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► **To cite this version:**

Louise Quinio, Malena Ripken, Thomas Klenke, Brice Trouillet, Henning Sten Hansen, et al.. Exploring ecosystem-based approaches in MSP through actor-driven perceptual mapping. *Marine Policy*, 2023, 152, pp.105604. 10.1016/j.marpol.2023.105604 . hal-04115682

HAL Id: hal-04115682

<https://cnrs.hal.science/hal-04115682>

Submitted on 2 Jun 2023

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Quinio, L., Ripken, M., Klenke, T., Trouillet, B., Sten Hansen, H., Schröder, L. (2023) Exploring ecosystem-based approaches in MSP through actor-driven perceptual mapping. *Marine Policy*, 152, 105604. <https://doi.org/10.1016/j.marpol.2023.105604>

Exploring ecosystem-based approaches in MSP through actor-driven perceptual mapping

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Abstract : This paper introduces an interactive method which aims to map out perspectives on the state of ecosystem-based approaches (EbA) in marine spatial planning (MSP). MSP meets a need for organising the allocation of space to maritime uses. MSP should also control and limit the pressures induced by these activities on marine ecosystems. To evaluate how EbA is actually applied, this research proposes a participatory method to assess the effectiveness of current EbA practices within MSP process using perceptual maps. The mapping focuses on two dimensions: relevance and implementation of a set of 13 key elements of EbA. The method was tested on a sample of marine planners from ongoing MSP processes in northern European sea basins. The study shows that perceptual maps provide four main benefits: participatory, visualization capacity, qualitative and quantitative applicability, and easy to use. This tool has undoubtedly the potential to illustrate the state of integration of EbA in MSP and highlight the priority issues to develop in future plans, and consequently to provide keys to revise marine plans in a way that better takes into account EbA principles.

Keywords: Ecosystem-based approach (EbA) - Marine spatial planning (MSP) - Participatory approach - Interactive assessment - Perceptual mapping

1. Introduction

Marine spatial planning (MSP)¹ is a political process which is aimed at “analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that are usually specified through a political process” (Ehler and Douvere, 2009). The objectives are, therefore, threefold and echo the pillars of sustainable development.

After adopting the Marine Strategy Framework directive (MSFD) in 2008 (Directive 2008/56/EC), the European Union enacted a Maritime Spatial Planning Directive (MSPD) in 2014 which obliges states to provide national marine plans by 2021 (Directive 2014/89/EU). One of the Directive’s prerequisites is to apply an ecosystem-based approach (hereafter EbA) through the process and establishment of marine plans: “(...) maritime spatial planning should apply an ecosystem-based approach (...) with the aim of ensuring that the collective pressure of all activities is kept within levels compatible with the achievement of good environmental status and that the capacity of marine ecosystems in terms of responding to human-induced changes is not compromised, while contributing to the sustainable use of marine goods and services by present and future generations” (Directive 2014/89/EU).

Despite being introduced three decades ago, EbA principles are still not fully and consistently defined. References can be found in the Convention on Biological Diversity (1992) and the 12 Malawi principles were defined in 1998 to support the EbA. In Europe, EbA is defined both in the Helsinki and OSPAR Conventions in 2003 and has been introduced in marine management with the MSFD Directive. However, not all the Directive’s sections are clear, questioning whether a partly

¹ Also referred to as maritime spatial planning

vague directive can be fully implemented in a common manner. For instance, Jay et al. (2016) mentioned EbA as merely a “buzz word”.

As a consequence, we can define and execute EbA in different ways. Marine scientists and planners have recognised a lack of clarity and applicability of the EbA. Time was needed to define and discuss the theory about the EbA and its role in the MSP process (Arkema et al., 2006; Douvere, 2008; Foley et al., 2010; Gilliland & Laffoley, 2008; HELCOM & VASAB, 2016; Kirkfeldt, 2019; Kostamo et al., 2020; Langlet & Westholm, 2019; Long et al., 2015). Reflections and criticisms have been ongoing to reduce the remaining gap between theory and practice in MSP (Ansong et al., 2017; Crowder & Norse 2008; Flannery et al., 2020; Frazao Santos et al., 2014; Katsanevakis et al., 2011). As a result, the balance between the social, economic, and environmental objectives appears rarely achieved (Frazao Santos et al., 2014; Gilek et al., 2019; Kirkfeldt et al., 2021; Trouillet, 2020). This raises questions, especially as this balance is increasingly highlighted in policies, as evidenced by new European regulations such as the Green Deal (COM(2019) 640 final) and the new approach for a sustainable blue economy in the EU (COM(2021) 240).

Therefore, the need to produce methods to assess the implementation of the EbA in marine plans has arisen in research and European policies (Alvater & Passarello, 2018; Alvater et al., 2019; Ansong et al., 2017; Buhl-Mortensen et al., 2017; Dominguez-Tejo et al. 2016; Long et al., 2015; Piet et al., 2019; Pinkau & Schiele, 2021; Rodriguez, 2017; Schmidtbauer Crona, 2017). Among the different attempts to take EbA into account, scientists took an interest in looking at views and institutional contexts of responsible planners (Ansong et al., 2017; Schmidtbauer Crona, 2017). Planners are familiar with regulatory needs, stakeholders, practices, and debates in MSP.

This paper looks into the complexity in making this regulatory norm a reality in MSP and contributes to the debate on EbA integration in MSP, both on scientific and policy sides. Taking the viewpoint of civil servants responsible for national MSP processes seems to be a promising way to learn empirically. This group of practitioners belongs to different governmental settings and handles different marine ecosystems and maritime use portfolios. Concretely, this study aims to examine which key EbA elements are the most relevant according to marine spatial planning. It presents a promising method to explore the extent to which EbA integration is effective in MSP. We used an actor-based, participatory tool called perceptual mapping. We then tested it with marine planners across northern European sea basins, with initial findings regarding the method and study area. Finally, we discuss the main insights and the strengths and weaknesses of such an approach to support EbA in MSP systems.

2. Material and methods

To build the methodology of this research, we conducted a comprehensive literature review on methods used to get an overview on how EbA has been addressed so far. Each step of the process presented in Figure 1 is detailed in the following subsections. Subsection 2.1 digs into the synopsis of methods applied in the analysis of EbA in MSP (step 1). The next subsection (2.2) presents the assessment framework used, including the perceptual mapping (step 2). Then, subsection 2.3 explains how we conducted interviews (step 3), while the last subsection (2.4) provides answers on possible ways to analyse collected materials (step 4).

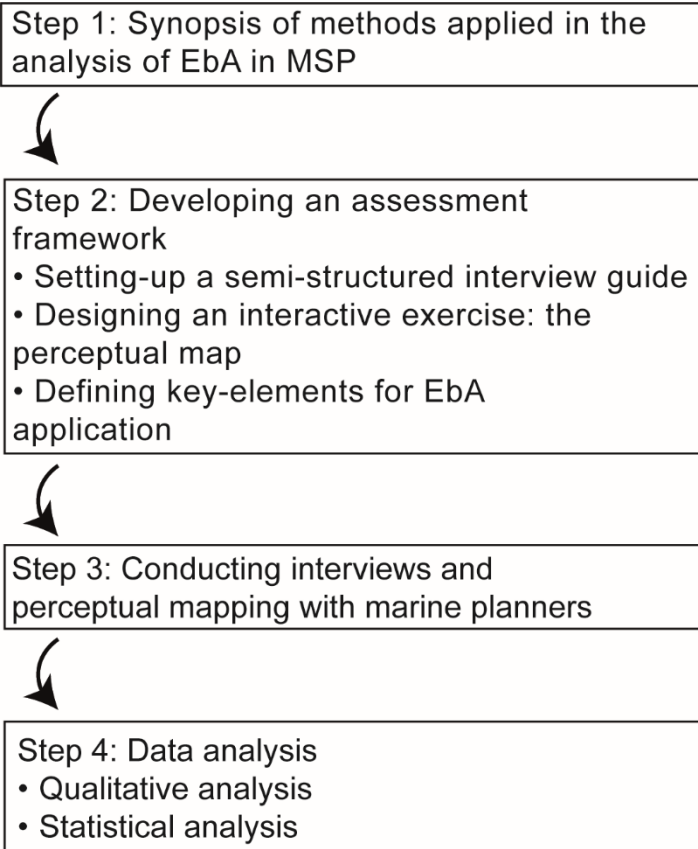


Figure 1: Stepwise process of the method of this study

2.1. Synopsis of methods applied in the analysis of EbA in MSP

This synopsis is the first step of the stepwise framework defined to build the methodology of this study, which is summarised in Figure 1. Methods to analyse the implementation of the EbA in MSP have been proposed in several studies (Ansong et al., 2017; Dominguez-Tejo et al., 2016; Kostamo et al., 2020; Rodriguez, 2017; Schachtner, 2019; Schmidbauer Crona, 2017).

An example of a method used to analyse EbA integration consists of a qualitative analysis per key element at the national level, or by comparing case studies (Kostamo et al., 2020; Schachtner, 2019). To supplement these qualitative approaches, we conducted several quantitative methods. For instance, Dominguez-Tejo et al. (2016), have created a six-steps scale to assess the level of application for each criteria inspired by the Malawi principles. Another method, developed in 2017, consists of quantifying the EbA integration by using software to conduct a correspondence analysis between selected indicators within a framework including core elements of the EbA in literature and planning documents (Rodriguez, 2017).

Another quantitative-oriented approach looks at stakeholders' opinions, by using a questionnaire for instance (Ansong et al., 2017). A check-list toolbox was developed in 2017 in which each key element is assessed by actors answering a written question (Schmidbauer Crona, 2017). The assessment consists of estimating the level of application on a scale, and then describing the motives and the methodology used to do so. Based on stakeholders' answers, a comparative analysis can be conducted between countries. A publication of WWF European Policy uses a similar approach with an equivalent method (WWF, 2021).

This synopsis shows the importance of key elements in assessment methods of EbA in the complex MSP process, as well as the interest in actor-based methods. Based on this observation, we expanded our research design by developing a participatory EbA assessment framework that includes interviews with planners.

2.2: Developing an assessment framework: a perceptual mapping exercise

In order to combine an evaluation with an explanatory verbal exchange, the method presented here is based on an interview supported by an interactive exercise - called perceptual mapping - using key EbA elements (Appendices A). It also brings together two dimensions of assessment, relevance and implementation and allows for real-time remarks and numbers, rather than ones handwritten.

Description of the exercise

Perceptual mapping can be defined as a representation of perception on two or more dimensions. Gower et al. (2010) explain that the intention is to present information in an “*engaging graphical manner.*” It is a method particularly used in marketing to assess “people’s perceptions of products, or relationships between pairs of products” (Gower et al., 2010). It has also been used for project prioritisation and selection (Zheng & Vaishnavi, 2011), or to study the tourism market (Kuo et al., 2012). This setup was also thought in a remote context, allowing online interviews, as other methods have been developed since 2020 (Köpsel et al., 2021).

The objective is to conduct the analysis on the planners’ perceptions. This allows planners to reflect on two points. On the one hand, they reflect on the relevance of each key element of the EbA (x-axis), ranging from low to high. This means the level of pertinence of this key element to reach an ecosystem-based MSP process. On the other hand, it allows planners to think about the degree of implementation of each key element in the process (y-axis), ranging from limited to fully. This assesses whether the objective has been achieved in the planner’s country. However, the axes are not graded during the exercise to avoid the planner reasoning too much in terms of scoring and performance. The aim is that the planner tries to explain and justify decisions for each key element represented by a dot on the map (Figure 2).

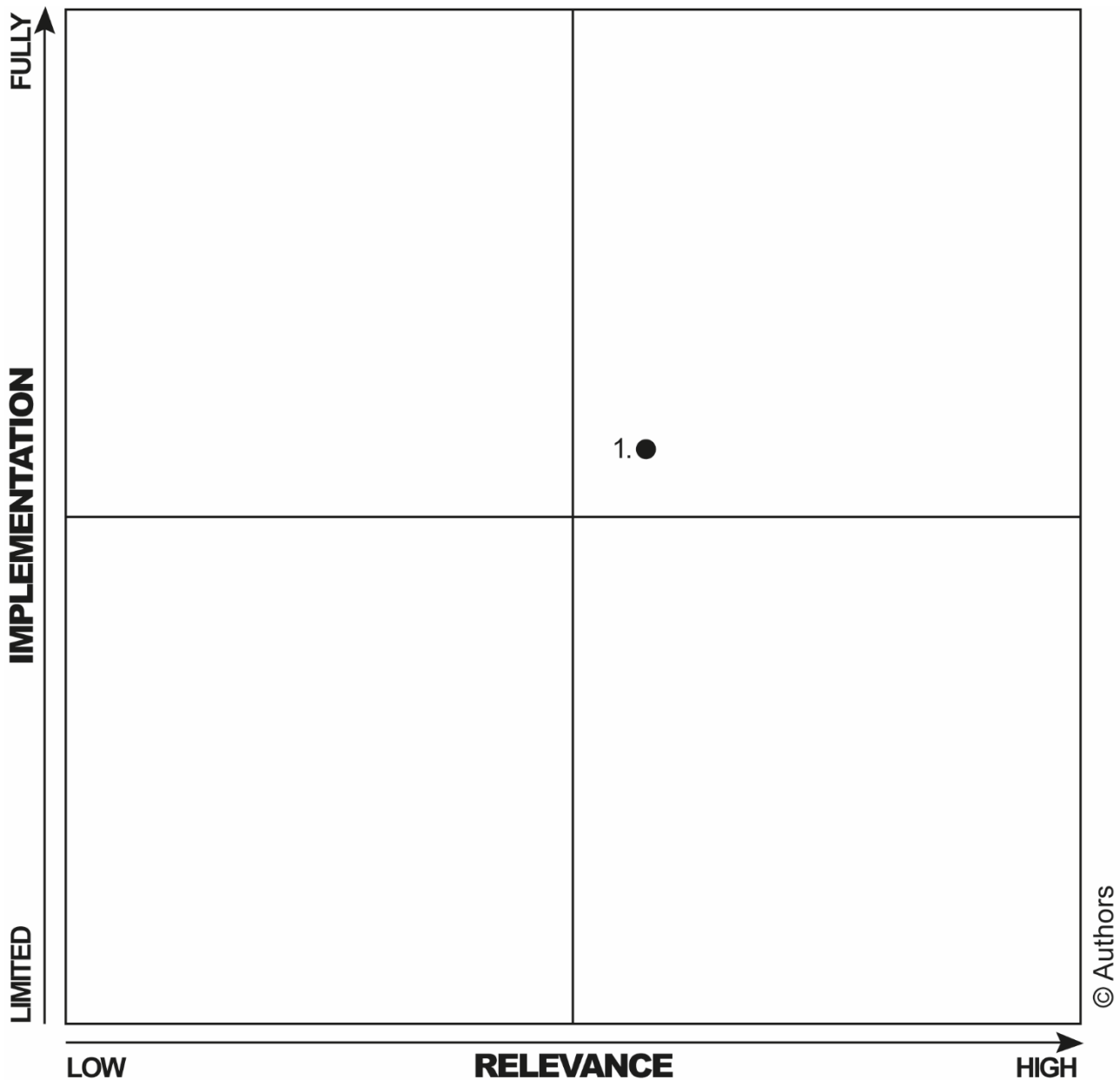


Figure 2: Picture of the perceptual map with the relevance and implementation, with a dot as an example of how the planner could reflect on the key element number 1.

Defining a list of key elements and their definition

During the interactive exercise, the planner has access to a list of key elements (Table 1). Therefore, we conducted preliminary work on their definition. Lists of elements defining the EbA already exist. The most acknowledged one was developed in 2016 by a working group under HELCOM and VASAB (Vision and Strategies for the Baltic Sea region) to complete the Baltic Sea broad-scale MSP principles in which the second one is the EbA (HELCOM and VASAB, 2010). They define nine key elements “as an operationalisation of the ecosystem-based approach in line with the Malawi Principles” (HELCOM and VASAB, 2016).

Some key elements were considered difficult to assess for a planner based on their phrasing or their construction. Firstly, three elements of HELCOM-VASAB use the conjunction “and”. However, this conjunction can induce different aspects, making it difficult to evaluate as a unique element. Therefore, three key elements from the original list were subdivided. Secondly, the phrasing of two other key principles was modified as they were considered too broad (Piwowarczyk et al. 2019). They needed to be more precise to allow planners to use the perceptual map, or modified because their definition could lead to confusion. For instance, *relational understanding* was subdivided into *cumulative impacts* and *land-sea interactions*.

Since the HELCOM-VASAB guideline from 2016, other attempts to improve the EbA definition have been tried out in MSP communities using various methods. Thus, it appeared necessary to

include insights from some other works (Alvater & Passarello, 2018; Ansong et al., 2017; Directive 2014/98/EU; Ehler & Douvère, 2009; Gilliland & Laffoley, 2008; Langlet & Westholm, 2019; Long et al., 2015; Schmidbauer Crona, 2017). Therefore, key elements, criteria, and principles were reviewed to offer an updated definition to planners during the interview (Table 1).

Table 1: Definition of EbA key elements available to planners for the perceptual mapping exercise

Key element	Definition	References
1. Best available knowledge	Ecosystem-based approach MSP shall consider all forms of information and be based on the latest state of knowledge of the ecosystems to make use of the best available data and information, including local knowledge, by encouraging the relevant stakeholders to share information.	Alvater & Passarello, 2018; Directive 2014/98/EU; Gilliland & Laffoley, 2008; HELCOM & VASAB, 2016; Langlet & Westholm, 2019.
2. Best practice	Best practice is considered as the practice of safeguarding the components of marine ecosystems in the best possible way which conserves ecosystem structure and function and manages it within its functional limits.	Alvater & Passarello, 2018; HELCOM & VASAB, 2016; Langlet & Westholm, 2019.
3. Precaution	Precaution means that planning should be anticipatory and preventive regarding risks and hazards of human activities on the ecosystem. When information is lacking, the precautionary principle should be applied. In this way, uncertainty is acknowledged until relevant information is available.	Dominiguez-Tejo et al., 2016; Gilliland & Laffoley, 2008; HELCOM & VASAB, 2016; Long et al., 2015.
4. Alternative development	In the planning process, when negative impacts on the environment or the ecosystem goods and services are identified, alternatives are developed to avoid or reduce them.	Ehler & Douvère, 2009 ; HELCOM & VASAB, 2016.
5. Identification of ecosystem services	Identification of ecosystem services allows evaluating socio-economic potentials provided by the ecosystem, and also allows evaluating socio-economic effects and the ecosystem limits.	HELCOM & VASAB, 2016; Langlet & Westholm, 2019.
6. Mitigation	When adverse effects on the ecosystem are identified, and that precaution and alternative developments are insufficient or cannot be applied, measures are taken to prevent, reduce and offset these effects as much as possible.	HELCOM & VASAB, 2016; Langlet & Westholm, 2019.
7. Cumulative impacts	Cumulative impacts translate the necessity to evaluate all kinds of impacts to ensure that the combined pressures of human activities are kept within safe limits. This includes direct/indirect, short/long-term, permanent/temporary and positive/negative impacts.	HELCOM & VASAB, 2016; Langlet & Westholm, 2019.
8. Integration of land-sea interaction	Land-sea interactions mean that not only marine activities are integrated into the planning process but that the need to integrate coastal and	HELCOM & VASAB, 2016; Langlet & Westholm, 2019.

	sometimes further landward activities is also considered.	
9. Participation	All relevant stakeholders are involved in the planning process at an early stage. The emphasis is put on cross-sectorial integration to facilitate planning and coordination.	Ansong et al., 2017; Ehler & Douvère, 2009 ; HELCOM & VASAB, 2016.
10. Communication	Progress and results during the process shall be communicated to all stakeholders to ensure transparency in the planning process.	Ehler & Douvère, 2009 ; HELCOM & VASAB, 2016 ; Schmidtbauer, 2017.
11. Subsidiarity	Planning is conducted at the most appropriate level.	HELCOM & VASAB, 2016.
12. Coherence	It is necessary to seek some coherence between levels both in terms of understanding and planning.	HELCOM & VASAB, 2016; Langlet & Westholm, 2019.
13. Adjustment	The planning process shall include monitoring, reviewing and evaluation of both the process and the outcome to ensure a gain in experience and improve development by adapting the process when needed.	Directive 2014/98/EU; HELCOM & VASAB, 2016.

2.3. Step 3: Conducting interviews

Once the perceptual mapping exercise is defined (including the two dimensions on which the evaluation is based - relevance and implementation - as well as the key elements), a third step consists in defining target actors to conduct the interviews. To analyse the overall planning process on which the reflection focuses, rather than concentrating on a specific field of expertise, the targeted actors were marine planners. These planners work for national authorities and have an overview of the entire MSP process. To get points of view from different national experiences and to analyse unique processes, interviewees from multiple countries with different skillset can be sampled.

The EbA is a prerequisite of the European MSP Directive. Therefore, the methodology was tested with marine planners from European countries where the directive applies. The study covered three sea basins: the Baltic Sea, the North Sea, and the Channel Sea. We identified one interviewee in each country. In total, we conducted 7 online video-conference interviews lasting between 60 and 120 minutes including the perceptual mapping exercise. The interviews were conducted in English and recorded between May and July 2021. The countries that responded positively to our request and took part in the interviews were: Belgium, Denmark, Estonia, Finland, France, Germany, and Sweden. The results are kept anonymous, as the objective is to show examples of analysis and results this method can produce. The goal was not to draw conclusions about any specific country, as the maps produced represent the perceptions of individuals. The aim was to discuss planners' understanding of EbA within MSP and to reflect on both its application in their MSP process and on possible futures for the EbA in MSP.

2.4. Step 4: Data analysis

Generally, the maps obtained can be analysed individually or compiled to facilitate comparative analysis. Qualitative analysis can be done using stakeholders' input, with their answers to general questions on the EbA, and explanations given during the perceptual mapping exercise for each key element. Planners are instructed to explain their choice, which enabled us to obtain a qualitative assessment of each key element and general remarks about the EbA. Quantitative analysis can also be conducted using the scatterplots obtained with the perceptual maps. To do so, after a few questions on MSP and EbA, the exercise was described to the planners. They were specifically asked to locate one by-one the key-elements on the map after reading their definition, and to justify their decisions (see Appendix A). Both dimensions of the diagram can be analysed separately. In

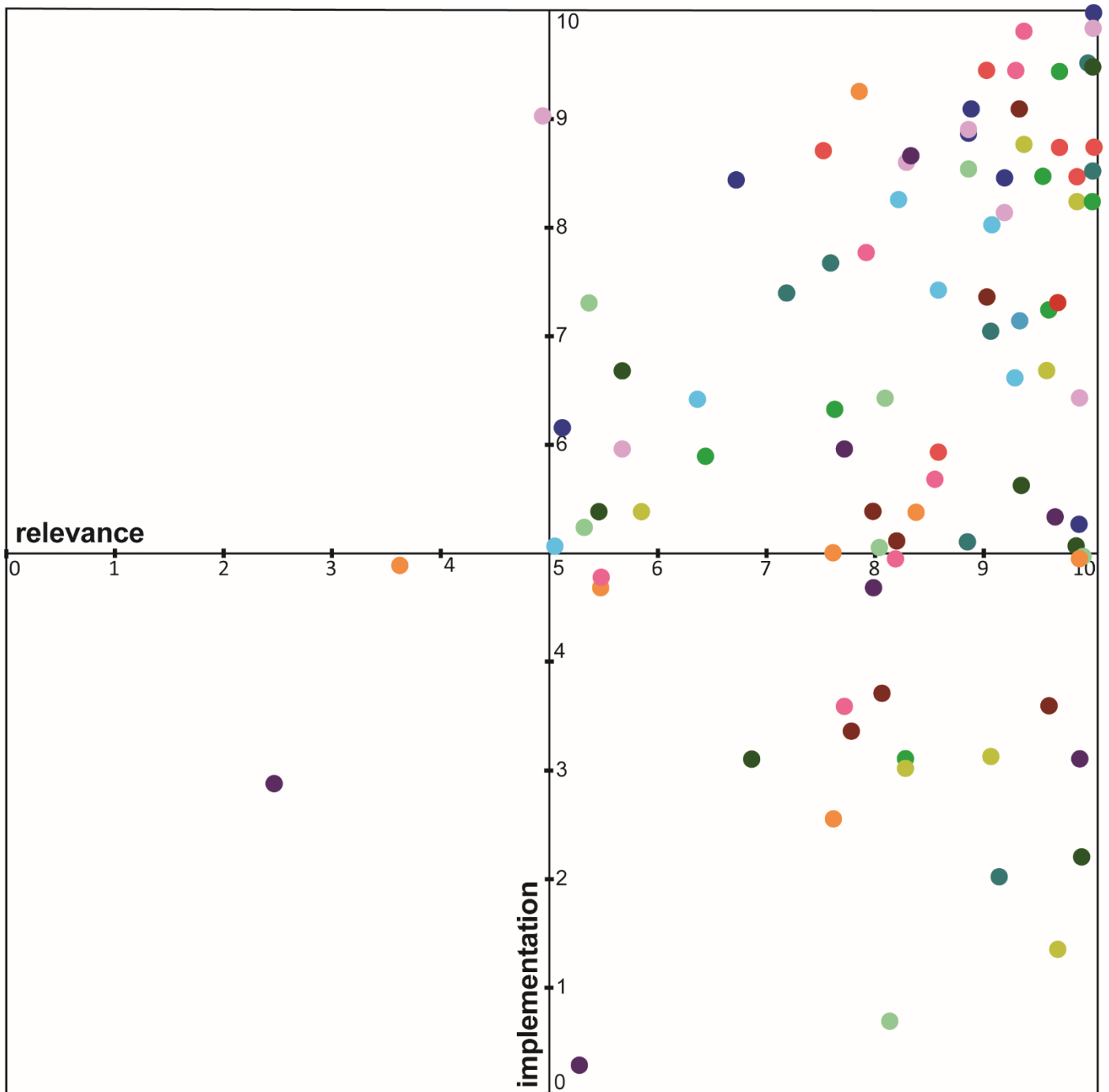
this study, we chose both paths, qualitative, and quantitative analysis to test the method. Through calculating the mean and standard deviation of each assessed element, we created a division into three 'classes' for the two dimensions (relevance and implementation) separately. The three 'classes' were defined as (i): above the mean, (ii) around the mean, and (iii) below the mean. The upper and lower boundaries of each 'class' was calculated through adding or subtracting the standard deviation of the mean. As an example, the limit for the 'class' below the mean for relevance was calculated with the mean of all key elements for all planners (8.24) minus the standard deviation (0.59): $8.24 - 0.59 = 7.65$ (see Appendix C).

3. Results

3.1. Qualitative approach

Two ways to look at the perceptual maps: focusing on key elements or interviewees

If both dimensions were analysed jointly, it is still possible to look at the results offered by the perceptual mapping from two points of view. Focusing on the key elements is one way to analyse the results (Figure 3), however, it is also possible to focus on interviewees (Figure 4). Compiling the results of the seven interviews conducted to test the method, the results show a total of 91 dots representing the 13 key elements assessed by the planners (Figure 3).



Key-elements of the EbA to MSP

- 1. Best available knowledge
- 2. Best practice
- 3. Precaution
- 4. Alternative development
- 5. Ecosystem services
- 6. Mitigation

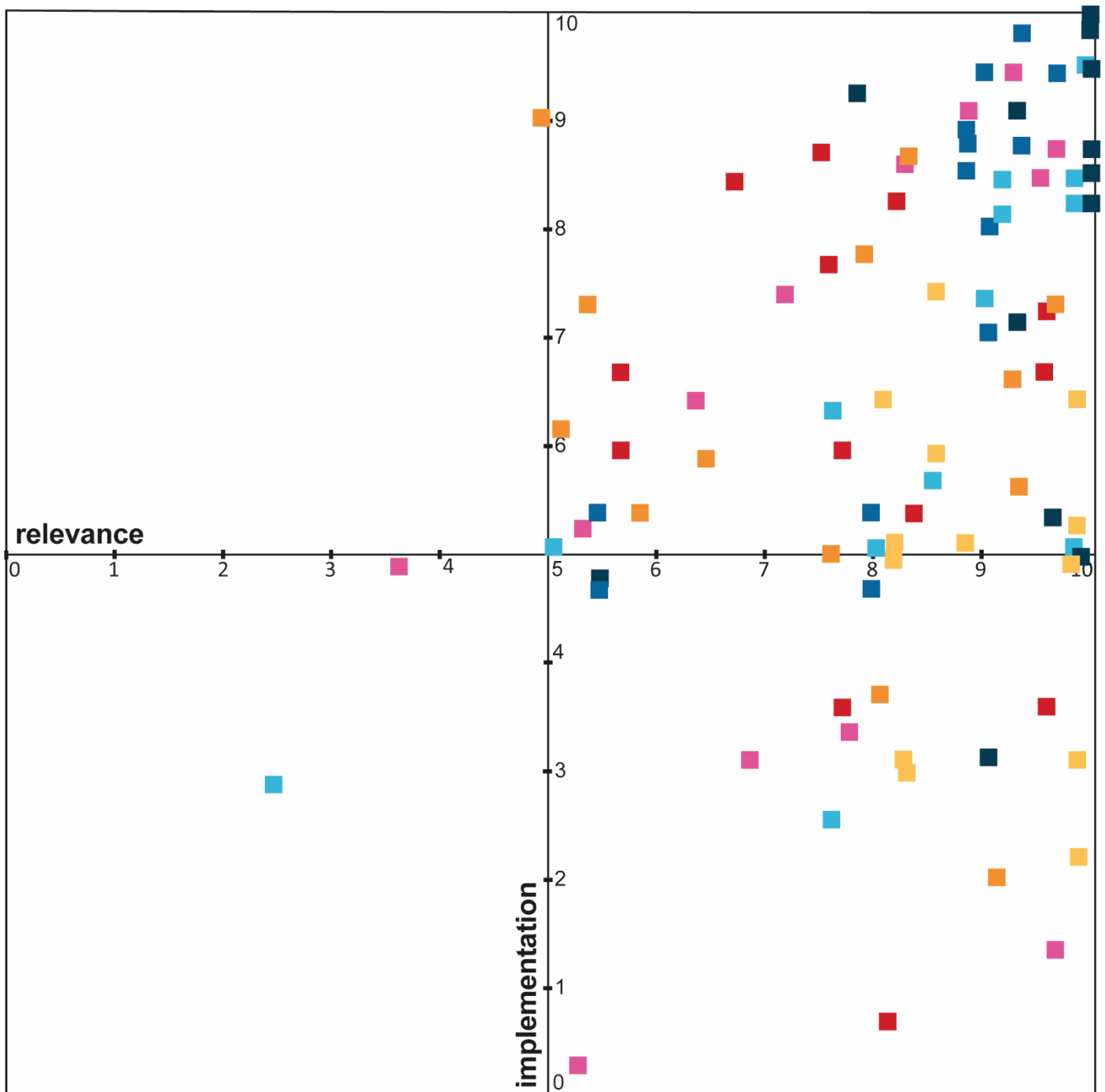
- 7. Cumulative impacts
- 8. Integration of land-sea interaction
- 9. Participation
- 10. Communication
- 11. Subsidiarity
- 12. Coherence
- 13. Adjustment

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Figure 3: Scheme compiling planners' original perceptual maps with relevance and implementation of EbA in MSP by differentiating the 13 key elements

As the presence of most of the key elements in the upper right-hand square shows, the general outcomes are quite positive. This reflects a positive overall assessment of both the relevance and implementation. Within the remaining key elements, a majority are located in the bottom-right square. This indicates a consistently high level of relevance but a lower level of implementation. This part of the map particularly involves *cumulative impacts*, *land-sea interaction* but also *alternative development* and *mitigation* at the edge.

Focusing on the interviewees is another possibility to present the results (Figure 4). This involves the same scatter plots (here squares) but the semiology highlights the planners, numbered from 1 to 7. The respondents from the Baltic Sea are in cold tones, and those from the North Sea and the Channel in warm tones. Two main observations can be highlighted. Firstly, some actors only arranged their key elements in a limited range, which is the case for interviewees 4, 5, and 7. The others used more space on the perceptual map and are therefore more spread out, which implies further differences between the key elements. This suggests disparities in the efforts invested in different dimensions of the EbA. Secondly, actors 1 and 3 also gave a rather positive assessment, although their key elements are more spread out and some have lower scores. Finally, planners 2, 6 and 7 are also similar because their key elements appear more intermediate or low. They include planners from the Channel and the North Sea.



Planner assessing each key-element

- | | | |
|------------|--|---|
| | ■ Interviewee 1 (I-1) | ■ Interviewee 2 (I-2) |
| Baltic Sea | ■ Interviewee 4 (I-4) | North Sea & the Channel |
| | ■ Interviewee 5 (I-5) | ■ Interviewee 3 (I-3) |
| | | ■ Interviewee 6 (I-6) |
| | | ■ Interviewee 7 (I-7) |

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Figure 4: Scheme compiling planners' original perceptual maps with relevance and implementation of EbA in MSP by differentiating the 7 planners

These two ways of looking at the perceptual maps using the key elements assessed and the interviewees, show how basic information can be drawn out of the results. The method is easy to read and interpret, even though perceptual maps express the evaluation of a relatively complex concept.

A positive general view on the current state of EbA in MSP across northern Europe

In addition to perceptual mapping, this method of interview also makes it possible to see whether there are any discrepancies in the understanding of EbA and its use in MSP, and to identify them.

Our study shows that planners shared a common vision of their understanding of the EbA, with all planners recognising how essential it is for the marine environment. Two of them emphasise the need to improve knowledge of the underwater world, which is still limited. Other planners put more emphasis on its importance as a shared concept *"that provides you with a platform to discuss"* (I-4). Since the introduction of EbA into marine planning, planners who were interviewed recalled the "complexity" (I-3, 6, 7) of this "broad" concept (I-5, 7), which indicated its lack of clarity. As a result, explaining the concept to stakeholders can be a challenge, and may sometimes weaken their involvement (I-6).

In terms of its implementation, the EbA is being pursued in all processes. However, the degree of implementation differs. Sometimes only "parts of it" are currently applied (I-1, 6), while in better examples it is implemented "for the most part" (I-2). A planner explains that *"if you're very strict (...) no we're definitely not there yet and we'll not be there for many years. Are we trying to get there and is there an honest attempt to, despite the uncertainty and the limitations, to do marine planning that is as ecosystem-based as possible, then the answer is yes, I think so"* (I-1). These differences in perceptions can be explained by the stage of the process, the choices made at national level, and the focus on which key elements of EbA are being addressed. The results show that efforts do not target the same issues everywhere, with examples given such as participation (I-4), knowledge (I-6), or sensitive areas (I-5), ecosystem services or coastal activities and recreation (I-3).

This general overview provided by the qualitative analysis is useful to draw similarities and differences and show how we can cross-reference different MSP processes without directly comparing them. The quantitative approach is another possibility to look more closely at the results.

3.2. Quantitative approach

The perceptual mapping allows the researcher to analyse the differences in the general understanding of EbA and its use in MSP, but also to look closely at the result for each key element. When quantifying the perceptual maps into coordinates, it is possible to get a mean per key element for its relevance as well as on its implementation.

We settled the statistical classification based on the standard deviation and the mean for relevance, on the one hand, and implementation on the other (see section 2.4). This led to the creation of three classes, which can be seen in Figure 5 with three tones of the colour gradient on the bars. The bars represent means of relevance and implementation for the 13 key elements in which major differences can be observed between key elements. The element *adjustment* is taken out because there are mixed views on this key element, depending on the stage of the MSP process. It is difficult to draw results on this element as several respondents were unsure of how to assess it at that time.

This method can lead us to the analysis mixing both, relevance and implementation, as general qualitative observations on the perceptual maps showed. However, a highly implemented key element with a lower relevance does not have the same meaning as a very relevant key element with a lower implementation. This second analysis testifies the interest to look deeper into the existing differences between relevance and implementation, because they are a baseline to find explanation and discussion to highlight related issues.

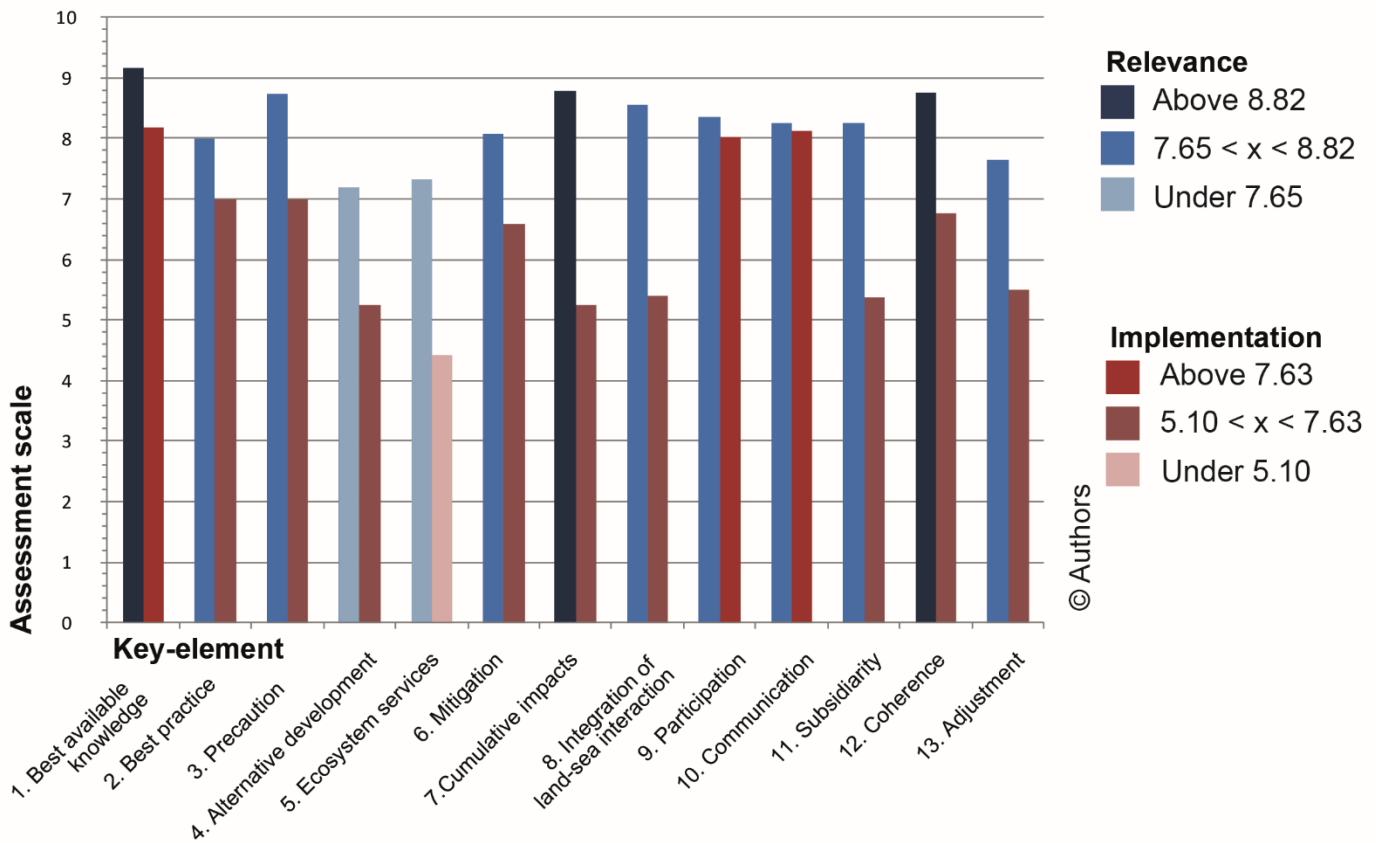


Figure 5: Diagram representing the average for each key element of relevance (blues) and implementation (reds) for EbA in MSP

Grouping key elements together allows us to express key messages from the results and put them into perspective. This grouping helps to make the issues behind the assessment's results more readable. This typology does not only follow the results of the quantitative analysis, but also looks at the differences observed between relevance and implementation. In this study, we set up three groups: (i) pillars of the EbA, (ii) key elements to be discussed, and (iii) promising key elements.

To begin with, pillars (i) are considered as important aspects of the EbA, since they are the key elements with the highest implementation which means that they are the most established within MSP processes. Key elements are included in this designation when their implementation is above 7.63 (dark red in Figure 5). This involves *best available knowledge, participation and communication*.

Secondly, when key elements show a lower relevance than average, we could discuss whether they should be considered within the EbA or receive less attention (ii). Two key elements are shown to have a less than average relevance with a mean under 7.65 (light blue in Figure 5). These two elements are: *alternative development and ecosystem services*.

The last category includes the other key elements, considered as promising (iii), which implies that it could be interesting to develop them in the future. Their relevance is higher than their implementation and their relevance is above 5.37 (medium or dark blue in Figure 5). *Best practice, precaution, mitigation, cumulative impacts, land-sea interaction, subsidiarity and coherence* are included in this last category.

This shows how qualitative interpretation can be useful to highlight similarities and differences in order to understand EbA better. Thus, the results indicate how the perceptual maps obtained can be assembled, and how they can present the information in two distinct ways. After this, another type of approach showed how the scatterplot obtained may be quantified. Finally, we showed that the method allows us to identify central issues based on the results to facilitate and clarify the discussion.

4. Discussion

The results obtained with perceptual maps illustrate how using this method can contribute to evaluations of how EbA is used in MSP processes. This paper mainly aimed to look at EbA key elements in MSP and assessed them by referring to two dimensions: relevance and implementation. Testing the method with a sample of marine planners led to interesting results. Similarities and differences were identified, and central issues were highlighted. These results also allowed us to discuss the overall potential of the method.

Important issues can be highlighted in each category of key elements created above. Firstly, regarding the category pillars of the EbA (i), the main argument raised by planners was that the key element *best available knowledge* is “critical” (I-5), which is why they “need to know more making any other decisions” (I4). For *participation* and *communication*, we can observe a slightly lower relevance than the first key element. Some planners’ doubted whether they are part of the EbA or the overall MSP process, and if it should take place from the very beginning of the process (I-2).

Secondly, within key elements to be discussed (ii), arguments also refer to the scale of planning. One planner explains that the *development of alternatives* is “relevant when you’re doing a licensing process or planning very concrete solutions. But in MSP we are more general, and we must find the solution for a whole sea and its different uses” (I-5). Another study also points out *alternative development* as a key element requiring a closer look to be well implemented, indicating its relevance within EbA reflection. Sometimes, opinions are contrasted, such as the case with *ecosystem services* as seen by the following statement: “they’re not clear, not quantifiable and they don’t make sense” (I-1). Another planner considers that “it could be a solution for the decision to be more accepted if we can prove that safeguarding the environmental stakes can be a source of benefits for some sectors” (I-7). However, another planner disagreed: “they are people who do not want to do that because they don’t want to put a price on nature” (I-5).

Lastly, the group of promising key elements (iii) involves most of the key elements and reflects the work still remaining to better apply the EbA in MSP. These elements have a relevance score at, or above, average and an implementation score which is lower but still around the mean. Different arguments explain their lower level of implementation. The list considers how easily one can access and collect data, but also the scale and boundaries of the national planning system. One example of implementing *best practice* consists in saying: “If you’re talking of very technical fields like engineering, then you can clearly relate to what is best practice in some areas, but I think when it comes to environmental management at such a scale, it’s not possible” (I-1). Lastly, as Pinkau & Schiele (2021) stress, it is essential to focus on *precaution*, as this key element is also considered as promising here, confirming the need for specific measures. Even if the relevance of promising key elements is around average, some planners had contrasting opinions on their relevance, for instance: “the mitigation is not, to my mind, relevant in this phase (...) it’s not a planning question on this strategic level” (I-5). For another, it is the temporal scale that is not appropriate: “it can be a bit challenging to plan for mitigation of activities that are not quite established yet or that aren’t planned yet, so we don’t know the actual impacts of the project” (I-7).

The results show some implication for each key element, often justified in relation to issues commonly discussed in the MSP community. Knowledge, time, and resources are major concerns in the implementation of EbA (Altvater et al., 2019; Buhl-Mortensen et al. 2017; Ehler, 2008; Gilek et al., 2019; Hammar et al., 2020; Jay et al., 2016; Langlet and Westholm, 2019), particularly concerning complex data needed for some key elements related to the knowledge of ecosystems. Stithou summarises three issues related to the data: availability, method, and organisation (Stithou, 2017). Several researchers have already worked on defining specific methods to upgrade our understanding and better consider and evaluate key elements, for instance: *ecosystem services* (Böhnke-Henrichs et al.; 2013) and *cumulative impacts* (Aps et al., 2018; Krikfeldt & Andersen, 2021).

The scale of planning seems to be a problematic issue. This refers to the broad scale used for the MSP process, which has been discussed by authors such as Cormier et al. (2017) and Westholm (2021). Early in the discussion, Ehler (2008) also emphasised that EbA is not only about MSP, as this is “only one part of the tool box”. Some have advocated applying EbA at the scale of activities (Cormier et al., 2017), by doing it in a more distributed manner, referring to the example of marine

protected areas (Sarda et al., 2017). Others have argued for better considering the local context to avoid what Kidd (2019) in the land-sea interaction context called the non-existent “one-size-fits all solution to establishing governance arrangements. Other authors are contributing to this ongoing discussion on why we need to focus more on the local context, mentioning traditions, management by sector (Kelly et al., 2018), or differences between countries (Rodriguez, 2017). Not everything depends on MSP, and it is questionable whether its approach is too holistic at times for the EbA.

Legal limitation is also a factor restricting the implementation of EbA, something that has been discussed extensively (Altvater & Passarello, 2018; Ansong et al., 2017; Hassler et al., 2018; Kidd, 2019; Kirkfeldt and Andersen, 2021; Rodriguez, 2017; Soderstrom and Kern, 2017; Westholm, 2019). This raises the question of whether an EbA is possible within a system made of governance and boundaries. Furthermore, this questions the ability of the system of governance to provide guidance. Some authors mention a purposely vague “new generation policy” (Hassler et al., 2018) to give member states freedom on its application. Others argue that the legislation needs to be updated (Cormier et al., 2017; Kirkfeldt & Andersen, 2021).

Results and issues pointed out in this paper are based on analysis conducted by using perceptual maps. This addresses the need for a more concrete understanding of the concept of EbA to support its implementation in MSP. In the following paragraphs, the effectiveness and appropriateness of the method will be discussed.

As a basis of the perceptual mapping exercise, the list of key elements was identified and adjusted to simplify some of them and facilitate their assessment (see 2.2). According to the results, the identified list of key elements was perceived as appropriate by the interviewees, except for the key elements *participation* and *communication*, for which the assessment is often similar. Therefore, we recommend conducting the perceptual mapping exercise by merging these two in the future, as it has already been done in guidance documents or literature. However, the other subdivisions (*best available knowledge*, *best practice*, *cumulative impacts*, *land-sea interaction*, *subsidiarity and coherence*) and subsequent definitions (Table 1) appear to be relevant, since their assessment does not overlap.

Moving from theory to practice has also brought forward new methods and tools to assess EbA implementation. The assessment method highlighted in this paper is interactive, participatory, and can be reused in various contexts. It can be a useful tool in national MSP process or transnational evaluation stages, which sparks interesting discussions between stakeholders about the EbA and raises awareness on how to improve and fill certain gaps.

However, this work has some shortcomings. Firstly, the results include perceptions of planners from seven countries and do not represent all MSP processes in northern Europe. It would be a subsequent step to consider countries in other sea basins as well. Secondly, the assessment is built on information provided by individuals who do not necessarily represent the opinion of a national institution. It would be rewarding to extend the participatory study to a larger number of maritime stakeholders to better reflect the situation in a given country. Nevertheless, this study details the level of heterogeneity of opinions on EbA, as well as some major issues related to the effectiveness of an EbA in MSP in northern Europe.

5. Conclusion

This study aimed to know whether EbA is well integrated in marine planning and to see if perceptual mapping can support the evaluation of EbA in MSP processes. One of the obligations of the 2014 MSP Directive is the application of EbA and the results of this research showed how a participatory tool can support the evaluation of EbA in MSP processes. We explored two aspects by considering relevance as well as implementation to investigate EbA integration in MSP. Whilst expressing relatively complex concepts, perceptual mapping proved to be a beneficial tool that is tangible, easy to explain, and easily understood by interviewees. Therefore, it can be used by regional, national, or international bodies to reflect on the EbA and compare points of view. In this research, we presented some of the possibilities offered by perceptual mapping, and tested the method on a sample of marine planners across northern Europe. The results indicated that the method is promising. For

example, various dimensions could be used to evaluate key elements and to enable or support the critical self-reflection of planners. The examples presented here highlight an updated vision of the key elements constituting the EbA in MSP, as well as some main issues raised during the interviews that continue to be debated within the MSP community, such as knowledge about ocean ecosystems, the appropriate level of planning or the legal constraints limiting EbA effectiveness. Improvement is still needed, but this kind of method, combined with others, can contribute to improving the evaluation of MSP processes and considering the marine ecosystem as a whole.

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