The emerging intersection between Marine Spatial Planning and Ocean Accounting: a global review and case studies

Jordan Gacutan a, b*, Kemal Pınarbaşı c, Messan Agbaglah d, Crystal Bradley e
Ibon Galparsoro f, Arrantza Murillas g, Ibukun Adewumi a, Teerapong Praphotjanaporn a
Michael Bordt a, d, h, Kenneth Findlay I, Coulson Lantz a, Ben M. Milligan a, j

a Global Ocean Accounts Partnership, University of New South Wales, Faculty of Law, The Law Building, Sydney, NSW 2052, Australia

b Centre for Marine Science and Innovation, School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, NSW 2052, Australia

c Baltic Sea Environment Protection Commission (Helsinki Commission, HELCOM), Katajanokanlaituri 6 B, 00160 Helsinki, Finland

d Economics, Statistics, and Data Governance, Fisheries and Oceans Canada, Ottawa, K1A 0E6, Canada

e Department of Agriculture, Water and the Environment, Australian Government, Canberra, Australia

f AZTI, Marine Research Division, Herrera Kaia z/g, 20110 Pasaia, Spain

g AZTI, Marine Research Division, Txatxarramendi Ugartea z/g, 48395 Sukarrieta, Spain

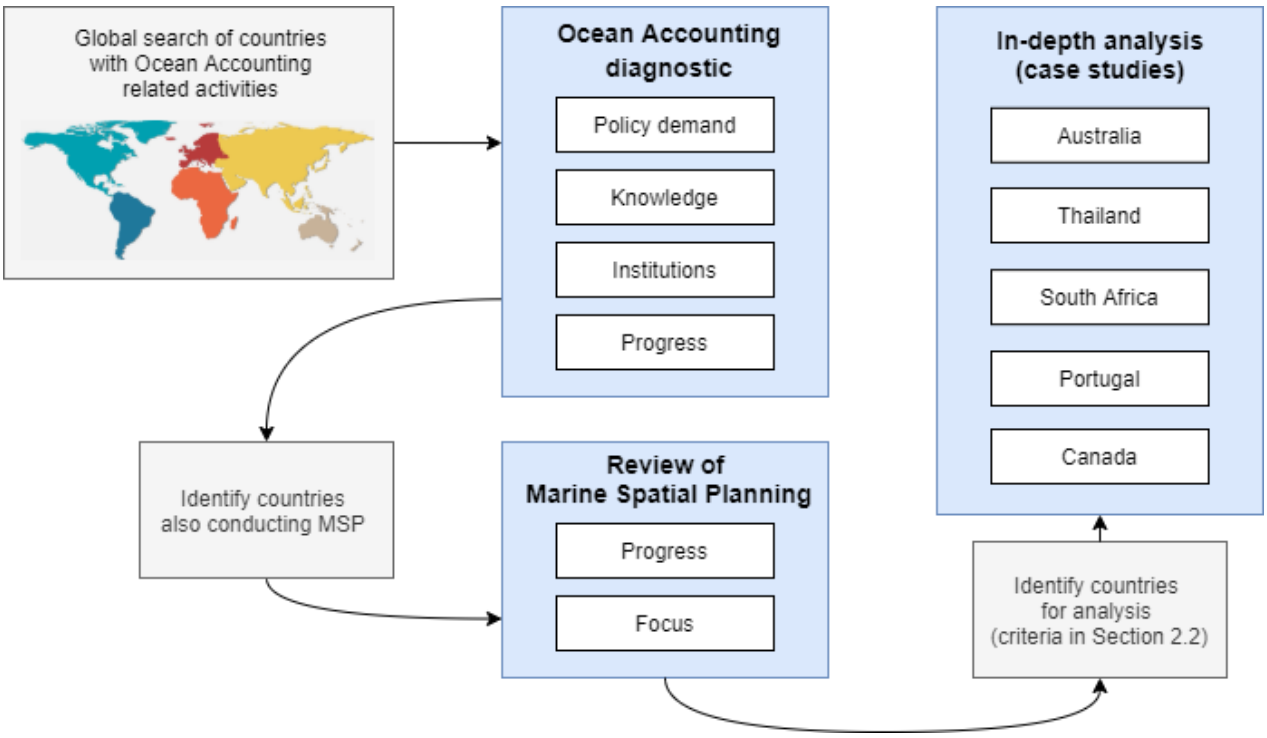
h Department of Geography, Environment and Geomatics, University of Ottawa, Ottawa, ON K1N 6N5, Canada

i Centre for Sustainable Oceans, Cape Peninsula University of Technology, Cape Town, South Africa

j University of New South Wales Law School, Law Building, UNSW Sydney, NSW 2052, Australia

*Corresponding author: j.gacutan@unsw.edu.au

Graphical Abstract



1. Introduction

Ocean strategic planning and management of national waters is guided by policies concerning the sustainable use of ocean ecosystems and their role within ocean-based economic development. Advancements in the use of the ocean has led to increased competition for its space and resources. As the ocean is seen by many nations as a driver for economic growth into the future (OECD, 2016), national ocean strategies have identified the development of the maritime economy as a key priority.[1] As such, there is a need to manage both conflicts between users and the pressures posed by human activities on the environment, to provide certainty given the changing nature of the maritime economy within rapidly changing oceans (Collie et al., 2013, Saunders et al., 2019).

In parallel, national ocean plans may also incorporate targets concerning the health of ocean ecosystems, following international agreements and obligations (e.g., Convention on Biological Diversity) and other domestic priorities (Obura, 2020). In this context there is an acute need for governance frameworks that implement actions towards achieving strategic objectives across economic, social, and environmental domains and evaluating the effectiveness of such actions. Two such frameworks, Marine Spatial Planning (MSP) and Ocean Accounting (OA) have been increasingly used to inform the implementation of legislation and policies within the marine domain and structure ocean information, respectively. Analysis of a growing intersection between both frameworks provides insights to their synergies and opportunities for co-development, supporting evidence-based ocean governance.

Over the last two decades, MSP has become a central framework towards integrating multiple policy considerations (e.g., social, environmental, and economic) in achieving a nation's strategic objectives within their sovereign ocean space. The MSP process has been embedded into regional legislation (e.g., Maritime Spatial planning Directive, European Union) and international MSP initiatives (e.g., MARISMA project, South-west Africa), with over 75 countries and 140 plans in various stages (Ehler, 2020). Through the spatial allocation of marine activities, MSP is an area-based framework that seeks to address the shortcomings of siloed sectoral management (Douvere and Ehler, 2009) (Figure 1). National MSP processes may also adopt an ecosystem-based management approach, which seeks to identify and incorporate the full array of interactions within a system within planning and trade-off assessments, inclusive of relationships between the environment, economy, and society (Katsanevakis *et al.*, 2011, Domínguez-Tejo *et al.*, 2016). A key challenge remains in ensuring social and environmental considerations are adequately weighted and integrated with economic priorities, where strategic and sectoral considerations are often prioritised during MSP implementation (Jones *et al.*, 2016, Trouillet, 2020).

A complementary framework, which facilitates an integrative understanding of ocean ecosystems, ecosystem assets and services, and their subsequent uses is Ocean Accounting (OA) within the marine and coastal space (henceforth, 'Ocean'). The framework extends national, environmental-economic and ecosystem accounting to describe the extent, condition and services of ocean

[1] There are varying definitions for sectors considered within strategies and policies of ocean-based economic development. For example, within the European Union (EU), aquaculture, biotechnology, offshore renewable energy, marine tourism, and seabed mining are prioritized under the EU Blue Growth agenda (COM2012/494/final). In contrast, Norway includes offshore oil and gas, and shipping within their ocean-based economic development agenda (Blue Opportunities, The Norwegian Government's updated ocean strategy, 2019).

ecosystems, their relationships with the economy and society, and how these factors may change over time (Figure 2) (see Fenichel *et al.*, 2020). As an extension of national statistical accounting standards, OA provides additional classifications, definitions, and testing needed to account for the dynamic and interconnected nature of the Ocean (GOAP, 2021a). In particular, the framework provides guidance in measuring ocean economic activities, the underlying ecosystems such activities are dependent upon, and the subsequent impacts of activities on these ecosystems.

The need for OA has been endorsed internationally by national statistical offices and international institutions. In 2020, 14 Heads of State, as members of the High-Level Panel for a Sustainable Ocean Economy,[2] have committed to 100% sustainable management of national waters. The Global Ocean Accounts Partnership (GOAP), as a multi-institutional collaboration mechanism, is recognised as an action coalition towards the achievement of the panel's action agenda for OA. Formal recognition of OA was also given by the UN Statistical Commission[3], and several ongoing and completed national OA pilots are supported by the work of the UN Economic and Social Commission for Asia and the Pacific (ESCAP). Therefore, the growing implementation of both MSP and OA will lead to their intersection, where an exploration of early efforts provides an opportunity to explore potential synergies and alignment towards strategic objectives.

This paper provides an overview of countries globally which are pursuing or having completed both MSP and OA related activities. A diagnostic was performed regarding the political, policy and legislative basis for both frameworks (Figure 3). The study identifies the experience of five countries conducting both MSP and OA and uses a Strength, Weakness, Opportunity, and Threat (SWOT) analysis to discern experiences from early efforts, delineating the potential synergies and opportunities between the frameworks nationally, and identifies barriers to further their co-development and implementation.

[2] High Level Panel for a Sustainable Ocean Economy, Action coalitions: https://oceanpanel.org/action#live (Accessed 12/05/2021)

[3] United Nations Statistical Commission, Report of the Committee of Experts on Environmental-Economic Accounting, Item 3(f) (E/CN.3/2021/10)

Figure 1. Generalized flow of stages within a marine spatial planning (MSP) process, based on best practice by Ehler and Douvere (2009), and country reporting to IOC-UNESCO.

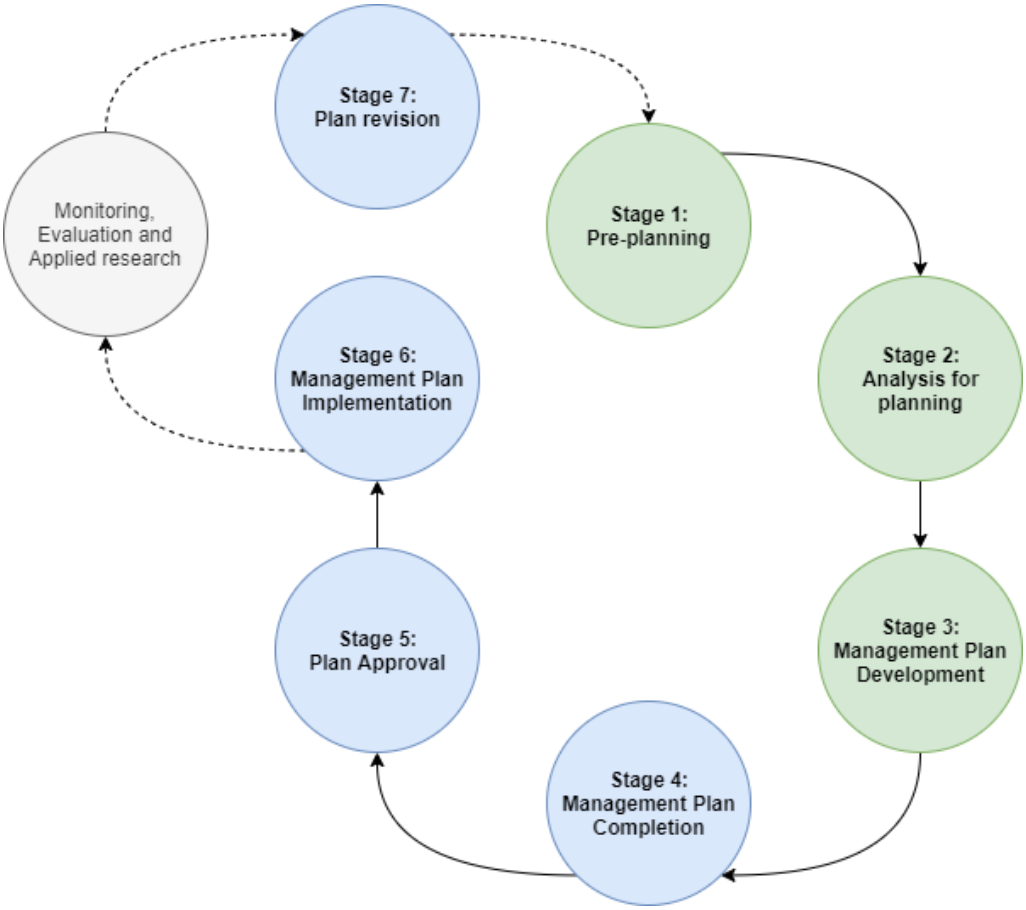
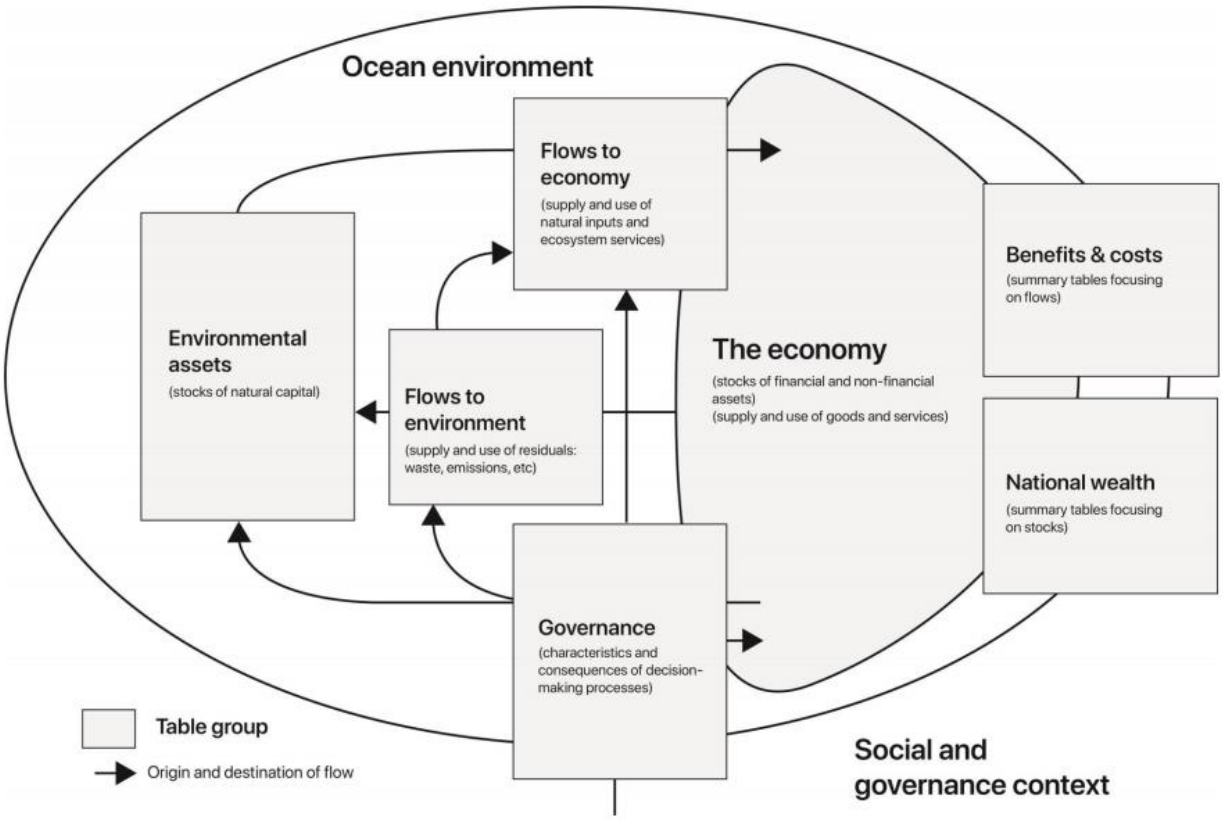


Figure 2. General structure of the Ocean Accounts Framework adapted from the Technical Guidance on Ocean Accounting (GOAP, 2021a). An environmental asset account could be compiled through ecosystem accounting, with flows to the economy measured through ecosystem services. Statistics related to the ocean economy could be contained within an Ocean Economy Satellite Account. Details for governance accounts are described in Supplementary Materials.



2. Methods

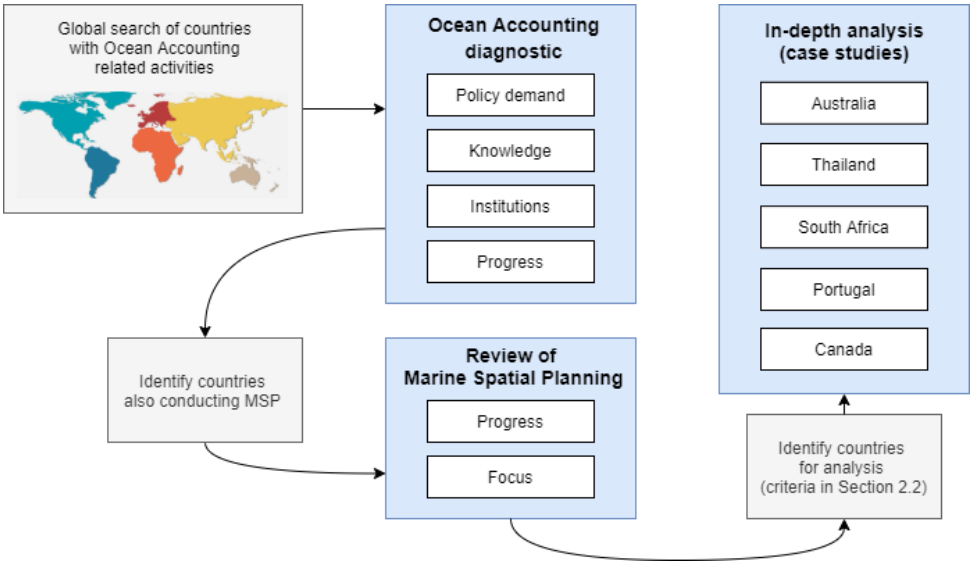


Figure 3. Structure of the study, from scoping and assessing Ocean Accounting-related activities globally (Asia, Africa, Oceania, Europe, and the Americas), identifying countries also conducting MSP and identifying five countries as case studies for further analysis.

2.1. Scoping Ocean Accounting activities globally

This research explores the political, institutional, and legal frameworks related to marine and coastal governance in countries conducting both OA- and MSP-related activities (Figure 3). OA activities included the development and testing of the OA framework, as described by the Technical Guidance on Ocean Accounting (GOAP, 2021a). Since accounting activities vary with policy demand, OA activities included the production of any accounts detailed in Figure 2, which include the disaggregation of ocean activities from the SNA (considered Ocean Economy Satellite Accounts, OESA), ecosystem accounts, (following the System of Environmental-Economic Accounting, SEEA) and disaggregating coastal and marine tourism statistics via Tourism Satellite Accounting (TSA), with account definitions provided in the Supplementary Materials (SM, Table SM1). We also considered activities that linked statistics between accounting standards, within the context of Ocean ecosystems, space, and resources.

A diagnostic tool developed by UN ESCAP (SM, Table SM2) was used to (1) identify if OA activities were conducted and (2) identify policy priorities, relevant institutions, available knowledge (and data) and the potential constraints in progressing towards an ocean accounting approach. A global search was conducted by region (Africa, the Americas, Asia, Europe, and Oceania). For each country, relevant government reports and documentation were accessed via department webpages and critically analysed. Most documentation assessed was in English or included summaries translated into English. However, the study also assessed documentation in Thai, Portuguese, Spanish, and French.

The policy priorities for conducting OA activities were thematically coded. Completed accounting activities were coded in relation to their policy use, whilst ongoing pilots were coded through a

discussion amongst the authors, guided by findings from the diagnostic. The diagnostic tool also noted the presence of an MSP process, assessed via the seven stages identified within the IOC-UNESCO database (see Figure 1). This study sourced information of MSP progress in Europe and Northern America using reporting to IOC-UNESCO[4] and the MSPglobal2030[5] roadmap. Progress in Asia and Oceania were also sourced from a review by Nakornchai *et al.* (2019), which reported progress using IOC-UNESCO stages.

2.2. Case studies

In identifying countries with both MSP and OA activity, the study selected countries with the potential to inform the intersection of both frameworks, containing any of the following criteria:

- Available documentation on both OA and MSP,
- Dedicated mandates or policy plans towards the development of both frameworks,
- Completed works and outputs for either MSP or OA,
- Explicit mention of both frameworks in a pilot, and
- Knowledge of the authors of individuals in a country engaged in MSP and OA.

Countries were further selected based on regional representation.

The selected countries were then analysed as case studies, compiling the context for both MSP and OA development in detail. A SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis (Chermack and Kasshanna, 2007) was chosen as an appropriate methodology to assess each case study and was performed to examine the progress towards the co-implementation of MSP and OA frameworks, in the context of their growing spatial intersection. The assessment was also conducted recognising the differing use-cases for environmental-economic accounting and spatial planning, generally. Environmental-economic accounting, including OA, is used to inform strategic planning, and performed to align with national accounts maintained by national statistics offices and finance ministries. Spatial planning, however, is a management use-case, performed predominantly by place-based institutions. Therefore, the comparison between the frameworks was used to identify synergies and potential conflicts, recognising their differing uses within ocean governance.

The SWOT analysis was performed by the multidisciplinary team of authors, from the fields of marine ecology, marine spatial planning, environmental economics, national accounting, and ocean governance. Each case study was assessed, and qualitative statements were procured through expert elicitation, which were iteratively discussed and adapted until a consensus was reached. When applied to the intersection between MSP and OA, ‘strengths’ were the present operational synergies between both frameworks, while ‘weaknesses’ were present knowledge gaps, redundancies, and conflicting processes limiting the use of both frameworks. ‘Opportunities’ were identified as compatible policies, legislation, and strategic objectives furthering the co-development of MSP and OA. By way of contrast, ‘threats’ were external barriers for the co-development of both frameworks.

[4] http://msp.ioc-unesco.org/world-applications/status_of_msp/ (Accessed 10/04/2021)
[5] https://www.mspglobal2030.org/msp-roadmap/msp-around-the-world/ (Accessed 12/04/2021)

3. Results

3.1. Countries with Ocean Accounting-related activities

The 'Global Progress Assessment' in Ocean Accounting (GOAP, 2021b) identified 36 countries conducting OA activities, of which, 26 were identified to have also conducted MSP activities. A summary of the diagnostic for each country identified are listed in the Supplementary (Table SM3), with the respective data sources presented in full in the 'Global Progress Assessment' in Ocean Accounting (GOAP, 2021b).

In general, OA activities were determined to pursue four inter-connected themes: (1) monitoring ocean ecosystems, (2) as a tool to inform strategic planning, (3) measuring the ocean economy, and (4) measuring the ocean-tourism nexus. Although marine and coastal tourism is a significant component of the ocean economy, explicit mention of tourism within strategic priorities and accounting efforts warranted a separate theme. In terms of policy focus, monitoring of ocean ecosystems was the most common motivating factor (n = 20), followed by measuring the ocean economy (n = 16). As OA is a recent framework, only two countries (i.e., Thailand and Australia) were identified as having existing overlaps between OA activities and spatial planning activities (including MSP and marine protected area zoning). Breakdowns per region for the number of countries and thematic policy motivation are presented in Table 1.

Table 1. Number of countries identified to contain both Ocean Accounting and Marine Spatial Planning results by region. Further breakdown of the ocean accounting focus of countries, and the number of completed marine spatial plans, per region.

Region	Number of countries	Ocean Accounting focus				Marine Spatial Planning
		Ocean ecosystems	Linked to Spatial Planning	Ocean economy	Ocean-tourism nexus	Completed plans*
Africa	4	4	-	2	-	-
Asia	8	7	1	4	4	4
Europe	6	5	-	4	1	3
Americas	5	3	-	5	1	3
Oceania	3	2	1	1	2	1
Total	26	21	2	16	8	12

*The presence of completed plans for one country, *c.f.* the sum of all plans within a country.

Table 2. Overview of the five selected case studies of the emerging intersection between Ocean Accounting and Marine Spatial Planning.

Country	National policy priorities			Marine Spatial Planning		Ocean Accounting	
	Environmental sustainability policies	**Ocean-based development strategies**	**Ecosystem-based management**	**National MSP activity**	**MSP situation**	**Ocean Accounts theme(s)**	**OA pilot objectives**
Australia	100% sustainably managed oceans by 2030, Ocean Policy (1998)[6], Global Ocean Alliance (30x30 initiative), Convention on Biodiversity (Aichi targets)	Considers traditional and developing ocean sectors although no national strategy[7].	Yes (Fisheries, MPAs)	Yes, under 6 marine bioregion plans and Great Barrier Reef Marine Park	7 plans in force, with plans concerning the conservation of bioregions through a network of marine protected areas.	Marine ecosystems, Spatial planning	Assess the services and benefits present within Geographe Marine Park.
Thailand	National Strategy V (Eco-friendly development and growth), Marine Park legislation	No direct mention, although National Strategy II concerns national competitiveness, economic growth, and income distribution.	Yes, ongoing MSP are required by the Department of Marine and Coastal Resources (DMCR) to be ecosystem-based.	Development ongoing, estimated delivery in 2025.	Pilot completed for Koh Tao. Plans are in development for Koh Larn, Koh Krok and Koh Sak islands, with another plan initiated in Phang Nga Bay in 2021.	Ocean-tourism nexus, Spatial planning	Assess the sustainable development of tourism and its impacts on natural resources in 5 provinces. Further support ongoing MSP efforts.

[6] Australian Government (1998). Australia 's Ocean policy. Canberra: Australian Government

[7] Australian Government (2012). Australia 's Submission to the Rio+20 Compilation Document, Rio+20 United Nations Conference on Sustainable Development. Canberra: Australian Government

South Africa	Convention on Biodiversity (Aichi targets), Global Ocean Alliance (30x30 initiative), Operation Phakisa (habitat representation and size of MPAs).	Yes, under Operation Phakisa (prioritising marine transport, offshore oil and gas, aquaculture, and marine protection services)	Yes, termed 'ecosystem-based adaptation,' endorsed by the Department of Environmental Affairs.	Development ongoing	The MSP process will deliver four plans, with three covering continental areas, with a fourth offshore marine area.	Marine ecosystems	Extensive history of environmental accounting, with efforts covering some ocean ecosystems.
Portugal	Convention on Biodiversity (Aichi targets), 100% sustainably managed oceans by 2030, Global Ocean Alliance (30x30 initiative), Habitat, Birds, and Marine Strategy Framework directives	Yes, under the EC 'Blue Sustainable Economy' (2021) and 'Blue Growth' agendas (2012)	Yes, endorsed by the Maritime Spatial Planning Directive (2014/89/EU)	2010 (Continental), Ongoing	MSP is embedded within legislation and plan development is underway. The subdivision of marine areas was approved in 2019.	Ocean economy	Maintains an Ocean Economy Satellite Account (OESA), in addition to developing SEEA accounts.
Canada	Convention on Biodiversity (Aichi targets), 100% sustainably managed oceans by 2030, Global Ocean Alliance (30x30 initiative)	Yes, Blue Economy Strategy (in development)	Yes, evolving from Integrated Management under the Oceans Act (1996)	Development ongoing, estimated delivery in 2024	The MSP process has been initiated in five marine bioregions.	Marine ecosystem, Ocean economy	Maintains an Ocean Economy Satellite Account (OESA), in addition to developing SEEA ecosystem accounts.

3.1. Intersection between Ocean Accounting and Marine Spatial Planning

Five countries (i.e., Australia, Thailand, South Africa, Portugal, and Canada) were identified using the criterion listed in Section 2.2, as an opportunity to further explore the synergies between the two frameworks and opportunities for their co-development and potential barriers for implementation via a SWOT analysis. An overview of the status of MSP and OA are presented in Table 2.

Australia

Australia's ocean resources are managed through a combination of policy and legislation limiting pollution, sectoral resource management regimes, and spatial protection (marine parks) (Vince, 2014). Australia's network of commonwealth, state, and territory-managed marine parks cover 3.3 million km^2, or 37% of Australia's marine jurisdiction. The overarching objective of all marine parks are healthy and resilient ecosystems which enhance Australia's wellbeing, coordinated through six 'bio-region' plans and an additional plan for the Great Barrier Reef (Vince, 2013). The plan for the Great Barrier Reef is considered one of the first marine spatial plans and influenced the subsequent development of plans globally (Vince, 2014). Australia's MSP instruments, however, differ to other MSP processes (e.g., within the European Union) in that Marine Protected Areas (MPA) are also within scope of the plan, which are conservation focused.

In 2018, the Australian Government established a National Strategy and Action Plan[8] to implement a nationally consistent approach to environmental-economic accounting. An interjurisdictional steering committee for environmental-economic accounting (Table 3), including the lead policy agency, national statistical agency and all states and territories, oversee the national approach. To understand the contribution of ocean ecosystems within marine parks, the then Department of Energy and Environment commissioned ocean accounts for Geographe Marine Park, Western Australia (IDEEA-Group, 2020). The pilot focused on the extent and condition of seagrass ecosystems in Geographe Bay, which form the largest continuous beds within Australia (Kirkman and Walker, 1989). It further extended analyses to the services provided to economic activities (commercial fishing, whale watching tourism), local communities (recreational fishing), and potential pressure of medium-large vessels on environmental assets.

The OA approach organised components of the system into assets (and their condition), services and benefits, which were used to organise and relate a diverse range of data. Key findings of the pilot included:

- Ecosystems in Geographe Marine Park contributed $AUD 316,000 in 2019 to the gross operating surplus of the local economy through whale watching ($AUD 254,000) and commercial fishing ($AUD 62,000).
- Recreational fishers took more than 12,000 fishing trips in 2018, which is valued at over AUD2.2 million (consumer surplus).
- Seagrass meadows in Geographe Marine Park were estimated to store 6.2 million tonnes of carbon in soil, and each year sequester a further 27,569 tonnes (net).

[8] Australian Government (2018). Environmental Economic Accounting: A common national approach strategy and action plan. Canberra: Australian Government, accessed: https://eea.environment.gov.au/about/national-strategy-and-action-plan

— The annual amount sequestered is equivalent to 1,500 households' average carbon emissions per annum, with an estimated dollar value of AUD443,865 (assumed AUD16.10 per tonne).

The resulting accounts can inform risk assessments for prioritising national scale monitoring and compliance of regulated activities across park management zones. The accounts also present a supporting narrative for the contribution of environmental assets within the Marine Park and can inform the national Monitoring, Evaluation, Reporting, and Improvement system. The process also required the compilation of a data inventory, which took stock of all data available for analysis and allowed the identification of knowledge gaps, to scale the OA framework.

Table 3. A SWOT analysis of the intersection between Ocean Accounting and Marine Spatial Planning activities in Australia.

Strengths	Weaknesses	Opportunities	Threats
• Scalability of approach facilitates cross-border integration through application to other marine parks and spatial planning activities. • Co-design approach, including tailoring accounts for Park Manager use, demonstrates potential for broader application of accounts by other spatial planning agencies. • Accounting areas assessed extent, condition and flows by marine park zoning, allowing comparisons between zones. • Standardization of datasets facilitated knowledge integration of diverse information. • Identified knowledge gaps for further research and scaling of OA to larger areas.	• Adjoining state marine park waters were not assessed in entirety, limiting cross-border comparisons. • Time-series of data was unavailable, limiting assessments of trends. • The interjurisdictional steering committee could strengthen its collaboration and coordination of accounting activities.	• Existing Commonwealth (Federal) and State commitments to support Environmental-economic accounting activities. • The strategies and actions of MSP include the need to consider social amenity and/or human health, aligning with the integrative nature of the OA framework. • Ability to adapt accounts with new information, facilitating temporal integration and evaluation of park management and spatial plans.	• An extensive and complex body of ocean policy and legislation may limit the compatibility of OA indicators with existing monitoring programs. • Multiple values are balanced in management of marine park, although policy targets of their condition are qualitative.

Thailand

Thailand's vision for ocean space, resources and activities are guided by the 'sufficiency economy philosophy,' in maximizing the interests of all stakeholders and having a greater focus on long-term profitability as opposed to short-term success (UNOSSC, 2017). Thailand's 20-Year National Strategy (2018 – 2037)[9] contains components that prioritise competitive enhancement (National Strategy II), social cohesion and equity (National Strategy IV) and Eco-Friendly development and growth (National Strategy V). Thus, the drive towards economic development via marine and coastal sectors is weighed by the need for equity and sustainably in the conservation of ocean ecosystems and their resources, enshrined into law via the Marine and Coastal Resources Promotion Act (2015) and the Fisheries Acts (2015). Within this context, Thailand has piloted area-based planning in several regions, including Surat Thani and Chon Buri provinces[10], in addition to several islands. Area-based measures for conservation and planning have long been used in Thailand, including Integrated Coastal Zone Management (ICZM) and Marine Protected Areas (MPAs).

In 2019, Thailand tested the OA framework, with a policy focus on sustainable tourism in the Andaman Tourism Cluster, consisting of five coastal provinces (Krabi, Phang Nga, Phuket, Trang, and Satun). The study addressed sustainable development concerns of the tourism sector, with regards to natural resources and environmental degradation both at land and sea. The study related statistics from a tourism satellite account with environment flows from thematic SEEA-CF accounts[11]. Through the resulting statistics, the study performed a spatial analysis of terrestrial, coastal, and marine areas with high risks of exceeding carrying capacity for accommodating tourism activities. Results of the analysis highlighted that although only one in nine persons in the cluster were tourists, tourism-related activities used 21% of the water, 57% of the energy and were responsible for 26% of the waste and 28% of the greenhouse gas emissions.

In 2020, the Department of Marine and Coastal Resources (DMCR) initiated an ecosystem-based MSP for Phang Nga Bay, a site of ecological and economic significance, building on experiences from completed MSP pilots.[12] Leveraging technical capacities and experience in OA, the DMCR launched a pilot project to create an integrated decision support information base for policies and programmes concerning the sustainable management of Phang Nga Bay through the production of a comprehensive set of Ocean Accounts, with a focus on land-ocean interactions and the vulnerability of ecosystems. MSP formulation is expected to align with the same statistical and accounting infrastructure as OA (spatial and economic boundaries, classifications, etc.). Through the coherent integration of accounting for ocean assets, ocean services and ocean governance, the information generated will inform and allow for the evaluation of future policies, spatial plans, and regulations.

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[9] Thailand 20-year National Strategy, 2018-2037: http://nscr.nesdb.go.th/wp-content/uploads/2019/10/National-Strategy-Eng-Final-25-OCT-2019.pdf (Accessed 10/04/2021)

[10] Chonburi Province MSP: https://www.jetro.go.jp/ext_images/thailand/pdf/chonburi_enpro.pdf (Accessed 12/05/2021)

[11] Through Tourism Satellite Accounts and SEEA Central Framework accounts (water, waste, energy, greenhouse gas emissions).

[12] MSP plans were formulated for Koh Larn, Koh Krok and Koh Sak, Chon Buri province, and Koh Tao, Surat Thani provinces in early 2010s.

Table 4. A SWOT analysis of the intersection between Ocean Accounting and Marine Spatial Planning activities in Thailand. Opportunities and threats are informed by Thubthimsang (2018)

Strengths	Weaknesses	Opportunities	Threats
• Cross-border integration of data (5 provinces). • Experience in combining TSA and SEEA accounts, to link tourism impact to the economy and environment. • Overlap between MSP and OA areas. • Data inventories have been compiled, and gaps identified. • The Department of Marine and Coastal Resources is responsible for both MSP and OA activities.	• Currently, limited spatially explicit approach to OA (i.e., aggregation by province), contrasting with MSP efforts. • Delivering department (DMCR) concentrated on conservation, lacking economic and social mandates required by national policies.	• Shared area designation, classifications and definitions between MSP and OA at the onset of plan formulation. • Long history of area-based planning measures in Thailand. • Attempt to integrate marine protected areas, defined under the same legislation (Marine and Coastal Resources Promotion Act, 2015).	• Many departments are involved, with a lack of an inter-ministerial coordinating body. • Lack of provincial administrative areas at sea. • Complexity in existing planning practices, where Marine Protected Areas lie outside ‘conservation areas’ (Marine National Parks, Wildlife Conservation, Fishery reserved areas etc.), due to differing legislative instruments. • Complexity in integrating MSP with MPAs, where MPAs prohibit all activities which impact ‘critical resources or habitats.’ • Adjacent land areas under the jurisdiction of provincial committees and not considered under MSP or MPA process.

South Africa

Policy and decision makers in South Africa have long recognised the importance of natural capital-based approaches, culminating in the National Plan for Advancing Environmental-Economic Accounting in 2015 (SANBI and Stats-SA, 2015). Implementation has been co-led by Statistics South Africa (Stats SA) and the South African National Biodiversity Institute (SANBI), with projects[13] resulting in the production of environmental-economic accounts nationally (e.g., fisheries, Ecosystem Accounts for rivers and estuaries) and sub-nationally (e.g., ecosystems within KwaZulu-Natal), encompassing coastal and marine ecosystems.[14]

Early regional spatial planning efforts began in KwaZulu-Natal, through the SeaPlan marine conservation planning project in the late 1990s (Harris *et al.*, 2012). National MSP has developed more recently, with the formal process beginning in 2014, developing a National MSP Framework in 2017 (DEA, 2017) and establishment of an MSP National Working Group and legislative basis in 2018[15]. The MSP process draws on extensive experience from terrestrial planning and the 12-year development of a representative MPA network (Lombard *et al.*, 2019, Sink, 2016). The plan, split into four zones covering the exclusive economic zone of South Africa, is expected to be delivered in 2021.

Whilst both MSP and environmental-economic accounting are still independent processes, there is strong alignment between the frameworks as many of the underlying datasets for ecosystem management are coordinated by common government departments and institutions. For example, SANBI is involved with accounting pilots but is also responsible for national assessments of biodiversity and habitat mapping using a national classification of marine ecosystem types, providing data on the extent and indicators of ecosystems condition (Botts *et al.*, 2016).

A potential conceptual intersection between OA and MSP is the multi-scale, multi-level approach for MSP has been tested within KwaZulu-Natal, where many of the underlying data processes (in compiling, modelling, and standardising) are aligned with the OA framework (Lagabrielle *et al.*, 2018). The approach described by Lagabrielle *et al.* (2018) organises data by 'planning units', which are analogous to basic spatial units within an accounting approach. Thus, there is an opportunity to incorporate OA as a data foundation at a regional scale (KwaZulu-Natal) and the potential to scale the approach nationally for monitoring and evaluation of marine spatial plans.

[13] Advancing Natural Capital Accounting (ANCA) project (2014 – 2016), followed by the Natural Capital Accounting and Valuation of Ecosystem Services (NCAVES) project (2016 – 2020).
[14] See the University of Cape Town compilation on Natural Resource Economics for access to all reports and accounts between 1980 to 2017.
https://libguides.lib.uct.ac.za/GovtPubs/NaturalResourceEconomics/GovtPUbs/NaturalResourceEconomics/SouthAfrica/Statistics (Accessed 10/04/2021)
[15] Marine Spatial Planning Act, *2018* (Act 16 of 2018), The Republic of South Africa

Table 5. A SWOT analysis of the intersection between Ocean Accounting and Marine Spatial Planning activities in South Africa.

Strengths	Weaknesses	Opportunities	Threats
• Shared inter-departmental coordinating structures for existing MSP and environmental-economic accounting efforts, which advance cross-boundary integration. • Extensive ocean data gathered from previous marine protected area and MSP processes, which could inform both asset and flow accounts in OA. • Available time series data (through national biodiversity assessments) to support temporal integration and evaluation of MSP effectiveness. • Indicative political will towards ecosystem-based management in both terrestrial and marine space.	• To date, no formal works between OA and MSP community. • Limited spatial overlap of MSP and OA activities (limited to KwaZulu-Natal) • Integrated ocean economy data (outside of fishing and aquaculture) is limited for South Africa.	• MSP is supported by national legislation. • There is a strong national commitment for environmental-economic accounting. • An extensive history of testing NC approaches. • A multi-scale, multi-level MSP approach in KwaZulu-Natal bears similarities to accounting processes. • South Africa's ratification of regional and global instruments for sustainable management of the marine ecosystem.	• To date, accounting efforts have primarily been focused on terrestrial assets, with ocean ecosystems tangentially covered. • The MSP process is weakly linked to the coast, with plans limited to the high tide line. • To date, no detailed timeline for MSP implementation has been developed, contrary to recommendations in National MSP Framework.

Portugal

Portugal's National Ocean Strategy (ENM, 2013-2020)[16], a component of the Portugal 2020 partnership agreement with the European Commission[17], calls for sustained growth, guided by the European Commission's 'Blue Growth Agenda' (COM2012/494/final). The strategic plan focuses on three 'Action axes,' concerning innovation and research, exploration and use of ocean resources and the preservation of ocean environments. As part of these actions, a legal basis for Portugal's policy on marine spatial planning and management of the national maritime space (n. 17/2014/April 10) entered into force. A recent resolution (No. 203-A/2019) approved the division of Portuguese marine waters, into the mainland, Madeira and extended continental shelf, as defined in the National Maritime Spatial Planning Situation Plan (PSOEM)[18]. Finalisation of the national plan is ongoing and will result in the largest maritime plans in Europe by area. One of the challenges recognised by Portugal in implementing their strategic plan (ENM) is the overlapping responsibilities of administrative departments and agencies, which is addressed through the establishment of a coordinating departmental body.

The monitoring and evaluation of plans is supported by several SEEA-compliant national accounts, led by Statistics Portugal[19]. Portugal is an international leader in the implementation and maintenance of an ocean economy satellite account and is the model for many accounts under development. These include a complete set of production, expenditure, and income accounts able to produce a set of balanced national aggregates for the ocean economy. The ocean economy satellite account considers 65 different products and services, capturing traditional industries (ports, shipping, and fisheries), in addition to recreational, sports, culture and tourism-related activities. The country further maintains a tourism satellite account, which distinguishes the contribution of ocean-related products and services that contribute to the economy. Thus, Portugal is well-poised to take advantage of maintained accounts for the implementation of MSP and to further the scope of existing accounts for improved management and decision-making.

[16] Estratégia Nacional para o Mar (ENM) - https://www.dgpm.mm.gov.pt/enm (Accessed 11/12/2020)
[17] Portugal 2020 Partnership - https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/policy-document/continente/portugal-2020-partnership-agreement-2014-2020-0 (Accessed 11/12/2020)
[18] National Maritime Spatial Planning Situation Plan, Republic of Portugal (Portuguese) - http://www.psoem.pt/
[19] Direção-Geral de Política do Mar do Ministério do Mar (DGPM) - https://www.dgpm.mm.gov.pt/conta-satelite-do-mar (Accessed 11/12/2020)

Table 6. A SWOT analysis of the intersection between Ocean Accounting and Marine Spatial Planning activities in Portugal.

Strengths	Weaknesses	Opportunities	Threats
• Coastal planning frameworks since 1998. Marine spatial plan embedded into legislation since 2014. • Clear governmental and institutional support, with an inter-ministerial coordinating commission overseeing MSP activities. • An established and maintained Ocean Economy Satellite Account, with overlap in reporting of MSP areas.	• Terrestrial and marine planning mandates are different instruments. • No standardized monitoring and evaluation plan for MSP. • No explicit links between OA and MSP activities.	• An inter-ministerial commission facilitates communication between MSP and accounting working groups. • Data gathered through MSP activities could form the basis of an 'asset' account. • OA may be used as the basis for a monitoring and evaluation plan. • A new ocean strategy will soon be released for 2021-30, with environmental accounting included as a potential future mandate. • Political commitment to development of environmental accounts, with ongoing SEEA efforts.	• Due to differing planning instruments between coasts and marine space, land-sea interaction data is fragmented. • Differing mandates and approaches between implementing governmental agencies may hinder synergies between frameworks. • A clear prevalence stated at the MSP law of the economic vector over sustainability and nature conservancy hinder the path to an ecosystem approach to MSP and stresses the institutional conflict.

Canada

Canada is surrounded by the Atlantic, Arctic, and Pacific oceans, which, along with their ecosystems, support human activities and the health of Canadians. In 2018, the economic contribution of Canadian maritime sectors was 1.7% of employment and 1.6% of GDP[20]. In response to increasing threats to Canada's oceans, MSP was chosen for ocean planning and management, to advance Canada's marine conservation targets, reconciliation with Indigenous peoples, and supporting its Blue Economy Strategy.

The Government of Canada, led by the Department of Fisheries and Ocean Canada (DFO), is undertaking MSP processes in five marine bioregions,[21] to integrate knowledge of a planning area and provide a decision-making tool that considers ecological, cultural, social, and economic factors towards long-term resilience and sustainability. Canada's MSP is expected to provide a predictable, stable environment that will attract growing investment in marine sectors. These efforts are supported by a Ministerial mandate to pursue initiatives working with provinces, territories, Indigenous Peoples, and all Canadians to better co-manage Canada's three oceans[22]. Delivery for at least four bioregions is expected by 2024, with the MSP process anticipated to continue beyond the four individual plans.

In parallel, Canada's Ocean Accounts (OA) project was initiated in 2019, coordinated by DFO and Statistics Canada. The ongoing project addresses incompatibility between datasets and fragmentation of knowledge amongst stakeholders, which limits the comprehensive mapping of ocean ecosystems extent, condition, services, and beneficiaries. Thus, a national OA is a priority for Canada to harmonize key ocean-related data, in addition to filling knowledge gaps. The OA pilot focuses on integrating spatial data on marine habitats, improving measurement of the marine economy, developing ecosystem accounts, and applying international standards to measuring market and non-market ecosystem services.

Realized progress includes the assessment of existing priorities and data to determine data gaps and priority accounts; the first inclusion of marine and coastal ecosystem accounts in Statistics Canada Human Activity and Environment (HAE) report, and an EnviroStats report of Marine Economy accounts. DFO, in collaboration with University of British Columbia, is also estimating the extent of eelgrass beds and associated blue carbon stocks across the Canadian coastlines. Canada's OA also benefits from and supports the Blue Economy Strategy, aimed at guiding and supporting sustainable growth and modernization of high potential sectors and related job creation, in part through targeted indicators from OA.

Although OA and MSP in Canada are independent initiatives, the strongest potential synergy is the coordination of data. As both initiatives are at initial stages of development, there is scope for co-development through effective information sharing and coordination, avoiding the duplication of efforts. Canadian OA could provide relevant ocean-related indicators as well as information on governance, assisting MSP development, in addition to monitoring and evaluation of their

[20] The Marine Economy Accounts, developed by Economic Analysis and Statistics (EAS) division in the Economics, Statistics, and Data Governance (ESD) directorate of Fisheries and Oceans Canada, provide estimates of the direct, indirect, and induced economic contribution of ocean dependent activities. Details including methodology are available here: https://www.dfo-mpo.gc.ca/stats/maritime-eng.htm

[21] The 5 marine-bioregions for MSP include the Pacific North Coast, the Pacific South Coast, Newfoundland and Labrador Shelves, Scotian Shelf – Bay of Fundy, and the Estuary and Gulf of St Lawrence.

[22] Within Canada, the rights of First Nations, Inuit and Métis peoples are constitutionally protected.

effectiveness. OA could provide a national perspective to identify priority areas for MSP and illustrate their relative performance from both a socio-economic and conservation perspectives. OA in Canada is currently limited in scope and could take advantage of extensive data-sharing amongst MSP planning partners, to expand priority indicators and broaden accounts coverage. Finally, the link of both MSP and OA to the BES could provide additional opportunities for coordination at a national level.

Table 7. A SWOT analysis of the intersection between Ocean Accounting and Marine Spatial Planning activities in Canada.

Strengths	Weaknesses	Opportunities	Threats
• Linkage of OA and MSP to the Blue Economy Strategy strengthens opportunities for collaboration. • Early stage of MSP initiative allows for coordination with OA. Examples include: 1) early engagement in both directions between OA and MSP, 2) ability build a joint workplan, that considers the needs of both initiatives, 3) ability to be responsive and adaptive in purpose, 4) early coordination in effective data management and communications, 5) OA will help provide knowledge to MSP through early coordination on data/tools development.	• Infancy of both OA and MSP initiatives. • OA lacks real world examples on its contribution to evidence-based management at a national level. Whilst no MSP have been implemented in Canada, there are extensive international examples. • Differences in scale: OA has a focus using a national lens, while MSP focuses on a bioregional/pilot area scale. For example, MSP data may be too granular to extrapolate nationally, or MSP may be limited in spatial extent. In Canada, the national perspective of OA would mean MSP bioregions/pilot areas would be embedded in the larger analysis.	• Strong political and institutional commitment for both OA and MSP. • Early data stewardship coordination to support the production of open and accessible outputs. • Having both OA and MSP in one Department (DFO) may produce synergies while increasing visibility of work. • OA focus on existing information and data collection processes, reduces resource needs for MSP, and assists in identifying relevant information and data gaps. • Opportunities for collation of regional information at national level using national OA pilots (e.g., eelgrass) • The MSP reporting process (i.e., MSP Atlas), is an opportunity to present OA results, making results more accessible to Canadians and increase OA's profile.	• Differences in mandate, agenda, stakeholders (private vs government) and scope (OA is national and MSP is by bioregions/pilot areas) create a challenge in coordinating and building joint workplans. • The size of the Department and dispersed data holdings is a challenge in identifying, assembling, and sharing data. • The coastal and ocean waters are large, creating a challenge to implementing OA pilot projects in a meaningful way. • MSP deliverable is for 2024, but there is no commitment for implementation. • Priority indicators for national level OA may not align with bio-regional MSP reporting needs.

4. Discussion

Strategic policies concerning ocean-based economic development have driven the need to analyse and allocate space and resources to human activities, leading to 75 countries having an MSP process (Ehler, 2020). There is, however, a growing recognition of the critical need to ensure the sustainability of ocean sectors, evidenced by the European Union's transition from 'Blue Growth' to a 'Sustainable Blue Economy'.[23] The Dasgupta review on the 'Economics of Biodiversity' further identifies the need to account for the contribution of ecosystems towards sustainable economic development (Dasgupta, 2021). OA provides the means to evaluate sustainability through multiple indicators, aggregated from diverse information. Whilst progress in both frameworks is rapidly increasing, this study demonstrates that the intersection of MSP and OA is still in its infancy, with Thailand as the only case study explicitly embedding both frameworks from the start of the project. An early exploration of approaches globally, however, reveals opportunities and threats for co-development.

4.1. Global trends in countries with Marine Spatial Planning and Ocean Accounting

There were 26 countries identified as undertaking both MSP and OA activities. Most OA activities were concerned with the monitoring of assets and flows within ocean ecosystems (e.g., mangroves, kelp, and seagrass), concentrating on one ecosystem type. Attempts were also made to link ecosystems to related economic sectors (e.g., fisheries, n = 6 countries) or ecosystem services (e.g., carbon capture). These efforts could be related to international reporting and evaluating progress towards environmental sustainability targets.

Another policy use case for OA was the measurement of the ocean economy, with 16 countries working towards the disaggregation of ocean economic sectors. Few countries have developed a comprehensive set of products and services within an OESA (USA, Portugal, Korea, and Canada), with Portugal measuring 65 products and services within their accounts. Other countries have compiled accounts concerning national priorities, such as fisheries. An additional eight countries solely concentrated on linking their Tourism Satellite Account (TSA) with environmental statistics (i.e., SEEA). Four countries were in Asia (Thailand, Viet Nam, Maldives, and The Philippines) and two in Oceania (Samoa and Fiji), with each country having a substantial proportion of Gross Domestic Product (GDP) linked to the tourism sector.

Links between Marine Spatial Planning and Ocean Accounting

Of the countries with OA activities, 10 have implemented MSP (considered as completed plans that have been accepted and in force). MSP implementation was focused on either prioritising conservation or intersectoral planning (as explored by Trouillet (2020)), where there was no clear relationship between the focus of plans and motivations for OA activities. For example, whilst 12 of China's plans focus on inter-sectoral planning, OA activities revolved around carbon sequestration from mangroves. Similarly, Netherlands' MSP also focuses on inter-sectoral planning, although the country compiles natural capital and ecosystem accounts for the North

[23] Sustainable Blue Economy, European Commission: https://ec.europa.eu/oceans-and-fisheries/ocean/blue-economy/sustainable-blue-economy_en

Sea. There is no apparent link, however, in the policy focus between both processes within this study, which is intuitive as no formal links are yet to be observed in national policy and legislation during the diagnostics for any country. As such, whilst coordinating bodies for both frameworks may be the same, it can be assumed that the organisations or working groups conducting MSP and OA activity are still separate operationally.

4.2. Assessment of Case studies

Strengths

Both frameworks are integrative in nature and support the collation of diverse information, as required by an ecosystem-based management approach. Through OA, existing knowledge may be collated into an account to generate novel insights. For example, Thailand combined two existing accounting systems (Tourism Satellite Accounts and SEEA water, energy, and green-house gas emission accounts) to differentiate resource use between tourists and locals. The Australian OA pilot advanced ecosystem service assessments through the OA framework, in identifying the services and benefits of seagrass to the local economy, by both multi-use and conservation areas, supporting compliance and evaluation activities. As MSP is increasingly framed within ecosystem-based management, ecosystem service assessments are increasingly used during scenario and trade-off analyses (Galparsoro *et al.*, 2021). Undertaking assessments using data sourced from accounts addresses the challenge of linking ecosystem services to the ocean economy and society.

The SWOT analyses also identified that several MSP and OA activities had shared coordinating organisations or data partners. Within Canada, the Department of Fisheries and Oceans (DFO) is responsible for MSP development and collaborating with the national statistical agency to deliver OA pilots. Similarly, the South African National Biodiversity Institute (SANBI) was responsible for coordinating environmental-economic accounting and for marine habitat mapping used within the MSP process. Thus, shared data and institutional support may already exist, overcoming departmental fragmentation, reducing redundancies in data gathering activities, and providing an existing coordinating body that allows for the streamlining of co-development at the national level.

Weaknesses and Threats

As both frameworks are still developing within each country, there are inherent weaknesses in their implementation and testing, with related threats that may limit the compatibility of MSP and OA into the future. For example, differing mandates and jurisdictions, especially at the land-sea interface may limit co-implementation, where MSP in most countries only covers marine areas (e.g., Australia, Portugal), leaving coastal areas to other instruments (Smith *et al.*, 2011). The OA framework endorses incorporating knowledge from both coastal and marine areas, limiting data coherence. Further, within Canada MSP has a ‘bioregional’ focus, whilst OA is considered a national exercise. Thus, differing focus may limit data flows between the two initiatives.

Whilst OA and MSP work in different domains of ocean governance, there is still overlap and potential redundancy due to the timing of implementation of both processes. For example, both OA and MSP begin with data gathering, which may already have concluded within an MSP process. Data collected for the purposes of MSP may address a specific need and be

incompatible with accounting activities, due to data granularity, differences in classifications and definitions, conceptual organisation, or opaque methodology in procuring the data. Further, as the OA framework matures from experimental to accounting standard, accounting systems will require stricter standardisation, controls on data quality and data coherence[24]. Thus, there may be an opportunity cost in the misalignment of data procurement between the two processes.

Opportunities

In assessing national policies, the integration of MSP and OA assists in achieving targets related to ocean-based economic strategies and are also relevant to ocean conservation and ecosystem-based management. Ocean-based economic development was a common national priority, driving inter-sectoral plans within MSP. Canada seeks to improve the coverage of OESA, towards an understanding of the nature of the ocean economy and a means to evaluate performance over time. Prior to the shift towards a 'Blue sustainable Economy,' MSP development within Portugal was guided by 'Blue Growth,' where the maintenance of its well-developed OESA facilitates the assessment of marine activities. Thus, OA supports the analysis of trade-offs, as required by MSP to allocate space and resources, thereby supporting ocean-based economic strategies.

Whilst legal and policy instruments shaping the sustainable use of ecosystems differ between countries, there is a recognition of the importance of ocean health in supporting livelihoods and human health. All five countries have ratified the Convention of Biological Diversity[25] and are thus obliged to conserve 10% of their marine domain. These efforts are furthered within Australia, Canada, Portugal, and South Africa as members of the Global Ocean Alliance, calling for 30% of the world's Oceans protected by area-based measures by 2030.[26] The zoning of MPAs falls, in part, within the MSP processes in Australia, Canada, and South Africa, although explicitly outside MSP within Portugal. In countries where MPAs are embedded within an MSP process, OA is a means to monitor effectiveness and flows of benefits.

Lastly, a central tenet to ecosystem-based management is sustainability through considering all relationships between components (including humans) within an ecosystem (Katsanevakis *et al.*, 2011). The balance of multiple considerations is, however, often overshadowed by economic priorities and OA provides an opportunity to weight such considerations alongside social and environmental indicators. Ecosystem-based management is required by all five countries, Australia, Portugal, and Canada as part of the High-Level Panel for a Sustainable Ocean Economy, have committed to managing 100% of national waters sustainably by 2030[27]. Thus ecosystem-based MSP may manage human activities and pressures, while OA provides a means to evaluate and quantify the sustainability of the accepted and enforced plans.

[24] As defined by the UN Fundamental Principles of Official Statistics (A/RES/68/261 from 29 January 2014)
[25] Convention on Biological Diversity, Strategic Plan 2011 – 20, Aichi Targets: https://www.cbd.int/sp/targets/ (Accessed 15/04/2021)
[26] Global Ocean Alliance (30 x 30 initiative): https://www.gov.uk/government/topical-events/global-ocean-alliance-30by30-initiative/about (Accessed 15/04/2021)
[27] High-Level Panel for a Sustainable Ocean Economy: https://oceanpanel.org/about#100 (Accessed 15/04/2021)

5. Conclusion

The intersection of OA and MSP is in its infancy, with a growing number of countries investing in both activities. The uptake of both frameworks is driven by national policies concerning environmental sustainability, ecosystem-based management, and ocean-based economic growth. OA activities included the monitoring of ocean ecosystems, and measurement of the ocean economy, with several countries focusing distinctly on tourism and its environmental impacts. Similarly, MSP was an implementation framework, towards inter-sectoral planning or the conservation of marine ecosystems. In assessing OA and MSP within five countries, operational and strategic synergies were identified. Operationally, resourcing could be reduced by data sharing, towards the compilation of accounts within OA, and formulation of spatial plans. The analysis also identified shared coordinating departments and institutional bodies for both MSP and OA, highlighting existing expertise in both frameworks, facilitating co-development. Internal and external barriers to co-implementation included differing focus and legislative instruments, respectively. MSP may be performed for smaller regions, while OA may be an exercise performed at larger scales and the policies, legislation and strategic plans may limit data coherence and integration.

Ocean governance requires addressing interrelated challenges, balancing competing considerations for ocean conservation, and dealing with significant uncertainty. Effective and equitable ocean decisions are contingent on combining information across domains to implement action. Through the co-development of OA and MSP, countries may gain a robust ocean data foundation and a means to operationalise ocean data to achieve policy goals. High level policy intent is behind both MSP and OA, where both play roles in managing and recording ocean assets and activities. The synergies between the two frameworks may prove key to effective ocean governance in the future.

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Supplementary Material

Table SM1. Definitions of international accounting standards and satellite accounts related to Ocean Accounting, sourced from the OECD Glossary of Statistical Terms (https://stats.oecd.org/glossary/index.htm).

Term	Acronym	Definition
System of National Accounts	SNA	The internationally agreed standard set of recommendations on how to compile measures of economic activity. The SNA describes a coherent, consistent, and integrated set of macroeconomic accounts in the context of a set of internationally agreed concepts, definitions, classifications, and accounting rules.
System of Environmental-Economic Accounting	SEEA	The System for integrated Environmental and Economic Accounting is a satellite system of the SNA that comprises 4 categories of accounts. The first considers purely physical data relating to flows of materials and energy and marshals them as far as possible according to the accounting structure of the SNA. The accounts in this category also show how flow data in physical and monetary terms can be combined to produce so-called “hybrid” flow accounts. Emissions accounts for greenhouse gases are an example of the type included in this category. The second category of accounts takes those elements of the existing SNA which are relevant to the good management of the environment and shows how the environment-related transactions can be made more explicit. An account of expenditures made by businesses, governments, and households to protect the environment is an example of the accounts included in this category. The third category of accounts in the SEEA comprises accounts for environmental assets measured in physical and monetary terms. Timber stock accounts showing opening and closing timber balances and the related changes over the course of an accounting period are an example. The final category of SEEA accounts considers how the existing SNA might be adjusted to account for the impact of the economy on the environment. Three sorts of adjustments are considered: those relating to depletion, those concerning so-called defensive expenditures and those relating to degradation.
Satellite Account	-	Satellite accounts provide a framework linked to the central accounts and which enables attention to be focussed on a certain field or aspect of economic and social life in the context of national accounts; common examples are satellite accounts for the environment, or tourism, or unpaid household work.
Ocean Economy Satellite Account	OESA	[Not defined within the OECD Glossary for Statistical Terms] A satellite account that measures all economic activity directly dependent on oceans, including activities that use ocean resources as an input (e.g., fishing), produce products and services for use in the ocean environment (e.g., shipbuilding) and depend on the ocean due to geographic proximity (e.g., coastal tourism, warehouses that service ports).
Tourism Satellite Account	TSA	Provides basic system of concepts, classifications, definitions, tables, and aggregates linked to the standard tables of the 1993 System of National Accounts from a functional perspective. This system has been developed to measure tourism economic impacts in a national economy on an annual basis.

Table SM2. Diagnostic framework used to determine the governance related to Ocean Accounting.

THEME	STAGE	DESCRIPTION
STATEMENT OF STRATEGY AND POLICY PRIORITIES	1a. Vision	National vision for sustainable development
	1b. Concerns	Ocean-related problems, challenges, concerns the country faces that prohibit/hold back the realization of the vision.
	1c. Priorities	Key national policy priorities in line with to the vision and concerns. Could be one or a combination of - Economic focus (e.g., ocean economy, tourism) - Environmental/conservation focus (e.g., protected areas and other protection schemes) - Social focus (for example, the multidimensional equity aspects of ocean economy and ocean conservation)
	1d. Plans	Existing or planned policy tools, including Marine Spatial Planning (MSP), in response to the priorities.
INSTITUTIONS	2a. Stakeholders	May be arranged according to the priorities (plus MSP). Include stakeholders that should be engaged.
	2b. Roles of NSO	Particularly environment statistics, SEEA and ocean accounts compilation
	2c. Mechanisms	That ensures integration across stakeholders, programs, projects, and processes (for example, senior steering committees).
KNOWLEDGE	3a. Data sources	May be arranged according to the priorities (plus MSP), including both official and non-official (such as academic, NGO, etc.) data and statistics
	3b. Other key documents	Other key documents relevant to ocean data and statistics as well as ocean policy and management
PROGRESS	4. Progress related to ocean accounts	- Parts of SEEA and ocean accounts that have been compiled/piloted, including efforts in harmonizing and integrating environmental data and statistics. - Existing or planned projects. - Types of outputs produced.
CONTEXT	5a. Statistical context	Other statistical development activities, such as statistical legislation, adoption or revision of new standards, new data collection or integration initiatives.
	5b. Other international activities	International support for statistical development and measurement of the ocean. May be arranged according to the priorities (plus MSP)

PRIORITIES FOR ACTIONS	6. Priority Ocean accounts	- What parts of ocean accounts should be prioritized for implementation/further improvement considering information above? - Who could/should be engaged, both nationally and internationally, in the compilation?
CONSTRAINTS AND OPPORTUNITIES	7a. Constraints	Specific constraints under each priority account. Otherwise, key common constraints to progress the compilation/use.
	7b. Opportunities	Specific opportunities under each priority account. Otherwise, general opportunities.
	7c. Priority actions	To overcome the constraints and take advantage of the opportunities to progress the compilation of priority accounts.

Table SM3. Non-exhaustive list of countries with Ocean Accounting (OA) related activities and Marine Spatial Planning (MSP) activities (as of December 2020), within Africa, Asia, Europe, Oceania, and the Americas. For implemented plans, the focus of the plan (either conservation or inter-sectoral planning) was drawn from a critical review by Troulliet (2020).

Region	**Country**	**Ocean Accounting**					**Marine Spatial Planning**		
		OA activity description	**Ocean ecosystems**	**Spatial Planning**	**Ocean economy**	**Ocean-tourism nexus**	**Plan completed**	**Progress**	**Plan focus ***
Africa	Kenya	Maintains comprehensive accounts on fisheries catch and aquaculture sector.			x		No	Pre-planning underway	-
	Mauritius	Tested ecosystem accounting at the island scale, specifically water, carbon, biodiversity, and biomass accounting.	x				No	Pre-planning underway	-
	Namibia	Developed extensive commercial fisheries accounts for several species.	x		x		No	Development of plan underway	-

		Accounts include physical accounts, resource rent and taxes, and monetary accounts.							
	South Africa	Maintains SEEA-CF compliant fisheries accounts and ecosystem accounts for estuaries and biodiversity accounts for specific regions.	x				No	Development of plan underway	-
Asia	China	Mangrove asset accounts (blue carbon).	x				Yes	12 plans approved and implemented	IP, C
	Korea	Ocean economy satellite account for sectoral planning (fisheries and marine sectors).		x	x		Yes	Approved, implemented, and revised	NA
	Malaysia	Piloted ecosystem accounts, linking temperature and primary production (condition) of mangrove areas (asset account) and fisheries catch (service).	x		x		No	Analysis for Planning	-
	Maldives	Linked Tourism Satellite Accounts to SEEA-CF accounts (water and solid waste). Maldives has also begun work on ecosystem accounting for coral reefs.	x			x	No	Pre-planning underway	-

	Myanmar	Mangrove asset and flow accounts (blue carbon, fisheries)	x				No	Pre-planning underway	-
	Thailand	Piloted the integration of Tourism Satellite Account data with SEEA-CF accounts (water, waste, energy, greenhouse gas emissions) to produce integrated maps to locate areas with high risks of exceeding carrying capacity for accommodating tourism activities.	x	x		x	No (Pilots only)	Several island-scale pilots completed, with national pre-planning underway	-
	The Philippines	Maintains fisheries and mangrove asset accounts, in addition to a Tourism Satellite Account.	x		x	x	Yes	Approved and implemented	C, IP
	Viet Nam	Linked marine pollution from economic activities including to tourism and its impacts on key ocean ecosystems using an accounting framework.	x		x	x	Yes	Approved and implemented	NA
Europe	Finland	Performing pilots of marine and freshwater ecosystem accounts.	x				No	Development of plan underway	-
	France	Performed a pilot assessment of the maritime economy within the Provence-			x		No	Pre-planning underway	-

		Alpes-Côte d'Azur region.							
	Netherlands	Statistics Netherlands released natural capital accounts of the North Sea, based on ecosystem accounting. The accounts included ecosystem extent and condition, and flows (services).	x				Yes	Approved and implemented	IP, C
	Norway	Developing an Ocean Economy Satellite Account. Piloted a kelp ecosystem account.	x		x		Yes	3 plans approved and implemented	C, IP
	Portugal	Maintains an Ocean Economy Satellite Account, containing 65 products and services, including recreational, cultural, and tourism-related activities.	x		x	x	No	Development of plan underway	-
	United Kingdom	Maintains natural capital accounts, which include wild caught fish and recreation. It also maintains ocean-related ecosystem accounts such as carbon sequestration, recreation, and fish (marine only).	X		x		Yes	16 plans in various stages of development. The most progressed plans (2) have been completed, but not approved.	IP, C

Americas	Canada	Working towards integrating Marine Economy (or satellite) Accounts and Ecosystem Accounts in SEEA for Oceans.	x		x		Development ongoing, estimated delivery in 2024	The MSP process has been initiated in five marine bioregions	IP, C
	Chile	Working towards advancing coastal and marine ecosystem accounts, in support of a sustainable ocean economy (fisheries and resources).	x		x		No	Pre-planning underway	C
	Costa Rica	Maintains fisheries accounts and is forming the basis for a governance account.			x		No	Pre-planning underway	-
	Mexico	Maintains SEEA-aligned fisheries accounts, with further efforts to compile SEEA-EA at state levels for coastal areas.	x		x		Yes	Three plans completed, with 1 in development	C, IP
	United States of America	Maintains an ocean economy satellite account and is exploring non-market sectors and values.			x	x	Yes	16 plans in various stages of development. Five plans have been approved.	IP, C
Oceania	Australia	Ecosystem asset and condition accounts (seagrasses), and flows (services and benefits) within a marine park. Services included blue carbon and fish nursery	x	x	x		Yes	Seven plans completed. Only 1 has been accepted, implemented, and reviewed.	C, IP

		services. Benefits explored contribution to local economy (e.g., fishing, whale-watching).							
	Fiji	Maintains Tourism Satellite Accounts, in addition to SEEA Water, energy, and waste accounts.				x	No	Preplanning underway	-
	Samoa	Focus on accounting for land-based pollution by spatially disaggregating waste generation by tourist and local population.	x			x	No	Preplanning underway	-

*The focus of plans is placed in order of perceived importance, where C = Conservation, IP = Intersectoral planning, and NA = plans approved, but not reviewed by Troulliet (2020).