



EcoScope

Ecocentric management for sustainable fisheries
and healthy marine ecosystems

Project Deliverable Report

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1 Executive Summary

The First EcoScope Foresight Workshop was held online on the 16th of February 2022. The objective was to receive input from key stakeholders on the ongoing design and elaboration of the EcoScope e-tools. Twenty-four stakeholders and 11 EcoScope Consortium members participated in the workshop. The stakeholder participants included policy/ regulatory stakeholders (e.g. European Commission officials and Regional Fisheries Management Organisations), advisory bodies (e.g. fisheries advisory bodies and scientific advisory bodies), and other groups, such as environmental NGOs, scientific associations and Ocean data aggregators. The workshop consisted of a welcome and context setting session; a short session to pilot an upcoming survey on societal expectations and ecosystem-based fisheries management values; a set of sessions in which scenarios were used as a starting point to obtain feedback on the EcoScope e-tools; and Deep Dive sessions in which key questions or concerns identified during the workshop were discussed further. The following three topics were selected for discussion in the Deep Dive sessions: (i) addressing and communicating uncertainties; (ii) incorporating socio-economic data; and (iii) presenting data and information to different audiences. A number of recommendations emerged from the workshop: There are data that are essential in the EcoScope Platform (e.g. demersal fish and acoustic survey data in the Mediterranean Sea collected within the Data Collection Framework), but that are not publicly available. The stakeholders wondered if there would be a way to include these data. For the visualisation of the Platform data, participants suggested to make it simple and intuitive, but at the same time showing limitations in the data and uncertainty. It was also stressed that EcoScope should define how the Platform will fit with other tools and databases (notable the EU Digital Twin Ocean) to make sure it is interoperable and efforts are not duplicated. Regarding the EcoScope Toolbox, participants had concerns about how to aggregate the indicators into a final score without bias, and questioned the added value of doing so. Moreover, it was noted that it is important to strike a balance between showing details versus maintaining a clear picture in the Toolbox outputs. Specific suggestions were to have the possibility to see individual components of the sustainability wheel; to add indicators of change (i.e. improvement/ worsening of indicator); and to have probabilistic plots rather than deterministic scores. In addition, it was stressed that the tools should not be a black box, as the background of the model outputs is important to make informed decisions and advise decision-makers appropriately. For the ecosystem models, participants wanted the option of bespoke scenarios being run by experts, in addition to having the basic infrastructure for running simple scenarios. Moreover, it was suggested that there could be two levels of outputs corresponding to the two main target audiences identified during the workshop: (i) stakeholders that want easy to understand summary results, and (ii) stakeholders that need details, statistics and the possibility to dig further and understand the background. Co-creation of scenarios was stressed as key and participants explicitly asked to be involved in this process. A key concern was the quality and reliability of the results. It was noted that it is important to highlight uncertainties in the data and model outputs – particularly when results are presented in simple graphics as uncertainties are then often forgotten. The pilot and discussion of the large-

scale surveys of societal expectations shed light on the EBFM attributes, the policy trade-offs and the ecosystem services to focus on. In conclusion, the first EcoScope Foresight Workshop was highly productive and provided important insights for the project going forward.

2 Introduction

EcoScope (Ecocentric management for sustainable fisheries and healthy marine ecosystems) is a Horizon 2020 funded project that runs from September 2021 to August 2025. The aim of the project is to develop a series of e-tools that will serve as an easy-to-use decision support system to implement an ecosystem-based fisheries management (EBFM). These tools will include an interoperable platform (the EcoScope Platform) and a robust decision-making toolbox (the EcoScope Toolbox), which will be available through a single public portal¹. The **EcoScope Platform** will organize and homogenise climatic, oceanographic, biogeochemical, biological and fisheries datasets of the European Seas in a common standard and format that will be available through interactive mapping layers. The **EcoScope Toolbox**, a **sustainability scoring system**, will operate as a decision-support tool to examine fisheries management, marine policy and spatial planning scenarios. The Toolbox will incorporate novel assessment methods for data-poor fisheries (including non-commercial species), as well as for biodiversity and the conservation status of protected megafauna. It will include methods for dealing with uncertainty and will be used during the project to assess the status of all ecosystem components across European Seas. **Ecosystem models** will be created using Ecopath with Ecosim (EwE) for eight case study areas (North Sea, Baltic Sea, Bay of Biscay, Balearic Sea, Adriatic Sea, Aegean Sea, Baltic Sea, Black Sea and Levantine Sea) and will form the basis for testing and evaluating various management and policy scenarios. They will allow users to explore the impact of very concrete management options, such as the effects of adding a new Seasonally Closed Area in the Adriatic Sea on fish stocks, on the wider marine ecosystem, and on fisher's profitability. Moreover, a new edition of the **Maritime Spatial Planning (MSP) Challenge Simulation Platform**² will be created to cover the eastern Mediterranean Sea, which will include a fisheries module to visualise the effects of different fisheries management scenarios. The fisheries edition will then be applied to existing MSP Challenge simulation platform editions, covering five out of the eight case studies (Baltic Sea, North Sea, Adriatic Sea, Aegean and Levantine Seas) by the end of the project. In order to make these tools and their outputs fit for purpose, EcoScope strives to co-develop them with end-users and stakeholders by involving them in the design and development of the tools.

On 16 February 2022, the European Marine Board³ organised the First EcoScope Foresight Workshop (task 8.2.2) to discuss the design of these e-tools with key stakeholders. The

¹ EcoScope website: <https://ecoscopium.eu/>

² MSP Challenge simulation platform: <https://www.mspchallenge.info/>

³ European Marine Board: <https://www.marineboard.eu/>

stakeholders were invited to provide substantive input, shaping the ongoing design and elaboration of these e-tools and their outputs, and ensuring that they are fit-for-purpose by the end of the project. This deliverable provides a summary of the workshop and the input of the participants, highlighting issues that need to be considered in the development of the EcoScope tools.

3 First Foresight Workshop

3.1 Aim and participants

The First EcoScope Foresight Workshop was organised on the 16th of February 2022 as a full-day online event, facilitated by Lizzie Crudginton from Bright Green Learning⁴. The workshop brought together experts from the EcoScope consortium with key stakeholders that were anticipated to use the EcoScope e-tools and/or their outputs (i.e. the EcoScope Platform, the EcoScope Toolbox sustainability scoring system, the ecosystem models and/or the MSP Challenge Simulation Platform). The aim of the workshop was to understand the needs of these stakeholders and to receive substantial input from the participants on the ongoing design and elaboration of these e-tools. To this end the workshop used a set of concrete high-level scenarios that illustrated when and how these tools could be used. The feedback obtained during the workshop will feed into the development of the tools to ensure that they are useful to the stakeholders and that they can deliver what is required by policy makers and other stakeholders to implement EBFM.

In total, 39 stakeholders were invited to the workshop comprising policy/ regulatory stakeholders (e.g. European Commission officials and Regional Fisheries Management Organisations), advisory bodies (e.g. fisheries advisory bodies and scientific advisory bodies), and other key stakeholders (e.g. the fishing sector, environmental NGOs, scientific associations and Ocean data aggregators). Invitees to the workshop were selected based on their relevance for EBFM at European level, and the total number was restricted to 30-40 individuals to facilitate active interaction during the workshop. Twenty-four of the invited stakeholders participated in the workshop, as well as 11 EcoScope Consortium members. The following organisations participated in the workshop: the European Commission (EC) Directorate-General for Maritime Affairs and Fisheries (DG MARE), the EC Directorate-General for Environment (DG ENV), the EC Directorate-General for Research and Innovation (DG RTD), the EC Joint Research Centre (JRC), the International Council for the Exploration of the Sea (ICES), the General Fisheries Commission for the Mediterranean (GFCM), the Mediterranean Advisory Council (MEDAC), the Baltic Sea Advisory Council (BSAC), the North Sea Advisory Council (NSAC), the European Fisheries and Aquaculture Research Organisations (EFARO), the Fisheries and Aquaculture

⁴ Bright Green Learning: <https://brightgreenlearning.com/>

strategic group of DG RTD (SCAR-FISH), OCEANA, Birdlife, and the European Global Ocean Observing System (EuroGOOS) (see Annex I for the list of participants).

3.2 Content

Ahead of the workshop, all invitees received a **briefing document**⁵ on the EcoScope project and were asked to fill in a **stakeholder survey** (EcoScope task 8.3.1). This survey was a first step to gauge the specific requirements of key stakeholders for the EcoScope tools and to understand their main needs, challenges and barriers for implementing EBFM. The results of the survey were used as input into the workshop. The workshop consisted of: (i) a welcome and context setting session; (ii) a short session on an upcoming socio-economic survey; (iii) a set of sessions in which scenarios were used as a starting point to obtain feedback on the EcoScope e-tools; and (iii) a final Deep Dive session to discuss key questions and/ or concerns (see Annex II for the full agenda).

3.2.1 Welcome and context setting

The workshop was opened by the Executive Director of the European Marine Board (EMB), Sheila Heymans. Sheila introduced the main **objectives of EcoScope** and the desired outcomes of the project, namely to have well designed and fit-for-purpose tools for holistic, ecosystem-based fisheries management. She stated that to achieve these outcomes the EcoScope team had the following **objectives for the workshop**: (i) describe the proposed tools in enough detail to give the participants a flavour of what EcoScope intends to do; (ii) listen to feedback on the tools; and in general (iii) understand what is important to policy makers and other stakeholders to ensure that, where practicable, EcoScope addresses those needs with its tools.

The opening presentation was followed by a short **introduction on the methodology of the workshop** by the professional facilitator, Lizzie Crudgington. Lizzie explained that most of the workshop time would be in breakout group discussions, and that the EcoScope project partners would be there as experts to listen to the participants and provide clarifications as requested. She also noted that there would be templates in Mural⁶ and Google Docs⁷ to guide the conversations, and that there would be Deep Dive sessions at the end of the workshop, for which participants could decide the topics of discussion.

Following a short introduction of the participants in breakout rooms, Sheila Heymans introduced the **EcoScope e-tools** and how they interlink (Fig. 1). She also introduced the assumptions made

⁵ Briefing document: https://storage.googleapis.com/ecoscopium-cms-content/Eco_Scope_briefing_document_eb5bd798fd/Eco_Scope_briefing_document_eb5bd798fd.pdf

⁶ Mural: <https://start.mural.co/>

⁷ Google Docs: <https://www.google.com/docs/about/>

for each of the tools and the needs they seek to address (Table 1), as well as the specific areas that the EcoScope models will address within the eight case study areas (Fig. 2).

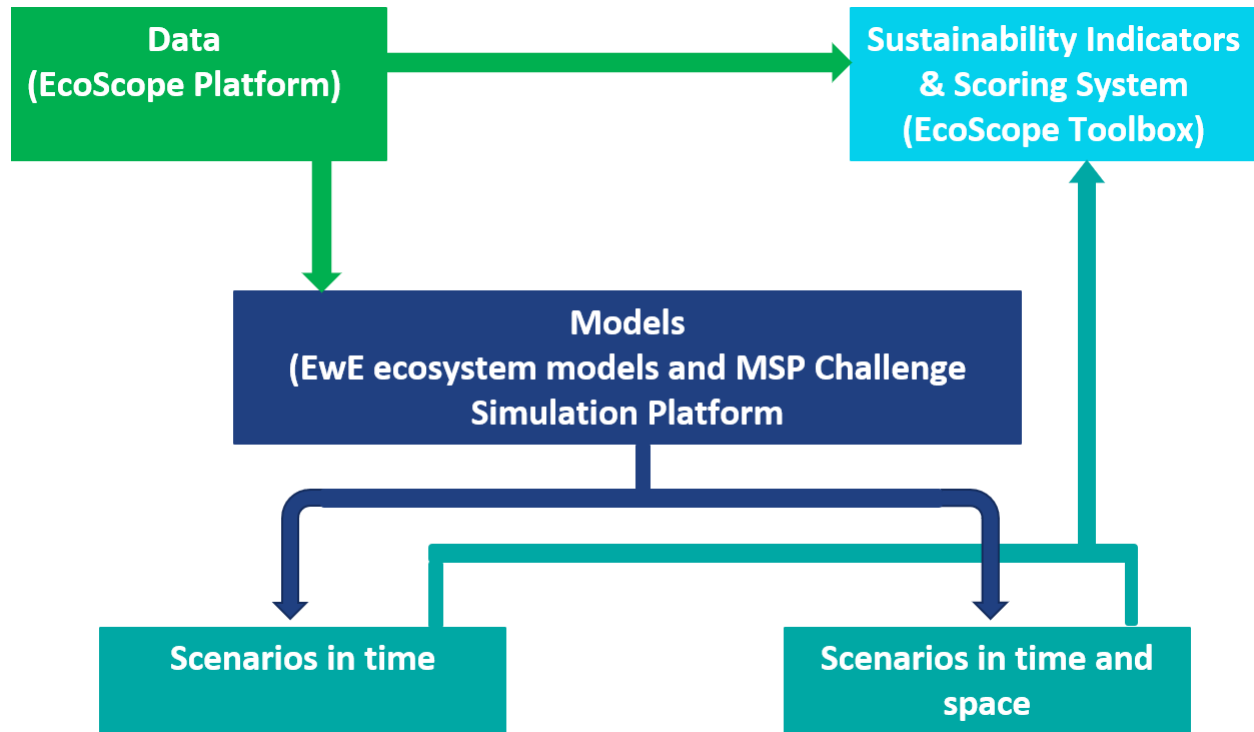


Figure 1: The different components of the EcoScope e-tools and how they fit together: the EcoScope Platform collates and visualises relevant data, the ecosystem models can be used to test management scenarios over time and space, and the EcoScope Toolbox evaluates the sustainability of management options based on indicators and a scoring system.

Table 1: Assumptions on EcoScope e-tools presented to workshop participant	
EcoScope e-tools	Assumptions
EcoScope Platform (data)	<ul style="list-style-type: none"> You need to access/download/visualize historic data relevant to EBFM It is valuable to bring lots of data together and visualise them Value for one stop portal to integrate EBFM data No such portal exists for European Seas You may want to access complex biological, human and economic data and visualize it in space and time

<p>Ecosystem models (including MSP Challenge Simulation Platform)</p>	<ul style="list-style-type: none"> • You may want to test ‘what if’ scenarios to help you see the impact of different options over time and space • Some scenarios are more relevant than others • You may want to have an easy-to-use tool to run scenarios on the platform • You may want experts to run a bespoke scenario for you on demand • You may want to visualize scenarios in a certain way to facilitate communication with decision makers • You may want to create your own management options and see the consequences over time and space • You may want to run management options in a gaming environment which engage/immerse users and allow multiple stakeholders to play together
<p>EcoScope Toolbox - Sustainability Indicators</p>	<ul style="list-style-type: none"> • You may want a sustainability score to help you summarize interdisciplinary data and model results in a clear visual way • You may need specific indicators to feed into that assessment

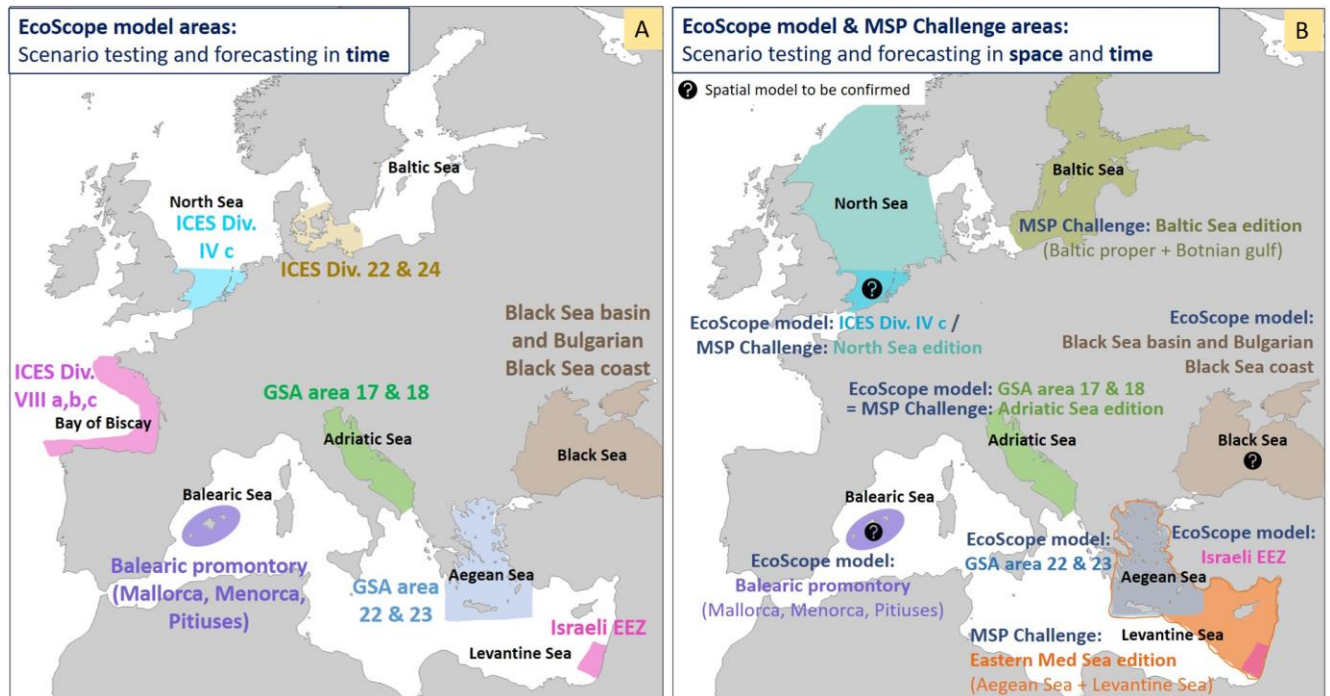


Figure 2: The specific areas that will be addressed by the EcoScope ecosystem models and the MSP Challenge Simulation Platform within the eight case study areas (North Sea, Baltic Sea, Bay of Biscay, Balearic Sea, Adriatic Sea, Aegean Sea, Baltic Sea, Black Sea and Levantine Sea). A)

Areas for which scenario testing and forecasting will be available in time. B) Areas for which scenario testing and forecasting will be available in space and time.

The final presentation in the welcome and context session was a summary of the **stakeholder survey results** by EMB Science Officer, Ana Rodriguez. The responses of this survey indicated that the main challenges stakeholders face in relation to implementing EBFM are knowledge and data gaps, followed by general policy/ management issues and stakeholder communication problems, as well as fundamental questions on the EBFM concept. The top EBFM related priorities for the respondents were effects of climate change, bycatch, protected areas/ fisheries restricted areas and biodiversity indicators. Climate change was also seen as one of the main future challenges in implementing EBFM. Assessing the impacts of specific management scenarios was a central need of the respondents and the survey identified a list of concrete questions/ scenarios for which respondents need answers (see section 3.3.3, Table 6). Although the stakeholders were mostly positive about the potential of using ecosystem models for management and to help meet EU policy requirements, they were also concerned about data gaps and model limitations and thus about the reliability and realism of the model's forecasts (for more information on the survey results see EcoScope deliverable D.8.1 "Report of stakeholder survey").

3.2.2 Feedback on survey of societal expectations

Workshop participants were invited to trial key elements of a **large-scale socio-economic survey** (EcoScope task 7.1) to be implemented in (a) the Atlantic Ocean, (b) the Mediterranean Sea and (c) the Black Sea. This survey aims to understand the perceptions, preferences and expectations of the public in relation to EBFM. Specifically, the objectives of the survey are to: (a) identify and model willingness to pay for EBFM features; (b) to forecast how EBFM impacts social wellbeing; and (c) to identify EBFM policy priorities among diverse segments of the public.

In order to make the results of this survey as relevant and useful as possible to stakeholders, participants were asked to complete a short feedback questionnaire⁸, followed by a discussion. This questionnaire covered the following topics: (i) the relative importance of a range of EBFM features to identify consumer willingness to pay; (ii) the relative importance of a number of ecosystems services for assessing wellbeing effects; and (iii) the relative importance of EBFM for achieving each of the 15 Sustainable Development Goals (SDGs) (Table 2). The aim of the feedback questionnaire was to make sure that the survey focused on questions that can inform policy making, as well as informing efforts to communicate EBFM and to influence consumer

⁸ Stakeholder feedback questionnaire for socio economic survey:
<https://docs.google.com/forms/d/e/1FAIpQLSd4PKpy7wICv3iJbmU6aJWYnuF9as4HM7CUq4q7k1r25cfVHQ/viewform>

behaviour. Participants were then invited to join an in-depth discussion on the survey during the Deep Dive sessions (see section 3.2.4).

Table 2: Questions posed to workshop participants to inform the large-scale socio-economic survey of the EcoScope project	
No.	Question
(i)	<p>We will employ a choice experiment (presenting “fish” choices to respondents). The features must be distinct, realistic, policy-relevant and easy to communicate. In our pilot we have identified these features:</p> <ul style="list-style-type: none"> i. Sustainably harvested; ii. Fishery does not cause harm to marine life; iii. Fishing effort generates low carbon footprint; iv. Coastal communities and fishers are consulted. <p>Are these the priority EBFM features we care about finding out willingness to pay for?</p>
(ii)	<p>We will estimate a model to test effects of ecosystems services on wellbeing. The ecosystems services we test must be related to EBFM. In our pilot we have identified these ecosystems services:</p> <ul style="list-style-type: none"> i. Sustained availability of fish for consumption; ii. Provision of secure marine-related jobs; iii. Recreational services in a healthy marine environment; iv. Existence value of abundant marine environment; v. Climate Adaptation. <p>Are these the relevant ecosystems services whose impact on social wellbeing we wish to assess?</p>
(iii)	<p>We will ask respondents to rank the importance of each Sustainable Development Goals (SDGs) to achieve EBFM. Are these the policy priorities we should ask the public to rank?</p>

3.2.3 Using scenarios to design the EcoScope e-tools

In the following session, **five hypothetical scenarios** were used as concrete examples of situations in which the EcoScope e-tools could be used (Table 3). The five scenarios were introduced to the participants in a plenary session and each participant was asked to choose one scenario for the upcoming breakout rooms sessions. The scenarios were used as a starting point in the breakout sessions to provide feedback on the EcoScope e-tools.

Table 3: Hypothetical scenarios used during the workshop as examples of situations in which the EcoScope e-tools could be used	
Scenario	Details
Scenario 1: Fisheries Restricted Area – Adriatic Sea	<p>Scenario:</p> <ul style="list-style-type: none"> GFCM receives a proposal to establish a new Fisheries Restricted Area (FRA) to protect Essential Fish Habitats of European hake and Norway lobster; There is disagreement between stakeholders whether this will be of added benefit considering that the Jabuka/Pomo Pit FRA⁹ has a similar purpose. <p>Specific question(s) of scenario:</p> <ul style="list-style-type: none"> What would be the impact on fish stocks, the wider marine ecosystem and fisher's catch of a new Seasonally Closed Area in the Adriatic Sea?
Scenario 2: Marine protected areas (strictly protected) + new windfarms – Southern North Sea	<p>Scenario:</p> <ul style="list-style-type: none"> It is the year 2025 and Belgium is reviewing its marine spatial plan; The country needs to designate 10% of its Exclusive Economic Zone (EEZ) as strictly protected Marine Protected Areas (MPAs). Moreover, it wants to develop new wind farms. <p>Specific question(s) of scenario:</p> <ul style="list-style-type: none"> Which areas within the Belgian EEZ would benefit most from strict protection in terms of biodiversity? What would be the impact of strictly protecting those areas on the fisher's profitability/ catches, and how would this be influenced by the newly planned wind farms? How will the placement of these new wind farms affect the ecosystem and the Natura 2000 sites?

⁹ Jabuka/Pomo Pit FRA: https://www.fao.org/3/cb2429en/online/cb2429en.html#chapter-7_3

<p>Scenario 3: Total Allowable Catches – Aegean Sea</p>	<p>Scenario:</p> <ul style="list-style-type: none"> • New Total Allowable Catches (TACs) are due to being negotiated; • In the Aegean Sea many fish stocks have been heavily overfished for many years; • STECF is asked to advise on how different TACs would affect the catch of the main commercial fish stocks and the wider ecosystem over the next 10 years in the Aegean Sea. <p>Specific question(s) of scenario:</p> <ul style="list-style-type: none"> • What would be the effect of different TACs on the main commercial fish stocks in the Aegean Sea (i.e. hake, red mullets, anglerfish, anchovy, sardine, picarels and bogue), the wider marine ecosystem and the fisher's profitability over the next 10 years?
<p>Scenario 4: Reducing bottom trawling – Balearic Sea</p>	<p>Scenario:</p> <ul style="list-style-type: none"> • As part of the Biodiversity Strategy to 2030, the Commission strives to reconcile the use of bottom-contacting fishing gear with biodiversity goals; • In the Balearic Sea trawler fishing grounds overlap with Essential Fish Habitats (mainly red algae and crinoid beds). Discards from trawl can reach 50-70% of the catch. <p>Specific question(s) of scenario:</p> <ul style="list-style-type: none"> • What is the effect of reducing trawling in the Balearic Sea by x percentage, on biodiversity, stock status and the fisher's catch and income?

<p>Scenario 5: Bycatch – Bay of Biscay</p>	<p>Scenario:</p> <ul style="list-style-type: none"> • The Bay of Biscay is a hotspot for marine megafauna and seabirds and it is characterised by very high by-catch rates of dolphins and seabirds; • NGOs have requested that responsible fisheries are closed for 3 months; • ICES is asked to provide advice as to what scenarios may improve the status of the species sensitive to bycatch. <p>Specific question(s) of scenario:</p> <ul style="list-style-type: none"> • What would be the impact of using Acoustic Deterrent devices on the bycatch of dolphins and of using illuminated gillnets on the bycatch of seabirds? • What would be the impact of a 3-month, 4-week or 2-week closure for all fisheries of concern on the bycatch of dolphins and seabirds, and on the profitability of the fisheries.
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The aims of the scenario breakout groups were that participants could validate and/or challenge some assumptions made by EcoScope about future user needs, learn more about the EcoScope Platform and tools, and provide feedback in response to specific questions. Pre-prepared **Mural templates** (see example in Fig. 3) were provided to guide the conversation. Different sections of the templates were uncovered as the group reached the corresponding phases of the discussion. Each breakout room had a facilitator from EMB to guide the conversation and the experts of the EcoScope Consortium were distributed throughout the breakout rooms to answer questions.

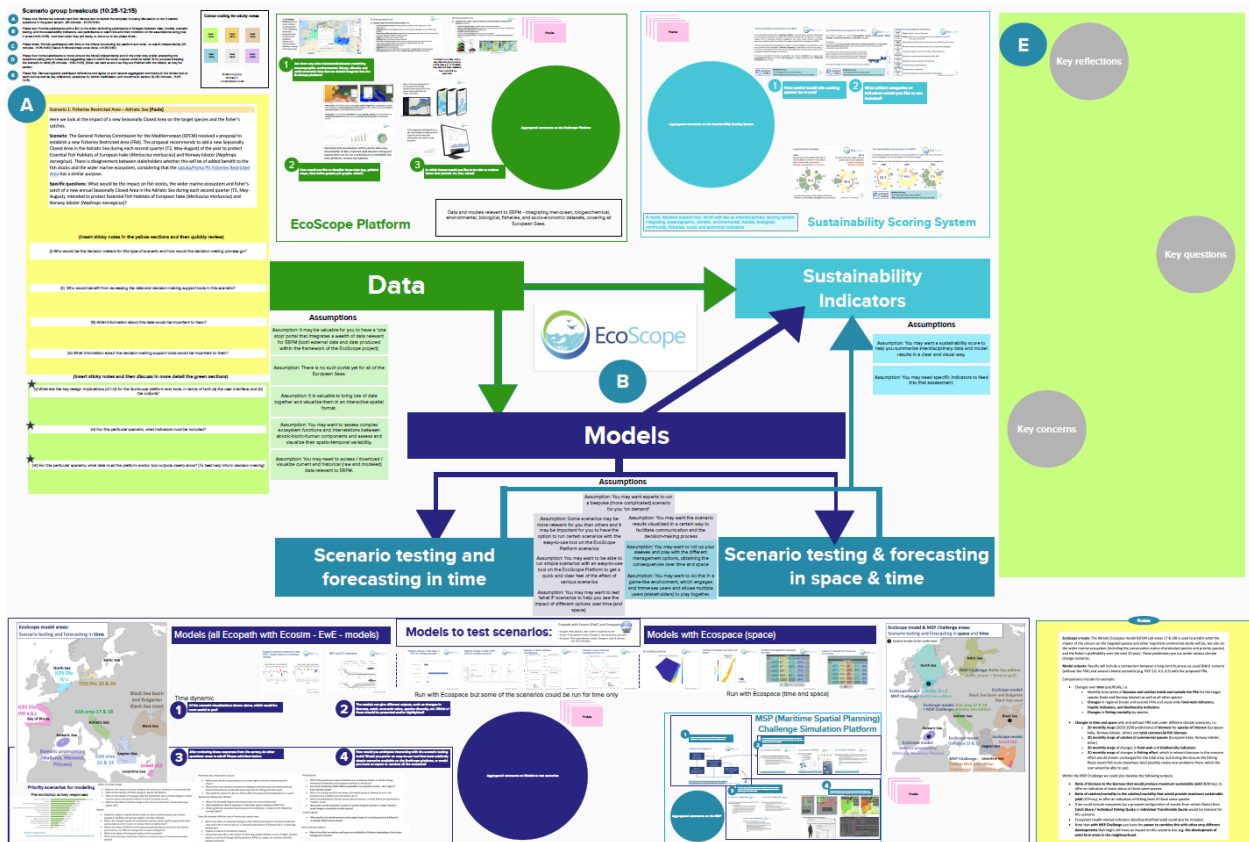


Figure 3: Example of a pre-prepared template that was used for the scenario work (phase 1) in the breakout rooms. The templates were created using the online website Mural¹⁰ and participants were able to zoom into the different sections and add comments¹¹.

In **part one** of the scenario breakout, participants were asked to go through a number of steps (Fig. 4) using the Mural template. These steps included: (1) Reviewing the scenario and completing a number of questions. (2) **Watching five videos**¹² on the EcoScope e-tools and their

¹⁰ Mural website: <https://start.mural.co/>

¹¹ Link to a Mural template (of scenario 1): <https://app.mural.co/t/lizziebgl3051/m/lizziebgl3051/1645175993001/6bfdadb7da86e1af05558ce71e173e233dd0e657?sender=6dcdc81e-725e-45cb-af44-c507b2f3ee24>

¹² Videos on EcoScope e-tools:

- **Video 1:** Introductory video on linkages between data, models, scenarios testing, and the sustainability indicators: <https://www.youtube.com/watch?v=yeyrCEBd-oA>

interlinkages and answering questions in relation to those videos. While answering the questions, participants were asked to focus on their needs, as well as to suggest ways in which the tools/ outputs could be better fit for purpose. (3) Discussing all participant comments together and agreeing on aggregated comments, as well as key reflections, questions, and concerns.

Scenario group breakouts (10:25-12:15)

- A** Phase one: Review the scenario and then discuss and complete the template, focusing discussion on the 3 starred questions in the green section (35 minutes - 10:25-11:00)
- B** Phase two: Provide participants with a link to the video reminding participants of linkages between data, models, scenario testing, and the sustainability indicators. Ask participants to watch this and then comment on the assumptions using post it notes (11:00-11:05). And then when they are ready, to move on to the phase three...
- C** Phase three: Provide participants with links to the videos introducing the platform and tools - to watch independently (25 minutes - 11:05-11:30) (Take a 5 minute break once done, c.11:25-11:30)
- D** Phase four: Invite participants to move around the Mural independently and in the order they prefer, answering the questions (using post-it notes) and suggesting ways in which the tools/ outputs could be better fit for purpose (keeping the scenario in mind) (15 minutes - 11:30-11:45). (Note: can start as soon as they are finished with the videos, so may be earlier)
- E** Phase five: Discuss together participant reflections and agree on and capture aggregated comments (in the circles next to each tool) as well as key reflections, questions for further clarification, and concerns (in section E). (30 minutes - 11:45-12:15)

Figure 4: The different steps of the scenario group breakouts that participants were invited to follow as they worked through the Mural.

For **part two** of the scenario work, **all comments** provided across scenarios **were consolidated by EcoScope e-tool** into another dedicated Mural template (Fig. 5). Three breakout rooms were established to discuss the consolidated comments further: one for the EcoScope Platform, one for the EcoScope Toolbox (the Sustainability Scoring System) and one for the models (including the EwE ecosystem models and the MSP Challenge Simulation Platform). Participants were asked to choose which group they would like to join and each room was joined by the relevant EcoScope experts. In this phase, the scenario-focused work shifted into looking across the

- **Video 2:** EcoScope Platform: <https://www.youtube.com/watch?v=yqobr645fA&list=PLx-M1rclt0mZETbDHxcpXgmyCfA08QZ97>
- **Video 3:** Scenario testing with EwE ecosystem models: <https://www.youtube.com/watch?v=4fKF5c1uMkl&list=PLx-M1rclt0mZETbDHxcpXgmyCfA08QZ97&index=3>
- **Video 4:** MSP Challenge Simulation Platform: https://www.youtube.com/watch?v=gBxsuwN_qBs&list=PLx-M1rclt0mZETbDHxcpXgmyCfA08QZ97
- **Video 5:** EcoScope Toolbox Sustainability Scoring System: <https://www.youtube.com/watch?v=w9snfFzj31Y&list=PLx-M1rclt0mZETbDHxcpXgmyCfA08QZ97>

scenarios and identifying what emerged across the groups, including key design implications for the EcoScope e-tools in terms of the user interface(s) and outputs.

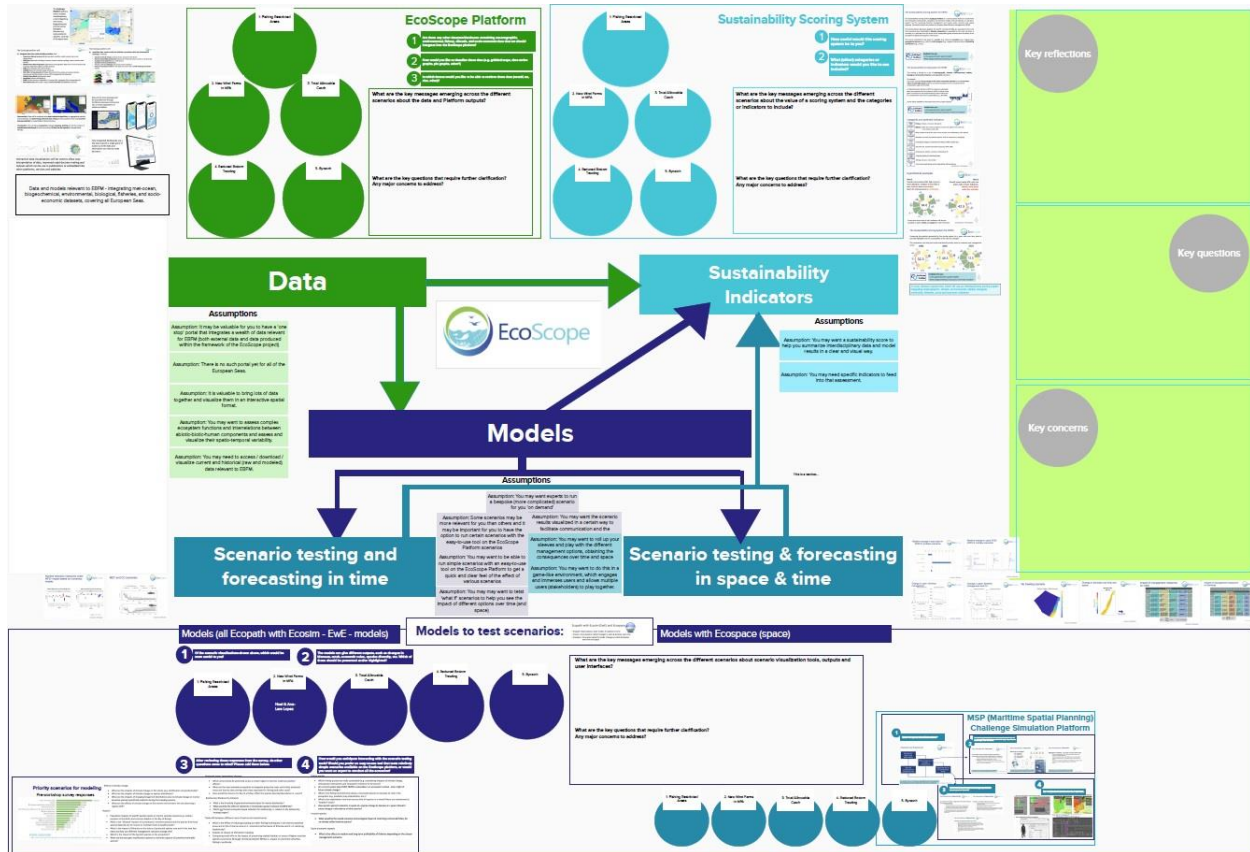


Figure 5: The consolidated Mural template for combining all comments provided across the scenario (phase two of scenario work)¹³.

The scenario breakouts were wrapped up with a **plenary discussion**, in which a rapporteur from each of the breakout rooms reported back on the key messages emerging across the different scenarios for the design and outputs of the EcoScope tool, as well as key questions or concerns that required further clarifications. This was followed by a group discussion, in which key areas that merited further attention were identified for discussion in the Deep Dive sessions.

¹³ Link to the Consolidated Mural template:
<https://app.mural.co/t/lizziebgl3051/m/lizziebgl3051/1645176194421/ef6d18e7b5e02a4a99b33860eb2744f8805d5e71?sender=dc334ed8-8a8d-43c1-bab4-ea1114591080>

3.2.4 Deep Dives and concluding session

The **Deep Dives** consisted of parallel group conversations in breakout rooms on prioritised topics that emerged from the preceding sessions. The topics for these sessions arose out of key questions, reflections and/or areas of concern expressed by participants. The focus was on identifying additional elements that stakeholders recommend that the EcoScope e-tool developers look into in order to strengthen the final product. Three topics were identified for further discussion: (1) addressing and communicating uncertainties; (2) incorporating socio-economic data; and (3) presenting data and information to different audiences. In addition, there was a Deep Dive on the socio-economic survey to discuss the components of the survey in more detail. Each Deep Dive breakout room was hosted by the relevant EcoScope experts. There was a breakout room facilitator in every room to take notes of the discussion in pre-prepared Google Docs (Fig. 6).

Topic A: INSERT during the coffee break
Question to address: INSERT during the coffee break
Discussion highlights:
Concluding recommendations to EcoScope:
•
Next actions:
•

Figure 6: Google Doc template that was used to take notes during the Deep Dive breakout room discussions.

The final part of the workshop was a **concluding plenary session**, in which the highlights from the Deep Dives were shared. This was followed by a discussion on some of the points raised in the Deep Dive sessions. The EcoScope project partners then shared their reflections and take-home messages and they informed all participants on the next steps and actions to carry this thinking forward. The facilitator, Lizzie Crudgington, concluded the day by thanking everyone for a productive workshop and taking all remaining closing remarks.

3.3 Results and insights from the workshop

3.3.1 Survey of societal expectations

Fourteen respondents (around 60% of the workshop participants) answered the online pilot questionnaire related to the large-scale survey of societal expectations, due to be implemented in Work Package 7.1. Of these, half (50%) were in advisory/scientific organisations, approximately a third (36%) were in policy/regulatory organisations and the rest (14%) belonged to other types of organisations.

The stakeholder responses indicated a general agreement with the priority features identified in the feedback questionnaire (Fig. 7). The stakeholders also wrote that they would like to find out about consumer willingness to pay for: reducing climate change; low waste and low-impact fishing; multispecies management; reducing impact on living coastal communities; and addressing social issues in general. Stakeholders also suggested that the questionnaire should provide an explanation of each of the attributes. One respondent argued that “willingness to pay”; questions should be complemented by other methods to capture consumer opinion on specific management alternatives.

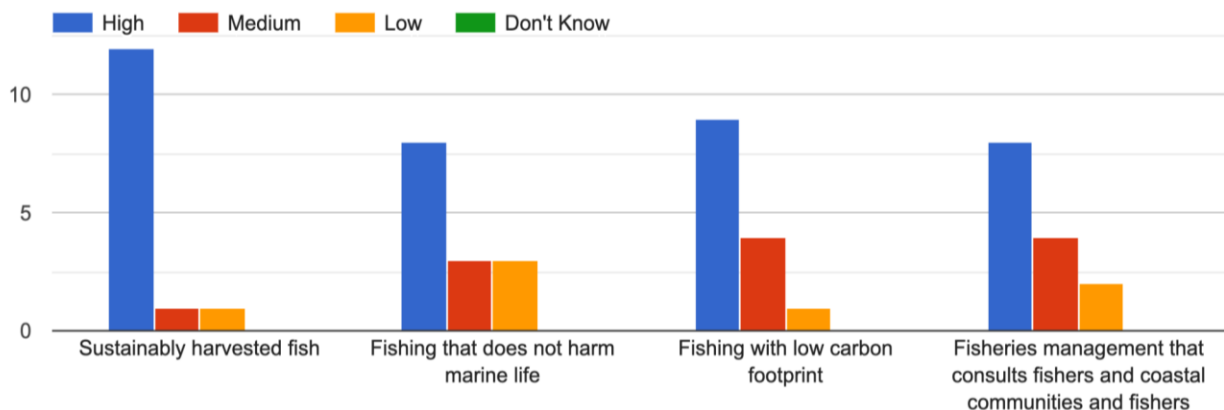


Figure 7: Workshop participant responses on to the relative importance of four EBFM features to identify consumer willingness to pay

There was also a general agreement with the priorities identified in the pilot to assess the wellbeing effects of a number of ecosystems services (Fig. 8). From these pre-selected ecosystem services, the least importance was given to valuing the wellbeing effects of “recreational services in a healthy marine environment” (Fig. 8). The respondents also suggested that the socio-economic survey could assess the wellbeing effects of the following two ecosystem services: (i) a clean environment with low amount of waste/pollution; and (ii) consequences of taking out large amounts of biomass (during fishing) on ecosystem functioning and other areas, such as economic, social and wellbeing. They also argued that clearer definitions were needed

for each of the phenomena being valued and that the method of subjective assessment by respondents should be complemented by objective valuation techniques.

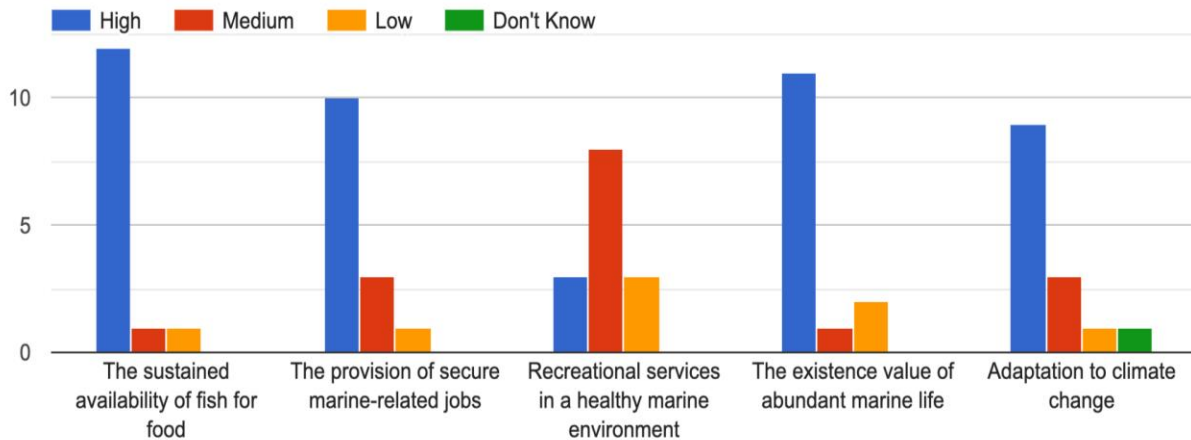


Figure 8: Workshop participant responses on the relative importance of five ecosystems services for assessing wellbeing effects

Regarding the relative importance of EBFM for achieving each of the 15 SDGs, the highest ranked SDG by respondents was “Life Below Water”. This was closely followed by “Climate Action” and “Responsible Consumption and Production”. “Decent Work and Economic Growth” was also considered a fairly relevant SDG, followed by “Zero Hunger”, and “Good Health and Wellbeing”. The least relevant SDGs were considered to be “Quality Education”, “Peace Justice and Strong Institutions”, “Gender Equality” and “Life on Land”. When asked whether other policy objectives should be presented to the public for ranking, the respondents suggested that it may be useful to pose questions about policy objectives that are relevant to specific regions. Finally, there were also suggestions to ask about the trade-off between traditional activities, community life and tourism.

Data collected in the stakeholder survey conducted *prior* to the workshop also provided various pointers to the survey. These included the stakeholder concern about the difficulties of defining EBFM, the need for additional research on socio-economic benefits, the need to identify levers to influence consumer behaviour and the need to inform policy on such matters.

3.3.2 Scenario-related questions

In each breakout room, the workshop participants provided answers to seven identical scenario-specific questions (Table 4). From these answers a number of principal needs and concerns arose (see Annex III for all original answers).

Table 4: List of questions for which participants were asked to provide comments in each scenario breakout room

No.	Question
(i)	Who would be the decision makers for this type of scenario and how would the decision-making process go?
(ii)	Who would benefit from accessing the data and decision-making support tools in this scenario?
(iii)	What information about this data would be important to them?
(iv)	What information about the decision-making support tools would be important to them?
(v)	What are the key design implications of (i-iv) for the EcoScope Platform and tools, in terms of both (a) the user interface; and (b) the outputs?
(vi)	For this particular scenario, what indicators must be included?
(vii)	For this particular scenario, what data must the platform and/or tool outputs clearly show? (To best help inform decision-making)

For the question *what information about the data would be important to you*, the workshop participants noted the following: **short-term versus long-term effects** (including seasonal variations); **socio-economic effects**; (cumulative) **ecological impacts** and **indirect impacts**; and **historical values**. The **data sources**, **quality of data**, **assumptions**, and **uncertainties** were also mentioned as important aspects of the data.

Uncertainty, credibility, and assumptions made were also key concerns across all scenarios in response to *what information about the decision-making support tools would be important to you*. Participants across the scenarios indicated that they need to understand the reliability and credibility of the results. Uncertainties should be clearly communicated for the scenarios modelled and the assumptions made.

In response to the question *what are the key design implications for the EcoScope Platform and e-tools, in terms of user interface and the outputs* the participants noted that the **interface and outputs** should be **simple and intuitive** to use and understand. However, respondents also underlined that the outputs should not be too simplified (i.e. they should be realistic and relevant) and that a clear representation of **confidence intervals and caveats** is be important. In scenario 1 (see Table 3), participants also said that it would be useful to have a **simple and expert interface** with a **customisable display** to select what types of outputs and indicators you get and in which format (e.g. charts, pies, tables). Furthermore, it was mentioned that it would be important

to be able to follow up model results with questions from decision-makers and stakeholders on e.g. the outputs and what the model sensitivity is.

The next question for each scenario was *what indicators must be included*. The overarching indicators were **biomass and catches** of the target species and other relevant species, **biodiversity indicators**, and **economic indicators** for fishers (e.g. profit). Furthermore, it was suggested to use **MSFD-related indicators** on e.g. biodiversity, food webs and sea bottom impact. In relation to setting up fisheries-restricted areas (FRAs in scenario 1, see Table 3), it was suggested to include the growth rate of target species prior versus post implementing the FRA.

The final scenario-related question was *what data the Platform and/or outputs must show to best help inform decision-making*. The respondents noted that the output should clearly show the **projected changes with the measures**. This could be a **graphical display of the current situation versus the forecasted situation** in x years (e.g. 1, 3 and 5 years) based on various management scenarios. Both **socio-economic and ecological impacts** were deemed to be important, including stock biomass and other species biomass trends, multi-species interactions, and changes in income, profitability and employment. Across scenarios, the respondents also indicated that the tools should show the **certainty/ uncertainty of the input data** (for instance through metadata), the **uncertainty related to the different indicators** calculated with the model outputs and the **assumptions made and data used in the modelling**. For scenario 4, a participant listed the following outputs that the Platform and/ or outputs should clearly show: (i) species and habitats protected under EU legislation (maps of distribution and condition); (ii) marine protected areas (e.g. Natura 2000 sites) and their conservation objectives/measures; (iii) future obligations from the Nature Restoration Law (habitats to be restored); (iv) habitats over which fishing with bottom trawling gear is prohibited by the Mediterranean Regulation; (v) important fish spawning and nursery areas; (vi) capacity of seabed sediments to mitigate climate change; (vii) detailed fishing activity; and (viii) economic data linked to spatial distribution of fishing (landings, profit).

3.3.3 Feedback on EcoScope tools

EcoScope Platform

Workshop participants were asked to provide feedback to the following three questions on the EcoScope Platform: **(1) are there any other datasets EcoScope should integrate in the Platform;** **(2) how would you like the data to be visualised** (e.g. gridded maps, time-series graphs, pie graphs, etc.); and **(3) in which format would you like to retrieve the data**.

For question 1, participants suggested **integrating the datasets compiled in Table 5 into the EcoScope Platform**. A key concern was that there is **indispensable data that is not publicly available** (such as the International Bottom Trawl Survey in the Mediterranean (MEDITS)). The stakeholders asked how EcoScope would deal with those situations. This was also reiterated in another comment where a participant noted that although the EcoScope Platform is a very nice

idea the main challenge will be getting agreement from some data providers and **validating datasets** coming from less official sources. These datasets can be very valuable but need to be **quality checked** and the participant wondered who will do that. Another question was to what extent **information from areas outside European Seas** could be included, since many relevant species do not always stay in European Seas (e.g. widely distributed species from the Northeast Atlantic). Participants also wondered what the **role of aggregators such as EMODnet and SeaDataNet** would be. Finally, a key concern was how to **integrate socio-economic data** into the Platform.

For question 2, participants reiterated that it is important that the **visualisation of the data** is **simple and intuitive**, but also **clearly shows their limitations**. They suggested that a **combination of options** (e.g. the suggested gridded maps, time-series graphs, pie graphs, etc.) should be available as the option that is most useful depends on the context and use-case. One participant further suggested that although the results should be simple and easy to understand, there should be the **option to dive deeper**. This might include different levels of information for different users, including the ability to understand limitations and strengths of the model approaches. Another participant highlighted the importance of **assumptions** and **certainty of data being clear**. It was suggested to visualise **the presence of data gaps** and any **weaknesses in the data**, and to communicate **uncertainty** when presenting results. Finally, it was suggested to add **statistical outputs in graphs and tables** to be exported, and that the **tools should be downloadable** to be used in research papers. Regarding how to retrieve the data (question 3), participants mentioned that **data in csv/ xlsx** and **images in pdf/ png** would be useful.

Table 5: Additional data that workshop participants suggested should be included in the EcoScope Platform	
Category	Details/ examples
Fisheries surveys	<ul style="list-style-type: none"> • IBTS (International Bottom Trawl Survey); • Other data included in DATRAS (Database of Trawl Survey)¹⁴; • MEDITS (International Bottom Trawl Survey in the Mediterranean).
Official EU level data on species and habitats	Official EU level data on protected habitats, species and areas (Natura 2000, conservation status assessments, etc.).
IUCN red list data	IUCN red list data on marine habitats

¹⁴ Database of Trawl Surveys (DATRAS): <https://www.ices.dk/data/data-portals/Pages/DATRAS.aspx>

Member States data	Member State or regional data on distribution/ condition of habitats (often hidden in government agencies or other data repositories, such as Regional Sea Conventions) → difficult to access, but worth trying
Output of studies and projects	Outputs of studies, projects like Horizon, scientific literature, expert reports → need validating before inserting
Fishing activity	For fishing activity, it would be good to get official Member State data in addition to independent information from other sources
Bycatch	For by-catch also Ocean Biodiversity Information System (OBIS) ¹⁵

Other comments on the Platform were to question the assumption that everyone will want to access the tools, pointing to the need of **defining the end user more clearly**, and that users may not want to access the platform and tools on their phones. Finally, there was a **concern** expressed by more than one participant that there are **already similar portals and whether we need another one**. It was also noted that there are already many new platforms and that we may be creating a lot of similar but not necessarily interoperable tools. It was stressed that EcoScope should define **how the EcoScope Platform will fit within the context of the EU Digital Twin Ocean (DTO)** and how to make sure it is **interoperable** and that we are **not duplicating efforts**.

EcoScope Toolbox

For the EcoScope Toolbox, workshop participants were asked to provide feedback on the following two questions: **(1) how useful is the scoring system; and (2) what (other) categories of indicators would you like to see included.**

Although some participants mentioned that the scoring system could be useful because it is easy to interpret, in general participants had **concerns about the usefulness of the scoring system**. The main concern was **how to weigh the various elements** to come up with a final score. It was noted that it is very difficult to assign the weight and score to each category and that this normally **involves bias** from the people setting it up. For instance, the fishing sector will probably have a different view on how things should be weighted than an environmental manager. It was therefore noted that a sustainability score may be more misleading than helpful. One suggestion was that the **users could produce their own scoring system** that corresponds to their needs and preferences. Another suggestion was that the **weighting should be decided among stakeholders**. Overall, it was seen as **essential to show how the indicators were weighted**

¹⁵ Ocean Biodiversity Information System (OBIS): <https://obis.org/>

and to know how they contributed to the overall sustainability score. Participants noted that this should be an integral part of the results the user receives together with underlying assumptions.

Another concern about the scoring system was its ability to **capture the complexity** of the system and being able to strike the right **balance between showing details versus a clear picture**. The participants said that although simple outputs are helpful, it is important to understand what is going on and that overly aggregated indices are not always useful. Specific suggestions included to have the **possibility to see the individual components of the sustainability wheel**, and to have a ‘basic’ information-dense output and an ‘advanced’ more detailed output and let the users chose between the two options. It was also noted that showing **indicators of change** would be interesting (e.g. **percent reductions or increase**) to see if the situation is getting better or worse and be able to apply action to solve the trend. This participant further noted that the scoring should be the last step, integrating all indicators into one score after the individual indicators with percent reductions or increase had been shown. Another participant suggested that rather than a “deterministic” score **a probabilistic plot or performance index might be more useful**. Finally, it was noted that for advocacy it is important to see how the components of the sustainability wheel have been developed (e.g. **no black-box**) and that decision makers would also like to see percentages and uncertainties, as well as how the model results have been translated into the indicators.

Regarding **other indicators that should be included** in the sustainability wheel, participants suggested **size and age distribution of commercial species** (because it is important as a warning flag) and **impact on different fleet segments** for scenario 1 (i.e. addition of a new FRA). For scenario 2 (i.e. addition of wind farms and a strictly protected areas) **changes in distribution, changes** in average **trophic level** and **seafloor disturbance** were suggested as additional indicators. For the **indicator on seafloor disturbance** it was specified that ICES is developing methods to assess seafloor disturbance by trawling and that such an indicator will be needed given the recent attention to demersal trawling and its consequences. For scenario 4 (i.e. reducing bottom trawling), a participant noted that the indicators linked to **biological communities** should be **status indicators (i.e. their condition) and not distribution** (as they may be there but in a bad condition). It was noted that the same applies for MPAs: their effectiveness rather than their presence would be a good indicator. This participant further noted that the challenge will be to **find indicators at the required scale**. Further comments included that the specific indicators depend on the context and that it is important to **be clear which indicators are included in each indicator category**.

EwE ecosystem models

For the EwE ecosystem models, the workshop participants were asked to provide feedback to the following three questions: **(1) which of the ten scenario visualisations shown in the Mural would be most useful to you** (Fig. 9); **(2) which of the model outputs should be presented and/or highlighted** (e.g. changes in biomass, catch, economic value, species diversity, etc.); **(3)**

would you want an easy-to-use scenario testing tool to test relatively simple scenarios on the EcoScope platform, or an expert to conduct all the scenarios. In addition, participants were asked to ***(4) review the priority questions for scenario testing that had emerged from the stakeholder survey*** (Table 6), ***and add any other questions that they deem important.***

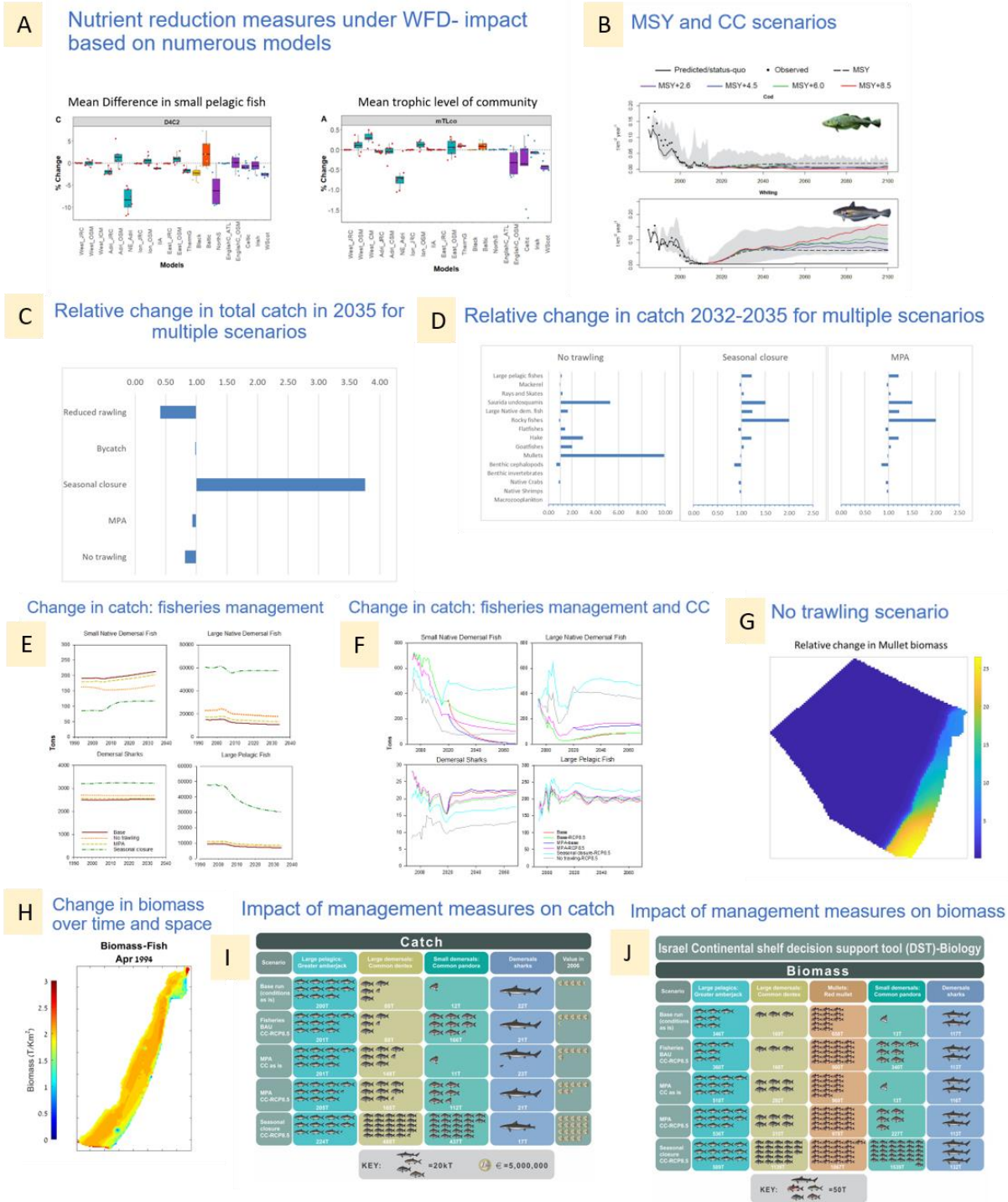


Figure 9: Scenario output visualisation options (A-J) presented to the workshop participants in the EwE modelling section of the Murals. Participants were asked to indicate which of these types of visualisations would be most useful to them.

Table 6: Priority questions for scenario testing that emerged from the stakeholder survey conducted prior to the workshop

Category	Questions
Effects of climate change	<ul style="list-style-type: none"> • What are the impacts on fish stocks (e.g. distribution and productivity)? • What are the impacts on species distribution? • What are the impacts of changing forage fish distributions due to climate change on marine sensitive species (specifically seabirds during the breeding season). • What are the effects on the marine environment. Are we observing a regime shift?
Bycatch	<ul style="list-style-type: none"> • Population impacts of specific bycatch levels on marine sensitive species (e.g. harbour porpoise in the Baltic and common dolphin in the Bay of Biscay); • What is the "allowed" bycatch of a protected / sensitive species (and the species that these species depends on) to recover or maintain them at healthy levels? • What is the impact of fisheries on the status of protected species now and in the next few years and how can different management scenarios change this? • Which is the impact of the bycatch species on the ecosystem? • What are the best gear modification options to minimize capture of juveniles/vulnerable species?
Protected areas/ restoration/ closures	<ul style="list-style-type: none"> • Which areas should be protected across a certain region to harness maximum positive effects? • What are the most valuable ecosystems to designate protected areas and strictly protected areas and how do they overlap with areas important for fishing (and other uses)? • How would the closure of x Bay to y fishery effect the species diversity/abundance in z years?
Biodiversity/ biodiversity indicators	<ul style="list-style-type: none"> • What is the threshold of good environmental status for marine biodiversity? • What would be the effect of reductions in 'charismatic species' (relevant to MSFD D1)? • Which are the best ecosystem based indicators for biodiversity, in relation to the Biodiversity Strategy targets?

Trade-off between different uses of marine and coastal areas	<ul style="list-style-type: none"> • What is the effect of reducing trawling (or other fishing techniques) in all marine protected areas and in X% of marine area on 1. economic performance of fisheries and 2. on restoring biodiversity? • Impacts of closure of x% bottom trawling; • Computing trade-offs on the impact of preserving seabed habitats or areas of higher sensitive species occurrence (through 'strictly protected' MPAs) vs. impact on economic activities, fishing in particular.
Fishing quotas	<ul style="list-style-type: none"> • Which fishing quotas are really sustainable (e.g. considering impacts of climate change, interspecies interactions and ecosystem resilience to stressors)? • Are current quotas (also FMSY; BMSY) sustainable in an ecosystem context - also in light of future climate change? • What is the fishing mortality that allows a harvested species to develop its role in the ecosystem (e.g. predator prey-interactions, etc.)? • What is the exploitation rate that ensures that all species in a mixed fishery are maintained at "healthy" levels? • How would x percent reduction in quota of y species change its biomass in z years? Would it cause changes in abundance of other species?
Invasive species	<ul style="list-style-type: none"> • What would be the overall economic and ecological impact of restricting commercial fishery for an already settled invasive species?
Socio-economic aspects	<ul style="list-style-type: none"> • What is the effect on medium and long-term profitability of fisheries depending on the chosen management scenarios

Four participants commented on question 1 (i.e. **which visualisation would be more useful**, Fig. 9). Two of these four participants indicated that the usefulness of the visualisations **depends on the context**, policy question and use case. For instance, a barplot would be more useful to understand percent recovery, a time series trend to understand the timeline of the recovery, and a map to visualise the locations where the recovery will happen. The third respondent answered that **summary advice graphs with the main indicators** would be useful, while the fourth said the graphs on the right (i.e. **graphs G-J in Fig. 9**) are **easier to interpret**. On the assumption “*you may want the scenario results visualized in a certain way to facilitate communication and the decision-making process*”, a participant commented that it would be helpful to not only have maps and spatial layers but also **numbers in addition to plots** (e.g. in tables or on the plot). Another participant noted that the more fancy the presentation of results, the less uncertainty is in the minds of the users. The participant therefore highlighted that it is **important to present**

assumptions and weaknesses together with fancily presented results. Overall, it was noted that EcoScope should be able to **give simple overviews** of the outputs, but **also allow to dive deeper** if needed to cater to a wide range of end-users.

For question 2, i.e. **which outputs should be presented or highlighted**, two participants noted again that it **depends on the context**, use case, policy question and indicator selected. A third participant indicated that all of the suggested ones (i.e. changes in biomass, catch, economic value and species diversity) would be important **depending on the stakeholder**. A fourth participant noted that biomass, economic value and diversity would be most important. It was also suggested that the **user should be given the option to select the relevant outputs**. One participant noted that it would be useful for multispecies management plans to show **species interactions related to the profit of different fleet types**, i.e. how the fishing of different species affects the economy of different fleets. Finally, the stakeholders asked whether it would be possible for users to get in contact with the scientists developing the models to make sure that the input is correct and used correctly.

For question 3, i.e. if they would prefer an **easy to use tool on the EcoScope Platform or experts to conduct the scenarios** the participants answered that **both will be needed** since some scenarios will be simple and others complex. There was also **strong support for bespoke scenarios run by experts**, with four participants explicitly approving this assumption in the Murals. Participants noted that the possibility of analysis on demand is a very good assumption, and that this will be very useful and important, as there is a need for scientific expertise. The need for bespoke scenarios testing was also highlighted by a participant in scenario 4 (on reducing bottom trawling by x percentage in the Balearic Sea). The participant indicated that it would be more useful to have more specific spatial scenarios tested than just 5-10-15% closure because fishing is not equally distributed in time and space. For instance: 1) all MPAs closed to trawling, 2) all MPAs and low effort areas closed (as in recent ICES advice for MSFD purposes), 3) fishing maintained in core areas outside MPAs, etc. The participant further suggested that the model should recognise as a baseline the legal prohibitions that are not open to flexibility in any given scenario, for example prohibited habitats under Mediterranean Regulation, measures in MPAs, etc.

No further **priority questions for scenario testing** were added to the preliminary list (Table 6). Two participants commented that they would like to see concrete examples of how the models answer those and other specific policy questions, and that this needs to be done together with stakeholders.

Other comments on the modelling section were that it would be useful to have **two levels of outputs**: detailed for scientists and advisors, and simpler for decision makers and stakeholders. It was suggested to develop **tutorials for non-experts** to use the models. It was also noted that it is **important to ensure that advisors can explain details to decision makers**, i.e. to ensure that the information is available to them if needed. One participant asked whether scientists could

develop modules that could be **integrated after the project is finished**, thereby developing the support system further. Three additional questions on the models were: whether they are time demanding to run, whether other ecosystem models (except EwE) can be used in EcoScope and how the models deal with uncertainty. Regarding the latter, participants noted that it is **crucial to visualise the level of uncertainty** in the model outputs, and that end-users should be able to see **where the data has come from** and if there are any **major data gaps**. They noted that the level of uncertainty and lack of data are important information for the decision-makers.

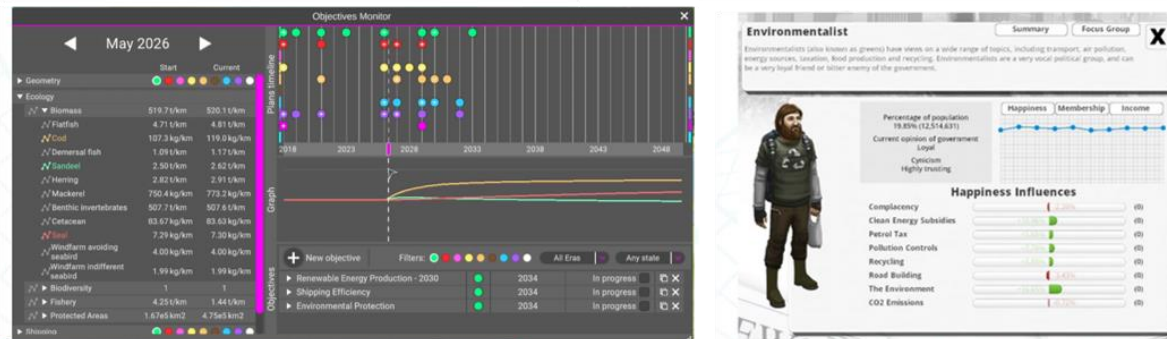
MSP Challenge Simulation Platform

Workshop participants were asked to provide feedback on the following questions for the MSP Challenge Simulation Platform: **(1) what are your first impressions of the MSP Challenge Simulation Platform and how might it help users in this scenario¹⁶**; **(2) are the assumptions about what users will want at the 'Overview' and 'Optional Dig' levels correct, and do you recommend any alterations**; and **(3) please provide comments on the mock-ups (Fig. 10) for presenting data to users: are they of interest and helpful? How can they be improved?**

- (A) With mind maps to discover what influences what
- (B) With 'before & after' option to compare spatial changes through time



- (C) With graphs and sliders to shift through time
- (D) With stakeholder-specific dashboards



¹⁶ i.e. in each of the five hypothetical scenarios (Table 3)

Figure 10: Mock-ups for visualising and adjusting MSP Challenge Simulation Platform outputs presented to the workshop participants for commenting on the Murals.

The section of the MSP Challenge Simulation Platform had the least amount of comments from all participants. There were two comments on the **mind maps** (Fig. 10A) indicating that they are **not clear** and that they are complex to understand. One participant suggested that something simpler (either up or down; or red or green) might be easier to understand. For the **Optional Dig** one participant commented that users may like the possibility of **comparing two scenarios**, or doing a trade-off analysis. For the **stakeholder-specific dashboards** a participant noted that it might look as if someone is attempting to assume what the different stakeholders like or appreciate and that this **could cause issues**. Finally, two participants commented on the **usefulness of the ‘before & after’ plots** (Fig. 10B) indicating that they are very useful for decision-makers, **especially the green and red colour coding as people are already used to these approaches**. This was also supported by another participant who indicated that it is useful to have outputs that people are familiar with and that you don’t have to explain from scratch.

3.3.4 Key reflections, concerns and questions

Each Mural included a section for key reflections, questions and concerns. **Key reflections** by participants were that: (i) this **cannot be a black box tool** because users need to be able to understand the underlying aspects to make informed decisions and be able to justify those to different parties; (ii) **co-creation in the scenario-addressing process is key**; (iii) it is important for users to be **pointed to weaknesses in data**; and (iv) there is a need to **emphasize uncertainty when presenting results**. Furthermore, a participant stated that the ‘you’ here (e.g. when asking ‘how useful would this be for you?’) would never be a decision-maker, but a scientific advisory group or advocacy group. It was further noted that **high-level decision makers will probably not be looking at the tools themselves**, but instead will be **guided by advisors and scientists** who will use them to provide guidance and outputs, as well as supporting background information.

Participants stated that **key challenges** would be to **involve the appropriate users** and **ensure coordination with other platforms**. Moreover, **co-developing of models** was seen as a challenge because it **can take a lot of time**. However, it was stated that co-development of the tools is key and that in many cases, when the tools are created without the direct involvement of the users, their use is limited.

Key concerns were that the **quality and reliability of the results** and that the **assumptions** in the modelling need to be **clearly explained**. Another key concern was that **creating general tools for different policy questions** was seen as **difficult** or not useful, because nowadays models are built to answer specific policy question and using the tools available to answer that question.

Key questions were: (i) to what extent is the **science robust enough** to be used by managers, and can it be **validated by STECF/ ICES**; (ii) what is the **reason for creating a new tool** since many tools and databases already exist; and (iii) are there any **examples** in which **ecosystem models** have been **used in managing resources** at medium or large scales, such as sea basins and management areas (e.g. GFCM GSAs)?

Finally, two participants commented that the **project is very interesting** and that the **work is very useful**.

3.3.5 Deep Dives

The three topics that were chosen for in-depth discussions in breakout rooms were: (1) addressing and communicating uncertainties; (2) incorporating socio-economic data; and (3) presenting data and information to different audiences. In addition, there was a Deep Dive on the socio-economic survey to discuss the components of the survey in more detail. The participants spread approximately evenly among the first three topics. No participant chose the socio-economic survey breakout topic. Therefore, the survey was not discussed further during the workshop.

Topic 1: Addressing and communicating uncertainties

This first Deep Dive topic was on addressing and communicating uncertainties. The EcoScope expert explained that there are **different types of uncertainties** (e.g. **data uncertainty, model uncertainty**, etc.) and that the complexity is that the data can be certain at some scales, but the models less certain or *vice versa*. Specific questions addressed in this breakout room were how to communicate and label these different types of uncertainties and the extent to which they influence the final results. Other questions were how to best label the quality of the data and portray any lack of data (e.g. blank spots in the map).

One suggestion was to have the **results validated** by large trusted organisation (such as ICES). The **label** could include who has looked at the data/ models and by whom it has been **peer-reviewed**. However, the EcoScope expert noted that even if the models have been validated they will still have uncertainty and that it is important that this is understood by non-modellers if they use the model outputs. A participant further noted that a perfect model that gives all the perfect answers will never exist and that **there will always be uncertainties associated with models**. But it is important to train decision-makers to understand that if the models are correct the uncertainties are much less than if you use other less detailed and complex tools.

Another suggestion for communicating uncertainties was to add a disclaimer box saying that there is uncertainty in the results. However, it was noted that this could lead to decisions not being made because of uncertainty and that **probabilistic approaches** are an alternative. Here you portray the output with the maximum likelihood or show **ranges of possible outcomes** (e.g. with

confidence intervals) instead of final numbers. This could help in applying the precautionary buffer in management, which is a policy requirement: the higher the uncertainty, the higher the precautionary buffer should be.

Lastly, it was noted that we should not allow the difficulty in communicating uncertainties to become a hindrance for stakeholder involvement, and that it is also very **important to communicate the certainty of the results**. For instance, the certainty about a trend, the continuation of certain activities or what the results will be. As an example: there is certainty that climate change will occur and that the consequences will be detrimental, but there is uncertainty about the extent of these detrimental impacts. It was therefore concluded that **trends may be more important than the values**, because there is much **more certainty in trends** and they are also **easier to communicate** than specific values.

Finally, participants re-iterated the importance of keeping in touch with the end-users as the tools are being developed.

Topic 2: Incorporating socio-economic data

The discussion on incorporating socio-economic data was opened with a note that it is important to **know what managers and stakeholders are interested in to include the correct data and indicators**. For instances, a management decision can have different effects for the various fleet segments, and some stakeholders may be interested in the amount of jobs created/ maintained/ or lost, while others may be interested in the overall profit or the profit per fleet segment. It was also noted that it is important to **balance social and economic indicators**. For instance, for the trawling sector economic indicators (e.g. fuel and energy input) are more important, while for small-scale fisheries social indicators (e.g. employment) are key. To keep this balance, participants recommended to talk about 'social- and economic indicators' rather than 'socio-economic indicators', as the latter term tends focus more on economic indicators.

Another participant noted that when **looking at policy, we already have a lot of frameworks with high level objectives**: in a sense there is a suite of legal documents that are illustrating the landscape in which we are operating. However, some targets are only vaguely defined and can be interpreted in different ways. It is therefore not always clear how these legal objectives could be operationalised for a given system. For instance, Maximum Sustainable Yield (MSY) from the Common Fisheries Policy (CFP) could be taken as a lower limit, while Good Environmental Status (GES) from the Marine Strategy Framework Directive (MSFD) could be seen as a higher objective because you also need to leave food for birds, mammals, etc. In addition, there is **national legislation** that is applicable in the case study areas. DG MARE, for instance, is interested in the requirements of the CFP, but the CFP is implemented nationally, where managers need other information. Thus, **not all managers are interested in the same information**. Here social and economic indicators can support a discussion between the different actors.

It was further stated that there is a **level of optimisation that needs to happen** to find the **optimal social and economic prosperity** and that **models are the right tool** to find this optimisation. The participant therefore stressed the important of including social and economic information into the models. Moreover, it was noted that **spatial distribution of socio-economic models is very important** for socio-ecological management, but we have not formalized this framework and that still needs to be done.

To this, one of the EcoScope experts answered that it is possible to do optimisations in models (at least temporarily). The **problem is that the data are often not available**. This person further suggested that if we could do this properly in one of the EcoScope case study areas, it would be very valuable. The expert also noted that you can use the models to check what will happen if, for instance, you implement all the requirements of the MSFD properly, but that the models will not give you a large amount of socio-economic data. The models might give you: price of fish, the value of the fish you catch and the number of jobs created. These outputs can then be a starting point to do more interesting socio-economic modelling on top of that.

Another participant noted that **a lot has been done already on socio-economic indicators**. For instance, the **JRC** annual report on fisheries and aquaculture contains information collected by Member States that can be accessed through the system. Also, **STECF** is looking at economic aspects of specific TAC decisions and what the impact is on different fleet segments. Moreover, **ICES** has working groups on economic and social indicators. These working groups are looking at identifying relevant indicators and the data you need to inform them. The participant suggested that **a relevant person from EcoScope could present the project to these ICES working groups** (particularly the economic one) and this may start an **exchange and collaboration** with benefits for both parties.

A further comment to the discussion was that **socio-economic data can be confidential** and are therefore often **difficult to obtain**. If the data are used in a way that respects the confidentiality perhaps it would be possible to obtain some of these data from ministries. Moreover, for organisations that formulate research agendas, it is important to know what socio-economic data are currently lacking, so that this can be added to future research calls. To the point of confidentiality another participant added that we have to find a way of **obtaining data in the right resolution**, so that it can **inform management but it does not compromise confidentiality**.

Finally, a participant noted that the **reason why ecological modelling has not been used much in management** to date is because managers are mostly interested in the **social and economic impacts** and these are **not sufficiently included** in models. For instance, for FAO important indicators are the number of people employed, the gender balance and the number of young fishers employed. Moreover, some managers regard **Maximum Economic Yield (MEY)** as a more meaningful target than MSY and this is often not included in models. **Socio-economic data are very variable** and they therefore need to be standardised. For instance, fuel prices can vary greatly between years, or invasive species can be suddenly an important source of income for

fishers. The participant therefore stressed the **need for regular and harmonised socio-economic data collection to improve the models**.

Concluding **recommendations** from this breakout discussion for EcoScope were: to (i) check with STECF and ICES for all economic and social data that are already out there and could inform the EcoScope models, and (ii) improve and develop coupled models between environmental and socio-economic aspects.

Topic 3: Presenting data and information to different audiences

The last Deep Dive was on presenting data and information to different audiences. Suggestions from previous sessions were to have: (1) **different interfaces depending on the target audience**; and (2) the **option to dig deeper into a summarised output**. The EcoScope experts invited the participants to provide their opinion on how best to present the results.

The breakout room participants agreed that the outputs will be a key component of EcoScope and that it is important that the project carefully defines the target audience to present the outputs accordingly. It was also noted that **different stakeholders are interested in different outputs**: for instance, socio-economic impacts are important for fisheries associations; biodiversity consequences for environmental managers; and indicators like MSY/ MSY biomass (BMSY) for performing stock assessments. Overall, the group identified **two main target audiences**: (1) **stakeholders that want summary results** with simple plots and numbers that are very clear and easy to understand (e.g. politicians, fishermen, etc.), and (2) **stakeholders that need more details** and the possibility to dig further and understand the background (e.g. scientific advisors, advocacy groups, etc.). It was suggested that a solution could be to **have different layers of information**.

The need to work together with stakeholders during the whole process of creating outputs was also stressed: **co-creation and involvement of stakeholders is key**. The participant further noted that **ICES is a key player** and that there is a **risk of creating very good models that ICES will not use** in the end. It was also noted that there can be **large differences within stakeholders**: for instance, from **North to South**, or **between fishing sectors** (e.g. pelagic trawler versus small scale fisheries) and that this has to be considered in the communication approach. Examples of past EU-funded projects with **excellent communication approaches** are: **CLIMEFISH** and **MareFrame**. The communication for both of these projects was done by CETMAR (Galicia, Spain).

The EcoScope partners noted that co-creation is an on-going process in EcoScope and that there will be many opportunities to interact and obtain feedback from key stakeholders. Moreover, it was stated that the ambition of EcoScope is that there will be **indicators for all the different types of stakeholders** (e.g. policy/ regulatory stakeholders, advisory bodies and advocacy organisations). Preliminary ideas from the EcoScope tool developers were that related indicators

could be shown side-by-side or there could be different interfaces relevant for different stakeholders. It was also stressed that it is important to remember the **concerns** from previous sessions of **simplifying and aggregating the outputs too much**. One option would be to have a **simple overview where you could click further** to see how this overview came to be. Another option could be to **allow users to modify the aggregations** to the extent that it makes sense to do so. For instance, the system could allow you to shift the weights of the indicators within a certain range (e.g. according to the uncertainty that there is in how they should be weighted).

There was support for this approach from the participants, noting that this could allow users to add their own views and priorities rather than showing a final output based on a weighting with which the users might disagree. Participants further noted that it is always a **dilemma how to aggregate individual scores** meaningfully and that another option would be to have a **range of indicators** like in the MSFD that are **not aggregated** to a final numerical score. The **status** of these indicators could be shown **with a traffic light system**: with green if they are in a good state and red if they are in a bad state. However, participants also noted that the problem with the traffic light approach is that you need either a **baseline or thresholds**, and that these **can be difficult to set**. One solution could be to have the year when the different management options are being evaluated as a baseline and project any improvements or deteriorations based on those management options for future years.

3.3.6 Plenary discussions

Three topics were discussed in more length during the plenary discussions: (i) scenario testing and how the policy issues will be identified, (ii) running scenarios as a non-expert, and (iii) the scoring system (assigning weights and uncertainty).

The first central query that came up during the plenary discussions was **how will EcoScope define the policy questions/ scenarios to be tested**. The question was whether the project is planning to test concrete policy issues that have been identified with stakeholders, or whether the aim is to have a conceptual framework that can be used in different settings. It was noted that the former would be more concrete and helpful. The EcoScope experts explained that the idea is to have both, i.e. an infrastructure to test hypothetical scenarios but also to go further and be able to ask concrete policy questions. A participant further stated the hypothetical scenarios used during the workshop are close to many needs of key stakeholders, such as how to protect marine areas while increasing the benefit for fishers. There is therefore definitely scope to use the scenarios for answering policy questions and there will be more concrete policy questions coming up in the near future with the EC Action Plan for Fisheries and the EC Nature Restoration Law. The participant therefore urged the EcoScope experts to stay in touch following the workshop and have a discussion on what is feasible with the models versus what questions stakeholders would need answers to. The EcoScope partners agreed about the importance of consultation and noted that for each case study area the specific scenarios will be identified with relevant (local) stakeholders through formal and informal consultations.

A second central discussion topic was on **using the EcoScope tools and running the scenarios as non-expert users**. Participants expressed a concern that the tools might be used wrongly by the public resulting in wrong results and “pseudo-science”. It was stated that to give advice we need to build on precautionary approaches. One suggestion was to have a “non-expert mode” and an “expert mode”, with the non-expert mode having more complicated features locked. Another participant provided support to this suggestion and stressed that uncertainty must be visible for the end-user. For instance, if there is no information about the discard rates, this should be clearly visible in the end results, so that people that are non-experts can take informed decisions. An EcoScope expert noted that while “fake news” and people doing their “own research” is a concern, we have to be mindful of the positives of open science and if people do not understand the models they will always be seen just as black boxes. It was therefore stressed that we have to find a solution for this. There was support for this from participants, noting that there should definitely be ways out of this dilemma. For instance, the “non-expert” tools could be used in Ocean literacy initiatives (e.g. for school classes, museums, etc.). It was noted, that overall it is important to work on trust and that there are indicators already being developed (e.g. in the context of the MSFD) which should ideally be supported and applied by EcoScope.

The third main topic of discussion was on the **sustainability scoring system**, i.e. the EcoScope Toolbox. First, it was noted that it is important to capture uncertainty in the scores. Second, a participant stated that a final single score may be misleading because one indicator may have increased, but five could have decreased. Moreover, each indicator is an integrated indicator and the individual indicators may not be comparable. It was therefore suggested that the final score could be the endpoint of the whole process and that it might be more useful to compare individual indicators over time. Another participant noted that a scoring system is always simplified and that there will always be people disagreeing with that particular way of scoring. Therefore, the participant recommended that EcoScope thinks carefully about the added value of combining all indicators into a final score as opposed to showing them separately as is done in other places (e.g. in the MSFD, JRC, etc.). One of the EcoScope experts suggested that indicators are useful for people to understand complex ecosystems, but that they should not be the only tool. Another EcoScope expert noted that the Ocean Health Index¹⁷ could serve as a good example, as it is very clear what each indicator includes. For instance, some ports do not have harbours and therefore they would score poorly for fish landings if they would be evaluated by that indicator. Moreover, the advantage of scores is that if two areas are similar and one has a better score, the area with the lower score could learn from the one with the better score.

¹⁷ Ocean Health Index: <https://oceanhealthindex.org/>

A final comment from a participant was that it is important that the **EcoScope models are kept up to date** with, for instance, the observed effects of climate change, the addition of hard substrates, etc. so that they remain useful and realistic in the future.

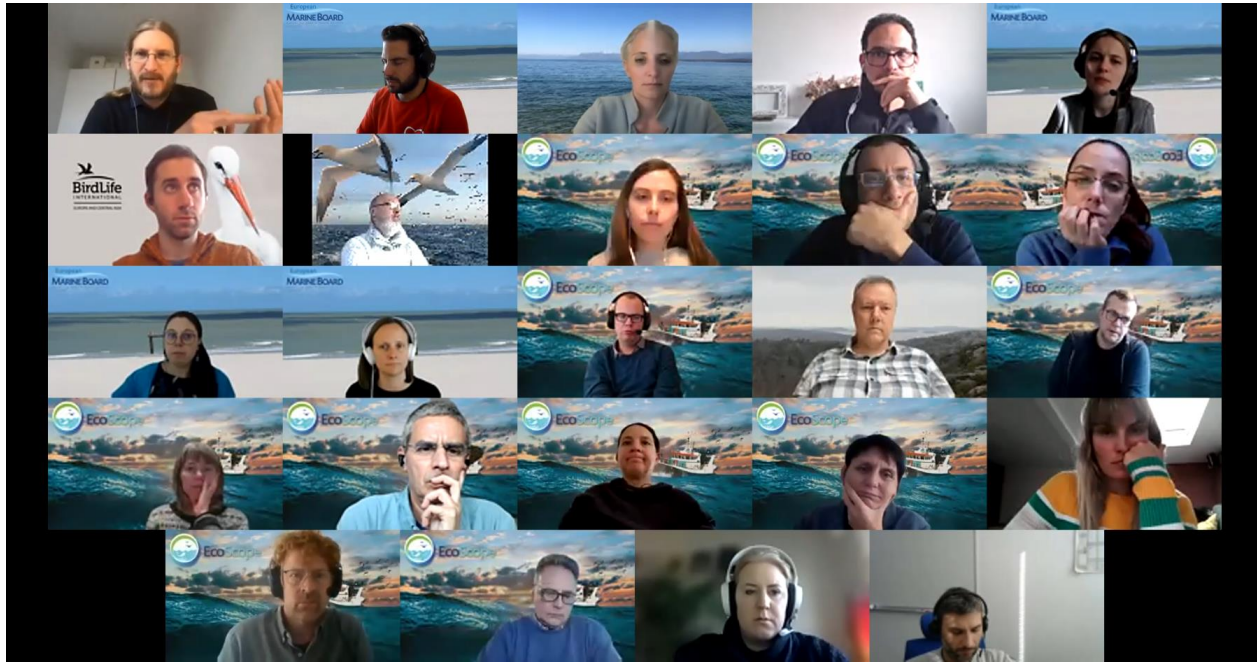


Figure 11: Screenshot of a plenary discussion during the workshop.

4 Conclusion

The first EcoScope Foresight Workshop was highly productive and provided important insights for the project going forward. The main take-home messages on how to improve the EcoScope e-tools were the following:

For the **EcoScope Platform** the workshop participants noted that there are data that are indispensable but that are not publicly available and they wondered if EcoScope would be able to find a solution for this. There were concerned about how and by whom the datasets would be validated. For the visualisation of the Platform data, the workshop participants suggested to make it simple and intuitive, but also showing limitations by pointing to weaknesses in the data and uncertainty of model outputs. Moreover, it was suggested to include statistics (e.g. confidence interval, etc.) in the model outputs. Another recommendation was to define the end-user more clearly to tailor the output accordingly. Finally, it was stressed that EcoScope should define how the Platform will fit in the context of the EU Digital Twin Ocean and other tools and databases, making sure the Platform is interoperable with them to not duplicate efforts.

Regarding the **EcoScope Toolbox**, there were concerns about the usefulness of the scoring system. Specifically, participants had concerns about how to weigh the indicators as this generally involves bias, and questioned the added value of aggregating all indicators to a final value. Moreover, it was noted that it is important to strike a balance between showing details versus maintaining a clear picture in the Toolbox outputs. Specific suggestions were to have the possibility to see individual components of the sustainability wheel; to add indicators of change (i.e. improvement/ worsening of indicator); and to have probabilistic plots rather than deterministic scores. In addition, it was stressed that the tools should not be a black box, as it is important to understand the background to make informed decision and advice appropriately. Regarding additional indicators, it was suggested to add MSFD-related indicators as well as the indicators on seafloor disturbance that ICES is currently developing. Moreover, it was strongly advised to draw synergies with the indicators already developed or in the process of being developed by relevant institutions, such as ICES, STECF and JRC. Finally, it was noted that it is important to be transparent about which indicators are included in which category.

For the **EwE ecosystem models** there was strong support from the participants for having the option of bespoke scenarios being run by experts. Moreover, it was suggested that there could be two levels of outputs corresponding to the two main target audiences that were identified during the workshop: (i) stakeholders that want summary results that are very easy to understand, and (ii) stakeholders that need details, statistics, and the possibility to dig further and understand the background of the model outputs. Co-creation in the scenario-addressing process was seen as very important. A key concern was the quality and reliability of the results. It was noted that it is important for the users to be pointed to uncertainties in data and model outputs – particularly when results are presented in graphics that are easy to understand as uncertainties are often forgotten when presented in this way. Moreover, it was suggested to add an option to customise which outputs are shown (e.g. changes in biomass, catch, economic value, species diversity, etc.) and to also add numbers to graphical outputs. Finally, participants also wondered whether there are other successful examples in which ecosystem models have been used in managing resources at medium or large scales management areas (e.g. the GFCM GSAs).

The participants main feedback on the **MSP Challenge Simulation Platform** was that the “before and after plots” are very useful and clear to understand. The mind maps, however, were not very clear to participants. It was also noted that the “stakeholder-specific dashboards” may be controversial.

The participants main feedback on the **large-scale surveys on societal expectations** can be summarised as follows: i) it is important to obtain insights on the public’s perception of EBFM and on what determines consumer behaviour; ii) there is a need to complement willingness to pay with other methods of preference elicitation; and iii) there is a need to move away from asking about SDGs to focus on regional policies and trade-offs that society faces. The workshop also identified key attributes of EBFM that are relevant for the survey and which cluster around 4 themes: a) sustainable harvest of fish; b) avoiding harm to other marine life/ multispecies

management/ low impact fishing; c) low carbon footprint/ low waste; and d) community consultation/ social issues in general. The key ecosystem services to focus on are: a) sustained availability of fish for consumption; b) provision of secure marine-related jobs, c) the existence value of abundant marine environment; and d) climate adaptation services.

The workshop was closed with many participants noting that it had been a very interesting and engaging event and that they wish to stay in touch for future EcoScope stakeholder events.

5 Abbreviations

BSAC	Baltic Sea Advisory Council	FAO	Food and Agriculture Organisation of the UN
CFP	Common Fisheries Policy	FRA	Fisheries Restricted Area
DATRAS	Database of Trawl Survey	GFCM	General Fisheries Commission for the Mediterranean
DG ENV	Directorate-General Environment	GSA	Geographical Subarea of GFCM
DG MARE	Directorate-General Maritime Affairs and Fisheries	IBTS	International Bottom Trawl Survey
DG RTD	Directorate-General Research and Innovation	ICES	International Council for the Exploration of the Sea
DTO	Digital Twin Ocean	JRC	Joint Research Centre
EBFM	Ecosystem-based fisheries management	MEDAC	Mediterranean Advisory Council
EC	European Commission	MEDITS	International Bottom Trawl Survey in the Mediterranean
EEZ	Exclusive Economic Zone	MPA	Marine Protected Area
EFARO	European Fisheries and Aquaculture Research Organisations	MSFD	Marine Strategy Framework Directive
EMB	European Marine Board	MSP	Marine Spatial Planning
EuroGOOS	European Global Ocean Observing System		
EwE	Ecopath with Ecosim		

MSY	Maximum Sustainable Yield
BMSY	Biomass Maximum Sustainable Yield
NSAC	North Sea Advisory Council
SCAR-FISH	Fisheries and Aquaculture strategic group of DG RTD
SDG	Sustainable Development Goal
STECF	Scientific, Technical and Economic Committee for Fisheries
TAC	Total Allowable Catch

6 Annex I – Workshop participants

Name	Role	Organisation	Country of institute
Zoi Konstantinou	Invited participant	European Commission - DG MARE	Belgium
Juan Ronco Zapatero	Invited participant	European Commission - DG MARE	Belgium
Nicolas Sturaro	Invited participant	European Commission - DG MARE	Belgium
Vedran Nikolic	Invited participant	European Commission - DG ENV	Belgium
Laurent Markovic	Invited participant	European Commission - DG ENV	Belgium
Nikos Zampoukas	Invited participant	European Commission - DG RTD	Belgium
Diego Macias Moy	Invited participant	European Commission - JRC	Italy
Natalia Serpetti	Invited participant	European Commission - JRC	Italy
Chiara Piroddi	Invited participant	European Commission - JRC	Italy
Alessandro Mannini	Invited participant	European Commission - JRC & STECF Secretariat	Italy
Paris Vasilakopoulos	Invited participant	European Commission - JRC	Italy
Jörn Schmidt	Invited participant	ICES	Denmark
Hans Polet	Invited participant	SCAR-FISH	Belgium
Huseyin Ozbilgin	Invited participant	GFCM	Bulgaria
Yoana Georgieva	Invited participant	GFCM	Bulgaria
Rosa Caggiano	Invited participant	Mediterranean Advisory Council	Italy
Marzia Piron	Invited participant	Mediterranean Advisory Council	Italy
Nils Höglund	Invited participant	Baltic Sea Advisory Council	Denmark
Sara Söderström	Invited participant	Baltic Sea Advisory Council	Sweden
Linda Planthof	Invited participant	North Sea Advisory Council	Sweden
Noél Holmgren	Invited participant	EFARO	Netherlands
Javier Lopez	Invited participant	OCEANA	Belgium
Daniel Mitchell	Invited participant	Birdlife	Belgium
Ana Lara-Lopez	Invited participant	European Global Ocean Observing System	Belgium
Georgios Sylaios	EcoScope Consortium – e-tool developer	Democritus University of Thrace	Greece

Simon Keeble	EcoScope Consortium – e-tool developer	Blue Lobster IT Limited	United Kingdom
Carmen Ferrà Vega	EcoScope Consortium – e-tool developer	National Research Council	Italy
Thanasis Tsikliras	EcoScope Consortium – e-tool developer	Aristotle University of Thessaloniki	Greece
Gideon Gal	EcoScope Consortium – e-tool developer	Israel Oceanographic & Limnological Research	Israel
Harald Warmelink	EcoScope Consortium – e-tool developer	Stichting Breda University of Applied Sciences	Netherlands
Jeroen Steenbeek	EcoScope Consortium – e-tool developer	Ecopath International Initiative	Spain
Jannike Falk-Andersson	EcoScope Consortium – socioeconomics	Norwegian Institute for Water Research	Norway
Ingvild Skumlien Furuseth	EcoScope Consortium – socioeconomics	Norwegian Institute for Water Research	Norway
Marie Briguglio	EcoScope Consortium – socioeconomics	University of Malta	Malta
Glen Spiteri	EcoScope Consortium – socioeconomics	University of Malta	Malta
Lizzie Crudgington	Professional facilitator	Bright Green Learning	Switzerland
Sheila Heymans	EcoScope Consortium & Breakout room facilitator	European Marine Board	Belgium
Ana Rodriguez	EcoScope Consortium & Breakout room facilitator	European Marine Board	Belgium
Paula Kellett	Breakout room facilitator	European Marine Board	Belgium
Ángel Muñoz Piniella	Breakout room facilitator	European Marine Board	Belgium
Britt Alexander	Breakout room facilitator	European Marine Board	Belgium
Jana Van Elslander	Breakout room facilitator	European Marine Board	Belgium

7 Annex II – Workshop agenda

Session	Details
09:00-10:00 Welcome session and context setting	<p>Opening welcome and introductions</p> <ul style="list-style-type: none"> • Desired outcomes and overview of the workshop agenda and methodology • Participant introductions • Introducing the EcoScope platform and tools • Summary of participant survey results
10:00-10:15 Future use scenarios	Introducing future use scenarios (concrete examples of situations in which the EcoScope platform and tools could be useful)
10:15-10:25	<i>Coffee break</i>
10:25-12:15 Using scenarios to design EcoScope e-tools that are fit for purpose (part one)	<p>Exploring user scenarios and elaborating ideas on how to make the e-tools and outputs fit for purpose, for example:</p> <ul style="list-style-type: none"> • Who would be the decision makers in this type of scenario and how would the decision-making process go? • Who would benefit from accessing the data and decision-making support tools in this scenario? • What data must the platform and/or tool outputs clearly show? • What are the key design implications of the above for the EcoScope platform and tools, in terms of both (a) the user interface; and (b) the outputs? <p>Validating and/or challenging some assumptions made by EcoScope about future user needs.</p> <p>Learning more about the EcoScope platform and tools.</p> <p>And providing feedback in response to specific questions.</p>
12:15-12:30	Introducing an up-coming survey on societal expectations and value of ecosystem-based fisheries management
12:30-13:30	<i>Lunch break</i>
13:30-14:00 Consolidating initial comments across scenarios	Shifting from scenario-focused reflections to looking across the scenarios and consolidating comments on the key design implications for the EcoScope platform and tools in terms of the user interface(s) and outputs.

<p>14:00-14:45</p> <p>Identifying the key messages emerging and areas for further discussion</p>	<p>Looking across the scenarios and tools, we identify the key messages emerging about the design of the tools and their outputs.</p> <p>We then focus on identifying key questions and/or or areas of concern merit further attention / a deeper dive (after the coffee break) in order to strengthen the EcoScope offering.</p>
<p>14:45-15:00</p>	<p><i>Coffee break</i></p>
<p>15:00-16:30</p> <p>Diving deeper into prioritized areas</p>	<p>Diving deeper, in response to key questions and/or areas of concern. Parallel group conversations on prioritized topics.</p> <ul style="list-style-type: none"> • What additional recommendations do participants have for EcoScope platform and tool developers?
<p>16:30-17:00</p> <p>Concluding session</p>	<p>Wrapping up:</p> <ul style="list-style-type: none"> • What are the highlights from the Deeper Dives? • Next steps and actions to carry this thinking forward. • Thanks, and closing remarks.

8 Annex III – Workshop participants' input into Murals¹⁸

Scenario 1: Fisheries Restricted Area – Adriatic Sea

Scenario 1: Fisheries Restricted Area – Adriatic Sea [Paula]

Here we look at the impact of a new Seasonally Closed Area on the target species and the fisher's catches.

Scenario: The General Fisheries Commission for the Mediterranean (GFCM) received a proposal to establish a new Fisheries Restricted Area (FRA). The proposal recommends to add a new Seasonally Closed Area in the Adriatic Sea during each second quarter (T2, May-August) of the year to protect Essential Fish Habitats of European hake (*Merluccius merluccius*) and Norway lobster (*Nephrops norvegicus*). There is disagreement between stakeholders whether this will be of added benefit to the fish stocks and the wider marine ecosystem, considering that the [Jabuka/Pomo Pit Fisheries Restricted Area](#) has a similar purpose.

Specific questions: What would be the impact on fish stocks, the wider marine ecosystem and fisher's catch of a new annual Seasonally Closed Area in the Adriatic Sea during each second quarter (T2, May-August), intended to protect Essential Fish Habitats of European hake (*Merluccius merluccius*) and Norway lobster (*Nephrops norvegicus*)?

Questions on scenarios

(i) Who would be the decision makers for this type of scenario and how would the decision-making process go?

- Ministry staff, then Minister. Regional process first, a potential proposal for a Delegated Act. Then approval by COM and EP
- Minister hopefully under a proper evaluation of the benefits and impact of the new FRA
- GFCM Parties, EU Member States and EU Commission, MEDAC and NGOs consulted A GFCM Party (in practice: the Commission would draft a proposal for a GFCM recommendation, discuss it iteratively with the MS, present it to the MEDAC, NGOs and key GFCM non-EU parties (here: Montenegro and Albania) and negotiate it during the GFCM annual session.

(ii) Who would benefit from accessing the data and decision-making support tools in this scenario?

¹⁸ All Mural responses have been extracted in this Annex. If a question was left unanswered in a Mural, the question was omitted from the respective scenario in this compilation.

- Science advisory groups or national expert agencies staff?
- Fisheries sector; Regional managers; Policy makers; General public
- Fisheries sector and science advisory groups
- All of the institutions listed above plus JRC, EEA, STECF, possibly ICES

(iii) What information about this data would be important to them?

- Spatial distribution of the species; Temporal dynamic of the stock; Present status of the stock; Projected changes with the measures
- Benefits in terms of target species biomasses, but also time-lag before these benefits can be seen in the catches
- Area knowledge, good resolution of current fisheries activities and if changed fishing can show impact
- Species abundance/ occurrence; food web dynamics; seasonality changes are all likely "questions" that will come up
- Assumptions, cost-benefit analysis for the short term vs. long term impact on the fishing sector and benefits to the habitats/ecosystem, robustness of the analysis, whether the scenario was co-built between the parties interested - ground truth check

(iv) What information about the decision-making support tools would be important to them?

- Decision makers are under pressure when they make decisions and can simply be unwilling to make a decision if they cannot definitely prove e.g. clear cause and effect - agree with other comment, we are asked to provide solid assessment to underpin the decisions taken
- Uncertainty in models can be difficult to assess - need to run variations to show uncertainty, or even different tools for the same scenario
- Uncertainty analysis, agreement within the tools used for the evaluation
- The decision makers do not normally need detailed information on the tools used. They need reliability and evaluation tools
- Making sure the scenarios were co-built to fully account for the socioeconomic-environmental dimensions - it works when co-built, as shown for Jabuka Pomo Pit. It takes longer but then the fishers become the best promoters of the closure (see also Euronews 'Ocean' episode on the Jabuka-Pomo Pit)
- Evaluation tools to measure progress in a particular tool - are we achieving what we wanted to and can we have indicators to show that

(v) What are the key design implications (of i-iv) for the EcoScope platform and tools, in terms of both (a) the user interface; and (b) the outputs?

- Co-design scenarios with stakeholders and scientists
- Not sure models and their design is relevant for decision makers at all, but they are for scientists and the advice process

- Outputs listed under vii, probably useful to have a simple and expert interface with tweakable results displays (graphs, charts, pies)
- We are really considering the decision-making TEAM not the specific high-level decision-maker
- A form of selection by the user, based on the same underlying data, to select what types of outputs and indicators you get and in which format
- Are sustainability indicators/scoring useful? Yes, but with supporting clarification from traditional information coming out of e.g. models Noting also issues of modelling where data and basis information simply doesn't exist
- Decision makers will NOT be looking at the tools themselves but will be looking to advisors to provide information - does this change what outputs the scientist users will need to be able to easily pass on to decision makers? They also need to be able to answer follow-up questions from decision-makers and other stakeholders - what is model sensitive to etc.

(vi) For this particular scenario, what indicators must be included?

- Important to not limit indicators to only fish, but bottom and habitat status, water clarity, e.g. multiple GES ambitions
- Biomasses and catches of the target species of course, but also biodiversity, and economic trade-off for fisheries
- Forecasted benefits to the catching sector (additional catches of larger fish --> €) and the environment (restoration of habitats in the FRA, growth rate prior vs post setting up of the FRA, additional benefits for bycatch and especially sensitive and protected species)

(vii) For this particular scenario, what data must the platform and/or tool outputs clearly show? (To best help inform decision-making)

- Present status of the stock; Projected changes with the measures; Range of uncertainty in the scenarios; Socio-economic indicators (present/scenarios)
- Graphical display of current situation vs. forecasted situation on 1, 3, 5, X years with variations based on the level of protection and various management scenarios (seasonal vs permanent closure, gear exclusion, others...)
- Spatial maps and temporal trends (for resilience)
- In the best of worlds - positive impacts that improve catches and resilience over time compared to a "zero" alternative or BAU
- Need to be clear how realistic the scenario is or does it go beyond the model sensitivity limits and are they robust? Avoid too much discussion on underlying science - stakeholders need to understand the outputs and their variations and see the different types of input - these are important to them

Feedback on EcoScope tools

EcoScope Platform

Are there any other datasets/databases containing oceanographic, environmental, fishery, climatic, and socio-economic data that we should integrate into the EcoScope platform?

- This is very data hungry and some of that data e.g., in the Baltic that data isn't even available - how could this be overcome?

How would you like to visualize these data (e.g. gridded maps, time-series graphs, pie graphs, other?)

- Do not believe that people will want to access the platform and tools e.g. on their phone

Other comments:

- Consider how to address data gaps
- Question assumption that everyone will want to access tools

EcoScope Toolbox

How useful would this scoring system be to you?

- There are barriers to communications - details versus a clear picture
- The degree of each variable is important - we are capturing the complexity of the system - but how do we then make this balance?
- How you weigh the various elements to come up with a final score is key. And the fishing sector would likely have a different view to environmental managers.

What (other) categories or indicators would you like to see included?

- Size and age distribution are key indicators – this needs to be reflected here
- We are managing human activities not the ecosystem, and then there are ecosystem effects (natural) - some are covered but be sure all are covered
- Jobs and impact on different fleet segments
- How do we consider the interrelations between these different variables/ indicators?
- Be clear what factors are included in the different groupings
- Not clear how the model eventually links to the indicators - what is driving what indicator?

Other comments:

- Whose perspective does the weighting take?
- Be clear on how indicators are weighted
- What are the interrelations between the indicators?
- What drives which indicators?

EwE models

The models can give different outputs, such as changes in biomass, catch, economic value, species diversity, etc. Which of these should be presented and/or highlighted?

- Two levels of outputs for different users?
- Interpretation of outputs are important - it needs to be straightforward to people to understand - need more explainers on outputs?

How would you anticipate interacting with the scenario testing tools? Would you prefer an easy-to-use tool that tests relatively simple scenarios available on the EcoScope platform, or would you want an expert to conduct all the scenarios?

- Is there a reason the platform is initially dealing with fisheries separately and only later with MSP, when many follow-up questions would be linked to MSP? Also notes that there are some existing tools e.g. the Symphony tool in Sweden - how are these linked to EcoScope?

Other comments:

- Have two levels of outputs - detailed for scientists and advisors, and simpler for decision makers and stakeholders
- Ensure advisors can explain details to decision makers as needed - ensure that information is available to them if needed

MSP Challenge Simulation Platform

Are these key assumptions about what the users will want and what will be useful to them at the 'Optional Dig' level correct/fitting? Any refinements or alterations you would recommend?

- The mind-mapping not clear? How does this work?

Please provide your comments on these mock-ups for presenting data to users. Are they of interest / helpful? What would be more useful / helpful?

- Some of the outputs and examples will be seen by fishers as further limitations on their work and activities - assuming multi-user thinking may not be correct - tools only likely to be used by one group of people - and then the outputs need to be clearly understandable to stakeholders
- Comment on the dashboard - some stakeholders e.g. fishers or NGOs would not like it if someone would attempt to assume what they will like or appreciate and that will cause issues.
 - Answer from EcoScope expert: wanted more to provide options to include / not include certain variable based on their stakeholder group, but agree that calling it "happiness" may be not good!
- The before and after plots are really useful for decision-makers and especially using the green to red colour coding as people are already used to these approaches

- Useful to have an output that people are familiar with and that you don't have to explain from scratch

Other comments:

- Using output formats that people are already familiar with as reduces need for explanations
- Be wary of making assumptions about what people want!

Key reflections, questions and concerns

Key reflections

- This cannot be a black box tool - need to be able to understand the underlying aspects to make informed decisions and be able to justify those to different parties
- Co-creation in the scenario-addressing process is key

Key concerns

- Be clear that the high-level decision makers and stakeholders will probably NOT be looking at the tools themselves, but instead they will be guided by advisors and scientist who will use them to provide guidance and outputs, as well as supporting and background information
- Need to provide information on wider impacts of decisions beyond just fisheries as this will be asked for by high-level decision makers

Scenario 2: Marine protected areas (strictly protected) + new windfarms – southern North Sea

Scenario 2: Marine protected areas (strictly protected) + new windfarms – southern North Sea [Britt]

Here we see which marine areas would benefit most from strict protection and what the impact will be of placing new wind farms on the marine ecosystem.

Scenario: It is the year 2025 and Belgium is reviewing its [marine spatial plan](#) linked to the Maritime Spatial Planning Directive (2014/89/EU), which is due to be updated in 2026. In order to comply with the commitments of the Biodiversity Strategy to 2030, 10% of the Belgian part of the North Sea has to be strictly protected for nature conservation. (Belgium already complies with the requirements to protect 30%, since 37% of its waters is designated as Marine Protected Areas (MPAs), but there is no strict protection yet). Moreover, in order to contribute to the requirements of the EU Green Deal of reducing greenhouse gas emissions, Belgium will [develop](#) three large wind farms areas in the west coast (Noordhinder North, Noordhinder South and Fairybank). These areas had already been reserved as Zones for Renewable Energy in the Marine Spatial Plan of 2020, but it is unclear how they will affect the wider ecosystem and the Natura 2000 protected areas, with which they overlap.

Specific questions:

- Which areas within the Belgian EEZ would benefit most from strict protection in terms of biodiversity? What would be the impact of strictly protecting those areas on the fisher's profitability/ catches, and how would this be influenced by the newly planned wind farms planned?
- How will the placement of these new wind farms affect the ecosystem and the Natura 2000 sites?

Questions on scenarios

(i) Who would be the decision makers for this type of scenario and how would the decision-making process go?

- Belgian fishery managers; European Commission; Belgian environmental managers
- 1) Look at legal requirements; 2) Background information on sites; 3) Data availability; 4) use of models to run scenarios; 5) check results and make decision; 6) do public consultation on potential decisions; 7) legislate
- Belgian government in consultation with stakeholders, including fishery/aquaculture sector, NGOs, wind farm operators, and other users such as e.g. gas exploitators
- Neighbouring countries?
- Federal government - stakeholder consultations and scientific advice are key in the process

(ii) Who would benefit from accessing the data and decision-making support tools in this scenario?

- Institutes and universities providing science for policy
- NGOs
- Researchers; General ocean industry
- Wind farm industry; Managers and policy makers (Belgian and EU); Fishery industry; NGO, general public;
- Government, fishermen, NGOs, and any other user that will be affected by assigning areas to specific users

(iii) What information about this data would be important to them?

- Information on the ecosystem, impact of structures
- Commercial viability
- (Cumulative) Ecological impact of activities; Economic impact of measures
- Long term data for evaluating the wind farm projects and its impact on the ecosystem
- Effect on environment and biodiversity; Effect of wind farms on fishery activities; Economic effects on each industry
- Effect on fisheries catches, effect on biodiversity, is there a spill-over effect? Displacement of fishing effort - where do fishermen go to when areas are closed?

(iv) What information about the decision-making support tools would be important to them?

- Best areas for each activity for wind farms where impact is less
- Benefit of wind farms on CO2 emissions

(v) What are the key design implications (of i-iv) for the EcoScope platform and tools, in terms of both (a) the user interface; and (b) the outputs?

- Areas which provide different ecosystem services, and other socioeconomic services
- Comments by same person:
 - Outputs need to be simple to interpret
 - Will seamlessly connect to data aggregators (NODC)
 - Flexible and intuitive to use
 - A good explanation of how it functions (no black box)
 - Needs to use real observations and data, not just assumptions
- Impact simulations
- Comments by same person:
 - What are the actual effects of wind farms on fish stocks?
 - The need to have better knowledge on spatial distribution and seasonal migrations of commercial fish - so move away from stock assessment for large areas and split up
 - The tools will need detailed fisheries data which are not easily accessible when detail is needed (e.g. VMS)
 - A spatial model would be the better choice

(vi) *For this particular scenario, what indicators must be included?*

- Primary production, physical descriptors, foodweb dynamics, ecosystem services, population health of different species, biodiversity, water quality
- Comments by same person:
 - Electricity production, fish stock production, aquaculture productivity, a set of ecosystem indicators
 - Include the concept of nature-based solutions for planning and evaluating.
 - To what degree it will be managed area/ecosystem.
- Hydrodynamics, biodiversity
- Seafloor disturbance by fisheries; Profitability of fisheries; Biodiversity

(vii) *For this particular scenario, what data must the platform and/or tool outputs clearly show? (To best help inform decision-making)*

- Quality data e.g. VMS data hard to get hold of (confidential). tools should show certainty/uncertainty in data. Can indicate with metadata. also heat maps of certainty in data within a model.
- Vessel traffic changes; trends in biodiversity; CPUE changes; Potential change in hydrodynamics due to windfarms
- Comments by same person:
 - A catch prediction model and advice for fishermen would help fishermen to explore new fishing grounds
 - Local stock status with and without wind farms
 - Spatial and seasonal distribution of fishing effort
- Forecast of impact

Feedback on EcoScope tools

Assumptions

Assumption: It is valuable to bring lots of data together and visualize them in an interactive spatial format

- What would be the role of aggregators such as EMODnet and SeaData net here?

Assumption: It may be valuable for you to have a 'one stop' portal that integrates a wealth of data relevant for EBFM (both external data and data produced within the framework of the EcoScope project)

- The wealth of data can look chaotic for the user. Easy overview and easy access to good data could help the lesser informed user
- From our perspective it will also be interesting to know data gaps and research needed to improve model results

Assumption: You may want experts to run a bespoke (more complicated) scenario for you 'on demand'

- I think it is important

Assumption: You may want to do this in a game-like environment, which engages and immerses users and allows multiple users (stakeholders) to play together.

- Game theory analysis can add to the understanding of conflicts of interest

Assumption: You may want the scenario results visualized in a certain way to facilitate communication and the decision-making process.

- The more fancy the presentation of results the less the uncertainties in modelling are in the minds of the user. It is important to present assumptions and weaknesses together with fancily presented model results

Assumption: You may need specific indicators to feed into that assessment.

- An indicator on seafloor disturbance by demersal trawling will be needed given the recent attention to demersal trawling and its consequences. Such indicators exist and are e.g. being developed in ICES

EcoScope Platform

Are there any other datasets/databases containing oceanographic, environmental, fishery, climatic, and socio-economic data that we should integrate into the EcoScope platform?

- Fisheries based data (from industry?), Vessel monitoring data?
- You may consider adding newly developed methods to assess seafloor disturbance by trawling

How would you like to visualize these data (e.g. gridded maps, time-series graphs, pie graphs, other?)

- Time series are always useful. Most important that they are simple. It is also important that weight of assumptions and certainty of data is clear
- Simple and easy to understand results are handy but the option should be there to dive deeper and be able to understand limitations and strengths of the model approach
- I think there should be several options as people may have different preferences

- Tools should be downloadable too to be used in research papers

In which format would you like to be able to retrieve these data (netcdf, txt, xlsx, other)?

- Data in csv/xlsx and images in pdf/png
- CSV

Other comments:

- Time series are always useful. Most important that they are simple. It is also important that weight of assumptions and certainty of data is clear.

EcoScope Toolbox

How useful would this scoring system be to you?

- Indicators and scores are handy and easy to use and interpret. So very welcome for the less experienced user. But this user should be made aware of the underlying assumptions - this should be an essential part of the results the user receives

What (other) categories or indicators would you like to see included?

- To what extent can ecosystem considerations/ multi-species interactions be included in the sustainability scoring?
- Seafloor disturbance
- Changes in distribution
- Changes in distribution; trophic level changes

EwE ecosystem models

Of the scenario visualizations shown above, which would be more useful to you?

- The graphs on the right are more easy to interpret

The models can give different outputs, such as changes in biomass, catch, economic value, species diversity, etc. Which of these should be presented and/or highlighted?

- Change in biomass, economic value, diversity
- Comments from same person:
 - Can users get into contact with scientists developing the models to make sure that the input is correct and used correctly?
 - Does it need to be only one or two? All of them will be important depending on the stakeholder
 - Can there be some research done on models and how they are built, and their life after the project. research community to develop legacy of models.

How would you anticipate interacting with the scenario testing tools? Would you prefer an easy-to-use tool that tests relatively simple scenarios available on the EcoScope platform, or would you want an expert to conduct all the scenarios?

- Both are needed. Some scenarios will be simple, others complex.
- Can scientists develop modules that can be integrated? And in this way research and develop the entire support system after the project is finished?

Other comments:

- Game theory analysis can add to the understanding of conflicts of interest (from assumption)
- The more fancy the presentation of results the less the uncertainties in modelling are in the minds of the user. It is important to present assumptions and weaknesses together with fancily presented model results (from assumption)

MSP Challenge Simulation Platform

Are these key assumptions about what the users will want and what will be useful to them at the 'Optional Dig' level correct/fitting? Any refinements or alterations you would recommend?

- Users may like the possibility to compare two scenarios, or do a trade-off analysis

Please provide your comments on these mock-ups for presenting data to users. Are they of interest / helpful? What would be more useful / helpful?

- The presentations of the mind-maps are complex, something simpler (up or down, red or green) may be easier to interpret

Key reflections, questions and concerns

Key reflections

- It is a very interesting project!
- Important for users to be pointed to weaknesses in data. Also need to make sure that the science is right. Need to emphasize uncertainty when presenting results.

Key questions

- What is the main reason for selecting EwE models as opposed to other end-to-end models (e.g. Atlantis)
- To what extent can information from areas not including the European Seas be included, i.e. widely distributed species from the Northeast Atlantic

Key concerns

- Quality and reliability of results
- To what extent is this science robust enough to be used by managers, i.e. can it be validated by STECF/ ICES?
- Lack of clarity about the assumptions. These need to be clearly explained

Scenario 3: Total Allowable Catches – Aegean Sea

Scenario 3: Total Allowable Catches – Aegean Sea [Ana]

Here we look at the effect of different Total Allowable Catch estimates on the targeted fish stocks and the wider marine ecosystem.

Scenario: DG MARE is due to negotiate new Total Allowable Catches (TACs). In the Aegean Sea many stocks have been heavily overfished for many years, which is reflected in the mean size of the catches. In view of commitments to restore marine biodiversity under the Biodiversity Strategy 2030, DG MARE asks STECF to advise on how different TACs of the main commercial species in the Aegean Sea would affect the catch of these fish stocks and the wider ecosystem over the next 10 years.

Specific question: What would be the effect of different TACs on the important commercial fish stocks in the Aegean Sea (i.e. hake, red mullets, anglerfish, anchovy, sardine, picarels and bogue), the wider ecosystem and the fisher's profitability over the next 10 years?

Questions on scenarios

Who would be the decision makers for this type of scenario and how would the decision-making process go?

- EC (DG MARE): TAC proposal AGRIFISH Council (EU member states): Decision on TACs In case TACs affect to shared stocks with third parties, GFCM would have the competence as well and EC would defend the negotiation mandate provided by AgriFish
- Greek fisheries Directorates (Regional levels)
- 1) GFCM as RFMO 2) EU as GRC is a MS so under the CFP commitments 3) GRC Authorities The process should be based on official evaluation of the stock status especially in the framework of an Management Strategy Evaluation in which, usually, stakeholders could be engaged
- Ministry of Agriculture & Ministry of Environment
- GFCM would have the lead. As for the process similar to the Adriatic presumably (i.e. involvement of EC - STECF - GRC and other stakeholders)
- National authorities - forum for DM Input different stakeholders EU COM prop AGRIFISH - formal decision

Who would benefit from accessing the data and decision-making support tools in this scenario?

- 1. Scientific consultants (local?); 2. STEFC; 3. Policy authorities

- Greek authorities, fishers, NGOs
- 1) GFCM as RFMO; 2) EU; 3) GRC Authorities; 4) other stakeholder NGOs, etc
- EC (DG MARE) Member States Fishing sector and other stakeholders
- All, in different parts of the process

What information about this data would be important to them?

- 1. Status of stocks; 2. Fishing capacity and seasonality
- Socioeconomic effects, stock status, trade-offs
- 1) Stock assessment results; 2) Bioeconomic models and simulation; 3) MSE results
- Socio-economic data related to the relevant stocks
- Fishing mortality rates. Mixed fisheries considerations. Management reference points. Socio-economic consequences. Forecast on the catches and socioeconomic performance under different management scenarios. Impact on marine environment (habitats, sensitive species...)
- Historical SSB and catches /TAC etc; INTERACTIONS BETWEEN SPECIES - i.e. how to avoid overfishing in the future (since this was part of the scenario); Precautionary buffer
- Important gaps

What information about the decision-making support tools would be important to them?

- 1) related uncertainties; and 2) level of credibility
- Level of uncertainty; robustness to background changes (e.g. climate/ environmental change; technological advances)
- Assumptions made
- Uncertainties in model estimations and impacts at social-economic level
- At minimum conceptual understanding of the structure of the Decision Support Tool (DST)
- Species interactions; precautionary buffer; trade-offs
- Consequences of the different management scenarios.

What are the key design implications (of i-iv) for the EcoScope platform and tools, in terms of both (a) the user interface; and (b) the outputs?

- a) User interface should be simple and intuitive (thus accessible for everyone); b) outputs should be provided with confidence intervals and mention of caveats
- 1) Matching fishery data with social economic ones; 2) Needs of model forecasting able to take in account fleet dynamics and environmental changes; 3) General issues for EFBM data needs and coverage
- Oversimplification and universal use is overestimated. Better to have a more complex design and better outcomes and explain functionality. Outputs should be presented in a universally understood manner

- a+b) most important: must be realistic and relevant = not too simplified (then it will make no sense). b) clearly visible the uncertainty levels in the outputs
- Outputs: summary advice, graphs with the main indicators

For this particular scenario, what indicators must be included?

- As a minimum: F/FMSY and SSB (or B/BMSY if available) for each stock. Also profits (or other economic indicator) and employment (or other social indicator) by fleet segment. Other MSFD-related indicators as well; e.g. on biodiversity, food webs, sea bottom impact
- 1) Social-economic indicators; 2) Impact on the others species/ fisheries
- MSY Impact on local fisheries
- Species biomass; Fishing mortality; Volume of catches; Economic indicators (gross profit?, net profit?...?; Social indicators (employment?); MSFD indicators
- MSY - precautionary buffet uncertainty + all the usual data (sorry for being unspecific: SSB; F etc etc)

For this particular scenario, what data must the platform and/or tool outputs clearly show? (To best help inform decision-making)

- 1) Social economic impacts; 2) Biomass trends
- Multi-species interactions (combined with ecosystem dynamics if possible); Implications for Article 17 of; the CFP?
- As a minimum F; SSB; socioeconomic variables
- Data on the indicators above (biomass, catches, revenues, employment...)
- Evaluation of policy alternative to achieve the goals; Effectiveness of measure regarding the stocks; Social and financial impacts

Feedback on EcoScope tools

Assumptions

Assumption: It may be valuable for you to have a 'one stop' portal that integrates a wealth of data relevant for EBFM (both external data and data produced within the framework of the EcoScope project)

- What about data that are indispensable but not publicly available (e.g. MEDITS)?
- Many fisheries data are not free available (e.g. in the Mediterranean). Moreover, how the quality of the data input is evaluated?
- Different level of information for different users - Is this something addressed through the platform?
- The number of new platforms is high nowadays. Such a platform doesn't exist indeed, but I am concerned that we are creating a lot of similar but not necessarily interoperable

tools. I would like to see how this will fit in the context of EU DTO. Same with data access: How do we end up not duplicating efforts?

Assumption: Some scenarios may be more relevant for you than others and it may be important for you to have the option to run certain scenarios with the easy-to-use tool on the EcoScope Platform scenarios

- I agree. Having the opportunity to run some scenarios (partially linked to the what if assumption) would be very useful

Assumption: You may want to be able to run simple scenarios with an easy-to-use tool on the EcoScope Platform to get a quick and clear feel of the effect of various scenarios

- Not clear for me what does exactly mean "simple"

Assumption: You may want experts to run a bespoke (more complicated) scenario for you 'on demand'

- Yes! The need for scientific expertise needs to be highlighted

Assumption: You may want the scenario results visualized in a certain way to facilitate communication and the decision-making process

- Yes. Not only maps or spatial layer but also tables and if needed plots

Assumption: You may want a sustainability score to help you summarize interdisciplinary data and model results in a clear and visual way.

- I don't really agree with this assumption, I believe that a sustainability score may be more misleading than helpful.

Assumption: You may need specific indicators to feed into that assessment.

- Most probably some indicators will be case specific
- Rather than a "deterministic" score I'd like to have probabilistic plots or performance index

Connection Data to modelling:

- For socio-economic impact and a transparent distribution of TAC within a MS Article 17 of the CFP must be fully implemented. This transparency will help the EcoScope modelling by providing data that is not visible today, although required by the CFP.

EcoScope Platform

Are there any other datasets/databases containing oceanographic, environmental, fishery, climatic, and socio-economic data that we should integrate into the EcoScope platform?

- Fisheries surveys (e.g. IBTS and others included in DATRAS; MEDITS)
- Are VMS data available for EcoScope?

How would you like to visualize these data (e.g. gridded maps, time-series graphs, pie graphs, other?)

- All of the above (a combination of options should be available)
- a) User interface should be simple and intuitive (thus accessible for everyone); b) outputs should be provided with confidence intervals and mention of caveats

In which format would you like to be able to retrieve these data (netcdf, txt, xlsx, other)?

- .xls/.csv

Other comments:

- The number of new platforms is high nowadays. Such a platform doesn't exist indeed, but I am concerned that we are creating a lot of similar but not necessarily interoperable tools. I would like to see how this will fit in the context of EU DTO. Same with data access: How do we end up not duplicating efforts?
- From where does the commercial data come from? Specially discard data. How is it collected?

EcoScope Toolbox

How useful would this scoring system be to you?

- Not so keen on scoring systems myself as they involve bias from the people setting this up. Maybe the user could produce their own scoring system adequate to their needs and preferences?

Other comments:

- Have also the possibility to see the individual components of the sustainability wheel
- There is also value in training the decision makers to understand the 'raw analytics'
- I don't really agree with the assumption that a score will be helpful, I believe that a sustainability score may be more misleading than helpful.

EwE ecosystem models

Of the scenario visualizations shown above, which would be more useful to you?

- I don't see any visuals on the impact of alternatives to social and economic factors and this will be necessary
- Outputs: summary advice, graphs with the main indicators

Other comments:

- Some scenarios more relevant than others: Having the opportunity to run some scenarios (partially linked to the what if assumption) would be very useful
 - I agree. Having the opportunity to run some scenarios (partially linked to the what if assumption) would be very useful.
- Two general questions on these models: are these models time demanding to run? How these models deal with the data uncertainty?
 - I have the same concern
 - Very valid. Also, how do you communicate the uncertainty
- A general note on uncertainty: it's crucial that the level of uncertainty is visible in the modelling, i.e. the amount of lack of data which affects the results. This is very important information to decision makers.
- A general concern: will there be visible multi-species interactions connected to profit and also ecosystem functioning? What I am aiming at is not only the multi-species interaction from an ecological point of view, but how the fishing of different species also affect the economy for different fleets. → How do species interactions affect the fishermen targeting those species?
 - An example: if X amount of FISH1 is caught with Y amount of FISH2 in the catch how will this affect SSB (and TAC) of FISH2 and what will be the economic consequence for the fishermen of FISH2 (if they are not the same).
 - Also, a bit more complicated, lets say that FISH3 and FISH4 is caught together but with different TACs, and also spatially distributed differently in certain areas but not all; how will the modelling adhere to this scenario? i-e- so not the whole TAC for FISH3 or FISH4 is caught in the same place = local overfishing = degraded ecosystem locally.
 - And also, will it show that lets say FISH3 and FISH4 is an important forage fish for FISH5: how will this affect the TAC? can it be made visible that the catches of forage fish affect a predator species (FISH5) and how large the economic losses for fishermen targeting this species will be? i.e. connected to the TAC of FISH3 and FISH4?

MSP Challenge Simulation Platform

Other comments:

- Couldn't you give two options? I.e. a 'basic' information-dense one and an 'advanced', more detailed one and let the user choose? (personally not very keen on overly aggregated indices)

Key reflections, questions and concerns

Key reflections

- This work is very useful. I see some key challenges: involving the appropriate users and ensuring coordination with other platforms.

Key concerns

- In many cases, when tools are created without the involvement of the users directly, they are very limited used
- Are there any examples in which ecosystem models have been used in managing resources? For example at medium / large scale (sea basin, management areas (e.g. GFCM GSAs), etc.

Scenario 4: Reducing bottom trawling – Balearic Sea

Scenario 4: Reducing bottom trawling – Balearic Sea [Sheila & Jana]

Here we test if bottom-trawling can be reconciled with biodiversity goals.

Scenario: As part of the [Biodiversity Strategy to 2030](#), the Commission strives to reconcile the use of bottom-contacting fishing gear with biodiversity goals (including through a new action plan to conserve fisheries resources and protect marine ecosystems). In the Balearic Sea trawler fishing grounds overlap with Essential Fish Habitats (mainly red algae and crinoid beds). Discards from trawl can reach 50-70% of the catch and are mainly composed of red algae, echinoderms, sponges and ascidians. Moreover, the most recent stock assessments indicate that all of the target species are overexploited. The General Commission for the Mediterranean is exploring the effects of reducing the amount of trawling in the Balearic Sea.

Specific question: What is the effect of reducing trawling in the Balearic Sea by x percentage, on biodiversity, stock status and the fisher's catch and income?

Questions on scenarios

(i) *Who would be the decision makers for this type of scenario and how would the decision-making process go?*

- Decision makers are Member States, in this case Spain or in case other MS have fishing interest, other MS. It could also be GFCM.
- Decision making process: Spain takes measures to limit trawling if its fleet is the only one affected. If more MS affected, the measures are proposed through CFP regionalisation. Alternatively, it can be GFCM.
- The decision makers are the MS involved that have to decide together with stakeholders which measures to adopt.

(ii) Who would benefit from accessing the data and decision-making support tools in this scenario?

- Member State authorities (fisheries and environmental), stakeholders (fishing industry, NGOs), EC, regional sea conventions, ...
- Member states authorities and the research institute commissioned to answer the question. Additionally, other stakeholders (fishers, NGOs) should have access to the tools (or the outputs from the tools, depending on the complexity) to facilitate inclusive decision-making processes.
- For sure the fishermen will benefit, but I repeat that the stakeholders have to be involved at all stages of the decision process

(iii) What information about this data would be important to them?

- All data, ecological, legal obligations, fishing activity socio-economic,... data sources, uncertainty in quality of data etc
- Uncertainties, assumptions and data sources
- First of all it is a condition sine qua non to gather info related to the socioeconomic aspects and consequences of the implementation of any management measure that will be adopted
- Indirect impact on fish stock from habitat protection

(iv) What information about the decision-making support tools would be important to them?

- The process and assumptions made in the model, the uncertainty, ...
- Uncertainties in scenario modelling

(v) What are the key design implications (of i-iv) for the EcoScope platform and tools, in terms of both (a) the user interface; and (b) the outputs?

- The user interface and output has to be spatial (GIS), user friendly and with as many details as possible on sources of data and what has been modelled and how.
- Easy to use and understand, both the user interface and the outputs
- That it doesn't hide uncertainty

(vi) For this particular scenario, what indicators must be included?

- Indicators linked to data/ parameters listed below under Vii
- 1) Habitat status; 2) Impacts on relevant species - Impact on relevant sectors (fishery, tourism etc.); 3) Impacts on provisional services (consumption products) like supply/demand and indicate impact on prices; 4) Impact on communities and cultural services (incl. cultural heritage practices etc.)

- The stakeholders have to be involved at all stages, from the beginning to the end of the decision-making process. One of the possible good solutions is the co-management where all stakeholders, national administrations and scientific experts are involved

(vii) For this particular scenario, what data must the platform and/or tool outputs clearly show? (To best help inform decision-making)

- List of things:
 - 1) Species and habitats protected under EU legislation (maps of distribution and condition);
 - 2) Marine protected areas (eg Natura 2000 sites) and their conservation objectives/measures;
 - 3) Future obligations from Nature Restoration Law (habitats to be restored);
 - 4) Habitats over which fishing with bottom contacting gear is prohibited by the Mediterranean Regulation;
 - 5) Important fish spawning and nursery areas;
 - 6) capacity of seabed sediments to mitigate climate change;
 - 7) detailed fishing activity;
 - 8) economic data linked to spatial distribution of fishing (landings, profit)
 - etc etc many more things.

Feedback on EcoScope tools

Assumptions

Assumptions on Platform:

- All ok for me

Assumptions on models:

- The possibility of analysis on demand is very interesting, very good assumption

Assumptions on Toolbox:

- It may be very difficult to capture the result in an indicator, so we would need to understand better the way it could be done.

EcoScope Platform

Are there any other datasets/databases containing oceanographic, environmental, fishery, climatic, and socio-economic data that we should integrate into the EcoScope platform?

- 1) Official EU level data on protected habitats, species and areas (Natura 2000, conservation status assessments, etc), also red list data on marine habitats; 2) Member State or regional data on distribution/ condition of habitats, often hidden in government

agencies or other data repositories (such as regional sea conventions), so difficult to access, but worth trying; 3) outputs of studies, projects like Horizon, scientific literature, expert reports - need validation before inserting. 4) for fishing activity data it would be good to use official MS data in addition to independent information from other sources

How would you like to visualize these data (e.g. gridded maps, time-series graphs, pie graphs, other?)

- All visualisations are useful, in particular spatial (need to deal with different scale of each dataset) and statistical outputs in graphs or tables to be exported

In which format would you like to be able to retrieve these data (netcdf, txt, xlsx, other)?

- In standard MS office formats incl. database, but also as ready made PDFs.

EcoScope Toolbox

How useful would this scoring system be to you?

- It could be very useful, but it is very tricky to assign the weight and score to each category...

What (other) categories or indicators would you like to see included?

- Indicators linked to biological communities should be status indicators (their condition) and not distribution (they may be there but in bad condition). The same for MPAs, their presence does not indicate much, but their effectiveness could be a good indicator. The challenge will be finding indicators at the required scale.
- The 'society' indicator should be defined more clearly; New indicator: Inclusiveness/ participation in decision-making processes.

EwE ecosystem models

Other comments:

- Spatial models are most relevant here so they should be tested and validated.
- It would be useful to have more specific spatial scenarios tested i, rather just 5-10-15% closure, because fishing is not equally distributed in time and space. For example: 1) all MPAs closed to trawling, 2) all MPAs and low effort areas closed (see recent ICES advice for MSFD purposes), fishing maintained in core areas outside MPAs, etc. Also, the model should recognise as a baseline the legal prohibitions that are not open to flexibility in any given scenario, for example prohibited habitats under MedReg, measures in MPAs, etc.

Scenario 5: Bycatch – Bay of Biscay

Scenario 5: Bycatch – Bay of Biscay [Angel]

Here we test which management options would improve the population status of species sensitive to bycatch.

Scenario: Bycatch of sensitive species is problem in the Bay of Biscay. The Bay of Biscay is a hotspot for marine megafauna and seabirds and it is characterised by very high by-catch rates of dolphins and seabirds. NGOs have requested that DG MARE close the responsible fisheries for 3 months, when most of the bycatch occurs. DG MARE asks ICES to provide advice as to what scenarios may improve the status of the species sensitive to bycatch.

Specific questions:

- What would be the impact of using Acoustic Deterrent devices on the bycatch of dolphins and of illuminated gillnets on the bycatch of seabirds?
- What would be the impact of a 3-month, 4-week or 2-week closure for all fisheries of concern on the bycatch of dolphins and seabirds, and on the profitability of the fisheries.

Questions on scenarios

(i) Who would be the decision makers for this type of scenario and how would the decision-making process go?

- EU Member States with fishing interests in the area
- European Commission
- CFP Articles 11/12/13
- PARLIAMENT

(ii) Who would benefit from accessing the data and decision-making support tools in this scenario?

- NGOs
- ICES Expert Groups (data)
- Research institutions
- EC

(iv) What information about the decision-making support tools would be important to them?

- Expected reduction in total bycatch
- Economic impact on fishers

(v) What are the key design implications (of i-iv) for the EcoScope platform and tools, in terms of both (a) the user interface; and (b) the outputs?

- Maps of indicators together with histograms/ barplots to see % of change in selected time
- Graphical outputs e.g. maps, graphs (easy to understand/interpret)
- Who is using the tool(s) and what are the tool(s)?

(vi) *For this particular scenario, what indicators must be included?*

- Biomass dolphins/seabirds species (in space and time);
Mortality rate of dolphins/birds (space time);
By-catch rate per species/gear (space time);
Effort per gear type (space time)
- Historic distribution of catch (quantity and value) in the area
- Catch Per Unit Effort;
Total bycatch (individuals)
- Fishing effort-CPUE and bycatch in time and space

(vii) *For this particular scenario, what data must the platform and/or tool outputs clearly show? (To best help inform decision-making)*

- Biomass dolphins/ seabirds species (in space and time); By-catch rate per species/gear (space time)
- Percent and amount reduction in target and bycatch, in short, medium and long term
- Assumptions/data used in the model on the efficacy/ efficiency of the mitigation measures; Uncertainty regarding bycatch rates (often little data available)
- Uncertainty per indicator
- Change in income, profitability, employment;
Impact on the abundance of other priority species

Feedback on EcoScope tools

Assumptions

Assumption: It may be valuable for you to have a 'one stop' portal that integrates a wealth of data relevant for EBFM (both external data and data produced within the framework of the EcoScope project)

- Who is you?

Assumption: There is no such portal yet for all of the European Seas.

- There are portals, do we need one more?

Assumption: You may want a sustainability score to help you summarize interdisciplinary data and model results in a clear and visual way.

- It will be important to know how any overall sustainability score is calculated (i.e. to know the component parts of the overall score)

EcoScope Platform

Are there any other datasets/databases containing oceanographic, environmental, fishery, climatic, and socio-economic data that we should integrate into the EcoScope platform?

- What does integration into the platform mean?
- For by-catch also: ocean biodiversity information system (obis)

How would you like to visualize these data (e.g. gridded maps, time-series graphs, pie graphs, other?)

- Gridded maps/ barplots/trend
- Depends on the context and use-case
 - Agree

In which format would you like to be able to retrieve these data (netcdf, txt, xlsx, other)?

- xlsx/text
- Depends on the context and use case
- Can't answer as I am unlikely to use the raw data directly - I agree though that it will depend on the context

EcoScope Toolbox

How useful would this scoring system be to you?

- This scoring is pretty but I am afraid it will be a bit complicated and full of info for policy makers to understand. I would try to simplify the information provided. I think first you should look at each indicator change (showing % reductions/increases). The scoring shown here is actually the last step of all this process which integrates all indicators into one scoring to see if the area/environment is in a good status or not. The weighting would need to be decided among the different stakeholders.

What (other) categories or indicators would you like to see included?

- Depends on the context
- These are already integrated indicators, thus a specific management measure might affect part of the indicators in different ways and thus difficult to assess the impact

Other comments:

- Indicators of change would be more interesting (if situation are getting better or worse - to apply action to solve this trend)
- Diagrams are complex and not the best format for advocacy. See how the components are developed (not a black box) would be key
- Decision-makers would like to see uncertainty and percentage, but the graph would be complicated. Would not like to see a final number.
- Graph implies a long process with stakeholders was done, considering uncertainties, assumptions, etc. that need to be agreed to make sure the response is relevant to the policy question

EwE ecosystem models

Of the scenario visualizations shown above, which would be more useful to you?

- Depends on the context and use case
- I think it depends on the policy question you want to answer: e.g. if it is to understand the % of recovery of certain area then probably a barplot (to understand how much), time series trend to understand when this will take place and a map to understand where this recovery will take place

The models can give different outputs, such as changes in biomass, catch, economic value, species diversity, etc. Which of these should be presented and/or highlighted?

- Depends on the context and use case
- User should be given the option to select the relevant outputs
- Again it depends on the policy question and on the indicator selected

Other comments:

- I think I would prefer EcoScope to be more concrete and rather than showing the usefulness of the tools to support policy questions in a hypothetical way, show instead how these models answer specific policy questions... this needs to be done together with stakeholders
 - I agree

Key reflections, questions and concerns

Key reflections

- The "you" here would never be a decision-making, but a scientific advisor or advocacy group
- Co-developing models would take lots of time to develop

Key concerns

- Models nowadays are built based on the policy questions, using the tools available. Creating general tools for different policies questions would be difficult or not useful
- Many tools and database exist, why create something new?

Consolidated Mural**EcoScope Platform**

What are the key messages emerging across the different scenarios about the data and Platform outputs?

- Some data is not available, how to overcome? How to harvest data that could be trusted? Validation from national and research data, who and how? How the data flow can be secured? Where this platform end up? Where would it be hosted and maintained? Or just to resolve some key questions?
- Fisheries data, species not always living in European Seas, socio-economic data, OBIS
- Graphics simple, but indicating limitations
- Other platforms exist, but to avoid duplication efforts, how to interoperate?
- Different outputs for different purposes, who is the end-user of the data, need to provide everything?

What are the key questions that require further clarification? Any major concerns to address?

- Not many new concerns, good old problems
- Changing landscape on integration issues, legacy, etc.
- EcoScope Tools not starting from scratch

Other notes from discussion:

- Socio-economic data – how to integrate?
- Who is the end-user?
- How is the data connected and integrated, noting not starting from scratch?
- A platform such as this does not exist but do need to consider how it will connect to others – considering interoperability and duplication of effort
- Cross-border and continental data / member state data / regional data, publicly available versus privately held data – how to access and integrate all of this
- Need simple and clear and attractive outputs that are intuitive and openly accessible
- Clearly indicate limitation of data, show confidence intervals
- Are the approaches state of the art, do we contact other communities about this?

- How do we link to other relevant initiatives such as the digital ocean twin?
- Need validated data / peer-reviewed / quality data

EcoScope Toolbox

What are the key messages emerging across the different scenarios about the value of a scoring system and the categories or indicators to include?

- How can we capture the complexity of where the fish are (e.g. model just for some part of the sea)
- How do you capture the uncertainty?
- Define more clearly the socioeconomic indicators
- Simple outputs are helpful, but important to understand what is going in
- Is MSY compatible with the ecosystem bases approach (e.g. fishing herring at MSY does it allow it to perform its role in the ecosystem)
- How to weigh the indicators?
- What about size and age distribution? It is very relevant as a warning flag (not just MSY)
- Scoring system is useful

What are the key questions that require further clarification? Any major concerns to address?

- How to capture variability in different areas? E.g. salinity not influenced by human activities in the Baltic Sea
- How to weigh different scores
- Where lie the data gaps, what research is needed to make models work, where are the big uncertainties
- How about pollution? And underwater noise? Is it possible to capture those problems?

EcoScope models (EwE ecosystem models and MSP Challenge Simulation Platform)

What are the key messages emerging across the different scenarios about scenario visualization tools, outputs and user interfaces?

- How to communicate outputs as modellers for decision making - struggle to communicate between stakeholders. Can use colour coding in outputs to make them easier to read for end-users. Also need a scoring system for outputs, and this is challenging.

- Uncertainty in outputs is important to visualize and include in the model outputs, need to be clearly represented to end-users.
- Should be able to see where the data has come from.
- When there is a lack of data this should be visible to decision-makers.
- Could have tool to evaluate several trade-offs simultaneously.
- Need to make sure that the assumptions of the model are clearly communicated.
- Species interactions related to profit for fleet - multispecies management plan. Need economic output to be visualized.
- Need to do right modelling for the question being asked. Can have bespoke models to address specific questions policy makers are asking.
- Need to start from realistic baseline for models e.g. closures. Use scenarios to address specific policy questions.
- Guide policy makers and other stakeholders through the whole process of the modelling. Can discuss with stakeholders all info that went into the indicators. Policy makers should be trained in the indicators.
- Should be able to give simple overview of outputs, but also be able to dive deeper if needed to be able to cater to a wide range of end-users.

What are the key questions that require further clarification? Any major concerns to address?

- How can researchers study different parts of model after the project is finished?
- How long will the modelling take?
- Can other models be used in EcoScope and not only the ones presented?
- Will there be tutorials developed for the models so non-experts can use them, and bespoke for specific scenarios. There are some plans for outreach of the EcoScope platform.