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Shared visions for marine spatial planning: Insights from Israel, South Africa, and the United Kingdom☆

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ABSTRACT

The online symposium *Shared Visions for Marine Spatial Planning: Insights from Israel, South Africa and the United Kingdom* was held from 9–10 March 2021. Insights from this multi-disciplinary and international symposium included 1) current states of marine spatial planning (MSP) in the three countries, 2) how MSP can be a helpful tool to advance marine conservation, 3) the use and challenges of geospatial technologies for MSP, 4) how multidisciplinary, interdisciplinary and transdisciplinary efforts can help improve MSP processes and 5) recommendations for effective and collaborative MSP. Key reflections from the symposium included the need for MSP to be multi-, inter- and transdisciplinary in its stakeholder collaborations and aligned with in-country and area contexts.

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1. Introduction

Marine Spatial Planning[1] (MSP) has been adopted as a common process to achieve an integrated and ecosystem-based approach to manage the marine environment and uses therein, with rapid uptake globally (Kidd et al., 2020; Ehler 2020). With the inception of the UN Decade of Ocean Research and the pursuit of fulfilling the Sustainable Development Goals (SDGs), coastal states such as Israel, South Africa (SA) and the United Kingdom (UK) are now exploring best practices for the implementation of MSP.[2] As a result, an online symposium entitled "Shared Visions for Marine Spatial Planning: Insights from Israel, South Africa, and the United Kingdom" was held on 9–10 March 2021. Insights from this symposium included current states of marine spatial planning (MSP) in the three countries (section 3), how transdisciplinary efforts can help improve MSP processes (section 5), how MSP can advance marine conservation (section 6), and the use and challenges of geospatial technologies for MSP (section 7). The article provides a synthesis of the main insights for effective and collaborative MSP by including country-specific examples (section 8) (the Symposium is available online[3]).

2. Literature review

2.1. Transdisciplinary stakeholder collaboration in MSP

By design, MSP is a public process and requires approaches to management which involves interested and affected stakeholders from different sectors and areas of society to enhance integration of different marine users (Ansong et al., 2021). From an academic perspective, MSP research therefore requires transdisciplinary[4] research approaches, making sure non-academic stakeholders are engaged in knowledge production for contextualised MSP and informing what MSP should look like from the very beginning (Lombard et al., 2019a; Grip and Blomqvist 2021; Flannery et al., 2018; Bakker et al., 2019; Morf et al., 2019; Gorris 2019; Kidd et al., 2020).

2.2. Advancing marine conservation through MSP

MSP can advance marine conservation by prioritising specific areas in need of biodiversity conservation, sustaining ecosystem services and identifying cumulative pressures on areas critical to socio-economic development or biophysical preservation (Foley et al., 2010). MSP can also offer different planning scenarios and assist in finding sustainable approaches to area-based ocean management (Portman 2015). An Ecosystem Based Approach (EBA) is put forward as the most appropriate framework underpinning the development of MSP, where the health of marine environments are recognised as the foundation for preserving the system (Friedrich et al., 2020; Winther et al., 2020).

2.3. Geospatial technologies to advance MSP

The oceans cover 71% of the Earth's surface, yet to date, only 20% of the seafloor has been measured by echo-sounders[5] (UNESCO 2020). Within the last two decades, a realisation that the ocean environment represents a 'last frontier' and initiatives to better understand the structural layout of the earth's seafloor are being promoted at both an international (e.g., GEBCO Seabed, 2030.[6]) and national (e.g., South Africa's Operation Phakisa[7]) level.[8] Fourth Industrial Revolution advances in ocean monitoring and research technologies have greatly increased access to, resolutions and volumes of ocean data, in many cases within spatial realms (OECD 2016; Johnson et al., 2020; Österblom et al., 2020; Sowers et al., 2020).

Understanding the ocean and the natural processes occurring at the seafloor from a marine geological perspective is not without its limitations, primarily due to technological challenges in operating in this environment (Weatherall et al., 2015). For example, the technology used to map, observe, and understand land topography cannot penetrate more than tens of meters in ocean waters. Satellite measurements of ocean surface height provide a general view of the deep ocean floor through altimetry-derived predicted seafloor depths, but only to a limited extent (Cutter et al., 2003; McAdoo et al., 2004). Seafloor mapping remains an intensive and expensive task and has left most of our planet virtually unmapped.

3. Context: current states of MSP in Israel, South Africa and the United Kingdom

3.1. Israel

Between 2013 and 2015 the Israel Institute of Technology (Technion) developed Israel's first marine spatial plan in response to the need to manage heightened activity in the country's EEZ related to newly confirmed offshore natural gas reserves (Portman 2015). Simultaneously, a government-led MSP process was initiated, but efforts to combine the two have been limited, resulting in two parallel processes. Subsequently, the government-led MSP process, by the National Planning Authorities, later incorporated some of the main principles of the Technion plan and was completed in May 2020 with the publication of the Israel Maritime Policy (IMP).

The process supporting the development of the IMP can therefore be divided into two stages: i) conducting multidisciplinary analysis of the existing conditions and ii) defining policy principles for required regulation, planning and management of the maritime environment (Israel Planning Administration, 2020). In 2020 the IMP process commenced with the preparation of a vision statement and policy goals, and was followed by 6–7 years of well-attended stakeholder engagements. Overall, the IMP includes four sections of policy principles, relating to: 1) the protection of the environment and natural resources of the maritime space, 2) development, 3) on-going economic activities and 4) management.

3.2. South Africa

MSP in South Africa had its inception in the 'National Environmental Management of the Oceans' (NEMO) white paper from 2014. Also in 2014, the Operation Phakisa "Unlocking the Ocean Economy" initiative was launched, aiming to unlock the economic potential of South Africa's

[1] Ehler and Douvere (2009) denote MSP as "a public process of 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". More current and critical definitions of MSP however acknowledge that MSP is, in fact, a political and social process informed by natural and social sciences where politics and power are inherent characteristics (Flannery et al., 2018; Ehler, 2020).

[2] These three case study countries were chosen because authors from Israel (Technion – Israel Institute of Technology) and the UK (University of Liverpool) were granted funding through the UK-Israel Inter-University Strategic Cooperation Programme (UIIUSCP) and then invited South Africa (Nelson Mandela University) to collaborate in order to engage with a global south country.

[3] https://portman.net.technion.ac.il/upcoming-conference-sustainable-governance-and-management-of-coasts-and-seas/.

[4] Transdisciplinary research moves 'beyond' the strict academic disciplines to involve inputs and viewpoints from stakeholders outside of academia in the knowledge production process (Manuel-Navarrete et al., 2021).

[5] Sonar used to determine the depth of water by transmitting acoustic waves.

[6] https://seabed2030.org/.

[7] https://www.operationphakisa.gov.za/Pages/Home.aspx.

[8] Without a level of certainty on habitat types it can be difficult to write prescriptive policies within a marine plan or assign areas to a particular activity if they are dependent on a specific habitat type.

oceans. As a result, a MSP act was fast tracked, while the NEMO white paper was not advanced. The MSP bill, finalised in 2017, outlines a framework that can enable a 'sustainable blue economy' whilst fostering socio-economic development (DEA 2018). In 2018 the MSP Act (MSP Act 2018) was gazetted and in April 2021 was signed into operation, providing mandatory requirements for the establishment of marine area plans (DEFF 2021). The Algoa Bay Project in the Eastern Cape of South Africa is currently the first pilot site exploring the legislative, biophysical and socio-economic practicalities to inform the country's first MSP (Dorrington et al., 2018). It is a civil society-led initiative funded by the Government's Department of Science and Innovation through the National Research Foundation.

3.3. United Kingdom

The legislative framework for MSP in the UK was formed by the 2009 Marine and Coastal Access Act, with more specific legislation for Scotland in the 2010 Marine (Scotland) Act. The 'UK Marine Policy Statement' sets out broad MSP terms and objectives throughout the UK which generally aligns with the European Union MSP process. MSP in the UK takes place independently in the four nations of England, Scotland, Wales and Northern Ireland. In England, marine plans are divided between inshore and offshore waters (covering internal and territorial waters and the EEZ respectively). England has 11 marine plan areas and as of June 2021, all outstanding marine plans were adopted.[9] Scotland has a two-tier system: a high level strategic national plan (2015) and 11 regional inshore plan areas at various stages of development. In Wales (2019) and Northern Ireland (draft 2018), a single plan covers the area for both inshore and offshore waters.

4. Methods and analysis

The symposium included three sessions with four invited experts from Israel, South Africa and the UK in each session (12 presentations in total[10]). After presentations, breakout sessions and round table discussions were facilitated around answering four questions: (1) Are there examples of transdisciplinary collaboration that have helped with the development of MSP? (2) Are there good examples of stakeholder engagement in MSP processes, and if so, what makes them effective? (3) How can MSP help to achieve marine conservation targets (such as those of the Convention on Biological Diversity)? and (4) What geospatial technologies (e.g. decision-support tools, visualization, virtual reality), could help understand and "know" the marine environment? Guided by these questions, co-authors summarised and analysed notes from breakout groups and roundtable discussions for primary themes and insights that emerged (see Section 8).

5. Transdisciplinary stakeholder collaborations in MSP

Examples from the three case studies helped answer the first two questions regarding (1) transdisciplinary collaborations and (2) examples of effective stakeholder engagement in MSP processes.

5.1. Israel

In Israel, MSP development has included consultation with various sectors such as shipping and trade, fisheries, gas exploration, heritage bodies and national parks. In order to integrate different interests and viewpoints into the MSP, a co-working steering committee was created to formulate policy and long-term strategies as well as coordinate processes with shared objectives. For example, through extensive research with different stakeholder groups on alternative protection scenarios and ecosystem service valuations, multi-sectoral perspectives can inform the zoning and planning of new Marine Protected Areas (MPAs) (Portman et al., 2016).

5.2. South Africa

In South Africa, the lead authority for the development of MSP is the Department of Forestry, Fisheries and the Environment (DFFE)[11] that engages with sectors from heritage, transport, mining, tourism and defense. Engagements with stakeholders is led by the Marine Spatial Planning National Working Group (MSP NWG). However, government capacity to carry out equitable stakeholder processes needs to be leveled up for this process to be effective and just. Cooperation across sectors and disciplines have proven fruitful, such as in the Algoa Bay Project where Nelson Mandela University is investigating how best to facilitate cooperation between different disciplines and sectors towards the first multi-sectoral, ecosystem-based MSP in the country (Dorrington et al., 2018). Research on the stakeholder engagement process in the project highlights the need for early, clear and consistent involvement of stakeholders as well as acknowledging and accommodating different knowledge systems and levels of understanding of ocean governance components.

5.3. United Kingdom

In the UK, MSP is required by law[12] to engage with a variety of stakeholders to understand their specific values. The marine planning authority in England, the Secretary of State for the Environment, is mandated to plan, implement, monitor and report through the Marine Management Organisation (MMO). As a result, the MMO has integrated stakeholder engagement in every step of the MSP process. The MMO considered what the 'hooks' into marine planning might be for different stakeholders. For example, it examined each of the local plans in coastal areas, identified marine-related issues, and then engaged with locals to discuss these (MMO, 2013).

6. Advancing marine conservation through MSP

Presentations from across the three case study countries also highlighted how MSP can advance marine conservation efforts.

6.1. Israel

MSP can also support other area-based management tools, such as MPAs, that may lack statutory power. In Israel for example, the co-development of a MPA management plan (2012) set a goal to protect 20% of Israel's territorial waters. However, since the plan held no statutory power, additional complementary processes were adopted through MSP, by allocating 9% territorial waters as no-take zones. Results from the process showed that no-take zones had substantial conservation benefits for vulnerable marine ecosystems as opposed to 'paper parks' which lack authority and regulation (Portman et al., 2016).

[9] In the UK, a marine plan sets out how the MSP will be implemented in context-specific areas, or marine plan areas (MMO 2013).

[10] http://www.irishseamaritimeforum.org/wp-content/uploads/2021/03/Shared-Visions_MSP-Symposium_March-9-10-compressed.pdf.

[11] This Department has undergone several name changes in recent years (from DEA to DEFF to DFFE).

[12] In the Marine and Coastal Access Act it states that 'interested persons' should be involved in the plan making process. Interested persons means - 'any person appearing to the marine plan authority to be likely to be interested in, or affected by, policies proposed to be included in a marine plan, and members of the general public' (MCAA 2009).

6.2. South Africa

To support ecosystem-based approaches to MSP, there is a need to envision and forecast the effects of management decisions on spatial and temporal outcomes under different scenarios, and to identify trade-offs between socio-economic and environmental goals (Foley et al., 2010). In South Africa, for example, system dynamics models are being developed to simulate temporal trends and sustainable outputs in selected marine uses, and to identify areas for management considerations in sectors to achieve a balance in social-ecological planning goals (Lombard et al., 2019b, Vermeulen et al. submitted).

6.3. United Kingdom

A presentation entitled "Big journeys for small islands: Developing a Blue Belt around the UK Overseas Territories" argued that we cannot neglect the importance of safeguarding biodiversity in MSP, and the programme aims to preserve the ocean for future generations.[13] The programme also supports the Convention of Biological Diversity's aim to protect 30% of the global oceans by 2030 and argues that there are clear tradeoffs between environmental, social and economic policies. The Blue Paper on National Accounting for the Ocean and Ocean Economy identifies that ocean accounting places an economic value on marine and coastal ecosystems and their services using metrics based on their impacts on "(1) real income and its distribution (and therefore social inclusivity), (2) ocean production (and economic metrics) and (3) changes in ocean wealth, including ecosystems" (Fenichel et al., 2020). The presentation concluded that changes in ocean wealth are an important indicator of sustainability and can identify knowledge gaps for evidence-based ocean policy cycles and conservation plans linked to MSP.

7. Geospatial technologies as one of the tools to advance MSP

Presentations and subsequent discussions provided insights on available geospatial technologies to better understand the marine environment.

7.1. Israel

To better understand the marine environment, the top priority on every marine researcher's wish list is a visual representation of the sea floor. Israel has begun the development of 3-D models for the ocean floor (http://sketchfab.com/Marine_Imaging_Lab) with the aim of image collection and analysis to become exclusively autonomous.[14] This comes with several challenges that are being addressed by the Marine Imaging Lab at the University of Haifa, such as image colour, visibility, scalability and autonomous image analysis. This ecosystem modeling in turn can be incorporated into marine spatial planning through an ecosystems-based approach to account for the complex and dynamic nature of ecosystems. Using these snapshots in time, ecosystem condition can be determined and modeled under different possible scenarios which can allow for analysis of future conditions and be adapted accordingly into MSPs (Shabtay et al., 2018).[15]

7.2. South Africa

According to a presentation given by South African researchers,[16] technology available to map the seafloor have vastly improved over recent years, and for MSP applications, sonar methods and geophysical mapping have been coupled with sampling or seafloor imaging campaigns that contribute to substrate maps. Specific geological and habitat boundaries are constructed using both supervised and unsupervised classification methods. Submersibles such as Autonomous Underwater Vehicles (AUVs) and Remotely Operated Vehicles (ROVs) are increasingly being applied as effective and efficient mapping tools (Sowers et al., 2020). It is anticipated that these maps can be used to model biological communities and produce benthic habitat maps for use in marine management. In South Africa, scholars are both mapping the seafloor and developing algorithms that use machine learning to model benthic habitats.

7.3. United Kingdom

Geospatial technologies can also be used to map human activity to better understand marine areas and threats. The Blue Belt Programme[17] in the UK, for example, uses a combination of satellite technologies and Automatic Identification Systems to improve maritime domain awareness by assessing fleet distribution at different times of the year, creating 'heat maps' of shipping activity, bunkering and transshipments. This helps marine planners to determine where measures need to be put in place (e.g., Areas to be avoided).

8. Insights for collaborative and effective MSP

Following the analysis of notes from breakout sessions and plenary discussions, several insights emerged to consider when working towards a shared vision of MSP across countries, sectors and disciplines.

8.1. Transdisciplinary stakeholder collaboration in MSP

1. **Transdisciplinary approaches for MSP**: MSP is by definition transdisciplinary and should therefore be based on transdisciplinary collaborations and engage stakeholders and professionals beyond academia through collaborative processes from the beginning). This was highlighted from participants from all three case studies as stakeholders are integral to MSP development in Israel, South Africa and the United Kingdom.
2. **Strong leadership for MSP development**: The Israel case study demonstrates the importance of strong leadership in the form of steering committees or advisory boards which are able to integrate different interests, formulate policy and long-term strategies as well as coordinate processes with shared objectives.
3. **Capacity of implementing and management authorities** to run effective and equitable stakeholder engagement processes needs to be leveled up in some contexts like South Africa.
4. **Cooperation across sectors and disciplines** such as that in South Africa among tertiary institutions, local to national government agencies and multiple sectoral ocean users, have proven fruitful towards investigating how best to co-create a pilot MSP for the country.
5. **Early and consistent stakeholder participation** through empowered involvement in MSP development and ongoing commitment from convening authorities is required. This is vital to the success of MSP and involves clear communication aimed at creating a participatory management framework. This approach can be seen in all

[13] https://www.gov.uk/guidance/the-blue-belt-programme, https://www.youtube.com/watch?v=aahTfzFn7nM.
[14] Using Autonomous Underwater Vehicles and machine learning.
[15] Using Ecopath and Ecosym modelling software. https://youtu.be/hZBm-Mr2SFI.
[16] https://www.youtube.com/watch?v=aahTfzFn7nM&ab_channel=MSPSymposium - Timestamp: 41:00.
[17] https://www.gov.uk/guidance/the-blue-belt-programme.

three case studies, although some stakeholder processes are more advanced than others.

6. **Inclusion of different knoweldge systems and levels of understanding** is required for MSP to be fair and equitable. MSP processes need to include alternative knowledge systems as well as for new concepts, goals and risks to be clearly communicated and discussed through neutral knowledge brokers. This is particularly pertinent for countries like South Africa, with stakeholders coming from diverse cultural, socio-economic and sectoral backgrounds.
7. **Context specific plans and incentives to support collaborative MSP** development were demonstrated in the United Kingdom where the MSP process specifically identified key stakeholder issues and then engaged around those, making MSP relevant to them.

8.2. MSP advancing marine conservation

8. **Ecosystem-Based Approaches for MSP** can help deliver different planning scenarios that offer the option to meet biological diversity targets which have been taken up in both Israel and South Africa.
9. **MSP to support other area-based management (ABM) tools**: The Israel case study demonstrated the potential of MSP to advance marine conservation by supporting other ABM tools such as MPAs that may lack statutory power.
10. **Knowledge co-production to support MSP**: In South Africa participatory methodologies like system dynamics modelling are being used to understand systems better and to forecast different management decisions. By building models with ocean users, they are actively involved in the MSP process.
11. **Ocean accounting** can help identify knowledge gaps for evidence-based ocean policy cycles and conservation plans linked to MSP.

8.3. Geospatial technologies to advance MSP

12. **Partnerships with the private sector** towards resource collaboration is beneficial for resource-poor contexts where expensive technologies are not readily available.
13. **Large scale mapping/modelling is required to inform MSP:** Cost effective options are needed for swarm-like (large number of AUVs) image collection.

During plenary discussions an artist listened to key insights and ideas and then drew her interpretation of these in real time. Fig. 1 provides the visual interpretation of what a shared MSP vision might look like.

9. Conclusion

Coastal nations from both the global north and south can learn from one another regarding best practice for the development and implementation of MSP. However, to facilitate an adaptive, country-specific MSP process, the acknowledgement of contextual realities and inclusion of all local stakeholders is required. The importance of transdisciplinary approaches and the early and consistent inclusion of all stakeholders impacted by and impacting on MSP is essential, not only for the sustainability and adaptive ability of MSP but also to ensure truly democratic processes. An enabling environment and investment in capacity building to enable stakeholders and implementers to engage equally and fairly were factors highlighted across all three country contexts.

MSP provides a framework to manage the marine and coastal space, and also offers tools to advance marine conservation by applying ecosystem-based approaches to management, identifying priority areas for conservation, using accepted and novel ocean accounting frameworks and supporting management interventions that may lack statutory power. In resource-poor contexts, public-private sector partnerships should be brokered to share expensive geospatial technologies. It is

Fig. 1. Artist's interpretation of shared MSP visions (illustration by Efrat Goldberg).

acknowledged that no country has all the enabling factors in place for the effective and just implementation of MSP but every effort should be made to work towards these if MSP is to effectively manage how we use and conserve the ocean now and in the coming decades.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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