‘Short communication’ targeted for Ocean and Coastal Management

Assessment of collective pressure in marine spatial planning: the current approach of EU Member States

Abstract

We report EU Member States’ assessment of the collective pressure through cumulative impact assessments (CIA) in their implementation of the EU Maritime Spatial Planning Directive (MSPD). While the MSPD is ambiguous on how to approach the assessment of collective pressures, the present study is based on a preunderstanding that CIAs are required in marine spatial planning (MSP) for two reasons. Firstly, to address all relevant human activities and their pressures in order to comply with the concept of an ‘ecosystem-based approach’ and to ensure a good environmental status. Secondly, indirectly, to ensure that land-sea interactions are taken into account. Our results show few and inadequate examples of CIA in national MSP processes. Most MSP processes address collective pressure through CIA as part of a strategic environmental impact assessment. In conclusion, while the MSPD requires MSP to ensure collective pressure is kept below a level compatible with good environmental status, as part of an ecosystem-based approach, the study found few examples of ecosystem-based MSP.

Keywords

Ecosystem-based approach

Collective pressure

Cumulative impacts

Marine spatial planning

Multiple pressures

Policy ambiguity

1 INTRODUCTION

European seas are not as clean, healthy and productive as they have been (Reker et al. 2020). In many areas, especially coastal, the overarching objectives laid down in the Marine Strategy Framework Directive (MSFD, 2008/56/EC), the Water Framework Directive (WFD, 2000/60/EC) and the Natura 2000 Directives (Habitat directive, 2008/99/EC; Bird Directive, 2009/147/EC) have not yet been achieved (Andersen et al., 2019a and 2019b; Vaughan et al., 2020). A key reason for impaired environmental status in many areas is high levels of pressures from multiple human activities (Korpinen et al., 2019). Marine biodiversity is under siege in all European regional seas (Reker et al., 2020; EEA, 2019). The key pressures in Europe's seas are fishing, especially overfishing and bottom-trawling, inputs of nutrients, climate change, tourism and, in some areas, introduction of non-indigenous species (Vaughan et al., 2019). Eutrophication is a large-scale problem in Europe, especially in the Baltic Sea and Black Sea and in the southern and eastern parts of the North Sea (Andersen et al., 2019a). Eutrophication problem areas are also identified in some coastal waters in the North-east Atlantic Ocean and in parts of the Mediterranean Sea, especially downstream catchments with intense agriculture and/or industry (Andersen et al., 2019a). Contaminants are also an extensive threat, with problem areas identified in the Baltic Sea, the Black Sea, the North-east Atlantic Ocean including the North Sea and in the Mediterranean Sea (Andersen et al., 2019b).

The increasing level of pressure on the marine environment from human activities has led to a growing practice of more holistic management initiatives such as marine/maritime spatial planning (MSP) (Kannen 2014; Kelly et al., 2014). In the European Union, the practice of MSP came into legislation through the directive for MSP (MSPD) in 2014 (Directive 2014/89/EU). This directive requires Member States to have marine spatial plans in place by March 2021, which, following the directive, should apply an "*ecosystem-based approach as referred to in Article 1(3) of Directive 2008/56/EC*" to ensure that "*the collective pressure of all activities is kept within levels compatible with the achievement of good environmental status*" (intr. (14)). The directive does not specify any directions for how member states are to ensure that the collective pressure stays beneath this threshold. It does however suggest a close connection to the Marine Strategy Framework Directive (MSFD, Directive

2008/56/EC), albeit the ecosystem-based approach is not further elaborated in the MSFD. The MSFD also refrains from giving clear instructions for how to approach the 'collective pressure' element, although it does specify that Member States should conduct: "*an analysis of the predominant pressures and impacts* (…)" which "*covers the main cumulative and synergetic effects*". Thus, the MSFD sets specific requirements for an assessment of cumulative pressures and impacts.

In the two Directives, the ecosystem-based approach is mentioned, however ambiguously, as a means for reaching the objective of Good Environmental Status (GES) by keeping collective pressures down. The objective of GES is thus shared by the two Directives, but means to achieve this objective are not specified. The type of ambiguity relating to the means for achieving a policy objective is often referred to as 'policy ambiguity' (Matland, 1995). Ambiguity can be related to both policy goals and means, and has been found connected to unclear problem definitions and policy responses (Arentsen et al., 2000; Liu et al., 2018, Matland, 1995). Through his ambiguity-conflict model for policy implementation, Matland (1995) argues that in cases of high level of policy ambiguity, the outcome could be either a symbolic implementation (if conflict levels are high) or an experimental implementation (if conflict levels are low). The outcome of the latter depends largely on contextual conditions and the actors involved in the implementation process (Matland, 1995). Ambiguous formulations are often used strategically in policy formulation processes as 'constructive ambiguity', with the purpose to facilitate the amalgamation of all signatories. Henry Kissinger defined 'constructive ambiguity' as "*the deliberate use of ambiguous language on a sensitive issue in order to advance some political purpose*" (Berridge, 2003). However, while 'constructive ambiguity' can be constructive in bringing signatories together, it has been found to lead to destructive outcomes (Mitchell, 2009; Jegen and Mérand, 2014; Dingley, 2005, Liu et al., 2018). This indicates that ambiguities in the MSPD, on how to assess and address collective pressures, can lead to either symbolic or experimental implementations, with the potential of leading to destructive outcomes.

While the MSPD does not specify how to address collective pressures, the most acknowledged and applied approach for assessing the level of collective pressure is through the practice of cumulative

impact assessments, originally developed by Halpern et al. (2008) (see review by Korpinen and Andersen, 2016). Terminology varies slightly between studies and directives (e.g. cumulative/collective/combined impacts/pressures/effects), but essentially, they refer to the same, i.e. an additive approach to map and analyse the potential effects of multiple human pressures on marine species, habitat and communities.

Cumulative impact assessment (CIA) is recognised as a crucial element of operationalising an ecosystem-based approach (Kelly et al., 2014; Andersen et al., 2015; Langlet and Westholm, 2019) and is therefore seen as a key element of MSP (Stock and Micheli, 2016; Menegon et al., 2018). It is also considered an ideal tool for the allocation of conservation initiatives (Ban et al., 2010; Fernandes et al., 2018). Furthermore, CIA is considered a crucial practice in the formulation and achievement of sustainability objectives (Kelly et al., 2014; Willsteed et al., 2018; Furlan et al., 2019). One way in which CIA can benefit MSP is by identifying which activities can or cannot be placed in the same area, and by locating areas where human pressures result in poor environmental status (Halpern et al., 2008). The latter is key in fulfilling its purpose in MSP within the MSPD framework.

Besides the requirements of the MSPD to address collective pressures as part of the MSP practice, Member States are bound by the EU Directive for strategic environmental impact assessments (Directive 2001/42/EC) to assess cumulative impacts. The directive states that for plans, such as marine spatial plans, a strategic environmental impact assessment (SEA) should be performed, in which: "(…) *the likely significant effects on the environment of implementing the plan* (…) *are identified, described and evaluated"*, including cumulative impacts. However, previous research has found limited proof of actual assessment of cumulative impacts in SEAs (Cooper and Sheate, 2002, 2004; Duinker et al., 2013; Kirkfeldt et al., 2017). These findings do not support an assumption that cumulative impacts of marine spatial plans are addressed adequately in SEAs. Rather, previous research supports an assumption that distinct and thorough CIAs are lacking in MSP.
This article examines the current practice of CIA in EU MSP, in order to find similarities and differences, challenges and successes, and finally, in order to assess the extent to which MSP in EU

marine waters can be seen as ecosystem-based MSP, and to reflect on the influence of 'policy ambiguity'.

2 METHODOLOGY

The empirical basis for this desk study at hand comprises a questionnaire and a desk study of previous and ongoing practices of CIA in EU Member States in relation to MSP. 22 Member States have maritime territories and thus need to comply with the MSPD. The desk study involved a systematic search, for each of the 22 Member States plus the UK (as data collection took place prior to Brexit), for information on potential CIA practices. Primary sources were: 1) marine spatial plans (draft and approved plans), 2) impact assessments, 3) national and project-based websites on MSP practices, as well as 4) the EU MSP platform (European MSP Platform, 2020). This leads to an overview of current (and prior) CIA initiatives.

Findings from this study were supplemented with a questionnaire, which was sent out to national MSP authorities (located through the European MSP Platform) in all 23 countries. The purpose of the questionnaire was to collect additional information on national practices as well as to validate the results of the desk study. Questions focused on CIA methodology, the role of CIA in MSP as well as personal perspectives and experiences. The questionnaire lead to 35 answers, with at least one answer from each country. Most respondents were planners or GIS experts from the MSP unit or (in three cases) a researcher who has been involved in the MSP process. The list of questions can be found in Appendix S1 in Electronic Supplementary Information.

3 RESULTS

3.1 Current practice of CIA in the EU MSP

The desk study of present or previous CIA initiatives for MSP in EU found cases of CIA. Some were presented in SEAs, however most evidence of CIA was found within projects and tool developments. These include SYMPHONY, SIMWESMED and SIMNORAT as well as the ADRIPLAN Cumulative impact tool (for a comprehensive overview of MSP related EU projects confer with Friess and Grémaud-Colombier, 2019). The findings from the desk study are presented in its entirety in Appendix S2 (in Electronic Supplementary Material). SYMPHONY is a model-based tool that was developed to assist an ecosystem-based approach in the Swedish MSP process (SwAM, 2019; Hammer et al., 2020). The cumulative impact is calculated following the methodology as presented by Halpern et al. (2008) and mapped, illustrating how the impacts on ecosystem components in relation to the intensities of various to human pressures are spatially distributed (SwAM, 2019). For each cell of 250 x 250 m, the impact is calculated as the sum of an average of all pressures multiplied by a sensitivity factor for each ecosystem component (European MSP Platform, no date). It can be used to assess and illustrate cumulative impacts of various planning scenarios (SwAM, 2019). SIMWESMED and SIMNORAT were two projects that ran from 2017-2019 with the purpose to assist the implementation of MSP in the Western Mediterranean and North Atlantic Region, respectively (European MSP Platform, 2020). These projects made a review of existing tools and methodologies for cumulative impact assessments (Gimard et al., 2019) and initiated further development through project-based CIAs, e.g. by combining CIA methodology with the decision support tool DESEASION (Loyer and Carval, 2019). The ADRIPLAN cumulative impact tool was developed through the ADRIPLAN project that ran from 2013-2015 with the purpose to facilitate MSP in the Adriatic-Ionian region (European MSP Platform, 2020). The methodology of the tool is primarily based on the framework presented in Andersen et al. (2013) which builds upon Halpern et al. (2007) but was as well further developed e.g. by suggesting a three-level methodology for how to perform and integrate a sensitivity analysis in a CIA (Gissi et al., 2017). While these projects and tools are examples where CIA has been practiced in relation to MSP

processes, the total list of located CIA initiatives was short, and with the exception of SYMPHONY, there were no examples of CIAs performed as part of the MSP for the entire MSP area.

The reason for the inadequate list of CIA initiatives can partly be explained by the stage at which some countries are at in their MSP process. In the questionnaire, 20 respondents stated that a CIA had been performed or was in the making, while six respondents answered that it will be performed, thus it has not yet been performed (Fig. 1). For the one respondent who answered no, another respondent from the same MSP area answered yes. The 'no' could therefore indicate different understandings of what constitute a CIA. Three respondents answered 'Don't know', which could indicate that the respective planning teams have not yet discussed the issue of CIA, or that the task of performing an SEA is outsourced with limited correspondence and therefore somewhat less transparent to the respondents. SEAs are often, but not always, outsourced to another agency or an external consultancy, thus the knowledge on the SEA process within the MSP unit depends on the level of communication between the two units. The 'Other' response clarifies that CIA has been performed but only for parts of the MSP area.

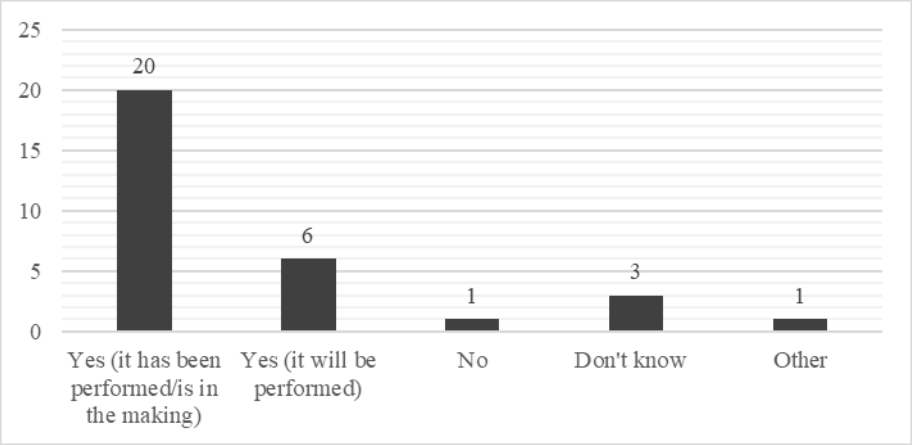

Fig. 1. *Answers to 'Is a cumulative impact assessment performed at any stage of the MSP process?'*

The findings from the questionnaire support the findings in the desk study in terms of the extent of distinct CIAs versus assessment of cumulative impacts as part of a SEA. 15 out of 18 respondents answered that a CIA was conducted as part of a SEA or another impact assessment. This indicates that the practice of CIA in MSP processes primarily depends on SEA legislation and that requirements for CIA is scarce if at all existing in national MSP legislation.

Of the 20 respondents who stated a CIA has been performed or is in the making, only 11 respondents could provide information on methodological details such as the number of ecosystem elements included in the assessment (of which six stated 'Above 25' cf. Fig. 2). The same picture was seen when respondents were asked how many pressures the CIA included, for which four respondents answered 'above 25', one answered between 21-25, two answered between 15-10 and three answered 'below 10'. The numbers of ecosystem components and pressures clearly show a varied picture of CIAs.

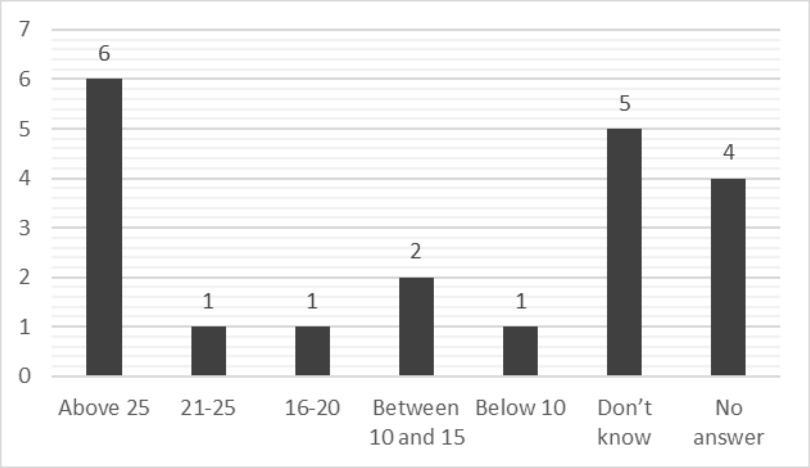

Fig. 2. *Answers to 'How many ecosystem elements are included (e.g. species, habitats etc.)?'*

When asked whether sensitivity weights were used, only two respondents, from two different countries, answered 'Yes' (while six answered 'No' and five answered 'Don't know'), which indicates a limited use of sensitivity weights in CIAs for MSP. While the limited number of answers on CIA

methodology might be an indication of outsourcing, it can also indicate that assessments of cumulative impacts are sometimes addressed qualitatively, without any model or use of quantitative indicators, and thus no use of sensitivity weights.

3.2 Applied models and software

When asked what methodology was used for the CIA, seven respondents gave concrete answers on applied methodologies; the one developed by Halpern et al. (2008), expert knowledge, Framework for the Assessment of Ecological and Cumulative Effects (Nordzeeloket, no date), multi-criteria analysis, PlanWise4Blue (PlanWise4Blue, no date), and the one presented by Kotta (2017). Of the six methodologies, three are known to involve modelling.

When asked about applied software, eight respondents said that no software was used for the assessment of cumulative impacts, while five answered 'Don't know'. Four respondents listed their applied software; two said spatial data analysis (ArcGIS) and two said Symphony. The low number of applied models and software indicates that most CIAs are done as qualitative assessments without the application of a specific model.

3.3 The role of CIA in ensuring good environmental status

While the purpose of assessing cumulative impacts in MSP is to ensure that the level of collective pressure of human activities is compatible with ensuring a good environmental status (GES), there was some disagreement among the respondents as to the exact role of CIAs (Fig. 3). Most respondents stated however that CIAs 'To some extent' ensure good environmental status.

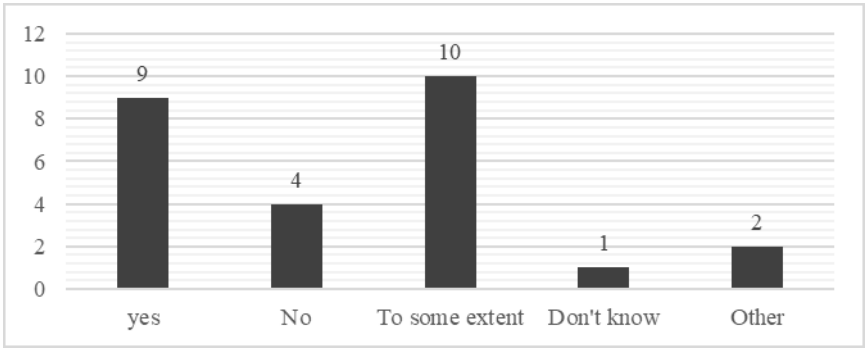

Fig. 3. *Answers to 'Does the assessment of cumulative impacts ensure a good environmental status?'*

One respondent emphasised that the role of CIA in MSP is not to ensure GES, while MSP in itself can only influence a few of the GES descriptors (EC 2019), and that MSP can only ensure that the practice of MSP in itself does not worsen the state of the environment. Most respondents saw CIA as a crucial step in ensuring GES but clarified that whether it facilitates GES depends on how the results are used. One statement exemplifies this view: '*The assessment of cumulative impacts alone will not ensure good environmental status (…). The planning or licensing authority and/or developer has to act on the outcomes and any recommendations within the assessment.*'. This respondent sees the role of key actors in the MSP as essential for whether CIA facilitates GES. Other statements on the role of CIA are summarised in Tab. 1.

Table 1 Statements from respondents on the role of CIA in ensuring GES.

Cumulative impact assessments…:
'… is one among various tools necessary to ensure a holistic management approach for then achieving a GES'
'...contributes towards considering the interactions of many factors by which Good Environmental Status is determined but cannot, by itself, ensure that it happens.'
'...helps ensure that the cumulative effect on the wider environment of the marine area and other relevant receptors is effectively managed.'
'...are the basis for ensuring considerations in decision making including the adoption of marine spatial plans. Therefore, they may play an important role in ensuring GES.'
'...identify the "hot spots" where there are more pressures, and to address measures in those areas.'
'...can contribute to insight on effects and mitigate them.'
'...envisages possible impact and ensures that all possible mitigation measures were considered and the most appropriate for the environment planning solutions were chosen.'
'...mandatory to understand how to achieve good environmental status - however difficult to assess and does not prejudge on how policies and MSP will be elaborated and implemented.'
'...forms the basis for the monitoring of the good environmental status, and by it for the possibility of keeping or achieving this status.'

While the initial picture was a divided group of respondents, the qualitative answers showed the complexity in defining the role of CIA in ensuring GES. This complexity could stem from the policy ambiguity concerning the GES concept and the CIA practice found in the MSPD. The general perception of the respondents was however that performing a CIA does not alone ensure GES, however, it is seen as a crucial element if GES is to be reached.

3.4 Challenges when assessing cumulative impacts

The lack of applied software and models can potentially be a result of challenges related to the practice of CIA. When asked about experienced challenges, respondents gave examples of which most can be seen as either data-related, or analysis-related. Data-related challenges included a general lack of data, storage of data, visualising data uncertainty and quality assurance (sometimes compromised because of security issues). Analysis-related challenges included difficulties in identifying synergistic effects, in developing sensitivity scores, in evaluating how pressures affect species and in dealing with uncertainties as well as a general lack of knowledge of some effects. These challenges could explain the low number of modelled, quantitative CIA cases found, and that only two respondents reported an application of sensitivity scores.

Another challenge mentioned by some of the respondents was the different approaches to MSP and therefore to the assessment of cumulative impacts, caused by the ambiguous formulations of the MSPD. The openness and ambiguity of the Directive leads to different MSP approaches not only between countries but also, to the frustration of some of the respondents, within countries (where the task of MSP is shared by multiple institutions). The latter is exemplified by the statement of one respondent: "*This has implications for cross-border and transboundary marine planning within a single state as well as between the component parts of that state and neighbouring countries.*". Issues related to transboundary and cross-border practices between different juridical and institutional systems have so far primarily been found in terrestrial planning such as water management practices (Kidd and Shaw, 2007; Kidd and Shaw, 2013). Now a similar level of institutional complexity is increasing within MSP. Part of the solution has been suggested to be that MSP could draw on experience from terrestrial planning as well as to increase the level of horizontal integration (Ritchie et al., 2020; Jay et al., 2016).

The implications referred to by the respondent are destructive outcomes of the (constructive) policy ambiguity of the Directive. Another respondent indicated how the ambiguity of the MSPD has trickled down into national legislation and finds that: "*the legislation that regulates MSP is quite loose*". This indicates that there is a high risk for either experimental implementation or symbolic implementation (as defined by Matland, 1995), potentially leaving MSP to nothing more than a mapping exercise. Matland (1995) suggests that the level of policy ambiguity is sought reduced: "*through explicit goals or a crystallization of discussion around a limited number of possible means*", in order to improve the policy outcome. Following this suggestion, the heterogeneity of MSP practices and the institutional complexity among and within MSP states could e.g. be reduced if guidelines related to the implementation of the MSPD were formulated by the commission. These guidelines could provide a framework for ideal implementation of the ecosystem-based approach including how to ensure that the collective pressure is kept at a level compatible with a GES.

One way of reducing the challenges mentioned by the respondents could be to increase the collaboration between CIA processes related to national (and/or regional) MSP processes and national marine strategy processes (the implementation of the MSFD). The questionnaire however revealed that collaboration is already taking place. 18 out of 26 respondents said that there has been cooperation between the two agencies responsible for the marine spatial plan and the marine strategy. Three respondents (from three different countries) stated however, that the two tasks are carried out by the same agency. The responses revealed that cooperation was mostly carried out on a strategical level and rarely on a technical and analytical aspect such as CIA. When asked whether the cooperation concerned the assessment of cumulative impact, only five answered 'yes', and one respondent emphasised that there could be more cooperation. This indicates a potential for better and further collaboration between the MSP and the marine strategy unit (ideally being the same unit) on the CIA practice, which could increase CIA competences and resources.

4 DISCUSSION AND CONCLUSIONS

Main lessons from this paper include that: 1) CIA practices in European MSP processes are so far scarce and primarily carried out as part of the SEA, which is usually performed in one of the final stages of an MSP process, 2) there are few examples of extensive, modelled CIAs that cover the entire MSP area, and 3) there is a need for further development of data and methodologies as well as an enhanced collaboration between MSP and strategy units.

The types of CIAs practised in the MSP cases studied can be categorised as either quantitative (model-based) or qualitative (based on qualitative data). While reasons for choosing the latter approach can be numerous (as mentioned above) and justified, it is important to be aware of the strengths and, more importantly, the weaknesses of the two approaches. The qualitative approach offers a way to assess cumulative impacts in cases where data is substantially scarce. It also draws on expert/stakeholder knowledge, which can sometimes deliver information on intricate effects from multiple pressures on ecosystem components, for example in terms of synergistic and antagonistic cumulative impacts and is in general found to be of great value in MSP processes (Morf et al., 2019; Käyhkö et al., 2019).

However, the main disadvantage of qualitative CIAs is the absence of the spatial dimension and limited spatial coverage. Qualitative CIAs often lack a geographical assessment of impacts. Indeed, this is one of the advantages of model-based CIAs. Quantitative, model-based, CIAs assess cumulative impacts in each cell (of a certain size) of a marine space. For MSP, this is the ideal approach, as it allows planners to take spatial planning decisions based on existing pressures in a particular zone. Quantitative CIAs are therefore better suited for MSP than qualitative, though there is still room for improvement in terms of advancing the current practice from a summation practice (adding impacts together) to incorporating knowledge on synergistic and antagonistic impacts as well as improving the coverage and comparability of data. Indeed, the transformation of expert knowledge into spatial data may be a good solution to cases where a model-based CIA is disregarded due to data gaps. Expert knowledge can be transformed into spatial data through participatory mapping, data interpretation and geo-computing as suggested by Tolvanen, Erkkilä-Välimäki and Nylén (2019). Examples from France and the UK have already shown how fishing activities can be spatially mapped through a collection of the knowledge from fishermen (Trouillet et al., 2019; Enever et al., 2017).

The diversity of how the collective pressure is addressed by member states exemplifies what Matland (1995) categorised as 'Experimental implementation', which largely depends on the actors involved in the implementation process and the context surrounding these actors. While diversity in practices does not in itself result in destructive outcomes, statements from the respondents indicate that differences in MSP approaches, caused by ambiguities and the openness of the MSPD, both on a national and international scale complicates the MSP process, including the practice of addressing collective pressures.

The findings from the questionnaire and desk study (in terms of the extent and methodology of existing CIAs for MSP) shows an incomplete coverage of CIAs. Of the 20 respondents who state, a CIA has been (or is being) performed, the level of provided information is limited, which might indicate a disconnection between the MSP team and the CIA process. It could also be a reflection of inadequate CIAs. The performance of quantitative, model-based, CIAs is very limited in EU MSP processes as most respondents assess cumulative impacts through the SEA process using qualitative,

expert knowledge. This leaves a risk that severe cumulative impacts, unknown to the MSP team, exist, and thus it can be questioned whether MSP can be labelled 'ecosystem-based' if the level of knowledge is too low to do quantitative CIAs.

Leaving the assessment of cumulative impacts to the SEA process also means that the collective pressure of already existing activities is not assessed prior to the formulation of the plan, which would be needed in order to 'base' the MSP process on ecosystem conditions (i.e. being ecosystem-based). Within the MSP processes studied for this article, there was therefore chokingly scarce evidence of ecosystem-based MSP.

We therefor suggest the following means for improving the current practice: 1) it should be clarified in legislation (MSPD and national frameworks) that an ecosystem-based approach requires a CIA of existing impacts as a point of departure in the MSP process (thus a CIA as part of the SEA is not sufficient), 2) efforts should be given to a continuous development of data, both quantitative as well as transforming qualitative data into spatial data, which would facilitate further development of the CIA methodology and tools, and 3) a closer collaboration between the MSP Competent Authorities and MSFD Competent Authorities is encouraged in order to facilitate sharing of knowledge, competences and resources, thus improving the CIA quality and strengthening the ecosystem-based approach.

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