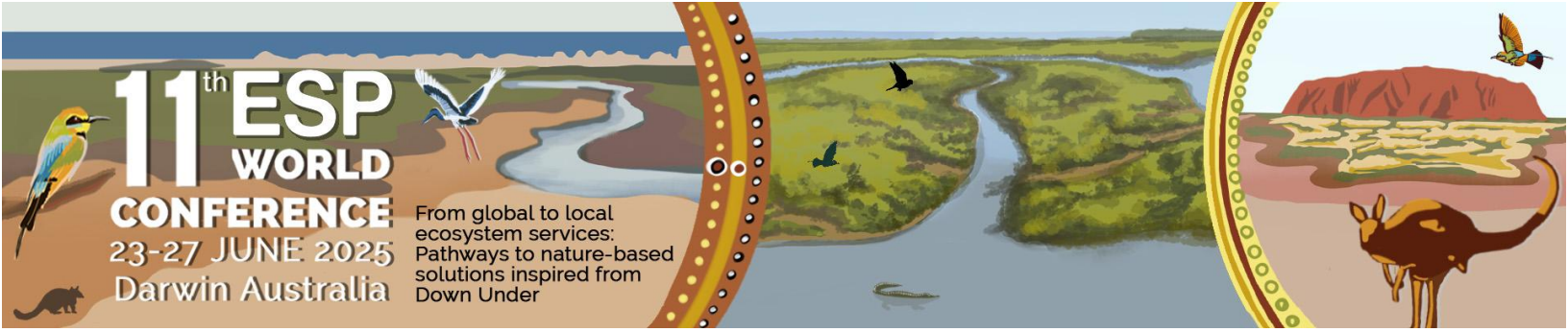


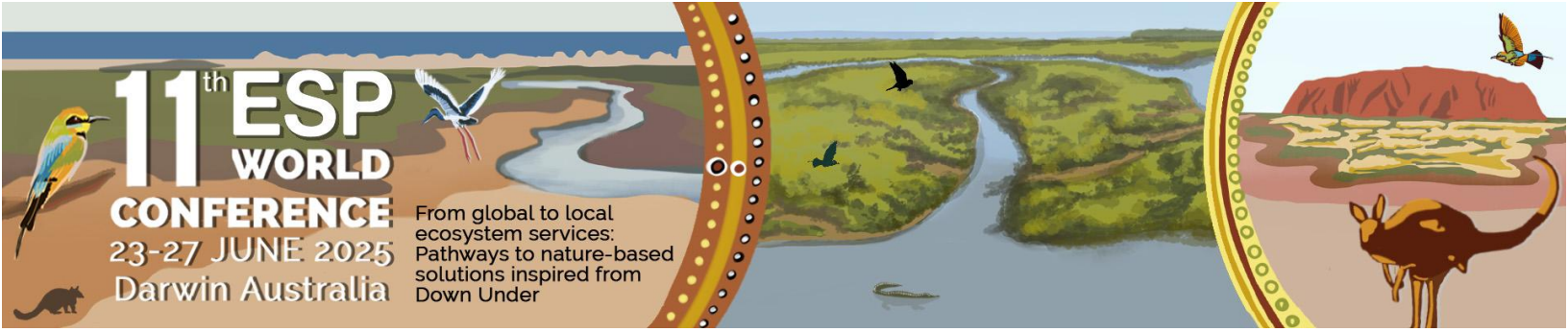
BOOK OF ABSTRACTS

I. SESSION DESCRIPTION

ID: B1b

Navigating tomorrow's seas through integrative ecosystem service assessments and decision-support tools

	Name	Organisation	E-mail
Host:	Yoann Baulaz	France Energies Marines, Plouzané, France	yoann.baulaz@france-energies-marines.org
Co-host(s):	Youssra Ghoussein	France Energies Marines, Plouzané, France	youssra.ghoussein@france-energies-marines.org
	Jan Vanaverbeke	Institute of Natural Science – Operational Directorate Natural Environment, MARECO –Belgium	jvanaverbeke@naturalsciences.be
	Ibon Galparsoro	AZTI, Marine Research Division, Spain	igalparsoro@azti.es
	Bridget Sparrow-Scinocca	Bangor University, School of Ocean Sciences, Isle of Anglesey, Wales, United Kingdom	brs23dvr@bangor.ac.uk
	Rhoda Fofack-Garcia	France Energies Marines, Plouzané, France	rhoda.fofack.garcia@france-energies-marines.org
	Maud Mouchet	Museum National d'Histoire Naturelle, UMR MNHN-CNRS-SU 7204 CESCO, Center of Ecology and Conservation Sciences, Paris, France	maud.mouchet@mnhn.fr



Abstract:

The growing intensity of human activities and their environmental impacts on marine and terrestrial environments requires long-term planning to balance blue growth with ecosystem preservation. This is the core purpose of marine spatial planning.

Over the past two decades, emerging challenges in energy transition (including the development of offshore wind farms), intensification of maritime transport and nature conservation (designation of marine protected areas) have created new planning needs. Political initiatives focused on energy strategies and marine spatial planning now span all scales—from local to national and international—to address these evolving demands and ensure effective space allocation.

However, implementing effective marine spatial planning faces key methodological challenges:

- Reconciling ecological and socio-economic issues
- Integrating the land-sea continuum
- Harmonizing planning across different spatial scales
- Ensuring meaningful engagement of stakeholders and citizens
- Adopting a sustainable long-term vision for the blue economy

The ecosystem service framework can address these challenges by helping to provide a comprehensive and integrated approach to support marine spatial planning (Depellegrin et al., 2020). It enables interdisciplinary methods that combine ecological and socio-economic data to map biodiversity, ecological functions, and sea uses—allowing to evaluate ecosystem services' supply, use, and demand while anticipating potential evolutions in response to global changes (Galparsoro et al., 2021; Van de Pol et al., 2023).

This framework helps develop decision-making tools by illustrating the connections between marine ecosystems and society (Baulaz et al., 2023). It enable testing various management scenarios while promoting participatory approaches and clear management objectives for sustainable ocean use.

This session explores how ecosystem services approaches can enhance spatial planning practices and ecological transitions across scales, with a particular focus on marine spatial planning and the sustainable management of ocean resources.

References

- Baulaz, Y., Mouchet, M., Niquil, N., Ben Rais Lasram, F., 2023. An integrated conceptual model to characterize the effects of offshore wind farms on ecosystem services. Ecosyst. Serv. 60. https://doi.org/10.1016/j.ecoser.2023.101513

• Depellegrin, D., Galparsoro, I., Pınarbaşı, K., 2020. Operationalizing ecosystem services in support of ecosystem-based marine spatial planning. Ocean Coast. Manag. 198, 105346. https://doi.org/10.1016/j.ocecoaman.2020.105346

• Galparsoro, I., Pınarbaşı, K., Gissi, E., Culhane, F., Gacutan, J., Kotta, J., Cabana, D., Wanke, S., Aps, R., Bazzucchi, D., Cozzolino, G., Custodio, M., Fetissov, M., Inácio, M., Jernberg, S., Piazzi, A., Paudel, K.P., Ziemba, A., Depellegrin, D., 2021. Operationalisation of ecosystem services in support of ecosystem-based marine spatial planning: insights into needs and recommendations. Mar. Policy 131. https://doi.org/10.1016/j.marpol.2021.104609

• Van de Pol, L., Van der Biest, K., Taelman, S.E., De Luca Peña, L., Everaert, G., Hernandez, S., Culhane, F., Borja, A., Heymans, J.J., Van Hoey, G., Vanaverbeke, J., Meire, P., 2023. Impacts of human activities on the supply of marine ecosystem services: A conceptual model for offshore wind farms to aid quantitative assessments. Heliyon 9, 14. https://doi.org/10.1016/j.heliyon.2023.e13589

Goals and objectives of the session:

We welcome presentations of diverse case studies—from local to regional and global—that showcase innovative methodologies and practical decision-support tools. These approaches can support marine spatial planning processes for renewable energy development, protected area identification and coastal planning while promoting an integrative and sustainable perspective.

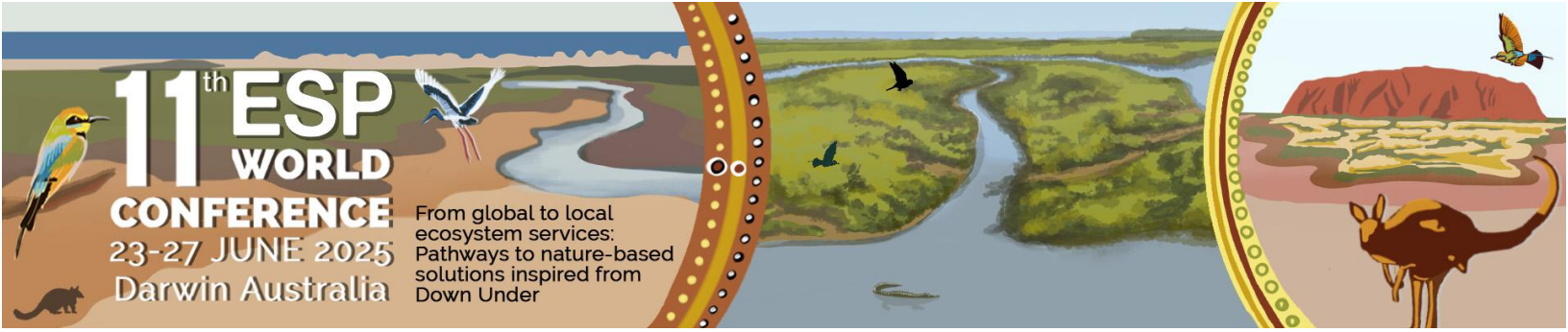
The session will focus on submissions demonstrating integrated assessment approaches, including:

- Methods that examine how marine spatial planning affects biodiversity and ecosystem services through changes in ecosystem structure and human activity distribution. This includes impacts on service supply, access, and demand.
- Assessment of ecosystem service bundles and their positive and negative responses to different planning scenarios.
- Innovative tools for coastal community engagement, such as participatory modeling tools and serious games.
- Transdisciplinary approaches that facilitate meaningful participation of local stakeholders and citizens.

Planned output / Deliverables:

Contributions should demonstrate a strong practical orientation, with the potential to inspire improvements in decision-support tools and the application of planning-related regulatory frameworks.

The planned outputs for this session could include a special issue or collective publication gathering the most innovative case studies and methodologies presented during the session. It could also include a shared repository of tools, methods and best practices for decision-makers and practitioners.

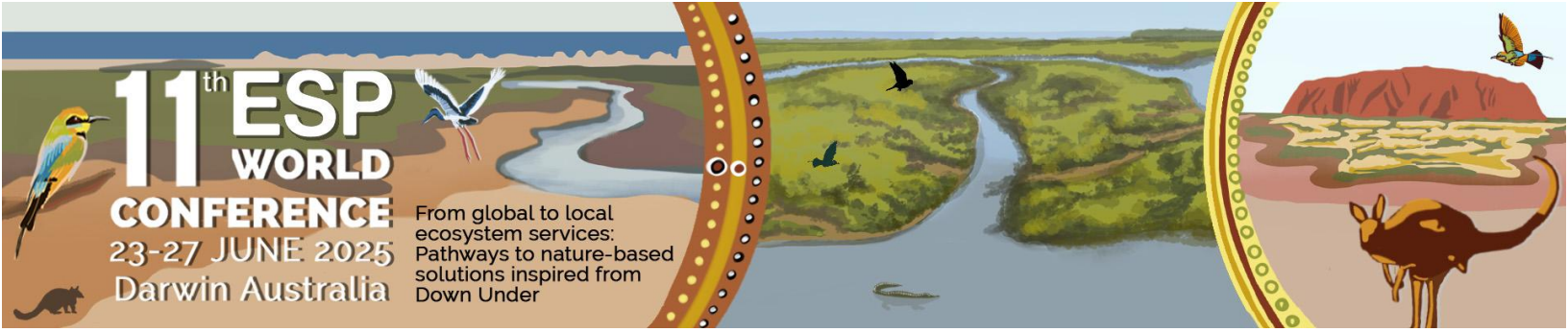


II. SESSION PROGRAM

Room: Betbiyan 3
Date of session: 23/06/25 (Monday)
Time of session: 14:00 – 15:30

Timetable speakers:

Time	First name	Surname	Organization	Title of presentation
14:05 – 14:20	Maud	Mouchet	CESCO – Museum National d'Histoire Naturelle, France	Balancing Marine Spatial Planning, Ecosystem Services, and Human Activities in the Bay of Biscay
14:20 – 14:35	Kuan-Ting	Lin	Department of Bioenvironmental Systems Engineering, National Taiwan University, Taiwan	Island Ecosystem Services: Unravelling the Interactions Between Marine and Terrestrial Systems
14:35 – 14:50	Bridget	Sparrow-Scinocca	Bangor University, School of Ocean Sciences, United Kingdom	Utilising trait-based approaches to understand offshore wind impacts on benthic ecosystem process and services
14:50 – 15:05	Yoann	Baulaz	France Energies Marines, France	From ecosystem service mapping to maritime spatial planning: a trophic-based approach to inform decision making in the context of offshore wind farm development
15:05 – 15:20	Yoann	Baulaz	France Energies Marines, France	Access ecosystem service for maritime spatial planning: A Bayesian belief network framework for evaluating offshore wind farm effects on the access to seafood supply



III. LIST OF ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Balancing Marine Spatial Planning, Ecosystem Services, and Human Activities in the Bay of Biscay

First authors(s): Maud Mouchet

Other author(s): Gaël Lavialle, Germain Boussarie, Marie Morfin, Dorothée Kopp

First author affiliation: Center of Ecology and Conservation Sciences (UMR7204 CESCO), Museum National d'Histoire Naturelle, Paris, France

Contact: maud.mouchet@mnhn.fr

Keywords: Marine spatial planning, ecosystem services, offshore windfarms, fisheries, biodiversity conservation

Coastal and continental shelf ecosystems provide vital ecosystem services (ES), yet they are under increasing pressure from human activities. Along the French Atlantic coast, the socio-ecosystem of the Bay of Biscay, and particularly the Grande Vasière (GV), is a key fishing ground. However, emerging activities such as offshore windfarms (OWFs) and sand extraction are increasing competition for space with fishing, biodiversity conservation and ES.

To address these challenges, we developed a marine spatial planning framework incorporating 62 bentho-demersal species' distribution and 9 ES (nutrient cycling, life cycle maintenance, food web functioning). We further identified ES hotspots and coldspots and their spatial overlaps with conservation areas (i.e. Natura 2000 and Marine Natural Park) and human activities (i.e. fishing, OWF, sand extraction).

Our study reveals strong spatial heterogeneities. Northern GV overlaps with intensive bottom trawling, while southern GV hosts high commercial species diversity and sole spawning grounds, coinciding with gillnet fisheries. Planned OWFs and sand extraction sites overlap with ES hotspots, highlighting potential conflicts. Using a prioritisation

algorithm, we explore alternative OWF and marine protected area (MPA) placements, balancing biodiversity conservation and fisheries interests.

The study demonstrates that achieving equity in spatial planning does not necessarily incur higher costs. Furthermore, the findings reveal that over 20% of four ES hotspots coincide with Natura 2000 areas, while the Marine Natural Park primarily encompasses ES coldspots in this part of the Bay of Biscay.

2. Island Ecosystem Services: Unraveling the Interactions Between Marine and Terrestrial Systems

First authors(s): Kuan-Ting Lin

Other author(s): Mei Hua Yuan, ColinKuo-Chang Wen

First author affiliation: Department of Bioenvironmental Systems Engineering, National Taiwan University, Taiwan

Contact: d09622005@ntu.edu.tw

Keywords: coastal ecosystems, ecosystem service, small island, tourism, fishery

Coastal zones are vital ecosystems that support both biodiversity and human activities, providing essential services through intricate interactions between marine and terrestrial systems. These areas offer critical habitats for wildlife, sustain fisheries, and support tourism and recreation. However, human activities such as tourism and fishing often contribute to habitat loss, fragmentation, and ecological degradation. While extensive research has been conducted on ecosystem services (ES) in terrestrial and marine environments, studies focusing on small island coastal zones—particularly where human and natural systems are tightly intertwined—remain limited. This study investigates ES interactions on Lyudao Island, Taiwan, using surveys (2023–2024) and InVEST modeling. Key indicators include fish provisioning (FP), habitat risk (HR), coastal vulnerability (CV), and cultural services (CS), such as outdoor recreation and landscape aesthetics. By analyzing coastal areas where major communities are concentrated, the study applies

hotspot analysis, correlation coefficients, spatial association, and k-means clustering to assess ES distributions and interconnections. Preliminary results show high FP and CS levels in residential and port areas, high CV on the western coast, and high HR on the northeast coast. Correlation analysis reveals a positive FP-CS relationship (r = 0.55), but negative correlations for FP-HR (r = -0.47) and HR-CS (r = -0.29). Cluster analysis identifies three zones: living functional areas, natural wilderness areas, and old settlement areas. These findings offer insights for managing island coastal ecosystems and inform sustainable development strategies that balance conservation, economic growth, and community well-being

3. Utilising trait-based approaches to understand offshore wind impacts on benthic ecosystem process and services

First authors(s): Bridget Sparrow-Scinocca

Other author(s): Craig M. Robertson, Stephen Watson, Katrien Van Landeghem, Jan Geert Hiddink, Nicola Beaumont

First author affiliation: Bangor University, School of Ocean Sciences, Isle of Anglesey, Wales, United Kingdom

Contact: brs23dvr@bangor.ac.uk

Keywords: Functional Ecology, Benthic Ecology, Offshore Wind Development, Ecosystem Services

Offshore Wind Farms (OWF) are expected to occupy over 500,000 km2 of the ocean worldwide by 2050. Yet limited understanding remains as to how the implementation of OWF effects the structure and function of seabed ecosystems. Benthic communities play an essential role in the ecosystem functioning of habitats, and in turn influence the provisioning of ecosystem services such as sediment turnover, carbon storage, and nutrient cycling. The potential changes to the community structure of ecosystems surrounding offshore wind farms must be documented to assess the impact of anthropogenic and environmental changes on ecosystem functioning. Due to the

increasing demand for OWF development globally, it is essential to utilize existing datasets to assess large-scale impacts efficiently and align with policy development. This project aims to conduct biological trait-based analysis to identify trends in community functioning derived from benthic invertebrate species that influence species-environment interactions. Novel methodologies will be proposed to display how a range of functional diversity metrics can be calculated using the Marine Data Exchange (MDE), a comprehensive repository (260 terabytes) managed by The Crown Estate UK, offering access to a vast collection of offshore marine industry data and evidence. By leveraging this publicly available information, this study aims to understand how dominant traits in a community can indicate prominent ecosystem service provision by key groups of organisms. Selected traits can be used to assess how changes in the community functioning in response to OWF development can impact ecosystem services of interest. Project outputs will aid the decision-making process for habitat condition assessments, offsetting measures and licensing requirements, balancing renewable energy growth with ecosystem conservation.

4. From ecosystem service mapping to maritime spatial planning: a trophic-based approach to inform decision making in the context of offshore wind farm development

First authors(s): Yoann Baulaz

Other author(S): Pierre Bourdaud, Emma Araignous, Hind Aguelal, Nathalie Niquil, Youssra Ghoussein, Maud Mouchet

First author affiliation: France Energies Marines, 525 Avenue Alexis de Rochon, Plouzané, France.

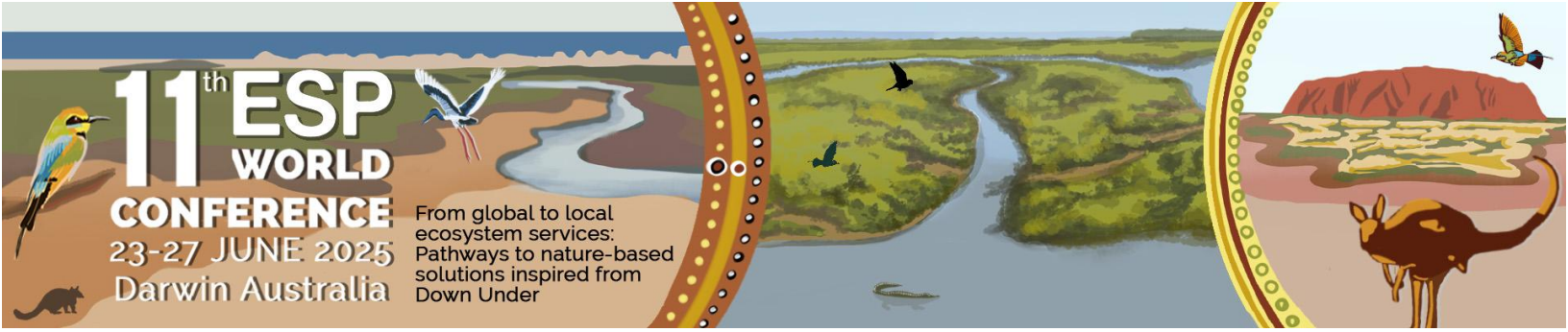
Contact: yoann.baulaz@france-energies-marines.org

Keywords: Marine Spatial Planning, Offshore Wind Energy, Marine Ecosystem Service Supply, Ecosystem-based Management, Cumulative Impact

Offshore wind farms potentially transform the structure of trophic networks and ecosystem service (ES) supply across multiple scales — particularly when considering interaction with other human activities and ecosystem disturbances. Given the growing development of these infrastructures, it is crucial to evaluate their cumulative impacts on biodiversity, human activities and the resulting trade-offs between ES. Such assessment requires detailed ES supply mapping and its evolution across wind farm lifecycle phases, while considering marine spatial planning priorities and long-term scenarios.

However, current ES mapping methods struggle to capture complex marine ES supply processes. To address this limitation, our approach combines ecological and economic indicators within a phenomenological model. Through the integration of ES-specific indicators encompassing biomass and fleet diversity data, Ecological Network Analysis, and key biophysical parameters (substrate, bathymetry, primary productivity …), we effectively model how trophic groups and their interactions influence ES. Applied to the Bay of Seine (Eastern English Channel - France), the model spatially represents the potential supply levels of three ES (seafood provisioning ; lifecycle maintenance ; water and substrate purification) and their response to specific impacts linked to each OWF development stage: 1. construction (resulting in habitat loss, reserve effect), 2. operational (triggering reef effect, reserve effect), and 3. cumulative impacts of four OWFs planned to be in operation by 2050. The comparison of temporal changes in indicators between stages provides additional insights to capture long-term ES supply dynamics.

Our findings advance knowledge on the impacts of OWFs on social-ecological systems, from local to regional scales, over the long term and across multiple ES. Our reproducible methodology also contributes to advancing marine ES mapping approaches. Finally, these insights foster dialogue between stakeholders and ES beneficiaries, inform spatial planning decisions, and guide the development of new mitigation measures for OWF impacts.



5. Access ecosystem service for maritime spatial planning: A Bayesian belief network framework for evaluating Offshore windfarm effects on the access to seafood supply

First authors(s): Youssra Ghoussein

Other author(s): Yoann Baulaz, Maud Mouchet

First author affiliation: France Energies Marines, Plouzané, France

Presenting author: Yoann Baulaz

Presenting author affiliation: France Energies Marines, Plouzané, France

Contact: youssra.ghoussein@hotmail.com

Keywords: Offshore wind farms, food through fisheries supply, ecosystem service access, Bayesian Belief Network, Bay of Seine, Maritime Spatial Planning

As Europe expands offshore wind farms (OWFs), a key challenge emerges: balancing renewable energy with existing maritime activities, especially professional fishing. OWFs may affect fishing accessibility by modifying practices, displacing fishing efforts, or raising operational costs. Marine spatial planning (MSP) requires a holistic approach to efficiently manage space and coexistence among multiple activities. By combining socio-economic and physical constraints into a unified framework, modelling the ecosystem service (ES) access can help evaluating OWF impacts on fishing.

This study aims to develop a spatially explicit Bayesian Belief Networks (BBN) model to anticipate the evolution of the "fishing" ES access in the Bay of Seine in France, an active maritime area for both fishing activities and OWFs development. BBN is a semi-quantitative model and is adaptable for scenario testing, making them relevant to assess OWF impacts on fishing access. We developed the BBN model considering two scenarios: the current situation with one OWF and a future scenario (2030) with three OWFs. The model development includes four steps: (1) defining variables and indicators through brainstorming and workshops, (2) constructing the conceptual model by identifying causal relationships between variables, (3) determining conditional probability

tables using empirical data (e.g., fishing effort) and expert judgments, (4) implementing the framework in NETICA®.

Our findings reveal a low impact of OWFs on regional fishing access. This impact increased slightly when more OWFs are considered. Despite this overall impact, a significant effects is detected on vessel trajectories, relocation of fishing efforts, and economic costs variables and indicators.