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Report

WP 3 CAPACITY BUILDING THROUGH STAFF TRAINING AND EQUIPMENT PURCHASE. THE AIM OF WP2 IS TO ENHANCE CAPACITIES RELATED TO FIELD OF MEP&M AND E-LEARNING.

DEV.3.4.4. KNOW-HOW TRANSFER TO TEACHING STAFF RELATED TO THE ENVIRONMENTAL MANAGEMENT

DEVELOPMENT OF REGIONAL JOINT MASTER PROGRAM IN MARITIME ENVIRONMENTAL PROTECTION AND MANAGEMENT
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Development of Regional Joint Master Program in Maritime Environmental Protection and Management – MEP&M
Project no. 619239-EPP-1-2020-1-ME-EPPKA2-CBHE-JP

REPORT ON KNOW-HOW TRANSFER RELATED TO THE LATEST TOPICS ON MARINE AND COASTAL POLLUTION AND EMISSION OF GHG FROM SHIPPING, NAUTICAL TOURISM, COASTAL TOURISM AND OFF-SHORE ACTIVITIES

Overview of MSc programs in field of MEP&M at EU HEIs

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Contents

1. Introduction

Author(s) of Introduction: María de Andrés García, Rosa Molina Gil and Ana Macías Bedoya. University of Cadiz (Spain)

1.1. Objective and format

In the project, the main objective of DEV.3.4.4 was to provide to Montenegrin and Albanian HEIs' teaching staff additional know-how related to the environmental management.

Based on this, the specific objectives to be achieved in DEV.3.4.4 are the following:

Obj. 1 In-depth study of environmental economics in the marine environment: Blue Economy.
Obj. 2 To learn about strategies to face coastal and marine risks.
Obj. 3 To specify the importance of ecosystem services for environmental management in the marine environment.
Obj. 4 To discuss in depth the importance of GIS for the management of coastal and marine environment.

Based on this, the format of DEV.3.4.4. were developed through specific topics, which were developed in the training session. Thus, the topics proposed for DEV.3.4.4 were as follows:

- **Topic 1.** Blue Bioeconomy: Fisheries, Aquaculture and blue biotechnology
- **Topic 2.** Coastal risks and vulnerability: Basis and strategies for protection and monitoring
- **Topic 3.** The ecosystem services – concepts and applications
- **Topic 4.** GIS applied to coastal and maritime environmental protection and management
- **Topic 5.** Environmental economics – how to combine environment and economy?

In this training session the topics were related to environmental management. Specifically, they focused on providing participants with useful tools for teaching concepts and strategies for the management of the coastal and marine environment.

In this sense, the environmental economy, specifically talking about blue economy, is a very recurrent topic at present and relevant for the deepening among the participants. In addition, the knowledge of strategies to prevent and mitigate environmental risks is a topic of current relevance.

Moreover, the concept of ecosystem services allows participants to learn new concepts from which to address the management of the marine environment. In this sense, Ecosystem-Based Management is a novel concept, based on the services offered by marine ecosystems.

All this is digitized and mapped thanks to geographic information systems. GIS are powerful tools for mapping and calculating multiple processes that support decision-making in the management of the marine environment.

As shown in this Report, the topics developed provide the participants with the appropriate tools to address the environmental management of the marine environment in the classroom.

The topics were developed by professors from the University of Cadiz, Spain (UCA-S) and the University of Cote D'Azur, France (UCA-F); they are researchers and specialists in the areas of knowledge proposed. Specifically, the University of Cadiz addressed **topics 1, 2 and 4**, while the Cote D'Azur University developed **topics 3 and 5**.

As for the format of the training sessions corresponding to DEV.3.4.4, it was the first time that they could be held in person. As a result, participants from the universities of Albania and Montenegro were able to attend and participate in the training sessions in person. For their part, researchers from the Spanish and French universities traveled to Montenegro to share their knowledge and experience with the participants.

Specifically, the training sessions took place at the University of Montenegro on July 11 and 12, 2022.

In general, the face-to-face training sessions have allowed for greater feedback and exchange of experiences between the participants and the speakers. A total of 26 participants attended the training sessions at the University.

1.2. Agenda

As shown in **Table 1**, the agenda was prepared by the University of Cadiz and the Cote d'Azur University. In addition, the agenda was previously supervised by the Project Coordination for its approval and verification of the contents. The agenda was provided before the training sessions.

Table 1. Agenda for DEV. 3.4.4 training sessions

Monday, July 11st 2022	
09:00 – 09:30	Registration of participants
09:30 – 09:45	**Official opening**
09:45 – 11:15	**Blue Bioeconomy: Fisheries** | Dra. Remedios Cabrera Castro (UCA-S) **Blue Bioeconomy: Aquaculture and blue biotechnology** | Dr. Manuel Alejandro Merlo Torres (UCA-S) **Discussion and questions**
11:15 – 11:30	Coffee break
11:30 – 13:00	**Coastal risks and vulnerability: Basis and strategies for protection and monitoring** | Rosa Molina Gil (UCA-S) **Discussion and questions**
13:00 – 14:00	LUNCH BREAK
14:00 – 15:30	**The ecosystem services – concepts and applications (part 1)** |Dr. Christophe Mocquet (UCA-F)
15:30 – 15:45	Coffee break discussion
15:45 – 17:15	**The ecosystem services – concepts and applications (part 2)** |Dr. Christophe Mocquet (UCA-F) **Discussion and questions**
17:15	Closure of the day

Tuesday, July 12st 2022

09:00 – 10:30	**GIS applied to coastal and maritime environmental protection and management** |Dr. Alfredo Fernández Enríquez (USA-S) **Discussion and questions**
10:30 – 10:45	Coffee break
10:45 – 12:15	**Environmental economics – how to combine environment and economy?** | Dr. Christophe Mocquet (UCA-F) **Discussion and questions**
12:15 – 13:00	**Discussion and closure of the training sessions**
13:00 – 14:00	LUNCH BREAK (PMB meeting starting at 14:00)

2. Overview of training sessions

2.1. **Topic 1:** Blue Bioeconomy: Fisheries (Part 1), Aquaculture and blue biotechnology (Part 2)

Author(s) of Topic 1: María de Andrés García, Remedios Cabrera Castro and Dr. Manuel Alejandro Merlo Torres (Spain)

Trainer: Dr. Remedios Cabrera Castro and Dr. Manuel Alejandro Merlo Torres

Contents taught:

The main objective to point out that marine living resources are renewable, as this characteristic is essential, together with good management, to maintain the different fisheries over time. Also, to emphasise that fisheries have to be seen as a complex fishing system with a multitude of interactions, to know the history, the most important milestones, as well as the state of the fisheries. The main impacts associated with fishing activities was also explained and the proposal of sustainable alternatives to solve them. To know the real scope of artisanal fisheries and highlight their strengths as a sustainable activity and highlight small-scale artisanal fisheries as a key to the development of coastal communities and villages.

Moreover, the part 2, related to aquaculture and blue biotechnology, had the objective to highlight the aquaculture as an essential engine for the consolidation of the blue economy in the countries. Also to know the history, status and the different extant aquaculture systems. To detect which are the main impacts associated to the aquaculture activity and propose sustainable alternatives to solve them, know the scope of blue biotechnology for the development of the blue economy, and to highlight biotechnology as a key discipline to reach a sustainable aquaculture.

The contents of the session were first related to the concept of fisheries, aquaculture and biotechnology. This was followed by the history and current status of the three topics, in order to address their current impacts. Finally, fisheries, aquaculture and biotechnology in the marine environment were discussed from the 2030 Agenda, to address the current challenges imposed by the United Nations.

Discussion and questions:

In the first part of the topic, a question was asked about the data source used. The data comes from the information published by the FAO and from the crossing of data and information between colleagues from the FAO and other centers. Also, a brief discussion about the globally relevant contribution of small-scale artisanal fisheries and the importance for so many coastal and island countries was made.

In the second part of the topic, about the technologies and facilities shown in the presentation, a question about the viability of them for all countries. This kind of technologies and facilities are expensive and complex technologies and it takes a lot of money to improve the facilities. In addition, not all countries use the blue biotechnology for the same purpose, in Spain it is focused on aquaculture.

Another question posed was the application of novel biotechnological advances, such as the CRISPR-CAS gene editing for aquaculture improvement. Although, now is the focus of several research in the aquaculture field, the establishment of such technique in improvement programs is nowadays far, taking into account that is a young technique and there is still too deep about it, even for the application in humans.

It was also discussed the use of biodiesel produced by microalgae as money source. This option is possible and possibly already done, since it is the companies that invest in blue biotechnology and decide.

Main conclusion:

The main conclusions are the importance of fisheries and aquaculture in the 2030 Agenda. This is due to the fact that international strategies address the issue affecting the marine environment and its management. Therefore, it is necessary to understand the changes faced by these economic activities, both from the ecological point of view and from the international policy level.

2.2. **Topic 2:** Coastal risks and vulnerability: Basics and strategies for protection and monitoring

Author(s) of Topic 2: María de Andrés García and Rosa Molina Gil (Spain)

Trainer: Dr. Rosa Molina Gil

Contents taught:

In this topic, the main objective was to expose the basis of coastal risk and vulnerability assessment.

In part 1, definitions and bases on coastal risks and vulnerability were described: differences in terminology, i.e. hazard and risk, vulnerability, disaster and catastrophe; risk study methods, i.e. prediction, prevention and mitigation strategies; and the main risks affecting coastal areas, i.e. erosion and flooding processes due to storms, hurricanes, Sea Level Rise (SLR), etc. The main problems and processes associated with climate change that constitute a risk were also presented.

In part 2, Coastal Vulnerability Index (CVI) and mitigation strategies against coastal erosion were discussed: main parameters and characteristics were presented, and a brief summary of recent studies, their advantages and disadvantages.

With regard to vulnerability, we worked with the Coastal Vulnerability Index, as it is a relevant tool for measuring the development of strategies.

Discussion and questions:

The first question was about the inclusion of economic data in coastal risk estimation. Economic data is not generally used in this step of the risk study, but in the estimation of coastal vulnerability, where a sub-index is introduced specifically for socio-economic data within the calculation of the Coastal Vulnerability Index (CVI).

The second question was about why Sea Level Rise (SLR) was negative in a spot of the Baltic Sea and how it is calculated. There are many factors that influence SLR and the Baltic Sea is a particular case. The reason is unclear: the main factor is the glacial isostasy adjustment (GIA) due to its proximity to the poles causing this difference in values with respect to the rest of Europe. The calculation of the values of sea level rise is very complex, in which numerous corrections must be added, such as the subsidence of the land, the GIA or the influence of the poles.

Main conclusion:

The training session on coastal risks was of interest to the participants as, on the one hand, they discussed types of risks and characteristics, and on the other hand, instruments and tools for measuring these risks were discussed.

2.3. **Topic 3:** The ecosystem services – concepts and applications

Author(s) of Topic 3: María de Andrés García and Rosa Molina Gil (Spain)

Trainer: Dr. Christophe Mocquet

Contents taught:

The objective of this topic was to talk about the ecosystems services as a tool for coastal management. The main objective was to expose the basic concepts about ecosystem services, focusing on the economic part, and exposing some applications.

In the first part the topic dealt with the basis of the ecosystems services, specifically, about the value and aspects of the environment, and the environment as a resource. To this purpose, the concept of ecosystem service was discussed, as well as its classification into

four groups, which was carried out by the United Nations and widely applied in the scientific world. The four groups in which ecosystem services are classified according to the type of benefit they provide: supporting, provisioning, regulating and cultural.

In the second part, an example of coral reefs was presented. First, an introduction to the biological aspects of coral reef organisms was given. This was followed by a discussion of the services provided by coral reefs.

Discussion and questions:

About important problems with invasive species, are they included as pest and disease in the group of 'Regulating' benefits from nature? – It needs to be studied case-by-case, identifying which are the species that compete and see which species should be protected to compete against the invasive species.

It was also discussed about posidonia sea grass as protective element of the coast: some people (it was exposed a specific case) does not understand the importance of posidonia, dunes, and other elements of the coast, as they only focused in fishery and tourism.

Another question discussed, derived from the previous one, was what can we do to convince people that they must protect the environment. About a specific case in Mexico concerning hotels, a company proposed a parametric system to calculate benefits taking into account the protection of the coast. The problem is that companies understand it and for this education is essential.

Main conclusion:

The topic of ecosystem services is of interest to participants because it is from the benefits that people derive from ecosystems that they can begin to care about their conservation. In this sense, the population's knowledge of coastal and marine ecosystem services is relevant for their management.

2.4. **Topic 4:** GIS applied to coastal and maritime environmental protection and management

Author(s) of Topic 4: María de Andrés García and Alfredo Fernández Enríquez (Spain)

Trainer: Dr. Alfredo Fernández Enríquez

Contents taught:

The topic was started talking about GIS application cases available in the European MSP platform and WebGIS tools, as is the cases of web map services, web feature services, and web coverage services. Next, Specific GIS utilities applied to the marine and coastal environment were presented. Among them, they can be highlighted the following:

- Biophysical: Species (Focal species and Seabird abundance and distribution, Population structure, Community composition, Genetic diversity).
- Biophysical: Habitats (Fish nursery areas, Suitable environmental conditions for species, Distribution of three key phytobenthic species, Coastal lagoons and large shallow inlets & bays, Habitat heterogeneity indicator).
- Geophysical (Interpolation of depth and elevation, Archipelago zonation.
- Socio economical Pressure (Shoreline exploitation, Human influence on coastal lagoons and large shallow inlets and bays, Communication infrastructure, Effects of recreational boating and fishing on sensitive habitats, Marine noise disturbance from vessels, Potential dredging sites in shallow coastal areas, Shoreline erosion induced by navigational activities).
- Socio economical (Effects of marine management activities on fishing, Economic value of marine areas exemplified for recreational activities).
- Governance/Stakeholder interaction (interaction between authorities and stakeholders, Compliance with management plans).

The topic followed with the presentation about geoplatforms, which providing information and ready to use web tools (maritime use conflicts, cumulative effects assessments and marine ecosystems services threat assessment). Moreover, it was talked about Interreg DST-MPA platform, Spatial Decision Support Systems (SDSS) for Blue Economy in Marine Protected Areas.

To finalise the topic, two GIS softwares were commented: Open Source software (QGIS), with practical exercises, such as, loading information, data sources, georeferencing, digitizing, geoprocessing, map algebra, Analytical Hierarchical Process... and ArcGIS Pro (geostatistical interpolation, model builder and Fuzzy logic).

Discussion and questions:

A brief discussion about the access to licensed software (ArcGIS Pro) and open source software (QGIS) and Open Geospatial Consortium (OGC) standards took place.
In the case of ArcGIS, it is a paid license, but there are other open access softwares. The platforms, in general, are usually all freely accessible.

Main conclusion:

Geographic information systems and digitization of the territory are fundamental tools for the management of the coastal and marine environment. For this reason, among the most relevant contents to be taught to future managers is the knowledge and advantages of GIS applied to management.

2.5. **Topic 5:** Environmental economics – hot to combine environment and economy?

Author(s) of Topic 5: María de Andrés García and Rosa Molina Gil (Spain)

Trainer: Dr. Christophe Mocquet

Contents taught:

In the first part, example of coral reef as ecosystem service was presented. In this case, the presentation was about benefits and difficulties of their economic valuation. Moreover, examples of different services supported as biotechnology for medicine and tourism and recreation as cultural service were showed.

Furthermore, comparison of the types of services according to the economic importance was deal with. In this case, the economic component was most important in the case to highlights the value of ecosystem services.

In the second part of the topic, the trainer presented some natural threats affecting ecosystem services. Moreover, other examples of ecosystem services were presented. Those were related to Mediterranean posidonia.

Discussion and questions:

The discussion was about how is ecosystem services regulated. It depends on where we are: each country has a specific regulation, as especial offices that regulates protected areas and develop the strategies.

There also are group of people and start-ups that develop their own business models, for example about local development, wives of fishermen who work in the fishery but are not officially registered.

Another topic discussed was the possibility of allow protected areas to be exploited economically. It needs to be regulated, allowing and proposing alternatives that allow their exploitation and protection.

Main conclusion:

The main conclusion of this topic was related to the importance of ecosystem services and their pressures suffered. The links about ecosystems services and economic activities were highlighted in this topic also.

3. General conclusions

The training on DEV.3.4.4. had as its main purpose the knowledge of elements and tools to facilitate the management of the marine environment. In this sense, the training session starts with coastal and marine economy issues, with the relevance of the blue economy. The training then focuses on coastal and marine environment management strategies in the face of coastal risks. These topics address relevant aspects to be taken into account for the management of the marine environment.

The training session is strengthened by the introduction of ecosystem services in the marine environment. In this sense, knowledge of the services that ecosystems offer to society is fundamental for their valuation and conservation.

The training session is completed with the introduction of Geographic Information Systems, an essential tool for mapping, management and monitoring ecosystems and economic activities in the marine environment.