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D2.2 E-LEARNING PLATFORM FOLLOWED BY MANUAL



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1. Introduction

The new syllabus and training material on marine ecosystem and climate change monitoring, that will be offered by the HEIs in the Partner Countries (India and Malaysia) has been designed, based on the findings and preparatory work of WP1: Preparation of Training and Monitoring. The syllabus provides hands-on training on a wide range of fields of marine ecosystem monitoring covering the fields of climate change at sea, blue carbon, plastic and microplastic debris as well as monitoring of protected marine ecosystems (coral reefs, mangroves, seagrass meadows). The final syllabus consists of three Modules:

Module 1: Monitoring of marine plastics and microplastics

Module 2: Monitoring and managing marine ecosystems.

Module 3: Monitoring climate change at sea and blue carbon.

The design of the training material syllabus has been based on a sequence of methodological steps:

1. Identification of the different programmes and the modules they will contain: The identification of these curricula was based on the analysis of the existing set of skills and competences of marine and environmental scientists in the Partner's countries; and b) the expected ones for optimum ecosystem monitoring
2. All skills and key competences will be also usable by other HEIs out of the partnership, while the related material will be developed in such a way that it can be easily upgraded in the future.
3. Designing the structure and core content of the programme modules: Once the different modules that comprise the educational programme(s) have been identified, we proceeded to the actual design of their content and of the respective teaching methodologies and resources. The five general components of the programme design will be: a) Planned learning outcomes; b) Recommended bibliography; c) Course Content or Subject Matter – What subject matter is to be included and how do these align to existing marine ecosystem monitoring d) Curriculum Experience - What instructional strategies/ resources/ activities will be employed and how will learners be assessed; e) Curriculum Evaluation – What methods and techniques will be used to assess the results of the curriculum.
4. Adaptation of the course programmes to the local needs: Following the generic design of the programme structure and the development of the module content, a second step of adapting them to the specific marine ecosystem context of India and Malaysia will take place. This 'adaptation' is necessary to ensure that the more generic structure and content, developed in collaboration by the partners and drawing on the breadth and wealth of knowledge, experience, needs and requirements across many countries, is fit-for-purpose and suited to the context and

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specific requirements of the partner's country. This task requires a clear set of methodological principles and guidelines for the adaptation of the curricula. It is, therefore, important to keep in mind the various parameters or elements of the given curriculum which require particular attention from the point of view of adaptation.

5. Designing supportive materials and resources: As a result of the whole procedure, 2 packages of supportive materials and resources were developed in order to guide and facilitate the implementation of the programmes by 2 main groups of stakeholders, namely the learners and the trainers. Part of these materials are programme specific (e.g. the trainers guide), while others will be more generic and will be used to support the delivery across all programmes.

1.1 The e-platform

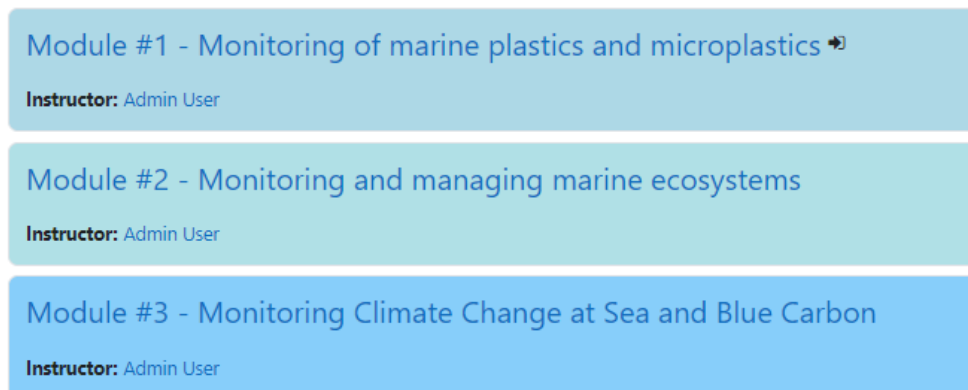
The e-platform of the ECOMARINE project has been developed at the following address:

<https://ecomarine-project.cs.ucy.ac.cy/moodle/>

The e-platform consists of three modules (See Fig. 1.1):

- Module 1: Monitoring of marine plastics and microplastics
- Module 2: Monitoring and managing marine ecosystems
- Module 3: Monitoring climate change at sea and blue carbon

Available Modules



The screenshot displays three stacked rectangular boxes, each representing a module. Each box contains the module title and the instructor's name. The first box is light blue, the second is a slightly darker blue, and the third is a medium blue.

Module Title	Instructor
Module #1 - Monitoring of marine plastics and microplastics	Admin User
Module #2 - Monitoring and managing marine ecosystems	Admin User
Module #3 - Monitoring Climate Change at Sea and Blue Carbon	Admin User

Fig. 1.1. The Modules of the ECOMARINE e-platform

The structures of Modules 1-3 are discussed in Sections 2-4, respectively. More specific information, including the youtube addresses of all videos produced are provided in Appendices 5.1-5.3. Finally, the User's manual for the e-platform is given as Appendix 5.4.

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2. Module 1: Monitoring of marine plastics and microplastics

2.1 Introduction - Objectives

Plastic waste is a major global issue. It is the most important and abundant marine litter material. Many marine organisms ingest microplastics or find themselves entangled in bigger pieces of marine litter. This course introduces the scientific questions concerning the global increase in environmental plastic and investigate the role of particle size in microplastic uptake by organisms. The lectures will introduce the global challenges related to plastic pollution as we understand them today and discuss future research needs and knowledge gaps. Topics covered: Plastic polymer chemistry, environmental sampling and analytical methods, effects of microplastics on marine organisms, needs for risk assessment for environmental and human health. The course will also encompass a practical session, with a demonstration of analytical methods in the laboratory as well as critical reading and discussion of published literature.

2.2 Syllabus

1. Introduction of Marine Litter pollution

- 1.1. Plastic litter as a global ocean concern
- 1.2. Composition of plastic litter
- 1.3. Types of plastic marine litter and physical descriptors
- 1.4. Impacts of marine litter

2. Designing Monitoring and Assessment Programmes

- 2.1. Indicators and targets
- 2.2. Data requirements for monitoring
- 2.3. Basics of survey design
- 2.4. Identification methods

3. Monitoring methods for shorelines

- 3.1. Description and relevance of the shoreline compartment
- 3.2. Examination of existing protocols

4. Monitoring methods for the sea surface and water column

- 4.1. Monitoring methods for the sea surface
- 4.2. Monitoring methods for the water column

5. Monitoring methods for the sea floor,

- 5.1. Description and relevance of plastic and microplastic on the seafloor
- 5.2. Methods of sample collection from the seafloor
- 5.3. Deposition trend of microplastics on the seafloor

6. Monitoring methods for marine biota

- 6.1. Description and relevance of marine litter-biota interaction



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- 6.2. Selection of biota for monitoring and monitoring of biota for plastic ingestion
- 6.3. Monitoring associated chemicals from ingested plastics
- 6.4. Occurrences, sources & effects of marine entanglement
- 6.5. Monitoring impacts of marine litter on habitats

7. Sample processing for microplastics

- 7.1. Physical characteristics
- 7.2. Chemical characteristics
- 7.3. Biological characteristics

2.3 References

1. GESAMP (2019). Guidelines on the monitoring and assessment of plastic litter and microplastics in the ocean (Kershaw P.J., Turra A. and Galgani F. editors), (IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP/ISA Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). Rep. Stud. GESAMP No. 99, 130p. <https://wedocs.unep.org/bitstream/handle/20.500.11822/30009/plasLit.pdf?sequence=1&isAllowed=y>
2. Giuseppe Bonanno, Martina Orlando-Bonaca (eds), 2022. Plastic Pollution and Marine Conservation: Approaches to Protect Biodiversity and Marine Life, 1st Edition, Paperback ISBN: 9780128224717
3. Eriksen M, Lebreton LCM, Carson HS, Thiel M, Moore CJ, et al., Plastic Pollution in the World's Oceans. (2014)
4. Laurent C. M. Lebreton, Joost van der Zwet, Jan-Willem Damsteeg, Boyan Slat, Anthony Andrady & Julia Reisser, River plastic emissions to the world's oceans (2017)
5. <https://mcc.jrc.ec.europa.eu/documents/201702074014.pdf>

2.4 Other useful references

Marine Plastic Debris and Microplastics: Global Lessons and Research to Inspire Action and Guide Policy Change, United Nations Environment Programme (2016)

K. Tsiaras, Y. Hatzonikolakis, S. Kalaroni, A. Pollani, G. Triantafyllou, Modelings the pathways and accumulation patterns of micro- and macro-plastics in the Mediterranean, Front. Mar. Sci., 04 October 2021 | <https://doi.org/10.3389/fmars.2021.743117>

[Frontiers | Modeling the Pathways and Accumulation Patterns of Micro- and Macro-Plastics in the Mediterranean | Marine Science \(frontiersin.org\)](https://doi.org/10.3389/fmars.2021.743117)

A. Gkanasos, K. Tsiaras, G. Triantaphyllidis, A. Panagopoulos, G. Pantazakos, T. Owens, C. Karametsis, A. Pollani, E. Nikoli, N. Katsafados, G. Triantafyllou, Stopping microplastic and microplastic pollution at source by installing novel technologies in river estuaries and waste water



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treatment plants: The CLAIM project, *Front. Mar. Sci.*, 24 December 2021 | <https://doi.org/10.3389/fmars.2021.738876>

[Frontiers | Stopping Macroplastic and Microplastic Pollution at Source by Installing Novel Technologies in River Estuaries and Waste Water Treatment Plants: The CLAIM Project | Marine Science \(frontiersin.org\)](#)

Training Module for Marine Microplastics Monitoring

<http://www.yslmep.org/wp-content/uploads/2020/05/Training-Module-for-Marine-Microplastics-Monitoring-EN.pdf>

[1] Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., ... Law, K. L. (2015). Plastic waste inputs from land into the ocean. *Science*, 347(6223), 768–771.

[2] Schmaltz, E., Melvin, E. C., Diana, Z., Gunady, E. F., Rittschof, D., Somarelli, J. A., ... Dunphy-Daly, M. M. (2020). Plastic pollution solutions: emerging technologies to prevent and collect marine plastic pollution. *Environment International*, 144, 106067.

[3] Yin, K.; Wang, Y.; Zhao, H.; Wang, D.; Guo, M.; Mu, M.; Liu, Y.; Nie, X.; Li, B.; Li, J.; et al. A comparative review of microplastics and nanoplastics: Toxicity hazards on digestive, reproductive and nervous system. *Sci. Total Environ.* 2021, 774, 145758.

[4] Henderson, L., & Green, C. (2020). Making sense of microplastics? Public understandings of plastic pollution. *Marine Pollution Bulletin*, 152, 110908.

[5] Costanza R, De Groot R, Sutton P, Van Der Ploeg S, Anderson SJ, Kubiszewski I, Farber S, Turner RK. 2014 Changes in the global value of ecosystem services. *Glob. Environ. Change* 26, 152–158.

2.5 Useful links

Workshop: Training of Trainers on Monitoring and Assessment of Marine Plastics and Microplastics, 9-13 September 2019, Bali, Indonesia

[Training of Trainers on Monitoring and Assessment of Marine Plastic Litter and Microplastics | Coordinating Body on the Seas of East Asia \(COBSEA\) \(unep.org\)](#)

Manual - Training of Trainers on Monitoring and Assessment of Marine Plastics and Microplastics, 9-13 September 2019, Bali, Indonesia

[Manual - Training of Trainers on Monitoring and Assessment of Marine Litter and Microplastics - 9-13 September 2019, Bali, Indonesia \(unep.org\)](#)



3. Module 2: Monitoring and managing marine ecosystems

3.1 Introduction - Objectives

This module will help in choosing the most appropriate marine monitoring method(s) in relation to the study objectives. The methods in this module are in line with ongoing international research and development into monitoring methods for the marine environment. The numerous ways in which these ecosystems are inter-connected and inter-dependent will also be discussed. Emphasis will be placed on indicators of stress that should be the focus of ecosystem health monitoring efforts. A broader context of managing these ecosystems will also be introduced. The class will examine management and advisory bodies of these ecosystems; how marine protected areas can be a tool for conservation and the impacts of these tools; engage stakeholders with design and implementation of management plans.

3.1.1 Learning Outcomes of the course

By the end of the course, the participants will be able to:

- Outline concepts and issues related to managing coastal and marine ecosystem and demonstrate the types and relevance of different monitoring methods in different scenarios.
- Conduct assessment and monitoring of coastal and marine habitats and species and prepare field reports.
- Be open to acquiring more knowledge on coastal and marine ecosystem relevant issues.
- Describe how long-term environmental monitoring programs are designed and conducted.
- Describe how monitoring results are used by the society and in research.
- Present the results for an environmental authority and the propose appropriate decisions and actions for a sustainable environment.

3.2 Syllabus

1. Introduction

- 1.1. Definitions
- 1.2. Design of marine monitoring programs
- 1.3. Opportunities in marine monitoring
- 1.4. Challenges in marine monitoring

2. Monitoring and managing marine ecosystems

- 2.1. Aims and benefits of monitoring
- 2.2. Designing monitoring programs
- 2.3. Optimising monitoring methods
- 2.4. Sampling natural systems

3. Types of data collected



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- 3.1. Marine data in perspective
- 3.2. Marine biological data
- 3.3. Marine physico-chemical data
- 3.4. Marine spatio-temporal data

4. Data Analysis

- 4.1. Use of Geographic Information Management systems
- 4.2. Statistics for spatial data
- 4.3. Monitoring biological oceanography from remote sensing
- 4.4. Ecosystem Modelling

5. Ecosystem Management

- 5.1. Management and Advisory Bodies
- 5.2. General Management Plans: Sea ranching & plantation
- 5.3. Restoration and Rehabilitation
- 5.4. Environmental Impact Assessment

6. Planning a successful study

- 6.1. Inheriting and adapting an existing study

7. Other considerations

- 7.1. Preventing the spread of marine pests
- 7.2. Health and safety
- 7.3. Data collection and storage

8. Key marine ecosystems

- 8.1. Benthic marine ecosystems
- 8.2. Pelagic marine ecosystems
- 8.3. Threats to marine ecosystems and management strategies

3.3 References

1. Md. Nazrul Islam, Sven Erik Jorgensen (eds), 2018. Environmental Management of Marine Ecosystems Copyright Year 2018, 1st Edition, ISBN 9780367571948, Published June 30, 2020 by CRC Press, 384 Pages 26 Color & 67 B/W Illustrations
2. C. R. Murthy, P. C. Sinha, Y. R. Rao, 2008. Modelling and Monitoring of Coastal Marine Processes, ISBN: 978-90-481-7844-5, Springer.

3.4 Other useful references

Noble-James, T., Jesus, A. & McBreen, F. 2018. Monitoring guidance for marine benthic habitats (Revised 2018). JNCC Report No. 598. JNCC, Peterborough.



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Hill, D.; Fasham, M.; Tucker, G.; Shrewry, M.; Shaw, P. 2005: Handbook of biodiversity methods: survey, evaluation and monitoring. Cambridge University Press, Cambridge.

Kingsford, M.; Battershill, C. 1998: Studying temperate marine environments: A handbook for ecologists. Canterbury University Press, Christchurch.

Quinn, G.P.; Keough, M.J. 2002: Experimental design and data analysis for biologists. Cambridge University Press, Cambridge.

Schmitt, R.; Osenberg, C. 1996: Detecting ecological impacts: concepts and applications in coastal habitats. Academic Press, San Diego.

3.5 Useful links

Shane Geange, Debbie Freeman, Vincent Zintzen and Kath Blakemore, Introduction to Marine Monitoring, V1.0 (2016).

<https://www.doc.govt.nz/globalassets/documents/science-and-technical/inventory-monitoring/im-toolbox-marine-introduction-to-marine-monitoring.pdf>

Tropical Marine Ecosystems - Monitoring and Management SFS 3530 Syllabus , Summer I The School for Field Studies (SFS) The Center for Marine Resource Studies South Caicos, Turks and Caicos Islands (2018)

<https://fieldstudies.org/wp-content/uploads/2018/12/TCI-Syllabus-SFS-3530-Tropical-Marine-Ecosystems-Monitoring-and-Management.pdf>

Hindo-German Biodiversity Programme

<https://www.indo-germanbiodiversity.com/detail-training-material-english-14.html>

It also contains e-learning platforms. The course is interesting, complete and contains useful modules but its emphasis is on management and not on monitoring. It doesn't include useful Bibliography.

Marine inventory and monitoring

<https://www.doc.govt.nz/our-work/biodiversity-inventory-and-monitoring/marine/>

Marine Ecosystems Dynamics, Stockholm University



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<https://www.su.se/english/search-courses-and-programmes/bl7056-1.430278?open-collapse-boxes=course-repo><https://www.um.edu.mt/courses/studyunit/BIO5003,course-detail,course-time-table,course-material>

https://sisu.it.su.se/pdf_creator/37751/52448/en



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4. Module 3: Monitoring climate change at sea and blue carbon

4.1 Introduction - Objectives

Climate change is a difficult, contentious, and important issue. It is defining environmental issue of the 21st century. This course aims to address the whole complexity of climate change as an issue, by bringing together the science, impacts, economics, abatement technologies, and policy solutions into one course. The main objectives of this module are the following:

- 1) How does climate work? How is the sea related to climate regulation? What has been changed in the last decades – Historical data showing changes. Climate modelling.
- 2) Climate change and life in the sea → How climate change affects marine life (including fisheries and vulnerable habitats).
- 3) What can we do about climate change? Sustainable adaptation and Management measures for coping with climate change. International and European directives and decisions regarding climate change.
- 4) What is the coastal blue carbon?
- 5) What methods are used to estimate blue carbon?
- 6) Which is the role of blue carbon in climate change mitigation?

4.2 Syllabus

1. Introduction

- 1.1. Oceans of the world and main physio-chemical characteristics
- 1.2. Ocean circulation and regulation of global climate
- 1.3. Marine carbon biogeochemistry
- 1.4. Global atmospheric circulation

2. Climate change and key issues in the marine environment

- 2.1. Climate change historical data
- 2.2. Primary productivity
- 2.3. Climate change impacts on marine invertebrates
- 2.4. The effects of ocean acidification on marine habitat
- 2.5. Cycling of water and nutrients
- 2.6. Disturbance from alien and alien invasive species
- 2.7. Bioindicators for investigation of the effect of climate change on aquatic ecosystems
- 2.8. The tropicalization phenomenon

3. Projections of future climate change

- 3.1. Introduction to climate modelling
- 3.2. Scenarios for future climate change
- 3.3. Intercomparisons of climate change model results
- 3.4. Sea level rise and projections
- 3.5. IPCC key findings



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- 3.6. Regional climate downscaling – dynamic approach
- 3.7. Statistical downscaling and bias correction
- 3.8. Observed and future climate change in the ocean

4. Blue carbon and climate change

- 4.1. Fluxes of carbon dioxide in blue carbon ecosystems
- 4.2. Global blue carbon stocks
- 4.3. Measuring blue carbon stocks
- 4.4. Future Challenges: filling knowledge gaps

5. International and European agreements on climate change and blue carbon

- 5.1. Aims, Implementation, Gaps
- 5.2. Protocols, Agreements, Reports

6. Blue carbon ecosystems

- 6.1. Types of carbon
- 6.2. Blue carbon ecosystems
- 6.3. Soil and biomass carbon

4.3 References

1. Marine Ecosystems and Global Change. Barange M., Field J. G., Roger P. Harris, Eileen E. Hofmann, R. Ian Perry, and Werner F., Oxford Scholarship Online: May 2010.
2. Marine Biology (11th Edition), Castro P. and Huber M., (Publication Date). McGraw-Hill Education (Publisher), 2018.
3. COASTAL BLUE CARBON, methods for assessing carbon stocks and emissions factors in mangroves, tidal salt marshes, and seagrass meadows. Howard, J.; Hoyt, S.; Isensee, K.; Telszewski, M.; Pidgeon, E.; (eds), 2014, International Union for Conservation of Nature (IUCN)
4. DHI July 2016 - Marine Climate Change Guidelines

4.4 Other useful references

Jennifer Frankel-Reed, Barbara Fröde-Thierfelder, Ilona Porsché, Alfred Eberhardt, Mark Svendsen, Integrating climate change adaptation into development planning A practice-oriented training based on an OECD Policy Guidance. Training Manual. Adapted for Marine and coastal environments. Eschborn, 2016

Hilmi N, Chami R, Sutherland MD, Hall-Spencer JM, Lebleu L, Benitez MB and Levin LA (2021) The Role of Blue Carbon in Climate Change Mitigation and Carbon Stock Conservation. *Front. Clim.* 3:710546. doi: 10.3389/fclim.2021.710546

Howard, J., Hoyt, S., Isensee, K., Pidgeon, E., Telszewski, M. (eds.) (2014). Coastal Blue Carbon: Methods for assessing carbon stocks and emissions factors in mangroves, tidal salt marshes, and seagrass meadows. Conservation International, Intergovernmental



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Oceanographic Commission of UNESCO, International Union for Conservation of Nature.
Arlington, Virginia, USA.

4.5 Useful links

<https://oceanservice.noaa.gov/facts/carbon-cycle.html>

<https://earthobservatory.nasa.gov/features/CarbonCycle>

<https://www.whoi.edu/press-room/news-release/the-oceans-biological-pump-captures-more-carbon-than-expected/>



5. APPENDIXES

5.1 Module #1 - Monitoring of marine plastics and microplastics

M1 - Module 1: Monitoring of marine plastics and microplastics		
Unit 1.1: Introduction of Marine Litter Pollution		
Topic 1.1.1: Plastic Litter as a global ocean concern		
		Lecture: Introduction
		Video: https://www.youtube.com/watch?v=sAb8jC3jS28
		Video: https://www.youtube.com/watch?v=tk4SMMhC044&t=27s
		Video: https://www.youtube.com/watch?v=f9Y2yFj0890
		Video: https://www.youtube.com/watch?v=31gFN3vP_0g
		Q&A session
Topic 1.1.2: Composition of plastic litter		
		Lecture: Plastic composition
		Q&A session
		Assignment
Topic 1.1.3: Types of plastic marine litter & physical descriptors		
		Lecture: Macrolitter
		Reading: "Marine litter associated with fisheries and aquaculture" https://doi.org/10.1016/j.marpolbul.2016.08.032
		Lecture: Microplastics
		Video: https://www.youtube.com/watch?v=49OJoTsZY00
		Video: https://www.youtube.com/watch?v=aiEBEGKQp_I
		Video: https://www.youtube.com/watch?v=sl82ZO9AT4Y
		Video: https://www.youtube.com/watch?v=bjWzEVd4rws
		Q&A session
		Assignment
Topic 1.1.4: Impacts of marine litter		
		Lecture: Impacts

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			Q&A session
			Assignment
Unit 1.2: Designing Monitoring & Assessment Programmes			
Topic 1.2.1: Indicators & targets			
			Lecture: Indicators
			Lecture: Seawater indicators
			Lecture: Sediment indicators
			Lecture: Seagrass indicators
			Lecture: Zooplankton indicators
			Lecture: Fish indicators
			Lecture: Targets
			Lecture: Actions
			Q&A session
			Assignment
Topic 1.2.2: Data requirements			
			Lecture: Categories
			Lecture: Measurement units
			Lecture: Data management
			Q&A session
Topic 1.2.3: Basics of survey design			
			Lecture: Survey assessment
			Lecture: Variables
			Lecture: Survey techniques
			Lecture: Data analysis
			Q&A session
Topic 1.2.4: Identification methods			
			Lecture: Identification
			Video: https://www.youtube.com/watch?v=ipOCUs32xvc
			Q&A session

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Unit 1.3: Monitoring methods for shorelines	
Topic 1.3.1: Description of shoreline compartment	
	Lecture: Shore description
	Reading: "Monitoring the abundance of plastic debris in the marine environment"
	Reading: "Guidance on monitoring of marine litter in European seas"
	Reading: "The physical and chemical impact of microplastic in the marine environment"
	Reading: "Assessment of microplastics in a municipal wastewater treatment plant with tertiary treatment: Removal efficiencies and loading per day into the environment"
	Q&A session
Topic 1.3.2: Examination of existing protocols	
	Lecture: Protocols
	Video: https://www.youtube.com/watch?v=nFGWoDXZOYQ
	Reading: "JRC TGML Monitoring Protocol"
	Reading: "Ospar Monitoring Protocol"
	Reading: "NOAA Monitoring Protocol"
	Reading: "NOAA Categorization Guide"
	Q&A session
	Assignment
	Reading: "Malaysia marine debris during Monsoons"
	Reading: "Malaysian mangrove marine debris"
	Reading: "NE India marine litter pollution"
	Reading: "Kerala India fishing-related debris"
	Q&A session
	Assignment
	Q&A session
Unit 1.4: Monitoring methods for the sea surface and water column	
Topic 1.4.1: Monitoring methods for sea surface	
	Lecture: Sea surface methods
	Q&A session

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		Topic 1.4.2: Monitoring methods for water column
		Lecture: Water column methods
		Q&A session
		Assignment
		Unit 1.5: Monitoring methods for the seafloor
		Topic 1.5.1: Description & relevance of plastic and microplastic on the seafloor
		Lecture: Seafloor plastics
		Video: https://www.youtube.com/watch?v=Z1b3yNgIfKw
		Assignment
		Q&A session
		Topic 1.5.2: Methods of sample collection from seafloor
		Lecture: Seafloor sample collection
		Q&A session
		Topic 1.5.3: Deposition trend of microplastics on seafloor
		Lecture: Deposition trends
		Q&A session
		Unit 1.6: Monitoring methods for marine biota
		Topic 1.6.1: Description & relevance of marine litter/biota interaction
		Lecture: Litter biota
		Q&A session
		Topic 1.6.2: Selection of biota for monitoring & Monitoring of biota for plastic ingestion
		Lecture: Selecting biota
		Q&A session
		Quiz
		Topic 1.6.3: Monitoring associated chemicals from ingested plastics
		Lecture: Associated chemicals
		Assignment
		Q&A session

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		Topic 1.6.4: Occurrences, sources & effects of marine entanglement
		Lecture: Marine entanglement
		Q&A session
		Topic 1.6.5: Monitoring impacts of marine litter on habitats
		Lecture: Litter impacts
		Lecture: Seafloor litter
		Q&A session
		Quiz
		Unit 1.7: Methods of characterization of plastic litter
		Topic 1.7.1: Physical characteristics
		Lecture: Physical characteristics
		Q&A session
		Assignment
		Topic 1.7.2: Chemical characteristics
		Lecture: Chemical characteristics
		Q&A session
		Topic 1.7.3: Biological characteristics
		Lecture: Biological characteristics
		Q&A session
		Assignment

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5.2 Module #2 - Monitoring and managing marine ecosystems

M2 - Module 2: Monitoring and managing marine ecosystems	
Unit 2.1: Introduction, definitions and examples	
Topic 2.1.1: Definitions	
	Lecture: Definitions
	Q&A Session
	Assignment
Topic 2.1.2: Design of marine monitoring programs	
	Lecture: Design
	Q&A Session
	Assignment
Topic 2.1.3: Opportunities in marine monitoring	
	Lecture: Opportunities
	Q&A Session
	Assignment
Topic 2.1.4: Challenges in marine monitoring	
	Lecture: Challenges
	Q&A Session
	Assignment
Unit 2.2: Monitoring and managing marine ecosystems	
Topic 2.2.1: Aims and benefits of monitoring	
	Lecture: Monitoring
	Q&A Session
Topic 2.2.2: Designing monitoring programs	
	Lecture: Designing programs
	Q&A Session
	Assignment
Topic 2.2.3: Optimising monitoring methods	
	Lecture: Optimising

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		Q&A Session
		Topic 2.2.4: Sampling natural systems
		Lecture: Sampling corals
		Q&A Session
		Lecture: Sampling mangroves
		Q&A Session
		Lecture: Sampling seagrasses
		Q&A Session
		Unit 2.3: Types of data collected
		Topic 2.3.1: Marine data in perspective
		Lecture: Data types
		Q&A Session
		Assignment
		Topic 2.3.2: Marine Biological data
		Lecture: Biological data
		Q&A Session
		Assignment
		Topic 2.3.3: Marine Physico-chemical data
		Lecture: Physicochemical data
		Q&A Session
		Assignment
		Topic 2.3.4: Marine Spatio-temporal data
		Lecture: Spatiotemporal data
		Q&A Session
		Assignment
		Unit 2.4: Data analysis
		Topic 2.4.1: Use of Geographic Information Management Systems
		Lecture: GIS
		Q&A Session

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		Assignment
		Topic 2.4.2: Statistics for spatial data
		Lecture: Mapping with LEK
		Q&A Session
		Assignment
		Reading: "Traditional Ecological Knowledge and the mapping of benthic marine habitats"
		Topic 2.4.3: Monitoring biological oceanography from remote sensing
		Lecture: Biological remote sensing
		Q&A Session
		Assignment
		Topic 2.4.4: Ecosystem modelling
		Lecture: Ecosystem model
		Q&A Session
		Assignment
		Unit 2.5: Ecosystem Management
		Topic 2.5.1: Management & advisory bodies
		Lecture: Management
		Q&A Session
		Assignment
		Topic 2.5.2: General management plans: Sea Ranching & Plantation
		Lecture: Sea ranching
		Lecture: Plantation
		Q&A Session
		Assignment
		Topic 2.5.3: Restoration & Rehabilitation
		Lecture: Restoration and Rehabilitation
		Reading: "Challenges in Marine Restoration Ecology: How Techniques, Assessment Metrics, and Ecosystem Valuation Can Lead to Improved Restoration Success"
		Reading: "ICRI-USA: Turning the tide for Coral Reefs"

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		Q&A Session
		Topic 2.5.4: Environmental Impact Assessment
		Lecture: EIA
		Reading: “UN Espoo Convention”
		Reading: “UN Rio Convention”
		Reading: “UN Aarhus Convention”
		Q&A Session
		Assignment
		Unit 2.6: Planning a successful study and value of existing data
		Topic 2.6.1: Inheriting and adapting an existing study
		Lecture: Successful studies
		Q&A Session
		Assignment
		Unit 2.7: Other considerations
		Topic 2.7.1: Preventing the spread of marine pest
		Lecture: Marine pests
		Q&A Session
		Topic 2.7.2: Health and safety
		Lecture: Health and Safety
		Q&A Session
		Topic 2.7.3: Data collection and storage
		Lecture: Collection and storage
		Q&A Session
		Assignment
		Unit 2.8: Key marine ecosystems
		Topic 2.8.1: Benthic marine ecosystems
		Lecture: Intertidal
		Lecture: Subtidal

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		Q&A Session
		Topic 2.8.2: Pelagic marine ecosystems
		Lecture: Pelagic communities
		Lecture: Demersal
		Q&A Session
		Assignment
		Topic 2.8.3: Threats to marine ecosystems and management strategies
		Lecture: Overfishing
		Assignment
		Lecture: Deep sea mining
		Lecture: Solid waste dumping
		Q&A Session
		Assignment
		Lecture: Water pollution
		Lecture: Tourism
		Q&A Session

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5.3 Module #3 - Monitoring Climate Change at Sea and Blue Carbon

M3 - Module 3: Monitoring climate change at sea and Blue carbon		
Unit 3.1: Introduction		
Topic 3.1.1: Oceans of the world and main physicochemical characteristics		
		Lecture: Ocean characteristics
		Q&A Session
		Assignment
Topic 3.1.2: Ocean circulation and regulation of global climate		
		Lecture: Ocean circulation
		Q&A Session
		Assignment
Topic 3.1.3: Marine carbon biogeochemistry		
		Lecture: Marine carbon
		Q&A Session
		Reading: "Global iron connections between desert dust, ocean biogeochemistry, and climate"
		Reading: "An Earth-system perspective of the global nitrogen cycle"
		Reading: "Oceanic sources, sinks, and transport of atmospheric CO ₂ "
Topic 3.1.4: Global atmospheric circulation		
		Lecture: Atmospheric circulation
		Q&A Session
		Assignment
Unit 3.2: Climate change and key issues in the marine environment		
Topic 3.2.1: Climate change historical data		
		Lecture: Climate change
		Lecture: Historical data
		Q&A Session
		Reading: "Sediment generation and sediment routing systems from a quantitative provenance analysis perspective: Review, application and future development"
		Reading: "Coral Skeletal Luminescence Records Changes in Terrestrial Chromophoric Dissolved Organic Matter in Tropical Coastal Waters"

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		Reading: “Sub-annual fluorescence measurements of coral skeleton: relationship between skeletal luminescence and terrestrial humic-like substances”
		Reading: “What Ice Cores can Tell us About Earth’s Past”
		Reading: “A compact wave and ocean data buoy system”
		Reading: “Holocene flood frequency across the Central Alps – solar forcing and evidence for variations in North Atlantic atmospheric circulation”
		Reading: “Reconstructing Climate and Environment from Coral Archives”
		Topic 3.2.2: Primary productivity
		Lecture: Primary production
		Q&A Session
		Reading: “Future phytoplankton diversity in a changing climate”
		Reading: “Global Warming Impacts Micro-Phytoplankton at a Long-Term Pacific Ocean Coastal Station”
		Reading: “Climate Change Induced Trends and Uncertainties in Phytoplankton Spring Bloom Dynamics”
		Reading: “Avoidable impacts of ocean warming on marine primary production: Insights from the CESM ensembles”
		Reading: “The Biological Productivity of the Ocean”
		Assignment
		Topic 3.2.3: Climate change impacts on marine invertebrates
		Lecture: Marine invertebrates
		Q&A Session
		Topic 3.2.4: The effects of ocean acidification on marine habitat
		Lecture: Ocean acidification
		Q&A Session
		Topic 3.2.5: Cycling of water and nutrients
		Lecture: Nutrient cycling
		Q&A Session
		Topic 3.2.6: Disturbance from alien and alien invasive species
		Lecture: Alien invasive species
		Q&A Session
		Reading: “Revealing polychaetes invasion patterns: Identification, reproduction and potential risks of the Korean ragworm, <i>Perinereis linea</i> (Treadwell), in the

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		Western Mediterranean”
		Reading: “DNA barcoding for assessment of exotic molluscs associated with maritime ports in northern Iberia”
		Reading: “Metabarcoding and post-sampling strategies to discover non-indigenous species: A case study in the estuaries of the central south Bay of Biscay”
		Reading: “The cryptogenic bait worm <i>Diopatra biscayensis</i> Fauchald et al., 2012 (Annelida: Onuphidae) – Revisiting its history, biology and ecology”
		Reading: “Barcodes of marine invertebrates from north Iberian ports: Native diversity and resistance to biological invasions”
		Reading: “To the Mediterranean and beyond: An integrative approach to evaluate the spreading of <i>Branchiommma luctuosum</i> (Annelida: Sabellidae)”
		Assignment
		Topic 3.2.7: Bioindicators for investigation of the effect of climate change on aquatic ecosystems
		Lecture: Bioindicators
		Q&A Session
		Topic 3.2.8: The tropicalization phenomenon
		Lecture: Tropicalization
		Q&A Session
		Assignment
		Quiz
		Unit 3.3: Projections of future climate change
		Topic 3.3.1: Introduction to climate modelling
		Lecture: Data types
		Q&A Session
		Assignment
		Topic 3.3.2: Scenarios for future climate change
		Lecture: Scenarios
		Q&A Session

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		Assignment
		Topic 3.3.3: Intercomparisons of climate change model results (CMIP5 & 6)
		Lecture: Model intercomparisons
		Q&A Session
		Assignment
		Topic 3.3.4: Sea level rise and projections
		Lecture: Sea level
		Q&A Session
		Assignment
		Topic 3.3.5: IPCC key findings
		Lecture: IPCC
		Q&A Session
		Assignment
		Topic 3.3.6: Regional climate downscaling – dynamical approach
		Lecture: Climate downscaling
		Q&A Session
		Assignment
		Topic 3.3.7: Statistical downscaling and bias correction
		Lecture: Statistical downscaling
		Q&A Session
		Quiz
		Topic 3.3.8: Observed and future climate change in the ocean
		Lecture: Ocean climate change
		Q&A Session
		Assignment
		Unit 3.4: Blue carbon and climate change
		Topic 3.4.1: Fluxes of carbon dioxide in blue carbon ecosystems
		Lecture: Blue carbon
		Video: https://www.thebluecarboninitiative.org/
		Q&A Session

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		Topic 3.4.2: Global blue carbon stocks
		Lecture: Blue carbon stocks
		Q&A Session
		Assignment
		Topic 3.4.3: Measuring blue carbon stocks
		Lecture: Blue carbon methods
		Q&A Session
		Assignment
		Topic 3.4.4: Future challenges: filling knowledge gaps
		Lecture: Carbon fluxes
		Lecture: Seagrass metabolism
		Q&A Session
		Lecture: Future challenges
		Q&A Session
		Assignment
		Unit 3.5: International and European agreements on climate change and blue carbon
		Topic 3.5.1: Aims, implementation, gaps
		Lecture: Agreements
		Q&A Session
		Topic 3.5.2: Protocols, Agreements, Reports
		Lecture: International agreements
		Q&A Session
		Topic 3.6.1: Types of carbon
		Lecture: Types of carbon
		Q&A Session
		Assignment
		Topic 3.6.2: Blue carbon ecosystems
		Lecture: Blue carbon ecosystems
		Q&A Session
		Assignment

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		Topic 3.6.3: Soil and biomass carbon
		Lecture: Soil and biomass carbon
		Q&A Session
		Assignment



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5.4 E-Platform Manual





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The ECOMARINE project E-Platform Manual



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619158-EPP-I-2020-1-CY-EPPKA2-CBHE-JP

Home Page

- The link of the home page of the platform is:
 - <https://ecomarine-project.cs.ucy.ac.cy/moodle/>

ecomarine Home Log in

Ecomarine e-platform

ECOMARINE e-courses

Available Modules

- Module #1 - Monitoring of marine plastics and microplastics
Instructor: Admin User
- Module #2 - Monitoring and managing marine ecosystems
Instructor: Admin User
- Module #3 - Monitoring Climate Change at Sea and Blue Carbon
Instructor: Admin User

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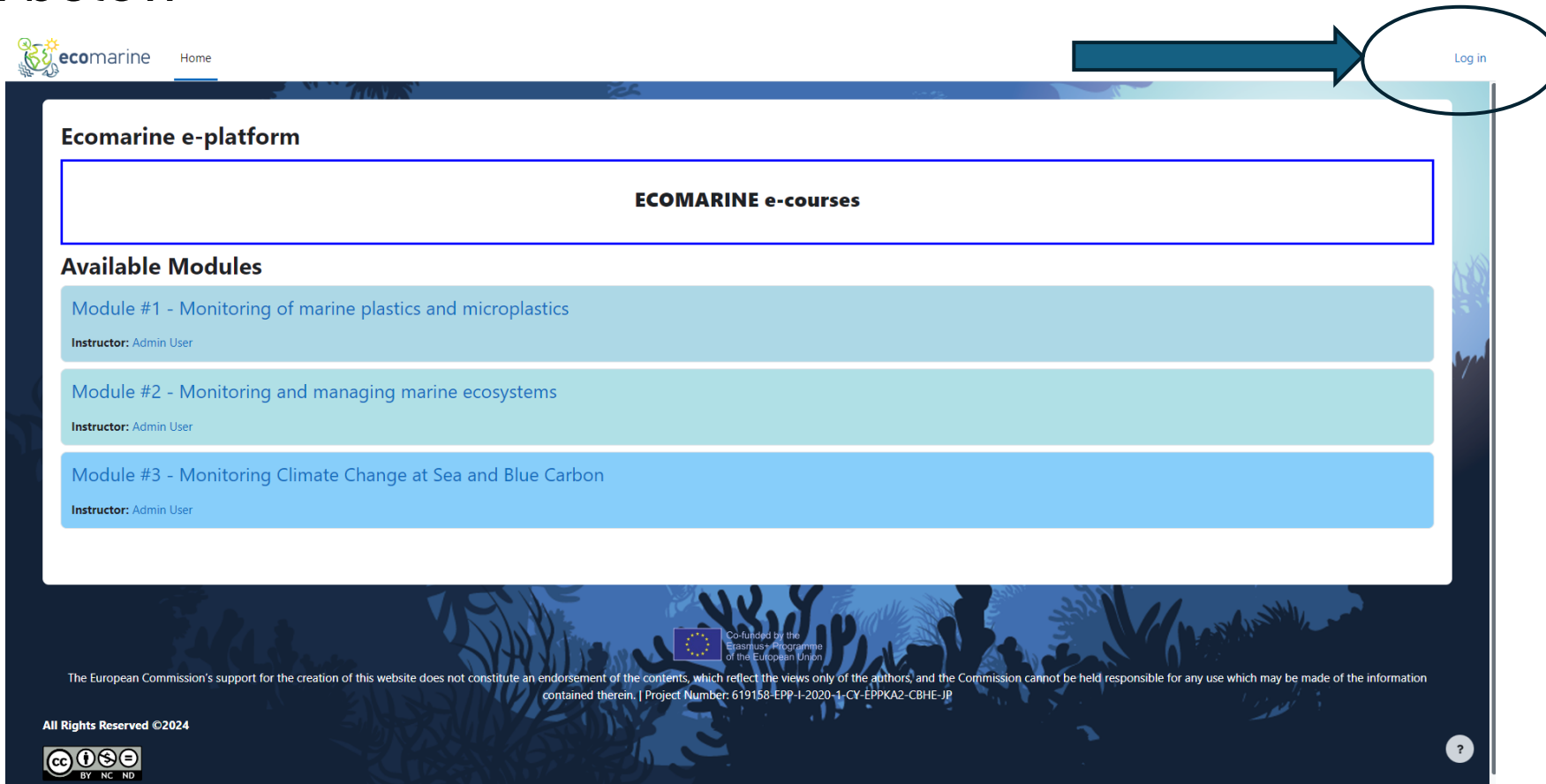
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?

Log in to the platform (1)

- Click on the “Log in” button in the top right of the page as the image shown below



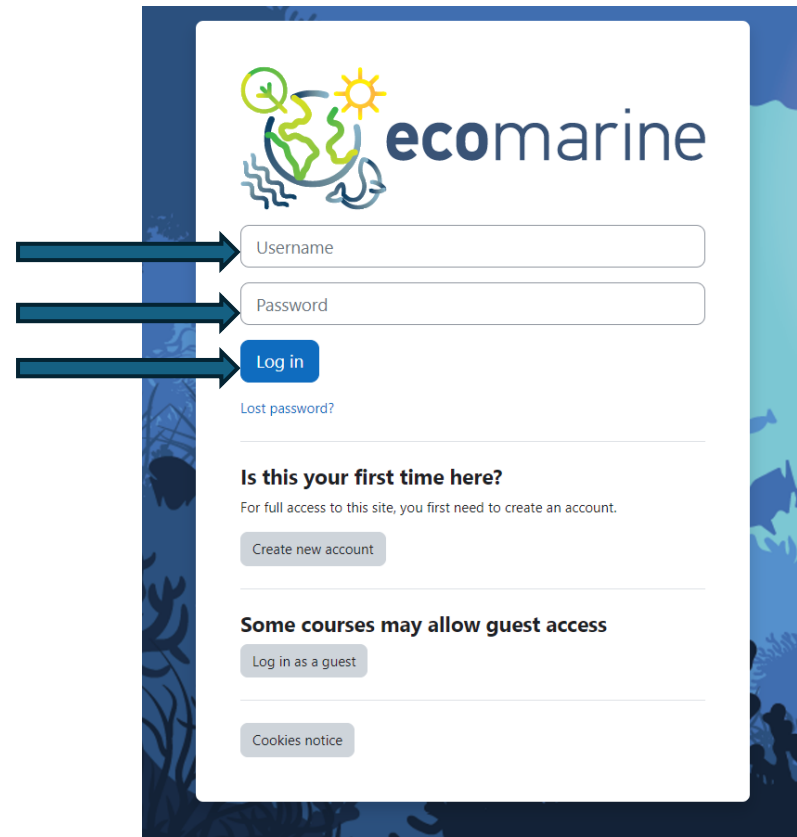
The screenshot displays the Ecomarine e-platform interface. At the top left, the 'ecomarine' logo and a 'Home' link are visible. In the top right corner, a 'Log in' button is circled in black, with a blue arrow pointing towards it from the left. The main content area is titled 'Ecomarine e-platform' and features a section for 'ECOMARINE e-courses'. Below this, there is a list of 'Available Modules':

- Module #1 - Monitoring of marine plastics and microplastics
Instructor: Admin User
- Module #2 - Monitoring and managing marine ecosystems
Instructor: Admin User
- Module #3 - Monitoring Climate Change at Sea and Blue Carbon
Instructor: Admin User

At the bottom of the page, there is a footer containing the European Commission's disclaimer, the project number (619158-EPP-I-2020-1-CY-EPPKA2-CBHE-JP), and the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International license logo (CC BY NC ND). A small question mark icon is located in the bottom right corner.

Log in to the platform (2)

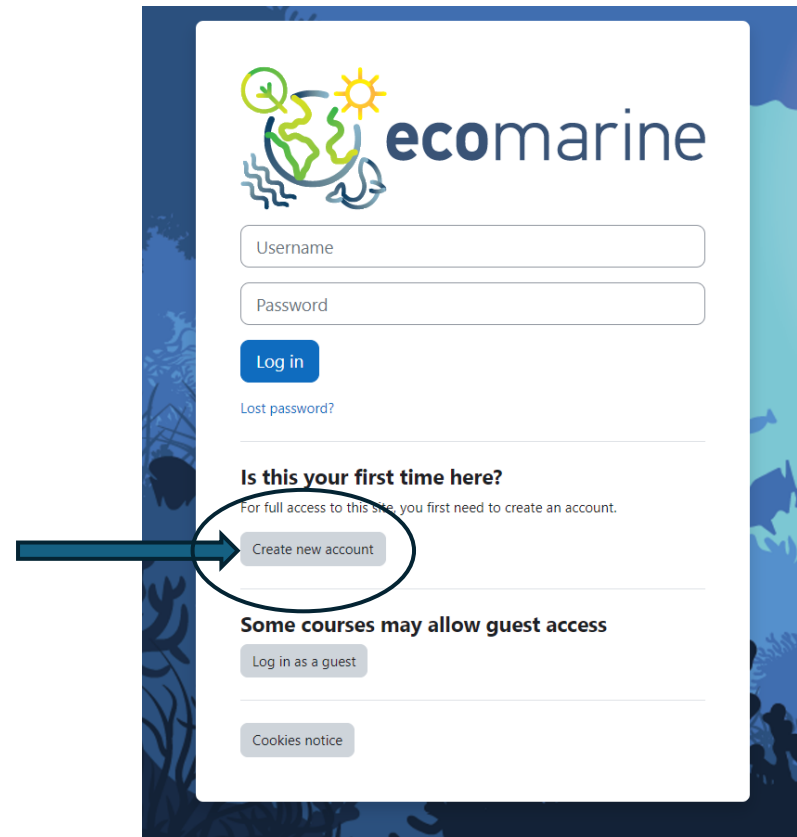
- If you already have an account, enter your username and password in the appropriate fields and click on the blue “Log in” button as the image shown below



The image shows a login interface for 'ecomarine'. At the top left is a logo featuring a globe with a sun and a fish. To the right of the logo is the text 'ecomarine'. Below the logo are three input fields: 'Username', 'Password', and a blue 'Log in' button. Three blue arrows point from the left towards these three elements. Below the 'Log in' button is a link for 'Lost password?'. Further down, there is a section titled 'Is this your first time here?' with a subtext 'For full access to this site, you first need to create an account.' and a 'Create new account' button. Below that is a section titled 'Some courses may allow guest access' with a 'Log in as a guest' button. At the bottom is a 'Cookies notice' button. The entire interface is set against a background with a blue and white wave pattern.

New account (1)

- If you do not already have an account, please click on the “Create new account” button as the image shown below



New account (2)

- Fill the form with your personal data
- The fields that are marked are the required fields
- In the end click on the “Create new account” button

New account

Username ❗

The password must have at least 8 characters, at least 1 digit(s), at least 1 lower case letter(s), at least 1 upper case letter(s), at least 1 special character(s) such as as *, -, or #

Password ❗

Email address ❗

Email (again) ❗

First name ❗

Surname ❗

City/town

Country

Select a country ▾

There are required fields in this form marked ❗.

New account (3)

- When you complete the form, you will see the following screen, which informs you that you have received an email at the email address you used to complete the form which gives you instructions on how to complete your registration to the platform

Ecomarine e-platform

An email should have been sent to your address at **mariosportaris@gmail.com**

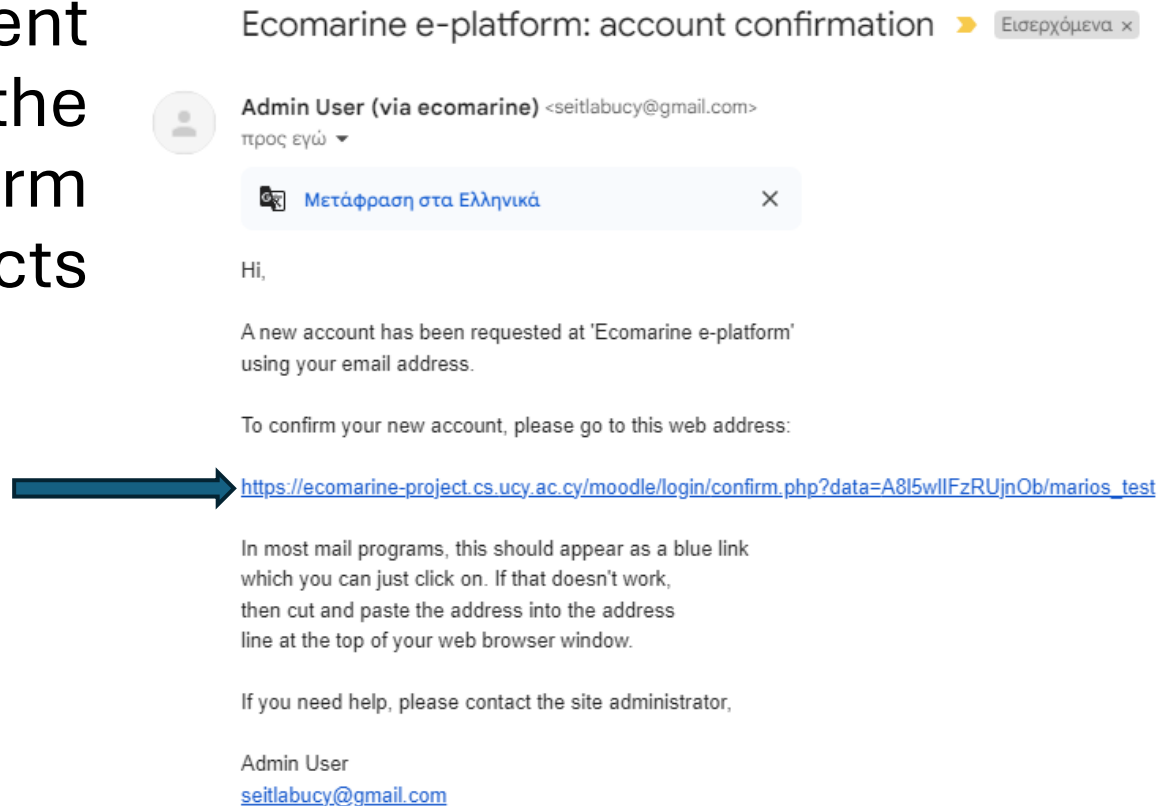
It contains easy instructions to complete your registration.

If you continue to have difficulty, contact the site administrator.

Continue

New account (4)

- Here we can see the email sent after completing the registration form to confirm your new account, it instructs you to visit a page.
- Click on the link



New account (5)

- Now, you can see a page like the image below.
- Click on the continue button

Ecomarine e-platform

Thanks, Marios Kyprianou

Your registration has been confirmed



Courses

- You can see the available Modules now
- Click on the Module you want to have access

Available Modules

Module #1 - Monitoring of marine plastics and microplastics →

Instructor: Admin User

Module #2 - Monitoring and managing marine ecosystems →

Instructor: Admin User

Module #3 - Monitoring Climate Change at Sea and Blue Carbon →

Instructor: Admin User

Enrolment in courses (1)

- Click on the “Enrol me” button to have access to the Module

Module #1 - Monitoring of marine plastics and microplastics

Enrolment options

[Module #1 - Monitoring of marine plastics and microplastics ↗](#)

Instructor: Admin User

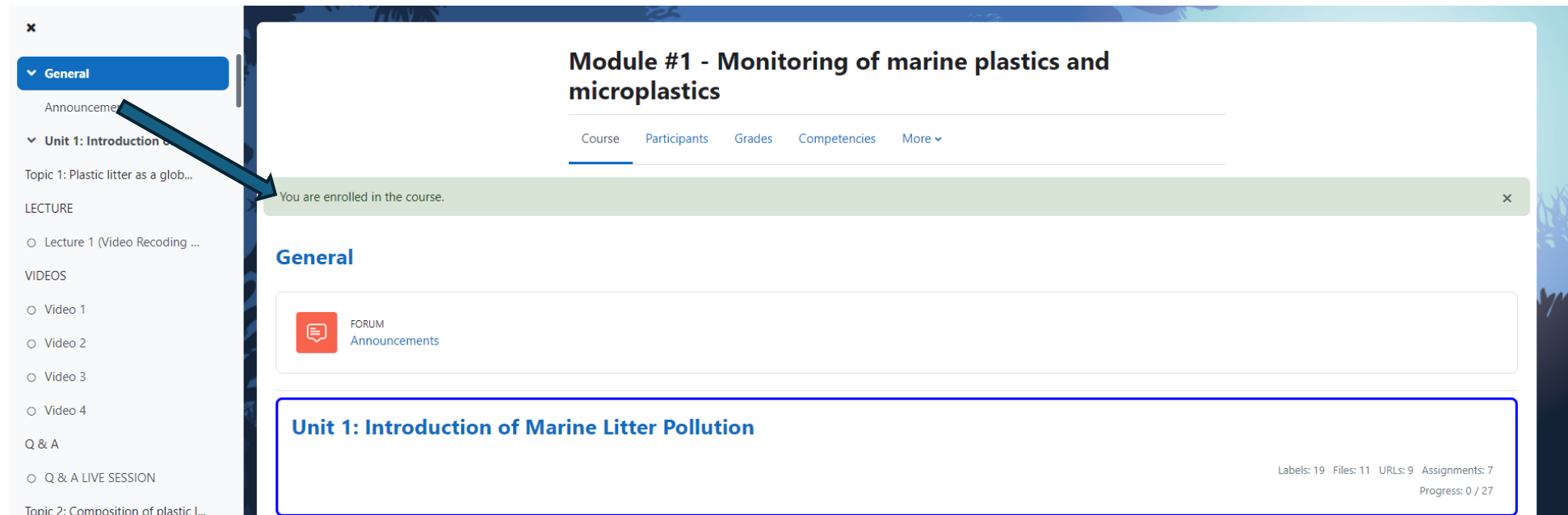
▼ Self enrolment (Student)

No enrolment key required.



Enrolment in courses (2)

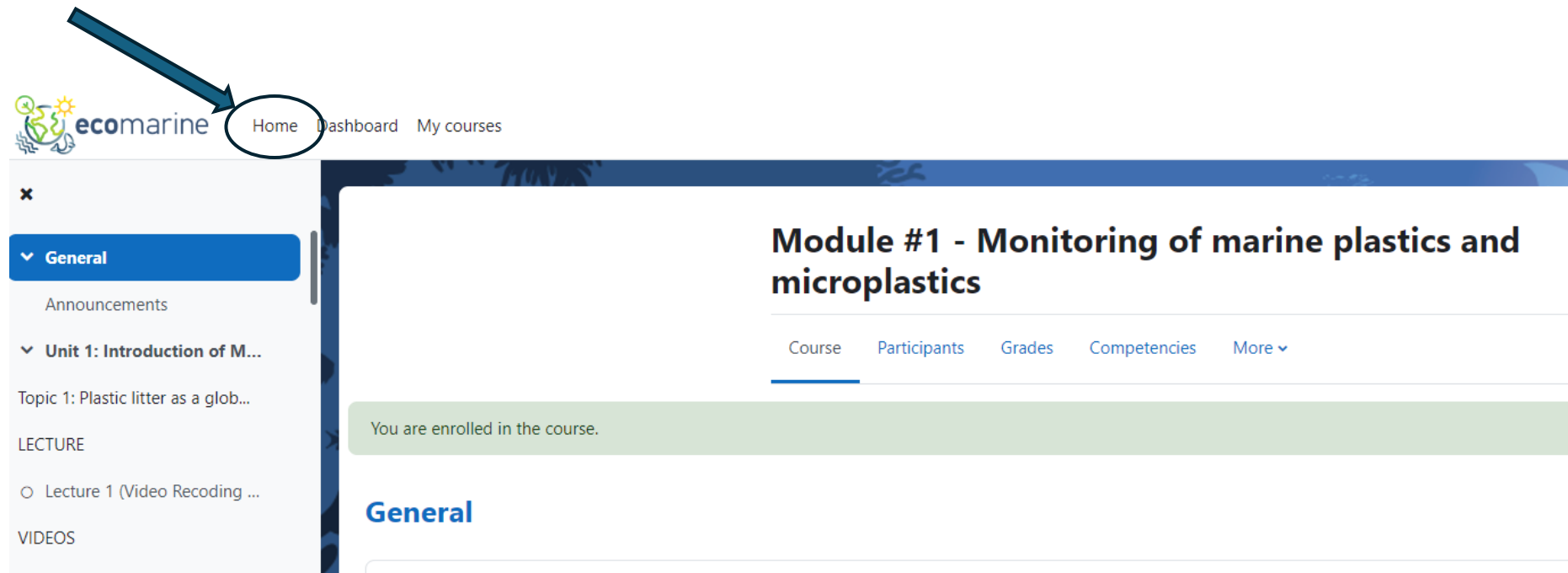
- After you enroll in a course, it tells you that you are enrolled and you can see what it contains



The screenshot displays a course page for "Module #1 - Monitoring of marine plastics and microplastics". A green notification bar at the top states "You are enrolled in the course." with a close button. The left sidebar contains a navigation menu with sections: General, Unit 1: Introduction of Marine Litter Pollution, LECTURE, VIDEOS, Q & A, and Topic 2: Composition of plastic litter. The main content area shows a "General" section with a "FORUM Announcements" icon. Below this is a section for "Unit 1: Introduction of Marine Litter Pollution" with a blue border. At the bottom right, course statistics are shown: "Labels: 19 Files: 11 URLs: 9 Assignments: 7 Progress: 0 / 27". A blue arrow points from the "Unit 1: Introduction of Marine Litter Pollution" item in the sidebar to the green notification bar.

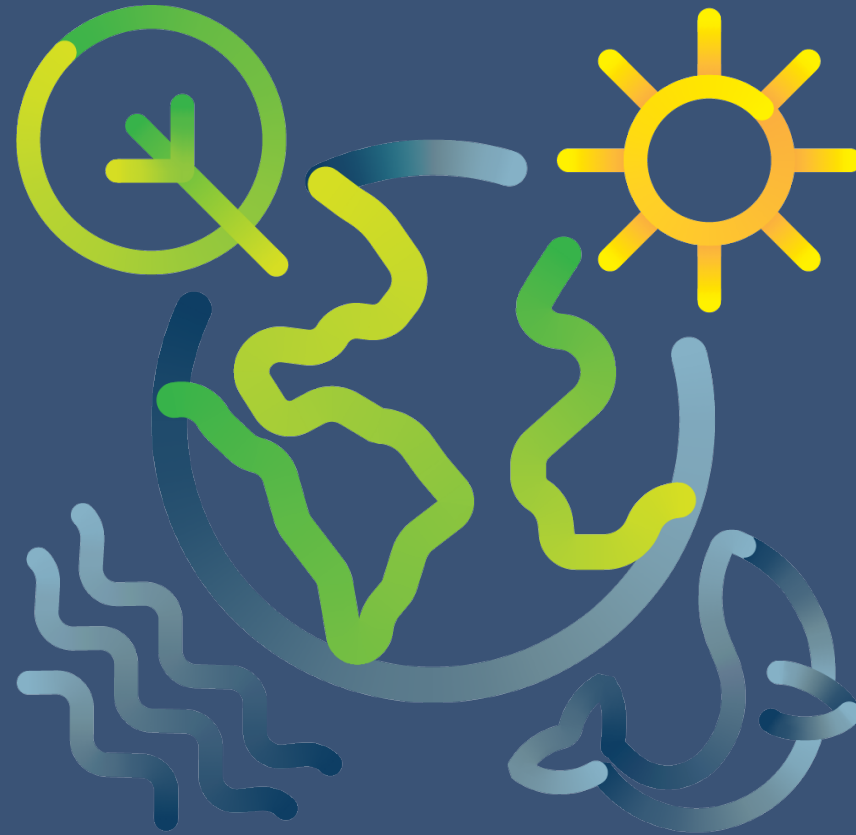
Enrolment in courses (3)

- If you click on the “Home” from the menu on the top of the page, you can see the Modules again and you can enrol to another one in which you are not enrol



The screenshot shows the ecomarine website interface. At the top left, the ecomarine logo is visible. To its right, a navigation menu contains the items 'Home', 'Dashboard', and 'My courses'. The 'Home' item is circled in red, and a blue arrow points from the text above to it. Below the navigation menu is a sidebar with a close button (x) and several sections: 'General' (expanded), 'Unit 1: Introduction of M...' (expanded), and 'VIDEOS'. The main content area features a blue header with the title 'Module #1 - Monitoring of marine plastics and microplastics'. Below the title are tabs for 'Course', 'Participants', 'Grades', 'Competencies', and 'More'. A green notification bar at the bottom of the main content area states 'You are enrolled in the course.' Below the notification bar is a section titled 'General'.

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