BOOK OF ABSTRACT

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    I.   **SESSION DESCRIPTION**

ID: **B1a**

Marine and coastal ecosystem service mapping and modelling: moving beyond land-based adaptations

Hosts:

	Title	Name	Organisation
Host:	Dr.	Evangelia (Valia) Drakou	University of Twente
Co-host(s):		Ana Ruiz-Frau, Elena Gissi, Angel Borja	

Abstract:

The quantification of marine and coastal ecosystem services (MCES) is gaining momentum, partly due to an increasing need to respond to a multitude of policy objectives for the sustainable management of the marine environment. The integration of MCES into decision-making requires robust and sound quantification of the societal, economic and environmental benefits derived from the marine environment. To that regard, the mapping and modelling of MCES is increasingly used to deliver sets of MCES indicators, value estimates on different aspects of marine and coastal systems and to produce maps that are used to aid planners and decision-makers in their decision-making process.

MCES mapping and modelling methods used often take stock from land-based approaches, adapting existing mapping and modelling methods to the marine realm. However, the difference between MCES from those provided by the terrestrial environment has been widely acknowledged, as well as the fact that land-based approaches might be limited in representing the highly dynamic, complex and tridimensional nature of marine systems. This raises a series of research questions that this session aims to address. For instance, how can we map and model ES provided by open ocean systems? Are the indicator sets used in land-based approaches suitable to quantify the benefits that society obtains from marine

systems? Can ES supply, flow and demand be mapped and modelled with the existing methods in the marine environment? What are the challenges in including the 3-dimensional and dynamic nature of the marine systems in ES Flow assessments? How can we include seasonality and temporal change in MCES quantification?

We invite submissions that have assessed and quantified marine and coastal ES using innovative methods and tools that go beyond land- based approaches. We invite authors to present the content of their work, but most importantly share the points of success and failure of their methodological approaches. We will also give special priority to work that is been done in non-coastal systems, 3-dimensional models that consider surface-water column-seabed domains, and any types of map and modelling approaches that consider the complexity and spatial-temporal dynamism of the marine environment.

Goals and objectives of the session:

In this session we aim to develop a pool of mapping and modelling methods that go beyond the standard land-based methods to assess marine and coastal ES. Through a participatory exercise we will also develop a set of priority methods that need to be further developed within the ESP Marine Biome WG.

Planned output / Deliverables:

A short paper sharing the mapping and modelling methods gathered through the session, which will be published in a relevant journal, for instance Ecosystem Services or IJBESM. In coordination with other marine sessions, a special issue in a scientific journal can be proposed to the session participants.

Related to ESP Working Group/National Network:

Biome Working Groups: B1a – Open oceans

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II.   SESSION PROGRAM

Date of session: Thursday, 18 October 2018
Time of session: 8:45 – 13:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
8:45–9:00	Rémi	Mongruel	IFREMER	Contextualizing Ecosystem Services National Assessments: lessons learned from the FrenchMarine Ecosystem Services Assessment (EFESE-Mer)
9:00–9:15	Chloe	Stanford-Clark	Azti	Assessing the value of natural capital through related ecosystem service flows and coastal andmaritime activities in the Basque Country: towards future conservation and sustainability.
9:15–9:30	Johanna	Ballé-Béganton	Université de Bretagne Occidentale	Extent versus strength: from open ocean to coastal 'Blue carbon' assessment
9:30–9:45	Fiona	Culhane	University of Liverpool	Risk to the supply of ecosystem services across aquatic realms
9:45–10:00	Daniel	Depellegrin	CNR – National Research Council of Italy, ISMAR – Institute of Marine Sciences Arsenale	From land to sea: Exploring land- and sea-based geospatial models for marine ecosystem services assessment, mapping and threat analysis
10:00–10:15	Heikki	Peltonen	Finish Environmental	Impacts of changing nutrient loads on the coastal

Time	First name	Surname	Organization	Title of presentation
			Institute – SYKE	ecosystemservices
11:30–11:45	Miriam	Von Thenen	Leibniz Institute for Baltic Sea Research	Modelling ecosystem services provided by mussel farms in the south-western BalticSea
11:45–12:00	Elisabetta	Manea	University IUAV of Venice	Mapping Ecosystem Services to support EB-MSP: A methodological approach
12:00–12:15	Carina	Vieira da Silva	NOVA Center for Environmental Economics	Stakeholders' Mapping and Valuation of Marine and Coastal EcosystemServices: a PPGIS application for Marine Spatial Planning
12:15–12:30	Maria C.	Uyarra	AZTI – Marine Research Division	Understanding human – natural capital interactions in coastal areas for better management of marine recreational activities
12:30–12:45	Sonja	Wanke	Deltares	Using Serious Gaming as an Ecosystem Service Management Tool in the Wadden Sea
12:45–13:00	Interactive discussion on mapping and modelling methods for marine and coastal ecosystem services			

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III. ABSTRACTS

The abstracts appear in alphabetic order based on the last name of the first author. The first author is the presenting author unless indicated otherwise.

1. *Type of submission:* **Abstract**

B. Biome Working Group sessions:B1a Marine and coastal ecosystem service mapping and modelling moving beyond land-based adaptations

Understanding human – natural capital interactions in coastal areas for better management of marine recreational activities

First author: Itziar Burgués

Other author(s): Arantza Murillas, Maria C. Uyarra

Affiliation, Country: AZTI , Spain

Presenting author: Maria C. Uyarra

Coastal areas support human well-being and livelihoods by providing numerous ecosystem services, including provisioning goods, regulation services and recreational opportunities. The interactions between people and Natural Capital are complex, especially when it comes to recreational activities; these often rely on the quality of Natural Capital but in turn, they can have an impact on it. In this study, we focused on Marine Recreational Activities (MRAs) taking place in the Basque Coast (Spain) to develop and propose a conceptual framework that enable classifying the MRAs, based on their dependency and impact on Natural Capital. In total, 12 categories of MRAs were identified, which were later classified into three activity types: 1) Activities that impact the same resource they rely on, 2) Activities that impact a resource they do not rely on and 3) Activities which rely on a resource upon which they do not have an impact. Different activities may be classified under more than one activity type. Secondly, we applied a participatory mapping approach to identify MRAs´ hotspots in the Basque coast. A questionnaire survey in which respondents were asked to provide information on the MRAs they practice in the Basque coast, location, frequency, dependence on Natural Captal and perception of their impact, was distributed through different means, including social media, among local people, which in turn were asked to redistribute the survey. Based on 295 responses, we mapped MRAs´ intensity in the Basque Coast. Heatmaps of MRAs intensity showed an heterogenous temporal and geographical distribution along the Basque Coast. Identifying MRAs hotspots with higher potential human-impact can help guiding further research and management efforts, which are strongly needed to maintain the ecosystem service benefit flow in coastal areas.

Keywords: Marine recreational activities, participatory approach, hotspots, cultural ecosystem services

B. Biome Working Group sessions: B1a Marine and coastal ecosystem service mapping and modelling moving beyond land-based adaptations

Risk to the supply of ecosystem services across aquatic realms

First author: Fiona Culhane

Other author(s): Heliana Teixeira, Antonio J A Nogueira, Daniel Trauner, Florian Pletterbauer, Ana Lillebø, Mathias Kuemmerlen, Juan Arevalo -Torres, Julian Barbière, Ana Luisa Barbosa, Alejandro Iglesias-Campos, Hugh McDonald, Tim O'Higgins, Gerjan Piet, Leonie Robinson

Affiliation, Country: University of Liverpool, United Kingdom

The capacity of ecosystems to supply ecosystem services is decreasing. Sustaining this supply requires an understanding of the links between the impacts of the pressures introduced by human activities, which are often driven by the demand for ecosystem services, and how this can lead to a change in the supply of ecosystem services. Here, we explore the risk to the supply of ecosystem services across a range of aquatic realms. The approach we take links aggregate impact risk from human activities on ecosystem components with a relative score of their potential to supply ecosystem services. The greatest risk to service supply is found where an ecosystem component with a high potential to supply services is subject to high impact risk. We explore variability in this across 191 aquatic ecosystem components from 14 aquatic realms ranging from oceanic waters to riparian wetlands. We go on to explore the reasons behind the overall shape of the relationship between level of human activity in a given habitat and it's potential for supply services. We also explore causes of variability in the risk to service supply observed, according to factors such as total assessment area, conservation status and human population density in the relevant catchments.

Keywords: Risk assessment, Sustainability, Biodiversity, Marine, Freshwater

3. *Type of submission:* **Abstract**

From land to sea: Exploring land- and sea-based geospatial models for marine ecosystem services assessment, mapping and threat analysis

First author: Daniel Depellegrin, Stefano Menegon

Other author(s): Stefano Menegon, Michol Ghezzo, Giulio Farella, Elena Gissi, Elisabetta Manea, Alessandro Sarretta, Chiara Venier, Andrea Barbanti

Affiliation, Country: CNR – National Research Council of Italy, ISMAR – Institute of Marine Sciences Arsenale, Italy

Although the recent methodological advancements in marine ecosystem services (MES) modelling and their wide spread spatial deployment (from global to local), applications considering the land or sea-based dynamics on the marine socio-ecological domain were still deficient. The complexity of the land-sea realm requires sophisticated modelling techniques and mapping procedures to better understand MES provisioning that can be accountable within a decision-making process. Based on a case study-driven approach this research highlights major differences among land- and sea-based ES assessment and will exemplify MES analysis with different geospatial models applied on macro-regional to local context. This includes the use of geospatial models for MES assessment and mapping, combined with evaluation of land-sea interaction processes and application of hydrodynamic numerical models for the characterization of biogeographical patterns relevant for supporting MES. In addition approaches to incorporate MES indicators into decision-making through a so called MES-Threat analysis will be presented with the aim of linking effects of MSFD pressure categories (biological, physical and substance-litter-energy) to relevant MES providing units for conservation and restoration prioritization. The research will highlight flexibility of the tool its applicability in near and offshore areas and in a land-sea interaction context. We conclude with highlighting the benefits and future challenges of the approach for MES analysis and decision-making.

Keywords: Marine ecosystem services, hydrodynamic numerical modelling, threat analysis, land-sea domain, MSFD

Mapping Ecosystem Services to support EB-MSP: A methodological approach

First author: Elisabetta Manea

Other author(s): Davide Di Carlo, Daniel Depellegrin, Elena Gissi

Affiliation, Country: Department of Design and Planning in Complex Environment, University IUAV of Venice, Italy

Ecosystem Services (ES) evaluation and mapping have gained even increased recognition as instruments noticed for their importance in orienting sustainable environmental management and in setting up conservation priorities. Despite this recognized importance, ES information are often omitted from conservation and planning processes and supporting ES are usually the last to be assessed despite their role in ensuring the existence of all other ES. The need to address supporting ES information towards the sustainable management of the marine environment calls for Ecosystem based Marine/Maritime Spatial Planning, which is acknowledged to be a powerful means for the achievement of both environmental and socio-economic objectives. Under this framework, we developed analytical approaches to map and quantify the delivery of supporting ES in the Adriatic Sea, which is a valuable, highly productive and heavily exploited sea basin. A set of key environmental components was used which represent measurable ecological functions in the study area. Areas hypothesized to be the most and least effective in ES delivery were recognised to spatially identify conservation priorities and to orient a better allocation of maritime uses. The applicability of such method for conservation purposes was test by comparing the ES delivery levels of areas which are and are not under conservation regimes. The importance of explicitly consider the pelagic realm raised out through our multidimensional approach, as well as important lack of knowledge related with deep-sea environments was confirmed. Such methodological approach aims to support and inform marine conservation and sustainable management actions in MSP processes.

Keywords: Ecosystem Services, Ecosystem-based approach, 3-dimensionality, Maritime Spatial Planning, Adriatic Sea

Contextualizing Ecosystem Services National Assessments: lessons learned from the French Marine Ecosystem Services Assessment (EFESE-Mer)

First author: Rémi Mongruel

Other author(s): Charlène Kermagoret (Ifremer-UBO), Antoine Carlier (Ifremer), Pierre Scemama (Ifremer), Patrick Le Mao (Ifremer), Alix Levain (INRA), Johanna Ballé-Béganton (UBO), Diane Vaschalde (AFB), Denis Bailly (UBO)

Affiliation, Country: IFREMER, France

The French national assessment of ecosystems and ecosystem services (EFESE), launched in 2012 by the Ministry of Ecology, has produced a set of assessments per biome. The EFESE program is in line with the "Aichi Targets", and is included as such in the French National Strategy for Biodiversity. EFESE main objectives are to summarize the available data for describing both metropolitan and ultramarine ecosystems as well as the goods and services that depend on them, and to prepare for the inclusion of ES assessments into accounting systems. The "marine and coastal working group" of the EFESE program (EFESE-mer), was led by Ifremer and the Western Brittany University, with the support of the French Agency for Biodiversity.Beyond the review of existing data, three specific research operations were carried out: i) a consultation of stakeholders interested in the marine environment and their uses, which allowed (a) to prioritize the assessments in a context of incomplete knowledge, then (b) to reveal the perception of the state of both the ecosystem and their services; ii) a study of the different types of demands for marine ecosystems and their services, which took into account not only the uses but also the institutional arrangements influencing the rules of use or the actions for ecosystem management; iii) an analysis of the heritage processes of marine ecosystems and their services.This communication presents the main results and lessons learned from this assessment. Broad scale assessments should explicitly account for their limitations: knowledge is still uncomplete for a majority of ecosystems and services; reliable and comparable economic data are available for a limited number of services only, with varying coverage. On the other hand, analyses of the existing institutions for using or maintaining ecosystem services and the stakeholder perceptions could help complement assessments based on conventional data.

6. *Type of submission:* **Abstract**
B. Biome Working Group sessions:B1a Marine and coastal ecosystem service mapping and modelling moving beyond land-based adaptations

Assessing the value of natural capital through related ecosystem service flows and coastal & marine recreational activities in the Basque Country: towards future conservation and sustainability.

First author: Chloe Stanford-Clark
Other author(s): Dr. Arantza Murillas-Maza
Affiliation, Country: Azti Tecnalia, Spain

The Basque coastline supports a huge variety of recreational activities (MRAs) in the coastal and adjacent marine environment. This work focuses on a selection of MRAs occurring along the coast and the natural capital these activities depend on, coupled with the ecosystem services generated through recreational use of this capital and associated benefits to humans contributing to well-being. The primary objective is to assess the economic value of coastal and marine natural capital following the flow through cultural ecosystem services. The inherently intangible nature of many cultural services makes this research area understudied. To overcome the lack of conventional markets, valuation instead utilises logistic econometric GLM/GAM modelling, applying the individual travel-cost methodology. Original demographic and logistical survey data- transformed into socio-economic shift variables- are modelled with Hicksian consumer-surplus to obtain a reflective value of the benefits people derive from visiting the Basque coast for recreational purposes. The model enables exploration of "future" scenarios, including effects of exceeding site carrying capacity, environmental quality change and variation in different demographics of a population. Service flows require healthy capital to transfer societal benefits through ecosystem services; conflictingly resource quality is degraded by the aggregated pressures of direct use commonly associated with "free" resources. No economic valuation currently exists for these coastal and marine resources, so by demonstrating a minimum-value estimate of this natural capital and its associated service flows, this study hopes to raise awareness of the crucial need to protect and conserve these naturally valuable coastal and marine assets. In the public domain this includes incentivising sustainable use, and politically through enhancement of effective efficiency both in regional policy-making, and compliance with international legislation. Future applicability aims to enable a benefit

transfer of the framework and model into other coastal regions to enhance integrated coastal management through-out Europe.

Keywords: Natural capital, valuation, cultural services, modelling, sustainable management.

7. *Type of submission:* **Abstract**

Stakeholders' Mapping and Valuation of Marine and Coastal Ecosystem Services: a PPGIS application for Marine Spatial Planning

First author: Carina Vieira da Silva

Other author(s): Ortigão M., Willaert T., Rosa R., Cunha e Sá M.A.

Affiliation, Country: Nova School of Business and Economics, Portugal

In this study, we describe the application of a Public Participatory Geographic Information System (PPGIS) to value and locate places important for the provision of marine and coastal ecosystem services (MCES) across the seascape of the Peniche-Nazaré area in Portugal. It involved the combination of GIS and a survey to stakeholders representing a wide range of interests. We used a token distribution mechanism to obtain the relative value of seven MCES. Participants were also asked to map the relevant places for each of the services. We discuss the effect of stakeholders' characteristics and the spatial distribution of the MCES in terms of value and diversity as measured by the Shannon Index. Finally, we compare maps drawn by fishermen with those drawn by stakeholders for food provisioning. The results suggest a spatial discounting effect, in which people value more attributes closer to their location. Our findings also show that stakeholders value more food provisioning and leisure and recreation along the study area and that the places perceived more important by the interviewed stakeholders coincide with those places more used by fisherman. The comparison between stakeholders' valuation and MCES diversity is also very interesting and relevant for management purposes, since the most valued areas are frequently those with more ecosystem services provided and where multiple and conflicting interests overlap. Thus, our results could serve as a starting point of discussion amongst stakeholders to improve marine spatial planning, under development at the national scale. Overall, by enabling the involvement of those potentially affected by or interested in the decision-making process, we contribute to welfare enhancing at the local level.

Keywords: Ecosystem Services, Marine Spatial Planning, PPGIS, Stakeholders

8. *Type of submission:* **Abstract**

B. Biome Working Group sessions:B1a Marine and coastal ecosystem service mapping and modelling moving beyond land-based adaptations

Modelling ecosystem services provided by mussel farms in the south-western Baltic Sea

First author: Miriam von Thenen

Other author(s): Senior Scientist Marie Maar, Dr. Kerstin Schiele, Prof. Henning Sten Hansen

Affiliation, Country: Leibniz Institute for Baltic Sea Research Warnemünde, Germany

Marine ecosystems are increasingly impacted by human activities. This development is leading to a loss of marine biodiversity which has consequences for the ecosystems' ability to provide goods and services. In contrast, some maritime activities, such as shellfish farming, may contribute to the provision of ecosystem services. Taking advantage of the filtering capacity of mussels, mussel farming can be an option to mitigate eutrophication effects or to reduce negative impacts of fish farms. In this study opportunities for mussel farming in the south-western Baltic Sea are investigated. The Baltic Sea is already now heavily used and eutrophication is still one of the major environmental problems. With a spatial mapping approach, existing and planned human uses are mapped and environmental conditions are analysed to find sites which are suitable for mussel farming. As a result of the mapping several sites are chosen which are further investigated in a 3D model of the area. The model can simulate the amount of nutrients removed by harvest, changes in water clarity, mussel growth and food depletion. Hence, it can provide quantification of selected ecosystem services: regulating services – nutrient removal and water clarity; provisioning services – mussel growth. We present results of the spatial analyses and first results of the modelling work. Furthermore, the presentation will discuss whether incorporating ecosystem services in the site selection process further advances ecosystem-based marine spatial planning.

Keywords: Aquaculture site selection, modelling ecosystem services, marine spatial planning

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9. *Type of submission:* **Abstract**

Using Serious Gaming as an Ecosystem Services Management Tool in the Wadden Sea

First author: Sonja Wanke

Other author(s): Ghada El Serafy, Alex Ziemba

Affiliation,Country: Deltares, Netherlands

The concept of ecosystem services is a growing tool in the management of marine natural resources and can greatly improve the environmental quality of an area and consequently the quality of life for humans benefiting from these resources. Defining, analysing and then managing ecosystem services is a challenge as various stakeholders and policy makers often focus on different aspects of them, often neglecting at least one service. To come to a good decision, available data and information should be reviewed. However, as these become more abundant and complex these days which makes it more complicated to draw meaningful conclusions. The Wadden Sea region is, among many areas around the globe, facing these issues. Through the use of serious gaming (SG), a sandbox free environment can be created in which one can explore and learn about the impacts of policy and management options, on ecosystems and the creatures within. By utilizing a wide array of data available from various modelling applications, which can be tailored to investigate the impacts of policy pathways, remote sensing images, which capture the environmental impacts of historical policy shifts and disasters, and expert opinion, which is further defined by stakeholder engagement, one has the ability to create an environment based on interactions and impacts seen in the real world. Single users or groups are able to play with this interactive platform to engage with dynamic systems and stimulate discussions. In order to connect and relate such large data sets Bayesian Networks (BN) can be taken advantage of to determine the strength of causal relationships within ecological domains and how these components relate and respond to various policy and managerial actions.

Keywords: Serious Gaming, ecosystem services, Bayesian Networks, Wadden Sea