Sustainable Blue Economy Partnership

WATERBORNE

Report Workshop SBEP-WAT

A coordinated view on key sectors of the Blue Economy

SBEP & Waterborne TP technical workshop, in collaboration with the Mission Oceans, on Ports, Marinas, Logistics and Sustainable Fisheries

Rome, 08 April 2025

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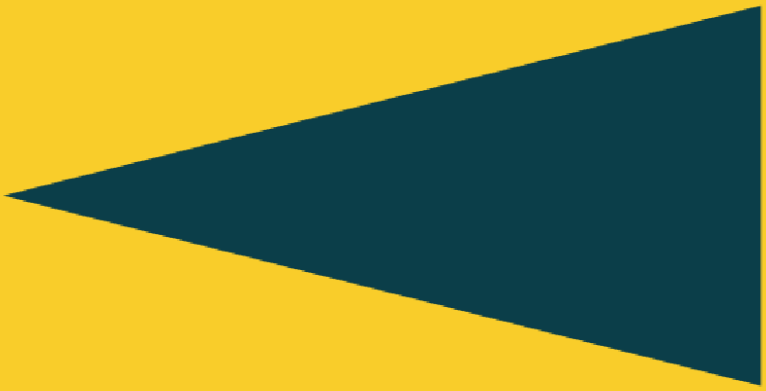

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1.0 SUMMARY

The SBEP-WAT Technical Workshop, held in Rome on 8 April 2025, brought together around 40 experts from EU institutions, research organisations, industry, and policymaking to align strategies for the sustainable development of Europe's blue economy. Organised by the Sustainable Blue Economy Partnership (SBEP), the Waterborne Technology Platform (WAT), in collaboration with the EU Mission "Restore Our Ocean and Waters", the event focused on two key themes: **(1) Ports, Marinas & Logistics** and **(2) Sustainable Fisheries**. Its main goal was to **foster collaboration, avoid duplication, and coordinate actions across European initiatives to accelerate the transition toward a climate-neutral, resilient, and competitive maritime sector.**

In the session on ports, marinas, and logistics, participants discussed pathways to transform port infrastructure and operations. A ten-year roadmap was presented for developing zero-emission, climate-resilient ports, highlighting measures such as onshore power supply systems, alternative fuel infrastructure, and renewable energy integration. The discussion stressed the need for **tailored strategies for small and remote ports**, where financial, technical, and governance constraints pose unique challenges. **Digital twin technologies** were showcased as key enablers for optimising logistics, predicting maintenance, and integrating emissions tracking. Projects like OceanPlanner demonstrated how combining artificial intelligence (AI), satellite data, and sensor networks can support marine spatial planning while balancing port development, renewable energy, fisheries, and biodiversity protection. On pollution, new **real-time monitoring technologies** were introduced, capable of remotely tracking emissions and integrating water quality data into port management systems. Participants highlighted **coastal management and marine spatial planning as the top priority**, emphasising stronger data sharing and coordinated decision-making. There was broad agreement on the need for joint SBEP-Zero Emission Waterborne Transport (ZEWT) funding calls to drive pilot projects and innovation.

The session on sustainable fisheries addressed the dual **challenges of decarbonisation and ecosystem protection**. The DecarbonyT project demonstrated how optimised fishing gear and energy audits can deliver 10–20% fuel savings, while SEAGLOW introduced hybrid propulsion, bio-based antifouling coatings, and energy monitoring systems for small-scale vessels. However, the sector faces barriers such as high retrofit costs, limited infrastructure for alternative fuels, and an aging workforce, making training and generational renewal critical. Advances in AI-driven monitoring were also presented, showing how combining AIS, radar, and satellite imagery can track global fishing effort and detect illegal activities. The DTO-Track project complements this approach by creating a digital twin of marine species, using acoustic telemetry to monitor migration and habitat use, thereby supporting ecosystem-based management. **A transition toward ecosystem-based fisheries management (EBFM)** was widely supported, aiming to move beyond single-species approaches and integrate biodiversity, climate impacts, and offshore renewable energy pressures into fisheries policy.

Closing discussions emphasised the urgency of breaking down silos between marine sectors and adopting integrated digital tools and open environmental **data sharing** to accelerate innovation and policy alignment. Participants called for **coordinated funding initiatives**,

stronger collaboration between partnerships, and inclusive strategies that address the social and economic dimensions of the maritime transition.

Overall, the workshop highlighted the importance of joint innovation, digital integration, and coordinated policies to achieve Europe's ambitions for a sustainable, zero-emission blue economy. By combining **technological advances with ecosystem-based approaches and stakeholder engagement,** the SBEP and WAT aim to lead the transformation toward a more resilient, competitive, and environmentally responsible maritime future.

2.0 CONCEPT

The joint declaration on the cooperation and collaboration between the co-funded European Blue Economy Partnership (SBEP) and the Waterborne Technology Platform (WAT) representing the co-programmed EU Zero Emission Waterborne Transport (ZEWT) Partnership, defines the following measures to ensure complementarities and synergies of the two Partnerships:

1) *Start the cooperation based on the first list of common topics included in the declaration*
2) *Cooperating both at programming level through a continuous and transparent dialogue and, at implementation level, sharing progress and results of projects*
3) *Liaising with other partnerships, initiatives and parties*.

The SBEP and WAT are promoting **interdisciplinary scientific and technical exchange** in the fields of Seas & Oceans, Blue Economy and Sustainable Waterborne Transport, through a joint workshop with SBEP, WAT and the European Mission "Restore our Oceans and Waters".

The technical workshop was held in Rome, at the National Research Council (CNR) on 8 April 2025. It gathered around 40 participants representing EU institutions, national ministries, academia, public and private research centres, industries, SMEs, port systems, international and European sector organisations and national agencies supporting R&D and public authorities in the implementation of policies in the marine and maritime sectors. The workshop addressed two topics: (1) **Ports, Marinas & Logistics** and (2) **Sustainable Fisheries** because of the important complementary and synergetic actions that can be carried out by the three communities. Subtopics were selected with the aim of giving an overview of models and methodologies adopted by the different communities to achieve the common goal of supporting the sustainable development of maritime activities while protecting the marine environment and biodiversity. Towards this end, the workshop structure provided, for each subtopic, both scientific insights and the showcase of relevant projects, implemented products/services with high technological/socio-economic value as well as the opportunity for exchange of views.

The overall objective of the workshop was to foster **alignment between the two initiatives, paving the way for possible joint actions.** Indeed, through interactive discussion and engagement approach, participants contributed to identify focus thematic area of cooperation and provided operational and feasible suggestions, that build on the portfolio of activities of the two Partnerships, for implementing impactful synergies, including fine-

tuning the respective strategies and development plans, support critical mass and avoid duplications. In this framework, ZEWT-MISSION joint calls in collaboration with the SBEP have been explored, also taking into consideration the role and potential of the upcoming marine Knowledge and Innovation Community (KIC).

3.0 OUTCOMES

3.1 Setting the scene

Claire Hellio from the French Research Agency (France) opened the workshop by welcoming participants and introducing the first speakers for the 'Setting the Scene' session.

Figure 1: Claire Hellio, ANR, welcoming the participants to the workshop

The first speaker, **Emilio Campana, CNR**, started by highlighting the Mediterranean as a powerful metaphor for cultural exchange and cooperation, emphasising the importance of **dialogue and collaboration across disciplines and nations**. He underscored the urgent need to protect marine ecosystems through joint efforts between scientists and engineers, stressing that only through such partnerships can biodiversity be preserved and the health of the seas ensured for future generations.

Emilio called for decisive action on the decarbonisation of maritime transport, advocating for **science-based strategies** and sustainable technologies to reduce environmental impact. He emphasised that research and innovation are fundamental to finding effective and lasting solutions to the industrial and environmental challenges we face. He highlighted the need for **strong collaboration with industrial partners**, to make the best use of shared knowledge and resources. He also stressed the importance of creating practical tools that have real-world impact, raising public awareness, and fostering a culture of sustainability.

Concluding, Emilio urged both scientific and industrial communities to work together to protect ocean health and secure a sustainable future. Only through active cooperation, he

asserted, can we address the complex challenges ahead and ensure a thriving marine environment for generations to come.

The second panel speaker, **Michaela Gigli**, newly appointed policy officer for the Sustainable Blue Economy Partnership at the European Commission's DG RTD emphasised the importance of collaboration between European partnerships to effectively address environmental and industrial challenges in the maritime sector.

Michaela provided updates on key EU policy developments, most notably the forthcoming **European Ocean Pact**. This comprehensive strategy aims to address the triple planetary crisis, climate change, pollution, and biodiversity loss, while strengthening maritime security, environmental sustainability, and the EU's global competitiveness. The Pact will include a **strong research and innovation component**, drawing on the achievements of the EU Mission "Restore our Ocean and Waters" and previous framework programmes. She underlined that broad stakeholder engagement has shaped the Pact, with over 900 contributions received through public consultation. Key concerns raised included the health and resilience of oceans and coastal areas, sustainable maritime transport, and the need for strong governance and knowledge systems. She also stressed the importance of aligning the Ocean Pact with other major EU initiatives, such as the Water Resilience Strategy, the Maritime Strategy Framework Directive, the Clean Industrial Strategy, and the upcoming Fisheries Policy for 2040.

In conclusion, she reaffirmed the **value of cross-partnership collaboration**, to pool expertise, avoid duplication, and generate impactful outcomes. The joint workshop, she said, marks a pivotal moment for advancing coordinated strategies, ultimately contributing to decarbonisation and reducing pollution in maritime environments.

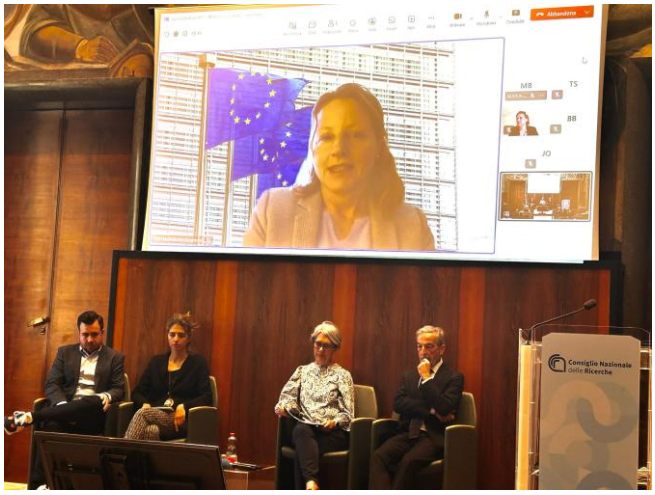

Figure 2: Mlchaela Gigli, DG RTD, European Commission

David Abril, representing the **Waterborne Technology Platform and the Zero Emission Waterborne Transport (ZEWT) Partnership**, encouraged active participation in the workshop and emphasising the collaborative nature of the discussions. He introduced the Waterborne Technology Platform as a European Commission-recognised body driving innovation across the entire waterborne transport sector, including maritime, inland navigation, and ports, with 127 member organisations. He outlined the platform's focus on four pillars:

decarbonisation and green transition, infrastructure and investment, digitalisation and efficiency, and continuous stakeholder dialogue.

He highlighted the **ZEWT Partnership's ambitious goal of developing and demonstrating zero-emission solutions for all ship types by 2030** to achieve full decarbonisation of waterborne transport by 2050. Key pillars of ZEWT include sustainable alternative fuels, electrification, energy efficiency, digital technologies, vessel design and retrofitting, and port integration. David stressed that this transformation requires joint effort, investment, and knowledge sharing, particularly in supporting ports and fisheries to adopt clean technologies and improve logistics. He concluded by underlining the need for ongoing collaboration between initiatives like ZEWT and stakeholders in the blue economy to build a sustainable and competitive future for European waterborne transport.

The last speaker of the opening, **Margherita Cappelletto, from the Italian Ministry of Universities and Research (MUR)** and **coordinator of the Sustainable Blue Economy Partnership**, thanked the hosting institute CNR and the team involved in the organisation of the workshop, and highlighted the importance of workshops like this one to inform future calls, ensuring the Partnership stays connected with real-world developments and needs.

She presented the SBEP as a major initiative involving 30 countries and the European Commission, jointly investing around €450 million to align research programmes and fund transnational projects. The Partnership focuses on five thematic areas: the ocean digital twin, sustainable blue economy transition, sea use management, blue bioresources, and coastal resilience.

Beyond funding, the SBEP supports market uptake through tools like BlueInvest and additional activities such as its **portfolio of projects**, which clusters projects on topics like sustainable fisheries and aquaculture. She concluded by stressing the **importance of coordination across national, EU, and global levels**, and highlighted the role of the SBEP Brussels-based team in strengthening strategic collaboration. The event, she noted, is part of a broader effort to add value to EU-level initiatives and avoid duplication, **reinforcing shared goals through strategic partnership.**

3.2 First session: port, marinas and logistics

The first session of the workshop was moderated by **Jessica Hjerpe Olausson (RISE)** and focused on port, marinas and logistics. Before introducing the speakers, she moderated the Mentimeter exercise.

3.2.1 Introducing the session - Mentimeter results

After the introduction of the session, the plenum was asked to reflect what comes into their mind when reading the session name. The results are shown in the word cloud in Figure

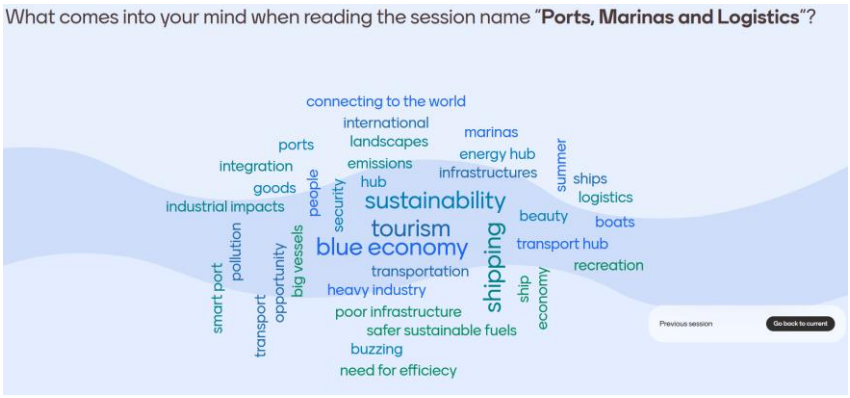

Figure 3: Word cloud of the Mentimeter question "What comes into your mind when reading the session name 'Ports, Marinas and Logistics'?"

The plenum was then asked to reflect their expectations for the session. Results are shown in Figure .

Figure 4: Word cloud of the Mentimeter question 'What are your expectations for this session?'

3.2.2 Sustainable infrastructures

The panellists of the first topic focus on '*Sustainable Infrastructures'*, **Maria Boile (University of Piraeus, Greece)** and **Yvonne Koldenhof (MARIN, Netherlands)** focused on a comprehensive vision for developing zero-emission, climate-resilient port infrastructure over a 10-year period, spanning from 2021 to 2031. This roadmap outlines key priorities for port transformation, including the implementation of **Onshore Power Supply (OPS)** systems, which are already high on the agenda for many European ports as a means of reducing emissions from vessels while docked. The roadmap also addresses the critical need to develop infrastructure for the bunkering of alternative fuels such as hydrogen, ammonia, and methanol, recognising these as essential to decarbonising maritime transport.

Energy resilience emerged as another central theme, with an emphasis on enabling ports to generate and store renewable energy locally. The presentations also highlighted broader objectives such as reducing emissions across operations, enhancing the climate resilience

of port systems, and evaluating whether to retrofit existing ports or construct new ones. In this context, it was emphasised that port infrastructure solutions must be tailored, particularly for small or remote ports, where needs and capabilities differ significantly.

The speakers shared insights from recent studies and pilot projects, including the 'Greening of European Seaports' initiative conducted for DG MOVE. This study explored global best practices and assessed their applicability to small and medium-sized EU ports. Furthermore, pilot activities in ports across the Aegean Sea demonstrated how sustainability and resilience can be effectively customised for remote island environments.

Addressing the barriers and enablers of port greening, the presentation made clear that financial capacity is only one part of the equation. Other critical factors include traffic composition, port governance structures, geographical conditions, and the complexities of energy logistics. A key takeaway was that **success in port sustainability efforts heavily relies on building local capacity, ensuring technology is transferable, and fostering a willingness among stakeholders to embrace innovative**, and sometimes risky, solutions.

In closing, both panellists stressed that port infrastructure sustainability must be approached holistically, integrating environmental, economic, and social dimensions. This is particularly vital for small or isolated ports, which face distinct challenges such as a lack of interoperability between systems, uncertainty about future fuel availability (notably hydrogen and ammonia), and limited financial or technical resources to support the transition.

3.2.3 Digital twins, digitalisation & logistics

The panellists of the second topic focus on '*Digital twins, digitalisation and logistics',* **Sotiris Theofanis (CITY College, Thessaloniki, Greece)**, and **Douwe van der Stroom (Port of Rotterdam, Netherlands)** explored the evolving role of digital twins in port operations. Defined as simulation-based tools, digital twins create dynamic virtual replicas of physical assets, such as ports and vessels, that allow for real-time testing, optimisation, and prediction of operational performance. These tools serve as powerful instruments for enhancing decision-making and efficiency within port environments.

Several practical applications of digital twins were discussed. These include tracking emissions and enabling predictive maintenance of port infrastructure, as well as conducting simulations to **improve logistics, boost energy efficiency, and optimise berth allocation**. A key advantage of digital twins lies in their ability to integrate diverse streams of environmental and sensor data directly into port management systems, offering a more holistic and data-driven approach to planning and operations.

Despite the potential of digital twins, the speakers identified several ongoing challenges. One major issue is the **fragmentation of data sources, particularly for small ports, which may lack the systems and resources to gather and integrate complex datasets**. There is also a pressing need to systematically merge aerial, underwater, and operational data to support comprehensive decision-making. Finally, concerns were raised about the accessibility of digital twin technology to smaller or less digitally mature stakeholders, underscoring the importance of promoting **inclusive digitalisation across all port types.**

3.2.4 Coastal management & Maritime Spatial Planning (MSP)

The third topic of the session was dedicated to *'Coastal Management & Maritime Spatial Planning (MSP)'*. The presentation delivered by **Andrea Barbanti (CNR)** and **Thomas Folegot (QUITE-OCEANS)** focused on tools and approaches that support more sustainable and integrated MSP, particularly in relation to underwater sound and ecosystem impacts. A central tool introduced was **OceanPlanner**, which is designed to support scenario planning by integrating underwater sound data with the costs and trade-offs of various MSP strategies. The tool aims to assist in aligning human activities such as port development, commercial fishing, and offshore wind energy with the overarching goal of protecting marine ecosystems.

A key theme throughout the presentation was the integration of multiple data layers, ecological, economic, and logistical, into spatial planning processes. This multidimensional approach allows for a more nuanced evaluation of how maritime activities intersect with environmental priorities. Special attention was given to the need to **value ecosystem services, such as fish nursery habitats**, when considering port expansion or the designation of **maritime corridors**. These natural assets play a crucial role in maintaining ecological balance and must be factored into any long-term planning strategy. The speakers stressed that the success of MSP tools such as OceanPlanner is based on several core capabilities. These include the ability to balance competing maritime uses, such as reconciling the needs of shipping lanes, marine protected areas (MPAs), offshore energy infrastructure, and fisheries, while also incorporating both real-time and forecasted environmental data. Furthermore, **MSP** must remain **adaptable in the face of climate-driven changes** that continue to reshape marine and coastal systems.

Participant contributions during the discussion underscored the need for MSP frameworks to include ecosystem impact modules. These modules are particularly critical for assessing and mitigating biodiversity pressures that arise from infrastructure-heavy activities like offshore wind development and from high-traffic maritime corridors. The overall message was clear: successful spatial planning must harmonise human use with ecosystem protection, using integrated data and flexible, forward-looking approaches.

3.2.5 Pollution

The fourth topic of the session was dedicated *'Pollution'*. **Katja Broeg (BSH)** and **Josep Sanz Argent (Fundación Valenciaport)** discussed **advancing environmental monitoring practices in ports, with a particular focus on ship emissions and water pollution.** They introduced new technologies capable of monitoring ship emissions remotely and in real time. These novel tools employ infrared sensors to detect carbon dioxide and hydrocarbons, while ultraviolet sensors are used to measure sulphur and nitrogen oxides. With the capacity to analyse ship plumes from distances up to one kilometre, these methods offer non-intrusive and continuous emission characterisation, enabling ports to improve compliance monitoring and reduce environmental impact more effectively.

Turning to water pollution, the speakers described how ports are increasingly conducting biannual water quality campaigns to assess local environmental conditions. In addition to chemical testing, some ports have adopted the use of biological indicators such as mussels,

which serve as natural bio-monitors for detecting contaminants over time. Despite these efforts, **monitoring remains challenging**, **especially in busy port environments** where pollutants such as microplastics and antifouling residues can be difficult to detect and trace.

Broeg and Sanz Argent emphasised the growing need for **more localised and real-time water quality monitoring systems** that can provide accurate, timely data to support environmental decision-making. They advocated for the **integration of these pollution datasets into broader digital infrastructure, such as digital twins** and port management platforms, to enhance situational awareness and response capabilities.

A final point underscored the importance of transparent and coordinated cooperation between ports and municipal authorities. Managing environmental concerns in port areas is not only about protecting ecosystems but also about addressing public health risks. For this reason, **collaborative governance and data-sharing** are essential to ensuring that environmental management efforts are both effective and socially responsible.

3.2.6 Brainstorming session – Mentimeter results

In the brainstorming session, the plenum was asked to vote on which are the most important topics of the session for them. Here the topic 'Coastal management and marine/maritime spatial planning' received the highest ranking (see Figure).

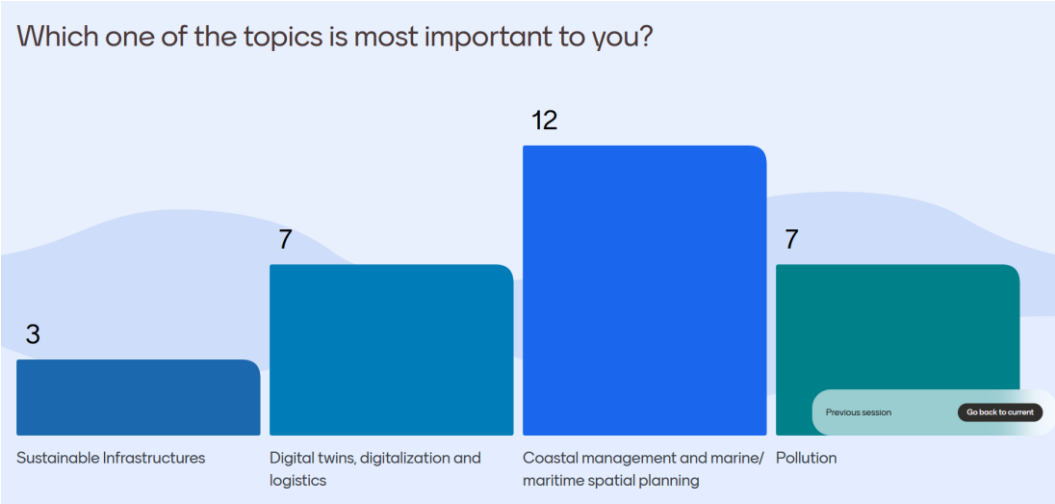

Figure 5: Results of the voting for the most important topics of the session by the plenum

The plenum was then asked to note any other topics important to them but not covered in the session. After showing the results, the plenum was able to vote which of the results are most important for them. Here 'Social dimensions' received the highest score (see Table 1).

Table 1: Mentimeter results of the question 'Are there any other topics important to you but not covered in the session?' including the subsequent voting on the results.

Responses	Upvotes
Social dimension	4
Offshore renewable production	3

Incentives	2
People acceptance of new solutions	2
Robotics	1
Legislation	1
Ecosystem assessment	1
Bridge to humans and species	1
Policies and policy coherence	1
Logistic of new fuels	1
Strategy for deployment	0
The economics/valuation of the environment is a key that was only briefly touched upon	0
Punishment that hurts	0
Finance	0

Finally, the plenum was asked to note future activities that should be jointly addressed. Subsequently they were asked to vote on the results with "Joint SBEP ZEWT calls" being the most ranked response (see Table 2).

Table 2: Mentimeter results of the question 'What future activities should be jointly addressed and how?' including the subsequent voting on the results.

Responses	Upvotes
Joint SBEP ZEWT calls	5
Impact of shipping and ports	3
Data sharing among industries and authorities	2
Mitigation of impacts (from technologies to implementation)	2
Training to port and maritime operators	2
Potential of blue economy initiatives for the energy transition of the shipping sector	2
Convincing the maritime industry that not only revenue counts for the green, digital and just transition	2
Data FAIRness	1
Exchange of experience between the regions	1
Joint portfolio of projects	1

Smart ports	1
Joint pilot action to support port authorities in data sharing	1
Real life - Case studies - e.g. plan for construction of the new Fiumicino port.	1
Supply chain	0
Renewables at ports	0
User driven data and tools	0

3.3 Second session: sustainable fisheries

The second session of the workshop was moderated by **Benjamin Kurten (FZJ, Germany)** and focused on sustainable fisheries.

3.3.1 Introducing the session - Mentimeter results

Benjamin Kurten welcomed the audience back after the lunch break and moderated the interactive Mentimeter exercise.

Figure 6: Benjamin Kurten presenting Mentimeter results

The plenum was asked to reflect what comes into their mind when reading the session name. The results are shown in the word cloud in Figure 7.

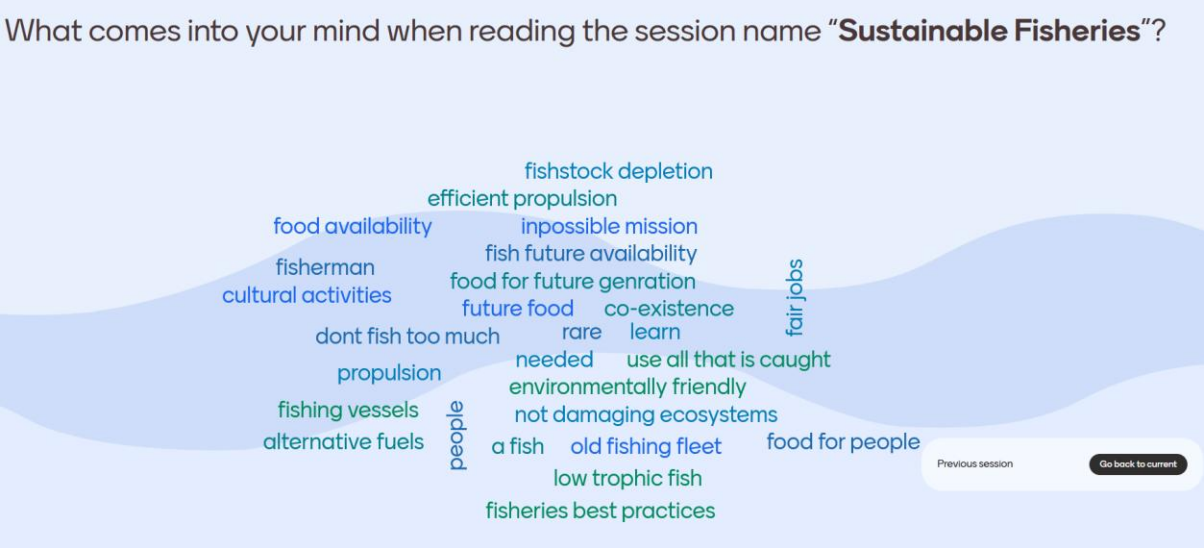

Figure 7: Word cloud of the Mentimeter question "What comes into your mind when reading the session name 'Sustainable Fisheries'?"

The plenum was then asked to reflect their expectations for the session. Results are shown in Figure 8.

Figure 8: Word cloud of the Mentimeter question 'What are your expectations for this session?'

3.3.2 Decarbonisation of fishing vessels

After the interactive part, Benjamin welcomed the first speaker of the panel *'Decarbonisation of fishing vessels'* **Antonello Sala,** Director of research at CNR, who presented the DecarbonyT project, a comprehensive project aimed at decarbonising the fishing fleet across the Mediterranean and Black Sea. Involving 17 partners from the entire region, the project is structured around four main work packages: assessing the current situation, enhancing fishing gear used at sea, conducting socio-economic analyses based on gear testing, and promoting stakeholder engagement through targeted dissemination.

A key component of the project is the implementation of pilot studies focused on increasing the **efficiency of fishing gear**, especially nets and trawl doors. These studies tested innovations such as replacing traditional doors with more efficient models and using advanced materials like Dyneema. The results demonstrated notable fuel savings, though they also underscored the importance of ensuring economic viability for widespread adoption.

Another critical aspect is the introduction of **energy audits**, which apply a systematic approach to evaluating energy use on fishing vessels. By installing specialised instrumentation to monitor power delivery, fuel consumption, and auxiliary systems, the project collects valuable data that informs technological upgrades and supports further reductions in fuel use.

To promote the adoption of energy-efficient practices in the fishing sector, it is crucial to reward best practices and consider redirecting fuel subsidies toward supporting the development of energy-saving technologies. Creating incentives and developing acceptable, practical solutions can lead to win-win situations that benefit both the environment and the industry.

Ensuring that objectives are realistic and achievable is essential for success, as is providing adequate training and technical support to facilitate the transition. A proactive approach that involves the industry as a central part of the solution will help foster ownership and long-term commitment. Finally, it's important to recognise that for some species, there are currently no realistic alternatives to trawling, making it even more vital to improve the efficiency and sustainability of existing methods.

Finally, he remarked that significant fuel savings (10–20%) can be achieved through better net design and improved otter board efficiency. However, matching the performance of well-established gear within a short testing window is difficult, requiring ongoing trials and industry feedback. Involving fishers from the start is essential to ensure practical and effective adoption. The DecarbonyT initiative underscores that current gear can be improved, with a relatively short payback period for fuel-saving upgrades.

The second speaker of the panel, **Gorka Gabiña (AZTI),** and also part of the Energy Transition Partnership, presented the SEAGLOW (Sustainable Energy Applications for Green and Low-impact Operation of small-scale fishing boats in the Baltic and North Sea basins). The project, part of the EU's Mission Ocean initiative, focuses on sustainable energy solutions for decarbonising small-scale fishing vessels in the Baltic and North Sea, involving 16 partners. It aims to understand community needs, adapt fuel-saving technologies, and test them in real-world conditions through pilot cases in Norway, Denmark, Sweden, and Estonia. The goal is to test hybrid propulsion systems powered by batteries and electric motors, supported by generators that use methanol, biodiesel, or modern combustion engines. Other innovations include toxin-free anti-fouling marine coatings, electric motors for noise reduction, and a non-intrusive energy monitoring system. This system helps analyse operational profiles and fuel consumption to develop tailored decarbonisation solutions for each vessel.

The third speaker, **Jules Danto,** policy officer at EAPO (European Association of Fish Producers Organisations) based in Brussels, introduced the organisation, which brings together over 3,000 producers' organisations across 12 EU Member States, primarily active in the Atlantic, North Sea, and Baltic regions. EAPO has been involved in various initiatives, including the Energy Transition Partnership, where the speaker coordinates the working group on large-scale fisheries.

He emphasised that the EU fisheries sector has a relatively small environmental footprint, with emissions reduced by over 50% since 1990. Despite its modest size, the sector plays an important role in providing a low-carbon source of animal protein. However, it is facing mounting pressures due to recent crises such as COVID-19, Brexit, and the ongoing energy crisis, along with increasing competition for maritime space from offshore renewable energy projects. Climate change and geopolitical uncertainties further strain access to traditional fishing areas.

While the sector is committed to engaging in the energy transition, it **lacks the technological and financial capacity** to lead the way. The aging and diverse fleet presents challenges for retrofitting and adopting new technologies like biofuels, hydrogen, or ammonia. Limited access to funding and infrastructure makes investment risky and uncertain. Another significant **issue is the workforce.** The sector suffers from labour shortages and an aging demographic, threatening its long-term sustainability. Without generational renewal, the future of fisheries is at risk.

In response to these challenges, the speaker outlined several types of solutions. In the short term, energy-saving practices such as **gear optimisation and route planning** can help reduce fuel use. In the medium term, retrofitting older vessels could offer benefits, though cost-effectiveness is a concern. For the long term, the sector needs access to alternative fuel infrastructure, regulatory flexibility, and consistent funding support.

The speaker concluded by highlighting the need for **more comprehensive data mapping,** such as energy audits across different fleet segments and the sharing of project outcomes and best practices. He stressed the importance of collaboration with research institutions and the creation of platforms to exchange knowledge and demonstrate successful innovations. The speech closed with a call for stronger cooperation and more support to ensure the future viability of the fisheries sector.

3.3.3 Artificial Intelligence (AI) for sustainable fishing

The first speaker of the second panel, Gianpolo Coro, from the Institute of Information Science and Technologies at CNR, presented a talk on **estimating fishing effort using Automatic Identification System (AIS) and radar data**, focusing on practical examples developed by CNR in collaboration with other institutions. The overarching theme was **global fishing monitoring**, which is essential for sustaining marine ecosystems, ensuring the livelihoods of fishing communities, assessing fish stock status, and supporting conservation and planning. The global fishing monitoring is highly data-dependent, relying on a variety of sources: terrestrial AIS data, satellite radio frequency (RF) data, Synthetic Aperture Radar (SAR) images, or combinations of these. The goal is to generate time series and spatial distributions of fishing effort.

He emphasised the relevance and limitations of data from **Global Fishing Watch** (GFW), a collaborative initiative by Google, Oceana, and SkyTruth, which provides broad global coverage but lacks transparency about primary data sources and completeness. For local and regional analysis, high-resolution terrestrial AIS data is preferred despite challenges like data gaps and unknown signal drop causes.

Here, **Artificial Intelligence (AI)** becomes crucial. When AIS data are rich—containing vessel IDs, coordinates, speed, direction, and timestamps—AI can effectively estimate fishing effort distributions over time, detect gaps, and infer activities during missing data periods. While satellite imagery can support such estimates, it lacks detailed vessel information and demands significant storage. Radar data from passive satellite sensors is valuable, especially for identifying non-cooperative vessels (those not transmitting AIS), though it lacks identifiers or behavioural information. AI compensates through data augmentation techniques, such as interpolation using ocean currents and bathymetry (from sources like Copernicus and JABCO), to infer potential fishing zones.

Gianpolo presented some examples such the case study developed with the Norwegian Space Agency, comparing 2023 radar-based estimates in the North Sea and Western Norwegian Sea with GFW data. The AI model achieved 75% agreement, which is notable given the generic nature of the input data. He then showed how results improve dramatically when even limited vessel identification (ID) data is available. Using Sentinel-3 satellite data that could associate AIS with RF points, AI models produced much more granular and accurate estimates, with total fishing hours differing by only 6% from GFW and improved spatial precision of high-intensity fishing zones.

In conclusion, Gianpolo emphasised that **AI-driven systems** can generate near-real-time, **global fishing effort overviews**, supporting organisations like FAO in monitoring and conservation. These tools are largely data-source independent and adaptable, provided sufficient data volume and richness.

The second speakers of the panel, **Ross McGill** (**Loughs Agency**) and **Widyatmoko Moko (Wageningen University)** presented DTO-Track, one of the SBEP co-funded projects, that aims to leverage existing telemetry infrastructure in eight different European nations to develop a **digital twin of North Sea fauna.** The core technology used is acoustic telemetry, which involves tagging marine species with small transmitters that emit signals detected by underwater receivers deployed in arrays. These systems can track species' presence, movement, depth, temperature, and more. Additional technologies, such as satellite tags, archival tags, and passive acoustic monitors, are also integrated. The passive monitors record ambient ocean soundscapes, detecting anthropogenic noise and marine mammal presence. Arrays are being installed in estuaries, coastal zones, and even offshore areas, including on offshore wind platforms, both existing and under development, to collect biological and environmental data.

The project's primary aim is to **gather extensive movement data on a wide range of species**, not just commercially important or vulnerable ones, but also more localised or ecologically significant fish. This includes tracking large migratory species like bluefin tuna. These data

are vital to understanding migration patterns, habitat use, and responses to environmental conditions.

Dr. Widyatmoko Moko expanded on the analytical approach, explaining that once the tracking data is collected, the project seeks to determine the reasons behind the animals' movements. These can be environmental (e.g., ocean currents, temperature), biological (e.g., reproduction or feeding), ecological (e.g., predation or competition), or anthropogenic (e.g., fishing pressure or habitat alteration). The project plans to use artificial intelligence, specifically transformer-based models similar to those used in language processing, to detect patterns in historical data and predict future movements. This allows for exploration of "**what-if" scenarios,** such as how changing environmental variables could alter migration routes.

All of this feeds into a larger goal: **building a digital twin of the ocean.** This is part of a Europe-wide initiative to create a comprehensive, real-time simulation of marine ecosystems to support decision-making in conservation, fisheries, and maritime policy. One of the critical gaps in current digital twin efforts is the lack of fine-scale biological data, especially regarding animal movement, something this project directly addresses. McGill emphasised that their open-data policy invites collaboration, aiming to place these tracking technologies in the most useful locations and contribute meaningfully to ocean governance and sustainability.

He concluded by noting that their biological tracking data could complement AI-driven models of fishing effort, as previously discussed in the conference, making the case for integrating telemetry and data science for a more complete understanding of ocean dynamic

3.3.4 Ecosystem based fisheries management

During the last panel session on *'Ecosystem based fisheries management',* **Anthony Starr (Finland's Ministry of Agriculture and Forestry)**, working in the Fisheries Industry Unit, gave an insightful talk on **Ecosystem-Based Fisheries Management (EBFM)**. He explained that EBFM is an integrated approach to managing fisheries by considering the entire ecosystem, including environmental, social, and economic factors. Unlike traditional fisheries management that focuses on individual species, EBFM accounts for species interactions and the broader ecosystem dynamics.

The motivation for adopting EBFM comes from the shortcomings of single-species management, which can lead to overfishing and ecosystem degradation. By contrast, EBFM supports biodiversity, sustainability, and long-term fish production. However, **implementation remains challenging**. He noted gaps in data and knowledge, institutional resistance, and the need for clearer definitions and multidisciplinary cooperation. He highlighted that although the EU's Common Fisheries Policy (CFP) includes EBFM in its legal framework, much of its regulation, especially through Total Allowable Catches (TACs), still focuses on single species.

Focusing on the Baltic Sea, he discussed regional considerations such as growing seal populations, species interactions, climate impacts like eutrophication, and pressures from

offshore wind development. He emphasised that **different marine regions require different approaches, and that EBFM must be tailored accordingly**.

He closed by highlighting the importance of **regional research and stakeholder input**, noting that a public consultation on the CFP is currently underway, offering a chance to influence future EU fisheries policy.

3.3.5 Brainstorming session – Mentimeter results

In the brainstorming session, the plenum was asked to vote on which are the most important topics of the session for them. Here all three topics received a similar score (see Figure 9).

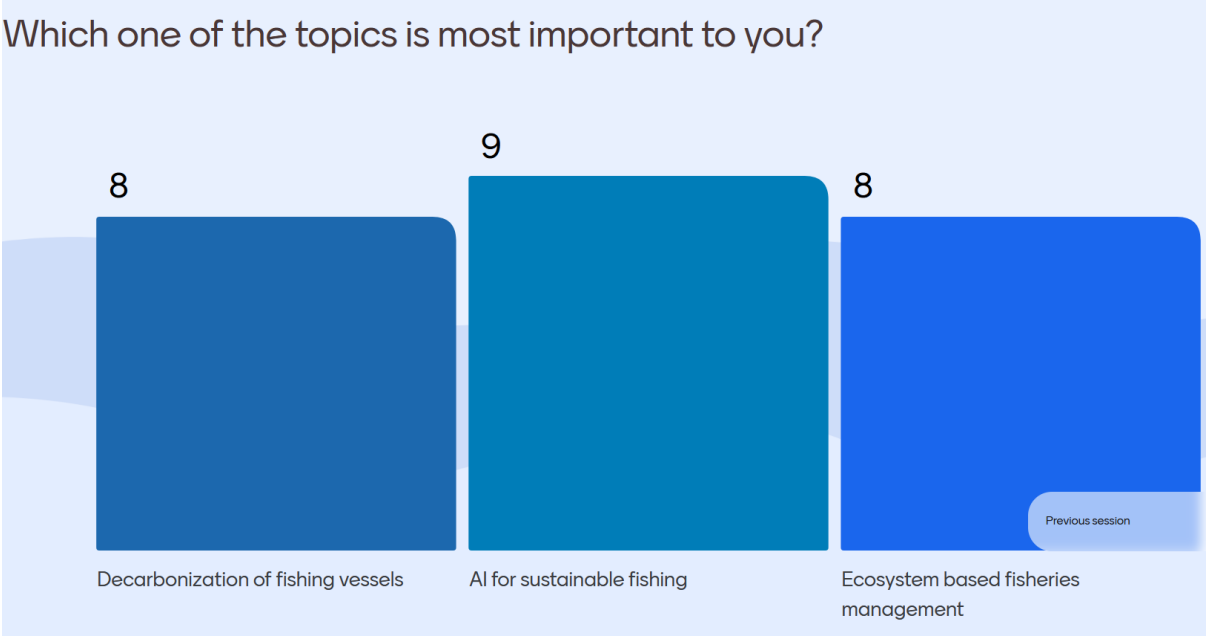

Figure 9: Results of the voting for the most important topics of the session by the plenum

The plenum was then asked to note any other topics important to them but not covered in the session. After showing the results, the plenum was asked to vote for the results most important for them (see Table 3Table 1).

Table 3: Mentimeter results of the question "Are there any other topics important to you but not covered in the session?" including the subsequent voting on the results

Responses	Upvotes
Social aspects such as acceptance	3
Climate adaptation strategies	3
Funding incentives for ecofriendly vessels	3
Hybridisation	2
Efficient propulsion	2
Food security	2
Fishing vessel operation	2

Renewable fuels	2
Other technologies other than AI and renewable fuel, there is more to learn from shipping sector	2
Fishing impact on ecosystem	1
Acceptance of measures among fishermen	1
Climate change effects on fisheries	1
Complete vessel design	1
Social aspect	1
Social dimension	0
Climate Change Adaptation	0
Link to shipyards	0

Finally, the plenum was asked to note future activities that should be jointly addressed. Subsequently they were asked to vote on the results with 'Joint SBEP ZEWT calls' being the most ranked response (see Table 4).

Table 4: Mentimeter results of the question "What future activities should be jointly addressed and how?" including the subsequent voting on the results

Responses	Upvotes
Marine energy and fishing	3
Fish stock traceability and product quality along value chain	2
Climate change effects on fishing and biodiversity	2
Putting sensor technology on ships and fishing vessels as well as leisure boats	2
Climate Change Adaptation Workshop	2
Biodiversity	1
Shipbuilding	1
Fisheries energy transition	1
Modern fishing vessels	1
Reskilling	1
Ship building and construction	0
Food security	0
Not to focus just and only on AI for the transition, as it is not so sustainable as well!	0

Support to SMEs	0
Water quality and marine biodiversity	0
Multi use / coexistence	0
Climate Change Adaptation Workshop INDEED	0
Business models and value chains	0
Climate resilience	0

3.4 The way forward

Emilio Campana closed the workshop with a discussion on operational development of joint activities and wrap-up. Emilio emphasised the **essential role of science in bridging gaps between sectors** involved in marine and ecosystem research, highlighting that the methods and tools used in marine science and fields like hydrodynamics and ship design are increasingly converging. Both disciplines now rely heavily on simulation, artificial intelligence, and predictive modelling, often using the same software and approaches to understand and anticipate system behaviours. He predicted that within the next five years, the tools used across these fields will become indistinguishable, underscoring the urgency for unified approaches.

A central message was that the ocean is one interconnected system, and scientific research, policy, and partnerships must reflect that unity. Emilio highlighted the **current fragmentation** among various marine organisations and initiatives, arguing that it leads to duplicated efforts, wasted resources, and inefficiency. Instead, **a consolidated framework is needed** to tackle shared challenges like pollution, underwater noise, and climate impacts more effectively.

Figure 10: Emilio Campana, CNR

Emilio concluded by calling for **mandatory data sharing**, arguing that just as regulations require safety features like double hulls in ships to prevent oil spills, access to ports or project funding should be contingent on the willingness to share environmental data. **Without open access to data, meaningful progress is hindered.** The European Commission must take firm action to enforce transparency for the benefit of both science and society.

Figure 10: Workshop group picture

4.0 ANNEX

Agenda of the workshop:

09:00	ARRIVAL AND REGISTRATION	
09:30	*WELCOME AND OBJECTIVES OF THE WORKSHOP* Moderator: Claire Hellio, French Research Agency	***Setting the scene:*** • *Emilio Fortunato Campana, Director, Department of Engineering, ICT and Technologies for Energy and Transport, Welcome from the Host* • *Michaela Gigli, DG RTD, European Commission (online)* • *David ABRIL MOLINS, Waterborne TP* • *Margherita Cappelletto, Italian Ministry of Universities and Research, SBEP Coordinator*
10:00-13:00	FIRST SESSION: PORT, MARINAS AND LOGISTICS Moderator: Jessica Hjerpe Olausson (RISE)	
10:00	*Introducing the Session*	• Participants share their thoughts (Mentimeter Word Cloud, 5 min)
10:10	*TOPIC 1*	***Sustainable Infrastructures*** • *Maria Boile (University of Piraeus, Coordinator Waterborne TP) (15 min) (online)* • *Yvonne Koldenhof (MARIN) (15 min)* Q&A (5 min)
10:45	*TOPIC 2*	***Digital twins, digitalisation and logistics*** • *Sotiris Theofanis, CITY College, University of York Europe Campus, Thessaloniki (15 min) (online)* • *Douwe van der Stroom, Port of Rotterdam (15 min) (online)* Q&A (5 min)
11:20	*TOPIC 3*	***Coastal management and maritime spatial planning*** • *Andrea Barbanti, National Research Council of Italy – Institute of Marine Science (15 min)* • *Thomas Folegot, QUITE-OCEANS, "OceanPlanner: a decision aid platform to assess underwater sound and costs of Marine Spatial Planning strategies" (15 min)* Q&A (5 min)
11:55	*TOPIC 4*	***Pollution*** • *"Ship emissions to water - Sources and impact" ,Katja Broeg, German Federal Maritime an Hydrographic Agency (BSH) (15 min) (online)* • *Josep Sanz Argent, Fundacion Valencia Port (15 min)* • *Q&A (5 min)*

12:30	Brainstorming Session	***Idea Collection*** *(Mentimeter Questions with open Ended Voting, 10 min)* ***Idea Discussion*** *in Plenum (20 min)*
13:00	LUNCH BREAK	
14:00-16:20	**SECOND SESSION: SUSTAINABLE FISHERIES** **Moderator: Benjamin Kurten (FZJ)**	
14:00	*Introducing the Session*	• Participants share their thoughts (Mentimeter Word Cloud, 5 min)
14:10	*TOPIC 1*	***Decarbonisation of fishing vessels*** • *Antonello Sala, National Research Council of Italy, Decarbonyt project (10 min) (online)* • *Gorka Gabiña, AZTI, SEAGLOW project (10 min)* • *Jules Danto, European Association of Fish Producers Organisations (EAPO) (10 min)* Q&A (5 min)
14:45	*TOPIC 2*	***AI for sustainable fishing*** • *Gianpaolo Coro, National Research Council of Italy – Institute of Informatic Technologies (15 min)* • *Ross Mc Gill, Loughs Agency (IR), Coordinator SBEP co-funded project DTO-Track & Moko Widyatmoko, Wageningen University (15 min)* Q&A (5 min)
15:20	*TOPIC 3*	***Ecosystem based fisheries management*** • *Ahmed Siliman (FAO) (15 min) (TBC)* • *Antony Starr (Ministry of Agriculture and Forestry, Findals, SBEP Expert Group) (15 min)* Q&A (5 min)
15:55	Brainstorming Session	***Idea Collection*** *Mentimeter Questions with open Ended Voting (10 min)* ***Idea Discussion*** *in Plenum (20 min)*
16:25	*THE WAY FORWARD* Moderator: Emilio Fortunato Campana (National Research Council of Italy)	***Discussion on operational development of joint activities and wrap-up***
17:00		END

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