MARINE SABRES

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Marine SABRES Deliverable 5.1

Scenarios to reach biodiversity, sustainability and climate targets: developing pathways to transformation.

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Abbreviations used in the text

DA	Demonstration Area
EBM	Ecosystem-based management
IPCC	Intergovernmental Panel on Climate Change
RCP	Representative concentration pathway
SES	Social-ecological system
SSP	Shared socio-economic pathway
Simple SES	Simple social-ecological systems analysis framework

Summary

The main aim of Marine SABRES is to restore marine biodiversity and ensure a sustainable blue economy by increasing the uptake of ecosystem-based management (EBM) in European marine areas. Making EBM more achievable and implementable requires us to comprehensively study and analyse marine social-ecological systems (SES), which is a very complex task. To address this complexity, Marine SABRES is co-developing with stakeholders a simple social-ecological systems analysis framework (the Simple SES) for understanding and assessing coastal and marine SES in three demonstration areas (DAs). The application of this Simple SES will also support the multi-actor co-development of *pathways to transformation*, which are a series of possible steps along a path towards each DA's EBM goals.

To create pathways to transformation we must explore what society might look like in future, because the pathways need to be future-proof (EBM goals can be long-term endeavours) and the paths may need to adapt if society changes. For example, the pathway to positive ecosystem change will differ depending on whether society is focussed on sustainability or whether it prioritises intense resource use. Methods exist to capture visions of future economic, social and environmental changes within a set of scenarios (such as 'shared socio-economic pathways' (SSPs)). However, the challenge is that not everyone will see the world in the same way. Different viewpoints, or worldviews, will exist among key actors and stakeholders and these may not always align with the more generic envisioned future scenarios. Where DA stakeholders' worldviews align with, or are more sustainability-minded than, higher-level 'green' futures, incremental improvement is all that is needed to reach EBM goals. Conversely, where conflicts exist between worldviews and the possible future scenarios, and where these worldviews are less 'green' than the future scenarios, this is the point at which transformation is most needed.

As co-creation and co-development is a fundamental element of Marine SABRES, potential divergence between the worldviews of DA stakeholders and the scenarios of possible future EU or global societies should be considered when developing the pathways to transformation. The first stage of this is to explore how generic worldviews compare to widely-adopted sets of future scenarios. Further stages examine the relationships between worldviews and future scenarios in the DAs themselves and how this shapes the transformation pathways. This report addresses the former; describing the comparison of future scenarios with generic worldviews. We do this by regionalising scenarios of global future scenarios (SSP-RCPs) to the European continental scale and by cross-comparing these scenarios to a set of recognised worldviews using a PESTLE framework, which describes the ***p***olitical, ***e***conomic, ***s***ocial, ***t***echnological, ***l***egal and ***e***nvironmental conditions in each future scenario. The scenarios and worldviews that we compare are:

Global future scenario (SSP-RCP)	
Sustainability (SSP1-RCP2.6)	*Global shift gradually but pervasively toward a more sustainable path, respect for perceived environmental boundaries. Warming <=2°C.*
Middle-of-the-road (SSP2-RCP4.5)	*Social, economic and technological trends do not shift markedly from historical patterns. Warming <=3°C.*
Regional rivalry (SSP3-RCP7.0)	*Nationalism, concerns about competitiveness and security result in increasing focus on domestic or, at most, regional issues. Warming <=4°C.*
Fossil-fuelled development (SSP5-RCP8.5)	*Increasing faith in competitive markets, innovation, and participatory societies to produce rapid progress. Warming > 4°C*

Worldview	
Egalitarian	*Prevention, urgency, fragility, participation, new relationship with nature, decentralization, community, spirituality.*
Individualist	*Rapid change, technology innovation, cultural diversity, maximizing individual quality of life.*
Hierarchy	*Sustainability, managerialism, targets, steering, scientific expertise, international negotiation, control, optimization.*

The results for all PESTLE categories are summarised here:

	SSP1-RCP2.6 Sustainability (conducive to EBM)						SSP2-RCP4.5 Middle-of-road (somewhat conducive to EBM)						SSP3-RCP7.0 Regional rivalry (not conducive to EBM)						SSP5-RCP8.5 Fossil-fuelled (not conducive to EBM)					
	P	E	S	T	L	E	P	E	S	T	L	E	P	E	S	T	L	E	P	E	S	T	L	E
Egalitarian																								
Individualist																								
Hierarchical																								

Blue cells – transformation would be needed in the DAs under the European future scenario. Light grey cells - transformation not required because the worldview is as conducive as, or more conducive than the SSP-RCP to EBM. Dark grey cell – transformation is required but is also needed at the Europe-wide scale (which is outside the scope of Marine SABRES).

Transformation is not required for stakeholders with Egalitarian worldviews because they are equally, or more, sustainability-minded than all four future scenarios (only incremental improvement is needed for Egalitarians in the DAs irrespective of future European society). For the less 'green' scenarios (SSP3 and SSP5), transformation may be needed within the DAs but it would also be required at the whole-Europe level, which is beyond the reach of Marine SABRES (e.g. Individualists under the Regional rivalry and Fossil-fuelled European futures). The most relevant transformation needs for the project are thus where Individual and Hierarchical viewpoints are present within the DAs under Sustainability and Middle-of-the-road European futures. The necessary transformation points range from being across the PESTLE spectrum for Individualists in a sustainability-minded future European society (SSP1-RCP2.6), to four elements of PESTLE (PEST__) for Hierarchy in a Sustainability European society (SSP1-RCP2.6).

This knowledge will determine how we shape further research on transformation pathways in Marine SABRES. Further evolution of the work includes investigating the mix of worldviews present in each DA, validating the cross-comparison with stakeholders, co-creating the transformation pathways by implementing the Simple SES and research on the economic costs associated with the pathways and the governance and behavioural changes that may be required to achieve them.

1. Introduction

The main aim of Marine SABRES is to address the dual challenge of biodiversity decline and climate change by promoting the conservation and restoration of coastal and marine biodiversity and hence integrating sustainable ecosystems and a sustainable blue economy. The project recognises that ecosystem-based management (EBM[1]; McLeod et al., 2005) is an effective method to integrate economic prosperity and environmental protection and that systems thinking is inherent to EBM. However, the uptake of EBM is challenged by the complex inter-connected nature of marine social-ecological systems (SES). Marine SABRES' response to this complexity is to co-develop, through a multi-actor approach, a simple social-ecological systems analysis framework (the Simple SES). The Simple SES is designed to simplify the analysis of human-marine ecosystem networks, providing a clearer visualisation of coastal and marine SES and thus enabling the exploration of cause and effect, and facilitating the discussions and actions needed to achieve uptake of EBM.

The Simple SES will be used as the basis for collaboratively exploring interventions that could be implemented within the project's DAs (Arctic, Macaronesia and Tuscan archipelago) to achieve their coastal and marine sustainable development goals. These possible interventions will be encapsulated within '*pathways to transformation*' which, in the context of Marine SABRES, represent a series of possible steps along a path towards a desired transformation. Transformation is often described as a significant reordering, one that challenges existing structures to produce something fundamentally novel (O´Brien, 2012). It describes more radical and ambitious changes in the system compared to incremental changes (Fisher et al., 2022; Scoones et al., 2020); such changes can be implemented when there is a desire to shift a system from one state to another.

In this case, the desired transformation is to conserve and sustainably use marine resources in the DAs, and hence transition towards a sustainable blue economy. The steps that form the pathway towards the goals align with the "responses" step of the DAPSI(W)R(M) concept (Elliot et al., 2017) that lies at the core of the Simple SES architecture. They may include physical interventions in the environment (e.g. construction or removal of structures, or habitat alterations associated with restoration), policy implementation (e.g. marine protected areas or fisheries policies), governance changes, societal interventions to elicit behaviour change, or any other activity designed to improve the state of marine ecosystems or the human uses of and interactions with them. EBM encapsulates these steps when they are developed with an integrative systemic view and point toward goals such as maintaining an ecosystem in a healthy, productive and resilient condition, so that it can provide the services humans want and need (McLeod et al., 2005).

The pathways to transformation are hypothetical, or possible, because there is no one 'absolute' or 'correct' pathway to transformation, there are multiple possible pathways depending on the priorities and desires of the scientists and other stakeholders in the DAs and depending on the political background within the DA, the wider EUROPEAN landscape and the global societal background. To be successful in the EBM context, the pathways should be co-developed with stakeholders and the steps along the pathways should be both feasible and acceptable

[1] Ecosystem based management is an integrated approach to management that considers the entire ecosystem, including humans. The goal of EBM is to maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the services humans want and need (McLeod et al., 2005).

environmentally, economically and socially (i.e. sustainable). The pathways should be flexible enough to be adaptable if local priorities, regional context or global societal shifts impact on the pathway; that is, while the end-point of the EBM goal will not change, the steps along the pathway may change in future in response to changing context. The pathways should thus be considered ongoing and evolving rather than as an immutable end-point.

The Marine SABRES pathways to transformation will be developed as follows:

- Task 5.1 of work package (WP) 5 will identify *where transformation is needed* to achieve the DAs' EBM goals.
- The Simple SES developed by WP3 and in WP4 will be used to *identify DA SES states, impacts and possible responses* and will be used as a basis for *developing the steps of the pathway(s) to transformation* for each DA. The EBM goal for each DA is placed at the centre of their SES and the various links and feedback loops are explored to identify and agree on the most useful and achievable steps. The testing and applicability of these steps and pathways will happen as part of WP4, Task 4.2.
- In parallel to Task 4.2, Task 5.2 of WP5 will examine the *economic impact of the developing pathways*, Task 5.3 will explore the *desired behavioural changes* to enable the transformations and Task 5.4 will investigate the *governance implications* of these transformations.

While feasibility and applicability of the transformation pathways will be assessed, wholesale implementation and monitoring of the pathways to transformation is beyond the scope of Marine SABRES. Instead, the project will create, test and assess the framework needed to define and achieve the EBM and co-develop the transformations pathways. The aim of this report is to describe the first of these development steps - determining **where transformation is needed**, based on the work carried out so far in the project and currently available information.

2. General methodology: determining where transformation is needed

There are two things to consider when preparing to develop transformation pathways and for ensuring their success (or otherwise) to deliver the desired transformation: (a) how society may function in the future and (b) contemporary stakeholders' worldviews.

Regarding (a), how society functions in future will be affected by various factors such as society's main priorities, how its economy functions and its political structure, and these factors will shape whether change can be achieved. For example, a scenario in which future global society collaborates to prioritise environmental goals could comfortably achieve EBM success. But a future society dominated by self-serving priorities, hyper-nationalistic governance and ignorance of ecosystem limits makes the pathway to conservation or sustainable resource use more challenging, particularly for marine systems that, by their nature, cross national and regional boundaries.

Regarding (b) it should be recognised that humans do not all view the world in the same way. What different stakeholders want and what they perceive as the most useful steps on the path to change will differ depending on their own viewpoint, or 'worldview' (Ney & Thompson, 2000; Verweij et al., 2006). For example, when people think about what the world might look like in the future, what they consider to be plausible is inherently value-based - an exercise of selecting what they consider

important (or irrelevant) about an unknown future, which is a process filled with personal judgment (see references above or Section 3.2).

The situation in (a) can be thought of as top-down forcing, which means the large-scale societal picture will influence a pathway, while (b) can be thought of as bottom-up forcing, meaning the worldviews of the individuals present within a geographic area will dictate whether they engage with EBM or whether their views are at odds with it (Figure 1).

Therefore, to both develop a pathway to transformation and ensure its success requires the recognition that (i) all of the relevant stakeholders must be able to engage with the pathway and (ii) the steps in the pathway will not be immutable. The work must explore multiple possible pathways and benefits from considering how well local worldviews fit with possible societal futures. Where the worldviews of the stakeholders within the DAs align with how broader society might look in future – and where that future society is aligned with environmental sustainability goals - there is no real transformation needed to achieve a particular EBM goal. In these cases, what are needed are incremental improvements to a system that is already moving in a coherent and sustainable direction. However, where the worldviews of the stakeholders in the DAs are not aligned with broader society (e.g., at continental or global level), then transformation (meaning a more radical change than just incremental) is needed to achieve the EBM goals in that possible future.

Our aim is thus to investigate where transformation may be needed to meet the DAs' EBM goals, by considering what the world might look like in future (using global/European scenarios) compared to the worldviews that may be present in the DAs. The resulting information will allow us to identify if there are priority transformation points for the DAs and which these are.

To enable our comparison, we use information from past projects and initiatives known to the research team that have already explored what global-scale scenarios might look like at the European level (this process is known as 'regionalisation'), together with an accepted set of worldviews developed in social science research. Both the nuance of the worldviews and the points where transformation is needed may evolve in future as a natural part of the co-development process. Note that the global scenarios and worldviews are described in more detail in the Marine SABRES Briefing Paper #8 'Scenarios Briefing Paper' (as part of Marine SABRES D3.2). The act of including a first step of examining possible futures and associated worldviews provides an element of 'future-proofing' for the pathways to transformation.

The report is one action within a project-wide process that includes the SES designers (WP3 and WP4), the DA scientists (coordinated by WP4) and the broader stakeholders (WP2). The report should thus be read as a 'version one' of pathways to transformation; the report outputs will then pass on to the next stage of validation with the stakeholders and refinement through the SES in a cycle of co-development (see next steps, Section 5).

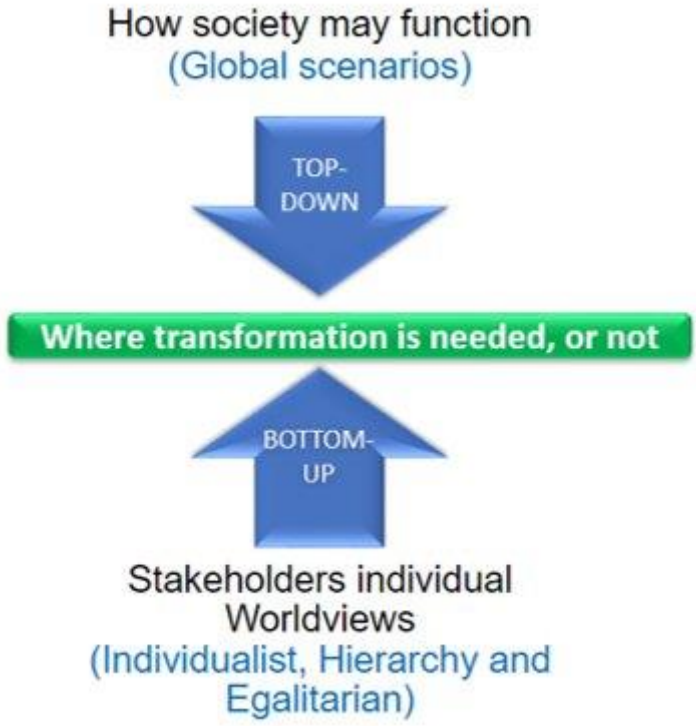

Figure 1. Visualisation of the global society versus stakeholder viewpoint relationship. Societies at the global level have particular outlooks (global scenarios). Stakeholders may share these outlooks, in which case (and where the global outlook is sustainability-oriented, or 'green') ecosystem-based management can be achieved by stakeholders with incremental actions. In other cases, stakeholder worldviews may be at odds with global society; in these cases transformation is needed – transformation at a local level when stakeholders' worldviews are less 'green' than global society and transformation at a global level when they are more 'green' than global society (the latter is outside the scope of Marine SABRES).

3. Steps in the methodology

3.1 Describing possible future European societies

We use a generally-accepted set of 'supporting' global scenario narratives to describe possible future societies. The scenarios, termed the shared socio-economic pathways - representative concentration pathways (SSP-RCP), were developed by climate researchers to describe "*plausible alternative trends in the evolution of society and natural systems over the 21st century at the level of the world and large world regions*" (O'Neill et al., 2014) - i.e. what greenhouse gas emissions and global society might look like to the end of the 21st century. They are a set of narratives that describe aspects of future demographics, human development, economy and lifestyle, policies and institutions, technology, environment and natural resources, accompanied by statements on possible changes in greenhouse gas emissions.

There are five SSPs (Figure 2) and a range of RCPs (see Marine SABRES D3.2), giving a number of possible SSP-RCP scenario combinations. Four of these SSP-RCP scenarios were adopted by the Intergovernmental Panel on Climate Change (IPCC) as Tier 1, or priority scenarios; these are the combined scenarios considered most relevant for the complex climate modelling needed for IPCC assessments and for facilitating climate research on model intercomparisons (O'Neill et al., 2016).

The fifth SSP is considered useful but of lesser priority than the tier 1 SSP-RCP combinations in this regard. We follow the IPCC selection and use the four Tier 1 SSP-RCPs:

- SSP1-RCP2.6: Sustainability – taking the green road [low greenhouse gas emissions]
- SSP2-RCP4.5: Middle of the road [intermediate greenhouse gas emissions]
- SSP3-RCP7.0: Regional rivalry – a rocky road [high greenhouse gas emissions]
- SSP5-RCP8.5: Fossil-fuelled development – taking the highway [very high greenhouse gas emissions].

The SSP-RCP scenarios differ in how conducive they are to pursuing EBM goals, based on the challenges they infer for mitigation and adaptation and the structure and drivers of the future societies they describe (O'Neill et al., 2017, Table 2 section on global narratives). These challenges are visualised in Figure 2 and their alignment with EBM goals can be interpreted from Box 1.

Box 1: How conducive are the SSP-RCPs to EBM goals?

SSP1-RCP2.5: Sustainability

- Well aligned with EBM goals, describing a future where greenhouse gas emissions are low and sustainability is a societal priority.

SSP2-RCP4.5: Middle of the road

- Somewhat conducive to EBM goals, describing a future where greenhouse gas emissions are moderate and social, economic, and technological trends do not shift markedly from historical patterns.

SSP3-RCP7.0: Regional rivalry

- Not conducive to EBM goals, describing a future where greenhouse gas emissions are high and where a low international priority for addressing environmental concerns leads to strong environmental degradation in some regions. The combination of impeded development and limited environmental concern results in poor progress toward sustainability.

SSP5-RCP8.5: Fossil-fuelled development

- Not conducive to EBM goals, describing a future where greenhouse gas emissions are very high and where a push for economic and social development is coupled with the exploitation of abundant fossil fuel resources and the adoption of resource and energy intensive lifestyles.

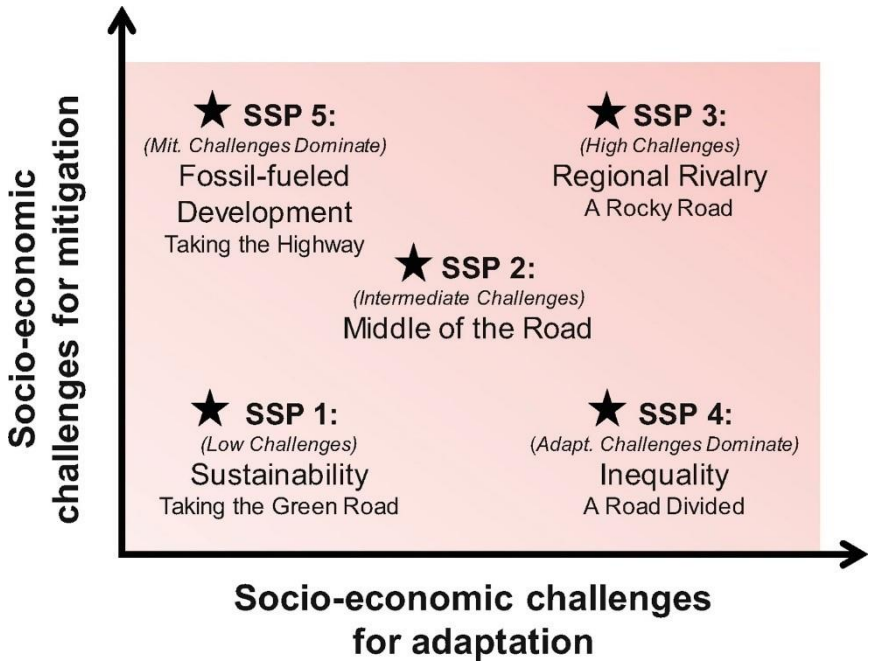

Figure 2. The five shared socio-economic pathways (SSPs) designed to consider different combinations of challenges to climate mitigation and adaptation. From O'Neill et al., (2017).

We regionalised the scenarios to the European scale to generate narratives of more direct relevance to the DAs. We did this by translating the published global SSP narratives into statements of direct relation to society in Europe. Firstly, we identified the main marine environmental foci of the DAs from the Grant Agreement and the Marine SABRES stakeholder engagement early-stage feedback. The elements identified were fisheries for the Arctic DA, (eco)tourism for the Macaronesia DA and conservation for the Tuscan Archipelago DA. Then we collated information from previous projects that, for the selected environmental foci, have already reduced the global narratives to a European context for the purposes of exploring possible marine ecosystem futures (Table 1). These are projects that a member of the research team (JP) was personally involved in thus had deep understanding of the research methodology and outputs. The projects used a mixture of expert-judgement and stakeholder knowledge elicitation to produce the narratives describing the possible fisheries, tourism and conservation futures. Note that Europe-scale narratives were available for fisheries and conservation, but not for tourism; tourism was therefore taken from a UK project.

Using pre-existing information in this way, including information generated from previous EU Horizon projects, is a time- and resource-efficient process that avoids the duplication of scientific effort. Some of the RCP elements of the scenarios used in previous projects differed slightly from those adopted for Marine SABRES (noted in Table 2), but these did not affect the regionalisation process because the narratives are based on the societal elements of the SSPs rather than the greenhouse gas emissions of the RCPs.

Table 1. Information on SSP-RCP scenarios in the European context extracted from previous projects. Some of the SSP-RCP combinations in these projects used different RCP levels to those used in Marine SABRES; they are included because the narratives are derived from the SSP elements rather than the RCP elements and are thus directly transferable. The AFMEC study used a predecessor of the SSP-RCP scenarios.

	Project and focal geography		
	FutureMARES Climate Change and Future Marine Ecosystem Services and Biodiversity (EU Horizon 2020) Europe (also Americas)	CERES Climate change and European aquatic RESources (EU Horizon 2020) Europe	AFMEC Alternative Future Scenarios for Marine Ecosystems (UK Government) United Kingdom
SSP-RCP			
SSP1-RCP2.6 Sustainability: taking the green road	Seafood harvesting, habitat restoration and conservation narrative.	General description and fisheries narrative (as SSP1-RCP4.5).	Tourism and leisure narrative (as 'global commons').
SSP2-RCP4.5 Middle of the road	Scenario not included in FutureMARES.	General description and fisheries narrative (supplementary text from aquaculture narrative where fisheries lacking). (as SSP2-RCP6.0)	Tourism and leisure narrative (as 'local stewardship').
SSP3-RCP7.0 Regional rivalry: a rocky road	Seafood harvesting, habitat restoration and conservation narrative (as SSP3-RCP8.5).	General description and fisheries narrative. (as SSP3-RCP8.5)	Tourism and leisure narrative (as 'fortress Britain').
SSP5-RCP8.5 Fossil-fuelled development: taking the highway	Seafood harvesting, habitat restoration and conservation narrative.	General description and fisheries narrative.	Tourism and leisure narrative (as 'world markets').

In line with the previous projects, we used the PESTLE framework to represent key elements of future societies under the four SSP-RCP scenarios. The PESTLE (or PESTEL) conceptual framework can be used to help develop the scope of scenarios (Pinnegar et al., 2021) and it involves describing the possible **p**olitical, **e**conomic, **s**ocial, **t**echnological, **l**egal and **e**nvironmental conditions in the future. When used with SSP scenarios, the scenario writers - either individually or in groups - imagine what the political, economic, social, technological, legal and environmental conditions might be in nations/regions in the future for one or more of the five scenarios of (SSP1) sustainability, (SSP2) middle of the road, (SSP3) regional rivalry, (SSP4) inequality and (SSP5) fossil-fuelled development.

Table 2 provides the resulting narratives on SSP-RCP scenarios for the European context, combining the information extracted from the sources listed in Table 1. The table describes how political, economic, social, technological, legal and environmental aspects of fisheries, conservation and tourism may change in Europe in future under the four SSP-RCP scenarios.

Table 2. The SSP-RCP future scenarios at the global level and in the European context. All narrative text for the European context was transferred directly from the original sources listed in Table 1. SSP-RCP = shared socio-economic pathway – representative concentration pathway. The RCPs represent modelled greenhouse gas emissions to 2100. The global narrative included here is a summary version to improve table readability; the full narrative is provided in Appendix 1.

	SSP1-RCP2.6 **Sustainability: taking the green road**	**SSP2-RCP4.5** **Middle of the road**	**SSP3-RCP7.0** **Regional rivalry: a rocky road**	**SSP5-RCP8.5** **Fossil-fuelled development: taking the highway**
RCP-SSP global narratives (text from O´Neil et al., 2017)				
	The world shifts gradually, but pervasively, toward a more sustainable path, emphasizing more inclusive development that respects perceived environmental boundaries. *[2]Warming to 2100 limited to 2ºC.*	*Social, economic, and technological trends do not shift markedly from historical patterns.* *Warming to 2100 limited to 3ºC.*	*Resurgent nationalism, concerns about competitiveness and security, and regional conflicts push countries to increasingly focus on domestic or, at most, regional issues.* *Warming to 2100 limited to 4ºC.*	*The world places increasing faith in competitive markets, innovation and participatory societies to produce rapid technological progress.* *Warming to 2100 exceeds 4ºC.*
RCP-SPP narratives for the European context and Marine SABRES environmental foci (fisheries, conservation, tourism) (text from sources in Table 1)				
Political Guiding question used by sources to generate narrative: *What is the political situation of the country or region (e.g., trade, fiscal, and taxation policies) and how might these affect the fisheries and tourism industries in each scenario?*	*A collaborative, international atmosphere exists and governments (e.g. UN, European) provide strong, consistent leadership.* **Habitat restoration and marine conservation:** *Habitat restoration is supported through consistent policies at regional, national and international levels. MPAs planned as a precautionary approach (not only based on cost-effectiveness), their size meets current 2030 targets (e.g. European >30%, >10% integral reserves). Trans-national marine spatial planning creates climate-ready conservation.* **Seafood harvesting:** *International treaties ensure sustainable fisheries management, including strong, cohesive trans-boundary regulations. High ecosystem considerations such as balanced harvesting, protecting large female fish.* **Tourism and leisure:** *Heavy taxes on fuel, discourages overseas travel.*	No general description provided in previous projects. **Habitat restoration and marine conservation:** *Conservation bodies, NGOs and recreational fishing groups have a role in regional management authorities.* **Seafood harvesting:** *Self-sufficiency viewed as important. Primary objective is maintaining local sustainability of fisheries. 'Bottom up' local/regional governance. Campaigns to eat local seafood rather than imported.* **Tourism and leisure:** *Focus on local identity. Unique selling points of destinations heavily drawn upon.*	*Lack of agreement between nations leads to inconsistent and smaller-scale (within EEZ) application of policies.* **Habitat restoration and marine conservation:** *Restoration strategies differ among countries. Restoration is relatively low on national policy agendas as opposed to meeting energy demands. MPAs used to protect species of national importance / value and they compete for space with energy and food provision. Conservation policy is not high on the political agenda. Lack of coordinated policies for (trans-boundary) species.* **Seafood harvesting:** *Strong political tension among nations regarding shared resources, particularly highlight migratory species or those experiencing range shifts. Maintaining national supply important. Frequent 'cod wars'. Decline in fish imports (import tariffs). Higher fish taxes.* **Tourism and leisure:** *Focus on national identity and local communities. Strong emphasis given to the regeneration of seaside resorts. Role of local authorities and tourist boards are enhanced.*	*Europe falls apart as a political force, and there is no unified strategy for national environmental policies, with environmental goals less valued than economic growth.* **Habitat restoration and marine conservation:** *Restoration largely abandoned or conducted for production (profit), or if the cheapest way to protect coastal assets. Political agendas are driven by global economic interests, omitting conservation and environmental needs.* **Seafood harvesting:** *Management based on maximum economic yield and not maximum sustainable yield. More competition for resources globally. Europe out-competed by Asia/China. Use of cheap immigrant labour. Low taxes, strong private sector. Decommissioning subsidies reduced.* **Tourism and leisure:** *Few constraints on international travel. Cruise ship industry and use of marinas continues to expand. Competition between resorts for investment and development. Resorts become more homogeneous.*
Economic Guiding question used by sources to generate narrative: *What are the prevalent economic factors in each scenario (e.g., employment or unemployment rates, raw material costs etc.)?*	*No general description provided in previous projects.* **Habitat restoration and marine conservation:** *Citizens and industries prepared to pay for restoration (either directly for access or via taxes). Sustainable, green business practices are the norm. Environmental conservation seen as economically beneficial with emphasis on valuation of natural capital and ecosystem services but not for profit*	*Public policies aim to promote economic activities that are small scale and regional. Slowly converging incomes between industrialized and developing countries.* **Habitat restoration and marine conservation:** SSP not featured in Future MARES, no specific lines in CERES. **Seafood harvesting:** SSP not featured in Future MARES, no specific lines in CERES.	No general description provided in previous projects. **Habitat restoration and marine conservation:** *Local/regional investment in restoration and conservation shifted to sectors that create jobs/have higher economic relevance. Restoration targeted to high-value harvestable species (shellfish). Less financial support for monitoring and enforcement of conservation. Potential subsidies to protect valuable assets.*	No general description provided in previous projects. **Habitat restoration and marine conservation:** *High-cost effectiveness of restoration actions (e.g. for blue carbon). Biodiversity banking possible to support restoration. Private sector may increase investment in restoration. Focus on short-term wealth generation – degradation in long term. Entrance fees to MPAs to support profitable ecotourism and/or exploitation of*

[2] RCP warming predictions from IPCC (2023) Cross-section box 2, Figure 1.

	SSP1-RCP2.6 Sustainability: taking the green road	SSP2-RCP4.5 Middle of the road	SSP3-RCP7.0 Regional rivalry: a rocky road	SSP5-RCP8.5 Fossil-fuelled development: taking the highway
	(MPAs freely accessible perhaps via government funding). **Seafood harvesting:** *Stock rebuilding may reduce fishing and profits. Subsidies provided to support alternative employment. Wild fish prices low, cultured fish prices increase. Fisheries shift towards balanced harvesting and/or EBM. High enforcement of regulations.* **Tourism and leisure:** *High revenue from ecotourism.*	**Tourism and leisure:** *Increased visitation by domestic tourists to domestic resorts. Co-operatives and joint ventures encourage development.*	**Seafood harvesting:** *Depending on national priorities, subsidies may support traditional fisheries; fish price increases due to international trade barriers.* **Tourism and leisure:** No specific lines in AFMEC.	*marketable ecosystem services such as harvesting, blue carbon, etc.* **Seafood harvesting:** *Huge multinational companies allow fish to be obtained from the cheapest sources worldwide (both for fishing and mariculture) benefiting a few countries. Market-based incentives dominate with no subsidies.* **Tourism and leisure:** *Low fuel prices, so jet-skiing, power boating etc. increase.*
Social Guiding question used by sources to generate narrative: *How much importance do culture and societal issues have in each scenario (e.g., changing family demographics, education levels, cultural trends, attitude changes and changes in lifestyles) and how might it affect the fisheries and tourism industries?*	*Increased awareness of the importance of well-functioning marine habitats and ecosystems supported by education programmes. Protecting natural capital is a priority.* **Habitat restoration and marine conservation:** *Increased demand for restored habitats for recreation and leisure and to meet ethical concerns. Improved MPA effectiveness by local community support. High value and legitimacy of local and indigenous knowledge. Education supports local ownership and engagement with conservation initiatives.* **Seafood harvesting:** *Increased desire for culture and consumption at the base of the food web (seaweeds and bivalves). Only sustainable fishing practices are permitted. Lower meat and fish consumption per capita. Equitable and ethical are important. Traceability and quality standards* **Tourism and leisure:** *Less powered activities, more focus on 'ecotourism'. More residents visit coastal resorts.*	No general description provided in previous projects. **Habitat restoration and marine conservation:** SSP not featured in Future MARES, no specific lines in CERES. **Seafood harvesting:** *Equity and ownership are important. Traceability standards and minimising food miles important. Improved opportunities for 'sport fisheries' as well as food production. Less interest in high-seas fishing.* **Tourism and leisure:** *Increased visitation by domestic tourists to domestic resorts.R sidents support seaside towns of yesteryear.*	No general description provided in previous projects. **Habitat restoration and marine conservation:** *Restoration is not a priority particularly of habitats (e.g. saltmarshes) that take up valuable farmland. Restoration targeted to iconic species/habitats and those protecting assets (resilience of coastline). MPA effectiveness improved by local community support. High value and legitimacy of local and indigenous knowledge. Education supports local ownership and engagement with conservation initiatives. A mosaic of societal attitudes on conservation. Some countries highly concerned, for others the main focus is on production.* **Seafood harvesting:** *Large support of traditional fisheries to sustain cultural heritage and employment at the national level. Focus on maintaining 'maximum social yield' (maximising employment). Increased disparity between rich and poor countries. Sport fisheries 'squeezed out' due to focus on maintaining production and employment.* **Tourism and leisure:** *Increased visitation by domestic tourists to domestic resorts. Growth of traditional activities, promenades and piers.*	No general description provided in previous projects. **Habitat restoration and marine conservation:** *Full support for conserving and restoring marine ecosystems that produce market valuable resources or services (e.g. cheap protection of coastal assets). Network of harvesting artificial created habitats - blue farms. Poor ocean and climate literacy. Loss of traditional knowledge and cultural values associated with conservation effectiveness in MPAs.* **Seafood harvesting:** *Migration and marginalisation of artisanal/traditional fishers and farmers continues to degrade coastal communities dependent on those activities. Loss of traditional knowledge, local identities and cultural values linked to fisheries due to economic rights. Increased reliance on aquaculture for protein security.* **Tourism and leisure:** *Domestic travellers more inclined to go overseas.*
Technological Guiding question used by sources to generate narrative: *What technological innovations are likely to occur and affect the development pathway of the tourism industries?*	No general description provided in previous projects. **Habitat restoration and marine conservation:** *Increased investment in technology leads to breakthroughs in low-cost, efficient environmental monitoring (e.g. satellite, drones). Biodegradable techniques for effective restoration and long-term monitoring of habitats. Biotechnology (e.g. assisted evolution) increases resilience of restored species. Advanced tools support connectivity planning.*	*An important focus is on using technology and new ideas to make the best use of local and regional resources.* **Habitat restoration and marine conservation:** SSP not featured in Future MARES, no specific lines in CERES. **Seafood harvesting:** *Large number of small/traditional locally-owned vessels. Moderate expansion of small-scale windfarms, which disrupt fisheries somewhat.* **Tourism and leisure:** No specific lines in AFMEC.	No general description provided in previous projects. **Habitat restoration and marine conservation:** *Concentration on locally-developed technologies and knowledge to restore habitats or species (little learning from elsewhere). Using technology to restore native habitats that have cultural meaning. Little or no technological advancement in marine conservation. Intensive monitoring of nationally important assets.*	*No general description provided in previous projects.* **Habitat restoration and marine conservation:** *Promotion of bio-engineering in conservation and restoration (i.e. assisted evolution to support MPAs, active restoration, etc.) in habitats considered profitable. Potential use of artificial habitats instead of traditional species. Investment in MPAs with artificial habitats. Low ethical constraints on technological development. Technological advances increase efficiency of monitoring and enforcement and better of MPAs deemed to support economic growth.*

	SSP1-RCP2.6 Sustainability: taking the green road	SSP2-RCP4.5 Middle of the road	SSP3-RCP7.0 Regional rivalry: a rocky road	SSP5-RCP8.5 Fossil-fuelled development: taking the highway
	Seafood harvesting: *Environmentally friendly fishing gear (low bycatch). Large-scale culture of lower trophic level species (seaweeds, bivalves). Sustainable, low impact fishing gears.* **Tourism and leisure:** No specific lines in AFMEC.		**Seafood harvesting:** *Pace of fishing and aquaculture innovation slows in some countries without international exchange and harvesting sector continues to operate as now. Depending on national priorities, some countries may have a large investment in technology for food security. High investment in innovation to monitor infringements into EEZ (investments in drone and remote sensing technology). Little new technology.* **Tourism and leisure:** specific lines in AFMEC.	**Seafood harvesting:** *Investment in high-tech aquaculture, fish feed rations decrease, increased efficiency/profitability (fish meal replacement) with little investment in offshore (deep water) solutions. Technology and automation important as a means to cutting labour costs (taken from the aquaculture scenario). Only a few high-tech boats. Few technical restrictions.* **Tourism and leisure:** No specific lines in AFMEC
Legal Guiding question used by sources to generate narrative: *Are there legal instruments (treaties, directives, bylaws) that regulate the industries? Are changes anticipated that could determine how the fisheries and tourism industry might develop in the future?*	*International commitments to agreed goals (e.g. Paris Climate Agreement) are fully embedded within legal frameworks in each country (including CBD, IPCC, IPBES).* **Habitat restoration and marine conservation:** *Regulations include severe penalties to ensure programmes are respected/effective.* **Seafood harvesting:** *Regulations include severe penalties to ensure programmes are respected/effective. EIA required for new fisheries.* **Tourism and leisure:** No specific lines in AFMEC	No general description provided in previous projects. **Habitat restoration and marine conservation:** SSP not featured in Future MARES, no specific lines in CERES. **Seafood harvesting:** *Regulation via a mosaic of different byelaws/legislation across different countries. Fisheries quota allocation might occur at sub-national level with regional management. Innovative (e.g. individual transferrable quota (ITQ)) schemes tried in some places.* *Discarding regulations strictly enforced, with reasonable exemptions.* **Tourism and leisure:** No specific lines in AFMEC	*International commitments to UN policies are poorly implemented and depend on national interests.* **Habitat restoration and marine conservation:** *Arguments and legal disputes between countries about transboundary issues and who is to blame for decline in vulnerable species. Weak conservation legislation.* **Seafood harvesting:** *Focus on protectionism (import/trade laws). Individual transferrable quotas (ITQs).* **Tourism and leisure:** No specific lines in AFMEC	*International commitments and agreements on environment/ocean heath objectives are abandoned.* **Habitat restoration and marine conservation:** *Conflicts arise in marine spatial planning due to economic vs conservation objectives. Increased international trade conventions, including CITES, with little legal focus on pure conservation or habitat restoration if deemed non-profitable. National legislation for MPA programmes is weak in favour of investment in sectors that create jobs.* **Seafood harvesting:** *Few legal restrictions. Promoting management of harvested species to maximum economic yield; GATT style trade agreements may take precedence over conservation and environmental legislation. Open trade for seafood and seafood processing. Profit driven efficiency of harvesting but not based on minimising pollution. Private access rights to fisheries and tradable permits.* **Tourism and leisure:** No specific lines in AFMEC
Environmental Guiding question used by sources to generate narrative: *What are the environmental concerns for the fisheries and tourism industries, including the impact of climate change?*	*Less severe, climate-driven changes and shifts in suitability of habitats for marine species.* **Habitat restoration and marine conservation:** *Large-scale habitat restoration and recovery increases ecosystem services (e.g. carbon capture). Recovery is fostered by reductions in pollution (plastics, chemicals) and other habitat stressors. Large-scale (in some cases trans-national) conservation efforts allow rehabilitation of sensitive ecosystems and associated species.* **Seafood harvesting:** *Long-term increases in fish stock sizes lead to recovery of top predators (marine mammals). Ecolabel certification schemes focus on reducing environmental impact (e.g. 'dolphin safe', low carbon emissions). Fish from sustainable sources worldwide. Fisheries displaced by windfarms and MPAs.*	No general description provided in previous projects. **Habitat restoration and marine conservation:** SSP not featured in Future MARES, no specific lines in CERES. **Seafood harvesting:** *Focus on maximum sustainable yield (i.e. without damaging resources). Improved status for many inshore stocks but management of trans-national species very difficult. Some closed Areas introduced to protect fish spawning/nursery Areas and for conservation benefit. Not worried about downstream impacts of activities.* **Tourism and leisure:** *Destinations provide more 'eco-friendly' activities. Development in keeping with existing natural landscape.*	*Stronger climate-driven changes in the suitability of habitats to support local species increase shifts and add uncertainty to regional management.* **Habitat restoration and marine conservation:** *Large Areas set aside for food production may pose carrying capacity issues. Smaller, regional conservation efforts with limited scope for planning MPAs based on large-scale connectivity patterns and other conservation actions. Biodiversity declines due to little restoration of habitat-forming species.* **Seafood harvesting:** *Food security more important than MPAs.* **Tourism and leisure:** No specific lines in AFMEC.	*Continued warming leads to changes in suitability of waters to support natural habitats and species.* **Habitat restoration and marine conservation:** *Changes in suitability of waters to support historical, natural habitat. Increased habitat degradation from short-term profit-driven activities. International trade leads to decline in biodiversity in developing counties. In some Areas, well-established populations of invasive species compromise restoration or conservation efforts. Loss/shifts of some keystone species may decrease ecosystem functioning.* **Seafood harvesting:** *Sequentially depleted fish stocks. Some stocks collapse or shifted due to bio-invasions – new assemblages offer opportunities to be exploited.* **Tourism and leisure:** *Warmer climate leads to domestic resorts becoming more attractive.*

	SSP1-RCP2.6 Sustainability: taking the green road	SSP2-RCP4.5 Middle of the road	SSP3-RCP7.0 Regional rivalry: a rocky road	SSP5-RCP8.5 Fossil-fuelled development: taking the highway
	Tourism and leisure: *Increased demand for blue-flag beaches and better standards.*			

3.2 Defining the worldviews of the DAs.

The role of worldviews in Marine SABRES is to show how multiple viewpoints on the future unfold and the implications of these bottom-up scenarios for transformative change. Worldviews are a heuristic to represent the system of values people use to understand the world they live in and to create plausible visions of the future. They represent a set of biases people use to fill the "blank spaces" that the future represents. The worldviews concept acknowledges that, rather than being objective, ahistorical, asocial and acultural, the process of creating plausible futures is socially, historically and culturally dependent (Latour, 2013). This means that the scenario-creation process is open to different rationalities about the future (see Marine SABRES D3.2).

The narrative of worldviews we used in this report (Individualist, Hierarchy and Egalitarian) come from Ney & Thompson (2000) who described each worldview and developed specific scenarios for each view (worldviews are present in several parts of this field, see for example Chuang (2020), Oliveira (2022) and Thompson (1997). These scenarios are broad and do not cover the specificities of each DA in Marine SABRES. In addition, in their original work, Ney and Thompson (2000) used different dimensions to create scenarios and therefore we had to rearrange the content from the original dimensions to fit into the PESTLE dimensions, but the content remains the same. The storylines for each worldview (Table 3) present the general description of a worldview and the PESTLE dimensions accordingly. For further information refer to Marine SABRES D3.2 or the cited literature. We expect to validate and elaborate more on these narratives in the next stage of the research (see Section 5).

Table 3. Worldviews descriptions extracted from Ney and Thompson (2000) and Rayner (2006). The extracted text was grouped according to the PESTLE element to which it was most relevant.

Worldview Elements:	INDIVIDUALIST	HIERARCHY	EGALITARIAN
Key words:	Rapid change, technological innovation, no limits, cultural diversity, maximizing quality of life at individual level.	Sustainability, managerialism, targets, steering, scientific expertise, international negotiation, control, optimization.	Prevention, urgency, fragility, participation, new relationship with nature, decentralization, community, spirituality.
Problem definition:	Global systems are resilient. The real challenge is overcoming obstacles to the innovation and growth that are key to improving quality of life.	Global environmental and economic systems are not under control.	Driven by government bureaucrats and reckless free markets that promote material consumption, society has overshot the world's natural limits, and also damaged community and the basis of society.
Solution:	Free markets to promote growth and innovation, focussing on quality of life at the individual level.	Development of better control systems and institutional arrangements to manage the globe.	Rebuild community life, and drastically reduce human interventions in ecosystems, to meet spiritual and social needs.
Summary:	*The global environmental concerns of the 1990s were clearly unfounded. With the planet resilient, humanity is free to concentrate on maximizing qualify of life. Free markets drive innovation. New technologies, especially in information, computing, biotechnology and cognitive science, revolutionize economic activity and lifestyles. A clean environment is pursued as part of a high quality of life, and enjoyed during free time. There is a wide diversity of lifestyles and kinds of work. At one end of the spectrum are low-consumption lifestyles, featuring preventative approaches to health, three days' work a week, and time for arts and leisure. At the other are high-income, hard-working professionals, with wealth to spend on exotic technologies and pursuits. Clean growth in the South leads to early demographic transitions, while economic growth and employment in the North is revitalized as entire economies begin to re-tool and rebuild with clean technologies.*	*Governments play a major role in correcting social and environmental market externalities through regulation and economic instruments, thus steering the world onto a sustainable path that carefully balances economic and environmental objectives, and provides the best possible world for the greatest number of people. Environmental problems are serious but are resolved, without major social and economic upheavals, as countries muster the international commitments to identify the changes needed, and to implement those changes in a fair and enforceable way. Governments draw widely on the expertise and skills of industry, academia and the public in ensuring optimal decision making, and the pursuit of cost-effective policies. The role of the United Nations and international government grows, to ensure effective co-ordination of economic and environmental policies. Careful stewardship enables continued but modest economic growth, needed to feed the growing population.*	*Environmental problems are seen to be truly serious, necessitating radical change in direction, before it is too late. Growing dissatisfaction with, and distrust of, government and big business catalyses a new bottom-up approach to decision-making and action. The message of non-government organisations (NGOs), grassroots initiatives and spiritual groups is seen to be right: humanity is an intrinsic part of the natural world, and must live in harmony with it. Societal organization focuses on communities and groups rather than on rigid hierarchical structures. Groups promote fairness and solidarity, forbidding the exploitation of fellow man or nature. This allows the regeneration of an active community that reduces the gaps between rich and poor, employed and unemployed, men and women. Rather than seeking wasteful and destructive consumption, people take a greater interest in their communities and in their inner lives, and realize that this is the source of true quality of life. Different communities evolve different responses. Some emphasise the use of sophisticated technologies and tools to minimize environmental impacts and improve social functioning. Others are more fundamentalist, rejecting technological "progress" with all the social and environmental damage it has brought, and adopting simpler and more holistic approaches to work, community, education, and the environment.*

Worldview Elements:	INDIVIDUALIST	HIERARCHY	EGALITARIAN
Political	*Decreasing importance of nation states, their role focussing on enhancing equality of opportunity (for example, in access to education systems). Shifting role of United Nations (UN) organizations towards facilitating market functioning (built on the World Trade Organization). Increasing importance of function-based informal institutions, which are often transitory.*	*International negotiations produce successful agreements for action on climate change, and United Nations Environment Programme (UNEP) is strengthened to form the World Environment Organization (WEO), which includes a structured network of international experts that work on a wide range of problems related to environment and development. Growing importance and complexity of international organizations. Formal structure is generic and recursive down to level of local government.*	*Nation states become less important as the role of communities is strengthened, and children are brought up with the idea of one humanity. People derive their community identity more from their river basin than from old-style national and regional boundaries. E-mail and computer-based democracy ensure a highly transparent and democratic political system. Higher institutional levels are vestigial and exist solely to support the community level. All kinds of temporary coalitions and alliances are formed for regional issues, including environmental ones, evolving from present networks and NGOs. Although such arrangements may lack long-term stability, they prevent bureaucracy and ensure a vital and active involvement of communities in political affairs. Free rider behaviour is dealt with primarily through sanctions at the community level, or through community coalitions and alliances ("we don't do that kind of thing in our community").*
Economic	*Worldwide free markets and trade, where the key government role is to ensure efficient market functioning, including strict anti-monopoly laws. Growing diversity of working and employment patterns, with many taking on 3-day working weeks to allow greater focus on leisure, learning, etc., while others work 80-hour weeks. Information, skills, learning increasingly important. Equality of opportunity, maintenance of level playing field. But very different outcomes, with some choosing to work hard and become rich in material terms, others working less and becoming rich in community, spiritual, artistic, educational or health terms. Diversity of scale, form, sectors. New ways of measuring progress (towards improved quality of life) gradually replace the limited monetary and material bias of the system of the 1990s. Companies flexibly organized, avoiding large bureaucratic multinationals, which prove unable to innovate rapidly or keep costs low enough, or are broken up in anti-trust cases.*	*A comprehensive system of regulation and economic instruments is in place to internalize environmental costs, including large scale ecological tax reform. The revenues make up a substantial portion of tax income and are redistributed through a number of environmental programmes and subsidies. This gives rise to many trade distortions, which are unfortunate but unavoidable given the priority of attaining environmental and social goals, including employment, at the national level. Large consortia of multinationals form to provide the necessary economic weight to compete effectively on world markets. Large multinationals are central in most sectors and form the centre of most people's lives: a community as well as a place of work. They provide a high degree of protection and quality of life, in exchange for the loyalty and service of employees. Corporations adopt voluntary "partnership" style environmental agreements with governments, allowing a smooth, controlled transition to sustainability.*	*Steady-state economies are essential. To stay within environmental limits, there are major changes in consumption. Sustainability of environmental systems and community solidarity take precedence over narrow economic considerations. Any proposed projects and activities have to demonstrate that they have no undesirable environmental or social impacts. The economy is greatly dematerialized, with reduced materials flows. This is consistent with the growth of the information economy, where value is based on content rather than bulk. Industrial trade is almost totally in high-tech products; food and building materials are largely derived from local resources. This is partly possible because of advances in using local biomass for fertilisers, plastics, etc. International commerce is partly trade-based, partly aid-based, on principles of solidarity and justice. There is great emphasis on low resource intensity and self-sufficiency. In combination with lifestyle changes, resource flows drop by a factor of 10 to 100. High-tech applications such as solar cells and electronic devices are manufactured on a large scale. Manufacturing and retail are run as community-based co-operatives, along the lines of Migros, Switzerland's largest supermarket chain in the 1990s. Since owners and consumers are the same people, there are incentives for low prices and good service, rather than high profits. The system also distributes resources much more fairly.*

Worldview Elements:	INDIVIDUALIST	HIERARCHY	EGALITARIAN
Social	*Rate of population growth is declining because of the worldwide demographic transition brought about by economic growth. People place growing importance on health as part of quality of life, either through prevention through individually chosen healthy lifestyles, or new bio-technological treatment. Wide nutritional diversity, from organic produce to high-tech bioengineered foodstuffs for investment bankers too busy to eat.*	*Population growth is steered and controlled by education and family planning. World population stabilizes at about 10-11 billion people. The health system is state-provided, with high-tech and preventative measures. A lot of government money is spent on public goods, such as the health system and environmental services. Better health habits are encouraged by public information and education. Consumption is changed by public service advertising campaigns, and by banning advertising that encourages unhealthy habits.*	*Given the finite carrying capacity of the Earth, the world's population is slowing down and eventually decreasing. Responsible behaviour, recognising Mother Earth's carrying capacity and the rights of the other species who share her with us, ensures that by the middle of the century the human population is around three or four billion. In the process, the basic needs of the poor are fulfilled by redressing the unequal distribution of resources. Diets are largely vegetarian, with animal supplements depending on the local environment. In more technological communities, the supplement is a biotechnological broth which uses trace minerals and sunlight.*
Tecnological	*New diverse technologies at appropriate scales, notably communication, biotechnology, computing, and cognitive technologies to enhance brainpower (the cornerstone of value creation in the information economy). Private modes of transport dominate, including remaining privatized public networks, but they are clean, and co-exist with bicycles and pedestrians. High-tech communications facilities are ubiquitous (everywhere).*	*The transition to a cleaner economy is steered by technology forcing. Technologies include alternative clean sources of energy and zero-waste production processes. Technological systems tend to be large-scale and centralized so as to optimise economies of scale. There is detailed technology assessment for new developments to ensure environmental compatibility, and a comprehensive system of permitting, labelling and regulatory control. Information and communications technologies are central to the control systems at all levels, with greater use of sophisticated computer technology to produce carefully regulated and optimal solutions, and also to ensure monitoring. There is an optimally structured mix between individual transport and integrated and public transport systems. There is growing use of technology to control criminal activity and black markets, for example using sophisticated informatics.*	*Where technologies are prevalent, they emphasize subtle and sophisticated ways of working with nature, such as wind turbines based on tree design and lining, the use of medicine in harmony with bodily clocks or integrated pest management techniques. They also focus on the spiritual rather than the material, with greater emphasis on traditional skills and insights, and craft work. There is greater emotional and spiritual depth, based on a sounder understanding of local ecosystems. There is great use of e-mail and computer communications, to share solutions to technical, economic and other issues. Physical transport is minimized, with an international flight being a once-in-a-lifetime experience. Rather than global uniformity, technologies are designed to fit closely with their surroundings, maximizing social and environmental harmony.*
Legal (ideas of justice)	This usage frees the term priority to be applied to distributional outcomes that are achieved through successful competition: in other words, first in time, first in right.	Proportionality to indicate a distributive outcome where benefits are allocated in accordance with an administrative determination of rank, contribution or need	The third principle of distribution is parity. This can be understood as the egalitarian principle of equal shares to all claimants.

Worldview Elements:	INDIVIDUALIST	HIERARCHY	EGALITARIAN
Environmental	*Increased emissions do lead to climate change, but the low climate sensitivity means that changes are gentle, slow, and non-destructive – not as bad as everyone thought. Ecosystems are resilient, agriculture benefits. Negative effects are addressed by adaptation. Coral reefs, wetlands, mangroves, fisheries etc., are preserved by markets because of their increasing scarcity and acknowledgement of their economic value (notably for tourism, leisure activity). Demand for fish increasingly satisfied by fish farms, restocking the oceans if necessary. Large increases in agricultural productivity, opening up large Areas in North for nature development. Productivity also increases in South, successfully addressing malnutrition. Other economic values of forests are recognized, leading to the slowing of deforestation and increased regeneration. This is particularly true for tropical forests and their biodiversity which is central to a vigorous biotechnology industry.*	*Emissions continue to grow but are gradually stabilised and eventually controlled through protocols under the Framework Convention on Climate Change. Negative impacts due to manifest climate change are compensated for by an internationally controlled aid programme. Climate change is a problem, but manageable. Growing knowledge and understanding help governments to plot the path that maximizes environmental returns for a given investment. Large-scale, highly engineered solutions. Agreements and protocols for oceans, fresh water and enclosed coastal seas. Different protocols for different levels, but all consistent and integrated, including a highly developed quota system. Land-use management by planning: nested form of planning in the form of an internationally negotiated Land-Use Protocol. Increasing productivity accompanied by designated preserves. Massive and successful development co-operation programmes prevent deforestation, land degradation and soil erosion, and promote more efficient use of water. Managed top-down.*	*Despite drastic emissions reductions, climate change materializes as expected because of apparent high climate sensitivity. Those who suffer are helped or compensated for by other communities on the basis of a transient intercommunity Climate Change Victim Fund. Coral reefs, wetlands and mangroves preserved for what they are: an integral and valuable part of the biosphere. Economic considerations are not allowed to affect their [non] management. Fish is a valuable food resource, all fisheries are managed sustainably. Forms of aquaculture are also used to provide highly productive protein sources. Communities depend largely on local resources for food, with land management based on strict principles of sustainability. Some also produce food for export to nearby communities. Ecosystems are managed sustainably at the local level, some emphasizing sustainable harvesting, others a return to wilderness. There are significant population migrations as people find they cannot live sustainably in many parts of the world that previously supported urban and industrial life. At the same time, those cities are made sustainable by city shrinking, pioneered in the Bay Area of Northern California in the 1990s. Undisturbed nature has a spiritual role as a teacher of life, as a way to reach out to the divine.*

3.3 Cross-comparing the future scenarios with the worldview narratives

A matrix was created to set the narrative text for the four regionalised SSP-RCPs against the three worldviews. The analysis team (Bremner, Oliveira, Mynott and Pinnegar) compared the text from each combination of SSP-RCP x worldview (across all three environmental foci of fisheries, conservation and tourism) and, using a process of discussion and group agreement, generated a statement for each combination to describe whether they broadly aligned or diverged. To simplify the process, the combinations were allowed to only align or diverge; no middle-ground of somewhat aligning or partially aligning was allowed. This does not allow for nuance, but since both the future scenarios and the worldview narratives are qualitative and subjective conceptual activities, we consider this approach justified with respect to our aims.

With the matrix of coherence, four results are possible:

a. Match – worldview and SSP are both conducive to EBM goals. No transformation needed, just incremental change.

b. Match – neither the worldview or the SSP are conducive to EBM goals. Both would require transformation, but transformation at the whole-European scale is beyond the scope of Marine SABRES.

c. Mismatch - the worldview is more conducive to EBM goals than the SSP-RCP (e.g. Egalitarians are sustainability-minded while SSP5 involves resource-intensive lifestyles). Here, a broadscale transformation would be necessary rather than a transformation within the DAs; this is outside the scope of Marine SABRES.

d. Mismatch - the worldview is less conducive to EBM goals than the SSP (e.g. Individualists versus SSP1 Sustainability). Here, transformations at the DA level are required. **This is the main focus of Marine SABRES.**

This process will be validated by the stakeholders later in 2024.

4. Results: where transformation is needed

Effective marine environmental management and biodiversity protection are fundamental to achieving the transformation to a modern, resource-efficient, and competitive low-carbon sustainable ocean economy. We compared from bottom-up futures (based on worldviews) against four top-down European socio-economic pathways (SSPs 1, 2 3 and 5) forming the “matrix of coherence” (Table 3). The matrix mapped where worldviews were inconsistent with global SSPs (regionalised to the European level), and therefore might require transformative changes.

The cross-comparison of the European futures *versus* worldviews is presented in Table 4. Note that, since the worldviews were not personalised to the individual DAs at this stage in the project, the resulting matrix comparisons are identical for each DA.

*Table 4. Cross-comparison of the top-down European SSP-RCP scenarios (across the three environmental foci of fisheries, conservation and tourism) and bottom-up narrative worldviews. Green cells indicate where the scenarios and worldviews are congruent (they are in alignment overall in the way they envision the future world) and red cells indicate where they are incongruent (they diverge overall in the way they envision the future world). **X** marks relations where the future worldview is more conducive to EBM goals than the SSP-RCP; these are not considered an immediate project priority because the worldview does not require transformation and transformation at the global/whole-Europe level is outside the reach of Marine SABRES' timeframe.*

		SSP1-RCP2.6 Sustainability (Conducive to EBM)						SSP2-RCP4.5 Middle-of-the-road (Somewhat conducive to EBM)						SSP3-RCP7.0 Regional rivalry (Not conducive to EBM)						SSP5-RCP8.5 Fossil-fuelled development (Not conducive to EBM)					
		P	E	S	T	L	E	P	E	S	T	L	E	P	E	S	T	L	E	P	E	S	T	L	E
Egalitarian	P	X												X						X					
	E														X						X				
	S															X						X			
	T				X						X						X								
	L					X						X						X						X	
	E						X												X						X
Individualist	P																								
	E																								
	S																								
	T																								
	L																								
	E																								
Hierarchy	P																			X					
	E																				X				
	S																					X			
	T																						X		
	L																							X	
	E																								X

From the comparison of worldviews and the European SSP-RCPs, several important inferences can be made relative to the direction each worldview might point to and its relation to the broader scenarios. Considering the goals of Marine SABRES, our focus was on the kernels in Table 4 where the worldview is incongruent (being less conducive to EBM goals) than European "greener" scenarios (i.e., if the local development is not compatible with the goals of the project, transformations might be required).

Worldviews are relevant because they point us to where the local system might be going, and therefore whether it is conducive to EBM goals, or the amount of effort that would be needed to transform the system towards the EBM goals.

To meet EBM goals, the most aligned European SSP would be 'Sustainability' (SSP1-RCP2.6; see Section 3.1. Box 1). The 'Regional rivalry' and 'Fossil-fuelled' scenarios (SSP3-RCP7.0 and SSP5-RCP8.5) would be the hardest situations since the challenges for climate change adaptation and mitigation would require more effort for EBM to reach desired goals, and therefore the risk of failing is larger in these cases, Middle-of-the-road (SSP2-RCP4.5) represents in intermediary state. The challenges of the Marine SABRES and EBM goals in general are lesser if Europe takes an SSP1

path in future. They will be worse if society evolves in line with SSP2, and massive in SSP3 (due to the "rocky road challenges to mitigation and adaptation") or SSP5 (described in the text) (see Box 1).

A transformation is needed when we identify an incongruence between one or all of the PESTLE elements from the worldview types compared to a global/European scenario (Table 4), and when those worldview elements are less conducive to EBM than the SSP. If the worldview points to a 'green' future (e.g., Egalitarian) but the broad European SSP-RCP is not conducive to the Marine SABRES goals (e.g., 'Fossil-fuelled', SSP5-RCP8.5) it is understood that, at the DA level, no transformation is needed because the local development pathway is already green, although unfortunately in a grey world. This implies that transformations would be required at the European level, but that is out of the scope of the Marine SABRES project.

When considering the worldviews in all considered dimensions (i.e. aggregating all PESTLE elements), only one comparison was completely congruent – the Individualist worldview versus Fossil-fuelled development (SSP5-RCP8.5). In this situation, neither the worldview or future European society are conducive to EBM goals; transformation at the Europe-wide scale is outwith the scope and reach of Marine SABRES and so, transforming the Individualist worldview may have little broader impact. Three comparisons were completely incongruent – Egalitarian worldview versus Regional rivalry (SSP3-RCP7.0), the Individualist worldview versus Sustainability (SSP1-RCP2.6) and Hierarchy versus Fossil-fuelled development (SSP5-RCP8.5). The remainder are a mix of congruent and incongruent depending on the PESTLE element.

We can examine the results in depth according to the elements of the PESTLE. When the worldview is congruent with SSP1 and SSP2 or more conducive to EBM than them, they illustrate that the DA is moving in a desired (SSP1) and tolerable (SSP2) direction in terms of EBM goals (see also Box 1). As the challenges will be smaller, it is expected that the economic costs would be lower compared to the other cases; the psychological changes and the governance policy-requirement are also presumably lower. This is the case for the Egalitarian worldview versus SSP1 (_ES___[3]) and SSP2 (PES__E) and Hierarchy with SSP1 (PE_TLE) (Table 3 and Appendix 1).

The **Egalitarian worldview** is incompatible with SSP3 (PESTLE) and SSP5 (PES_LE) (see Appendix 1 for details). This worldview is more aligned with EBM goals than the rest of the worldviews and thus an Egalitarian DA does not require transformation to reach Marine SABRES goals, although it might require incremental changes (not as radical as transformations). Transformations are needed when worldviews are misaligned to SSPs that are conducive to EBM (such as Individualist to SSP1 (_____), Individualist to SSP2 (___TL_), Hierarchy to SSP2 (____LE).

Individualist is slightly aligned with SSP3 (_____E), which flags that elements might be aligned with a European society that is not conducive to EBM, and therefore both DA and Europe-wide transformations would be necessary. This worldview has great affinity with SSP5 (PESTLE) which is far from conducive to EBM, allowing us to consider that both the worldview and the Europe-wide future must face transformations to achieve a more desirable (in terms of Marine SABRES and EBM goals) future.

[3] For each PESTLE element that is aligned between the worldview and the SSP, its initial is written after the name of SSP scenario. "_" is used where there is misalignment. For example, if Hierarchy and SSP1 match in all PESTLE elements except for the Social dimension, the relation between them is notated as PE_TLE.

The Hierarchical worldview is predominantly aligned with SSP1 (PE_TLE) and therefore requires little transformation, but in the case of SSP2 (__LE), some transformations are needed. This worldview has some alignment with SSP3 (_EST__); SSP3 is not conducive to EBM, meaning the _EST_ elements need transformations to point the system in another direction, but transformation would also be needed at the Europe-wide level. Hierarchy is also misaligned with SSP5 (PESTLE) because the worldview is more conducive to EBM goals (see Appendix 1).

Our conclusions are summarised in Table 5.

Table 5. Summary of where transformation would be needed within the DAs under the four European future scenarios (SSP-RCPs) (cells marked blue). Transformation is not required where the worldview is as conducive as, or more conducive than the SSP-RCP to EBM (EBM; light grey), or where transformation would also be needed at the Europe-wide scale (which is outside the scope of Marine SABRES; dark grey).

	Sustainability SSP1-RCP2.6 (Conducive to EBM)						Middle-of-the-road SSP2-RCP4.5 (Somewhat conducive to EBM)						Regional rivalry SSP3-RCP7.0 (Not conducive to EBM)						Fossil-fuelled development SSP5-RCP8.5 (Not conducive to EBM)					
	P	E	S	T	L	E	P	E	S	T	L	E	P	E	S	T	L	E	P	E	S	T	L	E
Egalitarian																								
Individualist																								
Hierarchical																								

As the table 5 highlights, the Individual and Hierarchical worldviews need transformation to achieve EBM in the DAs, but such transformation would be challenging in the context of Marine SABRES under a future of Regional rivalry (SSP3-RCP7.0) and Fossil-fuelled development (SSP5-RCP8.5) because these two scenarios are not compatible with EBM and would thus need transformation to occur at both DA and the Europe-wide scale.

5. Next steps

The next steps fall under the WP5 and WP4 of the project and can be embraced in three main parts: (a) an investigation of which worldviews are present in each DA and the nuances of their views in each system, (b) a collaboration with the stakeholders to conduct a validation-like process, and (c) the detailed investigation of the coherent pathways ahead, using the simple socio-ecological system (D4.1) as the blueprint of the system the researchers will navigate.

The investigation into the worldviews present in each DA has already started with the application of a questionnaire that will show the relevance of each worldview in each DA. As the worldview narratives are written at a general level, during the validation process a closer look will be made with stakeholders to finesse the general storylines of each worldview in bespoke descriptions of futures.

The validation process will be conducted in partnership with WP2 using the theoretical development and protocol already developed to assess the simple socio-ecological system "presumed utility" (see D4.1), using workshops, world cafes, serious games, or other appropriate methods.

An innovative and timely aspect that will be used by WP5 is to navigate the simple socio-ecological system developed for each DA particularly considering the requirements for transformation, to investigate the most feasible way to undertake a transformation process to align the DAs with the Marine SABRES/ecosystem-based management goals. The design of the pathways is a crucial step in the process as it will show the leverage points in the system that need to be managed to re-route the system towards the Marine SABRES/EBM goals. This step-by-step route (pathway) will feed the next steps of the project (described below).

Thus, the next steps of the scenario evolution will be:

- Investigation of the worldviews present in each DA; the results will be analysed and appraised with stakeholders in person during the validation step.
- Validation of the work done in D5.1 by
    - Going through the worldviews narrative with stakeholders to 'personalise' to DAs.
    - Exploring the SSP-RCP scenarios with the DAs (this may include further regionalising the scenarios from the European level to the DAs if this is desired by the DAs and useful to the pathway development process).
    - Refining the SSP-RCP and worldview comparisons to validate whether the 'draft' transformation points are representative of the current issues faced by each DA.
- The simple socio-ecological systems models will be used to explore in depth the leverage points in the system that form the pathways to Marine SABRES/EBM goals. With these pathways in hand:
    - A cost-benefit analysis will be undertaken in task 5.2 and the results presented in D5.2.
    - Behavioural change research will be undertaken in task 5.3 and presented in D5.3.
    - The institutional governance setting will be investigated in task 5.4 and presented in D5.4.
    - The results of these investigations will be integrated and tested in two additional documents, an "Options and pathways report" (D4.2) and an "Options appraisal document" (D4.3).
- These outputs (D5.1, D5.2, D5.3, D5.4, D4.2 and D4.3) represent the main parts of the broader project research that are relevant to scenarios development, and they will be used to feed the decision support systems (task 6.3) and provide part of the lessons learned necessary to upscale the simple socio-ecological systems approach (task 6.4).

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7. Appendix 1: Expanded global narrative description for SSP-RCPs

From Neil et al. (2017).

SSP1-RCP2.6 Sustainability: taking the green road	SSP2-RCP4.5 Middle of the road	SSP3-RCP7.0 Regional rivalry: a rocky road	SSP5-RCP8.5 Fossil-fuelled development: taking the highway
The world shifts gradually, but pervasively, toward a more sustainable path, emphasizing more inclusive development that respects perceived environmental boundaries. Increasing evidence of and accounting for the social, cultural, and economic costs of environmental degradation and inequality drive this shift. Management of the global commons slowly improves, facilitated by increasingly effective and persistent cooperation and collaboration of local, national, and international organizations and institutions, the private sector, and civil society. Educational and health investments accelerate the demographic transition, leading to a relatively low population. Beginning with current high-income countries, the emphasis on economic growth shifts toward a broader emphasis on human well-being, even at the expense of somewhat slower economic growth over the longer term.	*The world follows a path in which social, economic, and technological trends do not shift markedly from historical patterns. Development and income growth proceeds unevenly, with some countries making relatively good progress while others fall short of expectations. Most economies are politically stable. Globally connected markets function imperfectly. Global and national institutions work toward but make slow progress in achieving sustainable development goals, including improved living conditions and access to education, safe water, and health care. Technological development proceeds apace, but without fundamental breakthroughs. Environmental systems experience degradation, although there are some improvements and overall the intensity of resource and energy use declines. Even though fossil fuel dependency decreases slowly, there is no reluctance to use unconventional*	*A resurgent nationalism, concerns about competitiveness and security, and regional conflicts push countries to increasingly focus on domestic or, at most, regional issues. This trend is reinforced by the limited number of comparatively weak global institutions, with uneven coordination and cooperation for addressing environmental and other global concerns. Policies shift over time to become increasingly oriented toward national and regional security issues, including barriers to trade, particularly in the energy resource and agricultural markets. Countries focus on achieving energy and food security goals within their own regions at the expense of broader-based development, and in several regions move toward more authoritarian forms of government with highly regulated economies. Investments in education and technological development decline. Economic*	*Driven by the economic success of industrialized and emerging economies, this world places increasing faith in competitive markets, innovation and participatory societies to produce rapid technological progress and development of human capital as the path to sustainable development. Global markets are increasingly integrated, with interventions focused on maintaining competition and removing institutional barriers to the participation of disadvantaged population groups. There are also strong investments in health, education, and institutions to enhance human and social capital. At the same time, the push for economic and social development is coupled with the exploitation of abundant fossil fuel resources and the adoption of resource and energy intensive lifestyles around the world. All these factors lead to rapid growth of the global economy. There is faith in the ability to effectively manage social and ecological systems, including by geo-*

SSP1-RCP2.6 Sustainability: taking the green road	SSP2-RCP4.5 Middle of the road	SSP3-RCP7.0 Regional rivalry: a rocky road	SSP5-RCP8.5 Fossil-fuelled development: taking the highway
Driven by an increasing commitment to achieving development goals, inequality is reduced both across and within countries. Investment in environmental technology and changes in tax structures lead to improved resource efficiency, reducing overall energy and resource use and improving environmental conditions over the longer term. Increased investment, financial incentives and changing perceptions make renewable energy more attractive. Consumption is oriented toward low material growth and lower resource and energy intensity.	*fossil resources. Global population growth is moderate and levels off in the second half of the century as a consequence of completion of the demographic transition. However, education investments are not high enough to accelerate the transition to low fertility rates in low-income countries and to rapidly slow population growth. This growth, along with income inequality that persists or improves only slowly, continuing societal stratification, and limited social cohesion, maintain challenges to reducing vulnerability to societal and environmental changes and constrain significant advances in sustainable development.*	*development is slow, consumption is material-intensive, and inequalities persist or worsen over time, especially in developing countries. There are pockets of extreme poverty alongside pockets of moderate wealth, with many countries struggling to maintain living standards and provide access to safe water, improved sanitation, and health care for disadvantaged populations. A low international priority for addressing environmental concerns leads to strong environmental degradation in some regions. The combination of impeded development and limited environmental concern results in poor progress toward sustainability. Population growth is low in industrialized and high in developing countries.*	*engineering if necessary. While local environmental impacts are addressed effectively by technological solutions, there is relatively little effort to avoid potential global environmental impacts due to a perceived trade-off with progress on economic development. Global population peaks and declines in the 21st century. Though fertility declines rapidly in developing countries, fertility levels in high income countries are relatively high (at or above replacement level) due to optimistic economic outlooks. International mobility is increased by gradually opening up labour markets as income disparities decrease.*

8. Appendix 2: cross-comparison results

Table 6. The rationale used by the project team to determine whether the narrative description of each shared socio-economic pathway is congruent or incongruent with the narrative describing each worldview. Green cells indicate congruence between the SSP and worldview, red cells indicate incongruence. SSP = shared socio-economic pathway; WV = worldview.

		SSP1-RCP2.6 Sustainability: taking the green road	SSP2-RCP4.5 Middle of the road	SSP3-RCP7.0 Regional rivalry: a rocky road	SSP5-RCP8.5 Fossil-fuelled development: taking the highway
Egalitarian	Political	*SSP view is focussed on top-down international regulation, WV is focussed on community-based management.	Both involve governance and role of groups at local/community level, partially congruent to the low-level focus (assuming that in the SSP 'regional' is not something like European, and more like a watershed or else).	SSP focuses on national interest and needs with environment less important, while in WV nation states become less important.	SSP political focus is on individuals while WV is on communities.
	Economic	SSP the world is reducing profit to focus on environmental protection, WV similar approach.	Both focus on local/community, local resources and cooperatives.	SSP economic focus shifts from environmental protection to tradeable goods, while WV prioritises sustainability of environmental systems over narrow economic considerations.	SSP low-cost, high profit from environment/natural resources; WV economy dematerialised and steady state (no growth) is essential.
	Social	Both are focussed on low impact society, equality and social shifts needed to achieve sustainability.	SSP and WV both incorporate equity and more sustainable use of resources (vegetarian diets, traceability, domestic tourism).	SSP nationalistic focus and environmental protection focused on that of direct benefit to humans, while WV has more focus on flat understanding of biodiversity separate from its benefit to humans.	SSP society is willing to protect the environment if it benefits the individual; WV society is willing to care for the whole of society.
	Technological	*SSP focus on technology investment and sharing to reach a sustainable future while WV includes technology but more focus on local solutions and possible reduction in technology.	*SSP technology is applied to support local resource use while WV applies technology to complement nature rather than use resources. Economic activity and windfarms disrupting fisheries (SSP) is not aligned with	SSP technology development for domestic culture and food but not for marine conservation, development slows as no sharing; while WV focuses on sharing technology.	SSP has technological investment (for market/profit) with no ethical constraints; WV uses technology but brings in focus on craftwork because driver for technology development is for society to work with nature ethically.

		SSP1-RCP2.6 Sustainability: taking the green road	SSP2-RCP4.5 Middle of the road	SSP3-RCP7.0 Regional rivalry: a rocky road	SSP5-RCP8.5 Fossil-fuelled development: taking the highway
			working with nature, reducing flights or spiritual development (WV).		
	Legal	*WV focusses on equal treatment of all (benefits and costs), while SSP recognises different needs, abilities and responsibilities at the wider global scale (e.g. loss/damage, climate justice).	*SSP legal tools differ between countries (so are not 'equal') while WV works on equal access to resources. Mother earth as an equal claimant (WV) means a step back in the fisheries impact and therefore no need for quotas (SSP), an administrative enforcement of wisdom.	WV is equal shares, SSP protects particular elements nationally (quotas) and internationally (leading to transboundary disputes).	SSP legal framework arranged around markets and trade, WV is focussed on equal distribution rather than markets.
	Environmental	*SSP has less climate impact and a focus on environmental protection/global green goals (e.g. carbon reduction by offshore windfarms), potentially at the expense of food production; WV focus is on sustainability at the local level while also producing sufficient food.	Both involve conserving the natural landscape and sustainable use.	SSP focus on food production and environment is less important while climate degrades environments; WV protects environment and manages food production sustainably.	SSP focus on individual and market profit has degraded the environment; WV protects priority elements of the environment (e.g. coral reefs) and sustainable use of food resources for their intrinsic value.
Individualist	Political	Regulated SSP view versus deregulated market-based WV.	The WV is market based, with low interference from the estate and zero reference for sustainability; SSP has a focus in conservation, self-sufficiency, etc.	Decreased importance of nation states versus nation is the ultimate.	Both focussed on markets and individuals.
	Economic	SSP focus on costs of protection while WV focus is on free markets and deregulation.	SSP has community driven and converging economics while WV has diverging economics. Liberty of markets (WV) clashes with the small-scale economic activity and reduced income gap of SSP.	SSP includes trade barriers and subsidies while WV main focus is on free/efficient markets.	WV is free markets and trade, similar to SSP.

		SSP1-RCP2.6 Sustainability: taking the green road	SSP2-RCP4.5 Middle of the road	SSP3-RCP7.0 Regional rivalry: a rocky road	SSP5-RCP8.5 Fossil-fuelled development: taking the highway
	Social	WV is focussed on individual desires and needs rather than SSP whole-society view on sustainable future.	SSP focuses on sustainable use of resources while WV focuses on individual health. Equity (SSP) is incongruent with markets (WV).	SSP focuses on supporting national employment and resource use while WV focuses on individual lifestyles.	Both focus on individuals' wellbeing (SSP focused on individual and material wealth, while individualist WV focuses on choices on wellbeing at individual level).
	Technological	Both focus on technology development but SSP is for societal good while WV is for individual good.	The idea of the individual exploitation of resources and the technological development pushing this individual use of resources (SSP) is congruent with private modes of transport and technologies to enhance individual power (WV).	WV technology is focussed on the individual's needs/priorities whereas SSP is focussed on local/national.	Both focus on economic growth and efficiency.
	Legal	SSP focus on penalising failure to respect agreements, while WV focuses on competition for resources and finances and powerful interests gaining priority.	SSP and WV both include each country acting on their own interests, which infers competition.	WV is first come first served, while SSP is mainly not supportive of first come first served (eg quotas, protectionism); only international legal disputes are supportive of first come first served approach.	SSP legal framework arranged around markets and trade, WV is also aligned to individualist views of market (competition etc).
	Environmental	SSP prioritises environmental protection for sustainability goals and recognises need for large-scale environmental intervention, while WV protects environment only for market goals - if it is scarce and thus valuable and assumes environments are naturally resilient (may encourage degradation).	SSP conserves and sustainably uses natural resources while WV nature has value because of scarcity, which causes further degradation to some resources.	Food security important in both scenarios; biodiversity declines in both scenarios.	SSP focus on individual and market profit has degraded the environment; WV markets protect the value of the environmental resources which makes them scarce.

		SSP1-RCP2.6 Sustainability: taking the green road	SSP2-RCP4.5 Middle of the road	SSP3-RCP7.0 Regional rivalry: a rocky road	SSP5-RCP8.5 Fossil-fuelled development: taking the highway
Hierarchical	Political	Both focussed on high-level international cooperation.	SSP focuses on local and regional governance while WV focus is on international connections.	WV focuses on international negotiation and agreements while SSP has lack of agreements between nation states.	WV retains importance of global and international collaboration (big-state), while SSP is on individuals.
	Economic	SSP government drives the financial mechanisms to protect environment, aligned with WV.	SSP has community driven economic focus while WV focuses on national economic needs and multinationals.	SSP and WV use economic instruments to protect national interests.	*WV internalises environmental costs (polluter pays), SSP does not.
	Social	Both have similar aims but SSP is whole-society approach while WV has top down state-driven change.	SSP has a local focus while WV has top-down national focus.	Both focus on the national good (SSP on employment and tourism, WV on health and consumption).	*WV also protects society but with government control (WV is by community).
	Technological	Both focussed on technology as the optimal solution.	SSP technologies are local/regional while WV technology is large-scale and centralised (e.g. locally-owned vessels and fish farms versus large scale wind farms and centralized economy of scale).	Both have technology development (particularly for control) and little external sharing of technology.	*WV investment in technology is used to improve environmental protection, while in SSP it is about profit.
	Legal	Both aligned in focus on proportionality between incentive, need, damage and punishment.	The proportionality (WV administrative determination of rank, contribution or need) can underpin the fishing quotas, the mosaic of byelaws and regional management and strictly enforced regulations (SSP).	SSP emphasis on disagreement and individual approach/national protectionism while WV emphasises proportionality (attributing based on need etc).	*SSP legal framework arranged around markets and trade, WV is focussed on proportionality not individual/free-for-all.
	Environmental	Both put emphasis on stabilising/reducing carbon emissions and protecting the environment.	The eco-friendly activity and the development in keeping the natural landscape (SSP) with the "governments to plot the path that maximizes environmental returns for a given investment"	WV climate and impacts controlled by international co-operation and focus on environment; SSP focus on food and little international co-operation.	*SSP focus on individual and market profit has degraded the environment; WV large-scale initiatives to protect or mitigate environmental problems.

		SSP1-RCP2.6 Sustainability: taking the green road	SSP2-RCP4.5 Middle of the road	SSP3-RCP7.0 Regional rivalry: a rocky road	SSP5-RCP8.5 Fossil-fuelled development: taking the highway
			(WV). Despite sustainable stocks suggesting strong management (WV), the lack of coordination with transnational species (SSP) shows the opposite.		

* Where worldviews are incongruent with SSP-RCPs but describe a situation more conducive to EBM than under the SSP-RCP.