

9TH EUROPEAN MARINE BOARD FORUM PROCEEDINGS **ADDRESSING COASTAL AND WATER RESILIENCE ON THE LAND-SEA INTERFACE**

2nd April 2025, Brussels, Belgium and online



2021 United Nations Decade
2030 of Ocean Science
for Sustainable Development



*“All of our coasts are facing challenges.
We need to work together, listen and
share best practices.”*

Ms Hannelore Maelfait

EUROPEAN MARINE BOARD

The European Marine Board provides a pan-European platform for its Member organisations to develop common priorities, to advance marine research, and to bridge the gap between science and policy in order to meet future marine science challenges and opportunities.

The European Marine Board (EMB) is an independent and self-sustaining science policy interface organisation that currently represents 38 Member organisations from 19 European countries. It was established in 1995 to facilitate enhanced cooperation between European marine science organisations towards the development of a common vision on the strategic research priorities for marine science in Europe. The EMB promotes and supports knowledge transfer for improved leadership in European marine research. Its membership includes major national marine or oceanographic institutes, research funding agencies and national consortia of universities with a strong marine research focus. Adopting a strategic role, the European Marine Board serves its Member organisations by providing a forum within which marine research policy advice is developed and conveyed to national agencies and to the European Commission, with the objective of promoting the need for, and quality of, European marine research.

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EUROPEAN MARINE BOARD FORUM SERIES

The European Marine Board (EMB) Forum brings together European marine research stakeholders, representatives of the marine science community, funding agencies and national and European science institutions, to discuss research priorities and to promote marine science in Europe and globally. EMB Fora provide a platform for EMB members, partner organizations, individual scientists, and European and national policymakers to interact on a particular topic or theme of strategic importance to:

- Provide a focal meeting point for discussion;
- Facilitate the exchange of information and ideas and agree on a common position; and
- Enhance collaboration, and reduce fragmentation and/or duplication in the European research effort.

The main messages, discussions, and decisions from EMB Fora are recorded and published as proceedings. Presentations and outputs of EMB Fora are available on the European Marine Board website¹.

9th EMB Forum

The 9th EMB Forum was held as a hybrid event on 2 April 2025 at the Institute of Natural Sciences in Brussels and online. The event was also co-hosted by the Institute of Natural Sciences. This event was endorsed as supporting the UN Decade of Ocean Science for Sustainable Development. It was also a recognised action in support of the EU Mission: Restore our Ocean and Waters.

Over 40% of the European population lives at the coast and expects to continue to do so. However, this critical interface faces multiple threats including the impacts of climate change such as sea-level rise, water scarcity and increases in extreme weather, pollution, and habitat- and biodiversity loss. The land and sea are also addressed by different governance systems, making it difficult to manage the coastal region. This EMB Forum considered these challenges and how they can be overcome to ensure we retain coastal- and water resilience on the land-sea interface.

These discussions were of particular importance at this time given the new European Water Resilience Strategy and Ocean Pact, the objectives of the EU Mission: Restore our Ocean and Waters (Mission Ocean), and the challenges of the UN Decade of Ocean Science for Sustainable Development (Ocean Decade), such as increased community resilience to Ocean- and coastal risks.

During the event, two new EMB Policy Briefs² were presented: Policy Brief N°. 12 on *Requirements for Coastal Resilience in Europe*, and Policy Brief N°. 13 on *Navigating the Future VI: The Ocean's role in addressing global crises*.

This document is a summary of the discussions that took place during the 9th EMB Forum. The full recordings of the sessions are available on the EMB YouTube Channel³.

¹ <http://www.marineboard.eu/forum>

² <https://www.marineboard.eu/publications/policy-brief>

³ See EMB Forums playlist on YouTube: <https://www.youtube.com/@europeanmarineboard9043>

9TH EUROPEAN MARINE BOARD FORUM

Programme

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Moderator: Sheila Heymans, EMB Executive Director

Opening Session		
09:00 – 09:30	<i>Registration and welcome coffee / Livestream link opens</i>	
09:30 – 09:40	<i>Welcome</i>	Fiona Grant Chair, European Marine Board
09:40 – 09:55	<i>Presenting EMB documents (Navigating the Future VI and Coastal Resilience Policy Briefs)</i>	Fiona Grant Chair, European Marine Board
09:55 – 10:15	<i>Presenting the EU Ocean Pact</i>	Polyvios Eliofotou , speaking for Ioannis Hadiyiannis , Cabinet of Commissioner for Fisheries and Oceans
Session 1. Setting the scene on the land-sea interface		
10:15 – 10:40	<i>Keynote address – Transformative change and nexus assessment</i> including Q&A	David Obura CORDIO East Africa and Chair of IPBES
10:40 – 11:00	<i>Land-sea interactions in European marine governance</i> including Q&A	Cassandra Laetitia Tocco University of Portsmouth, UK
11:00 – 11:30	<i>Networking and coffee</i>	
Session 2. Pollution crossing the land-sea interface		
11:30 – 11:45	<i>Speaker 1 – Pollutants of concern and their pathways</i> including Q&A	Saša Marcinek Ruđer Bošković Institute, Croatia
11:45 – 12:00	<i>Speaker 2 – Tackling land-based pollution</i>) including Q&A	Efthymios Lytras Athens Water Supply and Sewerage Company, Greece
12:00 – 13:00	<i>Panel discussion with questions from audience</i>	Saša Marcinek Ruđer Bošković Institute, Croatia Efthymios Lytras Athens Water Supply and Sewerage Company, Greece Detlef Schulz-Bull Leibniz Institute for Baltic Sea Research Warnemünde, Germany Adriana Constantinescu GeoEcoMar, Romania, DOORS Black Sea and DANUBIUS-RI
13:00 – 14:30	<i>Group photograph, followed by lunch</i>	

Session 3. Coastal adaptation and livability on the land-sea interface		
14:30 – 14:45	<i>Speaker 1 – How can and should we adapt?</i> Including Q&A	Louis Celliers Climate Service Center Germany
14:45 – 15:00	<i>Speaker 2 – Working with coastal communities</i> including Q&A	Hannelore Maelfait Province of West Flanders, Belgium
15:00 – 16:00	<i>Panel discussion with questions from audience</i>	Louis Celliers , Climate Service Center Germany Hannelore Maelfait Province of West Flanders, Belgium Soetkin Vervust Free University of Brussels, Belgium Richard Cronin Department of Housing, Planning, Community and Local Government, Ireland
Closing Session		
16:00 – 16:10	<i>Closing words</i>	Fiona Grant Chair, European Marine Board
16.10 – 18:00	<i>Reception</i>	

The full programme is available for download on the EMB website⁴.

⁴ <https://www.marineboard.eu/events/9th-emb-forum>

KEY MESSAGES

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The speakers and panellists of the 9th EMB Forum discussed many different aspects of the land-sea interface, including pollution, and coastal- and water resilience. The main messages were:

- **The combined policy support within the EU Ocean Pact and Water Resilience Strategy will give us a source-to-sink approach that will address the land-sea interface.** This will help us address the policy integration and coherence challenges that currently exist. We should also consider the spatial scales over which policies are implemented, to help us manage human-Ocean interactions.
- **While we will need transformative change to ensure future coastal- and water resilience, not all steps or solutions towards that need to be transformative.** Every small step we take is helping us achieve this overall goal, and solutions already exist to support this pathway.
- **We do not yet have a good overview of the pollutants present in our water systems or their impacts on the environment, and this is exacerbated by the continued influx of new contaminants.** We need to conduct further research, develop relevant technology and reconsider how we monitor pollution in order to become more efficient at addressing this challenge.
- **While we acknowledge that pollution will always occur, there are steps we can take to reduce this.** This includes addressing emissions at source, engaging all actors in education- and awareness programmes, improving wastewater treatment technologies to reduce inflow into the environment, and exploring wastewater re-use.
- **Coastal communities are aware of how their environment is changing and are willing to engage in adaptation measures.** We can enhance this by collating all known data into a comprehensive database and presenting information and solutions at the local level in a relatable way and can also look for support from the arts.
- **Ultimately, we will have to change how we live at- and interact with our coasts.** This will require a fundamental shift in mindset, but we can take inspiration from the past.



OPENING SESSION

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Welcome

Dr Fiona Grant

Chair of the European Marine Board, and Head of International Programmes, Marine Institute, Ireland

Dr Grant welcomed participants to the 9th EMB Forum. She explained that given the ongoing initiatives and activities relevant to the Ocean, including the EU Ocean Pact and the Water Resilience Strategy, and the focus on supporting coastal communities, it was timely to discuss “addressing coastal- and water resilience at the land-sea interface”. She noted that the 9th EMB Forum has been endorsed as an official Ocean Decade event, and has been recognised as an action in support of the Mission Ocean. She introduced the European Marine Board and its activities and stated that she was looking forward to an interesting and inspiring event with a great line-up of speakers and panellists.

Presenting EMB documents

Dr Fiona Grant

Chair of the European Marine Board, and Head of International Programmes at Marine Institute, Ireland

Dr Grant presented two new European Marine Board Policy Briefs relevant to the Forum: Policy Brief N°. 12 on *Requirements for Coastal Resilience in Europe*, and Policy Brief N°. 13 on *Navigating the Future VI: The Ocean's role in addressing global crises*. Both Policy Briefs are summaries of longer EMB Position Papers on the same topics.

She first presented the main scientific recommendations from the Coastal Resilience Policy Brief to improve our knowledge on how to build coastal resilience, and presented the proposed six-step process that coastal managers, experts and researchers should follow to help them decide which concepts and frameworks to use to assess coastal resilience and implement resilience-based management.

She then presented the Policy Brief for Navigating the Future VI, the EMB flagship foresight document that explores the role of the Ocean in the wider Earth system and promotes collaboration between disciplines to tackle global issues. The Policy Brief is based on four main themes: Ocean and People, Ocean and Climate, Ocean and Fresh Water, and Ocean and Biodiversity. She explained that Navigating the Future VI specifically highlights the solutions-oriented role that the Ocean will play in solving the crises we have created, and in underpinning a Sustainable Blue Economy. The document stresses that solving the Ocean's problems will require concerted efforts across society, from science, policymakers, politicians, industry, the public and the finance sector. She presented examples of the research and policy recommendations arising within each theme, as well as the enablers that traverse all four themes and act as accelerators for the thematic recommendations.





Presenting the EU Ocean Pact

Mr Polyvios Eliofotou, speaking for Ioannis Hadiyiannis
Cabinet Expert, Cabinet of Commissioner for Fisheries and Oceans

Mr Eliofotou conferred the best wishes of Commissioner Costas Kadis, who could not attend the EMB Forum as he was at the European Parliament, for a good Forum and valuable future exchanges to the audience. He noted that his intervention was timely as it coincided with the preparations for the upcoming EU Ocean Pact. He stated that European maritime heritage is unmatched. With 22 Member States having access to the sea, the European Union is really an Ocean Union. He outlined the multitude of benefits offered by the Ocean, but also explained that the Ocean equilibrium is fragile, and is facing many threats.

“The Ocean has shaped our past, sustains our present, and will define our future.”

– Commissioner Kadis at the European Parliament Plenary, 2 April 2025

He explained that the EU Ocean Pact will be presented at the UN Ocean Conference in June 2025. It has been important for them to engage with all stakeholders as they developed the Ocean Pact, and they had already received more than 820 responses to the recent call for evidence, demonstrating strong public interest in helping to shape Ocean policy. The various consultations undertaken confirmed the growing pressure the Ocean is facing, and innovation, knowledge and collaboration are key tools to change this tide. Expanding our Ocean knowledge is a key requirement for responsive Ocean policy, and the Ocean Pact recognises this. He stressed that we must ensure that no one is left behind, and support needs to be provided to the blue economy sectors in their drive for innovation and job creation, to coastal cities, and to ensure sources of healthy food. He noted that demands for space and marine resources were increasing and reiterated the important role of Maritime Spatial Planning, noting that 20 out of 22 Member States have already adopted their plans. He expressed his support for an ecosystem approach taking into account land-sea connections, and the importance of retaining the principles of innovation and sustainability. He emphasised the need to enhance the adaptive capacity of coastal communities and collaborate with other players to ensure that the Ocean Pact supports Europe’s climate adaptation objectives.

He closed by reminding the audience that the EU Ocean Pact is being prepared now and invited everyone to come forward and share their views to ensure that the EU Ocean Pact is meaningful, can have real impact and can truly address the challenges our Ocean faces.

Audience Questions & Answers

Sheila Heymans: *Will Ocean knowledge and its importance be included in the Ocean Pact?*

Mr Eliofotou highlighted that the Commissioner regularly refers to Ocean knowledge, and with his scientific background he is very cognisant of its importance. The Ocean Pact will also reflect this and highlight the need for science-based policymaking.

Juan Ronco Zapatero (KU Leuven, Belgium): *As a former European Commission Official, I propose to take a comprehensive approach to Ocean policy and to scrutinise other policies to understand their potential impact on the Ocean. I also propose to have an expert group to advise on policy integration with the EU Ocean Pact in a similar manner to that used for the development of the Integrated Maritime Policy.*

Mr Eliofotou explained that within the Ocean Pact they will strive to include an integrated consultation process and recognise the importance of “Ocean proofing” where links to other policies are scrutinised. However, practical experience shows that this can be challenging, both in terms of response and administrative burden. He added that it has to be seen how we can achieve the objectives of such an exercise, without creating new and unnecessary processes.



SESSION 1

Setting the scene on the land-sea interface

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IPBES Transformative change and Nexus assessments: Perspectives on nature, economy and society in coastal & marine contexts

Dr David Obura

*Chair of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES),
and CORDIO East Africa*

Dr Obura introduced himself to the audience, noting his past work on coral reefs, small-scale fisheries, and coastal resilience, all of which relate closely to IPBES' work and objectives. He also noted his personal aim to ensure sufficient Ocean representation within IPBES. He highlighted the ongoing relevance of the Sustainable Development Goals (SDGs) in our understanding of what sustainable living means. As we continue to understand and address global crises, he urged the audience to consider addressing drivers of decline in addition to protecting the environment.

“In addition to trying to protect the spaces that are remaining, we really need to address the drivers of decline.”

– Dr David Obura

He introduced the numerous global assessments conducted and published by IPBES over recent years, but particularly focused on the two most recent assessments which were adopted by governments in December 2024, and which connect particularly well with the Forum's framing of coastal management. He noted that the IPBES conceptual framework synthesises peer-reviewed scientific knowledge, including other knowledge systems, in particular local and indigenous knowledge. IPBES' 2019 Global Assessment presented a significant body of work on status and trends of contributions of nature to people (which includes ecosystem services) and direct drivers of change. Further, he felt that translating this information using for example the SDGs to

highlight the policy relevance and help to interpret the assessment's finding for specific stakeholders and countries was particularly helpful. He applied this policy-relevant framing, considering the interactions between nature, economy and society, to the two most recent assessments, namely the Nexus Assessment⁵ and the Transformative Change Assessment⁶.

He explained that the Nexus Assessment looked at the interactions and interlinkages between health, food, water, climate change, and biodiversity. He noted that these linkages are very complex and hence challenging to synthesise. The Nexus Assessment was very actor- and solution-focused, and looked at balanced solutions and maximising co-benefits, and the nexus governance approaches needed to deliver these solutions. He highlighted that the response options proposed are based on solutions that already exist, with over half of the 70 assessed solutions closely relating to the land-sea interface and marine sectors. He also stressed that the main Assessment finding related to the importance of considering how solutions are implemented rather than solely what is implemented.

By contrast, the Transformative Change Assessment considers the root causes of the current global situation and proposes ways to transform economic- and societal systems to consider sustainability, bioeconomy, circularity and equitability. He highlighted that the Transformative Change Assessment explores the views, structures and practices that underpin our current political economies and that would be needed to achieve transformative change towards a sustainable and just future.

He closed by noting that IPBES has a range of assessments in preparation and urged the marine science community to engage as reviewers, to publish findings which can be included in the assessments, and to engage in policy outreach, impact and education using IPBES' findings.

Audience Questions & Answers

Louis Celliers (Climate Service Center Germany): *Can you clarify if there is a logical sequence to nexus governance and to transformative change, and what the relationship is between them? Secondly, the 2019 report is convincing regarding negative trends for many aspects, but do these recent reports also measure the trends in positive transformative change within systems to tackle these negative trends?*

Dr Obura explained that the two assessments were conducted in parallel, and they had to consider where Nexus governance becomes transformative because there is a gradient between them. They made sure not to limit the nexus propositions to only transformative ones, because there are many incremental changes needed, not all of which are transformative yet, but which should not be discouraged. Similarly, in the Transformative Change Assessment, the case is made that many elements are needed for something to become transformative, and early steps, while not transformative, are still needed. Relating to the second part of the question, the Transformative Change Assessment did compile a large amount of case studies, which are included in the full report. The authors also looked at the timescales to evidence of transformation and for the majority of case studies, this was between 1-10 years. You can see evidence of positive transformation quite quickly and that is very important for motivating continued investment.

⁵ <https://www.ipbes.net/nexus-assessment>

⁶ <https://www.ipbes.net/transformative-change-assessment>

Audience Questions & Answers

Kappo Ayorinde (National Space Research and Development Agency, Nigeria): Do you have solutions with regards to the Ocean-land interface specific for west African coastal areas?

Dr Obura said there were. The challenge for global assessments is that implementation is local. To address this, the Nexus Assessment and the case studies in the Transformative Change Assessment both have a strong local component, especially in the main assessment texts rather than the more generalised Summaries for Policymakers. With the case studies and response options presented in both assessments, the examples should be viewed as prototypes of how to do things, which can be adapted to different local contexts.





Land-sea interactions in European marine governance

Dr Cassandra Tocco

University of Portsmouth, UK

Dr Tocco opened her presentation, which was based on a research paper from 2024⁷, by asking what are land-sea interactions? We understand these to be processes that link marine and terrestrial environments, but they are not clearly defined in European legislation, although the Maritime Spatial Planning (MSP) Directive does attempt to define this concept. She stated that the coast is where these interactions take place, and these areas are also exposed to pressure from human activities, from urbanisation, and from natural events. She explained that the MSP Directive was an important step for making these connections within European legislation, as previously, land-sea interactions were only included in non-binding recommendations, such as those from 2002 on Integrated Coastal Zone Management (ICZM). The MSP Directive means that Member States are required to integrate land-sea interactions into their Maritime Spatial Plans. However, the Directive does not provide guidance on the institutional mechanisms that should be adopted, leaving Member States to choose the policy instruments best suited to their institutional context.

“Land-sea interactions are not clearly defined in European legislation.”

– Dr Cassandra Tocco

She noted that there are a range of options for institutional and legislative arrangements and strategies that could be used to consider land-sea interactions at different governance scales (local to regional) which can be used complementarily. Most policies are developed at the national- or sub-national level, and sectorial approaches are also widely used.

⁷ <https://www.sciencedirect.com/science/article/pii/S1462901124000972>

She explained that while the adoption of the MSP Directive was an important step, there are a number of factors which can lead to inadequate consideration of land-sea interactions and to the development of strategies or plans which are difficult to enforce. There are a variety of issue-, institutional-, process- and knowledge-related challenges preventing the integration of land-sea interaction in European marine governance. However, valuable insights can be drawn from Europe's experience that can inspire other regions in their governance of the land-sea interface. She recommended to improve the inclusion of land-sea interactions by reinforcing the link between MSP and ICZM.

Audience Questions & Answers

Gilles Lericolais (IFREMER, France): *Are you aware of JPI Oceans' work linking the MSP Directive and the Water Framework Directive (WFD) to avoid the disconnect between these two Directives at the land-sea interface, with a proposal to have the same indicators across both? This work was conducted between 2014-2017.*

Dr Tocco agreed that there are of course other directives and instruments that have a link to the land-sea interface; however, it was really the MSP Directive where its importance was recognised at European level. The problem with the MSP Directive is that it is very focused on maritime activities rather than the marine environment more broadly, even if the latter is particularly important when considering land-sea interactions.

Jos Brils (Deltares, Netherlands): I endorse the comment made by Gilles; we really need to make the connection to the WFD.

Jeremy Gault (University College Cork, Ireland): *By adopting a sectoral approach, aren't EU governments avoiding implementing "proper" Maritime Spatial Planning which is geographic (not sectoral) and therefore not advancing the governance of land-sea interaction? Land-Ocean interactions and governance have been studied for decades, and it is known what governments need to do. However, all EU states have retained terrestrial and marine policies and in a majority of States deliberately ignore the coast (the interface) – so how would you get governments to listen to the evidence and embrace good marine governance? Or will this never happen because the majority of citizens (voters) live and work on the coast?*

Dr Tocco stated that multi-level governance is a good way to improve the consideration of the connection between land and sea, and for her it is the only way forward.

SESSION 2

Pollution crossing the land-sea interface

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Pollutants of concern and their pathways

Dr Saša Marcinek*Ruder Bošković Institute, Croatia*

Dr Marcinek's presentation was based on a research paper from 2024⁸ on *Climate change driven effects on transport, fate and biogeochemistry of trace element contaminants in coastal marine ecosystems*, developed as part of the GESAMP working group 45⁹ effort. She presented on the natural and anthropogenic sources of trace element contaminants, such as mining, industry, transport, and agriculture, and explained that we are facing an increasing demand for metals as we continue to develop. Many of these trace metals, including rare Earth elements, end up in aquatic environments. She explained that they are considered emerging contaminants of concern as some, like lead, can be very toxic. However, she clarified that their presence in the environment does not automatically mean we should be concerned about their toxicity. Concentration alone is not enough to predict their biogeochemical behaviour. The complex dynamics and interactive factors present in transitional waters, including hydrodynamic conditions, and biological and urban activities, also impact the overall behaviour of trace metals in the environment.

“Understanding interactions is essential for managing trace metal impacts on coastal ecosystems.”

– Dr Saša Marcinek

Furthermore, she highlighted that climate change is impacting trace metals at their source, along transport pathways, and in terms of biological responses to the contaminants. Polar regions are being particularly impacted by climate change, with the additional concern that permafrost holds reserves of metals such as mercury which could be released into the environment if it melts. She did however acknowledge that there is no unified scientific consensus on how climate change is affecting how organisms react to metals, noting

⁸ <https://www.nature.com/articles/s43247-024-01679-y>

⁹ <http://www.gesamp.org/work/groups/wg-45-ghg-impacts-on-contaminants-in-the-ocean>

that there are a combination of drivers working together in a complex picture. She concluded that we know anthropogenic emissions of trace metals have increased in both volume and the variety of compounds, but that the toxicity, distribution and cycling of these is dependent on a number of factors. Climate change is adding further complexity by altering trace metal sources, transport, and biogeochemical cycles, as well as biological responses to combined stressors.

Audience Questions & Answers

Thorsten Kiefer (JPI Oceans): What should we do in terms of actions and/or policy measures?

Saša Marcinek proposed that we should conduct further research so we can understand the situation better and stressed that ecotoxicology experiments are needed. From a policy perspective, we should focus on reduction of emissions. This could include improving wastewater treatment processes, as well as addressing agricultural sources. She also highlighted the value of supporting adaptation strategies such as the protection and restoration of wetlands.





Tackling land-based pollution

Dr Efthymios Lytras

Athens Water Supply and Sewerage Company (EYDAP), Greece

Dr Lytras spoke about his experiences working with Athens' water and wastewater management system. Athens is a city with a population of around 4.5 million inhabitants located in an arid climate. He explained that its fresh water is provided by four reservoirs which have been created in the surrounding mountains starting in the 1930's. The water is transported through a 270 km-long aqueduct.

He then outlined EYDAP's five-step strategy for tackling pollution. He started by discussing prevention, and explained that legally, no industrial- or agricultural activities have been permitted around the reservoirs since the early 1980's to eliminate harmful influents. He highlighted that monitoring and quality control also play a key role in ensuring good wastewater treatment, with Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) added to the testing scheme in 2018. He noted that it is also important to cooperate with state-of-the-art testing facilities to develop and deploy new analytical methods. A third important step is to adapt the system and upgrade the infrastructure, for example to meet the requirements of the revised EU Urban Wastewater Treatment Directive¹⁰, which includes removal of micropollutants. He continued by explaining the importance of seeking to eliminate discharge and encourage reuse where possible. He gave an industrial reuse example where 100% of the wastewater effluent from a specific wastewater treatment plant will soon be directed to a nearby petroleum refinery. There are also examples of sewer mining, where sewer water is disinfected using a system run on green energy and used for urban irrigation, aquifer recharge and firefighting purposes.

“The best way to avoid having polluted discharge is to avoid having any discharge at all.”

– Dr Efthymios Lytras

He closed by recognising the important role EYDAP plays in research and development, hosting and supporting the development of innovative solutions. He presented a number of projects they are currently involved in, looking at innovative water and wastewater treatment technologies, including the Mission Ocean project RHE-MEDIation¹¹, as well as water reuse and circular economy innovation projects.

¹⁰ https://environment.ec.europa.eu/topics/water/urban-wastewater_en

¹¹ <https://rhemediation.eu/>

Panel Discussion

The panellists (**Dr Saša Marcinek**, **Dr Efthymios Lytras**, **Dr Detlef Schulz-Bull**, and **Dr Adriana Constantinescu**) were asked a series of questions by the moderator (**Prof. Sheila Heymans**), followed by a Q&A session with the audience.





Dr Saša Marcinek

Ruđer Bošković Institute, Croatia

Question: *What do we know about the impacts of climate change on known chemicals, and do we know enough? Do we already understand how climate change might affect chemical speciation?*

Dr. Marcinek reflected that even without the additional impacts of climate change, chemical speciation¹² is not well understood for many metals. We also need more holistic ecotoxicological studies at all trophic levels, at different life stages and at different locations to be able to see possible adaptations by organisms to both contaminants and climate change effects.



Dr Efthymios Lytras

Athens Water Supply and Sewerage Company (EYDAP), Greece

Question: *How do you think climate change will impact your ability to treat wastewater in the future and how are you adapting?*

Dr Lytras stated that wastewater treatment consumes a lot of energy. If climate change will increase general energy demand, then wastewater treatment will also be impacted. He further explained that a second important parameter is water demand. Climate change, at least in southern Europe, will mean lower rainfall, higher

temperatures and more water demand, resulting in greater wastewater volumes which require more energy to be treated. He noted that where possible, they are trying to use green energy but highlighted that it was not easy to do so. Even if Greece has a lot of sun and wind and can produce green energy, without infrastructure for large quantities of energy storage, it is difficult to meet their demand.

Question: *It is also possible that there will be more floods and run-off, and will that impact the effectiveness of the wastewater treatment system?*

Dr Lytras replied that in contrast to other cities, Athens has a separate water network for rainfall and sewerage, so there was no direct effect.

¹² Chemical speciation is the process of determining the different forms or species of a particular chemical element or compound present in a given environmental sample.



Dr Detlef Schulz-Bull

*Leibniz Institute for Baltic Sea Research
Warnemünde, Germany*

Question: *How able are we to detect different organic pollutants in coastal waters, and where are we still struggling?*

Dr Schulz-Bull explained that the analytics are very complicated, especially in seawater. Due to the concentrations in question, which can be a femtogram¹³ per ml, at present it is not possible to measure all contaminants, but we are able to measure some contaminants at these low concentrations. In the marine food chain, these

concentrations bioaccumulate until you reach toxic levels. He proposed that we should conduct testing at wastewater treatment plants where it is known that pollutants are present at higher concentrations, to try to identify new contaminants of concern. We have an understanding of how to measure known and some critical new contaminants (such as PFAS and flame retardants), and we know how they behave. However, there are few published studies relating to many other emerging contaminant compounds (e.g. UV filters) and those are the ones we should focus on.



Dr Adriana Constantinescu

*GeoEcoMar, Romania, DOORS Black Sea and
DANUBIUS-RI*

Question: *What is the DANUBIUS-RI and what makes it so impactful for the management of land-sea interfaces?*

Dr Constantinescu explained that the DANUBIUS-RI¹⁴ is a pan European research infrastructure being developed in several EU countries, with a vision “to achieve healthy river-sea systems and advance their sustainable use, in order to live within the planet’s ecological limits by 2050”. Their approach is to look at the complete river-sea system from

source to sink, and land-sea interactions are naturally a part of this system. She described the structure of DANUBIUS-RI, with a central hub supported by four thematic nodes and natural laboratory supersites for testing. The goal is to overcome fragmentation to provide solutions to climate change and resolve problems by using interdisciplinary perspectives from source to sea. She also noted that the approach ensures methods and parameters are comparable across systems.

¹³ A femtogram is 10⁻¹⁵ grams

¹⁴ <https://danubius-ri.eu/>

Question: *How have DANUBIUS-RI and the DOORS project been able to measure the impact of pollution in rivers, on land, and into the coastal zone?*

Dr Constantinescu said that one of the research priorities within DANUBIUS-RI is to quantify singular and combined effects of nutrients and pollutants in water and sediments to establish critical thresholds in water systems. There are now new pollutant classes (e.g. pharmaceuticals, caffeine, drugs, microplastics) which are gaining importance and, in some cases, may be easier to quantify. She stated that historical pollutants can sometimes be harder to quantify. They have applied these principles within the DOORS Black Sea Project¹⁵, specifically in two relevant studies. One study considered floating marine litter in the Black Sea, where the authors looked at the influence of rivers flowing into the Black Sea and were able to determine which areas were most impacted. The second study looked at the northern Black Sea effects of floods created by the destruction of a dam in Ukraine by Russia. The main impact from the flood wave was the creation of a plume of suspended solids and chlorophyll with concentrations 50 times higher than usual Black Sea concentrations. This led to algal blooms that lasted for 20 days.

Audience Questions & Answers

Pablo Abaunza (Spanish Institute of Oceanography): *In the EU we have the Marine Strategy Framework Directive (MSFD). What is your assessment of the situation in relation to pollutants since this Directive has been in force, and are we improving?*

Dr Schulz-Bull felt that we are doing better than we were in the past, but we have to think about new contaminants and how to integrate those. The MSFD and the WFD are good, but monitoring is costly. We also have the Baltic Sea Action Plan but so far, we have not reached its goals. It takes longer than expected to reach our goals, but we are on a good path, and we cannot stop efforts now.

Sheila Heymans added that we won't achieve our goals in just one cycle of these frameworks.

Fiona Grant (Marine Institute, Ireland): *Dr Lytras showed that they were accessing freshwater reservoirs increasingly far from Athens. Has there been any community resistance to this from those living close to the reservoirs?*

Dr Lytras replied that the large reservoirs are in the mountains where there is plenty of water available and with small populations, so they are not taking water from other communities. This is currently the only solutions for Athens, which needs 1.3 million m³ of water per day. That said, they are trying to promote water re-use. There is legislation for urban water re-use, but it is not obligatory. He added that re-use of water is more expensive because it requires more treatment steps, and people are not willing to pay more to use reclaimed water. He urged the EU to make water re-use obligatory where possible for uses such as irrigation, and to provide financial support for the required infrastructure investments. In an ideal case, the end user would pay less for reclaimed water than fresh water, so that this becomes the default option.

¹⁵ <https://www.doorsblacksea.eu/>

Cosimo Solidoro (OGS, Italy): *What is your vision for the future? Pollution will pose a significant challenge for achieving transformative change. We have a never-ending list of pollutants of concern but we only detect them if we look for them so we do not have a good overview of what is present where, and we will not be able to avoid all pollutant emissions. What is then the solution to achieving our zero pollution goals?*

Dr Schulz-Bull agreed that it is a never-ending story, but we can ensure that we use the best detection techniques we have. Some of the compounds are necessary, such as UV filters in sunscreen, but we can educate people about the best way to use them. We can and should also reduce our emissions of organic pollutants and focus on technological developments to remove pollutants from wastewater, before they reach the Ocean.

Gilles Lericolais (IFREMER, France): *In Greece, does every island also have links to wastewater treatment, where does their fresh water come from and is there some desalination?*

Dr Lytras explained that there is new legislation in Greece that allows water and wastewater companies to merge, which will enable better management especially for the islands. The islands do already use desalination, and there are plans to create small reservoirs on each island where water can be brought from elsewhere in Greece to supplement supplies to match peak demand in summer.

Jos Brils (Deltares, Netherlands): *Regarding contamination in sediments, a guidance document has already been produced to advise Member States on how to deal with these aspects within the WFD. One of the main messages relates to precautions that are required to avoid releasing legacy contaminants currently trapped on land, e.g. behind dams and in flood plains, during flooding or interventions. Do you agree with this?*

Dr Schulz-Bull responded that this is indeed a well-known concern, both in the hinterland and in coastal areas. At present, we can avoid releasing these contaminants from the sediments by avoiding their disturbance, but it is not clear if that will remain the case as we experience climate change induced impacts.

Sheila Heymans: *Following on from that, do we have enough science to quantify this well, and how do contaminants in sediments impact the health of soil?*

Dr Constantinescu felt that we do have enough science, but that we also need enough funding, infrastructure and relevant policies to enable appropriate actions to be taken.

Jan-Stefan Fritz (KDM, Germany): *There is currently significant funding available at EU level for innovation and technology. How would you invest this funding to maximise societal benefits in the short- and medium-term?*

Dr Constantinescu proposed to invest more in education at all levels, and to invest more in cohesive dialogue between society, policymakers and scientists on how to address issues.

Dr Schulz-Bull felt the investment should be in wastewater treatment technology as this is the biggest source of nutrients and trace metals emissions.

Dr Marcinek agreed that investment in education was needed, alongside adaptation strategies and Ocean literacy initiatives for pollutants, noting that knowledge alone is not enough and there also needs to be an emotional aspect. She also noted a need to invest in monitoring tools and strategies.

Dr Lytras replied that in the short-term, the investment should be in water reuse, but in the long-term we should focus on the root of the problem, which is overconsumption, and invest in policies and education programmes to reduce use of e.g. plastics, PFAS and pharmaceuticals.

Louis Celliers (Climate Service Center Germany) challenged the idea that only consumers have to change their behaviour, and suggested we also create supporting regulation and disincentivise the creation of pollution, to distribute roles and responsibilities more evenly.

Kate Larkin (EMODnet): *EMODnet is looking at how they can expand their services to better capture data on land-sea interactions. How can we work together to connect already mature marine knowledge with terrestrial and freshwater knowledge and data?*

Sheila Heymans responded that some individual land-sea based EU projects, such as RHE-MEDiation, are already feeding data into EMODnet.

Dr Schulz-Bull highlighted that there are already a lot of databanks for the different fields of expertise, but now we need to bring these communities together to also bring together the capabilities and data each holds.

Aurore Trottet (IMDC, Belgium): *There are thousands of PFAS, they are very prevalent everywhere and they are expensive to monitor. We will need the help of scientists to set thresholds. How can we move forward with capabilities to monitor them and with rules for their reduction?*

Dr Schulz-Bull disagreed that proposing thresholds would be the solution as ideally this would be zero, and it is also hard to monitor concentrations as PFAS are complex chemical mixtures.

Paula Kellett (EMB Secretariat): *You showed a lot of monitoring and analytical technology but also spoke about yet more contaminants of concern. Does this mean each organisation will need yet more expensive technology in the future, or is there a role for infrastructure sharing or machine learning applications?*

Dr Schulz-Bull agreed that it is an ongoing process with analytical techniques developing and becoming more expensive, however we should instead focus on preventing contaminants from entering the environment or make it expensive to do so as a deterrent.

Dr Constantinescu explained that in DANUBIUS-RI efficiency is increased by sharing each country's expertise and capabilities. There is a role for encouraging people to think about how they want to live: to change their mindset to not creating problems instead of trying to fix the problems later, and to consider small changes that can be made straight away.

Cosimo Solidoro (OGS, Italy) agreed on the need for education to reduce pollution but noted that we should also look to industry to play their role.

Dr Marcinek suggested a bottom-up approach with societal pressure requiring industry to changing.

Dr Schulz-Bull cautioned that if we push industry to produce alternative compounds, we will not know their impact on the environment, and it will take time to develop this understanding.

Ángel Muñiz Piniella (EMB Secretariat) noted the revision of the Urban Wastewater Treatment Directive which now includes the Polluter Pay Principle, so regulation is catching up.

Thorsten Kiefer (JPI Oceans): *Is the monitoring of chemical pollution good enough to see if we are making progress?*

Dr Schulz-Bull felt that it is not sufficient because we mostly focus on the past and on already banned chemicals, and not yet on new chemicals such as PFAS.

SESSION 3

Coastal adaptation and livability on
the land-sea interface

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How can and should we adapt?

Dr Louis Celliers*Climate Service Center Germany*

Dr Celliers opened by saying that he had overthought his presentation after seeing the title, and had wondered what came first – should adapt or could adapt? He stated that his presentation would discuss mitigation, adaptation and the limits of adaptation. But where do we need to adapt, what needs to adapt, and what does it need to adapt to? When considering adaptation, it is important to consider the context. We know more about some parts of the adaptation cycle, such as assessment, than other parts, such as implementing adaptations or monitoring those actions. Furthermore, we need to accelerate, so that the rate and extent of our adaptive actions can exceed the rates of negative environmental trends, for e.g. biodiversity loss and temperature increase. He then introduced the data, information, knowledge and wisdom inversion where the theory is that data when interpreted becomes information, information when used becomes knowledge, and knowledge when applied becomes wisdom. However, the existence of data does not guarantee that it becomes knowledge and wisdom, and so he stressed the importance of understanding and implementing the governance aspects that can enable this. This requires tools such as policy integration or structured collaborative conversation to ensure social innovation¹⁶.

“There are types of social innovation that are fundamental for establishing and maintaining the connection between people and the coast, which could result in achieving higher degrees of sustainability, now and in the future.”

– Dr Louis Celliers

He then presented the example of the Interreg BEACH-SOS Project¹⁷ which focuses on the municipality of Saulkrasti, on Latvia’s Baltic coast. Here, the national climate change adaptation strategy was not being effectively translated to the local level, and the project aims to bridge the gap by building institutional capacity at the local level, focusing on climate-resilient tourism. He closed by presenting how this initial intervention had delivered local champions and led to further actions.

¹⁶ Social innovation is any action by individuals, organisations, and networks to generate novel solutions that contribute to changing behaviour across numerous perspectives, across markets and public sectors, and to enhancing bottom-up responsible inventiveness (Celliers et al., 2003. <https://doi.org/10.1017/cft.2023.12>)

¹⁷ <https://interreg-baltic.eu/project/beach-sos/>



Working with coastal communities

Ms Hannelore Maelfait

Province of West Flanders, Belgium

Ms Maelfait started her presentation by asking what defines a coastal community and what makes them unique. She explained that it is a community that has been formed by the way the sea moves, a region that has learned to evolve with the sea and adapt to the changing coastline and seascape. She also noted that in Belgium, the coastal population is a grey population with more than 30% of people above 65 years. This demographic trend and its associated social impacts are also reflected in other European coastal areas such as in the Mediterranean. The coast is also an area with complex governance, where different policy levels and competencies need to be brought together.

“Given the fragmentation of competences, the integration and deliberation of sectoral visions and plans in the coastal area are crucial.”

– Hannelore Maelfait

She then stated that being a coastal community means being at the forefront of climate change impacts. She presented a study that had been carried out to gain an understanding of the awareness amongst coastal communities about climate change, which showed that they were aware of the risks and long-term implications. They are developing a roadmap for how to deal with sea-level rise along the Belgian coast. Acceptance of this roadmap required that this vision, information on its implementation and on Nature-based Solutions be brought to the impacted communities. It was supported by active engagement through storytelling based on scientific data and participative approaches. However, she noted that there were differences in acceptance to adaptations and feelings of ownership between residents and coastal tourists. There is still work to be done to share similar messages with tourists, and to foster stewardship amongst them. She closed by presenting some approaches they use to try to foster feelings of ownership amongst tourists, including using visitor centres, doing coastal safaris, and engaging in Ocean literacy initiatives for schools.

Panel Discussion

The panellists (**Dr Louis Celliers**, **Ms Hannelore Maelfait**, **Dr Soetkin Vervust**, and **Mr Richard Cronin**) were asked a series of questions by the moderator (**Prof. Sheila Heymans**), followed by a Q&A session with the audience.



Dr Louis Celliers

Climate Service Center Germany

Question: *Why is it so important to consider the whole socio-ecological system when dealing with coastal adaptation and resilience?*

Dr Celliers replied that if we look at the past, humanity has always been closely connected to nature and our societies developed as part of nature. However, at some point in our history humans thought it wise to separate ourselves from that understanding of what nature can offer. He explained that seeing ourselves as embedded in

ecological system gives us a buffering capacity against climate change. If we understand that, and if we can get back to the point where our socio-ecological system is functioning properly, then we have the potential to buffer against climate change and buy ourselves time to adapt, especially if we use Nature-based Solutions. Understanding the socio-ecological system gives us more options to deal with climate change and its impacts.

Sheila Heymans: *We have heard that tourists don't see themselves as part of the same socio-ecological system. How can we make tourists understand that they are also part of the system and have an impact on it?*

Dr Celliers explained that tourists stay at the coast short-term and there will always be issues with generating an understanding within that limitation. This challenge covers not only tourists, but also new coastal residents. There is an awareness and education problem. There are approaches we can use to address this, including educating school children about how nature works on the coast, but the question is how to broaden that awareness-raising to include all incoming communities and tourists. He noted that we have to think about monitoring and evaluation, enforcement, and driving "good" behaviour amongst people who are there for relaxation, but who should not be detracting from the functioning of the natural system while relaxing.

Ms Maelfait noted that a new principle of sustainable tourism supports the idea that tourism brings a positive impact to the area, leaving a positive footprint, and highlighted that there is already a drive to develop this concept, at least in Belgium.



Ms Hannelore Maelfait

Province of West Flanders, Belgium

Question: *Do coastal residents really understand the impacts of climate change better than tourists? How can we influence tourists more?*

Ms Maelfait felt that tourists did not necessarily have a strong attachment to the coast unless they return to the same area year after year. Residents see the coastal environment every day and hence are very aware of the changes taking place and of the need to take steps to address this. This provides a clear starting point for dialogue.



Dr Soetkin Vervust

Free University of Brussels, Belgium

Question: *Can you introduce the Testerep project to us?*

Dr Vervust explained that the Testerep Project¹⁸ is an interdisciplinary research project looking at the central part of the Belgian coast where there used to be an island during the Middle Ages called Testerep. The island no longer exists, and the project aims to understand why and when it disappeared, and to bring this historic narrative to local communities. She noted that the project engages historians and archaeologists alongside

coastal engineers and computer game designers to understand and share the narratives. They also aim to valorise the findings to generate societal impact by using the gained knowledge to inspire coastal management, improve heritage management and raise more public awareness of the natural processes that have shaped the coast.

Question: *Why must policymakers and the public today understand what has taken place in the past?*

Dr Vervust outlined two main reasons why it was important to understand what has happened in the past. Firstly, in terms of research and knowledge generation, their findings would give insights into the long-term processes that shape coastlines and their natural dynamics, using the past as a long-term evidence base. This knowledge could help to implement the most sustainable strategies and ensure that policies work with natural system dynamics to improve their efficiency. Secondly, telling stories about the past can help raise awareness about for example climate change impacts, because they can transform numbers into the lives of real people and provide perspective. It is possible to look at how people lived in these landscapes in the past and try to understand how choices made in the past have influenced the situation today.

¹⁸ <https://testerep-project.be/en>



Mr Richard Cronin

Department of Housing, Planning, Community and Local Government, Ireland

Question: *The European Ocean Pact is due to give clarity on how to integrate different Ocean policies. Do you think the MSP Directive, MSFD, WFD should be adapted and if so, how?*

Mr Cronin said that someone had quipped that at present the Ocean Pact was like the Loch Ness Monster: everyone is looking for it and hopes it will be there, but nobody knows what it looks like. He agreed that it should help to make policies and directives more coherent and implementable. They

should all be implemented at the same scale: the MSP needs to be implemented at sea-basin- instead of national scale, and needs to be supported by the other Directives. He commended the research that has already made it possible to make good science-based policy decisions through the MSFD. However, at present, the environmental targets are not binding which makes requiring economic and regulatory actors to implement them within MSP challenging. He called for MSP and MSFD to be more integrated, with binding targets at the right spatial scales. This would provide a mechanism to ensure human activities are regulated properly and fairly with a level playing field between Member States. The EU Ocean Pact will also be related to the new Water Resilience Strategy, which will be a source-to-sea strategy, and will link closely with the WFD. These strategies together should enable strong integration of Ocean-related directives and ensure the use of the environmental assessments we already have, to allow human activities to be carried out within ecosystem carrying capacity.



Audience Questions & Answers

Sheila Heymans: *Do you think that exhibitions help people to understand changes at the coast?*

Dr Vervust agreed that storytelling can be helpful in that respect. The Testerep exhibition tells a story about Ostend with visuals showing the storm that affected the island, and then in the next room the question is asked about what people would do if they were faced with a disaster like this - would they want to stay or move away? She noted that from the responses received, people already living on the coast want to stay even knowing it is not the safest place to be, while tourists have a different perspective.

Mr Cronin cautioned that we may be creating a false division between tourists and coastal communities. What they all have in common is enough of an interest in the coast to visit it or live by it. He noted that there are also many types of tourists, including those that do engage with the natural environment of the coastal zone. In terms of managing the impact of tourism, the first step is education, but we could do more to transfer a sense of ownership and stewardship to those at the coast. He gave examples of tools that Ireland has implemented including providing funding to citizen beach cleaning initiatives and biodiversity monitoring, and for green and eco school modules, to help change attitudes and values in society. He called for education before regulation.

Dr Celliers added that the tourism industry itself can also transform, and the value chain of tourism can be made sustainable.

Samantha Pellarini (Visual artist, The Netherlands): *Have you considered directly involving artists when developing narratives for climate adaptation to reach out to communities? Maybe this is a way you can influence the tourists, through artistic interventions and art exhibitions that create awareness and a sense of agency.*

Ms Maelfait agreed that this was important as it touches society directly. Imagination helps with storytelling and artistic impression can really help influence policy to break down a story and give it impact.

Dr Vervust explained that within the Testerep Project, they had collaborated with a theatre group who made a musical play to tell the story of the big storm that wiped away villages on the island. The actors portrayed historical people but were also holding up a mirror to the present day and how people react to climate change now. You can convey the same message but in an emotional way.

Juan Ronco Zapatero (KU Leuven, Belgium): *Firstly, we should not draw a hard line in distinguishing between coastal communities and tourists, because everyone pays taxes and those can be used to do good things for the coast. There was also an exercise done in the early 2010's that considered what the Belgian coast could look like in 2100 under different scenarios, including letting nature take its course. Should politicians be encouraged to consider alternatives like this?*

Ms Maelfait replied that as a society we must decide what price we want to pay to protect an area and consider how long we can hold it? We have to think strategically when planning at the coast and be aware of the risks. At present, the Flemish Government's policy is to hold the line.

Dr Vervust explained that if we look back in time, there have been two main strategies for managing how we live at the coast. Originally, there was a natural tidal environment that periodically flooded but did not prevent people from living there as they lived with the water and could retreat to higher ground in case of flooding. Then, around 1000 years ago, humans started trying to keep the water out as much as possible to enable more agriculture. At present, while we try to focus on Nature-based Solutions, we are still trying to keep the water out. She felt that we may be reaching the end of this strategy and will have to start thinking about working with the water again.

Mr Cronin highlighted that our coasts are not homogenous, both in terms of the natural landscape and the populations living there. Historically we have used hard solutions to hold back the sea, but our approaches tend to be very localised. We should consider the full spectrum of available strategies, from Nature-based Solutions to managed retreat and hard engineering and apply those most appropriate to the case in question.

Thorsten Kiefer (JPI Oceans): *We are experiencing sea-level rise denial in the same way as we are experiencing climate change denial, where communities do not want to hear about the risks or do not want to think about their houses being in peril, or are not even aware of the risks. Have you also experienced this perspective?*

Sheila Heymans added that she had read that in Belgium, the houses that are insured for the most are built on river flood plains.

Louis Celliers theorised that in general, those who will be affected by sea-level rise will be the very rich, who often have luxury seafront residences, and the very poor. However, the poor do not have any alternatives because they cannot afford to move, regardless of whether or not they agree with the science. People have the expectation that the government will keep them safe from the Ocean: this is where they live, and they should be able to stay there. He believed we need to make a fundamental shift because in the past, communities were always willing to move in response to the natural dynamics of the sea, whereas now, people are not yet serious about managed retreat options.

Mr Cronin felt that personal experience of recent extreme events has helped to change people's perspectives. These highlighted a lack of resilience in Ireland's infrastructure systems, and these are now being addressed. In policymaking, you cannot waste a crisis! There is a difference in the timings of political, economic and natural cycles, and within all of this, we need to enact social change, finding the right intervention point and the right intervention to ensure implementation. We need to make haste, but slowly.

Ms Maelfait noted that the 1953 storm which affected the North Sea caused the deaths of rich farmers in the Netherlands, and the reaction to this is still being seen in policy where they are very proactive in addressing coastal adaptation. By contrast, in Belgium, eight people from a poor community died and the reaction has been very different.

Adriana Constantinescu (GeoEcoMar, Romania): *In the Danube Delta, we work closely with local communities and have found a lot of traditional knowledge, but sometimes this is not considered enough. What is your experience of that?*

Mr Cronin replied with the example of Marine Protected Areas (MPAs). The science tells us that we need them, but there is no social buy-in in Ireland because we are not considering the knowledge of people in coastal areas who have connections with the Ocean, such as fishers. He felt that non-scientific knowledge needs to be incorporated for communities to feel that protection is meaningful to them.

Gilles Lericolais (IFREMER, France): *One of the speakers used the Intergovernmental Panel on Climate Change (IPCC) predictions for sea-level rise in their presentation. If we want to know what extreme events are coming, we need sustained in situ Ocean observations. However, today, 50% of observations come from ARGO floats managed by the USA, which may be at risk. How can we encourage coastal communities to lobby on the importance of Ocean observations?*

Mr Cronin felt that municipalities, small businesses and NGOs don't really have the ability to think about Ocean observations and what they need from those systems. They want to feel safe, do their business and have good lives. He did note however that they need to understand how to plan for extreme events. Coastal communities are becoming increasingly aware that there are things they should know but don't, but they don't really have the capacity to actively lobby for observations.

Ms Maelfait stated that we need science to influence the policy, and the science has to react to the needs of society. Often, communities' engagement with information arising from Ocean observations is via the weatherman.

Dr Vervust added that for communities which haven't yet faced the impact of storms we can use historical narratives to talk about how people prepared for storms in the past, and how we can take inspiration from that now.

Mr Cronin noted that marine observations are very expensive, but the time series they provide are very important. We should consider how to engage citizens in meaningful science to both support Ocean observing and give citizens a sense of ownership and stewardship.

CLOSING SESSION

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Dr Fiona Grant

Chair of the European Marine Board, and Head of International Programmes, Marine Institute, Ireland

Dr Grant gave the closing remarks for the 9th EMB Forum. She reminded the audience of the main messages presented by each of the speakers, and the points arising from the panel discussions. She then thanked the speakers and panellists for their input and enthusiasm, as well as the Institute of Natural Sciences and its staff for co-hosting and supporting the event. She acknowledged the work of the EMB Secretariat in organising the event and thanked the Ocean Decade and Mission Ocean teams for their support in endorsing the event. She closed by thanking the attendees both online and in person for their engagement.



ABBREVIATIONS

CORDIO	Coastal Oceans Research and Development – Indian Ocean
EC	European Commission
EMB	European Marine Board
EMODnet	European Marine Observation and Data Network
EU	European Union
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IFREMER	French Research Institute for Exploitation of the Sea
JPI Oceans	Joint Programming Initiative Oceans
KDM	German Marine Research Consortium
Mission Ocean	EU Mission: Restore our Ocean and Waters
MPA	Marine Protected Areas
MSFD	Marine Strategy Framework Directive
MSP	Maritime Spatial Planning
NGO	Non-Governmental Organisations
Ocean Decade	United Nations Decade of Ocean Science for Sustainable Development (2021-2030)
OGS	National Institute of Oceanography and Applied Geophysics, Italy
PFAS	Per- and polyfluoroalkyl substances
RI	Research infrastructure
SDGs	Sustainable Development Goals
UN	United Nations
USA	United States of America
WFD	Water Framework Directive









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