary tutorships.
Lecturing	

Assessment						
	Description	Qualification	Training and Learning Results			
Lecturing	The theoretical knowledge acquired on general issues of molecular and metabolic adaptation will be assessed through a final test exam.	35	A1 A2 A3 A5		C2 C3	D1 D2
Lecturing	The theoretical knowledge acquired on the molecular and metabolic mechanisms of adaptation to variable factors of the marine environment will be assessed through a final test exam.	35				
Seminars	In the work from seminars, the ability to relate the acquired knowledges and concepts, the correct use of specific terminology and the criticism and synthesis ability will be assessed.	30	A1 A2 A3 A4 A5	B2 B5 B6	C13 C14	D1 D2 D4 D7

Other comments on the Evaluation

The realization of seminars and / or bibliographic work is compulsory for passing the subject.

The final test exam is compulsory for passing the subject. The average note of the exam will have to be of 3,5 (35% of the assessment of subject) for to sum the score of the seminars or bibliographic work assessment.

Sources of information

Basic Bibliography

Complementary Bibliography

Atkinson D.E., **Cellular Energy Metabolism and its Regulation**, 1977

Di Prisco, G., **Life under extreme conditions**, 1991

Ewart K.V., **Fish antifreeze proteins. Molecular aspects of fish and marine biology**, 2002

Gilles E., **Animals and Environmental Fitness: Physiological and Biochemical Aspects of Adaptation and Ecology**, 1ª Ed, 1980

Hochachka, P.W. and Somero G.N., **Strategies of Biochemical adaptation**, 1973

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Le Gal, Y., **Biochimie Marine**, 1988

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Salway J., **Metabolism at a glance**, 2004

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Urich, K., **Comparative Animal Biochemestry**, 1994

Recommendations

Subjects that continue the syllabus

Subjects that are recommended to be taken simultaneously

Marine Ecology/V02M098V01105
Physiology of Marine Organisms/V02M098V01106
Marine Zoology/V02M098V01103

IDENTIFYING DATA

Techniques to Study Marine Organisms

Subject	Techniques to Study Marine Organisms			
Code	V02M098V01108			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	1st
Teaching language	Spanish			
Department				
Coordinator	Pérez Fernández, Juan			
Lecturers	Galindo Dasilva, Juan González Sotelo, María del Carmen Pérez Fernández, Juan Suárez Alonso, María del Pilar			
E-mail	jperezf@uvigo.es			
Web				
General description	It is a essentially practical subject, in which students will be familiar with histological, biochemical and genetic techniques. These techniques will be used in studying tissues, protein and gene expression, genetic markers, biomolecules purification and immunological techniques. Its main aim is that the student knows and evaluates the potentiality of a variety of techniques for the study of marine organisms.			

Training and Learning Results

Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	(*)Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	(*)Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	(*)Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B3	Aprendizaje de diversas técnicas y métodos analíticos tanto en el medio natural como en el laboratorio
B4	Desarrollo de habilidades en el manejo y tratamiento de herramientas, matemáticas, estadísticas e informáticas
C2	Conocimiento de la diversidad de organismos marinos y sus estrategias adaptativas
C8	Conocimiento y manejo de la metodología de investigación, de las técnicas muestreo e instrumentales y de análisis de datos aplicados al medio marino
C11	Estudios de dinámica poblacional, mejora genética y selección de stocks en pesquerías, acuicultura y programas de repoblación
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma

Expected results from this subject

Expected results from this subject	Training and Learning Results

Application of histological, biochemical and genetic techniques to the study of marine organisms	A1 A2 A3 A4 A5 B1 B2 B3 B4 C2 C8 C11 D1 D2 D4

Contents	
Topic	
1.- Histological techniques	1a.- Processing of samples for microscopy studies: applications of microscopy. 2b.- Inmunohistochemistry and its combination with other techniques.
2. Genetic techniques	2a.- Detection of the genetic variation. 2b.- Genetic markers and their applications 2c.- Molecular resources in the internet
3.- Biochemical techniques	3a.- Extraction, separation and quantification of biomolecules. 3b.- Spectrophotometric electrophoretic, chromatographic, fluorometric and of enzymatic determination.
4.- Identification of species	4.- Use of molecular tools for the identification of fisheries products.

Planning			
	Class hours	Hours outside the classroom	Total hours
Laboratory practical	15	14.5	29.5
Presentation	2	8	10
Seminars	1.5	0	1.5
Problem solving	1.5	0	1.5
Lecturing	2	8.5	10.5
Problem and/or exercise solving	2	0	2
Essay	0	20	20
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Laboratory practical	The techniques proposed in the content section will be carried out. In advance, a script will be delivered to the students explaining the basis and objectives to develop each technique. During or at the end of the development of the protocol students will make problems and solve practical cases .
Presentation	A practical problem with a combination of techniques will be proposed to the students who will have to choose the techniques that are best suited to solve that problem and, explain the basis of their choice.
Seminars	There will take place two 2 group tutorials, in which the doubts and questions will be ask about different aspects of the subject. The teacher will guide in the elaboration of personal works.
Problem solving	There will be an online problem solving test.
Lecturing	The theorical aspects and the usefulness of the laboratory techniques will be treated in the master sessions.

Personalized assistance	
Methodologies	**Description**
Seminars	In the group tutorials will raise doubts and questions of the subject. The student will be advised to carry out their work

Assessment

	Description	Qualification	Training and Learning Results			
Laboratory practical	Continuous evaluation by monitoring the student's work and attendance.	30	A2	B1 B3	C8	D2
Lecturing	Continuous evaluation by monitoring the student's work and attendance.	10	A1 A3	B1 B3	C8	D2 D4
Problem and/or exercise solving	Test in which the student will have to solve practical problems based on the work carried out in the laboratory and ist theoretical framework. The test will be online.	30	A1 A2 A3 A4 A5	B1 B3 B4	C8 C11	D1
Essay	The student will have to read and make a summary of a scientific article related to the techniques performed.	30	A1 A3 A4	B2		D1 D4

Other comments on the Evaluation

Sources of information

Basic Bibliography

Montuenga Badía, L., Esteban Ruiz, F.J., Calvo González, A., **Técnicas en histología y biología celular + StudentConsult en español**, 2ª, Elsevier-Masson, 2014

Perera, J., Tormo, A., García, L., **Ingeniería genética. Preparación, análisis, manipulación y clonaje de DNA.**, 1ª, Síntesis DL., 2009

Complementary Bibliography

Bergmeyer, H.U., **Methods of Enzymatic Analysis**, 3ª, Academic Press., 1995

Recommendations

IDENTIFYING DATA				
Experimental Design and Information Resources				
Subject	Experimental Design and Information Resources			
Code	V02M098V01109			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Roca Pardiñas, Javier			
Lecturers	Costa Martínez, Gema Roca Pardiñas, Javier			
E-mail	roca@uvigo.es			
Web				
General description				

Training and Learning Results	
Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B4	Desarrollo de habilidades en el manejo y tratamiento de herramientas, matemáticas, estadísticas e informáticas
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D3	Desarrollo de las capacidades de trabajo en equipo, enriquecidas por la pluridisciplinariedad

Expected results from this subject	Training and Learning Results
(*)	A1 A4
(*)	B1 B4
New	D2 D3

Contents	
Topic	
(*)*Introducción *al *diseño Of experiments: *aleatorización, Blockade, *factorización.	(*)
(*)*Diseños *unifactoriales.	(*) *Análisis *y *Diagnosis Of @el model.
(*)*Manejo Of statistical software.	(*)
(*)Access *y use of wool *informacióncientífica *especializada:	(*)*Manejo Of catalogues, bases of data *y scientific searchers.Organization *y *tratamiento of wool scientific information.

Planning	Class hours	Hours outside the classroom	Total hours
Practices through ICT	12	12	24
Lecturing	15	35	50
Problem and/or exercise solving	1	0	1
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	Description

Practices through ICT	(*)Actividade na que se formulan problemas e exercicios relacionados coa materia. O alumno debe, co apoio do profesorado, desenvolver a análise e a resolución dos problemas e exercicios
Lecturing	(*)O profesor exporá en clase e por videoconferencia a teoría básica da materia. Diversos exemplos ilustrarán a aplicación dos resultados teóricos.

Personalized assistance

Methodologies	Description
Lecturing	
Practices through ICT	

Assessment

	Description	Qualification	Training and Learning Results	
Practices through ICT	(*)Os alumnos entregarán ao longo da materia uno ou varios traballos relacionados coas prácticas que formarán parta do sistema de avaliación continua	40	B1 B4	D2
Problem and/or exercise solving	(*)Avaliación do proceso de aprendizaxe mediante exames escritos ou orais que poderían incluír probas tipo test, probas de ensaio de formato diverso, preguntas de razoamento, preguntas tema e curtas , e resolución de problemas ou casos prácticos.	60	B1 B4	D2

Other comments on the Evaluation

Sources of information

Basic Bibliography

Complementary Bibliography

Abraira Santos, V. y Pérez de Vargas, A., **Métodos Multivariantes en Bioestadística**, Centro de Estudios Ramón Areces.,

Maindonald, J. H., **Data analysis and graphics using R: an example-based approach.**, Cambridge University Press.,

Crawley, M.J., **The R book.**, Jonhn Wiley & Sons,

Zuur, Alain F, **A Beginner's guide to R.**, New York . Springer.,

Recommendations

IDENTIFYING DATA

Sampling Techniques for Identification of Marine Organisms and Communities

Subject	Sampling Techniques for Identification of Marine Organisms and Communities			
Code	V02M098V01201			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Ramil Blanco, Francisco José Besteiro Rodríguez, Celia			
Lecturers	Besteiro Rodríguez, Celia Parapar Vegas, Julio Peña Freire, Viviana Ramil Blanco, Francisco José Souto Derungs, Javier			
E-mail	framil@uvigo.es celia.besteiro@usc.gal			
Web				
General description	Methods of sampling for the obtaining of plankton, **bentos and **necton. Separation, fixation and conservation of the samples. Observation *in alive of the species **intermareais and **infralitorais more notable of the flora and marine fauna of Galicia. Main **carácteres **taxonómicos of the flora and marine fauna of Galicia. Identification of species. Recognition, statistical analysis and interpretation of communities.			

Training and Learning Results

Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	(*)Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	(*)Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	(*)Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B3	Aprendizaje de diversas técnicas y métodos analíticos tanto en el medio natural como en el laboratorio
B5	Desarrollo de la habilidad de elaboración, presentación y defensa de trabajos e informes técnicos
B6	Desarrollo de la curiosidad científica, de la iniciativa y la creatividad
C2	Conocimiento de la diversidad de organismos marinos y sus estrategias adaptativas
C3	Conocimiento y comprensión de las interacciones de los organismos marinos y los ecosistemas marinos y costeros
C8	Conocimiento y manejo de la metodología de investigación, de las técnicas muestreo e instrumentales y de análisis de datos aplicados al medio marino
C14	Elaboración, discusión, interpretación, asesoramiento y peritaje de informes científico-técnicos, éticos, legales y socioeconómicos relacionados con el ámbito marino y pesquero
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D3	Desarrollo de las capacidades de trabajo en equipo, enriquecidas por la pluridisciplinariedad
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma
D5	Desarrollo de las habilidades de comunicación y discusión de planteamientos y resultados

Expected results from this subject

Expected results from this subject	Training and Learning Results
New	A1 A2 B1 C2 C3 C8 D1 D2
New	A1 A2 B1 C2 C3 C8 D1 D2
New	A1 A2 B1 C2 C3 C8 D1 D2
New	A1 A2 B1 C2 C3 C8 D1 D2
New	A1 A2 B1 C2 C3 C8 D1 D2
New	A1 A2 B1 C2 C3 C8 D1 D2
New	A1 A2 A3 A4 A5 B1 B2 B3 B5 B6 C14 D1 D2 D3 D4 D5

Contents

Topic	
Flora and fauna **intermareal (**rochedos and sediment)	Explanation in situ of the *zonation and structure of the communities **intermareais of *sustrato rocky and **sedimentario. Harvest of material: review of the different methods, direct and indirect, employed for the *recolección of the fauna and flora of rock, sand and slime. Collected on foot in the zone **intermareal. Treatment, separation and preparation of the samples: it trace it back.Observation *in alive and study in the laboratory of the flora and fauna obtained, with special dedication to the seaweeds.
Fauna and flora **sublitoral (**rochedos and sediment)	Explanation in situ, on board of the ship **Polybius, of the methodology of **recoleción with **escafandro autonomous: technicians and material. Collected by means of diving with **escafandro autonomous of fauna and flora **infralitoral of rock.- Explanation in situ, on board of the ship **Polybius, of the methodology of **recoleción by means of indirect methods: *dragas of horizontal and vertical performance; *dragas qualitative and quantitative. Collected of sediment with the *draga of Rectangular horizontal performance of Naturalistic with the *draga of vertical performance go **Veen. Collected of **epifauna **sedimentaria by means of the *draga **Agassiz **trawl. **Peneirado, separation and preparation of the samples.- Demonstration in laboratory of the methodology of study of the **meiofauna. Separation and observation *in alive of fauna **intersticial.
Flora and fauna **planctónicas	Harvest of material by means of sleeves of plankton. Observation *in alive and study in the laboratory of the phytoplankton and **zooplancto obtained.
Treatment of the information	Recognition and interpretation of the communities. Organisation of the data obtained for his back preparation.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	3	7.002	10.002
Presentation	10	30	40
Studies excursion	31	62	93
Seminars	3	0	3
Report of practices, practicum and external practices	1	3	4
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies

	Description
Lecturing	Introduction of basic concepts and personal advice
Presentation	Preliminary presentation of the data of field obtained in campaign.
Studies excursion	Mission of sampling in craft of the marine station
Seminars	Resolution of doubts and approach of the tasks to make by the student of autonomous way out of the face-to-face hours.

Personalized assistance

Methodologies	Description
Seminars	The student will have of the necessary orientation for the preparation of the work.
Lecturing	Particular attention to the personal lagoons of knowledge of the half and marine taxonomy.
Presentation	Attention to the form of presentation of the data for his understanding, storage and transmission.
Studies excursion	Technological orientation in situ on processes, measures of security, tools, etc.

Assessment

	Description	Qualification	Training and Learning Results			
Studies excursion	Continuous evaluation of the assistance, attitude, active participation and work of the student during the sessions in him classroom, he laboratory, the exits of field, the seminars and the *tutorías	20	A1 A2 A3 A4 A5	B3 B6	C8	D3 D4 D5

Report of practices, practicum and external practices	Along the week of length of this matter, the student will go filling up a fascicle of practices, that will deliver him to the start, with all the educational activities made and that it will have to deliver at the end of the week, to be evaluated by the professors of the matter: 40%. Each student will have to elaborate a work of results with the data obtained and with his corresponding discussion. It will give special importance to the quality and presentation of this work: 40%.	80	A1 A2 A3 A4 A5	B1 B2 B5	C2 C3 C14	D1 D2

Other comments on the Evaluation

The evaluation of the students will be based on three different methodologies/exams:
- Continuous evaluation of attendance and the work of the student during the course (20%)- Evaluation of the practicum notebook (40%)- Evaluation of the work of results obtained during the course (40%)
The practicum notebook, scanned, and the wiriting document, inpdf, will be sent to the coordinator of the subjet in the two weeks following the end of teaching activity. The specific delivery date will be established for each academis year.

In the second opportunity, the evaluation of the students will make with the same methodology that at the earliest opportunity (20% - 40% - 40%).

Since it is an eminently practical course, attendance is mandatory. Non-attendance to the course will not allow evaluation in the second opportunity.

Sources of information

Basic Bibliography

Complementary Bibliography

Botosaneanu, L., **Stygofauna Mundi.**, 1986,

Braune, W. & Guiry, M.D., **Seaweeds.**, 2011,

Bunker, F., Brodie, J., Maggs, C.A., Bunker, A.Rker., **Seasearch guide to seaweeds of Britain and Ireland.**, 2017,

Cabioch, J.J., Floc'h, A., Toquin, C.F., Le, Ch., Boudouresque, F., Meinesz, A. & Verlaque,, **Guía de las macroalgas y fanerógamas marinas del Mediterráneo occidental**, 2013,

Dawes, C.J., **Marine Botany.**, 1997,

Eleftheriou,A. & Mcintyre, A., **Methods for the study of marine benthos.**, 2005,

Campbell, A.C., **Guía de campo de la flora y fauna de las costas de España y de Europa.**, 1983,

Falciai, L. & Minervini, R., **Guía de los Crustáceos Decápodos de Europa.**, 1995,

Giere, O., **Meiobenthology.**, 2009,

Hayward, P.J. & Ryland, J.S., **The marine fauna of the British Isles and North West Europe. 2 vols.**, 1990,

Higgins, R.P. & Thiel, H., **Introduction to the study of meiofauna.**, 1988,

Horner, R.A., **A taxonomic guide to some common marine phytoplankton.**, 2002,

Kermack, D.M. & Barnes, R.S.K., **Synopses of the British Fauna.**, 1970-2009,

Ramos, A., **Fauna Ibérica. Vols. 2, 4, 21, 25, 27, 29.**, 1992-2006,

Riedl, R., **Fauna y flora del mar Mediterráneo.**, 2000,

Rodríguez Iglesias, F., **Galicia. Natureza. Zooloxía. Vols. 36, 37, 38 e 39.**, 2002,

Tomas, C.R., **Identifying marine phytoplankton.**, 1997,

Varios autores, **Serie Inventarios. Vols. 1, 4, 6, 7, 10, 11, 14.**, 1985-1991,

Warner, G.F., **Diving and Marine Biology.**, 1984,

Recommendations

Subjects that it is recommended to have taken before

Marine Botany/V02M098V01102
The Marine Environment: Physical Oceanography/V02M098V01101
Marine Zoology/V02M098V01103

IDENTIFYING DATA				
Cartography, GIS and Remote Sensing				
Subject	Cartography, GIS and Remote Sensing			
Code	V02M098V01202			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	García Estévez, José Manuel Blanco Chao, Ramón			
Lecturers	Blanco Chao, Ramón García Estévez, José Manuel			
E-mail	ramon.blanco@usc.es jestevez@uvigo.es			
Web				
General description	In this subject, the student will be trained in spatial interpretation and analysis through the use of basic cartography and remote images and their implementation and analysis through Xeographic Information Systems			

Training and Learning Results	
Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	(*)Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	(*)Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	(*)Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B4	Desarrollo de habilidades en el manejo y tratamiento de herramientas, matemáticas, estadísticas e informáticas
B5	Desarrollo de la habilidad de elaboración, presentación y defensa de trabajos e informes técnicos
C1	Conocimiento físico-químico del medio oceánico y costero
C3	Conocimiento y comprensión de las interacciones de los organismos marinos y los ecosistemas marinos y costeros
C5	Conocimiento de los principios de explotación y sostenibilidad del medio marino y planificación y supervisión de su gestión
C6	Conocimiento, identificación y evaluación de la calidad ambiental del medio marino y de la legislación vigente. Dirección de consultorías ambientales
C7	Catalogación, evaluación, conservación, restauración y gestión de áreas marinas y litorales protegidos. Elaboración, asesoramiento legal y ejecución de planes de ordenación del litoral
C9	Conocimientos de instituciones, organismos y legislación relacionados con el medio marino y sus recursos empresariales y económicos
C13	Divulgación de conocimientos de la biología y el medio marinos: programas de formación y docencia; planificación y dirección de acuarios, museos, centros de interpretación ambiental, parques naturales y espacios naturales protegidos
C14	Elaboración, discusión, interpretación, asesoramiento y peritaje de informes científico-técnicos, éticos, legales y socioeconómicos relacionados con el ámbito marino y pesquero
C15	Gestión de actividades de ocio y turismo en el medio marino y litoral
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D3	Desarrollo de las capacidades de trabajo en equipo, enriquecidas por la pluridisciplinariedad
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma
D5	Desarrollo de las habilidades de comunicación y discusión de planteamientos y resultados
D6	Desarrollo de las capacidades de reflexión sobre responsabilidades sociales y éticas

D7	Desarrollo de habilidades para la divulgación de ideas en contextos tanto académicos como no especializados
D8	Desarrollo de la habilidad para hablar bien en público

Expected results from this subject	
Expected results from this subject	Training and Learning Results
(*)	A2 A5 B4 C7 C14 C15 D3 D8
New	A1 A2 A3 B2 B4 C1 C5 C6 C7 C9 D2 D3 D4 D6
New	A1 A2 B4 C1 C14 D1
New	A4 B5 C13 C14 C15 D5 D7 D8
New	A1 A2 A3 A4 A5 B1 C1 C3 C5 C6 C7 D1 D2 D3 D4 D5 D6 D7 D8

Contents
Topic

Basic cartography	Surfaces of reference in cartography: *xeoide, *elipsoide and topographical surface *Elipsoides and *datums Systems projected Systems of coordinates: geographical coordinates and *xeocéntricas Systems of coordinates: the projection UTM, coordinates UTM *Datum vertical: nets *xeodésicas and of *Nivelación. Altitude *ortométrica and *elipsoidal *Topografía: topographical representation, geometrical distance, reduced and real. Pending, directions and *acimuts
Systems of Geographical Information	Concepts of SIX: Definition. Elements of #a SIX The data in #a SIX: geographical and *alfanuméricos Structures and models of storage: models *ráster and *vectorial Analysis in #a SIX: Queries and rankings by attributes and space. Overlap of variable Results of #a SIX: Results *cartográficos and *alfanuméricos
Teledetection	Introduction to the Teledetection. Types of sensors and platforms. Introduction to the processing of images.

Planning

	Class hours	Hours outside the classroom	Total hours
Practices through ICT	15	15	30
Mentored work	0	17	17
Lecturing	2	4	6
Report of practices, practicum and external practices	5	5	10
Systematic observation	5	5	10
Laboratory practice	2	0	2
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies

	Description
Practices through ICT	Use of programs *SIGs
Mentored work	Follow-up of works *SIGs
Lecturing	Theoretical foundations

Personalized assistance

Methodologies	Description
Lecturing	Attention to the doubts of the student in real time, on concepts.
Practices through ICT	Attention to the use of computer technologies.
Mentored work	Personal orientation in the preparation of works and memories.

Assessment

	Description	Qualification	Training and Learning Results			
Report of practices, practicum and external practices	Work of the course *GIS	80	A1 A2 A3 A4 A5	B1 B2 B4 B5	C1 C3 C5 C6 C7 C9 C13 C14 C15	D1 D2 D3 D4 D5 D6 D7 D8
Systematic observation	Follow-up of the degree of *aprovechamiento of the work of the students	20	A1 A2 A3 A4 A5	B1 B2 B4 B5	C1 C3 C5 C6 C7 C9 C13 C14 C15	D1 D2 D3 D4 D5 D6 D7 D8

Other comments on the Evaluation

Sources of information

Basic Bibliography

Chuvieco Salinero, E., **Teledetección ambiental : la observación de la Tierra desde el Espacio**, Ariel, 2002

Bhatta, Basudeb, **Remote sensing and GIS**, Oxford University, 2009

Fernandez Garcia, F., **Introducción a la fotointerpretacion**, Ariel, 2000

Complementary Bibliography

ALDREY VÁZQUEZ, J. A., **Curso de Sistemas de Información Xeográfica.**, Publicado bajo licencia Creative Commons. URI: htt, 2018

LORENZO MARTÍNEZ, R, **Cartografía.**, Dossat, 2001

SANTOS PRECIADO, J.M., **Sistemas de Información Geográfica**, UNED, 2004

Recommendations

IDENTIFYING DATA

Environment Management: Socio-economics, Environmental Education and Legislation

Subject	Environment Management: Socio-economics, Environmental Education and Legislation			
Code	V02M098V01203			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	García Estévez, José Manuel Blanco Chao, Ramón			
Lecturers	Blanco Chao, Ramón García Estévez, José Manuel			
E-mail	ramon.blanco@usc.es jestevez@uvigo.es			
Web				
General description	(*)Esta materia trata de achegar aos alumnos/as aos espazos costeiros, onde se desenvolven tanto as actividades pesqueiras e marisqueiras, como ás industriais.			

Training and Learning Results

Code	
A2	(*)Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B6	Desarrollo de la curiosidad científica, de la iniciativa y la creatividad
C3	Conocimiento y comprensión de las interacciones de los organismos marinos y los ecosistemas marinos y costeros
C5	Conocimiento de los principios de explotación y sostenibilidad del medio marino y planificación y supervisión de su gestión
C6	Conocimiento, identificación y evaluación de la calidad ambiental del medio marino y de la legislación vigente. Dirección de consultorías ambientales
C7	Catalogación, evaluación, conservación, restauración y gestión de áreas marinas y litorales protegidos. Elaboración, asesoramiento legal y ejecución de planes de ordenación del litoral
C9	Conocimientos de instituciones, organismos y legislación relacionados con el medio marino y sus recursos empresariales y económicos
C15	Gestión de actividades de ocio y turismo en el medio marino y litoral
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D3	Desarrollo de las capacidades de trabajo en equipo, enriquecidas por la pluridisciplinariedad
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma
D5	Desarrollo de las habilidades de comunicación y discusión de planteamientos y resultados
D6	Desarrollo de las capacidades de reflexión sobre responsabilidades sociales y éticas
D7	Desarrollo de habilidades para la divulgación de ideas en contextos tanto académicos como no especializados

Expected results from this subject

Expected results from this subject	Training and Learning Results

(*)1. Analizar os espazos costeiros. Coñecer a súa dinámica e as características da súa regulación e ordenación.	A2 A4
2. Aproximarse aos criterios ordenadores das Zonas de Dominio-Público Marítimo Terrestre, en especial o que sobre as mesmas establece as Ley de Costas, e dun xeito especial o Plan de Ordenación do Litoral de Galicia.	B1 B6 C3
3. Coñecer en profundidade as dinámicas xeomorfolóxicas.	C5
4. Comprender a organización dos espazos costeiros: desde os asentamentos humanos tradicionais ate as intensas transformacións xeradas pola urbanización masiva do litoral.	C6 C7
5. Análisis das bases económicas das comunidades dependentes do mar: o declive das actividades pesqueiras, a pluriactividade e as competencias de usos na costa (turismo, urbanismo e actividades extractivas na plataforma continental)	C9 C15 D1
6. Comprender como a educación ambiental e a sensibilización en materia de Ordenación do Territorio aportan solucións de xestión sustentable.	D3 D4 D5 D6 D7

Contents

Topic
1.- The offshore zone, definition, terminology and - delimitation.
2.- Coastal xeodinamycs factors.
3.- The changes of the level of the sea.
4.- The Problematic of the Coastal: Problematic environmental. Processes of degradation.
5.- The Juridical Frame: the Coastal Law, Environmental Rule, Ordenation of the Coastal of Galicia
6.- Figures of protection in offshore systems.
7.- Strategies of environmental education.

Planning

	Class hours	Hours outside the classroom	Total hours
Presentation	5.5	16.5	22
Lecturing	15	35.1	50.1
Objective questions exam	2	0	2
Essay	1	0	1

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Presentation	Of *the advances in wool preparation of *the *works of wool matter.
Lecturing	The classes will be essentially theoretical *supported in abundant graphic material.To reinforce the contents will contribute him to the students/the complementary bibliography

Personalized assistance

Methodologies	Description
Lecturing	*Conceptual support for *esclarecer *doubts
Presentation	Orientation in wool preparation of *exhibitions

Assessment

	Description	Qualification	Training and Learning Results			
Objective questions exam	The theoretical contents of the matter will be object of an examination type test so that the students put of self-evident his level of knowledge of all the explained	50	A2 A4	B1 B6	C3 C5 C6 C7 C9 C15	D1 D3 D4 D5 D6 D7

Essay	The students will have to deliver a work on a subject that will choose between a smart proposal by the professor	50	A2 A4	B1 B6	C3 C5 C6 C7 C9 C15	D1 D3 D4 D5 D6 D7

Other comments on the Evaluation

Sources of information

Basic Bibliography

Haslett, Simon K., **Coastal systems**, Routledge, 2000

García Sanabria, J.; García Onetti, J.; Barragán Muñoz, J.M., **as Comunidades Autónomas y la gestión integrada de las áreas litorales de España : materiales para un debate sobre gobernanza**, Universidad de Cadiz, 2011

Barragán Muñoz, Juan Manuel, **Las áreas litorales de España : del análisis geográfico a la gestión integrada**, Ariel, 2004

Masselink, Gerhard, **Introduction to coastal processes and geomorphology**, Arnold, 2003

Flor, G., **Geologia Marina**, Univ. de Oviedo, 2005

Complementary Bibliography

Bird, E.C.F., **Coastal Geomorphology: An Introduction**, Wiley&Sons, 2008

Carter, R.W.G., **Coastal Environments. An introduction to the physical, ecological and cultural systems of coastlines.**, Academic Press, 1988

Davidson-Arnott. R., **An Introduction to Coastal Processes and Geomorphology**, Cambridge University Press., 2010

Haslett, S.K., **Coastal Systems**, Routledge, 2000

Recommendations

IDENTIFYING DATA				
Conservation Biology				
Subject	Conservation Biology			
Code	V02M098V01204			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	García Estévez, José Manuel Domínguez Conde, Jesús			
Lecturers	Domínguez Conde, Jesús Fernández Rodríguez, Nuria García Estévez, José Manuel Muiño Boedo, Ramón			
E-mail	jesus.dominguez@usc.es jestevez@uvigo.es			
Web	http://masterbiologiamarina.uvigo.es/			
General description	(*)Form to the student in the basic principles of the Biology of the Conservation, providing him tools of knowledge that allow him the resolution of relative practical cases to the marine environment			

Training and Learning Results	
Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B5	Desarrollo de la habilidad de elaboración, presentación y defensa de trabajos e informes técnicos
B6	Desarrollo de la curiosidad científica, de la iniciativa y la creatividad
B7	Entendimiento de la proyección social de la ciencia
C2	Conocimiento de la diversidad de organismos marinos y sus estrategias adaptativas
C3	Conocimiento y comprensión de las interacciones de los organismos marinos y los ecosistemas marinos y costeros
C5	Conocimiento de los principios de explotación y sostenibilidad del medio marino y planificación y supervisión de su gestión
C6	Conocimiento, identificación y evaluación de la calidad ambiental del medio marino y de la legislación vigente. Dirección de consultorías ambientales
C7	Catalogación, evaluación, conservación, restauración y gestión de áreas marinas y litorales protegidos. Elaboración, asesoramiento legal y ejecución de planes de ordenación del litoral
C13	Divulgación de conocimientos de la biología y el medio marinos: programas de formación y docencia; planificación y dirección de acuarios, museos, centros de interpretación ambiental, parques naturales y espacios naturales protegidos
C15	Gestión de actividades de ocio y turismo en el medio marino y litoral
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D3	Desarrollo de las capacidades de trabajo en equipo, enriquecidas por la pluridisciplinariedad
D6	Desarrollo de las capacidades de reflexión sobre responsabilidades sociales y éticas

Expected results from this subject	
Expected results from this subject	Training and Learning Results

(*)Knowledge of the diversity of the alive organisms in the marine ecosystems, his genetic diversity and his adaptative strategies.	A1 B1 B2 B5 B6 B7 C2 C3 C5 C6 C7 C13 C15 D1 D2 D3 D6
Knowledge of the nature, causes and consequences of the loss of genes, populations, species and habitats	A1 B1 B2 C3 C5 C6 C7 D1 D2 D6

Contents	
Topic	
1. Introduction to the Biology of the Conservation	1.1. What is and how arises the discipline. 1.2. *Biodiversidad Marine
2. Diversity in the half marine	2.1. History and current state of the knowledge 2.2. General patterns of geographic distribution 2.3. Means *pelágico and *bentónico 2.4. The means *estuarinos
3. Species loomed. Extinctions	3.1. Definitions 3.2. Temporary patterns of *biodiversidad 3.3. Human development and extinctions 3.4. Half aquatic: current state and estimate of taxes of extinction
4. Overexploitation of resources	4.1. Exploitation of natural resources *vs sustainability 4.2 Half marine: Evolution, current state and tendency of the *pesquerías world-wide 4.3. Ecological effects of the fishing: (to) direct Effects on species (*b) Effects on the ecosystems 4.4. Biological theory of the sustainable exploitation and models of management of the *pesquerías: Models of production *vs management *ecosistémica of the *pesquerías 4.5. The marine reservations like tool of management *pesquera: marine Reservations of interest *pesquero in Galicia: You *miñarzos
5. Species *invasoras	5.1. To what call species *invasoras. 5.2. Effects on the environment. 5.3. Roads of introduction of *invasoras in the half marine. 5.4. Spanish catalogue of Species *Invasoras.
6. Climatic change	6.1. Concept. 6.2. Changes observed in the last 100 years. 6.3. Climatic change in Galicia. 6.4. Changes in the half physicist and biotic.
7. The parasitism in the half marine	7.1. Parasitic system/*hospedador: biological Cycles and specificity 7.2. Biological cycles and transmission of the marine parasites 7.3. *Ecoparasitología
8. The *biodiversidad parasitic	8.1. Main parasitic groups presents in the half marine 8.2. Technicians of preparation, conservation and identification of marine parasites

9. Parasitism and conservation	9.1. Dynamics of parasitic populations-*hospedador: populational regulation of parasites and *hospedadores 9.1.1. Massive mortalities 9.1.2. Parasites and biological control 9.2. Parasites like *biomarcadores

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	20	53	73
Seminars	1	0	1
Objective questions exam	1	0	1

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	The student receives the contents and essential concepts for a correct understanding of the matter
Seminars	The student resolves relative doubts to the contents of the masterclasses and to the bibliographic work entrusted

Personalized assistance

Methodologies	Description
Lecturing	The professor will attend in the course of the session *magistral to the doubts and comments formulated by the students. Also it will answer to the questions formulated by email or in visits realised to the dispatch.

Assessment

	Description	Qualification		Training and Learning Results
Lecturing	They will evaluate by means of ad hoc proof the knowledge of the contents transmitted in the sessions *magistrales	40	A1	C2 C3 C5 C6
		20		C7 C13
		20		C15
		20		

Other comments on the Evaluation

Sources of information

Basic Bibliography

Ausden, M., **Habitat management for conservation: a handbook of techniques**, Oxford University Press, 2007

Bush, A.O.; Fernández, J.C.; Esch, G. & Seed J.R., **Parasitism. The diversity and ecology of animal parasites**, Cambridge University Press, 2001

Doody, J.P., **Coastal Conservation and Management - An Ecological Perspective**, Kluwer Academics Publishers, 2000

Primack, R.B. & Ros, J., **Introducción a la biología de la conservación**, Ariel Ciencia, 2002

Sinclair, M. & Valdimarsson, G, **Responsible fisheries in the marine ecosystem**, CABI Publishing, 2003

Complementary Bibliography

Bower, S.M., **Synopsis of Infectious Diseases and Parasites of Commercially Exploited Shellfish**, 2001

Grabda, S., **Marine Fish Parasitology. An outline**, . Weinhein; Basel (Switzerland): Cambrige, NY. VCH, 1991

Jennings, S. & Kaiser, M., **The effects of fishing on marine ecosystems and communities**, Academic Press, 2008

Roberts, L.S. & Janovy, J.S., **Foundations of Parasitology**, McGraw-Hill Science, 2005

Sodhi, N.S. & Ehrlich, P.R., **Conservation Biology for All**, Oxford University Press, 2010

Recommendations

IDENTIFYING DATA

Genetic Diversity and its Application to Study of Marine Organisms

Subject	Genetic Diversity and its Application to Study of Marine Organisms			
Code	V02M098V01205			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Pérez Diz, Ángel Eduardo			
Lecturers	Galindo Dasilva, Juan Martínez Lage, Andrés Naveira Fachal, Horacio Pérez Diz, Ángel Eduardo Quesada Rodríguez, Humberto Carlos			
E-mail	angel.p.diz@uvigo.es			
Web				
General description	The subject Genetic Diversity and his applications to the study of the marine organisms contributes a wide vision on concepts and genetic tools of application for the management, conservation and study of species and marine populations. The questions treated in this subject include the study of the molecular technicians for the analysis of the genetic variation, the distribution of the intraspecific variability and his quantification, the molecular footprint of the adaptation, the study of the genic expression, and the variation in quantitative characters. The lessons *magistrales will be complemented with practical sessions in which the students will be able to exercise the knowledges purchased in the theoretical classes. As I complement to the face-to-face training, will make activities no face-to-face in which the students will put in practice the concepts learnt in the matter through the resolution of practical cases and the realisation of works *tutorizados by a professor, facilitating like this the personalised work and the integration of different sources of information.			

Training and Learning Results

Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	(*)Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	(*)Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	(*)Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B3	Aprendizaje de diversas técnicas y métodos analíticos tanto en el medio natural como en el laboratorio
B4	Desarrollo de habilidades en el manejo y tratamiento de herramientas, matemáticas, estadísticas e informáticas
B5	Desarrollo de la habilidad de elaboración, presentación y defensa de trabajos e informes técnicos
B6	Desarrollo de la curiosidad científica, de la iniciativa y la creatividad
C2	Conocimiento de la diversidad de organismos marinos y sus estrategias adaptativas
C4	Conocimiento y búsqueda del potencial interés económico y biotecnológico de los organismos marinos
C7	Catalogación, evaluación, conservación, restauración y gestión de áreas marinas y litorales protegidos. Elaboración, asesoramiento legal y ejecución de planes de ordenación del litoral
C10	Inspección y asesoramiento técnico en la evaluación, explotación y gestión de pesquerías, extracción de recursos e instalaciones de acuicultura
C11	Estudios de dinámica poblacional, mejora genética y selección de stocks en pesquerías, acuicultura y programas de repoblación
C12	Control de calidad y seguridad de alimentos y de productos de transformación y biotecnológicos de origen marino

C14	Elaboración, discusión, interpretación, asesoramiento y peritaje de informes científico-técnicos, éticos, legales y socioeconómicos relacionados con el ámbito marino y pesquero
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma

Expected results from this subject	
Expected results from this subject	Training and Learning Results
Development of the understanding capacities, of analysis and synthesis	A1 A2 A3 A4 A5 B1 B2 B4 B5 B6 C2 D1
Utilisation of criteria and scientific methods in the approach and resolution of problems applying the knowledges purchased	A1 A2 A3 B1 B2 B3 C2 C4 C7 C10 C11 C12 C14 D1 D2
Development of the capacity of critical reasoning and *autocrítico	A1 A2 A3 B2 B6 C2 C4 C7 C11 C12 D2
Research, analysis and integration of information from different sources and capacity for his interpretation and evaluation	A1 A2 A3 A5 B1 B2 B4 B6 C2 C4 C7 C10 D1 D4

Learning of diverse technical and analytical methods so much in him half natural as in him laboratory	A1 A2 A3 B3 B4 C4 C10 C11 D1 D2 D4
Development of skills in him handle and treatment of tools, mathematical, statistical and computer	A1 A2 A5 B1 B2 B4 B6 C10 C11 C12 D1 D2 D4
Development of the capacity to update he knowledge of autonomous form	A3 A5 B2 B6 C12 C14 D4
Development of the skill of preparation, presentation and defence of works and technical reports	A1 A2 A4 A5 B5 B6 C14 D1 D2 D4
Development of the scientific curiosity, of the initiative and the creativity	A1 A2 A3 A4 A5 B1 B2 B6 C11 D1 D2 D4
Knowledge of the diversity of marine organisms and his adaptative strategies	A1 A2 A3 B1 B2 B3 C2 C11 D1

Knowledge and understanding of the interactions of the marine organisms and the marine and coastal ecosystems	A2 A3 B1 B2 B3 B4 C2 C7 C11 D1
Cataloging, evaluation, conservation, restoration and management of marine and coastal areas protected. Preparation, legal advice and execution of plans of ordination of the seaboard	A1 A2 A3 A5 B1 B2 B3 B4 B5 C7 C11 D1 D2 D4
Knowledge of the principles of exploitation and sustainability of the half marine and planning and supervision of his management	A1 A2 A5 B1 B2 B3 B4 C4 C7 C10 C11 C12 D2
Divulging of knowledges of the biology and the half marine: programs of training and teaching; planning and direction of aquariums, museums, centres of environmental interpretation, natural parks and natural spaces protected	A1 A2 A3 A4 B1 B2 B5 C7 D1 D2 D4
Preparation, discussion, interpretation, advice and *peritaje of scientific reports-technical, ethical, legal and socioeconomic related with him marine field and *pesquero	A1 A2 A3 A4 A5 B1 B2 B5 C14 D1 D2 D4

Knowledge and research of the potential economic interest and *biotecnológico of the marine organisms	A1 A2 A3 A5 B1 B2 B3 B4 C4 D1 D2 D4
Knowledge and handle of the methodology of investigation, of the technicians of sampling and instrumental and of analysis of data applied to the half marine	A1 A2 A3 A5 B1 B2 B3 B4 C10 D1 D2 D4
Studies of populational dynamics, genetic improvement and selection of stocks in *pesquerías, aquaculture and programs of *repoblación	A1 A2 A3 A5 B1 B2 B3 B4 C11 D1 D2 D4
Inspection and technical advice in the evaluation, exploitation and management of *pesquerías, extraction of resources and installations of aquaculture	A1 A2 A3 A5 B1 B2 B3 B5 C10 D1 D2

Contents

Topic	
SUBJECT 1: GENETIC VARIATION IN MARINE ORGANISMS	Molecular techniques for the scrutiny of the populational genetic variation. Databases. Identification of species (Barcoding), individuals and sexes.
SUBJECT 2: DISTRIBUTION OF THE GENETIC VARIABILITY INSIDE SPECIES	Estimators of the genetic diversity. Populational subdivision and migration. Phylogeography.
SUBJECT 3: GENETIC VARIATION IN NATURAL POPULATIONS: EFFECTS OF THE POPULATIONAL SIZE	Genetic drift in natural populations. Effective population size. Demographic effects. Inbreeding due to genetic drift. Strategies to handle populations in captivity.
SUBJECT 4: NATURAL SELECTION, ADAPTATION And GENETIC DIVERSITY	Natural selection and adaptation. Neutral theory of the molecular evolution. The molecular footprint of the natural selection. Inference of selection from intra- and interspecific molecular variation.
SUBJECT 5: ADAPTATIVE And NEUTRAL VARIATION IN THE GENIC EXPRESSION	Techniques to quantify gene expression. Proteomics. Variation of gene expression within and between populations. Neutral and adaptative variation in gene expression. Phenotypic plasticity.
SUBJECT 6: VARIATION IN QUANTITATIVE CHARACTERS	The continuous variation. Components of variance. Heridability. Estimation of the heridability. The action of the natural selection on the quantitative traits. Methods for the cartography of QTLs

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	56	84
Mentored work	0	30	30
Practices through ICT	12	24	36

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	The teacher explains the theoretical content of each topic. Extensive diagrams of the subject and a specific bibliography will be provided so that the student can delve into the different topics. The student assimilates and writes down concepts. It raises doubts and questions.
Mentored work	Students will prepare a written report on a topic proposed and tutored by a teacher
Practices through ICT	Students will be trained in the use of the most relevant online programs and tools related to each topic. The teacher guides and solves doubts.

Personalized assistance

Methodologies	Description
Mentored work	The process of learning of the student that complements the masterclasses and the practices, will be carried out by means of the preparation of a memory written on a topic related with the subject, proposed and supervised by a professor. The professors will reserve a time to attend and resolve the doubts of the students. In this activity professors have the function to orient and guide the process of learning of the students and will help them to make successfully the corresponding autonomous work. The professors indicate during the beginning of the term the place, day and hours for this personalised attention.

Assessment

	Description	Qualification	Training and Learning Results			
Lecturing	They will evaluate the answers to a final examination writing in which they will pose relative questions to the theoretical concepts given along the subject.	40	A1 A2 A3 A4 A5	B1 B3 B4 B6	C2 C4 C7 C10 C11 C12 C14	D1 D2 D4
Mentored work	It will evaluate the quality of the memory written presented by the students in base to the subject posed by his tutor.	30	A1 A2 A3 A4 A5	B1 B2 B5 B6	C2 C4 C7 C10 C11	D1 D2 D4
Practices through ICT	The answers to a practical exercise in which questions related to the practical concepts taught throughout the course will be evaluated.	30	A1 A2 A3 A4 A5	B1 B2	C2 C11	

Other comments on the Evaluation

It will be necessary to obtain a minimum score of 4,0 points in the final exam to pass the subject.

Delaying in the presentation of working tasks will be penalised up to 20% of the corresponding score assigned to the concerned task (if this is presented inside the penalised extended term, otherwise a zero will be obtained). It will not be admitted the delivery of works a week later of the term of delivery (penalised extended term).

Any attempt of plagiarism in the activities will make to get a qualification of zero in the activity affected, without possibility to recover it in the second chance-call (July).

The students that do not attend to the final exam will count as no presented.

To pass the subject will be necessary to obtain 5 points of 10 in the weighted global evaluation.

For the second chance-call (final exam in July), the student will conserve the scores of the activities made previously.

Date for examination (final exam, 1st and 2nd chance) can be obtained from:

Sources of information
Basic Bibliography
Complementary Bibliography
John C. Avise, **Molecular Markers, Natural History, and Evolution, Springer**, Second Edition,
Philip W. Hedrick, **Genetics of Populations, Fourth Edition, Jones & Bartlett**, Fourth Edition,
Anne Charmantier, Dany Garant, Loeske E.B. Kruuk, **Quantitative Genetics in the wild, OUP Oxford**, Primera Edición,
Arthur Lesk, **Introduction to Bioinformatics, OUP Oxford**, Fourth Edition,
Johanna R. Freeland, Heather Kirk, Stephen D. Petersen, **Molecular Ecology, Wiley-Blackwell**, Second Edition,

Recommendations
Subjects that continue the syllabus
Techniques to Study Marine Organisms/V02M098V01108

Subjects that it is recommended to have taken before
Molecular Basis of Adaptation to the Marine Environment/V02M098V01107

IDENTIFYING DATA				
Marine Pollution and Ecotoxicology				
Subject	Marine Pollution and Ecotoxicology			
Code	V02M098V01206			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	García Estévez, José Manuel Barreiro Lozano, Rodolfo			
Lecturers	Barreiro Lozano, Rodolfo García Estévez, José Manuel			
E-mail	jestevez@uvigo.es rodolfo.barreiro@udc.es			
Web	http://https://plus.google.com/+RodolfoBarreiroSP/posts			
General description	This course explore technigues for detecting, quantifying and predicting the effects of pollutants in the marine environment. These techniques are essential for protecting and managing the environment against the risks of polllution.			

Training and Learning Results	
Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	(*)Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B4	Desarrollo de habilidades en el manejo y tratamiento de herramientas, matemáticas, estadísticas e informáticas
B6	Desarrollo de la curiosidad científica, de la iniciativa y la creatividad
C6	Conocimiento, identificación y evaluación de la calidad ambiental del medio marino y de la legislación vigente. Dirección de consultorías ambientales
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico

Expected results from this subject	
Expected results from this subject	Training and Learning Results
Distinguishes and identifies the approaches of retrospective prospective ecotoxicology.	A1 A2 B1 C6
Describes the typical effects of the pollution on individuals, populations and communities	A1 A2 B1 C6
Assesses the advantages and limitations of each level of organisation to detect the impact of pollutants	A1 A2 B1 C6 D1 D2
Understands the fundamentals of ecotoxicology assays, bioaccumulation-dpuration studies and biomarkers	A1 A2 B4 D1 D2
Understands the relevance of the information provided by ecotoxicology assays	D1 D2
Understands the fundamentals and limitations of the predictions derived from models of the distribution and effects of pollutants	D1 D2

Is able to face the technical literature and place into context in the mainframe of ecotoxicology	B6 D1

Contents	
Topic	
Introduction and bioaccumulation (Retrospective ecotoxicology I)	Main environmental problems. Ecotoxicology. The concept of bioavailability. Factors of pollutant bioavailability. Use of bioacumulators. Requirements of a good bioaccumulator
Toxicokinetics	Kineticsl of pollutant accumulation. Concepts of Bioconcentración Factor (BCF), Bioaccumulation Factor (BAF).
Biomagnification along the food chain	Concept of biomagnification. Estimating trophic transfer and Biomagnification Transfer. Examples of *biomagnification and trophic dilution
Physiological effects	Main physiological detrimental effects used in ecotoxicology and biomonitoring.
Biomarkers (Retrospective Ecotoxicology II).	Classification, specificity and relation with adverse effects. Requirements of a biomarker. Examples of biomarker.
Toxicity assays (Prospective Ecotoxicology *I).	Concentration-response relationship. Types of assay: acute and chronic toxicity. Data analyses. Toxicity curves. LC50, NOEC, LOEC and MATC.
Prediction in ecotoxicology (Prospective Ecotoxicology II)	Species sensitivity distribution. Environmental risk assessment.
Changes in community composition (Retrospective Ecotoxicology III).	Bioindicator species. Relative abundance. Biotic indexes. Diversity indexes. Comparison with communities of reference.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	16	40	56
Problem solving	4	12.5	16.5
Autonomous problem solving	1.5	0	1.5
Objective questions exam	1	0	1
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Master session
Problem solving	Computer sessions with specialized software.
Autonomous problem solving	Personal guidance to students through one-to-one meeting and/or using TICs.

Personalized assistance	
Methodologies	**Description**
Autonomous problem solving	Personal guidance to students through one-to-one meeting and/or using TICs.

Assessment						
	Description	Qualification	Training and Learning Results			
Objective questions exam	A test	100	A1 A2	B1 B4 B6	C6	D1 D2

Other comments on the Evaluation

Sources of information
Basic Bibliography
Complementary Bibliography
Newman, M. C., and M. A. Unger, **Fundamentals of Ecotoxicology**, 2,
Walker, C. H., S. P. Hopkin, R. M. Sibly, and D. B. Peakall., **Principles of Ecotoxicology**, 3,
Clark. R.B., **Marine Pollution**, 5,

Recommendations

IDENTIFYING DATA				
Biology of Exploited and Potentially Exploitable Species				
Subject	Biology of Exploited and Potentially Exploitable Species			
Code	V02M098V01207			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	García Estévez, José Manuel Cremades Ugarte, Javier			
Lecturers	Besteiro Rodríguez, Celia Cremades Ugarte, Javier Fernández Rodríguez, José Luis García Estévez, José Manuel			
E-mail	jestevez@uvigo.es javier.cremades@udc.es			
Web				
General description	(*)Ciclo vital e dinámica de poboacións das especies actualmente explotadas no litoral galego, e de especies potencialmente *explotables. Hábitat, abundancia, distribución e propiedades *nutritivas			

Training and Learning Results	
Code	
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	(*)Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B5	Desarrollo de la habilidad de elaboración, presentación y defensa de trabajos e informes técnicos
C2	Conocimiento de la diversidad de organismos marinos y sus estrategias adaptativas
C3	Conocimiento y comprensión de las interacciones de los organismos marinos y los ecosistemas marinos y costeros
C4	Conocimiento y búsqueda del potencial interés económico y biotecnológico de los organismos marinos
C5	Conocimiento de los principios de explotación y sostenibilidad del medio marino y planificación y supervisión de su gestión
C9	Conocimientos de instituciones, organismos y legislación relacionados con el medio marino y sus recursos empresariales y económicos
C10	Inspección y asesoramiento técnico en la evaluación, explotación y gestión de pesquerías, extracción de recursos e instalaciones de acuicultura
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma
D7	Desarrollo de habilidades para la divulgación de ideas en contextos tanto académicos como no especializados
D8	Desarrollo de la habilidad para hablar bien en público

Expected results from this subject	
Expected results from this subject	Training and Learning Results
(*)	C5
(*)	B2 C2 C3 C4
(*)	C2 C3
(*)	C2 C3 C5
(*)	C4

New	C5 C9 C10 D4
New	A4 A5 B2 B5 D1 D2 D4 D7 D8

Contents	
Topic	
Seaweeds as marine resources.	Life cycles and biological types. Uses of seaweeds: alginophytes, agarophytes, carrageenophytes, ulvanophytes and edible seaweeds. Ecological value and ecosystem services of marine macroalgae. Study methodologies of its biology, distribution, and abundance. Main species of seaweeds of economic interest from the peninsular Atlantic coasts. Good practices and indicators of sustainability of the exploitation and cultivation of commercial seaweeds.
Marine invertebrates as marine resources.	Main species of benthic marine invertebrates that are currently exploited in Galicia. Life cycle and population dynamics. Habitat, abundance, and geographic distribution. Species associated with rocky bottoms: mussel seed, oysters, barnacles, and sea urchins. Species associated with soft substrates: cockles, clams, razor clams, and other bivalve molluscs. Other exploited or potentially exploitable species.
Pelagic, demersal and bottom species	Initially, a short introduction is made on the main oceanographic characteristics of the pelagic environment, in general, and of the coast of Galicia and the Cantabrian Sea in particular, to understand the main interactions of the species under study with their environment. Subsequently, the study of the life cycle and the essential biological aspects involved in the dynamics of the exploited populations of the main pelagic and demersal species of fish and crustaceans in Galicia and the Cantabrian coast are addressed. The study focuses on albacore tuna (Thunnus alalunga) as a model species of the oceanic pelagic environment, and mackerel (Scomber scombrus) within the coastal pelagic environment. Regarding bottom species, the hake (Merluccius merluccius) and the spider crab (Maja brachydactyla) are studied. Habitat and adaptations. Generalities and guide species. Typical examples: anchovies and sardines; bonito and swordfish. Potentiality of exploitable species (discards).

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	24	58.8	82.8
Presentation	4	16	20
Seminars	4	0	4
Mentored work	12	30	42
Objective questions exam	1	0	1
Essay questions exam	1	0	1
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Presentation by the teacher of the contents on the subject matter of study, theoretical bases and / or guidelines of a work or exercise that the student has to develop.
Presentation	Presentation by the students to the teacher and / or a group of students of a subject matter or content of the results of a job, exercise, project ... It can be done individually or in groups.
Seminars	Personalization of support and follow-up of the student.
Mentored work	Para desenvolver a capacidade de buscar e estruturar unha información traballando de forma autónoma e de expor publicamente os resultados obtidos.

Personalized assistance

Methodologies	Description
Presentation	Students will be attended personally via face-to-face in the classroom or through virtual platforms (Teams, Virtual classrooms, etc.).
Seminars	Discussion of the individual/group work presented

Assessment

	Description	Qualification	Training and Learning Results			
Presentation	The work done and delivered as well as the clarity and synthesis capacity in its public exposure will be evaluated	30	A4 A5	B2 B5	C9	D1 D2 D4 D7 D8
Mentored work	Both the attendance and attitude in the lectures will be evaluated.	10				D1 D2
Objective questions exam	The written test will consist of a series of objective multiple choice questions that cover all parts of the subject.	20	A5	B2	C2 C9	D2
Essay questions exam	The written exam will consist of a series of development questions of medium length and covering all parts of the subject	40	A5	B2	C2 C4 C5 C9 C10	D1 D4

Other comments on the Evaluation

Sources of information

Basic Bibliography

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Nielsen, S. Suzanne, **Análisis de los alimentos**, Editorial Acribia, S.A., 2003

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Vincent, A., Stanley, A. & Ring, I., **Hidden champion of the ocean: Seaweed as a growth engine for a sustainable European future**, https://www.seaweedeurope.com, 2020

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Complementary Bibliography

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Bell, M., F. Redant & I. Tuck, **Lobsters: biology, management, aquaculture and fisheries**, Bruce Phillips (ed.). Blackwell Publishing, 2006

Cruz, T., **Biologia e ecología do percebe, Pollicipes pollicipes (Gmelin, 1790) no litoral sudoeste portugués**, Universidad de Évora, 2000

Lustres Pérez, V., **El erizo de mar: Paracentrotus lividus (Lamarck, 1816) en las costas de Galicia**, Universidad de Santiago de Compostela, 2006

Manuel, R. L., **British Anthozoa (Coelenterata: Octocorallia & Hexacorallia)**, Synopses of the British Fauna (New Series)., 18 (R, 1988

Sakaguchi, M. (Ed.), **Developments in food science. More efficient utilization of fish and fisheries products**, Elsevier, 2004

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Recommendations

Subjects that continue the syllabus

Evaluation and Exploitation of Coastal Resources/V02M098V01208

Subjects that it is recommended to have taken before

Marine Botany/V02M098V01102
Marine Zoology/V02M098V01103

IDENTIFYING DATA				
Avaliación e Explotación de Recursos no Litoral				
Subject	Avaliación e Explotación de Recursos no Litoral			
Code	V02M098V01208			
Study programme	Máster Universitario en Bioloxía Mariña			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1	2c
Teaching language	#EnglishFriendly Castelán Galego			
Department				
Coordinator	Presa Martínez, Pablo			
Lecturers	Pérez Rodríguez, Montserrat Presa Martínez, Pablo			
E-mail	pressa@uvigo.gal			
Web	http://http://masterbiologiamarina.uvigo.es/			
General description	Materia orientada ao coñecemento dos sistemas actuais de avaliación dos recursos mariños vivos no litoral e o seu uso na xestión dos mesmos de forma integrada: conservación, explotación e sustentabilidade. Materia do programa English Friendly. Os/ as estudantes internacionais poderán solicitar ao profesorado: a) materiais e referencias bibliografías para o seguimento da materia en inglés, b) atender as titorías en inglés, c) probas e avaliacións en inglés.			

Resultados de Formación e Aprendizaxe	
Code	
A1	Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B3	Aprendizaje de diversas técnicas y métodos analíticos tanto en el medio natural como en el laboratorio
B5	Desarrollo de la habilidad de elaboración, presentación y defensa de trabajos e informes técnicos
C5	Conocimiento de los principios de explotación y sostenibilidad del medio marino y planificación y supervisión de su gestión
C8	Conocimiento y manejo de la metodología de investigación, de las técnicas muestreo e instrumentales y de análisis de datos aplicados al medio marino
C10	Inspección y asesoramiento técnico en la evaluación, explotación y gestión de pesquerías, extracción de recursos e instalaciones de acuicultura
C11	Estudios de dinámica poblacional, mejora genética y selección de stocks en pesquerías, acuicultura y programas de repoblación
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D3	Desarrollo de las capacidades de trabajo en equipo, enriquecidas por la pluridisciplinariedad
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma
D5	Desarrollo de las habilidades de comunicación y discusión de planteamientos y resultados

Resultados previstos na materia	
Expected results from this subject	Training and Learning Results

1 Que o alumno manexe os parámetros e a obtención de datos nos que se basea a avaliación dos recursos mariños vivos.	A1 B1 C5 D1
2 Que o alumno saiba identificar modelos, procesos e tecnoloxías que permiten optimizar a avaliación dos recursos mariños vivos.	A2 B2 C8 D4
3 Que o alumno coñeza os fundamentos da xestión de pesqueiras e manexe os criterios empregados en plans de explotación e recuperación.	A3 B3 C10 D1
4 Que o alumno comprenda e manexe os parámetros xenéticos subxacentes na xestión de recursos mariños vivos	A2 B2 C11 D4
5 Que o alumno saiba efectuar un manexo xenético adecuado de *stocks pesqueiros e de repoboación: a súa fundación, mantemento e seguimento.	A4 B3 C10 D3
6 Que o alumno saiba elaborar un plan integral de xestión de pesqueiras mediante as ferramentas xenéticas adecuadas para a súa avaliación e explotación.	A5 B5 C11 D2 D5

Contidos	
Topic	
TEMA I. Antecedentes e conceptos: sistemas de avaliación e explotación dos recursos mariños vivos.	Obxectivos, conceptos, técnicas de identificación de stocks, ciclo de vida, modelos de axuste recrutamento-stock, selectividade das artes, crecemento, mortalidade.
TEMA II. Ferramentas de avaliación dos recursos mariños vivos I.	Asesoramento dun stock: fontes de información; organismos internacionais que interveñen na regulación e xestion dos recursos vivos. Rede estatística e programas de seguimento para a avaliación de recursos.
TEMA III. Ferramentas de avaliación dos recursos mariños vivos II.	Concepto de sobrepesca e os seus tipos. Sustentabilidade e xestión de pesqueiras: fundamentos técnicos. Xestión baseada nos límites de capturas e control do esforzo pesqueiro. Plans de recuperación. Enfoque de precaución e enfoque ecosistémico. Puntos de referencia.
TEMA IV. Ferramentas de avaliación dos recursos mariños vivos III.	Avaliación de recursos pesqueiros: métodos indirectos. Modelos de produción. Modelos estruturais; análise de cohortes; método da poboación virtual.
TEMA V. Ferramentas de xestión dos recursos mariños vivos IV.	Sistema de asesoramento das pesqerías da UE. Censos e mostras. Estatísticas pesqueiras, capturas, esforzo, CPUE. Estratexias de mostraxe. Métodos directos de avaliación de recursos independentes dos datos pesqueiros. Tipos de campañas e obxectivos. prospeccións especie-específicas.
TEMA VI. Bases xenéticas da xestión de recursos mariños vivos.	Variación continua de caracteres de interese e métodos biométricos para a avaliación de caracteres.
TEMA VII. Manexo xenético de *stocks pesqueiros.	Selección de stocks fundadores; tamaño xenético efectivo poboacional; mantemento de stocks para repoboación de pesqueiras; selección xenética inducida por pesca e domesticación.
TEMA VIII. Ferramentas moleculares para a avaliación xenética de pesqueiras.	Tipos de marcadores moleculares: evolución e propiedades. Herramientas genéticas y genómicas. Aplicación de marcadores á xestión de pesqueiras.
TEMA IX. Avaliación xenética de pesqueiras demersais.	Avaliación xenética de pesqueiras demersais. Relación SSB - recrutamento e diversidade xenética. Criterios de xestión xenética de pesqueiras orientados ao obxectivo: explotación, conservación ou sustentabilidade.
TEMA X. Avaliación xenética de pesqueiras costeiras.	A estrutura xenética como marco de xestión. Xestión integral de pesqueiras. Fundamentos xenéticos dun plan de xestión de stocks cultivados ou salvaxes.

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	9	18	27
Prácticas con apoio das TIC	6	12	18
Resolución de problemas	5	10	15

Resolución de problemas e/ou exercicios	0	5	5
Exame de preguntas de desenvolvemento	2	0	2
Práctica de laboratorio	0	4	4
Debate	4	0	4

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Metodoloxía docente

	Description
Lección maxistral	Os créditos presenciais que corresponden coas clases conceptuais, terán lugar mediante videoconferencia. Nelas exporase a materia con medios telemáticos (gráficos e auditivos).
Prácticas con apoio das TIC	Efectúanse as prácticas de simulación de procesos de avaliación de pesqueiras, utilizando datos de campo. Teñen lugar na aula, utilizando todos os medios dixitais dispoñibles e con titoría en tempo real por videoconferencia.
Resolución de problemas	Os problemas e casos que sustentan a bagaxe conceptual da materia trabállanse diariamente durante a duración da docencia da materia. Preséntanse ao final da clase, execútanse como deberes externos, se reenvían para corrección ao docente e corríxense grupalmente en clase.

Atención personalizada

Methodologies	Description
Lección maxistral	Atención en tempo real ás dúbidas de comprensión e matemáticas que xurdan nas sesións presenciais.
Prácticas con apoio das TIC	Lidérase a execución dos procesos dixitais e ofimáticos.
Resolución de problemas	Oriéntase cara a unha interpretación non ambigüa dos enunciados dos problemas e casos prácticos.

Avaliación

	Description	Qualification	Training and Learning Results
Resolución de problemas e/ou exercicios	Cada sesión conceptual leva asociada a súa avaliación continua mediante a execución asíncrona dos deberes diários, a súa entrega ao docente con feedback e a corrección grupal na clase seguinte. Son esenciais para aprehender a materia.	30	A1 B1 C5 D2 A2 B2 C8 D3 A3 D5
Exame de preguntas de desenvolvemento	Test final de competencia conceptual e operativa, constituído por: definicións, test de respostas múltiples, descrición de procesos e resolución dun caso práctico.	40	A3 B5 C5 D1 A4 C10 D2 D4
Práctica de laboratorio	Valórase a correcta execución dos procesos dixitais e a implicación na aprendizaxe autónoma e colectiva durante as prácticas con software de simulación.	10	A4 B3 C11 D2 A5 B5 D3 D5
Debate	O debate presencial in situ implica o razoamento e posicionamento científicos ante situacións de xestión de recursos mariños vivos, de carácter técnico, científico, social ou económico. Valórase a participación construtiva no debate diário.	20	A4 B5 C11 D5

Other comments on the Evaluation

Primeira convocatoria do exame escrito previsto para o 21 de abril de 2023 (10-12h). Para a segunda convocatoria de avaliación escrita do día 21 de xuño de 2023 (10:00-12:00 horas), manterase a cualificación do resto dos elementos da avaliación continua e volverase calcular a puntuación resultante, incluído o segundo exame. As titorías implementaranse a criterio na aula virtual, como reforzo dos procesos de avaliación i.e. revisión de exercicios e exames.

Bibliografía. Fontes de información

Basic Bibliography

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TJ Pandian, CA Strussmann, MP Marian, **Fish Genetics And Aquaculture Biotechnology**, 1st, CRC Press, 2005

JD Ferraris, S Palumbi, **Molecular Zoology: Advances, Strategies and Protocols**, 1st, John Wiley & Sons, 1996

J Avise, **Molecular Markers: Natural History and Evolution**, 2nd, Sinauer Associates, 2004

S Jennings, MJ Kaiser, JD Reynolds, **Marine Fisheries Ecology**, 1st, Wiley-Blackwell, 2001

Complementary Bibliography

TJ Pitcher, PJB Hart, D Pauly, **Reinventing Fisheries Management**, 2nd, Chapman & Hall, 2001

M. Haddon, **Modelling and Quantitative Methods in Fisheries**, 2nd, Chapman and Hall/CRC, 2001

Recomendacións

Other comments

Orientacións para o estudo e a optimización curricular:

1. Consultar a bibliografía recomendada polo profesor nas distintas unidades temáticas.

2. Asistir a *tutorías *discrecionales personalizadas xa sexan presenciais ou virtuais, abertas (resposta diferida) ou pechadas (acordo de horarios para a *tutoría *online).

3. Participar activamente nas clases reais e virtuais.

4. Realizar os deberes de maneira regular durante o desenvolvemento das clases.

IDENTIFYING DATA				
Pesquería e Explotación de derivados da Pesca				
Subject	Pesquería e Explotación de derivados da Pesca			
Code	V02M098V01209			
Study programme	Máster Universitario en Bioloxía Mariña			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1	2c
Teaching language	Castelán			
Department	Bioloxía funcional e ciencias da saúde Dpto. Externo			
Coordinator	Iglesias Blanco, Raúl			
Lecturers	Aubourg Martínez, Santiago Pedro Castro Pampillón, José Antonio Iglesias Blanco, Raúl			
E-mail	rib@uvigo.es			
Web				
General description	Nesta materia abordarase o estudo das principais pesqueiras mundiais e nacionais, os fundamentos da bioloxía pesqueira e a xestión de pesqueiras, e os principais aspectos relacionados co tratamento postcaptura, transformación e control de aptitude dos produtos da pesca, incluíndo a importancia económico-sanitaria dos parasitos para o sector pesqueiro e a súa aplicación como bioindicadores de stocks en pesquerías.			

Resultados de Formación e Aprendizaxe	
Code	
A1	Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B3	Aprendizaje de diversas técnicas y métodos analíticos tanto en el medio natural como en el laboratorio
B4	Desarrollo de habilidades en el manejo y tratamiento de herramientas, matemáticas, estadísticas e informáticas
B7	Entendimiento de la proyección social de la ciencia
C7	Catalogación, evaluación, conservación, restauración y gestión de áreas marinas y litorales protegidos. Elaboración, asesoramiento legal y ejecución de planes de ordenación del litoral
C10	Inspección y asesoramiento técnico en la evaluación, explotación y gestión de pesquerías, extracción de recursos e instalaciones de acuicultura
C11	Estudios de dinámica poblacional, mejora genética y selección de stocks en pesquerías, acuicultura y programas de repoblación
C12	Control de calidad y seguridad de alimentos y de productos de transformación y biotecnológicos de origen marino
C14	Elaboración, discusión, interpretación, asesoramiento y peritaje de informes científico-técnicos, éticos, legales y socioeconómicos relacionados con el ámbito marino y pesquero
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D3	Desarrollo de las capacidades de trabajo en equipo, enriquecidas por la pluridisciplinariedad
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma

Resultados previstos na materia	
Expected results from this subject	Training and Learning Results

Poder realizar e/ou dirixir consultorías ambientais relacionadas coa xestión das pesqueiras.	A2 A3 A4 A5 B1 B2 B7 C10 D1 D2 D3 D4
Ser capaz de catalogar, avaliar, conservar, restaurar e xestionar as áreas mariñas e litorais protexidas, no que refire aos seus recursos pesqueiros, así como saber elaborar, asesorar legalmente e executar os plans de ordenación do litoral, no que se refire devanditos recursos	A1 A2 A3 A4 A5 B1 B2 B7 C7 C10 C11 C14 D1 D2 D3 D4
Ser capaz de inspeccionar e asesorar tecnicamente na avaliación, explotación e xestión de pesqueiras, así como na extracción de recursos e instalacións de acuicultura	A1 A2 A3 A4 A5 B1 B2 B3 B7 C7 C10 D1 D2 D3 D4
Demostrar que pode realizar estudos de dinámica poboacional e/ou selección de *stocks en pesqueiras, acuicultura e/ou programas de repoboación	A1 A2 A3 A4 A5 B1 B2 B3 B4 B7 C10 C11 C14 D1 D2 D3 D4

Ser capaz de analizar a calidade e seguridade de alimentos e de produtos de transformación e biotecnolóxicos de orixe mariña	A1 A2 A3 A4 A5 B1 B2 B3 B7 C12 C14 D1 D2 D3 D4
Demostrar que pode elaborar, discutir, interpretar, asesorar e *peritar informes científico-técnicos, éticos, legais e socioeconómicos relacionados co ámbito mariño e pesqueiro	A1 A2 A3 A4 A5 B1 B2 B7 C14 D1 D2 D3 D4

Contidos
Topic
1. Pesquerías mundiais e españolas
2. Avaliación de stocks pesqueiros
3. Asesoramento á xestión de pesquerías
4. Características da composición das especies mariñas
5. Mecanismos de alteración dos produtos mariños
6. Ferramentas para a determinación da perda de calidade
7. Novas tecnoloxías para a retención da calidade
8. Aproveitamento de recursos mariños: produtos de refugallo e especies infravaloradas
9. Parasitos en produtos pesqueiros: bioloxía, control e repercusión económico-sanitaria
10. Os parasitos como bioindicadores para a identificación de stocks en pesqueiras

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	20	5	25
Estudo de casos	2	20	22
Exame de preguntas obxectivas	1	13	14
Exame de preguntas obxectivas	1	13	14
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Metodoloxía docente	
	Description
Lección maxistral	As clases maxistrais impartiranse en sesións duns 50 min de duración mediante videoconferencia e o uso de presentacións Power Point. Tentarase fomentar a participación activa dos alumnos a través da formulación de cuestións ou situacións relacionadas cos contidos da materia

Estudo de casos	Os alumnos, a través do traballo individual ou grupal, deberán resolver unha serie de casos que tentarán simular situacións similares ás que se poden dar no mundo laboral relacionado coa presenza e control de formas parasitarias nos produtos da pesca. Para a súa resolución os alumnos deberán integrar todo o aprendido previamente durante as leccións maxistrais e, en ocasións, poderán necesitar buscar información adicional. Os casos resoltos serán expostos e/o discutidos durante as sesións presenciais destinadas á avaliación desta actividade.

Atención personalizada

Methodologies	Description
Lección maxistral	Os profesores atenderán as preguntas que poidan xurdir durante as clases presenciais, fomentando en todo momento a participación activa do alumnado, e a través das correspondentes titorías, que o alumnado poderá realizar de forma presencial, ou cando non sexa posible, mediante correo electrónico ou videoconferencia.
Estudo de casos	Durante esta actividade o alumnado contará en todo momento coa orientación do profesorado implicado, que poderá reconducir o traballo dos estudantes se os avances na resolución dos casos non progresan na dirección adecuada.

Avaliación

	Description	Qualification	Training and Learning Results			
Lección maxistral	Avaliásese a asistencia, actitude, e participación activa do alumno durante as sesións. A adquisición de coñecementos teórico-prácticos correspondentes aos contidos impartidos ao longo destas sesións será avaliada na proba test final integradora.	5	A1 A2	B3 B7	C7 C10 C11 C12 C14	D1 D2
Estudo de casos	Avaliarase a capacidade dos estudantes para dar resposta, de forma crítica e razoada, a certos casos ou situacións prácticas relativas aos temas 9 e 10, así como para defender os argumentos utilizados diante do profesor e compañeiros.	35	A2 A3 A4 A5	B1 B2 B3 B4	C7 C10 C12 C14	D1 D2 D3 D4
Exame de preguntas obxectivas	Avaliaranse diversos aspectos relacionados cos 3 primeiros temas relativos ás pesqueiras e a súa xestión	30	A1 A2	B1 B3	C7 C10 C11	D1 D2
Exame de preguntas obxectivas	Avaliaranse diversos aspectos relacionados cos temas 4 a 8 relativos ao tratamento postcaptura, transformación, e control de aptitude dos produtos da pesca, e ao aproveitamento dos seus refugallos/descartes.	30	A1 A2	B1 B3	C12	D1 D2

Other comments on the Evaluation

Dada a natureza práctica da actividade "Estudo de casos" e as habilidades e competencias a avaliar durante a mesma, a asistencia e participación na devandita actividade será obrigatoria para superar a materia. Por tanto, se algunha persoa optase polo modo de avaliación global, terá que realizar tamén esta actividade obrigatoriamente.

Para superar a materia será necesario sacar un 5.0, unha vez sumadas as notas ponderadas das 4 metodoloxías/probas avaliables. Con todo, tanto no estudo de casos como en cada unha das dúas probas de preguntas obxectivas, deberase alcanzar unha cualificación mínima de 4. En caso disto non ocorra, os alumnos deberá recuperar a actividade/é non superadas na 2ª oportunidade.

Bibliografía. Fontes de información

Basic Bibliography

FAO, **The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation**, FAO, Rome, https://doi.org/10.4060/cc0461en, 2022

Hilborn, R. and Walters, C.J., **Quantitative Fisheries Stock Assessment: Choice, Dynamics and Uncertainty**, http://dx.doi.org/10.1007/978-1-4615-3598-0, Chapman and Hall, Boston, 1992

Boziaris, I.S., **Seafood Processing: Technology, Quality and Safety**, Wiley-Blackwell, 2014

Alasalvar, C., Shahidi, F., Miyashita, K., Wanasundara, U., **Handbook of Seafood Quality, Safety and Health Applications**, Blackwell Publishing Ltd, 2011

Borresen, T., **Improving seafood products for the consumer**, CRC Press, 2008

Mackenzie, K., Abaunza, P., **Chapter Ten - Parasites as Biological Tags**, Stock Identification Methods (Second Edition) Applications in Fishery Science, Academic Press, 2014

Klimpel, S., Kuhn, T., Münster, J., Dörge, D.D., Klapper, R., Kochmann, J., **Food Safety Considerations**, Parasites of Marine Fish and Cephalopods, Springer, 2019

Complementary Bibliography

FAO, **Fishery Resources Division and Fishery Policy and Planning Division**, Fisheries management. FAO Technical Guidelines for Responsible Fisheries. No. 4. Rome, https://www.fao.org/3/w4230e/w4230e00.htm, 1997

He, P., Chopin, F., Suuronen, P., Ferro, R.S.T and Lansley, J., **Classification and illustrated definition of fishing gears**, AO Fisheries and Aquaculture Technical Paper No. 672. Rome, FAO, https://doi.org/10.4060/cb4966en, 2021

Cabado, A. G. & Vieites, J.M., **Quality parameters in canned seafoods**, Nova Science Publishers, 2008

Lal, R. et al., **Food security and environmental quality in the developing world**, Lewis Publishers, 2003

Gokoglu, N., **Novel natural food preservatives and applications in seafood preservation. A Review**, https://doi.org/10.1002/jsfa.9416, 2019

Ofusu, F. K., Daliri, E. B. M., Lee, B. H., Yu, X, **Current trends and future perspectives on omega-3 fatty acids**, Research & Reviews: Research Journal of Biology, 2017

U.S. Department Of Health And Human Services, **Fish and Fishery Products Hazards and Controls Guidance**, U.S. Department of Health and Human Services Food, 2011

Atef, M., Ojagh, M., **Health benefits and food applications of bioactive compounds from fish by-products. A review**, https://doi.org/10.1016/j.jff.2017.06.034, 2017

Agencia Española de Consumo, Seguridad Alimentaria y Nutrición (AECOSAN), http://www.aecosan.msssi.gob.es/AECOSAN/web/home/a,

European Food Safety Authority (EFSA), http://www.efsa.europa.eu/,

Mackenzie, K., **Parasites as biological tags in population studies of marine organisms: an update**, https://doi.org/10.1017/S0031182002001518, 2002

Recomendacións

Subjects that are recommended to be taken simultaneously

Bioloxía de Especies Explotadas e Potencialmente Explotables/V02M098V01207
Avaliación e Explotación de Recursos no Litoral/V02M098V01208

Other comments

Recoméndase traballar na materia de forma continua e participar activamente durante as sesións presenciais

IDENTIFYING DATA				
Estadística Espacial y Modelización				
Subject	Estadística Espacial y Modelización			
Code	V02M098V01210			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1	2c
Teaching language	Castellano			
Department				
Coordinator	Roca Pardiñas, Javier			
Lecturers	Conde Amboage, Mercedes Oviedo de la Fuente, Manuel Roca Pardiñas, Javier			
E-mail	roca@uvigo.es			
Web				
General description				

Resultados de Formación y Aprendizaje	
Code	
A1	Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación.
A4	Que los estudiantes sepan comunicar sus conclusiones, y los conocimientos y razones últimas que las sustentan, a públicos especializados y no especializados de un modo claro y sin ambigüedades.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B4	Desarrollo de habilidades en el manejo y tratamiento de herramientas, matemáticas, estadísticas e informáticas
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D3	Desarrollo de las capacidades de trabajo en equipo, enriquecidas por la pluridisciplinariedad

Resultados previstos en la materia	
Expected results from this subject	Training and Learning Results
Poseer y comprender conocimientos que acerquen una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación. Que los estudiantes sepan comunicar sus conclusiones, y los conocimientos y razones últimas que las sustentan, a públicos especializados y no especializados de un modo claro y sin ambigüedades.	A1 A4
Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos. Desarrollo de habilidades en el manejo y tratamiento de herramientas, matemáticas, estadísticas e informáticas.	B1 B4
Desarrollo de la capacidad de razonamiento crítico y autocrítico Desarrollo de las capacidades de trabajo en equipo, enriquecidas por la *pluridisciplinariedad	D2 D3

Contenidos	
Topic	
Introducción al software R	Introducción al software R: Presentación e instalación; Estructuras de datos: Vectores, matrices, listas y marcos de datos; Importación/exportación de datos; Procedimientos gráficos.
Modelo de Regresión	Introducción a los modelos de regresión lineal: estimación, predicción y inferencia. Diagnóstico del modelo: observaciones atípicas y/o influyentes , homocedasticidad y normalidad; otros modelos de regresión: regresión polinómica, modelos linealizables, modelos no lineales y regresión no paramétrica; aplicaciones en biología marina.
Estadística Espacial	Conceptos básicos de estadística espacial. Tipos de procesos; introducción a la geoestadística: estacionalidad y isotropía; Modelado da dependencia espacial: variografía; predicción kriging; aplicaciones en Biología Marina..

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección magistral	15	35	50
Prácticas con apoyo de las TIC	10	13	23
Resolución de problemas y/o ejercicios	2	0	2

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Metodologías	
	Description
Lección magistral	El profesor expondrá en clase y por videoconferencia la teoría básica de la asignatura. Diversos ejemplos ilustrarán la aplicación de los resultados teóricos.
Prácticas con apoyo de las TIC	Actividad en la que se formulan problemas y ejercicios relacionados con la materia. El alumno debe, con el apoyo del profesorado, desarrollar el análisis y la resolución de los problemas y ejercicios

Atención personalizada	
Methodologies	**Description**
Lección magistral	El profesor expondrá en clase por videoconferencia los fundamentos de carácter metodológico de la materia. Se utilizarán diversos ejemplos basados en datos reales relacionados con la Biología Marina para ilustrar la aplicación de la metodología anterior.
Prácticas con apoyo de las TIC	En el aula de informática los alumnos aprenderán a resolver de forma autónoma y crítica problemas reales usando la metodología vista en las sesiones magistrales. Se utilizará el sofware estadístico R, gratuito y de libre distribución y que puede ser instalado directamente desde https://www.r-project.org/.

Evaluación				
	Description	Qualification	Training and Learning Results	
Prácticas con apoyo de las TIC	Los alumnos entregarán al largo de la materia uno o varios trabajos relacionados con las prácticas que formarán parta del sistema de evaluación continua	40	B1 B4	D2
Resolución de problemas y/o ejercicios	La evaluación del alumnado se realizará a través de entregas y/o presentaciones de trabajos, que podrán ser individuales o en grupo.	60	B1 B4	D2

Other comments on the Evaluation

Para los casos de realización fraudulenta de ejercicios o pruebas (plagios o uso indebido de las tecnologías) será de aplicación el recogido en la normativa de evaluación del rendimiento académico de los estudiantes y de revisión de calificaciones.

En cuanto a la resolución de ejercicios, los alumnos tendrán que entregar 2 o 3 trabajos, de forma que el 60% de la calificación se dividirá entre el número de trabajos a paresentar

Fuentes de información

Basic Bibliography

Complementary Bibliography

Everitt, B. and Hothorn,T., **An introduction to applied multivariate analysis with R**, Springer.,

Maindonald, J. H., **Data analysis and graphics using R: an example-based approach.**, Cambridge University Press,

Wood S.N., **Generalized Additive Models: An Introduction with R.**, Chapman and Hall/CRC,

Recomendaciones

IDENTIFYING DATA				
Invasive Species and Fouling				
Subject	Invasive Species and Fouling			
Code	V02M098V01211			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	García Estévez, José Manuel Cremades Ugarte, Javier			
Lecturers	Besteiro Rodríguez, Celia Cremades Ugarte, Javier García Estévez, José Manuel			
E-mail	jestevez@uvigo.es javier.cremades@udc.es			
Web				
General description	(*)Exponse as principais rutas da introdución de especies foráneas, as características tanto dos invasores como dos sistemas receptores, e as consecuencias ecolóxicas, xenéticas e evolutivas dos devanditos eventos. Préstase especial atención á problemática do fouling, presentando os organismos que o compoñen, a súa sucesión, os seus efectos negativos e os seus posibles tratamentos preventivos			

Training and Learning Results	
Code	
B5	Desarrollo de la habilidad de elaboración, presentación y defensa de trabajos e informes técnicos
C2	Conocimiento de la diversidad de organismos marinos y sus estrategias adaptativas
C3	Conocimiento y comprensión de las interacciones de los organismos marinos y los ecosistemas marinos y costeros
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma

Expected results from this subject	
Expected results from this subject	Training and Learning Results
(*)*Conocer Characteristic wools of wools invading species *y *su *riesgo for *los @receptor ecosystems.*Reconocer Wools *principales invading species *halladas in wools coasts *gallegas.*Conocer Wool importance of *fouling how *vector of species *alóctonas *y *su problematic social *y economic.*Conocer *los *principales *tratamientos *antifouling *y *sus *desventajas.	C2 C3
(*)*Reconocer Wools *principales invading species *halladas in wools coasts *gallegas	C2 C3
(*)*Conocer Wool importance of *fouling how *vector of species *alóctonas *y *su problematic social *y economic	C2 C3
(*)*Conocer *los *principales *tratamientos *antifouling *y *sus *desventajas	C2 C3
New	B5 D4

Contents	
Topic	
(*)1. Invading species2. *Biodiversidad *alóctona *marina *gallega3. *Fouling	(*)1.1. Characteristics1.2. Routes of *introducción1.3. @Receptor systems1.4. Consequences2.1. Studio of cases: *principales species2.2. Roads of *introducción2.3. Dynamics of *colonización2.4. Problematic3.1. Definition *y problematic3.2. *Principales Organisms3.3. *Sucesión3.4. *Tratamientos *antifouling

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	18	45	63
Mentored work	0.1	0	0.1
Seminars	2	8	10
Objective questions exam	1	0	1
Essay questions exam	1	0	1

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
	Description
Lecturing	Presentation by the teacher of the contents on the subject matter of study, theoretical bases and/or guidelines of a work or exercise that the student has to develop
Mentored work	It will register the assistance of the students to the distinct classes
Seminars	Personalization of support and monitoring of the student.

Personalized assistance	
Methodologies	**Description**
Seminars	Discussion of the group work presented
Mentored work	Pertinent explanations
Tests	**Description**
Objective questions exam	Pertinent explanations

Assessment					
	Description	Qualification	Training and Learning Results		
Mentored work	Both class attendance and attitude will be evaluated in the lectures	10			
Seminars	Preparation and presentation of works in group	30	B5	C2 C3	D4
Objective questions exam	The written test will consist of a series of objective multiple choice questions that cover all parts of the subject.	20		C2	D4
Essay questions exam	The written test will consist of a series of essay questions of medium length and covering all parts of the subject.	40		C2 C3	D4

Other comments on the Evaluation

In the first opportunity the three methodologies will be considered. In the second the evaluation will result from the written exam, being able to be the 20-60% of the final note the qualifications obtained in activities evaluated positively previously.

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Biology of Exploited and Potentially Exploitable Species/V02M098V01207
Marine Botany/V02M098V01102
Marine Zoology/V02M098V01103

Other comments

It is recommended to work on the matter in a continuous form

IDENTIFYING DATA

Biology of the Development of Marine Organisms

Subject	Biology of the Development of Marine Organisms			
Code	V02M098V01212			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Megías Pacheco, Manuel Rodríguez Díaz, Miguel Angel			
Lecturers	Megías Pacheco, Manuel Rodríguez Díaz, Miguel Angel			
E-mail	miguelangel.rodriguez.diaz@usc.es mmegias@uvigo.es			
Web				
General description	This course introduces the biological principles that govern the development of marine organisms. The course delves into: 1) The biology of reproduction, development and organogenesis of marine animal species. 2) The general cellular mechanisms underlying the processes of differentiation and development. The teaching of this subject includes lectures, resolution of questions and other activities proposed by the teachers. In the lectures, the concepts outlined in the syllabus will be developed. Exercises and activities will allow solving, discussing and arguing about issues of general and current interest in the field of developmental biology.			

Training and Learning Results

Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	(*)Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	(*)Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	(*)Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B3	Aprendizaje de diversas técnicas y métodos analíticos tanto en el medio natural como en el laboratorio
B4	Desarrollo de habilidades en el manejo y tratamiento de herramientas, matemáticas, estadísticas e informáticas
B5	Desarrollo de la habilidad de elaboración, presentación y defensa de trabajos e informes técnicos
C2	Conocimiento de la diversidad de organismos marinos y sus estrategias adaptativas
C3	Conocimiento y comprensión de las interacciones de los organismos marinos y los ecosistemas marinos y costeros
C8	Conocimiento y manejo de la metodología de investigación, de las técnicas muestreo e instrumentales y de análisis de datos aplicados al medio marino
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma
D5	Desarrollo de las habilidades de comunicación y discusión de planteamientos y resultados

Expected results from this subject

Expected results from this subject	Training and Learning Results

	A1
That the student:	A2
- To understand the interactions of the marine organisms and the marine ecosystems and coast systems	A3
- To look for the potential economic interest and biotechnology of the marine organisms	A4
- To purchase knowledge, identify and evaluate the environmental quality of the marine environment and	A5
of the valid legislation. It can carry out the direction of environmental	B1
consulting	B2
- to know and be able to handle the methodology of investigation, sampling techniques , instrumental and	B3
of analysis of data applied to the marine environment.	B4
- To evaluate the quality and safety of food and of products of transformation and biotechnology of marine	B5
origin	C2
-To schedule and direct aquariums, museums, centers of environmental interpretation, natural parks and	C3
natural spaces protected	C8
- To elaborate, argue, interpret, advise and evaluate scientific-technical reports, ethical, legal and	D1
socioeconomic related with the marine	D2
environment and fishing	D4
	D5

Contents	
Topic	
Gametogénesis and Fecundation	Spermatogenesis. Structure of spermatozoa. Ovogenesis. Hormonal control. Egg structure. Fertilization: contact and recognition of gametes. Prevention of polyspermy. Activation of the egg metabolism.
Early development.Organogenesis	Cleavage. Cleavage patterns. Gastrulation. Embryonic germ layers. Ectodermal, mesodermal and endodermal derivatives. Principles of organogenesis. Evo-Devo.
Main processes and development concepts	Phases of ontogenetic development. Developmental patterns in animal models. Determination, differentiation, growth, morphogenesis and body pattern formation. Pattern alterations: mutations of developmental genes. Modifications of the body plan in postembryonic development: heterochrony and allometry. Techniques.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	15	34.95	49.95
Presentation	1	0	1
Seminars	4	16	20
Objective questions exam	1	0	1
Objective questions exam	1	0	1
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	The teacher explains the contents of the subject, the theoretical bases of the main topics of the marine animal developent.
Presentation	The organization and the guidelines of the course will be explained.
Seminars	Activities of different types that students will carry out individually or in groups, aimed at deepening their knowledge of the subject.

Personalized assistance	
Methodologies	**Description**
Lecturing	The teachers will attend to any questions that may arise during the lecture sessions. These doubts will also be attended to during tutoring hours.
Seminars	Any questions regarding the subject will be solved by e-mail or in person These doubts will also be answered during tutoring hours.
Presentation	The students will be able to ask any questions related to the organization of the course.

Assessment			
	Description	Qualification	Training and Learning Results

Seminars	There will be a continuous evaluation of the student's work in the seminars.	30	A1 B1 C2 D1 A2 B2 C3 D2 A3 B3 D4 A4 B4 D5 A5 B5
Objective questions exam	There will be a test consisting of short answer questions related to the topics of spermatogenesis and early development, where the knowledge acquired by the students will be assessed, as well as their ability to use this knowledge to solve problems.	40	A1 B1 C2 D1 A2 C3 D4 A3
Objective questions exam	There will be a test consisting of a question related to the topic of cellular differentiation and establishment of body axes, where the knowledge acquired by the students will be assessed, as well as their ability to use this knowledge in the resolution of problems.	30	A1 B1 C2 D1 A2 C3 D4 A3

Other comments on the Evaluation

The date for the evaluation tests will be announced at the beginning of the course and will appear in the schedule. In order to pass the course, a minimum of 40% of the maximum score in each of the objective question tests and in the activities carried out in the seminars will be required. If the 40% is exceeded in all the evaluated tests and activities, the mark to pass the course must be equal or higher than 5. The tests in which less than 40 % is obtained can be repeated in the second opportunity call. Those test with a mark higher than 50 % of the maximum score must not be repeated in the second opportunity call. Those students that do not score 5 points in the overall grade will have to repeat all those tests where the grade was lower than 50%.

Sources of information

Basic Bibliography

BROWDER, L.W. et al., **Development Biology.**, 3º, Philadelphia: Saunders College,, 1991

GILBERT, S. F., **Developmental Biology**, 10ª, Sunderland, Mass: Sinauer Associates,, 2013

WOLPERT, L. ET AL. ., **Principles of Development**, 6ª, Oxford: Oxford University Press, 1919

NORRIS D.O. et al, **Hormones and Reproduction of Vertebrates - Vol 1: Fishes**, 1ª, Academic Press, 2010

Complementary Bibliography

Recommendations

IDENTIFYING DATA

Toxicity and Detoxification Mechanisms of Xenobiotic Compounds

Subject	Toxicity and Detoxification Mechanisms of Xenobiotic Compounds			
Code	V02M098V01213			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	San Juan Serrano, María Fuencisla			
Lecturers	García Martínez, Paz San Juan Serrano, María Fuencisla			
E-mail	fsanjuan@uvigo.es			
Web				
General description	Absorption, distribution, metabolism, toxic effects and excretion of pollutants compounds in marine organisms.			

Training and Learning Results

Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	(*)Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	(*)Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	(*)Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B5	Desarrollo de la habilidad de elaboración, presentación y defensa de trabajos e informes técnicos
B6	Desarrollo de la curiosidad científica, de la iniciativa y la creatividad
B7	Entendimiento de la proyección social de la ciencia
C5	Conocimiento de los principios de explotación y sostenibilidad del medio marino y planificación y supervisión de su gestión
C6	Conocimiento, identificación y evaluación de la calidad ambiental del medio marino y de la legislación vigente. Dirección de consultorías ambientales
C7	Catalogación, evaluación, conservación, restauración y gestión de áreas marinas y litorales protegidos. Elaboración, asesoramiento legal y ejecución de planes de ordenación del litoral
C12	Control de calidad y seguridad de alimentos y de productos de transformación y biotecnológicos de origen marino
C13	Divulgación de conocimientos de la biología y el medio marinos: programas de formación y docencia; planificación y dirección de acuarios, museos, centros de interpretación ambiental, parques naturales y espacios naturales protegidos
C14	Elaboración, discusión, interpretación, asesoramiento y peritaje de informes científico-técnicos, éticos, legales y socioeconómicos relacionados con el ámbito marino y pesquero
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D3	Desarrollo de las capacidades de trabajo en equipo, enriquecidas por la pluridisciplinariedad
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma
D6	Desarrollo de las capacidades de reflexión sobre responsabilidades sociales y éticas
D7	Desarrollo de habilidades para la divulgación de ideas en contextos tanto académicos como no especializados

Expected results from this subject

Expected results from this subject	Training and Learning Results

Knowledge and understanding of the cellular and molecular mechanisms of toxicity and response of organisms to environmental pollution.	A1 A2 A3 B2 B6 C5 C6 C13 D1 D2 D4
Ability to integrate knowledge from different disciplines to understand and explain phenomena of environmental toxicology.	A2 A3 B7 C5 C6 D1 D2 D6
Ability to evaluate and interpret data about environmental pollution from a toxicological perspective	A2 A3 B2 C6 C7 C12 C14 D1 D2 D6
Ability to obtain information, analyze it critically and apply it to assess of quality, exploitation and sustainability of marine environment.	A2 A3 A5 B2 B6 B7 C6 C7 C12 C14 D1 D2 D4 D6
Ability to develop individual and / or team works, and to expose them and discuss them in public.	A3 A4 A5 B2 B5 B6 C13 D1 D2 D3 D4 D6 D7

Contents	
Topic	
Xenobiotics and Toxicity	Definition of xenobiotic. Factors Affecting Toxicity. Phases of toxic action.
Exposure, Absorption and Distribution of Xenobiotics	Factors affecting the absorption and distribution of xenobiotics in the body. Elimination / Excretion.
Mechanisms of toxicity	Genotoxicity. Neurotoxicity. Hormonal disruptors. Metabolic disorders. Destabilization of cell membranes.
Metabolism of xenobiotics	Oxidation reactions: dependent and independent cytochrome P450 monooxygenases. Reactions of reduction and hydrolysis. Conjugation Reactions.

Sequestration processes	Non-metabolizable xenobiotics. Mechanisms of sequestration. Immobilization and transport of metals in cells: metallothioneins. Toxic metal elimination.
Oxidative stress and antioxidant defense	Production of oxy-radicals and oxidative stress. Biological effects of reactive oxygen species. Antioxidant Cellular Defenses.
Biomonitoring and biomarkers	Specificity of biomarkers. Relationship between biomarkers and adverse effects of pollution. Global and specific biomarkers. Role of biomarkers in environmental assessment

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	18	34	52
Presentation	0	18	18
Seminars	2	2	4
Objective questions exam	1	0	1

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	In master sessions the teacher will give the fundamental concepts so that the student understands and can prepare the subject contents.
Presentation	Personal or team preparation of a bibliographic work on some specific topic related with the subject, which must be presented in writing..
Seminars	Oral presentation of the bibliographical work presented and discussion of it with teachers and classmates.

Personalized assistance

Methodologies	Description
Lecturing	Resolution of doubts during the subject study and the bibliographic work elaboration, individually and / or in group.
Presentation	Resolution of doubts during the subject study and the bibliographic work elaboration, individually and / or in group.

Assessment

	Description	Qualification	Training and Learning Results			
Lecturing	The acquired theoretical knowledge will be assessed through a final test exam.	40	A1 A2 A3 A5	B2	C6 C7 C12	D1 D2 D6
Presentation	In the presentation of bibliographic work will be assessed the ability to search information in databases, to handle scientific literature, to identify and synthesize the fundamental ideas, to relate and apply the concepts acquired, to use the appropriate terminology in toxicology, and to transmit information. As transversal skills, the initiative, capacity for autonomous learning, teamwork, organizational ability, critical capacity and handling of informatic tools, will be assessed.	30	A1 A2 A3 A4 A5	B2 B5 B6 B7	C5 C6 C7 C13 C14	D1 D2 D3 D4 D6 D7
Seminars	In the exhibition of works will be assessed the ability to identify and synthesize the fundamental ideas, to relate and apply the concepts acquired, to use the appropriate terminology in toxicology, and to transmit information. As transversal skills, the initiative, capacity for autonomous learning, teamwork, organizational ability, critical capacity and handling of informatic tools, will be assessed.	30	A1 A2 A3 A4 A5	B2 B5 B6 B7	C5 C6 C7 C13 C14	D1 D2 D3 D4 D6 D7

Other comments on the Evaluation

The realization of the bibliographic work (Presentation) and its exhibition (Seminar) are mandatory for passing the subject. The final test exam is compulsory for passing the subject and should be 5 (over 10) in order to take into account the bibliographic work score.

Sources of information

Basic Bibliography

Complementary Bibliography

Boelsterli U.A., **Mechanistic toxicology. The molecular basis of how chemicals disrupt biological targets**, 2007

Gibson G.G. and Skett P., **Introduction to drug metabolism**, 2001

Lewis D.F.V., **Guide to Cytochromes P450. Structure and function**, 2001

Malins D.C., Ostrander G., **Aquatic Toxicology: Molecular, Biochemical and Cellular Perspectives**, 1994

Taylor E.W., **Toxicology of Aquatic Pollution. Physiological, Molecular and Cellular Approaches**, 2009

Timbrell J., **Principles of Biochemical Toxicology**, 2008

Walker C.H., Hopkin S.P., Sibly R.M., Peakall D.B., **Principles of Ecotoxicology**, 2012

Frank C. Lu and Sam Kacew, **Lu's Basic Toxicology: Fundamentals, Targed Organs, and Risk Assessment**, 6ª Ed., 2013

Grune T., **Oxidants and Antioxidants Defense Systems**, 2005

Farooqui T., Farooqui A.A., **Oxidative Stress in Vertebrates and Invertebrates. Molecular aspects of cell signaling**, 2012

Recommendations

Subjects that it is recommended to have taken before

Marine Pollution and Ecotoxicology/V02M098V01206

Physiology of Marine Organisms/V02M098V01106

IDENTIFYING DATA				
Marine Genomics				
Subject	Marine Genomics			
Code	V02M098V01214			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	2nd
Teaching language	#EnglishFriendly Spanish English			
Department				
Coordinator	Presa Martínez, Pablo			
Lecturers	Canchaya Sanchez, Carlos Alberto García Souto, Daniel Presa Martínez, Pablo			
E-mail	pressa@uvigo.gal			
Web	http://http://bioloxia.uvigo.es/es/estudios/master-en-biologia-marina/			
General description	The last decade has witnesses an important development of methodologies for genomic sequencing, which have lead to an exponential knowledge increase of genomes. Those new technologies are also intensively applied to marine biota. This subject aims to approach the student to those technological advances in order to acquire the necessary knowledge to confront the scientific and industrial oportunities of applied marine genomics in the 21st century. English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A5	(*)Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B3	Aprendizaje de diversas técnicas y métodos analíticos tanto en el medio natural como en el laboratorio
B6	Desarrollo de la curiosidad científica, de la iniciativa y la creatividad
C2	Conocimiento de la diversidad de organismos marinos y sus estrategias adaptativas
C4	Conocimiento y búsqueda del potencial interés económico y biotecnológico de los organismos marinos
C8	Conocimiento y manejo de la metodología de investigación, de las técnicas muestreo e instrumentales y de análisis de datos aplicados al medio marino
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma

Expected results from this subject	Training and Learning Results
That the student knew the structure of the genomes in its distinct levels of organisation and the variation in the structural elements that generate molecular diversity.	A1 D1 D4
That the student knew the new technics of genome sequencing of high performance for the study of the genomes of marine organisms and thier applications.	A1 A5 B3 B6 C8 D1 D4
That the student identified the strategies for sequencing genomes of reference and the mechanisms to achieve it: assembling, annotation and mapping.	A1 A5 B3 B6 C8 D1 D2 D4

That the student knew the applications of genomics in the study of marine biodiversity, evolution and management of fisheries and aquaculture.	B6 C2 C4 D1

Contents	
Topic	
The organisation of marine genomes	The nuclear and mitochondrial genome. Chromosomes, genes and repetitive components of a genome. Karyotypes and size of marine genomes. Nucleotide variants and structural variantes in a genome. Genomic databases.
Applications of the NGS techniques to the analysis of marine genomes	New generation of high performant sequencing techniques. Modalities of genome sequencing and transcriptome sequencing. Strategies of sequencing for the identification of variants in a genome. Applications of genomic sequencing to the study of marine organisms.
Sequencing of genomes of reference	Strategies for sequencing a genome of reference. Scaffolding and assessment of quality of an assemblage (value of the parameter N50). Construction of genomic maps with data NGS. Annotation of a genome of reference. Calculation of the size of a genome by means of the k-mers abundance. Projects and databases of marine genomes of reference.
Applications of genomics to the study of the marine life	Biodiversity and biogeography. Change induced and adaptative evolution. Marine genomics and aquaculture.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	17	30	47
Problem solving	2	10	12
Presentation	2	9	11
Problem and/or exercise solving	2	2	4
Debate	1	0	1
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	The professor introduces the basic technical concepts to approach the genomic methodologies. He presents the materials and the specific bibliography for matter enrichment and discusses on applied cases in science and industry.
Problem solving	Each conceptual development implements exercises of qualification by resolution of technical problems associated to the genomic methodologies. Daily exercises constitute the continuous evaluation of the subject.

Personalized assistance	
Methodologies	**Description**
Lecturing	Attention in real time to the doubts of understanding.
Problem solving	Physical and virtual assistance on the explanation and execution of digital processes be means of group and individual tutorship.
Tests	**Description**
Presentation	Personalised attention for the selection and methodological approach to deep in an applied genomic study.

Assessment								
	Description	Qualification	Training and Learning Results					
Presentation	Selection, strategy of analysis, methodology of presentation and dissertation, of a practical case study.	40	A1	B3	C2 C4	D1 D2 D4		
Problem and/or exercise solving	The daily duties help to apprehend the methodologies treated in the subject. Students execute autonomous work, corrected digitally with feedback from the teacher and group reviewing in the classroom.	40	A5	B6	C8	D1 D4		
Debate	Positioning and argumentation of the student on the methodologies, applications and social repercussions of marine genomics. It demands participatory assistance, reflection and argumentation.	20				D1 D2 D4		

Other comments on the Evaluation

The first evaluation date of the course which corresponds with the lecture and defence of the practical case is due on 24 April 2024 (10-12h); the second date is due on 27 of June 2024 (12-14h). The qualificacions obtained along the course represent 60% of the final mark and will be kept across testing dates.

Sources of information

Basic Bibliography

Arthur M. Lesk, **Introduction to Genomics**, Tercera Edicción, Oxford University Press, 2017

T. A. Brown, **Genomes 4**, Cuarta Edicción, Garland Science, 2017

Complementary Bibliography

Recommendations

Other comments

The complementary bibliography will be proposed by the professor along the course, and will consist in an up to date list of articles, texts, links, and scientific blogs, that will serve as material of enlargement and work. The physical face-to-face classes will be simultaneously given in the classrooms of videoconference of the Máster in Marine Biology by the Faculties of Biology of UVI (classroom A6) of USC (classroom Sir David Attenborough) and the Faculty of Sciences of UDC (classroom of videoconference MBM). It is advisable the participatory assistance to all the classes of the course and the fulfillment of the commitments towards the group of work regarding schedules, deliveries and processes.

IDENTIFYING DATA				
Internships				
Subject	Internships			
Code	V02M098V01301			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	18	Mandatory	2nd	1st
Teaching language	Spanish Galician			
Department				
Coordinator	García Estévez, José Manuel			
Lecturers	García Estévez, José Manuel			
E-mail	jestevez@uvigo.es			
Web	http://masterbiologiamarina.uvigo.es/gl/			
General description	This matter gathers the majority of the competitions posed in the title since in her apply the knowledges purchased in the first year in some labour surroundings. It contemplates all the formative and professional activities and/or researchers that program and develop with one accord between the universities and the companies or institutions with which have established a specific agreement for the realisation of the External Practices.			

Training and Learning Results	
Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	(*)Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	(*)Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	(*)Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B3	Aprendizaje de diversas técnicas y métodos analíticos tanto en el medio natural como en el laboratorio
B4	Desarrollo de habilidades en el manejo y tratamiento de herramientas, matemáticas, estadísticas e informáticas
B5	Desarrollo de la habilidad de elaboración, presentación y defensa de trabajos e informes técnicos
B6	Desarrollo de la curiosidad científica, de la iniciativa y la creatividad
B7	Entendimiento de la proyección social de la ciencia
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D3	Desarrollo de las capacidades de trabajo en equipo, enriquecidas por la pluridisciplinariedad
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma
D5	Desarrollo de las habilidades de comunicación y discusión de planteamientos y resultados
D6	Desarrollo de las capacidades de reflexión sobre responsabilidades sociales y éticas
D7	Desarrollo de habilidades para la divulgación de ideas en contextos tanto académicos como no especializados
D8	Desarrollo de la habilidad para hablar bien en público

Expected results from this subject	
Expected results from this subject	Training and Learning Results
That the student acquires physico-chemical knowledge of oceans and coasts, of the diversity of marine organisms and its adaptative strategies and those interactions with the marine and coastal ecosystems.	A1 B1 D1
That the student was able to pursue the potential economic and biotecnológical interest of marine organisms, to know the principles of their exploitation and sustainability and the planning and supervision of its management.	A2 D3 D5

That the student identifies and evaluates the environmental quality of the sea upon current legislation. Be able to carry out the direction of environmental consultings and evaluate the quality and security of foods and secondary products of marine origin	A3 B2 D3 D6
That the student was able to catalog, evaluate, conserve, restore and manage the marine protected areas, as well as know how to elaborating, assessing and executing coastal management plans.	A3 B1 B4 D4 D5
That the student knows how to handle the methodology of investigation, the technics of sampling the instrumental usage and the analysis of data applied to the marine environment.	A3 B3 D1 D4
That the student can inspect and advise technically in the evaluation, exploitation and management of fisheries, as well as in the extraction of resources and installations of aquaculture	A4 B2 B5 D2 D7
That the student can perform studies of populational dynamics, genetic improvement and selection of stocks in fisheries, aquaculture and programs of restocking and can schedule and direct aquariums, museums, centres of environmental interpretation, natural parks and natural spaces protected	A1 A2 A3 A4 A5 B1 B2 B3 B4 B5 B6 B7 D1 D2 D3 D4 D5 D6 D7 D8
That the student was able to elaborate, argue, interpret, and evaluate scientific reports-technical, ethical, legal and socioeconomic related with marine fields and fisheries and manage coastal activities of leisure and tourism.	A1 A2 A3 A4 A5 B1 B2 B3 B4 B5 B6 B7 D1 D2 D3 D4 D5 D6 D7 D8

Contents
Topic

Topics will be those offered in the laboratory, department, area or plant of the institution receptor of the student. The contents on Marine Biology will be the handled in the centre receptor, previous agreement between the student, the internal tutor and the external tutor. The thematic offered to carry out the external practices will be varied, to cover the distinct formation expectancies of the student i.e. marine biotechnology, management of fisheries, coastal pollution and bioremediación, evaluation of resources, etc.	In line with the precise work in which the student will work at the receptor centre he/she will handle elements, processes and affine concepts to the education aprehended in the title, in terms of amplitude and multidisciplinarity. The background obtained in the first year of the title, allows to adapt to any discipline demanded in the company, centre or institution of received of students in external practices. The extension of subjects during the practic period has the support of internal and external tutors, to ensure the suitable training of the trainee.

Planning

	Class hours	Hours outside the classroom	Total hours
Practicum, External practices and clinical practices	404	45.0056	449.006
Report of practices, practicum and external practices	0.9944	0	0.9944

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Practicum, External practices and clinical practices	The practical will be of forced *tutela by an External Tutor of the centres and institutions with specific agreement with the *MBM (see in Criterion 5, general Explanation of the Plan of Studies) and by an Internal Tutor, necessarily Doctor and educational of the *Máster of Marine Biology. Each one of the centres receptors will be able to receive to several students in function of his annual demand. The student will integrate in the labour dynamics of an institute or department of investigation or in a company or centre of services. The student has to develop autonomous and cooperative works, to scale computational or experimental and on scientific appearances, technicians, economic or politicians applied to the study and exploitation of the half marine .

Personalized assistance

Methodologies	Description
Practicum, External practices and clinical practices	The practical will be of forced *tutela by an External Tutor of the centres and institutions with specific agreement with the *MBM (see in Criterion 5 of the Memory of the Title the general Explanation of the Plan of Studies) and supervised by an Internal Tutor, necessarily Doctor and educational of the *Máster. They explain besides with the personalised attention of the central services of attention to the student, of the universities and of the faculties of *matrícula, in addition to the coordinators of matter and of degree, local and autonomic. It will ensure the achievement of the external practices for the achievement of the title, *redestinando if it was necessary, to the student to a centre of destination in which develop fully his capacities and expectations.
Tests	**Description**
Report of practices, practicum and external practices	The student will have at all times advice and scientific follow-up-technical of his tutors, for the preparation of the report of the external practices.

Assessment

	Description	Qualification	Training and Learning Results
Practicum, External practices and clinical practices	Assessment by the Jury of the Report of the tutor or tutors of the external practices.	70	A1 A2 A3 A4 A5 B1 B2 B3 B4 B5 B6 B7 D1 D2 D3 D4 D5 D6 D7 D8

Report of practices, practicum and external practices	Assessment by the Jury of the quality of the memory of practices, its brief presentation and its defence. The report will be brief although it is advised that it collects all the formative aspects that the student wish to reflect, e.g. his experience in the host centre. The report must contain the place of destination, the dates and length of the practices and the name and signature of the external tutors. Also it must contain a reflection on the degree of achievement of the goals and competences pursued, the technics handled and the professional or academic improvement perceived by the student. The student can accompany graphic information and the report can be summarized, lectured and defended at the interuniversity court wich will publish the annual rules in December each year.	30	A1 B1 D1 A2 B2 D2 A3 B3 D3 A4 B4 D4 A5 B5 D5 B6 D6 B7 D7 D8

Other comments on the Evaluation

Do not describe the specific competitions evaluated as they are specific of the thematic tackled in the centre centre receptor, stranger a priori, of the work assigned to the student and of the economic nature of the company or institution *conveniada to realise the practices.

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Other comments

The external practices are the more visible professional aspect of the Master and place the student in very fist-line professional situation. Thus, it is of great relevance the selection of the destination centre upon the capacities of the student, his potentialities and his preferences. The Master offers more than 20 agreed companies which will receive students from the Master as well as all the academic Departments from SUG and centres associated to Galician universities and several Spanish universities. Along the second semester each student, tutorized by his internal tutor of the PAT will outline his preferences with regard to the centres of destination offered or will promote agreements with new ones better fitting his expectancies.

IDENTIFYING DATA				
Final Year Dissertation				
Subject	Final Year Dissertation			
Code	V02M098V01302			
Study programme	Máster Universitario en Biología Marina			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	12	Mandatory	2nd	1st
Teaching language	Spanish Galician			
Department				
Coordinator	García Estévez, José Manuel			
Lecturers	García Estévez, José Manuel			
E-mail	jestevez@uvigo.es			
Web	http://masterbiologiamarina.uvigo.es/gl/			
General description	The Work of End of *Máster is a fundamental activity in the training of the students of the title, since it includes all the process of approach, development and defence of a professional project. This involves the staged of all the competitions pursued by the student his evaluation by diverse the groups of interest (educational, court, tutors, and entrepreneurs).			

Training and Learning Results	
Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	(*)Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	(*)Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	(*)Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B1	Utilización de criterios y métodos científicos en el planteamiento y resolución de problemas aplicando los conocimientos adquiridos
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B3	Aprendizaje de diversas técnicas y métodos analíticos tanto en el medio natural como en el laboratorio
B4	Desarrollo de habilidades en el manejo y tratamiento de herramientas, matemáticas, estadísticas e informáticas
B5	Desarrollo de la habilidad de elaboración, presentación y defensa de trabajos e informes técnicos
B6	Desarrollo de la curiosidad científica, de la iniciativa y la creatividad
B7	Entendimiento de la proyección social de la ciencia
C1	Conocimiento físico-químico del medio oceánico y costero
C2	Conocimiento de la diversidad de organismos marinos y sus estrategias adaptativas
C3	Conocimiento y comprensión de las interacciones de los organismos marinos y los ecosistemas marinos y costeros
C4	Conocimiento y búsqueda del potencial interés económico y biotecnológico de los organismos marinos
C5	Conocimiento de los principios de explotación y sostenibilidad del medio marino y planificación y supervisión de su gestión
C6	Conocimiento, identificación y evaluación de la calidad ambiental del medio marino y de la legislación vigente. Dirección de consultorías ambientales
C7	Catalogación, evaluación, conservación, restauración y gestión de áreas marinas y litorales protegidos. Elaboración, asesoramiento legal y ejecución de planes de ordenación del litoral
C8	Conocimiento y manejo de la metodología de investigación, de las técnicas muestreo e instrumentales y de análisis de datos aplicados al medio marino
C9	Conocimientos de instituciones, organismos y legislación relacionados con el medio marino y sus recursos empresariales y económicos
C10	Inspección y asesoramiento técnico en la evaluación, explotación y gestión de pesquerías, extracción de recursos e instalaciones de acuicultura
C11	Estudios de dinámica poblacional, mejora genética y selección de stocks en pesquerías, acuicultura y programas de repoblación
C12	Control de calidad y seguridad de alimentos y de productos de transformación y biotecnológicos de origen marino
C13	Divulgación de conocimientos de la biología y el medio marinos: programas de formación y docencia; planificación y dirección de acuarios, museos, centros de interpretación ambiental, parques naturales y espacios naturales protegidos

C14	Elaboración, discusión, interpretación, asesoramiento y peritaje de informes científico-técnicos, éticos, legales y socioeconómicos relacionados con el ámbito marino y pesquero
C15	Gestión de actividades de ocio y turismo en el medio marino y litoral
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D3	Desarrollo de las capacidades de trabajo en equipo, enriquecidas por la pluridisciplinariedad
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma
D5	Desarrollo de las habilidades de comunicación y discusión de planteamientos y resultados
D6	Desarrollo de las capacidades de reflexión sobre responsabilidades sociales y éticas
D7	Desarrollo de habilidades para la divulgación de ideas en contextos tanto académicos como no especializados
D8	Desarrollo de la habilidad para hablar bien en público

Expected results from this subject

Expected results from this subject	Training and Learning Results
Capacity of synthesis and skills in the communication and critical discussion of ideas. Quality of the works or scientific reports. Acquisition of knowledges and methodologies advanced in a field of application or of biological investigation. Autonomy in the preparation of new hypothesis, in the interpretation of results. Reflection on the limits of the technical employees, of the possible artefacts and of the need of standardisation of the technicians.	A1 A2 A3 A4 A5 B1 B2 B3 B4 B5 B6 B7 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 D1 D2 D3 D4 D5 D6 D7 D8

Contents

Topic	
The Work of End of Máster is a fundamental activity in the training of the students, since it includes all the processes of approach, development and defence to a professional project. Its content include the planning of tasks to resolve a work or project, the realisation of said tasks and finally the concretion of the results in an explanatory memory of the problem posed, the procedure followed for his study or preparation, the interpretation of the results or of the design implemented and finally the results shown in the final report.	All the contents that contemplate the educations of the title, related with the management and exploitation of the marine environment and its resources.

Planning

	Class hours	Hours outside the classroom	Total hours
Project based learning	149.5	149.5	299
Presentation	1	0	1

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Project based learning	The methodology of the work of End of Master will change in function of the project posed i.e. more professional or more academic-scientific. Although conceptually they are similar, the methodology and the form to structure the information, can vary significantly between students, centres and interest and the supervisors. The methodology will be preferably the one of the Scientific Method, without prejudice that it can consist in a technical work, but yet will be methodologically rigorous in design, execution and presentation. The tasks to realise by the student will vary in function of the project realised and will reflect in the memory of the Work of End of Máster, that has to collect evidence of justification, methodology, results, discussion and comparison with other projects with similar results.

Personalized assistance

Methodologies	Description
Project based learning	Each student will have at least an Internal Tutor of the Máster to direct the Report off Máster's End, that will have academic responsibilities (selection of centres, academic orientation, treatment of data, etc.) and which can be co-directed by a External Tutor, upon agreement subscribed before the initiation of the works, whenever the work is realised out of the university centres. The ultimate orientation of the formal presentation of the memory of the Master will be responsibility of the internal tutor that necessarily will be Doctor, without prejudice of an equivalent maximum implication of the external tutor, if applicable. The student will be able to resort to the orientation of his tutor of the PAT and of the educational staff of the title, to resolve specific elements of the development of his TFM, p.ej. Preparation of mathematical models.

Assessment

	Description	Qualification	Training and Learning Results			
Project based learning	The interuniversity academic court will consider the qualification awarded to the student by the Tutor-s of the TFM, according to the available reports, the evaluation sheet of the student and the degree of professional training or scientifc excellence reached by the student according to the evaluation by peers developed by his supervisors.	30	A1 A2 A3 A4 A5	B1 B2 B3 B4 B5 B6 B7	C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15	D1 D2 D3 D4 D5 D6 D7 D8
Presentation	The interuniversity academic court will value the quality of the contents of the memory *TFM and his organisation and written presentation, the clarity in the exhibition and the capacity of defence upon questions raised by the interuniversitary court.	70	A1 A2 A3 A4 A5	B1 B2 B3 B4 B5 B6 B7	C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15	D1 D2 D3 D4 D5 D6 D7 D8

Other comments on the Evaluation

The Work End of *Máster will be necessarily the last matter *cursada in this degree, not being able to defend before the

*superación of the rest of matters, and will give place to the application of the title by the student. They will be able to present and defend simultaneously the *PE and the *TFM, in the announcements of February or of July, both equivalent to effects qualifiers, or will be able to effect the presentation and defence of the *PE in the announcement of February and the *TFM in the one of July, but no to the reverse.

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Other comments

The TFM is the conclusion of the formative activities and rofesionalizantion awarded by the master, and his concretion and evaluation is a right and a duty of each student. Its preparation can be generated after data or processes developed originally by the student in the centre of destination of the external practices, in companies or insititutions, although they are not synonymous at all, as the PE include the learning of a series of competences very distinct to the ones pursued and evaluated in the TFM. If by reasons of confidentiality there were not possible to ellaborate a TFM report from results obtained during the external practices, the title will ensure the preparation of the memory TFM in a thematic affine to the máster, for example, in a Research Department from the SUG universities involved.